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Special report

The EU's support for sustainable biofuels in transport

An unclear route ahead

CURIA RATIONUM

EUROPEAN
COURT
OF AUDITORS

Contents

Executive summary

I Greenhouse gas emissions have increased markedly in the transport sector over the past few decades. Using biofuels as an alternative to fossil fuels in transport may help to reduce these emissions, and increase energy security, hence biofuels have become part of the EU's climate and energy policy. In 2021, almost 93 % of the energy used in road and rail transport in the EU came from fossil fuels.

II The objective of the audit was to assess whether the EU is supporting sustainable biofuels in transport effectively and whether biofuels help the EU achieve its energy and climate targets. The assessment is highly relevant in light of the ongoing debates about food versus fuel, climate change, and energy security. The audit also aimed to add value by outlining the challenges facing the biofuels sector in the EU, as well as by considering the sustainable deployment of such fuels.

III Overall, we found that EU biofuels policy lacked stability, mainly because of sustainability challenges, and that 2020 targets had not been reached by most member states.

IV We found that the priorities in terms of biofuel types have shifted over time. The lack of policy predictability may increase risks for private investments and reduce the attractiveness of the sector. Furthermore, uncertainties about the categorisation of advanced biofuels may pose risks for long-term investments.

V Greenhouse gas emission savings from biofuels are often over-estimated, which then raises sustainability concerns. Biomass availability limits the deployment of biofuels, and meeting the increased EU climate ambition in transport may require higher imports of biomass or biofuels, thus maintaining energy dependence. Higher production costs compared to fossil fuels mean that biofuels are not yet economically viable and need policy measures to support production.

VI To promote the use of renewable energy, including biofuels, the EU has set targets for 2020 and 2030. Most of the member states did not achieve the 2020 targets for share of renewables in transport and greenhouse gas emission intensity reduction. In addition, EU supports deployment of biofuels from wastes and residues by financing research and demonstration plants. In the 2014-2020 programming period, EU support for research was about €370 million. Research funding is focusing on waste- and residue-based biofuels but deployment of these fuels is slow for various reasons, including issues of upscaling production. Member states can also support the

production and consumption of biofuels through national policies and funds under certain conditions such as state aid rules or fulfilling sustainability criteria.

VII Relevant EU legislation allows certain types of biofuels to be double counted for EU targets, but the Commission does not transparently disclose the impact of multipliers on the share of renewable energy in transport. We also identified data inconsistencies between two datasets used for tracking achievement of targets. While the Commission collects data on the consumption of biofuels, it lacks detailed data on the production side.

VIII We recommend that the Commission should:

- provide more policy stability by preparing a long-term strategic approach;
- improve guidance on advanced biofuels categorisation and assess capping of feedstock;
- improve data relevance and coherence, as well as transparency of reporting on achievement of targets.

Introduction

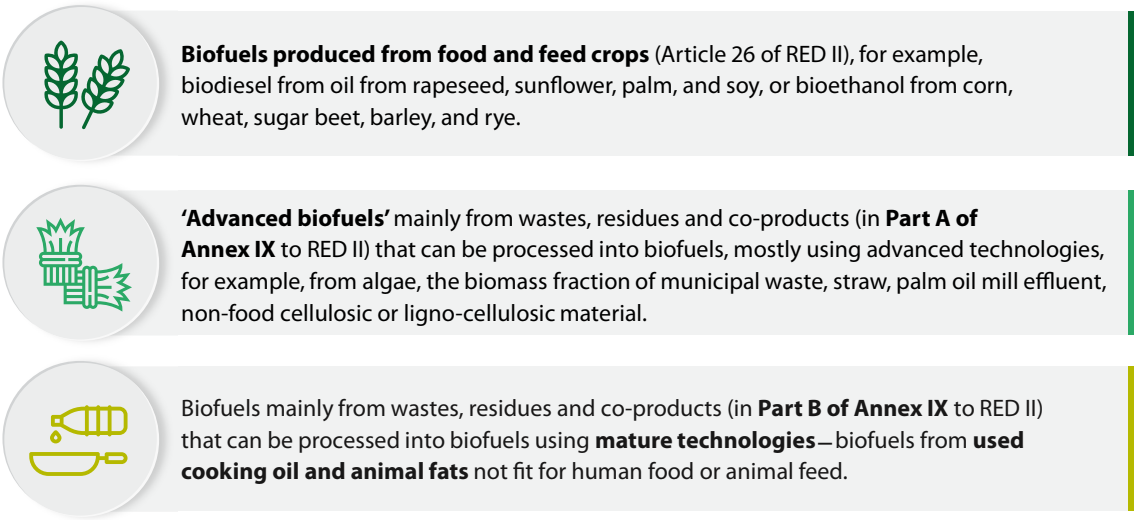
Biofuels explained

01 The latest EU Renewable Energy Directive defines biofuels as "liquid fuels for transport produced from biomass". Biofuels are renewable alternatives to fossil fuels, the aim being to help reduce greenhouse gas (GHG) emissions in the transport sector and improve the EU's security of supply[1].

02 In 2021, biofuels represented a fuel share of 4.3 % in the worldwide road transport sector[2]. The biofuels in use today tend to be blended with fossil fuels. Bioethanol can be blended with petrol, and biodiesel with fossil diesel.

03 Different types of biomass ('feedstock') can be used for biofuel production (see ***Annex I***). The 2018 recast of the Renewable Energy Directive (hereinafter 'RED II') distinguishes three main categories of biofuels depending on feedstock or technology (see ***Figure 1***). For the last two, RED II contains a list of specific feedstock and feedstock groups. Biofuels that do not use any of the feedstock covered by the three categories are categorised as 'other biofuels'. These can be, for example, biofuels from non-food or non-feed crops, such as *Jatropha*, or fibre crops like flax or hemp.

Figure 1 – Main categories of biofuels by feedstock



Source: ECA.

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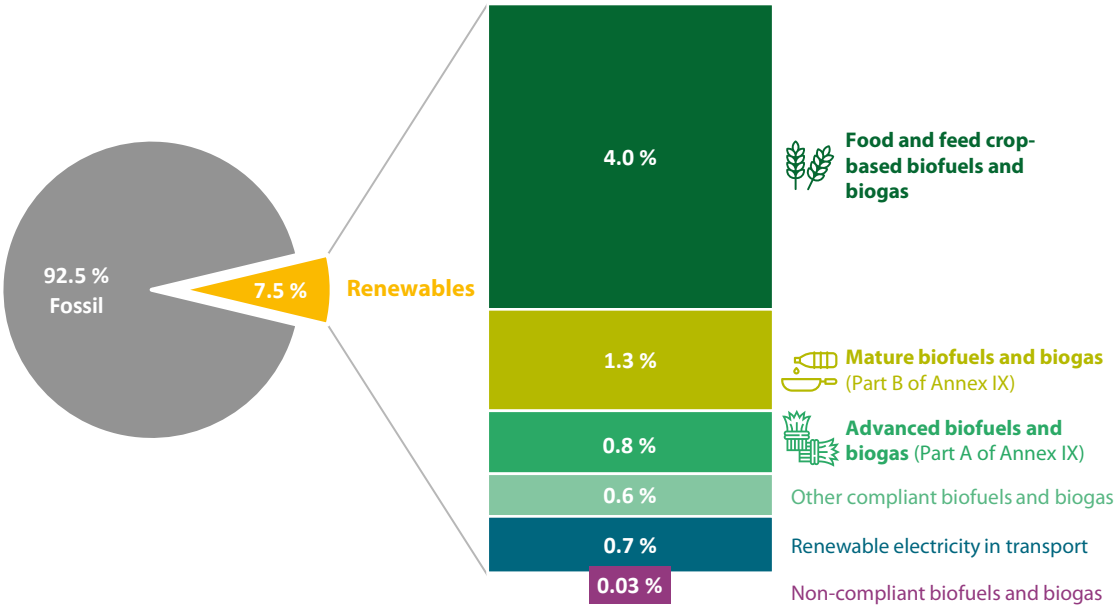
1 European Commission, Biofuels.

2 IFPEN, Biofuels in the Road Transport Sector.

04 In 2021, most biofuels consumed in the EU were crop-based (see ***Figure 2***). In addition to biofuels, renewable electricity and renewable liquid or gaseous fuels of non-biological origin (RFNBOs) are also carriers of renewable energy in transport. RFNBOs such as hydrogen are still emerging technologies.

Figure 2 – Energy mix in EU road and rail transport in 2021



Source: ECA, based on SHARES.

05 The biofuels sector competes with other sectors for raw materials, notably with the food sector, but also with cosmetics, pharmaceuticals, bio-plastics, and heating. This affects the availability and the market prices of these materials and can also raise ethical questions concerning the relative priorities of food or fuel.

06 Despite their potential to reduce GHG emissions, biofuels may sometimes have a negative impact on the environment and climate. For example, biofuels from feedstock using land to grow may adversely affect biodiversity, soil and water, and may fail to deliver reductions in GHG emissions compared to fossil fuel use if these crops require

additional land[3]. Extending agricultural land into areas like forests or peatlands may result in additional GHG emissions rather than reductions.

07 RED II sets several sustainability criteria for biofuels to mitigate the risk of negative effects on the environment and climate (see ***Figure 3***). Biofuels are considered "sustainable" if they meet all these criteria.

Figure 3 – Main elements of sustainability criteria for biofuels under RED II

Agricultural feedstock must NOT be obtained from:
- land with a high biodiversity value;
- land with high-carbon stock;
- land that was peatland in January 2008.

Forest biomass must be backed-up by evidence on mechanisms ensuring:
- the legality of harvesting operations;
- forest regeneration of harvested areas;
- protection of designated nature protection areas, including wetlands and peatlands;
- harvesting maintains or improves soil quality, biodiversity and the long-term production capacity of the forest.

The **GHG savings** from the use of biofuels compared to fossil fuels should be:
- at least 50 % if biofuel is produced in installations in operation on or before 5 October 2015;
- at least 60 % if biofuel is produced in installations starting operation from 6 October 2015 until 31 December 2020;
- at least 65 % if biofuel is produced in installations starting operation from 1 January 2021.

Source: ECA, based on Article 29 of RED II.

Role of biofuels in EU climate and energy policy

08 For some years, the EU has been increasing various climate and energy policy targets in order to respond to climate change. In 2007, the EU agreed to cut GHG emissions by at least 20 % (from 1990 levels) by 2020. In 2022, the Commission reported that this target had been achieved, since the actual reduction was 32 % by 2020. Under the 2015 Paris Agreement, the EU undertook to reduce GHG by at least 40 % by 2030 compared to 1990. In 2021, the EU adopted the European Climate Law to further increase the EU's ambition and reduce emissions by at least 55 % by 2030 (from 1990 levels), setting Europe on a path to becoming climate neutral by 2050[4].

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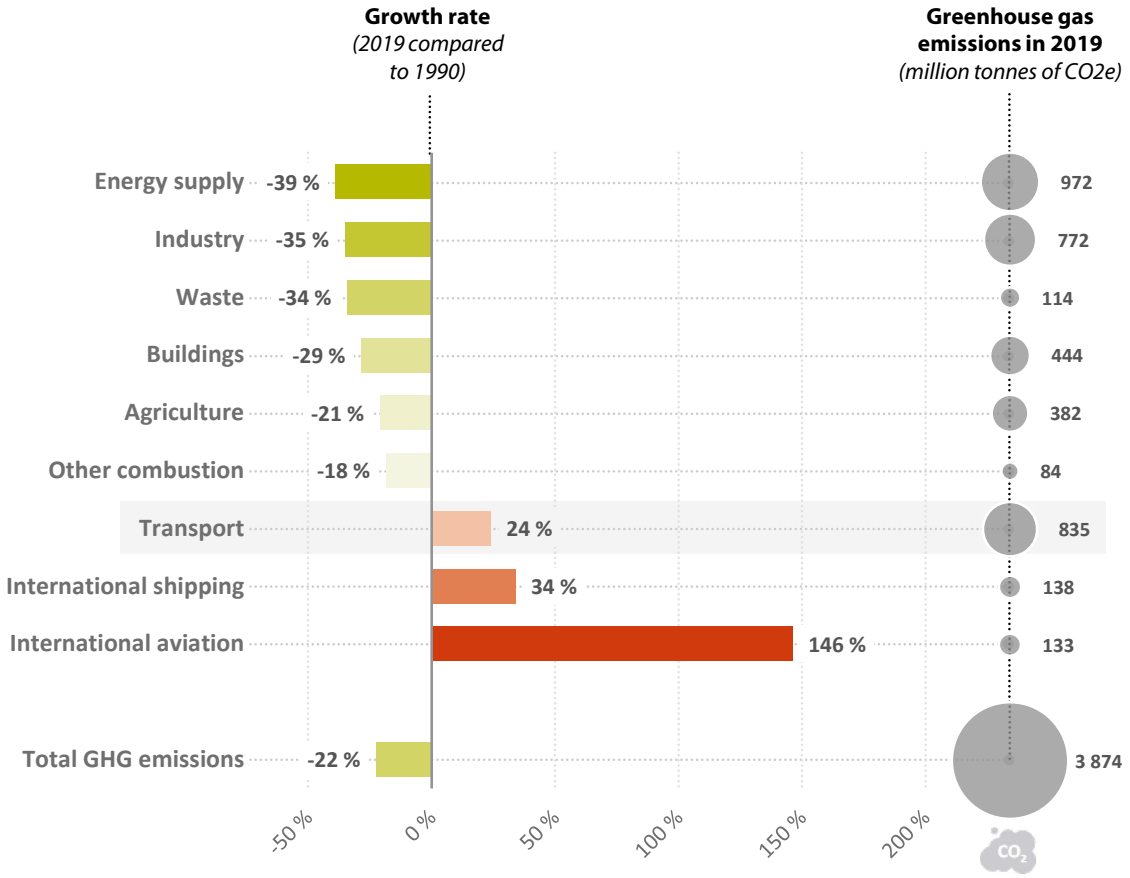
[3] Jeswani H. K., et al., Environmental sustainability of biofuels: a review, *Proceedings of the Royal Society A,* Vol. 476, 2020, p. 3.

[4] COM(2020) 562.

09 Transport is one of the sectors where the GHG emissions have increased markedly over the last three decades. This is shown below in ***Figure 4*** (2019 is more representative because the COVID-19 pandemic affected 2020 and 2021). According to the Commission, transport emissions need to be cut by 90 % by 2050 compared to 1990 in order to reach climate neutrality.

