



IEA Bioenergy
Technology Collaboration Programme



Decarbonising EU Aviation with SAF - current challenges and perspectives

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IEA Bioenergy TCP

Global Biofuel Alliance - SAF Webinar, 25 July 2025

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IEA Bioenergy TCP

Technology Collaboration Programme (TCP), functioning within a framework created by the International Energy Agency (IEA)

Goal:

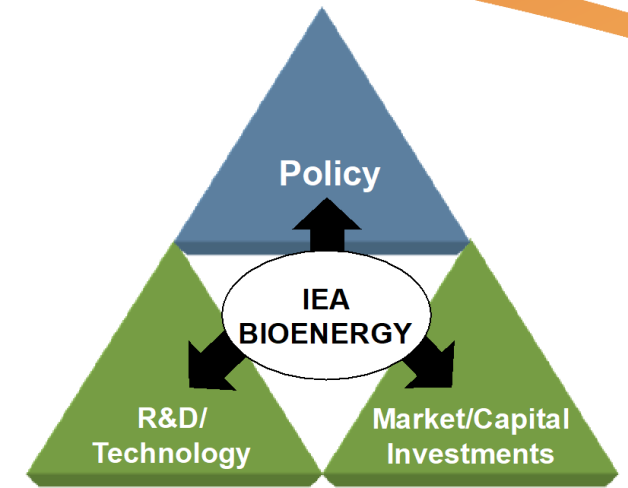
- International **collaboration** and **info exchange** on bioenergy research, technology development, demonstration, markets, and policy analysis
- Facilitate the commercialization and market deployment of sustainable bioenergy systems = **climate positive, environmentally sound, socially acceptable** and **cost-competitive** (incl. external costs)

Members:

13 European countries + EC, USA, Canada, Brazil, India, China, Japan, Korea, Australia, New Zealand, South Africa

Work programme:

Carried out through **Tasks** and **Special Projects**, covering the full value chain from feedstock to final energy product (~200 experts worldwide involved)



IEA Bioenergy TCP - overview of all activities

Industrial
Energy-Related
Technologies
and Systems

TCP Coordination Group on
Thermal Networks

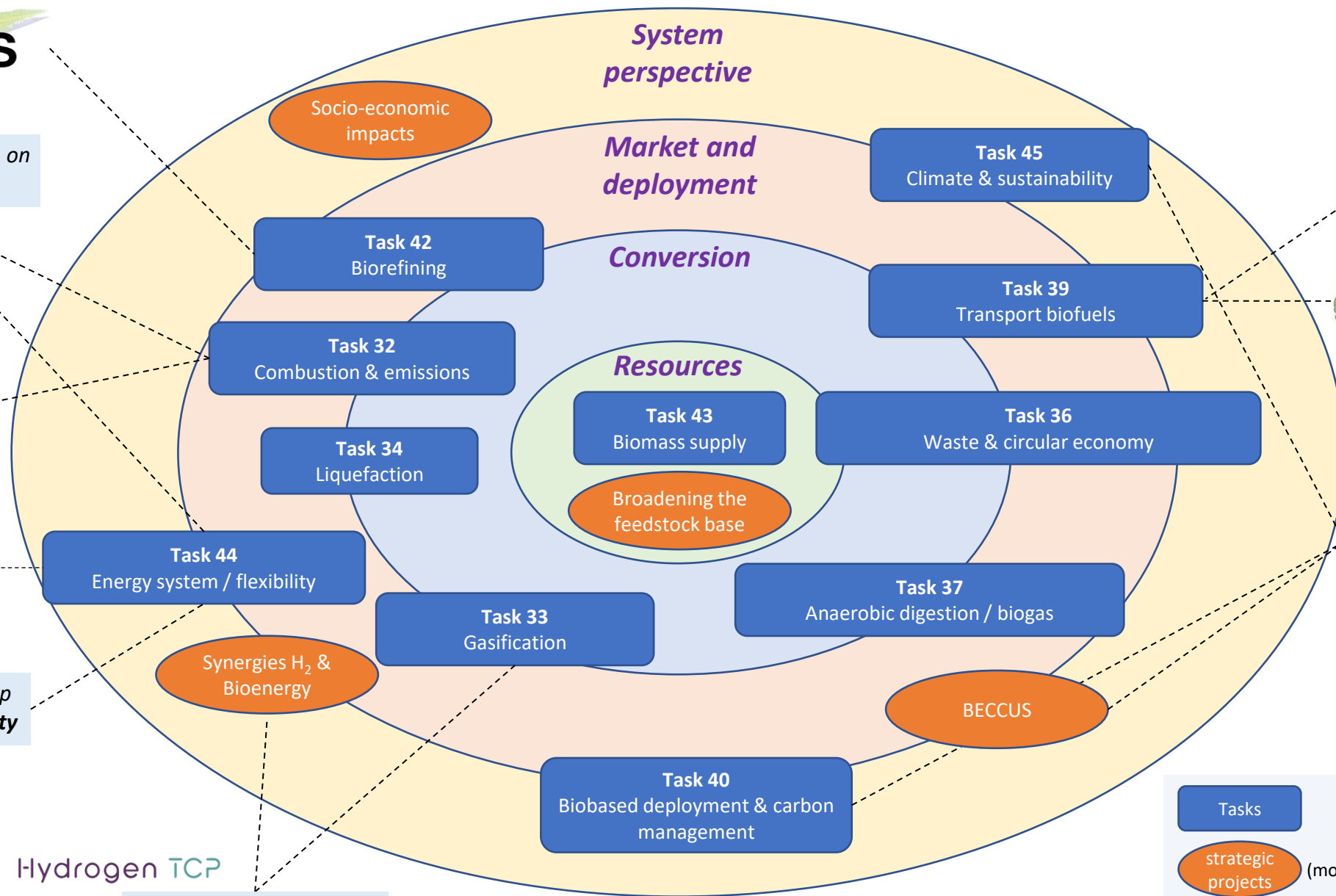


TCP Coordination Group
Energy System Flexibility

Hydrogen TCP



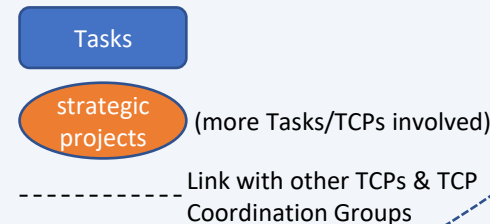
TCP Coordination Group
on **Hydrogen**



TCP **Transport**
Coordination Group



TCP Coordination Group
on **Carbon Management**





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Task 39 Biofuels to Decarbonize Transport

Key projects for 2025-2027

- Implementation Agenda including Emerging Markets
- Advanced Biofuels Demonstration Database
- Renewable Hydrocarbons for Diesel and Jet Sectors
- E-Fuels and synergies with biofuel production
- Marine Biofuels
- BECCUS - BioEnergy Carbon Capture Utilization & Storage



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Task 39
Biofuels to Decarbonize Transport

Renewable Hydrocarbons for Heavy Duty and Jet Fuel Sectors

- Feedstocks and Biofuel Process Conversion Routes (led by USA and Brazil)
- Assessing GHG LCA in Coprocessing of Renewable Diesel and Jet Fuels (led by EC)
- 11 participating countries

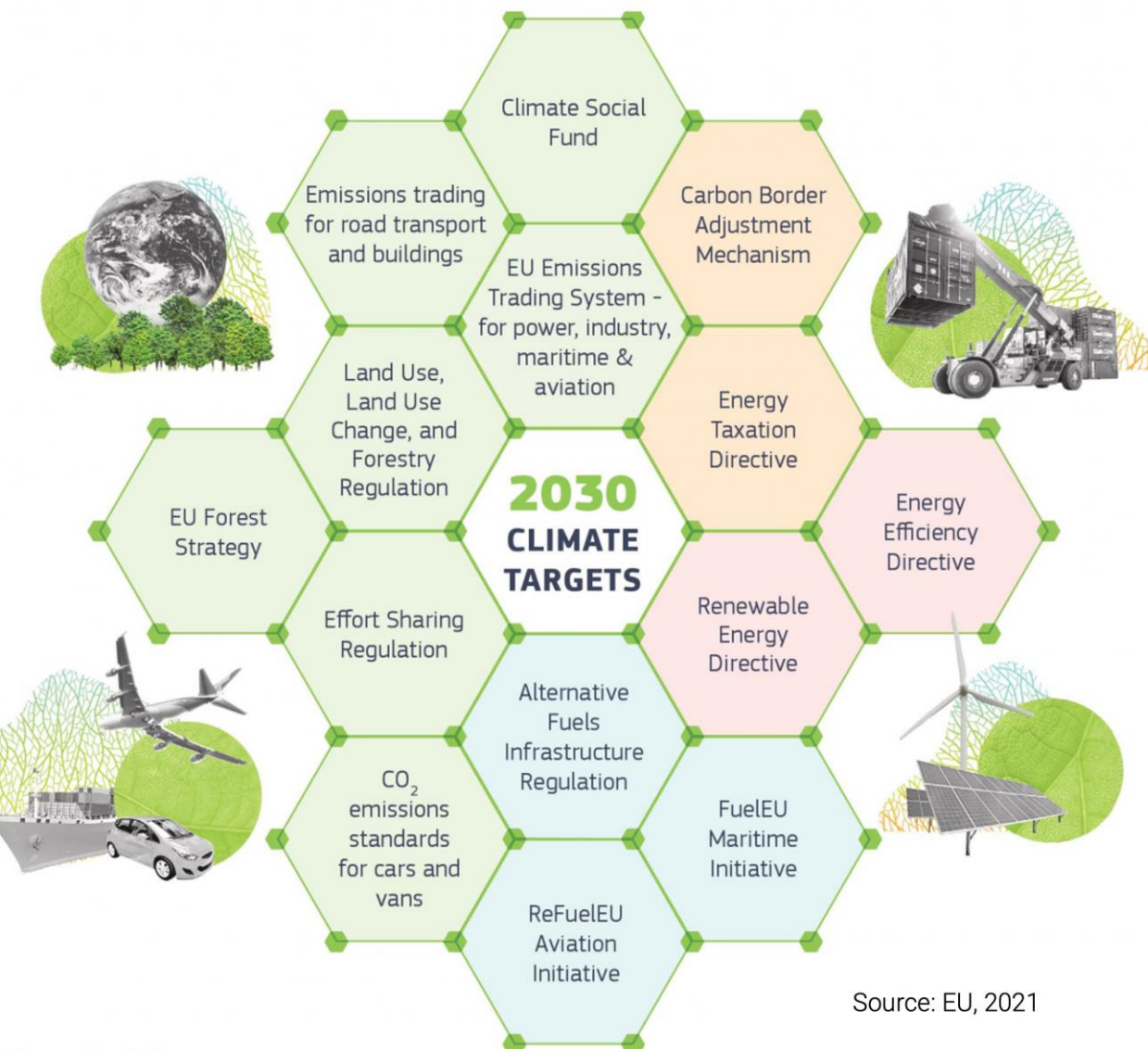
Country:	Representative:
Belgium	Robert Malina Sumit Maharjan
Brazil	Glaucia Mendes Souza Rubens Maciel Filho Luiz Augusto Horta Nogueira Jean Felipe Leal Silv
China	Fuli Li
EU	Nicolae Scarlet Marco Buffi
Germany	Franziska Müller-Langer Nicolaus Dahmen
Japan	Tomoaki Hara
The Netherlands	Jose Muisers Stephan Janbroers
Norway	Duncan Akporiaye
South Korea	Kyungsu Na
Sweden	Tomas Ekbom
United States	Ling Tao

