



# R&D in thermochemical and biochemical biomass conversion at RE-CORD

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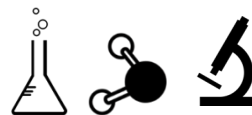
28.03.2019

Rural Development Innovation Week

ANNUAL EVENT OF THE TUSCANY REGION RDP EAFRD 2014-2020



- ✓ **Public-private no profit research Institution**
- ✓ **Funded & participated by the **Univ.of Florence****
- ✓ **Biomass / Bioenergy / Bioproducts → BIOECONOMY**



### MISSION

Generating **Knowledge** through **Innovation** and valorization of **Competences** in the Renewable Energy, **Bioeconomy** and **Sustainable Development** sectors, in a **Circular Economy** scheme

## MEMBERS

### Public

#### **Univ. of Florence**

- **CREAR** – Interdepartmental Center led by the Industrial Engineer.Dept.
- **Montepaldi** – Florence University Special Farm.

### Mixed Public-Private, no profit

**Start GAL Srl** No-profit Development Agency operating in the Florence/Prato Metropolitan area

### Private

#### **Bioentech**

*Innovative Start-up on thermochem.conversion.*

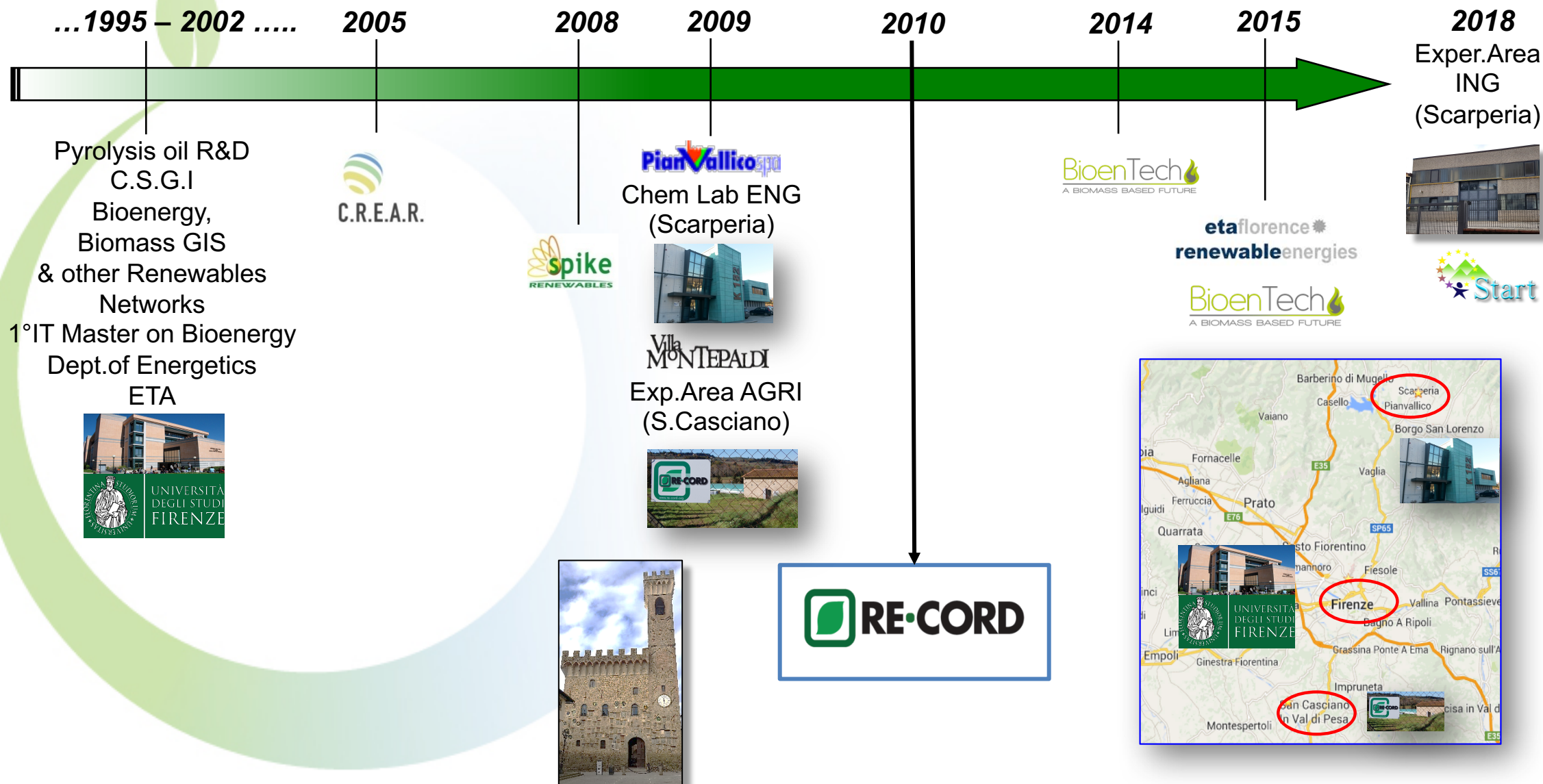
#### **Spike Renewables**

*Engineer. company specialized in energy projects.*

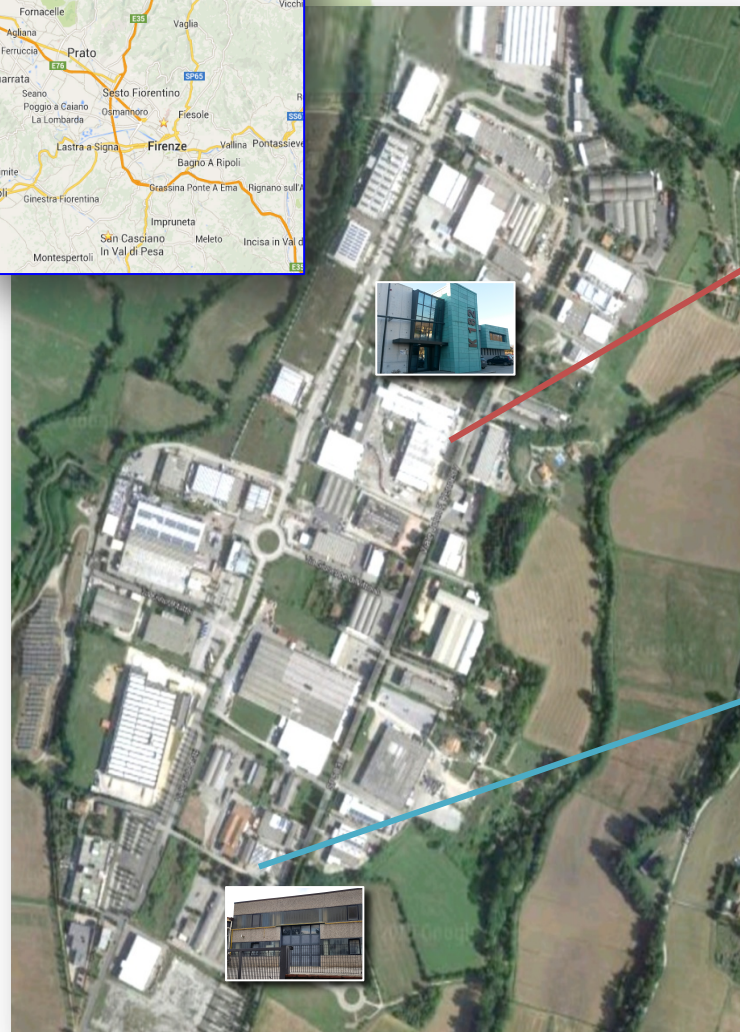
#### **ETA-Florence**

*Communication, Dissemination, Intern.projects.*









# RE-CORD

LABORATORY  
(>350 m2)



WORKSHOP  
(>500 m2)  
PILOT/DEMO  
PLANTS





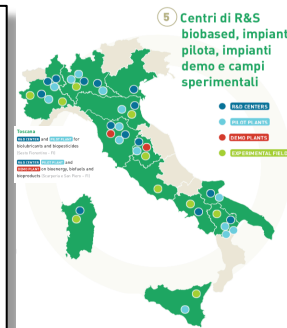
**R&D PLATFORM:** Experimental facilities, analytical capabilities, & skilled personnel to support industrial R&D and innovation on bioenergy and bioeconomy/bioproducts.