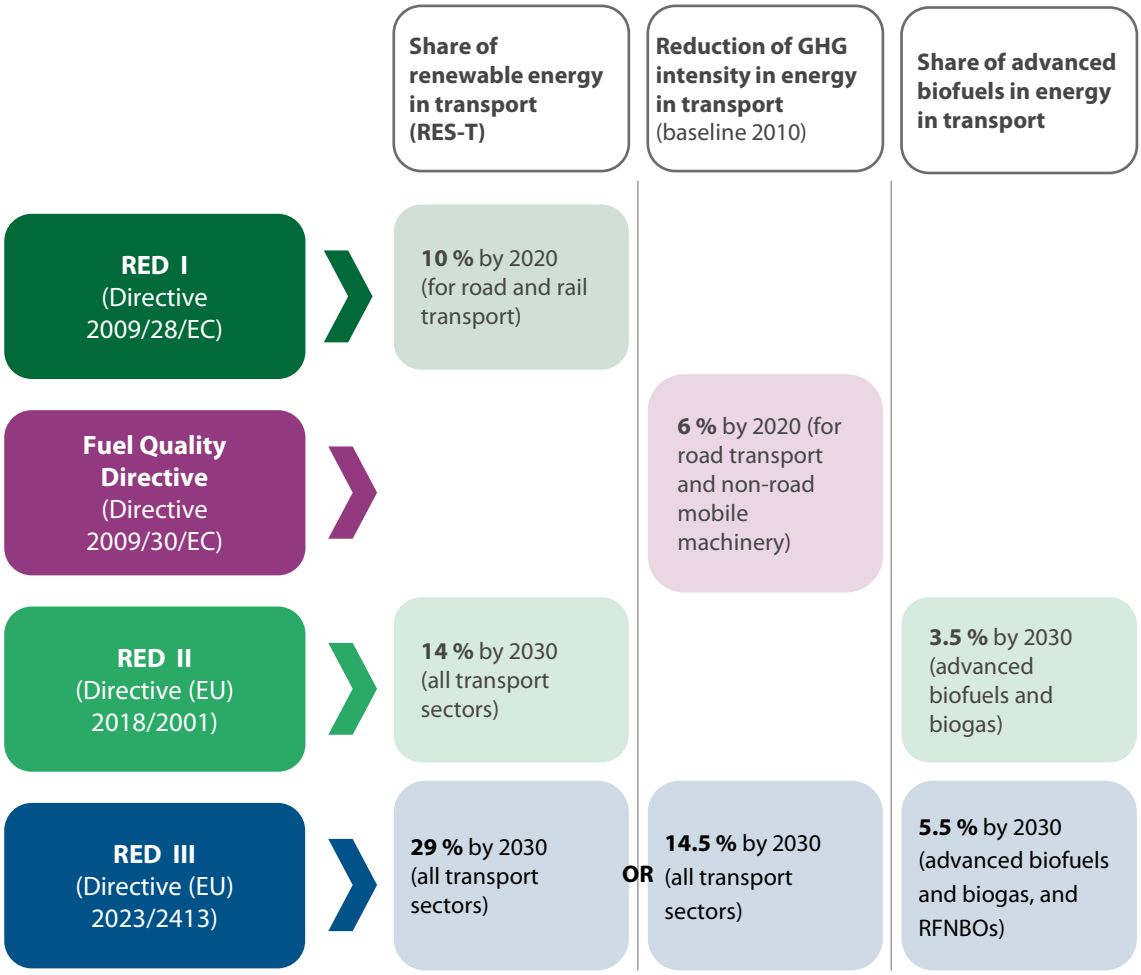
Figure 4 – Greenhouse gas emissions in the EU by sector (1990-2019)



Source: ECA, based on data of the European Environment Agency.

10 In 2003, the EU introduced its first biofuels-related targets with the Biofuels Directive, which preceded the more recent targets shown in ***Figure 5***. Only the biofuels that meet the sustainability criteria described in ***Figure 3*** count towards the targets in ***Figure 5***. Biofuels are one of the renewables contributing to the common targets.

Figure 5 – Biofuels-related targets

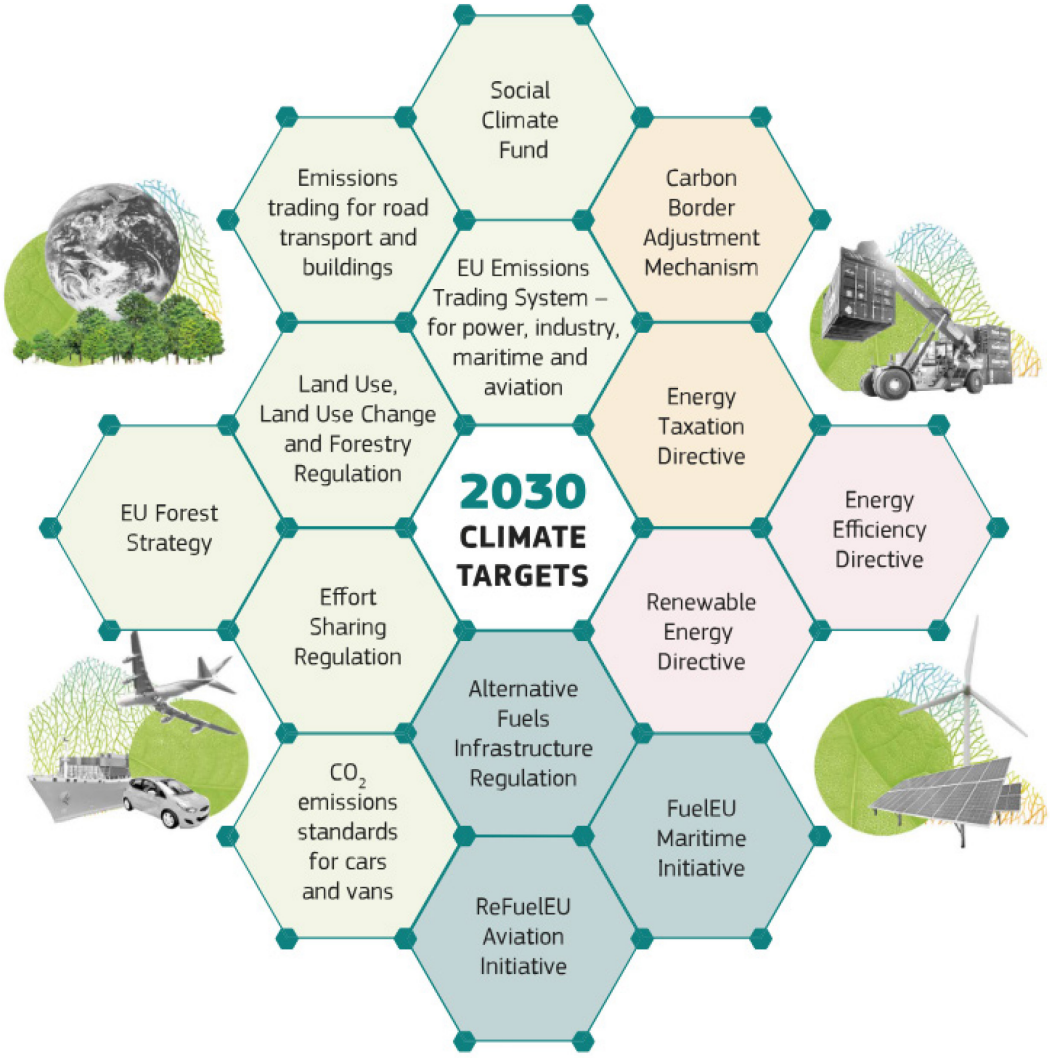


Source: ECA.

11 For all the targets in ***Figure 5***, the EU directives require member states to place an obligation on fuel suppliers so that the relevant target is met at national level. For this, many member states oblige fuel suppliers to supply a minimum quantity of biofuels or renewable fuels to the market, expressed as a percentage of all deliveries.

12 In 2021, the Commission presented the 'Fit for 55' package to revise EU legislation on climate, energy, and transport, bringing it in line with the EU's ambitions for 2030 and 2050 (see paragraph ***08***). Most of the elements of 'Fit for 55' (see ***Figure 6***) directly or indirectly affect the production or use of biofuels, including a revision of the Renewable Energy Directive, i.e. RED III.

Figure 6 – Elements of 'Fit for 55'



Source: Commission, COM(2021) 550, p. 14.

Responsibilities in biofuels policy

13 The Commission, member state authorities and economic operators all play a role in EU biofuels policy (see ***Figure 7***). ***Annex II*** provides an overview of the main tools and measures to promote biofuels. In the 2014-2020 programming period, for example, EU support for biofuels-related research under Horizon 2020 was about €370 million and for various actions under European Regional Development Fund about €55 million. ***Annex III*** presents the estimated EU funding for biofuels.

Figure 7 – Key responsibilities in biofuels policy

THE EUROPEAN COMMISSION

- Proposes the general legal framework and adopts implementing rules
- Monitors that the member states transpose and implement the rules correctly
- Follows the progress towards the targets
- Publishes aggregated data on biofuels use
- Makes funding available, including for research

MEMBER STATE AUTHORITIES

- Implement the RED and FQD and report on them
- Place on fuel suppliers an obligation to ensure a specific minimum share of renewable energy in the final consumption
- Can provide fiscal incentives and funding to support the sector

ECONOMIC OPERATORS (fuel producers and suppliers)

- Obtain certification under national or voluntary scheme on the sustainability of the biofuels
- Place the required share of biofuels on the market
- Report to the national authorities the quantities of biofuel put on the market by feedstock type

Source: ECA.

Audit scope and approach

14 The objective of the audit was to assess whether the EU supported sustainable biofuels effectively.

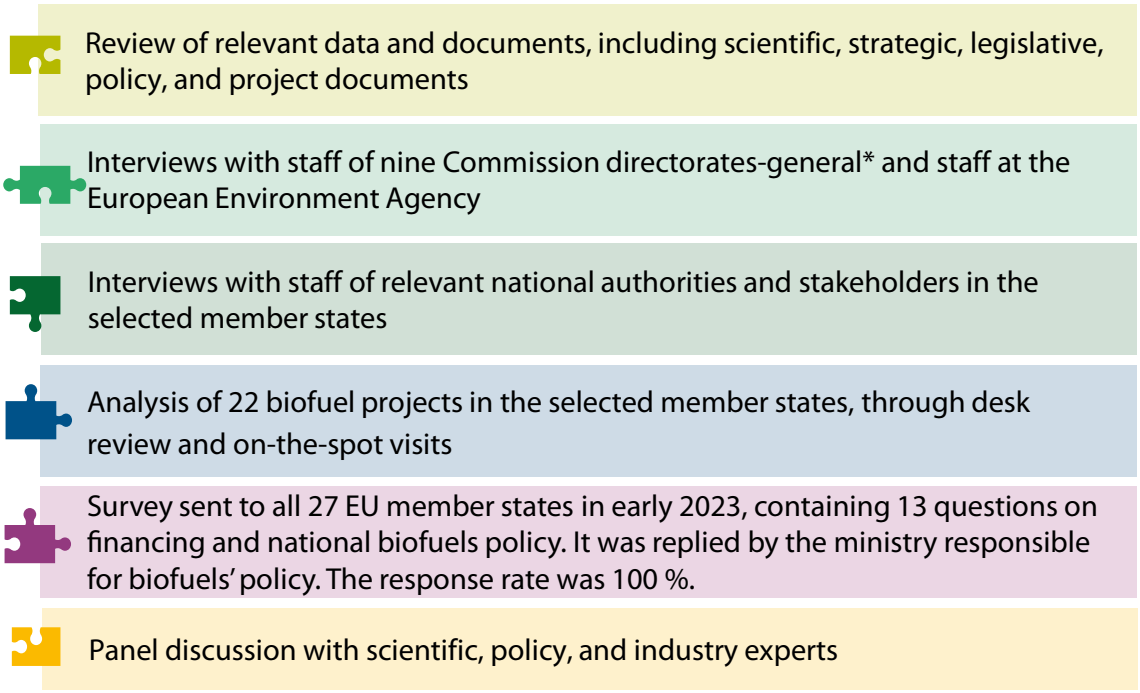
- First, we reviewed the soundness of the policy framework for biofuels.
- We also examined whether the Commission and member states addressed sustainability, biomass availability and cost challenges related to biofuels appropriately.
- Finally, we looked into the effectiveness of the EU support to the deployment of biofuels and whether data on biofuels is relevant and coherent.

15 We carried out this audit because of the high level of interest in biofuels as an alternative way of decarbonising transport in the EU. The debate over sustainability of biofuels is ongoing. From 2022, the war in Ukraine put greater focus on the issues of energy independence and the question of food versus fuel in the EU, all this against a background of greater EU climate ambitions. The audit also aimed to add value by providing an overview of challenges faced by the biofuels sector in the EU, as well as reflections on their sustainable deployment.

16 As the ECA had published a special report on the EU system for the certification of sustainable biofuels in 2016, our current report did not cover certification. We focused on liquid fuels, as gaseous fuels produced from biomass ('biogas') are no longer included in the definition of biofuels since the adoption of RED II. Our audit covered the period from 2014 up until May 2023.

17 We made audit visits to four member states: Germany, France, Romania, and Finland. Member states were selected on the basis of the share of various types of biofuels in use, biofuel production and consumption, and EU funding. We also took geographical coverage into account. ***Figure 8*** shows how we collected audit evidence.

Figure 8 – Our audit approach: work carried out



* Agriculture and Rural Development, Climate Action, Energy, Eurostat, International Partnerships, Joint Research Centre, Mobility and Transport, Regional and Urban Policy, and Research and Innovation.

Source: ECA.

Observations

EU biofuels policy lacks a long-term perspective

18 One of the EU's energy policy objectives is to promote the development of new and renewable forms of energy[5]. To promote transport decarbonisation, the EU has set targets and sustainability criteria for biofuels in the legal framework[6]. A key dimension of the Commission's efforts for better regulation is "to ensure that policymakers and institutions can anticipate changes and proactively shape the future developments"[7]. We examined whether the EU policy framework for biofuels is consistent and provides predictability for the fuel producers, suppliers, and consumers.

The policy framework for biofuels has changed frequently

19 The Commission has adopted various strategies[8] on transport and biofuels over the years. However, the only specific EU Strategy for biofuels dates from 2006 and has never been updated. This states that the EU is supporting biofuels to boost decarbonisation of transport and diversify fuel supply sources. The EU framework for biofuels is complex and has changed frequently over time (see ***Figure 9***).

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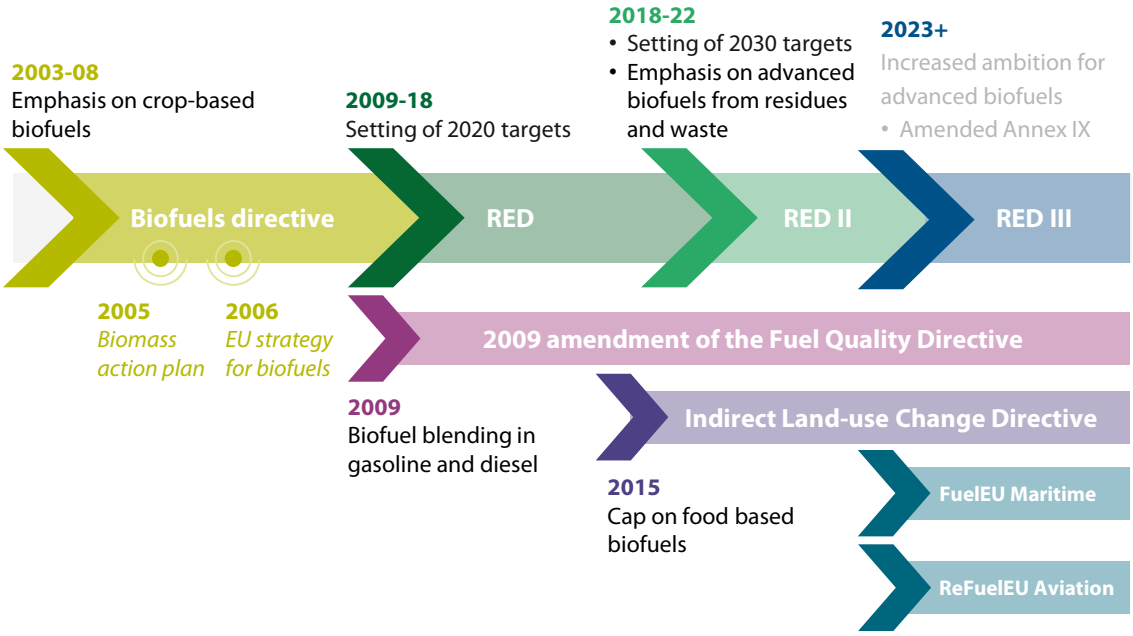
5 Article 194(1)(c) TFEU.

6 Article 3(4) of RED I, Articles 25 and 29 of RED II.

7 Better regulation toolbox, 2021.

8 For example, COM(2006) 34, COM(2020) 562, COM(2020) 789.

Figure 9 – Key developments in EU policy for biofuels



Source: ECA.

20 In 2009, the first Renewable Energy Directive (RED I) replaced the 2003 Biofuels Directive. It was repealed in 2018 with Directive (EU) 2018/2001 (RED II), and revised in 2023 with RED III. The transposition deadline for RED II was 30 June 2021 for member states, and the Commission presented its proposal for RED III in July 2021. As of March 2023, six member states had not yet transposed the provisions of RED II relating to the transport sector[9].

21 During our member state visits, some national authorities and industry representatives highlighted the late approval of the RED II implementing acts. One example is the implementing regulation on forest biomass, which was not adopted until December 2022, almost 2 years later than laid down in RED II. This in turn delayed implementation of legislation at national level, and meant that member states and industry had less time to prepare for the changes.

