ZEP Advisory Council 60

25th September 2019

Agenda Item 9: Review of Network Work Programmes

9.a. Network Policy and Economics

Appended to this paper is the following pre-read:

9.a. Network Policy and Economics Update

9.a.i. ZEP NWPE Agenda 18 July

9.a.ii. ZEP NWPE Meeting Minutes 18 July. Draft

9.a.iii. ISO-TC265 European Opinions

9.a.iv. ZEP Response State Aid Fitness Check

9.a.v. ZEP Response Targeted Consultation for the Evaluation of the EEAG

9.a.vi. Innovation Fund Workshop Agenda

9.a.vii. Innovation Fund Workshop Attendance List

9.a.viii. Innovation Fund Workshop Questionnaire

9.a.ix. Innovation Fund Workshop Summary

9.a.x. ZEP Horizon Europe CoDesign Consultation Response

9.a.xi. ZEP Horizon Europe CoDesign Consultation Response text input

9.a.xii. ZEP Feedback on TEN-E Evaluation Roadmap

9.a.xiii. ZEP Sustainable Taxonomy TEG Report Consultation response

9.a.xiv. ZEP Sustainable Taxonomy Governance Proposal Letter

9.a.xv. Letter to TEG on hydrogen manufacturing

9.b. Network Technology

Appended to this paper are the following pre-reads:

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9.b. Network Technology update

9.b.i. NWT meeting minutes 4th June 2019

9.b.ii. ZEP draft ToR for a TWG on CCUS Pipeline Networks

The AC are invited to approve the draft ToR

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ZEP Advisory Council 60

25th September 2019

Agenda item 9.a. Network Policy and Economics update

Co-chairs: Lamberto Eldering (Equinor), Kim ByeBruun (Shell), Jonas Helseth (Bellona)

The Network Policy and Economics meeting took place on the 18th July in Brussels. The next Network Policy and Economics meeting will take place on the 24th October, venue TBC, Brussels. The agenda is in preparation.

The 18th July NWPE meeting was well attended; presentations were heard from Christian Schwarck from IOGP on the Outcome of the June Madrid Forum and an Update on the Hydrogen for Europe Study (see agenda and minutes, attached as pre-reads 9.a.i. and 9.a.ii. respectively). Olivier d'Erceville from ADEME presented an update on the ongoing ISO TC265, international standards for CCS. A discussion led by Eve Tamme (GCCSI) was also had on CO2 transport in the EU ETS and the London Protocol.

The presentation on ISO standards highlighted that the Commission could potentially play a key role in helping to form some global standards. The secretariat has reached out to the Commission to inquire if the ISO TC26, CCS standards process is tracked internally. If the Commission could encourage more European nations to engage with the process (so far it is only Norway, France and Germany) and provide a united opinion, the standards can be favourably formed from a European perspective. A summary table of current issues and active member opinions in ISO TC265 Working Group 4 (on Quantification and Verification) is attached as pre-read 9.a.iii.

The conversation on CO2 transport in the EU ETS looked at current issues and possible short and intermediate term solutions to cover the period 2020-2030. The group discussed possible changes to the CCS Directive, and investigated how the Northern Lights project has proposed to include shipping. Lamberto Eldering gave an update, which included defining shipping within the capture process, with CO2 transport metered from the pipeline connecting the docking facility to the storage facility; this however commits one ship to one single capture facility. The Northern Lights project team submitted this proposal into DG CLIMA, the secretariat and co-chairs will follow the developments.

<u>State Aid Consultations:</u>

DG COMP launched a public consultation on a '**Fitness Check on State Aid legislation'**; part of this process also includes a more focussed consultation on the '**Evaluation of the Guidelines on State aid for Environmental Protection**'. It will be critically important that CCS remains eligible for state aid. A response to both consultations was be prepared with members and submitted on 10th July (attached as pre-reads 9.a.iv. and 9.a.v. respectively).

EIB Draft Energy Lending Policy

On Friday 26th July, the EIB published its draft Energy Lending Policy. This is designed to help deliver the climate and energy targets for 2030, and lay the foundation for a climate-neutral European economy. The publication of the draft ELP takes into account the response from the ELP Consultation which ZEP submitted a response to on 29th March 2019.

The EIB have made it clear that they will phase out support for energy projects reliant on fossil fuels, including infrastructure primarily dedicated to natural gas, power or heat based on fossil fuels, **unless** these projects are linked to abatement technologies (such as CCS) or the use of low-carbon gases. From the end of 2020 the bank will not present unabated fossil based projects to the EIB Board for approval, as all bank activities in the energy sector will now be fully aligned with the Paris Agreement. Furthermore, the Lending Policy reiterates clearly, that funding will continue for 'innovation and new energy infrastructure' projects which align with the SET-Plan and Innovation Fund goals

Temporary Working Group Policy and Funding

Chair: Theo Mitchell (Enerfair)

Innovation Fund

A workshop on the Innovation Fund was held on the 6th September at the Norwegian Ministry of Petroleum and Energy. This followed the High-Level EU Norway CCS Conference on the 5th September. The agenda for the workshop is attached as pre-read 9.a.vi.

The workshop was fully registered and reached the capacity of the venue, with approximately 60 present. Stakeholders gathered from a variety of sectors and projects. A list of the attendees is attached as pre-read 9.a.vii.

The workshop attendees were asked to complete a series of questions ahead of the workshop (attached as pre-read 9.a.viii). In total 13 responses to the questionnaire were submitted, the answers of which were collated and summarised ahead of the workshop. At the workshop, breakout sessions had attendees working in groups to discuss a subset of the questions, giving feedback to the group (including HoU Christian Holzleitner, DG CLIMA). After these discussions, individual projects were asked to present on how the innovation fund could help their projects. A short summary of the workshop has been written and can be found attached as pre-read 9.a.ix). The short summary and questionnaire responses will be submitted into the Commission, a longer more detailed summary will also be written by the secretariat for the Commission only (not available online). The first call is still expected to open in summer 2020.

Horizon Europe

On 28th June the Commission launched a public consultation on how Horizon Europe should be structured in detail and implemented in practice. The consultation document is a ranking exercise to gather a wide opinion on where and how funding should be allocated, and as such the response should be very brief. This consultation will inform the Strategic Plan of Horizon Europe and aims to identify key research areas/avenues in line with the Orientations document and UN development goals. The consultation consists of a series of multiple-choice answers and text

justifications/comments; a response was submitted on the 8th September (see attached pre-reads 9.a.x. and 9.a.xi.)

On the 11th September, the Commission launched a consultation on the 12 Proposed European Partnerships under the future Horizon Europe R&I Programme. This includes an increased scope partnership for clean hydrogen (phrased as 'nearly-zero carbon hydrogen' in some sections of the consultation. The questions are multiple choice, with opportunities for text input. The Secretariat will prepare a draft for circulation to the network in due course.

Temporary Working Group PCIs

Chair: Lamberto Eldering (Equinor)

TEN-E Roadmap

The TEN-E Regulation addresses the identification of PCIs which help implement energy interconnection projects across Europe and improve sustainability. Furthermore, the TEN-E Regulation also provides access to opportunities from the Connecting Europe Facility (CEF).
The Commission outlined why the Evaluation is taking place and opened their plans for public feedback with a deadline of the 12th July. Feedback will be incorporated in the TEN-E Evaluation Roadmap, before public consultation, most likely in Q1 2020.

A short document was prepared and circulated to the TWG welcoming the timing of the evaluation and suggesting some further references for the Commission to help inform assess the benefits of CO_2 cross border transport networks in Europe. This was submitted ahead of the 12th July deadline (attached as pre-read 9.a.xii).

Temporary Working Group Sustainability Taxonomy

Chair: Graeme Sweeney

In light of the publication of the Sustainable Finance TEG Taxonomy Technical Report, and the subsequent consultation, the TWG has worked to form ZEPs response. The membership of the TWG was also expanded for this phase, including two new participants.

It was decided that the feedback should form two individual submissions. The first, a submission through the online portal answering consultation questions. This includes highlighting obvious errors, areas where the criteria/methodology could be improved or questioned and suggesting areas to be considered. Within this the TWG identified issues with the hydrogen manufacturing thresholds, this was included in the ZEP response and the issue was also highlighted in a letter submitted in August to the TEG chairs.

The second form of feedback was considered recommendations on the governance and structure of the taxonomy in the future. These suggestions could not be encompassed under any of the predefined question categories within the consultation process. As such the TWG drafted recommendations which were submitted to Mr Martin Spolc, Head of Unit of Financial Technology and Sustainable Finance (B2, DG FISMA). The ZEP consultation response, letter to Mr Spolc and letter to the TEG chairs can be found as attachments 9.a.xiii, 9.a.xiv and 9.a.xv respectively.

ZEP Network Policy and Economics

Meeting Agenda: 18th July 2019

Location: Copernico Science`14, Rue de la Science 14, 1040 Bruxelles, Belgium
11:00-15:00 CET

Item		Lead Presenter	Time
1	Introduction, tour de table, safety notices	Co- chairs	11:00
2	Outcome of the Madrid Forum & Update on Hydrogen for Europe Study	François-Régis Mouton (IOGP)	11:10
3	ISO/TC 265: International Standards for CO2 Capture, Transport and Storage. • Update on developing standards	Olivier d'Erceville	11:40
4	Discussion on CO_2 transport in the: • EU ETS • London Protocol	 Eve Tamme (GCCSI) Lamberto Eldering NWPE Members	12:10
Lunch			12:45
5	Progress update: a. Network Policy & Economics • State Aid Guidelines Consultation • High Level Group for Energy Intensive Industries • Knowledge Sharing Network • National Energy and Climate Plans b. TWG PCIs c. TWG Policy & Finance • Innovation Fund Workshop	Co- chairs	13:15
6	Chair's update a. Feedback from ZEP March & June AC b. Feedback from SET-Plan IWG9 c. Feedback from Sustainable Finance EU Taxonomy Expert Groups Feedback from external engagements	Graeme Sweeney Co-Chairs	14:15
7	Next steps: a. AOB b. Chairs' summary c. Forward work activities d. Next meeting	Co- Chairs	14:45

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ZEP Network Policy and Economics
Minutes: NWPE meeting, 18th July 2019

Attendance

Name	Organisation
Olivier d'Erceville	ADME
Eric De Coninck	Arcelor Mittal
Jonas Helseth	Bellona
Lamberto Eldering	Equinor
Brian Murphy	Ervia
Eve Tamme	GCCSI
Christian Schwarck	IOGP
Kim ByeBruun	Shell
Fabrice Devaux	Total
Chris Gent	ZEP Secretariat
Per-Olof Granström	ZEP Secretariat
BY PHONE	
Tim Peeters	Tata Steel Europe
Graeme Sweeney	ZEP
Owain Tucker	Shell

Item 1: Introduction

Minutes approved pending secretariat checking distribution of slides from the February meeting.

ACTION: Check presentations attached from February meeting

Item 2: Madrid Forum Feedback and Update on Hydrogen for Europe Study

On the Madrid Forum Report:
CS Gave an update on the CCS and CCU study presented at the Madrid Forum on June 5th to the Forum and the European Commission.

The report was received well, and IOGP have had several follow-up meetings with DG ENER to discuss the role of CCS and CCU in the next gas package. Senior commission officials have been presenting on the importance for investment in CCS Transport and Storage infrastructure.

DG ENER see the industrial cluster model for CCS and CCU as the most achievable pathway for deployment, and are seriously considering the inclusion of CO2 transport in the future gas package(s), following the key recommendations of the report.

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The report has also been well received by the membership of the Madrid Forum, with many gas infrastructure companies actively looking at CO2 transport infrastructure as well as the future role of hydrogen in a European distribution system. This has increased the business opportunities for CO2 transport with DSOs and TSOs, including repurposing selected infrastructure for CO2 or H2 use.

CS mentioned that the Commission are particularly interested in the role of synthetic methane as a means to preserve current gas assets.

In October conclusions from the Madrid Forum should be published.

On the Hydrogen for Europe Study

Phase 1 is nearing completion, and consisted of an extensive literature review and some modelling.
Phase 2 will begin in October 2019, this will concentrate more on infrastructure requirements and a hydrogen deployment pathway to a net-zero 2050 Europe.

The group raised several questions about the Hydrogen for Europe study. Including presenting hydrogen as 'not so green', and encouraging IOGP to be aware of the generation footprint for electrolysers. CS took onboard feedback, and confirmed that H2 leakages have been included in the emissions footprint of the technology.

Item 3: ISO/TC 265: Update on developing International Standards for CCS

OdE presented on the ISO/TC 265 on CCS Standards. In the most part the presentation concentrated on the Working Group 4, Quantification & Verification, of which OdE is the lead.

4 main issues of the WG4 were presented:
CO2 vs GHG; CO2 Emissions Reductions; Boundaries; Principles.

The Boundaries issue, relates to proposed figures and how to include CO2 sources and potential quantification of CO2 emissions from a full chain CCS system. It is still in review.

Principles outlines some heading of 'Clause 5', which have been debated and opposed by Norway, Saudi Arabia and the USA, although this clause has been identified as essential to help build public perception, openness and trust.

OdE keenly highlighted the role the European Nations could play in 1) engaging with the ISO process, currently only Nor, Fra and Ger are active in this group. 2) When engaged, presenting a united front for votes/proposals. If only 8 nations vote with a united opinion, in OdE view this will be sufficient to pass almost all votes (as a simple majority is needed and only around 15 nations are present in any one vote).

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The group agreed that this could be very worthwhile, in establishing a global standard which aligns with European opinion. The secretariat will engage with the commission to establish whether this process is tracked internally, and discuss how the Commission could help to mobilise a united European input to the ISO 265 process.

ACTION: ZEP to approach the commission to inquire about their knowledge and interest in the ISO 265 process

ACTION: A table summarising the current opinions of contributing nations in WG4 to be drafted by OdE for the group.

Item 4: Discussion on CO2 Transport in; 1) The EU ETS; 2) The London Protocol

ET presented a summary of CO2 transport in the ETS and potential solutions (pros and cons) to resolve CO2 transport via shipping/freight.

ET informed the group that when the CCS directive was drafted, both shipping and pipelines were considered, however only pipeline transport in full chain projects were incorporated.

Furthermore, from 2030, when the next phase of the ETS begins, and amendments can be tabled, there should be no issues. However, projects relying on shipping/freight before 2030 have a regulatory risk associated with the projects (e.g Northern Lights, Dunkirk, Ruhr Valley, Ervia CCUS etc).

The group agreed that this issue is preventing projects scaling up/allowing for ambitious phasing plans. A map overlaying potential clusters/emissions density and shipping suitability would be useful (some of which have been mapped by the Dutch and Bellona previously).

ET suggested that one possible evidence piece could present the total amount of CO2 potentially abated by a shipping CCS project by 2030 if the ETS clarified CO2 transport for other uses.

LE highlighted that for the Northern Lights projects, one way of including shipping was to define the shipping process from a capture facility as part of the capture process, and the metering only occur from the point of docking. This would restrict each emitter to have a standalone vessel. It is an intermediate solution which will bring online 1 or 2 large emitters. A letter to the relevant Commission authority has been sent by the project pending approval.

The group agreed that changing the CCS Directive and ETS through a parliament process would not be optimal, and perhaps risk unwanted changes. The letter sent to DG CLIMA should be located, and ZEP should provide a position supporting this letter and encourage other member states to do so (Ire, Ger, Bel, Fra, Ned).

ACTION: ZEP to locate the letter sent on the ETS by the Northern Lights project. And encourage the recommendations to be realised.

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LE – Update on the London Protocol on the Vienna Convention. If this agreed without objection, after October, any country ratifying London Protocol can export CO2. This will be tabled with Germany, Netherlands, Norway and the UK. If a vote is decided the resolution may be withdrawn for a year of support building. Hard work with Norwegian Ministry of Petroleum and Energy have been solving. Germany are also preparing ratification for London Protocol.

KBB – For Northern Lights partners this is critical for FID which many companies are doing in Q2 2020. This may inhibit/cause withdrawal of projects.

BM – Confirmed that this issue is tabled with the Irish Government.

Item 5: NWPE Update

LE – PCI update. 5 CO2 transport projects submitted applications, all accepted (PORTHOS, CO2SAPLING, ATHOS, Northern Lights, Ervia). Pending acceptance of the entire list of all PCI later in the year (October if no delay)

BM – CEF could be early summer 2020 for next call – after the acceptance of the 4th PCI list.

JH – The money for PORTHOS is very helpful as now they can use budget to outreach to Antwerp and into Germany.

On I.F. Workshop

General update on IF process.

