Biofuel and Biochar Production Regulations

David Chiaramonti

Politecnico di Torino

RE·CORD

REC PARK- *THERMOCHEMICAL UNITS*

RE·CORD

- ✓**Rotary kiln** Slow Pyrolysis 100 kg/h
- ✓**Downdraft oxidative pyrolysis** 50 kg/h
- ✓**Oxidative reactor** for innovative Slow/intermediate pyrolysis 2-3 kg/h
- ✓**Interm. (catal.) pyrolysis unit** (paddle, batch)
- ✓**HydroThermal Liquefaction** unit
- ✓**Hydrothermal microreactor system**
- ✓**Downdraft Imbert-type gasifier** 10 kWe
- ✓Nr 2 **Bio-Adapted Microturbines**
- ✓**Fractional condensation unit**
- ✓**Chemical leaching unit**
- ✓Lab-scale furnace for **char activation**

<u>Under design & construction</u>:

1) 20 kg/h **oxidative innovative pyrolyser**, 2) PO cont.**hydrotreater**,

3) **CH4 pyrolyser** - *just published*: *<u>https://authors.elsevier.com/a/1hnvc4s9Hw9snS</u>* :

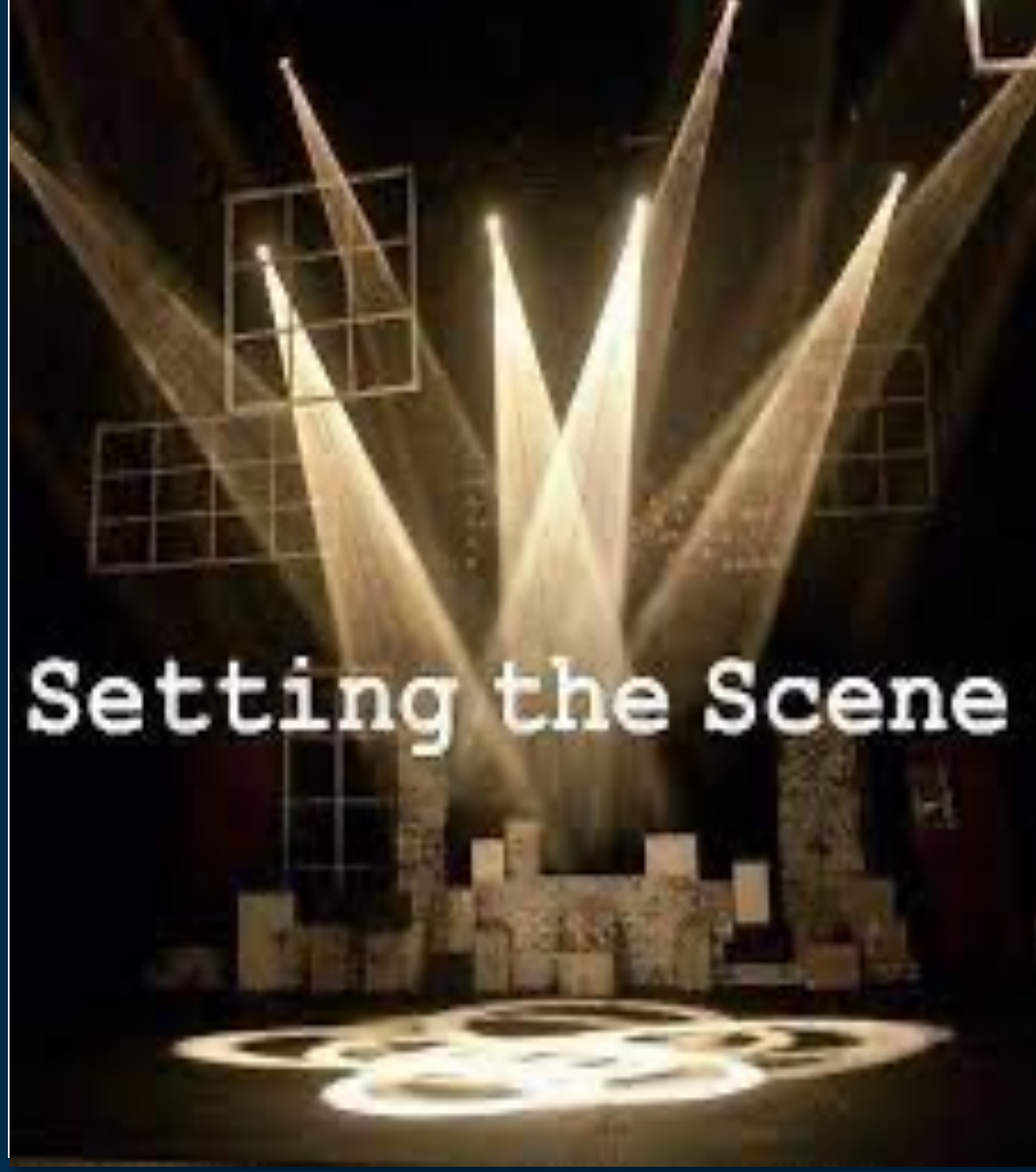
Review of methane cracking over carbon-based catalyst for energy and fuels

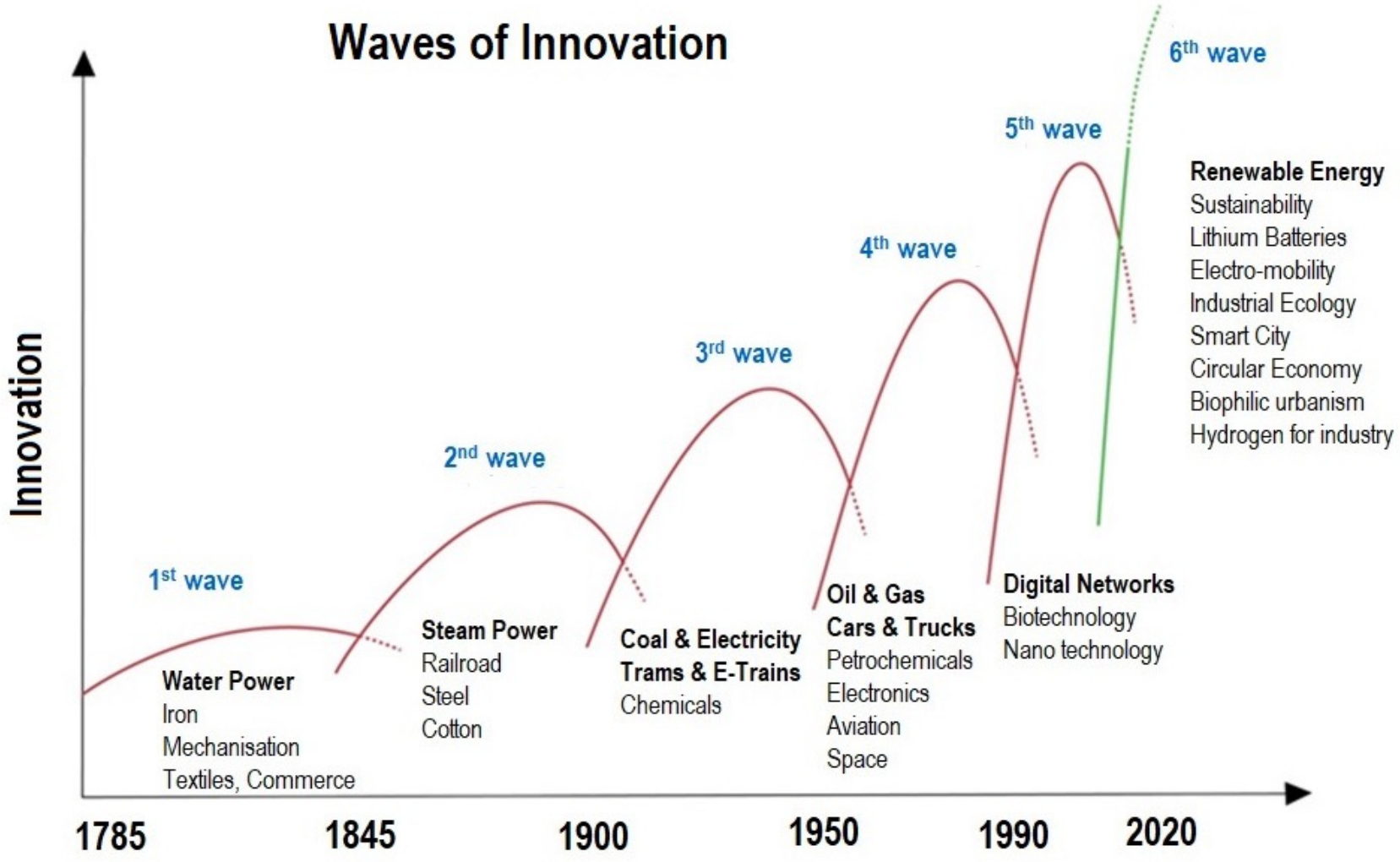
S.M.R. Mirkarimi [a], S. Bensaid [a], V. Negro [b], D. Chiaramonti [b,*]

[a] Politecnico di Torino, DISAT, Torino, Italy
[b] Politecnico di Torino, DENERG, Torino, Italy

Setting the scene

- Waves of Innovation: Technology evolution vs industrial and policy implementation
- Soil and degradation
- Biochar: a long-lived C form
- Decarbonisation of processes: in-sector vs inter-sector





Adapted from:
Newman,P.COVID,CITIES and CLIMATE: Historical Precedents and Potential Transitions for the New Economy. UrbanSci. 2020, 4, 32, doi:10.3390/urbansci4030032.

- **Industrial scale-up & Policy making need to adapt their action to such fast changes**
- **What is achievable in the given timeframe? Is this compatible with the urgency need?**
- **Which socio-economic impacts? How to build consensus (No One Left Behind..)**

