Market barriers, feedstock availability & suitability for advanced biofuels

ADVANCEFUEL

Barriers to the market roll-out of RES fuels

Prioritization based on the stakeholders' view

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ECN part of TNO
ADVANCEFUEL Stakeholder Workshop
Gothenburg, 20 September 2018

CONTENT

- The project scope versus REDII
- RESfuels' status in Europe
- Barriers to RESfuels (method)
- Stakeholders' view
- Conclusions

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

THE PROJECT SCOPE

ADVANCEFUEL aims at increasing the market uptake of 'RESfuels'.

REDII	ADVANCEFUEL project
Both liquid and gaseous biofuels	The focus is limited to liquid advanced biofuels Advanced gaseous fuels are considered as intermediates
Covers Annex IX A and B list feedstocks	Focuses to lignocellulosic feedstocks from list A
Also renewable electricity, other renewable fuels and recycled carbon fuels are included	Renewable PtL option is also included
	The main focus is on the demonstration and (near-) commercial scale technologies

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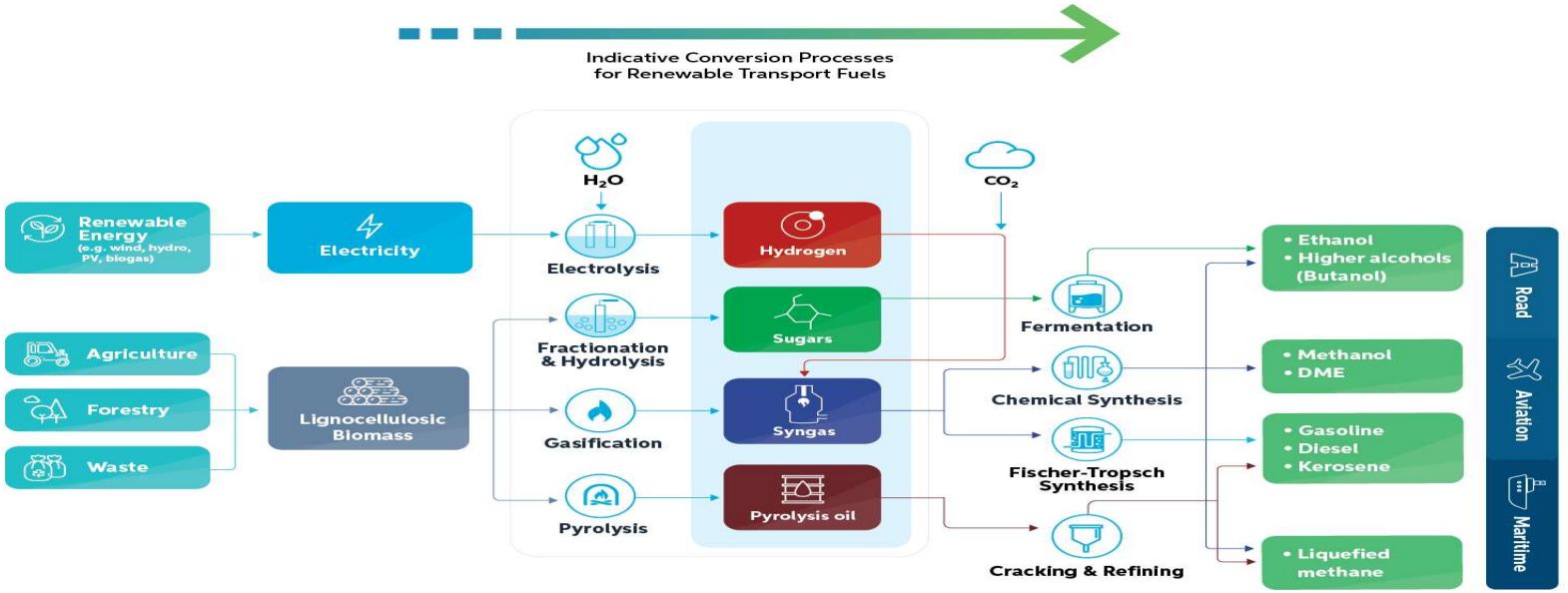
THE PROJECT SCOPE



Renewable resources
ADVANCEFUEL will focus on fuels produced from renewable resources, such as residues from agriculture and forestry, sustainable woody and grassy crops, waste and renewable energy, carbon dioxide and hydrogen.

Conversion processes
ADVANCEFUEL will look at different conversion processes that are already at a high development stage and have been validated in an industrial environment.