LE – Workshop is an opportunity for CCS to really benefit from Innovation Fund from the first call. This is a CCS focussed workshop, CCU will run a workshop facilitated by CO2Value Europe.

JH – This will be quite critical to get right the first time. Especially important with the presence of the EIB (or future Climate Investment Bank). As highlighted in the EU Auditors report, now DG CLIMA are more on board to assist than in NER300 scheme.

Item 6: Chairs Update

GS - Highlighted the need for a forward focus on action in the remainder of the year.

For sustainable finance taxonomy group, it is open for consultation. A circular with slides and notes will be distributed to the TWG Sustainable Finance very shortly.

The TEG welcomes feedback on the spreadsheet calculations and the philosophy, either directly through Graeme or through consultation response. CCS location in the report in mitigation actions and it applies to other economic activities to reach their thresholds and it is well described.

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For manufacturing and hydrogen it is explicitly mentioned that CCS can be applied to activities to reaching thresholds.

CCU is not included in the taxonomy currently because it has not been fully assessed and cannot be agreed on how a Life Cycle Analysis should be included. CCU processes included in industrial processes already described in manufacturing piece looking forward would be closest to qualifying depending on the LCA.

Our community needs to progress work on LCAs. Do no significant harm needs to be resolved before the nuclear issue is included, this split the council of ministers (French not pleased, Germany were content with the outcome). ZEP will need to keep engaged with the process.

Consultation process is primarily aimed at the commission not at the TEG. CCU, refineries, waste-to-energy are all activities not currently included in the taxonomy. A process of governance of this taxonomy will need to be established. The TWG need to think about this governance process, how to assess/reassess activities, and how these are potentially included in the taxonomy. Pathways for delivery of the Taxonomy is unclear and this could be reacted to in the consultation.

ACTION: distribute sus tax papers to the NWPE wider group as well as the TWG Sus Tax.

ERG engagements improved wording on LTS after engagement with Romanians.

Successful interactions with DG GROW. Including an official contribution to the HLG EII.

ACTION: Distribute the contribution papers with the group on NECPs, HLGEII.

LE – UK have taken into law net-zero 2050. New Commissioner has similar views and increasing ambition. It would be valuable to think about how to use this as a foothold to encourage investment in CCS to reach these targets. GS – Agreed, this links with capture rate work in NWT. TWG on LCA meeting in September to resolve our position on this, NWPE will be required pending the result of this.

LE – will the new net-zero targets need new ZEP modelling in 2020. GS – Would aim to do just transition, climate target scenario rather than a technical study. LE – if 2030 and 2050 goals are to be sharpened, that undermines current references which are in the public space. GS – Moving to 45 to 55% reductions will have profound effects for a 2030 target. LE – To achieve 55% without CCS is nearly impossible.

GS – a lot of work in Autumn will be in improving/continuing relationship with European officials. This will require new/repeat work. NWPE will have a key role to play in answering these questions.

GS – IWG9 underway with Secretariat functional. Common communications agenda with other CCS platforms is an ongoing discussion. GS is keen to get a review of NECPs and how the member states will achieve these goals.

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Item 7: Next Steps

ET – In the consultation response for the Sus Tax. Waste to energy is difficult to handle, however it could be useful to recommend the use with CCS for negative emissions potential.

ACTION: Secretariat to distribute the summary of the Innovation Fund Workshop for a round of comments. Ahead of the September Advisory Group.

ACTION: Distribute the CCU workshop to the network in association with the CCS Innovation Fund Workshop.

Next date was decided for October 24th.

Actions

Action		Owner	Completed
3	Approach Commission to engage with ISO Standards Process	ZEP Sec	
4	Find Northern Lights, ETS letter destination in DG CLIMA.	KBB, LE & ZEP Sec	
5	Distribute Summary of I.F. Workshop for comments ahead of AC60	ZEP Sec	
5	Distribute CCU and CCS Innovation Fund Workshop to the Network	ZEP Sec	
6	Distribute ZEP work on Sustainable Taxonomy, HLGEII, draft NECPs comments	ZEP Sec	

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CCS ISO TC 265 WG4 countries opinions on key issues (Annex to presentation 18/07/2019)

Key issues in TC265 WG4	Opinions	
	In Favour	Against
Quantify all GHGs	France, Germany, China, Japan, Australia, Canada	USA, Norway & Saudi Arabia
Quantify emission reductions	France, Germany, China, Japan, Australia, Korea	USA, Norway & Saudi Arabia
Quantify energy consumption	France, Germany, China, Japan, Australia, Korea	USA, Norway & Saudi Arabia
Illustrate boundaries for emissions from CCS projects	France, Germany, China, Japan, Australia	USA, Norway & Saudi Arabia
Include principles (stating desirable behaviours)	France, Germany, China, Japan, Australia, Korea	USA, Norway & Saudi Arabia

State Aid Fitness Check

Response from the Zero Emission Technology and Innovation Platform (ZEP)
10th July 2019

Effectiveness

Have the objectives been met?

In this section, we would like to have your opinion on the extent to which the State aid rules subject to the current Fitness check met their objectives.

1.Based on your experience, has the State aid modernisation package led to clearer rules? (Y, N, I Dont Know, Partially, Not relevant. If no/partially Explain 5000 characters)

- **General Block Exemption Regulation**
- **De Minimis Regulation**
- **Regional Aid Guidelines**
- **Research Development Innovation Framework**
- **Important Projects of Common European Interest Communication**
- **Risk Finance Guidelines**
- **Airport and Aviation Guidelines**
- **Energy and Environmental Aid Guidelines ---- IDK**
- **Rescue and Restructuring Guidelines**
- **Railways Guidelines**
- **Short Term Export Credit Communication**

I Don't Know:

It is difficult to assess the impact of the State Aid Modernisation Package as, to date there has been a very limited development of CCS and utilisation of State Aid rulings on the topic.

1.2. Which specific areas still remain unclear / could be clarified to improve the implementation? (3000 Characters)

Currently, the interaction between different elements of State Aid Rules remains unclear. For CCS there are a number of dimensions which relate to State Aid guidelines:

1. Technological support to fund new, state-of-the-art and first of a kind projects which help achieve greenhouse gas emissions under the EEAG, for example CCS.
2. Infrastructure development support for the cross-border construction of CO2 pipelines which are key to enabling CCS deployment at scale in Europe. These infrastructure projects can be considered eligible under the IPECI, EEAG, Regional Aid, and as Projects of Common interest under CEF funding.

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3. Regional Aid to support the transition to low-carbon industry and economy. For heavy industry regions transition to a low-carbon economy Regional Aid may become an increasingly important source of funding. These heavy industry regions or clusters are ideal for CCS to help decarbonise hard to abate sectors, such as steel, glass and ceramics, whilst maintaining international competitiveness. In a scenario with Regional Aid and State Aid for CCS in the EEAG, it is still unclear as to how these mechanisms will interact.

Overlapping eligibility creates uncertainty and risk for projects. Clarity on how these guidelines will interact will encourage investment and help enable deployment of CCS projects in Europe.

4. Based on your experience, have the State aid rules reduced the risk of subsidy races in the EU? For example, by setting maximum ceilings for public support, by laying down the conditions at EU level to grant public support, or by increasing the transparency of public support. (Y, N, I Dont Know, Partially, Not relavent. If no/partially Explain 5000 characters)

- **Rules for the categories of aid covered by the General Block Exemption Regulation**
- **Rules for De minimis aid**
- **Rules for aid for development in assisted areas**
- **Rules for aid for research, development, innovation**
- **Rules for aid for important projects of common European interest**
- **Rules for aid for access to finance for SMEs ***
- **Rules for aid for airports and aviation**
- **Rules for aid for energy and environmental protection (Partially)**
- **Rules for rescue and restructuring aid**
- **Rules for aid for railway and coordination of transport**
- **Rules for aid for short term export credit**

For Energy and Environment Protection (Partially)

State Aid is needed to support the deployment of new first of a kind and state-of the art technologies such as CCS and CCU. However, this has not come to realisation for CCS and CCU in Europe. As highlighted in response to Question 2 there is uncertainty on the State Aid process, for CCS projects this may have hindered development and increased a layer of project investment risk.

Furthermore, it is still unclear as to how state aid will be treated, including the mechanisms for awarding of aid; for example; whether funding is received upfront, during construction, or received post-construction, for a project in concept state this is an uncertainty which adds another level of risk to projects and is ultimately an inhibitor to development.

6. Based on your experience, have the State aid modernisation or the State aid rules under evaluation had any positive or negative impacts that were not expected or not intended? Please explain and reference the rules in question (5000 Characters)

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Currently the state aid guidelines for CCS (see Section 3.6, Energy and Environmental Protection Guidelines) are too technically narrow, and do not allow for future innovation or whole chain design flexibility. The guidelines as it stands assume a capture plant which feeds into CO2 transport and storage infrastructure, with a CO2 capture module/facility as additional to the CO2 emitting process. It is possible that CO2 capturing facilities can be an integral component of an industrial process, rather than additional.

For the first CCS projects in Europe, support will be required to help finance the transport and storage infrastructure. It is not clear if CCS transport and storage infrastructure is encompassed in the Infrastructure Guidelines or the State Aid Guidelines, specifically Section 3.6 of the Energy and Environmental Aid Guidelines. This is of particular importance as extra investment is required which can facilitate the oversizing of infrastructure essential to realise the economies of scale from CCS deployment.

7. Since mid-2016, the details of all individual State aid awards above EUR 500,000 are published on a public website.

7.1. Did the publication of individual awards above EUR 500,000 contribute to reaching the following objectives? (to a large extent, some extent, not at all, i don't know, explain 1000characters)

- **To promote accountability and enable citizens to be better informed about public policies and spending**
- **To enable companies to check whether legal aid was granted to competitors**
- **To reduce the administrative burden of Member States as regards reporting to the Commission State aid expenditure**

To A Large Extent

The publication of individual awards above EUR 500,000 is encouraged as good practice as it helps achieve the above outlined targets. This is particularly of importance for the deployment of innovative technologies such as CCS, which can benefit most from early project knowledge sharing and reduced administrative commitments.

7.2. Is the EUR 500,000 threshold appropriate to achieve the desired objectives listed above? (yes, too high, too low, i don't know, Explain 3000characters)

I Don't Know

The majority of CCS, CCU and low-carbon hydrogen projects require funding support which far exceeds the EUR 500,000 threshold. As such we are unable to make a statement on whether the EUR 500,000 is appropriate, too high, or too low.

8. Since mid-2014, the largest (annual average budget above EUR 150 million) State aid schemes are subject to ex-post evaluation studies to assess their effectiveness. Do you

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think that this threshold is appropriate? (yes, too high, too low, i don't know, explain 3000 characters)

I Don't Know

Relevance

Is EU action still necessary?

In this section, we would like to understand if the State aid rules analysed under the Fitness check are still relevant considering the changes in EU priorities and/or new market and technological developments

11. Based on your experience, how well do the objectives of State aid modernisation and of individual State aid rules still correspond to the current EU priorities?

11.1. On the State aid modernisation as a whole (fully, Partially, not at all, i don't know, explain 3000characters)

Partially

One of the 10 EU priorities for the 2014-2019 period is '*Making energy more secure, affordable and sustainable'* within this priority is a policy aim to **decarbonise the economy to help fulfil the EU's commitments to the Paris Agreement**.

Although State Aid Guidelines exist for CCS technology, as mentioned in response to Question 1, there has been limited uptake of CCS in Europe. As a result, recent studies suggest that wide scale deployment CCS is now becoming increasingly urgent for Europe to achieve its commitments to the Paris Agreement[1][2][3]. Widespread deployment of CCS at scale will be an important target over the next EU priority period if the EU is to be placed on the correct trajectory to achieve its climate targets.

11.2. On the individual rules (full, partially, not at all, i don't know, not relevant, if no/partially 5000 characters)

- **General Block Exemption Regulation***
- **De Minimis Regulation**

[1] Energy Transition Committee, 2017. Better Energy, Greater Transition.
Available at: http://energy-transitions.org/sites/default/files/BetterEnergy_fullReport_DIGITAL.PDF
[2] Material Economics, 2019. Industrial Transformation 2050: Pathways to Net-Zero Emissions from EU Heavy Industry
Available at: https://materialeconomics.com/material-economics-industrial-transformation-2050.pdf?cms_fileid=b9785e8b652ba47f227181543fc5d1e8
[3] IPCC, (2018) Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report*
Available at: https://www.ipcc.ch/sr15/

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- **Regional Aid Guidelines**
- **Research Development Innovation Framework**
- **Important Projects of Common European Interest Communication**
- **Risk Finance Guidelines**
- **Airport and Aviation Guidelines**
- **Energy and Environmental Aid Guidelines**
- **Rescue and Restructuring Guidelines**
- **Railways Guidelines**
- **Short Term Export Credit Communication**

Partially for the Energy and Environmental Aid Guidelines

The deployment of widespread renewable energy has been a success across Europe to help decarbonise the electricity generation sector. However, for CCS (Section 3.6 of the Energy and Environmental Aid Guidelines), the State Aid policy has not proven a success due to a lack of uptake of CCS projects in Europe.

As mentioned in Questions 4 & 6, the State Aid Guidelines do not provided clarity, and as a consequence increased uncertainty and investment risk. Furthermore, given the increasing necessity for CCS, the current Energy and Environmental Aid Guidelines will need to consider updated flexibility for investment in CCS and CCU, including:

- Technological flexibility to enable investment in new CO2 capturing, transport, and storage technologies. For example, following technological capture advancements, the CO2 capture process could now be envisaged as integral to certain manufacturing process, not additional (as highlighted in Paragraph 165, Section 3.6 of the Energy and Environmental Aid Guidelines).
- Part-chain CCS investment to enable separate investment in an individual component link of the CCS chain, rather than the whole chain, as envisaged in the EEAG.
-
- Funding support for infrastructure oversizing. To ensure all possible CO2 emitters with capture facilities can geologically store their CO2 emissions, support will be required to enable the oversizing of early project infrastructure. This oversized infrastructure will then have sufficient capacity to remove CO2 as an increasing number of emitters construct capture facilities and look to regional CO2 pipelines to move captured emissions to the storage site(s).

12. Based on your experience, how well adapted are the following State aid rules to recent developments in markets and technology? (Fully, Partially, Not at all, I don't know, Not relevant, if not/partially explain 5000 characters)

- **General Block Exemption Regulation**
- **De Minimis Regulation**
- **Regional Aid Guidelines**
- **Research Development Innovation Framework***

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- **Important Projects of Common European interest Communication**
- **Risk Finance Guidelines**
- **Airport and Aviation Guidelines**
- **Energy and Environmental Aid Guidelines**
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- **Railways Guidelines**
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On a global scale the European deployment of CCS is lagging behind the curve compared to other nations, including Canada and the United States of America. As mentioned in response to Question 11, this leaves the EU with an increasing necessity for CCS to achieve its climate goals whilst maintaining industrial targets in a 'just transition'.
The State Aid Rules are not well developed to accommodate potential technological and design innovation for CCS (Section 3.6 Energy and Environmental Aid Guidelines); this has been highlighted in responses to Questions 4 & 6. Should more clarity be provided, this will help State Aid play an important role in initiating the vast changes required to achieve the energy transition in Europe, and deliver on the EUs climate goals for a net-zero Europe in 2050

Coherence

Does the policy complement other actions or are there contradictions?

In this section, we would like to understand the extent to which the State aid rules subject to the current Fitness check are coherent with each other and with other EU rules

13. Based on your experience, are the State aid rules subject to the current Fitness check coherent with each other? (fully, partially, not at all, i don't know, if no/partially explain 5000 characters)

No

As mentioned in response to Question 1.2, the interaction between different elements of State Aid Rules remains unclear. For example if a CCS or low-carbon hydrogen project is accepted as a priority for development as a value chain in a **IPCEI**, how does this interact with the CCS state aid guidelines outlined in **Section 3.6 of the EEAG**.

Furthermore, as heavy industry regions transition to a low-carbon economy **Regional Aid** may become an increasingly important source of funding. These heavy industry regions or clusters are ideal for CCS to help decarbonise hard to abate sectors, such as steel, glass and ceramics, whilst maintaining international competitiveness. In a scenario with **Regional Aid** and State Aid for **CCS in the EEAG**, it is still unclear as to how these mechanisms will interact.

