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"Carbon4PUR - Turning industrial waste gases (mixed CO/CO₂ streams) into intermediates for polyurethane plastics for rigid foams/building insulation and coatings"

Research and Innovation Action

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Disclaimer



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7.	Technische Universität Berlin	TUB	Germany
8.	Commissariat à l'énergie atomique et aux énergies alternatives	CEA	France
9.	ArcelorMittal Maizières Research SA ¹	AMMR	France
10.	South Pole Carbon Asset Management Ltd. ²	SPG	Switzerland
11.	Grand Port Maritime de Marseille	MFPA	France
12.	Rheinisch-westfälische technische Hochschule Aachen ³	RWTH	Germany
13.	PNO Consultants BV	PNO	Netherlands
14.	Imperial College of Science Technology and Medicine	ICL	UK

¹ At ArcelorMittal two legal entities are involved as linked third parties: ArcelorMittal Méditerranée (AMMED) and ArcelorMittal Belgium NV (AMB)

² At South Pole the following legal entity is involved as linked third party: South Pole UK (SP UK)

³ At RWTH three departments are involved: *Chair of Fluid Process Engineering* (RWTH-AVT), *Catalytic Center* (RWTH-CAT), and *Chair of Communication Science & Human-Computer Interaction Center* (RWTH-COMM)

Acronyms and Definitions

Acronym	Defined as
CCU	Carbon Capture and Utilisation
ESI	Electronic Supplemental Information
EU	European Union
GA	Grant Agreement
КРІ	Key Performance Indicator
LCA	Life Cycle Assessment
ORDP	Open Research Data Pilot
PUR	Polyurethane
tbd	To be determined

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1. The Carbon4PUR project

Carbon4PUR aims at turning industrial waste gases (byproduct exhaust gas streams and flue gas streams of steel industry / mixed carbon monoxide (CO) / carbon dioxide (CO₂) / CO/CO₂ streams) into intermediates for polyurethane plastics for rigid foams/building insulation and coatings. The industrially driven, multidisciplinary consortium is developing a novel process based on direct chemical flue gas mixture conversion, avoiding expensive physical separation, thus substantially reducing the carbon footprint, and also contributing to high monetary savings. The interdisciplinary consortium consists of 14 partners from seven European countries (Germany, France, Belgium, The Netherlands, Greece, Switzerland and United Kingdom) and across sectors: four industries (Covestro Deutschland AG - short: COV, Recticel N.V. - short: Recticel, Viomichania Ritinon Megaron Anastasios Fanis Anonymos Etairia – short: Megara, ArcelorMittal – short: AMMR), five universities (Universiteit Gent – short: UGent, Universiteit Leiden – short: UL, Technische Universität Berlin – short: TUB, Rheinisch-westfälische technische Hochschule Aachen – short: RWTH, Imperial College of Science Technology and Medicine – short: ICL), one association (Dechema Gesellschaft fuer chemische Technik und Biotechnologie e.V. - short: Dechema), one research organization (Commissariat à l'énergie atomique et aux énergies alternatives - short: CEA), two service providers (PNO Consultants BV - short: PNO, South Pole Carbon Asset Management Ltd. short: SPG) and the Grand Port Maritime de Marseille-Fos (short: MFPA).

Both the consortium and the work are organized along the full value chain starting with the provision and conditioning of industrial emissions from a steel (*AMMR, UGent*) to a chemical company (*COV*) in line with the concept of industrial symbiosis exemplarily at *Marseille Fos*, going through the transformation into chemical building blocks (*CEA, RWTH and COV*), which both will be further transformed into polymer intermediates (*RWTH, COV*) and flow into desired sustainable polyurethane applications of rigid foams and coatings (*Recticel, Megara*). Life Cycle Assessment (LCA) and technology evaluation will be done (*UL, RWTH, TUB, SPG*) and replication strategies to transfer the technology to other applications will be elaborated (*Dechema, PNO, ICL*).

The distinctive feature of the developed process is avoiding resource-intense separation of the gas components before the synthesis, and developing a chemo-catalytic process to deal directly with the gas mixture instead. The challenge and innovation is coming up with an adjustable process in terms of on-purpose and demand tailor-made production of required products, taking into account all variables at the same time: the available flue gases characteristic from the steel plant, material and process parameters, and the market requirements for the end product, thus flexibly involving the whole value chain with best results and possibly lower the prices.

2. Objectives and overview

This deliverable represents the final report on the communication and dissemination activities of the Carbon4PUR project. It will cover the description of actions which have been taken to achieve the tasks outlined in the Grant Agreement and the communication and dissemination plans (deliverables D8.3 and D8.7). In particular, the following topics will be addressed:

- the project website and newsletters,
- the project videos and other communication materials,
- the project's social media channels (Twitter and LinkedIn),
- stakeholder events,
- open day(s) events at selected project partners,
- dissemination of results at conferences and fairs,
- dissemination of results in scientific and non-scientific journals and media and
- the main findings of the perception and acceptance study.

It will be shown that all project partners have equally contributed to a successful implementation of the communication and dissemination actions. Particularly, the project partners have attended 33 external conferences, workshops and fairs and have organised 9 own events to present the project to various stakeholder groups.

3. Communication and dissemination strategy and target audiences

Communication, in contrast to dissemination, is mainly oriented towards creating awareness and informing a variety of stakeholders about the project and the project partners' activities. Consequently, the target audiences are inherently heterogeneous and diverse, including academic and industrial stakeholders, networks, associations and initiatives with focus on carbon circularity, regulatory bodies comprising local, national and European authorities as well as other European or national projects. The identification of relevant stakeholders was a continuous process throughout the lifetime of the Carbon4PUR project. A more detailed description of target audiences and their potential interest and benefits can be found in deliverable D8.3 (Dissemination and Communication Plan).

With respect to dissemination, which is mainly oriented in presenting project results, learnings and outcomes, the audiences and individual stakeholders are slightly more limited, as the level of detail is higher and more scientific. The dissemination of results and outcomes is usually more restricted than the mere communication since the exploitable value must be assessed before publishing scientific results and technological developments. For this assessment, the project partners have agreed upon a publication workflow as follows. At least two representatives per project partner have been selected to constitute a publication board. Each publication, be it a public project deliverable, a scientific publication or presentation or general communication materials, was circulated with the publication board to seek for consent and obtain general approval. The review period was set to 45 days within which the board members could provide feedback and address concerns.

Despite the differences regarding content, communication and dissemination are closely related since an effective communication is driven by meaningful and unique content generated by the project. Thus, both activities can be pursued along the same channels and platforms. Consequently, the first steps were to create a webspace and profiles on social media platforms as well as to determine relevant events, e.g., conferences and fairs, for presenting the project. Press releases have been published at the beginning and the end of the project and on relevant occasions like the achievement of milestones. Likewise, the social media channels have been used to closely engage with stakeholders by continuously and regularly posting project-related news. Furthermore, the creation of awareness has been fostered by interacting with posts of our target audience. Besides these online activities, the project partners have actively engaged with target audiences by presenting the project and results at

conferences and fairs. Further, the project has created several videos and a set of standard communication materials, e.g., a project poster, flyers, roll-up banners, presentation and poster templates and a logo, to have a consistent visual identity.

While DECHEMA was in the lead of the strategy, the effective dissemination of project results to target audiences inherently relied on the engagement of the entire consortium in the individual activities, and all partners have reserved budget and personnel to perform these activities. The dissemination strategy has been divided in three consecutive phases reflecting the project progress and availability of project results, as shown in Figure 1. However, the success of communication activities relied on the close and coordinated cooperation among all partners.

Phase	Objective	Methods	
Awareness- oriented	Raise awareness about the project and its objectives within relevant communities and individual stakeholders	 Kick-off press release, Website, Printed communication materials, Social media platforms, Representation at conferences and ACHEMA 2018, 1st stakeholder event. 	
Results- oriented	Promote project results, allow potentially interested parties to get to know achievements and related benefits of the project	 Website with public deliverables, Newsletters, Open-access publications, Conferences and network events, Mid-term event with related projects site visits and open days. 	
Exploitation- oriented	Engage with specific stakeholders for exploitation-driven dissemination; replication opportunities	 Conference presentations, 2nd stakeholder event, Site visits, Trade fair representation, Case studies, Final conference, Final press release. 	

Figure 1: Envisaged phases of communication and dissemination with objectives and methods.

The following section will describe the implementation of the envisaged methods and assess their outcomes.

4. Communication and dissemination actions

4.1 Project website

4.1.1 Strategic purpose and implementation of the website

In accordance with the project proposal and Grant Agreement a project website has been set up by PNO at M3 of the project (December 2017) and reported as a public deliverable (D8.1 Website) at M5 (February 2018). The project website is hosted at the <u>https://www.carbon4pur.eu/</u>. As the project belongs to the portfolio of SPIRE projects, the website is also linked to the SPIRE web platform under <u>www.spire2030.eu/carbon4PUR</u>.

The establishment of the project website served as a dissemination tool following multiple objectives:

- raise awareness within general public and interested stakeholders about the project objectives and the added value of the novel technology,
- widely disseminate project information and relevant communication and dissemination materials,
- increase visibility at both project and partner level,
- inform external parties on project events and other potential events/meeting relevant to Carbon4PUR technology,
- provide a secured documents repository platform with restricted access used by the project partners to facilitate their collaboration and internal communication.

The website has been updated and edited at a regular basis, allowing external parties to maintain their interest on project developments.

4.1.2 Website statistics

During the project's lifetime **48 news posts** have been published on the website predominantly announcing the participation of project partners at conferences, fairs and other events. Similarly, the website was used to announce (stakeholder) events prepared by Carbon4PUR and invite potential participants to these events.

Public

Besides this news feed, the website offered the visitor **19 pages** to learn more about the project's background, concept and objectives (<u>https://www.carbon4pur.eu/about/the-project/</u>), the project partners (<u>https://www.carbon4pur.eu/partners/</u>), and the project outcomes. As the number of results increased over time, the website received a major update and the "Publications and Outcomes" section has been divided into different sub-sections hosting the communication materials (<u>https://www.carbon4pur.eu/public-documents/communication/</u>), the public deliverables (<u>https://www.carbon4pur.eu/public-documents/deliverables/</u>), the publicly available open source mapping tool (<u>https://www.carbon4pur.eu/public-documents/mapping-tool/</u>) as well as the scientific articles and posters published by the academic partners (<u>https://www.carbon4pur.eu/public-documents/deliverables/</u>).

Finally, the website provided the possibility to get into direct contact with the project coordinator and the exploitation manager using a **contact form** (<u>https://www.carbon4pur.eu/contact/</u>) and to subscribe to the project newsletter (<u>https://www.carbon4pur.eu/newsletter/</u>).

