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How can Europe develop a market for advanced renewable fuels?

Policy Briefing

Moderator: Simon Hunkin

Greenovate! Europe

Housekeeping

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- Clarification questions will be taken after each presentation
- General questions will be asked at the end

- Submission:
  - Clarification questions: Mark with ! at beginning
  - Questions for panel discussion can be submitted throughout

- We will try to respond by email to any questions we do not have time to tackle

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 764799.

Introduction to ADVANCEFUEL

Kristin Sternberg
Fachagentur Nachwachsende Rohstoffe (FNR)
Project Co-ordinator

The Project

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"Facilitating market roll-out of RESfuels in the transport sector to 2030 and beyond"

- **8 partners** from 7 different countries
- Duration: **3 years** (September 2017-August 2020)
- **Co-ordinated** by FNR, German Agency for Renewable Resources with the support of the Energy Research Centre of the Netherlands (ECN part of TNO)
- **Funded** by the European Commission under the Horizon 2020 programme

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Background

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- **GHG emissions in the transport sector** continue to **increase** creating major challenges to the efforts of reducing the emissions according to the **Paris Agreement goals**
- Increasing efficiency & moving to zero emission vehicles
- Use of (liquid) advanced renewable fuels : key (short-/ medium term) solution especially for HDV, ships & planes
  - Currently: 5% of total fuels are biofuels; 0.2% from lignocellulosic feedstock
  - Further development depends largely on policy and shaping of technology, sustainable supply chains & markets

ADVANCEFUEL: aimed to support the commercialisation of advanced renewable transport fuels ('RESfuels') by providing stakeholders with <u>new knowledge, tools, standards and recommendations</u> to help <u>remove barriers</u> to their uptake

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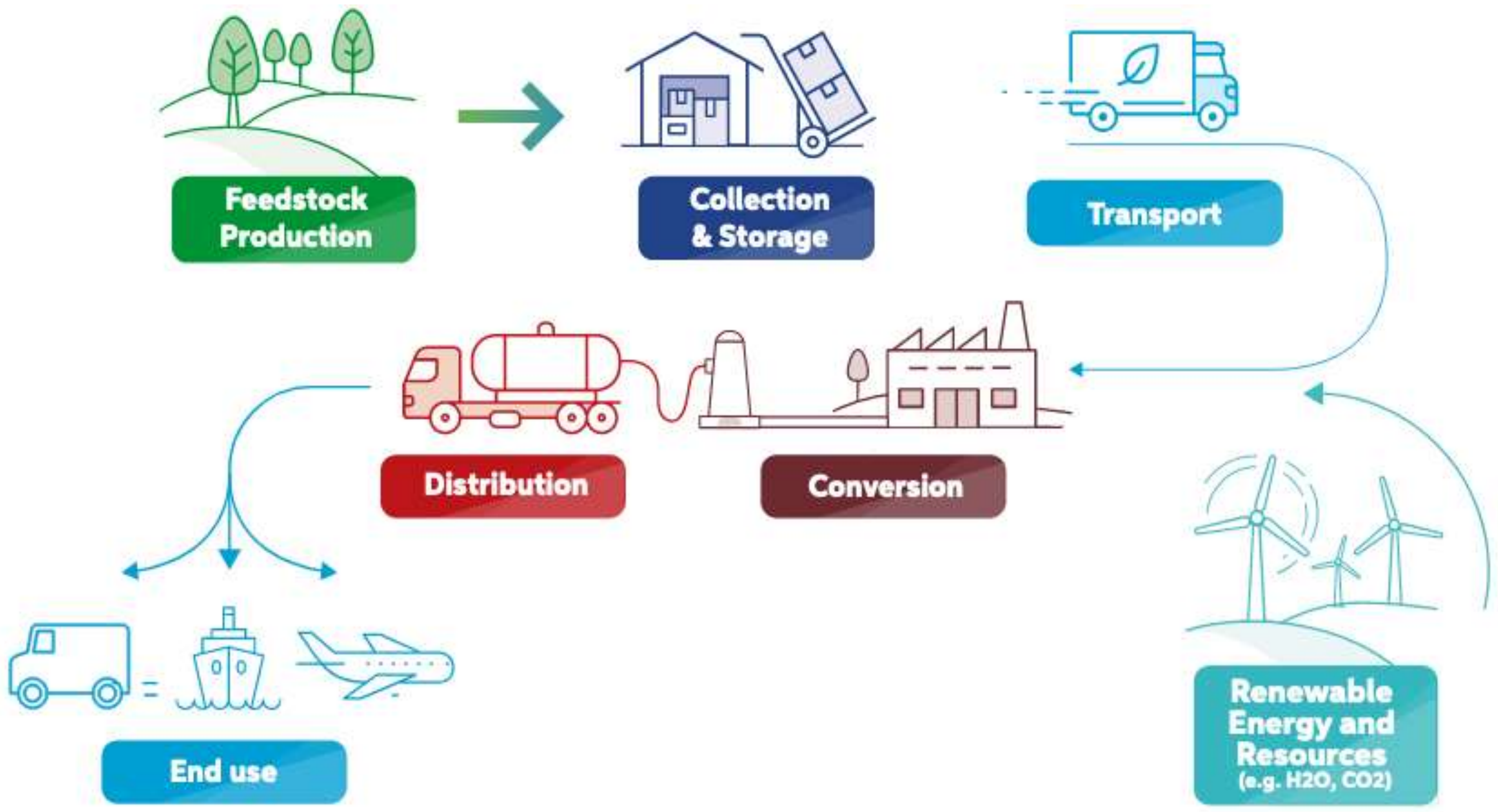
Project Scope

RESfuels refer to liquid advanced biofuels produced from lignocellulosic feedstock and liquid renewable alternative fuels produced from renewable hydrogen and CO_2 streams

Full Value Chain Approach



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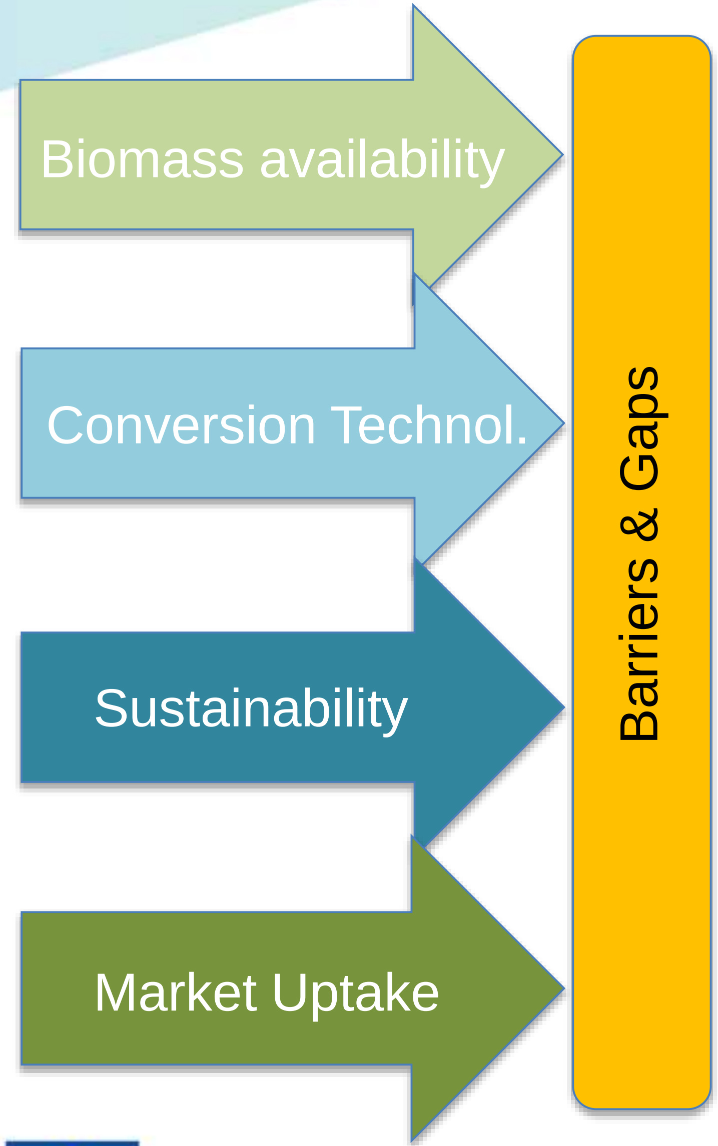
Approach



- Innovative approaches to improve biomass availability, with a special focus on new cropping schemes and use of marginal lands
- Techno-economic assessment
- Analysis of integration in to existing infrastructures
- Deliver a set of harmonised sustainability criteria and indicators
- Recommend measures to increase market acceptance and end use of RESfuels

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Stakeholder Engagement

Investigating the identified gaps/deficiencies/ hurdles – always in close collaboration with the market players and the Advisory Board

- Dedicated stakeholder **workshops**
- **Consultations** on different topics
- The ADVANCEFUEL **Stakeholder Platform**, to disseminate information and engage dialogue with targeted stakeholders
- Close cooperation with other EU-projects & **ETIP Bioenergy**

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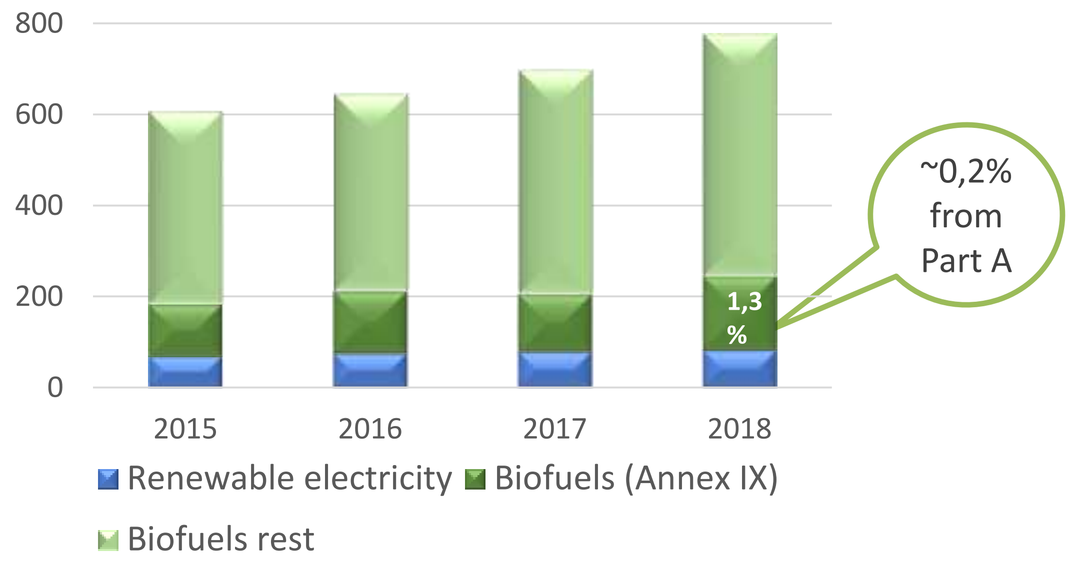
Market status, future pathways and identified barriers to advanced fuels

Ayla Uslu
TNO

RESfuel Status

CONSUMPTION

EU28 Renewable fuel consumption transport [PJ]

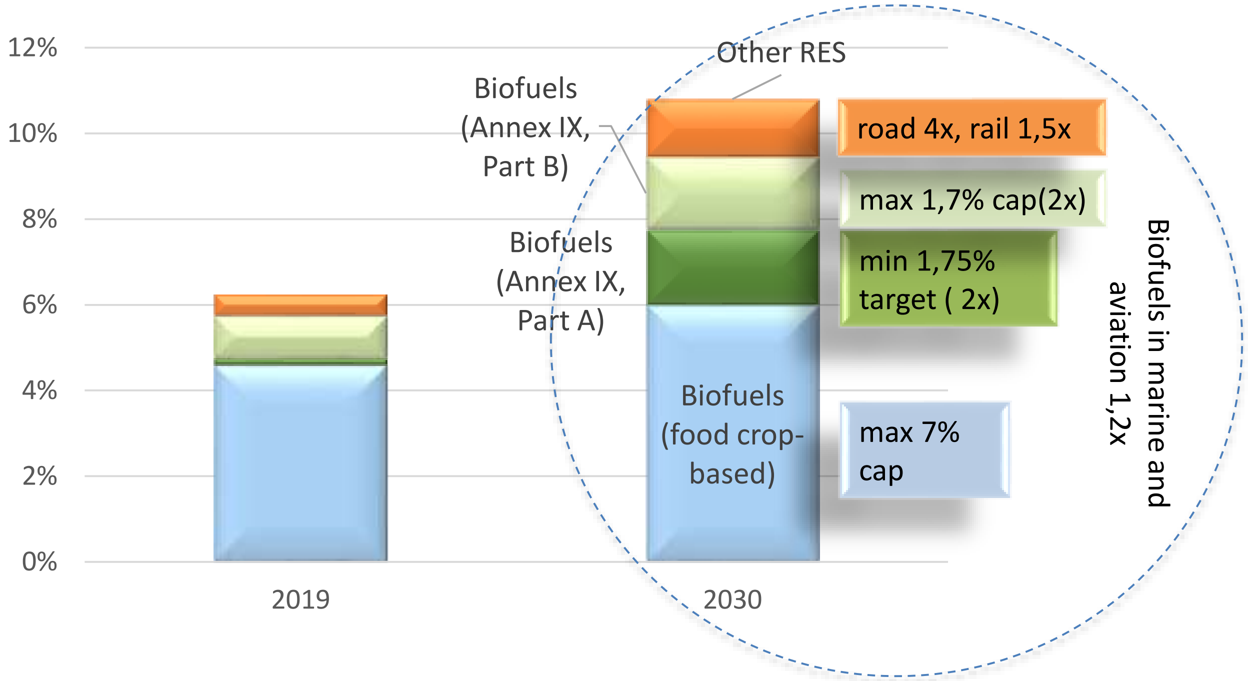


Eurostat, SHARE

REDII

14% RES in road and rail transport

EU28 Renewable fuels in transport



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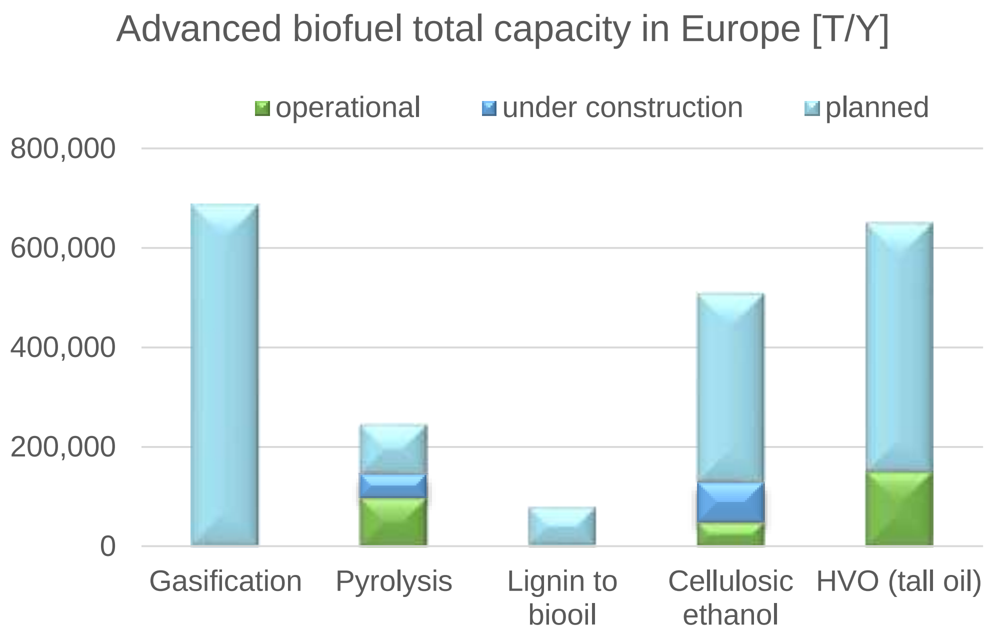
RESfuel Status

Advanced biofuel capacity & 2030 target (REDII)



**D1.5 Monitoring framework; ETIP Bioenergy, 2020*

- Total installed capacity of operational plants is around 300 kt/y
- Including constructions and planned capacity it can reach to 2 Mt
  - Less than 0,5% of transport demand
- E-fuels installed capacity 6 kt/y (0,1 PJ)

➢ REDII ~ 200 PJ biofuels based on Annex IX, Part A

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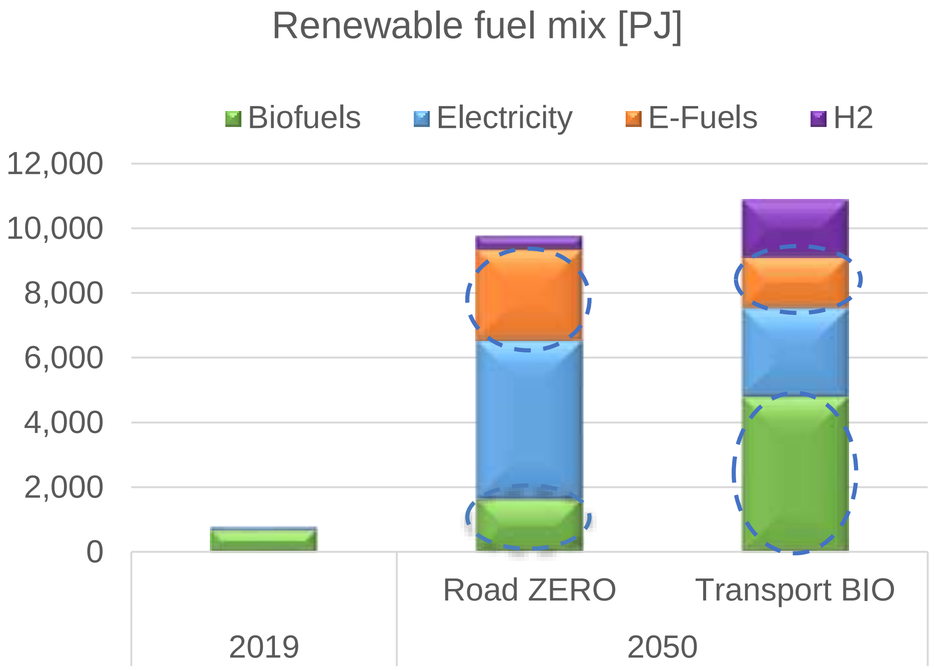
Future Prospects

Paris Agreement

- Transport sector is the only major EU sector where GHG emissions are continuously increasing. Contributing to Paris Agreement:
  - 85% CO_2 reduction in transport sector (including aviation with international extra-EU flights, excluding international maritime) in Europe by 2050 compared to 1990
  - 50% CO_2 emission reduction target for the international maritime sector by 2050 compared to 2008

