Shaping the SRIA for Renewable Fuels and Bioenergy

Dina Bacovsky, BEST

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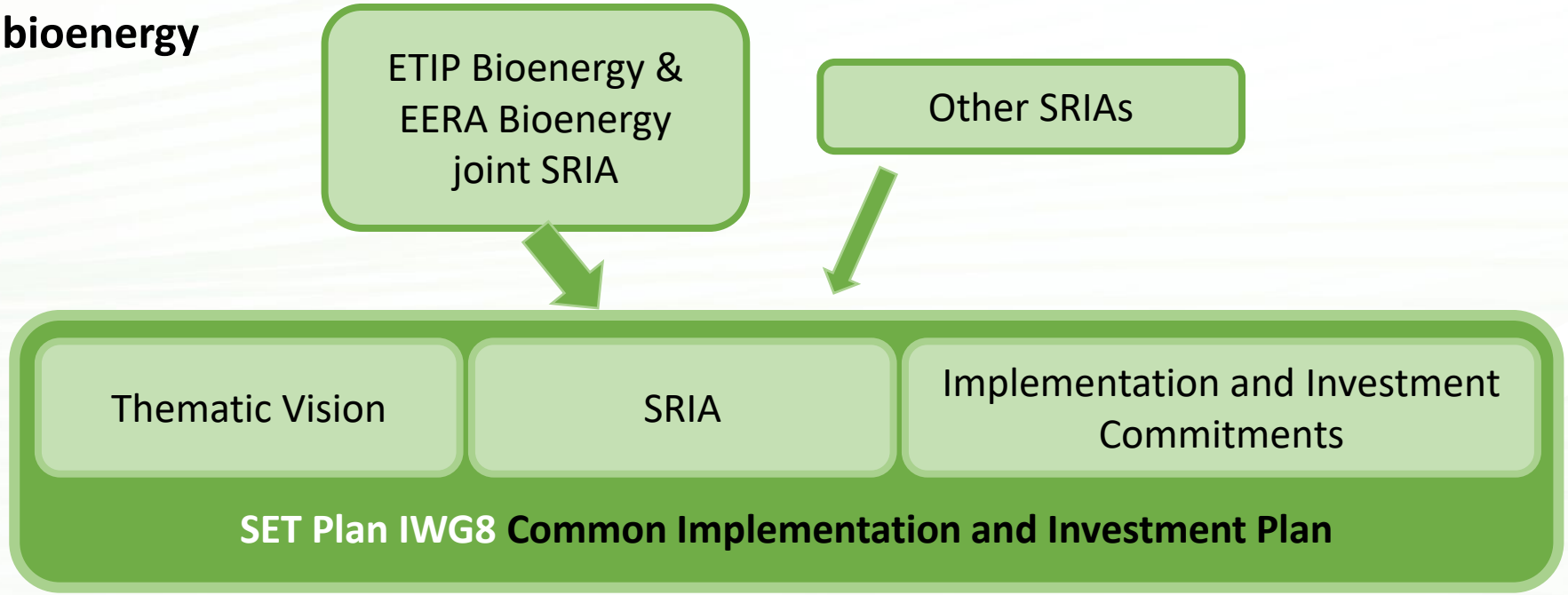
ETIP Bioenergy
European Technology and Innovation Platform

Strategic Research and Innovation Agenda

- ETIP Bioenergy supports **development of cost-competitive, innovative, world-class bioenergy and renewable fuels value chains**
- EERA Bioenergy assesses R&D&I priorities to **accelerate the implementation of biomass technologies in Europe**
- SRIA: highlight **key research and innovation priorities**
- Scope: **renewable fuels, bioenergy**



