ANCRE Position Paper: « Carbon sinks and negative emissions What roles for research to enhance their development in France?»

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Bioenergy task group

7th ACT Knowledge Sharing Workshop

4-5 October 2023, Paris, France

Accelerating CCS Technologies

ANCRE

Alliance Nationale de Coordination de la Recherche pour l'Énergie

ANCRE project presentation

- **Collaborative 24 months research project (2020-2022) based on voluntary work, several key stages:**
  - Workshop at mid-term (July 2021)
  - Position paper (October 2022)
  - 3 presentations in congress (France, India, EUBCE/Italy) and 1 article in *"The Conversation" (FR)*

- **Main contributors in the working group**
  - Other ad-hoc contributions: ADEME, Air Liquide, Karibati, INERIS, Cirad, B4C,….

Background: the climate targets (FR)

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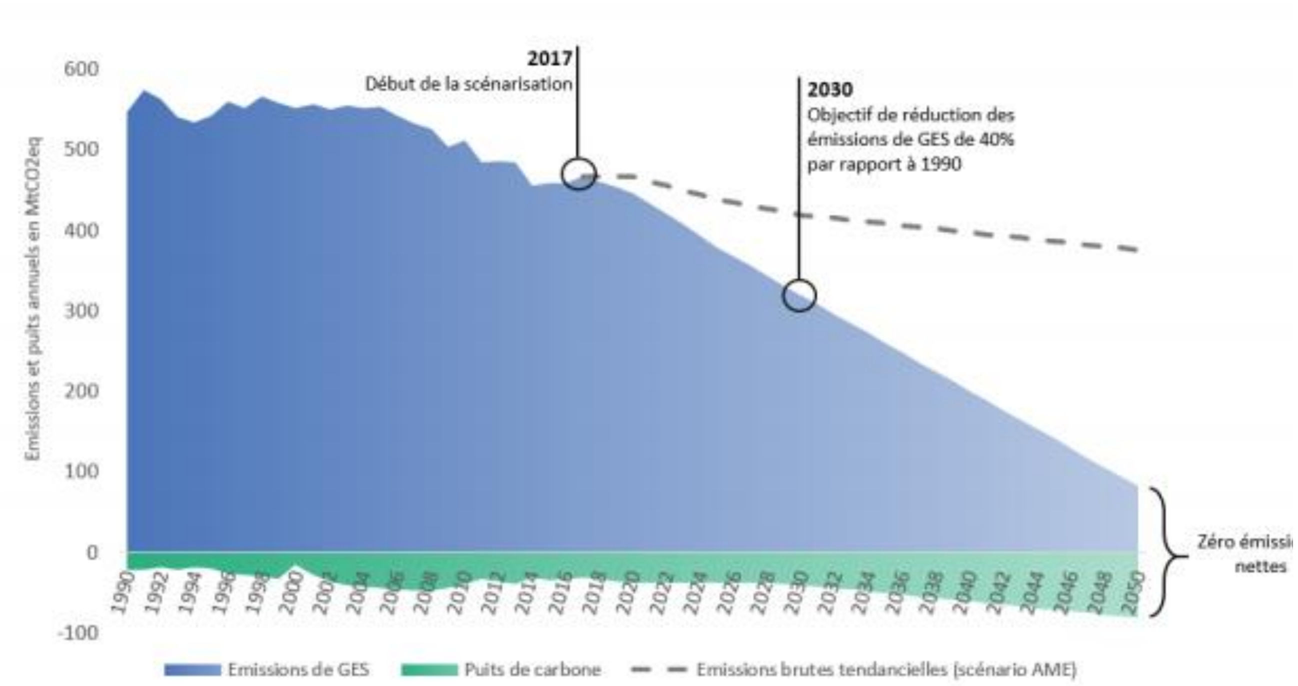
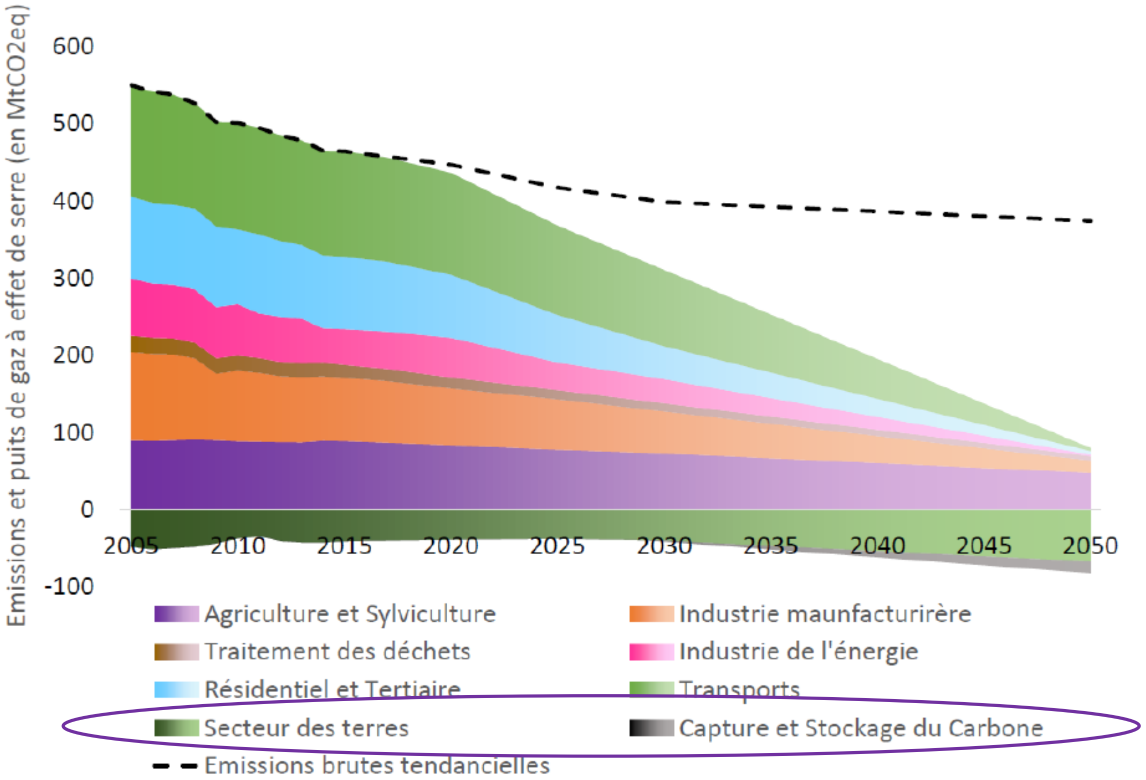
National Low Carbon Strategy of 21 April 2020: Emission trajectory of GHG sinks on the national territory of the SNBC scenario (with state incitation: SNBC-AMS)



