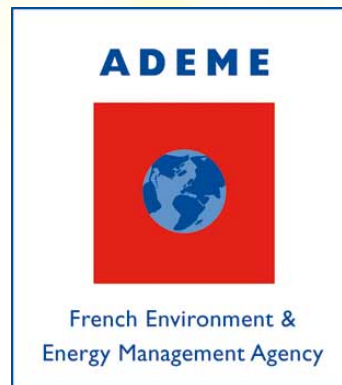


2nd CO₂ Reuse Seminar:

Conclusions of the Plenary Session.
Presentation of the Workshops.





CONCLUSIONS OF THE PLENARY SESSION

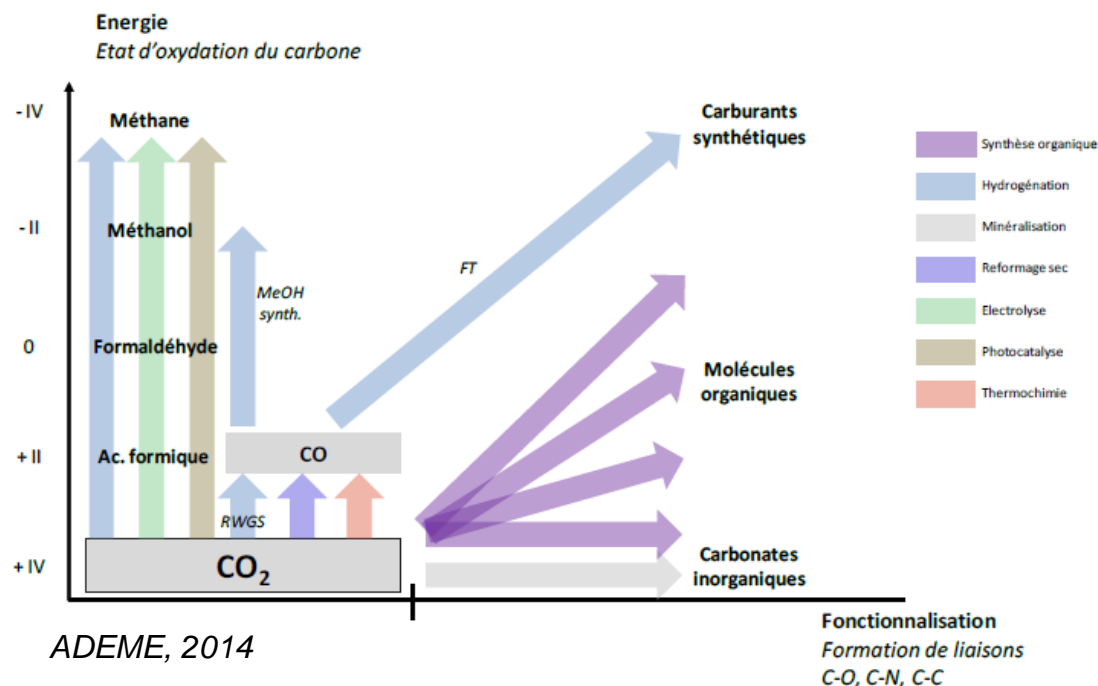
Preamble: a quick overview of CO₂ reuse

- **What is CO₂ reuse? It is a portfolio of developed or developing technologies:**
 - Using many grades, from diluted « raw » CO₂ to captured and highly pure CO₂
 - Giving a triple value to the CO₂:
 1. Environmental: by avoiding CO₂ emissions, limiting fossil fuel and raw materials requirements and improving the carbon footprint of chemicals
 2. Economical: with relevant business models for existing chemicals in existing markets
 3. Societal: by protecting human health and developing employment.
 - Based on physical processes or by biological or chemical conversion
- **CO₂ reuse in the global mitigation initiatives and efforts:**
 - CO₂ emissions from fossil fuels and industry: 35.9±1.8 Gt CO₂, 60% above 1990 emissions → Emissions are projected to decline by -0.6% in 2015 (range -1.6% to +0.5%) (*Global Carbon Project*)
 - If business models are relevant and regulations are in place: max **2 to 4% overall emissions** (0.5% today) could be reused → It is a way to deploy circular economy based on a robust EU industrial sector and infrastructure.
 - **It could act as a complement to other solutions** (efficiency, renewable energies,...) but it should not be exaggerated.