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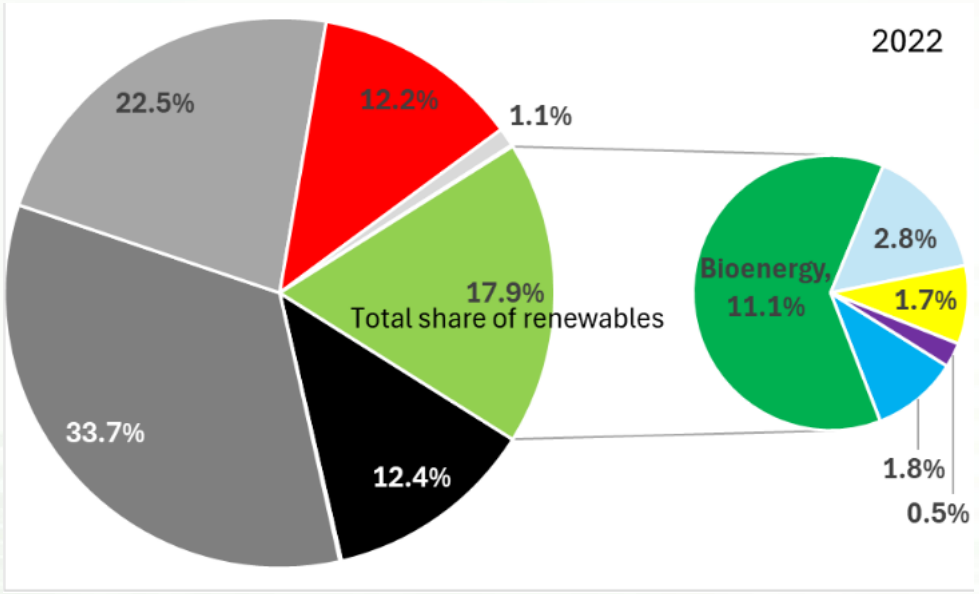
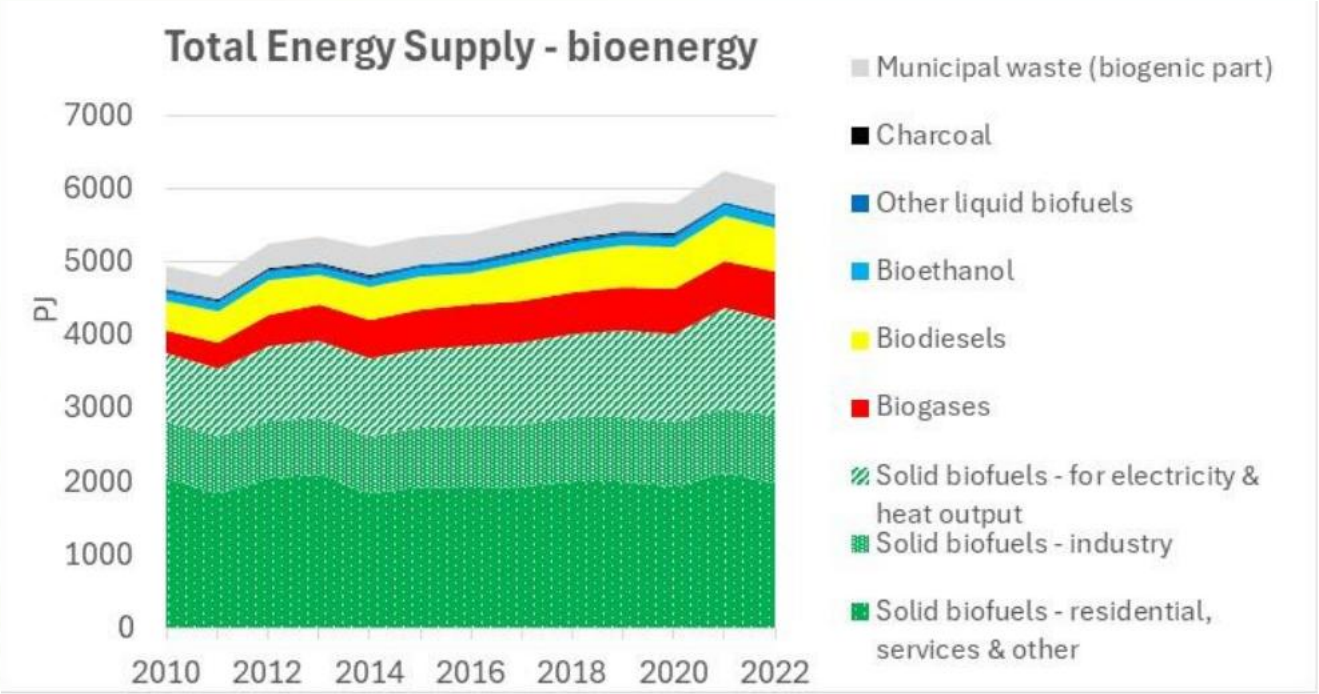
Deployment of Renewable Fuels





Figures taken from IEA Bioenergy Countries Report 2024, EU27;
Left: Total energy supply and the contribution of different energy sources in the EU27, with distribution in 2022
Right: Development of total energy supply from bioenergy in the EU27
Data source for both: IEA (2024) World Energy Balances and Renewables Information