RESfuel Demand



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Future Prospects

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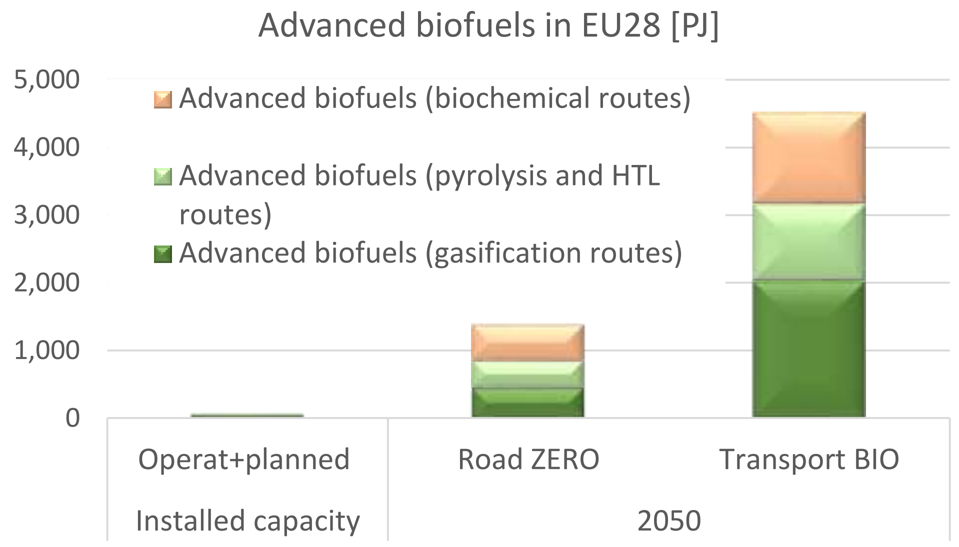
Advanced Biofuel Demand 2050

Biofuels comprise around 6-14% and and 20%-55% of the road and rail final energy demand in 2030 and 2050, respectively

- Advanced biofuels ~ 15% and 40% of biofuels in 2030, and
- ~70% and 90% of biofuels in 2050 according to Road ZERO and Transport BIO, respectively

By 2050, 25 to 75 times increase compared to the existing and planned installations



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Barriers to market uptake

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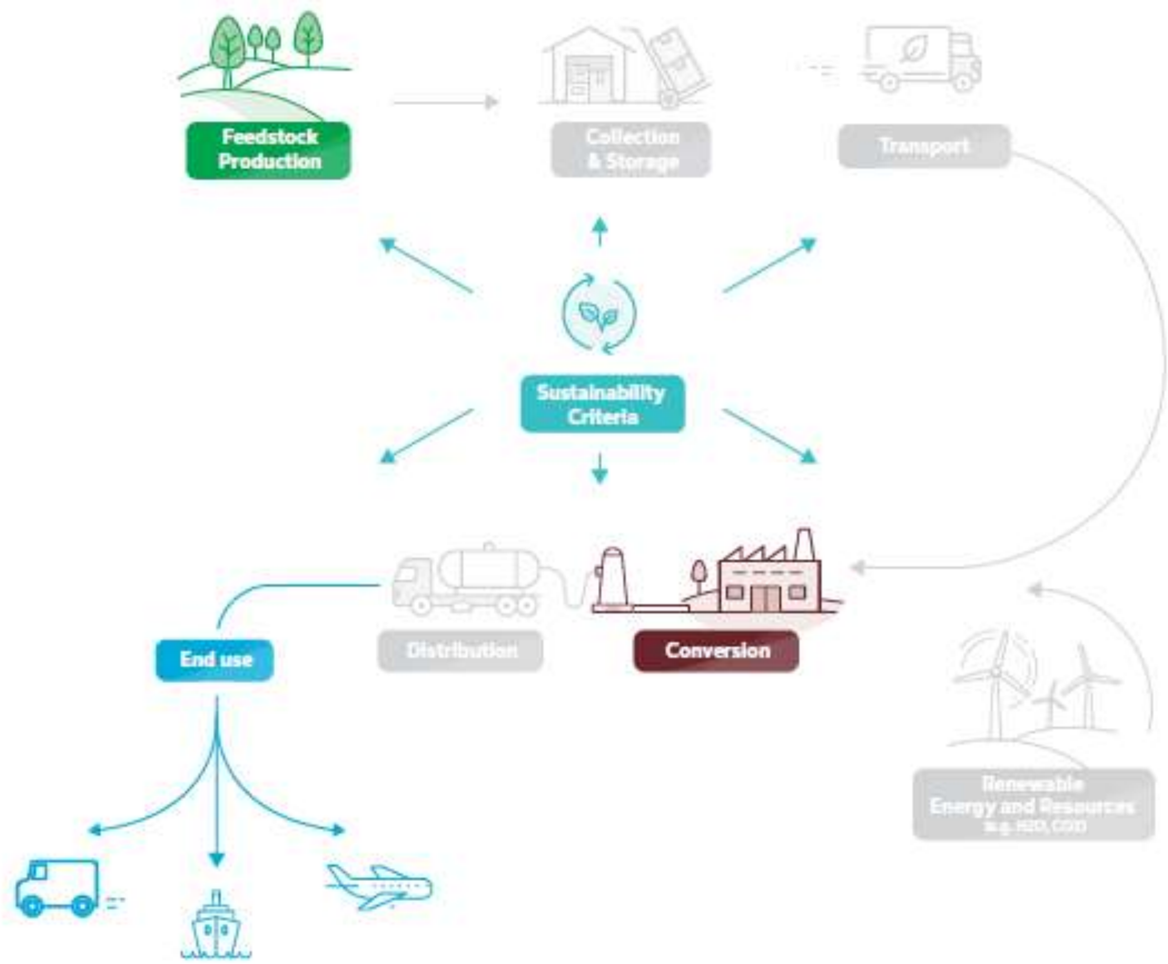

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Barriers to market uptake

- High costs of feedstocks
- Lack of clarity about environmental constraint and land availability
- Lack of harmonised regulations mainly for biomass residues

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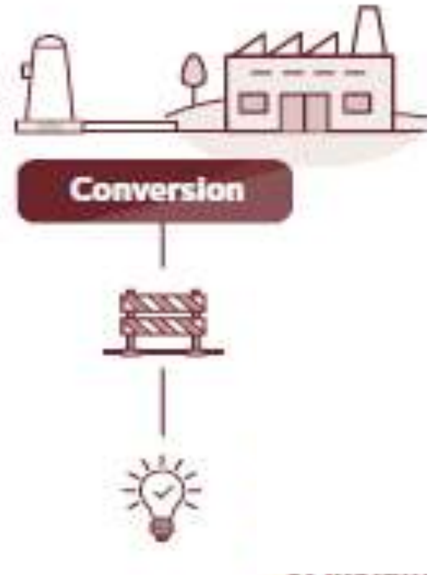
Barriers to market uptake



- High upfront CAPEX costs
- Absence of dedicated policy support and access to project finance
- Concerns on stability/security of the industry

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Barriers to market uptake

- High production costs compared to fossil fuels
- Absence of structural mechanism to bridge the price gap between renewable and fossil-based fuels

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Barriers to market uptake

- Clarity for sustainability requirements
- Sustainability criteria & certification for lignocellulosic biorefineries
- Lack of harmonised regulations

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Strategies to overcome the barriers?

Keep following!

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Supply of lignocellulosic feedstock within the EU

Sonja Germer

ATB Potsdam

Ivan Vera Concha

Utrecht University

Background / Objective

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Removing barriers to renewable transport fuels

Feedstock costs

Sustainability

Poplar miscanthus black locust
eucalyptus lupine switchgrass
sorghum willow lucerne giant reed
hemp black pine paulownia sunn
hemp triticale wheatgrass

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Dedicated Energy Cropping

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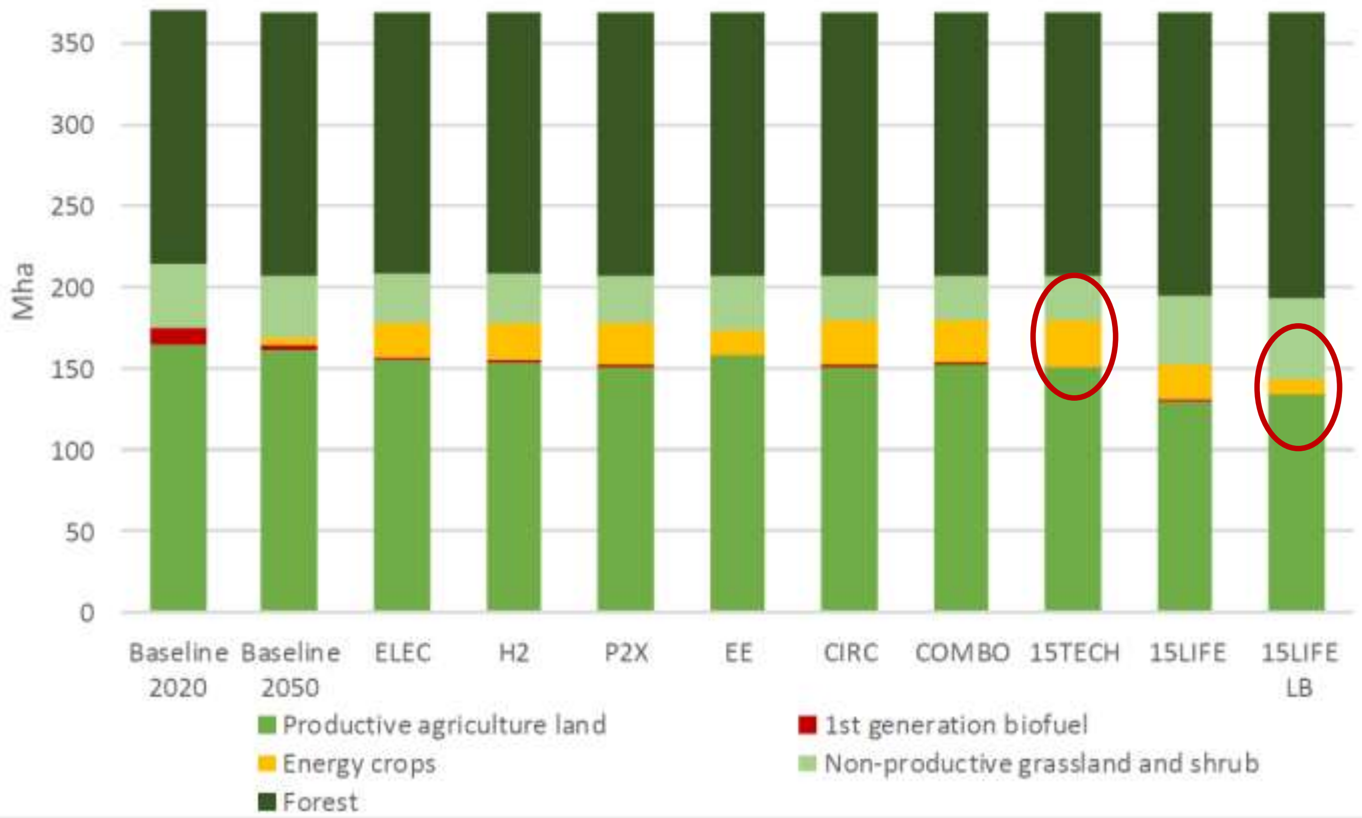
Today: **0.1 Mha**[1)] are used for dedicated energy crops

1) Bioenergy Europe (2019) Statistical Report

2050: According to scenarios dedicated energy cropping requires **9 to 29 Mha**[2)] in 2050



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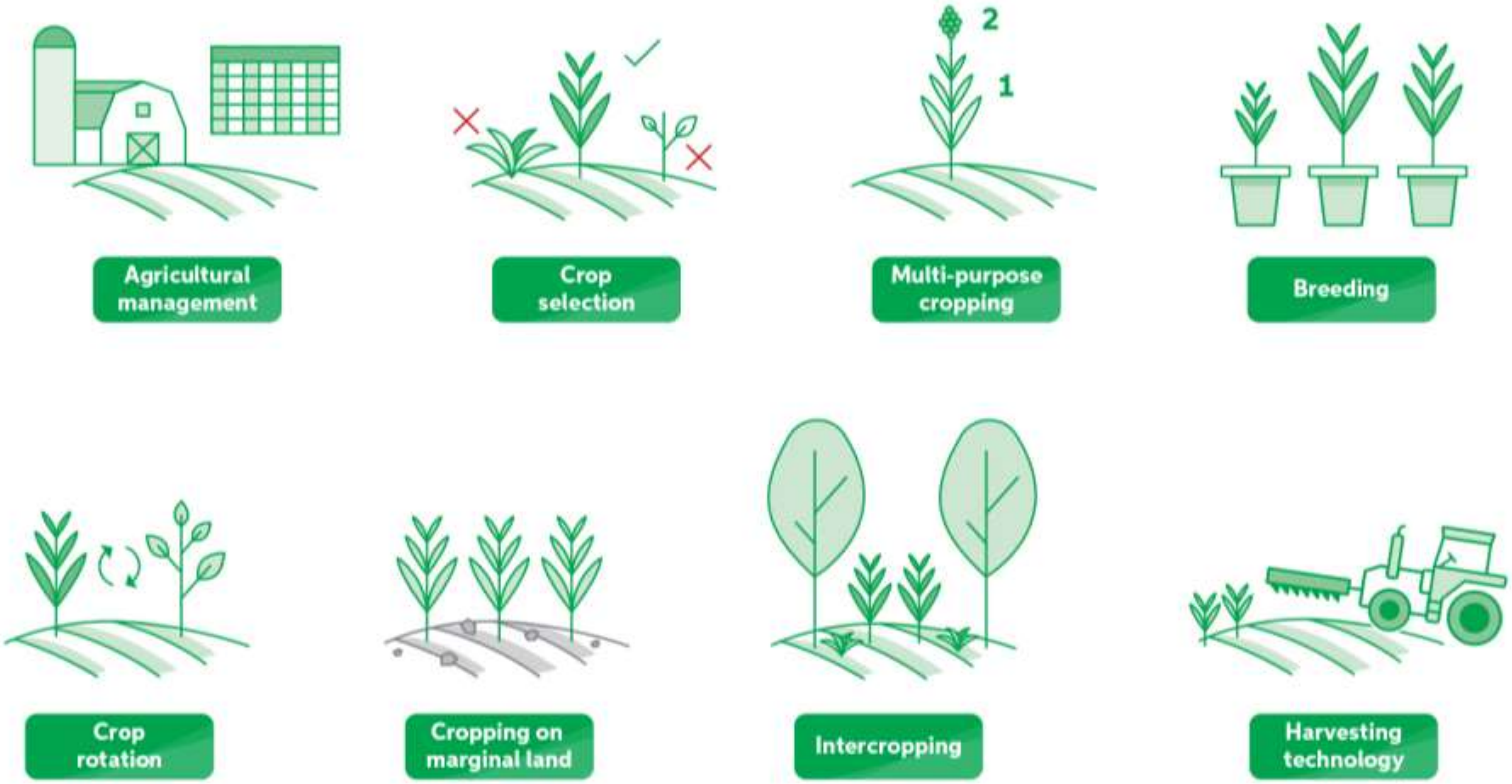
2) EC COM (2018) 773, GLOBIOM data

Innovation fields of lignocellulosic biomass cropping

Waste water:
25-30%
More yield



Miscanthus seed:
7-16%
Less costs

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Lignocellulosic biomass cropping on marginal land

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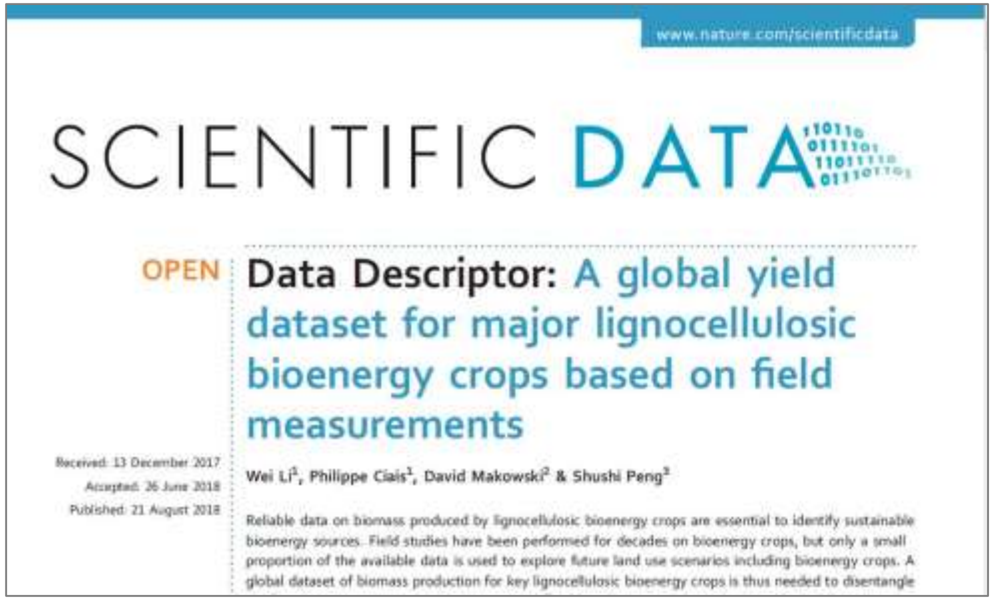
Marginal land*:
Land on which cost-effective food and feed production is not possible under given site conditions and cultivation techniques.


www.nature.com/scientificdata

SCIENTIFIC DATA

OPEN **Data Descriptor:** A global yield dataset for major lignocellulosic bioenergy crops based on field measurements

Received: 13 December 2017
Accepted: 26 June 2018
Published: 21 August 2018

Wei Li[1], Philippe Ciais[1], David Makowski[2] & Shushi Peng[3]

Reliable data on biomass produced by lignocellulosic bioenergy crops are essential to identify sustainable bioenergy sources. Field studies have been performed for decades on bioenergy crops, but only a small proportion of the available data is used to explore future land use scenarios including bioenergy crops. A global dataset of biomass production for key lignocellulosic bioenergy crops is thus needed to disentangle

* Wicke (2011)

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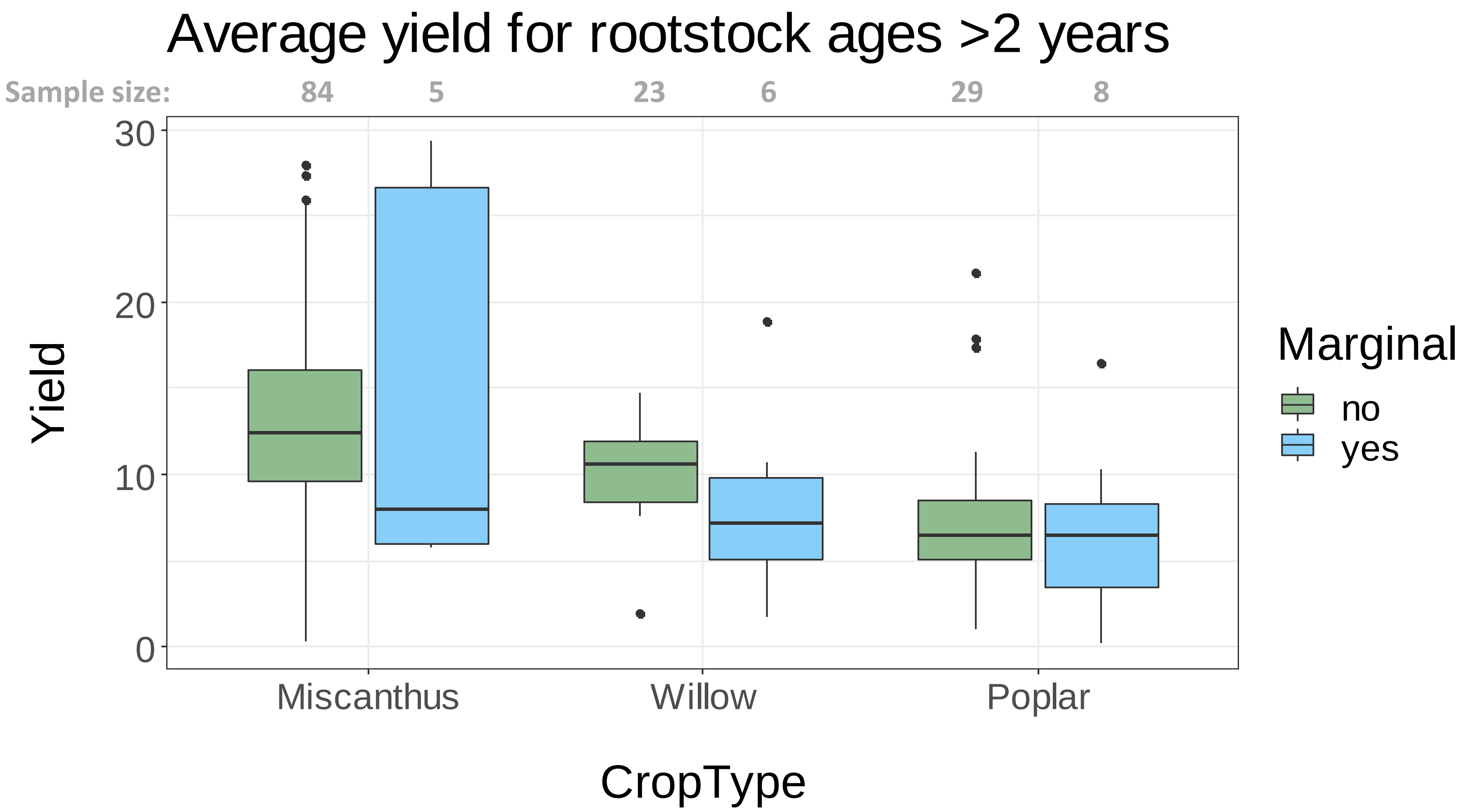
Lignocellulosic biomass cropping on marginal land (authors definition)