Biofuels Implementation Agenda (including Emerging Markets)

Provision of country-specific insights on:

- Policies related to biofuels and sustainability
- Research efforts and strategies
- Market development and main drivers for biofuel production and use
- Feedstock input for biofuels and land use
- Share of individual transport modes in total transport
- Contribution of transport to greenhouse gas (GHG) emissions
- Upcoming policies and developments
- Updates in relevant certification schemes

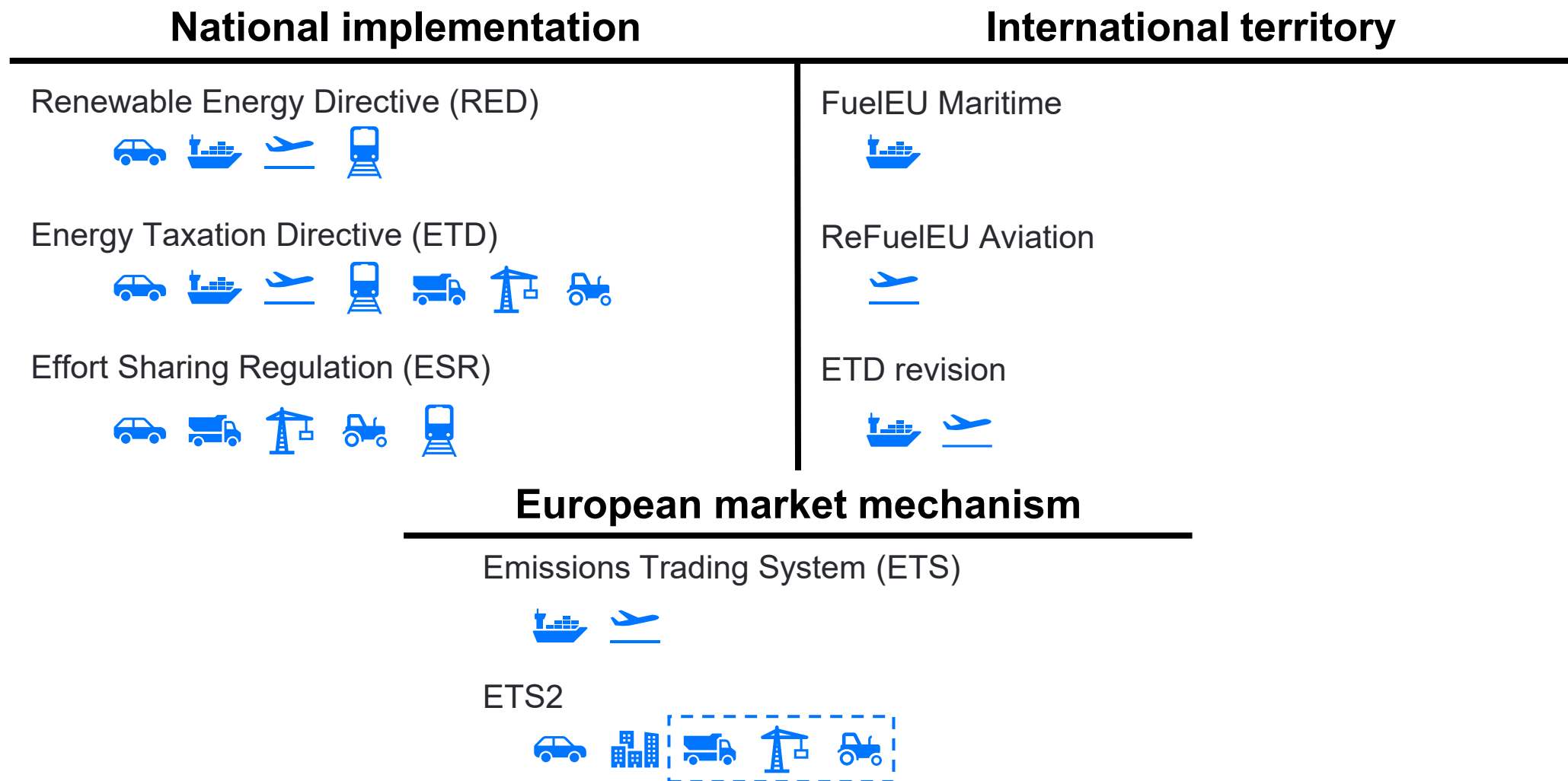
Market and Policy context for SAF in European Union



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EU Policy on energy in transport



Types of steering instruments

Mandated share of renewables	GHG emission intensity
RED II - e.g. minimum 14% renewable energy in fuel mix by 2030 ReFuelEU Aviation - e.g. minimum 6% of SAF in fuel mix by 2030	RED III - By 2030, -14.5% GHG emission intensity of energy in transport FuelEU Maritime - By 2030, -6% GHG emission intensity of energy used in ships
Effective GHG emission reduction	
ETS By 2030, -61% overall GHG emissions in these sectors compared to 2005	
ETS2 By 2030, -43% overall GHG emissions in these sectors compared to 2005	
Effort Sharing Regulation (ESR) By 2030, -48% GHG emissions in these sectors in the Netherlands compared to 2005	
Energy Taxation Directive (ETD) e.g. minimum tax tariff categories dependent aimed at reducing emissions from fuel usage	

