



ADVANCEFUEL

Good Practices Along the RESfuels Value Chain through mixed methods analysis

D5.6 Good Practices Along the RESfuels Value Chain

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ADVANCEFUEL at a glance

ADVANCEFUEL (www.ADVANCEFUEL.eu) is a market research project formed by eight partners from: Chalmers University, Imperial College London (ICL), Leibniz Institute for Agricultural Engineering and Bioeconomy (ATB), Aalto University, The Agency for Renewable Resources (FNR), Energy Research Centre of the Netherlands (ECN), Utrecht University and Greenovate Europe. The partners work towards the same aim of facilitating the commercialisation of renewable transport fuels by providing market stakeholders with new knowledge, tools, standards and recommendations to help remove barriers to their uptake. The project focuses on advanced renewable fuels – defined as liquid biofuels produced from lignocellulosic feedstocks from agriculture, forestry and waste – and liquid renewable alternative fuels produced from renewable hydrogen and CO₂ streams.

As a way to support commercial development of these fuels, the project primarily developed a framework to monitor the current status, and future perspectives, of renewable fuels in Europe in order to better understand how to overcome barriers to their market roll-out. Following this, the project investigates individual barriers through stakeholder consultations and discusses validation and potential solutions during stakeholder workshops. The project then examines the challenges of biomass availability for second-generation biofuels, looking at non-food crops and residues, and how to improve supply chains from providers to converters. New and innovative conversion technologies are also explored in an effort to see how they can be integrated into energy infrastructure.

Sustainability is a major concern for renewable fuels and as part of this report ADVANCEFUEL will look at socio-economic and environmental sustainability across the entire value chain, providing sustainability criteria and policy-recommendations for ensuring that renewable fuels are truly sustainable fuels. A decision support tool will be created for policy-makers to enable a full value chain assessment of renewable fuels, as well as useful scenarios and sensitivity analysis on the future of these fuels.

Stakeholders will be addressed throughout the project to involve them in a dialogue on the future of renewable fuels and receive feedback on ADVANCEFUEL developments to ensure applicability to the relevant audience, validate results and ensure successful transfer and uptake of the project results. For instance, the Stakeholder Platform (accessible online) contributes to this objective. ADVANCEFUEL is thus a coordinated effort to support the development of new transport fuel value chains that can facilitate the achievement of the EU's renewable energy targets while simultaneously reducing carbon emissions in the transport sector to 2030 and beyond.

To stay up to date with ADVANCEFUEL's stakeholder activities, sign up at: www.ADVANCEFUEL.eu/en/stakeholders



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Summary

This report presents Good practices cases in both the plant/biorefinery and policymaking arenas for the production and development of advanced renewable fuels. Its complementary report (D5.4) delivers a policy analysis with the aim of providing evidence on policy interventions which can be used to promote innovations across the RESfuels value chains.

The aim of this report is to inform stakeholders of what has been or is currently being carried out in industry and in policy making and how it facilitates the growing market uptake of advanced renewable fuels from renewable sources (RESfuels) for the European road, aviation and marine transport sectors.

Objectives

1. Presenting plant/biorefinery Good practices:

- 10 plants from pilot, demonstration and commercial development stages are analysed through an environmental, economic and social lens to make the case for Good practices enacted for the production and implementation of RESfuels along the full value chain
- Practices are measured against greenhouse gas emissions savings and sustainability measures, total production capacity and gross added value, and total employment generated by the plants
- 6 transferable practices as lessons learnt are presented to inform stakeholders
- The Annex of this report includes the methodology behind systems dynamics analysis whereby practices will be further analysed (D5.6) with mixed methods

2. Presenting policy Good practices:

- 12 renewable fuel policies are analysed from 10 different countries (Denmark, Finland, Germany, the Netherlands, Italy, Slovakia, Sweden, United Kingdom, Brazil, Canada), the European Union and the state of California in the US
- Policy mechanisms employed and respective special provisions for aviation, marine and heavy-duty road transport for markets in initial, early and mature development stages are presented and assessed for their transferability
- The preliminary assessment of good practice performance done jointly with interviewed stakeholders is measured against the quality of policy integration, strategy for market segments with limited alternatives for decarbonisation and stakeholder engagement

1. Introduction

1.1. Background

The European Union (EU) is committed to reduce greenhouse gas emissions (GHG) by 80-95% by 2050 compared to 1990 levels in line with the Paris Agreement to maintain temperature levels below 2°C, as compared to preindustrial levels. Renewable energy sources (RES) will have a major contribution to these targets. So far, the RES share in final EU consumption has increased from 8% in 2004 to 17% in 2016, while the first Renewable Energy Directive (2009) set a target of 20% by 2020 (RED, 2009/28/EC). Recently, the RED II recast has also set a binding Union target of at least 32% share of renewable by 2030¹. Amongst the renewable energy sources, RESfuels are expected to contribute highly towards the decarbonisation of transport and their sustainable production is of outmost importance for the successful market development.