- **Characterization of feedstocks and products** (*gaseous, liquid, solid; > 5000 parameters analyzed during 2018*)
- **Pyrolysis & Gasification of biomass and co-products** (as lignin-rich stream)
- **Biofuels:** process and component development & testing (*assistance to leading Biofuels and Bioproduct companies in developing and testing processes: liquid & gaseous transport fuels*)
- **Biochar:** production and development of biochar-derived products & integration in biorefinery and supply chains (*several in-house developed technologies and know-how*)
- **Algae** cultivation technologies, design of industrial plants, downstream processing
- **Policies & market** analysis/studies (*Institutional and for private clients*)
- **Education, Training and communication**
- **Transfer of know-how**



# RE-CORD's and the Tuscany Region Strategy on BIOECONOMY

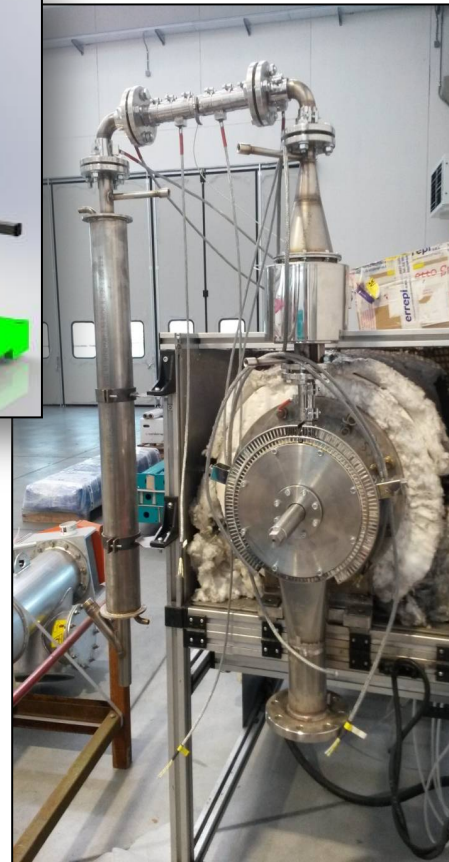
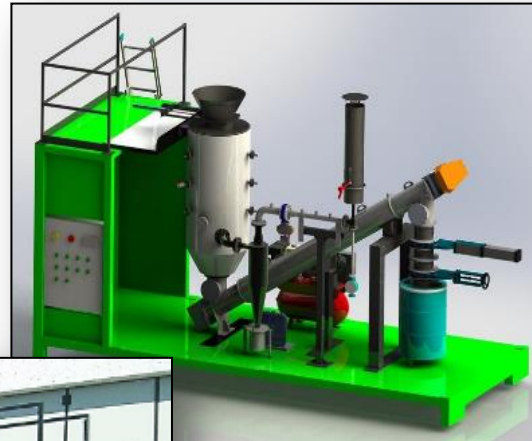
- Giornata di Studio sulla Bioeconomia (**Bioeconomy day**) 24.10.17
  - **Main RT Chains:** 1) *Agriculture*, 2) *Forestry*, 3) *Urban Waste*, 4) *Industrial wastes*, 5) *Marine waters + ENERGY*
  - *Actions and priorities preliminary selected (Circular Economy)*
- RE-CORD Institutional activities fully in line with RT Strategy
  - RE-CORD is member of the **CTS** (Scientific Technical Committee) of the IT Green Chemistry Cluster **SPRING**, mentioned as an excellence in the **IT Strategy on Bioeconomy and International Media (Digest)**.
  - RE-CORD is **transferring know-how and technologies to the Regional context** + catalyzing competences (examples given in following slides).
  - RE-CORD **networks** RT actions to the **EU R&D**, market development and stimulation of investments.





