

STRATEGY CCUS FINAL EVENT

June 14-15, 2022 – SCOTLAND House Brussels.

MEETING SYNTHESIS – Q&A

DAY 1 - Tuesday June 14, 2022, from 2pm

V 13/06/2022



STRATEGY CCUS
FINAL EVENT
June 14-15, 2022 - Scotland House, Brussels
Agenda

Day 1: Tuesday June 14, 2022				Connection link Session 1 https://urlz.fr/lvda		
Agenda item	START	Length	END	CONTENT	MODERATION	COMMENTS
1	13:30	30	14:00	Welcome Coffee and registration		The venue will be opened to participants from 13.00
2	14:00	5	14:05	Opening Session	I.Czernichowski (BRGM)	
3	14:05	20	14:25	Key-note Speaker Introduction	F. de Mesquita Veloso (BRGM)	Vassilios Kougiouas - Policy Officer for CCUS EC-DG RTD (TBC)
Session 1 - PRESENTATION OF SCENARIOS RESULTS /REGION FOCUS						
4	14:25	15	14:40	Overview of the 8 CCUS regional scenarios : Starting from an European map with the 8 localizations of the scenarios => 8 zooms in the 8 regions	R. Berenblyum (NORCE)	
5	14:40	20	15:00	Economics of the scenarios : "comparison" of the 8 regions	P. Coussy (IFPEN)	
6	15:00	15	15:15	Q&A session on Economics of Scenarios		
7	15:15	20	15:35	Transnational CCUS approach Presentation of 4 scenarios	X.Guichet (IFPEN)	
8	15:35	15	15:50	Q&A session on Transnational CCUS approach		
9	15:50	30	16:20	COFFEE BREAK		
10	16:20	20	16:40	Sustainability assessment of CCUS in the 3 main regions: LCA and MRIO results	Y. Lechon (CIEMAT) (online)	
11	16:40	15	16:55	Q&A session LCA & MRIO on the 3 main regions		
12	16:55	20	17:15	Social acceptance of CCUS	S.Preuß (Fraunhofer ISI)	
13	17:15	10	17:25	Q&A session on Social acceptance		
14	17:25	20	17:45	Storage maturity and actions towards bankability	F. de Mesquita Veloso (BRGM)	
15	17:45	10	17:55	Q&A session The specificity of storage maturity		
16	17:55	15	18:10	Conclusions	F. Delprat-Jannaud (IFPEN)	
16	17:55	120	19:55	ICE BREAKER		The ice breaker will take place at the venue, until 20.00/20.30, open to all participants

The meeting started at 2 pm after a welcome coffee.

Dr Isabelle Czernichowski welcomed the participants and opened the meeting. She provided information about the project, recalling the context of Covid-19 pandemics. Despite the impossibility



to meet in person, the team faced and adjusted to the situation in order to achieve the goals set in the Grant Agreement, including virtual meetings with regional stakeholders.

Dr Vassilios Kougionas, European Commission policy officer for CCUS, at DG Research and Innovation in the Clean Energy Transition Unit, shared the goals, policy tools and expected impacts regarding CCS and CCUS towards clean Energy transition in Europe. He followed with a review of Horizon Europe programme and next steps to reach CCUS 2030 targets, outstanding projects and Carbon Dioxide Removal (CDR) missions.

The STRATEGY CCUS regional teams and partners then took over to present scenario results from a regional point of view, focusing on economics, trans-regional CCUS approach, Life Cycle Assessment (LCA) and Multi Regional Inputs and Outputs (MRIO). The importance of Social acceptance of CCUS and the studies and interviews carried out with stakeholders at local, regional and national level were also stressed. Finally, project coordinator Fernanda de Mesquita Veloso wrapped up the review of project results exposing the challenges raised by storage maturity and the way to bankability in the various regions, pointing out main findings and prerequisite steps.

Florence Delprat-Jannaud from IFPEN and president of CO₂ French Club concluded the afternoon session with references to the IPCC report for Policy makers, pointing to the need for CCUS deployment, and the current situation of CCS and CCUS deployment projects mainly in Northern and Western Europe. She emphasised how the progress and achievements of STRATEGY CCUS, with their specific regional point of view, were opening new perspectives and European synergies for further deployment of CCUS in Europe, including a sequel project PilotSTRATEGY. She finally invited participants to register and join the next GHGT 16 conference in Lyon (France) on Oct 23-27, 2022.

DAY 1 Question and Answers

Speaker/Topic	Question	Answer
CCUS development plans, techno-economic assessments, transport, storage (Paula Coussy) Compare investment costs VS compliance costs	Yannick Le Gallo (Geostock) What is compliance costs on EUTS?	PC : When industry needs to provide allowance costs for CO ₂ emissions, they must give back as many allowances as CO ₂ emitted. Hence, depending on whether they are a sensitive industry or not, they can have it for free or need to buy on the market for one year (Paula to give definition) Our scenario hypothesis is based on 72€ EUTS > 225 in 2050. We compare the amount of the compliance costs and the computed cost of the CCUS, investing in CCUS or paying the allowances.
	Domagoj Vulin (Unizg_RGHf) = what is more effective?	We need to do everything in term of amount, very good question, in an industrial way, you cannot wait, to be out of the game in 2050