Renewable liquid fuels
Ultimately, ADVANCEFUEL aims to support uptake of both advanced biofuels and fuels produced from renewable hydrogen and CO2 in the road, aviation and maritime transport sectors.

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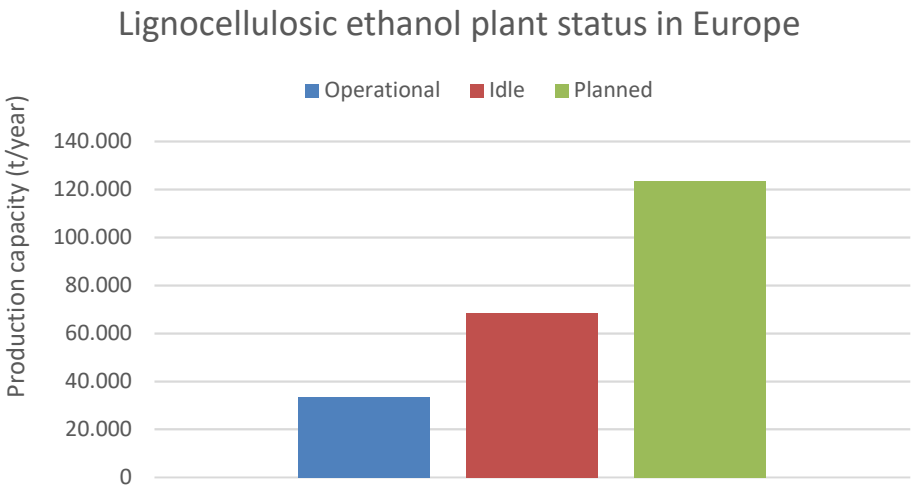
STATUS LIGNOCELLULOISC BIOFUELS in EUROPE



Two first-of-a-kind commercial plant in Europe,

- Norway-Borregaard Industries AS using sulfite spent liquor (SSL, 33% dry content) from spruce wood pulping (capacity 15556 t/y)
- Italy-BETA Renewables (Capacity 60000 t/y- IDLE)

- Prolysis oil plant operational in Finland (50000 t/y)
- Preem and Setra in Sweden start a collaboration to produce pyrolysis oil at the pulp mill in Vallvik, Söderhamn, using sawdust (2021).
- GoBigas 1 (Sweden) has demonstrated SNG production using waste wood. The project was terminated in March 2018.
- A project (BioTfueL) BY TOTAL mentions a demo plan by 2020 using straw to produce syngas.
- A commercial plant in Sweden (Varmlands metanol) is planned to use domestic forest residues and produce methanol (100000 t/y).

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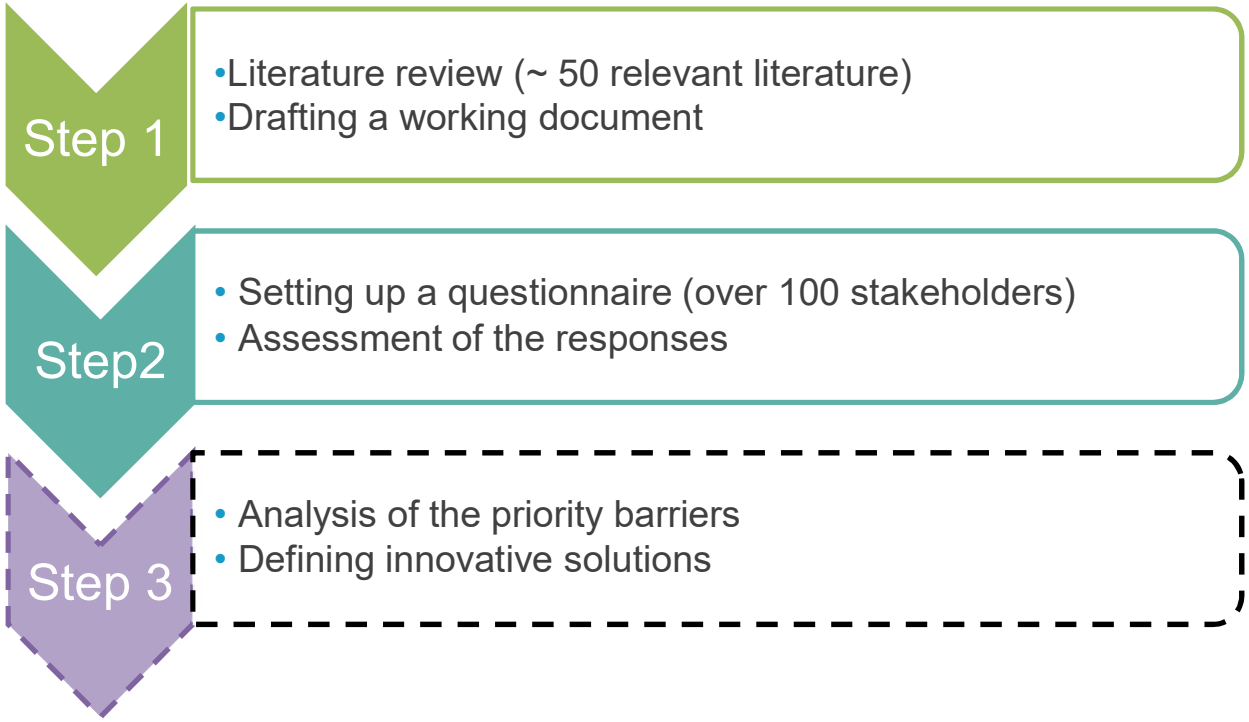
Barriers to RES fuels-main objectives & the methodology