According to the 2018 Bioeconomy Strategy published by the European Commission², there are more than 800 biorefineries throughout Europe, with more than 360 producing liquid biofuels. Multi-product biorefineries can improve the efficiency of biomass utilisation by exploiting side-flows, reusing waste and residues and adding further value to materials beyond their energy source, such as using lignin in lightweight material and chemical products. While there are high expectations from the RESfuels sector, most of the plants are first of a kind, demonstration and pilot, they include highly innovative components, involve high investment risks and as such there is much scope for learning from Good practices achieved so far both in the development and operation of the plants but also from the formation of consistent, long term and appropriately tailored policy.

The aim of Task 5.2 is to identify, jointly with stakeholders, Good Practices of successful market uptake of RESfuels in Europe and global level.

For the purposes of this analysis, a good practice³ is defined as '*a practice that has been proven to work well, produce good results and is designed to achieve some deliberative target*⁴.

¹ DIRECTIVE (EU) 2018/2001

² European Commission (2018) A sustainable Bioeconomy for Europe: strengthening the connection between economy, society and the environment, Updated Bioeconomy Strategy

³ FAO (2014) Good Practices template, www.fao.org/capacitydevelopment/goodpractices/gphome/en/

⁴ Bretschneider, S., Marc-Aurele Jr., F. J., & Wu, J. (2004) "Best Practices" Research: A Methodological Guide for the Perplexed, *JPART*, 15:307–323.

An overall of twenty-one (21) good practices are presented in this report; ten (10) concern advanced biofuel plants and twelve (12) concern renewable fuel policies.

1.2. Approach and data collection

The good practices presented here have been identified through literature and stakeholder consultations and the analysis was supported by semi-structured interviews.

The aim of conducting semi-structured interviews was to gather similar data with the questionnaire as well as seek additional contextual information surrounding either supply chain configurations and capabilities or past, present, and future trends in policy support mechanisms.

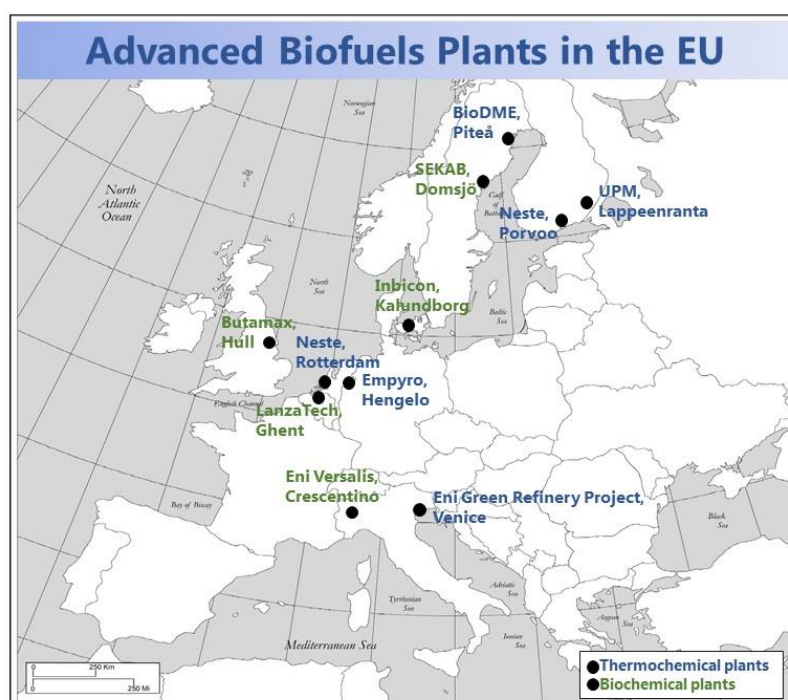
Two versions (one for plants and one for policy) of an online survey were launched in M16 for a period of two months on the project website. The rationale behind the survey was to ensure that the good practices identified were selected among a variety of cases that extend beyond the knowledge and capacities of the project consortium and also take into account the multi-actor approach and ensure a participatory process across the selection, mapping, analysis and formation of good practices and recommendation. The questionnaires and the list of stakeholders interviewed are included as Annexes in this report.



2. Good practices in advanced biofuel plants

2.1. Overview of good practices

Map 1 below presents an overview of the selected plants that are presented in this report.



Map 1 European biorefineries with good practices (own compilation)

Ten (10) thermochemical and biochemical were selected as good practice cases, based on their merit of promoting the uptake of advanced biofuels for the European transport market. Plants were chosen to highlight all three kinds of development stages (pilot, demonstration and commercial), differing partnership structure, funding mechanism, time in operation, source of feedstock, conversion and product types and quantities, distribution possibilities and sustainability measures (Table 1).