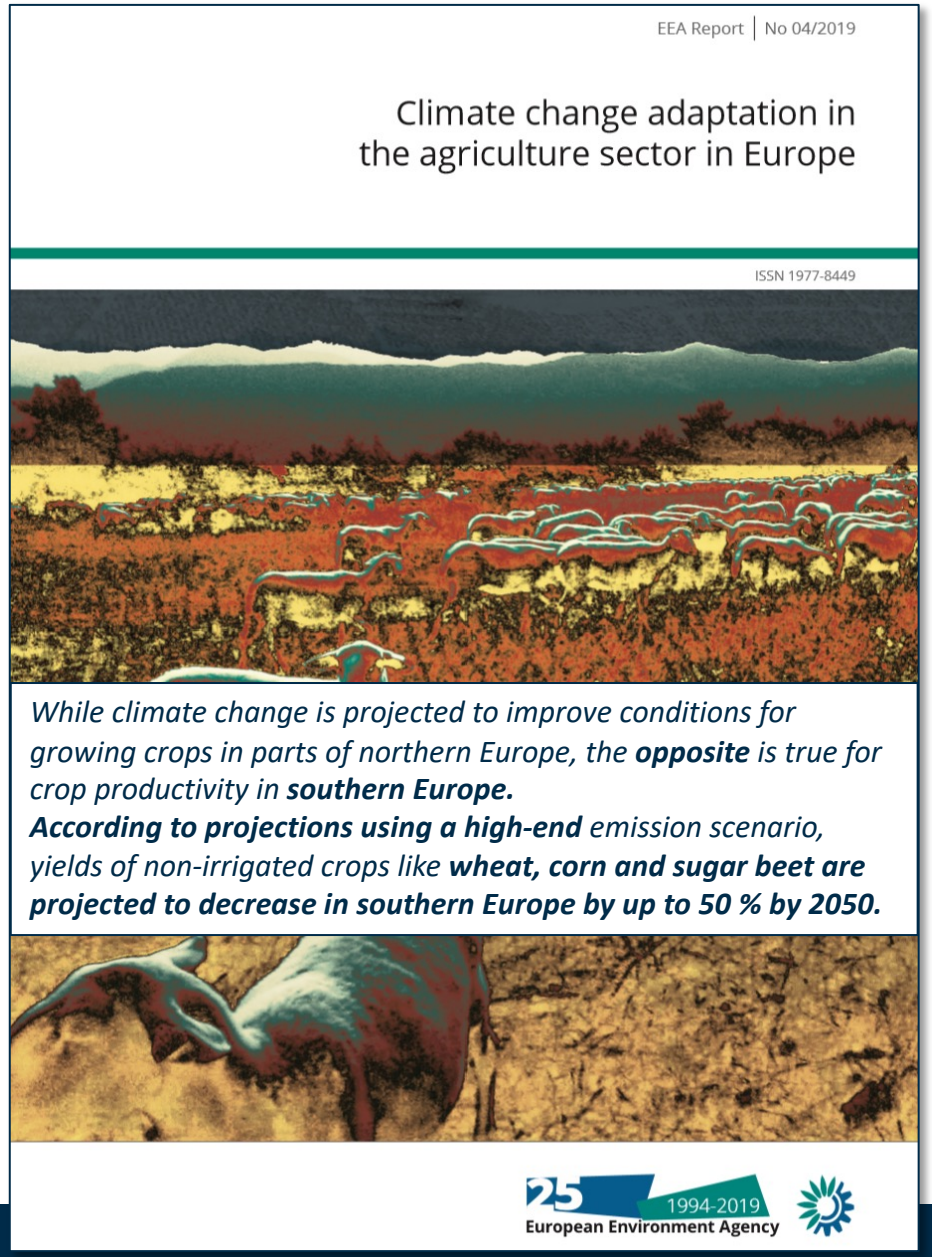
Soil: the urgent need to take action

EU Soils need more Organic Carbon and Matter (SOC/SOM) + Nutrients

< 1.5 %SOC (<3 %SOM) applies to a very large part of the EU agricultural area

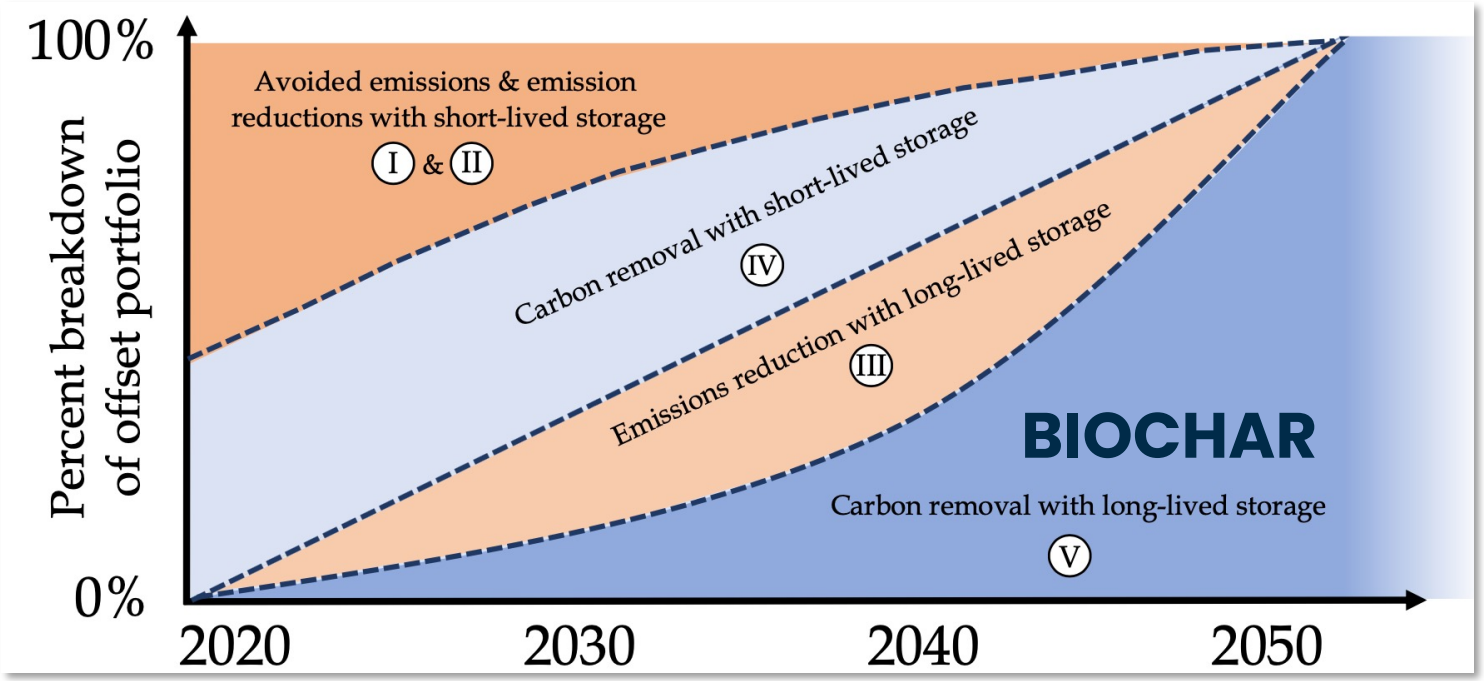
Land degradation quickly progressing, as documented by EC JRC, EC EEA, etc

V. [..] ***no EU-level strategy on desertification and land degradation****. Rather, there is a range of strategies, action plans and spending programmes, such as the Common Agricultural Policy, the EU Forest Strategy, or the EU strategy on adaptation to climate change, which are relevant to combating desertification, but which do not focus on it.*
[…] we make recommendations to the Commission aimed at better understanding land degradation and desertification in the EU; assessing the need to enhance the EU legal framework for soil; and stepping up efforts towards delivering the ***commitment*** *made by the EU and the Member States to achieve* ***land degradation neutrality in the EU by 2030.***

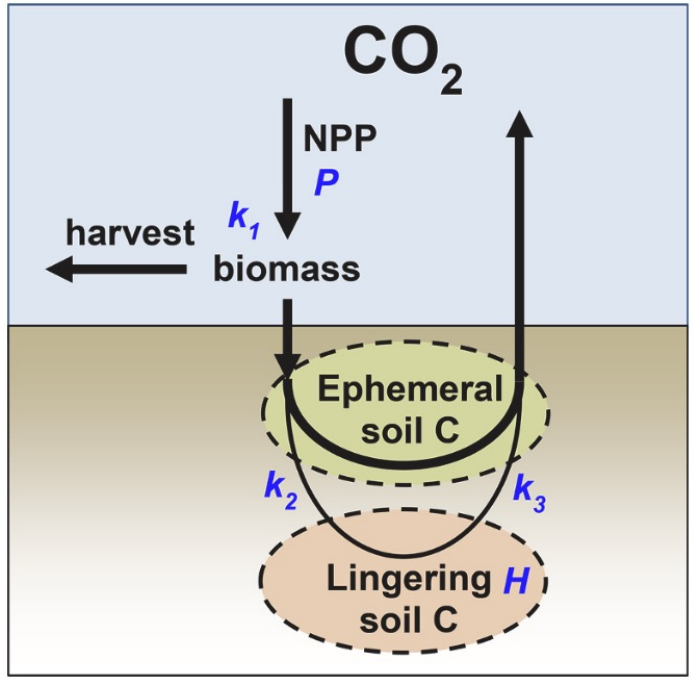


While climate change is projected to improve conditions for growing crops in parts of northern Europe, the ***opposite*** *is true for crop productivity in* ***southern Europe.***
According to projections using a high-end *emission scenario, yields of non-irrigated crops like* ***wheat, corn and sugar beet are projected to decrease in southern Europe by up to 50 % by 2050.***

Biochar
A long-lived storage



Adapted from: The Oxford Principles for Net Zero Aligned Carbon Offsetting, September 2020, University of Oxford



Geoderma 416 (2022) 115810

Table 2 Kinetic parameters of the double first-order exponential decay model describing biochar decomposition in soils. Values represent means ± standard errors

	Size	Decomposition rate	Mean residence time
Labile C pool	3 ± 0.6%	0.0093% day^{-1}	108 ± 196 days
Recalcitrant C pool	97 ± 0.6%	0.0018% $year^{-1}$	556 ± 483 years

GCB Bioenergy (2016) **8**, 512–523, doi: 10.1111/gcbb.12266

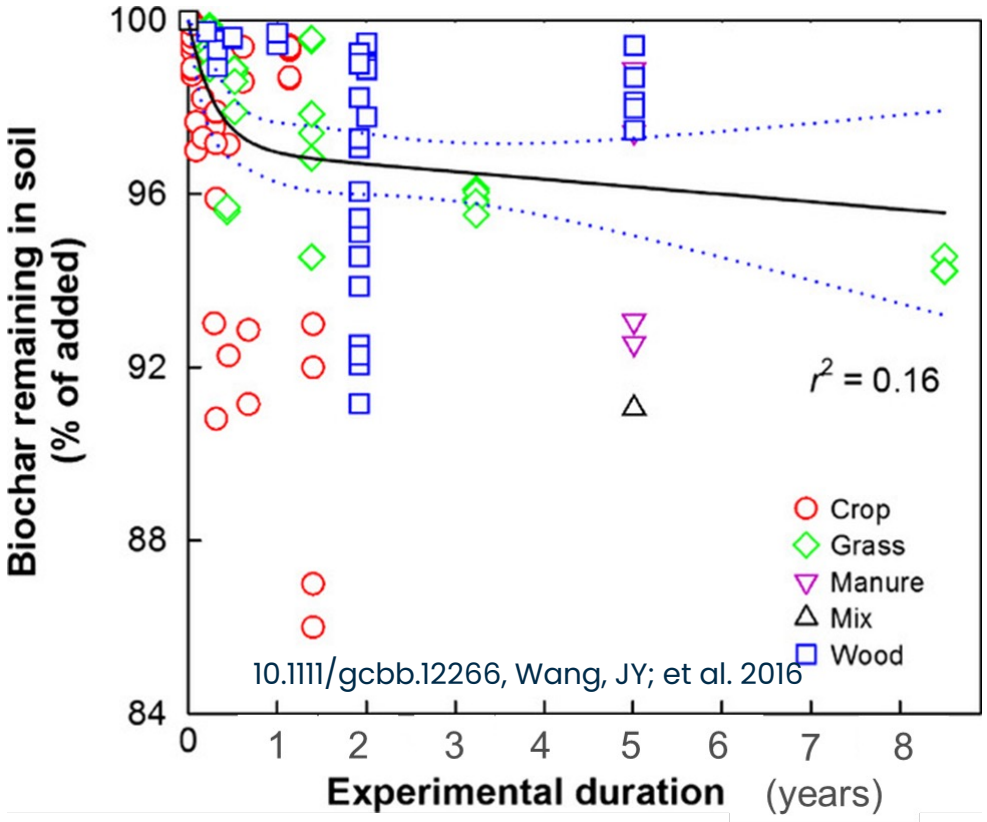
[..] We conclude that biochar can persist in soils on a centennial scale and that it has a positive effect on SOM dynamics and thus on C sequestration.

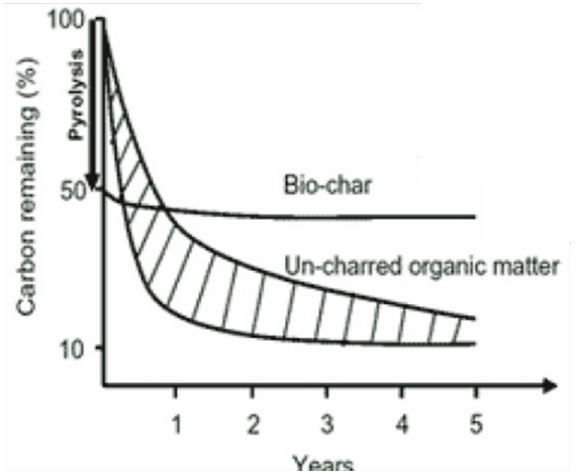
Biochar - Carbon decay rate

Model of decay rates:

- labile fractions (3% of biochar) = 3% /y (108 days)
- **recalcitrant fractions (97% of biochar) = 0.0018% /y(556 y)**

Models based on 10 years experiments.





IMAP project (Evidence Map)

- >7000 abstracts screened
- >1900 full texts screned
- Around **600** meta-analyses selected and analysed

https://wikis.ec.europa.eu/display/IMAP/Impacts+of+farming+practices+on+environment+and+climate