Inventories the barriers delaying the market roll-out of RESFuels

Cross-check with the stakeholders and based on their view prioritize the key barriers



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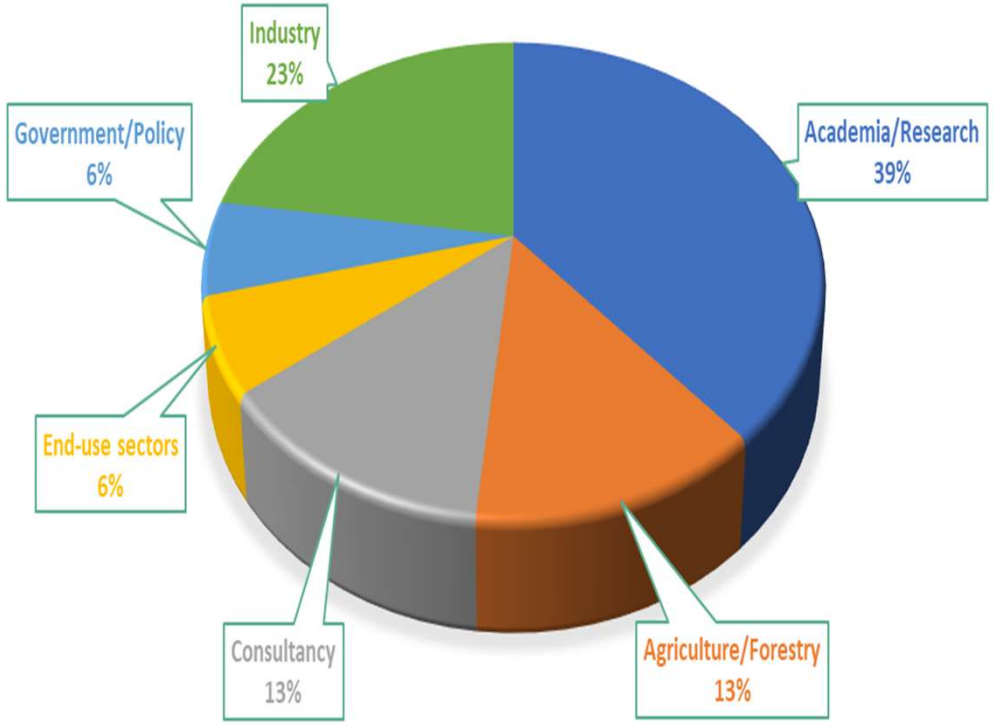
STAKEHOLDER RESPONSES

31 reactions received



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Questions to the stakeholders

Barriers prioritised by the stakeholders will receive further attention in the following work packages

- **What are your views on the prioritised barriers?**
- **Is the prioritisation in accordance with your experiences?**

