



CCUS MARKET STUDY

Overview of the CCUS Market



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No xxx.

Introduction

1. CCUS Market Key figures
2. CCUS Market in the world
3. CCUS Market in Europe
4. CCUS Market opportunitites for the AURA Region



CCUS Market in the world

Main Key figures
And mapping



CCUS Market – Context

CCUS plays an important role in achieving net zero emissions, especially since 3 million tonnes of CO₂ has been added worldwide each year since 2010, with annual capture capacity estimated to over 40MtCO₂.

In the next past years, we see a boost to recognize CCUS as necessary to meet national, regional and even corporate net zero goals.

Net zero emissions target announcements

agreed in law, as part of an initiative, or under discussion

Countries with no net zero target
27 %

United States
12 %

NET ZERO TARGETS
Global emissions covered
73 %

Other countries with similar net zero announcements
29 %

European Union (EU27)
7 %

China
25 %



Figure 1: Share of GHG emissions covered by countries that have adopted or announced net zero emission targets (agreed in law, as part of an initiative, or under discussion). Compilation based on ECIU (2021) as of 29 April 2021 complemented by CAT analysis. Emissions data for 2017 taken from EDGAR emissions database (EDGAR, 2019).



CCUS Market – Context



In addition, the production of low-carbon hydrogen has resulted in almost **50 facilities** under development to capture CO₂ from hydrogen related processes.



New policy incentives were created. As an example, since the start of 2020, governments and industry have committed more than USD 25 billion in funding specifically for CCUS projects and programmes.

Credit photo : Pixabay markus-s; Memed_Nurrohmadi/400



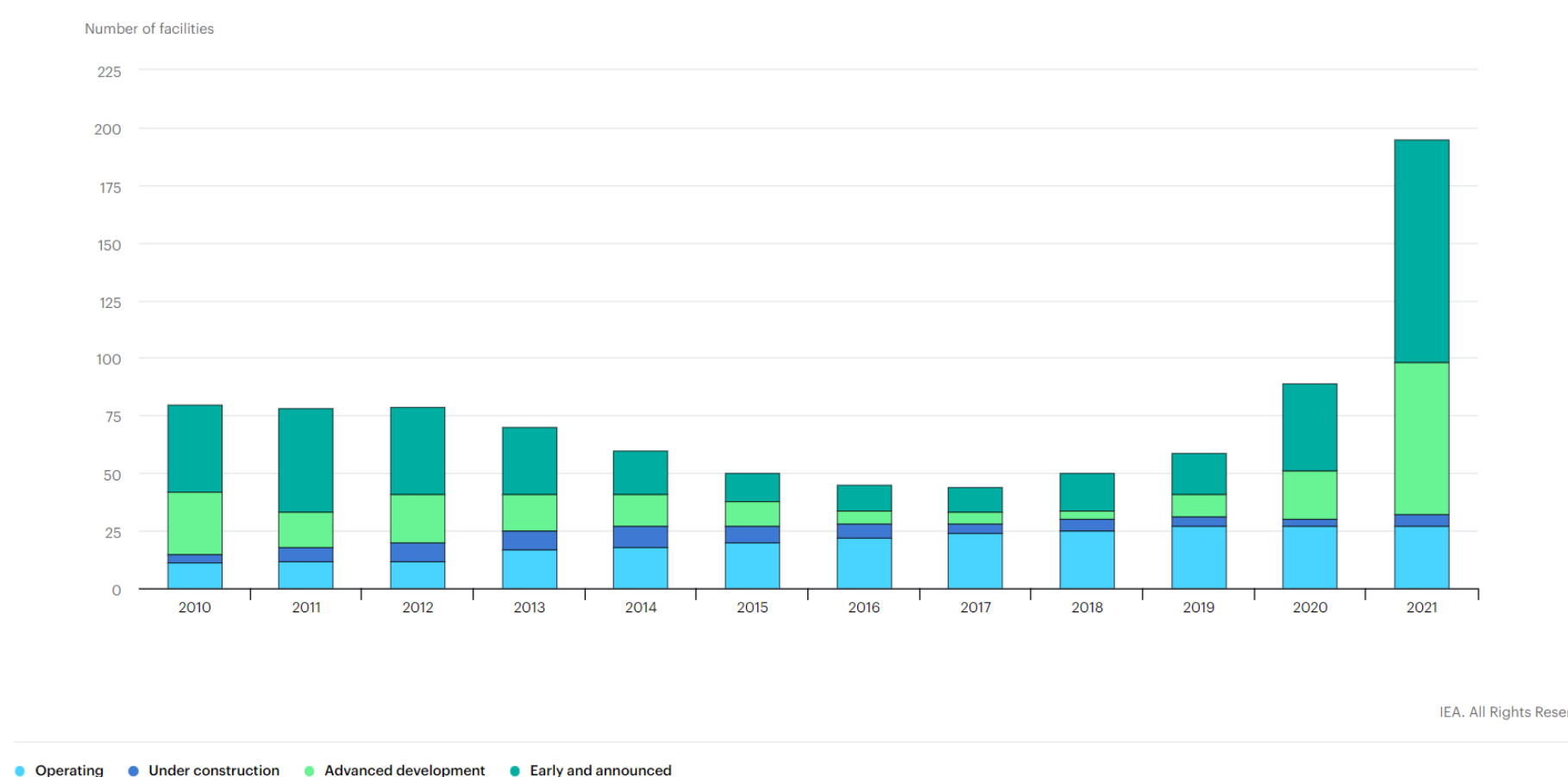
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CCUS Market – CCUS operating facilities 2010-2021