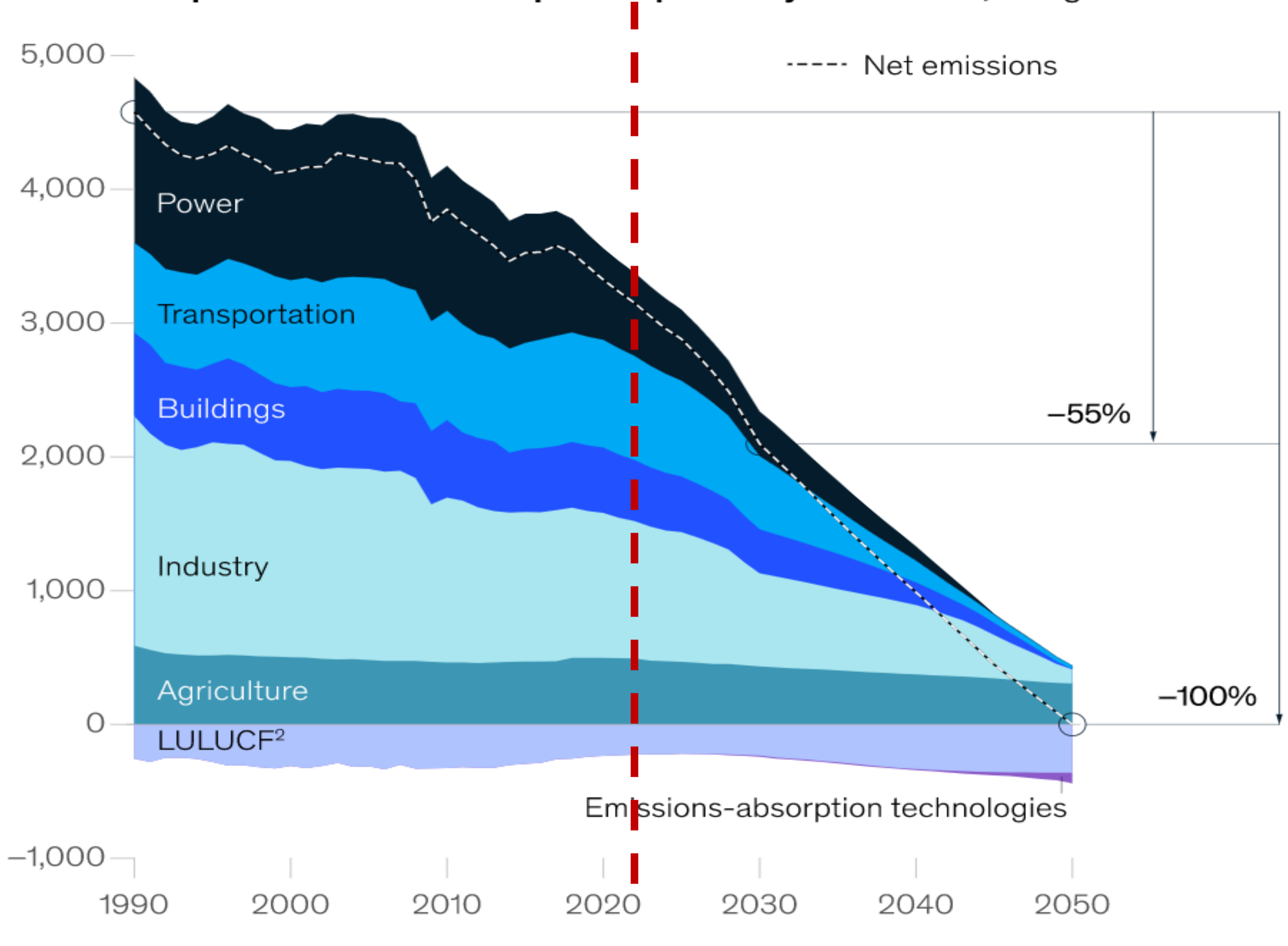


By 2050, by mobilising to the maximum the potential of each available lever to reduce greenhouse gas emissions, without however making any technological bets, a certain level of emissions appears to be incompressible (~85 Mt CO_2eq/year). To achieve carbon neutrality, these emissions must be offset by "carbon sink" solutions

Europe: Long is the road, short is the time

- **Around 2 Gt reduction in the previous 33 years**
- **About 1 Gt reduction needed in the next 6 years**
- **About 3 Gt reduction needed in the next 26 years**

Total emissions per sector in cost-optimal pathway for EU-27,[1] megatons of carbon dioxide equivalent

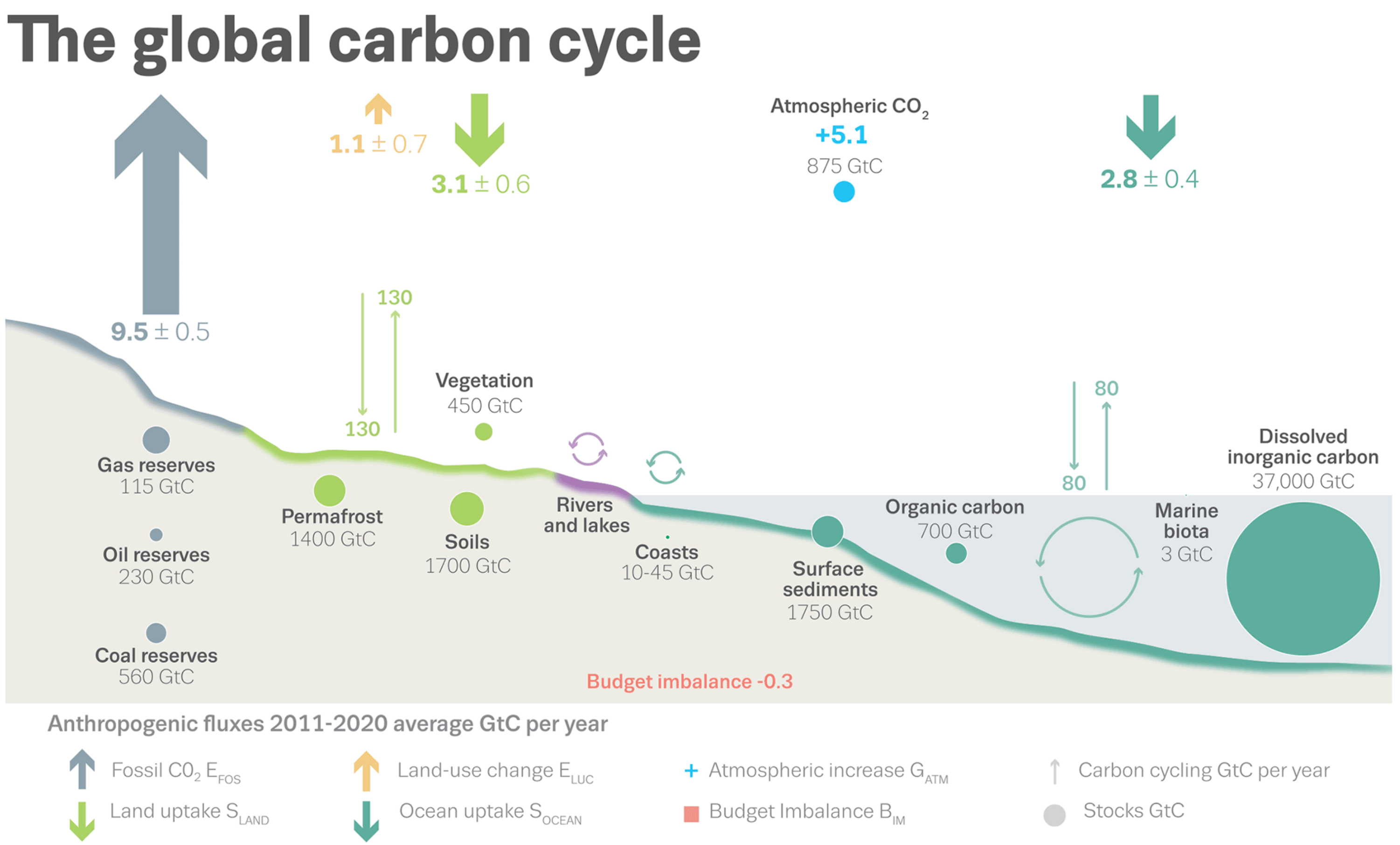


[1]Excluding international aviation and shipping.
[2]Land use, land-use change, and forestry entails all forms in which atmospheric CO_2 can be captured or released as carbon in vegetation and soils in terrestrial ecosystems.
Source: UNFCCC; McKinsey analysis

Source : https://www.mckinsey.com/capabilities/sustainability/our-insights/how-the-european-union-could-achieve-net-zero-emissions-at-net-zero-cost#/
European Commission, 2020 - The 2030 Climate Target Plan

Global carbon world stocks and flux between 2009 and 2018 in Gt of carbon per year

- **Complex natural phenomena need to be better understood**



Examples of challenges for France:

- Need for better monitoring of flux, at national and local levels
- Need to identify and implement practices **to preserve existing stocks** in environmental management
- Need to identify and implement stocking practices in the management of environments, in particular in forest, urban and aquatic environments
- Need to anticipate the **potential impacts of climate change** on these phenomena

P. Friedlingstein et al., Global Carbon Budget 2020, Earth Syst. Sci. Data, 12, 3269–3340, issue 4, 2020 (https://doi.org/10.5194/essd-12-3269-2020).

Background: LULUCF carbon sinks in France

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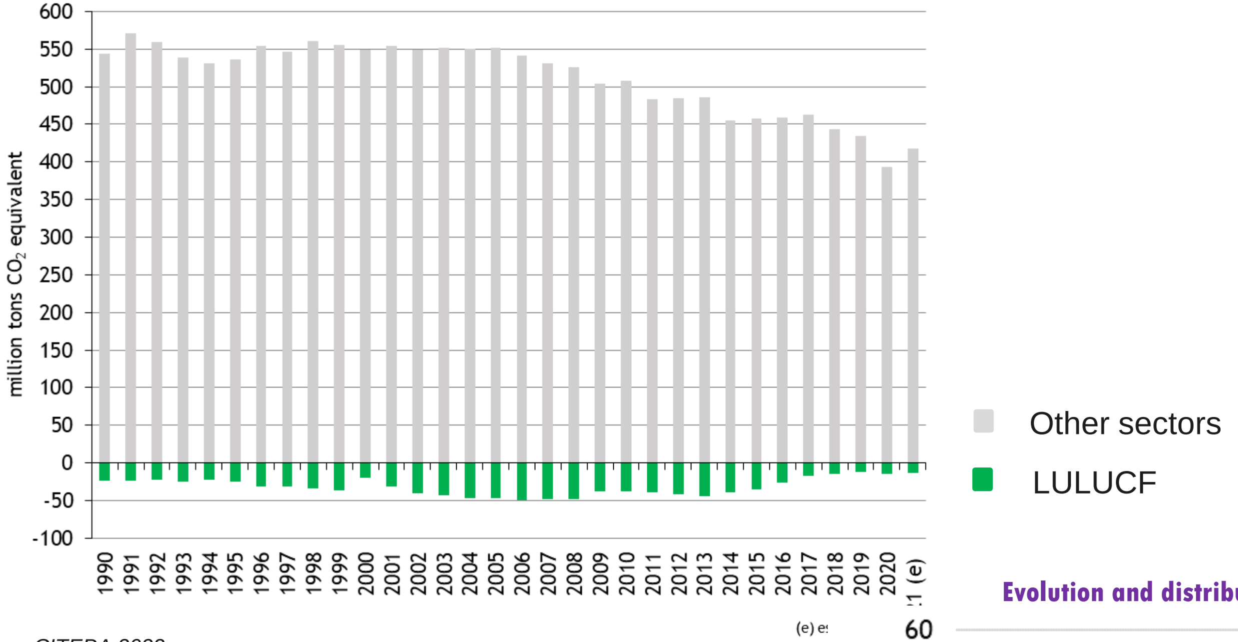
Evolution of CO2e emissions into the air since 1990 in France



