



**IEA Bioenergy**  
Technology Collaboration Programme

Task 42  
Biorefining in a circular economy



## Country Report Italy

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Denver (USA) November 2023

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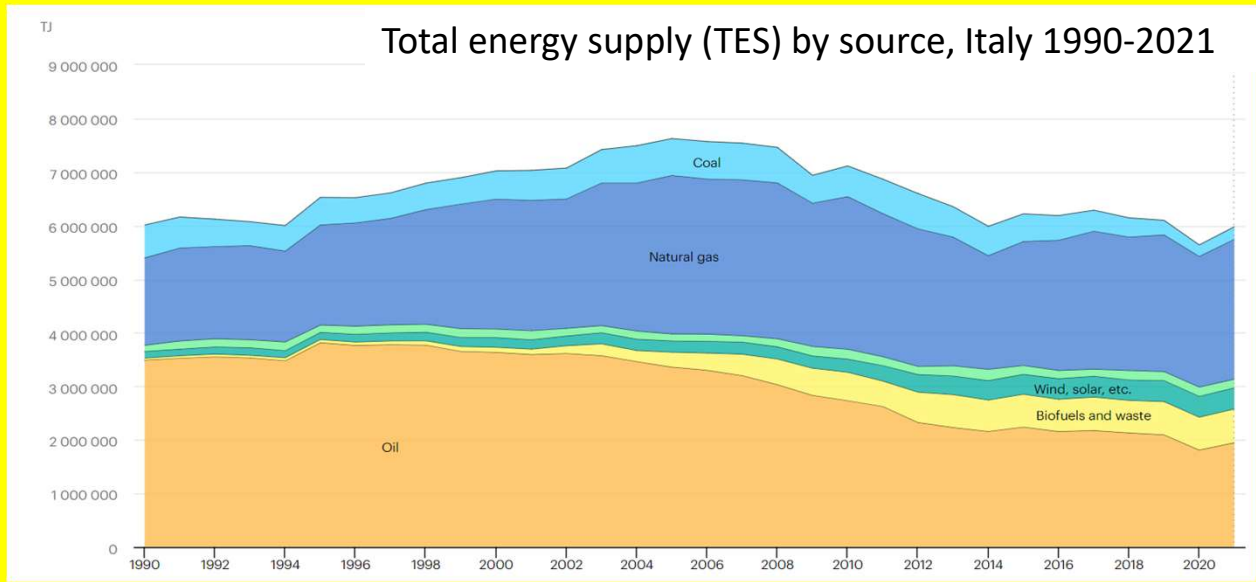
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**Technology Collaboration Programme**

by **iea**

# 1. Energy System Overview

Last Update 2021



TPES by source (%)	
Oil	32,6%
Natural Gas	43,7%
Coal	3,9%
Hydro	2,7%
Wind, Solar, etc.	6,6%
Biofuel and waste	10,5%

The share of overall energy consumption covered by RES in 2021 is **19%**

Source: GSE Statistical Report 2021  
[www.iea.org](http://www.iea.org)  
<https://ec.europa.eu/>

## 2. Electricity Generation and Consumption

Last Update 2021

Gross electricity production

289 TWh

+ 2,7%

Electricity final consumption

312.3 TWh

+ 3,2%

Share of RES

40.2 %

Total CO<sub>2eq</sub> emissions avoided

55 Mt of CO<sub>2eq</sub>

Share of RES  
(Gross RES production)

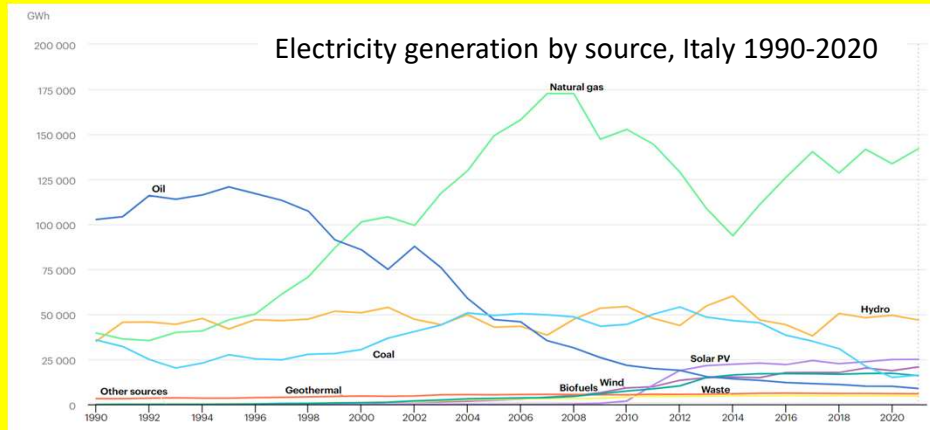
Hydro	39%
Solar	22%
Bioenergy	16%
Wind	18%
Geothermal	5%