The number of CCUS project has increased since 2010.

In 2021, we count :

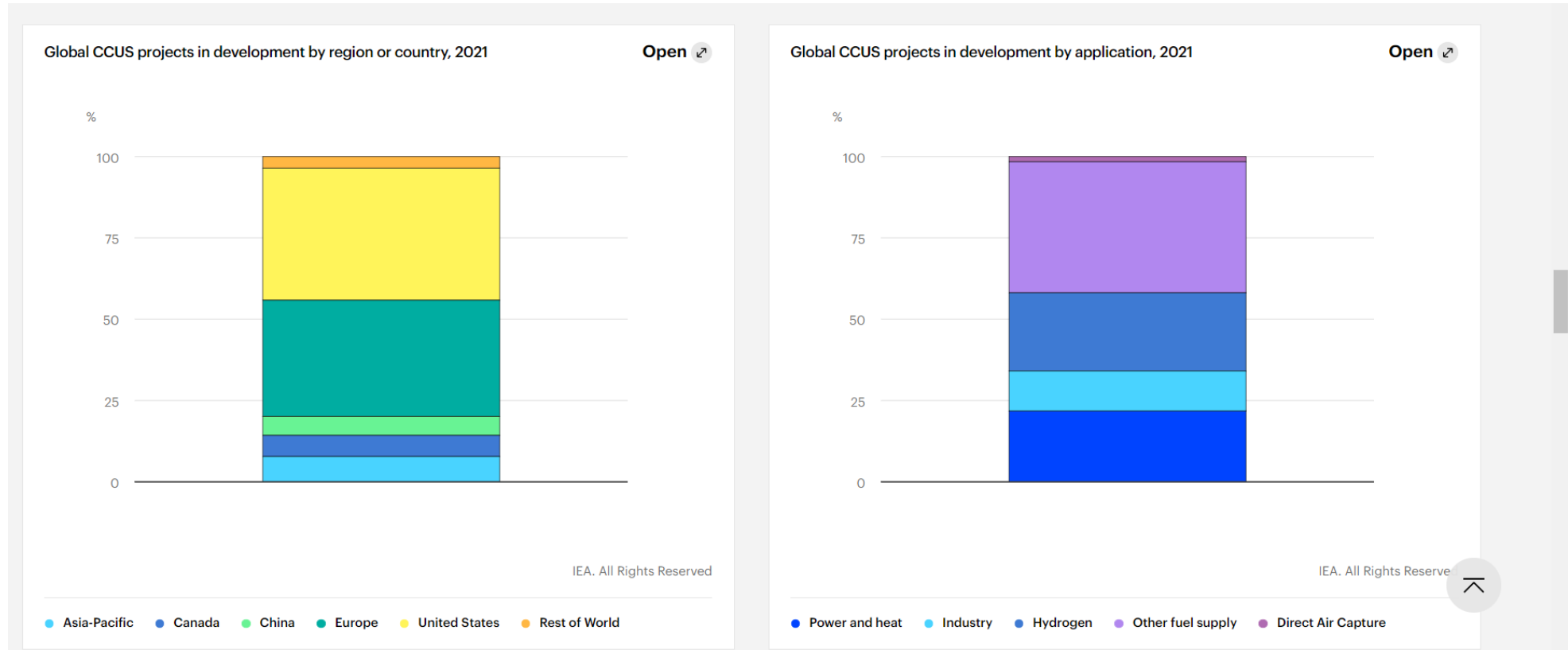
- 27 operating projects
- 5 under construction
- 66 advanced development
- 97 early announced (59 more than 2020)



CCUS Market – CCUS operating facilities 2010-2021

35,7% of the projects will be located in Europe.