	Why so low costs?	Low costs are drawn from literature, not updates, it's a long-term scenario, based on the quantity of CO ₂ avoided...this is why our cost is so low and we present discounted costs
Xavier GUICHET T5.3 Transnational Scenarios economic evaluation Overview of 3 regions: Northern Croatia/West Macedonia, Upper Silesia / Northern Croatia, Rhône V/Ebro Basin	Nicolas Peugniez (GRT Gas) Why the increase in storage costs in Macedonia? What if need to increase storage between Ebro / Marseille, storage available in Ebro area would be enough?	XG = In fact in the Ebro area only 1 storage is used, 3 others are identified. Even if we increase capture in the Ebro area, not all storages are filled, there is still room to store CO ₂ and even more
	Nicolas Peugniez (GRT Gas): and the link to Thessaloniki would allow more storage?	XG: yes, but transport would be and take longer
	Francisco Pangaro (Repsol) = what is the impact of compressing CO ₂ , on emissions?	XG: we have taken this into account, since it implies the use of electricity we used a specific table, so efficiency of captures is already considered. We consider the intermediate compressors for the transport from Marseille to Greece adding the CO ₂ from Ebro Basin
Yolanda Lechon (CIEMAT) online: Environmental and Socio-economic sustainability assessment of CCUS in 3 main regions (LCA/MRIO)	no questions	
Sabine Preuß (Fraunhofer ISI) Social Acceptance, Actors = SH and General public	F BORGES (GALP) = you take into account Stakeholders' opinion, yet public acceptance is crucial, and a major factor considered at government level before making a decision, what is the difference between social and public acceptance in your mind?	SP: We consider the public has not the knowledge as Stakeholders do, so we need to raise the knowledge of public. It is crucial because of public resistance. Stakeholders also influence the public, through the media for instance, and by interacting with them. So, their influence is strong. In PilotSTRATEGY, there will be more emphasis on public participation.
	Paulo Rocha (CIMPOR): who should take the lead on spreading knowledge and	Key Stakeholders can do a first step, but they should be supported by the state, policies and legal frameworks. In

	information and have the role? A shared work, some entities?	in addition, we need to consider the voice from the general public. Then with these 3 components working together, we can reach the goal, but we need to be careful with communication and with considering that everyone feels heard.
	[17:19] Bill Delday Seems we have an education challenge to explain that we need to reduce carbon in the atmosphere	Constantin Sava (GeoEcoMar): in Romania, CCUS and storage are a long process and related with storage, we present the process as preliminary, with feasibility studies before mentioning the capture project.
	16:58] Bill Delday: Were there reasons given for preference of CCU v CCS? for a region in particular? or all the regions? BD - in general given the results presented	SP: This finding is supported by existing literature. CCU was preferred, because of the notion of reuse and a less feeling of tampering with nature. Romain V: But CCS is more developed and common, people understand CCS is good for environment, but it is less the case for reuse as CCU is harder to implement. So, communication is important
	Fernanda de Mesquita Veloso (BRGM): Could you mention the work you are doing in PilotStrategy?	SP = Pilot is focusing more on public acceptance, doing several surveys in all the regions and analysis in the media (e.g., results when Google-ing CCU or CCS). An important source of information is what we find in Google, and interviews are very important. We focus on communities that could be influenced by the CCS implementation in the area, they are some good sources for the interviews.
	Francisco Pangaro (REPSOL): we need to point out the significant role of stakeholders and NGO's	FMV = NGO's engagement is very low. Industries are more represented. In STRATEGY CCUS, it proved very difficult to involve NGO's, they keep refusing discussion and getting involved.
Fernanda de Mesquita Veloso (BRGM) On storage maturity	Domagoj Vulin = Depleted Hydrocarbon fields are by definition Tier2 with proved seal, strange to see there's no seal data for the DHF prospect showed in the slide	FMV: Indeed. DHF has a proved seal properties as they retain Hydrocarbon for long. This "spider plot" of one of DHF prospect in Croatia was made from data collected in the beginning of the project. Mistake could be taken in filling in tables.

QUESTIONS AND COMMENTS IN THE CHAT (online participants)

[14:51] Bill Delday =

Is it possible to share contact details for the local teams for those online to follow up later? Not all for me - regions 2, 3, 4, 7 & 8 please – Information provided in the chat

1 EBRO Basin = Paula Fernández-Canteli Álvarez <paula.canteli@igme.es>

2 GALATI = Constantin SAVA <savac@geoecomar.ro>

3 Lusitanian = Júlio Ferreira Carneiro <jcarneiro@uevora.pt>

4 Northern Croatia = Domagoj Vulin <domagoj.vulin@rgn.hr>

5 Paris Basin = Fernanda de Mesquita Veloso <De Mesquita Lobo Veloso Fernanda <f.veloso@brgm.fr>

6 Rhone Valley = DUMAS Cecile <cecile.dumas@ifpen.fr>

7 Upper Silesia = Krzysztof Stańczyk <kstanczyk@gig.eu>

8 West Macedonia = Pavlos Tyrologou <tyrologou <tyrologou@certh.gr>

[15:04] Didier Bonijoly (Invité)

1 - Very surprising to see the results, particularly the very low cost of Avoided CO2

Reply on table above

2 - What is the reason of the onshore storage choice for almost all countries? Credibility of onshore storages (public acceptance) in Europe?

Storage resources were mapped from research made in previous projects. Public acceptance and engagement should be studied in each country. This is the work being done in PilotSTRATEGY

[15:25] Bill Delday

Very interesting, thank you. Good to hear that the follow-up will look at pan-European solutions as that should bring opportunities to leverage larger storage sites and lower costs.