14. Based on your experience, to what extent are the State aid rules subject to the current Fitness check coherent with changes in EU legislation which have occurred since the State

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aid rules were adopted (such as for instance in the Cohesion and Regional policy, Research and Innovation, Energy Union and Climate, Environmental protection and Circular Economy, Entrepreneurship and SMEs, Capital Markets Union, Investment Plan for Europe)? (fully, partially, not at all, i don't know, not relevant, if no/partially 5000 characters)

- **General Block Exemption Regulation**
- **De Minimis Regulation**
- **Regional Aid Guidelines**
- **Research Development Innovation Framework**
- **Important Projects of Common European interest Communication**
- **Risk Finance Guidelines**
- **Airport and Aviation Guidelines**
- **Energy and Environmental Aid Guidelines**
- **Rescue and Restructuring Guidelines**
- **Railways Guidelines**
- **Short Term Export Credit Communication**

I Don't Know

Since the State Aid Rules were adopted, the discussion on the Energy Union and Climate has proceeded at a significant pace. It is now widely accepted that net-zero emissions in Europe by 2050 should be strived for. State aid will play a key role in enabling a just transition in a net-zero Europe. However, the guidelines must be clear, coherent, and consistent across sectors to ensure the State Aid Guidelines are an enabler, not a hindrance towards 2050 climate targets.

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No Answer from ZEP

2. Based on your experience, did the factors below facilitate the compliance with the State aid rules by the Member States? (Y, N, I Dont Know, Partially, Not relevant. If no/partially Explain 5000 characters)

- Clear definition of the scope of the rules by excluding sectors or types of aid and clear definitions of those sectors and types of aid that are excluded
- Clear definition of the scope of the rules by explaining the overlaps between the different rules
- Common principles to assess the compatibility of the State aid measures
- Clear rules to identify the need for State intervention
- Clear rules to identify the incentive effect of the aid measure
- Clear rules to ensure that the aid is limited to the minimum necessary
- Clear rules to identify the distortive effects of the aid measure 8
- Publication of aid awards above EUR 500,000 on a public webpage
- Evaluation of novel or large schemes with budgets above EUR 150 million
- Clear and simplified definition of a company in difficulty
- Simplified rules for projects that are financed with EU funds (including structural funds)
- Simplified rules for SMEs

2.2. Please mention any other factors that led EU Member States to being more compliant with the State aid rules (3000 characters)

3. Based on your experience, since 2014 has the Commission focused its scrutiny on cases having a significant impact on the internal market?

3.1. For the State aid modernisation as a whole (yes, no, partially, I don't know) (3000 characters)

3.2. Have the scope and notification thresholds for the following types of aids allowed the Commission to focus its scrutiny on cases with a significant impact on the internal market? (Y, N, I Don't Know, Partially, Not relevant. If no/partially Explain 5000 characters)

- Scope and amounts under the De minimis Regulation
- Scope and notification thresholds under the General Block Exemption Regulation (in general)
- Scope and notification triggers for aid for regional development in assisted areas
- Scope and notification thresholds for aid for research, development, innovation
- Scope and notification thresholds for aid for SME access to finance
- Scope and notification thresholds for aid for airports and aviation
- Scope and notification thresholds for aid for energy and environmental protection
- Scope for aid for Important projects of common European interest
- Scope for aid for rescue and restructuring firms in difficulty
- Scope for aid for railways
- Scope for aid for short term export credit

5. Based on your experience, to what extent have the State aid rules achieved the objectives listed below while maintaining a competitive internal market? [see consultation document for questions 5.1 -5.13]

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9. Based on your experience, to what extent have the following State aid rules ensured efficient State expenditure? (to large extent, some extent, not at all, i don't know, not relevant, where you answered not at all or to some extent and reference the respective rules – 5000 characters)

- General Block Exemption Regulation
- De Minimis Regulation
- Regional Aid Guidelines
- Research Development Innovation Framework
- Important Projects of Common European Interest Communication
- Risk Finance Guidelines
- Airport and Aviation Guidelines
- Energy and Environmental Aid Guidelines
- Rescue and Restructuring Guidelines
- Railways Guidelines
- Short Term Export Credit Communication

10. Based on your experience, have the State aid rules subject to the current Fitness check reduced the administrative burden compared to the State aid rules in force before the State aid modernisation? (yes, partially, no, i don't know, not relevant. For no/partially –explain 5000 characters)

- For the public authorities
- For the beneficiaries

15. Based on your experience, have the State aid rules subject to the current Fitness check helped to deliver EU policies more efficiently? (yes, partially, no, i don't know, if no/partially - explain 3000 words)

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Targeted Consultation for the Evaluation of the Guidelines on State aid for Environmental protection and Energy 2014-2020 (EEAG)

Response from the Zero Emission Technology and Innovation Platform (ZEP)
10th July 2019

Effectiveness:

In this section, we would like your opinion on the extent to which the State aid Guidelines for environmental protection and energy (EEAG) and the provisions applicable to aid for environmental protection (which include provisions on energy) (Section 7) of the General Block Exemption Regulation (related GBER provisions) have achieved their objectives and delivered results.

1. Based on your experience, to what extent have the EEAG and the corresponding GBER provisions (e.g. tendering, technological neutrality, market integration) been effective in:

- **enabling the deployment of renewables while lowering societal costs and reducing the amount of aid needed?**
- **facilitating the integration of renewable energy into the electricity market?**
- **ensuring financing of support schemes to renewable energy sources, while limiting negative impacts on the competitiveness of EU firms?**
- **ensuring that capacity mechanisms were necessary and cost effective in providing security of supply and least-distortive to competition and intra-EU trade?**
- **ensuring that capacity mechanisms did not negatively impact the objective of phasing out environmentally harmful subsidies including for fossil fuels?**
- **ensuring that in cogeneration and district heating the most cost efficient projects could be realised?**

Please explain (10,000 Characters):

The State Aid Guidelines for EEAG have been incredibly successful for low-carbon technologies which have a positive impact for the environment. This is exemplified by the rapid and widespread uptake of onshore and offshore renewable electricity generation, where state aid has driven cost reductions and lowered societal costs.

As the EU looks to its 2030 climate and energy targets, State Aid will have an increasingly important role in addressing new challenges, not just renewable electricity generation, but for low-carbon electricity generation, decarbonisation of industry, heat and transport.

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5. Based on your experience, has State aid granted under the EEAG or the GBER generally achieved the relevant climate and environmental protection objectives while maintaining a competitive internal market? (1000 Characters)

State Aid for CCS is yet to prove its value in achieving the Climate and Environmental Protection Objectives. The practical experience from CCS projects is that the state aid process places a not insignificant financial cost and time delay to projects applying for aid.

The Guidelines for CCS (Section 3.6 EEAG) as they are currently written follow a rigid structure for the CCS chain. For example, capture technologies are seen as an accessory to current manufacturing processes (paragraph 164 & 165). In truth, both now and in the future, CO2 capture can be an integral part of the production process; therefore, the capture facility will not be additional to the process and be excluded from state funding.

Furthermore, when the Guidelines were written, CCS projects were seen as an integrated project with capture, transport and storage all within one project. Recently, it has become prevalent that an investment model can envisage investment in separate parts of the CCS chain.

Enabling flexible investment in part of the CCS chain and allowing state aid for integrated processes will help encourage investment in CCS. Widespread investment and deployment of CCS with state aid assistance will help achieve the EUs climate objectives and stimulate an internal market.

7. Based on your experience, have there been any unexpected or unintended results from the implementation of the EEAG and the corresponding GBER provisions? (1000 Characters)

The EEAG for CCS has unintentionally introduced the perception of additional project risk, and inhibited investment. For the delivery of projects this is not helpful for securing a wide profile and pipeline of projects which will help to achieve the EU climate and energy goals.

13. Based on your experience, has the higher aid intensity allowed under point 78 of the EEAG been adequate to address the double market failure linked to the higher risks of innovation and the environmental aspects of the project without creating unnecessary distortions of competition? (yes, Not adequate (too low), not adequate (too high), I don't know. (1000 characters))

Yes

The higher aid intensity allowed under point 78 of the EEAG is particularly important for CCS projects. The clarity allowing 100% aid intensity for CCS projects of all sizes is welcomed and essential to enable the deployment of CCS in Europe.

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Efficiency:

In this section, we would like to know your opinion about the efficiency of the EEAG and the related GBER provisions.

14. Based on your experience, to what extent are the different compatibility conditions and methodologies included in the EEAG and the GBER related provisions sufficiently clear and easy to apply (Yes, No, I Dont Know: explain 5000 characters):

- **in general terms?**
- **as regards the methodology for calculating eligible costs for investment aid to go beyond standards, in the absence of standards and early adaptation to standards under Article 36 of the GBER and points 73 to 75 of the EEAG?**
- **as regards the criteria for limiting bidding processes for renewables to specific technologies (see EEAG point 126 and GBER Article 42.3)?**
- **as regards the methodology for calculating eligible costs for investment aid to renewables and co-generation (CHP) projects?**
- **as regards the methodology to assess proportionality of aid based on levelised cost of energy (see point 131 of the EEAG and Article 43, paragraphs 5 and 6 of the GBER)?**
- **as regards the provisions for demonstration projects (as defined in point 19 paragraph 45 of the EEAG) and for the new and innovative renewable energy technologies (see Article 42.4 of the GBER)?**
- **as regards the methodology to assess eligible costs for energy-efficiency investment aid under Article 38 of the GBER?**
- **as regards the compatibility conditions (in particular the full passing on, the leverage condition, the conditions imposed on the financial intermediaries) for energy efficiency projects in buildings (see paragraphs 4 to 10 in Article 39 of the GBER)?**
- **as regards the compatibility conditions for aid for Resource Efficiency (section 3.5.1 of the EEAG read in combination with section 3.2 of the EEAG)?**
- **as regards the compatibility conditions (in particular the "state of the art" requirement, the "polluter pays principle" and the "treatment of the waste of others") for waste management projects under 47 of the GBER and section 3.5.2 of the EEAG?**
- **as regards the methodology for calculating eligible costs for waste management projects under Article 47 of the GBER and section 3.5.2. of the EEAG?**
- **Other (please specify)**

As regards the provisions for demonstration projects (as deined in point 19, paragraph 45 of the EEAG) and for the new and innovative renewable energy technologies? NO

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Point 19 Definition 45 states: " 'demonstration project' means a project demonstrating a technology as a first of its kind in the Union and representing a significant innovation that goes well beyond the state of the art."

Carbon capture and storage and climate abating carbon capture and utilisation technologies are representative of a complex cross sectoral chain encompassing a large variety of processes. There are opportunities for multiple first of a kind (FOAK) demonstration projects to provide state of the art technological advancement across the CCS chain.

Subsequent CCS projects after the first project may demonstrate several FOAK and state of the art technologies. As it is currently written, the definition of demonstration project for CCS and CCU can lead to the assumption that the first CCS project will be considered the FOAK for all technologies which fall under the CCS and CCU umbrella. This adds uncertainty and does not encourage applications for support for demonstration projects which may represent a part of a complex chain of new technologies.

The current model assumes that a CCS is a full chain system point to sink system where capture facilities are additional to a process. However, for decarbonisation of industrial regions, CO2 transport and storage infrastructure will most likely receive CO2 from a multitude of capture facilities. The State Aid Guidelines using eligibility costs does not consider how enabling the construction of infrastructure, such as pipelines and injection facilities, may benefit the decarbonisation of several industrial processes.

Relevance:

16. Based on your experience, have the EEAG and GBER adequately addressed recent market developments or technological changes such as: (yes, no, partially, I don't Know, explain 5000 characters)

- **Storage**
- **Zero subsidy bids**
- **Repowering**
- **Renewable energy power purchase agreements**
- **Renewable self consumption and/or active consumers**
- **Citizens energy communities and/or renewable energy communities**
- **Hydrogen, synthetic fuels and low carbon gas**
- **Alternative fuel infrastructure (publicly accessible or dedicated infrastructure)**
- **Low or zero emission vehicles**
- **Carbon Capture, Storage and/or Utilisation**
- **Nearly-zero-energy buildings**
- **Smart energy technologies (e.g. in buildings)**
- **Energy services (e.g. energy performance contracting)**

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- **Advanced technology for water reuse (e.g. membranes and UV)**
- **Other (please specify)**

NO

The EEAG and GBER have not adequately respond to the recent technological changes and increase in scope seen in the CCS, CCU and hydrogen sectors.

When the State Aid Guidelines were drafted CCS was primarily seen as a technology to produce low-carbon electricity, with the transport and storage infrastructure tied to a gas or coal fired power plant. CCS is still an important option to decarbonise electricity. As shown by recent studies, CCS is now concluded as an essential technology to decarbonise industry[1] and hydrogen production[2].

The State Aid Guidelines has no scope for CCU technologies. We encourage the Commission define a life cycle analysis methodology which will enable a quantification of the climate abatement potential of different CCU technologies. For future State Aid guidelines, CCU products which have significant carbon abatement, or 'sink factor'[3] should be considered for State Aid.

State Aid needs to include and encourage technologies which can permanently remove CO2 from the atmosphere, also known as negative emissions technologies. The IPCC 1.5ºc report[4] and many scenarios proposed in the EU LTS rely on negative emissions technologies especially to address residual emissions, notably from agriculture[5].

There are limited options for enabling negative emissions: land use change and afforestation can, and must play a key role, as can bioenergy coupled with CCS (BECCS) when used in combination with industrial processes, such as steel and cement production. Direct air capture of CO_2 combined with CCS may also have an important role to play.

17. To what extent do recent economic developments – such as the falling renewable energy costs and possible changes to trade intensity and electro intensity of the sectors concerned – impact the relevance of the rules which apply to reductions for energy-intensive users (EIUs)? (to a large extent, to some extent, not at all, i don't know, explain 3000 characters)

[1] Material Economics, 2019. Industrial Transformation 2050: Pathways to Net-Zero Emissions from EU Heavy Industry
Available at: https://materialeconomics.com/material-economics-industrial-transformation-2050.pdf?cms_fileid=b9785e8b652ba47f227181543fc5d1e8

[2] Navigant 2019. Gas for Climate: The optimal role for gas in a net-zero emissions energy system.
Available at: https://www.navigant.com/-/media/www/site/downloads/energy/2019/navigant2019gasforclimateoptimalrolenetzeroemissio.pdf

[3] ZEP, 2017. Sink factor methodologies.

[4] IPCC, 2018. Summary for Policymakers. In: *Global Warming of 1.5°C. An IPCC Special Report*
Available at: https://www.ipcc.ch/sr15/

[5] European Commission, 2018. A Clean Planet for all A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy.
Available at: https://ec.europa.eu/clima/sites/clima/files/docs/pages/com_2018_733_en.pdf

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- **Falling costs of renewable energy producers**
- **Changes to the trade intensity of the sectors listed in Annex 3 and 5 of the EEAG**
- **Changes to the electro intensity of the sectors listed in Annex 3 of the EEAG**
- **Other (please specify)**

Other: Necessity for CCS

To some extent

The fall in renewable energy costs as mentioned previously are welcomed and a success of the State Aid scheme. However, increased reliance on renewable energy alone is not sufficient to enable energy intensive industries (EIIs) to transition to a low-carbon future.

Energy intensive industries currently emit 500 million tonnes of CO2/year in Europe, accounting for 14% of total EU emissions. Studies have shown that to decarbonise these energy intensive industries alone using renewable electricity would require an increased renewable generation capacity of over 700TWH of electricity, more than the total generation capacity of Germany today[6]. State Aid supporting CCS will play a vital role for the future of energy intensive industries. CCS is essential to decarbonise EIIs in a cost effective manner, whilst retaining output and competitiveness on a global scale[7][8][9].