40,5% in the USA



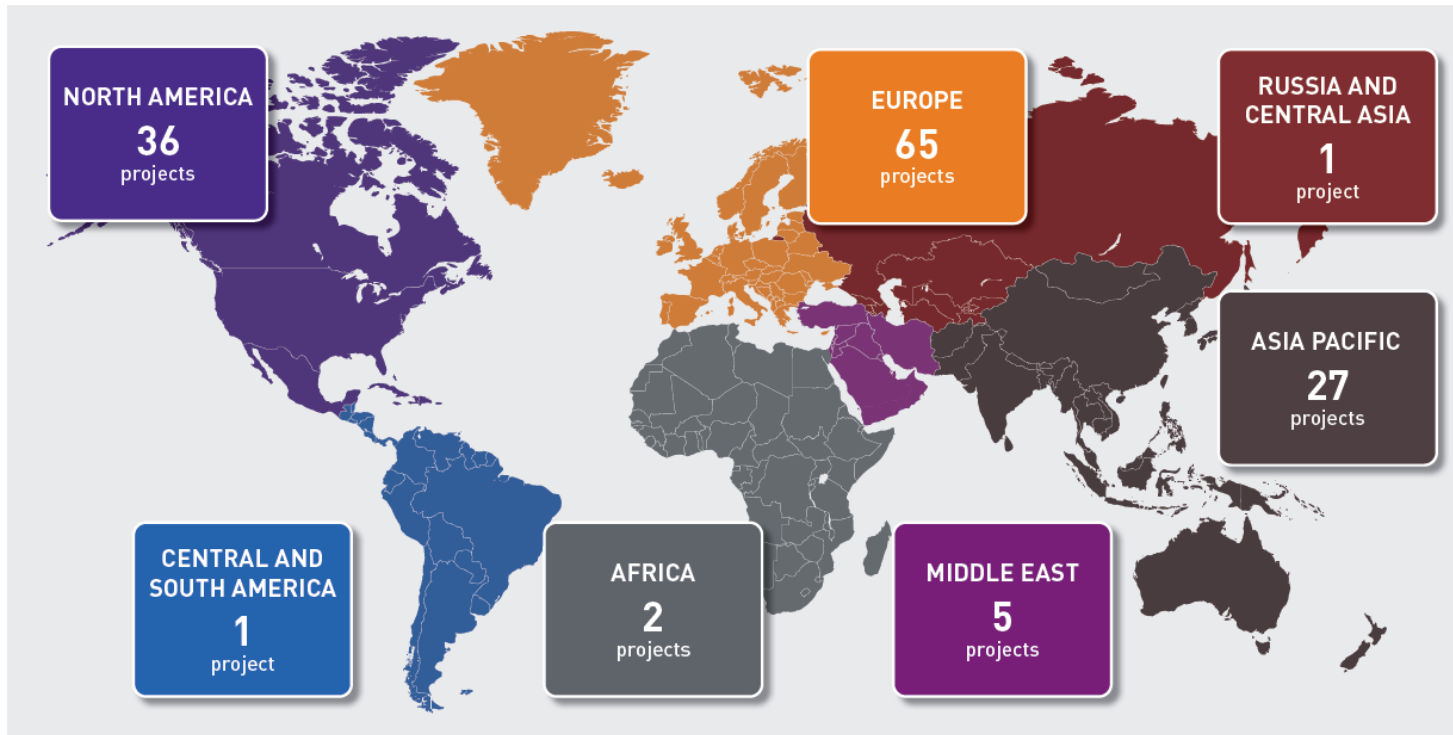
CCUS Market – World map



JANUARY
2022

Global CCUS projects

Overview of existing and planned CCUS facilities



Source: Global CCS Institute and IOGP data

[https://www.iogp.org/bookstore/wp-content/uploads/sites/2/woocommerce/uploads/2020/03/GRA002_220131.pdf](https://www.iogp.org/bookstore/wp-content/uploads/sites/2/woocomerce/uploads/2020/03/GRA002_220131.pdf)



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CCUS Market – Main Key figures

- 2021 : more than 100 new CCUS facilities have been announced
- CCUS projects under development in 25 countries



CCUS Market in Europe

Key figures

Mapping of the main CCUS European projects



Key figures

- **In Europe : 4.45 billion tonnes of CO₂ are released** every year with the average person adding 24 kg of CO₂ into the atmosphere every day.
- **The European Union has committed to a binding target** of at least a 40% reduction of greenhouse gas emissions by 2030, compared to 1990 levels.