[15:26] Melissa Bacatelo

Thank you for the great presentation! What kind of CO2 capture technology was used in the scenarios? Was it the same for all the countries?

Different mature capture technologies were considered in the database of the economic tool. Capture was chosen accordingly with the industrial sector

[15:29] Didier Bonijoly (Invité)

Thanks for precisions!

[14/06/2022 18:07] Leonardo da Silva Ribeiro

I would like to know if the cost (70 E) of the storage is about the total or per year?

Scenario costs, including storage, represented the total cost for the a given quantity of CO2 captured and stored during the period (26 years)



DAY 2 - Wednesday June 15, 2022, from 9 am to 4.30pm

Day 2 of STRATEGY CCUS Final Event was dedicated to presentations, roundtables and discussions on crucial steps for CCUS delivery in Europe in the morning, followed in the afternoon by talks and discussions on the way forward, progressing from results to actions. The panel of participants and speakers was composed of policy and decision makers at national and European level, stakeholders and Advisory Board and Industry Club members.

Morning Session – 9 am to 12.15pm

Day 2: Wednesday June 15, 2022				Connection link Session 2 (am) https://urlz.fr/ivdl		
Session 2 - Morning - ROUND TABLE: CRUCIAL STEPS FOR CCUS DELIVERY, WITH POLICY MAKERS AND STAKEHOLDERS AND ADVISORY BOARD MEMBERS						
Agenda item	START	Length	END	CONTENT	MODERATION	COMMENTS
1	8:30	30	9:00	Welcome Coffee and registration		The venue will be opened to participants from 8.30
2	9:00	5	9:05	Introduction from one project partne	F.de Mesquita Veloso (BRGM)	
3	9:05	30	9:35	Industry clusters How UK and Norway tackled these challenges, what they did and how they overcame them. Testimony from other projects	Ch. Gorecki (UNDEERC)	to introduce the session and chair
	9:35	30	10:05	Roundtable > Key Questions		
4	10:05	30	10:35	COFFEE BREAK		
5	10:35	15	10:50	CCUS in sectors – Introduction from one project partne	F.de Mesquita Veloso (BRGM)	
	10:50	60	11:50	6 Sector presentations (10min per sector) • EOR (Dubravko Novosel, INA d.d.) • Cement (Maxime Butler, Lafarge Holcim) • Coal (Corwyn Bruce, Sask Power and Lehigh Hanson) • Steel (Damien Chambolle, Arcelor Mittal) • Refinery (Ivan Rodriguez, Concawe) • Waste to Energy (Marius Tednes, Fortum Oslo Varne)	Romain Viguier (UEDIN/SCCS)	
6	11:50	25	12:15	ROUNDTABLE: eliciting and gathering opinions, concerns and advice of roundtable participants (online & in-person – enable input from All)	Romain Viguier (UEDIN/SCCS)	
7	12:15	60	13:15	LIGHT LUNCH		The lunch will take place at the venue, open to all participants

Session 2 on Crucial steps for CCUS deployment was broken down in 2 blocks.

The first part looked at **Industry Clusters**, the way they tackled challenges and how they overcame them, bringing in testimonies from other projects and experiences.

Charles GORECKI (UNDEERC), a STRATEGY CCUS Advisory Board member, first gave an account of US achievements in terms of CCUS deployment through various stages over nearly two decades (small scale injection projects, commercial demonstration phase, commercial deployment...) and partnerships to support these steps through the "Regional Carbon Sequestration Partnership Initiative". The current initiative is looking at addressing regional capture, transport use and storage challenges that are facing the commercial deployment of CCUS in the United States. The focus is on strengthening the technical foundation for geologic storage and enhanced oil recovery. The biggest economic hurdle is the capture costs and the economic cost related to capture. Other important subjects are monitoring technologies, promoting the integration between capture, transport, storage and use in the industries involved, facilitating the regulatory framework and bringing scientific support to policy makers and elaborating economic drivers (tax credits and other incentives) to knock down barriers.



In the United States, the biggest incentive that has really pushed the deployment of CCUS forward is the federal tax credit. It's \$50 per ton for dedicated storage or storage and saline formations, \$35 a ton, yeah, if it's stored in association with enhanced oil recovery that that price is ramping up until it gets to that point in 2026. Ethanol producer, biodiesel producer can apply into low carbon fuel standards programs, and get a 45Q tax credit and sell their fuel into a low carbon fuels market. There are also a lot of state incentives.

To conclude, they developed an adaptive management approach to help implement projects starting with site screening through the feasibility and design construction operation and closure post closure. And they have a best practices manual on this through the Pico Partnership program that they would be happy to share as well.

Then Philip Neele from TNO took over saying that as in North America and around the world there are many CCS/CCUS initiatives in Europe, the technology is mature enough to be rolled out on a large scale. The message for stakeholders, for perhaps the general public, is that there are lots of storage capacity in this region, especially in the North Sea as all of the countries on the map and no leakage of any kind have ever been reported for all the ongoing projects around the world which is a good result. Through the EU CCS directive, all member states have, same regulatory basis to deal with CCS, but not all countries are at the same advancement level.