Figure 2 shows the number of users from the date when the website was published (December 2017) to End of March 2021, which is the end of the Carbon4PUR project and the date of the preparation of this deliverable. The website has been accessed by over 9,300 visitors in roughly 15,500 session, resulting in a Sessions-per-User count of 1.66. The bounce rate¹ of roughly 60% is only slightly above typical average values of 40-55%. However, considering that some users have accessed the website by referral link or search engine, this value is not critical due to the following reason. A referral or search engine link may lead the visitor directly to a sub-page of the website which is of particular interest to the visitor, e.g., "The partners" or a news post. When the visitor obtains the sought information and leaves the website without proceeding to another page, this will be counted as a bounce, although the visitor had a positive experience.

The other 40% of users, which were not categorized as bounced, have accumulated a total page views count of more than 40,600 pages corresponding to 2.63 pages per session.

The evolution of page accesses shows a constant increase until the beginning of 2019 followed by a slight decrease towards the summer break. A similar behaviour can be also observed for 2020.

¹ The bounce rate is single-page sessions divided by all sessions or the percentage of all sessions on the site in which users viewed only a single page and triggered only a single request to the analytics server. The session duration of such a session is counted as 0 seconds, as there is no further request trigger available to calculate a duration.



Figure 2: Carbon4PUR website statistics – traffic and user behaviour.

Demographics	Country	Users	% Users
Language	1. 🥅 Germany	2,369	25.02%
Country >	2. 📑 United States	1,466	15.48%
City	3. III France	882	9.31%
System	4. Belgium	833	8.80%
Browser	5. E Netherlands	608	6.42%
Operating System	6. III Italy	362	3.82%
Service Provider	7. 🛗 United Kingdom	360	3.80%
Mobile	8. 🔟 Spain	307	3.24%
Operating System	9. 🛅 China	255	2.69%
Service Provider	10. 🔍 Japan	198	2.09%

Figure 3: Carbon4PUR website statistics – user demographics.

The website traffic (Figure 2) can be correlated well with the announcement and implementation of the stakeholder events organized by Carbon4PUR. In particular, the first stakeholder event has been announced in September 2018 and took place in November 2018 in Brussels, resulting in a visible peak in website traffic especially in October and November 2018. In January 2019, Carbon4PUR published its first explanatory video and in February 2019 the mid-term event has been announced. The event took place in March 2019. Consequently, these three months are characterized by an increased number of website visitors (350-370 visitors/month) before decreasing back to the base level of approx. 200 users per month during the summer period. Peak traffic to the website (656 users) was reached in February 2020, which is when the 3rd stakeholder event was announced via all available channels, including Twitter, LinkedIn, newsletter, direct mailing, and the website itself. Two further peaks can be observed in May 2020 (528 visitors), when the project published a major progress update via newsletter, as well as in October 2020 (400 visitors), when the second project video, produced on behalf of CORDIS (cf. section 4.6), has been intensively circulated via social media. Finally, with the announcement and continuous advertisement of the final stakeholder event (cf. section 4.8.5) from January to March 2021 the number of website visitors has constantly increased from 367 (Jan '21) over 450 (Feb '21) to 733 (Mar '21) and the pagesper-session count spiked to 9 in February 2021.

The demographics of website users (Figure 3) shows that the online presence has reached stakeholders from both Europe and the US, where the latter constitute a share of more than 15% of total users.

4.1.3 Conclusions and outlook with respect to the website

The website was used as a general long-term information repository to provide news and updates about the project and the partners. The website is a good measure for the success of the communication and dissemination actions and demonstrates the wide interest of different stakeholders from both Europe and abroad. However, a website is intrinsically and generally not the method-of-choice to create awareness but acts as an entry point to obtain more information after a stakeholder has been approached. Therefore, communication through different channels, as described in the sections hereinafter, has been used and a reference to the website has been set whenever it was useful.

After the end of the project, in March 2021, the website will receive a final major update and make-up including the latest deliverables, communication materials and project videos as well

Public

as a short summary about the final stakeholder event and the information that the project concluded at the end of March 2021.

The website will persist for at least 2 years after the end of the project. However, further content updates are not planned to be posted after the end of the project.

4.2 Newsletter

4.2.1 Strategic purpose and implementation of the newsletter

The newsletter is a state-of-the-art tool to provide purposeful information to a rather small but highly engaged audience, since the newsletter recipients must actively subscribe to the newsletter list. In order to not loose already subscribed recipients by overburdening them with frequent emails, it was decided to send newsletters only for relevant updates like the achievement of milestones or as invitation to events prepared by the Carbon4PUR consortium. The envisioned newsletter frequency was twice a year. The project newsletter was intended to:

- provide a flexible structure with short key messages in the first 1-2 pages, with interactive links to the more detailed information,
- use a pdf format which allows to place it on the project website as downloadable pdf files and for direct mailing,
- ensure a professional level of quality in terms of design.

To meet these specifications a newsletter plugin² was connected to the backend of the Carbon4PUR website. Thus, newsletters could be drafted and tested in terms of content, design and appearance directly from the used plugin. Further, this method allowed to include a newsletter archive to the website (<u>https://www.carbon4pur.eu/newsletter/</u>), thus making it possible for new visitors and non-subscribers to view past newsletters.

Before publishing content updates via newsletter, the draft was circulated for approval with the publication board members. All partners were involved in the curation of content.

² <u>https://www.thenewsletterplugin.com/</u>

4.2.2 Newsletter statistics

So far, 6 newsletters have been sent out. The main goal of the 1st newsletter (<u>https://www.carbon4pur.eu/newsletter/?email_id=2</u>) distributed in October 2018 was to inform the subscribers about the first stakeholder event and contained a save-the-date invitation for the mid-term stakeholder event. Further, information about the last consortium meeting and about the Port of Marseille Fos, the designated location for the implementation of the project results, were provided. Finally, articles about the results achieved so far had been highlighted and linked to the "news and events" section of the website.

The 2nd newsletter (<u>https://www.carbon4pur.eu/newsletter/?email_id=3</u>) distributed in January 2019 announced the details for the mid-term stakeholder event and presented the first project video. Again, a brief summary of attended events was given and the reader was encouraged to visit the "news and events" section of the website to learn where and when project partners will present results in the near future.

The 3rd newsletter (<u>https://www.carbon4pur.eu/newsletter/?email_id=4</u>) distributed in February 2020 invited the subscribers to the 3rd stakeholder event, the "Sustainable Plastics Symposium", which was intended to be held in Aachen, Germany. However, due to the fast and insecure evolution of the COVID-19 situation, which was just about to emerge at this time, the event had to be postponed, which has been done, amongst others, with a 4th newsletter (<u>https://www.carbon4pur.eu/newsletter/?email_id=5</u>) distributed two months later in April 2020.

A 5th newsletter (<u>https://www.carbon4pur.eu/newsletter/?email_id=10</u>) has been compiled only 1 month later (May 2020) to give the subscribers a major content update, since the stakeholder event could not take place. The newsletter informed our audience about the latest achievements, like

- the election of Carbon4PUR as Project of the Month (PotM) of the February 2020 issue of research*eu, CORDIS magazine highlighting results from the projects funded by the EU's framework programmes for research and innovation,
- the complementation of project tasks by acceptance and perception studies conducted by the newly onboarded partners from the Chair of Communication Science & Human-Computer Interaction Center at the RWTH Aachen University and
- the publication of the public, open-source mapping tool to visualise CO/CO₂ emitters, steel mills and polyol plants in Europe, allowing to filter data depending on individual preferences.

Further, this newsletter compiled a flashback to own events and activities showcasing the successful stakeholder engagement and dissemination.

The 6th newsletter (<u>https://www.carbon4pur.eu/newsletter/?email_id=11</u>) distributed in January 2021 served again as a tool for inviting the subscribers to our final stakeholder event, which was held online.

In the course of the project the number of newsletter subscribers has constantly increased proving the general success of the global communication strategy and the strong interest of individuals from different target audiences in the project. Figure 4 shows that the number of newsletter recipients (blue bars) has increased over time and reached 170 subscribers in January 2021. The orange bars indicate that neither newsletter has been opened by all recipients. The open rate was at about 70% for the first newsletter and decreased to 40% for event postponement and the content newsletter, number 4 and 5, respectively. The invitation to the final event (6th newsletter) has been opened by 50% of the recipients.

On the other hand, the click rate remained generally rather constant at 40% to 50% of individuals who opened/viewed the newsletter. However, the postponement newsletter counted a lower click rate since the message has been provided clearly and the reader apparently did not seek any further information. Likewise, the content update email had a fairly low click rate of only 22% based on the total opens, which is attributed to the fact that most of the information was contained within the email itself.



Newsletter recipients and interactions

Figure 4: Carbon4PUR newsletter statistics.

4.2.3 Conclusions and outlook with respect to the newsletter

In conclusion, the steadily increasing subscription numbers indicate the constant stakeholder interest and the success in raising awareness and interest through the continuous communication and dissemination actions.

At the end of the project, after the final event, a final newsletter will be delivered concluding the major results and outcomes.

4.3 Social media

4.3.1 Strategic purpose and implementation of social media activity

In contrast to other channels like the website, which require an active part of the stakeholder (information pull), social media posts are pushed to the profile followers and other interested individuals, rather than requiring a pull from the audience. Therefore, these channels offer a tremendous potential if the working principles are well understood und good use is made of them. Consequently, social media allows to receive a worldwide attention. Networks, experts, professionals, the general public and authorities can be actively engaged and can help raising awareness by interacting with the posts. Especially liking and sharing of own posts by others enhances the own visibility, since the followers of the other (interacting) account may get notified about the interaction, thus generating leads to the own profile. Consequently, interactions can leverage the own visibility and lead to an expansion of the own stakeholder group. To trigger a high awareness and interaction it is worthwhile to use meaningful hashtags and mention profiles of stakeholders in the own posts.

Each social media platform has its own specific dynamics, profiling algorithms and audiences. Notwithstanding, Twitter and LinkedIn are the most common channels for business news and networking. Hence, Carbon4PUR has created its own presence on these two platforms and followed a dynamic engagement and interaction strategy.

4.3.2 Twitter statistics

The online presence of Carbon4PUR on Twitter started in May 2018 using the profile name "Carbon4PUR" and the handle "@Carbon4PUR" (cf. Figure 5, left). From the very beginning the Twitter communication strategy has been planned such as to raise a high awareness of the project. Therefore, meaningful hashtags have been identified and consequently used and relevant news have been posted several times a month. Besides that, the project profile started engagement with envisioned stakeholders by mentioning and following their profiles and interacting with relevant posts.