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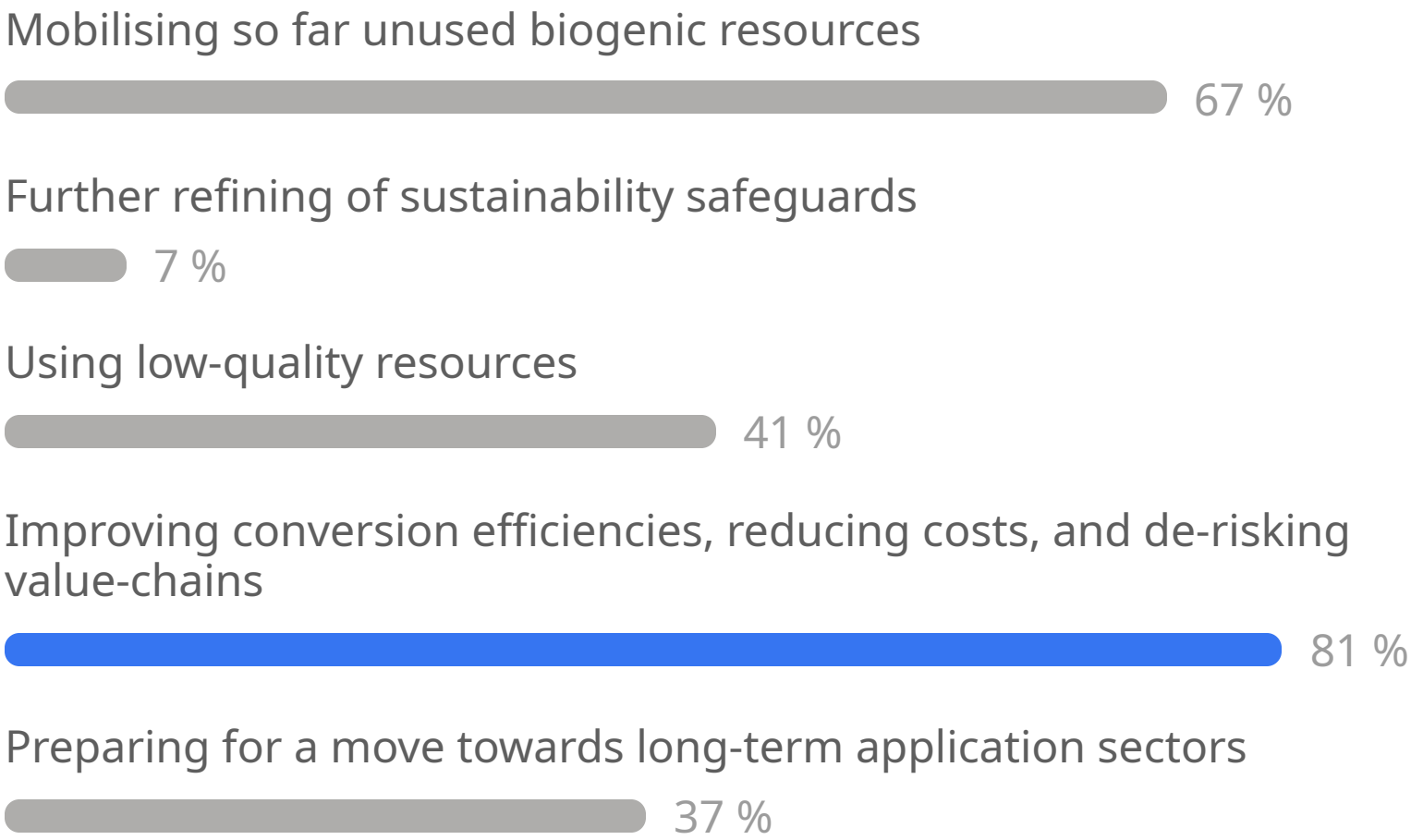
Multiple-choice poll (Multiple answers)

Which R&I challenges for further deployment do you still consider relevant?

0 2 7

(1/2)



Which R&I challenges for further deployment do you still consider relevant?

0 2 7

(2/2)

Developing efficient approaches for infrastructure

19 %

Preparing long-term solutions such as algae or solar fuels

26 %

Are there any other challenges for deployment?

0 1 7

(1/2)

- Funding for beaker-to-bucket-to-barrel-to-bunker deployment
- Sustainability concerns
- Integration of stakeholders
- Technology leadership
- Make use of digitalisation for increased efficiency
- Market supportino measurements
- Energy efficiency issues
- No R&I framework for integrating dedicated energy crops (Salix, Poplar) on marginal lands with decentralised pyrolysis in Central and Eastern Europe
- Realize credible agro-industrial projects that farmers can rely on in order to fully commit to produce the feedstock needed for long term projects
- Market support measures
- Stable policy perspectives
- Clear and stable regulations
- Visibility (clear mandates -> offtake)
- Coordinating policies on energy, agriculture, environment
- upgraded pipelines and storage * blending facilities * hydrogen refueling stations * compatible engines and distribution systems

Are there any other challenges for deployment? (2/2)

0 1 7

- Close liaison with financial actors
- Still too strong fossil lobby
- Consistency across the energy system
- Offtakers
- even more incentives for European domestic production
- Create and coordinate critical mass of stakeholders
- Increase bankability
- Full European value chain establishment
- Offteakers
- Positive and predictable political framework
- Financing packages
- Make off-take agreements work
- Find the early adopters in the market
- Stable policy framework on national and European level

Biomass Mobilisation

Figure 3 Annex IX/A, B biomass potential in technical, low, medium, and high potentials in 2030 and 2050 and distribution over sectors delivering biomass

