BioTheRoS

Collaborative actions to bring novel **BIO**fuels **THE**rmochemical **RO**utes into industrial **S**cale

Advancing Industrial-Scale Biofuels: Innovative Pathways in Thermochemical Conversion

Logistics for biomass valorisation to aviation and maritime

circe

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12th March, 2025

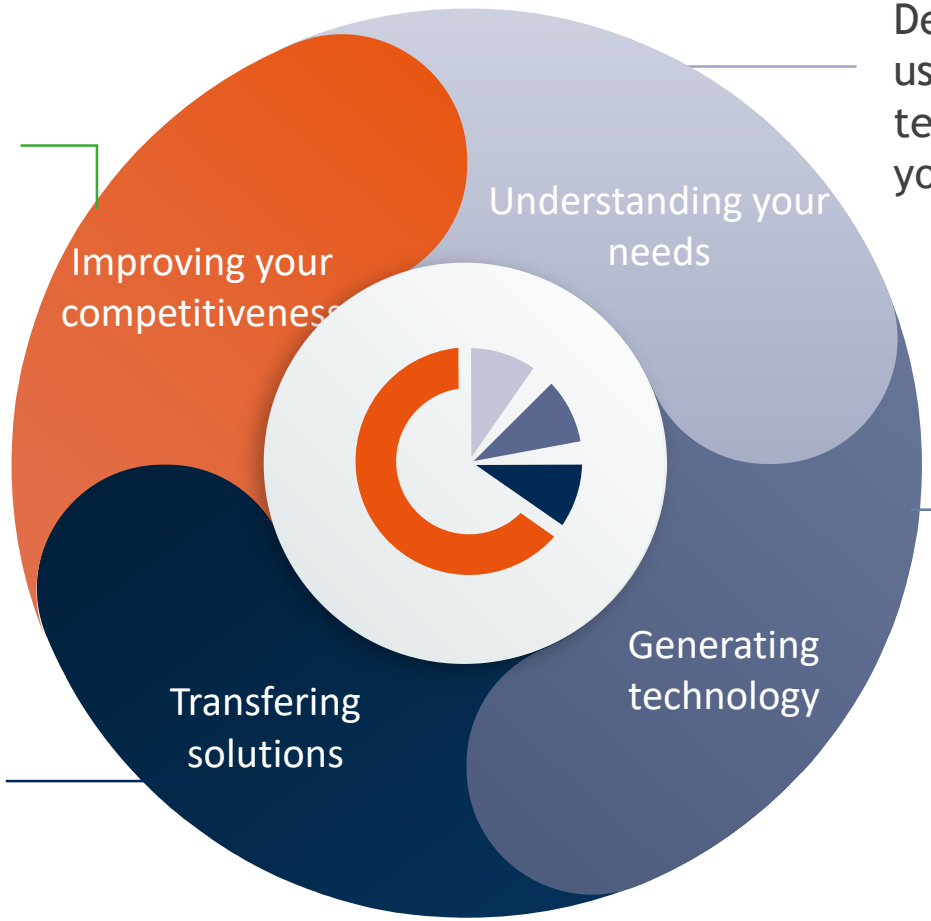
ABOUT CIRCE

Our identity

CIRCE is a Technological Center specialized in energy and sustainability, ruled by these principles:

Innovation serves as a tool to **enhance competitiveness** and proactively address the challenges posed by a progressively rigorous market

Deep **market knowledge** enables us to serve as a dependable long-term technology partner, assisting you effectively



Technology development with immediate applicability in the business world."

Support provided throughout the technology implementation process within your organization, with a constant focus on contextual priorities."