Bioenergy Electricity Production

Solid Biomass + Waste	6.8 TWh
Biogas	8.1 TWh
Bioliquid	4.0 TWh

Electricity generation by source  
2021  
(GWh)

Coal	16290
Oil	8863
Natural gas	142062
Biofuels	15968
Waste	4674
Hydro	46831
Geothermal	5897
Solar PV	25039
Wind	20789
Other sources	492



RES-E penetration in 2021 is **40.2%**

Decrease of around 0.6 TWh compared to 2020 (-0.5%) due to the contraction in the production of hydroelectric plants (-4.6%) and bioenergy (-2.9%), not offset by other sources (wind power +11.5 %).

Source: GSE Statistical Report 2021

[www.iea.org](http://www.iea.org)

[www.statista.com](http://www.statista.com)

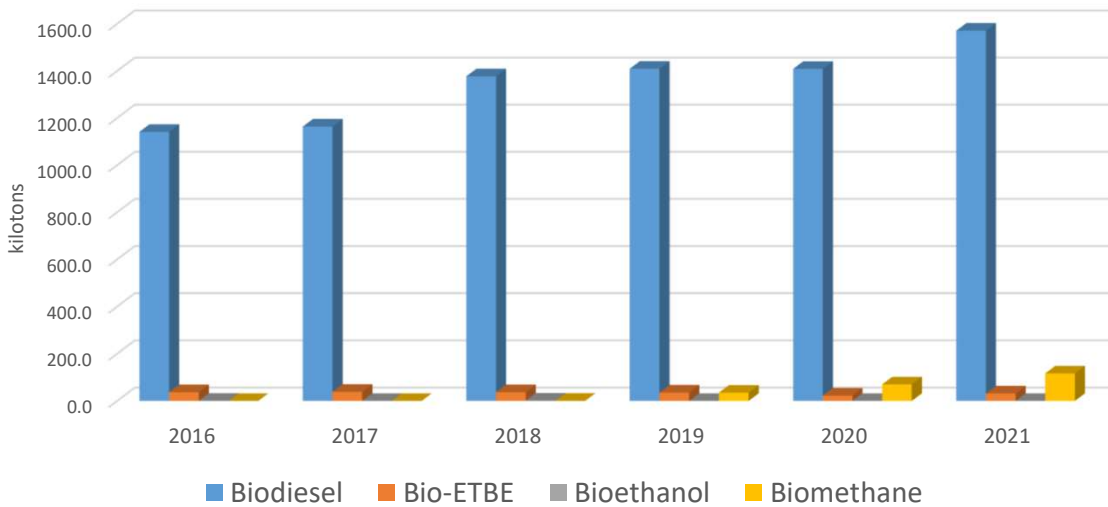
# 3. Biofuels for Transport

Last Update 2021

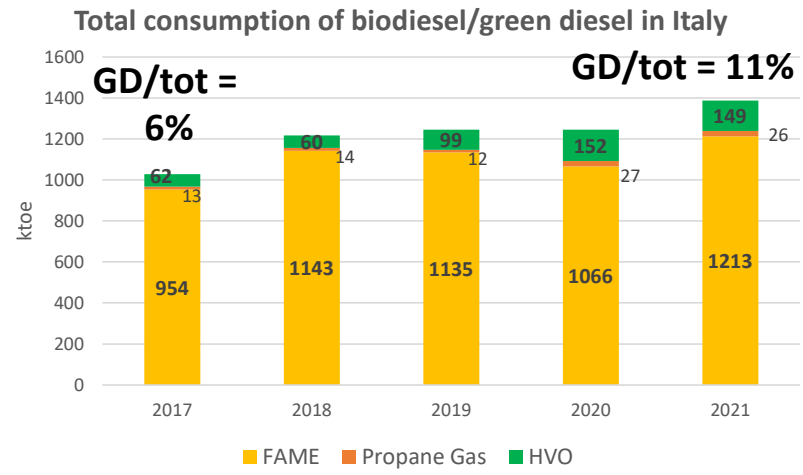
**Biofuels consumption** → **1.55 Mtoe – 1719 ktors**  
**Biomethane consumption** → **137 ktoe – 116 ktors**