[6] Material Economics, 2019. Industrial Transformation 2050: Pathways to Net-Zero Emissions from EU Heavy Industry
Available at: https://materialeconomics.com/material-economics-industrial-transformation-2050.pdf?cms_fileid=b9785e8b652ba47f227181543fc5d1e8
[7] Material Economics, 2019. Industrial Transformation 2050: Pathways to Net-Zero Emissions from EU Heavy Industry
Available at: https://materialeconomics.com/material-economics-industrial-transformation-2050.pdf?cms_fileid=b9785e8b652ba47f227181543fc5d1e8
[8] BDI (BDC), 2018. Klimpfade fur Deutschland.
Available at: https://bdi.eu/publikation/news/klimapfade-fuer-deutschland/
[9] Energy Transition Committee, 2017. Better Energy, Greater Transition.
Available at: http://energy-transitions.org/sites/default/files/BetterEnergy_fullReport_DIGITAL.PDF

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Not Answered by ZEP

2. Based on your experience, have Member States created a level playing field for imported and domestically produced biofuels and/or biomass energy when providing support (for instance by supporting a specific type of domestically produced biofuels and/or biomass energy, but not other types of biofuels and/or biomass energy with similar costs or greenhouse gases emissions)? (1000 Characters)
3. Based on your experience, to what extent has the GBER ensured public support for waste recycling while limiting the amount of aid to the minimum and limiting distortions of competition to the minimum? (1000 Characters)
4. Based on your experience, to what extent has Article 39 GBER (Investment Aid for Energy Efficiency Projects in buildings) allowed aid through financial instruments for energy efficiency measures in buildings while limiting distortions of competition at the level of the financial intermediary and the funds involved? (1000 Characters)
6. Based on your experience, has State aid granted under the EEAG or the GBER generally achieved the relevant energy objectives while maintaining a competitive internal market? (1000 Characters)
8. Are there sectors (at NACE 4 level[2]) and products (at Prodcom 8 level[3]) which, were included in the list of eligible sectors and products for reductions under section 3.7.2. of the EEAG (c.f. Annex 3 and Annex 5 of the EEAG), but which, according to your experience, were not particularly affected by the financing costs of renewable energy support and therefore were not put at a significant competitive disadvantage? (if Yes, list sectors & subsectors & substantiate (1000 Characters))
9. Are there sectors (at NACE 4 level[4]) or products (at Prodcom 8 level[5]) which, according to your experience, were particularly affected by the financing costs of renewable energy support and therefore were put at a significant competitive disadvantage, but were not included in the list of eligible sectors for reductions under section 3.7.2. of the EEAG (c.f. Annex 3 and Annex 5 of the EEAG)? (if Yes, list sectors & subsectors & substantiate (1000 Characters))
10. Based on your experience, have the minimum own contributions of the full electricity surcharges of 15 % of the full renewable surcharge, and 4 % and 0.5 % of the Gross Value Added of the undertaking concerned (see points 188 and 189 of the EEAG) been adequately set to ensure a sufficient financing basis for the underlying energy policy? (1000 Characters)

	Too High	Too Low	Adequate	I Dont Know
15% of full renewable surcharge				
4% of Gross Value Added				
0.5% of Gross Value Added				

11. Based on your experience, have the reductions in electricity surcharges given to energy-intensive users (EIUs) created market distortions? (Substantiate 3000 Characters)
12. Based on your experience, what impact have reductions granted to energy intensive users had on renewable energy charges and other relevant charges paid by non-energy intensive industrial consumers and households? (Substantiate 3000 Characters)
15. Based on your experience, how do administrative costs incurred by the aid application under the EEAG and GBER related provisions compare with the actual amount of compensation

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received? Please rate from very low (administrative costs representing less than 1% of the actual amount of compensation received) to very high (administrative costs representing more than 20% of the actual amount of compensation received) (table then Explain 1000 Characters):

	Very Low	**Low (1-5%)**	**Intermediate (5-10%)**	**High (10-20%)**	**Very High (20%+)**	**I Dont Know**
Proportion of administrative costs in total actual amount of compensation received						

18. Based on your experience, to what extent are the EEAG and the related GBER provisions coherent with relevant EU policies and legislation such as: (yes, No, Partially, I don't know, explain 5000 characters)

- Renewable Energy Directive Electricity Directive
- Electricity Market Regulation
- Risk-preparedness Regulation
- EU ETS Directive Industrial Emissions Directive
- Alternative Fuels Directive
- Energy Efficiency Directive
- Energy Performance of Buildings Directive
- EU Waste legislation
- Water Framework Directive
- Air Quality Directive
- Birds Directive
- Habitats Directive
- ERDF Regulation

Other (please specify

19. Have the EEAG and GBER rules on exemptions or reductions from energy taxation produced inconsistencies with other EU rules? (yes, no, partially, I don't know, explain 1000 characters)

- **Energy Taxation Directive**
- **Other**

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Innovation Fund Workshop for CCS

Agenda: 6th September 2019

Location: Room R5 D2511, Akersgata 59, Ministry of Petroleum and Energy, Oslo, Norway
09:00-15:00 CET

Item		Lead Presenter	Time
1	Introduction	Lamberto Eldering (ZEP Vice-Chair)	09:00 – 10:15
	Setting the Scene for the Innovation Fund Workshop	Christian Holzleitner (DG CLIMA)	
	Lessons learned from NER300 and the future role of EIB in supporting CCS projects	Roland Schultze (EIB)	
	Connecting Europe Facility: support to CCS projects and synergies with the Innovation Fund	Henriette Nesheim (DG ENER)	
2	Selection Criteria & Knowledge Sharing *Breakout Groups to Discuss*	All Attendees	10:15 – 11:45
	Sharing of Conclusions	*Facilitators*	
Lunch	*Sponsored by CCUS Project Network*		11:45 – 12:45
3	Milestones & Project Development Decisions *Breakout Groups to discuss*	All Attendees	12:45 – 14:00
	Sharing of Conclusions	*Facilitators*	
4	Overview of Projects (5mins per project)	Individual CCS Projects	14:00 – 14:45
5	Summary and AOB	Lamberto Eldering (ZEP Vice-Chair)	14:45 – 15:00

Ahead of the workshop a number of questions will be circulated to attendees. If you have not completed the questionnaire, could I ask for a response by COB Friday 13th September for input into the Commission.

If you have any additional input, please send to chris.gent@zeroemissionsplatform.eu

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Innovation Fund Workshop for CCS

Attendance List

Attendee		Organisation
De Buchet	Vianney	Air Liquide
Blinksbjerg	Peter	Amager ressourcecenter, ARC
De Coninck	Eric	Arcelor Mittal
Stuen	Johnny	City of Oslo - Waste to Energy Agency
Anker-Nilssen	Per	Confederation of Norwegian Enterprise
Connolly	Philip	Department of Communications Climate Action & Environment
Velkova	Maria	DG CLIMA
Holzleitner	Christian	DG CLIMA
Nesheim	Henriette	DG ENER
Helle	Kaare	DNV GL
Gow	Richard	Drax
Quale	Sverre	ECCSEL ERIC
Hole	Markus	EEAS
Marušic	Hrvoje	Embassy of Croatia
De Filippo	Renato	ENI
Paceviciute	Irma	Equinor
Sandberg	Per	Equinor
Eldering	Lamberto	Equinor
Murphy	Brian	Ervia
Schulze	Roland	European Investment Bank (EIB)
Frisvold	Paal	europeiskpolitikk.no
Van Dessel	Michiel	Exxon Mobil
Sopranzetti	Antonella	Exxon Mobil
Hanegreefs	Leander	Fluxys SA
Van Rompaey	Senne	Fluxys SA
Bjerkas	Jannicke	Fortum
Svalestuen	Jørild	Gassnova
Viumdal	Aslak	Gassnova
Turan	Guloren	GCCSI
Fischer	Almut	German Ministry of Economic Affairs and Energy
Theulen	Jan	HeidelbergCement
Schwarck	Christian	IOGP

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Habib	Ziad	lhoist
Chopin	Thierry	lhoist
Haselton	Tom	Minijos Nafta
Semundseth	Ragnar	Ministry of Petroleum and Energy
Svenningsen	Stig	Ministry of Petroleum and Energy
Shimamoto	Fumiharu	Mitsubishi Heavy Industries Group
Kakaras	Emmanouil	Mitsubishi Hitachi Power Systems Europe GmbH
Yde Aasen	Emil	Northern Lights
Wilhelmsen	Kjetil	Northern Lights
Hazell	William	Pale Blue Dot
Zaborowska	Katarzyna	PGE Polska Grupa Energetyczna S.A.
Van Kraaij	Hanna	Port of Antwerp
Demaerel	Anne-Frédérique	Port of Antwerp
Lundqvist	Karin	Preem AB
Van De Sande	Martijn	RVO
Bye Bruun	Kim	Shell
Riboldi	Luca	SINTEF
Bysveen	Marie	SINTEF
Jordal	Kristin	SINTEF
Hoff	Karl Anders	SINTEF Industry
Øye	Olav	The Bellona Foundation
Mikunda	Tom	TNO
Rycroft	Lydia	TNO
Seilhan	Bruno	Total
Hiegel	Jean-Philippe	Total
Guevara Opinska	Liliana	Trinomics
Granström	Per-Olof	ZEP
Gent	Chris	ZEP
Svendsen Skriung	Camilla	ZERO

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Questions by DG CLIMA for the CCS Innovation Fund Workshop

Could responses please be completed by September 2nd and submitted to Chris.Gent@zeroemissionsplatform.eu.

About you	
Name of Organisation	
Name of Project	
Project Partners	
Brief Project Description	
Indicative Project Timeline	

Selection criteria
Degree of Innovation
How can the degree of innovation in comparison to the state-of-the art be best evaluated? *Answer:*
Project Maturity
Which criteria should be used to evaluate project maturity? ☐ Business plan, capacity of the promoters behind the project ☐ Financial structure (private investors, other public support, strength of commitments) ☐ Societal acceptance ☐ Legal setup and permitting ☐ Stage of project development (concluded feasibility studies, FEED, etc.) *Answer:*
What are the essential elements that need to be in place for a project to be able to reach financial close within 4 years? Should a completed feasibility study be made a condition for applying for the Innovation Fund? *Answer:*
What are the key risks and barriers to implementation, respectively pre-conditions for projects to go ahead?

Answer:
Relevant Cost Calculation
What are the key variable factors determining the financial gap? *Answer:*
What are the financial risks and how best they can be evaluated? *Answer:*
Other
What weights, if any, should be applied to different selection criteria? *Answer:*
Milestones
What is the expected timeline to financial close and entry into operation for innovative projects in your sector? *Answer:*
What are the key milestones before financial close, e.g. feasibility or FEED study, permitting, State-Aid approval, etc. and before full entry into operation, e.g. how long are the construction, testing and commissioning periods? *Answer:*
How should the grant be optimally disbursed over the project life cycle? To what milestones can/should disbursements be linked? *Answer:*
What additional milestones would be useful? *Answer:*
Project development assistance (PDA)
Will project development assistance (PDA) be useful for projects in the sector? If yes, what types of assistance? *Answer:*

Should there be maximum amounts for different types of PDA and what would these levels be, taking into account that PDA support will count towards the 60% maximum support by the Innovation Fund? *Answer:*
Should projects be required to publish the results of any studies done with PDA, if they decide not to apply for Innovation Fund full support or are discontinued? *Answer:*
Should FEED be financed by PDA or only after successful application for an Innovation Fund award? *Answer:*
Knowledge-sharing requirements
What type of technical, economic, project management, regulatory and permitting information will be useful to share with other projects from the sector in order to speed up the uptake of the innovative technologies and to advance the regulatory environment without at the same time compromising the legitimate intellectual property rights, the competitiveness and the first-mover advantage of the companies involved in the projects? *Answer:*
What types of knowledge-sharing activities should the implementing body organize for projects benefiting from Innovation Fund (and other EU programmes) and for the general public? *Answer:*
What should be the form of knowledge sharing tools that would be useful for the market? *Answer:*

Innovation Fund Workshop for CCS

Hosted by ZEP and the Norwegian Ministry of Petroleum and Engineering

On the 6th September, Zero Emissions Platform (ZEP) hosted a workshop with the European Commission DG CLIMA on the design elements for the first call of the Innovation Fund (IF). The main objectives of the workshop was to:

- Provide the CCS community an opportunity to understand more about the IF with direct Q&A with DG CLIMA
- Provide DG CLIMA with the CCS community perspectives on the elements of the IF first call design.
- Provide an opportunity for the CCS community to discuss in detail elements of the IF first call design.
- Provide a platform for a pipeline of projects to present themselves to the European Commission and the CCS community.

Agenda

Item		Lead Presenter
09:00	Introduction	Lamberto Eldering (ZEP Vice-Chair)
	Setting the Scene for the Innovation Fund Workshop	Christian Holzleitner (DG CLIMA)
	Lessons learned from NER300 and the future role of EIB in supporting CCS projects	Roland Schultze (EIB)
	Connecting Europe Facility: support to CCS projects and synergies with the Innovation Fund	Henriette Nesheim (DG ENER)
10:15	Selection Criteria & Project Development Assistance (PDA) *Breakout Groups to Discuss*	All Attendees
	Sharing of Conclusions	*Facilitators*
11:45	**Lunch:** *Sponsored by CCUS Project Network*	
12:45	Milestones & Knowledge Sharing *Breakout Groups to discuss*	All Attendees
	Sharing of Conclusions	*Facilitators*
14:00	Overview of Projects (5mins per project)	Individual CCS Projects
14:45	Summary and AOB	Lamberto Eldering (ZEP Vice-Chair)

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The presentations above are available as attachments. Ahead of the workshop attendees were asked to complete a questionnaire with a series on questions relating to the design of the IF first call. The results of these questionnaires were compiled by the secretariat and helped steer the discussion in the scheduled breakout sessions of the workshop.
Summary of Discussions

Introduction Session: Setting the Scene.

The ZEP Vice-Chairman Lamberto Eldering welcomed participants, the European Commission and the EIB to the workshop, which was hosted by the Norwegian Ministry of Petroleum and Energy. He made specific reference to the previous days High-Level EU-Norway CCUS Conference which took place in Oslo and drew together Governments, industry and academia to discuss CCUS in Europe. This workshop, in particular was aimed to build on the enthusiasm of the previous day and concentrate on the Innovation Fund.

Mr Christian Holzleitner, Head of Unit, DG Climate Action (DG CLIMA), highlighted the design features of the first call of the Innovation Fund, and provided clarity on the scope of the fund, including its role with other EU initiatives, key features of the fund, project selection process, support profiles and next steps for the fund.

Mr Roland Schultze, European Investment Bank (EIB), presented the EIB's historic role in the NER300 and the learnings which came out of the NER300 process, which has been investigated in many reports including one by the European Court of Auditors. Furthermore, Mr Schultz highlighted that in the pending Energy Lending Policy, CCS is eligible, however unabated fossil fuel projects will not. The EIB has gained valuable experience in assessing CCS projects, and learnt from the process which will streamline the future use of the EIB for lending for CCS projects.

Ms Henriette Nesheim, DG Energy, presented the Connecting Europe Facility (CEF) and its support for CCS projects and synergies with the Innovation Fund. The CEF is a tool which can enable the deployment of technologies at scale in Europe and is the funding mechanism which can realise the large-scale CO2 transport infrastructure projects in Europe. Ms Nesheim highlighted that the CEF is supporting the early studies for several CCS projects across Europe, which has enabled these projects to continue and expand.

Breakout Session 1: Selection Criteria & Knowledge Sharing

The first breakout session concentrated on the proposed selection criteria and project development assistance. The group was split into five groups, whereby each group answered one of two subsets of questions. Each group presented their conclusions back to the room at the end of the breakout session. In addition to the feedback submitted in the questionnaire process, key points included:

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- Project maturity could easily be communicated with a **Maturity Roadmap**. This will contain plans, timings, milestones and decisions. This way it will be easier to know, compare and communicate project development.
- Social acceptance is difficult to measure and can only be reviewed after project implementation. Alternatively, a **Stakeholder Engagement Plan**, which highlights all stakeholders including the general public will have more value (this can be integrated with the above).
- The potential for deployment, **scalability and consortium strength** should be considered in the selection criteria
- The **timing of funding calls** across the European Commission climate toolbox (Horizon Europe, IF, CEF etc) should be aligned so payment schedules are clear and give clarity to projects.

After the breakout session there was a brief presentation by the CCUS Projects Network. The CCUS Projects Network represents and supports major industrial projects under way across Europe in the field of carbon capture and storage (CCS) and carbon capture and utilisation (CCU). For information on how to join the network, please follow the imbedded link.

Break Session 2: Project Milestones and Knowledge Sharing

The second breakout session concentrated on the definition of project milestones, and allocating funding against pre-defined milestones, as well as a discussion on knowledge sharing scope and tools. The format was identical to the morning breakout session, with groups feeding back to the room, key points included:

- The **current milestone structure for project development should not be changed** for Innovation Fund projects, as these are well understood in many sectors.
- Within the milestone structure there should be room for **flexibility**.
- **Additional project milestones** can include, **Government support, regulation/legislative changes at a member state level, PCI status**.
- Current EU funded initiatives such as the **CCUS Projects Network** and **SET-Plan IWG9** are prime mechanisms to encourage knowledge sharing between EU funded projects
- **Horizon Europe funded projects linked with IF applications** should add strength to an application.
- **Softer dimensions of knowledge sharing** need to be presented. Including public/private interaction process, streamlining project timelines, public acceptance, regulation and legislation acceptance, CCUS deployment and learning expertise
- **A database of CCUS expertise** companies could be assembled to ensure projects are developed by companies with a track history of CCUS facility (capture or T&S) construction and operation.