He provided information CO₂ transport and storage in the Netherlands, illustrating his presentation with several projects such as PORTHOS and ARAMIS. In NL it is about showing the feasibility, safety, viability of offshore storage (onshore will be considered in the future). Storage reservoirs are depleted gas fields for 6 of them, and one saline formation. Total capacity is estimated to 960 Mt, so NL are in a situation to store their own CO₂.

Porthos project = 3 depleted gas fields, storing CO₂ from Rotterdam. Support = National and EU funds, ETS plus floor price guaranteed for 15 years. For storage permits, PORTOS project uses the legacy of a previous project. The project structure it's a close cooperation between the emitters, the transport operator and the storage operator and support come from national subsidy with a minimum price guarantee that emitters can count on and there are also EU funds that help. There is almost 40 megaton capacity. When the full storing capacity is reached, we'll close the fields and eventually abandon the structures, so any new CCS activities need a second project Aramis.

Aramis Project = also operates out of Rotterdam. The plan is to construct a large pipeline to the guest fields further north in the offshore area. Aramis project aims to construct large scale: depleted gas field (400MT capacity) with emissions from Rotterdam to offshore platform at 200km, using a pipeline 20Mt per year. They have contact with emitters in NL, BE, DE, FR. Start of operations should be around 2026.

There are operation limits when using depleted gas fields, especially gas fields that are at low depletion pressure, since they present a risk of hydrate formation (high pressure in pipes, low pressure in field). These are being considered in both projects, through devising injection scenarios to find reasonable transport and injection solutions adjusting various parameters (pressure, lower injection rates ...). CCS/CCUS directive regulates all this. It dictates the need for a monitoring plan on operational plan. These projects are building expertise and knowledge, they are in our country (NL) but could serve as model for other neighbouring countries. transport and storage tariffs are around €90.00 per ton, at ETS level this is expected to increase over the next years.



Speaker/Topic	Question	Answer
<p>Charles GORECKI (UNDEERC) Regional Carbon Sequestration Partnership Initiative North Dakota and Wyoming are the two states in the USA having the authority to permit CO2 storage. It requires a delay of 7 to 8 months. 2 projects of 150 mt/year and 4Mt/year Regulation and permitting, inspection fees > long term liability, Incentives = 45 Q Tax credits carbon</p>	<p>N PEUGNIEZ > C. Gorecki > how did overcome the problems with Stakeholders? What kind of company involved in the summit?</p>	<p>CGORECKI: When storage site is close to the emitters, no real problem with local stakeholders. The problem is when storage is far from the emission point and many kilometres of pipeline are needed to transport CO2.</p> <p>P.Neele: In the NL, the summit and Navigator Project managed to raise \$1.5 billion in capital, and they made individual agreements (ethanol and biodiesel facilities) to operate pipeline, storage facilities. So, investors payed. They are mostly agricultural companies and decided to create new companies to add value, tax credits are incentive too. They have the commodities to decide and build a solution for CO2, the next step is to bring down carbon intensity of agriculture. They are central and the money people.</p>
<p>Filip NEELE Porthos and Aramis projects</p>	<p>Y Le Gallo = In both projects what about well integrity and the abandoned wells when reusing depleted gas fields?</p>	<p>PNeele In Porthos project, we are reusing wells after workover. Fixing wells where needed. No details for Aramis project but should be the same. CGorecki = there is need of lots of investments on checking well integrity. For EOR, every well is re-entered, there are more challenges with old (legacy) wells (up to 1900) and it is costly to evaluate their integrity. To have permit we need to locate the legacy wells (50 to 70 years old) which are our</p>

		biggest potential leakage pathway and to have monitoring plans for them.
	R.Beremblyum = Pipelines are built for EOR. Switching to storage funded by 45 tax credit. To which extent the experience is linkable to EOR for CO2 transport? How do you explain the rapid growth?	CGorecki = in oil recovery pipelines can transport up to 10M tons /y, but with tax credits, pipelines are built for EOR, but the business model is changing. They are switching to gas storage because of the tax credit on low carbon fuels programme rather than EOR
	RB so the existence of incentive is more important than the existing infrastructures	Incentives=>YES incentive such as tax credits are a major driver mechanism.
	Eadbhard PERNOT - Clean Air Task Force (NGO)= What about Environmental NGOs, social acceptance and public opposition. How do you address these problems? How can they be overcome to make these projects happen?	CG = it is a huge issue, transport from one to other state, is causing lots of concern from Stakeholders, lots of things are done to help with SH engagement, to lower opposition of the public, with meetings with scientists, educating people as much as possible but it is a difficult process, public acceptance remains a big concern with pipelines in Iowa for instance
	F Pangaro: The Porthos project is done for 15 years storage. Is it related to minimum price guarantee or subsidy length or just capacity driven?	F NEELE: it is both. the capacity of the fields is limited (full after 15yrs) and same period for the subsidy scheme. So, the emitters' part of Porthos found another solution, which could be Aramis project when Porthos project is at full capacity, and its lifetime of 15 years comes to an end
	FMV >time to get permits in US is amazing, for a research permit in EU, it requires several years (2 to 5 years at least). What could we do here to	CG = EDA is 4 years. The big challenge with EDA is that EDA have a number of experts, who do not know about geology etc... So, we are insisting with local governments who have

	<p>reduce this time and change policies, what is your advice?</p>	<p>their experts already there who understand geology, local knowledge and good relations with regulators help to shorten the delays. When the regulator is involved in the project they understand it, so it takes much less time to get the permit. Need to hire their experts to be your consultants. The closer the regulator is with the suitable experts, the shorter the time to get the permit. The coarser the regulation is, the harder it is....</p>
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Romain Viguier thanked both speakers for their contribution to this morning's discussion and for the expertise they developed in both the Netherland and the USA.