Types of steering mechanisms

Mandated share of renewables

RED II

- e.g. minimum 14% renewable energy in fuel mix by 2030

ReFuelEU Aviation

- e.g. minimum 6% of SAF in fuel mix by 2030

GHG emission intensity

RED III

- By 2030, -14.5% GHG emission intensity of energy in transport

FuelEU Maritime

- By 2030, -6% GHG emission intensity of energy used in ships

Effective GHG emission reduction

ETS

- By 2030, -61% overall GHG emissions in these sectors compared to 2005

ETS2

- By 2030, -43% overall GHG emissions in these sectors compared to 2005

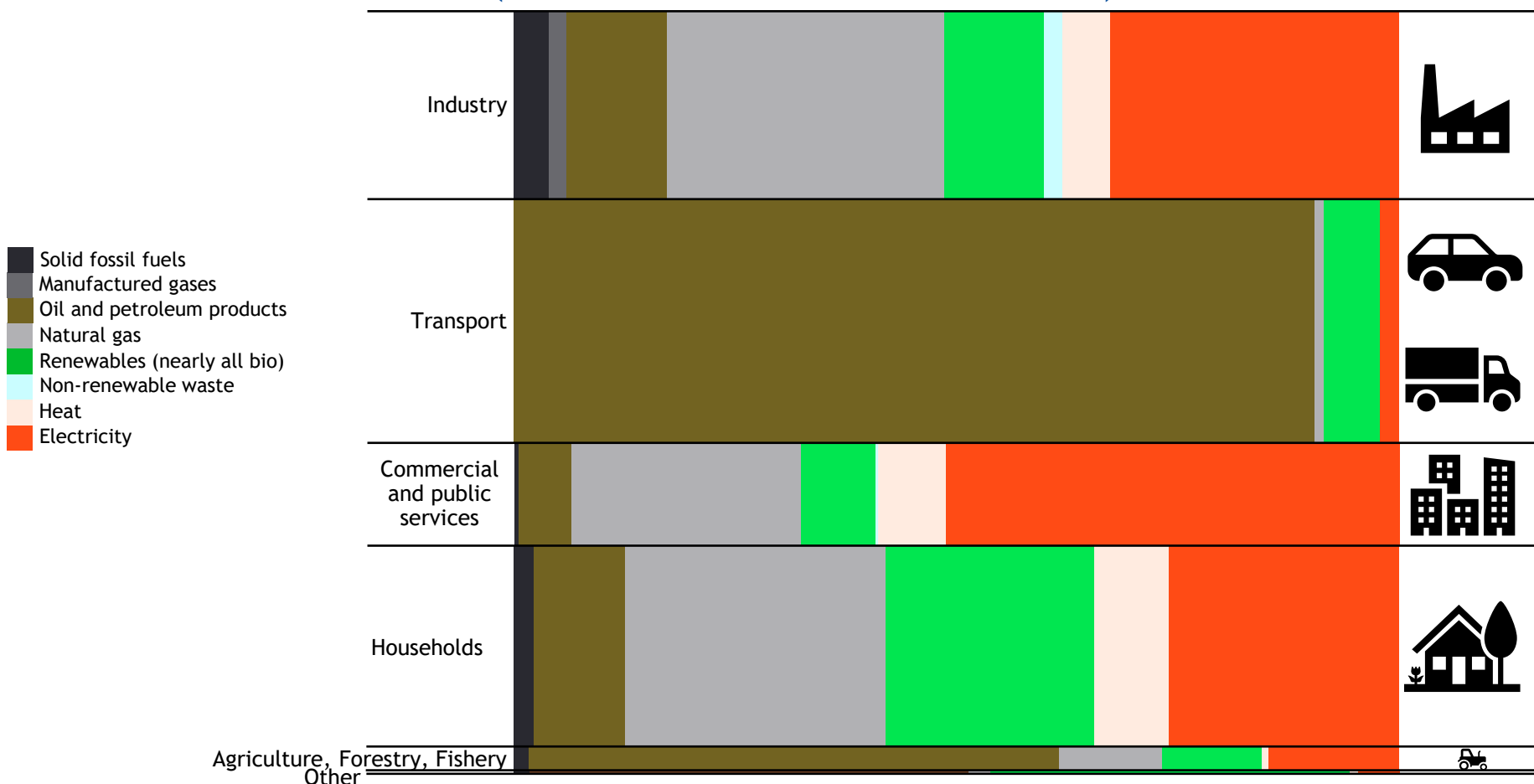
Effort Sharing Regulation (ESR)

- By 2030, -48% GHG emissions in these sectors in the Netherlands compared to 2005

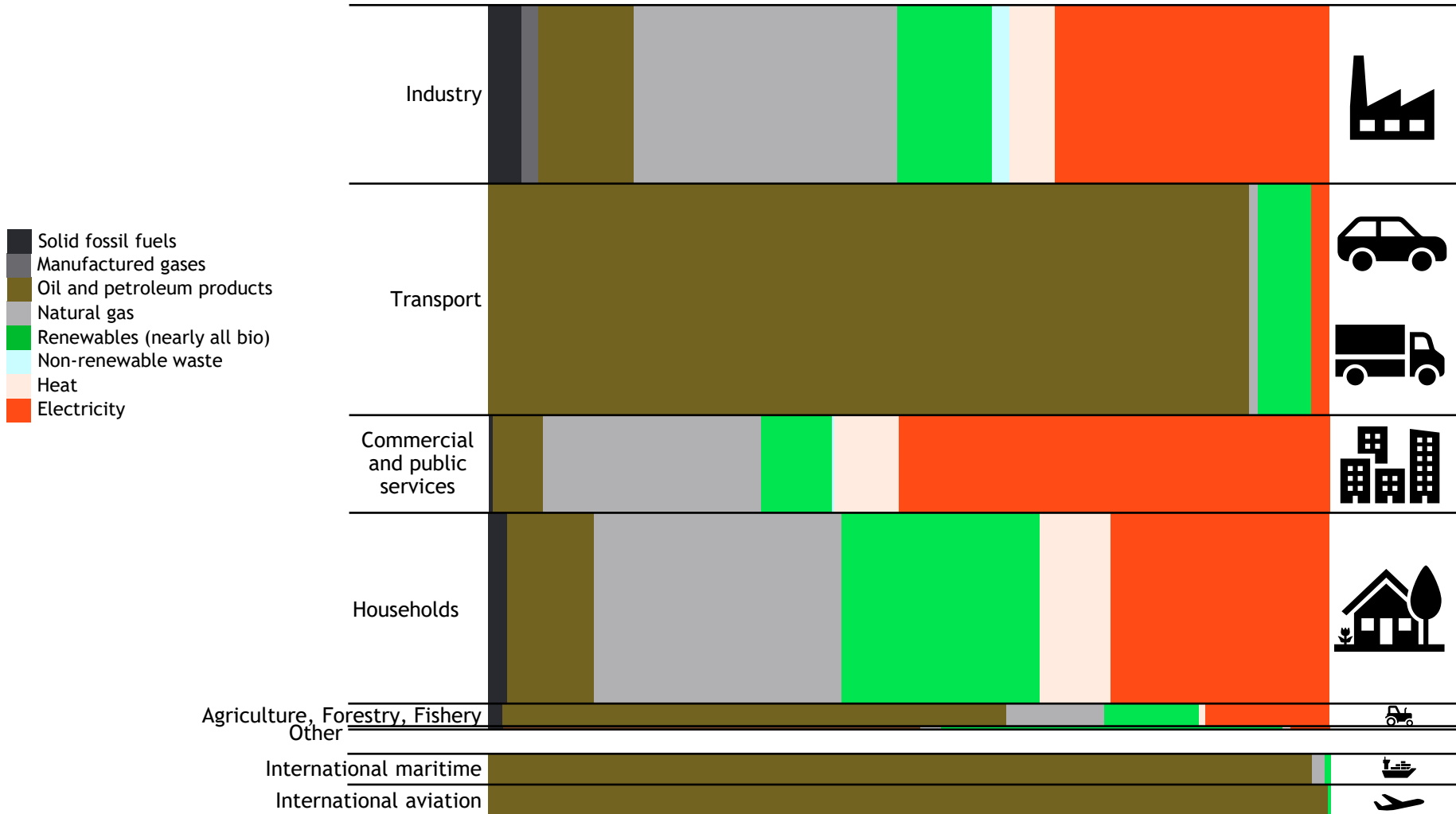
Energy Taxation Directive (ETD)

- e.g. minimum tax tariff categories dependent aimed at reducing emissions from fuel usage

Per sector, final energy consumption in the EU27 in the year 2023: 873 Mtoe (excl. int. aviation and maritime)



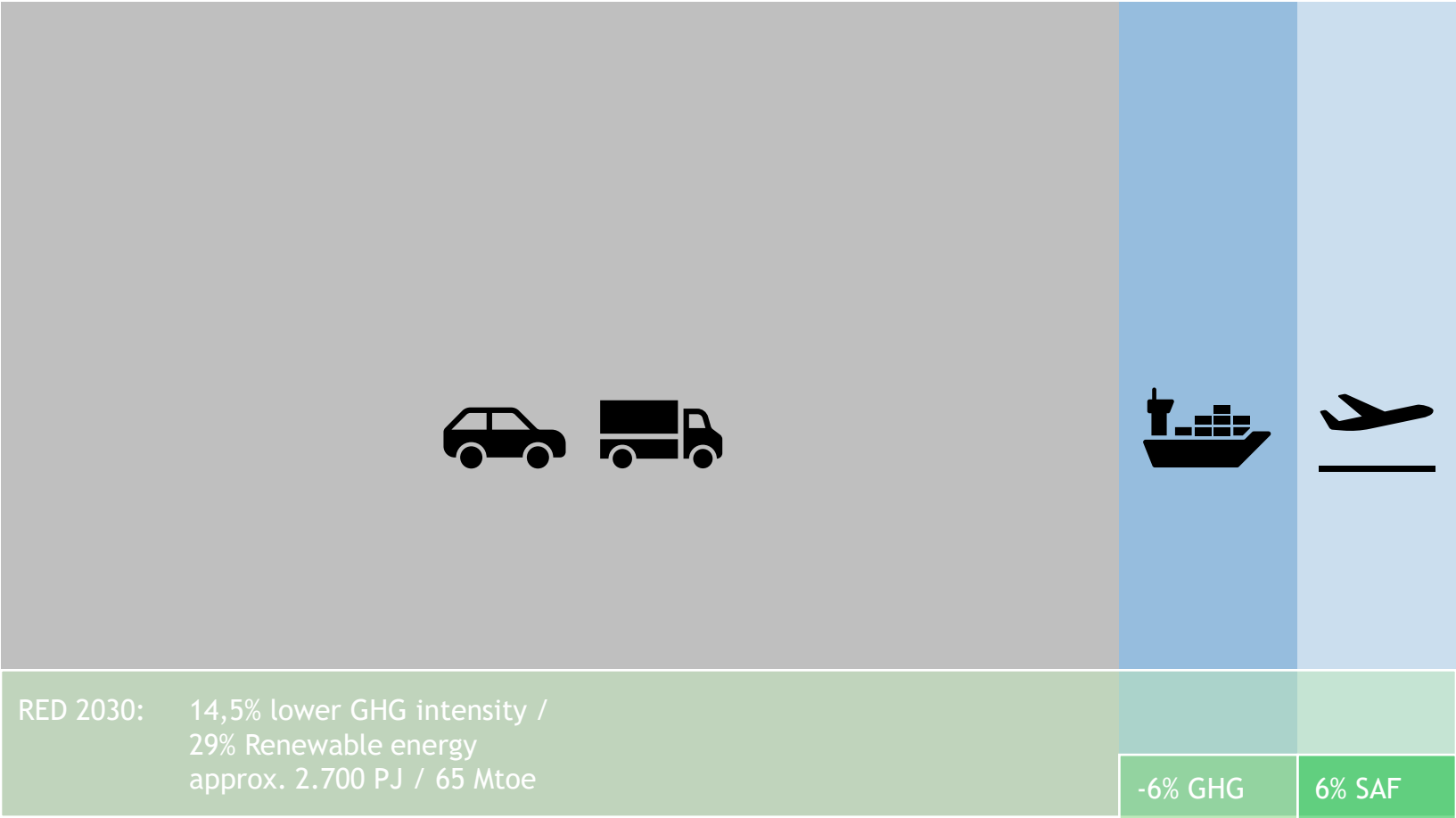
Per sector: final energy consumption in the EU27 in the year 2023: 950 Mtoe (incl. int. aviation and maritime)



