RE·CORD

POLITECNICO DI TORINO

Towards a new Bioeconomy

The role of Biofuel in the post-pandemic era to achieve EU Green Deal goals

David Chiaramonti
Polytechnic of Turin and RE-CORD

BIO4ECO
Interreg Europe

Our analysis

- The EU SEM hindered during the pandemic. Relevance of domestic supply chains and strategic storage became evident
- BIOeconomy & CIRCULAR economy: most of the attention so far focused on GHG savings, expecially in the EU
- Sustainable transport fuels are a major part of Bio/Circular
- These value chains are indeed also real ECONOMY
- Decarbonization and economic recovery are not competing, but can rather be two complementary sides of the same coin
- Domestic supply chains for food, materials and energy are needed in the post Covid-19 scenario for economic recovery

→The economic impact of well-designed sustainable Biorefinery fuels chains is as important as their effects on GHG emissions

Applied Energy 271 (2020) 115216

Contents lists available at ScienceDirect

Applied Energy

journal homepage: www.elsevier.com/locate/apenergy

Security of supply, strategic storage and Covid19: Which lessons learnt for renewable and recycled carbon fuels, and their future role in decarbonizing transport?

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COVID-19

- Which impact on energy? (Renewable and Recycled Carbon Fuels - RCCF)
- Which role for RRCFs in the post-pandemic era?

Energy and Investments Dynamics

- **Energy and investments: a reality check!**
  - **2015-2019** energy demand and emission growth **> than 2011-2015**
  - 2018: **only 1/3rd of 1800 bill.$** global energy investments on **Low-Carbon**
  - G20 Countries: out of **7.4 Trill.$** to economic recovery, **only 4% Green** (reducing GHG)
  - **Oil**: **- 1000 bill$** in 2020 vs 2019. **Electricity**: **- 180 bill$**
- **Investments decline expected in 2020**, due to bad economics (lower profits and cash flows, higher debts, reduced demand):
  - **HC -30%, RES -10%, Electricity Infrastructures -8%**
  - Compared to investment levels needed for the **Energy-Climate transition** the **reduction is even more significant**
- **Under-investing in the energy sector could cause production/demand unbalances** and increased energy prices when demand will recover
  - Reduced investments **now → 9 MMBD reduced production at 2025**
  - **Rebound** effects?
- **Biofuel** production expected to fall by **13% in 2020** due to lower demand, 2021 back to same level as 2019

Sources: A. Clò, Energia, 2020; IEA Ener.World Investments 2019; IEA Ren.En.Market update

ENERGY MARKET DYNAMICS

Shell Warns Of Massive $22 Billion Write Down After Oil Crash

By Tsvetana Paraskova - Jun 30, 2020, 9:00 AM CDT

Royal Dutch Shell warned on Tuesday it could take as much as
impairment charge for Q2, becoming the latest oil major warni
of its assets as it revised its price assumptions after the oil pric

"In the second quarter 2020, Shell has revised its mid and long-
margin outlook reflecting the expected effects of the COVID-19
macroeconomic as well as energy market demand and supply
a statement.

Shell now assumes Brent Crude prices at $35 a barrel this year
year, with a long-term oil price assumption at $60 a barrel.

OILPRICE.com
The No. 1 Source for Oil & Energy News

Big Oil's Nightmare Is Coming True

By Nick Cunningham - Jun 30, 2020, 5:00 PM CDT

Royal Dutch Shell said that it could cut the value of its oil and gas assets by as much as $22 billion, as it takes a dim view of the state of the oil market. The move adds more evidence to the notion that a huge slice of oil reserves will wind up as stranded assets. Shell cut its Brent oil prices forecast from $60 per barrel to $35 for this year, and lowered its 2021 and 2022 forecasts to $40 and $50 per barrel, respectively, down from $60 previously. The lower outlook reflects the expected damage to the oil market due to the coronavirus and the negative impacts on the global economy, Shell said.

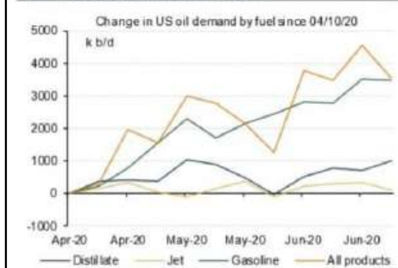
As a result, the value of Shell's assets will be cut by between $15 and $22 billion. Broken down by segment, Shell's integrated gas unit will take an $8 to $9 billion hit, mostly related to Australian LNG assets, including its gargantuan Prelude project, a floating LNG vessel, which came in over budget and is now underutilized in a weak LNG market. Shell's upstream unit will be impaired by $4 to $6 billion, a cut related to Brazil and U.S. shale. Finally, its refining portfolio will be reduced by $3 to $7 billion.

Debt Destroys A Shale Giant

By Editorial Dept - Jul 03, 2020, 12:00 PM CDT

1. Gasoline demand rebounds, jet fuel stays down

Chart 7: Apparent US gasoline demand has rebounded more than 3.5mn b/d from the lows of April...

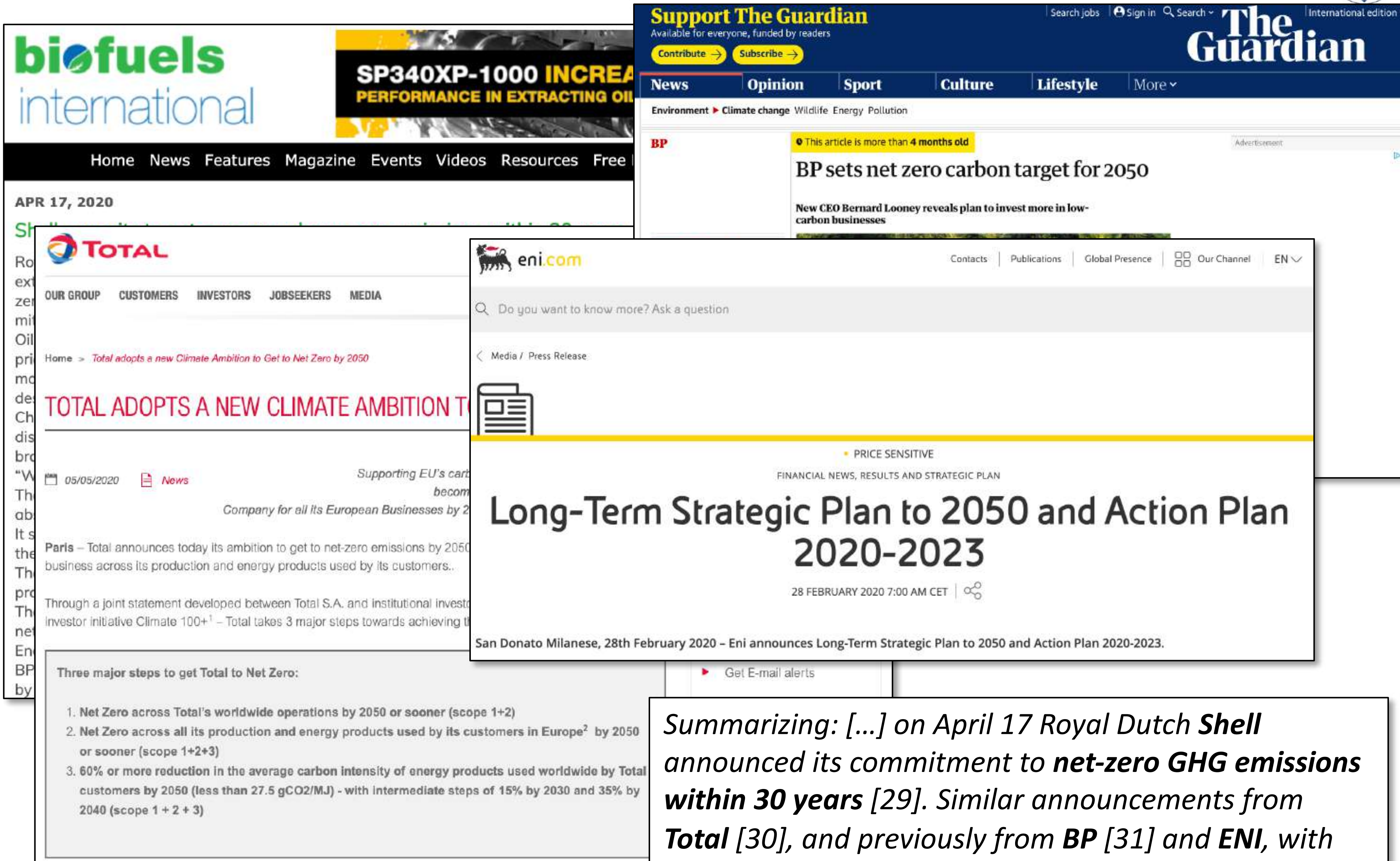


Source: Bloomberg

[..] nearly 240 North American shale companies have filed for bankruptcy since 2015.