In the course of the project Carbon4PUR has posted 210 Tweets (Figure 5, left) and created 4 so-called "Moments" (Figure 5, right) to aggregate relevant tweets regarding the three stakeholder events and the release of the project presentation video.



Figure 5: Header of the Carbon4PUR Twitter profile showing the project title and the funding note, as well as the number of tweets, followers and followed accounts (left) and the moments created to aggregate distinct tweets by topic.

The number of followers has constantly grown each month (Figure 6) showing two distinct increases from November 2018 to March 2019 and from February 2020 to May 2020. Both periods are in good correlation with the announcement and implementation of the stakeholder events organized by Carbon4PUR. In particular, the first stakeholder event took place in November 2018 in Brussels. In this month, the tweet impressions reached an outstanding number of 23,000 (Figure 7). In January 2019, Carbon4PUR published its first explanatory video and in February 2019 the mid-term event has been announced, which then took place in March 2019. Similar to the website visitor numbers, these three months are characterised by an increased number of new followers and impressions, before decreasing back to the base level during the summer period. In February 2020 the 3rd stakeholder event was announced via all available channels, including Twitter, LinkedIn, newsletter, direct mailing, and the

website, which started a new wave of awareness leading to the second increase in numbers of impressions and followers. Until the end of the project, the Twitter account has reached a total of 300 followers.

The success on Twitter was, amongst others, also largely due to the fast and efficient connection with the accounts of SusChem ETP and SPIRE, which started following Carbon4PUR already in the first two months. Several mentions of Carbon4PUR as well as retweets of Carbon4PUR posts by @SusChem (3,800 Follower), @SPIRE2030 (1,800 Follower), @EU_H2020 (134,000 Follower) and @CORDIS_EU (38,000 Follower) have helped in increasing visibility just as much as being followed, by e.g., Jean Eric Paquet (Director-General for Research & Innovation; 12,000 Follower) or Philippe Moseley (Policy Officer at European Commission DG GROW; 3,200 Follower).



Figure 6: The number of followers on Twitter has constantly increased.



Tweet impressions by months (@Carbon4PUR)

Figure 7: The average number of tweet impressions per month was between 1,000 and 5,000, whereas three months spiked out indicating the outstandingly high engagement with the tweets about the stakeholder events.

4.3.3 LinkedIn Statistics

At the beginning of the project Carbon4PUR has created a LinkedIn company account to post relevant news to the business audience on this platform. Until January 2020 the account reached 59 followers. The highest monthly follower increase of +81 was achieved in February 2020 with the announcement of the Sustainable Plastics Symposium followed by another 49 followers in the successive 3 months (Figure 8). Thus, the total number of followers could be tripled within only 4 months. Further 68 followers could be obtained until end of January 2021, which is when the final event was announced. After the announcement of the final event and starting the communication and awareness campaign in January 2021 another 66 followers have been obtained, finally reaching a total of 307 followers at the end of the project in March 2021. The conversion numbers are shown in Figure 9. High awareness and visibility was obtained in February 2020 (announcement of Sustainable Plastics Symposium planned for April 2020 in Aachen, Germany, c.f. section 4.8.4), in August 2020 (publication of the Carbon4PUR video prepared on behalf of CORDIS, publication of the first project-related scientific article; invitation to the CO2 World Tour - an online event prepared and hosted by DECHEMA, with contribution of Covestro and high relevance to the Carbon4PUR stakeholders), and in January 2021 when the final Carbon4PUR stakeholder event has been announced. The following two months, i.e., February and March 2021, were finally characterized by the highest impression numbers of up to almost 4,000, which consequently led to the increase of follower numbers.



Follower Statistics on LinkedIn (Carbon4PUR project)

Jan 20 Feb 20 Mrz 20 Apr 20 Mai 20 Jun 20 Jul 20 Aug 20 Sep 20 Okt 20 Nov 20 Dez 20 Jan 21 Feb 21 Mrz 21

Figure 8: Number of new followers broken down by month. A peak was observed after the announcement of the Sustainable Plastics Symposium Event planned for April 2020.

Conversion Statistics on Linkedin (Carbon4PUR)



Figure 9: Conversion statistics broken down by month. The higher the number of post impressions was the higher was the number of page views and new followers.

These statistics prove the importance of relevant posts coupled with the engagement of followers as well as followed accounts. Particularly, for example, the CORDIS video has been shared by a multitude of accounts of members and employees of the European Commission. The general conversion rate of impressions to page views was in the range of 10% to 20% and the conversion rate from page views to followers ranged between 20% to 35%.

4.3.4 Conclusions and outlook with respect to social media

Regarding the social media it was generally found that posts always have to include a visual element to trigger interest. Text-only messages do not obtain much engagement (impressions and interactions), whereas pictures and videos of, e.g., project meetings as well as event announcement are of high relevance to the audience. Engagement can and must be fostered by using meaningful hashtags and mention individual or company/organisation accounts whenever it is purposeful. This triggers both interaction and impressions, finally resulting in building a strong community of followers.

In accordance with the website and newsletter activities, at the end of the project, after March 2021, the social media channels will be used to announce the successful finalisation of the project and spread the latest news related to the final event and the latest website update. The social media channels will also persist after the end of the project. However, further content updates are not planned to be posted after the end of the project.

4.4 Printed communication materials

Initially, i.e., within the first 6 months, the following materials have been provided:

- A project logo and templates for Word documents and PowerPoint presentations in uniform easily recognisable design,
- A project overview presentation prepared by Covestro for the kick-off event and shared with all partners for their individual dissemination activities throughout the project lifetime,
- A project overview poster,
- A project flyer describing the project objectives, ambitions, structure, and partners,
- An e-brochure providing more detailed information about the project and
- two roll-up banners to display the project at events.

Figure 10 shows some examples of these dissemination materials.



Figure 10: Examples of printed dissemination materials, which can be downloaded from the website.

4.5 Press releases and press coverage

Press releases were aimed to inform journalists and newspapers about the start and goals of the project as well as the achievement of major milestones and the publication of content relevant to the general public and expert audiences.

At the beginning of the project all project partners have issued a kick-off press release which was published on the company/organisation website. Table 1 summarizes some examples providing the links to the websites and Figure 11 visualises the Covestro press release.



Specifically, the project aims to use mixtures of carbon dioxide and carbon monoxide, which are generated during steel production, to produce polyols – key components of polyurethane-based insulating materials and coatings that are otherwise obtained from crude oil.

Significantly smaller carbon footprint



Table	1: Press	releases and	project-related	websites of the	Carbon4PUR	partners
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	Partner	Title / Description	Link	
	Covestro	Europeans join forces on CO ₂	https://www.covestro.com/press/europ eans-join-forces-on-co2/	
	DECHEMA	Carbon4PUR - Low-carbon plastic from steel industry flue gases	https://dechema.de/carbon4purprojekt. html	
	South Pole	The Carbon4PUR project: Low-carbon plastic from steel industry flue gases	https://www.southpole.com/de/news/th e-carbon4pur-project	
RWTH Aachen Carbon4PUR University		Carbon4PUR	https://www.rwth- aachen.de/cms/root/Forschung/Projekt e/EU-Projekte/EU-Projekte-in- Horizon/~cjnfc/Carbon4Pur/?lidx=1	
			https://www.comm.rwth- aachen.de/cms/COMM/Forschung/Pro jekte/~fzywv/Carbon4PUR/	
	ΡΝΟ	Kick-off for Carbon4PUR project	https://www.pnoconsultants.com/news /kick-off-carbon4pur-project/	
	Megara Resins	Carbon4PUR Kick-off meeting	https://www.megararesins.com/news- media/carbon4pur-kick-meeting	
	Gent University	Leadership in enabling and industrial technologies - SPIRE - Carbon4PUR	https://www.ugent.be/en/research/rese arch-ugent/eu- trackrecord/h2020/collaborative- h2020/leit/leit-spire-corbon4pur.htm	
	Port of Marseille Fos	An European industrial fumes recovery project	https://www.marseille- port.fr/en/projets/carbon4pur	
	TU Berlin	Carbon4PUR - Turning industrial waste gases (mixed CO/CO ₂ steams) into intermediates for polyurethane plastics for rigid foams/building insulation and coatings	https://www.reaction-engineering.tu- berlin.de/menue/forschung/aktuelle_pr ojekte/carbon4pur/	
	Recticel	Sustainability & Innovation	https://www.recticel.com/sustainability- innovation/innovation/sustainable- innovation-programmes.html	
	Leiden University	Carbon4PUR Turning industrial waste gases (mixed CO/CO ₂ streams) into intermediates for polyurethane plastics for rigid foams/building insulation and coatings	https://www.universiteitleiden.nl/en/res earch/research-projects/science/cml- carbon4pur	

Over time the project has received a high amount of press and media attention from newspapers and expert journals, including PROCESS³, The Chemical Engineer⁴, PortsEurope⁵ or Materials Today⁶ (Springer) to name just a few.







Press Release – Marseille Fos – CARBON4PUR Project: 14 partners experiment with industrial C02 recovery – March 21, 2019 In a context of rising carbon costs, circular economy solutions promoting C02 recovery become a strategic element both for the industrial attractiveness of our territory, and for environmental issues related to climate change. The exchanges will be structured in three phases around interventions of industrials and

30.10.2017 | Materials Technology | News | Onlineartikel Europeans Join Forces on CO2 Use

Autor: Nadine Winkelmann



a European Construction on rouncern partners, ready coversito, is planning to investigate row no gases from the steel industry can be used to produce plastics efficiently and sustainably. © Coverto

The use of carbon dioxide as a new source of raw materials is increasingly a topic of interest at the European level. A consortium of fourteen partners intends to investigate how flue gases can be used to produce plastics.

Figure 12: Selected examples of press coverage after the publication of the kick-off press release.

³ <u>https://www.process.vogel.de/bringt-carbon4pur-den-durchbruch-fuer-chemikalien-aus-abgas-a-654178/</u>

⁴ <u>https://www.thechemicalengineer.com/news/14-partners-join-co2-to-plastic-consortium/</u>

⁵ <u>https://www.portseurope.com/carbon4pur-project-14-partners-experiment-with-industrial-co2-recovery/</u>

⁶ https://www.springerprofessional.de/materials-technology/manufacturing/europeans-join-forces-on-co2-use-/15169964

Further, in August 2018, Carbon4PUR has been highlighted in the SusChem News⁷ as a success story of the use of CO_2 as an alternative feedstock for the chemical industry.

Another press release was published by Covestro⁸ in January 2019 announcing the mid-term stakeholder event and the release of the Carbon4PUR project video.

In July 2019, the German newspaper "Sueddeutsche Zeitung" published an article⁹ entitled "How companies use CO₂ as a raw material", highlighting Covestro's vision of CO₂-based polymers for, e.g., mattresses or polymer fibres and Carbon4PUR was presented.