Biofuels consumption for transport - 2021		
	ktoe	%
Biodiesel/green diesel	1388	89,4 %
Bioethanol	0	0 %
Bio-ETBE	27	1,7 %
Biomethane	137	8,8 %
<b>TOTAL</b>	<b>1552</b>	

Biofuels consumptions in Italy



**RES-T penetration in 2021 is 11 %**



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Source:  
 • GSE Energia nel settore Trasporti 2005-2021  
 • GSE Statistical Report 2021

[www.ieabioenergy.com](http://www.ieabioenergy.com)  
<http://task42.ieabioenergy.com>

### 3. Biofuels for Transport

Last Update 2021

Contribution of renewables in the transport sector in 2021, according to the criteria defined in **RED I** for calculating the obligations for fuel and electricity suppliers (ktoe)

	Multiplication factor *	ktoe	Contribution % Applying multiplication factor
<b>Numerator</b>		<b>3526</b>	
<i>Renewable share of electricity for road transport</i>	x 5	13,2	2%
<i>Renewable share of electricity for rail transport</i>	X 2,5	165	12%
<i>Renewable share of electricity for other transport</i>	1	156	4%
<i>Biofuel Double Counting</i>	X 2	1338	76%
<i>Biofuel Single Counting</i>	X 1	214	6%
<b>Denominator – Gross final consumption in the transport sector</b>		<b>32307</b>	
<b>RES-T share (%)– RED I</b>		<b>10,9%</b>	

\* The contributions of the individual components are shown without applying the multiplication factors. The overall numerator, however, is obtained taking the multipliers into account.

### 3. Biofuels for Transport

Last Update 2021

Biofuels released for consumption in Italy in 2021 by country of production

	Total (ktoe)	Total (%)
<b>Italy</b>	<b>583</b>	<b>36,2%</b>
Spain	422	27,8%
Netherlands	97	6,4%
Bulgary	88	5,8%
UK	64	4,2%
Austria	61	4,0%
France	56	3,7%
Germany	53	3,5%
Czech Republic	38	2,5%
Argentina	35	2,3%
Denmark	32	2,1%
Other Country	23	1,5%

**36,2 %** of total biofuels released for consumption in Italy in 2021 **are produced in Italy**

Biofuels released for consumption in Italy in 2021 by country of origin of the raw material

	Total (ktoe)	Total (%)
Cina	317	20,8%
Indonesia	257	16,9%
<b>Italy</b>	<b>218</b>	<b>12,2%</b>
Spain	121	8,0%
Malaysia	92	6,1%
UK	60	3,9%
France	58	3,8%
Argentina	49	3,2%
Germany	33	2,1%
Denmark	22	1,4%
Austria	21	1,4%
Other EU	154	10,1%
Other Country	150	9,9%

Only the **12,2%** of total biofuels released for consumption in Italy in 2021 was produced from raw materials of national origin. Overall, **43%** of the raw materials used come from European countries (EU27 + UK).

### 3. Biofuels for Transport

Last Update 2021

#### Feedstocks used for Biofuels released for consumption in Italy in 2021

1. Biofuels Single Counting

	Biodiesel	Bio-ETBE	Bioethanol	Biomethane
Palm tree	62,1%	-	-	-
Soy	28,9%	-	-	-
Corn	-	89,8%	100%	-
Rapeseed	6,0%	-	-	-
Derived from the processing of vegetable oils	2,8%	-	-	-
Wheat	-	5,4%	-	-
Barley	-	4,8%	-	-
Animal by-products (ABPs)	-	-	-	100%
Sunflower	0,1%	-	-	-

2. Biofuels Double Counting – Not Advanced

	Renewable diesel
UCO - Used Cooking Oil	51%
Animal Fat	49%

## 3. Biofuels for Transport

Last Update 2021

### Feedstocks used for Biofuels released for consumption in Italy in 2021

#### 3. Advanced Biofuels Double Counting

Data need some check of the sources

	Biodiesel	Bioethanol	Biomethane
Palm oil mill effluent (POME)	54,73%	-	-
Agro-industrial waste and other waste	44,81%	-	4,59%
OFMSW	0,01%	-	77,02%
Animal manure and sewage sludge	-	-	9,29%
Other cellulosic materials of non-food origin	-	-	3,09%
Biomass fraction corresponding to unsorted municipal solid waste	-	-	1,92%
Grape marc/Wine lees	-	100%	1,70%
Tall oil	0,38%	-	-
Bacteria	-	-	1,27%
Straw	-	-	0,99%
Algae	0,06%	-	-
Rice husk	-	-	0,11%
Corn cobs	-	-	0,003%