Source: Eurostat, Energy Balance, 2023 data. Data are excluding international aviation and maritime bunkering, graph created by studio Gear Up

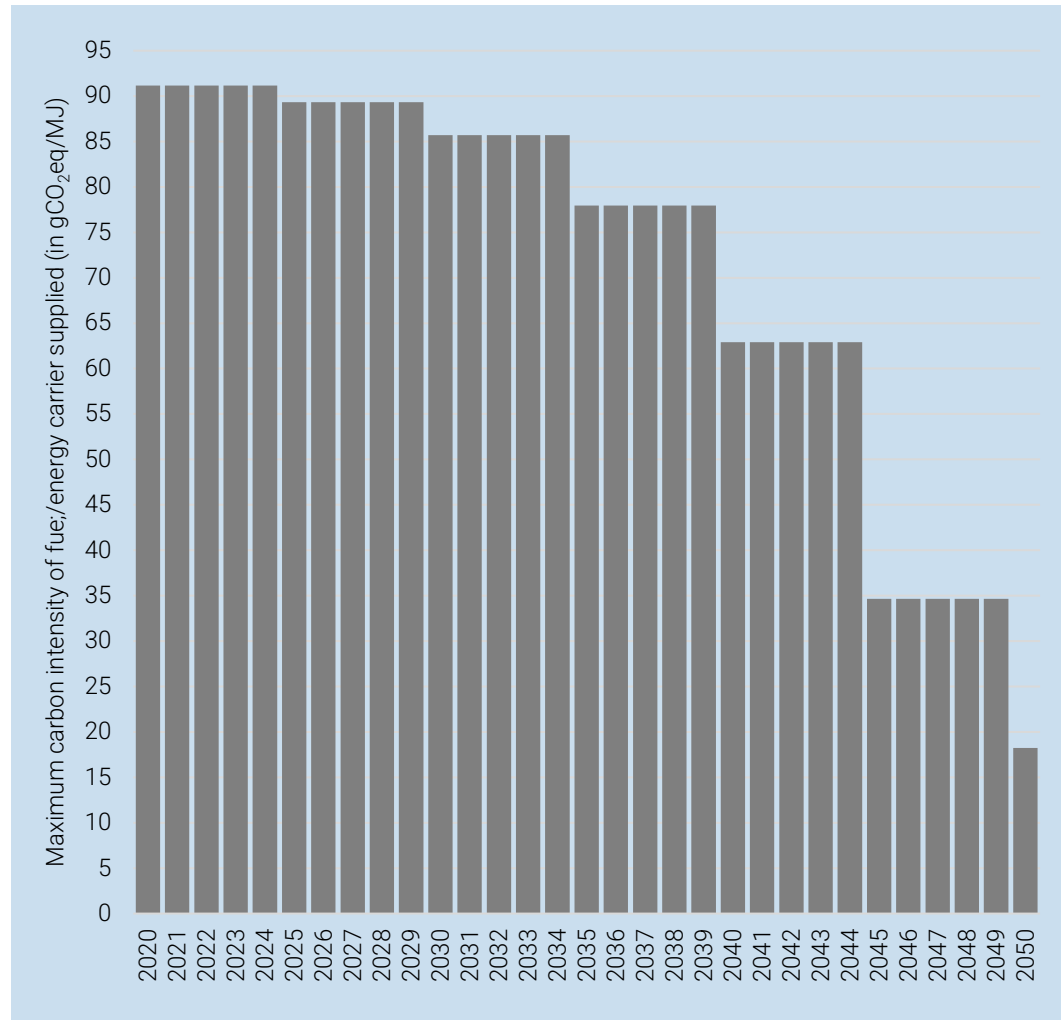
The need for renewable fuels over time in the various transport sectors in EU

The upcoming 2030 targets for the EU Renewable energy directive in comparison to the FuelEU Maritime and ReFuelEU Aviation mandates



Fuel EU Maritime

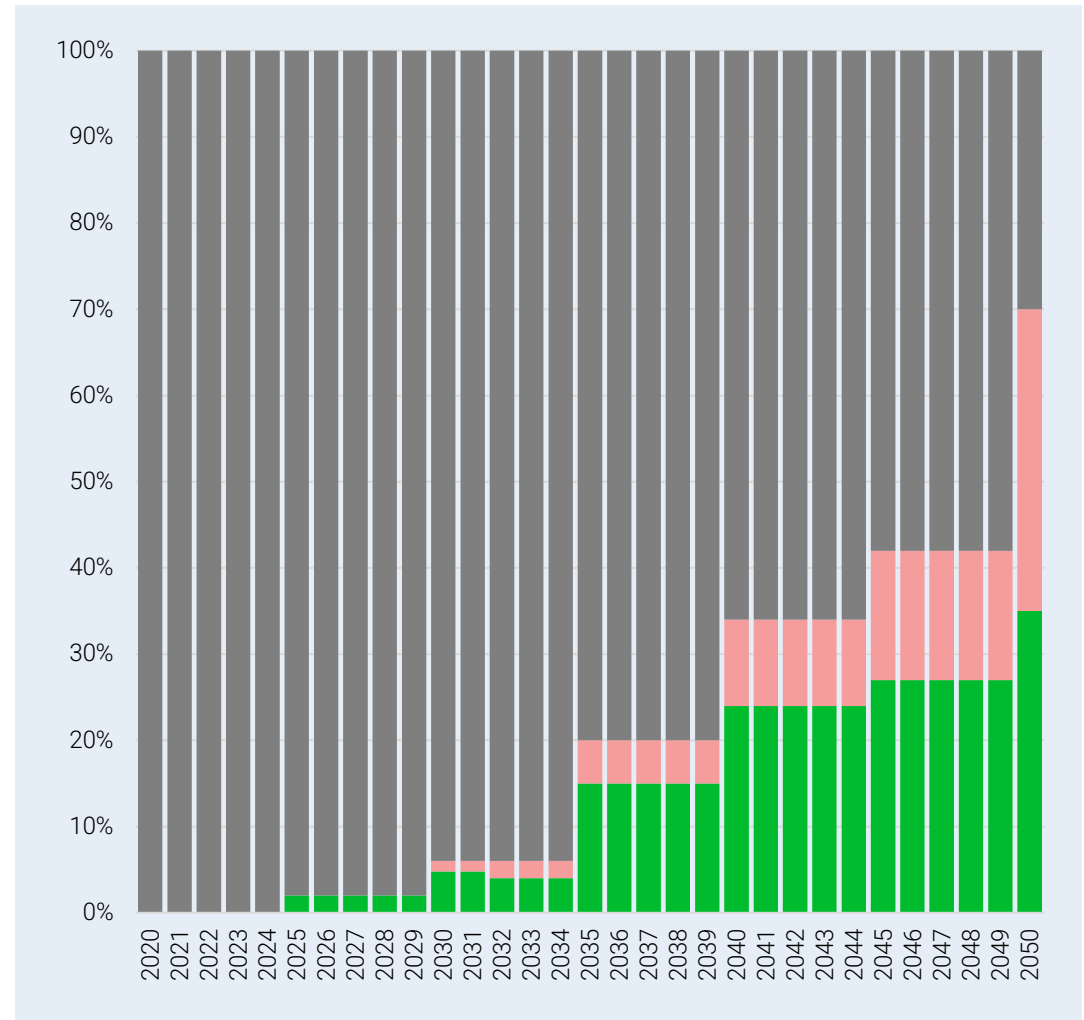
Focus on lowering GHG intensity



Source: EC, 2023, Fuel EU Maritime agreed percentages for carbon intensity reduction.
Reference value of 91,16 gCO₂eq/MJ