Our team

+290
EMPLOYEES

37,5
AVERAGE AGE

28
PHDs

36%
WOMEN

17
NATIONALITIES

RETORNO joven ARAGÓN

Great Place To Work. Certified ESPAÑA

Sello de ENTIDAD RSA 2024

Sello de ENTIDAD RSA+ 2024

HR EXCELLENCE IN RESEARCH

CIRCE's ROLE IN BIOTHEROS

CIRCE´s role in Biotheros

New value chains for biomass valorisation to aviation and maritime biofuels

Feedstock potential at NUTS2 level (tonnes)

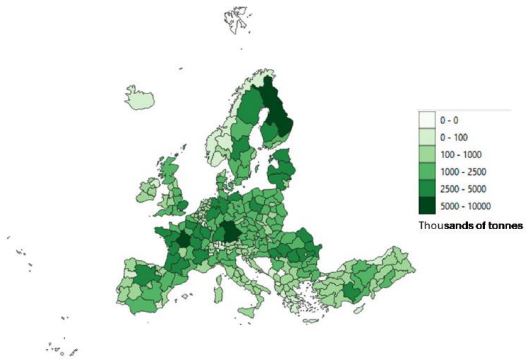
Pre-treatment and cost associated of each feedstock (€/t)

Feedstock mobilisation, cost of each feedstock, harvesting + logistic (€/t)

Design the value chain, stakeholders involved, identification of main variables that affect to the value chain

Development of a tool that integrate the previous information and process the data through AI techniques

Feedstock evaluation potential



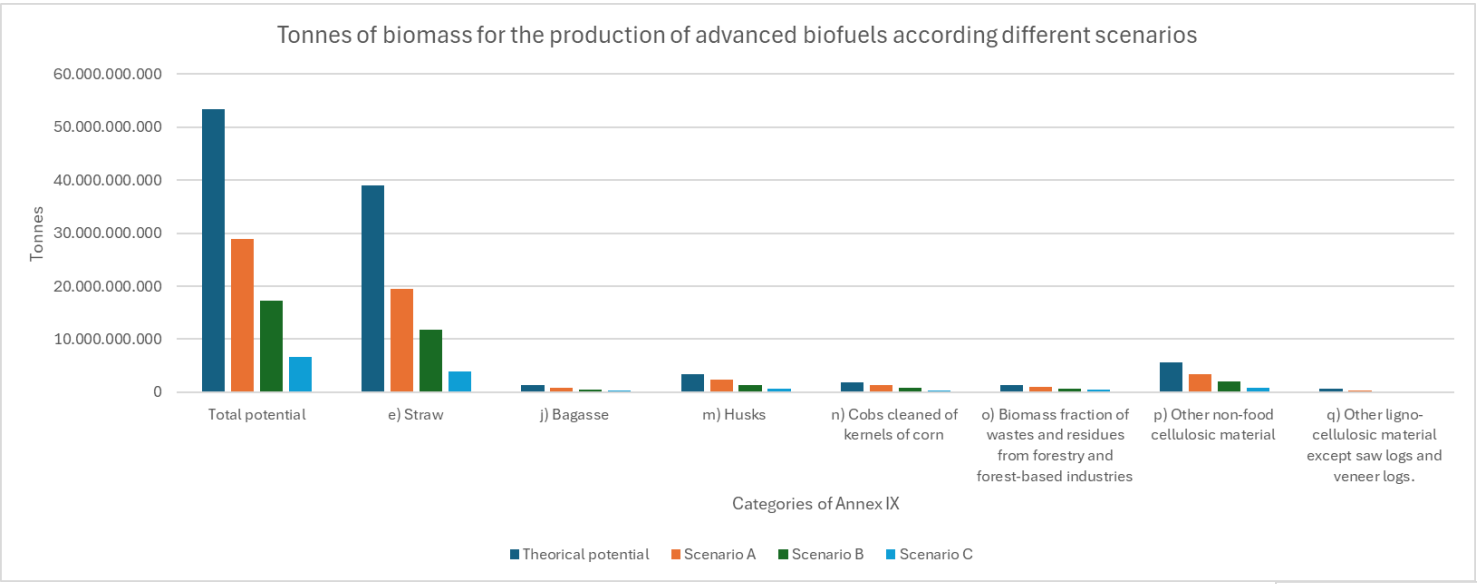
Identificati on of new plants

Feedstock potential

- Developing the methodology to assess biomass potential
- Selection of feedstock suitable for pyrolysis ang gasification at European and Global, according Annex IX of RED II and RED III
- To represent the biomass potential in Europe (NUST 2 level) and Global (NUTS 0 level) for the production of aviation and maritime biofuels via pyrolysis and gasification