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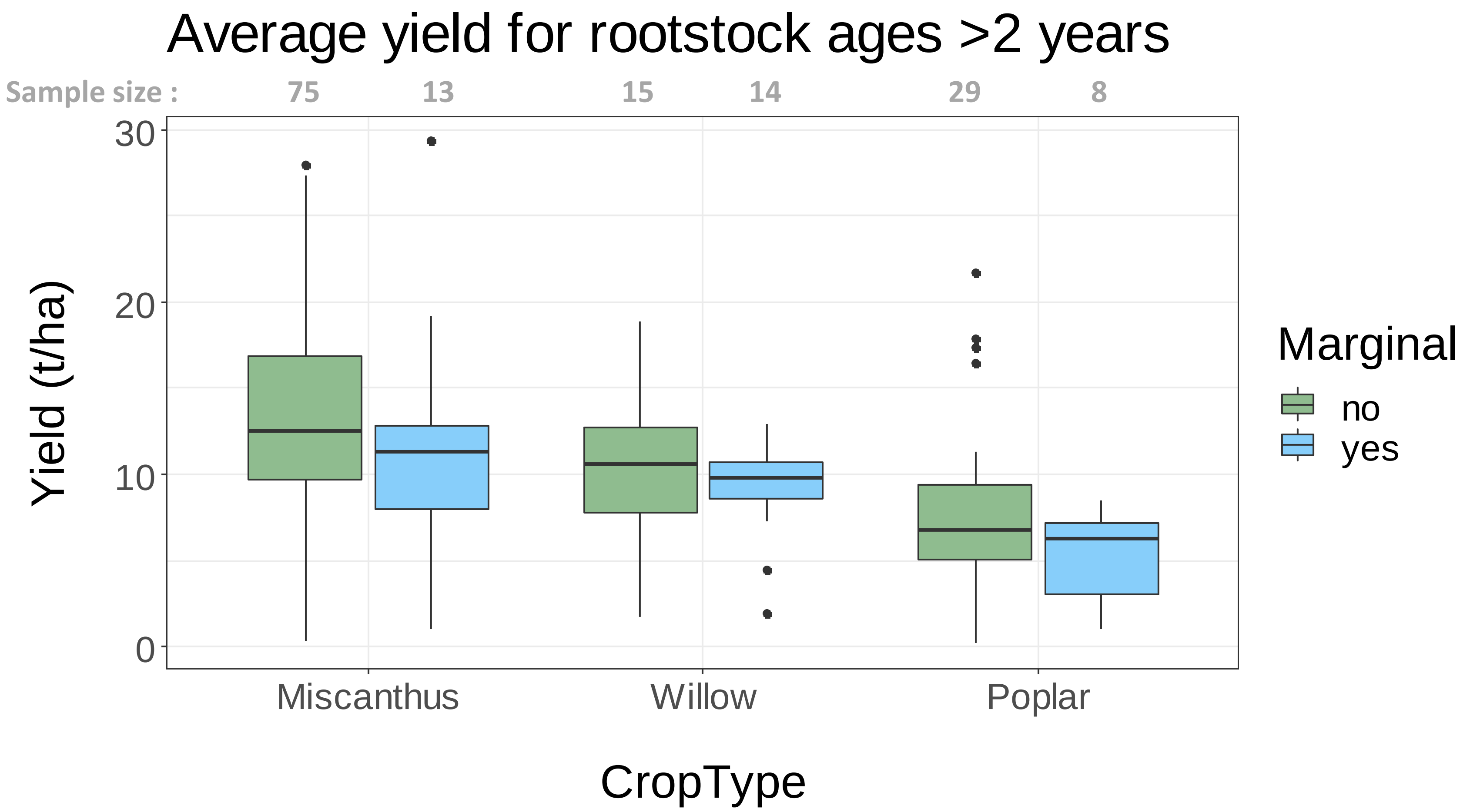
Lignocellulosic biomass cropping on marginal land (Magic definition)



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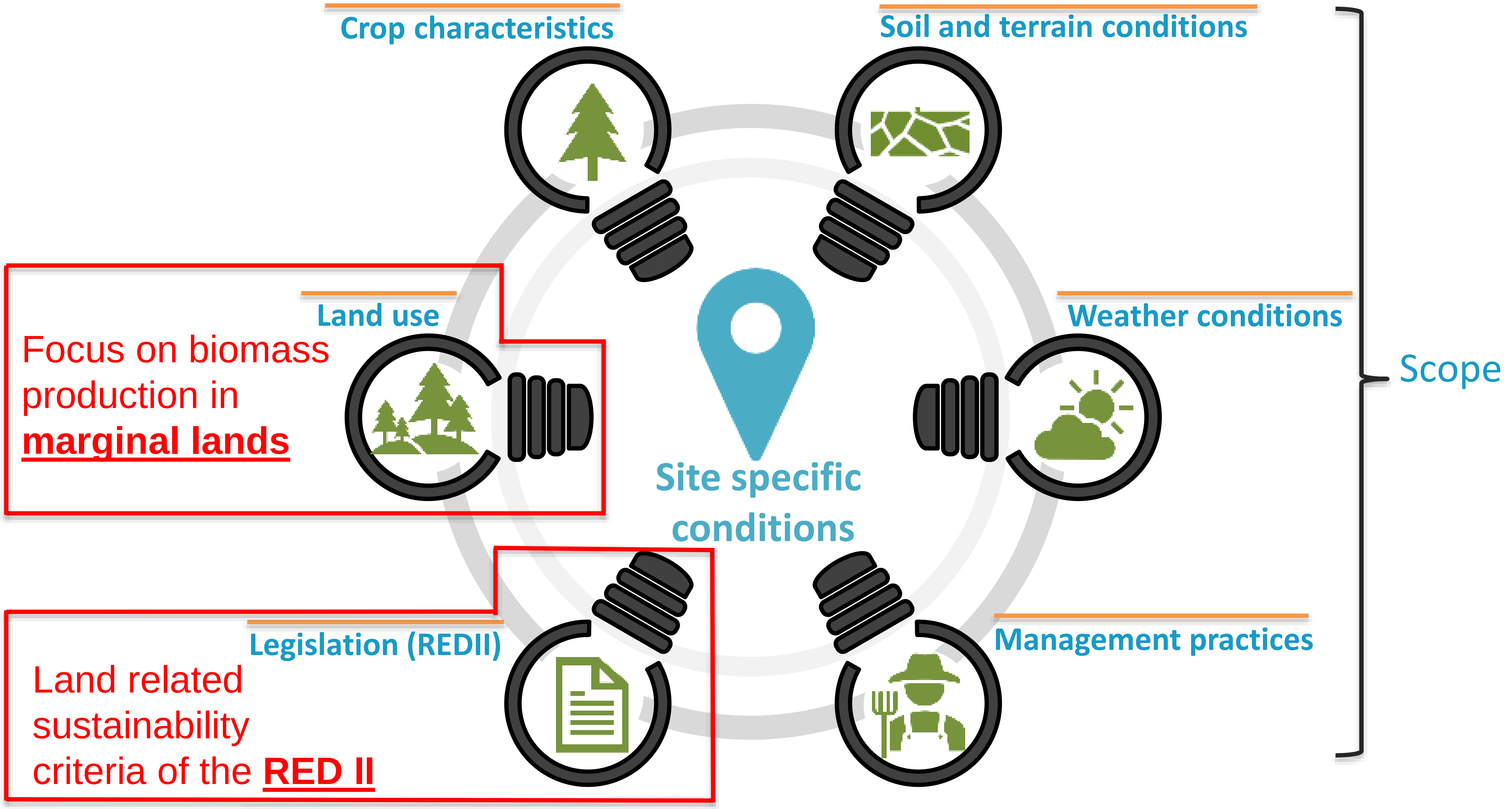
The importance of location for feedstock supply



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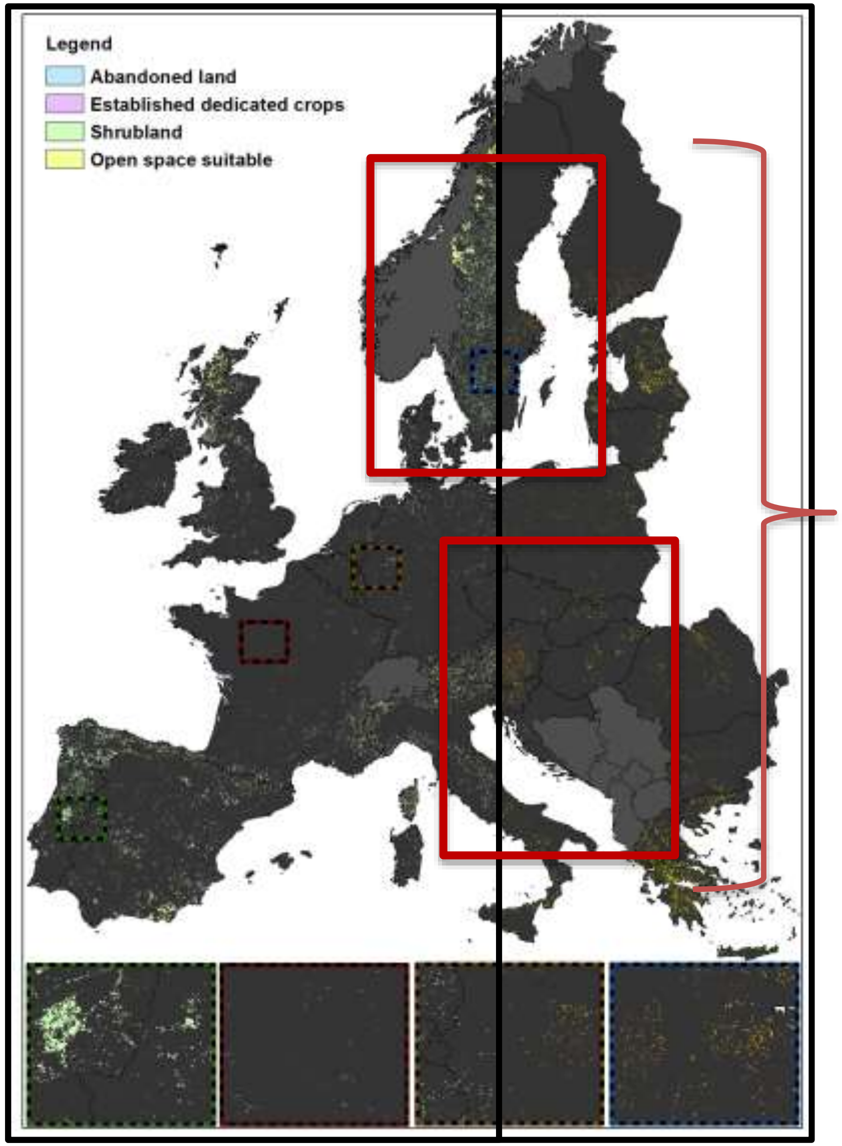
The importance of location for feedstock supply



Available potential land for the production of lignocellulosic energy crops reduces considerable when the suitability of the crops is accounted

Biomass potentials for each lignocellulosic energy crop and yield efficient biomass potential in Europe.

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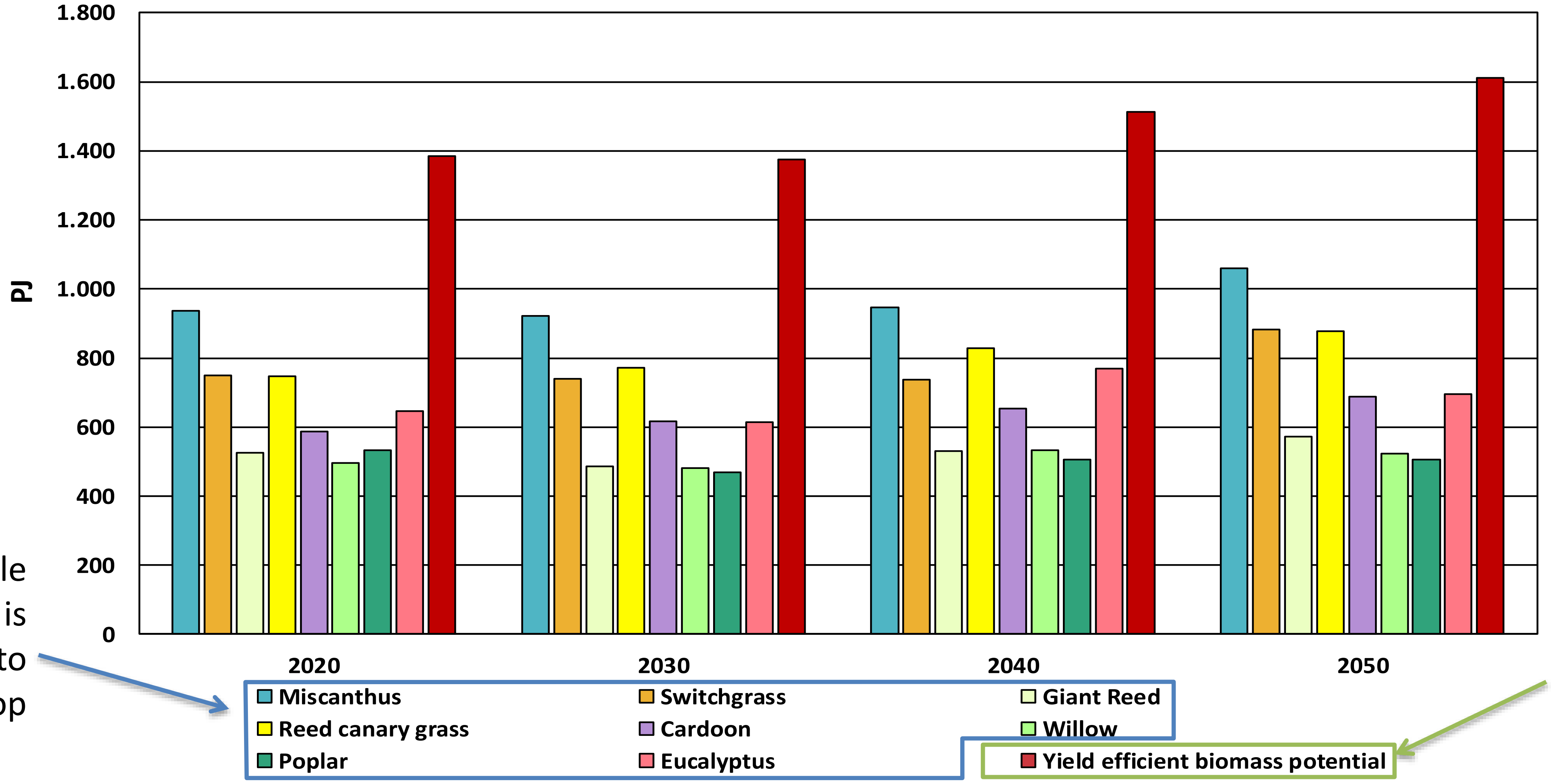

All available land is allocated to one crop

For each location the crop with highest potential biomass yield is selected

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Feedstock supply: Conclusions

- **Site specific innovations** and the **learning effect** have the potential to further increase yields of lignocellulosic cropping
- **Availability of data** on cropping area in EU and on achievable yields on marginal land need to be enabled for decision making that is based on quantitative data.
- Feedstock-specific yields and biomass potential are largely driven by **crop phenological characteristics** and **local biophysical conditions.**
- **The importance of considering location-specific characteristics** becomes apparent for the potential production of lignocellulosic energy crops in order to meet bioenergy demand
- The use of **marginal lands** for lignocellulosic energy crop production is a valuable strategy to cover to some extent biomass demand that also requires efforts in the development of infrastructure, farming experience, regulatory compliance and support, as well **as enabling sustainable biomass production** in the EU under RED II.