COFFEE BREAK

The second part of the morning session investigated the challenges faced by the industry sector with the testimonies of several industries representatives. Each speaker had 10 minutes to present their industry context, situation, requirements and prospects regarding the deployment of CCUS.

• **EOR (Dubravko Novosel, INA d.d.) from Croatia**

INA is an EOR company in Croatia. Presentation of an EOR project overview and impact on carbon footprint in Croatia (CO₂ from gas field, transport over an 88km pipeline).

• **Cement (Maxime Butler, Lafarge Holcim)**

Cement (Maxime Butler, Lafarge Holcim) – Holcim Plan= Net zero by 2050. Reduction pathway =1st step in 2030 > 475kg CO₂ /T cementitious (currently 555KgCO₂). CCUS has a major role in reduction with around 50%.

• **Coal (Corwyn Bruce, Sask Power and Lehigh Hanson)**

Life extension of 1969 build coal fired power unit. Economics driven by value of existing infrastructure, fuel cost savings for coal vs. natural gas, value for CO₂ produced to supply Enhanced Oil Recovery (EOR), Project Launch 2008, Approved 2011, commissioned 2014•\$1.242B (cad) budget, final cost app. \$1.5B (cad)•Over-run related to coal power life extension, not CCUS

• **Steel (Damien Chambolle, Arcelor Mittal)**

"Decarbonisation roadmap with CCUS". Steel is everywhere, but recyclable and recycled and only the process bears carbon. The low C process exists, and carbon avoidance can reach more than 80%



France our roadmap to reach -35% CO2 emissions by 2030 Steel is a choice material for transition – 0 emission is achievable with CCUS

• **Waste to Energy (Marius Tednes, Fortum Oslo Varme)**

Some Challenges in the Hafslund Oslo Celsio CCS project -World's first full-scale CCS project on Waste-to-Energy. Permanent geological storage below seabed. 400 000 tons CO2/year, 90%CO2 capture. CCS on Waste-to-Energy provides 50 % CDR.

Challenges:

- Carbon capture on WEE plant raises problem of heat supply. We use steam first for carbon capture, then for heating in combination with a heat pump, but there is an electricity production loss.
- the multiple sources.
- the fluctuating composition of flue gas.
- the size of the capture plant.

• *Refinery (Ivan Rodriguez, Concawe) > planned but finally not present.*

A roundtable followed with a round of questions and answers and discussions.

Speaker/Topic	Question	Answer
Waste to Energy (Marius Tednes, Fortum Oslo Varme)	C. Gorecki What type to treatment technology?	The emission technology is strict-> we have no specific treatment, we use the flue gas treatment system
Arcelor Mittal and Holcim	J Carneiro: have you an idea about the Marseille offshore site? What capacity Cement sector -> is it mineralisation proposed?	Damien C->we are talking of 1 million ton/year of CO2 captured/stored; we need to use hydrogen to reduce the main part of the emissions, we don't know how it will be done... Maxime Butler= Mineralisation will only be a small part of the solution. For cement it was indeed Upper Silesia, for mineralisation, the average is 1mil tons/year in a single point source practically very difficult to get all storage with mineralisation technique, it is not the only/perfect solution, but a small part: we work with all industries.
Arcelor Mittal M B.	Bill Delday (online) Are there any concerns about investment in capture	Maxime Butler: Investment is huge, business model not feasible without subsidies to



	<p>solutions when the stores are still being developed and we still do not have international agreements to allow cross border shipment?</p>	<p>support development. We have bottlenecks since we have too much volume/storage, so need to put the resources on the development of volumes, and cross boarder shipment will take time. Reservoir volume is coming in the next years. It would take time to unblock agreements to avoid the London protocol. I don't see this that a great block, but the storage volumes-> yes But it is not a challenge. When we have projects on, we can go ahead</p> <p>Damien Chambolle: this is under discussion, not without public funding, we are ready to present orders</p>
<p>Waste to Energy (Marius Tednes, Fortum Oslo Varme)</p>	<p>FMV= CO2 capture is public help or private?</p>	<p>Part of it is private; partly from Norway government, they funded costs 300 M € out of the 900M€ of the project, it covers the cost of transport</p>
<p>Lafarge, Maxime:</p>	<p>FMV = more questions to Lafarge Holcim: Why do you use CCU/ S? Why not CCUS or CCS;</p>	<p>M. Butler = to us it is all going together, but more likely that we have more CCS rather than CCUS, but rather communication from the group (CC/S)</p>

End of Session 2 and LUNCH BREAK



Afternoon Session – 13.30 to 16.30

Session 3 - Afternoon - DISCUSSION: WAY FORWARD: TALKS and DISCUSSIONS " FROM RESULTS TO ACTION"