Significant changes in policy priorities: from promoting to capping

22 At EU level, one of the main tools to promote the use of biofuels is setting targets in the legal framework. We assessed whether EU targets on biofuels provide a stable

[9] Belgium, Bulgaria, Greece, Luxembourg, Poland, and Portugal, according to ePure.

framework for investment, are based on sound analysis, and are in line with current EU policy of limiting crop-based biofuels and promoting advanced biofuels.

23 The policy focus has shifted from supporting crop-based biofuels to promoting advanced and non-food-based biofuels. We also noted that the legislative process and related political discussions had a significant impact on the level of relevant targets for renewables in transport and biofuels (see ***Annex IV***).

24 Since the adoption of RED I in 2009, **advanced and some non-food-based biofuels** are counted twice towards the achievement of some targets, to promote their use. Since 2016 however, the Commission has tried to remove the multipliers in transport in the legislative proposals for RED II and RED III, while co-legislators decided to keep them.

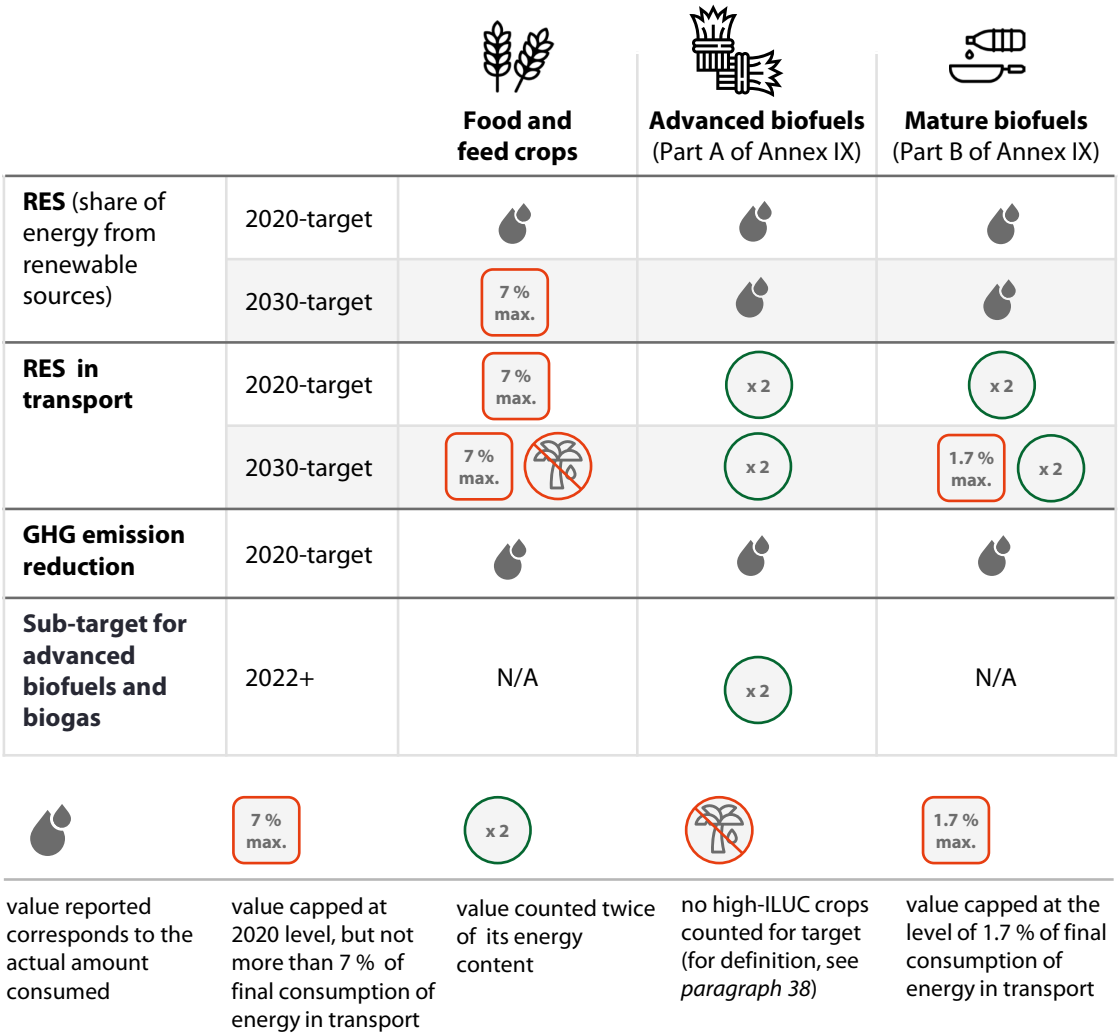
25 To reduce the conflict between food and fuel and encourage the use of advanced biofuels, the Indirect Land Use Change (ILUC) Directive of 2015 introduced a 7 % cap on the contribution of energy from **crop-based biofuels** to the renewable energy in transport (RES-T) target. This cap was further reduced for some member states with RED II by taking their 2020 level of crop-based biofuels into account (for details, see ***Annex V***).

26 With RED II, co-legislators decided to cap the contribution of biofuels from **used cooking oil and certain animal fats,** in light of the limited feedstock availability, the risk of fraud, and to promote innovative renewable fuels[10]. Neither the impact assessment nor the legislative proposal specified why 1.7 % was selected as the capping level. Capping does not limit the import or use of such fuels but only relates to their contribution to EU targets.

27 Different feedstocks are treated differently under the various targets, increasing the complexity of the targets (see ***Figure 10***).

[10] SWD(2016) 418.

Figure 10 – How biofuel types count towards EU targets



Source: ECA, based on the FQD, RED I, RED II and RED III.

The aviation and maritime sectors have long-term decarbonisation objectives, but no roadmap on how to achieve them

28 Aviation is a sector difficult to electrify, so sustainable biofuels present a viable option for decarbonisation. RED II does not provide specific obligations regarding biofuels in the aviation and maritime sectors. According to Eurostat data, member states did not declare any sustainable biofuels consumption in the aviation and maritime sectors in 2021.

29 The 'Fit for 55' proposals in 2021 included separate pieces of biofuels-related legislation for the aviation and maritime sectors for the first time, namely ReFuelEU Aviation and FuelEU Maritime, both adopted in 2023.

30 ReFuelEU Aviation requires all fuel suppliers at EU airports to supply a minimum share of sustainable aviation fuels (SAF) that are low-carbon substitutes for kerosene, made either from biofuels (except biofuels produced from food and feed crops), recycled carbon aviation fuels or synthetic fuels. The minimum share of SAF should increase from 2 % in 2025 to 70 % in 2050. The EU definition of SAF is stricter than the one by the International Civil Aviation Organisation. It excludes biofuels from food and feed crops and is subject to the sustainability criteria of RED III.

31 The SAF industry is at an early stage of development. The estimated EU supply of SAF was less than 0.05 % of jet fuel demand in EU in 2020[11]. Demand for aviation fuel at EU airports is expected to be around 46 Mtoe in 2030[12], from around 26 Mtoe in 2021. The new ReFuelEU Aviation legislation set the required SAF level for 2030 at 6 %. In order to reach this target, approximately 2.76 Mtoe of SAF would be required, while the potential SAF production capacity in 2020 in the EU was around 0.24 Mtoe, i.e. only 9 % of that amount[13].

32 For maritime transport, the aim is to stimulate ship operators to gradually replace fossil fuels by low-carbon and renewable fuels, excluding biofuels from food and feed crops. Unlike ReFuelEU Aviation, FuelEU Maritime does not prescribe the share for the specific fuels to be used but sets a target for reduction of GHG intensity of the energy used onboard of at least 2 % in 2025 to 80 % in 2050 versus levels reported for 2020.

33 ReFuelEU Aviation and FuelEU Maritime provide for penalties for operators that do not meet the targets. There is, however, no EU-level roadmap yet on how to speed up SAF production. SAF production in the United States is supported under the Inflation Reduction Act via a blending tax credit, and, from 2025 onwards, the clean fuel production tax credit.

The future of biofuels in road transport is unclear

34 There is currently a 2030 target for the use of renewable energy in all transport sectors combined (RES-T), but no specific target for road transport. RED III increased the 2030 target for the share of advanced biofuels in energy used in all transport from 3.5 % to 5.5 % (but at least one percentage point must come from renewable fuels of

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[11] EASA. European Aviation Environmental Report 2022, 2023.

[12] Study supporting the impact assessment of the ReFuelEU Aviation initiative, 2021.

[13] Ibid.

non-biological origin, RFNBOs). A large part of this increase could be absorbed by the aviation and maritime sectors, while capping is limiting the expansion of crop-based and mature (Part B) biofuels in road transport. This leaves little room for greater use of biofuels in road transport. To reach the ambitious 2030 RES-T target (see ***Figure 5***), other renewable energy sources will need to increase significantly.

35 There also is no clear indication of biofuels policy after 2030. In 2021, with the revision of CO_2 emission performance standards for new cars, the Commission proposed banning the sale of new passenger cars using internal combustion engines from 2035. In the compromise achieved in 2023, co-legislators asked the Commission to make a proposal for registering vehicles after 2035 that run exclusively on "CO_2-neutral fuels", a term which is not yet legally defined. As things currently stand, biofuels can still be used from 2035 in cars that have already been registered. Concerning heavy-duty vehicles such as trucks, which are more difficult to electrify than cars, a Commission proposal includes a 90 % greenhouse gas emissions reduction target by 2040, which may significantly limit the registration of new diesel trucks.

Biofuels face issues of sustainability, biomass availability and cost

36 The Commission should monitor the impact of biofuel production that is consumed in the EU, and the impact on land use as a result of displacement, both in the EU and in the main non-EU countries of supply[14]. Biofuels policy must avoid significant distortive effects on markets for (by-)products, wastes or residues[15] and increase the EU´s security of supply. We examined whether the selected member states have taken additional measures to address land use change and how market operators calculate the GHG emissions savings. In addition, we considered biomass availability in light of increased targets, and costs associated with reducing GHG emissions by using biofuels.

[14] Article 33 of RED II.

[15] Article 28 of RED II.

Sustainability concerns: GHG emissions savings are subject to over-estimations

37 In 2014, the Commission recognised that food-based biofuels have a limited role to play in decarbonising the transport sector[16]. Nonetheless, it is those biofuels that are still predominantly used in the road and rail transport, as shown in ***Figure 2***.

38 One sustainability concern related to crop-based biofuels is the risk of indirect land use change (ILUC) which can lead to increased GHG emissions. ILUC occurs when "agricultural land previously destined for food and feed markets is diverted to biofuel production". As demand for food and feed still needs to be satisfied, agricultural land may be extended into areas with high carbon stock such as forests, wetlands or peatlands, implying land use change, or there will be intensification of current production[17]. ILUC causes GHG emissions, offsetting the intended impact of biofuels replacing fossil fuels, particularly for so-called "high ILUC-risk biofuels" produced from food and feed crops where there is a significant expansion of the production area into land with high carbon stock. The conditions for low or high ILUC risks are defined in Regulation (EU) 2019/807. The highest ILUC risk is assigned to palm oil, followed by soybean oil[18]. GHG emissions from ILUC cannot be measured but only estimated by modelling[19].

39 RED II includes a formula for calculating the GHG emissions savings from biofuels, to be used by the member states when operators place biofuels on the market. The formula does not take ILUC into account, thus overstating the savings. We looked at a calculation used by the German authorities in the Nabisy database, where each biofuel batch indicated savings with and without ILUC. Based on our German sample of 16 batches, we found that the required reduction of at least 50 % of GHG emissions to meet the sustainability criteria (see ***Figure 3***) would only be achieved in 10 out of 16 cases of our sample if the ILUC estimate was taken into account.

40 Article 26(2) of RED II provides for a progressive phasing out of high ILUC-risk biofuels mainly from palm oil and soybean oil by 31 December 2030[20]. Some member states we visited have already excluded palm oil as eligible feedstock for biofuels

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16 COM (2014)15.

17 Recital 4 of Directive (EU) 2015/1513.

18 Annex to Commission Delegated Regulation (EU) 2019/807.

19 IPCC, 2019: Climate Change and Land, Cambridge University Press, p. 194.

20 Article 26(2) of RED II.

(France in 2020, and Germany in 2023). France has also excluded soybean oil (in 2022). Indonesia and Malaysia have filed separate cases at the WTO, primarily regarding ILUC and sustainability criteria for biofuels imposed by the EU and its member states on palm oil and oil palm crop-based biofuels. As of May 2023, both cases remained open.

41 Overestimations of GHG emissions savings also come from the use of default values. Default values can be used for the GHG emissions savings when calculating the emissions from transporting feedstock. We analysed a sample of 16 biofuel batches for a number of feedstock in Germany, and 12 batches in France. In 12 instances in Germany and 9 in France we found that the default values had been used to calculate the emissions from transport. When using these values, rapeseed produced, processed and used in Germany or France has the same CO_2 emissions value from transport and distribution as rapeseed imported from Australia, and used cooking oil from Germany or France has the same CO_2 emissions value from transport and distribution as used cooking oil from China.

Biomass availability limits deployment of biofuels

42 While biofuels use should increase energy independence, the biomass used for biofuels should avoid distortions in raw materials markets within and outside the EU. According to the Commission, in the early 2000s, about 90 % of biofuel consumption in the EU-25 was covered by domestic raw materials and 10 % by imports. At the same time the Commission expected that biofuels could help reduce energy import dependency compared to fossil fuels[21]. The examples below show that two decades later, dependence on feedstock imports has increased due to the rising demand for biomass over the years.

43 Data from the Finnish authorities indicate that, in terms of energy content, about 90 % of biofuels consumed in Finland in 2021 used non-EU biomass. In France, about 90 % of feedstock for bioethanol consumed in 2014 originated from France; by 2022 however, the total EU share (including France) of such feedstock had fallen to 78 %. Over the same period, bioethanol consumption in France more than doubled. For biodiesel feedstock, the dependency on imports is even higher[22].

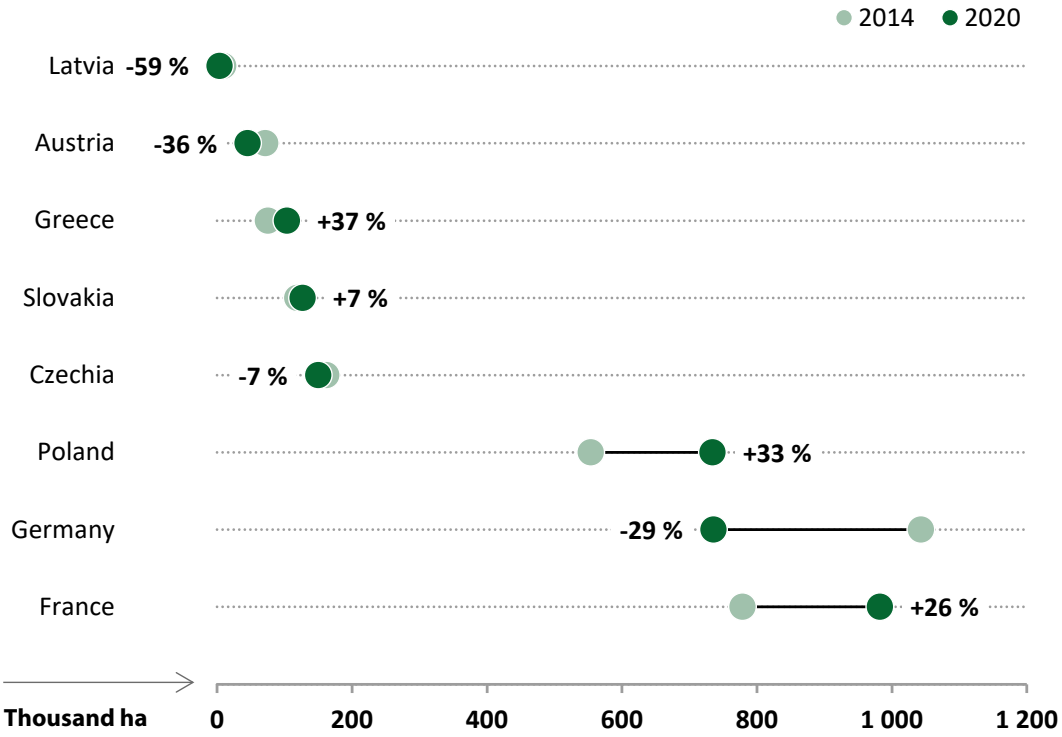
44 Challenges exist for all three main feedstock categories. When it comes to the **food and feed crops** used for biofuels, the Commission lacks an overview of the total

[21] Recital 22 of Directive 2003/30/EC.

