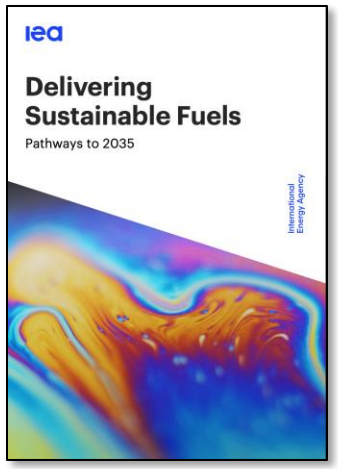
Le fondamenta della bioraffineria agricola: ricerca, dati e bioeconomia

David Chiaramonti
CEM BFP, Politecnico di Torino

Politecnico di Torino

F4F
Fit4Foresight - Fuel

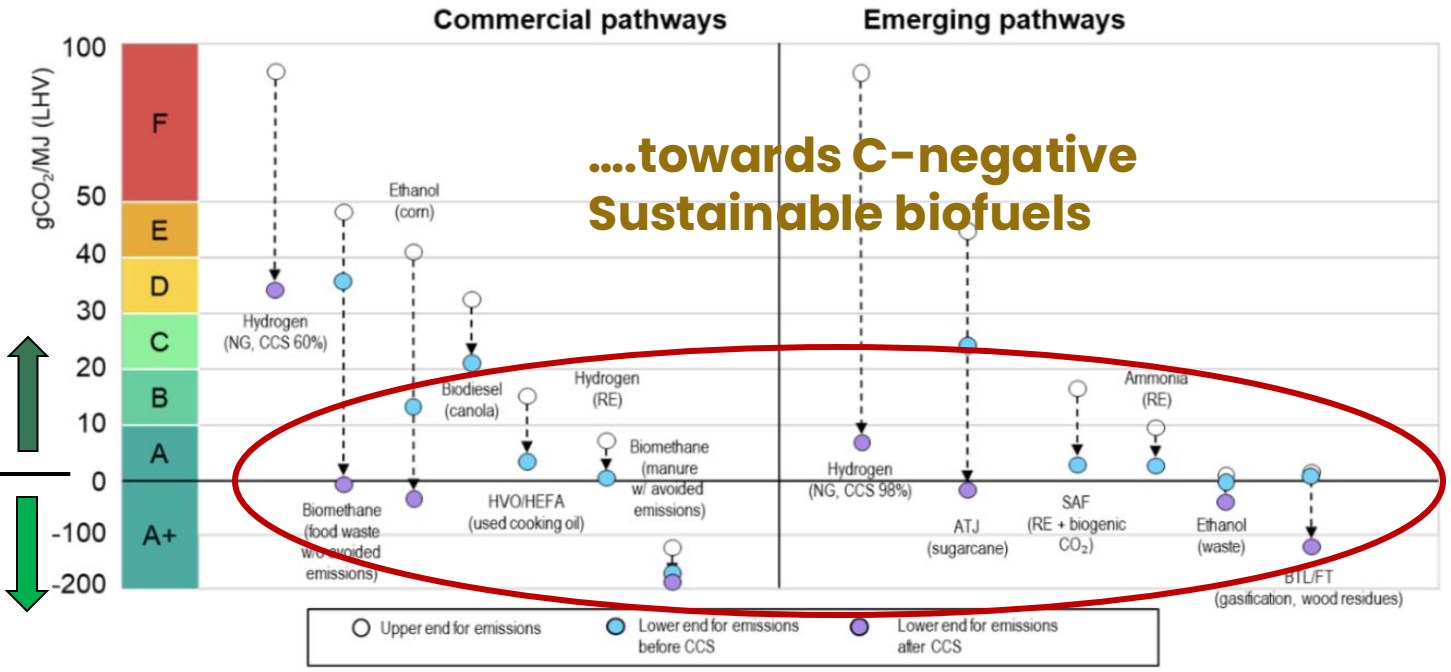
GHG performances & Labelling



Low Carbon

Carbon Negative (CDR)

Figure 4.3 Lifecycle GHG emission ranges for selected fuel pathways



IEA. CC BY 4.0.

How is it possible?