→ *Impact on* ***jobs*** *and* ***economy*** *well-beyond the oil sector*

DECARBONIZATION ANNOUNCEMENTS IN OIL SECTOR



*Summarizing: […] on April 17 Royal Dutch **Shell** announced its commitment to **net-zero GHG emissions within 30 years** [29]. Similar announcements from **Total** [30], and previously from **BP** [31] and **ENI**, with net zero carbon footprint by 2040 [32].*

HYDROGEN ON THE SPOT *(GREEN..BUT ALSO BLUE)*

To Executive Vice-President Frans Timmermans

To Executive Vice-President Frans Timmermans

Also sent to Commission President von der Leyen, Executive Vice-President Dombrovskis, Executive Vice-President Vestager, Commissioner Simson, Commissioner Breton, Commissioner Vălean, Director-General Juul Jørgensen, Director-General Petriccione, Director-General Jorna, MEP Bușoi, MEP Krasnodębski, MEP Petersen, MEP Toia, MEP Gálvez Muñoz, MEP Canfin, MEP Eickhout, MEP Luena, MEP Motreanu, MEP Hazekamp, President of the European Council Michel, Ambassador Clauss, Ambassador Léglise-Costa, Ambassador Andrassy, Ambassador Szech-Koundouros, Ambassador Dubreuil, Ambassador Štefanić

Subject: Wide industry coalition call for a Hydrogen Strategy inclusive of all clean hydrogen pathways

Brussels, 24 June 2020

As we firmly believe that Europe's future energy system needs to take a technology-neutral approach to drive the most **cost-efficient and cost-effective decarbonization**, we support a **strategy which comprises all clean hydrogen production pathways**, including electrolysis, methane pyrolysis and natural gas reforming in combination with carbon capture, utilisation and storage (CCUS). The clean hydrogen economy could provide up to 5.4 million jobs by 2050,[1] and retain existing high-skilled jobs in EU energy-intensive industries. **For this to materialise, an inclusive approach to clean hydrogen is necessary.**

Today, hydrogen produced from natural gas delivers the lion's share of the EU's industrial hydrogen, while hydrogen from clean electricity is produced in much smaller volumes.[2] We fully recognize and support the growth in hydrogen from clean electricity, which will become a significant part of the hydrogen mix in 2050, while market design will need to ensure that the requirements of different consumer groups are met. However, this hydrogen alone will not be enough to **develop a commercial market for clean hydrogen** in the next decade. It will take time to scale up, which is why we need to deploy all scalable, enabling technologies starting today.

Hydrogen from natural gas with carbon management technologies such as CCUS and pyrolysis will be needed to **create the necessary scale and make hydrogen applications cost-competitive**. Today, it is 2 to 5 times cheaper than renewable hydrogen and its deployment will help reduce the latter's cost.[3] Furthermore, the flexibility and resilience provided by the gas system significantly reduce investments needed and facilitate the integration of large-scale variable renewable energy.

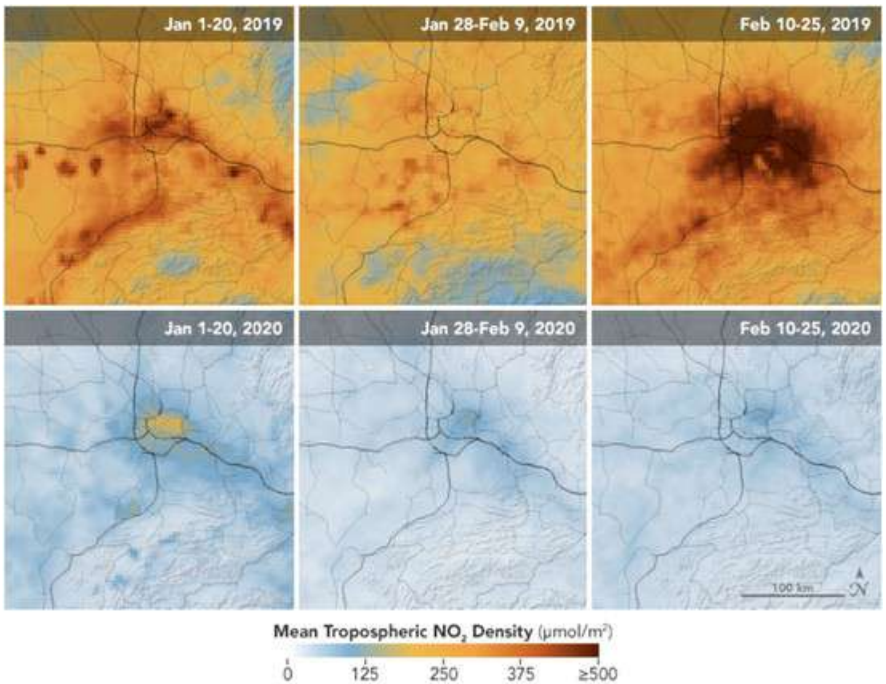
In order to create these European opportunities in the short-, mid-, and long-term both for economic growth and decarbonization, it is of key importance for the EU to invest in all hydrogen technologies to unlock the nascent hydrogen market, while supporting the development of EU hydrogen ecosystems. **We thus urge the EU to create a strong policy framework in support of all forms of clean**

[1] FCH JU (2019): *Hydrogen Roadmap Europe*. Available from: https://www.fch.europa.eu/sites/default/files/Hydrogen%20Roadmap%20Europe_Report.pdf
[2] https://www.iea.org/reports/the-future-of-hydrogen, June 2019.
[3] *Ibid.*

AkerSolutions · Cerame-Unie · eni · entsog · equinor · EUGINE · EUROFER The European Steel Association · eurogas · EUTurbines · ExxonMobil · FuelsEurope · gas naturally · GasTerra · GE · gie Gas Infrastructure Europe · Global CCS Institute · IADC · IGU · Industri Energi · IOGP International Association of Oil & Gas Producers · marcogaz · Mitsubishi Heavy Industries · MHPS · MOLGROUP · Neptune Energy · NOGEPA · Norsk olje&gass · OGUK · PGNiG · ACUE · uniper · wintershall dea · erdgas

COVID-19 AND AIR POLLUTION: WAS THAT LASTING ENOUGH?

earth observatory



January 1, 2019 - February 25, 2020

Pollutant drops in Wuhan during Covid19. No rebound effect observed till end of February 2020

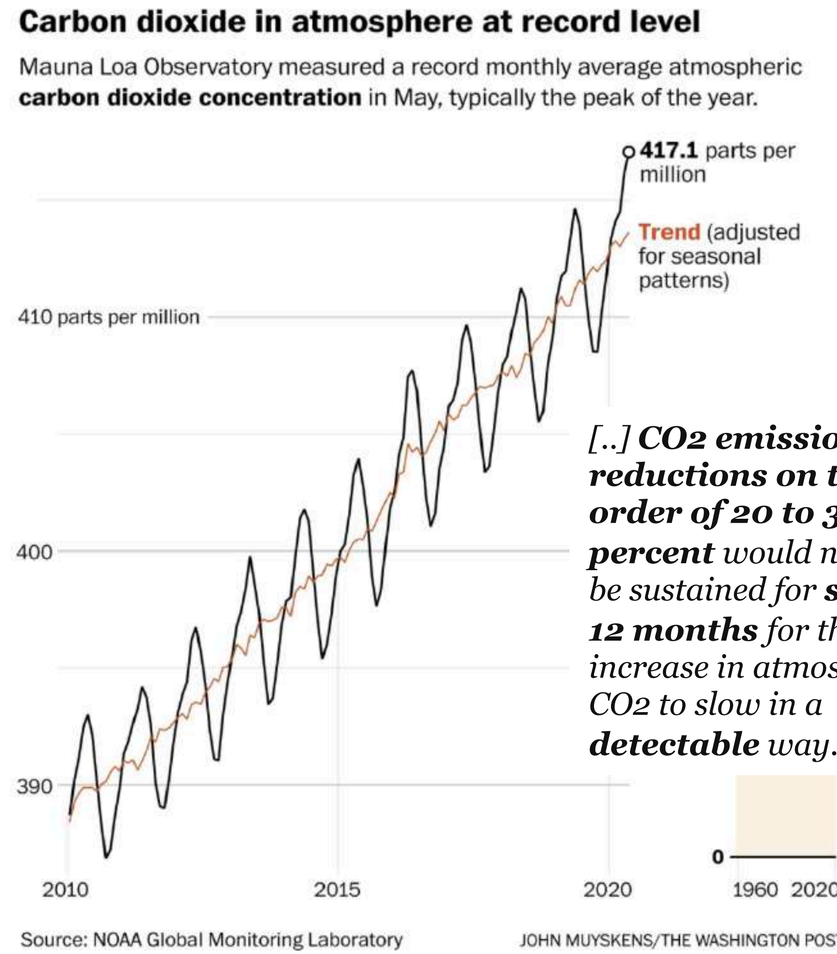
Earth Observatory. Airborne Nitrogen Dioxide plummed over China. Available at https://earthobservatory.nasa.gov/images/146362/airborne-nitrogen-dioxide- plummets-over-china