[22] CarbuRe.

agricultural land in the EU used for such crops, therefore it cannot assess the impact of crop-based biofuels on food availability. In our survey, 14 member states did not have information on the area under biofuel crops in 2014 and 2020 and 5 member states stated that no land was used for biofuel crops. For the remaining 8, the area has increased in some and decreased in others, but the total overall figure in ha has remained about the same (see ***Figure 11***).

Figure 11 – Change in area for crops used for biofuel production between 2014 and 2020 (in % and ha), in selected member states



Note: the comparison uses 2015 data for Germany and 2018 data for Austria because data for 2014 and 2020, respectively, were not available.

Source: ECA.

45 Feedstock in **Part B of Annex IX** to RED II includes **certain animal fats and used cooking oil**. For the latter, there is a proven risk of fraud[23]. A study recognises that the nature of used cooking oil makes it difficult to confirm that imported waste oil is a waste product[24]. In addition, the price of used cooking oil can be higher than that of

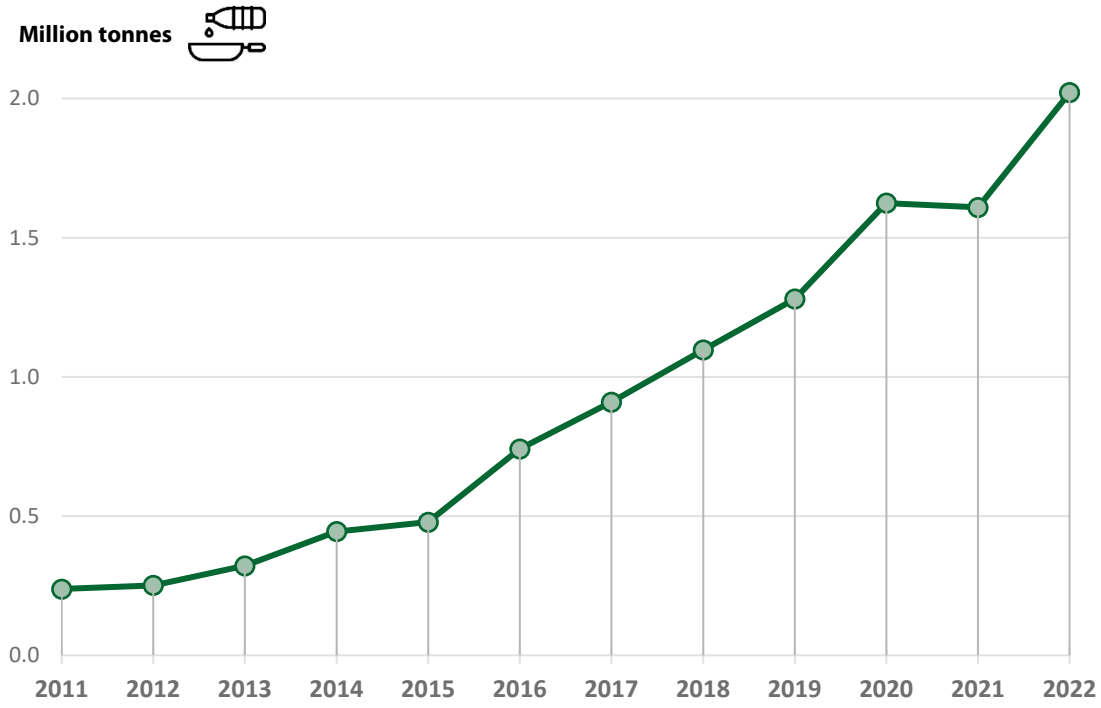
[23] The OLAF report 2019, p. 26; French Court of Auditors, report on biofuel policy, 2021, p. 138.

[24] Cazzola P, et al., Assessment of the potential of sustainable fuels in transport, European Parliament – Annexes, 2022, p. 26.

virgin oil[25], due to increased demand for biofuel production. In February 2022, the price of a tonne of used cooking oil reached €1 400, almost double the price of February 2020.

46 In 2022, the International Energy Agency (IEA) warned that globally, "biodiesel, renewable diesel and biojet fuel producers are headed for a feedstock supply crunch during 2022-2027 if current trends do not change"[26], referring in particular to used cooking oil and animal fats. Between 2011 and 2020, the EU-27 consumption of sustainable biofuels from used cooking oil increased from 0.09 Mtoe to 2.53 Mtoe[27]. Imports of used cooking oil to the EU have increased significantly since 2011 (see ***Figure 12***), with a large proportion from China, the UK, Malaysia and Indonesia. According to a study, in 2019, more than half of the used cooking oil used as biodiesel feedstock was imported from outside the EU-28.

Figure 12 – Used cooking oil imports to the EU-27 from non-EU countries



Source: ECA based on DG TRADE, 2022. Access2Markets Database (product code 15180095).

47 In France, in 2014, 56 % of used cooking oil used for biofuels produced were collected in France, but in 2022, the figure was only 14 %. The amount of such oil

[25] CE Delft, Used Cooking Oil (UCO) as biofuel feedstock in the EU, 2020, p. 52.

[26] IEA, Renewables 2022, 2022, p. 141.

[27] Eurostat Data Browser.

actually available in France was estimated in 2016 at 100 000 tonnes a year. In 2022, 172 979 tonnes of used cooking oil were used for biofuel production in France. Thus, even if all the domestic used cooking oil were collected in France and used for biofuels, this would still not meet demand. A study confirms similar availability issues at EU level[28].

48 For **advanced biofuels,** the Commission acknowledged that feedstock supply may be another main barrier to development, alongside technological challenges, in particular, finding materials not used by other sectors in order to limit costs and price volatility[29]. Fraud risk cases have recently been confirmed for advanced biofuels[30].

49 In 2014, the Commission stated that an improved biomass policy is "necessary to maximise the resource efficient use of biomass in order to deliver […] greenhouse gas savings and to allow for fair competition between the various uses of biomass"[31]. As of May 2023, there is no such biomass policy. The main tools to limit overexploitation of specific biomass for biofuels are caps in the targets, and sustainability criteria. Despite the Commission's studies on biomass[32], there has been no all-embracing EU biomass strategy after the biomass action plan of 2005, nor an assessment of biomass availability and its potential in relation to the targets for renewables. Assessment of biomass availability has been left to the member states in their national energy and climate plans. A study commissioned by the Commission concluded that a small majority (14 of 24)[33] of member states referred in their plans to their domestic potential for biomass production.

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[28] Imperial College London, 2021, Sustainable biomass availability in the EU, to 2050.

[29] SWD(2021)621.

[30] ISCC, ISCC Response to Recent Suspected Cases of Mislabelling of Advanced Biodiesel, 2023; Fastmarkets, EC confirms China-EU waste biofuel probe after complaint raised, 2023.

[31] COM(2014) 15, p. 7.

[32] Sustainable and optimal use of biomass for energy in the EU beyond 2020, 2017; Biomass production, supply, uses and flows in the European Union, 2023.

[33] The study did not cover Cyprus, Germany, and Luxembourg.

Due to high costs, biofuels are not yet economically viable

50 As the price of biofuels is higher than their fossil fuel counterparts, biofuel production and supply are driven by public policy rather than the market [34]. The biofuels sector is the only economic sector using biomass with mandates. Without these mandates, biofuel production would probably decrease and biomass would become cheaper for other sectors[35].

51 Production costs of biofuels vary depending on production pathway (see ***Figure 13***). Biofuels have a lower cost profile than renewable fuels of non-biological origin (RFNBOs), particularly in the short term[36]. Since advanced biofuels have higher GHG savings compared to crop-based biofuels, they also have lower GHG reduction costs than crop-based biofuels.

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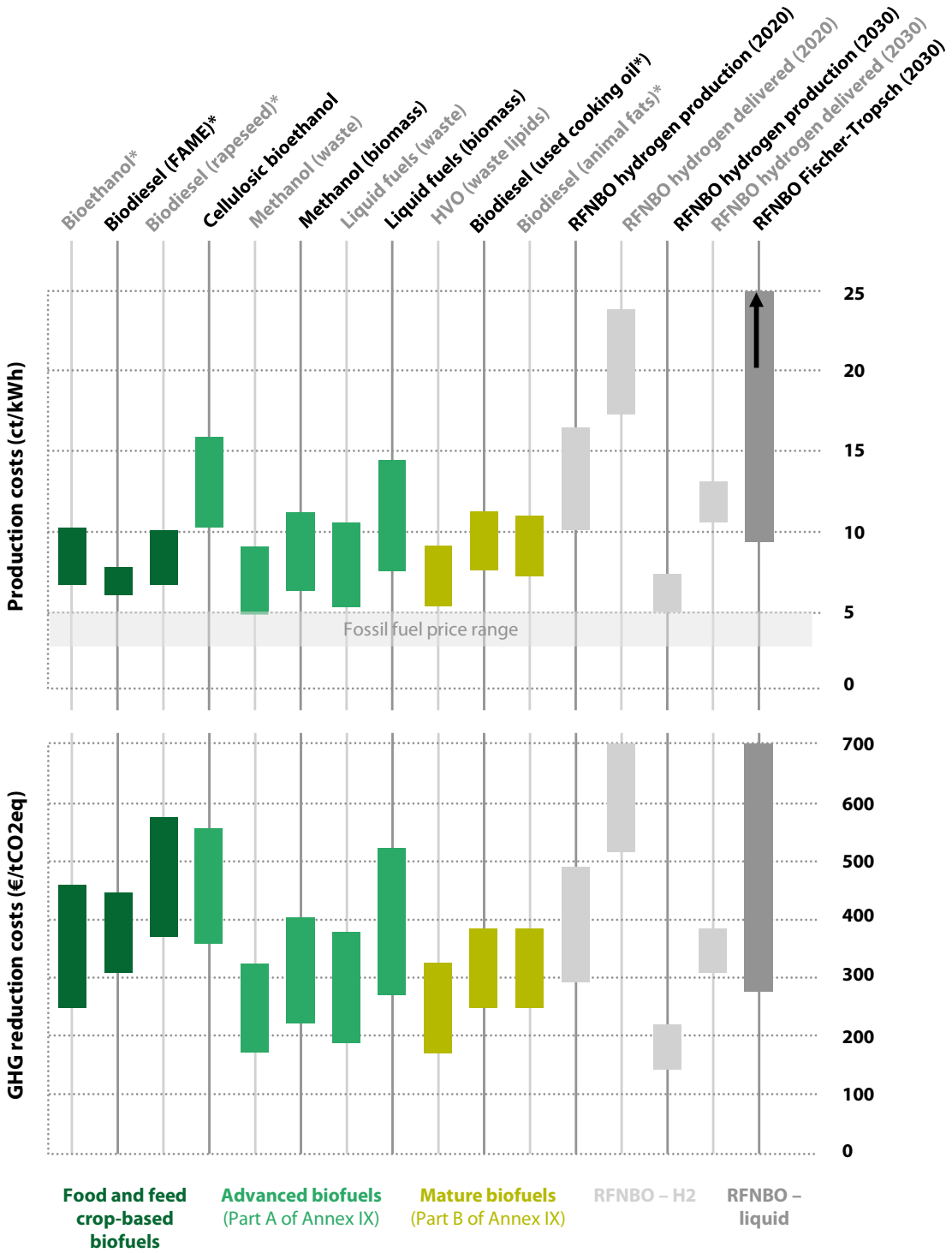
[34] Chiaramonti, D. and Talluri, G., 2021, The future of Sustainable Biofuels towards the 2°C target: forecasting process, technologies and sector demands, E3S Web Conf.

[35] Philippidis, G. et al., 2019, Levelling the playing field for EU biomass usage, Economic Systems Research, 31:2, pp. 158-177; Araujo Enciso, S. R. et al., Abolishing biofuel policies: Possible impacts on agricultural price levels, price variability and global food security, Food Policy, 2016, pp. 9-26.

[36] Cazzola P. et al., 2023, *Research for TRAN Committee: Assessment of the potential of sustainable fuels in transport*, European Parliament, p. 58.

Figure 13 – Fuel costs/prices, and costs of GHG reduction



Note: Values marked with * are based on market price data.

Source: Trinomics, Technical support for RES policy development and implementation, 2021, pp. 548-549, modified.

52 According to our survey, six member states adapted their biofuels policy as a result of the war in Ukraine, mainly due to increased energy prices but also raw

material shortages. These were planned as temporary measures for 2022 or 2023. They included reducing obligations on fuel suppliers, freezing increases, or making obligations voluntary. The Finnish authorities estimated that reducing the distribution obligation for 2022 by 7.5 percentage points had a downward effect on the pump price of diesel of approximately 10 cents per litre.

53 The main purpose of biofuels is to decarbonise transport. The cost for avoiding a tonne of CO_2 depends on the sector and the technology used. To deal with emissions from the energy and heavy industry sectors, the EU has set up the emissions trading system (ETS), a cap and trade system under which operators can exchange emission allowances to meet their emission reduction obligations. Transport operators subject to the ETS do not have to use allowances for sustainable biofuels, which should help reduce the price gap with fossil fuels. In 2020, the highest price of ETS was only €35/tCO_2, while at the beginning of 2023, that price was around €100/tCO_2. These prices are significantly lower than the cost for reducing CO_2 emissions through biofuels shown in ***Figure 13***. The cost is also an issue in aviation (see ***Box 1***).

Box 1

Sustainable aviation fuel – high hopes, but high costs too

Sustainable aviation fuel (SAF) can help to decarbonise the aviation sector. The ReFuelEU Aviation legislation introduced binding targets for SAF, see paragraph ***29***. According to the IATA, in aviation, fuel represents around 30 % of operating costs on average. SAF prices are 1.5 to 6 times higher than fossil-based jet fuel. The Commission's impact assessment for ReFuelEU Aviation explains this wide range by different levels of industrial and technological maturity, and little certainty about the production costs of certain SAF pathways.