- **What would be you expectations (as outcomes) from this project?**

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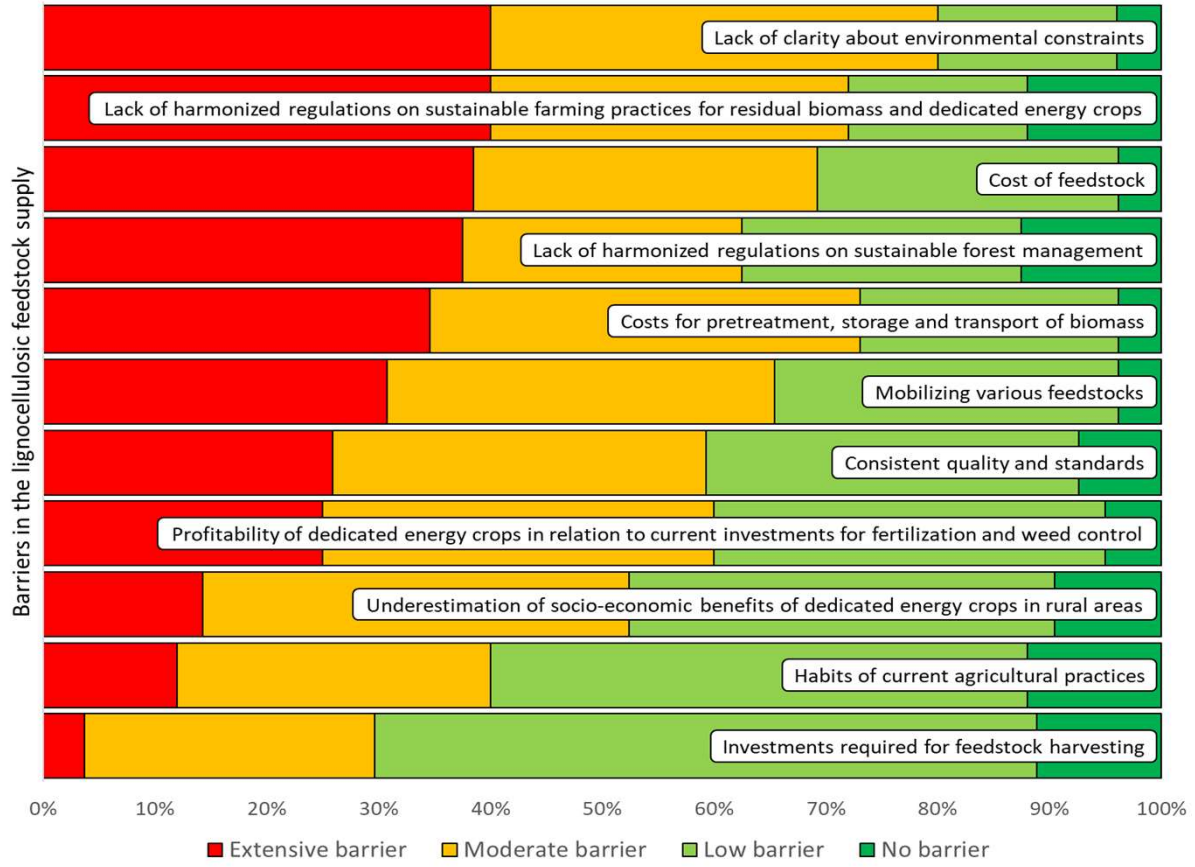
STAKEHOLDER RESPONSES