CITEPA,2022

- Since 2005, net decline of negative emissions from land use, land use change and forestry
- Last 10 years, reduction of emissions and mostly absorption in wood products and in forest (due to slowed growth and increase in mortality induced by more frequent drought, disease, fire, and storm)

Evolution and distribution of CO2e emissions and absorptions from the LULUCF sector in France

CITEPA,2022

Background

- **Main issues to be raised:**

  - ✓ **What sink solutions are available to achieve the 2050 target? Which environments? Which practices? Which technologies?**

  - ✓ **How can the dynamics of existing natural sinks be preserved or even reversed?**

  - ✓ **What can we expect from the new solutions? Can we precisely assess their potential? What are associated challenges?**

  - ✓ **What role can research play? what are the priority actions to be developed?**

The 6 families of carbon sink solutions of the ANCRE project

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Natural capture and/or sequestration solutions

S1. Photosynthesis in agricultural and and forestry

S2. Photosynthesis in urban environments

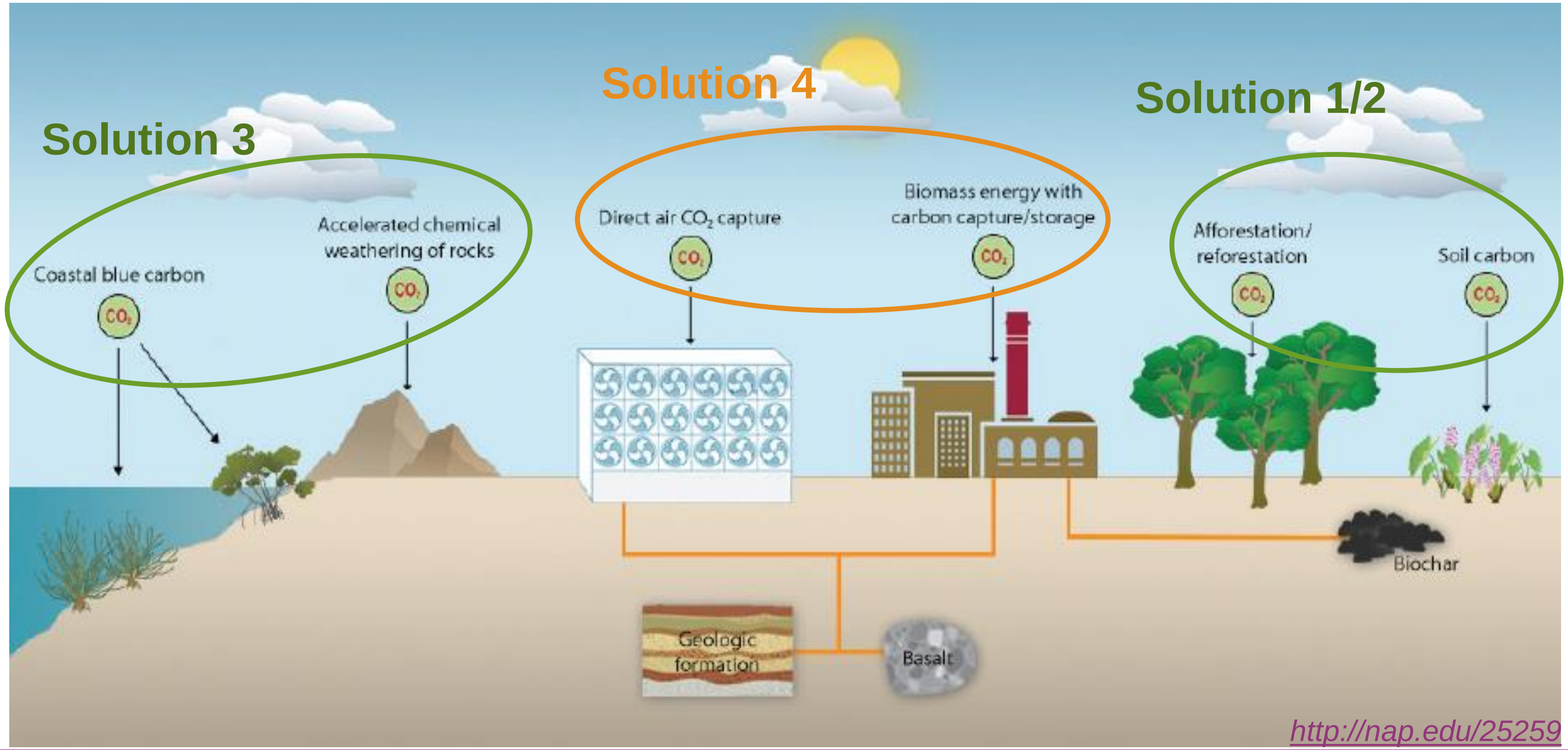
S3. Aquatic environments and alteration of rocks

Technological capture and/or sequestration solutions

S4. Atm CO_2 capture and geological sequestration (DACCS+BECCS)

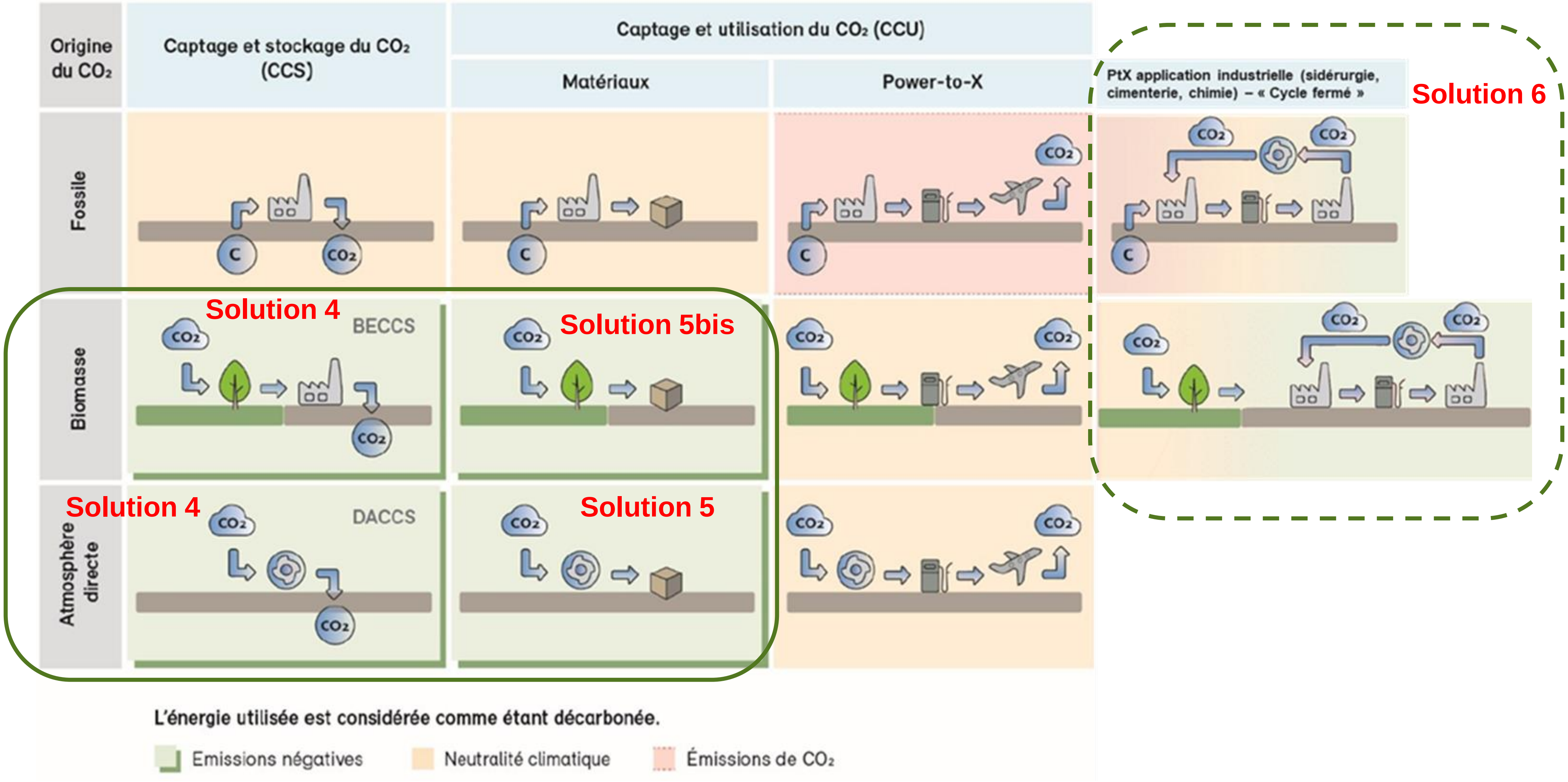
S5/5bis. Atm CO_2 capture and usage and storage in materials (CCUS)