ReFuelEU Aviation

Focus on increasing share of SAF

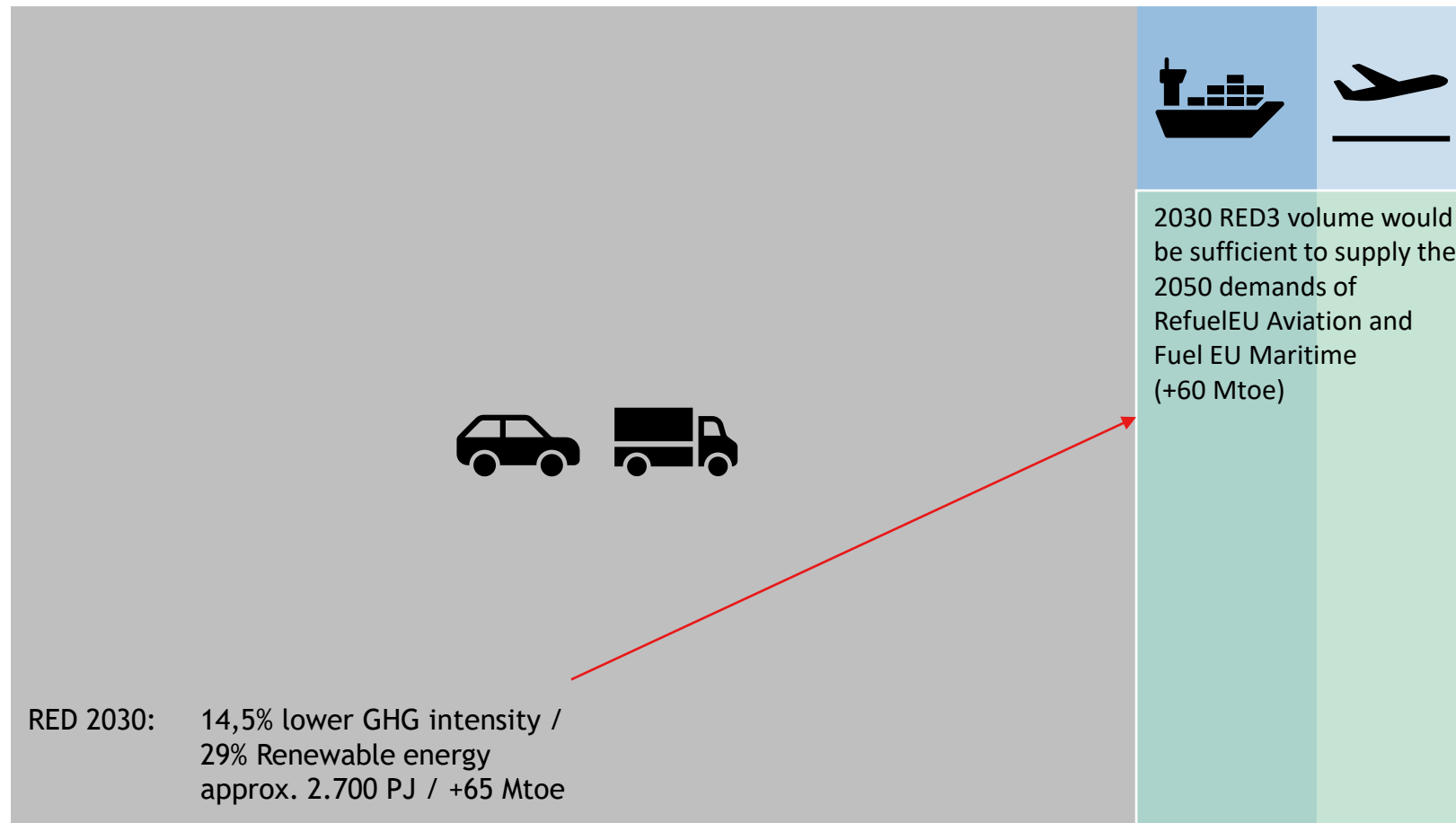


Source: EC, 2023, ReFuelEU Aviation agreed percentages for mandates of SAF to be used in aviation fuel

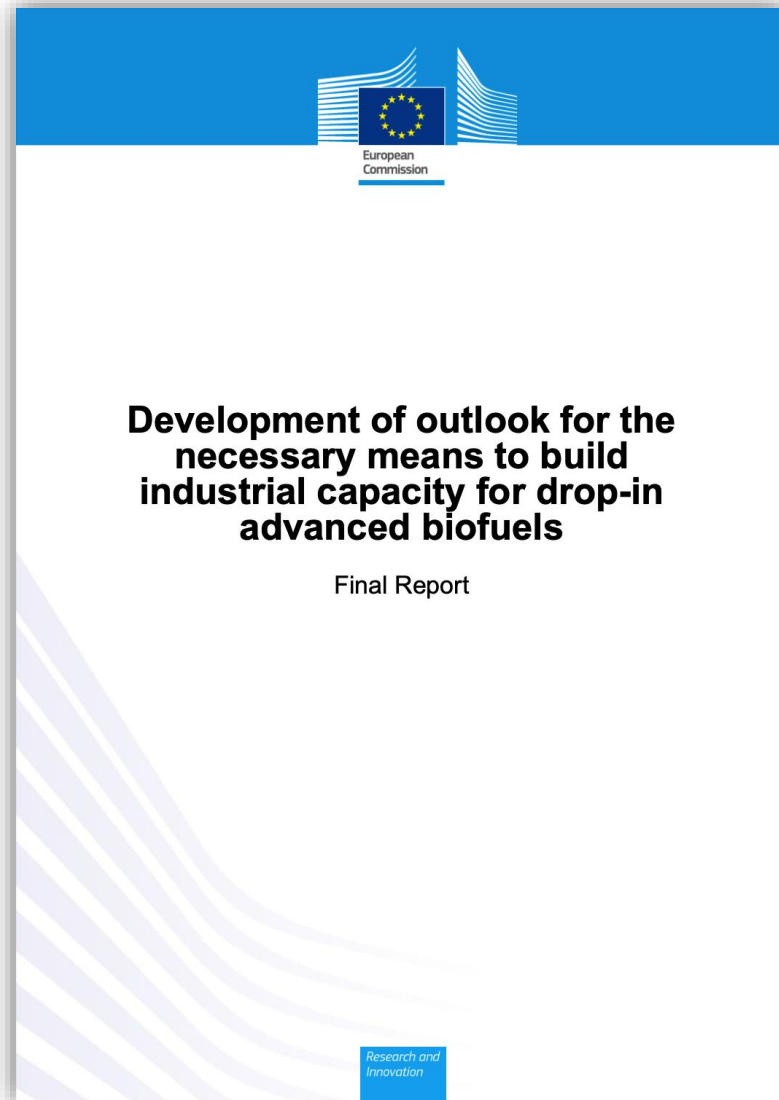
The upcoming 2030 targets for the EU Renewable energy directive in comparison to the FuelEU Maritime and ReFuelEU Aviation mandates



The upcoming 2030 targets for the EU Renewable energy directive in comparison to the FuelEU Maritime and ReFuelEU Aviation mandates



2024 study on outlook advanced biofuel capacity published by EC sheds some light on the required pathways for expanding production capacity



Development of outlook for the necessary means to build industrial capacity for drop-in advanced biofuels

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Manuscript completed in December 2023
First edition

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PDF	ISBN 978-92-68-09662-8	doi:10.2777/679307	KI-09-23-571-EN-N
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Luxembourg: Publications Office of the European Union, 2024