The Washington Post — Democracy Dies in Darkness

JUNE 4, 2020

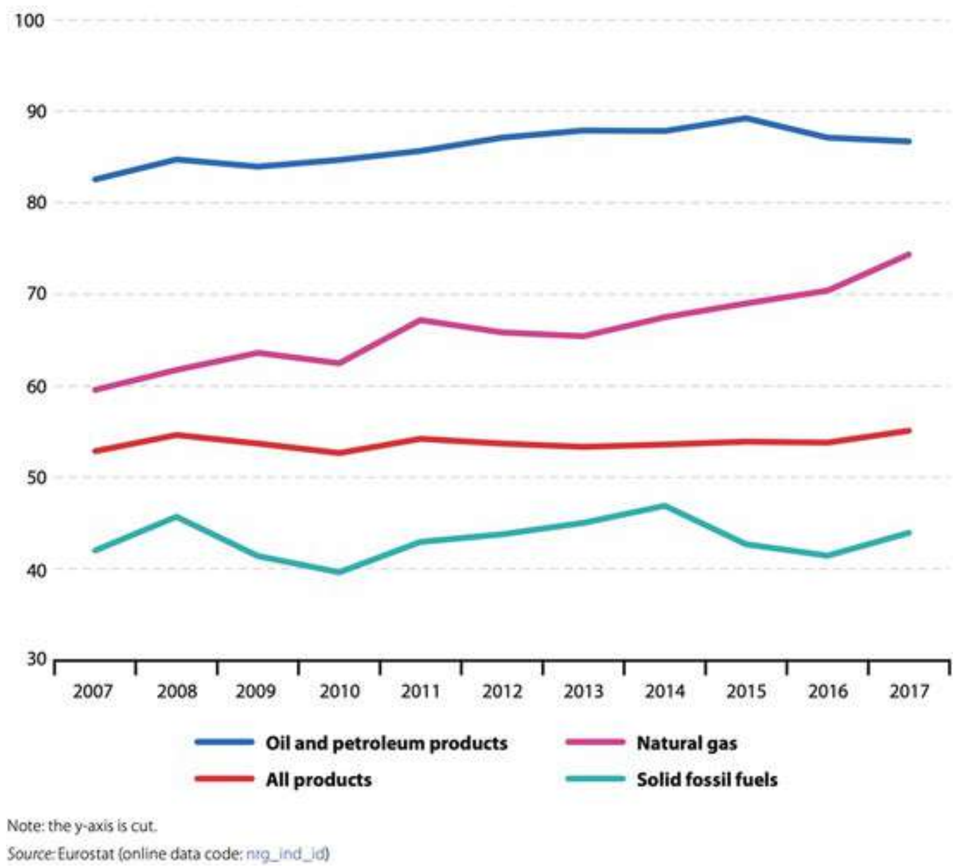
Capital Weather Gang

Earth's carbon dioxide levels hit record high, despite coronavirus-related emissions drop



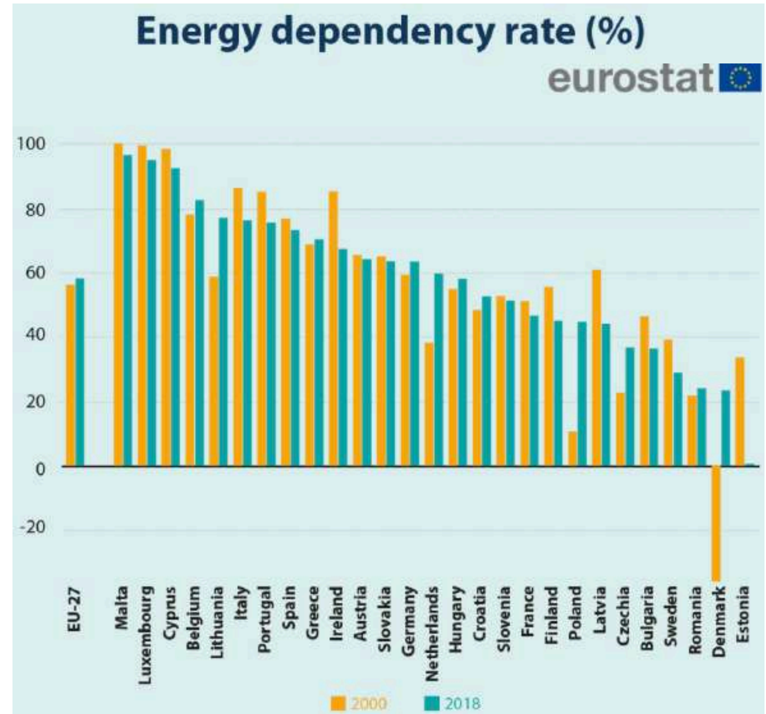
[..] ***CO2 emissions reductions on the order of 20 to 30 percent*** *would need to be sustained for* ***six to 12 months*** *for the increase in atmospheric CO2 to slow in a* ***detectable*** *way.*

EU: High Dependence on Imports



Energy dependence rate, EU-28 2007–2017, % of net imports in gross available energy

EUROSTAT. EU imports of energy products – recent developments Statistics Explained. November 2019. Available at https://ec.europa.eu/eurostat/statistics-explained/pdfscache/46126.pdf



- **EU depended on energy import by 58% in 2018** (56 % in 2000).
- **2/3rd** of 2017 imports refer to **petroleum** products, **NG** (**26%**) and **solid fossil fuels** (**8%**).
- Transports in the EU are mostly linked to **imported quotas**.

SHORTER AND MORE SECURE SUPPLY CHAINS

Top economist: US coronavirus response is like 'third world' country

Joseph Stiglitz attacks Donald Trump, saying US on course for second Great Depression

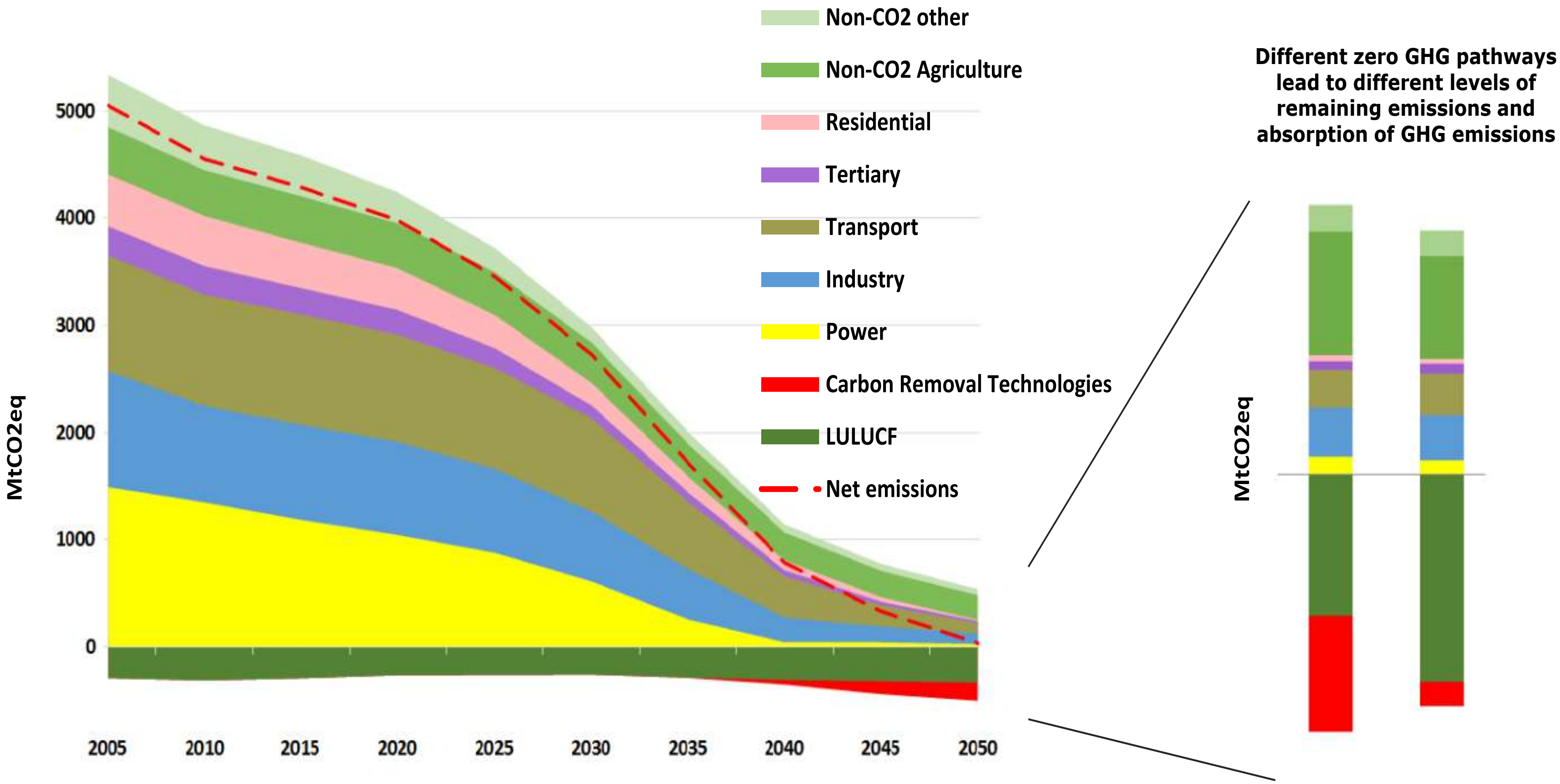
- Coronavirus - latest updates
- See all our coronavirus coverage

The Guardian

Stiglitz said the current crisis would force countries to make themselves less vulnerable, and this would lead to shorter supply chains and a greater emphasis on self-sufficiency in food and energy.