S6. Re-use and cycle closure of industrial CO_2 towards long-term storage (CCUS)



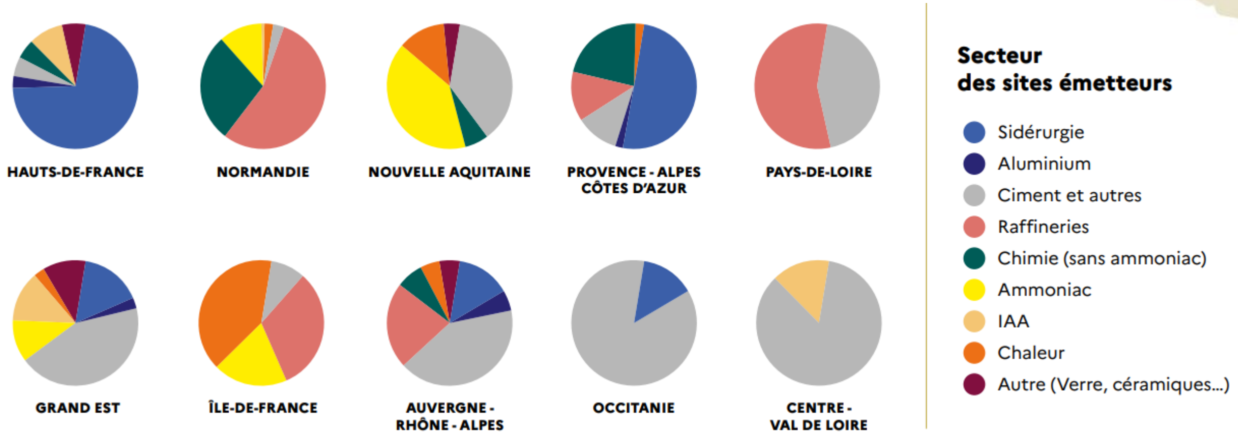
http://nap.edu/25259

Numerous technological solutions with varying degrees of maturity

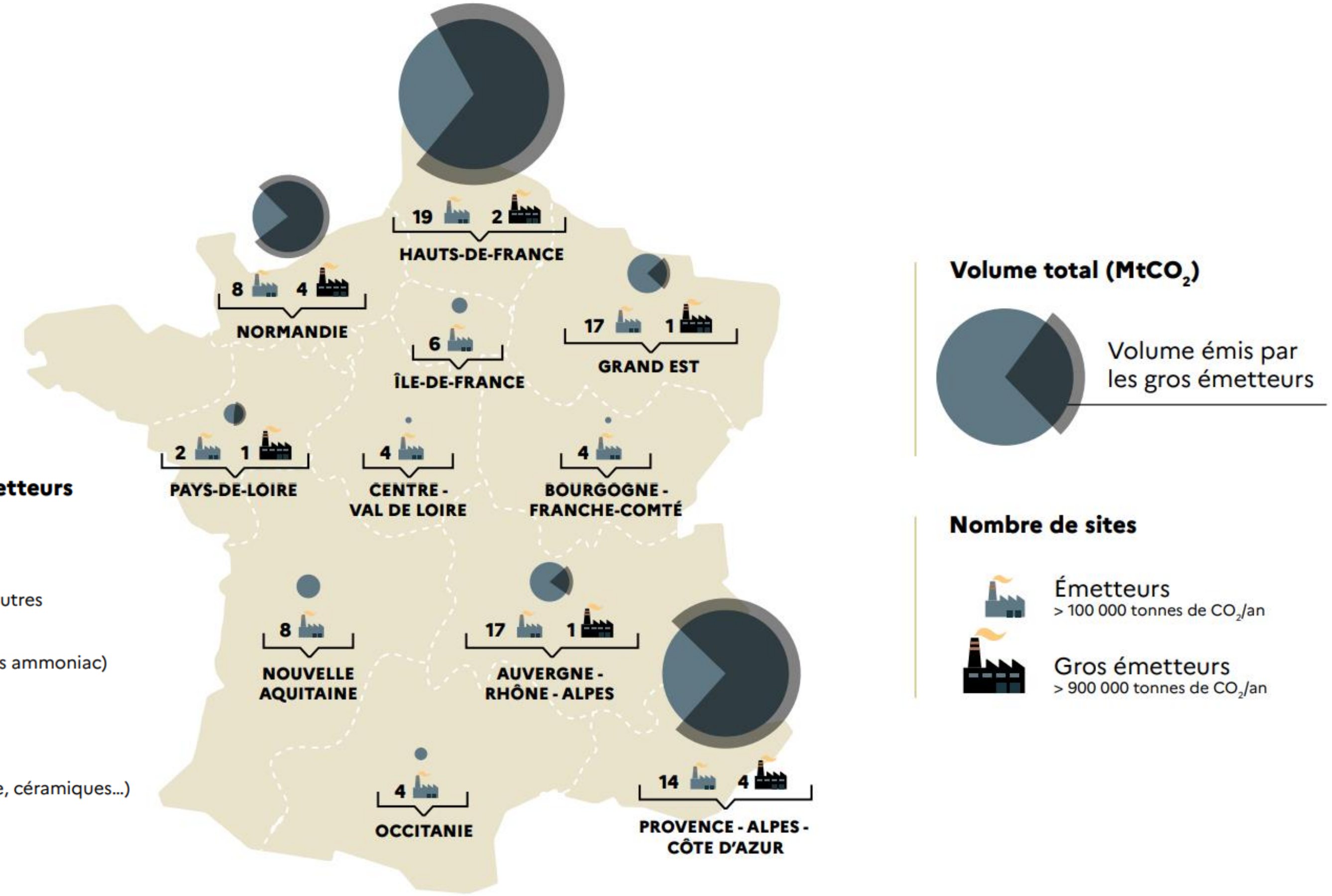


CO2 emissions by region in France : point sources

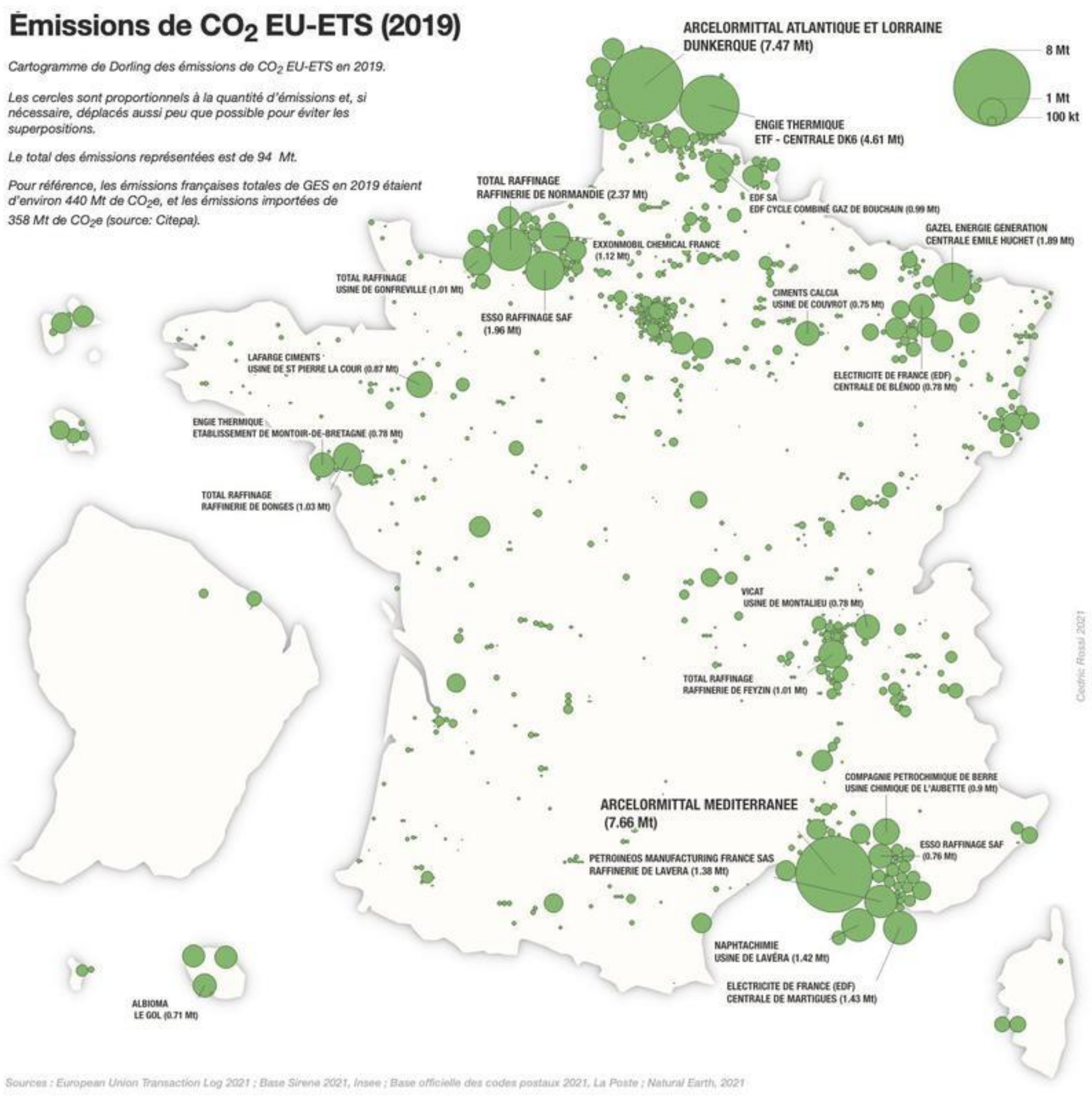
- **Les Hauts-de-France et PACA are the main emissions regions**
- **Harbours: petroleum and chemical industry**