CCUS projects in Europe

65 projects
identified

Around
60MtCO₂/year
stored by 2030

<https://iogpeurope.org/resource/map-of-eu-ccus-projects/>

Overview of existing and planned CCUS facilities

AUSTRIA

1. Vienna Green CO₂*

BELGIUM

1. Leilac (pilot capture only)
2. Antwerp@C (Port of Antwerp)*
3. Carbon Connect Delta*
4. Flite*
5. C4U
6. North-CCU-Hub
7. Power-to-Methanol Antwerp BV
8. Kairos@C

CROATIA

1. iCORD*
2. Bio-Refinery Project*

CZECHIA

1. Onshore storage project

DENMARK

1. Greensand*
2. C4: Carbon Capture Cluster Copenhagen
3. Copenhill

FINLAND

1. SHARC

FRANCE

1. DMX Demonstration in Dunkirk*
2. Pycasso*
3. K6 Program

GERMANY

1. H2morrow*
2. Leilac 2
3. Wilhelmshaven

GREECE

1. Energean Carbon Storage

ICELAND

1. Orca
2. Hellisheidi
3. Silverstone

ITALY

1. CCS Ravenna Hub*
2. ClinkerK

THE NETHERLANDS

1. Porthos (Port of Rotterdam)*
2. Aramis (Den Helder)*
3. Magnum (Eernshaven)*
4. H-Vision*
5. Twence
6. AVR-Duiven
7. Project Everest*
8. Vlissingen Cryocap FG

NORWAY

1. **Steipner CO₂ Storage***
2. Longship (including Northern Lights)*
3. Polaris CCS*
4. Norsk e-fuel
5. Borg CO₂*
6. Fortum Oslo Varne
7. Barents Blue*
8. Norcem Brevik
9. Pilot CCS project

POLAND

1. Poland EU CCS Interconnector

REPUBLIC OF IRELAND

1. ERVIA

ROMANIA

1. Onshore storage project

SPAIN

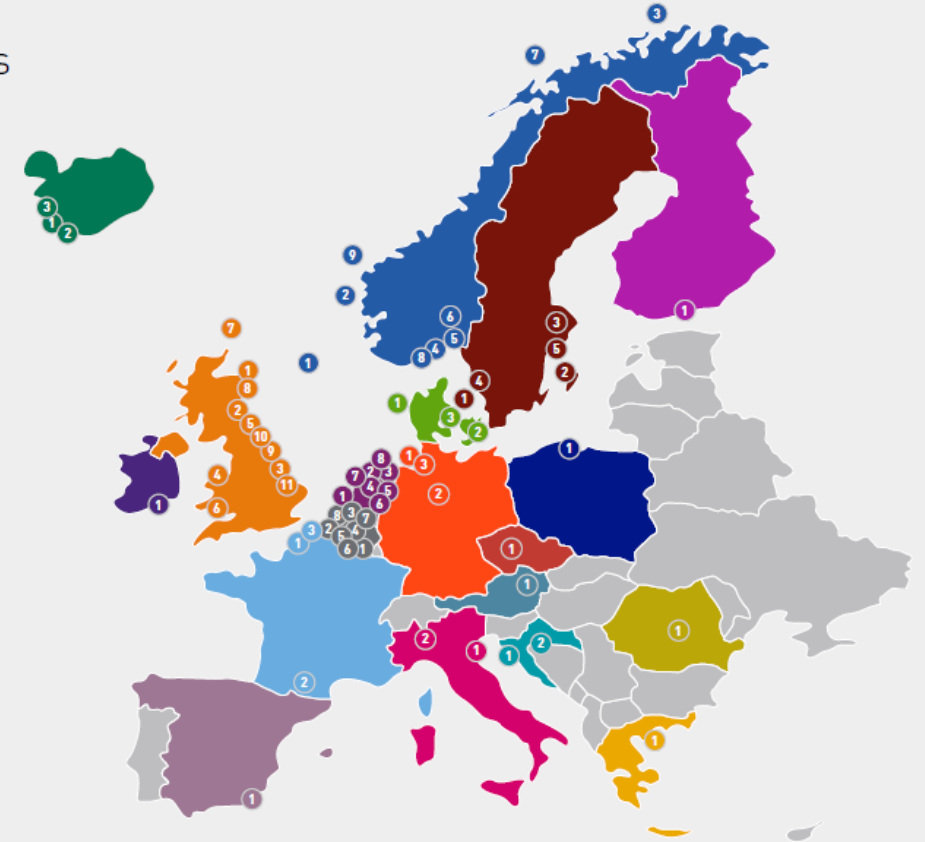
1. CCU Lighthouse Carboneras

SWEDEN

1. Preem CCS*
2. Cementa Slite Plant
3. Vattenfall Uppsala
4. CinfraCap
5. BECCS@STHLM

UK

1. Acorn*
2. Caledonia Clean Energy
3. Zero Carbon Humber*
4. HyNet*
5. Netzero Teesside*
6. South Wales Industrial Cluster
7. STEMM-CCS*
8. CO₂ Sapling Transport Infrastructure Project
9. Northern Endurance Partnership*
10. H2Teesside*
11. H2H Saltend*



* Project where IOGP Members are involved
† Project is cross-border with the Netherlands
Projects listed in **bold** are in operation