THE DECARBONISATION PATHWAY IN THE EU: AGRICULTURE AND FORESTRY MUST BECOME KEY ACTORS

GHG emission trajectory for 1.5 ˚C



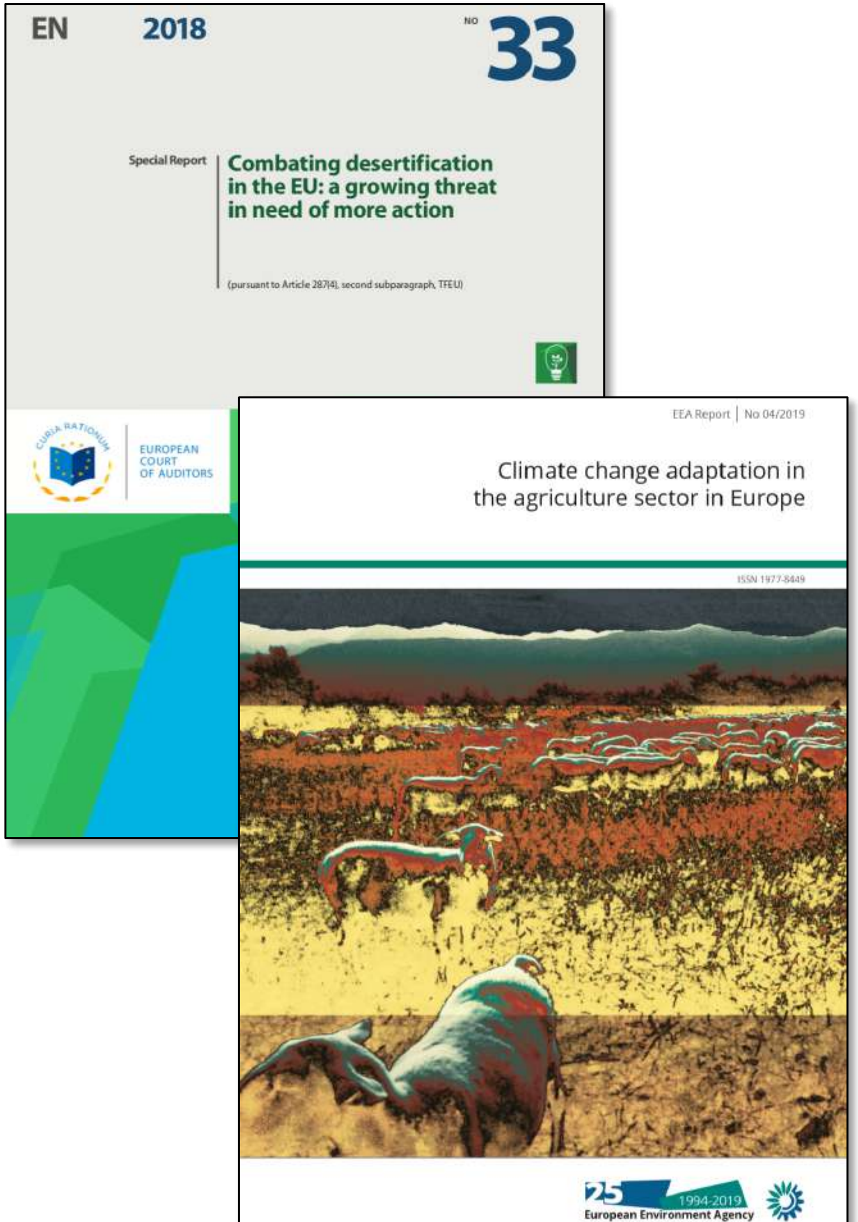
Source: A Clean Planet for All, EC

AN EXEMPLARY WIN-WIN CASE FOR BIOECONOMY: BIOCHAR, SOIL FERTILITY, AND C STORAGE

- Improvement of soil **physical** properties
  - *Mechanical structure*
  - *Soil porosity and aeration*
  - *Moisture retention capacity*
- Improvement of soil **chemical** properties
  - *pH increase in acidic soils*
  - *CEC and AEC*
  - *Improved N-cycle*
  - *Addition of C-recalcitrant to soil*
  - *Environment suitable for microorganism*
  - *Nutrient addition (slow release) and reduced leaching*
- Improvement of **biological** properties
  - *Effects strictly linked to the two previous ones*
- Cost-competitive permanent C sequestration




AGRICULTURE & SOIL: URGENT NEED TO TAKE ACTION



- **Healthy soil**: essential for food/feed, sustainable bioenergy and bioeconomy
- **REDII** includes C-in-soil measurements (Annex V)
- **EU Mission on Soil** (https://ec.europa.eu/info/horizon-europe-next-research-and-innovation-framework-programme/mission-area-soil-health-and-food_en)
- Soil is a key component in the new **EU Green Deal** (part of 6 in 9 EU Green Deal goals) and **UN SDGs**

IPCC LATEST REPORTS WELL ADDRESS BIOCHAR


Contents lists available at ScienceDirect

Soil Biology & Biochemistry

journal homepage: www.elsevier.com/locate/soilbio

Biochar stability in soil: Decomposition during eight years and transformation as assessed by compound-specific ^{14}C analysis

Yakov Kuzyakov[a,b,*], Irina Bogomolova[a], Bruno Glaser[c]

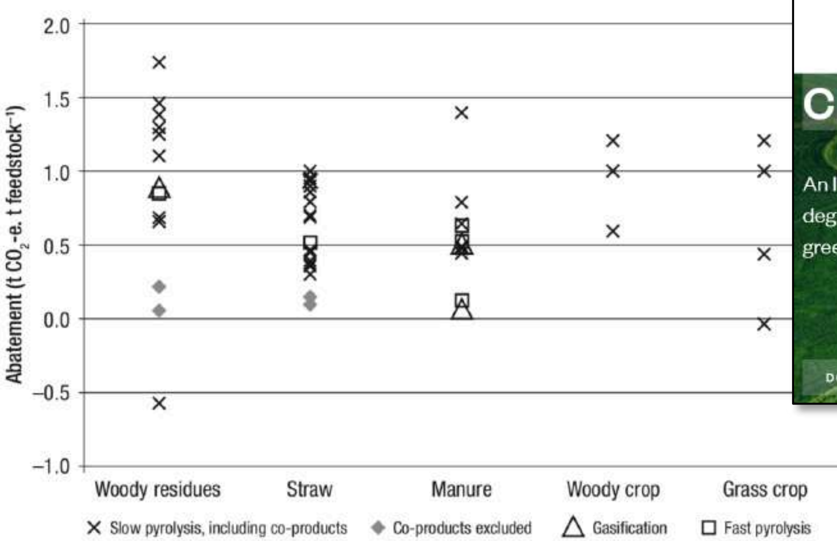
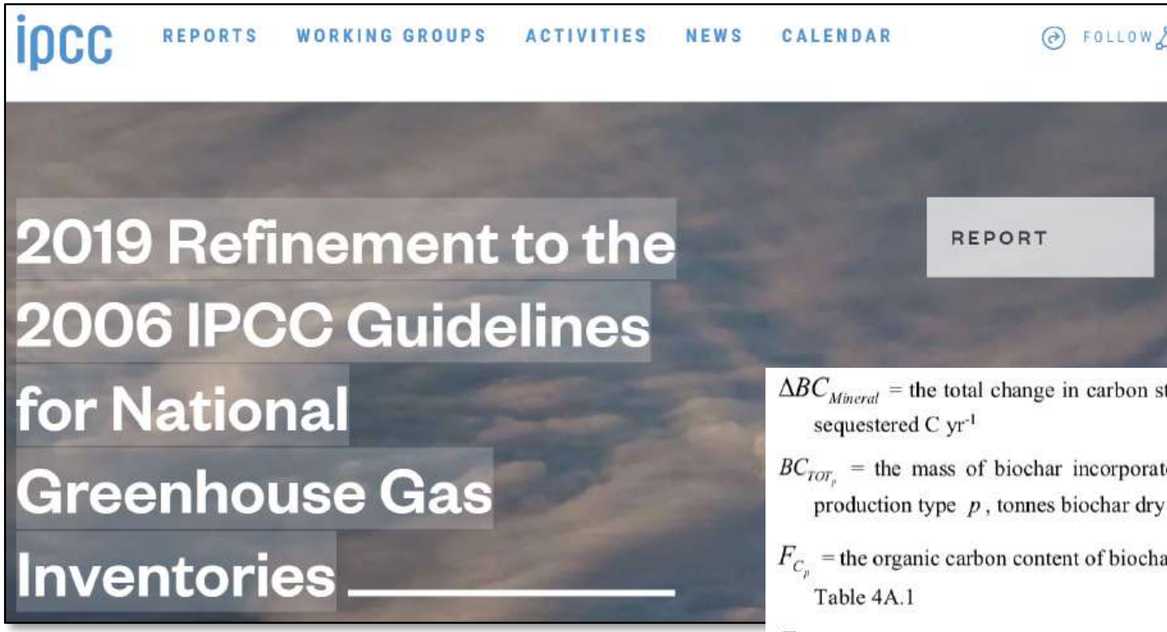


Figure 27.1 *GHG abatement per unit of feedstock dry matter, for a range of feedstocks, from LCA studies. 'Manure' also includes biosolids and poultry litter. The data sources are indicated in Table 27.1*

IPCC AND BIOCHAR: NEWLY DEVELOPED AND PUBLISHED ACCOUNTING FOR C-REMOVAL FROM BIOCHAR



GHG savings from biochar well documented by IPCC & other sources → Accounting is Possible

$\Delta BC_{Mineral}$ = the total change in carbon stocks of mineral soils associated with biochar amendment, tonnes sequestered C yr^{-1}

BC_{TOT_p} = the mass of biochar incorporated into mineral soil during the inventory year for each biochar production type p, tonnes biochar dry matter yr^{-1}