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Overview of Projects.

The final session consisted of an overview of projects (see attached presentations). These included presentations from the Northern Lights Project, Eriva Cork CCUS project, the Port of Antwerp CCUS project and Minijos Nafta Allam Cycle & EOR project. The presentations were a quick overview of the project, then concentrated on how the Innovation Fund would add value to their project and where it would have the most impact (spend profile etc).

Summary

Christian Holzleitner and Lamberto Eldering summarised the workshop and brought it to a close. Mr Holzleitner emphasised that projects need to consider how the financing will work, and what criteria and milestones are unique to the sector.

The ZEP secretariat will compile the questionnaire responses and workshop feedback and prepare a longer written conclusion for the participants of the workshop and DG CLIMA.

Attendance List:

Attendee		Organisation
De Buchet	Vianney	Air Liquide
Blinksbjerg	Peter	Amager ressourcecenter, ARC
De Coninck	Eric	Arcelor Mittal
Stuen	Johnny	City of Oslo - Waste to Energy Agency
Anker-Nilssen	Per	Confederation of Norwegian Enterprise
Connolly	Philip	Department of Communications Climate Action & Environment
Velkova	Maria	DG CLIMA
Holzleitner	Christian	DG CLIMA
Nesheim	Henriette	DG ENER
Helle	Kaare	DNV GL
Quale	Sverre	ECCSEL ERIC
Hole	Markus	EEAS
Marušic	Hrvoje	Embassy of Croatia
De Filippo	Renato	ENI
Paceviciute	Irma	Equinor
Sandberg	Per	Equinor
Eldering	Lamberto	Equinor
Murphy	Brian	Ervia
Schulze	Roland	European Investment Bank (EIB)
Frisvold	Paal	europeiskpolitikk.no
Van Dessel	Michiel	Exxon Mobil
Sopranzetti	Antonella	Exxon Mobil

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Van Rompaey	Senne	Fluxys SA
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Svalestuen	Jørild	Gassnova
Viumdal	Aslak	Gassnova
Turan	Guloren	GCCSI
Fischer	Almut	German Ministry of Economic Affairs and Energy
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Schwarck	Christian	IOGP
Habib	Ziad	lhoist
Chopin	Thierry	lhoist
Haselton	Tom	Minijos Nafta
Semundseth	Ragnar	Ministry of Petroleum and Energy
Svenningsen	Stig	Ministry of Petroleum and Energy
Shimamoto	Fumiharu	Mitsubishi Heavy Industries Group
Kakaras	Emmanouil	Mitsubishi Hitachi Power Systems Europe GmbH
Yde Aasen	Emil	Northern Lights
Wilhelmsen	Kjetil	Northern Lights
Hazell	William	Pale Blue Dot
Zaborowska	Katarzyna	PGE Polska Grupa Energetyczna S.A.
Van Kraaij	Hanna	Port of Antwerp
Demaerel	Anne-Frédérique	Port of Antwerp
Lundqvist	Karin	Preem AB
Van De Sande	Martijn	RVO
Bye Bruun	Kim	Shell
Riboldi	Luca	SINTEF
Bysveen	Marie	SINTEF
Jordal	Kristin	SINTEF
Hoff	Karl Anders	SINTEF Industry
Øye	Olav	The Bellona Foundation
Mikunda	Tom	TNO
Rycroft	Lydia	TNO
Seilhan	Bruno	Total
Hiegel	Jean-Philippe	Total
Guevara Opinska	Liliana	Trinomics
Granström	Per-Olof	ZEP
Gent	Chris	ZEP
Svendsen Skriung	Camilla	ZERO

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DEADLINE: 8th SEPTEMBER

Horizon Europe Co-design 2021-2024

Fields marked with * are mandatory.

With a proposed budget of 100 billion euro from 2021 to 2027, the Horizon Europe framework programme represents the largest collaborative multinational research and innovation investment in Europe and is open to participants worldwide.
The European Parliament and the Council, the co-legislators have provisionally agreed on the Horizon Europe legislative package. Based on the agreement, a Strategic Plan will put forward the targeted impacts for the investment in research and innovation and the priorities for the first four years of implementation of Horizon Europe.
We invite you to contribute to co-designing and help shaping the future research and innovation investment by responding to this questionnaire. It takes approximately 20 minutes to respond. The results will inform the work on the first Strategic Plan of Horizon Europe. You can further engage by participating in the European Research and Innovation Days on 24-25-26 September 2019 in Brussels.
It is recommended that prior to responding to the questions, you read the attached document: Orientations towards the first Strategic Plan implementing the research and innovation framework programme Horizon Europe.

Section A – About you

* 1 You or your organisation are mainly active/interested in the following areas of Horizon Europe (Please select all that apply):
- ☐ Health (cluster 1)
- ☐ Culture, creativity and inclusive society (cluster 2)
- ☐ Civil security for society (cluster 3)
- ☐ Digital, industry and space (cluster 4)
- ☐ Climate, energy and mobility (cluster 5)
- ☐ Food, bioeconomy, natural resources, agriculture and environment (cluster 6)
- ☐ Widening Participation and Strenghtening the European Research Area
- ☐ Pillar I Excellent Science
- ☐ Pillar III Innovative Europe
- ☐ Other

* 2 You are responding:
- ○ As an individual
- ○ As a representative of a single organisation
- ○ As a representative of an 'umbrella' organisation (a group of organisations)

* 3. You are responding as:
- ○ a researcher
- ○ an entrepreneur

- ○ an expert in research and innovation
- ○ a citizen
- ○ other

* 3. You are representing:

- ○ a university
- ○ a research organisation
- ○ a business or an industry
- ○ an international organisation
- ○ a national public authority
- ○ a regional or local public authority
- ○ a non governmental organisation including civil society organisations
- ○ other

* 4 Name of the organisation

150 character(s) maximum

4 Your name and last name

150 character(s) maximum

* 5 What is your country of residence or establishment?

- ○ Afghanistan
- ○ Albania
- ○ Algeria
- ○ Andorra
- ○ Angola
- ○ Antigua and Barbuda
- ○ Argentina
- ○ Armenia
- ○ Australia
- ○ Austria
- ○ Azerbaijan
- ○ Bahamas
- ○ Bahrain
- ○ Bangladesh
- ○ Barbados
- ○ Belarus
- ○ Belgium
- ○ Belize
- ○ Benin
- ○ Bhutan
- ○ Bolivia

- ◯ Bosnia and Herzegovina
- ◯ Botswana
- ◯ Brazil
- ◯ Brunei Darussalam
- ◯ Bulgaria
- ◯ Burkina Faso
- ◯ Burundi
- ◯ Cabo Verde
- ◯ Cambodia
- ◯ Cameroon
- ◯ Canada
- ◯ Central African Republic
- ◯ Chad
- ◯ Chile
- ◯ China
- ◯ Colombia
- ◯ Comoros
- ◯ Congo
- ◯ Costa Rica
- ◯ Côte D'Ivoire
- ◯ Croatia
- ◯ Cuba
- ◯ Cyprus
- ◯ Czech Republic
- ◯ Democratic Republic of the Congo
- ◯ Denmark
- ◯ Djibouti
- ◯ Dominica
- ◯ Dominican Republic
- ◯ Ecuador
- ◯ Egypt
- ◯ El Salvador
- ◯ Equatorial Guinea
- ◯ Eritrea
- ◯ Estonia
- ◯ Ethiopia
- ◯ Fiji
- ◯ Finland
- ◯ France
- ◯ Gabon
- ◯ Gambia
- ◯ Georgia
- ◯ Germany
- ◯ Ghana
- ◯ Greece
- ◯ Grenada

- ◯ Guatemala
- ◯ Guinea
- ◯ Guinea Bissau
- ◯ Guyana
- ◯ Haiti
- ◯ Honduras
- ◯ Hungary
- ◯ Iceland
- ◯ India
- ◯ Indonesia
- ◯ Iran
- ◯ Iraq
- ◯ Ireland
- ◯ Israel
- ◯ Italy
- ◯ Jamaica
- ◯ Japan
- ◯ Jordan
- ◯ Kazakhstan
- ◯ Kenya
- ◯ Kiribati
- ◯ Kuwait
- ◯ Kyrgyzstan
- ◯ Laos
- ◯ Latvia
- ◯ Lebanon
- ◯ Lesotho
- ◯ Liberia
- ◯ Libya
- ◯ Liechtenstein
- ◯ Lithuania
- ◯ Luxembourg
- ◯ Madagascar
- ◯ Malawi
- ◯ Malaysia
- ◯ Maldives
- ◯ Mali
- ◯ Malta
- ◯ Marshall Islands
- ◯ Mauritania
- ◯ Mauritius
- ◯ Mexico
- ◯ Micronesia
- ◯ Monaco
- ◯ Mongolia
- ◯ Montenegro

- ◯ Morocco
- ◯ Mozambique
- ◯ Myanmar
- ◯ Namibia
- ◯ Nauru
- ◯ Nepal
- ◯ Netherlands
- ◯ New Zealand
- ◯ Nicaragua
- ◯ Niger
- ◯ Nigeria
- ◯ North Korea
- ◯ North Macedonia
- ◯ Norway
- ◯ Oman
- ◯ Pakistan
- ◯ Palau
- ◯ Panama
- ◯ Papua New Guinea
- ◯ Paraguay
- ◯ Peru
- ◯ Philippines
- ◯ Poland
- ◯ Portugal
- ◯ Qatar
- ◯ Republic of Moldova
- ◯ Romania
- ◯ Russian Federation
- ◯ Rwanda
- ◯ Saint Kitts and Nevis
- ◯ Saint Lucia
- ◯ Saint Vincent and the Grenadines
- ◯ Samoa
- ◯ San Marino
- ◯ Sao Tome and Principe
- ◯ Saudi Arabia
- ◯ Senegal
- ◯ Serbia
- ◯ Seychelles
- ◯ Sierra Leone
- ◯ Singapore
- ◯ Slovakia
- ◯ Slovenia
- ◯ Solomon Islands
- ◯ Somalia
- ◯ South Africa

- ○ South Korea
- ○ South Sudan
- ○ Spain
- ○ Sri Lanka
- ○ Sudan
- ○ Suriname
- ○ Swaziland
- ○ Sweden
- ○ Switzerland
- ○ Syrian Arab Republic
- ○ Tajikistan
- ○ Tanzania
- ○ Thailand
- ○ Timor-Leste
- ○ Togo
- ○ Tonga
- ○ Trinidad and Tobago
- ○ Tunisia
- ○ Turkey
- ○ Turkmenistan
- ○ Tuvalu
- ○ Uganda
- ○ Ukraine
- ○ United Arab Emirates
- ○ United Kingdom
- ○ United States of America
- ○ Uruguay
- ○ Uzbekistan
- ○ Vanuatu
- ○ Venezuela
- ○ Viet Nam
- ○ Yemen
- ○ Zambia
- ○ Zimbabwe

* 6 Please select the option that best describes your interest in European Union research and innovation framework programmes:

- ○ I/my organisation is currently participating in at least one project funded by a European Union research and innovation framework programme.
- ○ I/my organisation has proposed and/or participated in project(s) funded by a European Union research and innovation framework programme in the past, but I am/it is not participating in a running projects at this moment.
- ○ I/my organisation has not yet proposed or participated in projects funded by European Union research and innovation framework programmes, but would be interested to do so.
- ○ I/my organisation currently does not intend to propose and/or participate in projects funded by European Union research and innovation framework programmes, but I may be interested in the results of the projects/programme.

* 7 Publication privacy settings

The Commission will publish the responses to this public consultation. You can choose whether you would like your details to be made public or to remain anonymous.

- ○ **Anonymous**
  Only your type of respondent, country of origin and contribution will be published. All other personal details (name, organisation name and size, transparency register number) will not be published.
- ○ **Public**
  Your personal details (name, organisation name and size, transparency register number, country of origin) will be published with your contribution.

☐ I agree with the personal data protection provisions

Section B – Where should Horizon Europe play its greatest role?

If you want more information to help answer this section, please follow the link towards the general orientations part of the document. A reading guide is as well available.

1. In your view, what is the role of Horizon Europe research and innovation investments in addressing the following challenges (as identified in the "Orientations" document)?

	1 (no role)	2	3	4	5 (very strong role)	I don't know
* European security and the well-being of our citizens	○	○	○	○	●	○
* Future prosperity and sustainable growth	○	○	○	○	●	○
* Climate action and environment preservation	○	○	○	○	●	○

2. In your view, what is the role of Horizon Europe research and innovation investments in achieving the United Nations Sustainable Development Goals (as identified in the "Orientations" document)?

	1 (no role)	2	3	4	5 (very strong role)	I don't know
* 1 No poverty	○	○	○	○	○	●
* 2 Zero hunger	○	○	○	○	○	●
* 3 Good health and well-being	○	○	○	○	○	●
* 4 Quality education	○	○	○	○	○	●
* 5 Gender equality	○	○	○	○	○	●
* 6 Clean water	○	○	○	○	○	●
* 7 Affordable and clean energy	○	○	○	○	●	○

* 8 Decent work and economic growth	○	○	○	○	●	○
* 9 Industry, innovation and infrastructure	○	○	○	○	●	○
* 10 Reduced inequalities	○	○	○	○	○	●
* 11 Sustainable cities and communities	○	○	○	●	○	○
* 12 Responsible consumption and prooduction	○	○	○	○	○	●
* 13 Climate action	○	○	○	○	●	○
* 14 Life below water	○	○	○	○	○	●
* 15 Life on land	○	○	○	○	○	●
* 16 Peace, justice and strong institutions	○	○	○	○	○	●
* 17 Partnerships for the goals	○	○	○	○	○	●

3. In your view, what is the role of Horizon Europe research and innovation investments in supporting the following EU policy objectives (as identified in the "Orientations" document)?

	1 (no role)	2	3	4	5 (very strong role)	I don't know
* Protective Europe	○	○	○	○	○	●
* Competitive Europe	○	○	○	○	●	○
* Fair Europe	○	○	●	○	○	○
* Sustainable Europe	○	○	○	○	●	○
* Influential Europe	○	○	○	●	○	○

4. Please provide here your comments on where Horizon Europe should play its greatest role in terms of global challenges, Sustainable Development Goals, and EU policy priorities.

500 character(s) maximum

5. In your view, to what extent will the following elements contribute to increase the scientific, economic and societal impacts of Horizon Europe investments (as identified in the "Orientations" document)?

	1 (no contribution)	2	3	4	5 (very strong contribution)	I don't know
* Integration of gender aspects in research and innovation content	○	○	○	○	○	●
* Social Sciences and Humanities role across clusters	○	○	○	○	○	●

* Development and uptake of Open Science practices,such as open access, open data, citizen science, in Europe	○	○	○	●	○	○
* Adequate balance of research and innovation	○	○	○	○	●	○
* Integration of Key Enabling Technologies in strategic value chains	○	○	○	○	○	●
* Fostering excellence by promoting collaboration of actors in higher education, research, innovation and business throughout the European territory	○	○	○	○	●	○
* Cooperation with the rest of the world	○	○	○	○	●	○

Section C - What kind of impacts should Horizon Europe target?

A strategic and targeted approach to European research and innovation investment is needed to maximise the impact of Horizon Europe in line with the sustainable, fair and prosperous future we want.

Protective Europe

Policy objectives: While the establishment of the European Union in itself has brought unprecedented peace and prosperity, there is a continued need to address terrorism and security issues, which are among the top concerns for European citizens, and to enhance internal security within and across the European Union, and along its external borders. The overarching ambition of secure societies is also reflected in Sustainable Development Goal 16 – Peace, Justice and Strong Institutions.
There are a number of EU policy responses to current security challenges. As regards disasters, these include the Union Civil Protection Mechanism, the EU Adaptation Strategy and the Sendai Framework for Disaster Risk Reduction (2015-2030). In the framework of the European Agenda on Security and as part of the development of a Security Union, the EU has adopted policies and instruments on integrated border management, on protection of public spaces, on security (including cybersecurity) of infrastructure, and on fighting crime, including cybercrime and terrorism. An EU Maritime Security Action Plan addresses relevant challenges. Policies have also been put in place to ensure cybersecurity, such as the Directive on security of network and information systems (NIS Directive) and the EU Cybersecurity Act, and online privacy.

If you want more information, in particular on cluster 3 (civil security for society), please follow the link to the specific annex.