Deployment of advanced biofuels is slower than expected

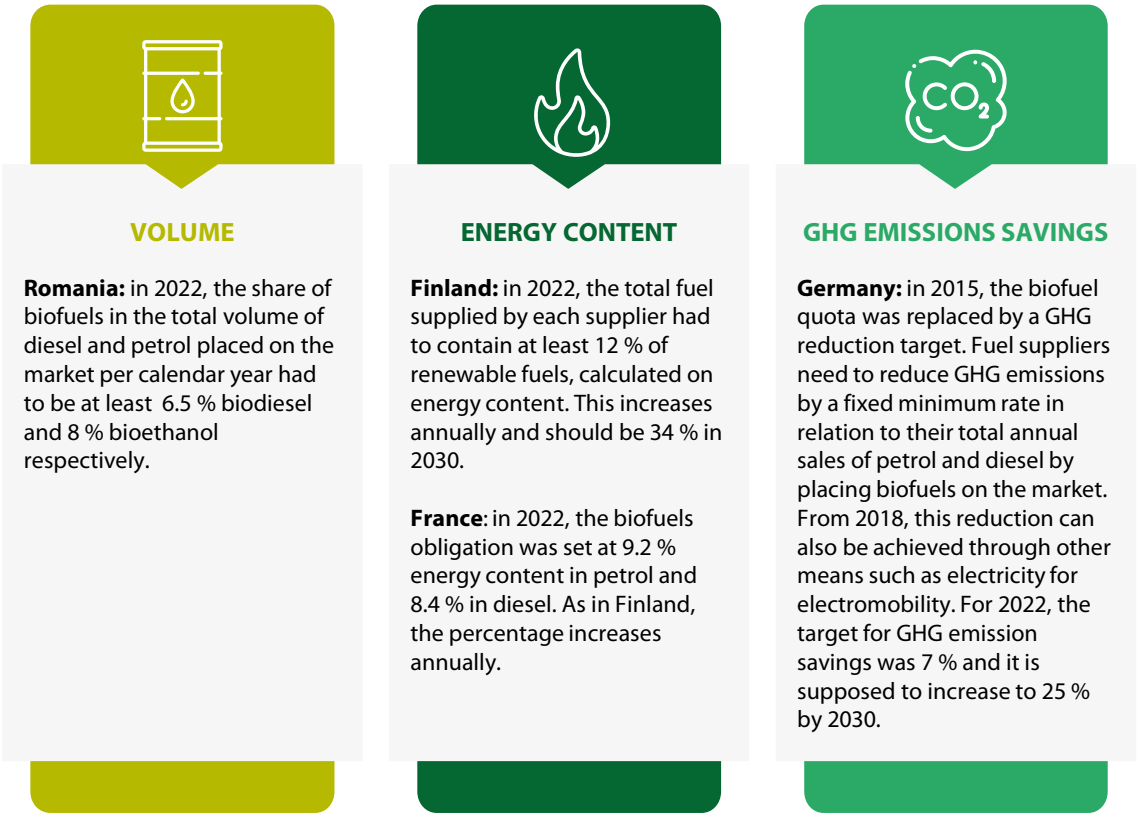
54 The Commission and member states must help to develop the decarbonisation potential of advanced biofuels[37]. We examined the instruments that member states use to achieve the targets. We also analysed EU support for research and innovation and whether this has been sufficient to increase the production of advanced biofuels.

[37] COM(2016) 767, p. 4.

All member states placed obligations on fuel suppliers, but fewer than half of member states achieved relevant targets in 2020

55 RED I and II required member states to place obligations on fuel suppliers to ensure that the share of renewable energy in the road and rail transport sector (RES-T) is at least 10 % by 2020, and 14 % in all transport sectors by 2030. This can be done via various measures[38] (see examples in ***Figure 14***). In addition, three of the member states we audited (Germany, France, and Finland) have set obligations on fuel suppliers regarding advanced biofuels.

Figure 14 – Examples of obligations set for fuel suppliers



Note: Finland reduced the obligation for 2022 from 19.5 % to 12 % due to the energy crisis.

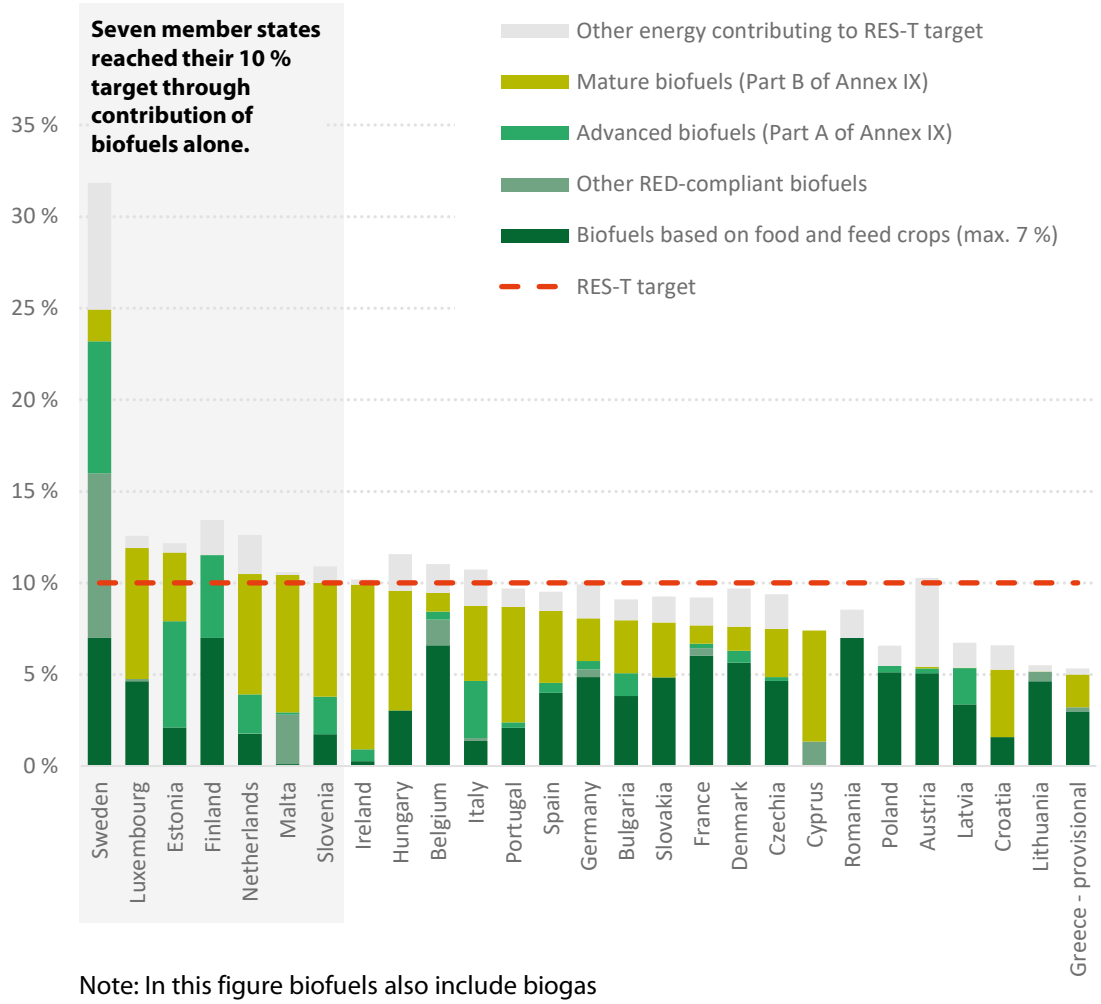
Source: ECA.

56 Seven member states reached their binding RES-T target for 2020 pursuant to RED I with biofuels and biogas alone (see ***Figure 15***). Fifteen member states did not reach the target. If binding targets are not met, the Commission can start infringement procedures and this may lead to the European Court of Justice sanctioning a member state for failing to reach its targets. As of May 2023, the Commission had not yet

[38] Article 25 of RED II.

started infringement procedures, despite the targets being binding under the relevant Directive[39].

Figure 15 – Contribution of biofuels to the 2020 target for renewable energy in transport (RES-T), with multipliers



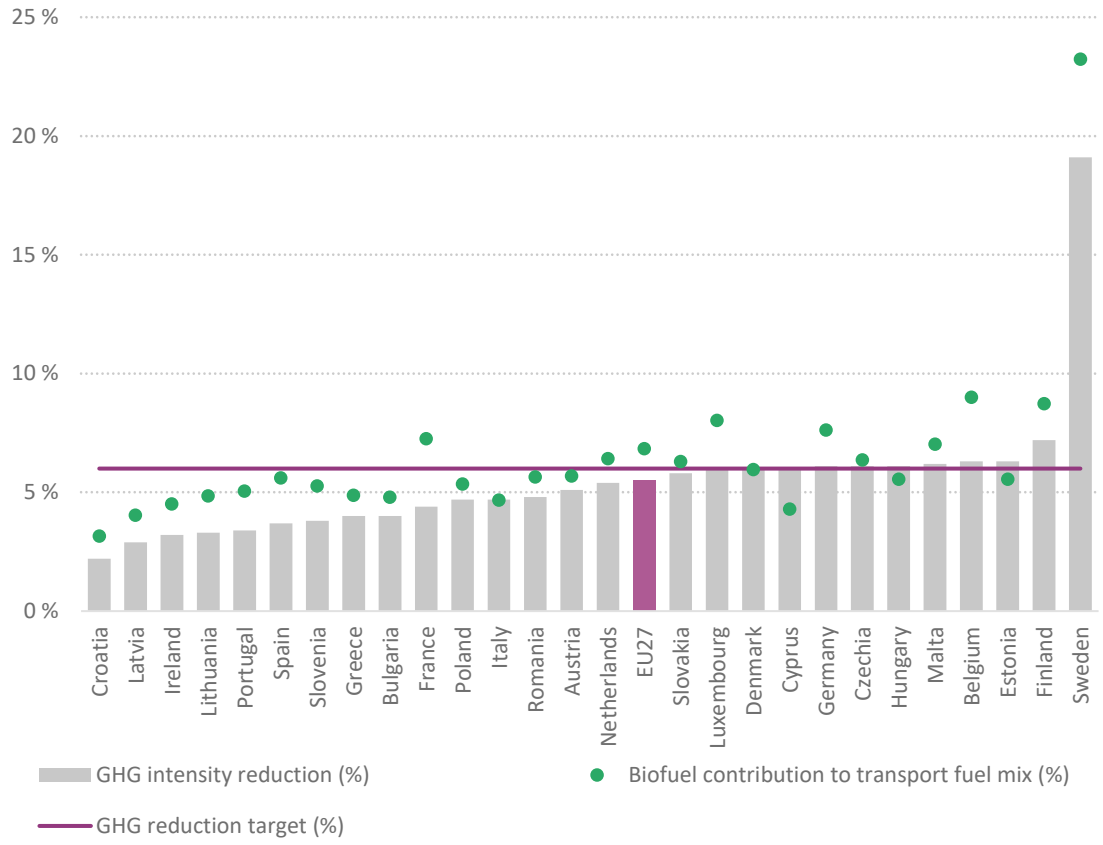
Note: In this figure biofuels also include biogas

Source: ECA, based on SHARES data.

57 By 2020, eleven member states had reached the target of a 6 % reduction in GHG emissions intensity (from 2010 levels) from energy in road transport and non-road mobile machinery. This was mainly a result of using biofuels in the energy mix (see ***Figure 16***). Overall, the EU average reduction was 5.5 %; taking ILUC into account, the average reduction was only 3.3 %, according to the Commission.

[39] Recitals 13 and 16 of Directive 2009/28/EC.

Figure 16 – Reduction in GHG emissions intensity (excl. ILUC), 2010-2020, (%)



Source: ECA, based on EEA data.

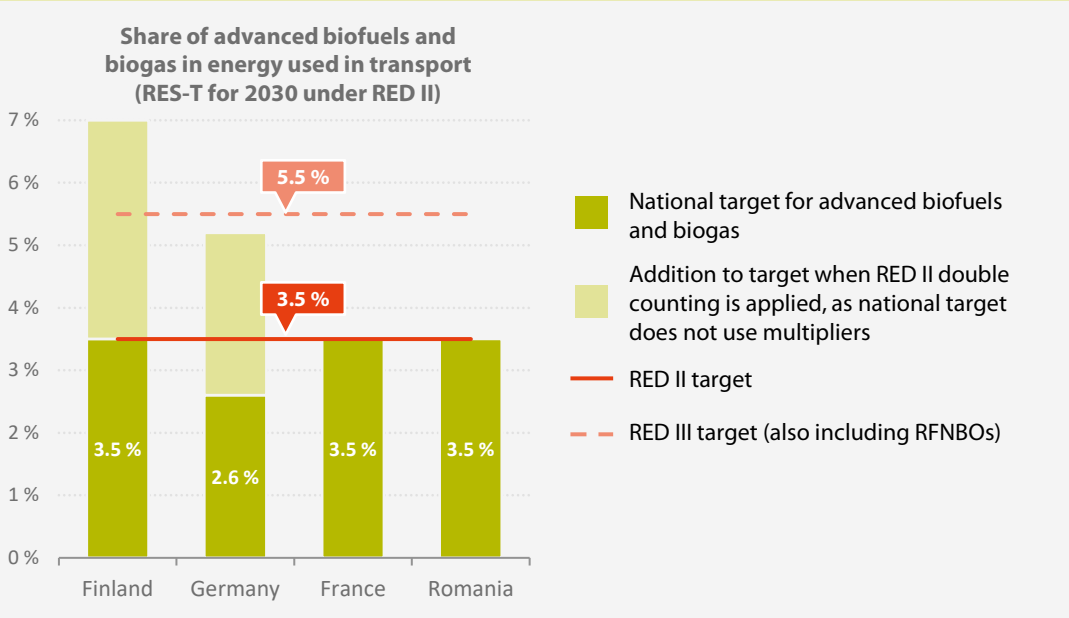
58 National biofuels targets for 2030 sometimes go beyond the relevant EU targets in RED II, including the ones for advanced biofuels (see ***Box 2***). In Finland and Germany, the higher RES-T targets reflect the need to cut emissions from sectors not in the EU ETS to meet obligations under the Effort Sharing Decision.

Box 2

Member states' ambitions for advanced biofuels above RED II targets by 2030 – examples

The national **target for advanced biofuels** in Finland and Germany is higher than the RED II target as it does not include double counting. In addition to its target for advanced biofuels and biogas, which is 3.5 %, Finland has also a separate target including advanced biofuels and biogas and RFNBOs, which is 10 % for 2030, without double counting.

France and Romania have set national target equal to the one in RED II. France has separate sub-targets for petrol and diesel. For 2023, the targets are 1.2 % for petrol and 0.4 % for diesel (with double counting). Those targets are due to rise to 3.8 % for petrol and 2.8 % for diesel in 2028.



59 For RED III, each member state must meet the 2030 targets individually, so those that did not meet the 2020 targets are already at a disadvantage. One member state with large maritime and aviation sectors indicated in our survey that the extension of the scope of the 2030 targets to maritime and aviation sectors under RED III might mean that targets for that member state more than double.

60 To ensure national targets are met, the sampled member states have established penalty systems for those economic operators that do not fulfil the biofuel use mandates or meet the GHG reduction targets (see ***Figure 17***).

Figure 17 – Penalty systems

Germany Fine is linked to **shortfall in GHG emission reductions**

- The charge for a shortfall is €0.60 per kg of CO_2-eq for 2022. By comparison, the highest price of the ETS in 2022 was €0.1 per kg of CO_2.
- The total charges collected between 2015 and 2020 amounted to almost €22 million.

France Fine is linked to **volume of non-supplied fuel**

- Tax charges for petrol and diesel imposed on economic operators whose biofuel blending rates are below the targets set, increased by 40 % from 104 €/hl in 2021 to 140 €/hl in 2023.
- The tax collected has been marginal.

Romania Fine is decided on a **case-by-case basis**

- The penalties range from RON 70 000 to RON 100 000 (about €14 000 to €20 000) and are not directly linked to fuel quantities.
- By the time of our audit visit, no penalties had been applied according to the national authorities.

Finland Fine is linked to the **energy content** of fuel that was not supplied

- Penalty for non-compliance is €0.04 per non-delivered MJ for biofuels and €0.03 per MJ for non-delivered advanced biofuels. It can be cheaper to buy the biofuel from a competitor than to pay the fine (about €1.3 per litre).
- As of January 2023, only one operator has been fined for not meeting the advanced biofuels obligation.

Source: ECA.

61 Fiscal policy does not always favour biofuels. We observed that, while the taxation rate on biofuels is lower than on fossil fuels in France and in Finland, biofuels and fossil fuels are taxed at the same rate per volume (litre or tonne) in Germany and (if biofuels are blended) in Romania. The ECA previously noted that the level of taxation of energy sources often does not reflect their GHG emissions[40]. The Commission acknowledges that the "taxation of fuels according to volume and not according to their energy content discriminates against renewable fuels in favour of conventional fossil fuels"[41]. This is because biofuels contain less energy than fossil fuels[42].

62 The Energy Taxation Directive's minimum tax rates are mostly based on volume. The proposal to revise the Directive aims to align taxation of fuels more closely with their energy content and environmental performance, with minimum tax rates for

[40] ECA review 1/2022, Energy taxation, carbon pricing and energy subsidies, paragraphs VI and 24.

[41] SWD(2021) 641.