F_{C_p} = the organic carbon content of biochar for each production type p, tonnes C $tonne^{-1}$ biochar dry matter, Table 4A.1

F_{perm_p} = fraction of biochar carbon for each production type p remaining (unmineralised) after 100 years, tonnes sequestered C $tonne^{-1}$ biochar C, Table 4A.2

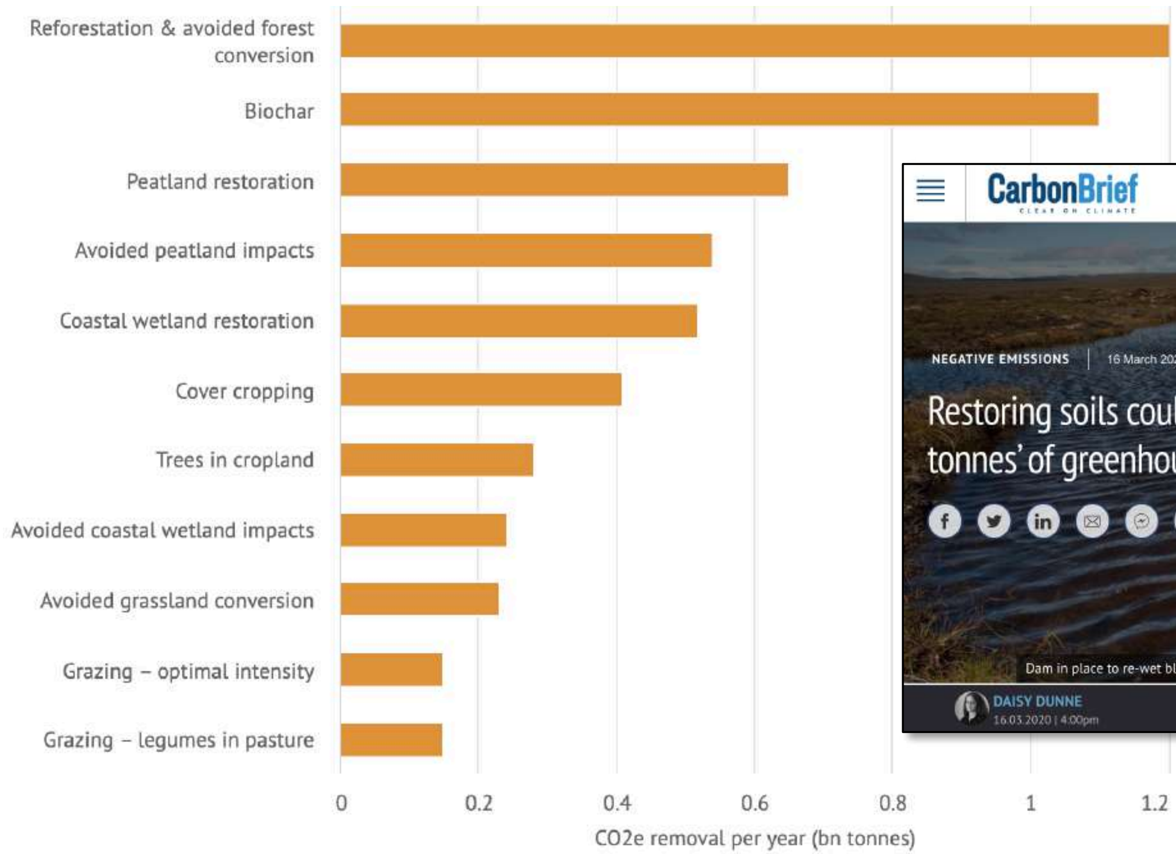
n = the number of different production types of biochar

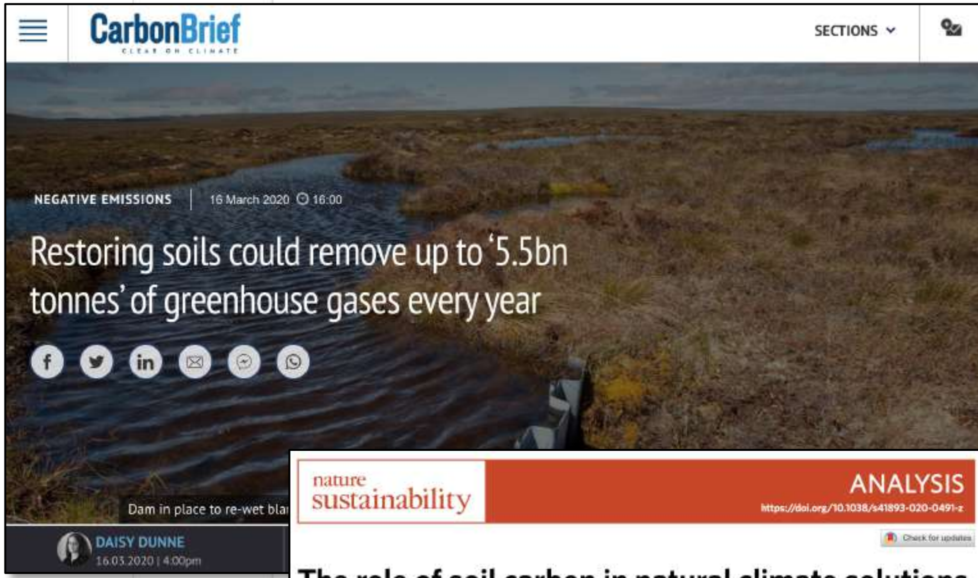
EQUATION 4A.1

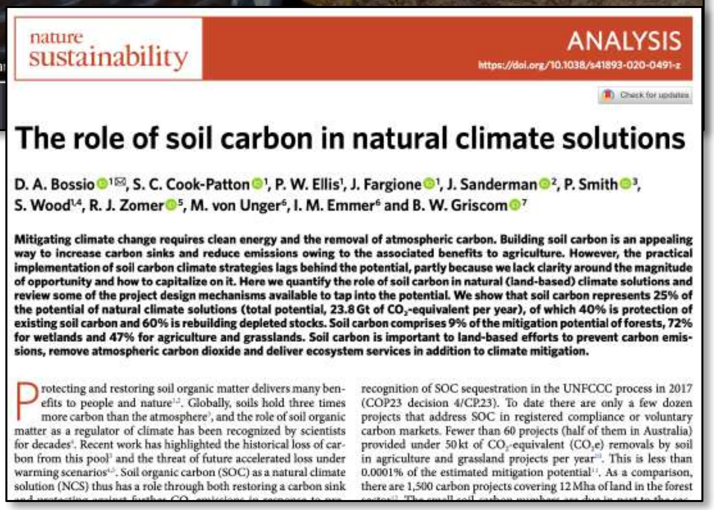
ANNUAL CHANGE IN BIOCHAR CARBON STOCK IN MINERAL SOILS RECEIVING BIOCHAR ADDITIONS

$$\Delta BC_{Mineral} = \sum_{p=1}^{n} \left(BC_{TOT_p} \bullet F_{C_p} \bullet F_{perm_p} \right)$$

BIOCHAR: HUGE POTENTIAL FOR C STORAGE







nature sustainability

ANALYSIS

https://doi.org/10.1038/s41893-020-0491-z

Check for updates

The role of soil carbon in natural climate solutions

D. A. Bossio[1], S. C. Cook-Patton[1], P. W. Ellis[1], J. Fargione[1], J. Sanderman[2], P. Smith[3], S. Wood[1,4], R. J. Zomer[5], M. von Unger[6], I. M. Emmer[6] and B. W. Griscom[7]

Mitigating climate change requires clean energy and the removal of atmospheric carbon. Building soil carbon is an appealing way to increase carbon sinks and reduce emissions owing to the associated benefits to agriculture. However, the practical implementation of soil carbon climate strategies lags behind the potential, partly because we lack clarity around the magnitude of opportunity and how to capitalize on it. Here we quantify the role of soil carbon in natural (land-based) climate solutions and review some of the project design mechanisms available to tap into the potential. We show that soil carbon represents 25% of the potential of natural climate solutions (total potential, 23.8 Gt of CO_2-equivalent per year), of which 40% is protection of existing soil carbon and 60% is rebuilding depleted stocks. Soil carbon comprises 9% of the mitigation potential of forests, 72% for wetlands and 47% for agriculture and grasslands. Soil carbon is important to land-based efforts to prevent carbon emissions, remove atmospheric carbon dioxide and deliver ecosystem services in addition to climate mitigation.

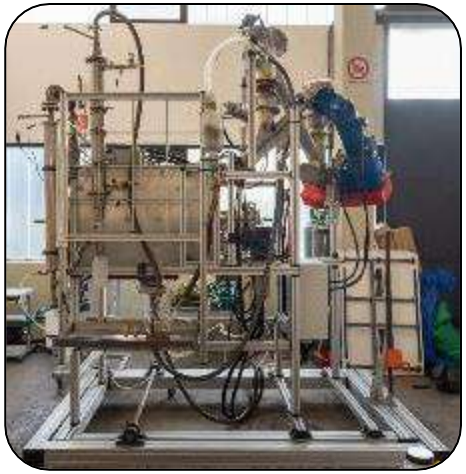
Protecting and restoring soil organic matter delivers many benefits to people and nature[1,2]. Globally, soils hold three times more carbon than the atmosphere[3], and the role of soil organic matter as a regulator of climate has been recognized by scientists for decades[4]. Recent work has highlighted the historical loss of carbon from this pool[5] and the threat of future accelerated loss under warming scenarios[6,7]. Soil organic carbon (SOC) as a natural climate solution (NCS) thus has a role through both restoring a carbon sink

recognition of SOC sequestration in the UNFCCC process in 2017 (COP23 decision 4/CP.23). To date there are only a few dozen projects that address SOC in registered compliance or voluntary carbon markets. Fewer than 60 projects (half of them in Australia) provided under 50 kt of CO_2-equivalent (CO_2e) removals by soil in agriculture and grassland projects per year[10]. This is less than 0.0001% of the estimated mitigation potential[11]. As a comparison, there are 1,500 carbon projects covering 12 Mha of land in the forest

Biochar production facilities at Re-Cord

Rotary Kiln
Slow pyrolysis of biomass & waste to fuels and products

- Solid (as fuel or amendment) + high T heat
- Integration in large-scale Advanced Biofuel supply chain
- IN=100 kg/h



CarbOn RE-CORD
Slow pyrolysis of biomass for charcoal and biochar making.