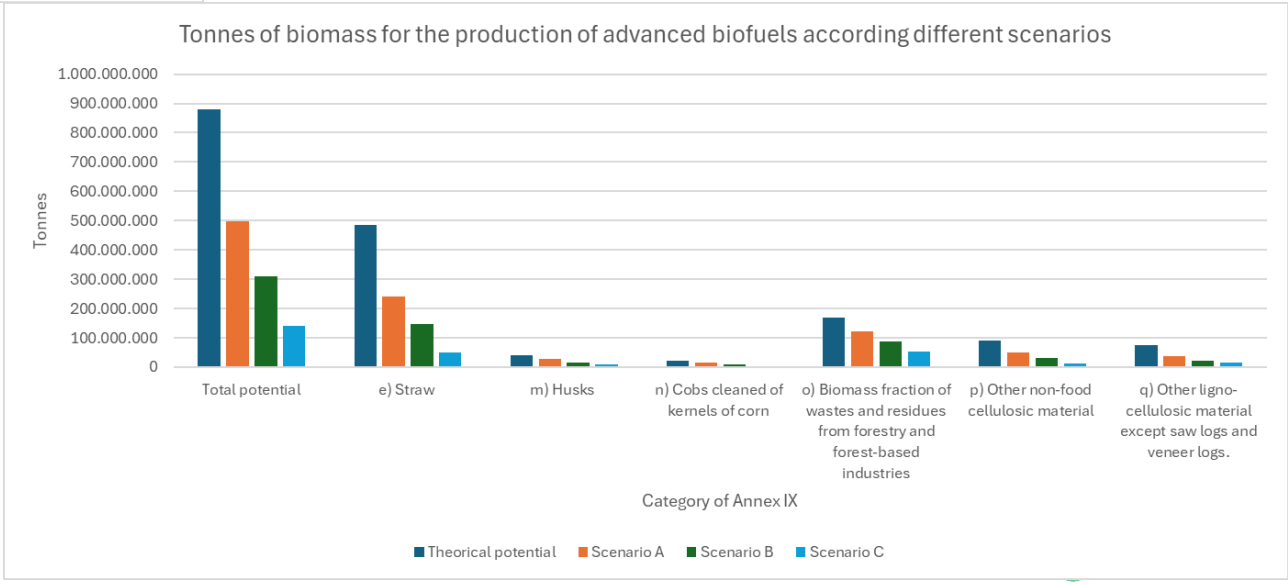
Categories Annex IX	Biomass considered at European level	Biomass considered at Global level
e) Straw	Maize Stalk	Maize Stalk
	Barley Straw	Barley Straw
	Wheat straw	Wheat straw
	Soya straw	Rice straw
	Rye straw	Sugar cane straw
	Oats straw	Soya beans straw
	Triticale straw	Yams straw
	Rape seed straw	-
j) Bagasse	-	Sugar cane bagasse
m) Husks	Wheat husk	Wheat husk
		Rice husk
n) Cobs cleaned of kernels of corn	Maize cob	Maize cob
o) Biomass fraction of wastes and residues from forestry and forest-based industries	Primary residual forestry biomass	Primary residual forestry biomass
	Secondary forestry biomass	Secondary forestry biomass
p) Other non-food cellulosic material	Fruits pruning	Apples pruning
	Grape pruning	Grape pruning
	Olive pruning	Grape pomace
	Potatoes leaves	Orange pruning
	Sugar beet leaves	Potatoes leaves
	Sunflower seed leaves	Potatoes peel
	Grape pomace	Sugar beet leaves
	Olive pomace	Sweet potatoes leaves
	Rape seed pomace	Sweet potatoes peel
	Potatoes peel	Yams peel
q) Other ligno-cellulosic material except saw logs and veneer logs.	Forestry wood fuel	Forestry wood fuel