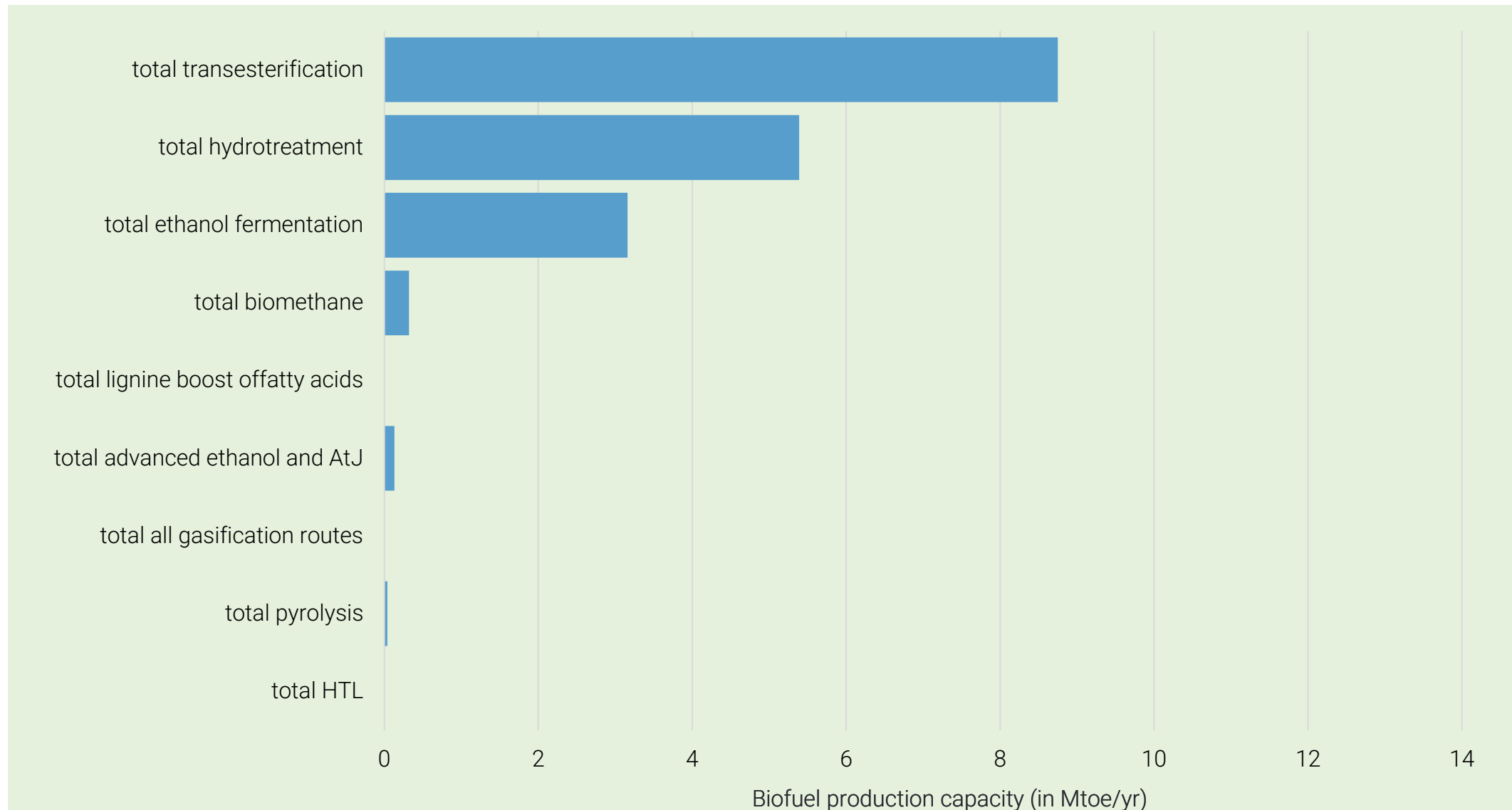
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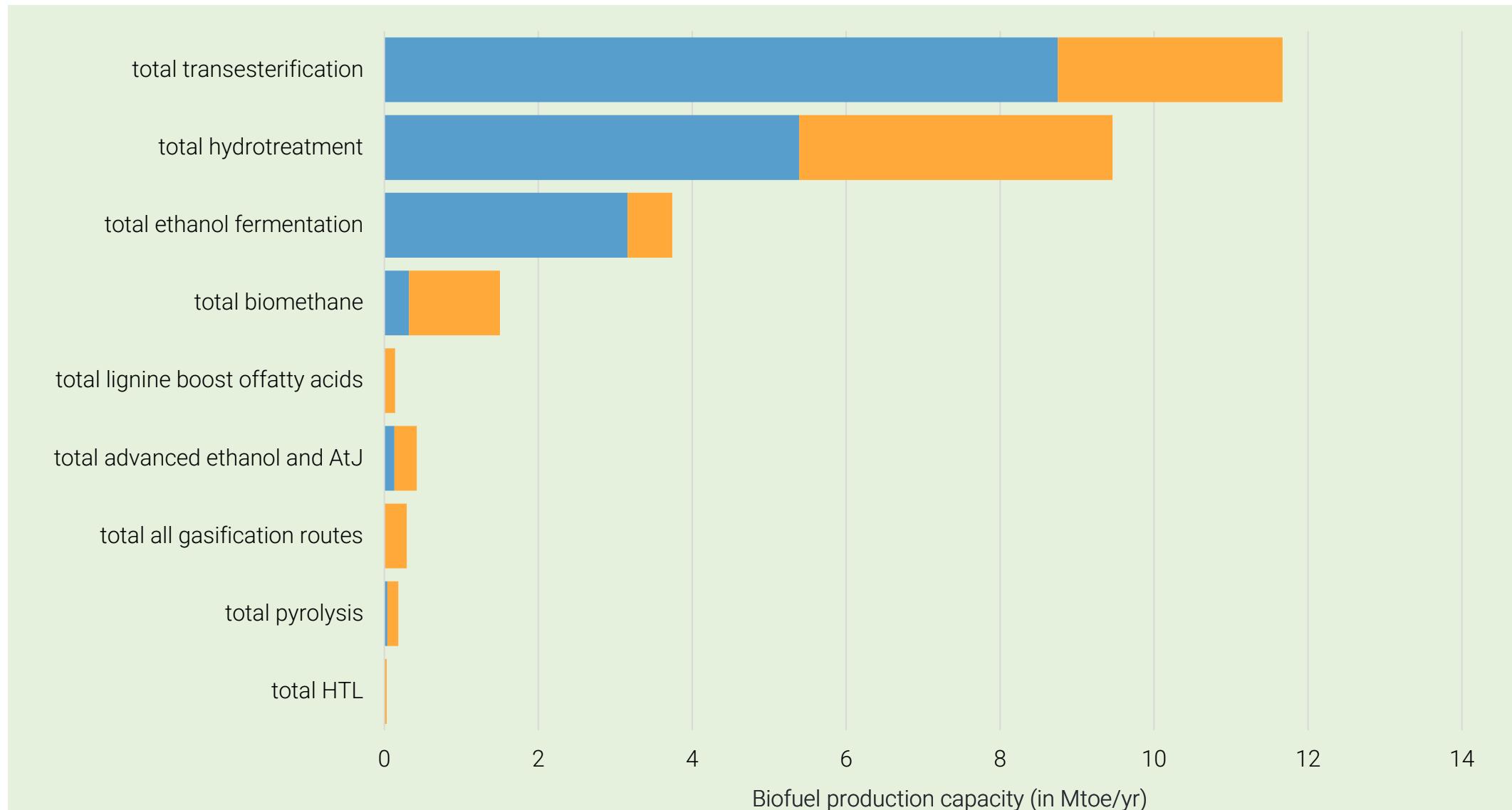
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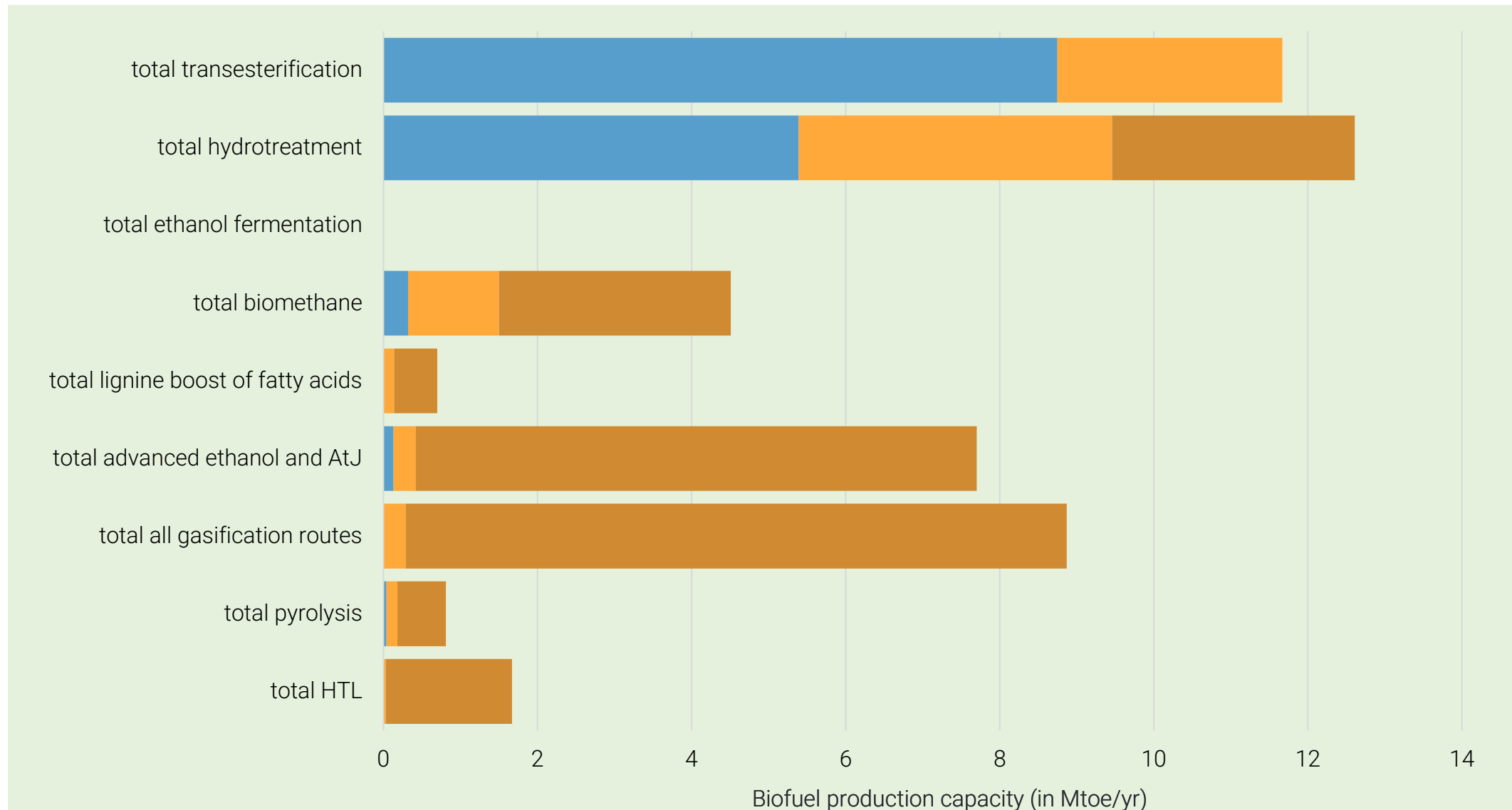
Production capacity for biofuels used in 2023 in EU27



Production capacity for biofuels used in 2023 in EU27



Production capacity for biofuels used in 2023 in EU27 and further development to 2050 (dark orange)



Production capacity for biofuels used in 2023 in EU27 and further development to 2050 (dark orange)