Feedstock supply | Conversion step | End use



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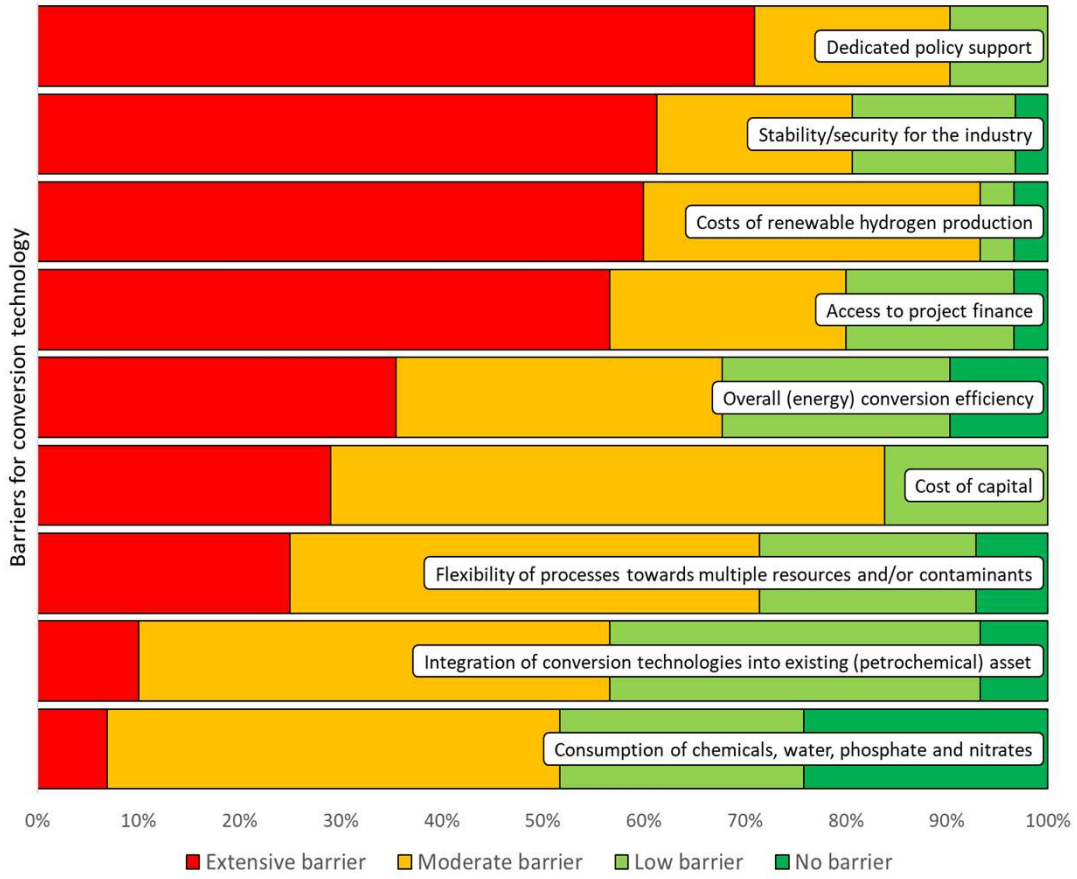

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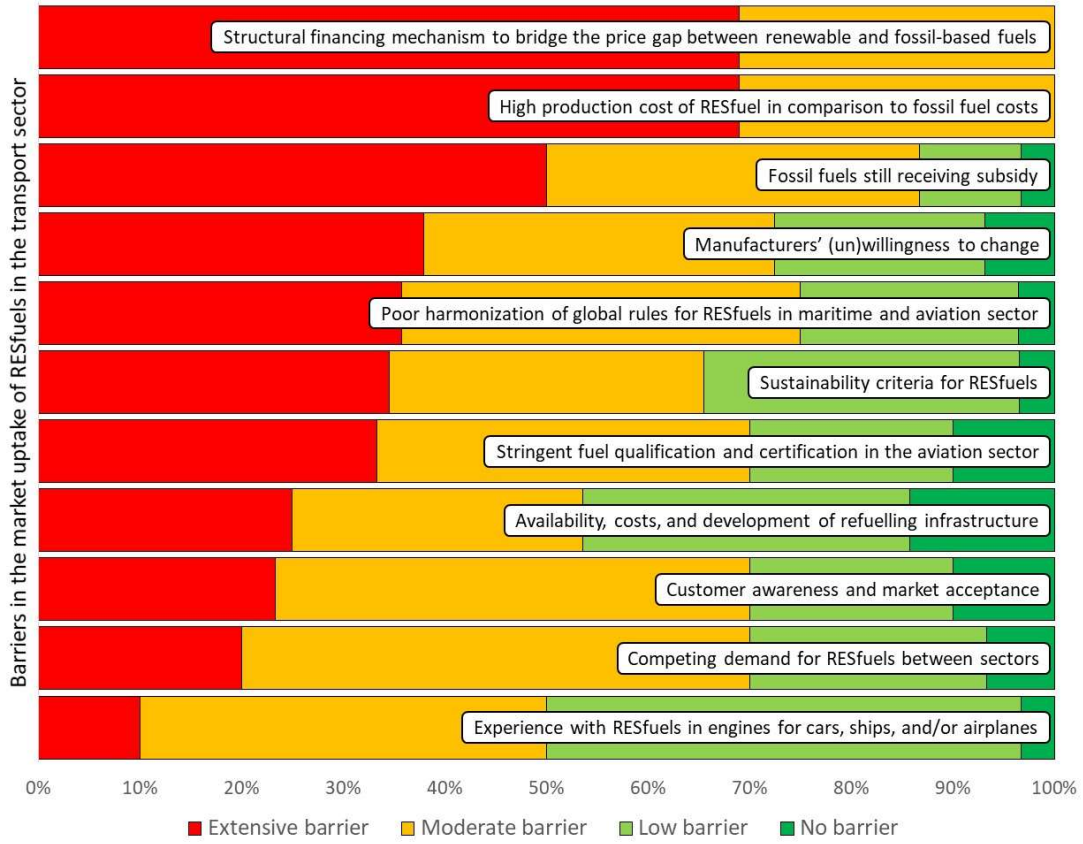
Feedstock supply | Conversion step | End use