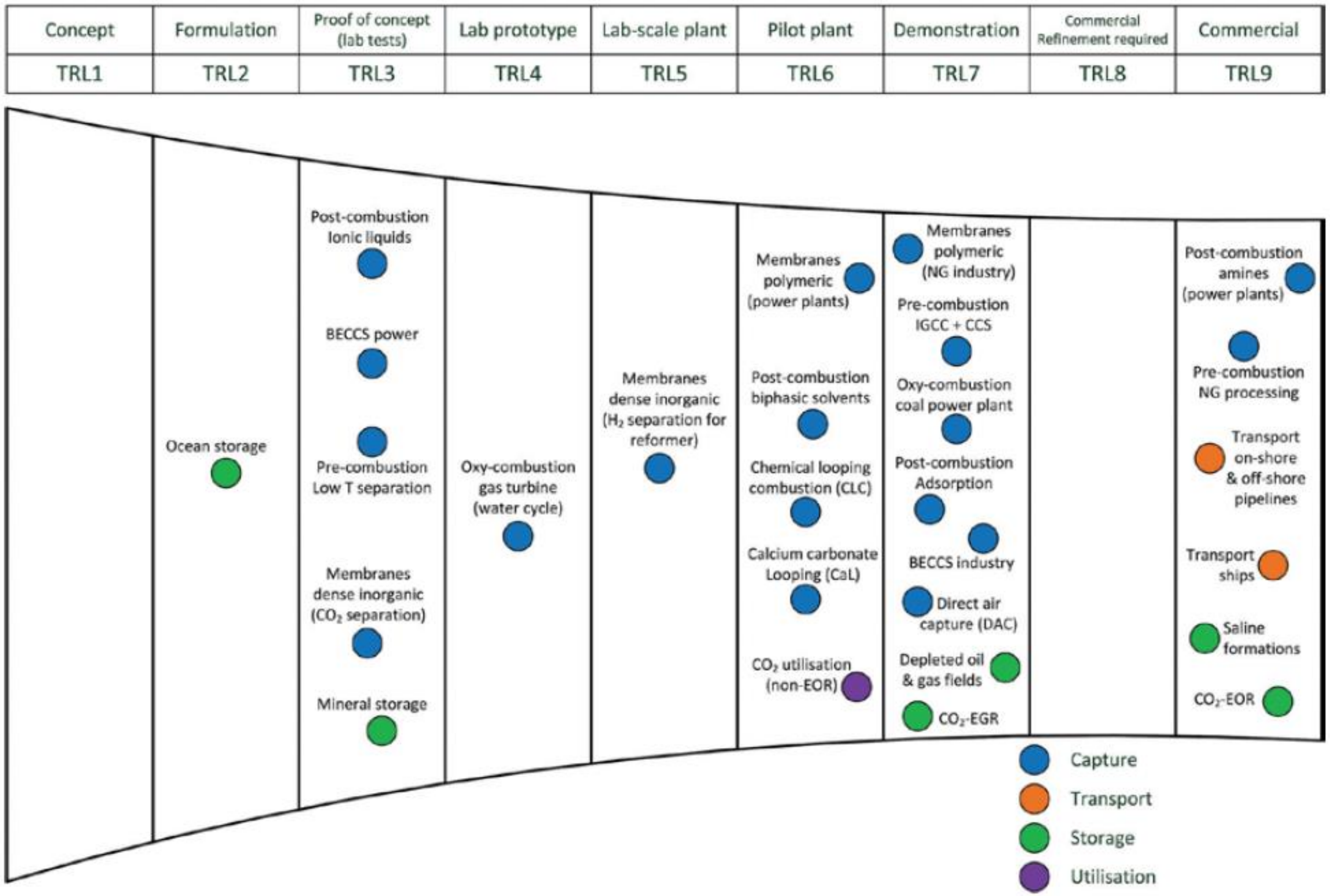
Emissions industrielles en MtCO2, par région



Source : ADEME, 2020


Émissions de CO_2 EU-ETS (2019)
Cartogramme de Dorling des émissions de CO_2 EU-ETS en 2019.
Les cercles sont proportionnels à la quantité d'émissions et, si nécessaire, déplacés aussi peu que possible pour éviter les superpositions.
Le total des émissions représentées est de 94 Mt.
Pour référence, les émissions françaises totales de GES en 2019 étaient d'environ 440 Mt de CO_2e, et les émissions importées de 358 Mt de CO_2e (source: Citepa).
8 Mt
1 Mt
100 kt
ARCELORMITTAL ATLANTIQUE ET LORRAINE DUNKERQUE (7.47 Mt)
ENGIE THERMIQUE ETF - CENTRALE DK6 (4.61 Mt)
EDF SA EDF CYCLE COMBINÉ GAZ DE BOUCHAIN (0.99 Mt)
TOTAL RAFFINAGE RAFFINERIE DE NORMANDIE (2.37 Mt)
EXXONMOBIL CHEMICAL FRANCE (1.12 Mt)
GAZEL ENERGIE GENERATION CENTRALE EMILE HUCHET (1.89 Mt)
TOTAL RAFFINAGE USINE DE GONFREVILLE (1.01 Mt)
ESSO RAFFINAGE SAF (1.96 Mt)
CIMENTS CALCIA USINE DE COUVROT (0.75 Mt)
LAFARGE CIMENTS USINE DE ST PIERRE LA COUR (0.87 Mt)
ELECTRICITE DE FRANCE (EDF) CENTRALE DE BLÉNOD (0.78 Mt)
ENGIE THERMIQUE ETABLISSEMENT DE MONTOIR-DE-BRETAGNE (0.78 Mt)
TOTAL RAFFINAGE RAFFINERIE DE DONGES (1.03 Mt)
VICAT USINE DE MONTALIEU (0.78 Mt)
TOTAL RAFFINAGE RAFFINERIE DE FEYZIN (1.01 Mt)
Cedric Rossi 2021
COMPAGNIE PETROCHIMIQUE DE BERRE USINE CHIMIQUE DE L'AUBETTE (0.9 Mt)
ARCELORMITTAL MEDITERRANEE (7.66 Mt)
ESSO RAFFINAGE SAF (0.76 Mt)
PETROINEOS MANUFACTURING FRANCE SAS RAFFINERIE DE LAVERA (1.38 Mt)
NAPHTACHIMIE USINE DE LAVÉRA (1.42 Mt)
ELECTRICITE DE FRANCE (EDF) CENTRALE DE MARTIGUES (1.43 Mt)
ALBIOMA LE GOL (0.71 Mt)
Sources : European Union Transaction Log 2021 ; Base Sirene 2021, Insee ; Base officielle des codes postaux 2021, La Poste ; Natural Earth, 2021

Technologies TRL



- **Current progress in the development of carbon capture, storage and utilisation technologies in TRL.**
  - **BECCS = bioenergy with CCS**
  - **IGCC = gas-fired combined cycle**
  - **EGR = enhanced gas recovery**
  - **EOR = enhanced oil recovery**
  - **NG = natural gas.**

Kapetaki Z., Carbon Capture Utilisation and Storage Technology Development Report 2020, EUR 30506 EN, Publications Office of the European Union, Luxembourg, 2020, ISBN 978-92-76-27278-6, doi:10.2760/082813, JRC123163.