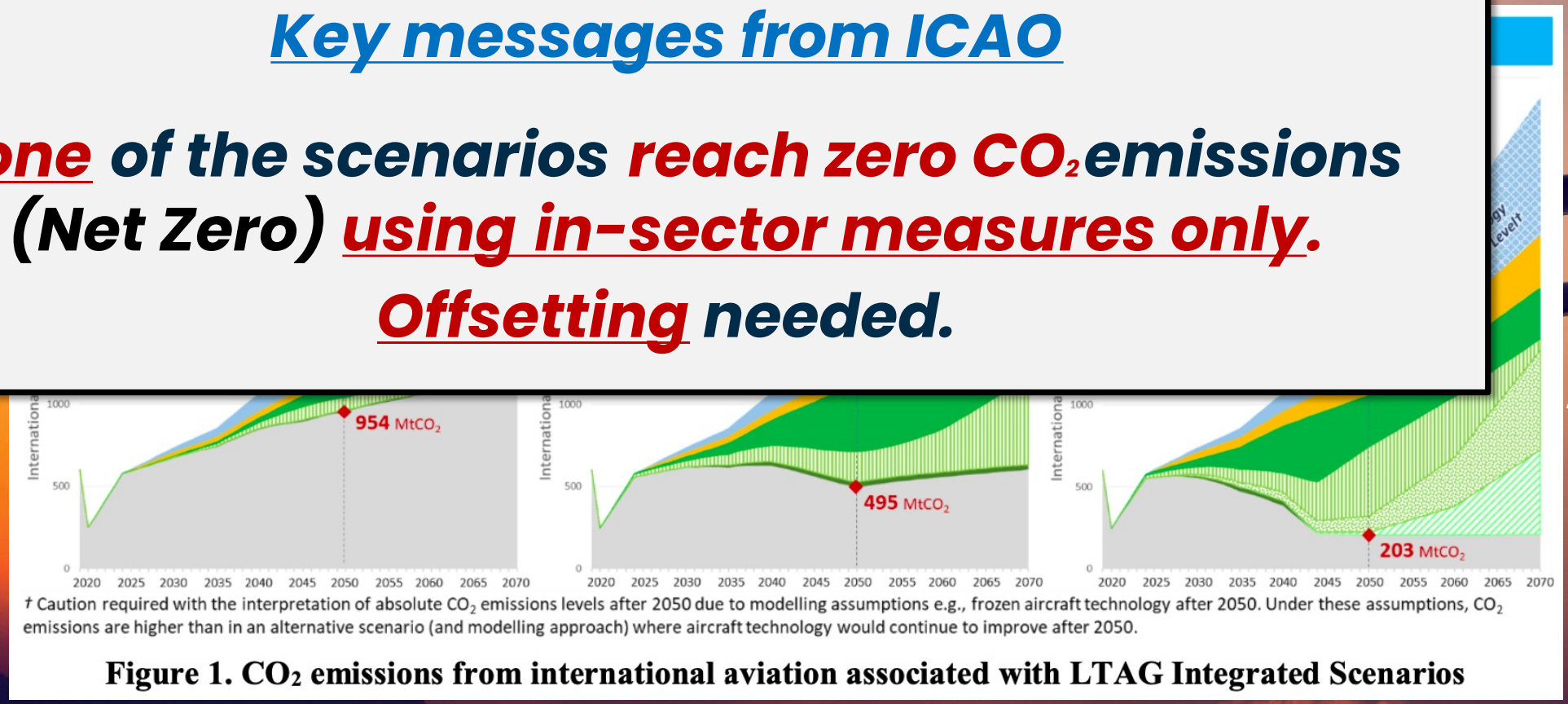
- **ICAO, 2017 → 142** Mt CAF at 2010 → 570-**860** Mt at 2050 (Intern. Aviation) + 400-600 % !!
- **100% CAF substitution (MAX scenario)** – **170 new biorefineries each year** from **2020 to 2050** (15-60 $B/y) –
- **MAX** would **reduce CO_2 emission by 63%**

LTAG Scenarios *(ICAO, March 2022)*

Key messages from ICAO

***None** of the scenarios **reach zero CO_2 emissions** (Net Zero) **using in-sector measures only**.*

***Offsetting** needed.*



† Caution required with the interpretation of absolute CO_2 emissions levels after 2050 due to modelling assumptions e.g., frozen aircraft technology after 2050. Under these assumptions, CO_2 emissions are higher than in an alternative scenario (and modelling approach) where aircraft technology would continue to improve after 2050.

Figure 1. CO_2 emissions from international aviation associated with LTAG Integrated Scenarios

Aircraft Technology

Operations

Biomass SAF
Gaseous Waste SAF

Atmospheric CO2 SAF

Hydrogen

- ***Aircraft Techn:*** *Advanced tube and wing, unconventional airframe/propulsion concept aircraft, non-drop-in fuels such as battery electric etc*
- ***Operations**: improvements in the performance of flights across all phases*

Policy in the EU

“Fit for 55” package

Source: M.Georgiadou, 2023

Revision of Renewable Energy Directive II	•Collective binding target of renewables in EU’s energy mix to **40%** by 2030 •**Advanced biofuels** and **biogas** produced from Annex IX Part A feedstock in energy supplied to transport at least 0,2 % in 2022, 0,5 % in 2025 and **2,2 %** in 2030, renewable fuels of non-biological origin at least **2,6 %** in 2030 •GHG intensity reduction at least **13 %** in 2030 by all renewable fuels and renewable electricity supplied to transport
Revision of the Effort Sharing Regulation	•EU-wide reduction of **40% by 2030** in the transport, buildings, agriculture and waste sectors compared to 2005
Revision of the Emissions Trading System Directive	•By 2030 reduce sectors’ GHG emissions by **61%**, compared to 2005 levels •Carbon pricing for maritime, aviation, buildings and road transport from 2026
Revision of the Land Use Land Change and Forestry regulation	•Increase EU’s natural carbon sinks with new EU target of net GHG removals in the LULUCF sector of **310 Mt CO2eq** from 2026 to 2030
ReFuelEU Aviation legislative proposal	•In **2030** SAF at least **5%** of which synthetic aviation fuels share at least **0.7%,** rest being advanced biofuels(**4,3%**) •In **2050** SAF at least **63%** of which synthetic aviation fuels at least **28%,** rest being advanced biofuels (**35%**)
FuelEU Maritime legislative proposal	•Biofuels, biogas, renewable fuels of non-biological origin and recycled carbon fuels are taken into account to reduce the GHG content of the energy in ships by **-6% in 2030 and -75% in 2050** from the 2020 average
Revision of the Energy Taxation Directive	•Exemptions for renewable electricity, renewable fuels, advanced biofuels/ bio liquids/ biogas/ biomass fuels

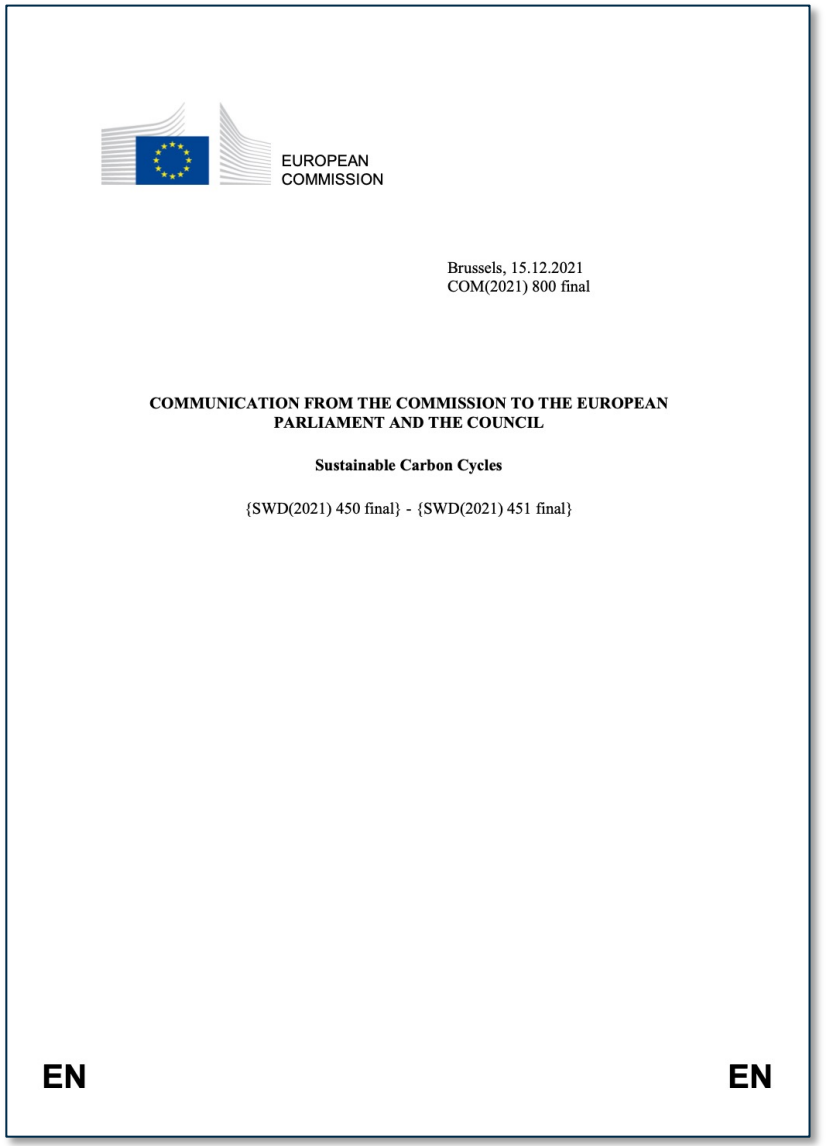
+ CO2 Regulation + Green Deal Industrial Plan

EC COM 2021 on Carbon Cycles

EUROPEAN COMMISSION

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL Sustainable Carbon Cycles.

EC 15.12.2021, COM(2021) 800 final



EUROPEAN COMMISSION

Brussels, 15.12.2021
COM(2021) 800 final

COMMUNICATION FROM THE COMMISSION TO THE EUROPEAN PARLIAMENT AND THE COUNCIL

Sustainable Carbon Cycles

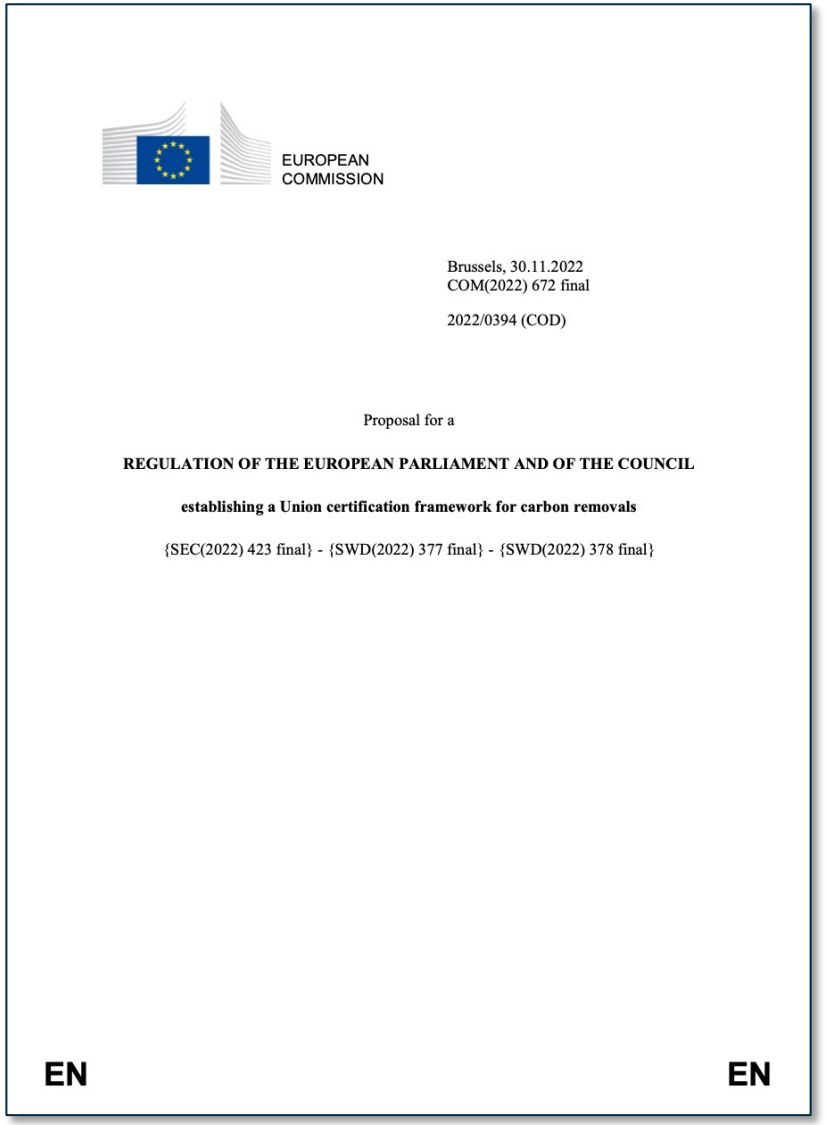
{SWD(2021) 450 final} - {SWD(2021) 451 final}

EN **EN**

EC COM 2022 on Carbon

Proposal for a REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL establishing a Union certification framework for carbon removals.

EC 30.11.2022, COM(2022) 672 final



EUROPEAN COMMISSION

Brussels, 30.11.2022
COM(2022) 672 final

2022/0394 (COD)

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

establishing a Union certification framework for carbon removals

{SEC(2022) 423 final} - {SWD(2022) 377 final} - {SWD(2022) 378 final}

EN **EN**

EC 2021 & 2022 COMs

EUROPEAN COMMISSION

KEY REMARKS & RECOMMENDATIONS FOR IMPROVEMENT

- ✓ Better address the possibility to **sequester and use C instead of CO_2**
- ✓ **Biochar**, the most cost-competitive nature-based solution to permanently remove C from the atmosphere, **only marginally addressed.**
- ✓ **COM focuses on long lived C removal**. **Only biochar (+DACCS)** meet this requirement, among nature-based options. COM should also remark the high value of delivering most-needed **biogenic C instead of CO_2**
- ✓ More focus on **developing a C farming market.** Goal: **regulated markets with positive cash-flows.**
- ✓ **Creating a new Carbon market will require many years**. Also, EC PAC per ha and not per t of CO_2 sequestered. Why not **expanding EU ETS**, which already exists?
- ✓ **Biogenic Carbon** mentioned for **buildings**, while it should preferably be brought back to **soil**

Official Journal L 328

of the European Union

English edition — Legislation — Volume 61 — 21 December 2018

REDII (2018)

Contents

(1) Text with EEA relevance.