### 3. Biofuels for Transport

Last Update 2021

## Bioethanol in Italy

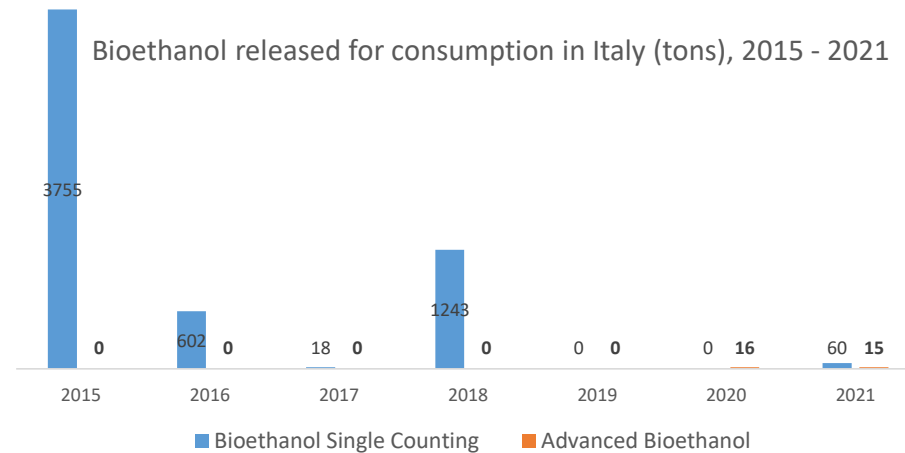
The quantity of bioethanol released for consumption in Italy in 2021 was

**75 tons**



- Produced in **Other Country**
- Feedstock is **Corn**, produced in **Austria**

- Produced in **Italy**
- Feedstock is **Grape marc/Wine lees**, produced in **Italy**



Source: GSE Energia nel settore Trasporti 2005-2021

## 3. Biofuels for Transport

Last Update 2021

### Advanced Bioethanol Plants in Italy

#### Caviro Extra (Faenza, RA)

**Production Capacity:** 71 ktons/year

**Feedstock:** Grape marc/Wine lees

#### Eni - Versalis (Crescentino, VC)

**Production Capacity** 40 ktons/year

**Feedstock:** Straw



At the beginning of February 2022, bioethanol production restarted. Currently the plant is able to treat 200 ktons/year of biomass, for a maximum production capacity of about 25 ktons of bioethanol per year (Source: [www.eni.it](http://www.eni.it))

## 5. Bioeconomy in Italy

- 415.3 billion € overall value of production for around 2 million employees in 2022

Key sectors	Value of production (million of €)	Share (%)	Employees (thousand person)	Share (%)
Agriculture, forestry and fisheries	69 940	17.4	895	44.8
Food industries , beverages and tobacco	176 900	42.1	485	24.3
Textiles bio-based	10 998	2.7	51	2.5
Bio-based clothing	17 962	4.1	95	4.8
Tanning and leather goods / footwear bio-based	18 898	4.8	76	3.8
Wood and products of wood	19 104	4.6	91	4.5
Paper and paper products	33 569	7.6	86	4.3
Biobased chemicals	5 540	1.7	9	0.4
Biobased pharmaceutical products	16 407	4.1	37	1.9
Biobased rubber plastic	1 630	0.4	5	0.3
Bio-based furniture	14 011	3.4	63	3.1
Bioenergy	4 150	0.0	2	0.1
Biofuels	N.A.	N.A.	N.A.	N.A.
Water cycle	15 375	3.7	50	2.5
Biodegradable waste management and recovery	10 824	2.5	42	2.6
<b>Total Bioeconomy</b>	<b>415 308</b>	<b>100</b>	<b>1 996</b>	<b>100</b>

616 M€/kWorkers

EMERGING SECTOR

Source: «La Bioeconomia in Europa» 9° Rapporto Intesa San Paolo - Assobiotech

## 6. Policy Document

# The National Recovery and Resilience Plan (NRRP)

The exploitation of RES/waste is part of the MISSION 2 of the National Recovery and Resilience Plan