Position paper ANCRE

- https://www.allianceenergie.fr/etudes-et-rapports/
  - https://www.allianceenergie.fr/position-paper-les-puits-de-carbone-quels-roles-de-la-recherche-pour-accelerer-leur-developpement-en-france/

- 7 carbon sink solutions Fact Sheets (3 pages each)
  - State of knowledge
  - Issues
  - Challenge and barriers
  - Recommendations for research and support

- 7 transversal recommendations

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ANCRE Position paper and fact sheets

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Example worksheet 1

Worksheet 1

Carbon storage in biomass and agricultural and forest soils

State of play

The natural mechanism of photosynthesis allows the sequestration of atmospheric CO_2 in the form of organic matter, in almost equal parts, between agricultural and forest biomass and soils. French terrestrial ecosystems already constitute a very significant carbon sink that EFESE estimates in Metropolitan France at nearly 20% of 2015 French emissions, i.e. approximately 90 Mt CO_2 eq/year [EFESE, 2019]. The vast majority of these sinks are in forest environments (more than 60 Mt in 2018 in mainland France according to ADEME, 2021). In the French Overseas Territories and in Guyana in particular, it is considered that these forests have reached their maximum carbon storage capacity and therefore their sink seems to have stopped (according to ADEME Guyane, 2016).

With regard to metropolitan soils in particular, the study conducted by INRAE in 2019 indicates that forest soils account for 38% of the total carbon stock, permanent grasslands 22% and field crops 26.5%. It is the latter which have the highest additional storage potential in the litter because of their current low carbon content and the size of their surfaces. On the already hand, for forest soils and permanent grasslands, which have a high carbon content, the challenge is to maintain their stock and preserve their surface area. The report highlights concrete actions to maintain and develop carbon storage in soils and the type of practices to achieve this, assuming no change in land use. The practices are potentially diverse (agroforestry, intermediate crops, hedges, extension of temporary grasslands, return of co-products to the soil, etc.) and they are accompanied by co-benefits in terms of water quality and biodiversity. However, all these practices must be considered in a given geographical and temporal context (soil conditions, stocks of origin, costs in line with existing crop rotation and existing opportunities). Through this study, a maximum additional storage potential of 30 Mt of CO_2 eq/year has been estimated for agriculture. However, there are many major risks to these carbon sinks due to, among other things, the reduction in forest area as a result of fires, pest attacks, drought and reductions in area through changes in land use. More work is therefore needed to improve understanding of the long-term effects of these practices and the effects of climate change on storage and sequestration.

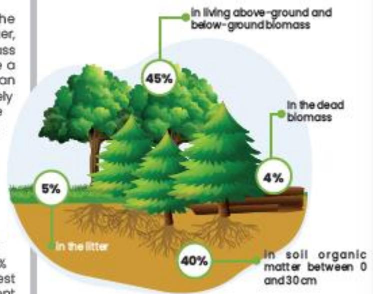


Figure 1 - Carbon storage in the forest (ADEME, 2021)

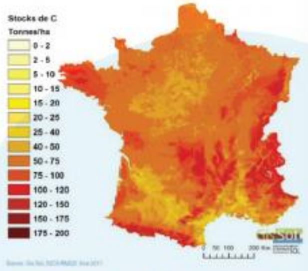
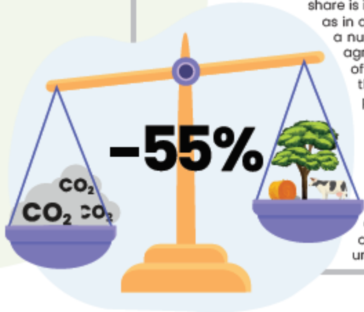


Figure 2 - Mapping carbon stocks in metropolitan soils (INRAE, 2019)

Challenges

At EU level, among the measures to accompany the latest proposed target of at least a 55% reduction in GHG emissions by 2030 are actions to preserve and expand the capacity of natural carbon sinks in each Member State, with binding targets from 2026. By 2035, the Union should strive to achieve climate neutrality in land use, forestry and agriculture [...] (Green Pact for Europe of 14 July 2021).

In addition, in its National Low Carbon Strategy (SNBC, 2020), France attributes an important role to natural carbon sinks for achieving carbon neutrality in 2050, which should be doubled to reach approximately 65 Mt CO eq2 /year in 2050, of which a growing share is in long-lived wood products (20 Mt, see sheet 5bis) as well as in agricultural areas (11 Mt). This scenario is accompanied by a number of measures such as increasing carbon storage in agricultural soils through changes in practices; the development of active and sustainable forest management, allowing both the adaptation of the forest to climate change and the preservation of carbone stocks in the forest ecosystem; the development of afforestation adapted to climate change and the reduction of land clearing.



France must therefore now acquire the means to consolidate existing data and knowledge in order to specify the real potential of these carbon sinks and to improve the monitoring of land use and the understanding of carbon dynamics within ecosystems. It also appears necessary to construct quantified scenarios of the evolution of these sinks under the impact of climate change. Locks

Barriers

LACK OF DATA
on the current evolution of carbon stocks and fluxes in ecosystems and the interactions between carbon, nitrogen and water,

LACK OF PROJECTION
on the dynamics of these developments under the impact of climate change,

LITTLE BACKGROUND
on the effects of changes in agricultural practices on long-term carbon storage,

LACK OF SCENARIOS
on projections under the impact of climate change,

NEED FOR TRACEABILITY
competition between agricultural and forestry land uses and artificial development (land reclamation vs.urbanisation),

LACK OF STUDIES AND INDICATORS
on assessing the environmental impacts of biomass harvesting,

LACK OF KNOWLEDGE
and regulations on the agronomic use of bioenergy co-products (digestates, biochar, etc.),

COMPARTMENTALISATION OF SECTORS
agri-food and energy, lack of systemic vision,

LACK OF PUBLIC POLICY
in the long term and lack of coherence between agricultural, food and energy policies,

Actions

Research recommendations

Behaviour of media and products:

- **Propose technological solutions** for in-situ biogeochemical analyse (biosensors, miniaturised geochemical and geophysical sensors, smart samplers).
- **Maintain databases** and samples of French soils, including the diversity of the macrofauna and microflora of the soil.
- **Build databases** on material transfer processes and establish behaviour laws to assess the consequences of these transfers (quantify the closing of C, N, P cycles).
- **Analyse the sensitivity** of ecosystems to the export of small wood and the return of ash to the soil (Sensitivity indicators for major mineral elements and overall combination - Field diagnostics).
- **Develop multi-criteria approaches** to the duality of biomass removal addressed on all elements: physical, chemical and biological, develop multiscale predictive models of the evolution of sustainability indicators.
- **Understanding the relation between the structure** of biochars and digestates from methanisation and their properties when returned to the soil.
- **Develop scenarios** for sustainable biomass harvesting at the levels of territories under climate change impact.

Identification of practices

- **In terms of silvicultural** practices, develop biophysical and economic approaches to identify practices for sustainable forest management (conversion of coppice to high forest, reasoning out soil preparation, avoiding clear-cutting with soil degradation, not harvesting the whole tree), and transfer these stocking practices to professionals.
- **Develop strategies for optimising climate** change mitigation in the choice of stand rotation length at the scale of territories, propose new stands with species resistant to biotic and abiotic stresses (rather than considering only one economic criterion).
- **Conducting trials on forest** (and agroforestry) plots to intensify biomass growth and soil carbon storage, carrying out complete balances of the biogeochemical cycle of the plots over a long period of time and then integrating the entire (multiproduct) wood value chain.
- **In terms of agricultural practices:** broaden the species of intermediate crops and refine the practices of insertion in rotations; deepen the trials of spreading digestates and biochars, characterise the carbon that can be stored and feed the soil/microorganism/plant models.
- **Couple pyrolysis** and methanisation for the agronomic quality of the digestate and favour its return to the soil.

Implementing recommendations

- Need to centralise, record and appraise FAIR data from experiments with new practices and environmental behaviour,
- Deploy or maintain the national infrastructure for long-term monitoring of C, N, P cycles.
- Deploy projects that can benefit from a low-carbon label with generation of carbon sinks in agricultural and forestry environments.
- Identify the full range of ecosystem services from new practices.
- Strengthen public agricultural and forestry policies at national and territorial levels that promote sustainable agricultural and forestry practices to increase carbon storage.
- Identify and reforest degraded land.
- Enable the resilience and adaptation of forest stands to the effects of climate change so as to ensure the preservation of their different ecological functions in order to carry out mitigation action.