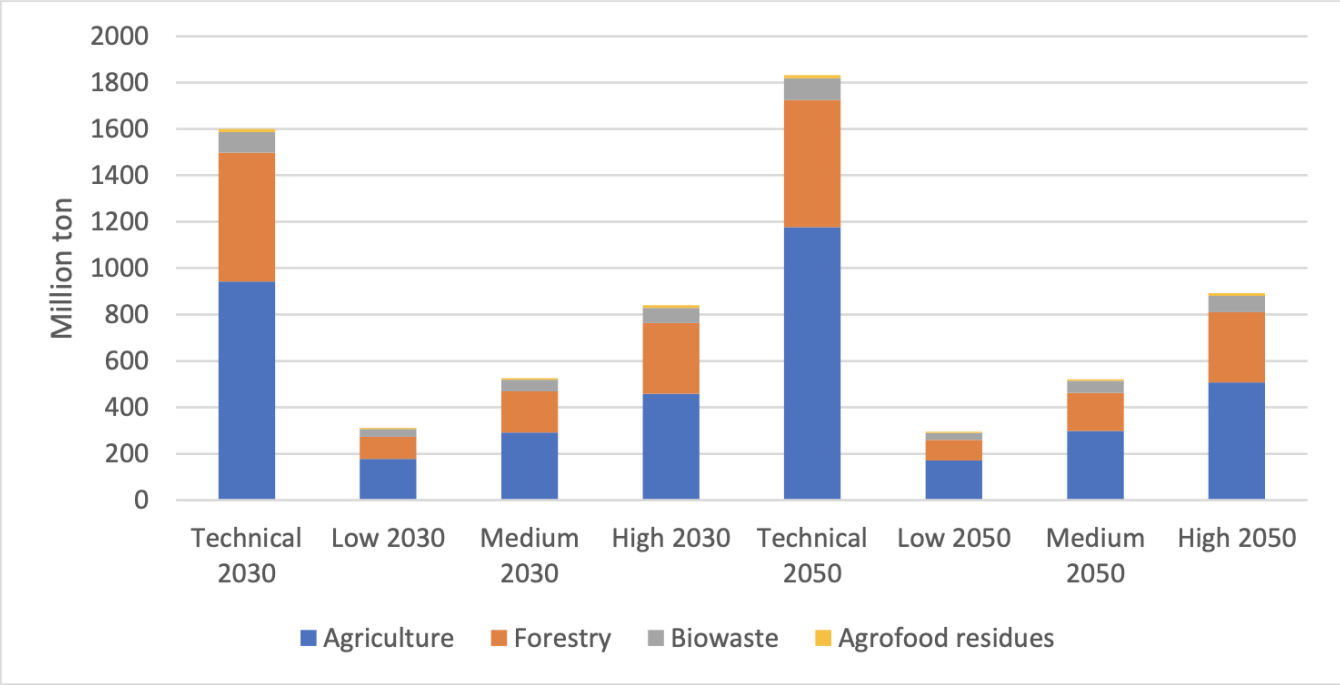


Figure taken from: European Commission: Directorate-General for Research and Innovation, Exergia, E3Modelling, Wageningen University & Research, BEST, BTG and POLITO, ***Development of outlook for the necessary means to build industrial capacity for drop-in advanced biofuels – Final report***, Georgiadou, M.(editor), Goumas, T.(editor) and Chiaramonti, D.(editor), Publications Office of the European Union, 2024, https://data.europa.eu/doi/10.2777/679307
Technical biomass potential in Europe and resulting potential biomass availability under low, medium and high mobilization scenarios

Annex IX to Directive (EU) 2018/2001 is amended as follows:

(1) in Part A, the following feedstocks are added:
“
(r) Fusel oils from alcoholic distillation;
(s) Raw methanol from kraft pulping stemming from the production of wood pulp;
(t) Intermediate crops, such as catch crops and cover crops that are grown in areas where due to a short vegetation period the production of food and feed crops is limited to one harvest and provided their use does not trigger demand for additional land, and provided the soil organic matter content is maintained, where used for the production of biofuel for the aviation sector;
(u) Crops grown on severely degraded land, except food and feed crops, where used for the production of biofuel for the aviation sector;
(v) Cyanobacteria.”.

(2) in Part B, the following feedstocks are added:
“
(c) Damaged crops that are not fit for use in the food or feed chain, excluding substances that have been intentionally modified or contaminated in order to meet this definition;
(d) Municipal wastewater and derivatives other than sewage sludge;
(e) Crops grown on severely degraded land excluding food and feed crops and feedstocks listed in Part A of this Annex, where not used for the production of biofuel for the aviation sector;
(f) Intermediate crops, such as catch crops and cover crops, and excluding feedstocks listed in Part A of this Annex, that are grown in areas where due to a short vegetation period the production of food and feed crops is limited to one harvest and provided their use does not trigger demand for additional land and provided the soil organic matter content is maintained, where not used for the production of biofuel for the aviation sector.”.