[42] Ibid.

different groups of fuels to further harmonise the sector and provide specific price signals. The Commission has proposed the same minimum tax rate from 2033 for sustainable food and feed crop biofuels (that meet RED II sustainability criteria, but still require land) and for fossil fuels for general use in transport (10.75 €/GJ, before indexation). This is about twice as high as the minimum tax rate for the other sustainable biofuels and 70 times higher than for advanced biofuels (0.15 €/GJ, before indexation). As of October 2023, this proposal is under discussion at the Council.

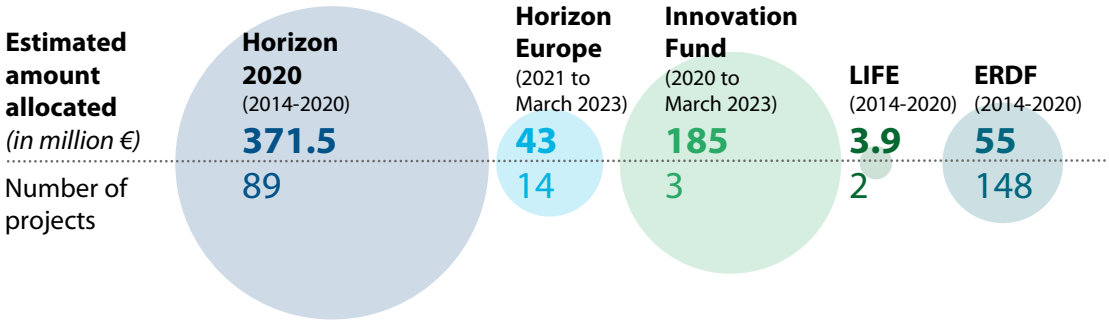
While EU funding targets research on advanced biofuels, EU farmland is used to produce crop-based biofuels

63 The Commission has emphasised the need to support advanced biofuels, in particular through research[43]. The EU budget has several funds and instruments that support biofuels, notably in the research sector, but also in the areas of cohesion, environment and agriculture. Biofuels can also be promoted through national or regional initiatives, often via subsidies or fiscal policies. We checked whether the EU funding for biofuels mostly targeted research in advanced biofuels.

64 The Commission has public portals like Cordis or Kohesio to disseminate information on the EU-funded projects but it does not keep track of the total amount of EU money paid out for biofuels projects. To get an overview of the funding, we examined the Commission's websites and portals and surveyed all member states for information. We identified **Horizon 2020** (H2020) as the main funding source supporting advanced biofuels (see ***Figure 18*** and ***Annex III***).

[43] SWD(2016) 418.

Figure 18 – Selection of estimated EU funding for biofuels



Note: The figure contains only the projects we identified during our audit (cut-off date March 2023) and hence may not be exhaustive.

Source: ECA, based on Commission databases and our survey of member states.

65 Between December 2013 and May 2020, the Commission published calls under the H2020 programme on 15 topics specifically targeting next generation or advanced biofuels. The Commission has continued this under Horizon Europe by publishing six such calls by May 2023. We did not find any project related to food- or feed-based feedstock, except crops on abandoned or severely degraded land. The **Innovation Fund** and its predecessor, **NER 300**, have funded advanced biofuels demonstration plants and commercialisation (for details, see ***Annex III***). ***Box 3*** provides examples of biofuel projects financed by LIFE and the European Regional Development Fund (ERDF).

Box 3

Examples of biofuel projects

A LIFE project in France (EU grant of €1.5 million)

The project developed a prototype for producing biodiesel from used cooking oil with a daily capacity of 5 000 litres. It patented the enzyme synthesis of biodiesel from used cooking oil and brought the technology to commercialisation. The project coordinator is a social enterprise which collects local used cooking oil and processes it into biodiesel for public transport in a city in the north of France.

An ERDF project in Finland (EU grant of €45 480)

The grant helped a microenterprise to start mass production of E85 conversion kits for road vehicles and commercialise them internationally. This conversion kit enables a petrol-driven car also to use E85 fuel, which contains 85 % (bio)ethanol. Without the kit, most petrol cars can only run with a maximum of 10 % ethanol in the fuel blend. The Commission acknowledged that the lack of a vehicle fleet running on ethanol content higher than 10 % is one element hampering the market deployment of ligno-cellulosic ethanol.

Source: ECA, based on LIFE Public Database and the Finnish authorities' database.

66 Our survey results indicate that the **European Agricultural Fund for Rural Development** (EAFRD) has also supported biofuels. Direct payments from the **European Agricultural Guarantee Fund** do not differentiate on the basis of final crop use whether they end up in food, feed or biofuels. According to estimates from a German research body, about 3.7 million hectares of land in the EU and the UK (more than 3.6 % of the available arable land) are allocated to producing crop-based biofuels.

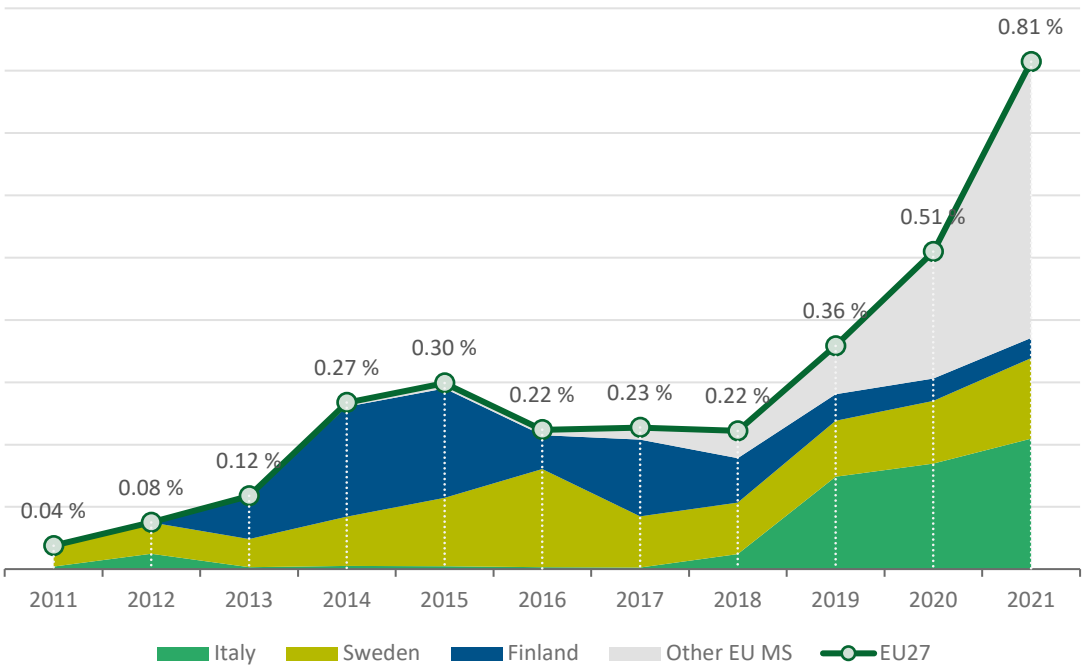
67 According to Section 3.3.1 of the Guidelines on **State aid** for environmental protection and energy 2014-2020, investment aid for food-based biofuels ceased from July 2014, but operating aid for such biofuels could be granted until 2021. In February 2022, the Commission published new guidelines, which allow support for crop-based biofuels if they are compliant with the RED II sustainability and GHG emissions saving criteria. On the other hand, these guidelines indicate that state aid for crop-based biofuels that exceed the ceiling for inclusion in the RES target "is unlikely to produce positive effects which could outweigh the negative effects of the measure". Based on the Commission's state aid database, Lithuania is providing operating aid for the production of bioethanol from cereals and biodiesel from rapeseed until the end of 2023, to compensate for the difference between the production costs and the price of

biofuels[44]. The Commission found that this was acceptable as the share of crop-based biofuels is expected to remain below 7 % until 2023 in Lithuania.

Production of advanced biofuels faces scaling-up issues

68 In 2021, the Commission admitted that advanced biofuels "may encounter difficulties fulfilling the existing 2030 requirements with regard to their volume availability as well as technological availability"[45]. In 2021, the share of advanced biofuels and biogas reached 0.81 % of the energy in transport, as shown in ***Figure 19***, while six member states reported no consumption of advanced biofuels.

Figure 19 – Advanced biofuels and biogas (Part A of Annex IX) in EU road and rail transport energy consumption



Source: ECA, based on SHARES data for 2020 and 2021.

69 The Commission has pointed that higher costs and low technological and commercial maturity limit the supply potential of advanced biofuels[46] compared to crop-based biofuels. There is no EU source for detailed information on advanced biofuel refineries. We have therefore used data from the United States Department of

[44] State Aid SA.100766 (2021/N).

[45] SWD(2021) 621.

[46] SWD(2021) 621.

Agriculture (USDA). It indicates that, in the EU in 2021, advanced biofuel refineries were mainly in Finland, the Netherlands, Sweden and Italy. Finland is also providing support to set up biorefineries and large demonstration projects (see ***Box 4***).

Box 4

National energy aid for advanced biofuel refineries in Finland

By mid-October 2022, three refineries had received support for bioethanol production. One of these was the world's first facility to produce cellulosic ethanol from sawdust. It became operational in 2016. In 2020, production was 20 % of capacity, as it was still adapting to the test runs.

The most promising feedstock for Finland are domestic forest residues, pre-commercial thinnings, and waste-based feedstock (e.g. black liquor, bark). Advancement in technologies may make it possible to start using a broader range of forest industry residues and to reduce import dependency.

Source: ECA, based on information provided by national authorities and publicly available data.

70 In 2022, there were, according to the Commission, two commercial plants (highest technology readiness level, i.e. TRL 9) and nine first-of-a-kind plants (TRL 8) producing advanced biofuels in the EU. The combined production capacity is around one billion litres per year[47], though the Commission does not collect detailed data on actual biofuel production in the EU. By comparison, in 2021, the total sales of petrol and diesel for road transport in the EU was 319 billion litres[48].

71 According to the USDA, the main factors that prevent operators in EU from investing in cellulosic biofuels are high research and production costs and regulatory uncertainty. ***Box 5*** presents an example of a first-of-a-kind commercial ligno-cellulosic biofuel project financed by H2020.

[47] JRC, Clean Energy Technology Observatory: Advanced biofuels in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets, 2022, Publications Office of the European Union, p. 20.

[48] ETC/CM report 2023/01: Fuel quality monitoring in the EU in 2021.

Box 5

A first-of-a-kind commercial plant financed under H2020

Between 2017-2023, **H2020** supported a first-of-a-kind commercial plant in Romania for producing bioethanol from straw, an advanced biofuel. The total cost of the project was €35 million, of which the EU grant was €24.7 million. This project was part of a much larger investment in the plant, including EU support for research since 2014.
By the time of our audit visit (6 months after opening), the plant was operating at partial capacity due to scaling-up issues. In December 2022, the company recorded a €227 million write-down in the value of the plant in the annual accounts.

©Clariant

Source: ECA, based on Cordis database and other publicly available information.

72 Among the projects visited, we found one where the demonstration phase had finished and the technology was waiting for commercialisation (see ***Box 6***). Both examples in ***Box 5*** and ***Box 6*** demonstrate that moving from initial laboratory research to producing a biofuel based on a specific technology takes at least one or two decades[49].

[49] ECAC Guidance on Sustainable Aviation Fuels, 2023, p. 47.

Box 6

A demonstration plant for biodiesel and bio-jet fuel

The project resulted in an industrial demonstration plant in France. The aim was to develop processes to transform ligno-cellulosic biomass into biodiesel and bio-jet fuel and to patent the technology. Including the research phase, it took 12 years to develop the technology and complete the demonstration unit.

The project finished in April 2021 and the demonstration unit shut down. As of May 2023, commercialisation of the technology has started with a plan to build a production unit for sustainable aviation fuel in France that will start up by 2027.

The total cost of the project was €190 million, financed mainly by the private sector, but also with some support from the French Environment and Energy Management Agency (€30.1 million) and regional authorities (€1.6 million), as well as from the EU (ERDF contribution: €1.6 million).

Source: ECA, based on information provided by national authorities.

Categorisation of advanced biofuels feedstock creates uncertainties

73 Annex IX to RED II categorises feedstocks depending on whether the processing technology is mature (Part B) or emerging/advanced (Part A). Article 28 of RED II states that the Commission is to review Annex IX every 2 years. It can amend the list by adding feedstock types, but not by removing them.

74 Part A of Annex IX contains some broad categories such as point (d), "biomass fraction of industrial waste not fit for use in the food or feed chain". Member state authorities decide whether a specific feedstock belongs under Part A or not. We found that a list of approved feedstock is public in Germany, but confidential in Finland for reasons of competition amongst fuel suppliers, including relating to securing investments.

75 We identified instances where the same feedstock (e.g. brown grease, starch slurry, palm fatty acid distillates) was classified differently across several member states. A Commission study also highlights feedstock classification issues, for example, stating that for starch slurry, its "qualification as biowaste (part A d) could not be clearly established, due to potential other uses". During our audit visits and in our survey some authorities said they would like more clarification and guidance from the Commission, particularly on point (d). In December 2022, the Commission published a draft delegated act proposing adding new feedstock categories to Annex IX of RED

(3 for advanced biofuels and 14 for mature ones). Among the 14 were starch slurry and brown grease. Stakeholders indicated to the Commission that changes to categorisation create an uncertain investment environment for advanced biofuels[50]. Reclassifying an advanced biofuel as mature means that its contribution to the target for renewables in transport is subject to the 1.7 % cap in RED II and that it is no longer counted towards the advanced biofuels target. This limits the possible expansion of such biofuel and affects the profitability of past and future investments in the related processing technologies.

Data reporting for biofuels has weaknesses

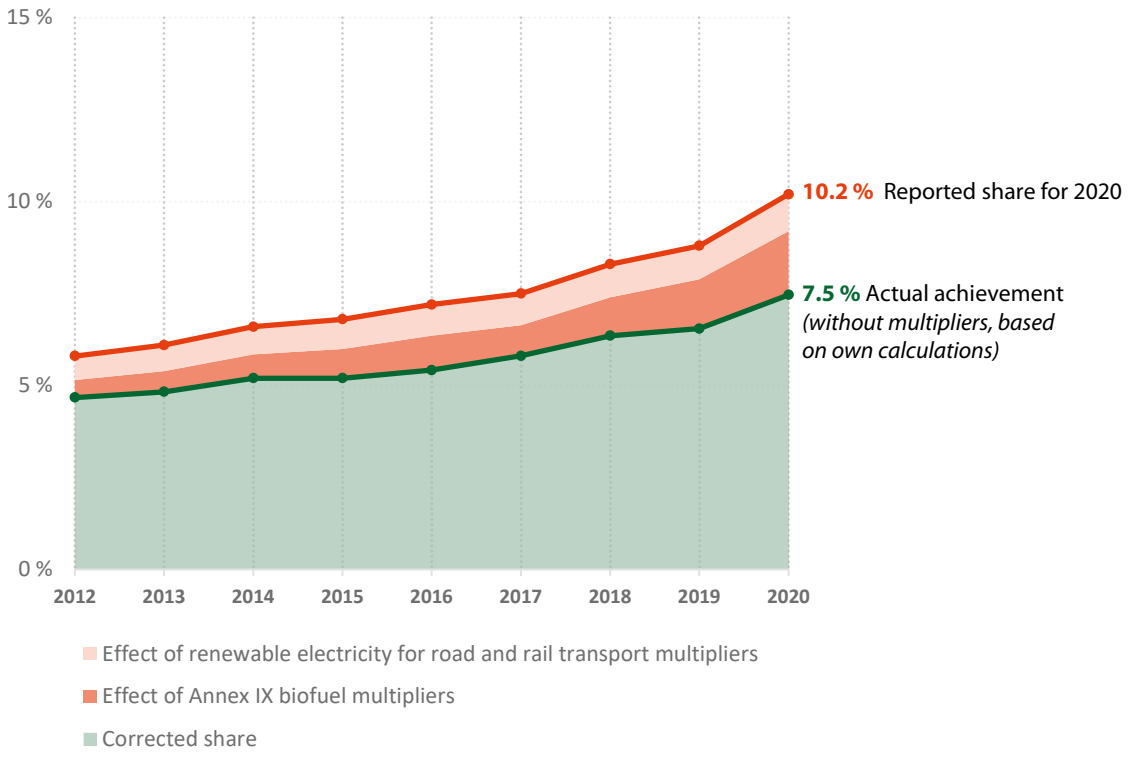
76 Reporting on the contribution of biofuels to EU targets ought to be reliable and clear. We examined the impact of multipliers on the targets, and corroborated data from various datasets used for tracking target achievement.