Total number of projects: **65**
Around 60 MtCO₂/yr stored by 2030



The challenges

- Voir les pays qui soutiennent les financements de ses projets (ex. Norvège, UK)
- A noter que l'Allemagne à ce jour n'a pas de solution d'export et ni d'aide pour investir dans les projets CCUS



CCUS Market in France

CO2 emission
National Strategy
Focus on the AURA Region



Stratégie nationale Bas Carbone

Objectif global : atteindre la neutralité carbone en 2050.
Pour se faire, l'industrie française doit réduire ses émissions de gaz à effet de serre **de 35 % d'ici 2030.**

- Soit une réduction des émissions industrielles de CO₂ de **5 millions de tonnes par an**



La neutralité carbone

C'est un équilibre entre :

- les émissions de GES sur le territoire national ;
- l'absorption de carbone :
 - par les écosystèmes gérés par l'être humain (forêts, sols agricoles...) ;
 - par les procédés industriels (capture et stockage ou réutilisation du carbone).

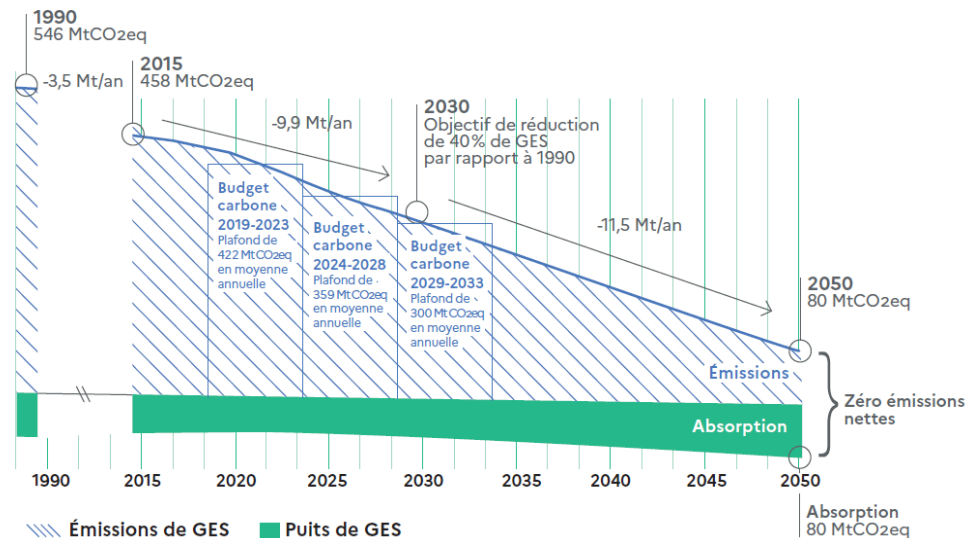


Facteur 6

La neutralité carbone implique de diviser nos émissions de GES au moins par 6 d'ici 2050, par rapport à 1990.



Évolution des émissions et des puits de GES sur le territoire français entre 1990 et 2050 (en MtCO₂eq). Inventaire CITEPA 2018 et scénario SNBC révisée (neutralité carbone)

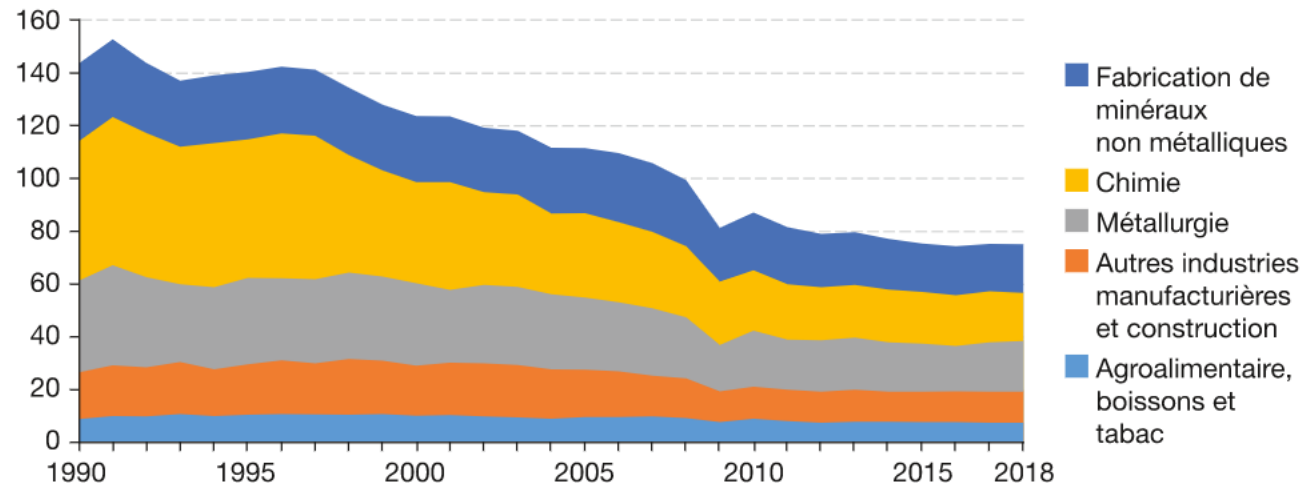


La SNBC s'appuie sur un scénario prospectif d'atteinte de la neutralité carbone à l'horizon 2050, sans faire de paris technologiques. Celui-ci permet de définir un chemin crédible de la transition vers cet objectif, d'identifier les verrous technologiques et d'anticiper les besoins en innovation.