Besides that, a lot of international attention has been gathered by the Carbon4PUR project, for example in the French¹⁰, the Spanish¹¹, the Italian¹², the Belgian¹³ or the UK¹⁴ scientific and expert press.

In January 2019, Markus Steilemann, CEO of Covestro, published an article as part of the World Economic Forum Annual Meeting¹⁵.

With the nomination of "Team CO₂", made up of partners from Covestro and RWTH Aachen, for the German President's Award 2019, CORDIS has published an article¹⁶ highlighting Carbon4PUR in December 2019.

⁷ "KETs Impact: CO₂ as a raw material – The Carbon4PUR Project, 2018, <u>http://suschem.org/newsroom/kets-impact-co2-as-a-raw-material-the-carbon4pur-project</u>

⁸ "European industry fosters CO₂ reutilization, 2019, <u>https://www.covestro.com/press/european-industry-fosters--co-reutilization/</u>

⁹ "Wie Firmen CO₂ als Rohstoff nutzen, 2019, <u>https://www.sueddeutsche.de/wirtschaft/co2-rohstoff-covestro-1.4501816-0#seite-2</u>

¹⁰ "Carbon4PUR oeuvre sur la reconversion de gaz pour des plastiques", 2017, <u>https://www.info-chimie.fr/carbon4pur-oeuvre-sur-la-reconversion-de-gaz-pour-des-plastiques,85289</u>

¹¹ "European intersectorial research to harness waste gases and turn them into plastics", 2019, <u>https://www.energynews.es/en/gases-residuales-en-plasticos/</u>

¹² "Carbon4PUR: gli europei uniscono le forze per sfruttare la CO₂", 2017, <u>https://www.massimo-riboldi.it/carbon4pur-gli-europei-uniscono-le-forze-per-sfruttare-lanidride-carbonica/</u>

¹³ "Turning industrial waste gases (mixed CO/CO₂ streams) into intermediates for polyurethane for rigid foams/building insulation and coating", <u>https://capture-resources.be/projects/carbon4pur</u>

¹⁴ "European industry fosters CO₂ reutilisation", 2019, <u>https://www.britishplastics.co.uk/plastics-industry-news/european-industry-fosters-co2-reutilisation/</u>

¹⁵ "CO₂ can be a valuable raw material, not just a climate killer. Here's how", 2019, <u>https://www.weforum.org/agenda/2019/01/turning-co2-from-climate-destroyer-into-useful-raw</u> <u>-material/</u>

¹⁶ "How a team of finalists for the German President's Award is giving carbon a second life", 2019, <u>https://cordis.europa.eu/article/id/411630-how-a-team-of-finalists-for-the-german-president-s-award-is-giving-carbon-a-second-life</u>

Subsequently, in February 2020, Carbon4PUR has been elected as the Project of the Month¹⁷ (PotM) of February 2020 by the editorial board of research*eu, CORDIS' magazine highlighting results from the projects funded by the EU's framework programmes for research and innovation.

Also in February 2020, Prof. Mark Saeys from the University of Gent has been invited to an interview by EngineeringNet¹⁸, a flemish engineering magazine. Therein, he talks about CCU, CCS and DAC and highlights the concept of geo-engineering in view of CO₂ emissions.

Late 2019, Carbon4PUR coordinator Liv Adler has been interviewed by the Office of Industries of the U.S. International Trade Commission (USITC), which aimed at summarizing the current global landscape of waste carbon feedstocks from steel industry to chemicals in the United States, the European Union, and China. Results have been published in April 2020 in the working paper "Using Waste Carbon Feedstocks to Produce Chemicals"¹⁹ The paper looks at the conversion of waste carbon in industrial emissions to biofuels and chemicals, addressing chemical and steel industries in the United States, the European Union, and China.

Further, in 2020 a scientific article²⁰ published in the MDPI-journal "Metals" mentioned Carbon4PUR amongst other public-funded projects in its CCU section.

Also in 2020, the IEA "Survey of Current Projects and Novel Technologies in the Steel Industry"²¹, which compiled projects in the fields of Carbon Capture, Utilization and Storage as well as Carbon Direct Avoidance and Alternative Paths for CO₂ Reduction, briefly described Carbon4PUR in the CCU technology section and names the partners and the involved countries.

Finally, a last press release has been developed by Covestro indicating the finalisation of the project and the project's major outcomes and aligned with the partners. This press release has

¹⁷ "Project of the Month: Converting carbon dioxide into a raw material for increased sustainability and a more circular economy, 2019, <u>https://cordis.europa.eu/article/id/413330-converting-carbon-dioxide-into-raw-material-for-increased-sustainability</u>

¹⁸ "Geo-engineering: leven mét CO₂-uitstoot, 2020, <u>https://www.carbon4pur.eu/wp-content/uploads/2020/04/engineeringnet-202-saeys-interview.pdf</u>

¹⁹ "Using Waste Carbon Feedstocks to Produce Chemicals", Elizabeth R. Nesbitt, U.S. Office of IndustriesWorking Paper ID-065, 2020, <u>https://www.usitc.gov/publications/332/working_papers/using_waste_carbon_feedstocks_to_produce</u> chemicals_0.pdf

²⁰ "Society, Materials, and the Environment: The Case of Steel", Jean-Pierre Birat, Metals 10(3), 2020, 331, <u>https://doi.org/10.3390/met10030331</u>

²¹ "Survey of Current Projects and Novel Technologies in the Steel Industry", IETS (Industrial Energy-Related Technologies and Systems), 2020, https://iea-industry.org/app/uploads/IETS-Survey_Iron-and-Steel-industry-2020.pdf

been published in English, German, French and Dutch on March 29th, 2021 and was circulated with the partners, which could adapt it to their own needs, if necessary. Figure 13 shows a part of this final press release as published by Covestro²² or by the Imperial College London²³. The press release has readily been taken up by the general and expert press, e.g., by technologiebox.de²⁴, newsonline24.net²⁵, the Deutsche Presseindex²⁶, the CHEManager²⁷, the Recycling Magazin²⁸, VOGEL²⁹ or susanova³⁰.



- ²² Final Press Release on the Covestro Website, "Valued materials from the chimney", <u>https://www.covestro.com/press/valued-materials-from-the-chimney/</u>
- ²³ "Waste carbon from steel production can be recycled into new products", <u>https://www.imperial.ac.uk/news/218773/waste-carbon-from-steel-production-recycled/</u>
- ²⁴ "Wertstoffe aus dem Schornstein", <u>https://www.technologiebox.de/2021/03/29/wertstoffe-aus-dem-schornstein/</u>
- ²⁵ "Wertstoffe aus dem Schornstein", <u>https://www.newsonline24.net/2021/03/wertstoffe-aus-dem-schornstein/</u>
- ²⁶ "Wertstoffe aus dem Schornstein", <u>https://www.deutscherpresseindex.de/2021/03/29/wertstoffe-aus-dem-schornstein/</u>
- ²⁷ "Forschungskonsortium schließt Projekt Carbon4PUR erfolgreich ab", <u>https://www.chemanager-online.com/news/forschungskonsortium-schliesst-projekt-carbon4pur-erfolgreich-ab</u>
- ²⁸ "EU-Forschungsprojekt Carbon4PUR erfolgreich abgeschlossen", <u>https://www.recyclingmagazin.de/2021/03/29/eu-forschungsprojekt-carbon4pur-erfolgreich-abgeschlossen/</u>
- ²⁹ "Hochofengas als Rohstoff für nachhaltigere Kunststoffsysteme", <u>https://www.maschinenmarkt.vogel.de/hochofengas-als-rohstoff-fuer-nachhaltigere-kunststoffsysteme-a-1011742/</u>
- ³⁰ "Isolatiemateriaal op basis van hoogovengas? Covestro, Recticel en UGent bewijzen dat het kan", <u>https://susanova.be/artikels/isolatiemateriaal-op-basis-van-hoogovengas-covestro-recticel-en-ugent-bewijzen-dat-het-kan?share=ccaa4335f866ff6450321f7ee4f921b9</u>

Figure 13: Final press release as published by Covestro²² (left) and by Imperial College London²³ (right).

Besides that, Carbon4PUR has further been mentioned in the annual reports of the industrial partners.

Furthermore, not only text-based articles have been published about Carbon4PUR. Rather the project has also been highlighted in the local television channel TV MARITIMA³¹ on the occasion of the mid-term stakeholder event in March 2019 (cf. section 4.8.3) or by Anastoasios Perimenis (CO₂ Value Europe) in his talk about "CCU in the EU context" ³² given in December 2020.

These examples are not exhaustive but represent selected highlights in the press and media coverage to which the Carbon4PUR project partners have contributed actively and passively.

4.6 Project videos

4.6.1 Project presentation video

In the beginning of 2019, a video to present the project has been prepared and published. The video explains the project in 3 minutes, with impressions from a consortium meeting, a lab, a 3D animated explanation of the process and three interviews with consortium members. The project video is available on YouTube with English voice-over³³ as well as with French³⁴ and German³⁵ subtitles. The English-only version has also been embedded into the highlight box of the Carbon4PUR main page of the website and on a dedicated subpage in the "publications and outcomes" section (https://www.carbon4pur.eu/public-documents/new-video/).

³¹ Projet Européen Carbon4Pur dans journal TV MARITIMA du 21 mars 2019, <u>https://www.youtube.com/watch?v=TtP2b_FevIE</u>

³² Anastasios Perimenis_CCU in the EU context", Presentation during the 1st SUNERGY Industrial Webinar: Energy carriers and approaches towards a closed carbon-cycle, 2020, Sunergy Project Channel, <u>https://www.youtube.com/watch?v=bTX0Myms2BE</u>

³³ Carbon4PUR presentation, 2019, Cabon4PUR Channel, <u>https://www.youtube.com/watch?v=OF9FdQdeZLc&t</u>

³⁴ Présentation Carbon4PUR, 2019, Cabon4PUR Channel, <u>https://www.youtube.com/watch?v=JaC0GZowISg</u>

³⁵ Vorstellung Carbon4PUR, 2019, Cabon4PUR Channel, https://www.youtube.com/watch?v=kvdpYQNrVdl&t

4.6.2 VRIB-Video on behalf of CORDIS

In March 2020 the Carbon4PUR communication team has been approached by Cine Plus, a video maker and contractor of the publications office of the European Commission, to which CORDIS belongs administratively, asking us to provide footage and visual material for a video commissioned by CORDIS. The video was meant to be the first in a series called "Video Results in Brief" (VRIB), presenting results of different European projects funded under the Horizon 2020 research and innovation programme.