Feedstock potential



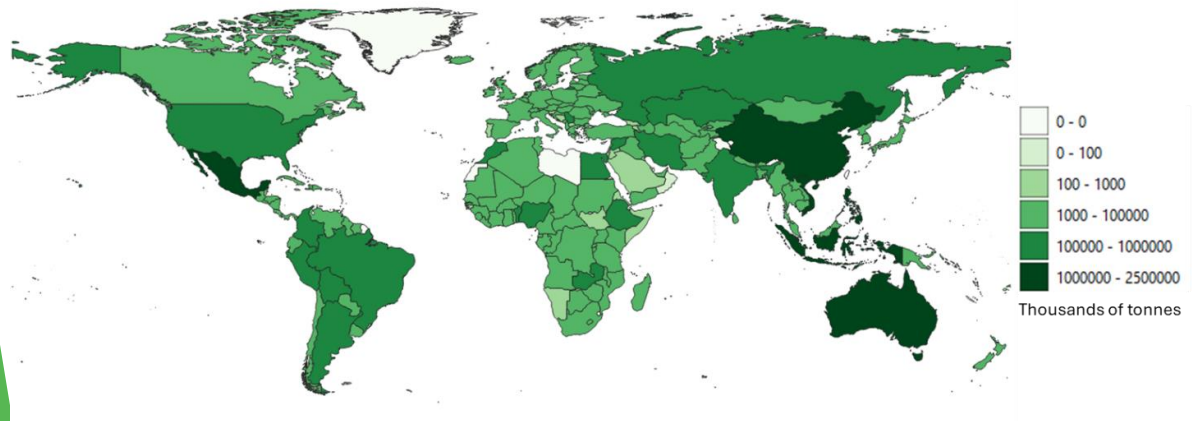
Global biomass potential according different scenarios