The Commission does not transparently present the effect of double counting of some biofuels on the share of renewable energy in transport

77 Eurostat data indicate that the EU reached its 2020 renewable energy in transport target (RES-T). In line with RED, the reported figure of 10.2 % was calculated making use of multipliers, which allowed double counting of energy content for Annex IX biofuels, and fivefold multiplication of energy content of renewable electricity for road transport. Consequently, the reported figure does not represent the actual share of renewables in road and rail transport. We calculated the actual share without applying these multipliers to be 7.5 % (see ***Figure 20***).

[50] For example, feedback from the Advanced Biofuels Coalition, the Austrian Federal Economic Chamber, Danish Shipping, the European Biodiesel Board, EWABA, Fuels Europe, Neste, Nature Energy, and the Netherlands Platform Renewable Fuels.

Figure 20 – RES-T target achievement with and without multipliers



Source: ECA, based on SHARES data.

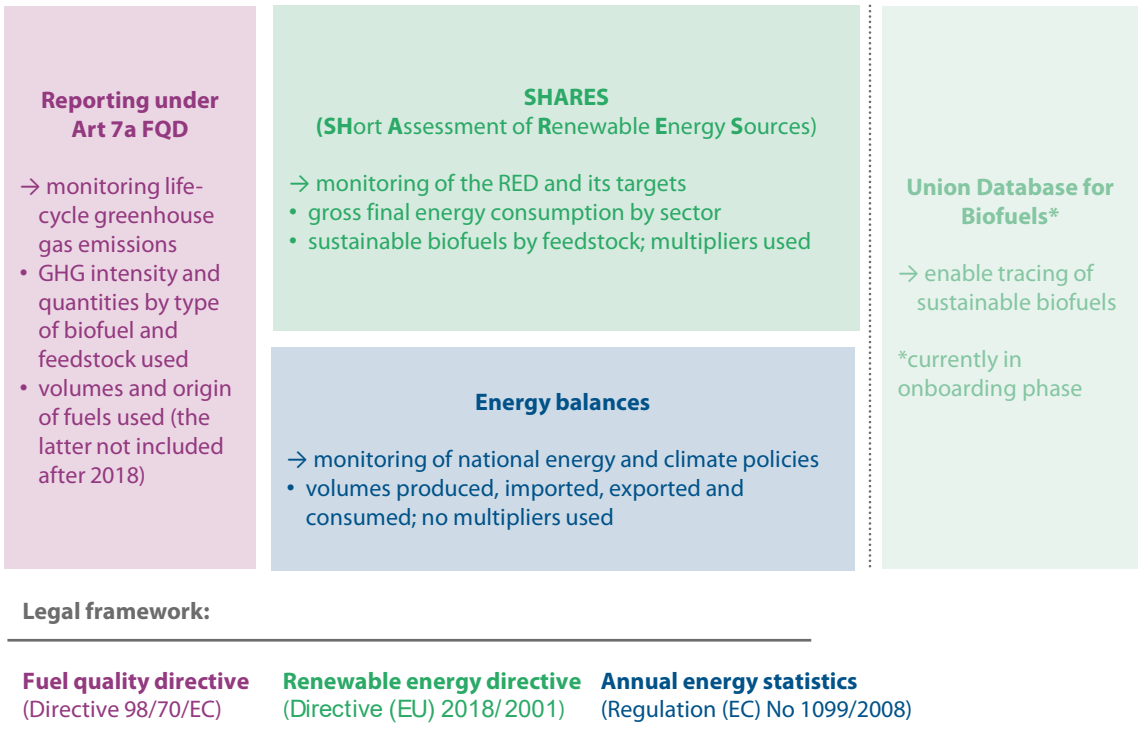
78 Double counting can also directly impact the biofuel use mandates in member states that allow multipliers. Using double counting here supports the production of advanced biofuels at the expense of biofuels based on food or feed crops, but half of the advanced biofuel is in reality a fossil fuel[51]. Thus, while double counting can work as an incentive to move to advanced biofuels, it disguises some fossil fuels as renewables.

Inconsistencies and gaps in data collected

79 Data on biofuels at EU level ought to be relevant, complete, accurate and without inconsistencies. Member states have to report annually on their use and consumption of biofuels. ***Figure 21*** provides an overview of the main datasets, as well as the relevant frameworks and responsibilities. These form the basis of the aggregated data that Eurostat or the Commission publishes.

[51] Boutesteijn, C. et al., The interaction between EU biofuel policy and first- and second-generation biodiesel production, *Industrial Crops and Products*, Vol. 106, 2017, pp. 124-129.

Figure 21 – Main biofuel data sources at Commission level

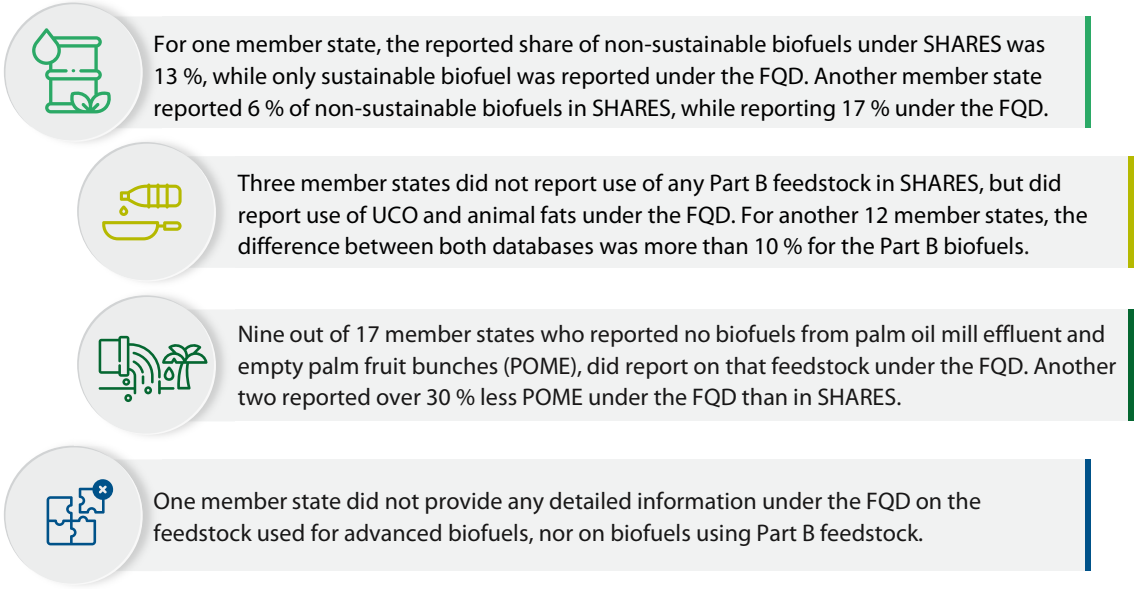


Source: ECA.

80 The Commission does not currently have full information on the country of origin of feedstock used to produce biofuels. Under annual energy statistics, biofuels produced from imported feedstock show the relevant member state as the place of primary production. However, we found that some member states like Germany, France and Finland collect information about the country of origin in national databases. These databases are not publicly accessible, but France has made some data accessible via Carbure.

81 As the Commission does not compare the information provided in SHARES with the information provided under the FQD, any inconsistencies in the member states' reporting under the different frameworks remain undetected. We checked consistency in member state reporting for the 2020 targets under Article 7a FQD with reporting done in the SHARES tool (RED obligations) and found some issues with the data (see ***Figure 22***).

Figure 22 – Examples of data issues in biofuel reporting



Source: ECA.

82 Article 28 of RED II required the Commission to put in place a Union database to enable tracing of biofuels that count towards the RED II targets. This database is to be operational by the end of 2023. As of March 2023, the Commission was in the process of getting economic operators and voluntary schemes to register in the database as it is these bodies that are to enter the relevant data. According to the Commission, the database is to cover the whole supply chain from the first collection point of the feedstock until final consumption, including information on the origin of the feedstock.

Conclusions and recommendations

83 Overall, we found that EU biofuels policy lacked stability, mainly because of sustainability challenges, and that 2020 targets have not been reached by most member states.

84 Biofuels legislation and priorities have changed frequently, meaning the sector lacks a long-term perspective. Biofuels from food and feed crops require land, so the contribution of such fuels to EU targets has been limited to a certain maximum share since 2015. All these changes and uncertainties may impact investors' decisions (paragraphs ***18***-***27***).

85 With the 'Fit for 55' package and 2023 revision of the Renewable Energy Directive (RED III), the Commission set higher biofuels-related targets for 2030. Two recent regulations set increasingly ambitious long-term objectives for the aviation and maritime sectors, but there is no roadmap on how to achieve them (paragraphs ***28***-***33***).

86 In addition, the future of biofuels in road transport is unclear. As things currently stand, a significant part of the targeted share of renewable energy in road transport by 2030 would have to come from other renewable energy sources, rather than biofuels. There is also no clear indication of the policy direction after 2030, which is particularly important given the proposed banning of new passenger cars using internal combustion engines from 2035 (paragraphs ***34***-***35***).

87 The biofuels sector competes with other sectors for raw materials, notably with the food sector but also with cosmetics, pharmaceuticals, and bio-plastics. The issues of biomass availability and sustainability may create upscaling problems as well as distortions in prices and markets for raw materials. In addition, dependence on feedstock imports has increased due to the rising demand for biomass over the years. There is no specific EU strategy for biomass and the targets for renewable fuels are set without taking into account the available biomass from sustainable sources (paragraphs ***36***-***53***).

88 Member states have placed biofuels-related obligations on fuel suppliers, as required by EU directives. Nonetheless, fewer than half of member states reached the required share of renewables in transport pursuant to RED I and achieved the targeted reduction in GHG emissions intensity in 2020 (paragraphs ***55***-***62***).

89 There is EU financial support alongside the main tools to promote biofuels, which are the targets for 2020 and 2030 and renewables obligations on fuel suppliers. The Commission has funded research into advanced biofuels and relevant demonstration projects, but deployment of these fuels has been slower than expected. The main barriers are lack of investment security, high costs, and scaling-up issues (paragraphs ***63***-***72***).

Recommendation 1 – Prepare a long-term strategic approach

The Commission should:

(a) develop a strategic pathway towards decarbonisation beyond 2030 to increase biofuels policy stability, safeguard sustainable production of biofuels and facilitate the energy transition of the main transport sectors;

Target implementation date: 2024

(b) when preparing the post-2030 framework, address the efficient use of biomass as a key source for sustainable biofuels, by considering the challenges related to, for example, biomass availability and needs, viable supply chains, sustainability, and use prioritisation.

Target implementation date: 2027

90 Annex IX of RED II differentiates biofuels according to whether their processing technology is advanced (Part A) or mature (Part B). We found that member state authorities would like more clarification on the categorisation of some feedstocks under Part A, and we identified instances where the same feedstock was classified differently across member states. The contribution to EU targets of mature biofuels is currently capped. The Commission justified this by the limited availability of the feedstock and the risks of fraud, for example, through imported virgin oil being declared as used cooking oil. The Commission's proposal to add new feedstocks to mature biofuels, some of which were previously considered advanced in some member states, may limit their growth potential and create investment security issues (paragraphs ***45***-***48***, ***73***-***75***).

Recommendation 2 – Improve guidance on advanced biofuels categorisation and assess capping of feedstock

The Commission should:

(a) improve the guidance for member state authorities on categorisation of feedstock for advanced biofuels to avoid inconsistencies between member states, helping to provide a level playing field and more stability and security for the biofuels sector;

Target implementation date: 2025

(b) when preparing the post-2030 framework, assess whether and how to use capping to address the high fraud risk and the limited availability of some feedstock, irrespective of the technology level.

Target implementation date: 2027

91 To promote certain types of biofuels, their contribution to the target of renewable energy in transport is double counted. We found that the Commission does not present transparently the effect this has on the actual share of renewable energy in transport. Furthermore, while Eurostat and other Commission directorates-general collect data on biofuel consumption by feedstock type, they currently lack origin of feedstock data and detailed biofuel production data for policy analysis. The Commission aims to address this data gap with the future Union Database for Biofuels. Data collected under the Fuel Quality Directive and RED II are in two different datasets and contain inconsistencies, which begs questions about the reliability of the data and target achievement calculations (paragraphs ***77***-***82***).

Recommendation 3 – Improve data and transparency

The Commission should:

(a) while implementing the Union Database for Biofuels, improve the relevance of the data that is used for policy design, monitoring and evaluation (e.g. by collecting information on country of origin of feedstock and fuels);

(b) take measures to address inconsistencies between different datasets on biofuels (Fuel Quality Directive, Short Assessment of Renewable Energy Sources (SHARES) and the new Union Database for Biofuels) to improve data quality for users;

(c) improve transparency about the impact of multipliers on the reporting of targets.

Target implementation date: 2026

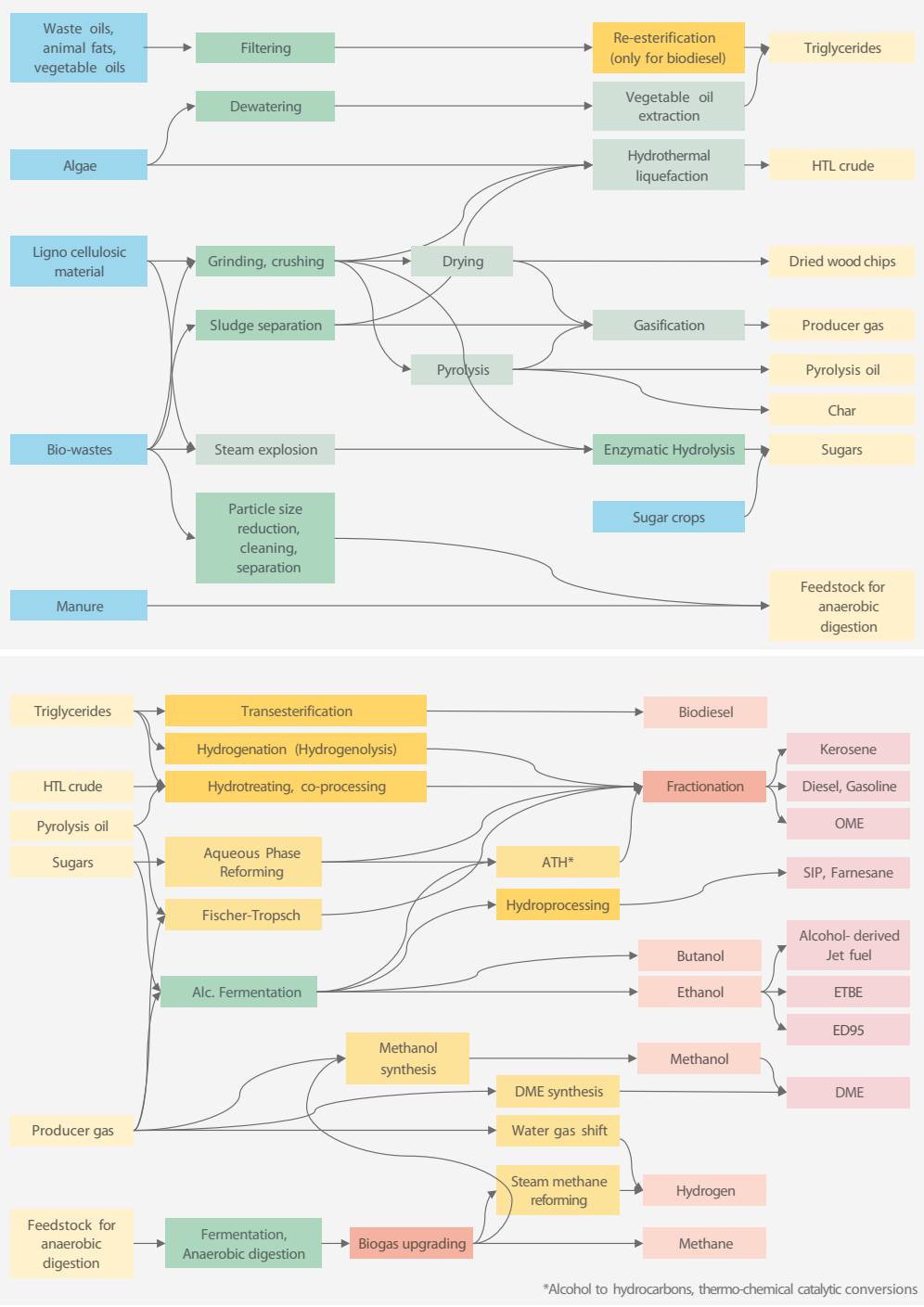
This report was adopted by Chamber I, headed by Ms Joëlle Elvinger, Member of the Court of Auditors, in Luxembourg at its meeting of 9 November 2023.