Two (2) biochemical plants chosen are currently either closed or idle. They have been included in this report due to the innovative contribution they brought to their industrial area and invested companies. Along with the eight (8) other plants, all represent a good practice case at the time of operation in terms of environmental, economic and social performance, as well as transferability or replicability factors.

Table 1 Overview of thermochemical biorefineries

	BioDME	Empyro	Neste	UPM	Eni Green
Region/ country	Piteå, Sweden	Hengelo, Netherlands	Porvoo, Finland & Rotterdam, Netherlands	Lappeenranta, Finland	Venice, Italy
Partnership	CHEMREC, Delphi Diesel Systems, ETC research centre, Haldor Topsoe, Preem, Total, Volvo	Zeton and Tree Power, joint partnership with Twence Holding B.V.	Kilpilähti industrial area/Porvoo port and Port of Rotterdam collaboration opportunities	BNP Paribas, Leaders of Sustainable Biofuels, Zero Emission Resource Organisation, Technical Research Centre of Finland	Honeywell UOP, Bayern Oil, PCK and Ceska Rafinerska
Financing (private or public)	€28.4 million Funded by the European 7th framework programme (FP7) and The Swedish Energy Agency	€19 million Financing from the EU FP7, the Dutch government (TKI-BBE) and equity investments from the province of Overijssel (EFO) and a local investor	Porvoo : €100 million Rotterdam : €60 million Private	€179 million Private	€100 million Private
Development stage	Pilot	Demonstration	Commercial	Commercial	Commercial
Hours in operation	11,000	3,500		10,000	Continuous since 2014
Feedstock type(s) & capacity	Sulphate (kraft) black liquor, 3MW; 20t of dry BL per day	120t dry clean wood residues	Various vegetable oils and waste streams	Crude Tall Oil	Vegetable oils, animal fats and greases; 11,575 barrels/day

Conversion pathway	Chemrec gasification technology, HaldorTopsoe synthesis oil	Biomass Technology Group	NEXBTL: Own technology for hydrogenated vegetable oils processing	HaldorTopsoe hydro-treatment	Ecofining process: with deoxygenation, isomerization and product separation
Product (by-product)	4t/day DME	77t/day or 20 million litres/yr crude pyrolysis oil	Renewable diesel; 200,00t/yr; 1,000,000t/yr ; 40,000t/yr bio-propane	100,000t/yr	Hydrocarbon fuels (naphtha, LPG and jet fuel) and projected 420,000t/yr green diesel
Distribution and end use	Standalone with dedicated DME tanks, piloted for heavy trucking industry	Heat & power, automotive fuels after co-refining and Biorefineries	Renewable diesel for road vehicles, jet engine fuel compatible with existing jet fuel	Biodiesel can be blended with fossil diesel or used alone and it is compatible with vehicle engines and fuel distribution systems. Bio-naphtha can be used as a biocomponent in fossil gasoline	Blending 15% of the Green Diesel additive to a fossil diesel fuel
Sustainability measures	The biofuel produced uses a neighbouring sulphite mill by-product while yielding low PM matter and absence of soot	Energy efficiency using non-condensable pyrolysis gases to generate steam and power and excess heat used for drying; the plant uses clean woody biomass from local sources and recycles minerals back into soil	Significant reductions in tailpipe emissions while renewable diesel also reduces particle, hydrocarbon and nitrogen oxide emissions	UPM selected for climate change mitigation in UN Global Compact initiative; pulp and paper mill integration benefits such as no land use change and crude tall oil is classified as a residue	15% of the fuel is made of renewable "green" diesel and significantly reduces polluting emissions, cutting unburnt hydrocarbons and carbon monoxide