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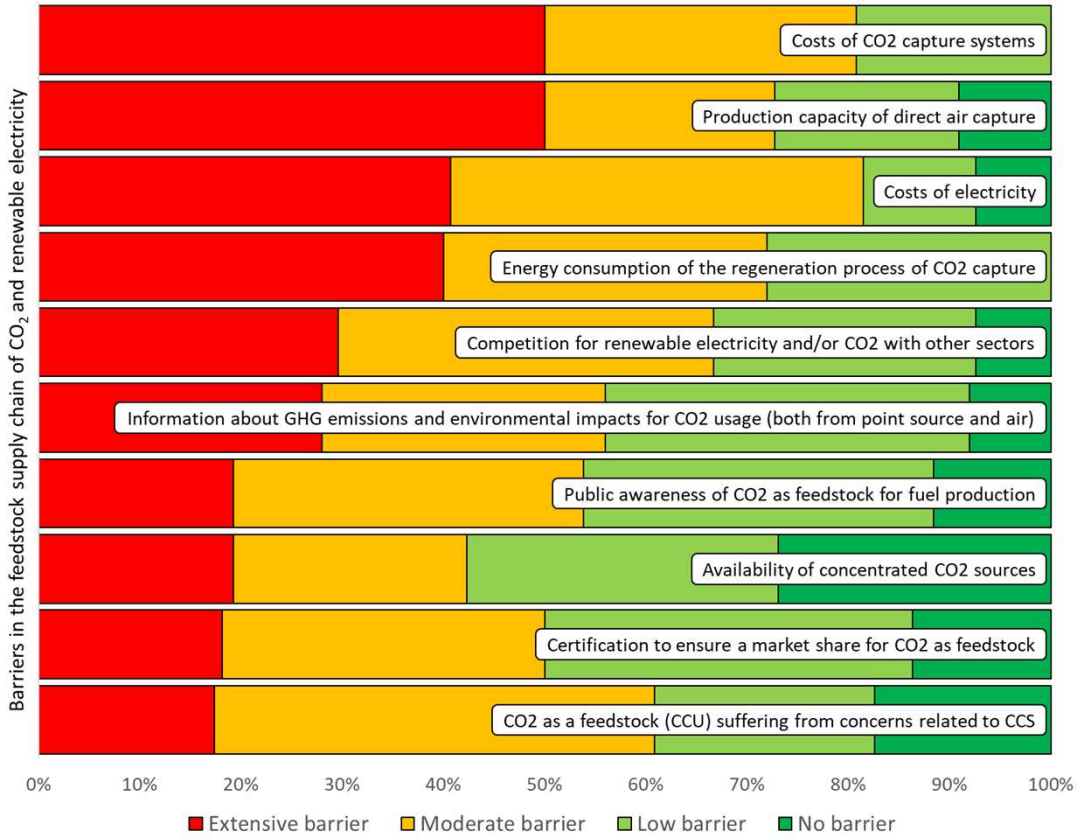
STAKEHOLDER RESPONSES

Renewable PTL



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CONCLUSIONS

The most prevailing barriers

- dedicated policy support & the stability/security for the industry
- structural financing mechanism to bridge the price gap between renewable and fossil-based fuels
- high production cost of RESfuel in comparison to fossil fuel costs
- costs of renewable hydrogen production

The issues as low barrier

- habits of current agriculture practices
- investments required for feedstock harvesting
- integration of conversion technologies into existing petrochemical assets
- experience with RESfuels in engines for cars ships and/or airplanes

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CONCLUSIONS

Other challenges highlighted by the stakeholders are:

- competition with countries outside the EU
- diverging fuel quality standards
- lack of optimization of a specific value chain
- lack of renewable electricity and grid capacity
- patent protection, and
- vehicle tank-to-wheel CO_2 regulation

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Questions to the stakeholders

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Thank you for your attention