European biomass potential according different scenarios

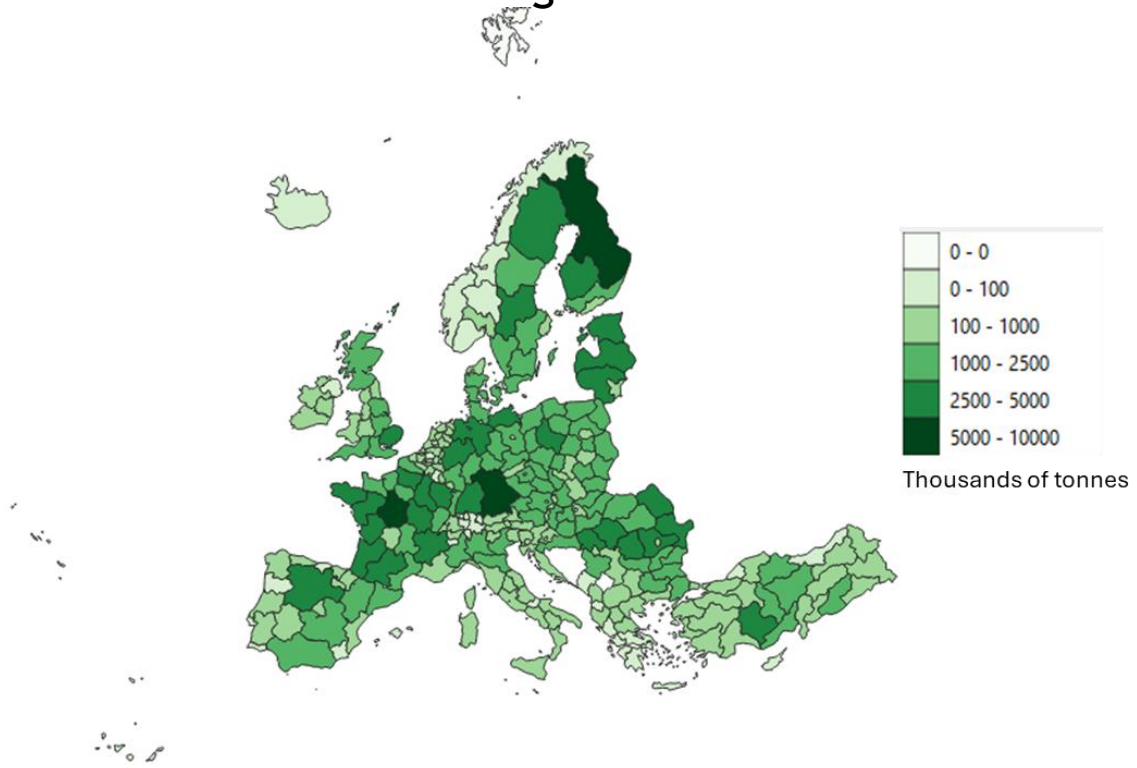


Feedstock potential

Geographical distribution of global biomass potential of sustainable biogenic feedstock for the production of advanced biofuels according to the Scenario B



Geographical distribution of European biomass potential of sustainable biogenic feedstock for the production of advanced biofuels according to the Scenario B



Feedstock potential

Contribution of biomass categories to meet energy demand for decarbonizing aviation and maritime sectors

- *The report of the International Transport Forum 2023 indicates an estimated data of kerosene for the aviation sector and fossil fuels for the maritime sector per year:*
  - *Aviation sector: 320 MToe at Global level and 50 Mtoe at European level*
  - *Maritime sector: 310 Mtoe at Global level and 65 Mtoe at European level*
- *Different efficiency (15 and 30 %) for conversion from biomass to advanced fuels has been considered*

Categories of Annex IX	Europe, scenario B		World, scenario B	
	Efficiency of 15 %	Efficiency of 30 %	Efficiency of 15 %	Efficiency of 30 %
e) Straw	7%	15%	120%	240%
j) Bagasse			5%	10%
m) Husks	1%	2%	14%	28%
n) Cobs cleaned of kernels of corn	0%	1%	8%	15%
o) Biomass fraction of wastes and residues from forestry and forest-based industries	4%	9%	7%	14%
p) Other non-food cellulosic material	2%	3%	20%	41%
q) Other ligno-cellulosic material except saw logs and veneer logs.	1%	2%	2%	4%
Total	16%	31%	159%	317%

The report will be available on the Biotheros website shortly (June 2025)

Pre-treatment needed and cost associated

Identification of the pre-treatments needed

- *Feedstock to be considered (output task 2.1)*
- *Requirements for Biotheros technologies*
- *Characterization of the feedstock selected*

Definition of the pre-treatment needed to fulfil with the requirements

- *Baling*
- *Chipping/Shredding*
- *Screening*
- *Drying*
- *Pelletising*

The report will be available on the Biotheros website shortly (June 2025)

Pre-treatment needed and cost associated

Categories Annex IX	Biomass considered at European level	Baling	Chipping/ Shredding	Screening	Drying	Pelletising
e) Straw	Maize Stalk	YES	NO	NO	NO	Optional
	Barley Straw					
	Wheat straw					
	Soya straw					
	Rye straw					
	Oats straw					
	Triticale straw					
	Rape seed straw					
m) Husks	Wheat husk	NO	NO	NO	NO	NO
n) Cobs cleaned of kernels of corn	Maize cob	NO	Shredding	NO	NO	NO
o) Biomass fraction of wastes and residues from forestry and forest-based industries	Primary residual forestry biomass	Optional	Chipping	Optional	Natural drying is recommended	Optional
	Secondary forestry biomass	NO	NO	NO	NO	Optional
p) Other non-food cellulosic material	Fruits pruning	Optional	Shredding	Recommended	Natural drying is recommended	Optional
	Grape pruning					
	Olive pruning					
	Potatoes leaves	NO	Chipping or Shredding	Recommended	Forced drying	NO
	Sugar beet leaves					
	Sunflower seed leaves					
	Grape pomace	NO	NO	NO	Forced drying	NO
	Olive pomace					
	Rape seed pomace					
	Potatoes peel					
q) Other ligno-cellulosic material except saw logs and veneer logs.	Forestry wood fuel	Optional	Chipping	Optional	Natural drying is recommended	Optional