EN

Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

The titles of all other acts are printed in bold type and preceded by an asterisk.

Official Journal L 168

of the European Union

English edition — Legislation — Volume [illegible] — 27 June [illegible]

Implementing Regulation (2022)

Contents

(1) Text with EEA relevance.

EN

Acts whose titles are printed in light type are those relating to day-to-day management of agricultural matters, and are generally valid for a limited period.

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II

(Non-legislative acts)

REGULATIONS

COMMISSION IMPLEMENTING REGULATION (EU) 2022/996 of 14 June 2022

on rules to verify sustainability and greenhouse gas emissions saving criteria and low indirect land- use change-risk criteria

THE EUROPEAN COMMISSION,

Having regard to the Treaty on the Functioning of the European Union,

Having regard to Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (1), and in particular Article 30(8) thereof,

Whereas:

(1) Directive (EU) 2018/2001 expands the role of voluntary schemes to include the certification of the compliance of biomass fuels with sustainability and greenhouse gas (GHG) emissions saving criteria and the compliance of renewable liquid and gaseous transport fuels of non-biological origin and recycled carbon fuels with the respective GHG emissions saving criteria. Furthermore, the voluntary schemes can be used to certify biofuels, bioliquids and biomass fuels with low indirect land-use change-risk.

(2) In order to establish whether biofuels, bioliquids, biomass fuels, renewable gaseous and liquid transport fuels of non-biological origin and recycled carbon fuels comply with the requirements of Directive (EU) 2018/2001, the correct and harmonised functioning of voluntary schemes is essential. Harmonised rules should therefore be established, to apply across the certification system, bringing about the necessary legal certainty on the rules applicable to economic operators and voluntary schemes.

(3) With a view to minimising the administrative burden, the implementing rules should be proportionate and limited to what is required to ensure that compliance with the sustainability and GHG emissions saving criteria and other requirements is verified in an adequate and harmonised manner that minimises the risk of fraud to the greatest extent possible. The implementing rules should therefore not be considered as a comprehensive standard but rather as minimum requirements. The voluntary schemes may accordingly complement these rules as appropriate.

(4) Economic operators may decide at any time to participate in a different voluntary scheme. However, in order to prevent an economic operator that has failed an audit under one scheme from immediately applying for certification under another scheme, all schemes receiving an application from an economic operator should require that operator to supply information about whether it failed an audit in the previous 5 years. This should also apply to situations where the economic operator has a new legal personality but remains the same in substance, so that minor or purely formal changes, for instance, in the governance structure or the scope of activities, do not exempt the new economic operator from such a rule.

(1) OJ L 328, 21.12.2018, p. 82.

Carbon and Sust.Fuels: REDII

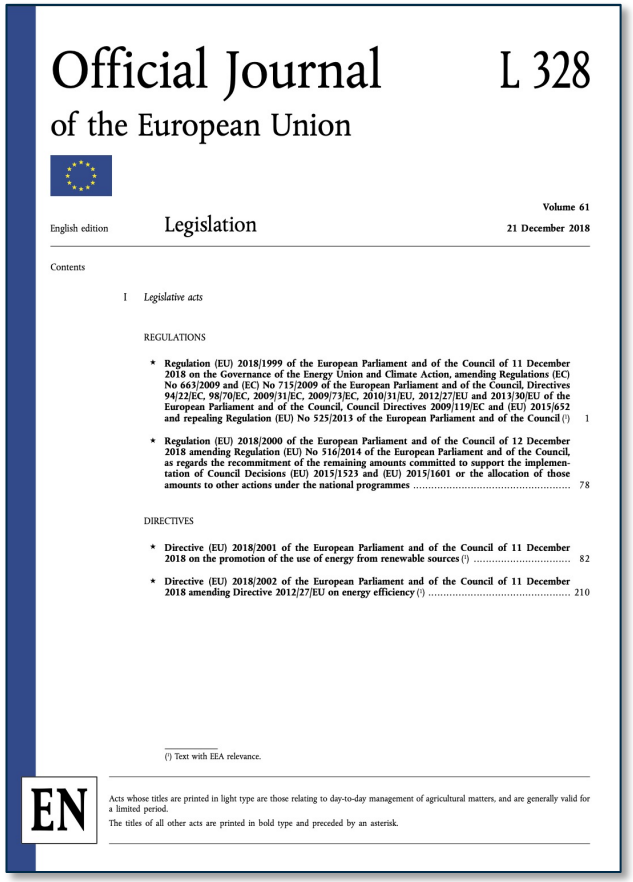
(a) greenhouse gas emissions from the production and use of biofuels shall be calculated as:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr},$$

where

E	=	total emissions from the use of the fuel;
e_{ec}	=	emissions from the extraction or cultivation of raw materials;
e_l	=	annualised emissions from carbon stock changes caused by land-use change;
e_p	=	emissions from processing;
e_{td}	=	emissions from transport and distribution;
e_u	=	emissions from the fuel in use;
e_{sca}	=	emission savings from soil carbon accumulation via improved agricultural management;
e_{ccs}	=	emission savings from CO_2 capture and geological storage; and
e_{ccr}	=	emission savings from CO_2 capture and replacement.

Solid evidence C increase to be provided



Official Journal of the European Union

L 328

English edition — Legislation — Volume 61, 21 December 2018

Contents

I *Legislative acts*

REGULATIONS

* Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (1) 1

* Regulation (EU) 2018/2000 of the European Parliament and of the Council of 12 December 2018 amending Regulation (EU) No 516/2014 of the European Parliament and of the Council, as regards the recommitment of the remaining amounts committed to support the implementation of Council Decisions (EU) 2015/1523 and (EU) 2015/1601 or the allocation of those amounts to other actions under the national programmes 78

DIRECTIVES

* Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources (1) 82

* Directive (EU) 2018/2002 of the European Parliament and of the Council of 11 December 2018 amending Directive 2012/27/EU on energy efficiency (1) 210

(1) Text with EEA relevance.

EN

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6. For the purposes of the calculation referred to in point 1(a), greenhouse gas emissions savings from improved agriculture management, e_{sca}, such as shifting to reduced or zero-tillage, improved crop/rotation, the use of cover crops, including crop residue management, and the use of organic soil improver (e.g. compost, manure fermentation digestate), shall be taken into account only if solid and verifiable evidence is provided that the soil carbon has increased or that it is reasonable to expect to have increased over the period in which the raw materials concerned were cultivated while taking into account the emissions where such practices lead to increased fertiliser and herbicide use (1).

Carbon and Sust.Fuels: REDII–Implementing Regulation

(a) greenhouse gas emissions from the production and use of biofuels shall be calculated as:

$$E = e_{ec} + e_l + e_p + e_{td} + e_u - e_{sca} - e_{ccs} - e_{ccr},$$

where

$$e_{sca} = (CS_A - CS_R) \times 3{,}664 \times 10^6 \times \frac{1}{n} \times \frac{1}{P} - e_f$$

Where:

CS_R	is the mass of soil carbon stock per unit area associated with the reference crop management practice in Mg of C per ha.
CS_A	is the mass of soil estimated carbon stock per unit area associated with the actual crop management practices after at least 10 years of application in Mg of C per ha.
3,664	is the quotient obtained by dividing the molecular weight of CO_2 (44,010 g/mol) by the molecular weight of carbon (12,011 g/mol) in g CO_{2eq}/g C.
n	is the period (in years) of the cultivation of the crop considered.
P	is the productivity of the crop (measured as MJ biofuel or bioliquid energy per ha per year).
ef	emissions from the increased fertilisers or herbicide use

Improved agriculture management practices, accepted for the purpose of achieving emission savings from soil carbon accumulation, include shifting to reduced or zero-tillage, improved crop/rotation, the use of cover crops, including crop residue management, and the use of organic soil improver (e.g. compost, manure fermentation, digestate, biochar, etc.).

The calculation of the actual values of CS_R and CS_A shall be based on measurements of soil carbon stocks. The measurement of CS_R shall be carried out at farm level before the management practice changes in order to establish a baseline, and then the CS_A shall be measured at regular intervals no later than 5 years apart.

ANNEX V

METHODOLOGY FOR DETERMINING THE EMISSION SAVINGS FROM SOIL CARBON ACCUMULATION VIA IMPROVED AGRICULTURAL MANAGEMENT

II

(Non-legislative acts)

REGULATIONS

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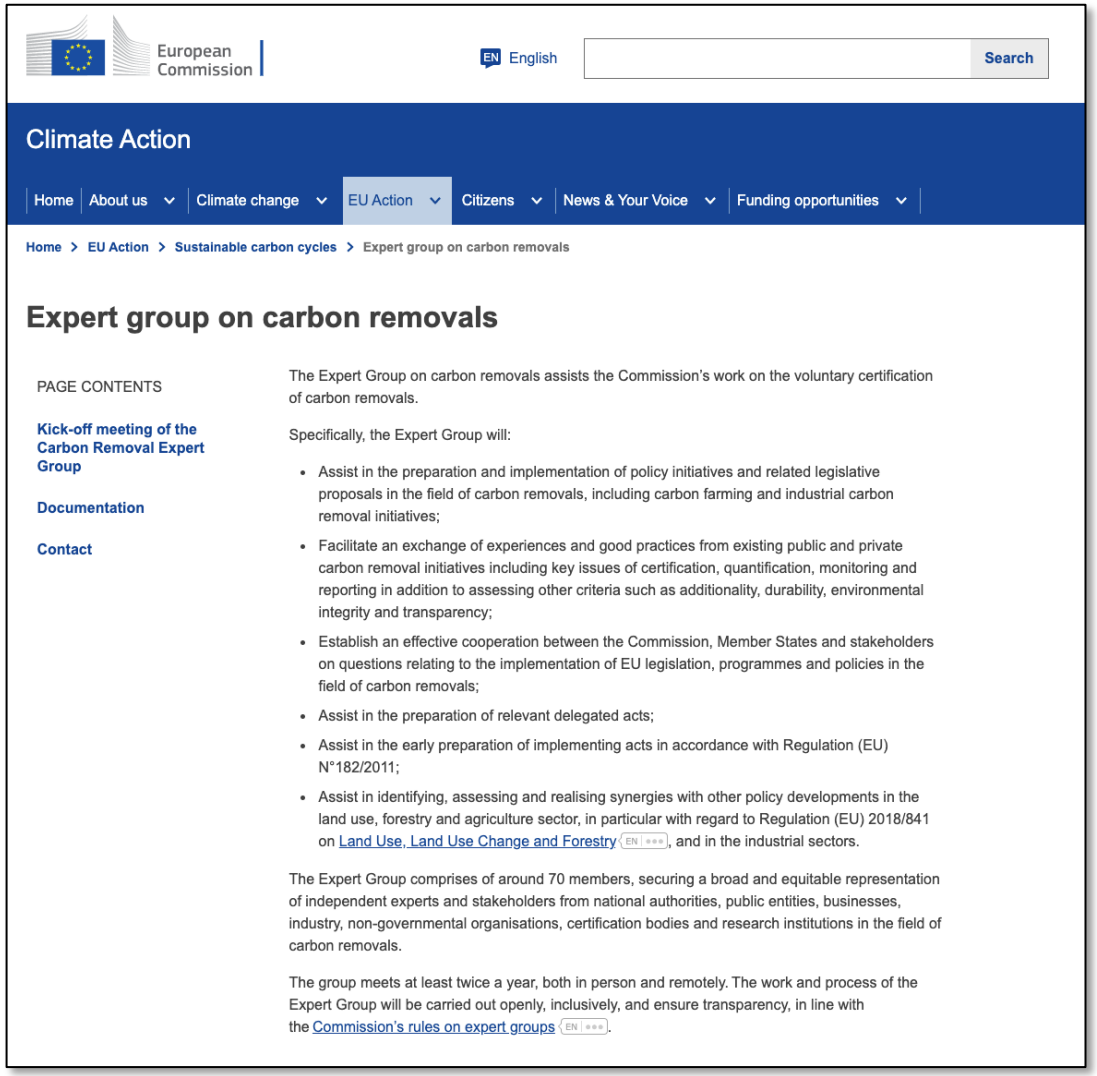
(1) OJ L 328, 21.12.2018, p. 82.

EC Expert Group on C removal certification

Most of the previously mentioned issues are addressed within this group



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Expert group on carbon removals

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- Kick-off meeting of the Carbon Removal Expert Group
- Documentation
- Contact

The Expert Group on carbon removals assists the Commission's work on the voluntary certification of carbon removals.

Specifically, the Expert Group will:

- Assist in the preparation and implementation of policy initiatives and related legislative proposals in the field of carbon removals, including carbon farming and industrial carbon removal initiatives;
- Facilitate an exchange of experiences and good practices from existing public and private carbon removal initiatives including key issues of certification, quantification, monitoring and reporting in addition to assessing other criteria such as additionality, durability, environmental integrity and transparency;
- Establish an effective cooperation between the Commission, Member States and stakeholders on questions relating to the implementation of EU legislation, programmes and policies in the field of carbon removals;
- Assist in the preparation of relevant delegated acts;
- Assist in the early preparation of implementing acts in accordance with Regulation (EU) N°182/2011;
- Assist in identifying, assessing and realising synergies with other policy developments in the land use, forestry and agriculture sector, in particular with regard to Regulation (EU) 2018/841 on Land Use, Land Use Change and Forestry, and in the industrial sectors.