Footage from Covestro and ArcelorMittal as well as from the initial project video has been used along with new interview sequences from Carbon4PUR consortium partners to produce this 2 minutes video, which was officially published in August 2020.

This video has received some media impact by being shared via YouTube, LinkedIn and Twitter by a high number of stakeholders, including CORDIS. This video is hosted on the YouTube channel of CORDIS and can be accessed here: https://www.youtube.com/watch?v=TSRQYV8nh48.

4.6.3 "People behind Carbon4PUR" video

Within the last three months of the project, the consortium partners decided to prepare a final video designated to raise awareness for the final stakeholder event and to point out the multitude of individuals involved in the Carbon4PUR project. To this end the Carbon4PUR polyurethane brick shown in Figure 14 was meant to be handed from a representative of each partner to another and end up with a final statement of the project coordinator, Dr. Liv Adler.



Figure 14: Carbon4PUR polyurethane brick prepared by Covestro.

The video will be hosted on the Carbon4PUR YouTube Channel³⁶ and linked in the Carbon4PUR website and was used for social media activities:

- Twitter: https://twitter.com/Carbon4PUR/status/1375468462781444100 and
- LinkedIn: https://www.linkedin.com/feed/update/urn:li:activity:6781249028081360896.

4.6.4 Final results video

Further, also within the last three months of the project, Covestro has decided to prepare a final video to summarize the goal and the major achievements within the project. Similar to the first presentation video, also this final video is available with English voice-over as well as with English, French and German subtitles. This video will be hosted on the Carbon4PUR YouTube Channel and the Carbon4PUR website and has also been shared with the public via the social media channels:

- Twitter: https://twitter.com/covestro/status/1376513469793497096 and
- LinkedIn: <u>https://www.linkedin.com/feed/update/urn%3Ali%3AugcPost%3A6782275889217458</u> <u>177/</u>

4.7 Participation in conferences, congresses and fairs

Participation in conferences, congresses and fairs is a key activity in research and innovation projects allowing to build a strong network of individual contacts and to spread project results to expert audiences form academia and industry. The Project Proposal and Grant Agreement have anticipated the attendance of at least 12 national as well as international conferences, congresses and other events (e.g., fairs and workshops) in order to ensure a wider dissemination of the outcomes.

The project partners have attended a total of 33 events, thus, achieving and overfulfilling the initially planned number of congress and conference participation. A list of the attended conferences, fairs and events including the involved partners and the type of involvement is provided in Table 2 below. Own stakeholder events and events prepared by the Carbon4PUR

³⁶ https://www.youtube.com/channel/UCNifpoJWIkWw6S53KIPiEaw

project partners, at which the Carbon4PUR project has been presented, are not listed here but can be found in the following section 4.8 hereinafter.

Table O. Lint of		fation and a			
I ADIE 2: LIST OF	conterences,	tairs and e	events attended i	by Carbon4PC	<i>iR partners</i>

Event	Type and character	Involvement
6 th Conference on Carbon Dioxide as Feedstock for Fuels, Chemistry and Polymers, 15-16 March 2018, Cologne, Germany	Conference, industry and academia	COV: presentation
Status conference of the German funding programme on CO ₂ utilisation, 17-18 April 2018, Berlin	Conference, industry and academia	DEC: organization COV: presentation
19 th Annual Handelsblatt meeting Chemie 2018, 24-25 April 2018, Düsseldorf	Conference, industry and academia	COV: presentation
UTECH Europe, 29-31 May 2018, Maastricht	International fair and conference for the polyurethanes industry	COV: exhibitor and presentation
ISCRE 25 - 25 th International Symposium on Chemical Reaction Engineering, 20-23 May 2018, Florence	Scientific conference, chemical engineers	UGent: presentation
ACHEMA2018, 11-15 June 2018, Frankfurt	International fair and congress for the process industries	DEC: organization COV: keynote (CCO), large CO ₂ utilisation booth and congress session, presentation
Rohstoffgipfel / Resource summit, 25 June 2018, Berlin	Green chemistry innovation and start- up conference	Hosts: TUB, DEC, COV COV: presentation
CarbonNext final conference, 17 July 2018, Brussels	CO and CO ₂ as feedstock	DEC: organization, AMMR: presentation
16 th ICCDU (International Conference on Carbon Dioxide Utilization), 27-30 August 2018, Rio de Janeiro	Conference, industry and academia	TUB: presentation
ProcessNet Annual Meeting 2018, 10-13 September 2018, Aachen	Conference	CO ₂ utilisation congress session COV: presentation RWTH AVT: poster
5 th International Conference on Chemical Looping, 24-27 September 2018, Park City, UT	Conference, industry and academia	UGent

Table 2 (continuation): List of conferences, fairs and events attended by Carbon4PUR partners

Event	Type and character	Involvement
11 th Carbon Dioxide Utilisation Summit, 26-27 September 2018, Manchester	Conference, industry and academia	COV: presentation
AIChE Annual Meeting, 28 October-2 November 2018, Pittsburgh	Conference, industry and academia	TU Berlin: presentation
Circular economy for textiles and plastics "Rethinking the value chain of textiles and plastics", 13-14 November 2018, Brugge	Conference	Recticel: presentation
Circular Polymers in Furniture Conference, 26 November 2018, Brussels	Conference	Recticel: presentation
2019 EU Industry Days, 5 February 2019	Conference	AMMR: presentation
7 th Conference on Carbon Dioxide as Feedstock for Fuels, Chemistry and Polymers, 20-21 March 2019, Cologne	Conference	DEC, COV: presentations
PSE Europe, 26-28 March 2019, Munich	Conference for the polyurethanes processing industry	COV: presentation
NanoMEMC² workshop, 11 April 2019, Brussels	Stakeholder event organized by the NanoMEMC ² project	PNO: presentation
1st BioCatPolymers Workshop, 15 May 2019, Delft	Workshop	COV: presentation
SETAC Europe 29th Annual Meeting, 26-30 May 2019, Helsinki	Conference	ULeiden: poster
17 th ICCDU (International Conference on Carbon Dioxide Utilization), 23-27 June 2019, Aachen	Conference, industry and academia	COV: presentation
ISIE2019 (International Conference on Industrial Ecology), 7-11 July 2019, Beijing	Conference, industry and academia	ULeiden: presentation

Table 2 (continuation): List of conferences, fairs and events attended by Carbon4PUR partners

Event	Type and character	Involvement
Grand challenges: answers from North Rhine-Westphalia, 12 September 2019, Brussels	Symposium	COV: presentation
ICCOS2019 (International Conference of Catalysis and Organic Synthesis), 15-20 September 2019, Moscow	Conference, Industry and academia	COV / RWTH CAT: presentation
14 th Carbon Dioxide Utilisation Summit, 10 October 2019, Düsseldorf	Conference, Industry and academia	COV: presentation
ERSCP 2019 (Circular Europe for Sustainability: Design, Production, Consumption), 15-18 October 2019, Barcelona	Conference, Industry and academia	TU Berlin: poster
1 st annual CAPTURE conference, 22-23 October 2019, Gent	Conference, Industry and academia	UGent: presentation and booth
Prospektive multidimensionale Bewertung von Energietechnologien und -szenarien, 20-21 February 2020, Oldenburg	Workshop	ULeiden: presentation
SETAC Europe 30 th annual meeting, 3-7 May 2020, online	Conference	ULeiden: presentation
17 ^{èmes} Rencontres de Chimie Organique, 19 April 2019, Gif-sur-Yvette	Conference, Academia	CEA: poster
5 ^{ème} Journée de l'Ecole Doctorale, 11 June 2019, Evry	Conference, Academia	CEA: presentation
CO₂ days of the Axelera network, 30 June 2020	Round Table Discussion	CEA: presentation

Due to the COVID-19 pandemic and the increasingly insecure global situation in 2020 most of the planned conferences had been postponed or cancelled. Consequently, no further conferences and events could be attended. Before the global insecurities started to increase, however, the project has been invited for example to the **Hannover Messe** international industry fair (20-24 April 2020) by the European Commission to join the European Union stand. The EU stand was aimed to tackle the overall theme of the Hannover fair "Industrial Transformation" by focusing on two challenges European industry currently faces and that are determining for its success in the future: Sustainability and Digitalisation. Carbon4PUR was

recommended by colleagues from the Directorate General of Research and Innovation, as it appeared to fit very well under both 'Waste to value' and 'Climate-neutral industry' headings. Similarly, in June 2020, Carbon4PUR has been invited to present at the **Carbon Capture Technology Conference & Expo** planned to take place in Frankfurt in November 2020. However, the conference could not take place.

Nevertheless, partners still had the opportunity to communicate about the project at several smaller bilateral meetings. Specifically, ArcelorMittal had regular occasions to present the levers of its Climate Action Plan, of which Carbon4PUR is a part of to, e.g., EVONIK, INEOS, BASF, ENGIE, DEMI, OERSTEDT, universities and NGOs. Likewise, Covestro has its socalled IR ESG Presentation open to the public for download at https://www.covestro.com/en/investors/reports-and-presentations and used it for their investors relation communication activities.

4.8 Stakeholder events and open-door events organised by Carbon4PUR partners

4.8.1 Strategic purpose and overview

Besides the attendance of external events, it was also envisaged to organise own stakeholder events, community events and open-door events. According to latest Grant Agreement a total of three stakeholder events, two open-door events and the participation at the ACHEMA 2018, the world's leading fair for process industry, were planned.

The events were aimed to:

- spread results and raise awareness among industrial stakeholders at different levels,
- exchange experience with fellow developers of potentially synergistic technologies resulting from sister projects,
- present the final results to a broad public,
- raise awareness among the general public, particularly pupils and undergraduate students (open-door days).

These goals have been achieved. The events organised by Carbon4PUR are listed in chronological order in Table 3. Details about the events are briefly presented in the following subsections.

Public

Table :	3: List o	f events	organised	bv	Carbon4PUR
			e.gameea	~,	

Event	Type and character	Oganiser
Kick-off event, 16 October 2017, Leverkusen	Own event. Representatives of key stakeholder associations and networks	COV.
1 st stakeholder event = "SPIRE projects on the utilisation of CO ₂ and CO", 12 November 2018, Brussels	Own event. Industrial stakeholders, EU representatives, EU funded projects	DECHEMA, COV, PNO.
2 nd stakeholder event = Mid-term event, 20 March 2019, Marseille / Fos sur Mer	Own event. Industrial and academic stakeholders, (local) authorities	MFPA, DECHEMA, jointly with other projects.
Your future starts here, 19 May 2019, Antwerp	Open-door day at COV	COV.
PNO Energy days, 26 September 2019, Brussels	Own Event. Energy Stakeholders and EU funded projects	PNO.
L'usine extraordinaire, 14-16 November 2019, Marseille / Fos sur Mer	Open-door day at MFPA	MFPA.
Polymer Materials, 27 February 2020, Wetteren	Open-door day at Recticel.	Recticel.
3 rd stakeholder event = "Sustainable Plastics Symposium" 2020, postponed	Own event planned for April 2020 in Aachen (Germany) postponed due to COVID-19	DECHEMA, COV, jointly with CO ₂ EXIDE (other SPIRE project).
Final stakeholder event = "Sustainable Plastics Symposium" 2021, 25 March 2021, online	Own event. Industrial stakeholders, EU representatives, EU funded projects, CCU associations and networks	DECHEMA, COV, jointly with CO ₂ EXIDE (other SPIRE project).