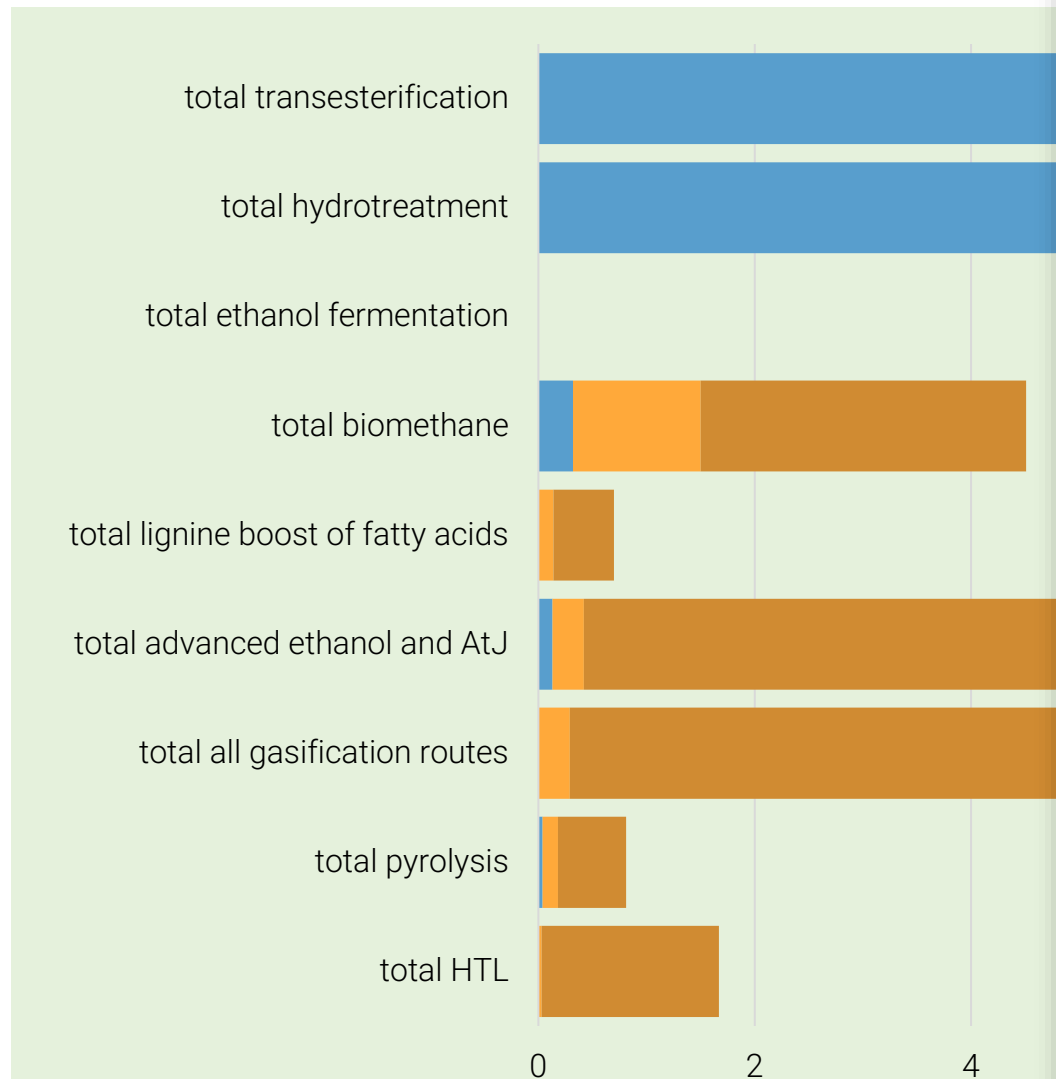
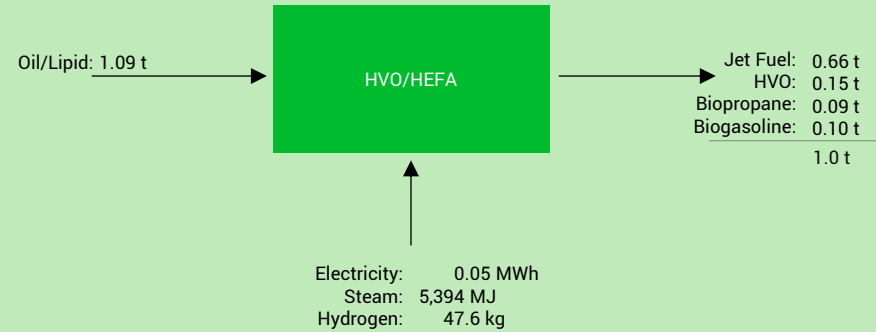


Figure 3-13 Technically possible capacity evolution from Annex IX Part A feedstocks in Mtoe/yr by technology (no allocation to specific sectors)

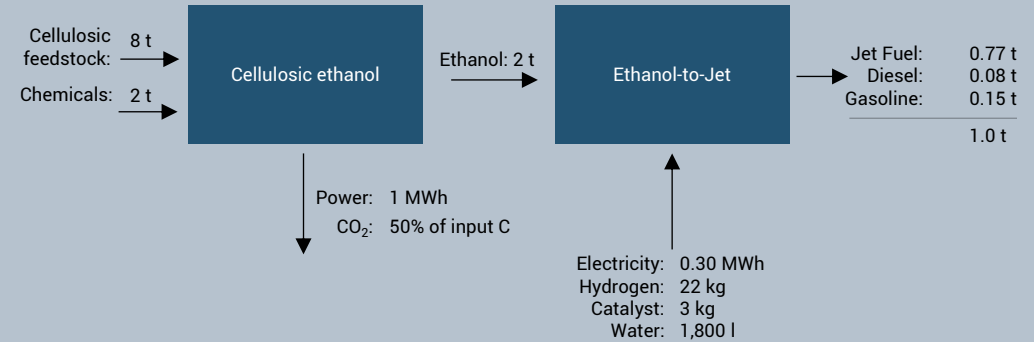
	Capacity 2023	Capacity 2030	Capacity 2050
Current market conditions (cmc)			
Total volume	17.8	27.4	48.5
Conventional	13.0	14.1	10.4
Annex IX Part A	1.7	4.3	26.2
<i>Advanced biofuels</i>	<i>1.4</i>	<i>2.8</i>	<i>21.7</i>
<i>Biomethane</i>	<i>0.3</i>	<i>1.5</i>	<i>4.5</i>
Annex IX Part B	3.1	9.0	12.0
Technically possible capacities (tpc)			
Total volume	17.8	61.1	207.0
Conventional	13.1	21.0	16.9
Annex IX Part A	1.7	30.0	174.3
<i>Advanced biofuels</i>	<i>1.4</i>	<i>28.5</i>	<i>169.7</i>
<i>Biomethane</i>	<i>0.3</i>	<i>1.5</i>	<i>4.5</i>
Annex IX Part B	3.1	10.1	15.9
Capped by feedstock (cbf)			
Total volume	17.8	57.4	129.2
Conventional	13.1	21.1	16.9
Annex IX Part A	1.7	30.3	101.3