- **More organic Carbon in coproducts** (residues) than in main product
- Wording is important… **Organic Carbon is not a residue**, it has a high-value for soil, agriculture & environment
- **High GHG performing fuels essential** to the alternative fuel mix to reach 2040-2050 GHG targets

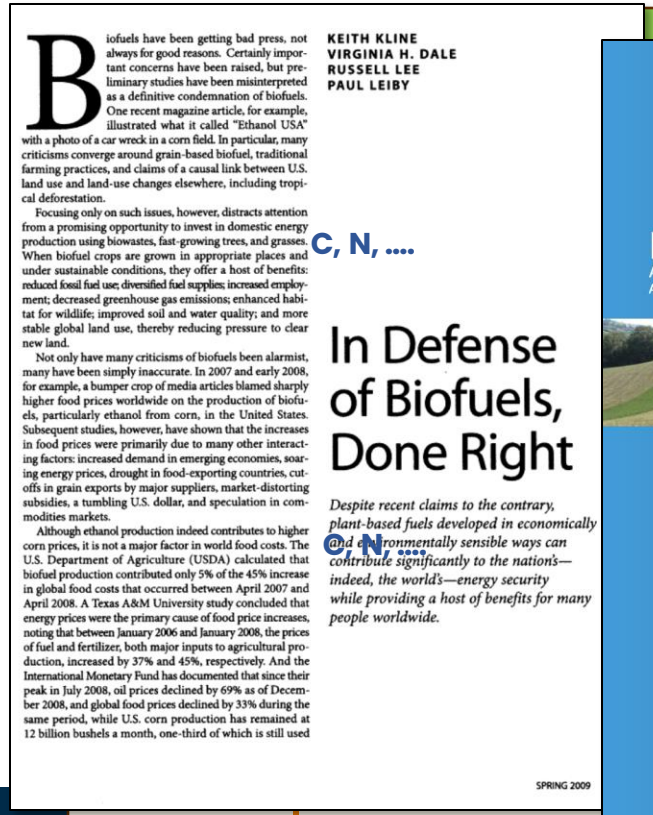
This Carbon can be used towards two targets

- **Sustainable Fuels (RED: e_{SCA}, ICAO: F^{SCA})**
- **Carbon Removals**

Biogenic Carbon is essential to Carbon Negative

“Biofuels Done Right”: C-Negative & sustainable farming

- Food/feed primary production suffer from climate change impacts: more “fossil” use in agriculture
- Energy can support food/feed production while removing CO2 from the atmosphere:
  - ✓ *improved soil resilience to climate change via sustainable farming and soil health*
- From LOW Carbon, to Carbon NEUTRAL, to Carbon NEGATIVE and CO-BENEFITS & “MADE IN EU”



Biofuels have been getting bad press, not always for good reasons. Certainly important concerns have been raised, but preliminary studies have been misinterpreted as a definitive condemnation of biofuels. One recent magazine article, for example, illustrated what it called "Ethanol USA" with a photo of a car wreck in a corn field. In particular, many criticisms converge around grain-based biofuel, traditional farming practices, and claims of a causal link between U.S. land use and land-use changes elsewhere, including tropical deforestation.

Focusing only on such issues, however, distracts attention from a promising opportunity to invest in domestic energy production using biowastes, fast-growing trees, and grasses. When biofuel crops are grown in appropriate places and under sustainable conditions, they offer a host of benefits: reduced fossil fuel use; diversified fuel supplies; increased employment; decreased greenhouse gas emissions; enhanced habitat for wildlife; improved soil and water quality; and more stable global land use, thereby reducing pressure to clear new land.

Not only have many criticisms of biofuels been alarmist, many have been simply inaccurate. In 2007 and early 2008, for example, a bumper crop of media articles blamed sharply higher food prices worldwide on the production of biofuels, particularly ethanol from corn, in the United States. Subsequent studies, however, have shown that the increases in food prices were primarily due to many other interacting factors: increased demand in emerging economies, soaring energy prices, drought in food-exporting countries, cutoffs in grain exports by major suppliers, market-distorting subsidies, a tumbling U.S. dollar, and speculation in commodities markets.

Although ethanol production indeed contributes to higher corn prices, it is not a major factor in world food costs. The U.S. Department of Agriculture (USDA) calculated that biofuel production contributed only 5% of the 45% increase in global food costs that occurred between April 2007 and April 2008. A Texas A&M University study concluded that energy prices were the primary cause of food price increases, noting that between January 2006 and January 2008, the prices of fuel and fertilizer, both major inputs to agricultural production, increased by 37% and 45%, respectively. And the International Monetary Fund has documented that since their peak in July 2008, oil prices declined by 69% as of December 2008, and global food prices declined by 33% during the same period, while U.S. corn production has remained at 12 billion bushels a month, one-third of which is still used

KEITH KLINE
VIRGINIA H. DALE
RUSSELL LEE
PAUL LEIBY

SPRING 2009

C, N, ...

In Defense of Biofuels, Done Right

Despite recent claims to the contrary, plant-based fuels developed in economically and environmentally sensible ways can contribute significantly to the nation's—indeed, the world's—energy security while providing a host of benefits for many people worldwide.