# Biomass Thermochemical Conversion

- Pyrolysis (Slow-Carbonisation, Interm., Fast)
- Hydrothermal processing (Liquefaction-HTL, Carbonization-HTC)
- Gasification
- Combustion



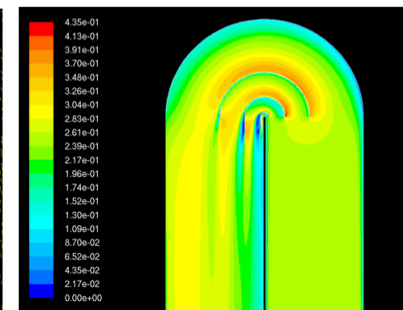
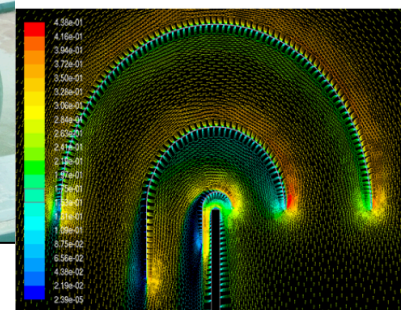
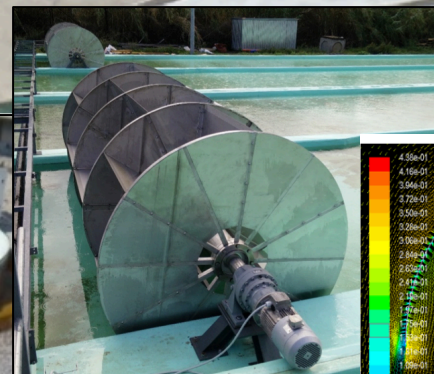
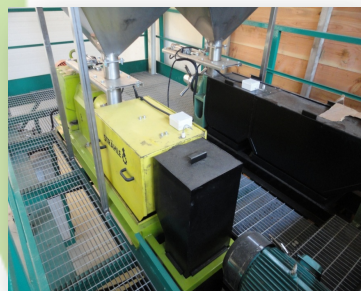
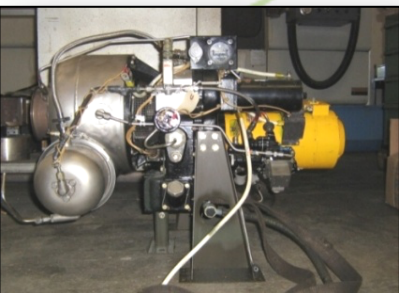