The Expert Group comprises of around 70 members, securing a broad and equitable representation of independent experts and stakeholders from national authorities, public entities, businesses, industry, non-governmental organisations, certification bodies and research institutions in the field of carbon removals.

The group meets at least twice a year, both in person and remotely. The work and process of the Expert Group will be carried out openly, inclusively, and ensure transparency, in line with the Commission's rules on expert groups.

Kick-off meeting of the Carbon Removal Expert Group

The first meeting of the Expert Group took place on 7 March 2023 in Brussels:

- Agenda
- Recording, split up per agenda point
- Presentation

Your opinion is important to us and we would appreciate it if you could take a few minutes to complete our post-event feedback survey.

The meeting notes will follow shortly.

Next steps: There will be quarterly meetings in 2023 focused on best practices and challenges for certification methodologies: on carbon farming, industrial removals and on the certification process. In 2024, more targeted sub-groups will be formed.

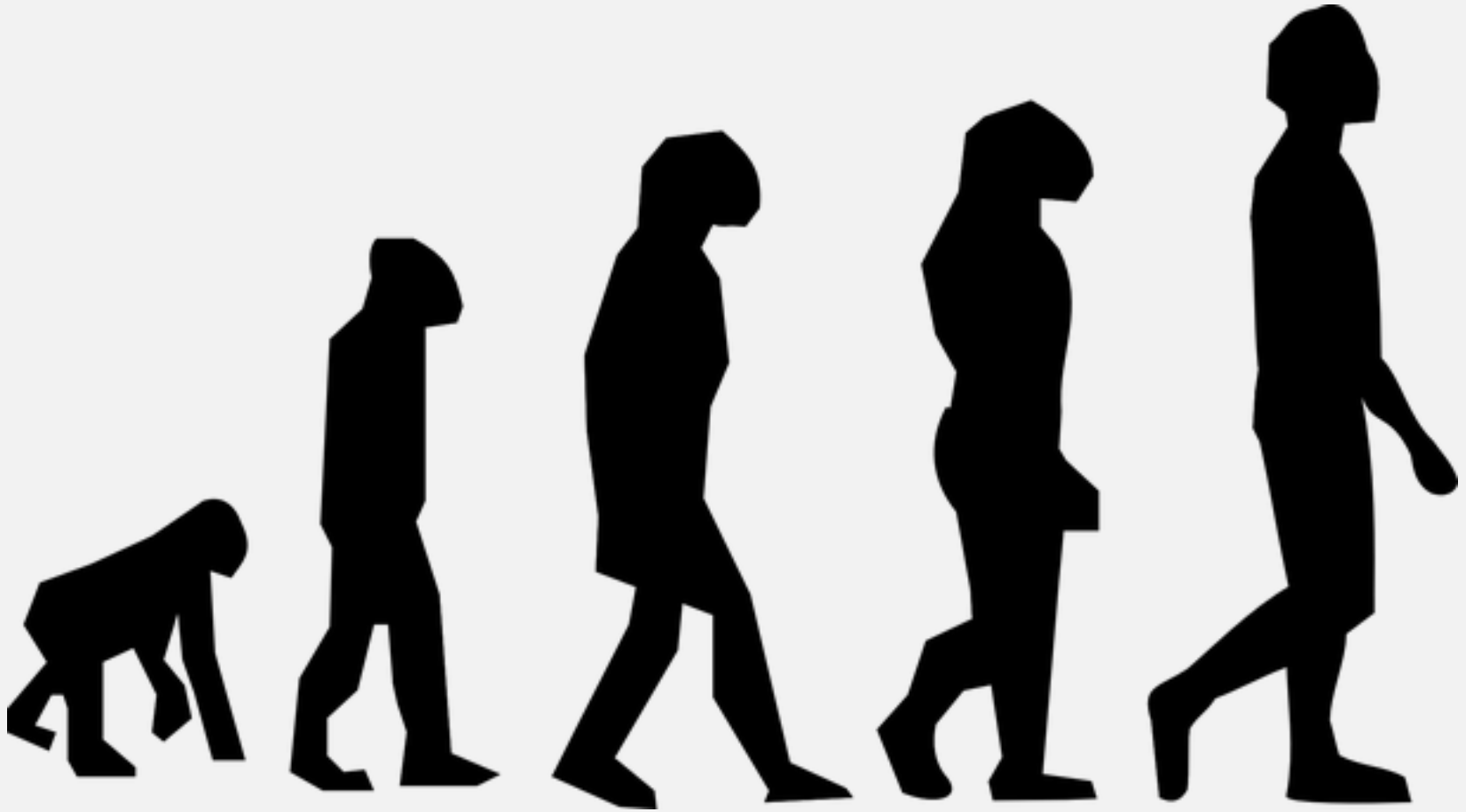
June 2023 — **Meeting on carbon farming methodologies**
- Soil
- Forest
- Peatlands

Sep/Oct 2023 — **Meeting on industrial removals**
- Permanent storage
- Long-lasting carbon storage products

Oct/Nov 2023 — **Meeting on certification process**
- Certification schemes
- Third-party verification
- Registries

Q4 2023 or Q1 2024 — **Meeting for 2024 work program**
- Report on best practices

Biochar Value Chain evolution



BIKE

Bringing organic C back to soil, and promoting **soil health** and **fertility** , are key elements for Sus… as E… Agr… fully… poli… des… pro…

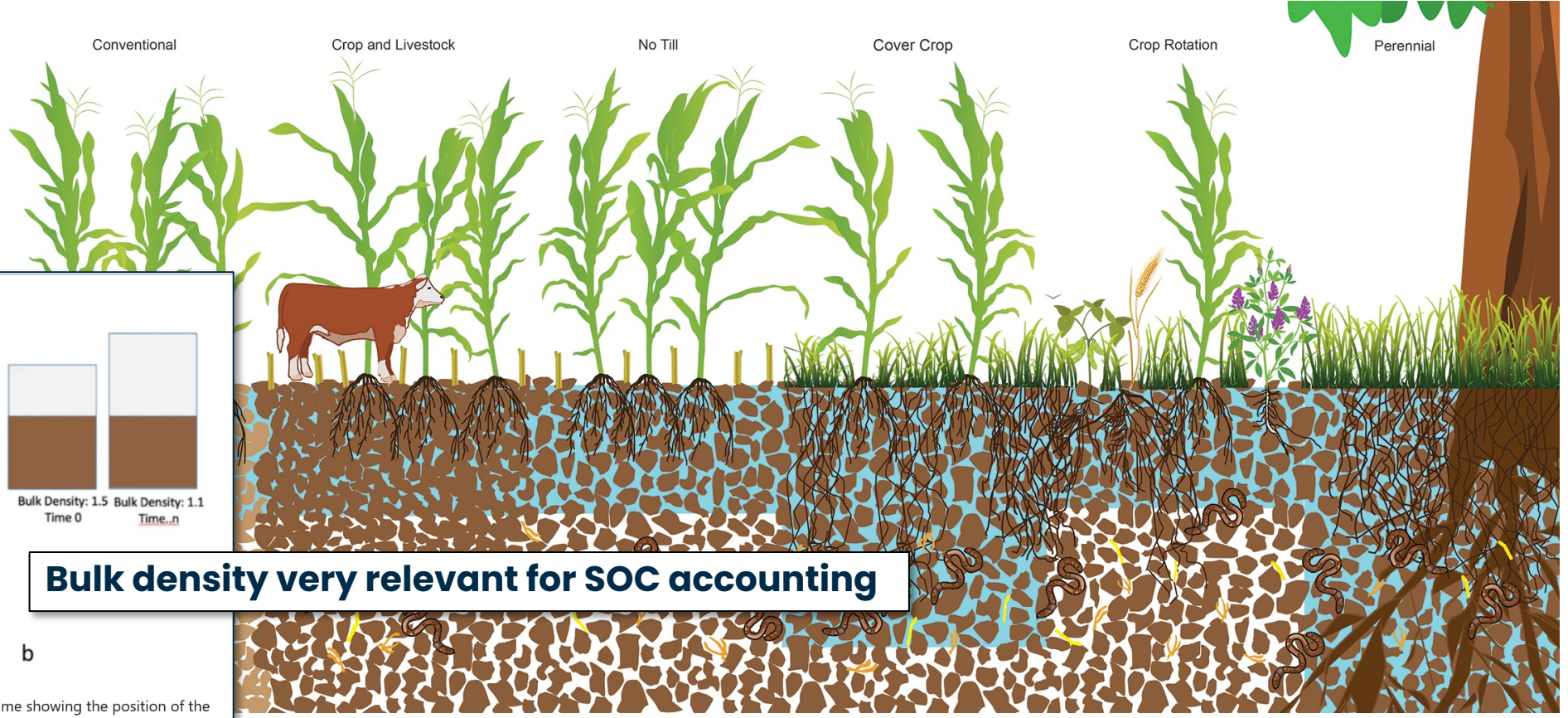
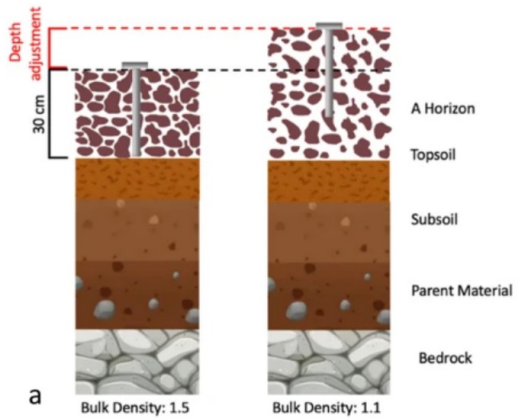


Figure 1

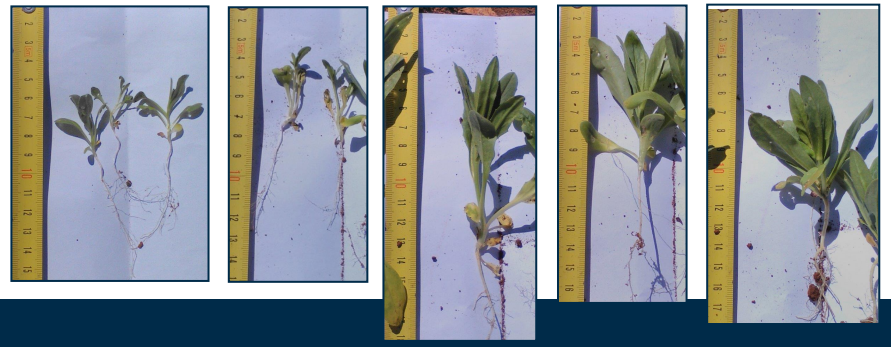


(**a**) Example of pedon alteration due to changes in bulk density over time showing the position of the soil sampling device from the soil surface to the same fixed depth. (**b**) Example of pedon after the correction showing the difference in air space, while the soil mass remains constant.

Bulk density very relevant for SOC accounting

Comparing infiltration rates in soils managed with conventional and alternative farming methods: A meta-analysis
Andrea D. BascheMarcia S. DeLonge

No fertilization | **Mineral fertilization** | **100% Compost** | **100% Biochar** | **Biochar+ Compost 10%**



FOOD, FEED AND ENERGY (FUELS)

Reverse ILUC approach:
Barley & Camelina in recovered soil in Spain.

Food/feed otherwise not produced.

Bio4A

CARBON NEGATIVE: Offset (Compensate)

- ✓ **Low-ILUC** : Camelina&Barley in recovered land under marginalization (**BIO4A, BIKE**)
- ✓ **Offsetting CO2** at EU airport land, landside and/or airside + Circular Airports (**TULIPS**)
- ✓ **Nature-based offsetting** next to **SAF** production, or in combination with it (**BIO4A, BIKE**)

→ **Energy** can **support more sustainable agriculture** through **Biofuels Done Right models**

The Biogas Done Right case

Biomethane comes with C, N, P… in the Biogas Done Right model.