For the Court of Auditors

Tony Murphy
President

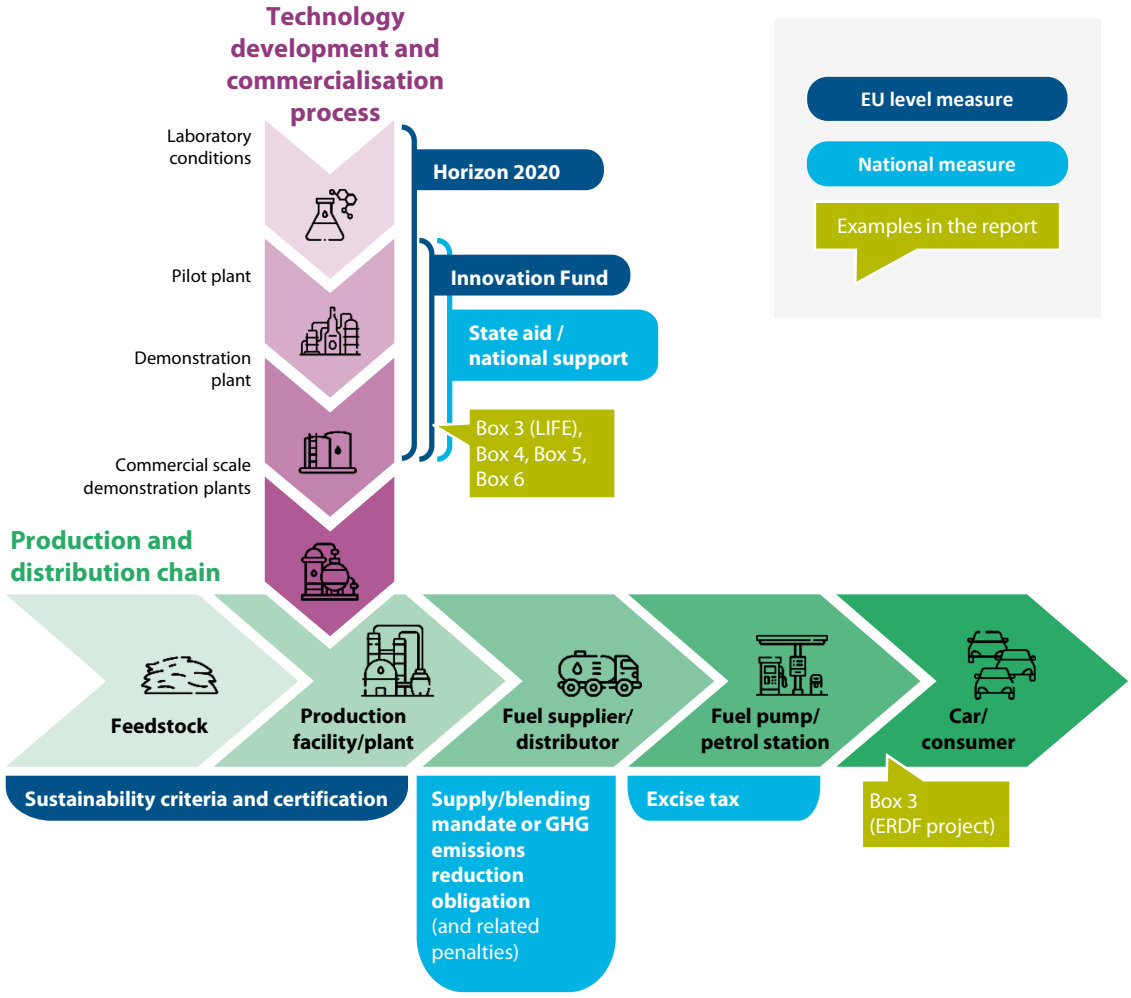
Annexes

Annex I – Selected pathways for producing Annex IX biofuels



Source: Hurtig O., Buffi M., Scarlat N., Motola V., Georgakaki A., Letout S., Mountraki A., Joanny G., *Clean Energy Technology Observatory: Advanced biofuels in the European Union – 2022 Status Report on Technology Development, Trends, Value Chains and Markets*, Publications Office of the European Union, Luxembourg, 2022, doi:10.2760/938743, p. 2.

Annex II – Overview of the main tools and measures to promote biofuels



Source: ECA.

Annex III – Selected EU funding

	Funding mechanism	Funding and comments	Evidence/source
Research and innovation funding programme	Horizon 2020 (2014-2020)	**Projects identified:** 89 (€371.5 million) **Comments:** The Commission uses Technology Readiness Levels (TRL 1-9) to indicate in the calls the technological maturity level that projects should reach. Under H2020, the Commission targeted funds at levels 4-7, meaning projects validating a technology in a laboratory or relevant environment, or demonstrating a technology in a relevant or operational environment.	Keyword search in Cordis and description of project objectives
	Horizon Europe (2021-March 2023)	**Projects identified:** 2 (€43 million)	Keyword search in Cordis and description of project objectives
Funding programme for demonstration of innovative low-carbon technologies	NER 300 (2012-2014)	5 of 23 projects selected in the first call of NER 300 from 2012 related to advanced biofuels (in total €516.8 million), but 4 of them were later withdrawn (in total €488 million), 1 potentially due to "ongoing uncertainty over the regulatory environment for advanced biofuels in Europe"[52]. In the second call, in 2014, only 1 project out of 19 related to biofuels (€29.2 million).	NER website
	Innovation Fund (2020-March 2023)	**Projects identified:** 3 (€185 million) One of the three projects was terminated in summer 2023.	Innovation Fund dashboard
Funding for the environment and climate action	LIFE (2014-2020)	**Projects identified:** 2 (€3.9 million)	Extract provided by the Commission

[52] ETIP Bioenergy, BtL demonstration projects in Europe.

	Funding mechanism	Funding and comments	Evidence/source
European Structural and Investment Funds	EAFRD (2014-2020)	While the total amount for the EAFRD is not known, 4 member states indicated in our survey that the total support provided for the 2014-2020 programme period was €8 million (EU and national financing). These projects range from support to micro-enterprises in rural areas for production and sale of biofuels to converting tractors to use vegetable oils.	ECA survey sent to member states
	ERDF (2014-2020)	**Projects identified:** 148 (€55 million)	Kohesio database and ECA survey sent to member states

Note: The table contains only the projects we identified during our audit (cut-off date March 2023) and hence it is not exhaustive.

Annex IV – Target setting for biofuels in transport since 2008

Target	Commission proposal	Adopted legislation
RES-T by 2020 (RED I)	**10 %** (with multipliers).	**10 %** (with multipliers).
RES-T by 2030 (RED II)	Target: at least 1.5 % in 2021, increasing up to at least **6.8 %** in 2030 (without multipliers). Fuels contributing to the target: (a) biofuels and biogas from feedstock in Annex IX; (b) renewable liquid and gaseous fuels of non-biological origin; (c) waste-based fossil fuels; and (d) renewable electricity. Food crop-based biofuels would not contribute to the RES-T target, but only to RES target. Means: member state places an obligation on fuel suppliers.	Target: at least **14 %** by 2030 (with multipliers). Fuels contributing to the target: renewable energy. Means: member state places an obligation on fuel suppliers.
RES-T, and **GHG intensity reduction, by 2030** (RED III)	GHG intensity reduction of at least **13 %.**	Target of GHG intensity reduction of **14.5 %.** Or: Share of at least **29 %** of renewables within the final consumption of energy in transport (with multipliers).
Advanced biofuels (RED II)	Within the RES-T target, the contribution of advanced biofuels and biogas from feedstock in part A of Annex IX should be at least 0.5 % of the transport fuels supplied for consumption or use on the market as of 1 January 2021, increasing up to at least **3.6 % by 2030** (with multipliers).	Within the RES-T target, the contribution of advanced biofuels and biogas from the feedstock in Part A of Annex IX as a share of final consumption of energy in the transport sector is to be at least 0.2 % in 2022, at least 1 % in 2025, and at least **3.5 % in 2030** (with multipliers).
Advanced biofuels (RED III)	The share of advanced biofuels and biogas from the feedstock listed in Part A of Annex IX in the energy supplied to the transport sector should be at least 0.2 % in 2022, 0.5 % in 2025, and **2.2 % in 2030**, and the share of renewable fuels of non-biological origin (RFNBOs) should be at least 2.6 % in 2030 (without multipliers).	A target of **5.5 % by 2030** for advanced biofuels (Part A of Annex IX) and RFNBOs (mostly renewable hydrogen and hydrogen-based synthetic fuels) in the share of renewable energies supplied to the transport sector. Within this target, there is a minimum requirement of 1 % of RFNBOs (with multipliers).

Source: ECA, based on RED I, RED II, RED III and legislative proposals for each.

Annex V – Development of caps and multipliers

Legislative act	Commission proposal	Adopted legislation
Caps on crop-based biofuels		
ILUC Directive, amending RED I	Cap: 5 % of the "final consumption of energy in transport in 2020". Coverage: energy from biofuels produced from cereal and other starch-rich crops, sugars and oil crops. Reasoning for the level: 5 % was the estimated share of such biofuels and bioliquids consumed in transport in 2011.	Cap: for 2020, 7 % of the final consumption of energy in transport in 2020. Coverage: energy from biofuels produced from cereal and other starch-rich crops, sugars and oil crops and from crops grown as main crops primarily for energy purposes on agricultural land.
RED II	Cap: 7 % in 2020 and to be reduced to 3.8 % by 2030. Member states may set a lower limit. Coverage: food and feed crops. Reasoning for the level: keeping the share of crop-based biofuels at 2020 levels by 2030 would not address ILUC. Total phasing out of crop-based biofuels by 2030 would require a share of 6.8 % of advanced biofuels in transport.	Cap: no more than one percentage point higher than the share of such fuels in the final consumption of energy in the road and rail transport sectors in 2020 in that member state, with a maximum of 7 % of final consumption of energy in the road and rail transport sectors in that member state. Member states may set a lower limit. Coverage: food and feed crops.
RED III	Cap: unchanged. Note: while the capping under RED II applied only to road and rail sectors, the RED III cap applies to all sectors.	Cap: unchanged
Caps on biofuels from feedstocks in Part B of Annex IX		
RED II	Cap: 1.7 % of the energy content of transport fuels supplied for consumption or use on the market. Reasoning for the capping: limited availability of animal fats and used cooking oil. In addition, there is a need to promote innovative renewable fuels with a high potential. Reasoning for the level of 1.7 %: not given.	Cap: 1.7 % of the energy content of transport fuels supplied for consumption or use on the market. Member states may, where justified, modify that limit, taking into account the availability of feedstock. Any such modification is subject to Commission approval.
RED III	Cap: 1.7 % as in RED II, without possibility to modify that limit.	The same as in RED II, including the possibility to modify the limit.

Legislative act	Commission proposal	Adopted legislation
Use of multipliers		
RED I	Contribution to the RES-T target of biofuels produced from wastes, residues, non-food cellulosic material, and ligno-cellulosic material should be considered to be twice that made by other biofuels.	Same principle as the Commission proposal.
ILUC Directive	Biofuels produced from feedstocks in Part A of Annex IX should be considered as having four times their energy content. Biofuels produced from feedstocks in Part B of Annex IX should be considered as having twice their energy content.	Biofuels produced from feedstocks listed in Annex IX are considered as having twice their energy content.
RED II	No multipliers, except the contribution of fuels supplied in the aviation and maritime sector should be considered as having 1.2 times their energy content.	The share of biofuels for transport produced from feedstocks listed in Annex IX is considered to be twice its energy content. With the exception of biofuels produced from food and feed crops, the share of fuels supplied in the aviation and maritime sectors is considered as having 1.2 times their energy content.
RED III	Multipliers to be abolished in general, but 1.2 multiplier to be retained for aviation and maritime targets. Reasoning: expressing the transport target as a GHG intensity reduction target "makes it unnecessary to use multipliers to promote certain renewable energy sources. This is because different renewable energy sources save different amounts of greenhouse gas emissions and, therefore, contribute differently to a target".	The share of biofuels for transport produced from feedstock listed in Annex IX is considered to be twice its energy content

Source: ECA, based on RED I, RED II, RED III and legislative proposals for each.

Abbreviations

EEA: European Environment Agency

FQD: Fuel Quality Directive

GHG: Greenhouse gases

GJ: Gigajoule

ILUC: Indirect land use change

RED: Renewable Energy Directive

RES: Share of energy from renewable sources in total energy consumption, including heating, cooling and transport sectors

RES-T: Share of renewable energy within the final consumption of energy in the transport sector

RFNBOs: Renewable fuels of non-biological origin

SAF: Sustainable aviation fuel

SHARES: Short Assessment of Renewable Energy Sources

Glossary

Biomass: Biodegradable material from agriculture, forestry, fisheries, industrial waste and residues, and municipal waste.

Demonstration project: Project designed to prove the technical viability of a new technology or approach.

GHG emission intensity: Greenhouse gas emissions per unit of energy.

Indirect land-use change: Displacement of crop production to formerly non-agricultural land, such as grassland or a forest, to make way for biofuel production.

Renewable energy (renewables): Energy from wind, solar, hydroelectric, geothermal and other non-fossil sources.

Replies of the Commission

https://www.eca.europa.eu/en/publications/SR-2023-29

Timeline

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Audit team

The ECA's special reports set out the results of its audits of EU policies and programmes, or of management-related topics from specific budgetary areas. The ECA selects and designs these audit tasks to be of maximum impact by considering the risks to performance or compliance, the level of income or spending involved, forthcoming developments and political and public interest.

This performance audit was carried out by Audit Chamber I Sustainable use of natural resources, headed by ECA Member Joëlle Elvinger. The audit was led by ECA Member Nikolaos Milionis, supported by Kristian Sniter, Head of Private Office and Matteo Tartaggia, Private Office Attaché; Ramona Bortnowschi, Principal Manager; Liia Laanes, Head of Task; Jan Huth, Deputy Head of Task; Marika Meisenzahl, Auditor and graphic design; Anca Florinela Cristescu, Céline Ollier and Servane De Becdelievre, Auditors. Jennifer Schofield provided linguistic support.

From left to right: Kristian Sniter, Liia Laanes, Jan Huth, Nikolaos Milionis, Anca Florinela Cristescu, Servane De Becdelievre, Marika Meisenzahl, Matteo Tartaggia, Céline Ollier.

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As an alternative to fossil fuels, biofuels are intended to help reduce greenhouse gas emissions in the transport sector. We assessed whether the EU is supporting sustainable biofuels effectively and whether these fuels have helped the EU achieve its energy and climate targets. We found that the lack of a long-term perspective in EU biofuels policy has affected investment security, and that sustainability issues, biomass availability and costs are limiting the deployment of biofuels. Overall, despite EU support for research, the deployment of waste- and residue-based biofuels has been slower than expected. We make a number of recommendations, including the need for a long-term strategic approach and improvements in data coherence.

ECA special report pursuant to Article 287(4), second subparagraph, TFEU.

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