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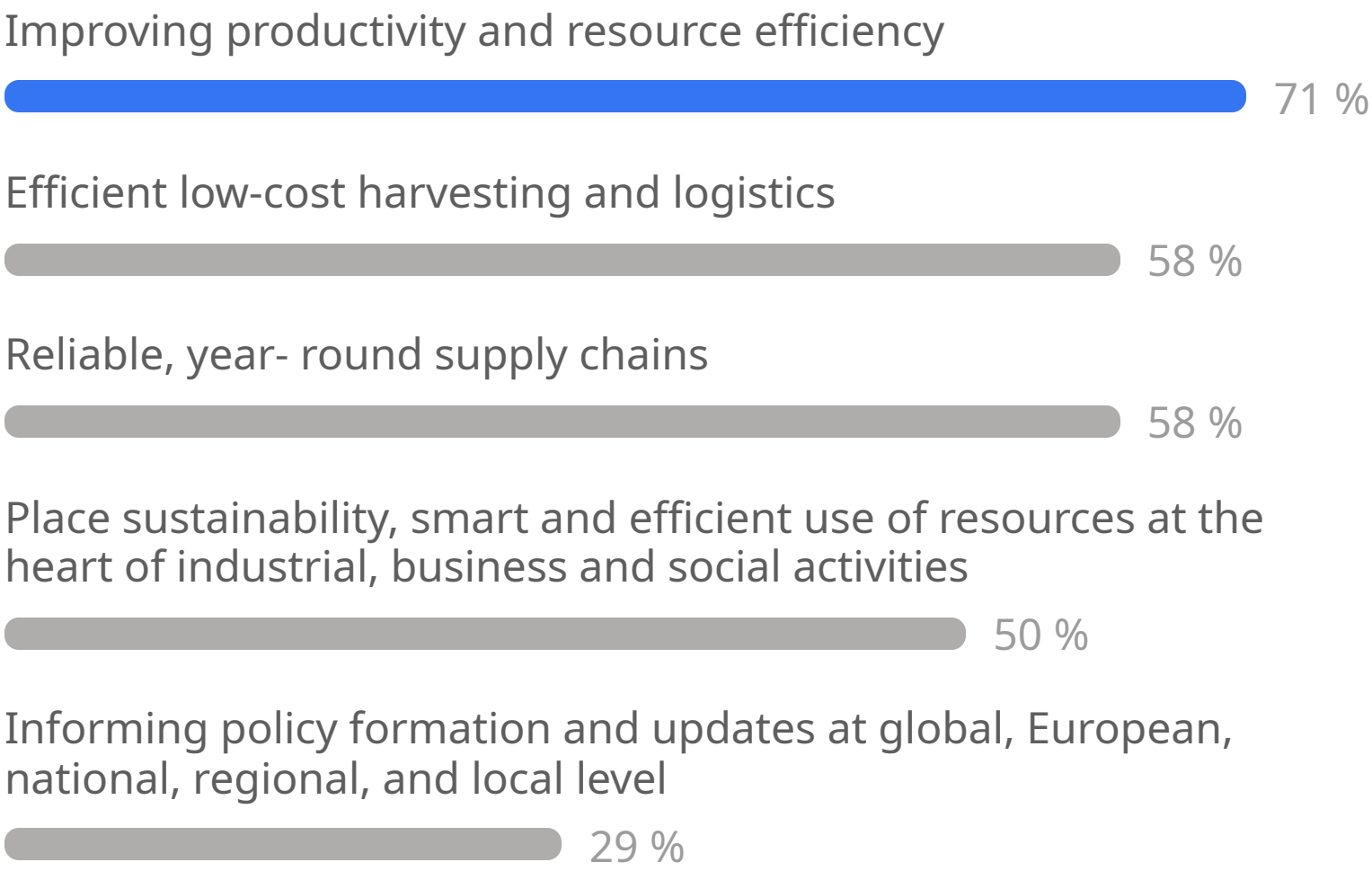
Multiple-choice poll (Multiple answers)

Which R&I priorities on biomass do you still consider relevant?

0 2 4



Are there any other R&I priorities on biomass?

0 1 6

(1/2)

- Long term inter topping systems
- Biological capture of Co2
- Biorefinery approaches for chemicals and fuels
- microbial biomass potential
- Synergies between biomass handling/processes and waste handling
- Aquatic biomass
- Algae biomass
- Dedicated short-rotation energy crops (Salix, Poplar) on marginal lands as reliable, year-round feedstock for decentralised pyrolysis
- Standardization
- Integrated multiproducts biorefineries
- Understanding and implementing the potential of AI and automation for the specific challenges fo our sector both for supply and conversion
- Use of low-value and waste biomass
- Defining better what is marginalnetc land...
- Biomass integration in the overall system
- Biomass logistics and value chains

Are there any other R&I priorities on biomass?