MISSION 2 - Green revolution and ecological transition

Component 1: Sustainable agriculture and circular economy

Component 2: Renewable Energy, Hydrogen, Network and Sustainable Mobility

Areas of intervention

efficient and sustainable management of waste and circular Economy	Develop a sustainable supply chain	Increase the share of energy produced from renewable sources	Increase the share of energy produced from renewable sources	Support startups and venture capital active in the ecological transition			
1.5 €bn	0.6 €bn	0.5 €bn	1.1 €bn	1.92 €bn	0.16 €bn	0.5 €bn	0.5 €bn.
New waste management facilities and existing modernization	Circular Economy "Lighthouse" Projects	Innovation and mechanization in the agricultural and food sector	Agro-voltaic development	Biomethane development	R&D on Hydrogen	H2 production on abandoned industrial areas	Promoting the transfer of research into innovative patents and businesses

## 6. Policy Document

# The National Recovery and Resilience Plan (NRRP)

MISSION 2 - Component 2: Renewable Energy, Hydrogen, Network and Sustainable Mobility

Increase the share of energy produced from renewable sources

### H2 production on abandoned industrial areas



### Next Steps

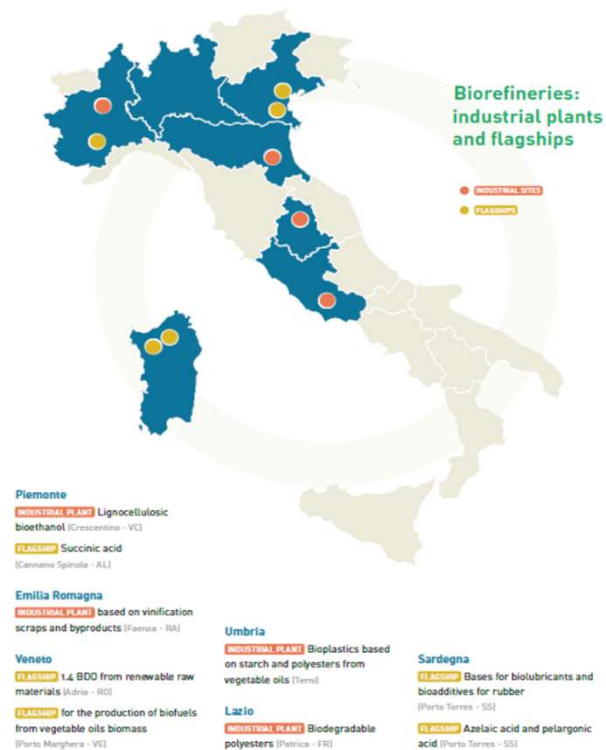
- **By March 2023** adjudication of hydrogen producing projects in abandoned industrial areas
- **By June 2026** completion of 10 projects with a capacity of the least 1-5 MW each

**Create 10 hydrogen valleys**, or rather, in order to promote, at the local level, the production and use of H<sub>2</sub> in industry and transports. Instruments and tools for the production of hydrogen thanks to RES will be installed specifically in brownfield areas which are already connected to the electrical grid.

Piedmont, Friuli-Venezia-Giulia, Umbria, Basilicata and Puglia have chosen to select “Hydrogen Valleys” as the flagship project under the NRRP.

# 7. Industrial Biorefineries

## Map of industrial plants



Source: BIT II



### Mater-Biopolymer (Patrica, FR) **INDUSTRIAL**

- **Products** Origo-Bi®
- **Capacity** 100 ktons/year



### Novamont (Terni, TN) **INDUSTRIAL**

- **Products** Biolubricants and bioplastics from local crops
- **Capacity** 20 ktons/year -compounding; 60 ktons/year - polyesters



### Eni - Versalis (Crescentino, VC) **INDUSTRIAL**

- **Products** Bioethanol
- **Capacity** 40 ktons/year



### Caviro Extra (Faenza, RA) **INDUSTRIAL**

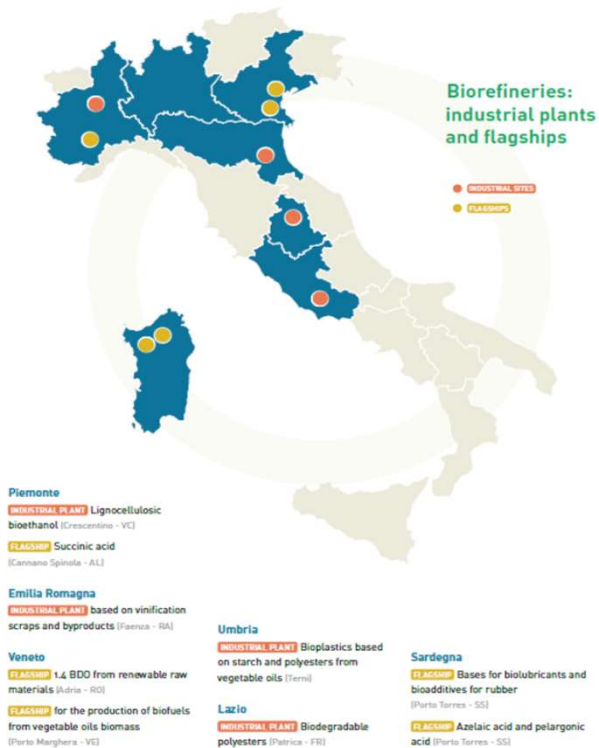
- **Products** Bioethanol, Ethyl alcohol, Biogas
- **Capacity** 71 ktons/year