# Veg Oils, Biofuels, Biojet

- R&D on Production and use in Turbines and Engines

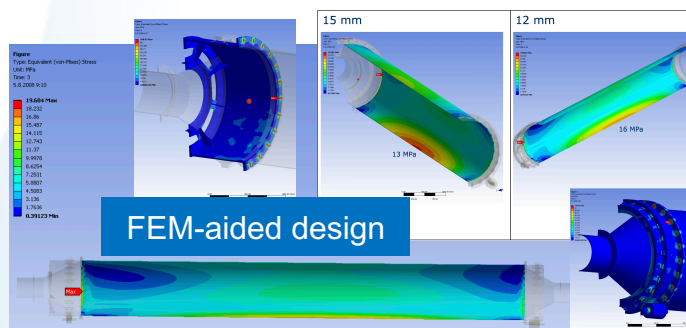
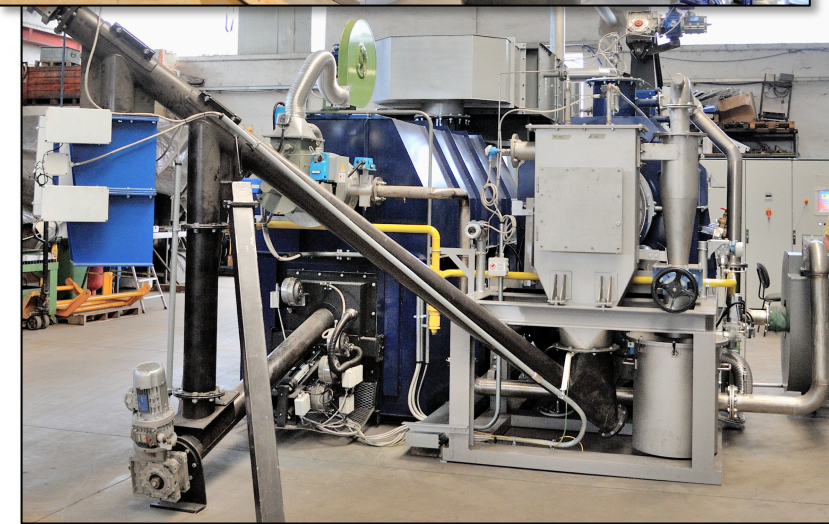
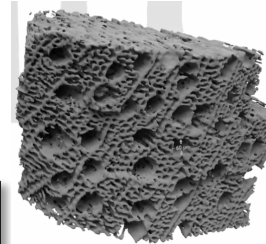
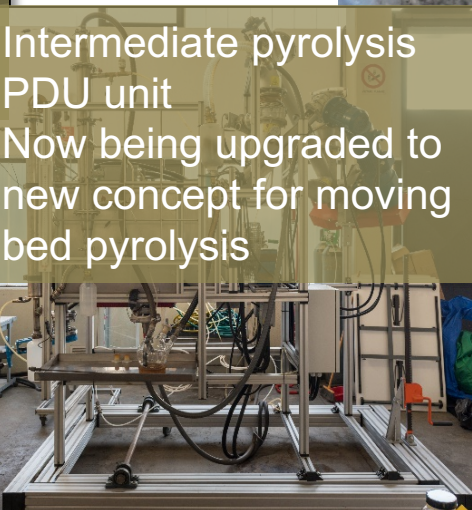
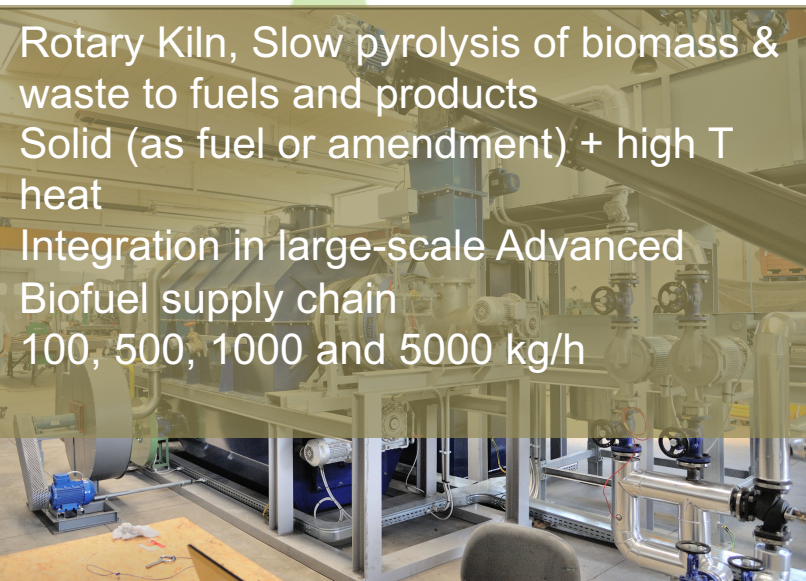
## Algae