Pre-treatment needed and cost associated

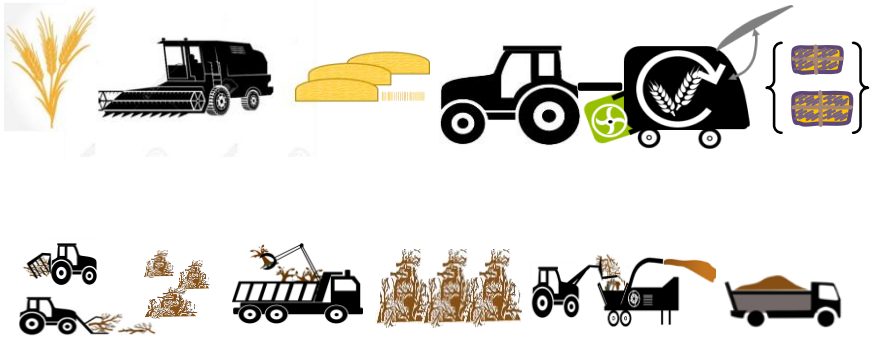
Categories Annex IX	Biomass considered at European level	Baling		Chipping/ Shredding		Screening		Drying		Pelletising	
		CAPEX (€)	OPEX (€/t)	CAPEX (€)	OPEX (€/t)	CAPEX (€)	OPEX (€/t)	CAPEX (€)	OPEX (€/t)	CAPEX (€)	OPEX (€/t)
e) Straw	Maize Stalk	20,000 - 100,000	7 - 15	-	-	-	-	-	-	50,000 - 300,000	12 - 22
	Barley Straw										
	Wheat straw										
	Soya straw										
	Rye straw										
	Oats straw										
	Triticale straw										
	Rape seed straw										
m) Husks	Wheat husk	-	-	-	-	-	-	-	-	-	-
n) Cobs cleaned of kernels of corn	Maize cob	-	-	10,000 - 50,000	5 - 10	-	-	-	-	-	-
o) Biomass fraction of wastes and residues from forestry and forest-based industries	Primary residual forestry biomass	50,000 - 150,000	10 - 20	50,000 - 250,000	10 - 18	30,000 - 80,000	2.5 - 6	5,000 - 30,000	1 - 2.50	500,000 - 3,000,000	15 - 26
	Secondary forestry biomass	-	-	-	-	-	-	-	-	500,000 - 3,000,000	15 - 26
p) Other non-food cellulosic material	Fruits pruning	30,000 - 120,000	8 - 18	20,000 - 100,000	7 - 15	20,000 - 80,000	3.5 - 8	5,000 - 30,000	1.50 - 2.50	50,000 - 300,000	12 - 22
	Grape pruning										
	Olive pruning										
	Potatoes leaves	-	-	10,000 - 50,000	5 - 12	20,000 - 50,000	3.5 - 7	50,000 - 300,000	7 - 15	-	-
	Sugar beet leaves										
	Sunflower seed leaves										
	Grape pomace	-	-	-	-	-	-	100,000 - 500,000	10 - 17	-	-
	Olive pomace										
	Rape seed pomace										
	Potatoes peel										
q) Other ligno-cellulosic material except saw logs and veneer logs.	Forestry wood fuel	50,000 - 150,000	12 - 23	50,000 - 250,000	12 - 18	30,000 - 80,000	2.5 - 6	5,000 - 30,000	1 - 2.50	500,000 - 3,000,000	15 - 26

Feedstock mobilisation

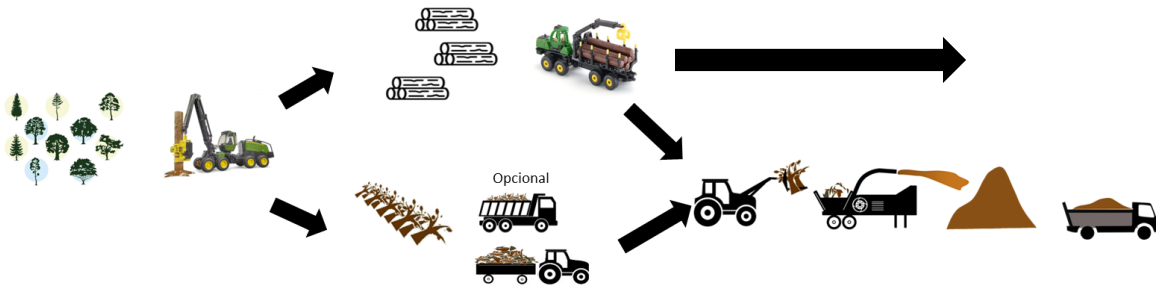
Feedstock mobilisation

- *Describe how the collection of the selected feedstock is usually done*
- *Cost associated*