Examples of pathway synergies in aviation

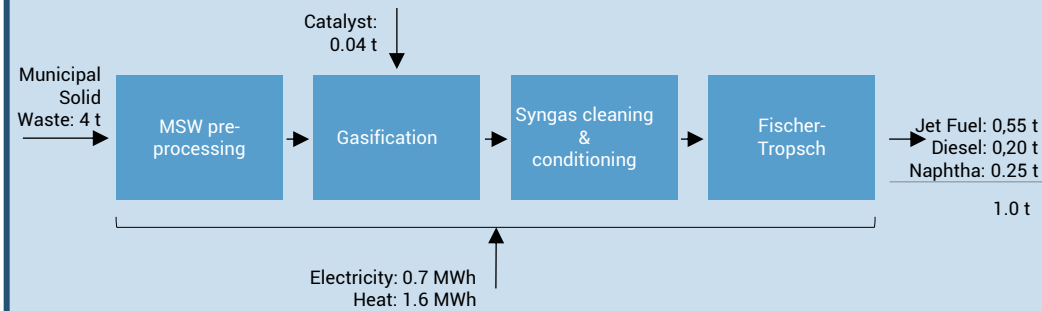
HEFA pathway



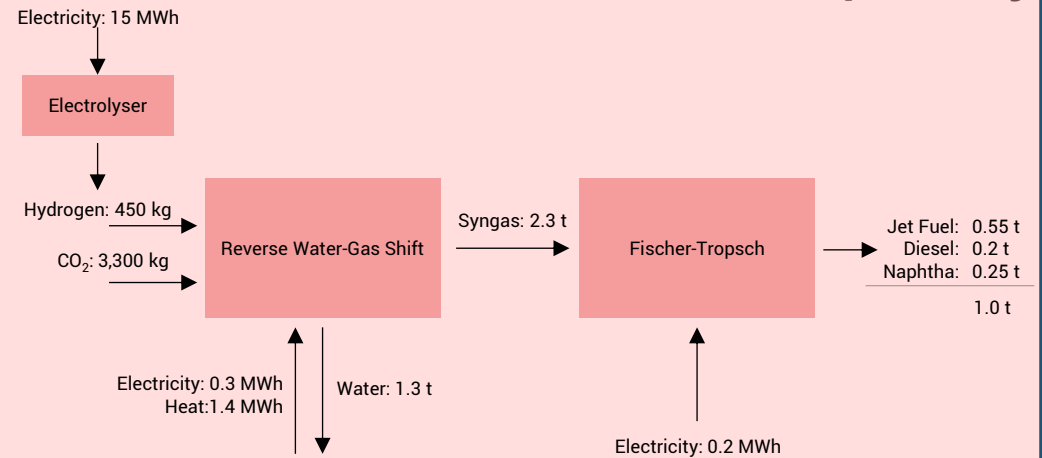
Alcohol to Jet pathway



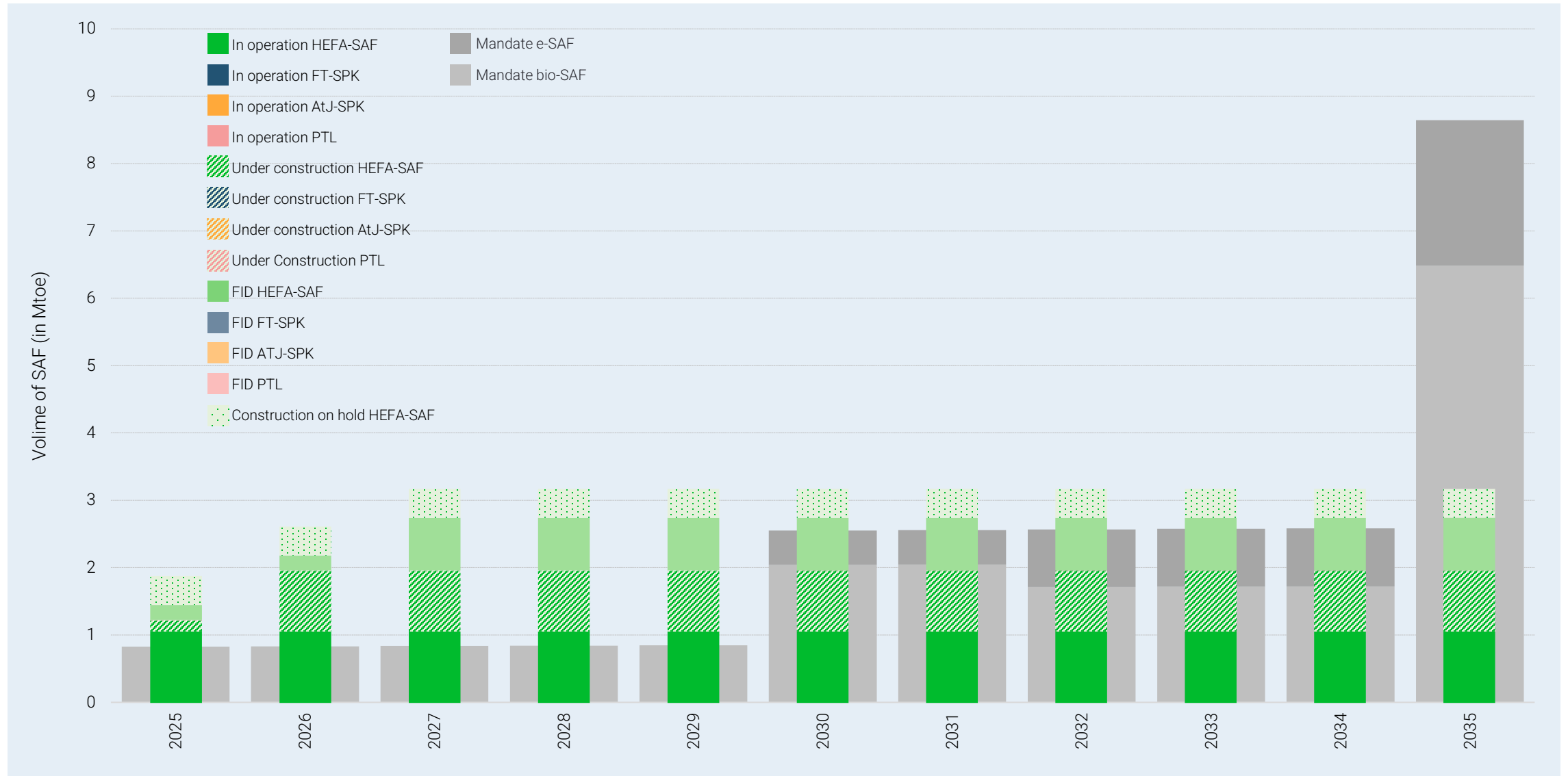
Syngas-FT pathway



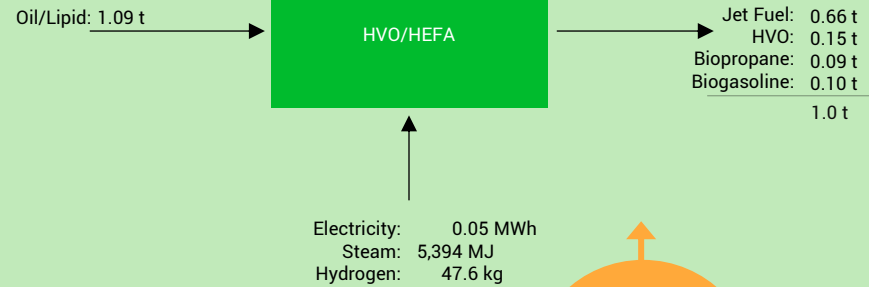
Power to Jet pathway



Production capacity for biofuels used in 2023 in EU27

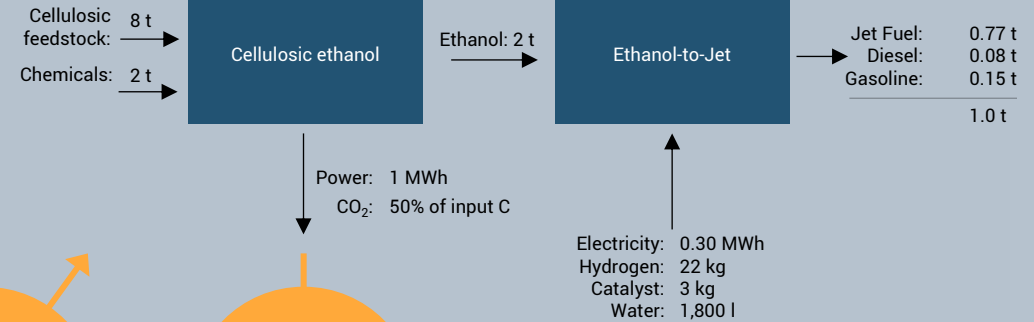


HEFA pathway



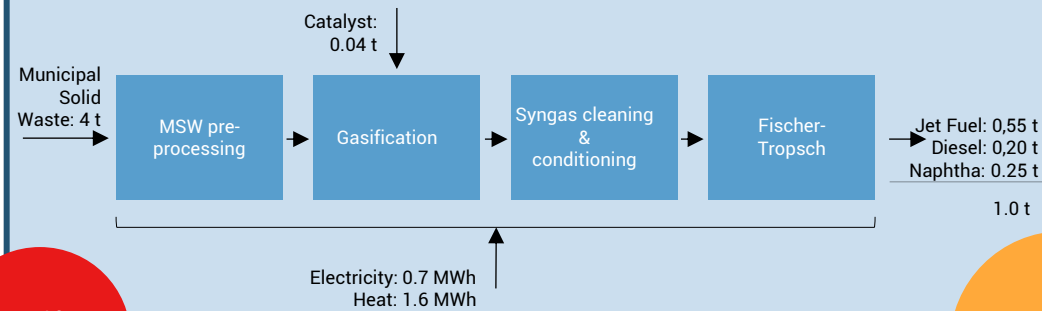
Synergy
with HVO in
road sector

Alcohol to Jet pathway



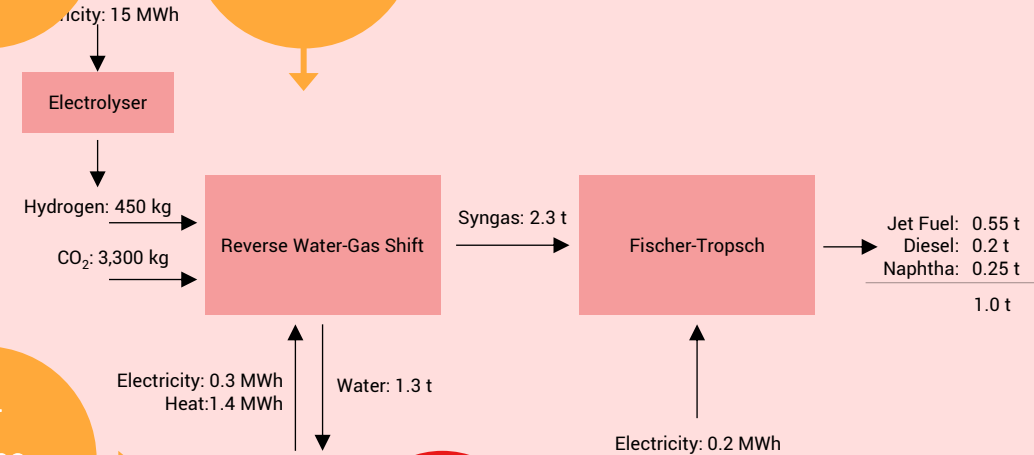
Built up
capacity
ethanol in
gasoline

Syngas-FT pathway



Need for
drop-in in
road diesel

Power to Jet pathway



RFNBO use
in road

Feed-
stock

hydrogen

Synergy
of CO₂

FT
techno-
logy

Key take aways

- **Transport sector is 'Achilles heel'** in reaching EU climate goals - and it is behind
- **2030 RED3 renewable energy volumes are much larger** than the 2030 volumes equivalence in FuelEU Maritime and ReFuelEU Aviation
- **2030 RED3** renewable energy volumes are **±4 times larger** than the volumes deployed in **2020**. A rapid scale-up is needed to comply to targets
- Expanded deployment needs to come from electricity, **Advanced Biofuels and RFNBO**
- The advanced production pathways rely on **Annex IX-A (mainly lignocellulosic) wastes**
- The **road sector provides the 'volume'** to establish **scale-up, learning curve and economies-of-scale** for later **deployment in aviation sector** (and maritime)
- Among pathways potential **synergies exist**
- The renewable fuels industry could **benefit** from the **collaborative development** of an **integral, multi-sectors, multi-pathways, investment and innovation agenda** for synergetic production capacity built up, that built up over time and serves these demand sectors, finetuned, in time.

Available for further questions and discussions

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