Examples of recommendations for research ➔ Knowledge

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S1. The carbon storage in biomass and soils and forest soils

- LUCLUF strategy / Agricultural new strategies: carbon into soils
- New strategies for optimising climate change mitigation in the selection of new forest
- Develop multi-criteria approaches and multi-scale predictive models of the evolution of sustainability indicators

S2. The carbon storage in biomass and soils in urban environments

- Inventory of practices and assessment of impact in terms of storage for anthropised areas
  - Are the amount in the same order of magnitude compared to natural areas ?
- Conducting emission balances vs. storage in parks, urban agriculture and shared gardens.
  - Functional soils able of providing a wide range of services (e.g. biodiversity, carbon storage, hydrology, pollution)

S3. Carbon storage in aquatic environments and through the alteration of rocks

- Study of biogeochemical processes as CO_2 sinks and sources and determine their time constants.
- Research assessing the potential for CO_2 sequestration WITH protection, preservation and restoration of environments considered as CO_2 sinks
- Beware of oceans acidification !

Examples of recommendations for research ➔ Technology

S4. Technological solutions for the capture of CO_2 from the atmosphere for geological storage

- Improve CO_2 capture and purification processes and develop integrated Direct Air Capture demonstrators adapted to local conditions. DAC process able of producing a controlled CO_2 flux
- Continue exploration, selection and characterisation of storage sites in France / Europe
  - deep geological reservoirs, former mines/quarries, etc.
  - mainland France, French overseas departments and territories, onshore and offshore

S5. Storage of CO_2 in materials via mineralisation

- Increase mineralization kinetics under the most favourable implementation conditions
  - e.g. with the development of innovative catalytic or biological pathways
- Explore the coupling between CO_2 mineralisation and DAC

S5 bis. Biogenic CO_2 capture and storage in bio-based materials

- Rationalise the growth of the wood materials sector in relation to the availability of French resources and compliance with the rules of sustainable forest management
- Adapting bio-based materials to existing uses (e.g. flax to replace fibreglass)

S6. Technological solutions of carbon capture recycled, reuse and long-term storage

- Evaluate systems through multi-criteria analyses including technical, economic and carbon footprint aspects using "well-to-wheel" approaches
- Develop efficient CO_2 conversion systems from point sources to produce fuels or materials

Perspectives: Multicriteria analyses based on literature

	Critères Captage du C				Critères Stockage du C					Critères faisabilité filière					
	Rendement, [C]	Cout	Besoin en énergie	Consensus scientifique	Evolution du tonnage de C stockable 2050	Cout/ technicité du processus de stockage	Cout logistique ou annexes (transport, tri, …)	Stabilité, durée de stockage	Consensus scientifique	TRL	Positionnement acteurs français	Perspective attractivité du produit/ milieu	Acceptabilité sociétale	Contraintes règlementaires	Externalités autres
SG1 – milieux agri/foret															
Foret															
Prairies															
Agroforesterie															
Cultures intermédiaires															
Rendu au sol															
SG2 – milieux urbains															
Parcs et jardins															
Agriculture urbaine															
Friches industrielles															
Toit, façade															
Periurbain (routes, aéroport)															
SG3 – milieux aquatiques															
Fleuves															
marin côtier															

	Critères Captage du C				Critères Stockage du C					Critères faisabilité filière				
	Rendement, [C]	Cout	Besoin en énergie	Consensus scientifique	Evolution du tonnage de C stockable 2050	Cout/ technicité du processus de stockage	Cout logistique ou annexes (transport, tri, …)	Stabilité, durée de stockage	Consensus scientifique	TRL	Positionnement acteurs français	Perspective attractivité du produit/ milieu	Acceptabilité sociétale	Contraintes règlementaires
SG4 – stockage géologique du Catm														
DACS														
BE-CCS	A ajouter aux critères de Captage du SG1 (ou SG2)													
Combustion														
Gazif														
Ethanol														
méthanisation														
…														
BioChar + Biomines														
SG 5 – carbonatation minérale														
Résidus miniers														
Saumures résiduaires														
SG 5 bis	A ajouter aux critères de Captage du SG1 (ou SG2)													
Batiment (charpente, isolant,…)														
Composites														
Voiries														
Emballage, papier														
Textile														
SG 6														

Key takeaways

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- Carbon I not the enemy ! Totally Defossilise rather than totally decarbonise !
  - First reduce fossil CO_2 emissions
  - Then compensate the residual ones

- Technology solutions are important but not everything: practices, behaviours, sobriety, efficiency

- From a carbon linear economy to a carbon circular economy, including jointly:
  - Relevant biomass uses : bio-economy (food, materials, chemicals), bioenergy,
  - Natural sinks solutions
  - Agricultural and forestry practices
  - Technology solutions (be careful not to encourage the use of fossil fuels)

- Legislation: must be based on scientific knowledge
  - Fossil uses reduction
  - Synergies: carbon skins, biomass uses, and CO_2 re-uses

General recommendations

- Develop observatories of carbon flux in natural environments

- Develop practices for carbon storage in more or less anthropised environments

- Develop knowledge of national geological reservoirs
- Supporting national demonstration projects for negative emission technologies
- Develop geographic information expert system for the deployment of CO_2 mineralization (ex: contact between alkaline waste (e.g. bottom ash, ashes and CO_2)

- Improvement and harmonisation of environmental assessment methods of negative emission solutions and multicriteria analysis

- Governance and support measures harmonised at national and European level

Carbon sinks in Europe : stakeholders taking action to bring out the next solutions for carbon neutrality

EERA European Energy Research Alliance | ANCRE Alliance Nationale de Coordination de la Recherche pour l'Énergie

9:15 Introduction	
1. Welcome by **Pierre Franck Chevet**, *CEO IFPEN, President of ANCRE*, "ANCRE presentation" (10')	Pdf file
2. Alexandre Paquot, *DG CLIMA Director Innovation For A Low Carbon, Resilient Economy*, DG CLIMA's vision: situation, solutions, institutional decisions *(25')*	
3. Daphné Lorne, *IFPEN & ANCRE task leader*, ANCRE position paper: "What roles for research to enhance carbon sinks development in France?" (15')	Pdf file
10:15 – 11:15 Round Table 1: How to preserve carbon sinks in natural areas?	
Preservation/knowledge of carbon sinks in **totally or predominantly natural areas** (natural habitats, protected areas, aquatic ecosystems, etc.). This round table devoted to the "preservation/knowledge of carbon sinks in totally or predominantly natural areas" will take stock of the understanding of bio-geochemical mechanisms, of the knowledge of natural flows and will anticipate their evolution. It will also look at what additional political measures are needed given the current state of play.	
Moderator : **Monique Axelos**, INRAE & ANCRE	
1. Nicolas Viovy, CEA & LSCE - *Climate and Environment Sciences Laboratory & ANCRE*, "How to preserve carbon in a changing climate" (12')	Pdf file
2. Guillaume Soulet, *IFREMER & ANCRE*, « Costal blue carbon ecosystems and rock weathering » (12')	Pdf file
3. Liselotte Jensen, *Policy analyst in the European Parliamentary Research Service's unit on Climate Action and Research Tracking* (EPRS CART), « EU certification framework for carbon removals » (12')	Pdf file

OFFICIAL EVENT PROGRAMME 2023 | MAISON IRÈNE ET FRÉDÉRIC JOLIOT-CURIE

11:30 – 12:45 Round Table 2: How to harness the potential of biomass-based solutions for carbon removal?	
Actions to deploy carbon stocking practices through biomass management (in agriculture, forestry, urban areas, industrial wastelands, other anthropised areas, etc.). This round table devoted to "actions to deploy new sinks via biomass" will attempt to take stock of the available stocks and to identify actions with high potential for storing carbon and CO2, such as carbon farming. It will also look at what political measures are needed at European level to encourage and support these actions.	
Moderator: **Jack Legrand, CNRS, Nantes Université & ANCRE**	
1. Nicola Di Virgilio, *DG AGRI - Policy officer at EU Commission DG Agriculture and Rural Development, Unit B2 Environmental sustainability,* « Common Agricultural Policy 2023-2027 and its role in supporting EU carbon sinks» (12')	Pdf file
2. Philippe Delacote, *INRAE, environmental economist, the Climate Economics Chair*, « Forest-based climate change mitigation and adaptation in Europe » (12')	Pdf file
3. Pierre Faure, *CNRS & GISFI, Interdisciplinary Laboratory of Continental Environments & ANCRE*, « Carbon sinks from re-naturalisation of anthropized and urban environments » (12')	Pdf file
4. David Chiaramonti, *Politecnico Torino, RE-CORD - Professor of Energy Economics, and Bioeconomy*, « Biochar as biomass-based solutions for carbon removal » (12')	Pdf file
14:00 – 15:15 Round Table 3: How to enhance carbon capture actions, industrial processes, geological storage and long-term storage solutions	
The most practical solutions of atmospheric and biogenic carbon capture and storage (industrial pathways, geological reservoirs, long-life materials, etc.). This round table is devoted to "carbon capture actions, the industrial sectors, geological storage and long-term storage deployment of new sinks via biomass". It will deal with national and EU potential, technical issues, scenarios, roadmap and political measures.	
Moderator: **Adel El Gammal, GS EERA**	Pdf file
1. Jeroen Schuppers ; *DG RTD, Deputy Head for Advanced Energy Production,* "Role of European Research to achieve Net Zero Emissions" (12')	Pdf file
2. Florent Guillou, *IFPEN, Carbon Capture Project Manager*, Potential and challenge of (non-fossil) carbon capture technologies, (12')	Pdf file
3. Christiane Hennig, *IEA Bioenergy, Task 40 leader*, IEA Bioenergy work program on bioenergy and negative emissions (12')	Pdf file
4. Aïcha El Khamlichi, ADEME, prospective on energy and bio-based solutions, "Carbon sinks in Net zero emission scenarios in the French Report "Transition(s) 2050" (20')	Pdf file

« Carbon sinks and negative emissions What roles for research to enhance their development in France?»