5. In your view, how relevant is it for Horizon Europe to deliver on the following impacts for a "Protective Europe"?

	1 (not relevant)	2	3	4	5 (very relevant)	I don't know
Improved maritime security	○	○	○	○	○	●

Improved disaster risk management and societal resilience	○	○	○	○	○	○
Better protection of public spaces	○	○	○	○	○	○
More effective fight against crime and terrorism	○	○	○	○	○	○
Improved management of EU external borders	○	○	○	○	○	○
Improved management of EU external borders (air, land and sea)	○	○	○	○	○	○
Increased cybersecurity	○	○	○	○	○	○
Improved security and resilience of infrastructure and vital societal functions	○	○	○	○	○	○

6. Please provide here your comments or suggestions on the above (if any)

300 character(s) maximum

Competitive Europe

Policy objectives: Research and innovation plays a central role in enhancing competitiveness throughout Europe and Europe has the potential to become a world leader in the ongoing and foreseeable sustainable and digital transitions. However, there is a need to prepare our technological and industrial future in a more strategic way, including incentivising and steering innovation and facilitating the uptake of new technologies and innovative solutions New developments within mobility and transport, including automated and connected mobility, will also require new solutions, still to be developed and implemented. Furthermore, the need to promote inclusive and sustainable economic growth and industrialization and to foster innovation is reflected in Sustainable Development Goals 8 - Decent Work and Economic Growth, and 9 - Industry, Innovation and Infrastructure.
The renewed EU Industrial Policy Strategy shows how the EU must tackle missing segments in key strategic value chains if its industry is to stay competitive and become sustainable at the same time. This requires a stepping up of the level and quality of the EU research and innovation effort with focus on the key parts of strategic technology supply chains: from secure and sustainable supply of raw materials, maximising the value of its resources and materials, to batteries, low-carbon industry, space critical components smart connectivity platforms. At the same time, breakthrough technologies and solutions are necessary to bring about a deep decarbonisation of EU industries by 2050, and foster a circular economy. Future factories will be carbon-neutral, resource efficient and fully integrated in the circular economy. The zero-carbon and circularity ambitions should reinforce one another.

If you want more information, in particular on cluster 4 (digital, industry and space), please follow the link to the specific annex.

Please, remember that Investment in research and innovation regarding health (Cluster 1) will support an innovative, sustainable and globally competitive health-related industry, while investments in research and innovation for mobility and transport (Cluster 5) will contribute to developing low-carbon and competitive transport solutions across all modes

7. In your view, how relevant is it for Horizon Europe to deliver on the following impacts for a "Competitive Europe"?

	1 (not relevant)	2	3	4	5 (very relevant)	I don't know
Increased industrial leadership in key enabling and digital technologies and uptake of new technologies	○	○	○	○	●	○
Climate-neutral, circular and clean EU industries	○	○	○	○	●	○
Increased inclusiveness	○	○	○	○	○	●
Increased autonomy in critical raw materials	○	○	○	○	○	●
Increased industrial leadership in key enabling technologies and uptake of new technologies	○	○	○	○	●	○
More appealing and creative jobs in Europe	○	○	●	○	○	○
Low-carbon and competitive transport solutions across all modes	○	○	○	○	●	○
Help achieve climate-neutral, circular and clean EU industries	○	○	○	○	●	○

8. Please provide here your comments or suggestions on the above (if any)

300 character(s) maximum

Fair Europe

Policy objectives: The promotion of social cohesion and inclusiveness and the health and well-being of its people are central aims of the European Union's policies and programmes. With the European Pillar of Social Rights, the EU set the direction towards a fairer, inclusive and more social Europe for all citizens based on a European social model that is fit for the challenges of the 21st century. To continue delivering on this agenda and to safeguard shared values and mutual trust, it is important to support Member States in addressing social challenges and inequalities, e.g. related to health or education, within and across their territories and regions. Further efforts should equally be devoted to make high-quality health care both available and affordable for citizens as well as to render health care systems more accessible and sustainable, including through the digital transformation of health and care.
These aims are also reflected in Sustainable Development Goals: 1 – No Poverty; 3 – Good Health and Well-being; 4 – Quality Education; 5 – Gender Equality; 6 – Clean Water and Sanitation, 8 – Decent Work and Economic Growth; 10 – Reduced Inequalities; 11 – Sustainable Cities and Communities, and 16 – Peace, Justice and Strong Institutions.

If you want more information, in particular on cluster 1 (health) and cluster 2 (culture, creativity and inclusive society), please follow the links to the specific annexes.

Please remember that Investments in research and innovation concerning digital, industry and space (Cluster 4) will also aim to contribute to create more appealing and creative jobs in Europe and increased inclusiveness in the development of technologies and the acquisition of skills to put the new technologies, for instance the digital area or the area of advanced manufacturing, to use.

9. In your view, how relevant is it for Horizon Europe to deliver on the following impacts for a "Fair Europe"?

	1 (not relevant)	2	3	4	5 (very relevant)	I don't know
Healthy citizens in a rapidly changing society	○	○	○	○	○	○
Healthy and health-promoting living and working environments	○	○	○	○	○	○
Effective health services to tackle diseases and reduce the burden of diseases	○	○	○	○	○	○
Improved access to innovative, sustainable and high-quality health care	○	○	○	○	○	○
Unlocking the full potential of new tools, technologies and digital solutions for a healthy society	○	○	○	○	○	○
A sustainable and globally competitive health-related industry in the EU	○	○	○	○	○	○
Enhanced democracy and governance	○	○	○	○	○	○
Better approaches to tackle political extremism and polarisation	○	○	○	○	○	○
Reversing socio-economic and gender inequalities	○	○	○	○	○	○
Improved understanding of societal – including political, ethical and economic - effects of technological advancements and the impact of drivers of change	○	○	○	○	○	○
Novel growth model	○	○	○	○	○	○
Increased use of evidence-based strategies in the management of mobility and migration and the integration of migrants in European society	○	○	○	○	○	○
Better valorisation of European cultural heritage	○	○	○	○	○	○

10. Please provide here your comments or suggestions on the above (if any)

300 character(s) maximum

Sustainable Europe

Policy objectives: In order to achieve the objectives of the Sustainable Development Goals, significant changes are needed to modernise our economy towards sustainable consumption and production patterns, reinforce efforts to fight climate change and reverse environmental degradation, promote biodiversity and the transition to a circular economy respecting planetary boundaries. This includes maximising the potential of the Energy Union, including promoting a cleaner and more reliable energy supply to households and businesses.
These objectives also are reflected in especially Sustainable Development Goals 2 – Zero Hunger, 6 - Clean Water, 7 - Affordable and Clean Energy, 11 - Sustainable Cities and Communities, 12 - Responsible Consumption and Production, 13 - Climate Action, 14 - Life below Water and 15 - Life on Land.
In the areas of climate change and planetary boundaries, the EU is at the forefront of implementing the Paris Agreement. This EU has already put in place the legislation required to reach the Nationally Determined Contribution for 2030, and the Commission adopted a vision for achieving a climate neutral economy by 2050. The long-term strategy outlines a vision of the technological, economic and societal transformations required to achieve climate neutrality and to ensure a socially fair transition that does not leave any EU citizens or regions behind. It recognises that a forward-looking research and innovation strategy should be guided by zero-carbon solutions that have the potential to be deployed by 2050, and that climate action is at the heart of Horizon Europe, with the intention of devoting 35% of the budget to climate objectives. In January 2019, the Commission adopted the reflection paper 'Towards a Sustainable Europe by 2030', with the intention of launching a forward-looking debate among citizens, Member States and other stakeholders on how to best progress with the Sustainable Development Goals.

If you want more information on cluster 5 (climate, energy and mobility) and cluster 6 (food, bio-economy, natural resources, agriculture and environment), please follow the links to the specific annexes.

11. In your view, how relevant is it for Horizon Europe to deliver on the following impacts for a "Sustainable Europe"?

	1 (not relevant)	2	3	4	5 (very relevant)	I don't know
Advanced climate science and solutions	○	○	○	○	●	○
Novel competitive cross-sectoral solutions for decarbonisation	○	○	○	○	●	○
Novel energy system	○	○	○	○	●	○
New demand side solutions to decarbonise the energy and transport systems	○	○	○	○	●	○
Increased adaptation of production systems	○	○	○	○	○	●
Reinforced supply of sustainable biomaterials and bio-economy	○	○	○	○	○	●
Reduction of greenhouse gas emissions	○	○	○	○	●	○
More sustainable management of natural resources, prevention and removal of pollution	○	○	○	○	○	●

Halt of decline, and restoration, of biodiversity and ecosystems services	○	○	○	○	○	●
Establishment of new primary production and food systems	○	○	○	○	○	●
Establishment of new governance models enabling sustainability	○	○	○	○	●	○
A built Environment better fit for EU citizens	○	○	○	○	○	●

12. Please provide here your comments or suggestions on the above (if any)

300 character(s) maximum

Influential Europe

Policy objectives: In an increasingly fractured and multipolar world, the EU will need to strengthen its position in order to guarantee its prosperity and competitive position. Through EU international cooperation in research and innovation, the EU can shape new technologies and solutions to global challenges, set world standards and disseminate its values.

Innovation value chains and knowledge production are increasingly global and previously emerging economies have become major players in the research and innovation area. The EU is well placed to tap into this new wealth of research excellence and resources across the world. It has a long history of international cooperation within research and innovation, lies at the centre of most international collaborative networks and offers a general openness to international participation. The EU needs to build upon and further intensify this to fully benefit from the new global opportunities. Activities should promote and integrate international cooperation based on mutual benefits, EU interests, international commitments and, where appropriate, reciprocity, with each area developing its strategy for engaging internationally, in coherence with the overall EU strategy for international cooperation in research and innovation.

The Sustainable Development Goals are increasingly providing a reference point to prioritise and reshape research and innovation policy agendas, and international programmatic coordination through multilateral initiatives are more and more used as a means for global cooperation in areas such as climate change, biodiversity, clean energy, sustainable cities, infectious diseases, seas and oceans, sustainable agriculture and food and nutrition security. The expanding scope and interconnectivity of these challenges require that the EU strengthens its role in multilateral and bilateral setups while also asserting more pro-actively EU values and interests, including in strategic alliances and networks such as global environmental conventions on climate, desertification and biodiversity, the Belmont Forum, the Group on Earth Observations, the Mission Innovation initiative, the International Bioeconomy Forum, and a range of Global Health initiatives.

Increased attention is being paid to achieve sovereignty in strategic technology areas and critical infrastructures. Though no jurisdiction is fully autonomous in terms of design, development and production of enabling technology, in a world of globe-spanning value chains the EU should now do more to strengthen alliances with key actors in a strategic and principled way so as to ensure its competitive position.

International cooperation in research and innovation is indispensable for effectively tackling global challenges and for implementing global commitments. Collaborating with the world's top researchers, innovators and knowledge-intensive companies should strengthen the EU's research and innovation

excellence and attractiveness, increase the quality of research and innovation results, and reinforce the economic and industrial competitiveness of the Union. Increasing international engagement should also lead to an enhanced EU role in setting the research and innovation policy agendas and shaping global research and innovation systems and innovative solutions for the global challenges.

Engaging internationally should allow for a better assessment of challenges in their global, regional or local context, produce more targeted results, expand and diversify the global flow of knowledge and increase innovation capacity, contributing also to more efficient EU responses in key areas of political dialogue. The growing role of science diplomacy as a key element of EU external action should also foster mutual understanding, stability and progress.

13. Please provide here your suggestions for relevant Horizon Europe impacts to contribute to an "Influential Europe".

300 character(s) maximum

For more informations on missions and partnerships, please follow the link.

Section D - More in detail on the "Orientations" document

Please click on the part of Horizon Europe for which you would like to provide further general input regarding the targeted impacts from Horizon Europe.

- ☐ Health (cluster 1)
- ☐ Culture, creativity and inclusive society (cluster 2)
- ☐ Civil security for society (cluster 3)
- ☐ Digital, industry and space (cluster 4)
- ☐ Climate, energy and mobility (cluster 5)
- ☐ Food, bioeconomy, natural resources, agriculture and environment (cluster 6)
- ☐ Widening Participation and Strengthening the European Research Area
- ☐ Pillar 1 Excellent Science
- ☐ Pillar 3 Innovative Europe

Please provide here further general input regarding the targeted impacts from Horizon Europe.

5000 character(s) maximum

Thank you very much for your input.
An analysis of the results of this co-design consultation will be available after September 2019. The replies will also feed into the organisation of the debate in the co-design sessions at the European Research and Innovation Days where you are welcome to register for engaging in further discussion: European Research and Innovation Days on 24-25-26 September 2019 in Brussels.

Consultation on Horizon Europe Co-design 2021-2024

Response from the Zero Emission Technology and Innovation Platform (ZEP)
8th September 2019

Q4: Please provide here your comments on where Horizon Europe should play its greatest role in terms of global challenges, Sustainable Development Goals, and EU policy priorities.
500 character(s) maximum

Reducing greenhouse gas emissions is a global challenge. Horizon Europe can play a key role in enabling the research into climate technologies to ensure Europe achieves its climate targets set out in the Paris Agreement and outlined in the Long-Term Strategy.

Technologies such as CCS, CCU, and hydrogen will be essential for Europe to sustainably achieve these goals and research, with industry, will be fundamental to achieve the deployment of these climate mitigating technologies at scale in the 2020s and 2030s.

Q6: Please provide here your comments or suggestions on the above (if any)
300 character(s) maximum

No Comment

Q8: Please provide here your comments or suggestions on the above (if any)
300 character(s) maximum

No Comment

Q10: Please provide here your comments or suggestions on the above (if any)
300 character(s) maximum

No Comment

Q12. Please provide here your comments or suggestions on the above (if any)
300 character(s) maximum

No Comment

Q13. Please provide here your suggestions for relevant Horizon Europe impacts to contribute to an "Influential Europe".
300 character(s) maximum

CCS, CCU, negative emissions (DACCS and BECCS), blue and green hydrogen technologies, as well as re-use/repurposing of oil and gas assets for low-carbon gases are just some areas where active research funded by Horizon Europe can place Europe at the forefront of the global energy transition and climate action.

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Q15. Please provide here further general input regarding the targeted impacts from Horizon Europe.
5000 character(s) maximum

ZEP welcomes the inclusion CCUS under 4.3.3. Develop carbon capture, utilisation and storage (CCUS) solutions for the power and energy-intensive industries, in the Orientations document. The potential research challenges concentrate on the capture and storage element of the CCUS value chain, whilst these areas will certainly present opportunity for research, the transport of CO2 also warrants attention.

Carbon dioxide transport by pipeline and shipping is a developing area of interest. Furthermore, the reuse and repurposing of current assets, for the transport and injection of CO2 into storage formations is a fledgling area of research where collaborative research with industry could yield significant technological advancements and realise rapid cost reductions. This could not only extend the life of current assets, but also lead to the development of more efficient transport and storage infrastructure for future CCS and CCU projects.

Low-carbon hydrogen is produced by reformation of natural gas in association with carbon capture and storage. The cross-cutting objective 4.2.2. is to Strengthen the European value chain for low-carbon hydrogen and fuel cells. It has been shown by several studies that both electrolysis and reformation will have a role to play in Europe's hydrogen production future.

The objectives for hydrogen should be more explicit in its support for low-carbon hydrogen with CCS. Research can target methods to increase the efficiency of current reformation processes, carbon capture processes and investigate novel reforming methods with new materials.

In addition to the construction of new hydrogen infrastructure, certain current infrastructure can be repurposed for hydrogen transport. Investigating the technical challenges and feasibility of hydrogen in current networks could extend asset lifetime, prevent the risk of stranded assets and present a very cost-effective pathway to hydrogen deployment across sectors at scale.

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ZEP feedback on the Proposed Trans-European Energy (TEN-E) Evaluation Roadmap

18th June, 2019.

ZEP is a European Technology and Innovation Platform (ETIP) under the Commission's Strategic Energy technologies Plan (SET-Plan), and acts as the EU's technical adviser on the deployment of Carbon Capture and Storage (CCS), and Carbon Capture and Utilisation (CCU).

ZEP welcome the timing of the TEN-E review as Europe prepares for the rapid decarbonisation required to achieve climate targets outlined in the Clean Energy for all Europeans[1] and European Commission's 2050 vision[2].

The TEN-E Regulation is vitally important to enable cross-border decarbonisation, and is particularly essential to enable the deployment of cross-border CO_2 transport infrastructure networks for CO_2 storage.

There are currently five candidate PCI projects in cross-border carbon dioxide transport networks being considered for the 4th PCI list. This is one more than the 3rd PCI list, and for the 2020-2030 period; as more CO_2 storage projects are realised, the desire for support for cross-border CO_2 transport networks is expected to rise.