4.8.2 The first stakeholder event

The first stakeholder event – SPIRE projects on the utilisation of CO₂ and CO – has been organised on September 12th, 2018 and took place in Brussels. The event started with a welcome from Jürgen Tidje (European Commission - DG Research and Innovation) and an introduction from Alexis Bazzanella (DECHEMA). A total of seven EU funded projects, spearheaded by Carbon4PUR, have had the opportunity to present themselves and their goals. Particularly, the Carbon4PUR project has been jointly presented by Liv Adler (Covestro) and Geert Snellings (Recticel). The invited projects were FReSMe, MefCO₂, ICO2CHEM, RECO2DE, ENGICON and EPOS. Beside the project presentation, a representative of ArcelorMittal gave a talk about "smart carbon pathways for steel industry waste gases". Further, new "standardised guidelines for Life Cycle and Techno-Economic Assessment of CO₂ utilisation" have been discussed. The day was concluded by a panel discussion about "cross-sectorial aspects of CO and CO₂ utilisation" with Liv Adler (Covestro), Damien Dallemagne (CO₂Value Europe), Dennis Krämer (DECHEMA), Angel Sánchez Díaz (Everis), Michiel Stork (ECOFYS) and Sophie Wilmet (CEFIC). The event was successful and counted 77 participants (25% industry) from 23 countries.

A news post about the event has been issued on our website³⁷ and several tweets have been posted on our Twitter channel receiving more than 400 interactions. Figure 15 shows some impressions of the day. The programme of the event can be found in the annex section 6.1.





Figure 15: Impressions of the first stakeholder event: Liv Adler and Geert Snellings presenting Carbon4PUR to the audience (left) and panel discussion with Liv Adler, Damien Dallemagne, Dennis Krämer, Angel Sánchez Díaz, Michiel Stork and Sophie Wilmet (right).

³⁷ <u>https://www.carbon4pur.eu/news-and-events/past-events/spire-projects-on-the-utilisation-of-co2-and-co/</u>

4.8.3 The second, mid-term stakeholder event

On March 20th, 2019, Carbon4PUR organized the next stakeholder event at the port authority in Fos sur Mer to promote the project mainly towards local stakeholders (authorities such as region, metropolis, state services, local development agencies, local industrial association, academics, ...). The purpose of this event was also to give to the audience a general overview of CO_2 valorisation opportunities and current sister projects. The focus was on possible benefits, risks and open questions for the industrial area and the territory linked to the CO_2 question. The aim was also to prepare the local stakeholders to the potential future realisation dealing with the industrialisation phase of the project and to give the opportunities to the participants to strengthen their network.

Figure 16 shows some impressions of the day. The programme of the event can be found in the annex section 6.2. A brief review of the event, including the programme and more impressions, has been posted on the Carbon4PUR website³⁸.



Figure 16: Impressions from the second (mid-term) stakeholder event.

³⁸ <u>https://www.carbon4pur.eu/news-and-events/past-events/carbon4pur-stakeholder-event/</u>

The second stakeholder event in Marseille Fos was equally successful as the first one, with 80 participants mostly from local authorities, associations, agencies and companies. Sister projects have been presented and the foundations for interaction and symbioses between the stakeholders has been laid. After the event, the potential site for the implementation of Carbon4PUR was visited by boat.

4.8.4 The third stakeholder event – Sustainable Plastics Symposium

The third stakeholder event was aimed to draw a picture of a carbon circular economy of plastics, particularly polyurethanes. Therefore, the event was entitled "Sustainable Plastics Symposium" and intended to present a potential synergy between three European Horizon 2020 projects (CO₂EXIDE, Carbon4PUR and PUReSmart) and a German BMBF-funded project (Carbon2Chem) as shown in Figure 17.





The event was planned to be held on April 27th, 2020 in Aachen and has been jointly developed with our sister project CO₂EXIDE. Besides high-level talks and the project presentations along the proposed value chain to close the carbon cycle towards a carbon circular economy, we had also envisaged to engage the participating stakeholders in round table discussions on different relevant topics in worldcafé format. The event was supposed to end with a panel discussion with Walter Leitner (RWTH Aachen University / MPI-CEC), Maximilian Fleischer (Siemens Energy), Sophie Wilmet (CEFIC), Carmine Marzano (European Commission) and

Florian Ausfelder (DECHEMA) about the demands and next steps towards a circular European industry. The invitation and advertising campaign have been kicked-off in February 2020. However, already in March 2020 it became unambiguously clear that travelling was increasingly restricted due to the COVID-19 situation and representatives from both industry and academia would not be able to join the event. Consequently, the event has been postponed and was planned to be merged with the final event. The final programme of the event is attached in the annex section 6.3.

4.8.5 The final stakeholder event – Sustainable Plastics Symposium

With the postponement of the third stakeholder event (cf. section 4.8.4 above) it has been decided to maintain the general idea of a "Sustainable Plastics Symposium" for the final event and to also build on the good relation and collaboration with the CO_2EXIDE project. Notwithstanding, the content of the event had to be adapted considering that this event was planned to be the final, concluding event of both projects. Consequently, the agenda was restructured allowing more time for the presentation of results of both projects.

The final stakeholder event took place on March 25th, 2021 and was held online. It started with a high-level keynotes session with presentations of Søren Bøwadt (European Commission) about perspectives of the European Green Deal and Horizon Europe, Àngels Orduna Cao (A.SPIRE) about the new Processes4Planet Roadmap and Michael Carus (nova-institute) about the Renewable Carbon Strategy. This session was followed by the results session of Carbon4PUR, which was introduced by a statement of Markus Steilemann (Chief Executive Officer of Covestro). After the lunch break, Nieves Gonzalez Ramon (SusChem ETP) presented the freshly published Sustainable Plastics Strategy, prior to the start of the CO2EXIDE results session, which was introduced by a statement of Armin Schnettler (Executive Vice President of Siemens Energy). The event was concluded with a panel discussion focused on the demands and next steps towards a circular industry in Europe.

The invitation and communication campaign were both kicked-off in January 2021 and stakeholders have been invited via all available channels including the project newsletters, direct mailing, repeated social media posts on Twitter and LinkedIn and the project websites. Networks like Cefic, SusChem, CO₂ Value Europe, Plastics Europe, the European composites, plastics and polymer processing platform, European Plastics Converters, PU Europe, CO₂Chem and CO₂-WIN have been engaged and invited to share our invitation with their networks to leverage the visibility of the Sustainable Plastics Symposium. In this context, it is

Public

worth mentioning that the contributions of SusChem and SPIRE to the final event agenda have been added after the publication of the invitation, rather than before, as these two organisations have approached us based on this initial invitation and asked for a speaker slot. Of course, we were more than happy about these requests and have readily accepted.

The event has been broadcasted via Zoom Webinars and more than 440 participants from 46 different countries from five continents registered (Figures 18 and 19). The participants were affiliated to 238 different organisations.

The programme of the final "Sustainable Plastics Symposium" event is added in the annex section 6.4.



Figure 18: Regional demographics of the participants of the final stakeholder event. The virtual event allowed a participation from 24 different countries from three continents.



Figure 19: Regional demographics of the participants of the final stakeholder event. The virtual event allowed a participation from 24 different countries from three continents.

4.9 Scientific articles and outcomes (including public deliverables and the Carbon4PUR mapping tool)

4.9.1 Strategic purpose and implementation of written dissemination

The publication of scientific articles in peer-reviewed journals is a fundamental pillar and best practice for publishing research results to the expert scientific community, thus fostering a strong and wide-ranging dissemination. According to Article 29 of the Grant Agreement, beneficiaries of EU-funded project have the obligation to disseminate results as soon as possible, unless it goes against their legitimate interests. Further, each beneficiary must ensure open access to peer-reviewed scientific publications relating to its results. To comply, all beneficiaries have stored a machine-readable electronic copy of the published version or the final peer-reviewed manuscript accepted for publication in their institutional repository. If the publication was not subject to a peer review process, as particularly in the case of the Carbon4PUR Mapping Tool, the publication (open-source code) was published via GitHub and reposited on Zenodo.

Carbon4PUR did not take part in the Open Research Data Pilot (ORDP) and was, therefore, not obliged to publish the underlying research data according to the FAIR principles. However, it is a best practice in scientific publishing to add Electronic Supplemental Information (ESI) to a submitted article. This ESI is commonly well findable and easily accessible, since it is always published along with the main scientific article and is typically open access, even if the main article may be subject to a paywall. Hence, the ESI meets the criteria for Findability and Accessibility quite well. On the contrary, the Interoperability is usually restricted, since all supplemental data are typically condensed in a single pdf-file, rather than in the native format or a non-proprietary format like csv. Consequently, also the Reusability is hampered to a certain extent.

According to the latest Grant Agreement, the publication of at least 8 scientific articles in peerreviewed journals or conference proceeding was planned. To date of publication of this deliverable, 3 scientific articles have been accepted for publication and another 4 have been submitted and are under review. Further, the source code of the Carbon4PUR Mapping Tool

has been published on GitHub³⁹, reposited on Zenodo⁴⁰, and transferred to the public domain under MIT License.

For completeness, the public deliverables will be also listed in this section but will not be counted as scientific publication according to the definition above.

4.9.2 List of scientific articles and outcomes

The following Tables 4 and 5 give an overview of the scientific articles and public deliverables, respectively. For the scientific articles, the status to date of the publication of this deliverable, i.e., 31 March 2021, is provided. So far 5 articles have been accepted and are published or in press. Further, one article has been written and submitted and is in the peer-review process. Three more publications are in preparation, but could not be written earlier, since the protection of results according to Article 27 of the Grant Agreement had to be thoroughly assessed.