0 1 6

(2/2)

- Farmers awareness and incentives
- New sources of triglicerides
- Discussion on prioritizing to which end biomass should be used.
- Marginal lands
- Crops from marginal and degraded lands
- Efficient collection and logistics * Reduce the cost of biomass transport and storage * Develop decentralized preprocessing systems (pelletizing, torrefaction, densification) * Use digital tools
- Advanced digitalisation
- Smart and flexible approaches for all uses of biomass
- Biomass mechanised collection
- Integrazion of biogenic value chains with availability of green h2
- Intermediate crops
- Use of AI/ML for better knowledge on available biomass
- New innovative crop systems

Decarbonising Aviation

Hydroprocessed Esters and Fatty Acids (HEFA)

HEFA is the most technologically mature pathway that uses waste oils or used cooking oils (UCO)/fats as a feedstock. Currently, all operational SAF facilities globally are based on HEFA.

Process: Removal of oxygen by hydrodeoxygenation → cracking & isomerisation of paraffinic molecules to jet fuel chain length.

Yield: 70–80% depending on feedstock and parameters.

Alcohol-to-Jet (AtJ)

AtJ involves dehydration, oligomerisation and hydro-processing to convert alcohol feedstock to SAF. Alcohols have a standard chemical formula, so feedstock variation is minimal.

Yield: ~60%, potentially 70–90% SAF with remaining renewable diesel and light ends.

Note: Scaling and integrating these processes at large scale poses engineering challenges.

Fischer–Tropsch (FT)

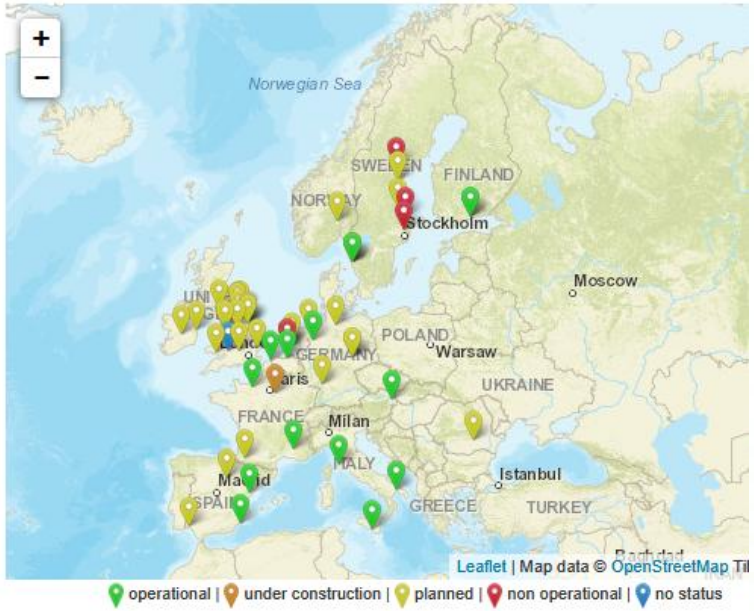
FT is one of the earliest ASTM-approved routes, converting carbonaceous waste/residues to syngas (H_2, CO) and then catalytically upgrading it to jet/diesel. Certified jet specs: SPK & SKA.

Challenges: Feedstock-specific, capex-heavy, slow to build, hard to stabilize, limiting scale.

Power-to-Liquid (PtL)

PtL combines green hydrogen (from renewables) with captured CO_2 to form syngas, then converts it via Fischer–Tropsch.

Status: Low maturity today; expected to grow post-2040 as green hydrogen & carbon capture mature.



Left: Copied from https://www.safassociation.com/about-saf.php

Right: ETIP Bioenergy Production Facilities Database, SAF Facilities

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Which R&I priorities for aviation do you still consider relevant?

0 2 1

(1/2)

Improve the technical, environmental, social and economic performance of SAF

33 %

Develop a better understanding of the chemical impact of SAF on engine emissions and non-CO2 effects

29 %

Develop technologies for the conversion of EU RED Annex IX-A feedstocks to HEFA

29 %

Support First-of-a-Kind commercial plants for ATJ production

67 %

Which R&I priorities for aviation do you still consider relevant?

0 2 1

(2/2)

Make alcohols (ethanol, methanol) from cellulosic feedstock or of non-biological origin more available

48 %

Increase SAF yields from the Fischer-Tropsch synthesis step

29 %

Increase the selectivity for kerosene in pyrolysis- or HTL-based SAF production processes

38 %

Open text poll

Are there any other R&I priorities on aviation?