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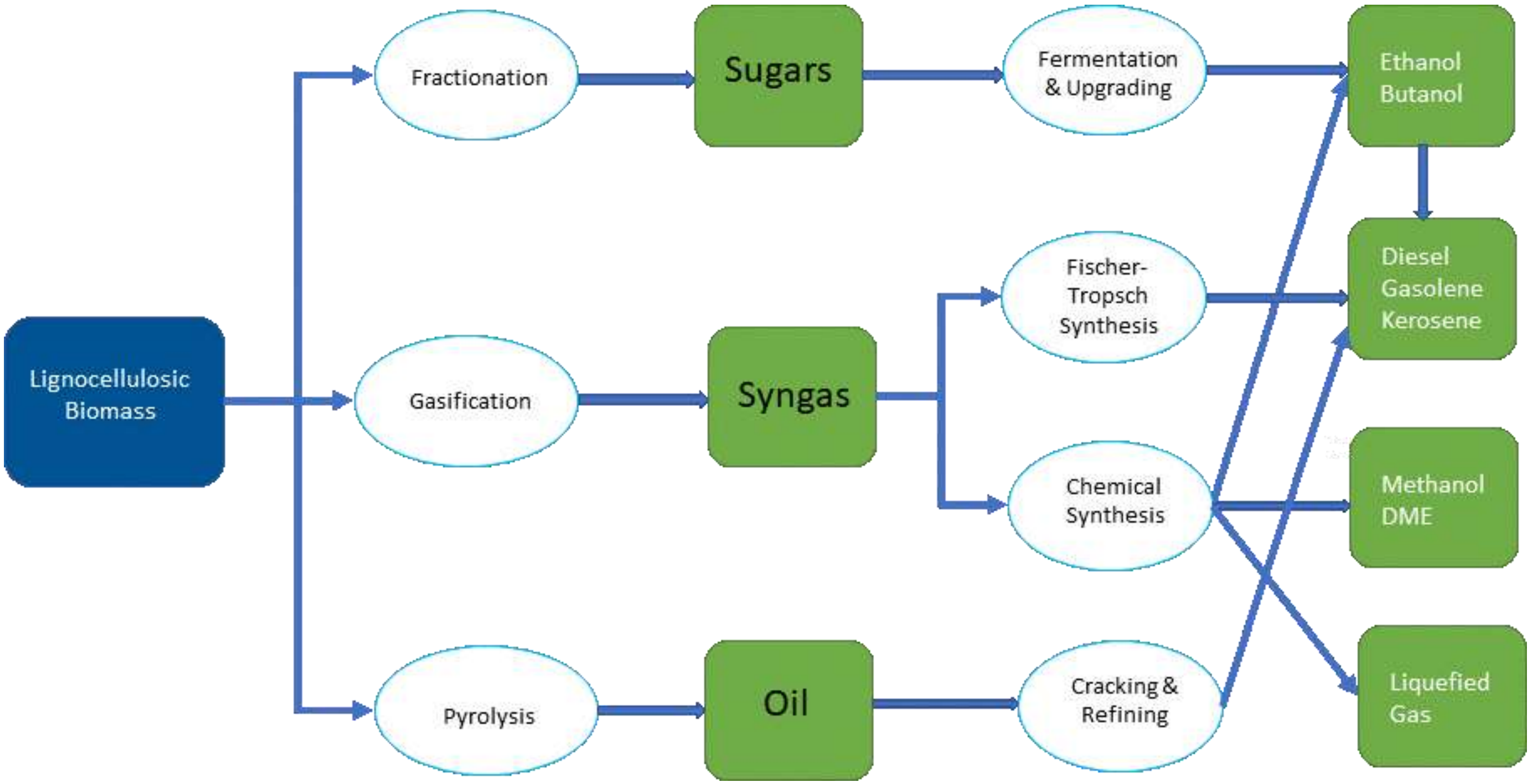
Bringing down the cost of conversion processes

Stavros Papadokonstantakis
Chalmers University of Technology

Conversion Pathways at a Glance



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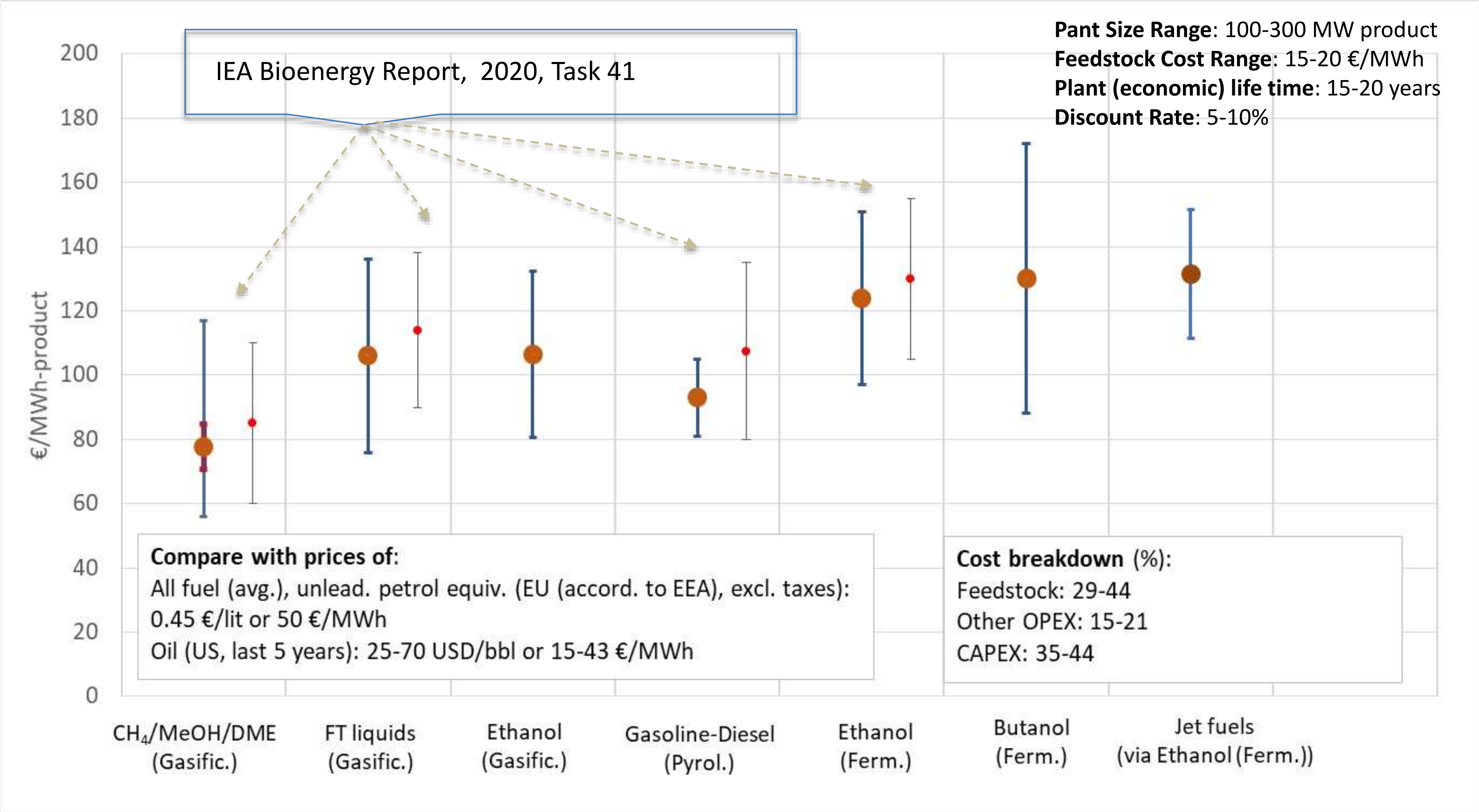
Current Status for Production Costs



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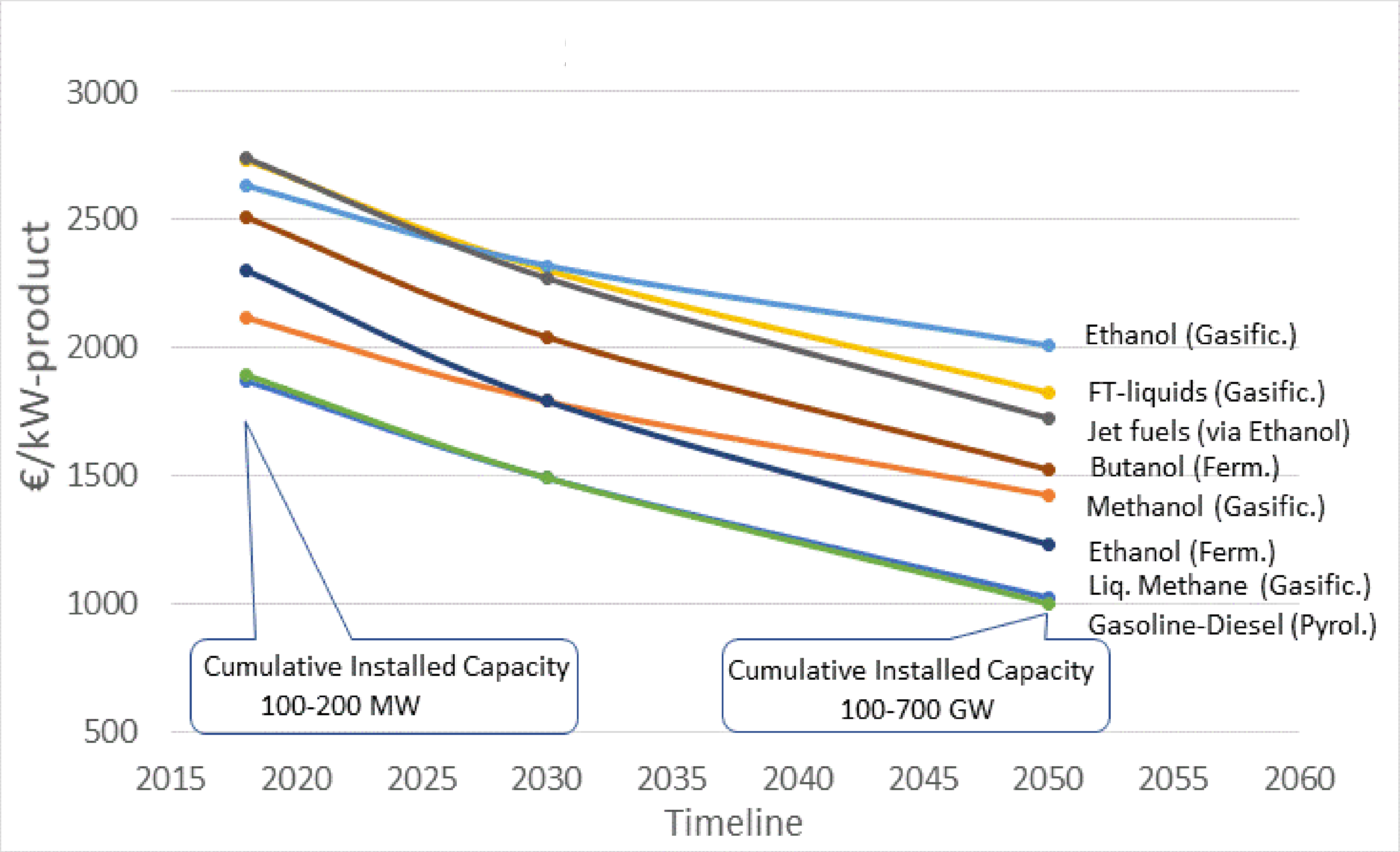
Scope for CAPEX Reduction



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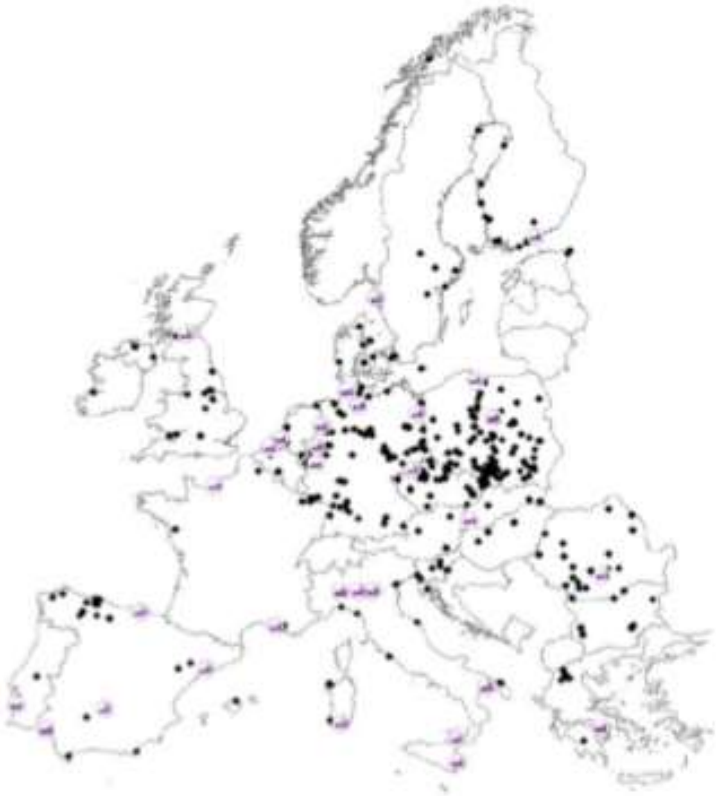
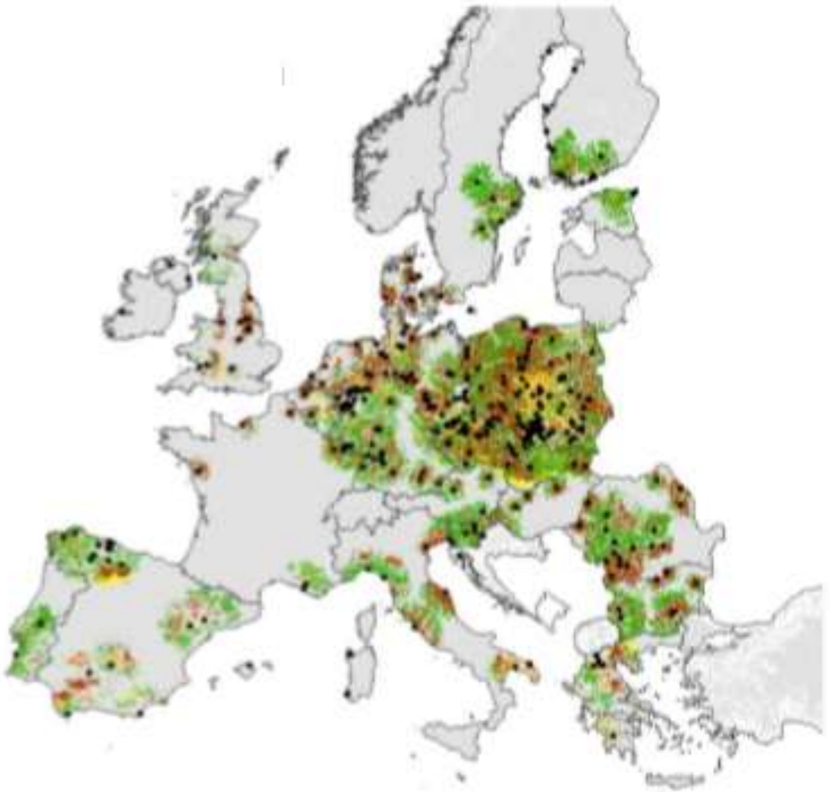
Scope for Integration to Existing Infrastructures





Black dots: existing coal power plant sites that are assumed suitable for construction of bio-oil units and/or biomass co-firing as stepping-stone for development of biomass market and infrastructures
Purple dots: oil refineries identified as suitable for biobased feedstock (i.e., co-processing of bio-oil)
Coloured areas: feedstock used to cover the demand (200 km transport limitation)

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Conclusions

- There is a **significant gap** between the production cost of advanced biofuels and the price of conventional fossil fuels of at least **20 to 40 €/MWh-product**.

- **Feedstock cost** is a large share of production cost, which can have important implications on policy measures (i.e., use of biomass in several sectors may drive up biomass prices), so that biofuels may need to be **sourced to sectors** where **substitution** away from carbon based fuels **is difficult** or costly.

- **In long-term**, technical efficiencies and operating costs can be significantly improved by advanced utilisation of **lignin fraction** from biochemical pathways and efficient utilisation of biogenic **CO_2 sources** via power-to-fuels approaches.

- **High capital cost for the required large-scale production** implies high financial risk.

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Conclusions

- In **short- to mid-term** (e.g., by 2030) the gap between advanced biofuel production costs and fossil fuels cannot be fully bridged by technical improvements

- At an initial phase, this can be achieved via subsidies, but in the long run **the cost to use fossil fuels must be (become) higher than the cost to use biofuels** (e.g., via additional CO_2 taxes for fossil fuels)**.**

- After **installations of hundreds to thousands of plants** and efficient use of the existing biomass handling and fuel production infrastructure, investment reductions of 40% to 50%.

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Ensuring the sustainability of advanced biofuels along the value chain

Ivan Vera Concha
Utrecht University

Towards sustainable biomass production, harmonised sustainability standards and certification

Main objectives:

1) Provide a set of sustainability criteria and indicators relevant to demonstrate the sustainability performance of RESfuels.

2) Provide recommendations on the options for harmonization of national and voluntary sustainability certification schemes at the EU level.

3) Provide spatially explicit and quantitative insights regarding environmental impacts of lignocellulosic biomass feedstock production.

4) Assess GHG footprints and socio-economic performance of RESfuel supply chains and further tailor and refine tools to harmonise GHG calculations of RESfuels for road, marine and aviation.

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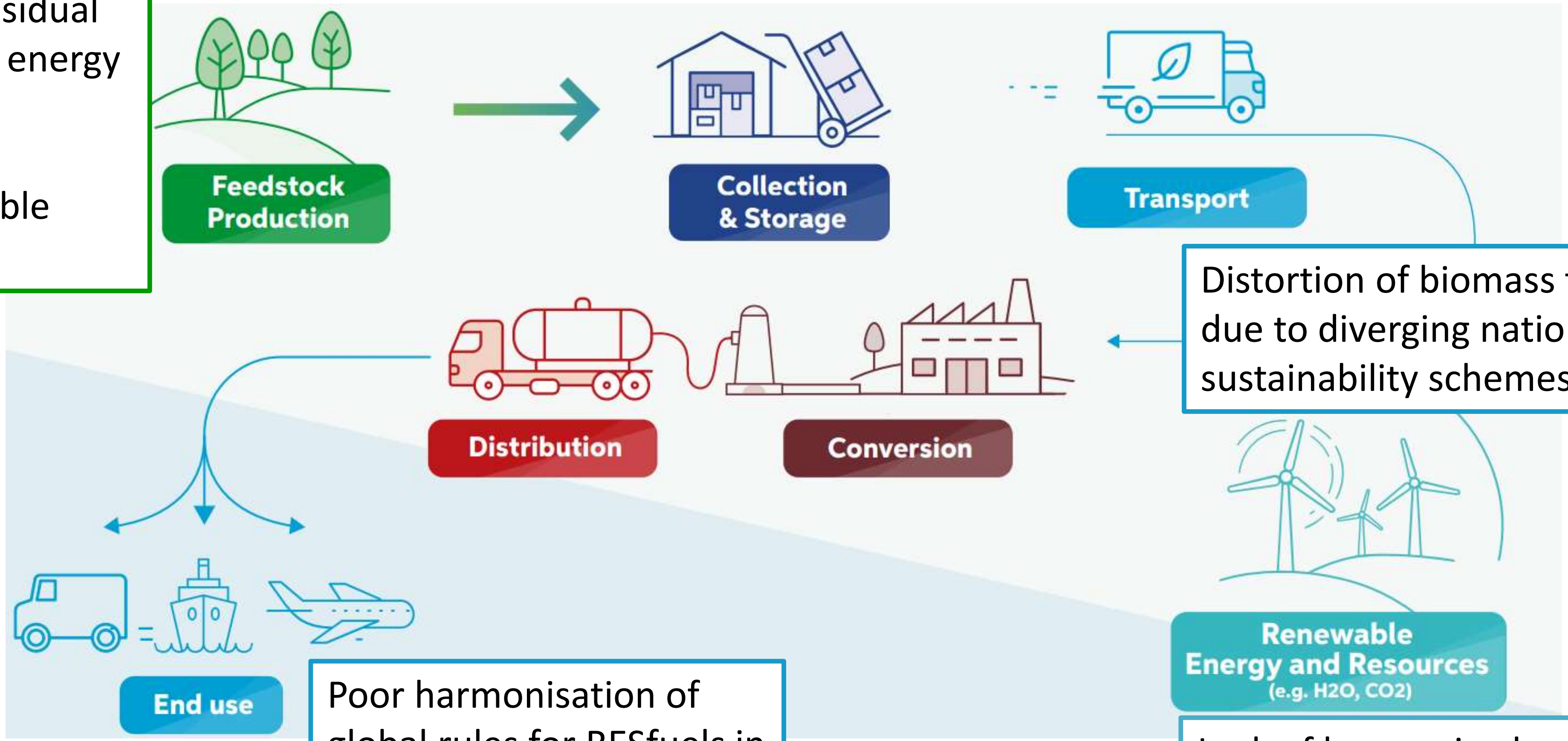
Prominent sustainability barriers to advanced biofuels

Lack of harmonised regulations on sustainable farming practices for residual biomass and dedicated energy crops.
Lack of harmonised regulations on sustainable forest management.



Distortion of biomass trade due to diverging national sustainability schemes.

Poor harmonisation of global rules for RESfuels in maritime and aviation sectors

Lack of harmonised criteria between different bioenergy sectors/outputs.

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Main insights from the research and stakeholder consultation

14 stakeholders: 3 policymakers and 10 industry representatives

Literature review, interviews, online survey, workshop

Sustainability criteria in the RED II are a major step forward, but not yet sufficiently broad and stringent to address all concerns.