### ENI (Gela, CL) **INDUSTRIAL**

- **Products** Hydrotreated vegetable oils (based on Ecofining™ technology)
- **Capacity** 720 ktons/year max capacity; 600 ktons/year HVO production

# 7. Industrial Biorefinery Plants



## Reverdia (Cassano Spinola, AL) FLAGSHIP

- Products Succinic acid
- Capacity 10 ktons/year



## Mater-Biotech (Bottrighe, RO) FLAGSHIP

- Products 1.4 BDO
- Capacity 30 ktons/year



## ENI (Porto Marghera, VE) FLAGSHIP

- Products HVO (green-diesel, green-naphtha and green-gpl)
- Capacity 560 ktons/year at 2024 (currently about 360 ktons/year) with a production of about 420 ktons/year of total HVO (currently about 300 ktons/year)



## Matrìca (Porto Torres, SS) FLAGSHIP

- Products Biolubricants, Bioadditives, Azelaic acid, Pelargonic acid
- Capacity 350 ktons/year

## 9. Projects of Significant National Interest for Hydrogen and biofuels

### NEXTCHEM + ENI

- Waste to Hydrogen plant in Porto Marghera (Venice, Italy)
- Waste to Methanol plant in Livorno (Italy)

### EDISON + ANSALDO ENERGIA + ENI

Production of Green/Blue hydrogen for use in place of methane in Edison's new power station in Porto Maghera. Installed capacity 780MW

### ENI

Waste to Fuel: bio-oils production from the Organic Fraction of Municipal Solid Waste, Pilot plant in Gela (Italy)

### ENEA

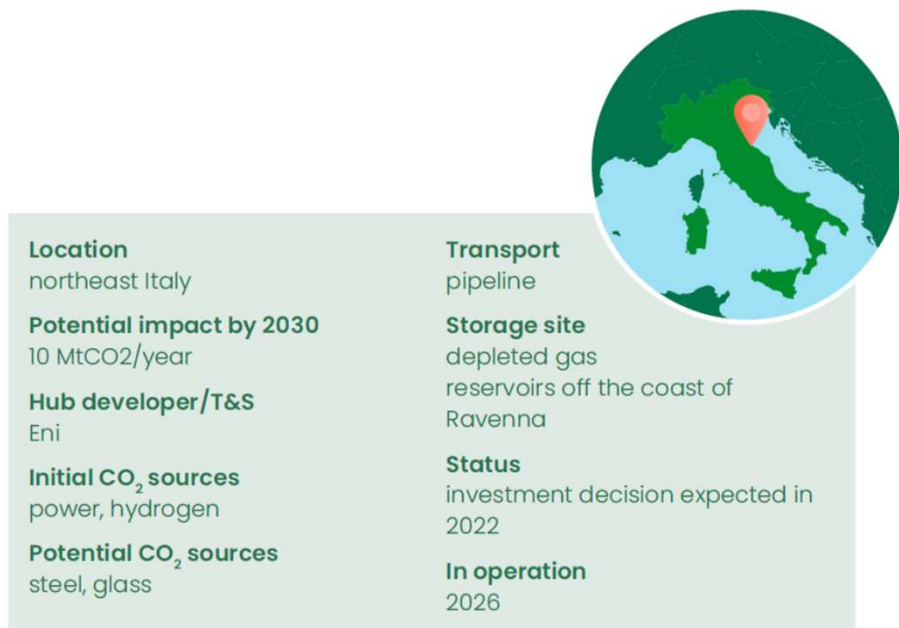
ENEA Casaccia Hydrogen Valley: the research center will also allow the test of new technologies for the production of hydrogen, for example, through the use of waste and the use of renewable medium-high temperature heat produced by concentrating solar plants



## 9. Projects of Significant National Interest

### ENI Ravenna Hub (North Italy) - CO<sub>2</sub> storage site

This hub aims to become the reference hub for Italy and the Mediterranean.