				Connection link Session 3 (pm) https://urlz.fr/ivdw		
Day 2: Wednesday June 15, 2022						
Session 3 - Afternoon - DISCUSSION: WAY FORWARD : TALKS and DISCUSSIONS " FROM RESULTS TO ACTION"						
Agenda item	START	Length	END	CONTENT	MODERATION	COMMENTS
1	13:30	5'	13:35	Welcome note	P.Rocha (CIMPOR)	
2	13:35	15'	13:50	Setting the scene A vision from three different angles	Paulo Rocha (CIMPOR / Innovation & Sustainability)	
3	13:50	40'	14:30	The major techno-economical roadblocks and how to overcome them - Roundtable Structured Session (Q&A with final notes)	F.de Mesquita Veloso (BRGM)	Volker Hoenig (ECRA / Managing Director) (OK / online) Nicolas Peugniez (GRTgaz / Deputy Strategy & Regulation Director) (OK / in person) XXXX XXXX (CEFC in Brussels) (tbc / online) Per-Olof Granström (Zero Emissions Platform / EU Director) (OK / in person)
4	14:30	10'	14:40	BREAK		
5	14:40	30'	15:10	The central role of social dialogue in CCUS deployment Structured Session based on Mentimeter questions (Q&A + Mentimeter) Remarks from moderator and invited person on Q&A of Mentimeter:	Sabine Preuß (Fraunhofer ISI) + Diana Cismaru (Comunicare Ro)	
6	15:10	40'	15:50	Moving ahead and required supporting policies Structured Session (Q&A with final notes)	Jonas Helseth (Bellona / Director Bellona Europa aisbl)	Carlos Zorrinho (MEP S&D PT / ITRE Committee) (OK / online) Maria da Graça Carvalho (MEP EPP PT / ENVI Committee) (OK / online) Pedro Mora (PTECO2-Spanish CO2 Technology Platform / Vice-President) (OK / in person) Volker Sick (Director 'Global CO2 Initiative') (OK / online)
7	15:50	10'	16:00	Wrap-up & Thanks	F.de Mesquita Veloso (BRGM)	
8	16:00	10'	16:10	Closure	I.Czernichowski (BRGM)	

The afternoon session was dedicated to talks and discussions on how to move ahead to deploy CCUS further, which requirements, policies, regulatory framework, etc... and how to step from results to action.

After recalling STRATEGY CCUS project main features and results, Paulo Rocha (CIMPOR) provided an overview of the global situation, introducing a vision from 3 different angles: techno-economics, societal and policy recommendations (Political / Regulatory & Legal). He then left the floor to the 1st Round table on the major techno-economical roadblocks and how to overcome them. Moderated by Fernanda Veloso (BRGM / Project coordinator). Members of the panel:

- Volker Hoenig (ECRA / Managing Director) (online)
- Nicolas Peugniez (GRTgaz/ Deputy Strategy & Regulation Director) (in person)
- Carla Pedro (APQuímica -Managing Director) (online)
- Per-Olof Granström (Zero Emissions Platform / EU Director) (in person)



Then followed the second panel with an open discussion on “The central role of social dialogue in CCUS deployment”, led by Sabine Preuß (Fraunhofer ISI) who set up the context then used Mentimeter sessions to interact with the attendees (online and in person).

The last roundtable, chaired by Jonas Helseth (Bellona/ Director Bellona Europa aisbl), welcomed the participation in person of two EC Members of Parliament, Maria da Graça Carvalho (MEP EPP PT / ENVI Committee) and Carlos Zorrinho (MEP S&D PT / ITRE Committee) and Pedro Mora (PTECO2-Spanish CO2 Technology Platform / Vice-President). Volker Sick (Director 'Global CO2 Initiative') participated online. The discussion subject focused on how to move ahead, and planning/setting up the required supporting policies.

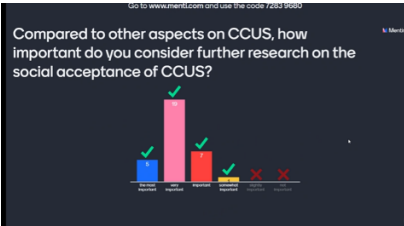
Isabelle Czernichowski and Fernanda de Mesquita Veloso (BRGM) wrapped-up and delivered the conclusions of the event. They thanked participants and attendees for these interesting presentations, discussions and inputs, and congratulated them for their contributions to help with CCUS deployment, wishing it would continue for the best to reduce CO2 emissions significantly.

Speaker/Topic	Question	Answer
Carbon capture with permanent storage (CCS) or utilization of the captured CO2 (CCU) are tools for reducing CO2 emissions, and both are needed to combat climate change. While CCU is an integral part of the long-term vision, CCS is necessary on the way to reach large-scale reduction of CO2 emissions as quickly as possible.	FMV = What kinds of possible synergies with other industrial sectors does GRT Gaz foresee, particularly energy intensive industries that need CCUS technologies for their respective decarbonisation?	GRTGaz : Nicolas Peugniez As pipeline operators, for these long terms assets, we are interested in how usage and CO2 storage evolve to make hypothesis on time frames. Ex in cement, it needs a long time, in steel, one process might change in another, we are in the middle. We try to build synergies with other parts of energy transition: CCS is here a solution for the long-term transition from fossil to biofuels, it fits well with transformation of bio-fossils to bio-methan...
	Online Comment> Didier Bonijoly Following this morning's discussion, CCU(S) perhaps illustrates the doubts of manufacturers about the real availability of transport and storage infrastructures in certain European countries. Which countries (except UK, NL, N) are really ready to put in place national programs that could address these concerns?	