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Name of barrier
Lignocellulosic feedstock supply step
Lack of clarity about environmental constraints
Lack of harmonised regulations on sustainable farming practices for residual biomass and dedicated energy crops
High cost of feedstock
Lack of harmonised regulations on sustainable forest management
Conversion step
Absence of dedicated policy support
Concerns on stability/security of the industry
Cost of renewable H_2 production
Access to project finance
End-use step
Absence of structural mechanism to bridge the price gap between renewable and fossil-based fuels
High production cost of RESfuels
Fossil fuels still receiving subsidy
Manufacturers unwillingness to change
RES fuels of non-biological origin
Cost of CO_2 capture systems
Production capacity of direct air capture
Cost of electricity
Energy consumption of the regeneration process of CO_2 capture

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Country-Company	Product	t/y
Sweden-North European Oil Trade Oy	Operational	4.000
Finland-north European oil trade oy (formerly St1)	Operational	7.900
Finland-Chempolis Ltd.	Operational	5.029
Germany-Clariant	operational	1.000
Norway-Borregaard Industries AS	Operational	15.556
Italy-BETA Renewables	Idle	60.000
Spain-Abengoa Bioenergy	Idle	4.000
Denmark-Inbicon (DONG Energy)	Idle	4.300
Swede- sola Heby Energi	Planned?	3900
Finland-Fiber EtOH	Planned	19444
Slovakia	Planned	50000
Romania	Planned	50000

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SGAB, 2017- biofuel production costs

Biofuel type production costs	Feedstock price EUR/MWh	Production cost range EUR/MWh	Production cost range EUR/GJ
Aviation HEFA	40-60	80-90	22-25
Aviation sugar fermentation or FT synthesis	Sugar: 65-85 FT: 10-20	110-140	31-39
HVO liquids	40	50-70	14-19
	60	70-90	19-25
Biomethane from biogas	0-80	40-120	11-34
Cellulosic ethanol	13	103	29
	10	85	24
Biomethane & ethanol from waste	(1)	67-87	19-24
FT liquids from wood	20	105-139	29-35
	10-15	90-105	25-29
Biomethane, methanol or (DME (Dimethyl Ether) from wood	20	71-91	20-25
	10-15	56-75	16-21
Pyrolysis bio-oil co-processing	10-20	58-104	14-27
Pyrolysis bio-oil stand alone	10-20	83-118	23-33

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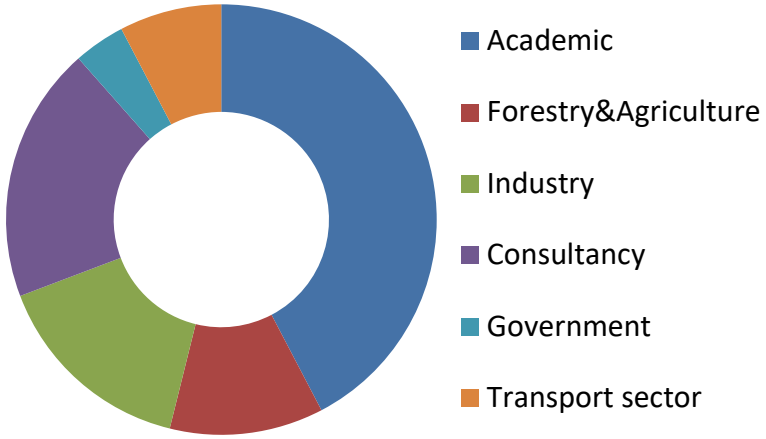
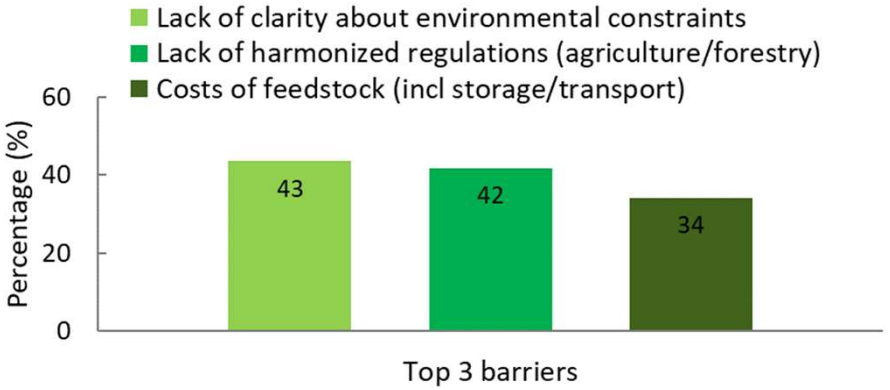
Preliminary results barrier survey