Focus sur les émissions industrielles nationales de CO2

ÉMISSIONS DE GES DANS L'INDUSTRIE MANUFACTURIÈRE ET LA CONSTRUCTION EN FRANCE

En Mt CO₂ éq



Note : les émissions de chaque secteur incluent les émissions liées à l'utilisation d'énergie et celles liées aux procédés industriels.

Source : AEE, 2020

Plus de **150Mt CO₂** équivalent enregistrées en 2020

Les émissions de GES de l'industrie manufacturière (y compris les procédés industriels) proviennent principalement de secteurs produisant des produits de base intensifs en CO₂ tels que la métallurgie, la chimie ou la fabrication de minéraux non métalliques (ciment, chaux, verre...).

Ces trois sous-secteurs représentent **75 %** des émissions de l'industrie manufacturière et la construction en 2018 en France (contre 5 % pour la construction), et 70 % à l'échelle de l'UE.

Source : <https://www.statistiques.developpement-durable.gouv.fr/edition-numerique/chiffres-cles-du-climat/12-emissions-de-ges-de-lindustrie>

Une transformation industrielle impactante, l'exemple d'Arcelor Mittal

Les investissements engagés sur les sites de Arcelor à Dunkerque et Fos permettront de **transformer en profondeur la production d'acier en France** et d'atteindre d'ici 2027 une réduction totale de près de 40 % des émissions de CO2 d'ArcelorMittal en France, soit 7,8 millions de tonnes annuelles.

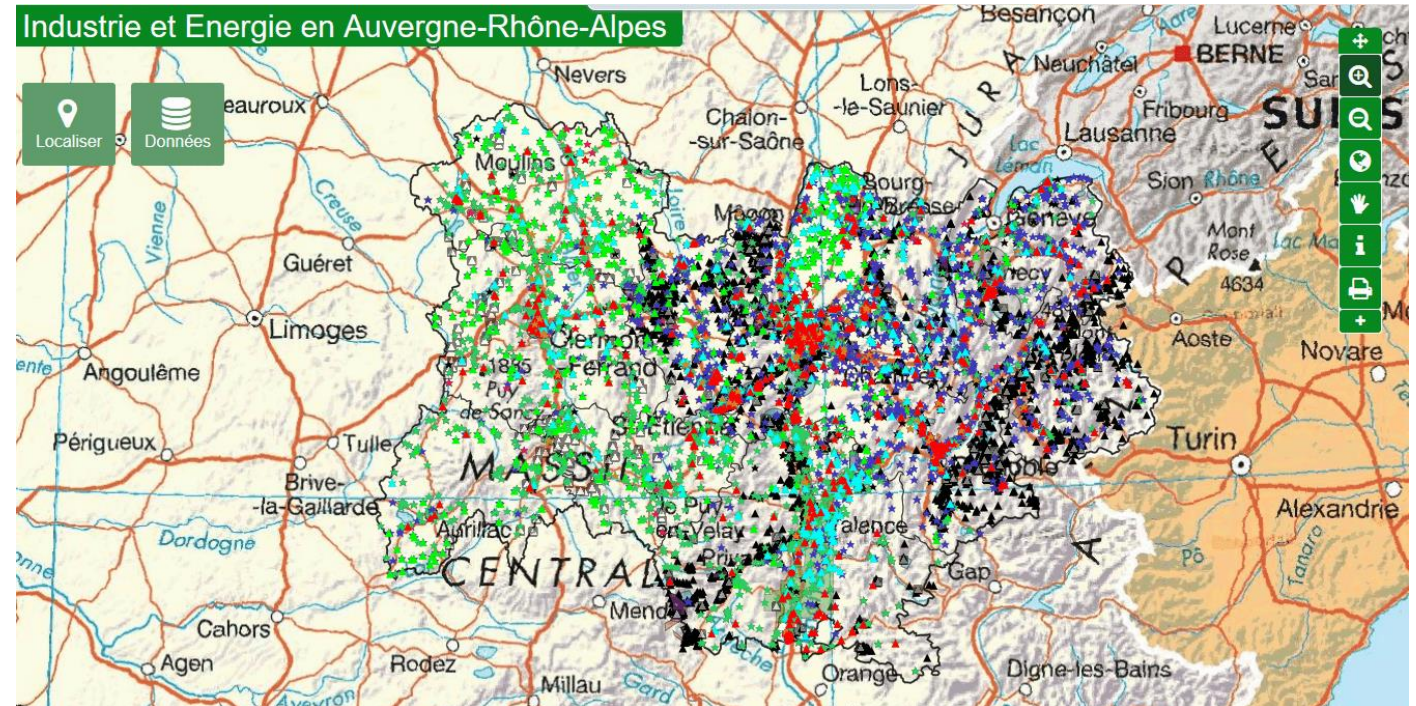
Cette transformation représentera une réduction de 10 % des émissions industrielles de gaz à effet de serre en France