Additional sustainability criteria are needed to safeguard sustainable bioenergy supply. They should address stakeholder concerns, and at the same time avoid becoming an unnecessary burden or barrier to bioenergy development.

More transparency needed in market & sustainability reporting

Inclusive sustainability criteria (env., social & economic) desired; Harmonised criteria beyond RED I & II, definition (e.g. feedstocks), measurements (SFM, iLUC) at EU level preferred

General EU guidance sufficient but more improvements in national regulation and accompanying measurements in MSs required still

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A translation of RED II sustainability criteria to bioenergy supply from lignocellulosic energy crops in the ADVANCEFUEL project

RED II Scenario: sustainability criteria
Exclusions of Natura 2000/protected areas
Exclusion of High Nature Value farmland (HNVf)
Exclusion of high carbon stock areas
Exclusion of wetlands and peatlands
Exclusion of natural grasslands
Only use of surplus/abandoned agricultural
Marginal land: as established in MAGIC

Article 29

Sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels

3. Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall not be made from raw material obtained from land with a high biodiversity value, namely land that had one of the following statuses in or after January 2008, whether or not the land continues to have that status:

(a) primary forest and other wooded land, namely forest and other wooded land of native species where there is no clearly visible indication of human activity and the ecological processes are not significantly disturbed;

(b) highly biodiverse forest and other wooded land which is species-rich and not degraded, or has been identified as being highly biodiverse by the relevant competent authority, unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes;

(c) areas designated:

(i) by law or by the relevant competent authority for nature protection purposes; or

(ii) for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the International Union for the Conservation of Nature, subject to their recognition in accordance with the first subparagraph of Article 30(4),

unless evidence is provided that the production of that raw material did not interfere with those nature protection purposes;

(d) highly biodiverse grassland spanning more than one hectare that is:

(i) natural, namely grassland that would remain grassland in the absence of human intervention and that maintains the natural species composition and ecological characteristics and processes; or

(ii) non-natural, namely grassland that would cease to be grassland in the absence of human intervention and that is species-rich and not degraded and has been identified as being highly biodiverse by the relevant competent authority, unless evidence is provided that the harvesting of the raw material is necessary to preserve its status as highly biodiverse grassland.

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A translation of RED II sustainability criteria to bioenergy supply from lignocellulosic energy crops in the ADVANCEFUEL project

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Article 29

Sustainability and greenhouse gas emissions saving criteria for biofuels, bioliquids and biomass fuels

4. Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall not be made from raw material obtained from land with high-carbon stock, namely land that had one of the following statuses in January 2008 and no longer has that status:

(a) wetlands, namely land that is covered with or saturated by water permanently or for a significant part of the year;

(b) continuously forested areas, namely land spanning more than one hectare with trees higher than five metres and a canopy cover of more than 30 %, or trees able to reach those thresholds *in situ*;

(c) land spanning more than one hectare with trees higher than five metres and a canopy cover of between 10 % and 30 %, or trees able to reach those thresholds *in situ*, unless evidence is provided that the carbon stock of the area before and after conversion is such that, when the methodology laid down in Part C of Annex V is applied, the conditions laid down in paragraph 10 of this Article would be fulfilled.

This paragraph shall not apply if, at the time the raw material was obtained, the land had the same status as it had in January 2008.

5. Biofuels, bioliquids and biomass fuels produced from agricultural biomass taken into account for the purposes referred to in points (a), (b) and (c) of the first subparagraph of paragraph 1 shall not be made from raw material obtained from land that was peatland in January 2008, unless evidence is provided that the cultivation and harvesting of that raw material does not involve drainage of previously undrained soil.

……Indirect land-use change occurs when the cultivation of crops for biofuels, bioliquids and biomass fuels displaces traditional production of crops for food and feed purposes. Such additional demand increases the pressure on land and can lead to the extension of agricultural land into areas with high-carbon stock, such as forests, wetlands and peatland, causing additional greenhouse gas emissions.

……The restoration of land that has been severely degraded and therefore cannot otherwise be used for agricultural purposes is a way of increasing the amount of land available for cultivation.

Special attention

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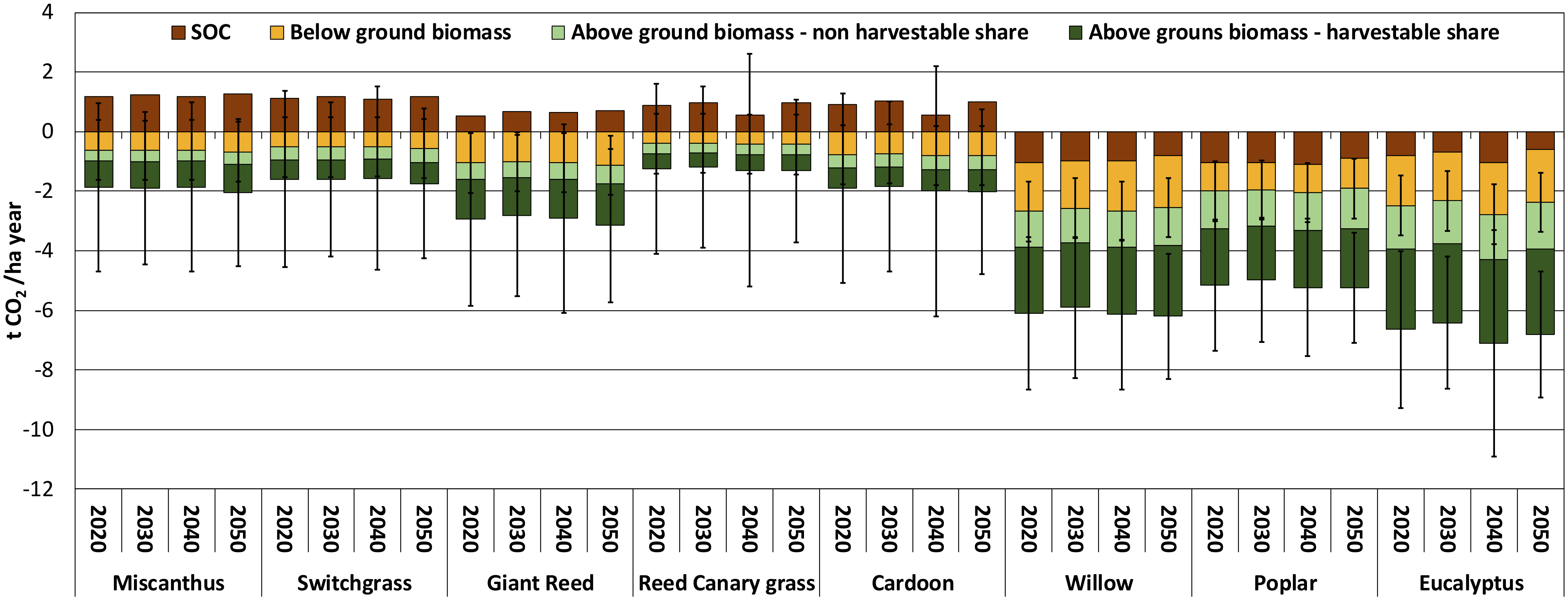
Despite meeting RED II sustainable criteria there is a strong variation in LUC-related CO_2 emissions



Average LUC related GHG emissions with two standard deviations for the cultivation of each lignocellulosic energy crops on marginal land in Europe for 2020, 2030, 2040 and 2050 The ranges indicate the spatial variability of LUC GHG emissions due to the heterogeneity in biophysical conditions

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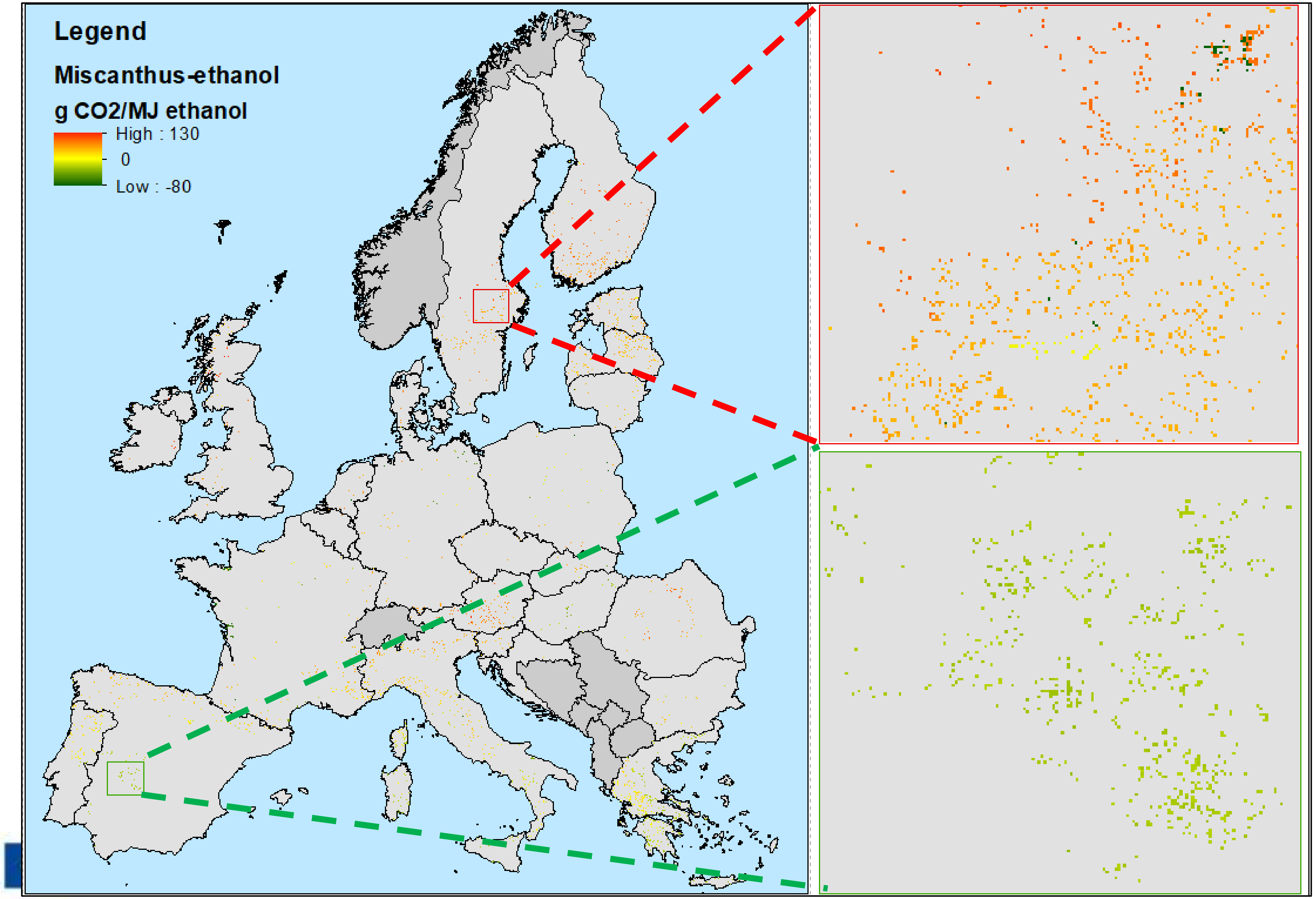
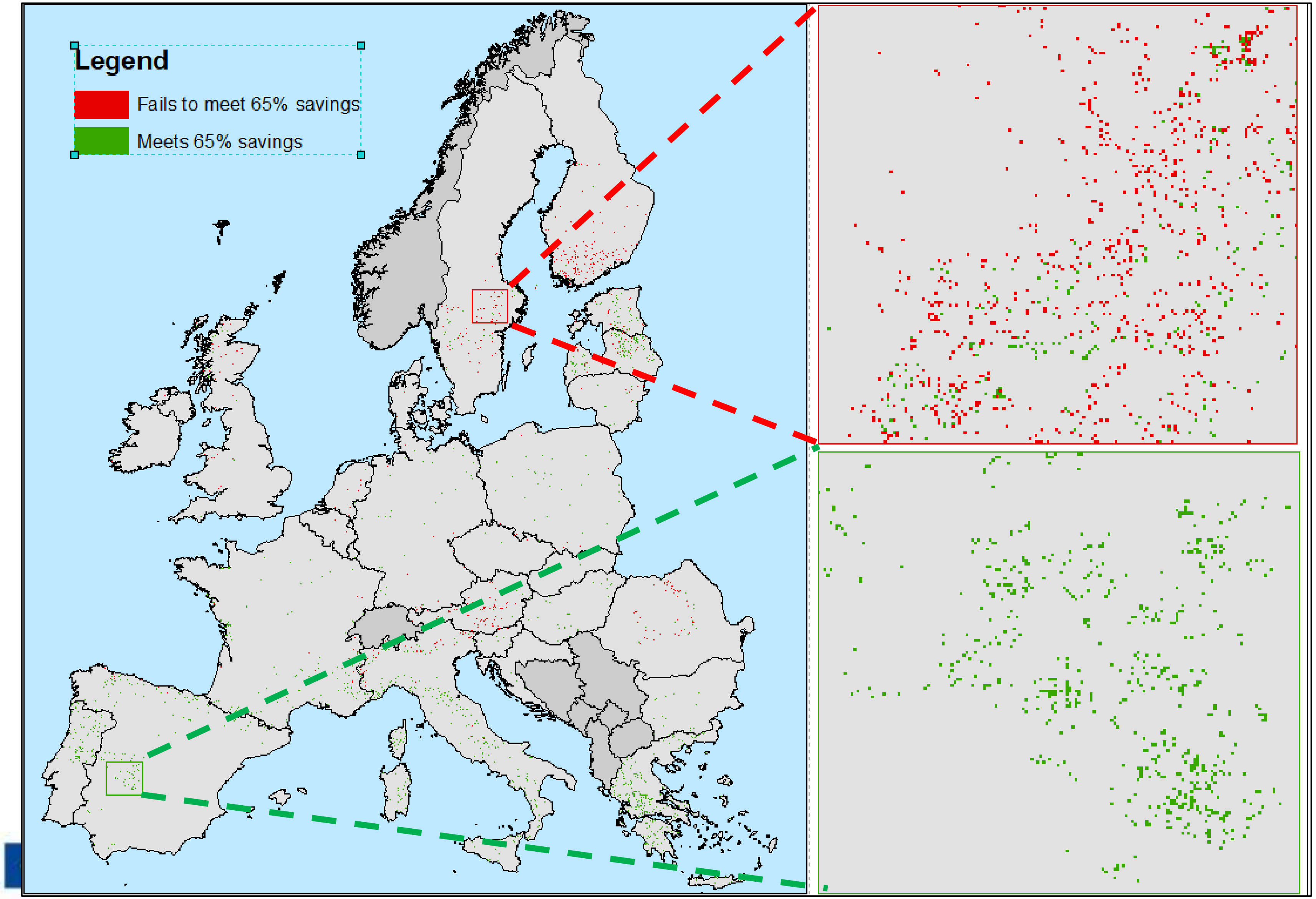
What is the panorama for Europe? Example: Miscanthus to ethanol (via steam explosion), the is still quite some variation



- We calculated the supply chain GHG emissions for all Europe
- For the Spain location, GHG emissions are calculated to be on average -15 g CO_2/MJ ethanol
- For the Sweden location, GHG emissions are calculated to be on average 40 g CO_2/MJ ethanol
- Other parameters such as conversion and transport are calculated with standard values (JRC) and are constant between the two locations

What is the panorama for Europe? Several locations lack to comply with RED II GHG savings



- Supply chains GHG emissions variation is strongly driven by LUC-related and N2O field emissions
- GHG emissions vary depending on crop type, location and point in time
- Even in relative small regions there are areas that comply and areas that lack to comply with RED II
- Tradeoffs between impacts were found

The importance of location: the location specific biophysical conditions steer considerable the environmental performance from lignocellulosic energy crop production.

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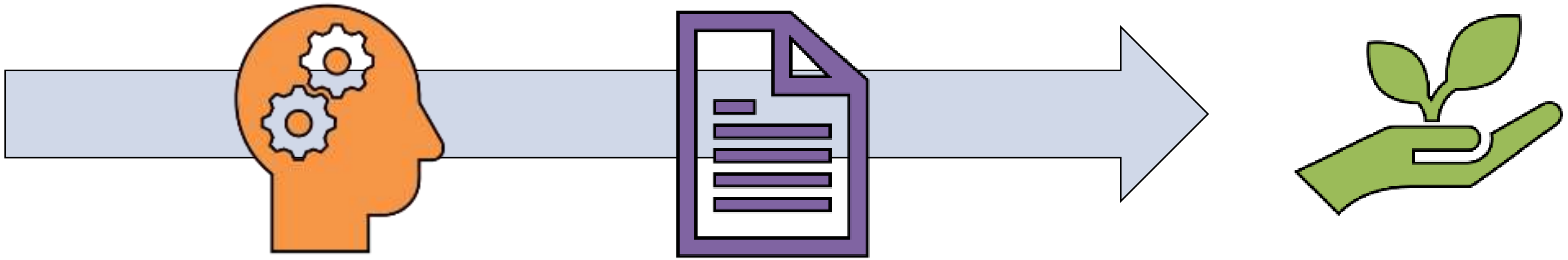
- The production of lignocellulosic energy crops in marginal lands can cover to **some extent future bioenergy** demand and contribute to EU **GHG emissions reduction targets**. However, it can also generate impacts in other areas

- Smart choices on location and crop type for lignocellulosic energy crop production can be made to **enable sustainable biomass production in Europe under RED II sustainability criteria** and overcome challenges of biomass availability

- Tools are provided to assess the sustainability of biomass production in Europe



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N.° 764799.

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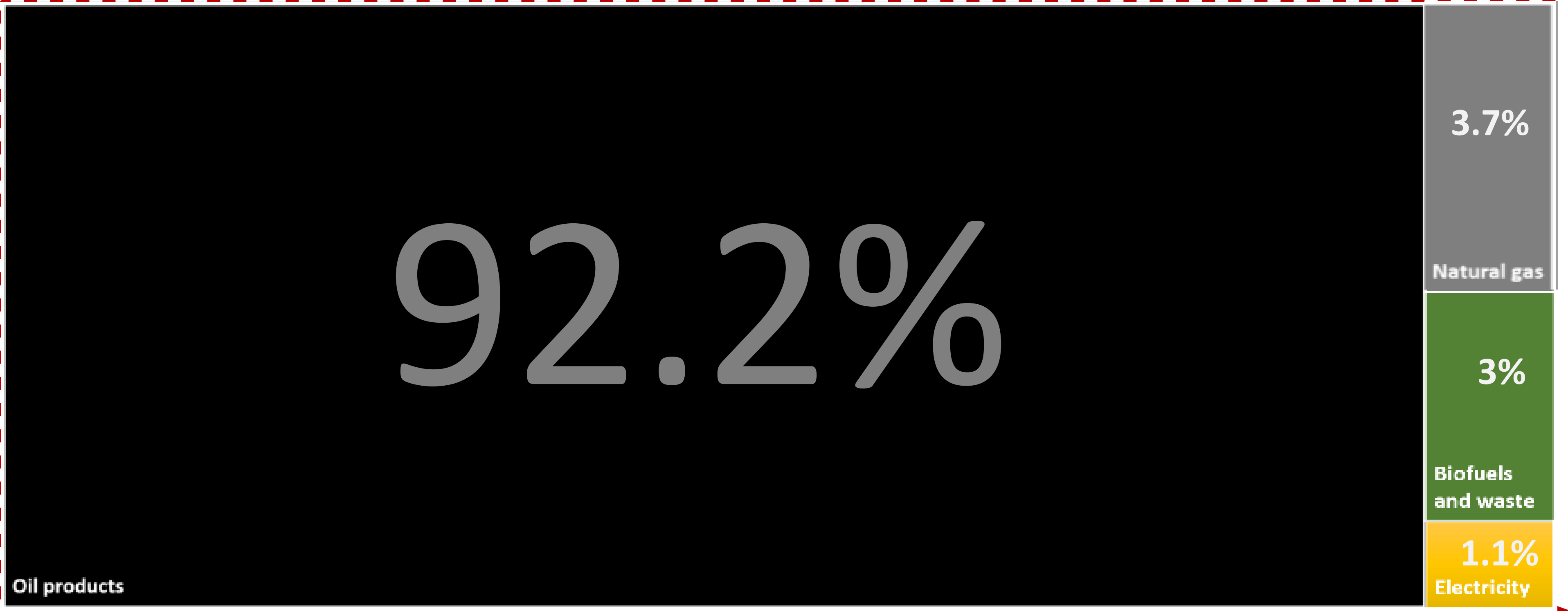
The performance of advanced fuels in end-use sectors

Yuri Kroyan
Aalto University

Evolution of energy use in transport sector by fuel type, worldwide



At least over **4 Gtoe** in 2050

Made based on:

1. **IEA. Data and statistics** (https://www.iea.org/data-and-statistics/data-tables?country=EU28&energy=Balances&year=2017)
2. **IEA.** *Transport energy and CO2: Moving towards sustainability*. OECD Publishing.