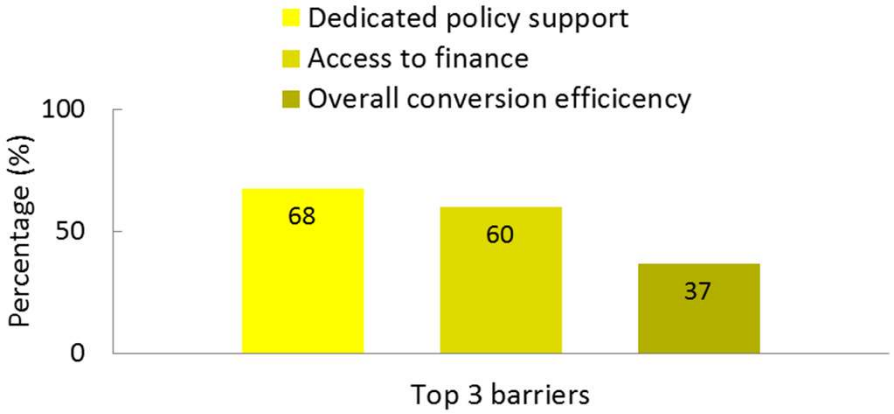
So far 26 reactions



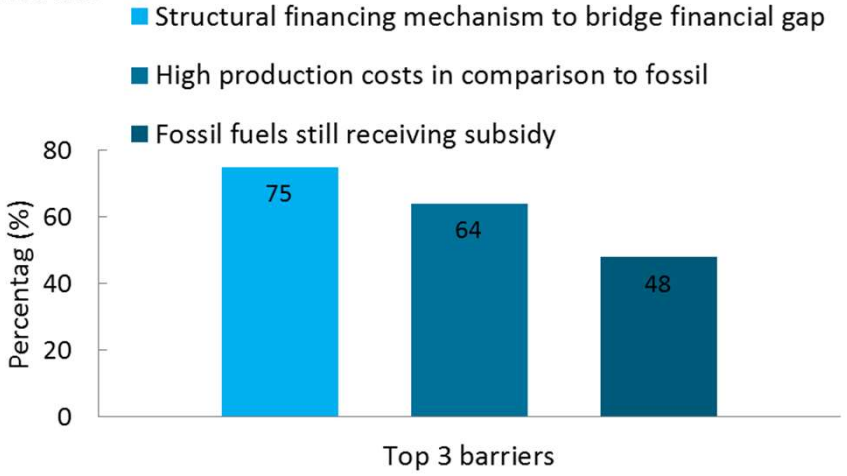
Lignocellulosic feedstock supply



Conversion technology



End-use



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REDII

- share of renewable fuels is at least 14% by 2030
- the contribution of biofuels and biogas produced from part A of Annex IX shall be at least 0.2% in 2022, 1% in 2025 and, increasing up to at least 3.5% by 2030.
- the contribution of RE-E shall be considered 4 times its energy content when supplied to road vehicles.
- the contribution of RE-E may be considered 1.5 times the energy content when supplied to rail transport.
- the contribution of biofuels and biogas produced from feedstock listed in Annex IX to be twice their energy content
- Conventional biofuels shall be no more than 1 % higher than the contribution from those to the gross final consumption of energy from renewable energy sources in 2020 in that Member State, with a maximum of 7% of gross final consumption in road and rail transport in that Member State.
- part B of Annex IX shall be limited to 1.7 %
- the contribution of fuels supplied in the aviation and maritime sector shall be considered to be 1,2 times their energy content.

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iLUC

- The contribution of high indirect land-use change risk biofuels for which a significant expansion of the production area into land with high carbon stock is observed, shall not exceed the level of consumption in 2019 in the Member State, unless they are certified as low indirect land-use change-risk biofuels, pursuant to the following two subparagraphs: As of 31 December 2023, this limit shall decrease gradually to 0% by 31 December 2030 at the latest.
  - The Commission shall submit, by 1 February 2019, a report on the status of production expansion of relevant food and feed crops worldwide and
  - adopt a delegated act setting out the criteria for certification of low iLUC-risk biofuels and for determining the high iLUC risk feedstocks
  - By 1 September 2023 the Commission shall review the criteria and adopt a delegated act amending such criteria and including the trajectory to gradually decrease the contribution to the targets

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