- Residual primary agricultural biomass



- Residual primary forest biomass



Design of the value chain

To design the value chain:

- *From the field/source of the biomass to the transformation plant*
- *Identification of the type of stakeholders involved*

PRODUCERS OF THE BIOMASS

Agreement and collaboration to transfer the biomasss

BIOMASS SUPPLY & PROCESSING

Agreement on biomass format, quality and price

NEW BIOREFINERIS AND REFINERIES (Production of intermediate and final alternative sustainable fuels)

Key role:
- Find the best form to produce savings in the management of biomass
- Establish dialogue and collaboration with actors downstream

Farmers

Cooperatives/Agroindustry

Key role:
- Establish dialogue and agreement with producer of the biomass
- Organise the logistics and processing to preserve quality whilst keeping expenses low

Agro-service companies

Biomass suppliers

Cooperative/Agroindustry

Biomass platforms

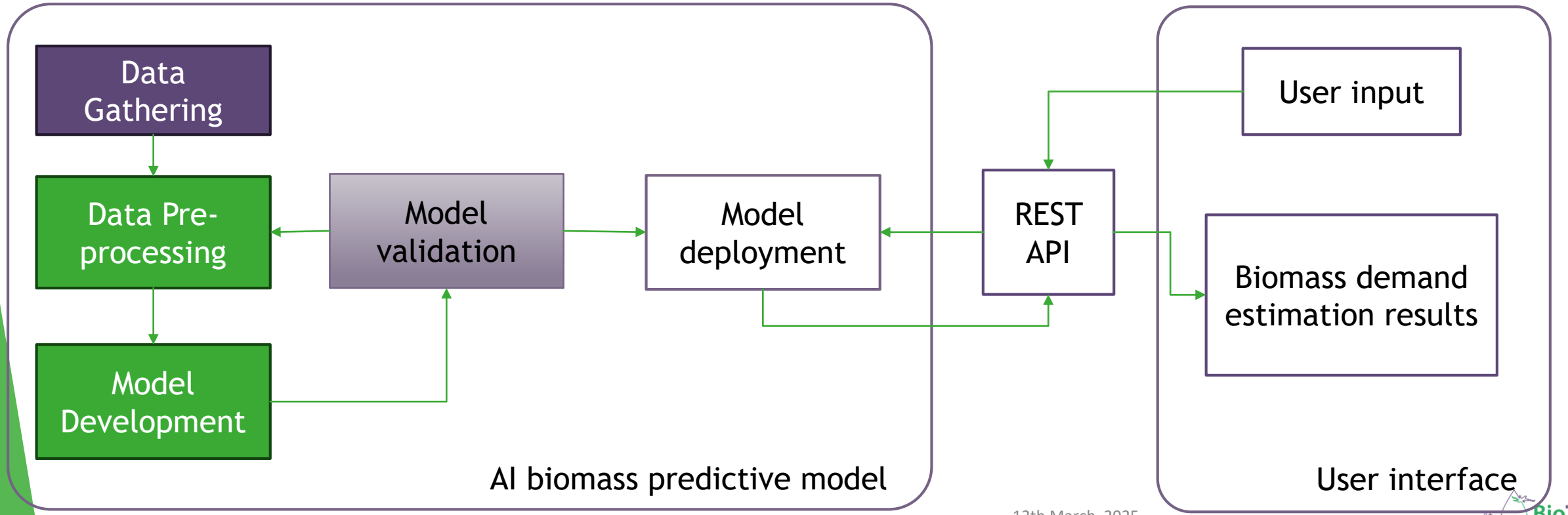
Key role:
- To produce the alternative sustainable fuels with the quality required by the final users
- Ensure this product can be utilized in its facilities prior any actor performs an investment