CONCLUSIONS OF THE PLENARY SESSION

Preamble: a quick overview of CO₂ reuse

- What are the current chemistry-based CO₂ reuse technologies under development?



- Conversion by reduction:**
 - C1-building blocks
- Conversion by fonctionnalization:**
 - Inorganic carbonates, concrete curing,
- Conversion by reduction & fonctionnalization:**
 - Synthetic fuels
 - Polymers, organic carbonates, urea,...
- CO₂ used (mainly captive, out of EOR):** 180 Mt CO₂/yr (Armstrong et al., 2015)
- Among the challenges:**
 - No joint methodology to highlight environmental benefits
 - Most of the time, CO₂-based chemicals aren't competitive vs fossil-fuel based chemicals
 - Except for fuels, lack of regulation



CONCLUSIONS OF THE PLENARY SESSION

Research insights

- **International :** CCUS (3rd axis) is part of the Mission Innovation
- **Europe:**
 - ERANET (ACT / Accelerating CCS technologies, ACT II...)
 - Energy Union and SET Plan action 9 CCUS; Horizon Price for CO2 reuse for 2019 for 1.5 M€ (ongoing process)
 - H2020: CCS and CCSU identified
- **National level:**
 - Stratégie Nationale de la Recherche : among 10 challenges : secure, clean and efficient energy / Industrial renewal → should be released by the end of the year.
 - Public funding: ANR, ADEME, BPI, perhaps not as visible as in Germany, but funding does exist
- **Collaboration and Network is a key**



CONCLUSIONS OF THE PLENARY SESSION

Regulation

- **WW : COP21 : accord de Paris has been ratified (74 parties; 59% GHG emissions)**
- **EU 28 is really committed in CO₂ Utilization**
- **France : Energy transition for green growth act: 2 tools**
 - SNBC: France low-carbon development strategy (eg: carbon footprint, CO₂)
 - PPE: Energy strategy master plan (5 years)
- **CO₂-based productt:** need to harmonized regulation within EU



CONCLUSIONS OF THE PLENARY SESSION

Environmental insights

- There is a potential for CO₂ Utilization to reduce some CO₂ emissions (not to exaggerate)
- Reduce C footprint / Matter of efficiency
- Perform environmental assessment / LCA at early stages of projects
- Need of renewable energy
- Importance of CO₂ storage time



CONCLUSIONS OF THE PLENARY SESSION

Economical insights

- **Worldwide: Carbon Pricing leadership:** fix one global price
- **European ETS :** today 4€/t ; prospects : France proposition: corridor to regulate
- **New initiatives:** Financial Stability Board, Institutional Investors Group on Climate Change, Portfolio Decarbonization Coalition...
- **France:** tax @ 56 €/t by 2020 ; 100 €/t by 2020.
- **Nice, but even if changing, our economy is still based on fossil fuels**
- **For a 2°C scenario: we need to invest 5 000 G\$/yr of public and private investment flows;**
today, 391 G\$ of climate finance in 2015
- **Open question:** do we need economic incentives?
- Think of the services brought by CO₂ reuse not only of the chemicals
- CO₂ Utilization could be a **new opportunity of growth**



CONCLUSIONS OF THE PLENARY SESSION

Vision and Perspectives

- **CO₂ Utilization topic is growing due to CCS slow down**
- **Potential:**
 - 1.5 Gt CO₂/yr could be utilized in the future
 - Many different uses: chemicals, fuels, aggregates
 - Not a massive game changer for GHG emissions; but potentially a growth engine
- **Mix together academia, corporate business, policy orienters**
- **We need to involve territories:** how to make them energetically independent? How to use synergies?
 - Le Havre Développement : unique opportunity of R&D tools from lab to demonstration units)
 - Marseille Fos authority: CO₂ Utilization as a new growth engine
- **European Association on CO₂ transformation**
 - Why ? to accelerate R&I and market development; to become a reference organization
 - Bring together a unique network and analyse the opportunity to build a large European PPP dedicated to CO₂ Utilisation



CONCLUSIONS OF THE PLENARY SESSION

Industrial insights





METHODOLOGY OF UPCOMING WORKSHOPS

⑨ Find the conditions for a successful emergence of CO₂ transformation technologies

Principle :

- The participants will gather in 2 break-out groups
- Running the 2h-workshops in parallel
- Workshops are managed by Club CO₂ and CO₂ Forum team members :

Workshop 1

"Can you grow your CO₂ Utilization business?"