Thank you for your attention

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Backup Slides

BioNET at a glance

BioNET – Multi-level Assessment of Bio-based Negative Emission Technologies

- **Project duration:** January 2022 – December 2024
- **Funded by:** German Federal Ministry of Education and Research (BMBF)
- **BioNET:** 1 of 10 projects of the federal research program "CDRterra“

SPONSORED BY THE

Federal Ministry of Education and Research

BioNET Project partners in Germany:

Helmholtz Centre for Environmental Research	German Biomass Research Centre	The Thünen Institute	University of Giessen	University of Greifswald	Zittau/Görlitz University of Applied Science	Technical University of Munich

BioNET Project lead: Prof. Dr. Daniela Thrän (UFZ/DBFZ)

ANCRE presentation

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MEMBERS AND PARTNERS

- **4** founding members
- **15** associated members

Background: the climate targets (EU)

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- **The Paris Agreement (2015), Art 4.1:**

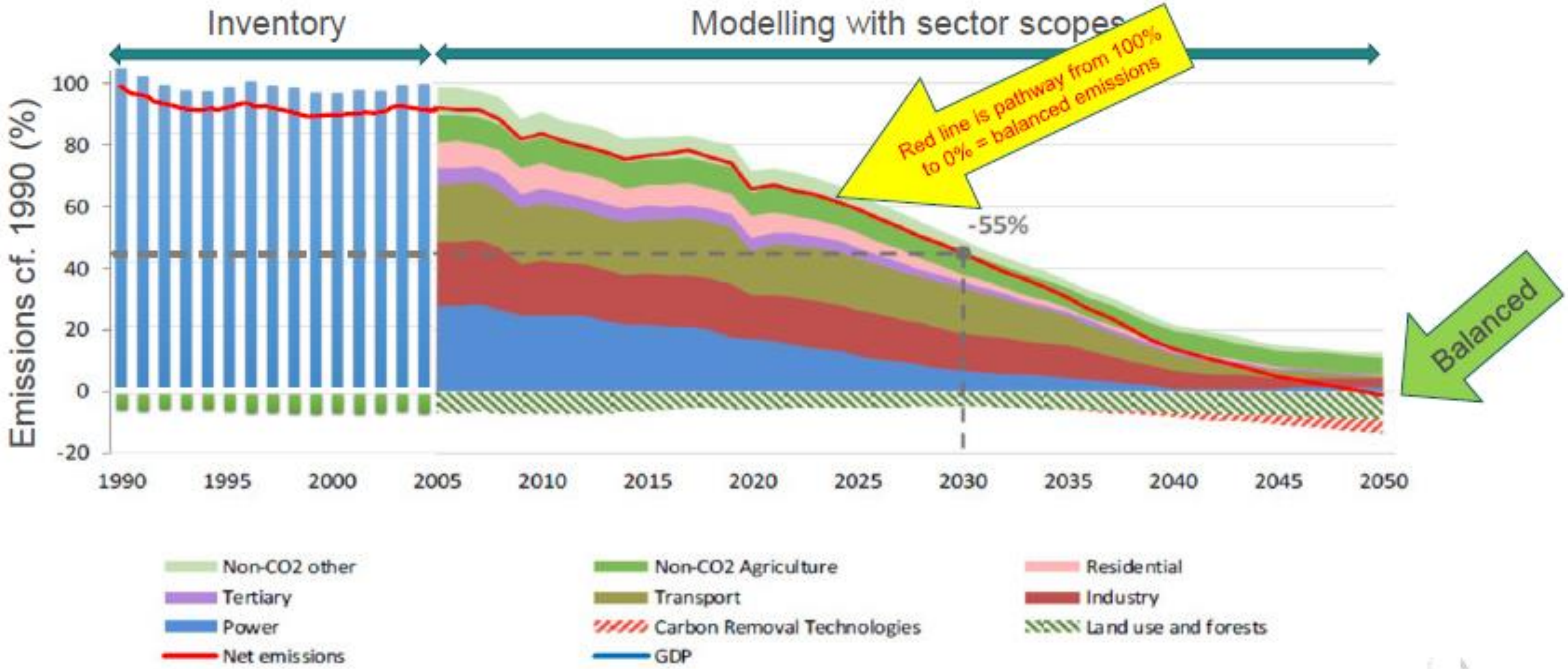
Article 4

1. In order to achieve the long-term temperature goal set out in Article 2, Parties aim to reach global peaking of greenhouse gas emissions as soon as possible, recognizing that peaking will take longer for developing country Parties, and to undertake rapid reductions thereafter in accordance with best available science, so as to achieve a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century, on the basis of equity, and in the context of sustainable development and efforts to eradicate poverty.

- **Towards a climate neutral European Union by 2050**
  - **« Climate Law » 4 March 2020 proposal**: to legally endorse the EU target by setting a trajectory for achieving climate neutrality by 2050
  - **« Climate Target Plan » 17 September 2020 proposal:** EU economy-wide net GHG emission reduction target of at least 55% by 2030, compared to 1990(Fit for 55)
  - Two texts that include net GHG emissions and removals from land (land use, land use change, agriculture, forestry, housing, etc.)
- 2030 Climate Target Plan : https://europa.eu/!bm49qq

Background: the climate targets (EU)

- **EU climate target trajectories**



Source: European Commission, 2020 - The 2030 Climate Target Plan

Current and predictable CO2 emissions - SNBC

Emissions CO2eq	1990		2019			2030			2050		
	MtCO2eq	% total (without L.)	MtCO2eq	Var. % Vs./90	% total (without L.)	MtCO2eq	Var. % Vs./90	% total (without L.)	MtCO2eq	Var. % Vs./90	% total (without L.)
Transport	124	23%	136	10%	31%	99	-20%	32%	4	-97%	5%
Wastes	15	3%	14	-7%	3%	11	-27%	4%	6	-60%	7%
Residential / Tertiary	93	17%	81	-13%	18%	45	-52%	14%	5	-95%	6%
Industry	145	26%	78	-46%	18%	53	-63%	17%	16	-89%	20%
Energy	78	14%	46	-41%	10%	31	-60%	10%	2	-97%	2%
Agriculture / Forest	93	17%	85	-9%	19%	73	-22%	23%	48	-48%	59%
LUCLUF	-22	-4%	-26	18%	-6%	NC	NC	NC	NC	NC	NC
Total (without LUCLUF)	**548**	**100%**	**440**	**-20%**	**100%**	**312**	**-43%**	**100%**	**81**	**100%**	**100%**
Total	526		414	-21%		312	-41%		81		

Source : SNBC, 2020

- **2020 emissions**
  - **140 Mt capturable / 300 Mt non capturable**
- **2050 emissions (following the National Low Carbon Strategy)**
  - **25 Mt capturable / 55 Mt non capturable**
  - Goal : 80-85 MTCO2 negatives emissions
- Industry, energy, residential and transport: massive cuts planned
  - CCS solution only or additional CCU ?
  - If CCU Risk of competition between CO2 sources in the long term?
  - What about the transitional period?

CO2 emissions by sector (2017) – Focus industry

- **Steel sector (17 $MtCO_2$), cement & other non-metals (11,8), refineries (5,6) are the most important CO_2 capturable emissions[1]**
- **84 % of theses emissions are included in the EU Emissions Trading System[2]**
- **Emissions by overall sectors[2] (2017) :**
  - **Fossil combustion for industrial energy: 64%**
  - **Industrials processes: 36%**

Amount of CO2 capturable by sector

Secteurs	Nombre de sites	Volume 2017 ($MtCO_2$)	Volume « captable » ($MtCO_2$)
Acier	11	23	17
Chimie (sans production ammoniac)	23	10,7	5,8
Production ammoniac	4	1,9	1,9
Ciment et autres non-métalliques	33	11	11,8
Raffineries	9	10,3	5,6
Autres (papier, verre)	12	2,4	2,6
IAA	14	2,5	2,6
Aluminium	4	1,2	0,9
Production chaleur (industrielles)	10	2,2	2,3
Total	**120**	**~ 65**	**~ 51**

Sources : [1]ADEME, 2020, [2]SNBC, 2020