Table	4:	List	of	scientific	publications	of	results	obtained	during	to	the	Carbon4PUR	project.
(Bibliog	grap	ohic a	lata	is provide	d in the footn	ote	s where	applicable)				

Title	Authors	Partners	Journal	Status
Minimizing CO ₂ emissions with renewable energy: A comparative study of emerging technologies in the steel industry	M. M. Flores- Granobles, M. Saeys	Ghent University	Energy & Environmental Science	Published ⁴¹
Upscaling methods used in ex ante life cycle assessment of emerging technologies: a review	N. Tsoy, B. Steubing, C. van der Giesen, J. Guinée	Leiden University	The International Journal of Life Cycle Assessment	Published ⁴²
Catalytic challenges and strategies for the carbonylation of σ-bonds	T.N. Allah, L. Ponsard, E. Nicolas, T. Cantat	CEA	Green Chemistry	Published ⁴³

³⁹ <u>https://github.com/Carbon4PUR</u>

⁴⁰ Hurtig, Oliver, Castillo Castillo, Arturo, & Barascu, Andrei. (2019, September 27). Carbon4PUR mapping tool (Version 1.0.0). Zenodo. <u>http://doi.org/10.5281/zenodo.3465806</u>

⁴¹ Link to version in institutional repository: <u>http://hdl.handle.net/1854/LU-8665943</u>; Link to publisher's version: <u>http://dx.doi.org/10.1039/d0ee00787k.</u>

⁴² Link to version in institutional repository: <u>https://hdl.handle.net/1887/138750</u>; Link to publisher's version: <u>https://doi.org/10.1007/s11367-020-01796-8</u>.

⁴³ Link to version in institutional repository: <u>https://hal-cea.archives-ouvertes.fr/cea-03096007</u>; Link to publisher's version: <u>https://dx.doi.org/10.1039/d0gc02343d</u>.

Table 4 (continuation): List of scientific publications of results obtained during to the Carbon4PUR project. (Bibliographic data is provided in the footnotes where applicable)

Title	Authors	Partners	Journal	Status
Coupling electrocatalytic CO ₂ reduction with thermocatalysis enables the formation of a lactone monomer	L. Ponsard, E. Nicolas, N.H. Tran, S. Kamaison, D. Wakerley, T. Cantat, M. Fontecave	CEA	ChemSusChem	Published ⁴⁴
What drives public acceptance of sustainable CO ₂ -derived building materials? A conjoint-analysis of eco- benefits vs. health concerns	K. Arning, J. Offermann- van Heek, M. Ziefle	RWTH Comm	Renewable and Sustainable Reviews	Accepted – in press ⁴⁵
A model for deriving economic potential and GHG emissions of steel mill gas for industrial symbiosis	J. Collis, T. Strunge, B. Steubing, A. Zimmermann, R. Schomäcker	TU Berlin, Leiden University	Frontiers in Energy Research	Submitted – under revision
Carbon monoxide production using a steel mill gas in a combined chemical looping process	V. Singh, H. Poelman, V. Galvita, G. Marin	Ghent University	Applied Energy	In preparation
Social acceptance factors for insulation boards produced with CO ₂ -derived foams	tbd	RWTH Comm	Energy Policy (tbd)	In preparation
Turning CO/CO ₂ -containing industrial process gas into valuable building blocks for the polyurethane industry	tbd	COV, RWTH-CAT	Green Chemistry (envisaged)	In preparation
Carbon4PUR Mapping Tool	O. Hurtig, A. Castillo, A. Barascu	DECHEMA, ICL	GitHub / Zenodo	Published ^{39,40}

⁴⁴ Link to version in institutional repository: <u>https://hal.archives-ouvertes.fr/cea-03166022/;</u> Link to publisher's version: <u>https://doi.org/10.1002/cssc.202100459</u>.

⁴⁵ Ms. Ref. No. (Manuscript Reference Number): RSER-D-20-04236R1; Article Reference Number: RSER_110873; Renewable and Sustainable Energy Reviews 144C (2021) 110873; DOI not yet assigned.

Deliverable number	Title	Lead beneficiary
D5.5	Pilot scale rigid foam fulfilling rigid foam specifications	Recticel
D6.2	Baseline LCA on conventionally produced polyol/PUR and flue gas treatment	Leiden University
D6.4	Review of scenario techniques applied so far in ex-ante LCAs	Leiden University
D6.5	LCA of upscaled versions of novel technologies	Leiden University
D6.9	Overall economic potential of CO/CO2-based polymer technologies	TU Berlin
D7.1	Mapping of CO_2/CO (CO/CO ₂) mixed and pure sources in Europe	DECHEMA
D7.2	Study including replication potentials and preferred sites for industrial symbiosis	DECHEMA
D8.1	Website	PNO
D8.3	Dissemination and Communication Plan	DECHEMA
D.8.7	Dissemination and Communication report and update of plan	DECHEMA
D8.8	Dissemination and communication report	DECHEMA
D8.9	Exploitation report	PNO

Table 5: List of public deliverables disseminating results obtained during to the Carbon4PUR project.

4.9.3 Conclusions and outlook with respect to scientific publications

The goal was to publish 8 scientific articles and outcomes to disseminate results of the Carbon4PUR project. 7 publications, i.e., 6 scientific articles and 1 source code for the Carbon4PUR mapping tool, have either been already published or are under revision. Furthermore, at least 3 scientific articles are in preparation. Upon the acceptance of publication, the lead beneficiaries will inform the communication and dissemination manager about the successful achievement. The communication and dissemination manager will then update the website accordingly and publish a post via the Carbon4PUR social media channels to account for these outcomes and raise awareness. These actions are planned to be implemented also after the end of the project. Further, if other publications will be prepared based on results obtained during the project's lifetime, the partners (particularly, the publication board members) will be further informed about the intention or decision to publish, since these articles will also need to pass the publication workflow as described in section 3.

4.10 Stakeholder engagement within the perception and acceptance study PACO₂

4.10.1 Strategic purpose of the perception and acceptance study

In the course of the Carbon4PUR project, it became increasingly evident that the general public still has a low level of knowledge about CO₂ utilisation and its benefits but also potential drawbacks and limitations. The climate debate is still being conducted very emotionally and is only partially rational and fact-based.

When developing a novel technological approach, like Carbon Capture and Utilization (CCU), extensively studying the technology's technical aspects helps to identify and develop the opportunities offered by the technology. However, for the successful adoption of CCU, it is equally important to consider the acceptance of the technology and related products. More specifically, as a technology developer and IP holder it is important to understand what fosters the acceptance and adoption of CCU and CCU products, and how people differ in this regard. Hence, the Carbon4PUR project partners unanimously decided to include a study entitled "Perception, acceptance and communication concepts for a CO/CO₂-derived product in Carbon4PUR" to the Communication, Dissemination and Exploitation Work Package. To this end, the Chair of Communication Science & Human-Computer Interaction Center from the RWTH Aachen University was added to strengthen the consortium as a new partner.

In acceptance research there are many possible models, frameworks, and theories, as well as many aspects to consider. In the perception and acceptance study conducted for Carbon4PUR, we only focused on the acceptance of CCU products by the consumers. We did this using an example of a CCU product: insulation boards consisting of polyurethane foam that is made with polyols which are produced by means of CCU. In the study this product was referred to as CCU insulation boards. It is worth to note that in the study, polyurethane foam was referred to as plastic to keep things simple for the participants. For similar reasons, the study also only covered the use of CO_2 in CCU technologies, although we were aware that Carbon4PUR also captures and reuses CO. However, we assumed that this would quickly become too complex for laymen to understand based on the short explanation we were able to provide.

4.10.2 Methodology and main outcomes

To learn as much about the acceptance of CCU insulation boards as possible, an empirical, iterative, and human-centred approach has been chosen. In the beginning a qualitative interview study has been conducted, in which we talked to laymen, technical experts, and field experts. This helped us to understand which factors could be relevant for the acceptance of CCU insulation boards. This study was followed by a relatively small quantitative preliminary study which allowed to calibrate the measuring instrument. The results hereof are not relevant for the discussion in this report and are therefore not presented. Finally, a larger quantitative study using a refined questionnaire was distributed in Germany and the Netherlands. After cleaning the collected responses, we ended up with a good-quality dataset of N = 643responses. These were analysed using both descriptive and inferential statistics. Based on the results of this analysis, the following can be said: The study set a small step in the long journey towards understanding the social acceptance of CCU. Using CCU insulation boards as a product example we studied the product's acceptance by the consumers. We learned that, generally, the product is accepted rather than rejected. More specifically, of the respondents, 80% tended to accept the product. However, it should be noted that about half of these accepting respondents accept CCU insulation boards hesitantly at this moment.

So, although these are good starting conditions for the roll-out of this innovative product, we should be careful not to take the product's acceptance for granted. Good communication strategies are necessary to boost the acceptance levels and increase the chances of the product's success.

We also learned that for the acceptance, the product's perception is particularly important. For this reason, communication strategies should focus on highlighting the benefits, as well as clarifying misconceptions which might lead to a larger barrier perception. For some respondents, it could be useful to include environment-related arguments since environmental concern and behaviour also seems to be related to the acceptance of the product. However, for most these should not overshadow the regular functional properties of the product.

Finally, it is interesting to note that the Germans seemed to accept CCU insulation boards better than the Dutch. This could be caused by the fact that the Dutch respondents tended to perceive more barriers than the Germans. In addition, the German respondents indicated to be more environmentally concerned and also to behave more environmentally aware. Whether these are the reason for the nationality differences remains to be validated.



4.10.3 Conclusions and outlook with respect to the perception and acceptance study

There is a remaining need for research into the social acceptance of CCU insulation boards and CCU in general. Nevertheless, the gathered knowledge on the acceptance of CCU insulation boards and the well-considered guideline for a communication strategy that was formulated on its basis brought us a step closer to understanding how the product's introduction to the market should be shaped.

First results have been published in a scientific article and at least one more is in preparation, as indicated in section 4.9. More details and information will be provided in the final technical report of the Carbon4PUR project.

5. Conclusion and outlook

Well-manged communication actions which followed a purpose-oriented approach and stakeholder engagement have led to the constant increase of public awareness of the project. Thus, the number of followers of the project's social media channels and the number of newsletter subscribers has constantly increased over the project lifetime and finally reached 282 followers on Twitter, 255 followers on LinkedIn and 175 newsletter subscribers. The social media channels and the website will persist also after the project's lifetime.

The key performance indicators and goals with regard to dissemination have also been met. The project partners have attended 33 external conferences, workshops and fairs to present the project and results. Further, 9 own events have been organized including 3 stakeholder events and 3 open-door events7 publications, i.e., 6 scientific articles and 1 source code for the Carbon4PUR mapping tool, have either been already published or are under revision. Furthermore, at least 3 scientific articles are in preparation and the project partners commit to comply to the publication workflow for obtaining publication consent even after the end of the project. The project website will be updated accordingly, as soon as scientific articles will be accepted and published.