- Engineering & Design of plants (IT, Chile)
- Biofuel & Bioproducts





# Biomass carbonization



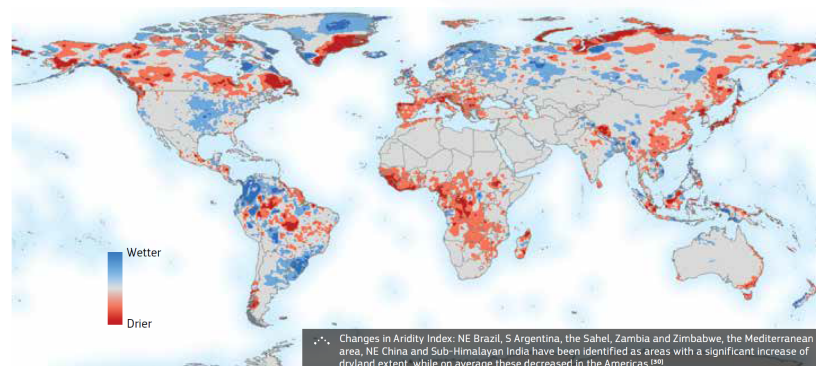
**Innovative high TRL-solution under study:**

- ✓ Slow Pyrolysis providing char (as fuel or arid-soil amendment) AND decentralized renewable heat to large scale Advanced Biofuel biomass supply chains

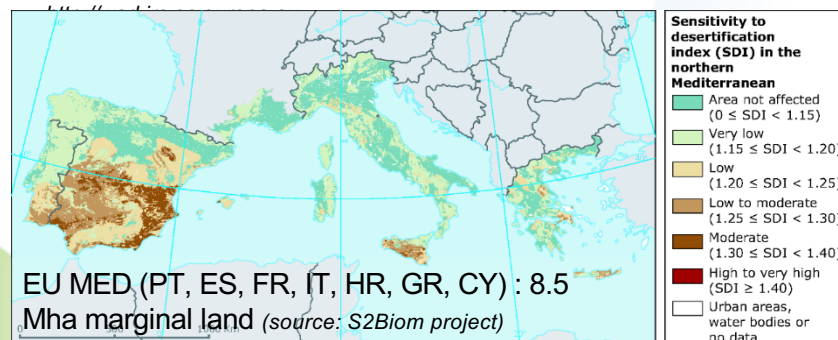




## The groundbreaking nature of **BIO4A**: Sustainable lipids for the SAF industry



Source: EC-JRC. World Atlas of Desertification, 3<sup>rd</sup> Edition. Mapping Land Degradation and Sustainable Land Management Opportunities. 2015.



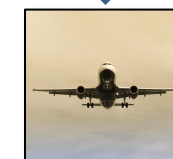
Residual biomass  
(agri-woody)



CARBONIZATION  
(Innovative Oxidative  
Slow Pyrolysis  
System)