0 0 9

(1/2)

- 100% saf compatibility with engines
- Understand de-risking and visibility roles to facilitate investment for scaling production
- Do not take increasing aviation for granted - realistisch market estimates
- integration between agriculture, forestry, and aviation sectors
- Integrazion between agricoltures, forest and aviation
- Refurbished infrastructure
- Industrial symbiosis
- process intensification
- Stop the silo thinking between application sectors. Many technologies produce for more than one application.
- Business models
- Synergies for market transport sectors
- integration between agriculture, forestry, and aviation sectors
- A clear path towards realistic feedstock supply for SAF. HEFA feedstocks may run out faster than we think
- Better understanding synergies with production with marine fuels, and valorizing byproducts

Are there any other R&I priorities on aviation?
(2/2)

0 0 9

- Stable policy framework

Decarbonising Shipping

	Feedstock Availability	Fuel Production	Fuel storage, logistics & bunkering	Onboard energy storage & fuel conversion	Onboard safety & operations	Vessel Emissions	Regulation & certification
e-ammonia							
Blue ammonia							
e-methanol							
Bio-methanol							
e-methane							
Bio-methane							
Bio-oils							
e-diesel							
Bio-diesel							

Fuel Pathway Maturity Map, copied from https://www.zerocarbonshipping.com/fuel-pathways
Green: Mature, Yellow: Solutions Identified, Red: Major Challenges Remain

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Multiple-choice poll (Multiple answers)

Which R&I priorities for shipping do you still consider relevant?

0 1 8

Improve the technical, environmental, social and economic performance of alternative shipping fuels

22 %

Facilitate the sourcing of suitable low-carbon feedstocks, the industrial production and the use by shipping companies in a competitive context