In order to more accurately assess the benefits of cross border CO_2 networks, ZEP recommends that the Commission incorporate the findings of both the North Sea Basin Task Force's study into the *Development of a CO_2 transport and storage network in the North Sea*[3], as well as the Neele et al, (2013) study titled A *Roadmap Towards a European CO_2 Transport Infrastructure*[4].

[1] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans
[2] A Clean Planet for all — A European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy (COM(2018) 773 final), 28 November 2018.
[3] Pershad, H. and Slater, S., 2007. Development of a CO2 transport and storage network in the North Sea (Report to the North Sea Basin Task Force). *Department for Business, Enterprise and Regulatory Reform (BERR), Element Energy, BGS and Pöyry Energy*.
Available at: https://hub.globalccsinstitute.com/sites/default/files/publications/179408/development-co2-transport-storage-network-north-sea-report-north-sea-basin-task-force.pdf
[4] Neele, F., Mikunda, T., Seebregts, A., Santen, S., van der Burgt, A., Stiff, S. and Hustad, C., 2013. A roadmap towards a European CO2 transport infrastructure. *Energy Procedia*, *37*, pp.7774-7782.

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Call for feedback on the TEG report on EU Taxonomy

Response from the Zero Emission Technology and Innovation Platform (ZEP)
13th September 2019

The Zero Emission Technology and Innovation Platform (ZEP) is the technical adviser to the EU on the deployment of Carbon Capture and Storage (CCS), and Carbon Capture and Utilisation (CCU), a European Technology and Innovation Platform (ETIP) under the Commission's Strategic Energy Technologies Plan (SET-Plan).

ZEP would like to commend the approach developed by the Technical Expert Group on the inclusion of CCS in the taxonomy. Specifically, the recognition that CCS is a sustainable economic activity that can help to decarbonise existing industrial activities, such as manufacturing and electricity generation.

1. Climate Change Mitigation Activities

For each activity presented, please select the elements of the activity to which you would like to provide feedback

- Boundary of the activity
- Metric for substantial contribution criteria
- Threshold for substantial contribution criteria
- DNSH criteria
- International applicability of activity criteria

21.5 Manufacturing of Hydrogen

☑ Threshold for substantial contribution criteria

Capture technology has own definition in the same document which states capture technology qualifies if it "*enables the economic activity to operate under its respective threshold*" which for the case of hydrogen production could refer back to the 0.95 tCO2/tH2 or if the hydrogen unit is within a refinery this could refer to a refinery threshold – unclear and potentially impactful

The first two proposed thresholds under Manufacture of Hydrogen/Mitigations criteria, on page 205 in the report, appear to be in line with the overarching goals, based on life cycle analyses and clearly stating the criteria to promote truly sustainable development for investment. The third proposed threshold, however, *"Average carbon intensity of the electricity produced that is used for hydrogen manufacturing is at or below 100 gCO2e/kWh (Taxonomy threshold for electricity production, subject to periodical update).",* is clearly discriminating and not technology neutral:

- It would effectively exclude all electricity grid connected manufacturing sites and thus negatively impact the action required to deliver climate goals.
- It is unique to hydrogen and discriminatory against this manufacturing technique.

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- It is redundant as the first threshold delivers the environmental benefit.

ZEP sees this as a clear and obvious error and would thus like to see the third threshold deleted.

Further on thresholds, it is important that the Taxonomy supports a rapid transition. Hence it's argued that the threshold should be higher at the start and then be tightened over time, aligned with 2050 targets. This to allow for retrofitting and hybrid solutions and to encourage a broader range of technologies and projects which will stimulate industrial projects and economic of scale. A threshold starting point of 4 tCO2e/t hydrogen is sensible in the way that it will allow for retrofitting of e.g. SMR technologies and such project has the potential to significantly reduce emissions in the short to medium term. The threshold should be tightened in time towards the proposed threshold 0.95 tCO2e/t hydrogen to reach 2050 targets.

Example calculations for natural gas reforming with CCS (Equinor value chain calculations):

- Based on 60 % capture rate and assuming EU South gas: 4 tCO2/t hydrogen
- Based on 90 % CO2 capture rate and assuming EU North gas: <0.98 tCO2/t hydrogen

22.7 Production of Electricity from Gas Combustion

☑ Metric for substantial contribution criteria
☑ Threshold for substantial contribution criteria

The proposed threshold, "Facilities operating at life cycle emissions lower than 100gCO2e/kWh, declining to 0gCO2e/kWh by 2050, are eligible", to reduce life cycle emissions to 0gCO2e/kWh would effectively exclude gas generation with CCUS technologies. Capture rates of 95-98% are expected to be possible with CCUS technologies, however 100% capture rates are very unlikely.

Given the importance of Gas CCUS technologies in reaching a net zero target we would encourage the TEG to amend the threshold to "Facilities operating at lower than 100gCO2e/kWh with a trajectory to net-zero CO2 emissions in 2050, are eligible. Criteria and methodology for Life Cycle of Emissions (LCE) and Life Cycle Analysis (LCA) should be introduced later and in line with EU policies."

22.8 Production of Electricity from Bioenergy

☑ Boundary of the activity

In the sector classification there should be a reference to the addition of CCUS technology to bioenergy facilities, resulting in the production of "negative emissions" through BECCS. Given the importance of BECCS to meeting emission reductions targets, a provision should be included to encourage the development of this technology.

Under the "Do no significant harm assessment" number 5 on Pollution – The "Do not transport feedstocks over long distances" section is an unnecessary provision that does not address the issue

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of air pollution directly. It is likely to act as a barrier to the efficient operation of markets and the development and deployment of BECCS technologies. Equally, this is a supply chain issue and so should be covered in 22.11, “Manufacture of Biomass, Biogas or Biofuels”. Instead, as discussed in 22.11, requirements should be placed on supply chain actors to meet all relevant local, national and international air pollution regulations (e.g. MARPOL regulations for shipping).

23.9 Direct Air Capture

☑ Boundary of the activity

The ISO standard reference for capture refers to integration in a power station. Here the ISO Standard ISO/TR 27912 “Carbon dioxide capture – Carbon dioxide capture systems, technologies and processes”, would be much more appropriate than the future standard ISO/CD 27919-2 for post-combustion capture integrated with a power plant.

23.11 Transport of CO2

☑ Boundary of the activity
☑ Threshold for substantial contribution criteria

“Only pipelines which lead directly to an eligible permanent sequestration site are eligible”. This can be interpreted as the taxonomy is only eligible for pipeline transport of CO2 and exclude other means of transporting CO2.

Ship to ship or ship to well are very interesting possibilities, but under the proposed definitions they would be excluded from qualifying. Several new cross-border CO2 projects in Europe that are currently applying to receive a PCI status rely on the shipping solution for CO2 transport to permanent storage.

The shipping solution has several advantages for the start-up phase of a European CCS network:

- It offers an agile and tailored made solution for industrial sites with smaller volumes of CO2 which are out of reach of CO2 pipeline for economical or technical reasons. In contrast, a certain minimum capacity is needed to justify the rationale of constructing a CO2 transport pipeline.
- The shipping solution increases the flexibility of the CCS chain in Europe as it allows to connect emitting sites to several sequestration sites and can add new CO2 volumes from elsewhere.
- A ship-based CO2 transport network increases the reliability of a CCS system in the event of technical issues in a sequestration site or a pipeline.
- Developing a shipping connection to a CO2 source is likely be less time-consuming to establish, as the planning, permitting and construction of pipelines over longer distances will need considerable time and effort.

Investing in ship infrastructure could make CO2 transport network expansion more feasible for emitters from various coastal parts of Europe to start with smaller CO2 volumes, allowing for a gradual maturation of demand for CO2 transport and storage. This would in turn contribute to reducing overall CO2 transport costs, thereby making CCS more viable for emitters across Europe.

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Therefore, a shipping solution can support the industrial start-up of CO2 capture, transport and storage and it will be essential for scaling up and achieving cost-reductions across the full CCS value chain.

The exclusion of the shipping solution from Taxonomy would not treat different capture projects – part of a CO2 network – equally either: it would for instance give preferential treatment to a steel plant located close to pipeline connection against another steel plant located where there is no pipeline to transport CO2 and which would therefore have to be carried out by ship.

In the same way, also transport of CO2 in trucks could be an option for the first smaller start-up projects.

Hence, other means than CO2 pipeline transport should be eligible for Taxonomy.

Links to evidence; https://ccsnorway.com/

Also referring to the proposed threshold above, the word "directly" could be interpreted from A to B "as the crow flies". This may not be the most economic or efficient pathway for transport infrastructure. In some scenarios CO2 could be transported to temporary onshore gas storage facilities, while awaiting shipping or as a temporary solution whilst regular maintenance is undertaken on CO2 transport and storage facilities,

It is also recommended to include the standard ISO 27913: Carbon dioxide capture, transportation and geological storage – Pipeline transportation systems under Rationale.

2. Climate Change Adaptation

2.1. Do you consider that the qualitative criteria for adaptation apply equally to all sectors? (Y/N/IDK) Please Explain (2000 characters)

Yes

While the expected range of activities and absence of obvious quantitative criteria justify the proposed approach, reviewers of adaptation-related submissions must ensure compelling links for all activities to emissions reductions. That needs disciplined methodical practices. Otherwise, there is a risk that qualitative descriptions could invite creative or speculative applications for activities that have, at best, tenuous links to sustainability and emissions reductions.

2.2. Are the illustrative templates provided in the Technical Report useful for indicating the potential application of the criteria? (Y/N/IDK) Please explain what other information would be useful (3000 characters)

Yes.

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4. Future Development of the Taxonomy

4.1. What economic activities that can make a substantial contribution to the climate change mitigation objective should next be considered for the Taxonomy? (2000 characters)

Carbon utilisation technologies could have a climate change mitigation role, this can only be considered when an agreed lifecycle emissions analysis calculation methodology is endorsed by the European Commission.

Oil and gas refining activities

Retrofitting and reuse of installed oil and gas infrastructure for the (not pipelines) injection and storage of low-carbon gas and carbon dioxide. This infrastructure, particularly offshore infrastructure (wells, platforms etc) could be repurposed for CO2 injection and permanent storage (and potentially in the future, H2 storage in depleted reservoirs).

The manufacturing or generation activities with bioenergy and CCS, or biomethane derived hydrogen with CCS can result in negative emissions (net-removal of CO2 from the atmosphere). GHG removal technologies should be assessed independently, as these activities should be considered more beneficial or sustainable than counterparts with other energy sources (renewable or fossil fuel with CCS).

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Martin Spolc
Head of Unit of Financial Technology and Sustainable Finance
DG FISMA B2
European Commission
B-1049 Brussels
Belgium

Date: 13 September 2019

Input to the EU Taxonomy Technical Report regarding governance and future use of Taxonomy for Sustainable Finance

Dear Mr Spolc,

The Zero Emissions Technology and Innovation Platform (ZEP) is the technical adviser to the EU on the deployment of Carbon Capture and Storage (CCS), and Carbon Capture and Utilisation (CCU), a European Technology and Innovation Platform (ETIP) under the Commission's Strategic Energy Technologies Plan (SET-Plan).

In order to ensure the success of an enduring green finance sector, ZEP has recommendations on the future process and governance of the taxonomy in addition to our answers and comments to the online Taxonomy Technical Report feedback questions.

Three sets of review periods

To ensure that the defined list of sustainable taxonomy retains flexibility as economic activities develop, for new or existing activities, there should be a regular and thorough review process. The review process as such could be structured to follow three periods:

- Annually: review opportunity for new economic activities which have not yet been assessed. Activities will nominate themselves to an independent regulator/panel for review and must provide sufficient supporting documentation. The ratification by an independent and impartial panel will follow the same template and threshold criteria as activities already ratified as sustainable. There will be a need for some kind of minimum size limit for an economic activity, otherwise the system may risk overloaded from many small niched individual activities.
- Every 2-3 years: reassessment opportunity for existing economic activities which have previously not reached the thresholds. These activities must present suitable advancement to reach the criteria. The ratification by an independent and impartial panel will follow the same template and threshold criteria as activities already ratified as sustainable. Activities can nominate themselves to an independent regulator/panel for reassessment and must provide sufficient supporting documentation. If the activity is not accepted, then the sector cannot reapply until the next reassessment window.

- Every 5 years: complete review to be undertaken by an independent expert group on the activities, thresholds and criteria. In parallel, a public heath-check consultation should be run to identify successes and shortfalls of the current landscape. The taxonomy should then be flexible and able to accommodate appropriate changes.

Important to use an independent and expert advisory panel

To ensure that any subsequent review which results in the retention, inclusion, or exclusion of particular activities from the sustainable finance taxonomy remains fair, an Advisory Panel – comprised of experts from a wide variety of industries associated with the specific processes – should be used.

This will ensure that any activity subject to review will be held accountable to the same process as those in the first round of taxonomy review. It will also prevent any undue lobbying of the European Commission which may influence an otherwise impartial and technical process. The members selected in an Advisory Panel will have intricate knowledge of the economic activities presented and be able to make an accurate and swift conclusion to any proposals.

Central standards, local monitoring, verification and reporting

If standards both regarding interpretation and implementation of the taxonomy between Member States and can be reassured, local monitoring, verification and reporting would be preferable. It would lower the administrative burden on the European Commission and logistics therein and encourage Member States to take the sustainability drive internally to help Europe achieve their climate targets.

Central monitoring, verification and reporting of the activities can be implemented for assessing emissions under the current EU ETS process. This may be more challenging regarding electricity generation, considering that the carbon footprint can vary quite extensively nationally but also in the same place seasonally and daily.

We would be more than happy to meet, to discuss this further.

Yours sincerely,

Dr. Graeme Sweeney

ZEP Chairman

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21 August 2019

Technical Expert Group on sustainable finance

Input to the EU Taxonomy Technical Report by the Zero Emission Technology and Innovation Platform

Dear Members of the Technical Expert Group,

The Zero Emission Technology and Innovation Platform (ZEP) is the technical adviser to the EU on the deployment of Carbon Capture and Storage (CCS), and Carbon Capture and Utilisation (CCU), a European Technology and Innovation Platform (ETIP) under the Commission's Strategic Energy Technologies Plan (SET-Plan).

Firstly, ZEP would like to commend the approach developed by the Technical Expert Group on the inclusion of CCS in the taxonomy. Specifically, the recognition that CCS is a sustainable economic activity that can help to decarbonise existing industrial activities, e.g. manufacturing. We will of course provide comments to the TEG Taxonomy Technical Report through the call for feedback that is presently running until the 13 September and we would also like to take this opportunity to directly highlight one very important issue in the report.

The first two proposed thresholds under Manufacture of Hydrogen/Mitigations criteria, on page 205 in the report, appear to be in line with the overarching goals, based on life cycle analyses and clearly stating the criteria to promote truly sustainable development for investment. The third proposed threshold, however, *"Average carbon intensity of the electricity produced that is used for hydrogen manufacturing is at or below 100 gCO2e/kWh (Taxonomy threshold for electricity production, subject to periodical update).",* is clearly discriminating and not technology neutral:

- It would effectively exclude all electricity grid connected manufacturing sites and thus negatively impact the action required to deliver climate goals.
- It is unique to hydrogen and discriminatory against this manufacturing technique.
- It is redundant as the first threshold delivers the environmental benefit.

ZEP sees this as a clear and obvious error and would thus like to see the third threshold deleted.

We would be more than happy to meet, to discuss this further.

Yours sincerely,

Dr. Graeme Sweeney

ZEP Chairman

European Zero Emission Technology and Innovation Platform

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ZEP Advisory Council 60

25th September 2019

Agenda Item 9.b.: Network Technology update

NWT co-chairs: Filip Neele (TNO), Arthur Heberle (Mitsubishi Hitachi Power Systems)

The last Network technology meeting took place on Brussels on 4th June and considered how to progress the new work items identified in the 2019-2020 work programme.

The meeting also included a presentation from the IEA GHG on CCS and capture rate assumptions in climate scenarios and a discussion on potential work on CO2 transport costs and risks. Meeting minutes are attached as pre-read 9.b.i.

The co-chairs and the Secretariat will hold a catch-up call on 18th September.

TWG Collaboration across the CCS chain

TWG Co-chairs: Ward Goldthorpe (Sustainable Decisions)/Hallvard Høydalsvik (Gassnova)

WS1 (storage-related risks):

The CO2 storage safety report is currently under review. The Secretariat works on addressing final comments from TWG members. The report will then be formatted and published.

WS2 (risk sharing in a CCS network):

The workstream organised two workshops and produced two summary papers on outcomes and recommendations from the workshops. The workstream also developed two data sets on 1) investment barriers, business risks and mitigation measures; and 2) public-private collaboration requirements for removing investment barriers. Building on these, it has been agreed that WS2 will draft a short report.