- The plan is to launch phase 1 in 2023, testing technologies in a full capture, transport and storage chain handling up to 100,000 tons per year.
- Phase 2, scheduled to start in 2027, will allow **storage of 4 million tons of carbon dioxide per year**, about half of it from three power stations and a hydrogen plant owned by Eni, and the rest from other emitters
- **Storage will be in offshore depleted gas reserves in the Adriatic Sea.** Total storage resource in the Adriatic is estimated at 500 million tons.

# Projects of Significant Interest



The H2Steel project aims at supporting the decarbonization of the European steel production sector

**Goal:** creating a ground-breaking competitive solution for sustainable green hydrogen and bio-coal production from circular biowaste streams



## Innovation for green H<sub>2</sub> production

The project presents an innovative, disruptive solution to convert wet waste streams into green Hydrogen, Carbon and Critical Raw Materials.

- Biomethane production, via **Anaerobic Digestion**, of Wet Wastes
- Production of **Biochar - based catalyst** from a by-product of anaerobic digestion, **digestate**
- Application of **carbon-based catalytic pyrolysis of biomethane**, to produce **Green-H<sub>2</sub>** and **Carbon**
- After biomethane cracking, the **catalyst combined with the produced carbon** can be used as **bio-coal** in the **production of steel**, as a substitute of metallurgical (fossil) coke, **promoting a net Greenhouse gas emissions reduction**

# Projects of Significant Interest

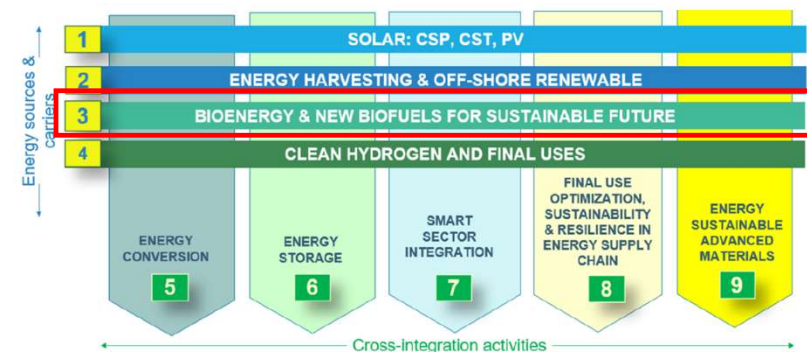


## SPOKE 3: BIOENERGY & NEW BIOFUELS FOR SUSTAINABLE FUTURE-objectives

Development of:

- **novel-thermochemical, chemical, biochemical and bioelectrical conversion processes and systems** to convert biomass into *useful power, advanced biofuels and value-added products*.
- novel processes and technologies for **CCUS in bioenergy systems**.