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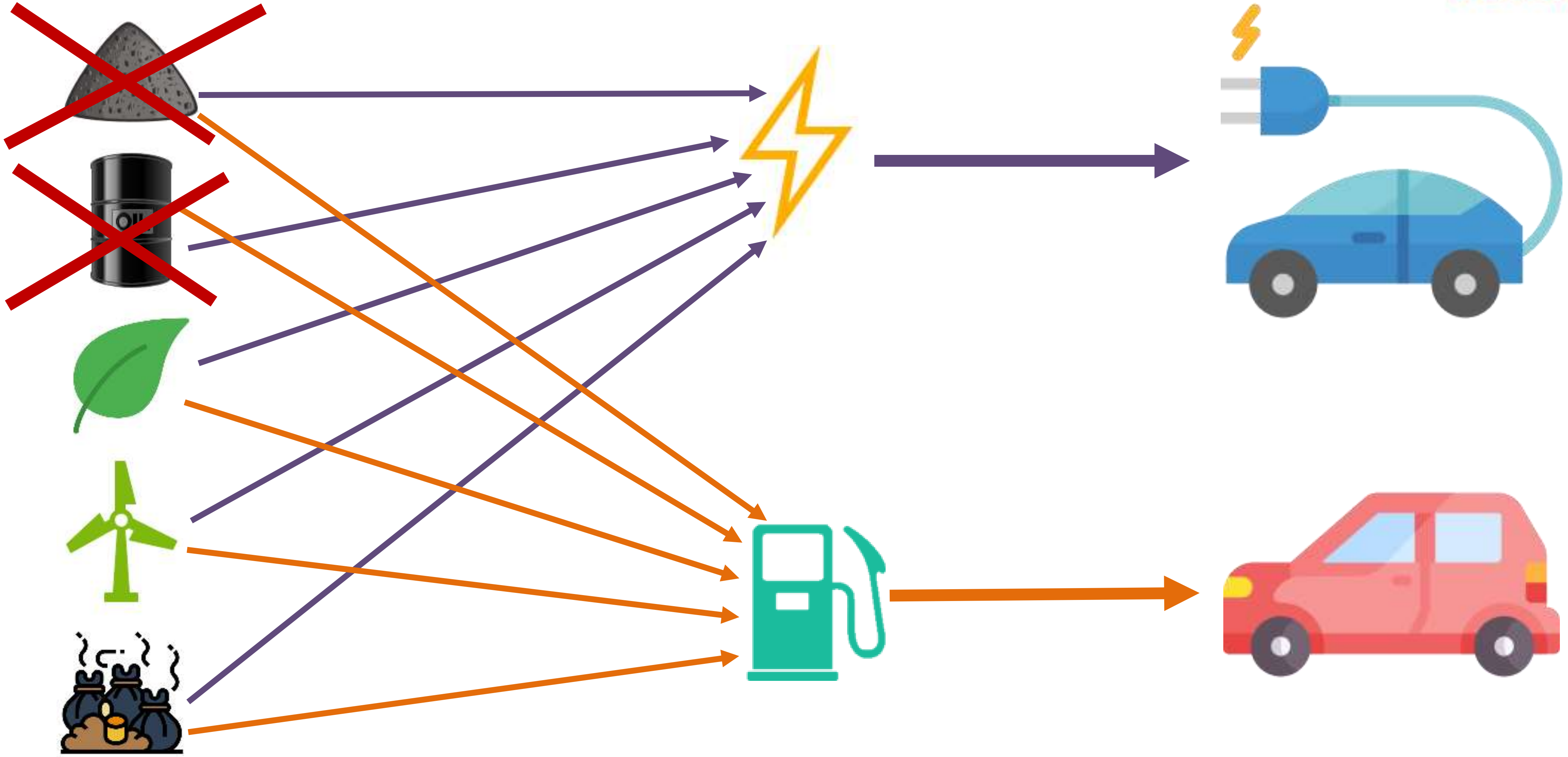
Technologies should not compete with each other!



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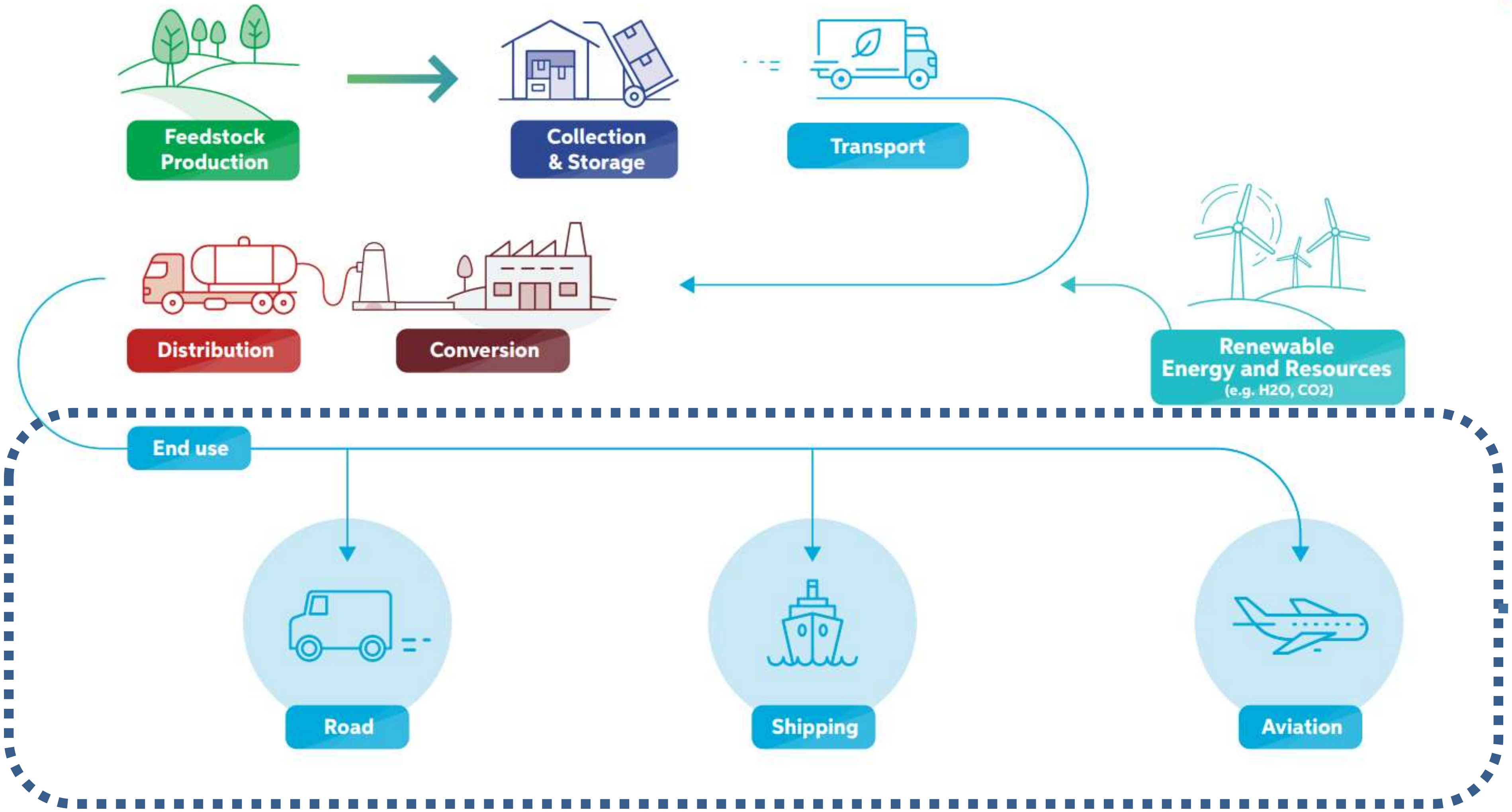

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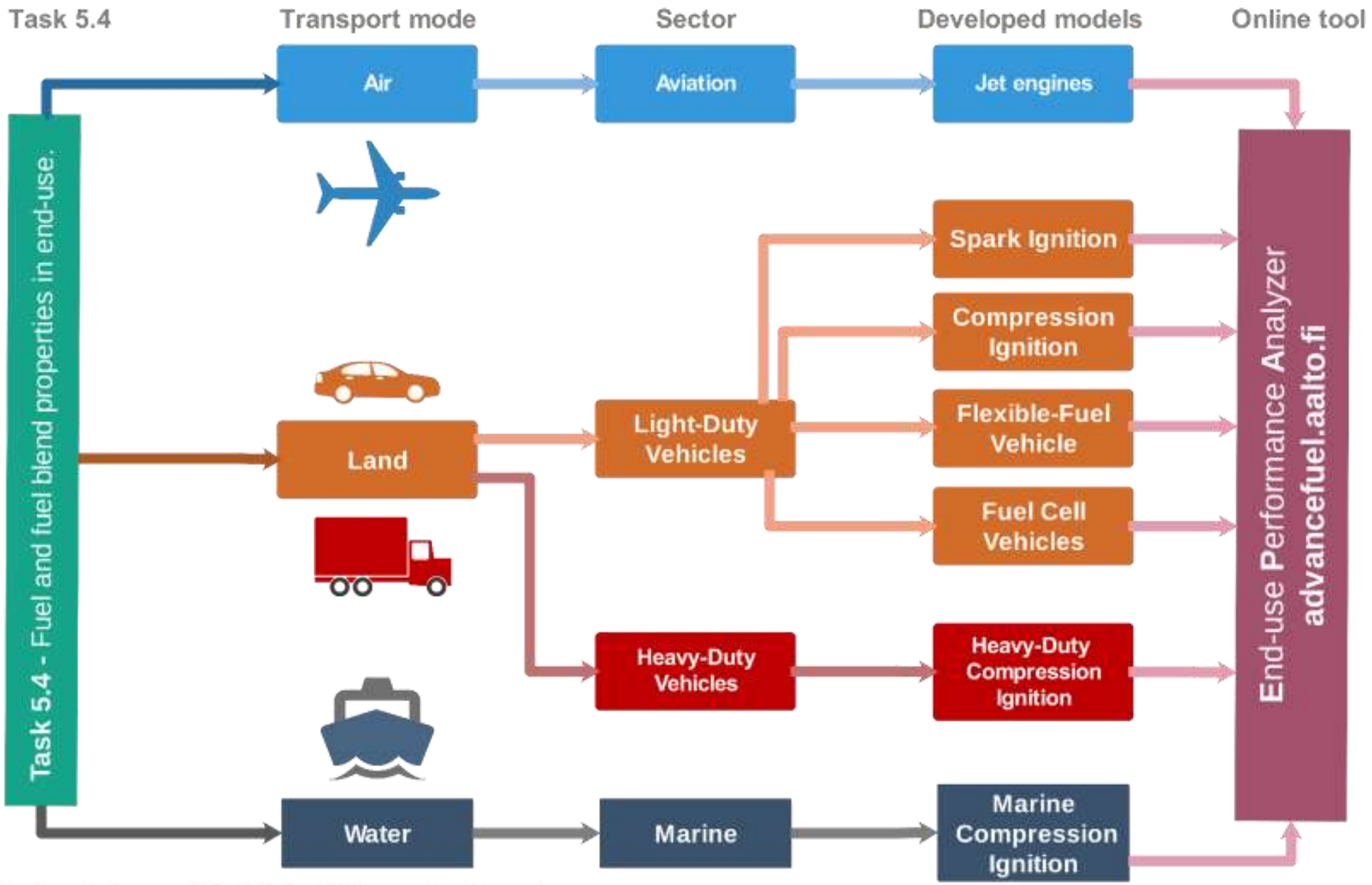
End-use Analyser



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The end-use performance in Spark-Ignition (SI) Light-Duty Vehicles (LDV)

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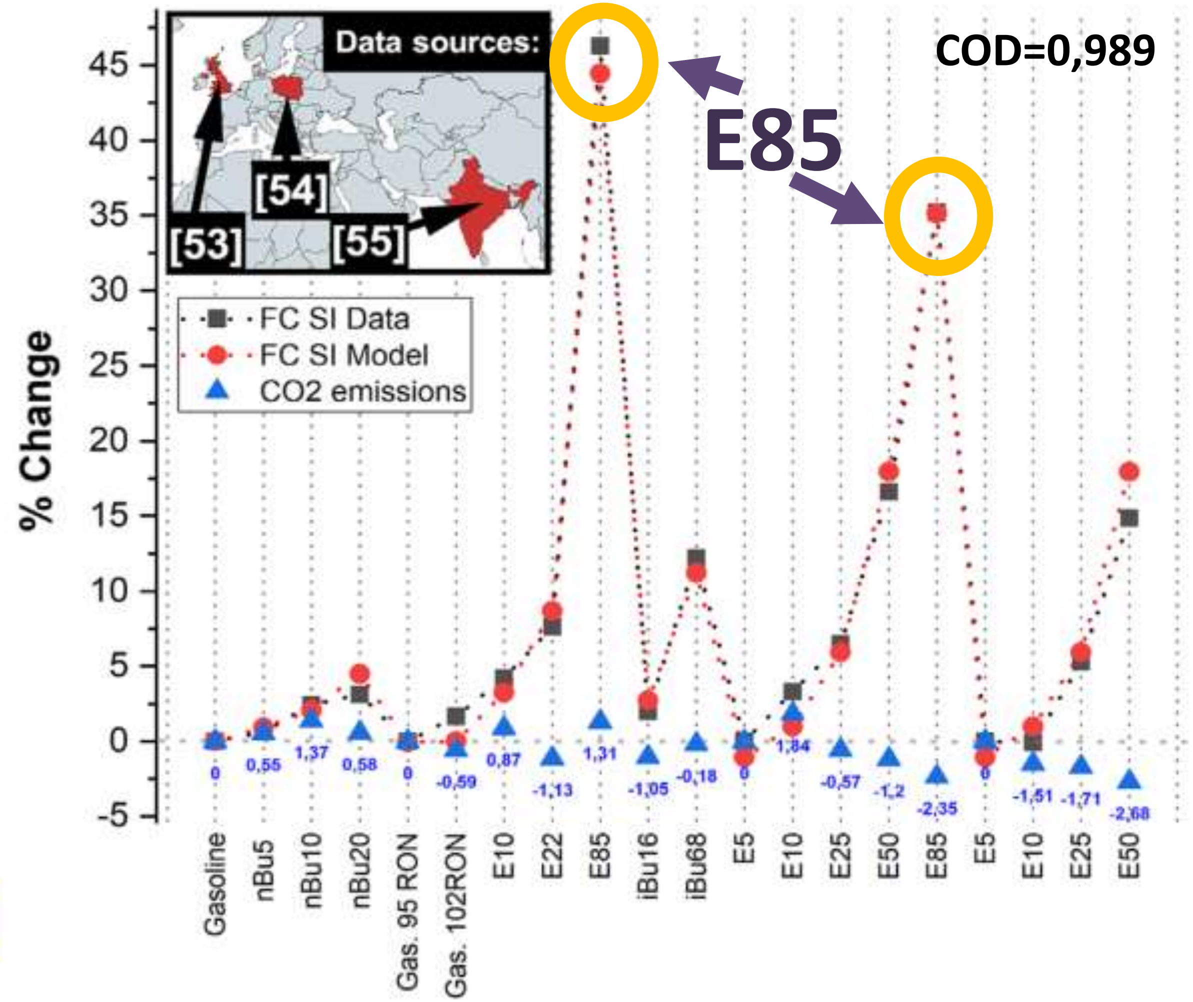
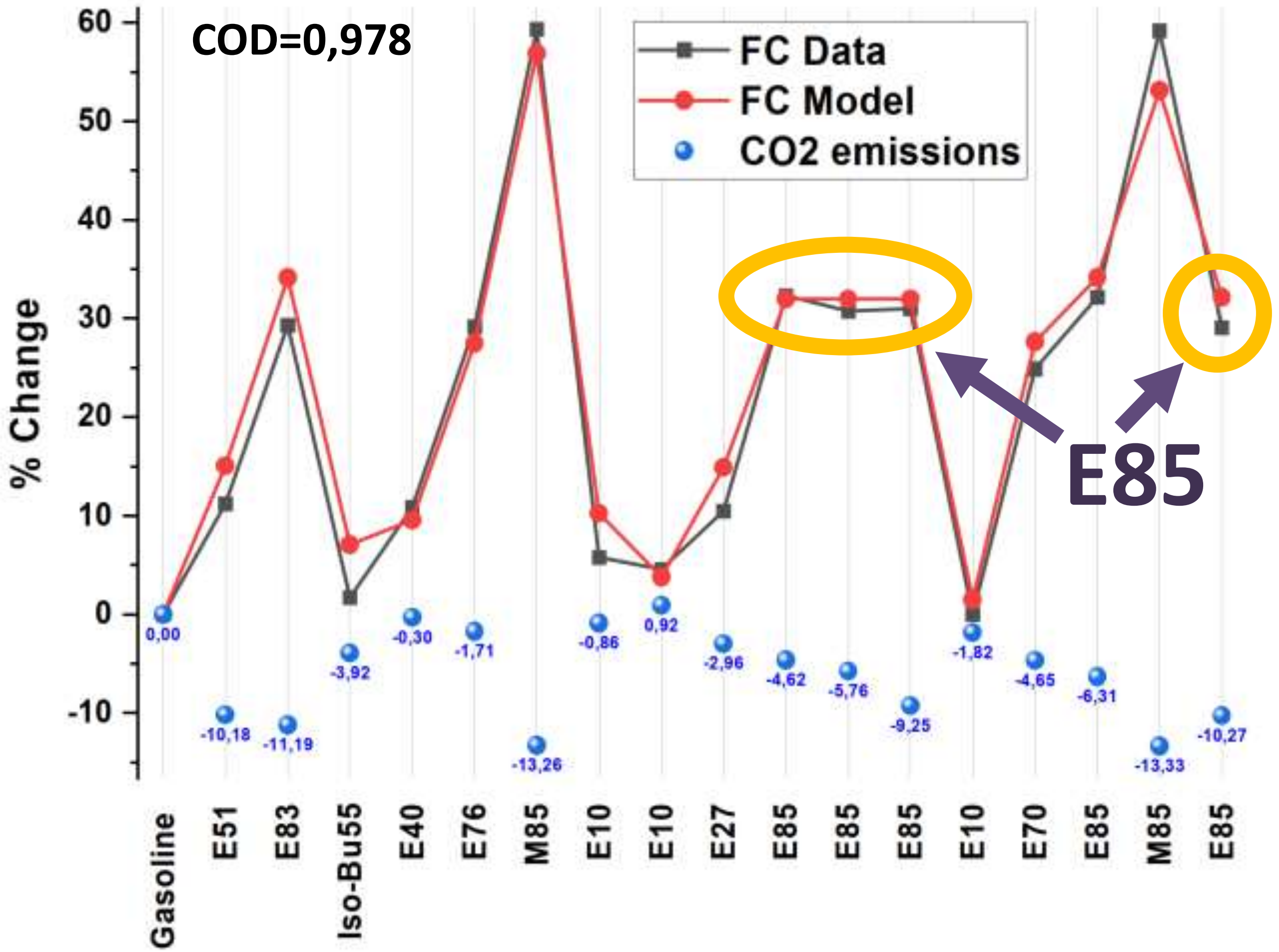
Regular SI fleet

$$FC = -0{,}771 \cdot RON + 1{,}883 \cdot Density - 2{,}220 \cdot LHV_{vol} - 0{,}613 \cdot O_2$$



FFV-SI fleet

$$FC = -0{,}418 \cdot RON - 1{,}233 \cdot Density - 1{,}674 \cdot LHV_{vol}$$



End-use performance (fuel consumption and GHG emissions) of alternative fuels in various modes of transportation.