- Fixed bed, Open-top Oxidative Reactor (Autothermal)
- Designed and developed for small farmers
- Continuous operation.
- IN=50 kg/h. OUT=12kg/h
  (ηc = 24 wt.%)

Intermediate pyrolysis
Pilot Demo Unit

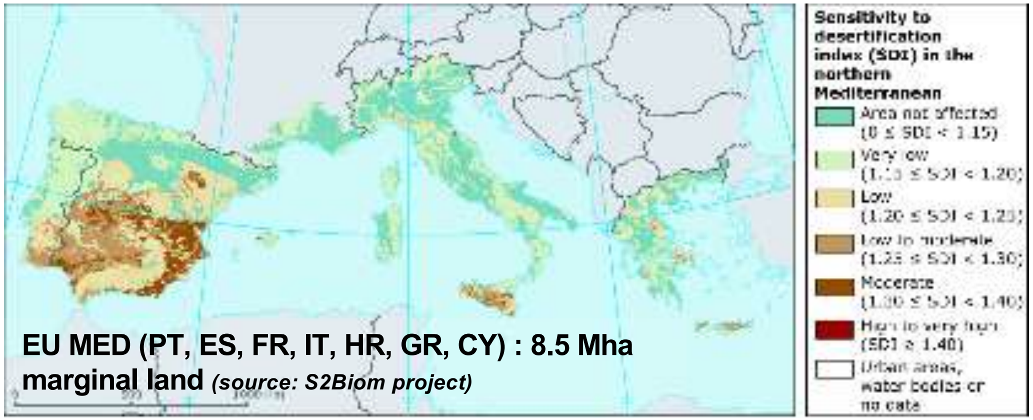
Many uses of Biochar

- ✓ *Animal Feed, Biogas/Biomethane, Metallurgy, Buildings, Water Treatment, Air Treatment, Textiles, Food, Preserving, Colour, Medicine, Cosmetics, Electronics, Batteries, Industrial Materials, Dessiccant, etc..*

Source*: *Ithaka institute: «55 uses of Biochar»

→We will focus on Biochar use in sustainable agriculture

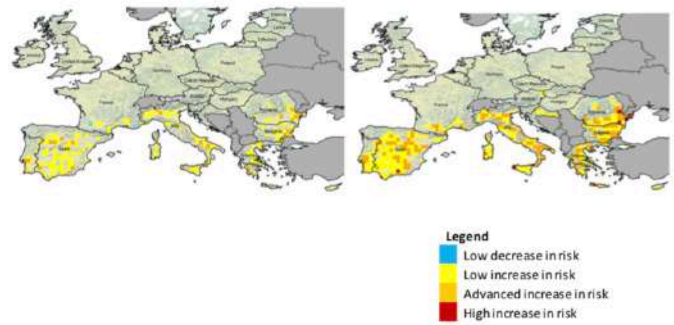
ROOM EXIST FOR MANY VALUE CHAINS: EU-MED



EU MED (PT, ES, FR, IT, HR, GR, CY) : 8.5 Mha marginal land ***(source: S2Biom project)***

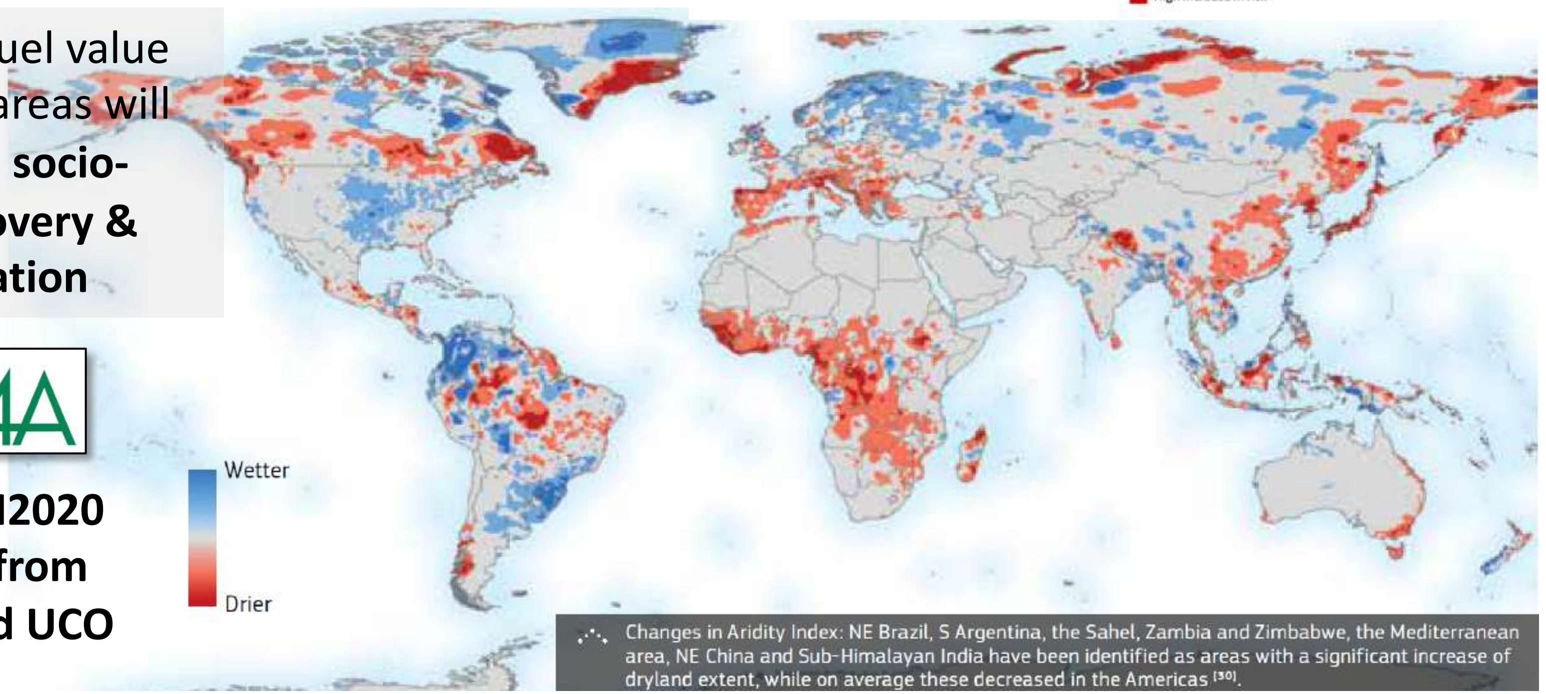
Figure 3 – Predicted change in desertification risk and aridity index in 2071-2100 compared to 1981-2010

– Predicted change in desertification risk[24] under 2.4°C scenario (RCP 4.5 – left) and 4.3°C scenario (RCP 8.5 – right) in 2071-2100 compared to 1981-2010[25].



Developing biofuel value chains in these areas will promote both **socio-economic recovery & decarbonization**

BIO4A: >10 M€ H2020 project on SAF from marginal land and UCO



Changes in Aridity Index: NE Brazil, S Argentina, the Sahel, Zambia and Zimbabwe, the Mediterranean area, NE China and Sub-Himalayan India have been identified as areas with a significant increase of dryland extent, while on average these decreased in the Americas [30].

Source: EC-JRC. World Atlas of Desertification, 3rd Edition. Mapping Land Degradation and Sustainable Land Management Opportunities. 2015. http://wad.jrc.ec.europa.eu

Bio4A

- **COMBI** produced, characterized and tested in two sites in Spain, in the framework of the H2020 BIO4A project on HEFA biojet (**www.bio4a.eu**)

Biomass Conversion and Biorefinery
https://doi.org/10.1007/s13399-019-00482-6

ORIGINAL ARTICLE

Check for updates

Production and characterization of co-composted biochar and digestate from biomass anaerobic digestion

David Casini[1] · Tommaso Barsali[1] · Andrea Maria Rizzo[1] · David Chiaramonti[1,2]

Open Access

Received: 30 March 2019 / Revised: 15 July 2019 / Accepted: 16 July 2019

Abstract
Biochar, produced through pyrolysis of lignocellulosic biomass, is attracting increasing interest as soil amendment thanks to its potential numerous benefits to agriculture, as well as its ability to sequester carbon in soil. Solid fraction of digestate from anaerobic digestion is a well-known N-rich substrate, most often composted in large and small agro-industrial plants. Co-composting biochar and digestate has the potential to synergistically increase the agronomic value of both components: however, it needs further process and on-field research. The present research work reports on the experimental tests on producing biochar and co-composting various biochar amounts with digestate from biomass anaerobic digestion (product here named COMBI). Biochar was produced by feeding wood chips from chestnut to an innovative oxidative reactor. In order to evaluate the quality of the products obtained by composting and co-composting, correlating this with the final biochar rate in the material, the net organic matter yield, the humified organic matter, the compliance with the European Compost Network Quality Assurance Scheme (ECN-QAS) limits for inorganic pollutants, and the product stabilization and sanitization indexes were investigated. The 11.2% *w/w* d.b. biochar rate in the initial blend (19.8% *w/w* d.b final concentration in the co-composted products) offered the best performances and is recommended for further investigation. Additional benefits from co-composting were also assessed, as the reduced dust load that favors safety and health during logistics and use.