Focus sur les émissions industrielles régionales de CO2

X Mtonnes de CO2 émises
en Région Auvergne Rhône-
Alpes en 2020

XMtonnes enregistrées sur
la Vallée de la Chimie



Source Phar'Eco – Sources : IGN,
DREAL Auvergne-Rhône-
Alpes <https://phareco.auvergnerhonealpes-entreprises.fr/entreprises-et-territoires/cartes-et-annuaires/industrie-et-energie>

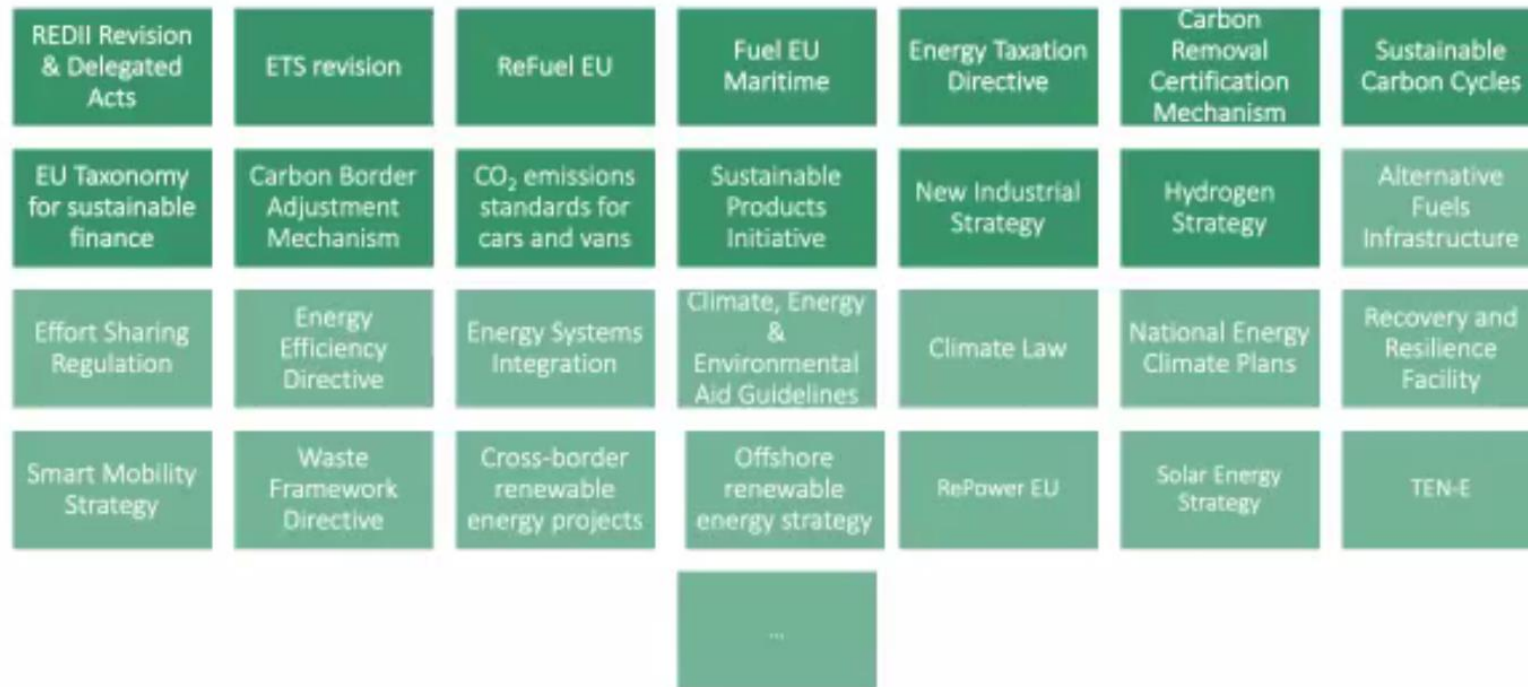
Regulation

Policy support



Policy landscape

Policy landscape



CO₂-based fuels and chemicals - Nova Conference – 23/03/2022

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Policy landscape

Policy support...