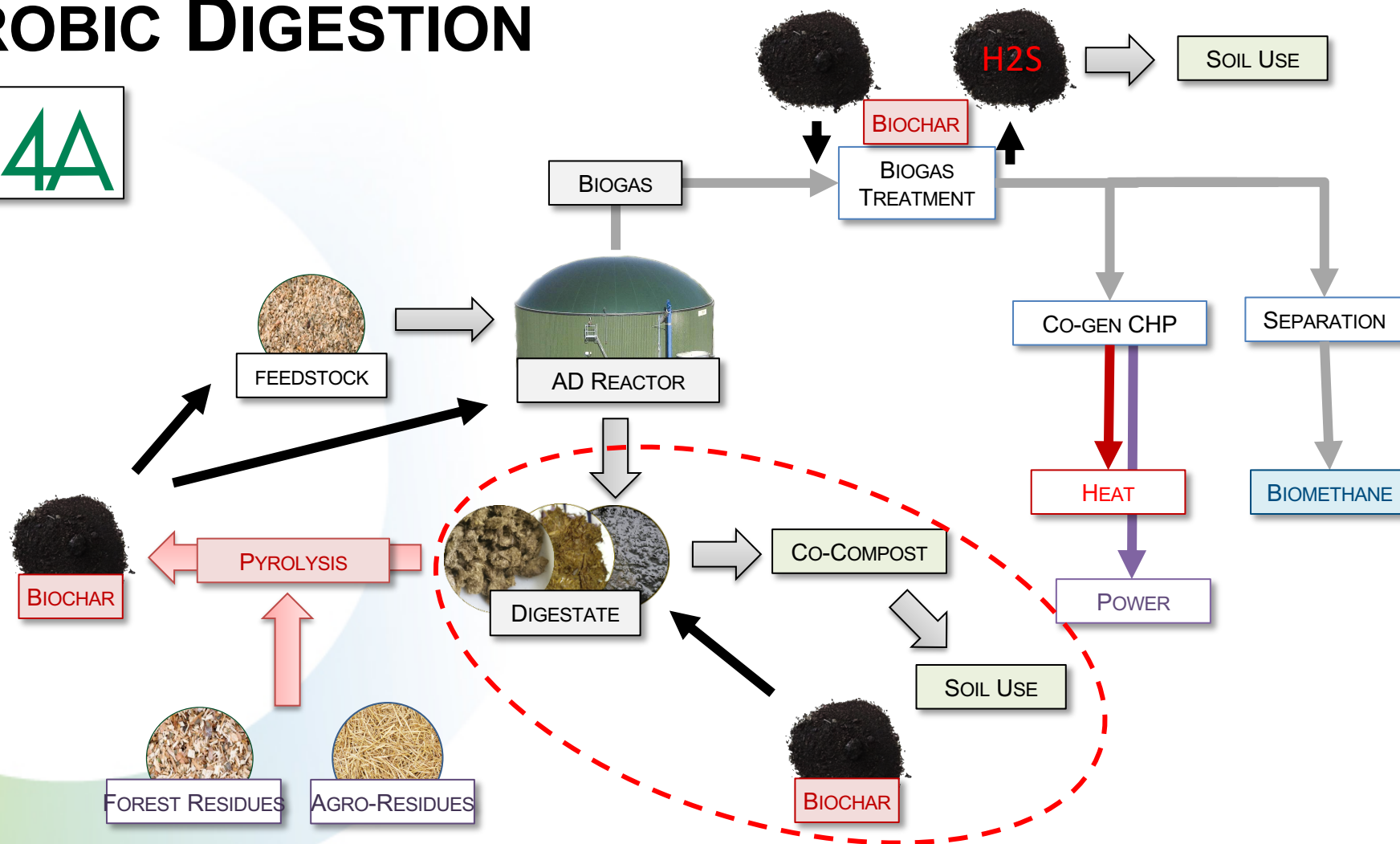


Biochar &  
Compost  
(COMBI)





# BIOCHAR FROM LIGNOCELLULOSIC BIOMASS & ANAEROBIC DIGESTION





# Dedicated & residual lipid-based chains





# Aviation Biofuels

## BIOREFLY

2,000 TONY INDUSTRIAL SCALE DEMONSTRATION  
BIOREFINERY ON LIGNIN-BASED AVIATION FUEL



Co-funded by the European Commission in the 7<sup>th</sup> Framework Programme

Duration: 4 years (2014-2018)

Project Budget: 25.4 m€ – EC Contribution 54%

- ❖ Validation at pre-commercial scale on novel competitive technologies for lignocellulosic-based aviation fuel production
- ❖ Design, construction and operation of a first in its kind paraffinic fuel industrial based on innovative second generation technologies
- ❖ Address the complete value chain, thus including the conversion of lignocellulosic energy crops and agro residues into biofuel
- ❖ Test of jet fuel use in turbines and engines including demonstration flights

biochemtex



ETH Zürich



Initiative Towards sustAinable  
Kerosene for Aviation



SEVENTH FRAMEWORK PROGRAMME

ITAKA will link supply and demand by establishing a relationship under guaranteed conditions between feedstock grower, biofuel producer, distributor and airlines.

SENASA



BIOTEHGEN



NESTE OIL



EADS

camelina company

España



EU Horizon 2020

10.2 M€ EC max Contr, > 5 kt biojet  
RE-CORD coord.



etaflorence  
renewableenergies



## ALGAE to BIOJET

Etherotrophic Algae – La  
Sapienza Coord. Verona Univ. &  
Florence Univ.  
Pilot plant design & Engineering



Enac

Italian Civil Aviation Authority





# Thanks for your attention !

*Contacts*

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