Keywords Biochar · Compost · Digestate · Co-composting · Soil amendment

1 Introduction

Sustainable production of biomethane is a key option to substitute conventional natural gas and decarbonize the energy system [1]: anaerobic digestion (AD) is the leading route to generate biogas, which can then be further upgraded to biomethane by CH4 separation. Today, the AD process is a well-mature process, bringing environmental and social benefits at both local and global level [2, 3]: the main co-product of biomass anaerobic digestion is a sludge (digestate), which can be applied to soil for agronomic purposes as an organic amendment. Composting is another well-known pathway to stabilize organic matter of various origins through a bio-oxidative process [4], which brings benefits as volume reduction, sanitization from pathogens, reduction of liquid contaminants, and economic and environmental returns [5, 6]. In anaerobic digestion plants, the composting stage of the solid fraction of digestate generally occupies large volumes and requires long residence time, in addition to complex logistical steps [7, 8]. The addition of a bulking agent in the compost pile is normally recommended, in particular when substrates as digestates are used. The small particle size of the material generates risks of anaerobic conditions within the pile, leading to the production of undesired phenomena as ammonia volatilization [9, 10].

Biochar is the solid product from lignocellulosic biomass pyrolysis, characterized by a high content of stable C, mostly produced through slow pyrolysis. Biochars from intermediate/fast pyrolysis and gasification are often discussed in literature, even if these show different characteristics. Biochar is a highly porous material with a wide range of possible uses, including

Electronic supplementary material The online version of this article (https://doi.org/10.1007/s13399-019-00482-6) contains supplementary material, which is available to authorized users.

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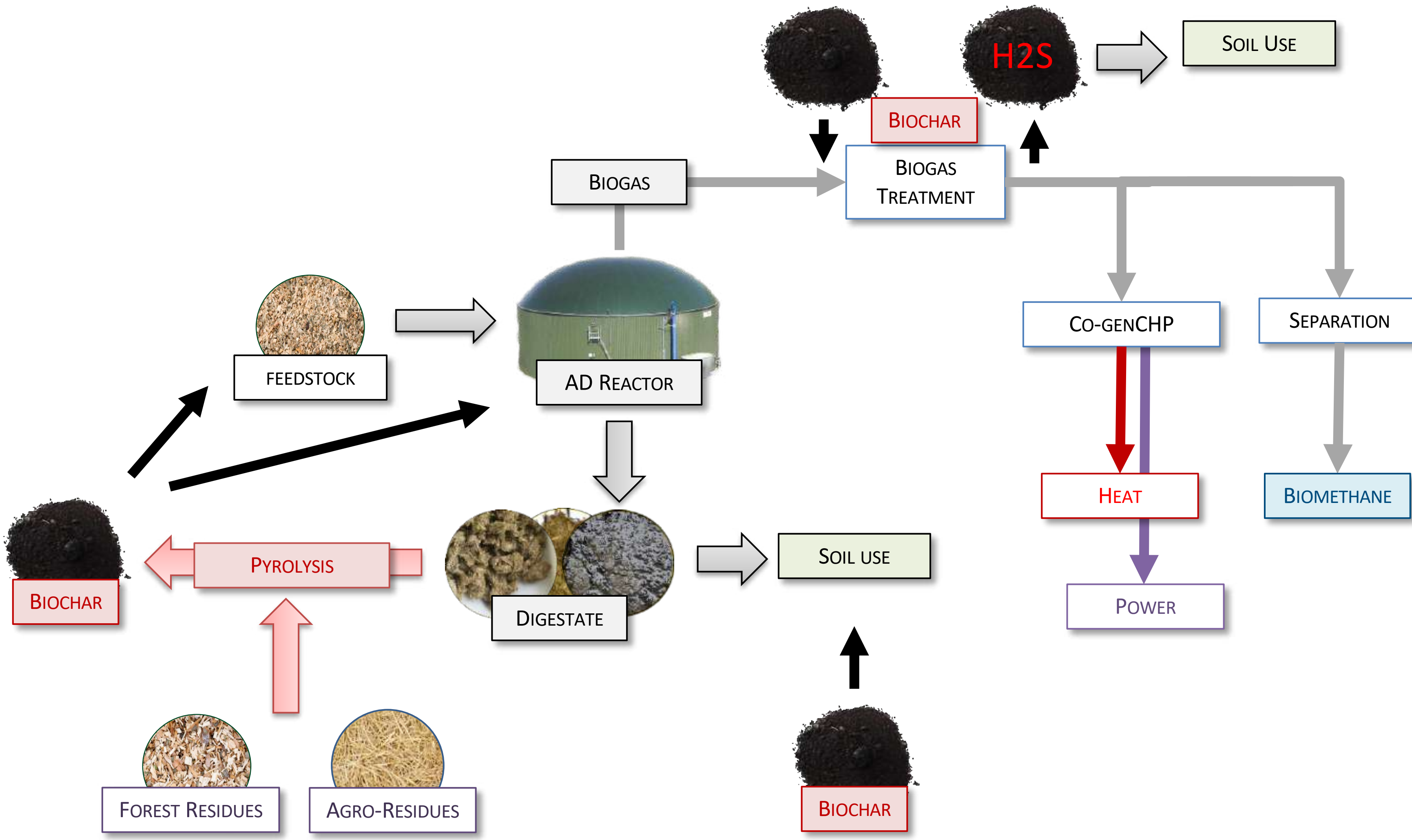
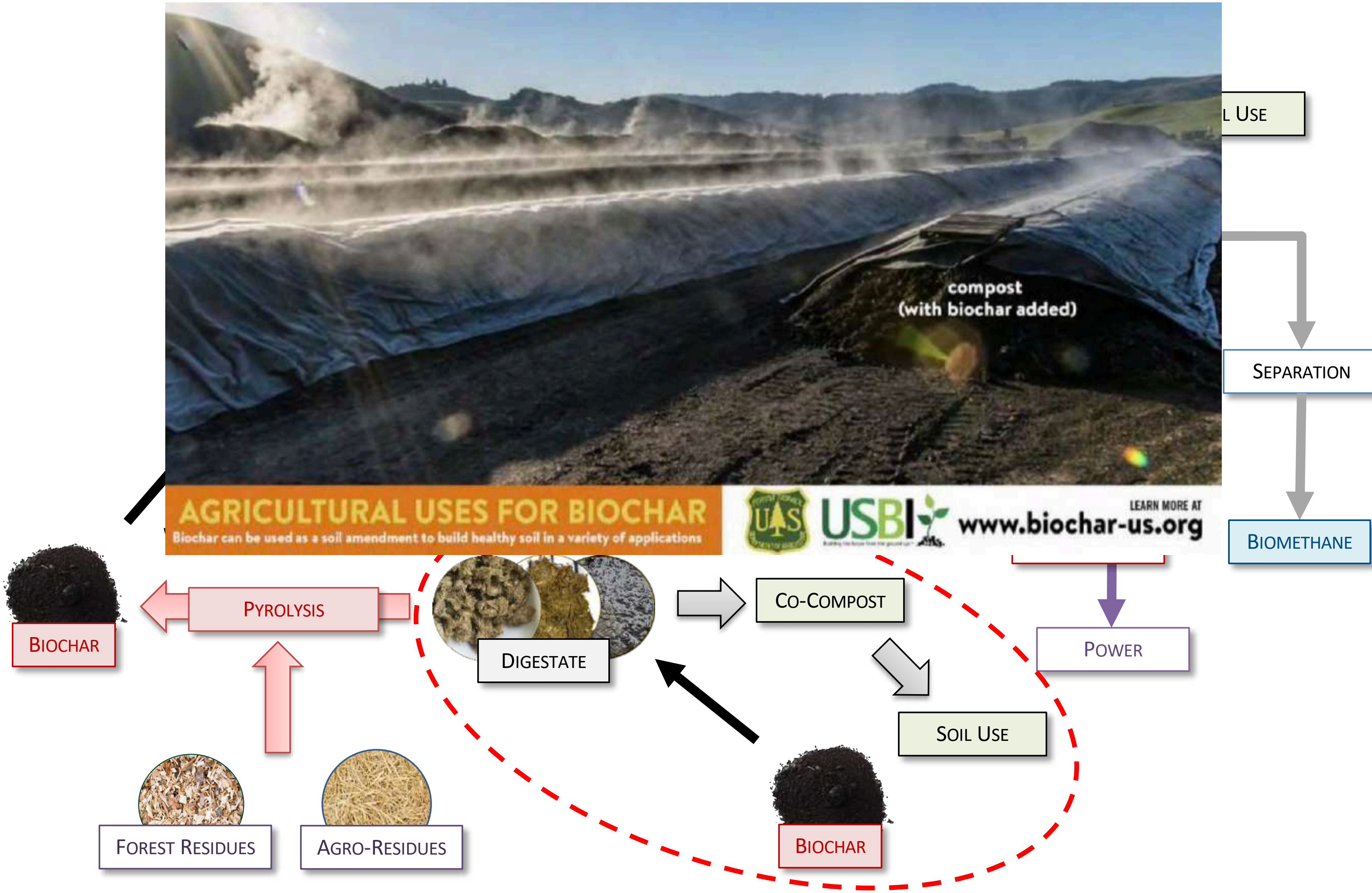
Springer