Instrument	Impact on CCU
<u>EU Emissions Trading System (EU ETS) revision</u>	<ul style="list-style-type: none"> ✓ CO₂ which is chemically and permanently bound in a product under normal use (e.g. CO₂ mineralisation) is excluded from the obligation to surrender allowances; ✓ Avoid double-counting of emissions released by the use of RFNBOs*.
<u>Renewable Energy Directive (REDII) revision</u>	<ul style="list-style-type: none"> ✓ At least 2.6% of the energy supplied to transport by 2030 is covered by RFNBOs; ✓ 50% of the use of hydrogen in the industry is covered by RFNBOs.
<u>ReFuelEU Aviation</u>	<ul style="list-style-type: none"> ✓ Binding targets per volume shares for RFNBOs: min 0.7%, 8%, 28% of RFNBOs by 2030, 2040, 2050, respectively and minimum 28% by 2050.
<u>Fuel EU Maritime</u>	<ul style="list-style-type: none"> ✓ Binding GHG reduction targets for ships: 2%, 6%, 26%, 75% in 2025, 2030, 2040, 2050, respectively, by including RFNBOs to reach these targets.
<u>Sustainable Carbon Cycles</u>	<ul style="list-style-type: none"> ✓ At least 20% of the carbon used in the chemical and plastic products should be from sustainable non-fossil sources by 2030 ✓ Tracing the origin of CO₂ used in products
<u>Energy Taxation Directive revision</u>	<ul style="list-style-type: none"> ✓ Minimum taxation rate of zero for 10 years for RFNBOs for specific types of air and waterborne navigation.

*RFNBO: Renewable fuels on non-biological origin (CCU fuels are included in this category)



CO₂-based fuels and chemicals - Nova Conference – 23/03/2022

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Policy landscape

- CCUS fuels are part of biofuels definition
- ETS system suggest that when biofuels is produced the CO₂ is not counted twice. Introduce in the first time in ETS. Where the CO₂ will be account for (ongoing discussion)
- Open regulation to non transport sector
- More sectorial Regulation (Aviation and Maritime) : introduction of sustainable fuels. Reduction targets in the maritime sector that can be reached by alternative fuels.
- 20% of carbon used in chemicals and plastics products should be from non fossil sources by 2030. The origin will be traced.



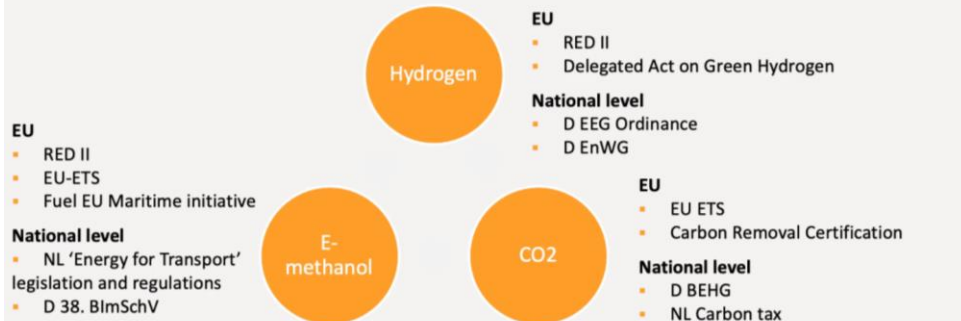
Other policy that need to be worked

- Inclusion of the CCU in the taxonomy
- Difficulty to invest without clear regulation

Challenge 1: Fragmented and changing framework conditions



- Various regulations on EU and national level need to be considered (selection)



23/03/2022 Zeichen setzen: Carbon Reduction Strategies for Waste to Energy

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Thank you!

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Challenges

What are the main challenges to develop CCUS Technologies?



Support needed: Policy & regulation

➤ More than money we need to create the market conditions to build the business

- **Certification** as well as Guarantees of Origin (**GOs**) for renewable and low-carbon gases
 - E fuels must be considered as carbon neutral fuel otherwise CCU project has no sense.
 - A company using E-fuels must be able to valorise the use of **carbon neutral fuel** to produce a **carbon neutral product** (e.g. green steel & green chemicals) or to become carbon neutral like aviation or maritime.
- Create adequate **regulatory framework**
 - Creating a **mechanism to secure** the investor payback (e.g. contract for difference)
 - Setting up **economy-wide renewable fuel target** comprising both E fuels and renewable H₂ .
 - Possibility to use fuel switch to achieve carbon neutrality.
 - **End-use sector-specific targets** for renewable H₂/synthetic fuels in transport (complementing the biomethane/biofuels target), for renewable H₂ and other renewable gases in (certain) industries and/or for green products in construction and other sectors (e.g. green steel, green cement, green plastics)

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