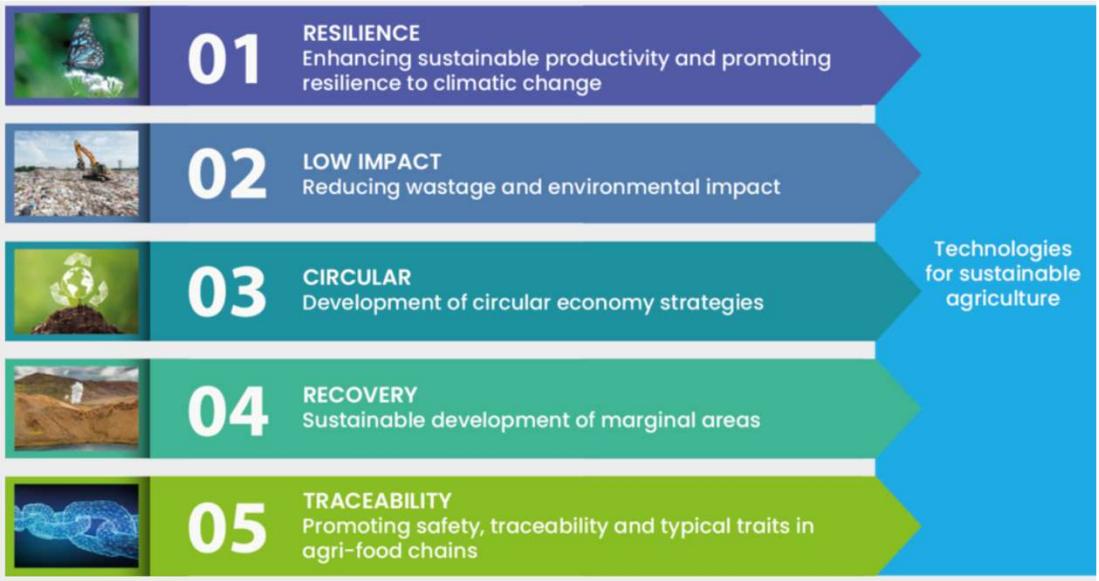
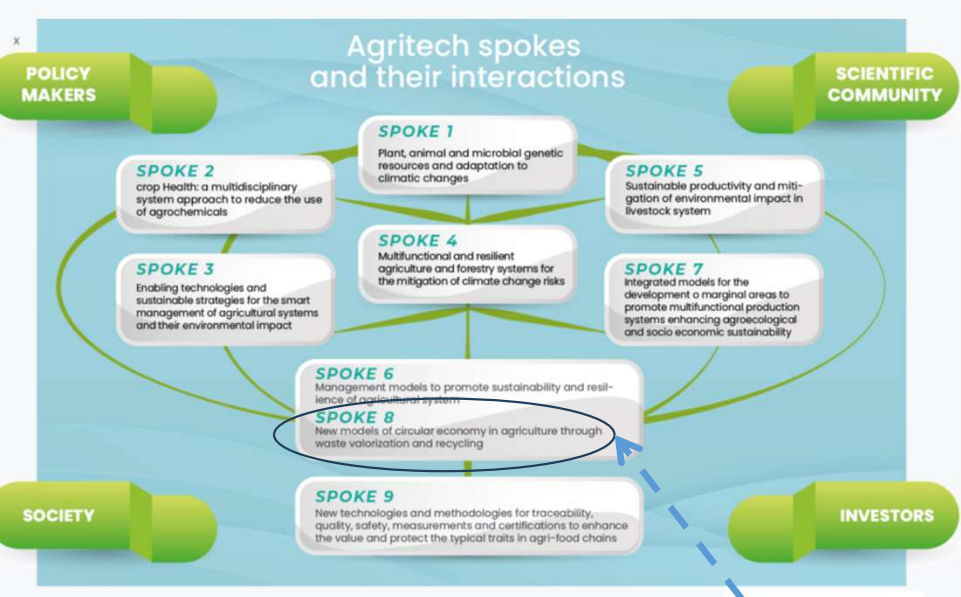
**Overcoming** the limiting factors relative to the integration of the thermochemical and biological processes into value chains, in order to optimize the integration and to fill the shortcomings of a single process  
**Legislation and policy trends** provide the overarching criteria for identifying risk and opportunities in the development of **low TRL bioenergy** and **new biofuels pathways** and to identify *sustainable biomass availability* in medium and long term for their exploitation in the *Italian scenario*.



# Projects of Significant Interest



## 9 Spokes across the 5 strategic objectives



## Novamont acquisition by ENI Versalis

# Versalis: acquisition of Novamont completed

18 OCTOBER 2023 - 2:05 PM CEST | 

*San Donato Milanese (MI), 18 October 2023* - Versalis announces that it now holds the entire share capital of Novamont, of which it already owned 36%. The transaction, announced on 28 April and authorised by the relevant authorities, was completed today with Mater-Bi, a subsidiary of Investitori Associati II and NB Renaissance, acquiring 64% of Novamont's shares.

Novamont, whose CEO remains Catia Bastioli, is a benefit company, certified B Corporation, and a world leader in the production of bioplastics and the development of biochemicals and bioproducts through the integration of chemistry, environment and agriculture. Novamont has 650 employees and is headquartered in Novara. It has production plants in Terni, Bottrighe (RO) and Patrica (FR); research laboratories in Novara, Terni and Piana di Monte Verna (CE), as well as the Matrìca site in Porto Torres (SS) (in an equal joint venture with Versalis) and a company with Coldiretti for the development and distribution of agricultural solutions. It holds around 1,500 patents and patent applications and has an international presence with offices in Germany, France, Spain and the United States and a network of distributors in over 40 countries worldwide. Following the acquisition of a Norwegian company that is a world leader in the development, production and marketing of certified biodegradable and compostable applications, it now also has a production plant in Estonia.

Adriano Alfani, Versalis' CEO said: *"The acquisition of Novamont will allow us to drive our strategy towards chemistry from renewables through the integration of the two portfolios. Today the process of integrating our businesses begins, which will enhance the skills of our people and establish a business plan that will leverage a unique technology platform and an increasingly low-carbon product portfolio, in line with Versalis' strategy and Eni's energy transition journey"*.

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