It is a Carbon – Negative model (ANNEX VI RED)

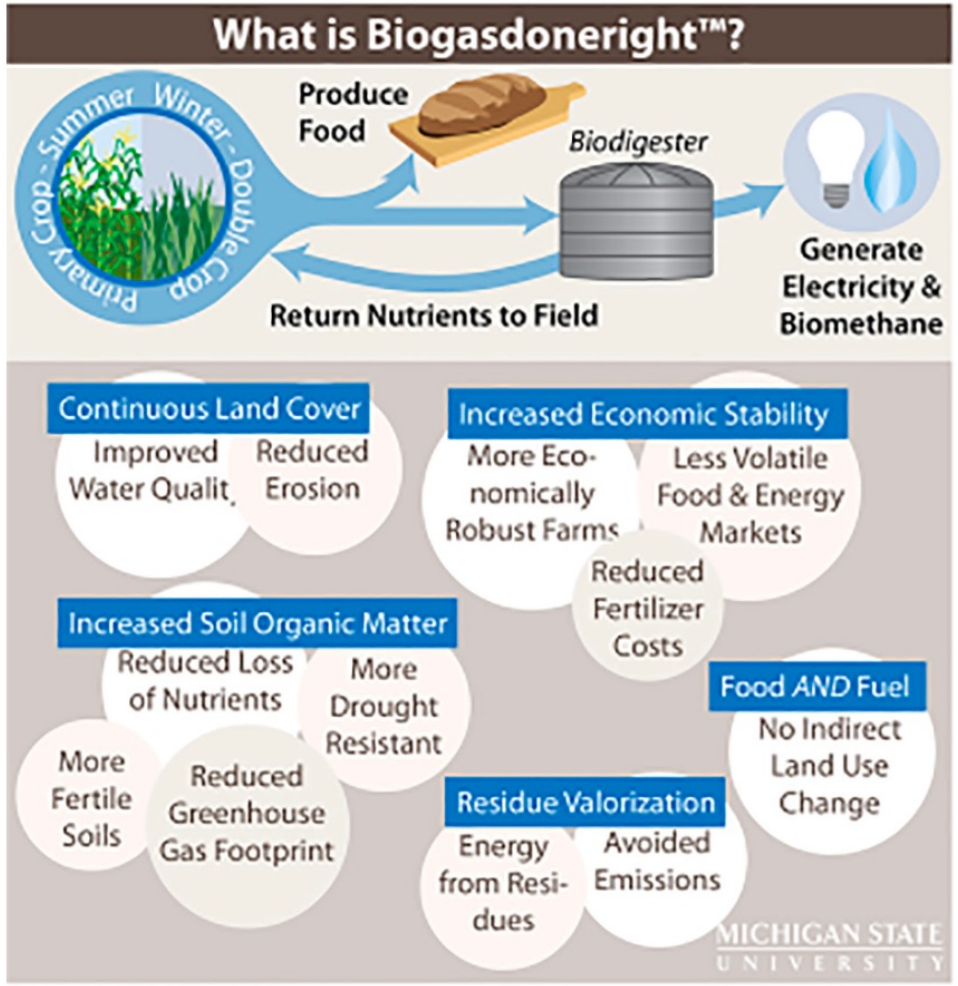
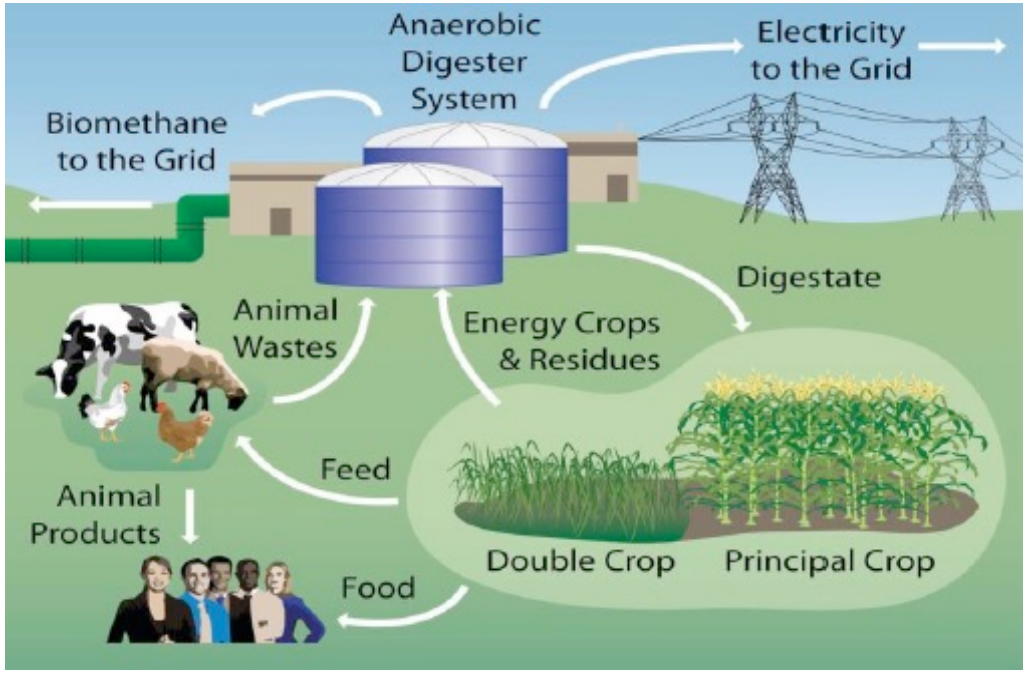
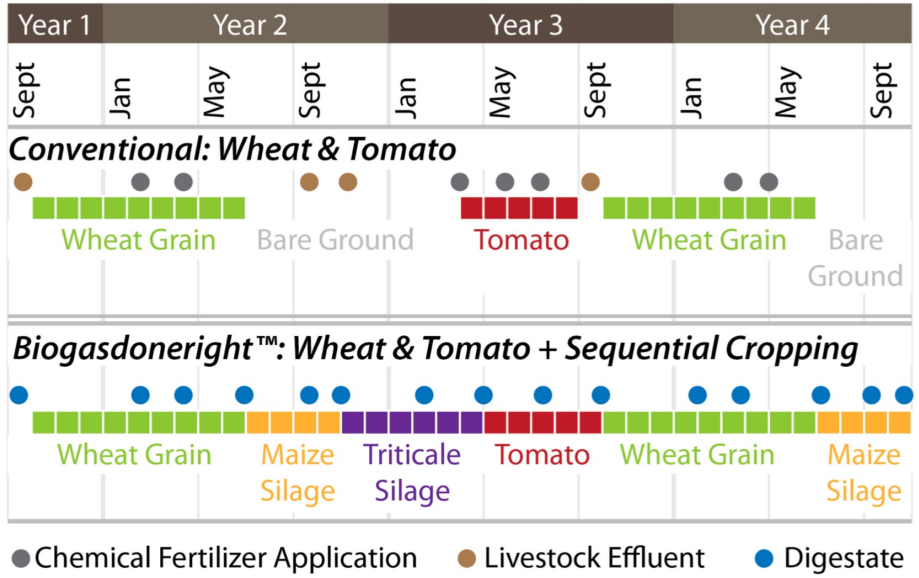


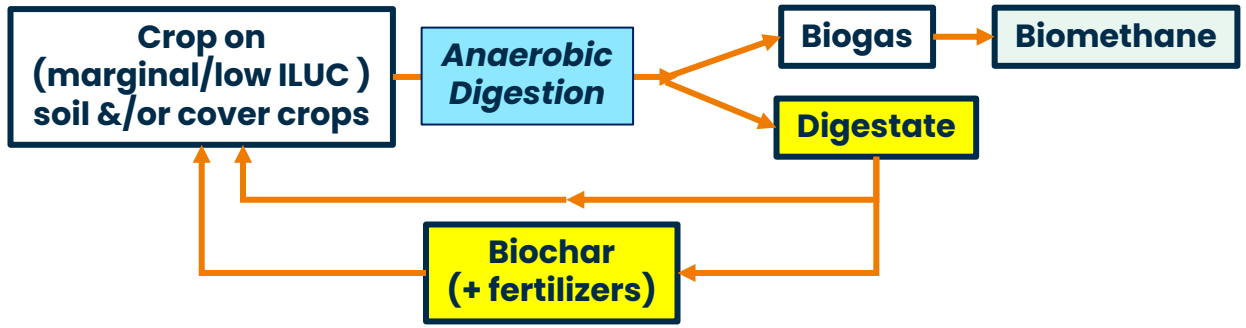
Figure 1. Basic processes and effects of the Biogasdoneright ™ system.

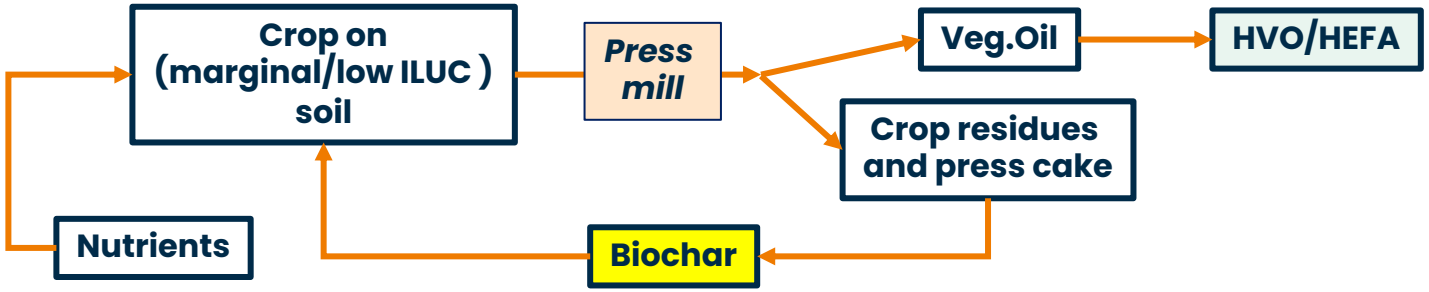


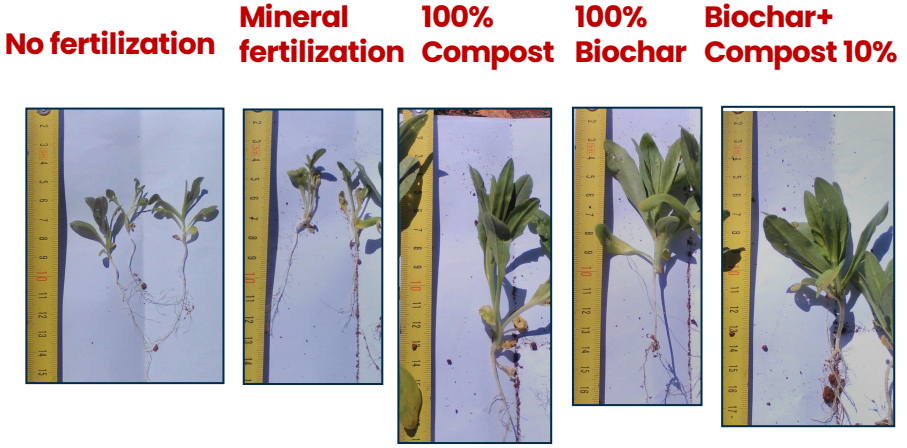


“Biofuels Done Right” can be Carbon Negative and support farming in EU

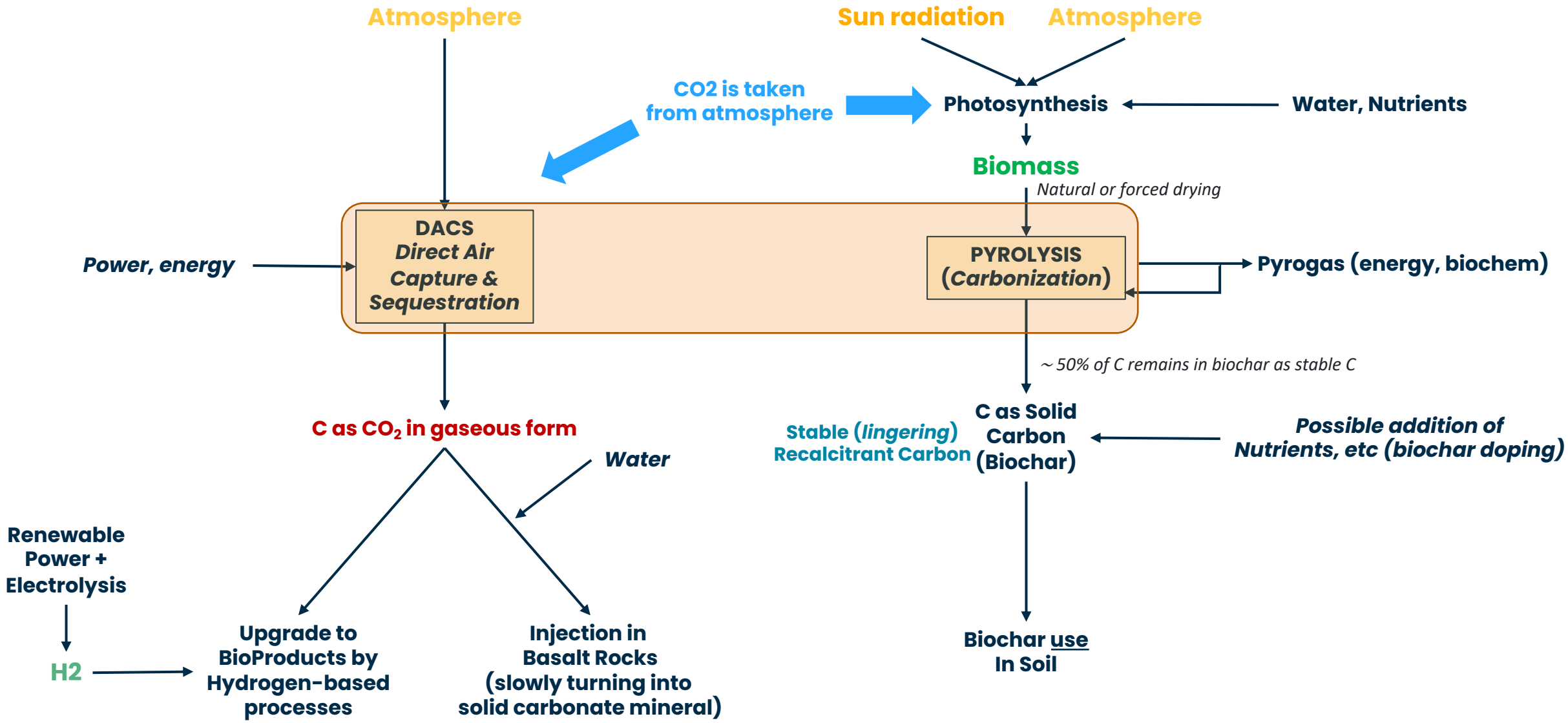
- **Carbon NEUTRAL vs Carbon NEGATIVE: renewable BIOfuels can be C-Negative**
- **Biogas Done Right and Digestate, or Pyrolysis of residues to Biochar are some examples**
- **Fully deploying REDII-IR (Esca factor → C in soil in GHG assessment)**