67 %

R&D on both biofuels and RFNBO production technologies

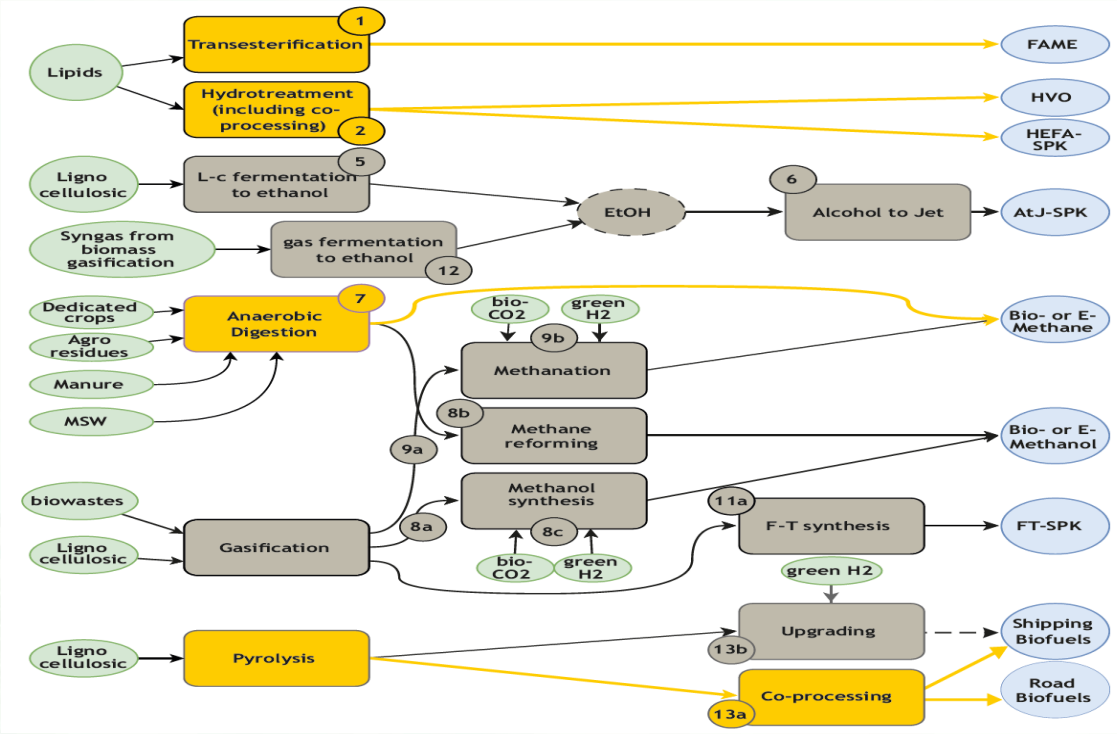
44 %

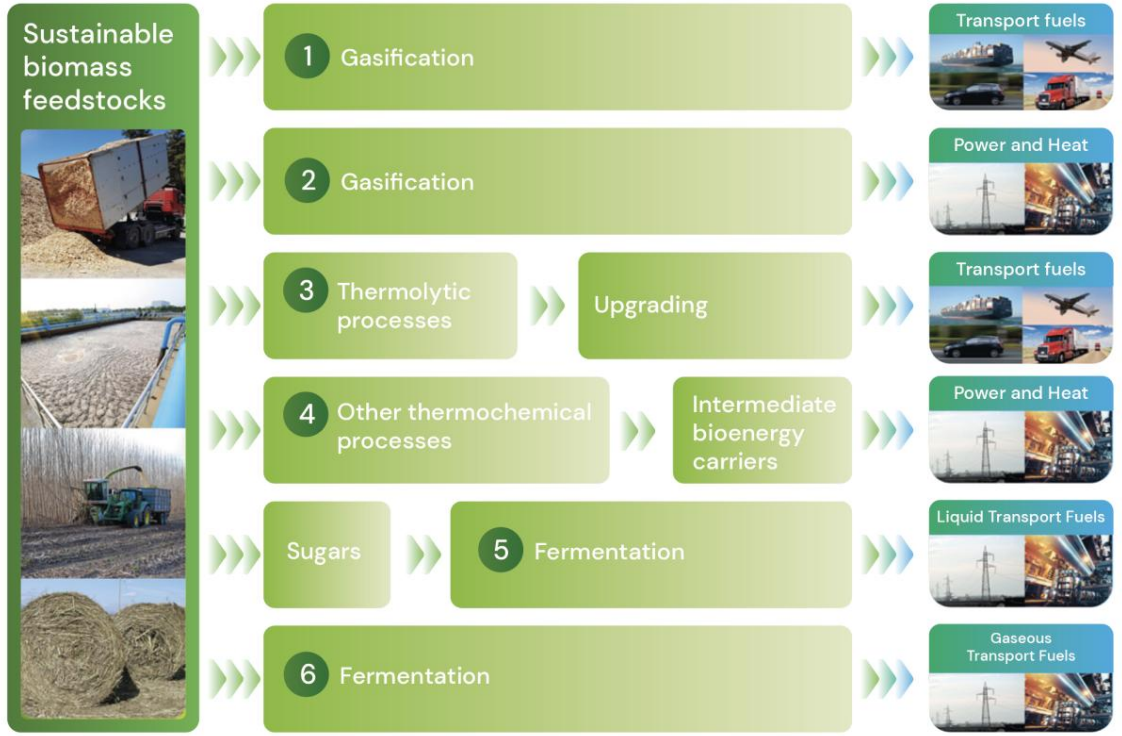
Are there any other R&I priorities on shipping?

007

- How to move away from single focus on cost
- Simulation to optimize regional production of marine biofuels (for each fuel type) in relation to regional demand
- Flexible value chains for more sectors (maritime, aviation)
- Engine and vessel compatibility
- Safety systems
- Low cost drop in biofuels for shipping
- Narrow down a bit. Ammonia is very questionable
- See SAF comment. Produce for more than one sector
- Secure supply chains and flexibility

Conversion Technologies





Left: Important Renewable Fuel Production Pathways,
Figure taken from: European Commission: Directorate-General for Research and Innovation, EXERGIA, POLITO and BEST, ***Mobilization of industrial capacity building for advanced biofuels – Final report***, Georgiadou, M.(editor), Goumas, T.(editor) and Chiaramonti, D.(editor), Publications Office of the European Union, 2026, **https://data.europa.eu/doi/10.2777/2375274**

Right: ETIP Bioenergy Priority Value Chains, https://www.etipbioenergy.eu/value-chains/

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Please provide R&I priorities for specific technologies in brief words. Make sure to mention the specific technology you are referring to.

(1/2)

0 1 2

- Financing that does not involve the undertaking in difficulty clause for start-ups and scale ups
- Combine biomass with other RES
- Innovative technologies for pirolisi of plastic containing feedstocks
- Focus on facilitiating Green Corridors for deployment -support to practitioners
- catalyst development for downstram in AtJ and syngas to SAF
- Diversify rather than support single technology
- Integrating high temperture solid oxide electrolysis (highest efficiency) to eSAF production routes
- Upgrade ofHTL - biocrude stabilization
- Applied biotechnologies to develop novel microbial and enzymatic biocatalysts
- Pyrolysis HTL etc biooils and liquids at cooprossecunq > 5%
- upgrading of HTL-based biocrude
- HTL of marine

Please provide R&I priorities for specific technologies in brief words. Make sure to mention the specific technology you are referring to.

(2/2)

biomass (seaweeds)

- Intermittent pyrolysis (Salix biomass): R&I priority — carbon efficiency >85%, biochar standardisation as carbon sink, techno-economic validation for marginal lands in Central & Eastern Europe
- Focus on researching the scaling of already commercislly existing pathways to achieve volumes on the market quickly.
- Upscale technologies which are already at high TRL.

This will directly cause new R&D questions

- In the end gasification is key. Pin down the key challenges for scaling and cost reduction

ETIP Bioenergy & EERA Bioenergy joint SRIA - Next Steps

Joint SRIA	Who	When
Document outline	Core group	May 2026
Collect input from stakeholders	Stakeholders	May/June 2026
First draft SRIA	Core group	June 2026
Collect feedback from stakeholders	Stakeholders	July/Aug 2026
Final document	ETIP Bioenergy SC EERA Bioenergy BoD	Sep 2026

Your input to the document will be valuable!

Please contact secretariat@etipbioenergy.eu to ensure that we reach out to you!

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PROJECT PARTNERS

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ITA INSTITUTE OF TECHNOLOGY ASSESSMENT

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