New units

Current refineries

Development of predictive biomass demand models

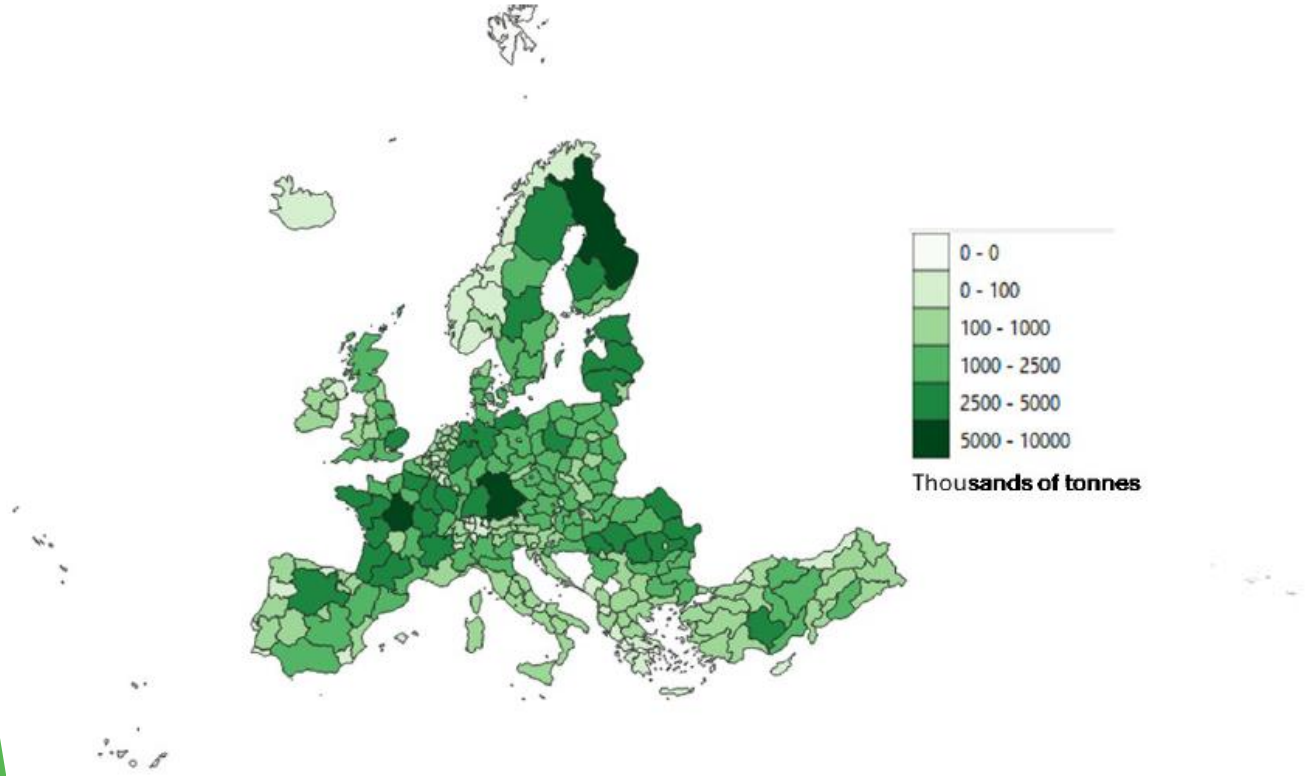
- *Integration of the output of the other task:*
  - *The biomass demand will be highly dependent on the resource availability*
  - *The pre-treatments will be also considered in the model*
  - *Feedstock mobilization and the design of the value chain*
- *AI techniques will be developed*
- *Identification of the location of new plants, and representation through a data visualisation interface*



Development of predictive biomass demand models

Main outputs of the tool:

Feedstock evaluation potential:



Identification of new plants:

Thank you!

Contact

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