CARBON SEQUESTRATION (AND USE): DACS vs BIOCHAR



CARBON SEQUESTRATION (AND USE) – IMPROVED MODEL BY ADDITIONALITY

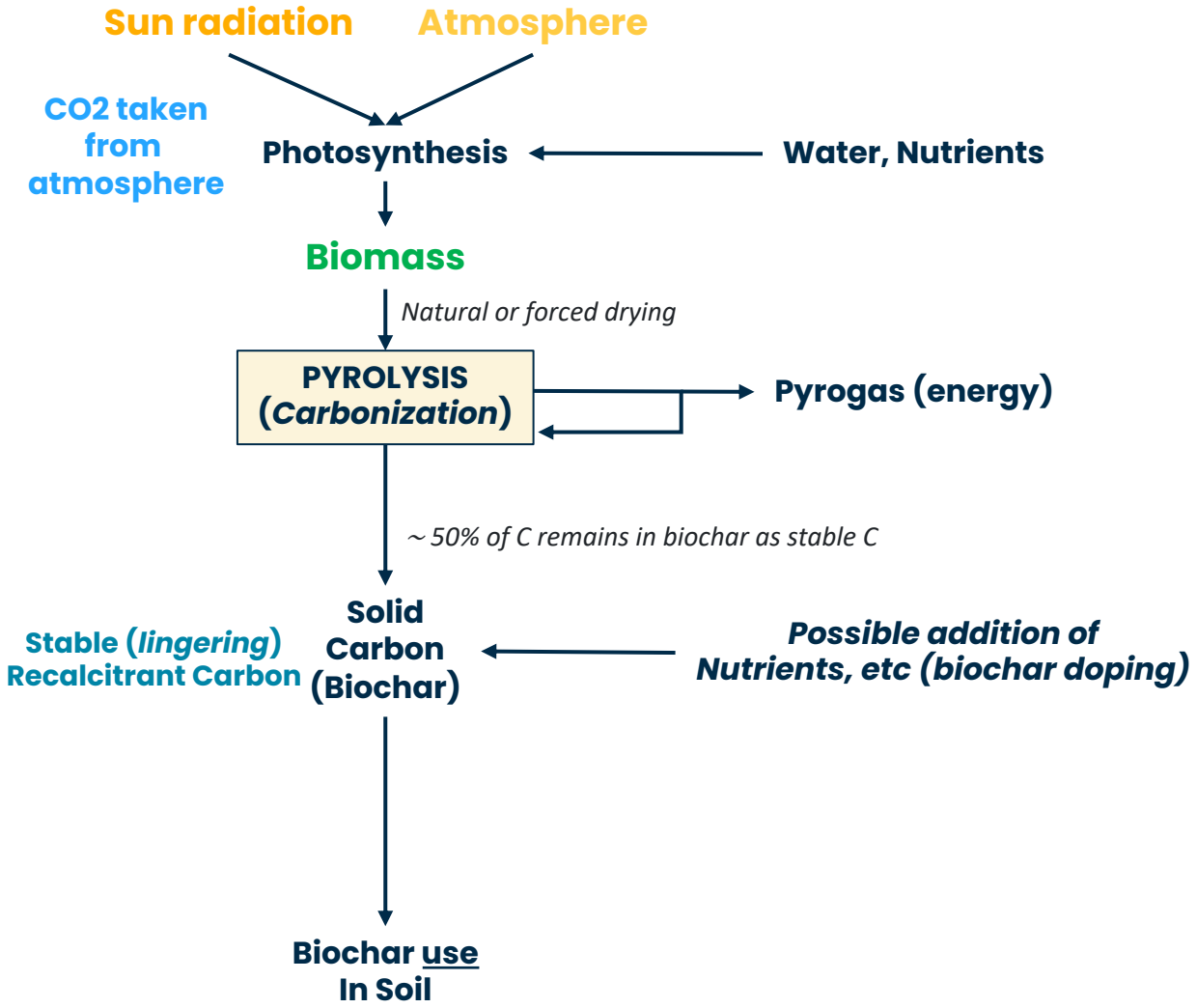
ADDITIONALITY OF BIOCHAR
***(BEYOND SEQUESTRATION)*:**

Only if

- Biomass is cultivated by recovering **marginal land** (climate change mitigation) and/or
- **Productivity is increased** by **restoring soil** and **regenerative/sustainable agricultural models**

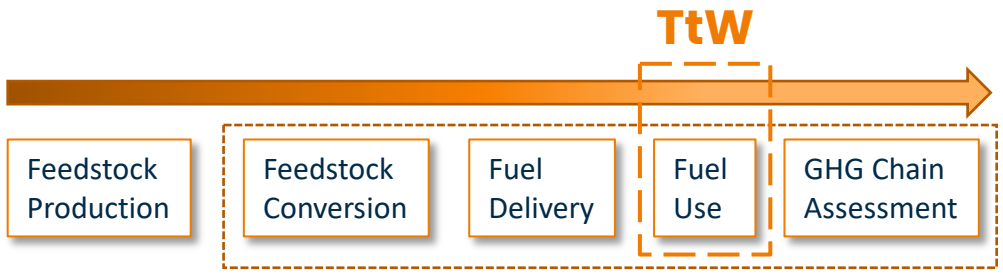
Both cases addresses improving **Soil Health** and **Photosynthetic Efficiency**.

If biomass is produced through **rotation** on marginal land: **food/feed is produced on difficult soils, otherwise unproductive → Reverse ILUC concept**

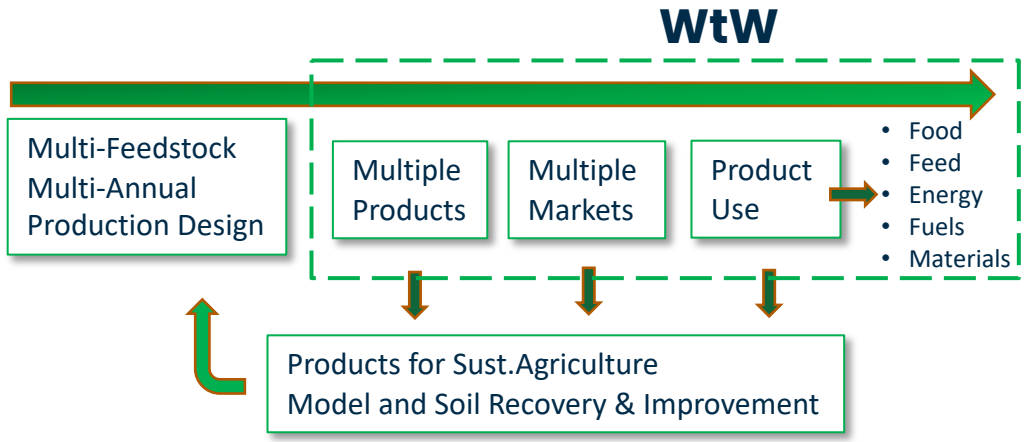


Simultaneous CCS&U

Enabling more sustainable agriculture & Negative Carbon through Sustainable Biofuel chains



How to make this linear biofuel thinking sustainable (GHG) enough?

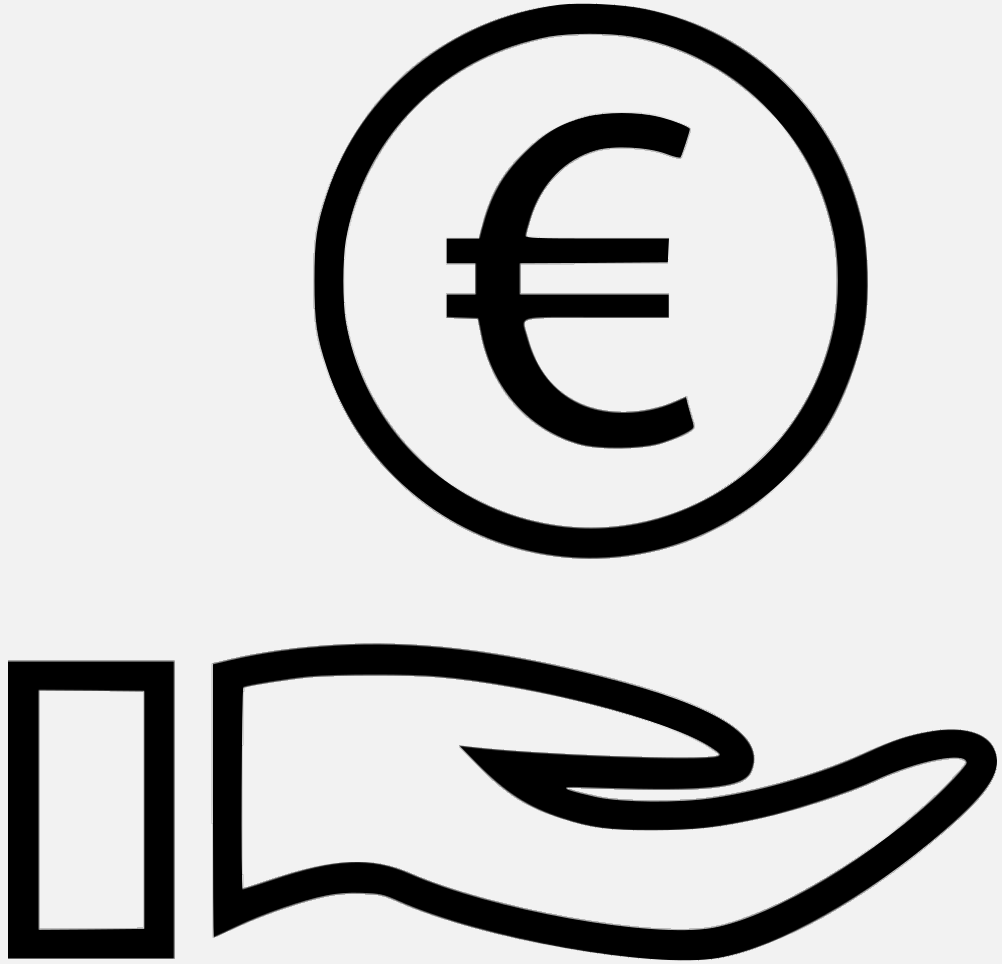


Which opportunities Bioenergy & Bioeconomy offer to sequester Carbon and make agriculture more sustainable (beyond GHGs, towards SDGs)?

From linear to circular, from energy-driven to C-negative sustainable agricultural models

Bioenergy / Bioeconomy enabling more Sustainable Agriculture AND Carbon removal

Policy and Economics of NETs in EU ETS



US: support to DACS

- **Biochar** removes CO_2 from the atmosphere, like **Direct Air Capture System** (DACS).
  - ✓ In the case of Biochar the CO_2 removal is performed by the crop/tree
  - ✓ In the case of DACS, it is done through dedicated RES technologies/processes
- In the US DACS is already economically well supported by the Country

> - **Carbon Sequestration and Utilization credit**
>   - **Bonus credit:** Increased credit to $60 per metric ton (with utilization)
>
>   New credit for DAC CO_2 of $130 per metric ton (with utilization)

- It would be reasonable, not to penalize the EU industrial and agricultural stakeholder, to allow the proposed interpretation and include biochar in the ETS (coherently also with the support given to the investments in this sector through EU funds as EU Innovation Fund and others)
- **Biochar can deliver measurable (evidence-based) CO_2 removal at a much lower cost and with many additional benefits**

ETS

Council adopted 25/4/23

EU ETS Reform is one of the five laws adopted by the Council on 25/4

- EU ***Emission Trading* Scheme** (revised) – following the provisional agreement of Dec 2022
- **Maritime** Transport Emission
- **Building, Road Transports** and **Additional** Sectors
- Emissions from **Aviation**
- **Carbon Border Adjustment Mechanism** (**CBAM**)

EU ETS

Council adopted 25/4/23

The EU's emissions trading system (EU ETS) is one of the world's largest carbon markets and the EU's key tool for reducing greenhouse gas emissions.