Contact:
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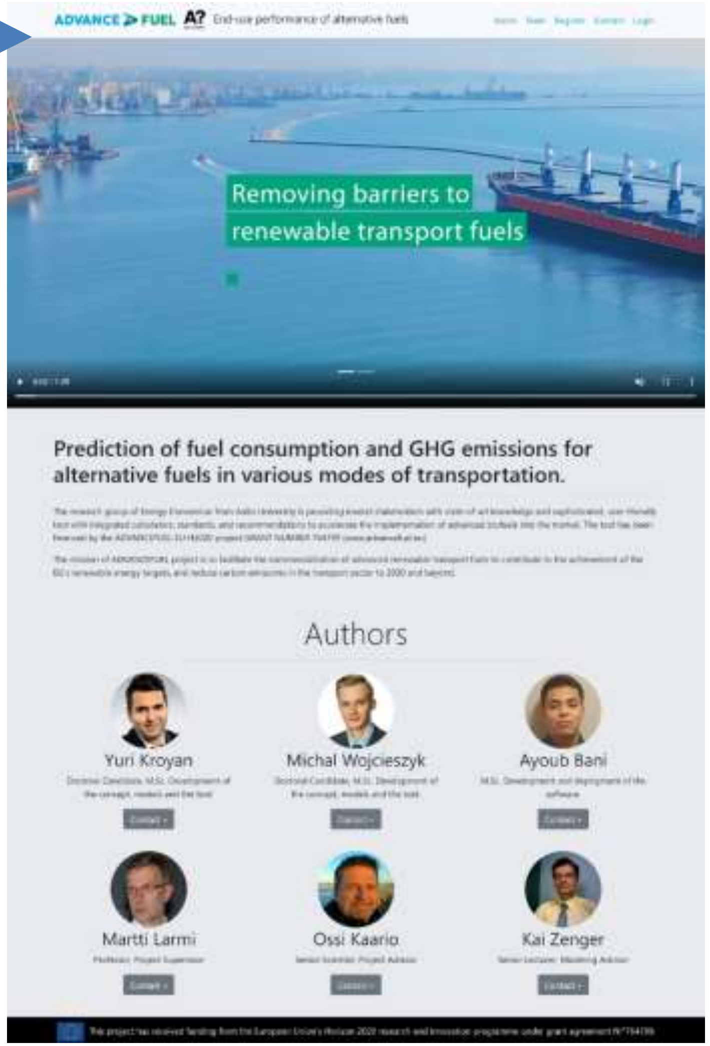
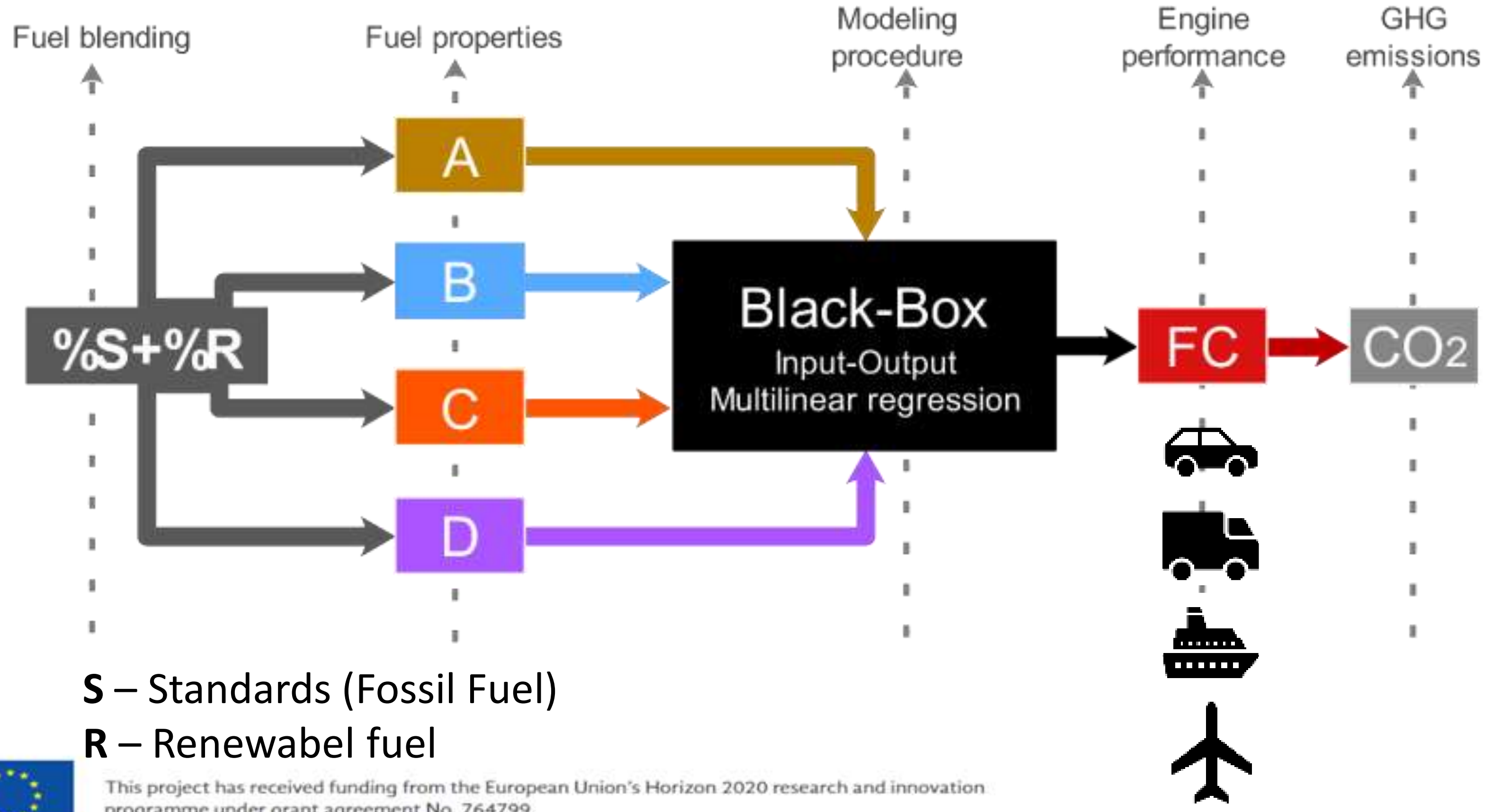
Michal Wojcieszyk – michal.wojcieszyk@aalto.fi

THE ONLINE TOOL
http://advancefuel.aalto.fi/





S – Standards (Fossil Fuel)
R – Renewabel fuel

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 764799.

Recommendations (good candidates by 2040)

	Aviation	Marine	LDV	HDV
Electricity	• Low energy density, aviation is most difficult to be electrified • Might be available after 2040	• Possible for short-distance freight	• Feasible and commercially proven • Poor vehicle range and infrastructure • High investement costs (both vehicles and infra)	• Low energy density, large space needed • Not feasible for long-haul HDV
Hydrogen	• Big safety concerns • Might be available after 2040	• Under R&D phase • Technologically possible, in bends with methane • No carbon and no sulfur content	• Feasible for Fuel Cell Vehicles • Challanging storage - 700 Bar compression • Lack of infrastructure and vehicles (high price)	• Safety concerns • Challanging storage - 700 Bar compression • Lack of infrastructure and HDVs
DME	Not applicable	• Technologically possible • High price, low availability, need for dedicated infra	• Feasible and commercially proven • Lack of infrastructure and vehicles	
Methane (biogas)	• Commercialy applied in the past (Tupolev Tu-155 and SUGAR Freeze Boeing supersonic) • Low energy density fuel for aviation	• Feasible and commercially available as LBG • No sulfur content • Very low avaliablity of LBG in comparison to LNG • Moderate Infrastructure	• Feasible and commercially utilized as CBG • Possibility for the conversion of SI and CI LDVs • Moderate infrastructure	• Feasible and widely used as CBG and LBG especially in public transportation, but also in trucks • Moderate infrastructure
Methanol	Not applicable	• Feasible and commercially proven • Pilot assisted mixing controlled combustion or DF • No sulfur content • Cheaper than ethanol, but 50% more expensive than HFO	• Feasible and commercially proven (case China) • Currently low blending walls (max 3% EN228) • Excellent fuel, with big potential (high RON) for FFV and dedicated engines • Lack of vehicles and infrastructure in the EU	• MD95 (95% methanol, 5% of ignition improvers) under the R&D phase • Low NOx, lower than in the case of ED95 • Requires dedicated engines with high CR
Ethanol	Not applicable	• Technologically possible, but methanol is cheaper • No sulfur content • Nearly double of HFO price but cheaper than FAME and HVO	• Feasible and commercially utilized • Currently low blending walls (max 10% EN228) • Excellent fuel, with big potential (high RON) for FFV. The additional cost of the powertrain 180 EUR only vs 2265 EUR for the whole gasoline powertrain (Roland Berger study 2016) • Poor infrastructure in the EU	• Feasible and commercially utilized as ED95 • ED95 has 95% ethanol and 5% of ignition improvers, and it is diesel-like fuel • Requires dedicated engines with high CR; 28:1 • Very limited infrastructure and a low number of HDVs
Renewable Gasoline	Not applicable	Not feasible	• Under R&D phase • Renewable drop-in solution for SI engines	Not applicable
HVO (Renewable diesel)	Not applicable	• Commercially proven (no sulfur content) • Excellent quality renewable drop-in fuel • Nearly double of HFO price but cheaper than FAME	• Feasible and commercially utilized in CI engines • Renewable and fully drop-in substitution for fossil diesel	
FAME	Not applicable	• Commercially proven (no sulphur content) • More than double of HFO price	• Feasible and commercially utilized, known as traditional biodiesel • Only low concentration blends are compatible max. 7% EN590 • Causes various engine-related problems in higher concentrations	
Biocrude from HTL	Not applicable	• Promising renewable candidate • Low TRL (3-6), efficient upgrading process needed	Not applicable	Not applicable
FT-SPK, HEFA, FT-SKP/A, ATJ	• Feasible and commercially used, blending wall 50%, high costs	Not applicable	Not applicable	Not applicable
SIP	• Feasible and commercially used, • Blending wall 10%, high costs	Not applicable	Not applicable	Not applicable

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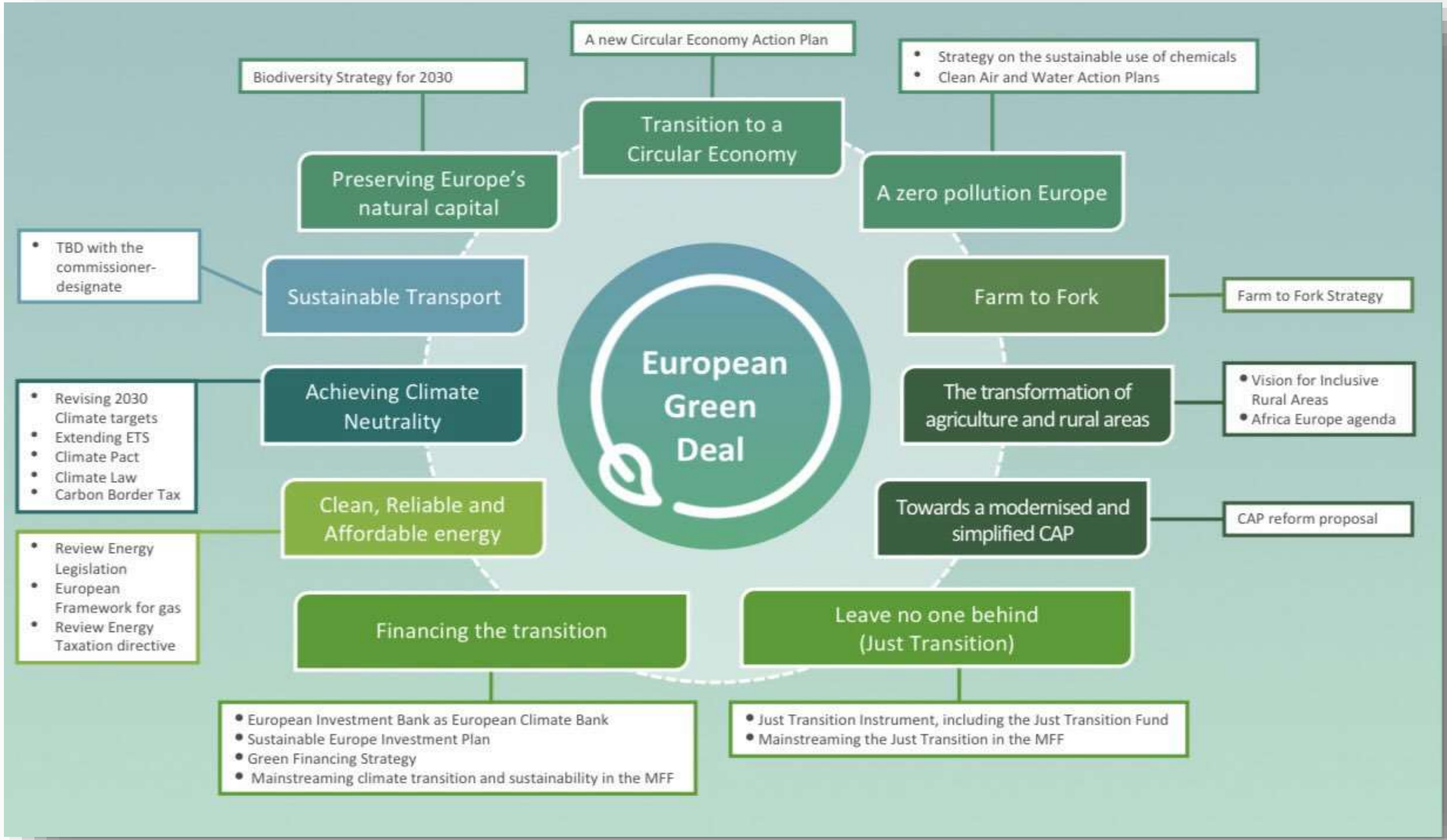
Policy recommendations for the market uptake of advanced renewable fuels

Calliope Panoutsou
Imperial College London

Policy for advanced renewable fuels

What's new?



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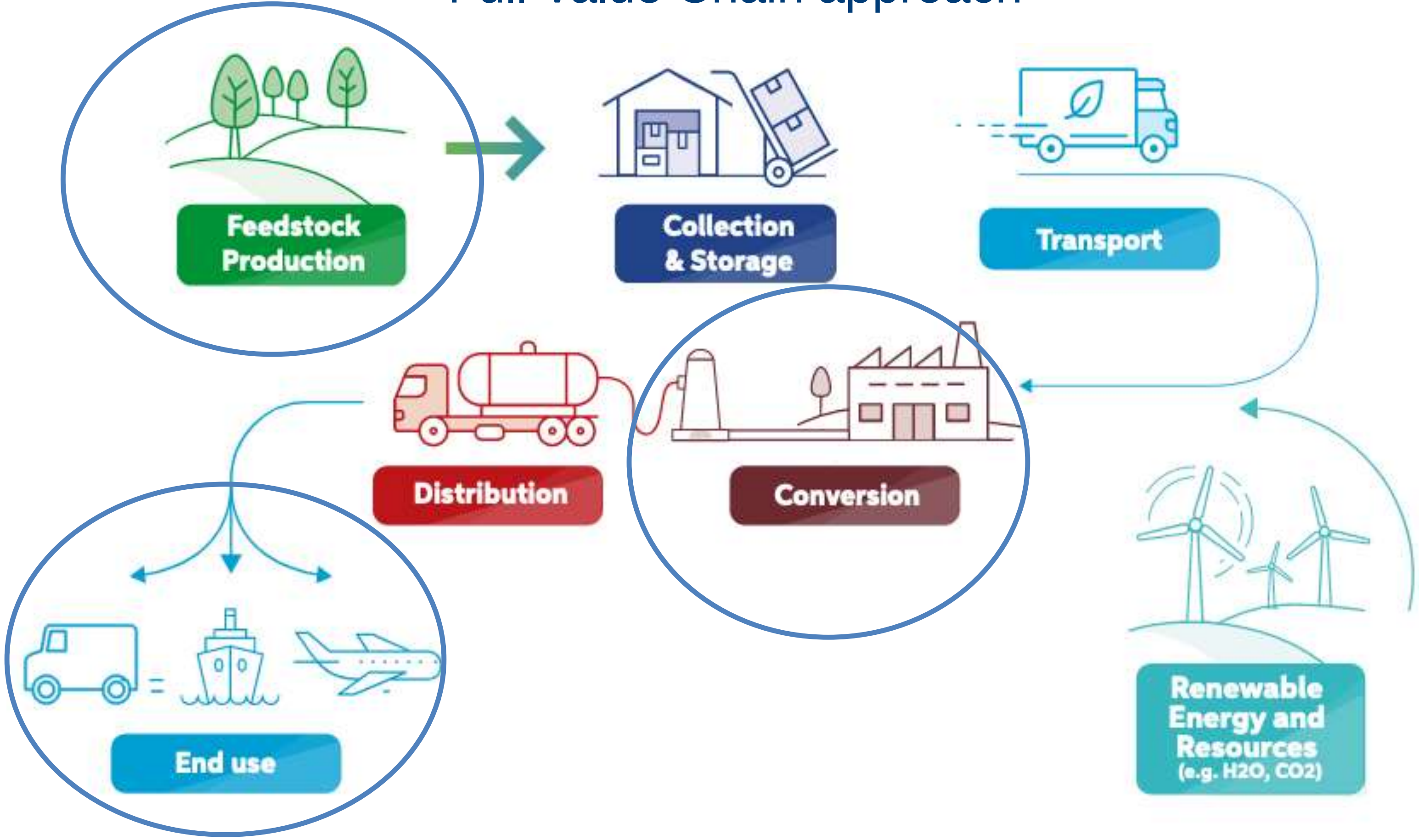
https://www.compostnetwork.info/wordpress/wp-content/uploads/green-deal.jpg

Approach

- ✓ Value chain approach
- ✓ Focus on barriers and challenges that restrict market uptake
- ✓ Co-design policy suggestions with stakeholders
- ✓ Provide recommendations for optimised policy focus based on competitive priorities
- ✓ Impact assessment for expected added value