C, N, ...

methane

BIOGASDONERIGHT®

ANAEROBIC DIGESTION AND SOIL CARBON SEQUES
A SUSTAINABLE, LOW COST, RELIABLE AND WIN WIN BECCS



Modeling and Analysis

Biofpr

The potential for expanding sustainable biogas production and some possible impacts in specific countries

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Abstract: Current food production practices tend to damage and deplete soil, diminish biodiversity, and degrade water supplies. For agriculture to become environmentally sustainable and simultaneously increase food output for a growing world population, fundamental changes in agricultural production systems are required. Renewable energy can reduce greenhouse gases (GHGs) but we also need simple, low-cost approaches to remove atmospheric carbon and sequester it in stable forms. Recycling of digestate from the anaerobic digestion of agricultural and waste materials to soils can sequester atmospheric carbon and provide many other economic, social and environmental benefits. Biogasdoneright™ (BDR) is a set of practices that link biogas production with sustainable agriculture. The BDR approach to sustainable agriculture is being implemented on a large scale in Italy. In this paper, we examine the potential impact of implementing BDR in selected other countries. The biomethane potential in these countries, estimated conservatively, varies from about 10–30% of their current annual natural gas consumption. Biomethane from sequential (double) crops provides by far the greatest fraction of the biomethane potential. Double cropping also drives many of the environmental and economic benefits of BDR systems. Depending on where and how widely it is implemented, the production of biogas in BDR systems could have very significant national-level impacts. For example, sufficient biomethane could

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C, N, ...

Biochar

Bio4A

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



Quale orizzonte temporale e quale integrazione?

Le integrazioni dirette tecnicamente possibili sono numerose, ma deve essere tenuta in considerazione la taglia caratteristica della filiera biogas/biometano e della tecnologia da integrare

Digestione Anaerobica e Pirolisi : maggior produzione di Biometano (Avanzato), Biochar, e Nutrienti

Benefici **:**

- ***Maggior produzione di BioCH4 avanzato***
- ***Biochar per***
  - ***miglior GHG biofuel o***
  - ***crediti o***
  - ***altre industrie (Acciaio)***

Orizzonte temporale **: *immediato, breve termine***

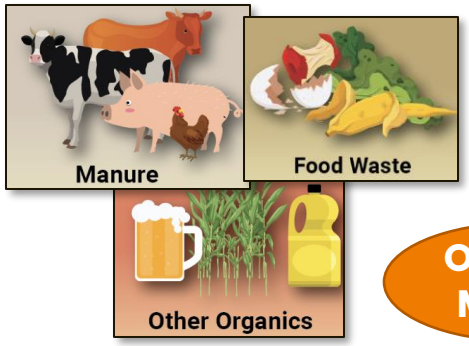
Altre numerose integrazioni indirette possibili.

Tra queste

- Biometano per produzione di Acciaio (impiegando GO)
- CO2 per CCS e CCUS

Orizzonte temporale **: *sia breve che medio-lungo termine***

Digestione Anaerobica e Pirolisi : Biometano (Avanzato), Biochar, Nutrienti



Make up water



Organic Matter

Anaerobic Digestion

Biogas

CH_4

CO_2

CCS, CCUS Other uses

Digestate

Liquid digestate

Solid digestate

APL

Patented

Nutrients

Leaching

Patented

Biochar





Gas

Oil/APL/Gas separation

Pyrogas

Oil

Slow Pyrolysis (*Carbonization*)

Moisture Reduction

Other Lignocell Biomass

Patented



Sustainable Fuels and Carbon: main EU/INT Policies

Very **complex** and **continuously evolving** legislative environment – **Opportunities & Barriers**

In force:

- **REDII/REDII–IR** and **REDIII** on **Sustainable Biofuels**
- **ReFuelEU Aviation** and **FuelEU Maritime**
- **CRCF**: **Carbon Removals and Carbon Farming**, DG Clima. Relevant to voluntary and (possibly) mandated (ETS revision, EC proposal in 2026) carbon markets
- **ICAO** for **SAF**

Incoming:

- **CO2 Regulation** (for Passenger cars/LDV, HDV)
- **996 RED Implementing Regulation** (intermediate crop, soil carbon)
- **New EU RED**
- **EU ETS**: 2026 revision; **ETS2**, delayed to end 2026, on buildings and road transport sector and fuels for additional sector
- **IMO**: announced April 2025, decision postponed to late 2026

CARBON at the core of policy.
Biofuels moving towards GHG saving targets more than Volume/Energy.
Opportunity for Biogas and Biofuels


Thanks for your attention
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