Biochar & Anaerobic Digestion



Biochar & Anaerobic Digestion



BIO4A: >10 M€ H2020 project on SAF from marginal land and UCO

RE-CORD · TOTAL · SkyNRG · CENER · etaflorence renewableenergies · Camelina Company | España · European Commission

A

No fertilization	1	2	3	4
NPK	5	6	7	8
10% Biochar + Compost	9	10	11	12
15% Biochar + Compost	13	14	15	16
20% Biochar + Compost	17	18	19	20
100% Biochar + NPK	21	22	23	24
100% Compost	25	26	27	28
	Rep 1	Rep 2	Rep 3	Rep 4

B C D

Field trials: Ciudad Real (ES)

Background fertilization: 11/01/19

Seeding date: 14/01/19

Camelina Company | España

No fertilization

Mineral fertilization

100% Compost

100% Biochar

Biochar+ Compost 10%

Farm to Fork, Agriculture, and Biomethane

European Commission

From Farm to Fork

Our food, our health, our planet, our future

The use of pesticides in agriculture contributes to pollution of soil, water and air.

The Commission will take actions to:

- **reduce by 50%** the use and risk of chemical pesticides by 2030.
- **reduce by 50%** the use of more hazardous pesticides by 2030.

The **excess of nutrients** in the environment is a major source of air, soil and water pollution, negatively impacting biodiversity and climate. The Commission will act to:

- **reduce nutrient losses by at least 50%**, while ensuring no deterioration on soil fertility.
- **reduce fertilizer use by at least 20%** by 2030.

Antimicrobial resistance linked to the use of antimicrobials in animal and human health leads to an estimated 33,000 human deaths in the EU each year. The Commission will **reduce by 50% the sales of antimicrobials for farmed animals and in aquaculture by 2030.**

Organic farming is an environmentally-friendly practice that needs to be further developed. The Commission will boost the development of EU organic farming area with the aim to achieve **(25 % of total farmland) under organic farming by 2030.**

BIOENERGY AS ENABLER OF SUSTAINABLE AGRICULTURE AND SOCIO-ECONOMIC RECOVERY

Feedstock Production → Feedstock Conversion → Fuel Delivery → Fuel Use → GHG Chain Assessment

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

Multi-Feedstock Multi-Annual Production Design → Multiple Products → Multiple Markets → Product Use

- Food
- Feed
- Energy
- Fuels
- Materials

Products for Sustainable Agriculture Model and Soil Recovery & Improvement

Bioenergy & Bioeconomy can make ***agriculture more sustainable*** *(beyond GHGs, towards* ***SDGs****) and* ***support the Economic Recovery***

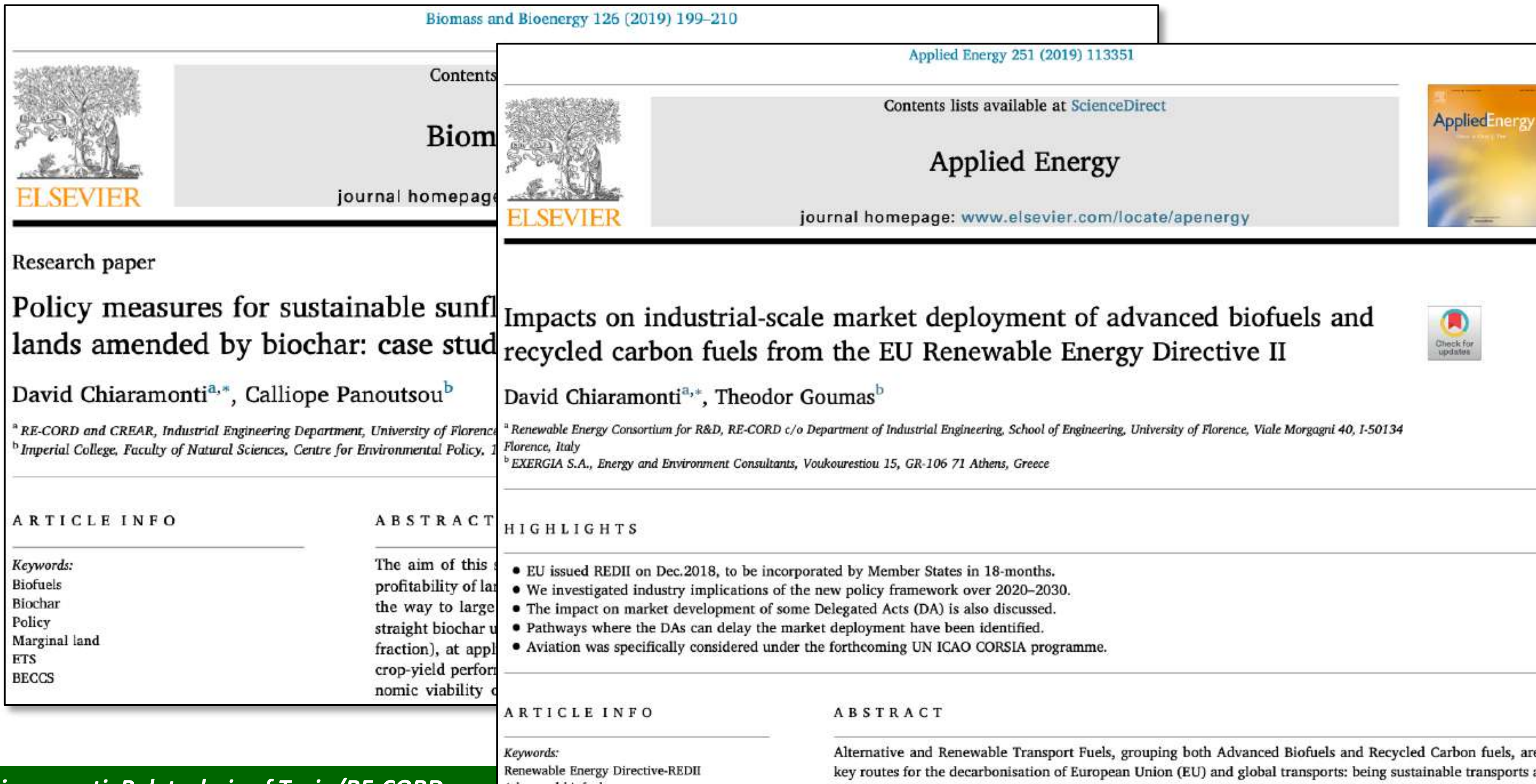
From linear to circular, from energy-driven to sustain.agricultural models

Well-designed domestic biomass value chain support post Covid19 economic recovery & bring Carbon back to soil

Sector Integration/Coupling requires Policy Integration

TRANSPORT FUELS: A POLICY DRIVEN ECONOMY

- Large-scale deployment of RRCF is a **(multiple) policy-driven matter** (EU: LULUCF in CAP)
- **Policies must interact to improve impacts**. Studies needed to provide policy makers with recommendations.



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Policy measures for sustainable sunfl
lands amended by biochar: case stud

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Policy
Marginal land
ETS
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ABSTRACT

The aim of this
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nomic viability

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Applied Energy

journal homepage: www.elsevier.com/locate/apenergy

ELSEVIER

Impacts on industrial-scale market deployment of advanced biofuels and recycled carbon fuels from the EU Renewable Energy Directive II

Check for updates

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HIGHLIGHTS

- EU issued REDII on Dec.2018, to be incorporated by Member States in 18-months.
- We investigated industry implications of the new policy framework over 2020–2030.
- The impact on market development of some Delegated Acts (DA) is also discussed.
- Pathways where the DAs can delay the market deployment have been identified.
- Aviation was specifically considered under the forthcoming UN ICAO CORSIA programme.

ARTICLE INFO

Keywords:
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Advanced biofuels

ABSTRACT

Alternative and Renewable Transport Fuels, grouping both Advanced Biofuels and Recycled Carbon fuels, are key routes for the decarbonisation of European Union (EU) and global transports: being sustainable transports a policy-driven area, the development and deployment of advanced biofuels and recycled carbon fuels will depend

CONCLUSIONS

Based on Covid-19 first analysis of impacts on the transport fuel sector, Policy Makers should consider acting at two different timescales:

- **SHORT/MEDIUM-TERM** goals – **Assist fuel companies to overcome the collapse of demand** and the economic shock, **preserving direct and indirect jobs and business**
- **MEDIUM/LONG-TERM** goals – Increase the ambition and promote **higher amounts of domestic Renewable and Low Carbon Fuels, injecting post-Covid recovery resources on green domestic supply and conversion chains**.

To be carefully monitored and accounted for:

- **Rebound effects** (shift to private transports)
- **Systemic** vs **short-term business-oriented benefits**
- **Resource spending** (Non-Performing Loans NPL - Zombie firms)

→ **Farm-scale decentralized biorefinery models** will enhance benefits

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