Workshop 1.1 and 1.2 MERGED (in French) –

Amphitheater

Laurent FORTI, IFPEN

Frederick BERNARD, Le Havre Développement

Salvatore BERTUCCI, ARCELOR MITTAL

Workshop 2

"Deploy CO₂ Utilization in a regional area"

Workshop 2.1 and 2.2 MERGED (in French) –

ROOM F002

Solène VALENTIN, AIR LIQUIDE

Sylvain PICHON, Grand Port Maritime de Marseille



METHODOLOGY OF UPCOMING WORKSHOPS

⑨ Find the conditions for a successful emergence of CO₂ transformation technologies

Agenda :

Start	End	Titre
14:15	14:30	Conclusions of the Plenary Session Presentation of the Workshop Session <i>David SAVARY, SOLVAY</i>
14:30	14:40	Transfer to Workshops Locations
14:40	16:40	Workshops : Sharing and building together.
16:40	16:45	Transfer to amphitheatre
16:45	17:05	Conclusions of the Workshops
17:05	17:20	Closing remarks <i>Daniel CLEMENT, ADEME</i>

Deliverables :

1. Find levers that can be implemented within an industrial park into a territory to make business with CO₂-based chemicals.
2. Make recommendations or even build an action Plan to roll out this new sector.



METHODOLOGY OF UPCOMING WORKSHOPS

Workshop 1: "Can you grow your CO₂ Utilization business?"

Timing	Description	Deliverable
13h55-14h05	<u>Phase 0 (10 min):</u> Detailed presentation of the workshop by the moderator(s)	n/a
14h05-14h35	<u>Phase 1 (30 min) :</u> Analysis of levers and hurdles for the 4 following CO₂-based chemicals: Methanol, formic acid, polymers, mineral aggregates Levers and hurdles: technological, economic, regulatory, financial, politic, societal, environmental...	Levers and Hurdles per chemical
14h35-15h05	<u>Phase 2 (30 min) :</u> Based on a simple block diagram or chemical reaction, find how to unlock hurdles defined in Phase 1 so that you deploy your plant and your business (think for instance of local synergies).	One strategy per chemical
15h05-15h55	<u>Phase 3 (50 min) :</u> How to unlock the remaining hurdles by integrating the 4 strategies within an industrial park? Some ideas: <ul style="list-style-type: none"> • Think CO₂ purification, conversion and utilization of CO₂-based chemicals • Think out of the local synergies: what do you need at national, EU scale? • Think integration (materials, energy, services, transportation... • How could be designed the ideal territory? 	One integrated strategy for the 4 chemicals



METHODOLOGY OF UPCOMING WORKSHOPS

Workshop 2: "Deploy CO₂ Utilization in a regional area"

Timing	Description	Deliverable
13h55-14h05	<u>Phase 0 (10 min):</u> Detailed presentation of the workshop by the moderator(s)	n/a
14h05-14h35	<u>Phase 1 (30 min):</u> Future search: Describe past and present and imagine the future on 4 areas at different scales <ul style="list-style-type: none"> • Home/Residential → Energy independency • Rural → biomass valorisation • Urban → zero waste • Industrial Harbour → Carbon-free transportation 	4 diagrams or description of future scenario
14h35-15h05	<u>Phase 2 (30 min):</u> Enrich and strengthen each future scenario by collective intelligence	Improvement of previous scenario
15h05-15h55	<u>Phase 3 (50 min):</u> Merge and integrate the 4 future scenarios in one scenario at regional level	One presentation of a global future scenario in front of regional institutional



Thank you for your attention.