Full Value Chain approach



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Innovative approaches to improve biomass availability, with a special focus on new cropping schemes and use of marginal lands

Challenge	Policy relevant gaps	Future policy focus
Cultivate in marginal land	Current legislation has ambitions to sustainably exploit areas with natural constraints however land use planning, financing and awareness interventions are required to facilitate uptake of solutions tailored to local ecology, climate, economy, and societal needs	Refine policy for the exploitation of marginal land for biomass production Develop dedicated financial mechanisms to support such exploitation
Innovative cropping systems	Common regulatory framework and indicators for carbon farming practices	Improve standardised methodologies for data collection on SOC levels
	Scale up and commercialisation of innovative cropping systems including biomass crops	Lack of funding mechanisms to invest in the initial infrastructures and to train human resources and build capacity

Enabling policies

Farm to Fork
Biodiversity
RED II
CAP reform
Vision for Inclusive rural areas

Good Practice

Climate change objective in CAP post 2020
Farm to Fork: Carbon farming initiative
ESIF, ERDF
ENRD

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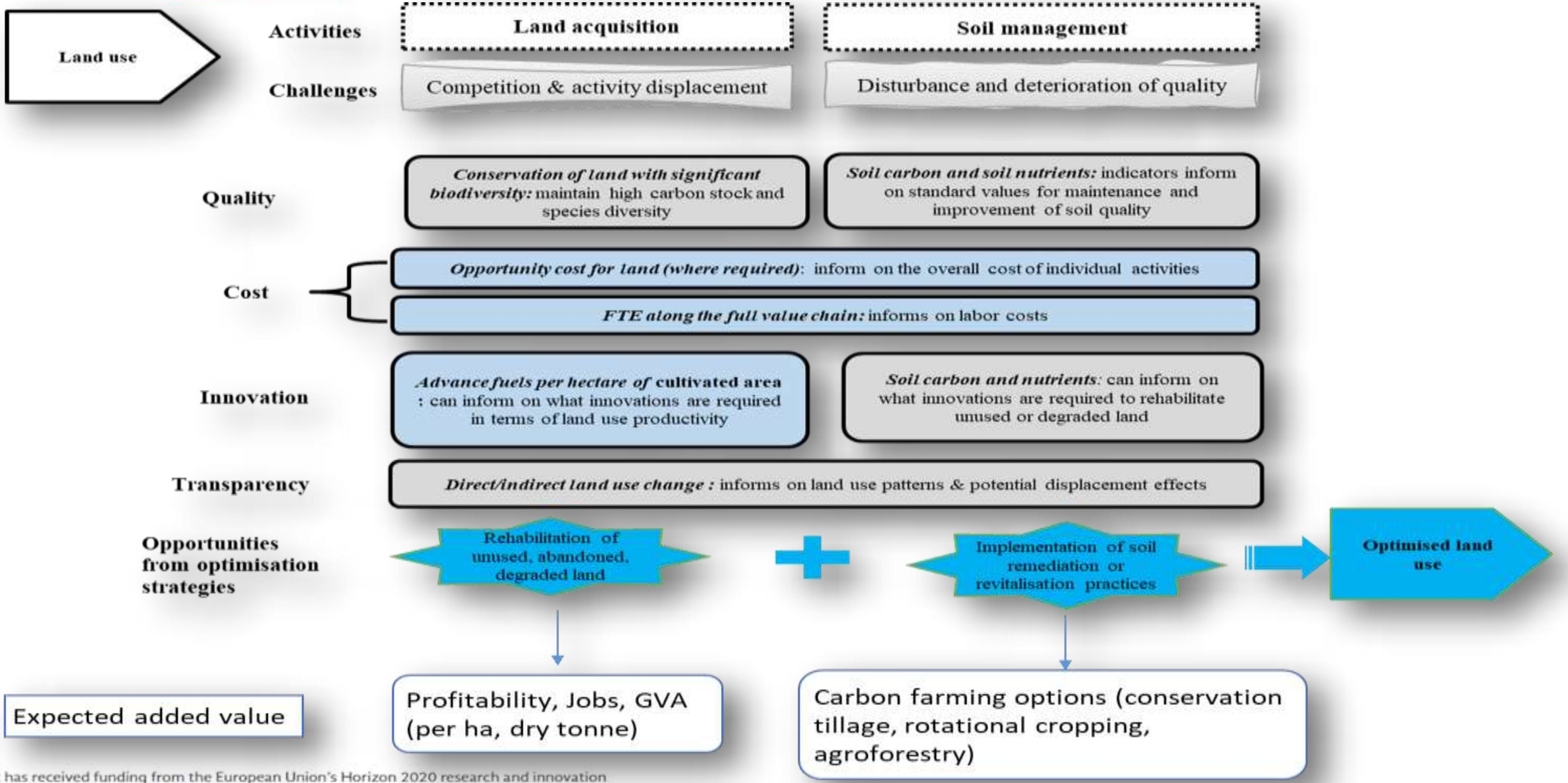
Innovative approaches to improve biomass availability, with a special focus on new cropping schemes and use of marginal lands



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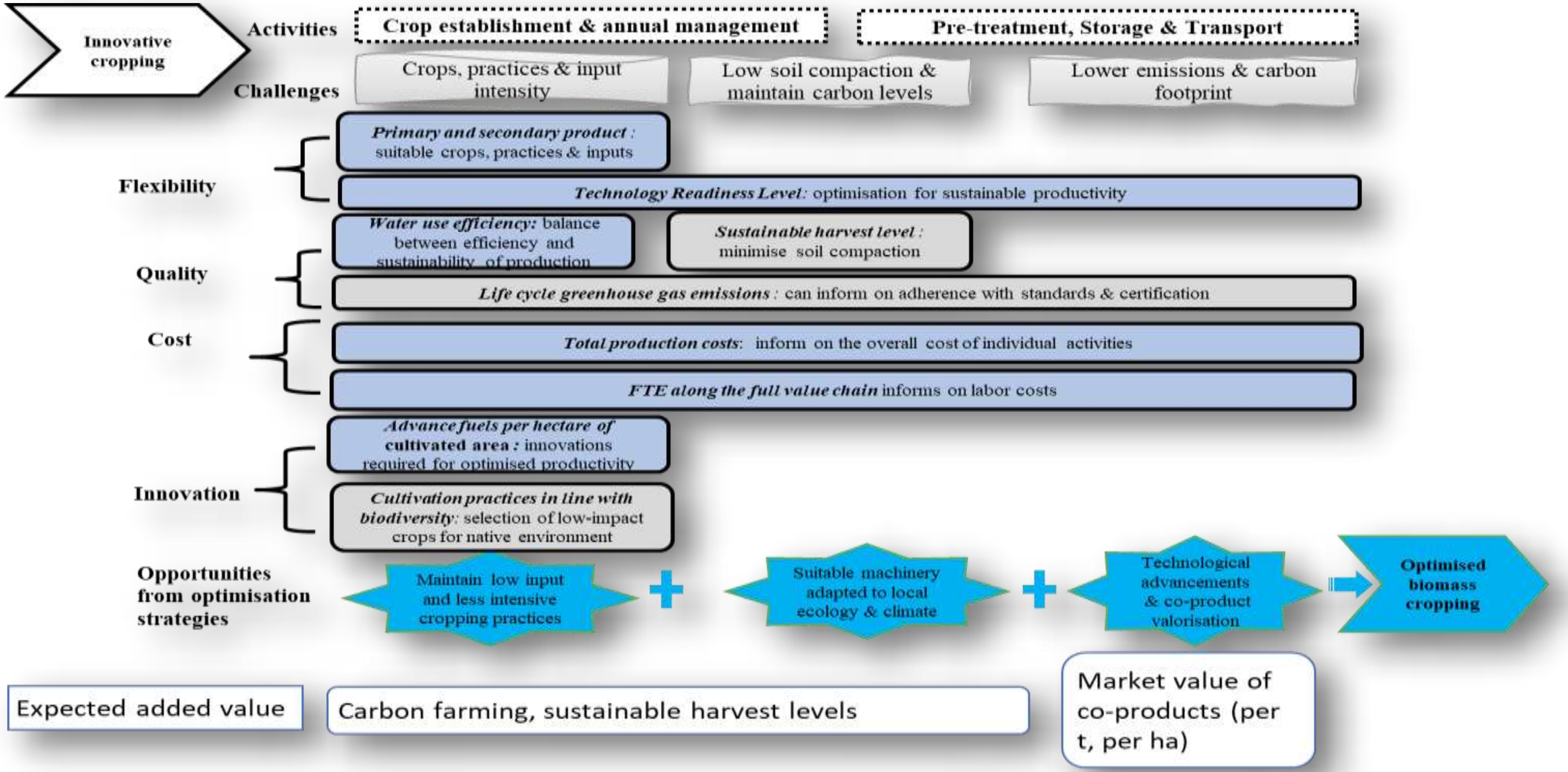
Innovative approaches to improve biomass availability, with a special focus on new cropping schemes and use of marginal lands



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Feedstock Production

Recommendations (under final revision)

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- Sustainable biomass feedstocks are present in Europe but their efficient and timely mobilisation remains a challenge.
- Rural land-use planning must be combined with incentives to produce biomass.
- Financial support measures like the European Structural and investment funds (ESIF), including the European Regional Development Fund (ERDF), etc. must account for capital costs related to the development of infrastructure for the logistics related to waste and residue collection, as well as large scale energy crop production, supply and logistics.
- The roll-out of new innovations can be supported via the European Innovation Platform for Agriculture (EIP-Agri), knowledge sharing through the European Network for Rural Development (ENRD), and provision of funding from ESIFs, namely the ERDF, Cohesion Fund, and funding for farm diversification under the European Agricultural Fund for Rural Development (EAFRD).

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Conversion

Cost reduction of innovative technologies
Integration into existing infrastructures

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Challenge	Policy relevant gaps	Future policy focus
Cost reduction of innovative technologies	Generic financing options and instruments in current legislation.	Optimise policy focus to ensure that significant amounts of RESfuels and ZEVs are deployed. These need to go hand in hand with the energy efficiency improvements
Integration into existing infrastructures	Only a few SMEs and industries are aware of potential opportunities and most of them have limited access to capital that will allow them to invest in new technologies	Improve access to finance, regulatory support and information to SMEs and industries to facilitate decision making for co-location of biorefineries in existing infrastructures

Enabling policies

Industrial Strategy
RED II
Just transition mechanism
Innovation Fund

Good Practice

NER 300
Innovation Fund
SET Plan

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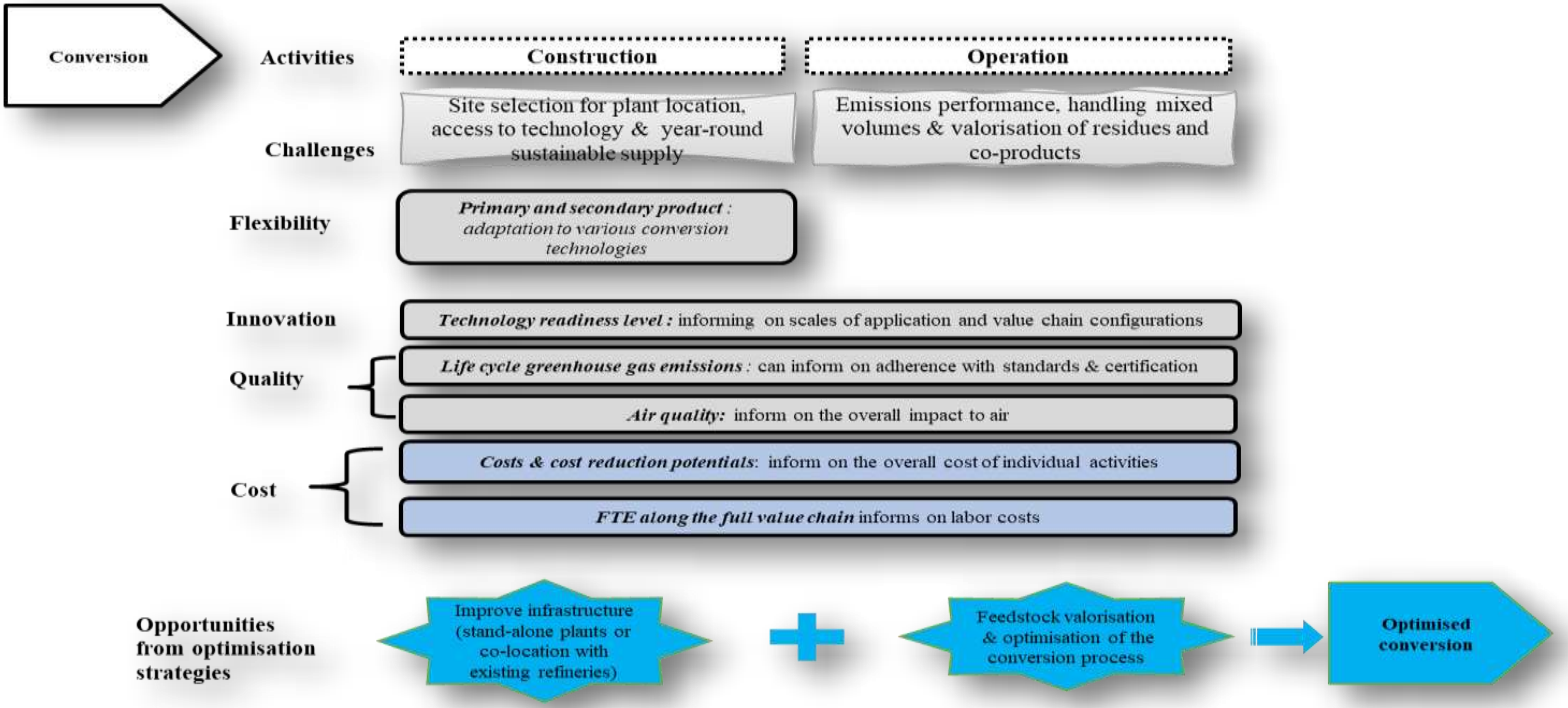
Conversion

Cost reduction of innovative technologies
Integration into existing infrastructures

ADVANCEFUEL



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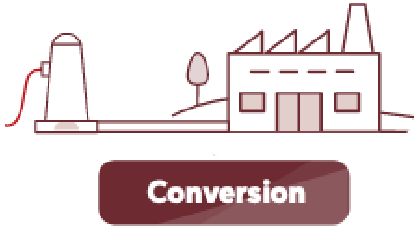

Recommendations (under final revision)

ADVANCEFUEL

- Tailored financing mechanisms (such as feedstock premiums, feed in tariffs and premiums, CO2 taxes, etc.) are necessary to develop a secure framework to reduce capital investment and uncertainties of production costs.
- Innovations in technology development involve high capital costs and thus high financial risk; measures to bolster this must be introduced.
- Funding schemes (e.g. European Innovation Fund), banks and financial institutions must increase budget shares for RESfuels in their investment portfolios.
- Capacity building and public-private partnerships will help tackle barriers such as those related to investor risk premium and access to debt financing.
- Research and innovation grants should ensure continuity in funding for RESfuels to overcome technical barriers such as process design (i.e. increase process efficiency) and scale-up considerations.

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End use

Measures to increase uptake of RESfuels

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Challenge	*Policy relevant gaps*	*Future policy focus*
Slow uptake of RESfuels because of their high costs and lower, competing fossil fuel prices.	Absence of regulatory mechanism to bridge the price gap between renewable and fossil-based fuels	Market regulation with feed-in premiums, certification, and standardization
Low uptake of advanced biofuels for aviation, maritime and shipping sectors	Aviation, marine and freight sectors are excluded from biofuel obligatory quotas, GHG emission reduction targets and national targets and have no specific provisions in place to promote the use of advanced biofuels	Financial incentives to promote innovation in low carbon technologies

Enabling policies

Industrial Strategy
RED II
Just transition mechanism
Innovation Fund

Good Practice

Clean Sky
Sustainable Marine Biofuels Initiative

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Recommendations (under final revision)

ADVANCEFUEL

- Ambitious decarbonization plans require deployment of all renewable options, increased efficiency of the transport system and significant shifts towards more energy efficient transport modes.
- RESfuels are likely to exhibit increased shares first in road transport, however it is critical to enable similar and timely shift to heavy duty vehicles, maritime and aviation which have less alternatives and are more challenging in terms of CO2 emissions reduction. Without tailored targets for these sectors this shift may be difficult to manage.
- E-fuels, produced from renewable electricity and direct air capture, are essential to complement the contribution of advanced biofuels in transport decarbonisation. They can be particularly useful in aviation due to the limited number of certified biofuel value chains for this sector.
- Biomass to Liquid (BtL) value chains such as bioLNG, bioDME, FT liquids, pyrolysis oil co-processing must be deployed before 2030 to ensure fossil diesel substitutes are in place to meet the targets.

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Recommendations for sustainability across value chains (under final revision)

ADVANCEFUEL

- Sustainability criteria in the RED II are a major step forward, but not yet sufficiently broad and stringent to address all concerns.
- Harmonised criteria beyond RED I & II, definition (e.g. feedstocks), measurements (SFM, iLUC) at EU level preferred.
- More transparency needed in market & sustainability reporting.
- Provide spatially explicit and quantitative insights regarding environmental impacts of lignocellulosic biomass feedstock production.

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Panel Discussion

Ayla Uslu – TNO

Sonja Germer – ATB

Ivan Vera Concha – Utrecht University

Stavros Papadokonstantakis – Chalmers University of Technology

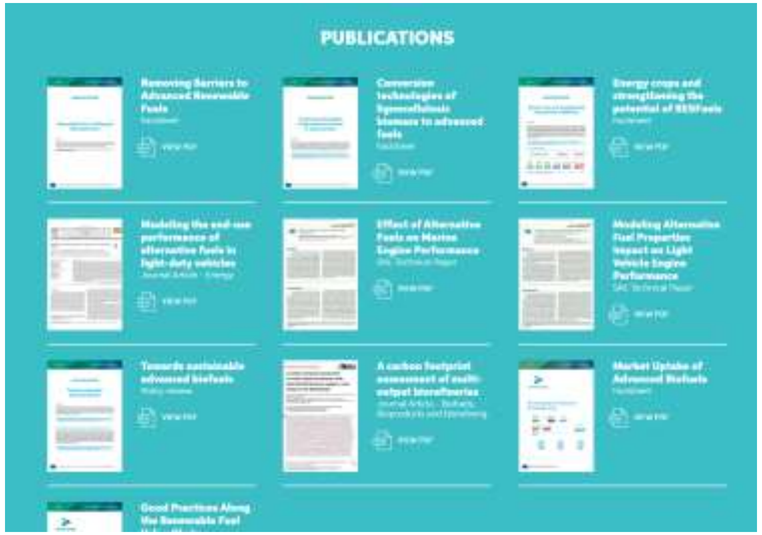
Yuri Kroyan – Aalto University

Calliope Panoutsou – Imperial College London

Launch

Final Publication & Visual Journey

Explore ADVANCEFUEL



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6 July: Poster presentations:

- Impact of Alternative **Transport Fuel Properties** on Engine Performance (Aalto University)
- Key challenges and opportunities on the development of liquid transport **biofuel technologies** in short- and long-term timeframes (Chalmers University)

8 July: Oral presentations

- **Systemic Analysis** of Renewable Fuels (RESfuels) for 2030 and Beyond (TNO)
- **Sustainability Criteria** of the Revised Renewable Energy Directive (RED II): Towards Harmonised Criteria and Possible Trade-Offs for Multi-Output Biorefineries (UU)

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Thank you for your attention!

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