	How could natural gas networks contribute to the energy transition and carbon neutrality of the European economy while profiting at the same time from the expected deployment of CCUS technologies that are required for of decarbonisation pathways of several other sectors?	We must reconfigure the pipelines to avoid continuing and importing from faraway, we could reuse them in two directions; to hydrogen or to CO2; we need to find the switch point when methane gas is less used or produced. Need to upscale perhaps...
	Do you have an idea of consumption of natural gas?	Energy efficiency gas demand flat or decrease. If replaced by another gas; CO2 is more or less related to similar question. Having something and reuse it is more affordable, using the existing network and infrastructure>.
	Ch Gorecki: all pipelines, reusing is not done because of the design for that; hydrogen is a tiny molecule, we need a pipe 3 time the capacity. Need to build new infrastructure?	NP -Reusing is not best, but it is an advantage that this exists; we are doing the same for CO2, we are delivering gas for big emitters, we can keep on this and start with gas reuse search to find how for H2. a quick way to have it. for small volumes CG - For CO2 (supercritical liquid) and hydrogen (need more capacity as these infra are not suitable NP: in fact, at our stage and level, pipeline is a quick way to have it, reducing pressure for hydrogen, it is a shortcut to get it done. Need to start the process even if not perfect...
It is widely known CCUS will be necessary for the cement industry to reduce its CO2 emissions due to its hard-to-abate process emissions representing 65% of total emissions (combustion emissions will be	What are the main techno-economic challenges for the deployment of these technologies in this sector?	VOLKER... Capture itself it is not the biggest challenge; lots of capture technologies are developed for the cement industry. Biggest challenges are with CO2 infrastructure, storage, and utilisation mean lots of challenges. 2/3 of emissions are coming from material which are not avoidable for the main industry. We must capture,

<p>addressed with net-zero fuels) and to the fact of being a high enthalpy process with limited chances of electrification.</p>		<p>develop infrastructure for big volumes 1.5-2 Mt /year, Regulatory aspects /permitting procedure: we are involved in Germany including for cement, we need to discuss and adapt the legislation. Legislation wants to reuse the current legislation big-time consumption large quantities, storage.</p>
<p>CEFIC APQuímica (Chemical Industry) Carla Pedro (Managing Director) Carbon will be always necessary in our economy to manufacture the products we need. Converge towards a common goal of deep de-carbonisation or carbon neutrality by converting CO2 labelled as a villain into a hero is one of the ways out, providing its recycling or recovery instead of sourcing it from petroleum, when using CCUS technologies.</p>	<p>What could be the role of the chemical industry in front of the need to take advantage of the CO2 that may be harvested from industries' emitting stationary sources, where it is more concentrated than in the air? Could they be converted it into other value-added products, which are required for our economy that will continue to rely on carbon for their manufacturing processes?</p>	<p>Carla Pedro, director gral of APChemicA in Portugal, a competitiveness cluster , developing projects. Chemical sector is both emitter and converter of CO2, we are focused on the U of CCUS, using recycled CO2 in our processes is important, as a source in carbon instead of use petroleum. It is the basis for interesting partnership with high emitters not only to contribute to the decarbonistaion, but also economic. Using CO2 of other high emitting industries requires a specific business model elaboration Framework is not ready to open the way to large utilisation, technologiess are generally there, there are solutions and lots of possibilities at an initial level, the biggest challenge is to scale up, with adjustable business models allowing to go to commercial path. You can't have a basic rule, nor on technical nor financial terms, we need framework that is flexible enough to allow CO2 mutualisation to take place at commercial level and allowing CCUS deployment to take off and succeed.</p>
	<p>What could be the roles of the private and public sector in this process? How could this pathway be partially a credible alternative to permanent CO2 storage? What</p>	<p>It is about how we address the investors. The technologies are there...Startups, possibilities of prototypes, pilots, the biggest challenge is the scale to support that makes a lot of possibilities. It would</p>



	kind of incentives need be created to make it happen?	allow to accelerate the process and doing a commercial development.
	We need a business perspective that will make these solutions attractive. What kind of business models would we need for removing existing barriers and promote the market development of all the pieces of the chain (CO2 capture, transport, storage and utilisation) of these CCUS technologies? What kind of interactions should we create to make it happen?	<p>ZEP platform (Sweden) Per-Olof Granström :</p> <p>ZEP platform broad set of members from all sectors of Industry (innovation & technologies, oil gas energy industry...), working closely with EU members and institutions.</p> <p>The approach from CCS and CCUS is very different. The approach to CCUS is cross-border.</p> <p>The platform has set up a document with propositions of strategies, including all targets needed. This will be a working group on CCUS shortly including and focusing on CO2 infrastructure.</p> <p>2nd step = the need regulatory framework for transport, not only storage.</p> <p>Very few examples of business models in EU. UK and Norway have very different ways of tackling these issues. Still not much in the rest of EU, so we are supporting the regulatory flexibility. We discuss all these in ZEP, talking openly. Pipeline transport and shipping are quite different.</p> <p>60 of these CCUS projects will be active and operational in the next few years, it is very important, and we need to let them develop and take off.</p>
Sabine Preuß presentation of Social acceptance and Stakeholders engagement, including Mentimeter sessions asking various questions to the attendance in person and online		<p>Comment: Emma TER Mors (Leiden University NL)</p> <p>Education is an important part, knowledge and information too, participation is important. Sharing thoughts, community engagement managers in participatory formats.</p> <p>SP: Yes, we need more awareness in the general public but also consider people's feelings and emotions</p>