Price on Carbon (CO2)

The system puts a price on carbon. Every year, entities covered by the ETS have to buy "allowances" corresponding to their greenhouse gas emissions.

CAP

Every year, a cap is set on how many allowances are put on the market for that year and each year; that cap then decreases with every passing year. This creates financial incentives for companies to cut emissions.

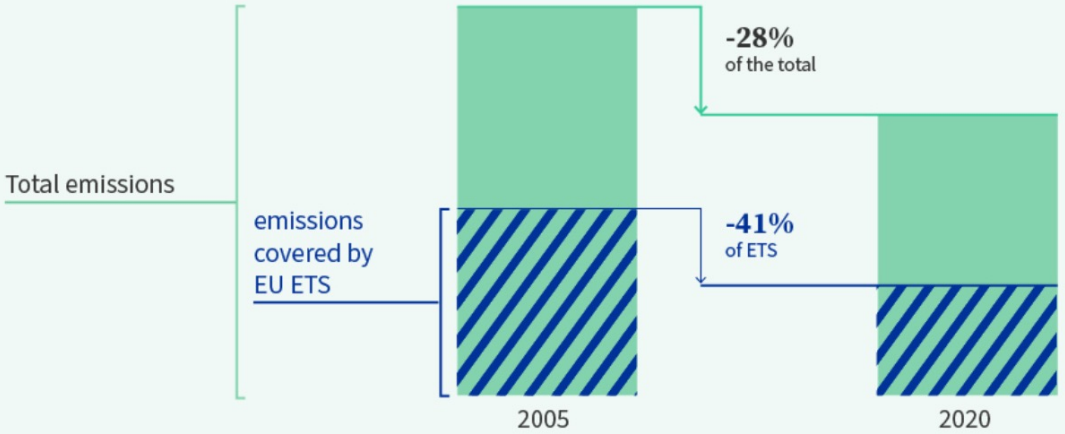
"Carbon Leakage" risk

However, certain sectors that are exposed to 'carbon leakage' get free allowances to support their competitiveness.

How does the EU ETS contribute to the goal of climate neutrality?

The EU ETS covers around 40% of total EU emissions and has already proved to be the key tool for emissions reduction.

Since 2005 (when it was introduced) EU emissions have been cut by 41% in the sectors covered.



EU ETS

Council adopted 25/4/23

Which sectors are currently covered

The EU ETS covers approximately **10 000 companies**

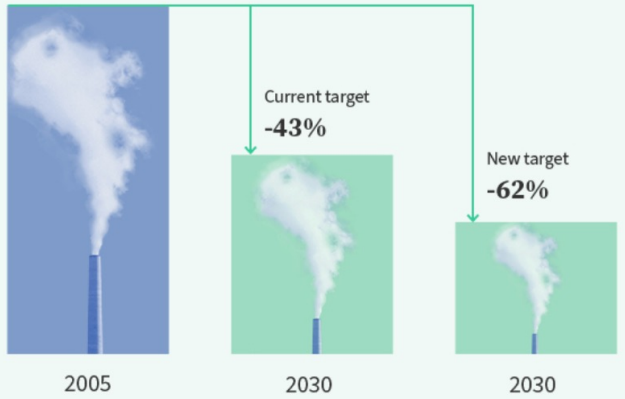
electricity and heat generation

energy-intensive industry sectors (e.g. oil refineries, steel industry, cement, glass and paper production)

commercial aviation (flights within the European Economic Area)

What will change with the reform?

more **ambitious** emissions reduction **goals**



faster reduction of the cap, fewer allowances on the market:

reduction of **117 million allowances** over two years

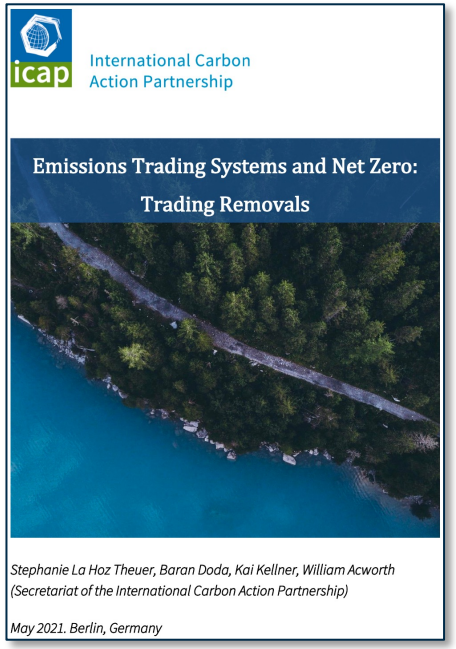
gradual **phasing out of free allowances** for certain sectors (in parallel with the introduction of the **carbon border adjustment mechanism** – a carbon pricing system applicable to energy-intensive products imported into the EU in order to avoid carbon leakage)

the ETS to cover new sectors:

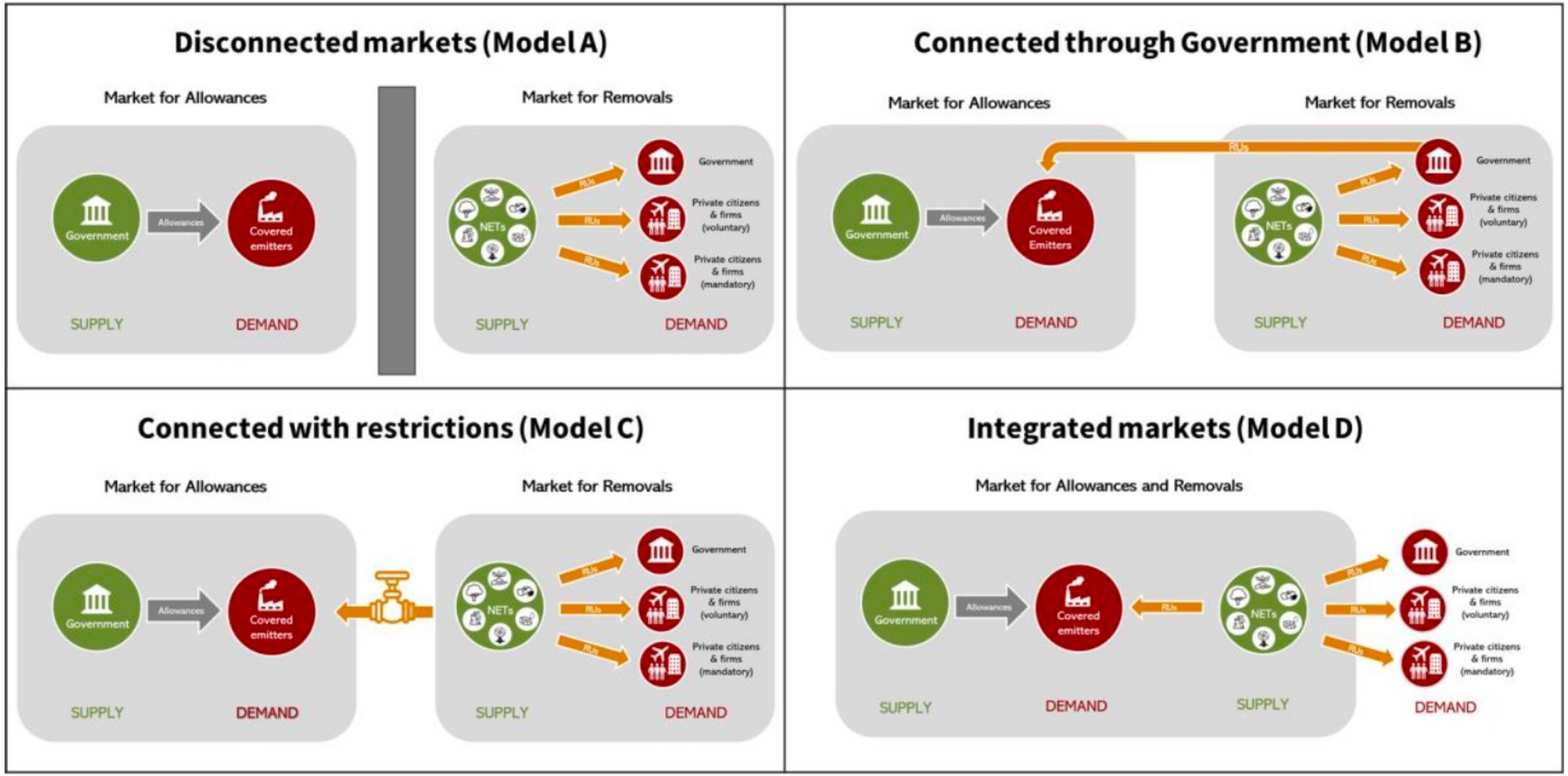
→ extension to **maritime transport** (introduced gradually between 2024 and 2026)

→ a separate new ETS for **buildings, road transport and fuels** for additional sectors

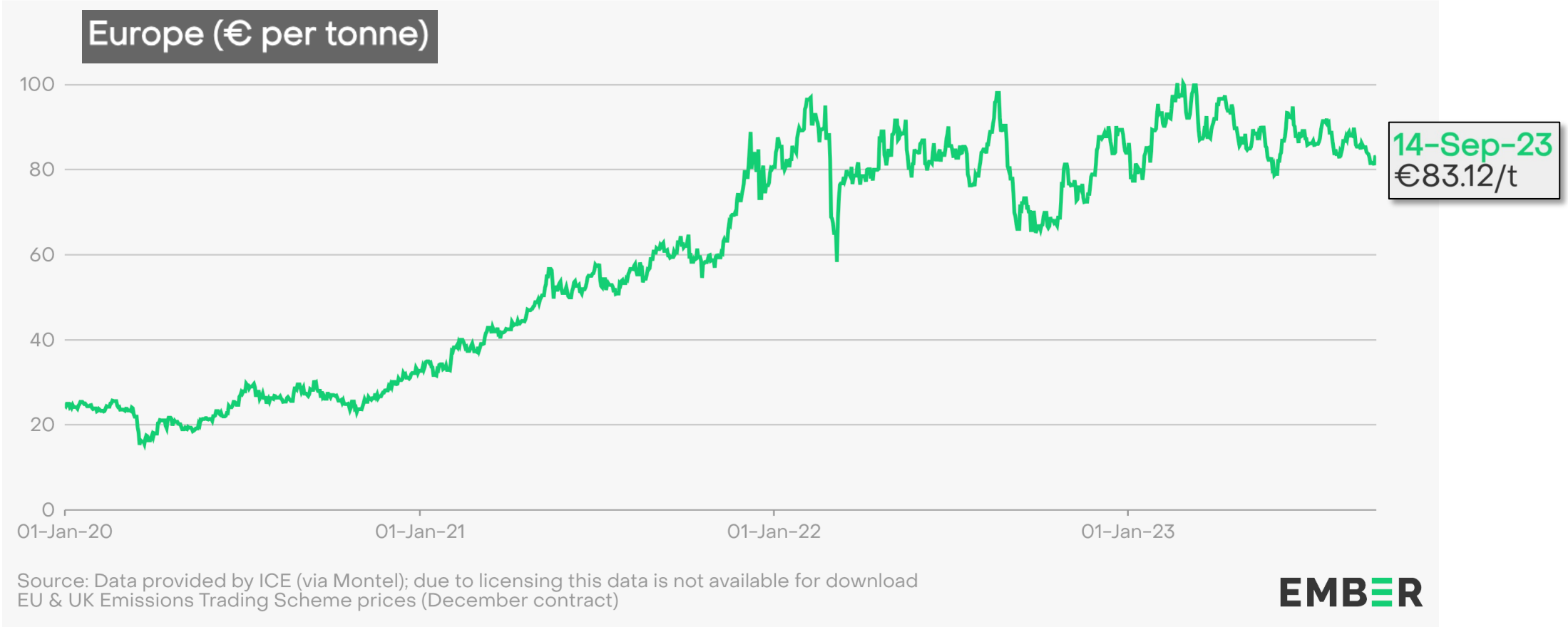
ICAP studies: why connecting NETS and Allowances can make the difference…



International Carbon Action Partnership (ICAP) is an international forum for **governments and public authorities** that have implemented or are planning to implement emissions trading systems (**ETS**).



Biochar (as NET) and Carbon Market



Source: https://ember-climate.org/data/data-tools/carbon-price-viewer/

Conclusions

- Biochar as NET for CDR, the only nature-based option for long-lived C
- Even if EU Goals on RES are achieved, removal and compensation will always be needed.
- International dimension (e.g.UN ICAO) also considering inter-sector offsetting
- Beyond supporting investments, the creation of stable and balanced market mechanisms is needed for large scale deployment
- Connecting RU and NETs needed
- Economics and market development depend on policy evolution
- Focus on biogenic C in soil, given the ongoing desertification (EU MED)


Thanks for your attention
David Chiaramonti
Politecnico di Torino
david.chiaramonti@polito.it
Politecnico di Torino
1859
RE·CORD