TWG CCU and Sink Factor Methodology

TWG Chair: Rob van der Meer (Heidelberg Cement)

The TWG met on 9th September in Brussels. The meeting included a discussion on the Global CO2 Initiative work and a discussion on the TWG's forward work programme.

It was agreed that the TWG will prepare a paper (approx. 10 pages) addressing the following questions:

- How much CO2 will be used?
- How much energy will be needed?
- What is the real mitigation effect of CCU technologies?
- What CCU applications should be promoted?

- What legal framework and funding will be needed to bring these to the market?

The intention is to develop two tables about existing 1) capture technologies; 2) utilisation and storage technologies. These will include their deployment status, expected time to commercialisation, energy need by tonne, mitigation potential, etc.

It is expected that this paper will be delivered by January 2020 to feed into the European Commission's work.

AC are invited to provide feedback on this process.

Other work items

It was agreed at the last NWT meeting that the Network will start a piece of work on the risks and costs associated with CO2 transport via pipeline and shipping. The aim of this will be to show the design solutions that have been or are being developed in existing or planned transport networks (e.g Snohvit, ROAD, Teesside Humberside & South Wales, current Projects of Common Interest, etc.)

The intention is to form a third workstream under the TWG Collaboration across the CCS chain 'CCUS Pipeline Networks', which will be responsible for developing a report. A draft term of reference (ToR) developed by Filip Neele (TNO), Haroun Mahgerefteh (University College London) and Roland Span (Ruhr-Universität Bochum) is attached as pre-read 9.b.ii.

The AC are invited to approve the draft ToR.

In addition, the Network currently works with the IEA GHG to develop a policy brief building on their most recent study on capture rates. This policy brief will be shared with the Network Policy and Economics for feedback shortly.

ZEP Network Technology

Minutes: Network Technology meeting 4th June 2019

Attendance

Brian	Murphy	Ervia
Eric	De Coninck	ArcelorMittal
Filip	Neele	TNO (NWT Co-Chair)
Graeme	Sweeney	ZEP
Haroun	Mahgerefteh	UCL
Keith	Burnard	IEA GHG
Keith	Whiriskey	Bellona
Lucie	Boost	Equinor
Marine	d'Elloy	ZEP Secretariat
Rob	Van der Meer	Heidelberg Cement
Stephen	Goodyear	Shell
Ward	Goldthorpe	Sustainable Decisions

Item 1: Introduction and issues update

Filip Neele (FN) introduced the meeting agenda. The meeting agenda was adopted.

Item 2: Policy update (Sustainable Taxonomy and European issues)

GS updated the Network on the EU Taxonomy for Sustainable Finance. GS has been selected as an expert for second phase of taxonomy work. The goal of this work is to define criteria to enable the categorisation of processes which can inform a 'sustainable project' to investors.

GS noted that the energy work is focussed on delivering emissions thresholds that are consistent with net-zero by 2050. Activities are defined around declining emission thresholds.

GS said the definition of what is sustainable is driven by two main outcomes: emissions reductions and do no significant harm (DNSH). The work done by the Energy Group will be subject to review by the DNSH group (in which ZEP is not involved). In particular, the DNSH will review nuclear and ZEP's understanding is that it is likely to be excluded from the Taxonomy.

With respect to the production of electricity, GS said that sustainable is defined as a declining threshold over time (100gCO_2/kWh then 0gCO_2/kWh by 2050). Therefore, projects would need to demonstrate that they were under the threshold over their lifetime.

GS said that CCS is considered as an economic activity in its own right and is therefore applicable to other activities. DACCs qualify.

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GS said that refining and CCU are not included in this round. GS talked about the LCA issues and summarised discussions on distributional versus consequential LCAs.

With regards to forestry, GS said there is an ongoing debate on the timeline for recovery.

GS noted that there was intense resistance from Austria and Germany regarding the inclusion of CCS in the Taxonomy.

Regarding the political process, GS said that the European Parliament took a view on the Taxonomy. It took the view to exclude nuclear and solid carbon (which has not been defined yet, i.e. does it include solid biomass?). In addition, the EP intends to avoid carbon lock-in but did not say how that would be achieved / how to evaluate how carbon lock-in occurs.

It is expected that the Council will not reach an agreement under the Romanian Presidency and therefore this file should be handed over to the Finish Presidency. If this is the case, there might need to be a new position from the EP. It was agreed that ZEP will be meeting with the Finnish Presidency.

Item 3: Session on CCU & LCA

RvdM presented the work from the TWG on CCU (see slides).

RvdM encouraged participants to attend the Commission's meeting on 9th July, which will discuss progress on the LCA for CCU. Bellona will attend this event on behalf of the TWG.

KB highlighted an IEA study on CCU that would be very relevant to the TWG.

There was a discussion about how much volumes of CCU will be needed in the future.

It was agreed that RvdM will present the same set of slides to the AC on behalf of the Network.

EdC said Dominque Copin from Total is part of a joint EU/US working group focusing on LCA guidelines, which could be of interest to the TWG.

Item 4: Session on CO2 transport

HM presented a proposal for a new TWG on risks and costs related to the transportation of CO2 (see slides).

FN highlighted that the objectives of the study should be to demonstrate that storage is safe. FN noted the need to define targets and approach the topic by looking at empirical evidence (i.e. the safe operation of pipeline in the United States and Norway). The audience of the report should be future network operators and national governments. The report should aim at demonstrating that CCS is feasible, safe and available. FN said that a section at the end of the report could highlight the areas that need further R&D work.

It was agreed that the report should focus both on CO2 pipelines and CO2 shipping.

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It was agreed that HM will develop a draft ToR, which will then be shared with the Network for feedback. The intention is to present the draft ToR at the Advisory Council in September.

Item 5: Session on capture rates & CCUS in modelling

KB presented a new study from the IEA GHG on CCS in energy and climate scenarios (see slides). KB said the final report is in preparation.

The study shows that CCS capture costs (<$100/tCO2) are considerably lower than IAM marginal abatement costs of CO2 across the whole energy system by mid-century; therefore there are other limiting and competing constraints on CCS, that are not solely related to the direct cost calibration of CCS in IAMs but are related to indirect assumptions and model dynamics.

KB stressed that much of the data used in climate and energy models is out of date.

FN asked how the Network could support the IEA GHG in delivering its work. KB said the IEA GHG will aim at looking at all integrated assessment models used in the IPCC reports. ZEP could play a role in providing modellers with the up-to-date information they require. ZEP could also play a role in communicating the outcomes of the IEA GHG studies on capture rates.

It was agreed that ZEP could also write a paper building on the IEA GHG studies, communicating issues on capture rates and climate modelling to policy makers. It was also agreed that NWT will support the IEA GHG by providing updated data for the integrated assessment models.

Item 6: Progress update on WS2 Collaboration across the CCS chain

WG update the Network on WS2's work progress (see slides). The TWG held two workshops addressing the following issues; dealing with the financial security, recommendations for removing barriers to investment in CCS chain businesses, prioritising risk mitigation mechanisms for sharing risks between CCS chain businesses, etc.

WG described the four key recommendations from the TWG.

There was a discussion on the recommendation to establish a mutual fund, which would involve the participation of countries who intend to use CCS. LB asked whether this fund would be dedicated to first projects or established projects. WG said the fund could evolve over time to accommodate both. It is expected that government's financial support would reduce over time.

It was agreed that the TWG final report should focus on how to make first projects happen.

LB said that the report's recommendations should align with the Madrid Forum's recommendations.

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Actions

Action	
4	HM to develop draft ToR on CO2 transport costs and risks (pipelines & shipping) to be presented at the AC60 in September
5	NWT to follow-up up with the IEAGHG and discuss how ZEP could support their work on integrated assessment models
5	NWT to produce a short brief on capture rates for policy makers
6	TWG Collaboration across the CCS chain WS2 to start report drafting process

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ZEP Temporary Network Group: CCUS Pipeline Networks

Background

Carbon capture, utilisation and storage (CCUS) clusters involve the capture of CO_2 from a variety of industrial emission sources, followed by its storage or utilisation using a shared CO_2 transportation infrastructure. Overall, it is estimated that CCUS could provide up to 37% of the total CO_2 abatement potential by 2050 (1).

Despite its importance, as of 2019, there are only few CCUS facilities operating in Europe (2); examples are Sleipner & Snohvit (Norway; Natural Gas Processing), Port Jerome (France: Hydrogen production) and OCAP (CO_2 from industrial sources delivered to greenhouses). To meet the European Commission's climate neutral scenarios, CO_2 capture and storage or utilisation capacity needs to increase by between 200 to 400 fold by 2050 (3).

Currently the majority of operational CCUS clusters are located in the US (4); the largest being the Cortez (24 Mton/yr CO_2 capacity) and the Central Basin (27 Mton/yr CO_2 capacity) CO_2 hubs. These have been developed on an ad-hoc basis, with each hub having its own standards for CO_2 purity, acceptable types of impurities (5), and operating pressure and temperature.

In order to accelerate the development of a CO_2 infrastructure in Europe, the EU has recently widened the scope of Projects of Common Interest to include CO_2 transport pipelines; opening the CEF funding (6) scheme to CCS. Five cross border CO_2 transport networks are currently under consideration for the second PCI list by the Commission in October 2019 (7).

With a total capacity for handling up to 10 Mton/yr CO_2 by 2030, CO2TransPorts PCI is the largest of the planed transport networks. It is intended to develop the infrastructure to facilitate large-scale capture, transport, utilisation and storage of CO_2 from three of the most important CO_2 capture sites including the ports of Rotterdam, Antwerp and Terneuzen.

In several industrial regions in Europe the deployment of CO_2 capture and storage is being considered, with plans for CO_2 transport and storage networks at various levels of development.

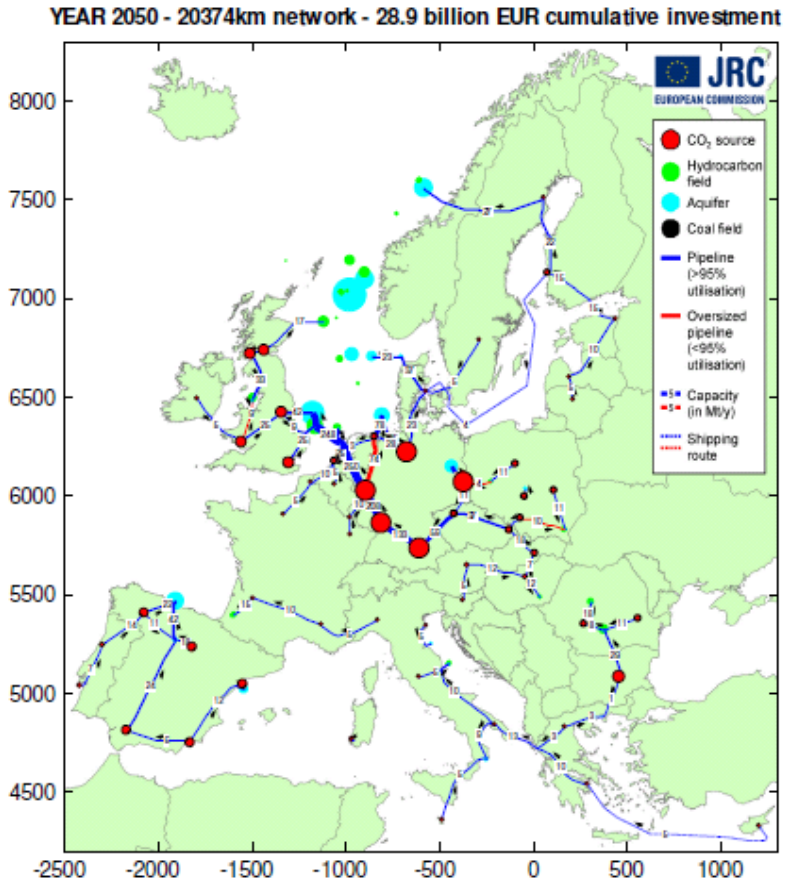
The Challenge

The large-scale deployment of CCUS clusters in Europe will require the development of appropriate infrastructure capable of transporting hundreds of millions of tonnes of captured CO_2. Given the fact that many CO_2 sources and sinks will not be directly accessible by ship means that the most economical mode of transportation involves the use of shared high-pressure pipeline networks connecting the various emitters to one or more geological storage sites. The option of transporting by ship is include in several of the proposed PCIs; it is an integral component of the Northern Lights project in Norway.

According to the CO_2 network Joint Research Centre report (11), the size of CO_2 pipeline networks in Europe is expected to grow steadily from the current 770 km to 8800 km until 2030, requiring around 9 billion euros of cumulative investment, followed by a step-change increase towards 2050 to over

20,000 km, requiring a total investment of around 29 billion euros. Figure 1 is a schematic of the European CO_2 routing projected for 2050.

Figure 1: Scenarios identified by the EU's Joint Research Centre for the development of a trans-European CO_2 transport network (9)



The physical properties of CO_2 differ from those of natural gas, creating some important design and operational challenges. For example, the most practical cost-effective option for transporting CO_2 is in the dense phase or liquid phase, i.e. above 75 bar given the lower pressure drop along the pipeline as compared to the gas phase and the larger 'line pack'. However, this requires pipelines to operate at higher pressures than most existing natural gas pipelines, whilst handling low levels of stream impurities. Water concentrations have to be low to avoid corrosion. Concentrations of non-condensable gases such as N_2 should be low to avoid two-phase flow resulting in compressor/pump malfunction, and also requiring pipeline materials with high fracture toughness. Given that CO_2 is an asphyxiant at concentrations greater than 10% v/v, there are also safety concerns in the unlikely event of an accidental release.

It should be noted that pipeline transportation of CO_2 is a well-established technology. However, most of this experience is confined to sparsely populated areas in the US where 7240 km of CO_2 pipelines have been in operation for almost four decades. These pipelines mostly transport CO_2 from natural sources for enhanced oil recovery. CCUS clusters pipeline-networks are significantly more complex presenting a new set of challenges. Such networks take CO_2 from a multiple sources, which are characterised by varying flow rates, process conditions and compositions. These flows are blended and delivered to one or more, potentially quite different sinks. CO_2 impurities that may be

tolerated in the pipeline, may not necessarily be acceptable during storage even if present in relatively small percentages (ca. 0.1 %) given their long-term cumulative effects (5).

Several dedicated design standards exist or are under development for CO_2 pipelines:

- Unites States: CFR part 195
- Canada: CSA Z662
- Europe: DNV-RP-J202
- ISO 27913:2016

These standards need to be reviewed in the context of the operation of pipeline networks.

Aims and Objectives

Clearly without viable plans for CO_2 transportation infrastructures, CCUS will not happen in Europe. Investors are unwilling to invest in a capture plant where there is uncertainty regarding the availability of transport and storage infrastructure; and, conversely, infrastructure investors are unwilling to invest without the certainty that capture plants will emerge.

This working group aims to show the design solutions that have been or are being developed in existing or planned transport networks. While large-scale CO_2 transport is a new industrial activity, the technology is proven and available. A number of CO_2 transport systems will be reviewed (e.g Snohvit (ongoing), ROAD (design was ready, but project cancelled), UK projects (Teesside Humberside, & South Wales (ongoing)), as well as the current Projects of Common Interest.

Nevertheless, there are some areas that require further work to reduce cost, ensure optimal operation and integration into CCUS clusters whilst addressing public concern. Onshore, high-pressure CO_2 pipelines may require different regulations in some Member States, with some aspects of accidental discharge from leaks or ruptures remaining R&D topics. These remaining questions and issues will be outlined and the current state of knowledge will be reported. Regulatory regimes in different Member States need to be analysed. A harmonisation of regulatory regimes may become highly relevant in particular to enable transnational projects.

Topics

A list of topics to be covered will be set up, as the first activity of the TWG. Topics will be related to areas that require further work and will range from those in the legal and regulatory domain, to technical matters (e.g., CO_2 quality specification in a network), network design (required resilience and flexibility) and liability (around venting and leakage). While the focus of the work will lie on transport by pipeline, ship transport will also be considered.

TWG members

The TWG will be led by Haroun Mahgerefteh (UCL, for ZEP) and Roland Span (Bochum University, EERA CCS transport lead).

TWG membership should cover industry (representatives from ongoing or recent CCS projects), R&D, standardisation (ISO groups working on a transport standard), legal and regulatory fields. The TWG will be run jointly with the transport subgroup of EERA CCS.

Timeline

The TWG aims to present a draft report to the March 2020 AC meeting.

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