	<p>Strategy CCUS. We have experience in Scotland. It is a very long journey, which involves engaging with policy makers. We have to accept that CCUS is quite technical, so our work is to make much easier to understand by the media and public. We have to be creative and "careful" in how to communicate</p>	
	<p>Jonas Helseth > Bellona Europa > introduction on Moving ahead</p>	<p>MG Carvalho > from the EU point of view, we need to have a clear methodology to accompany the deployment of Co2 CCS and CCUS, innovation plans...</p>
	<p>JH > It is encouraging to have the support of the EU parliament in these projects and new technologies.</p>	<p>Carlos Zorinho = Thanks for inviting me. I am interested in knowing about the processes, I am not in this area (prof of Management at University), but eager to learn and understand better about these issues. In my work, the solutions we achieved are the basis to us politicians to make our decisions. The solution is we need to align to be successful. Each goal, work, process or technology is valid by itself but need to confront and be consistent with other technologies and the environment must be aligned with a business model. So, if CCS needs be a solution, we need to show this techno makes a difference and helps us to improve possibilities and opportunities and make decisions at our level!!! The level of use CO2 could create a possibility to store in a competitive way. It is fair competition.</p>
	<p>JH > addressing Pedro Mora Peris (Spanish CO2 platform) In Spain, how are policies?</p> <p>Storage is necessary. What happens with critical infrastr, transport?When EU decide ti use</p>	<p>PMP – These are complex questions, we all have same objectives, plenty of concepts but we don't know how we play?? With at least 2-300 M€? Investment is on long term (30 years) and what if policies change? We must align legal line with political line, to know about legal safety and technical equipment to make own</p>

	<p>natural gas, all countries developed a plan for critical infrastructure. It is not possible that one company could develop by itself. We are working to reduce the transport. Depending on countries, we wasted 10 years...some countries are more advanced (No)</p>	<p>decisions. We face contradictory factors and uncertainties legally, politically and commercially. Storage is necessary. What happens with critical infrastructures, transport? When the EU decided to use natural gas, all countries developed a plan for critical infrastructures. It is not possible that one company could develop it by itself. We are working to reduce the transport.</p> <p>How are we going to manage the concept of use of CO₂, so we make the right decisions considering all the factors/criteria for CCUS, critical infrastructures (transport, storage...), we need to have transnational EU infrastructures (like for Gas in other time) and these companies cannot do on their own</p> <p>For politicians, we need 10 years to develop CCUS projects</p> <p>Depending on countries, we wasted 10 years, some countries are more advanced (No)</p>
	<p>JH introduces = Volker Sick - from Berlin (UNI Michigan) > There is a focus on infrastructure, you are supporting projects, how do you see the market developing? What are your expectations?</p> <p>Last decade of inactivity. Possible TRACK1 CCU and TRACK2 material. In both cases you have climate benefit. All things are a system. One of the key aspects to look really firm and long-term policy guidelines. We have 70 capacities...not enough.</p> <p>We need to release a market study to provide as much carbon removal as we need. Need to capture and store a huge quantity</p>	<p>VS</p> <p>From the last 10 years, we have been striving to develop. We see 2 possible ways: TRACK 1 CCU and TRACK 2 material.</p> <p>In both cases, you have a climate benefit. All things form a system. One of the key aspects is to look really firm and have long-term policy guidelines. We have 70 capacities...it is not enough.</p> <p>My idea is to have more utilisation products and projects to increase the USE of CO₂ as much as possible. But locality (various countries) is vital, not all projects can work in all countries, need to adjust to local conditions ...</p> <p>My projections: We should soon release a market study to provide as much carbon removal as we need. We need to</p>

	now, but in future, less...Is a long-term exercise. A balance CCS CCU	capture and store a huge quantity now, but in future, it will be less...It is a long-term exercise. A balance CCS CCU. There are 2-time scales to deal with CO2, CS need to be done quickly, but I believe we should on the long-term focus on utilisation, we need to capture CO2, then we come to a cost, and it's an economic decision, with taxes, ... and then CCS will decline over the years (for CCU?)
	JH wrapping participants talk about importance of the critical infrastructures, their spread and access, and how linked costs matter (difference btw Norway and Austria)	CZ = with the current energy cost rise, it is important to have a strategic alignment, need for a regulatory framework...but techno is constantly changing, we need a new way to set up the regulatory framework, adjusting to evolution of technologies, business models... Which are incentives? Setting up an incentive system as in solar energy, which is now on the market. Which are the prices people being ready to pay to implement these technologies? Then compare with competitive projects.
	JH - will this be enough to mitigate with infrastructures?	MGC - Evolution is critical, we have a different approach from US, in way we set the targets, reaching the integration of technology with a process approach, For instance, in the recovery for coal plants by the Commission, only one project survived, since many factors were not enough nor reached.
Conclusion by Isabelle Czernichowski	With STRATEGY CCUS an important milestone has been reached in EU. For the 1st time, scenarios on CCUS have been elaborated at local level, with local solutions, local integration and with common technologies, with SH engagement, and solutions tailored to local regions, and costs	

	<p>that seem rather low but still to be studied further.</p> <p>The conditions (COVID) were not good, but the team managed to go on and give way to a new project, and new future scenarios and ideas are now coming up after end of STRATEGY CCUS.</p>	
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The conference was closed at 16.30

All information and presentations will be wrapped-up and shared with participants in a few days.
Thanks for your patience!