A variety of stakeholders could be engaged during the project and the awareness towards Carbon4PUR has constantly increased. This is affirmed by the constantly increasing number of followers on social media, the increasing number of newsletter subscribers as well as the increasing number of participants at the Carbon4PUR stakeholder events. Particularly, stakeholders from industry, academia, non-profit organisations and networks as well as European, national, and local authorities and other national and EU-funded projects have been successfully engaged.

The mass media response and uptake of Carbon4PUR was similarly successful. A lot of international attention has been gathered by the Carbon4PUR project, for example in the German, the French, the Spanish, the Italian, the Belgian or the UK scientific and expert press.

The outcomes of the project will be used by the project partners to strengthen their international position as experts in their field. Building on the knowledge and the network obtained during the project, the partners will develop further follow-up projects. Further engagement, also after the end of the project, may be pursued with stakeholders identified during the development of the exploitation strategy, depending on the strategic orientation of the individual project partners.

6. Annex

6.1 Programme of the first stakeholder event

Carbon4PUR ng industrial waste gases (mixed CO/CO2 streams) into intermediates for polyurethane plastics for rigid foams/building insulation and coating SPIRE projects on the utilisation of CO₂ and CO Agenda of the stakeholder event, 12th of November 2018, Covent garden, Brussels 9:50 🔾 Registration and coffee Welcome 10:20 🔿 Jürgen Tiedje, European Commission - DG Research and Innovation Introduction 10:35 🔿 Alexis Bazzanella, DECHEMA Turning industrial waste gases into valuable polyurethanes - European research collaboration between steel and chemical industry 10:40 🔾 Project Carbon4PUR Liv Adler, Covestro | Geert Snellings, RECTICEL Smart Carbon pathways for steel industry waste gases 11:10 🕚 ArcelorMittal's projects Wim Van Der Stricht, ArcelorMittal Methanol production from flue and residual steel gases 11:30 🔾 Projects FReSMe & MefCO₂ Angel Sánchez Díaz, Everis Standardised Guidelines for Life Cycle and Techno-Economic Assessment of CO2 Utilisation 12:00 🔿 Technologies Raoul Meys, RWTH Aachen 12:15 🔘 Lunch break From industrial CO2 streams to added value Fischer-Tropsch chemicals 13:10 🔾 Project ICO₂CHEM Noora Kaisalo, VTT Recycling CO2 in the cement industry in production of added-value additives 13:40 🥥 Projects RECO2DE & ENGICOIN Sergio Bocchini, IIT | Marios Katsiotis, TITAN | Mariana Paredinha Araujo, Avantium Enhanced energy and resource Efficiency and Performance in process industry Operations via onsite and cross-sectorial Symbiosis 14:20 🕚 Project EPOS Gérard Griffay, ArcelorMittal 14:40 🔿 Coffee break Panel discussion: cross-sectorial aspects of CO and CO2 utilisation Moderator: Alexis Bazzanella, DECHEMA e.V. 14:55 🎱 Panelists: Liv Adler, Covestro | Damien Dallemagne, CO2Value Europe | Dennis Krämer, DECHEMA e.V. Angel Sánchez Díaz, Everis | Michiel Stork, ECOFYS | Sophie Wilmet, CEFIC Closing remarks 15:50 🔿 Jürgen Tiedje, European Commission - DG Research and Innovation 16:00 End of the event This project received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 768919

6.2 Programme of the second, mid-term stakeholder event

PROVI- SIONAL PRO- GRAM	PORT CENTER FOS1 CARBON
	41011
9.00 9.30	Welcome
9.30 10.30	GENERAL CONFERENCES I SUSTAINABILITY AND INDUSTRIAL CO ₂ ISSUES CLUB CO₂ I General overview and issues of CO₂ valorization ARCELOR MITTAL CO₂ issues for Arcelor Mittal COVESTRO Sustainability @ Covestro LEIDEN UNIVERSITY General insight to LCA (Life Cycle Assessment)
10.30 11.15	CARBON4PUR Project presentation and questions
11.15 11.30	Coffee
11.30 1 13.00	 ARCELOR MITTAL I VALORCO project I Recovery and reduction of CO₂ emissions GRT GAZ I JUPITER 1000 project I Industrial demonstrator based in Fos for methanation GPMM I VASCO2 project I Industrial demonstrator based in Fos for microalgae production based on industrial smokes and CO₂ input CARBON RECYCLING INTERNATIONAL (CRI) I Methanol production based on CO₂ input COVESTRO I Carbon productivity I Value creation through smart use of Carbon VICAT AND ALGOSOURCE I CIMENTALGUE project I Optimized bio-mitigation of CO₂ in cement industry
13.00 13.45	Buffet lunch Networking
13.45 14.30	Panel discussion (infrastructure, CO2 valorization, sustainability, future projects, etc.)
14.30 15.00	Transfer to the boat (to confirm)
15.00 16.30	Visit of the port by boat (to confirm)
	ACCESS MAP PORT CENTER FOS1 D268 V Port Saint-Louis D268 V Marseille

6.3 Programme of the third (postponed) stakeholder event



Programme

Moderation: Christoph Gürtler, Covestro; Alexis Bazzanella, DECHEMA e.V.

09:00	Registration and welcome coffee
10:00	Welcome
	Moderators
10:10	CO ₂ as raw material for sustainable polymers: towards a closed carbon circle Walter Leitner, Director MPL-CEC and Professor BWTH Aachen University
	water center, on ector with ecco and hojesson with Addien oniversity
10:40	Keynote
	Søren Bøwadt, European Comission
10:50	CO ₂ EXIDE – Electrochemical CO ₂ conversion to ethylene, ethylene oxide and
	polyethylene
	Arne Roth, Fraunhofer IGB, Coordinator CO2EXIDE
11:10	Coffee break
11:25	Carbon4PUR – Catalytic conversion of CO/CO ₂ mixed gas streams to
	polyurethanes
	Liv Adler, Covestro, Coordinator Carbon4PUR
11:45	PUReSmart – Polyurethane recycling towards a smart circular economy
	Joke De Geeter, Recticel, Coordinator PUReSmart; Karin Clauberg, Covestro
12:00	Technical panel: From scientific research to industrial realisation -
	connections and challenges
	Coordinators of the projects
12:30	Networking Lunch

SYMPOSIUM JOINTLY ORGANIZED BY

Carbon4PUR AND CO2EXIDE



12:30	Networking Lunch
13:20	Sustainability assessment of CO ₂ -based polymers Niklas van der Assen, Professor RWTH Aachen University
13:35	Introduction to round tables and Key Notes to round tables Moderators of the round tables
14:15	Round tables (2 sessions a 20 min with 5 min break)
	 Life cycle assessment and potential economic implications Johannes Lindorfer, Energy Institute Linz; Bernhard Steubing, Leiden University
	 The role of electrification for a greenhouse-gas-neutral chemical industry Alexis Bazzanella, DECHEMA e.V.; Elfriede Simon, Siemens Energy
	 Network building Dennis Krämer, DECHEMA e.V.; Andrei Barascu, DECHEMA e.V.
	Policy as an enabler for CCU technology uptake Francisco Koch, South Pole; Marientina Laina, South Pole
	 Public acceptance and perception – obstacle or chance? Christopher vom Berg, nova-institute; Ulrich Eimer, EPC
15:00	Coffee break
15:15	Summary of round tables Moderators of the round tables
15:30	Panel Discussion: How to implement carbon capture and utilisation technologies? Sucheta Govil, CCO Covestro Søren Bøwadt, European Comission Walter Leitner, Director MPI-CEC and Professor RWTH Aachen University Maximilian Fleischer, Chief Key Expert Siemens Energy Eric de Coninck, Low Impact Steelmaking Project Manager ArcelorMittal
10.20	End of the event

SYM

6.4 Programme of the final stakeholder event



Programme

Moderated by Alexis Bazzanella, DECHEMA and Christoph Gürtler, Covestro

	Welcome and Keynotes
10:00	Welcome Moderators
10:05	Green Deal and Horizon Europe – Facilitating a European circular economy Søren Bøwadt, European Commission, Deputy Head "Advanced Materials and Nanotechnology"
10:20	Processes4Planet: Transforming the European process industry for a sustainable planet & a prosperous society Marta Domper, A.SPIRE
10:35	Renewable Carbon Strategy – CO ₂ utilization for a resilient European circular economy Michael Carus, CEO nova institute
10:50	Short break
	Carbon4PUR Highlights Session
11:00	Innovation for tomorrow – today's chemical champions for more sustainable products Markus Steilemann, CEO Covestro
11:10	Carbon4PUR – Industrial waste gases from steel industry for more sustainable polyurethane applications Liv Adler, Covestro, Coordinator Carbon4PUR
11:20	 Carbon4PUR – Building bridges along industries Consortium partners Status quo and future needs from the point of view of the steel industry Gas purification and conditioning developed in Carbon4PUR Chemical approaches to produce sustainable CO/CO₂-based polyols Application potentials, products, and markets for the new polyols Challenges and implementation of industrial symbiosis

FINAL SYMPOSIUM JOINTLY ORGANIZED BY

Carbon4PUR AND CO2EXIDE

12:00	Carbon4PUR – Assessment of environmental impact, economic aspects, acceptance and perception of CO ₂ /CO utilization and policies and regulations Consortium partners
12:30	Q&A Moderators
12:45	Lunch break
	Keynote
13:15	Sustainable Plastics Strategy Nieves Gonzalez Ramon, SusChem
	CO ₂ EXIDE Highlights Session
13:30	Power-to-X and the chemical industry – The role of electrification for future sustainable markets Armin Schnettler, EVP Siemens Energy
13:35	CO ₂ EXIDE – Electrochemical CO ₂ conversion to produce ethylene and ethylene oxide derivates Arne Roth, Fraunhofer IGB, Coordinator CO ₂ EXIDE
14:00	CO ₂ EXIDE – The CO ₂ EXIDE electrochemical cell: Simultaneous ethylene and hydrogen peroxide production Kerstin Wiesner-Fleischer, Siemens Energy
14:30	CO ₂ EXIDE – Life cycle assessment and impact-related studies Johannes Lindorfer, Energy Institute at the Johannes Kepler University Linz
15:00	Q&A Moderators
15:15	Short break
	Joint Session
15:30	Lessons learned during Carbon4PUR and CO2EXIDE Liv Adler and Arne Roth, Coordinators Carbon4PUR and CO2EXIDE
15:45	Panel discussion: Demands and next steps towards a circular industry in Europe Walter Leitner, MPI-CEC / RWTH Aachen University Maximilian Fleischer, Siemens Energy Sophie Wilmet, CEFIC Carmine Marzano, European Commission, DG Research and Innovation Florian Ausfelder, DECHEMA
16.15	Wrap-up of the event
10.15	Moderators

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