Table 2 Overview of biochemical biorefineries

	SEKAB	Butamax (closed)	Inbicon (idle)	Eni Versalis	LanzaTech
Region/ Country	Domsjö, Sweden	Hull, UK	Kalundborg, Denmark	Crescentino, Italy	Ghent, Belgium
Partnership	BioFuel Region, Europa-Bio, F3, Företag-sutbildarna, KOMTEK, Processum, Scania, Svebio, Taurus Energy, UNICA, Collaboration	Joint venture between BP and DuPont; consultancy for refiner and producer partners; working with leading companies across the existing U.S. biofuels industry; partnership with Early Adopters Group	Dong Energy; suppliers of Novozymes and Danisco Genencor; distribution to Statoil; partnership with Great River Energy and Otoka Energy for development in North Dakota	Joint venture with Mossi Giosolfi Group	ArcelorMittal, Sulzer Chemtech
Financing (source & type of funds)		\$50 million Private (BP & DuPont)	€54 million (construction), €10m of which was given from the Danish Energy Authority under Danish EUDP, €9m supported by FP7	€150 million Support from NER 300 and the FP7 framework program	€150 million Horizon2020
Development stage	Pilot	Demonstration	Demonstration	Commercial	Commercial
Hours in operation	50,000		15,000		8,000hr/yr
Feedstock type(s) & capacity	2t dry/d feedstock	0.2-0.3t/d unmodified yeast	96t/d; wheat straw	Agricultural and forestry residues, and energy crops	50,000Nm ³ H ₂ +CO (carbon-containing gas from blast furnaces)
Conversion pathway	Own technology CelluAOP: heat treatment	Microbial production with a batch process	Biomass mechanical conditioning; hydrothermal pre-treatment; pre-enzymatic hydrolysis at high dry	Own technology: PROESA (heat treatment and enzymatic hydrolysis) to extract sugars	Microbes that feed on carbon monoxide produce ethanol

	ment and enzymatic hydrolysis with detoxing technology		matter consistency (up to 30% d.m.) for continuous liquefaction	from lignocellulosic biomass; 200,000t/yr	
Product (by-product)	3.5 MWh/d ethanol; 4MWh/d lignin; 1MWh/d biogas	0.057-0.068t/d Bio-isobutanol	13t/d ethanol; 30t/d lignin ; 45t/d C5molasses	Ethanol; 25,000 – 40,000t/yr	143t/d bioethanol
Distribution and end use	Diesel engines; buses and lorries; E85 available in 1,500 locations in Sweden; and ED95 for adapted diesel engines	Drop-in biofuel that can be used in existing infrastructure or blended into gasoline	Ethanol produced is used by blending with conventional petrol; animal feed and lignin used as fuel for power plants	Competitive cost of product compared to oil	Transport fuel or potentially production of plastics
Additional information	Produces ED95, an ethanol fuel that reduces emissions of fossil CO2 by up to 80 per cent; created its own Verified Sustainable Ethanol Initiative	Bio-isobutanol yields a higher potential for replacing gasoline as it has a higher energy content than ethanol	The plant makes use of heat energy generated by Asnae coal-fired plant, a co-location which reduces CO2 emissions by 25,000t	20,000 tonnes of ethanol from a biorefinery saves 72,000 tons of CO2 through bioethanol production; this plant ensures complete water recycling and sources biomass locally	Operating at ambient temperature and pressure; 120,000 tonnes per year of CO2 reductions were reported for the first phase of the plant

2.2. Environmental, economic and social performance per plant and development stage

This section provides an overview of Good practices implemented by 11 plants, 5 thermochemical and 6 biochemical, and an initial characterisation of their performance based on environmental, economic and social indicators. These are respectively: i) greenhouse gas emissions reduction or other environmental safeguards, ii) production capacity, and iii) employment (direct and indirect) or other social partnership factors.

The work provides an overview of their performance as defined by these indicators firstly by comparing environmental achievement with targets from the recast of the Renewable Energy Directive (RED II)⁵, which includes annexes listing default values for greenhouse gas reductions achieved through different advanced biofuel production pathways.

Secondly, the economic performance of the plants is described by the impact of their production capacity (or its potential) on national shares and mandates of biofuels. The sources for this information include:

- Eurostat Shares for Renewables⁶ which provides the share of solid biofuels, other renewables (including biogas) and biofuels in transport per European country in 2017,
- the International Renewable Energy Agency⁷ (IRENA) which provides data on energy power capacity for bioenergy (liquid biofuels, solid biomass and biogas) in 2017, and
- policy and statistic reports from EurObserv'ER, Renewable Energy Policy Factsheets for 2018 which highlight the share and trajectory of renewable energies for EU member states.
- The energy content of fuels listed in Annex III of the recast of the Renewable Energy Directive (RED II) and the International Energy Agency unit converter⁸ used as a tool

⁵COM/2016/0767 final/2 - 2016/0382 (COD)

⁶ <https://ec.europa.eu/eurostat/web/energy/data/shares>

⁷IRENA (International Renewable Energy Agency) (2018) Country Rankings <https://www.irena.org/our-work/Knowledge-Data-Statistics/Data-Statistics/Capacity-and-Generation/Country-Rankings>, Last Visited on [13/04/2019]

⁸ <https://www.iea.org/statistics/resources/unitconverter/>

- The prices of ethanol⁹ and biodiesel (FAME)¹⁰ are taken from the Independent Chemical Information Service (ICIS) for 2019 in € per cbm (cubic metre) FOB (free on board) Rotterdam

Finally, overall data describing the production activity and performance of plants (summarised in Table 1) was collected from the 2017 Technology status report from the Sub Group on Advanced Biofuels¹¹, including feedstock types and capacities, conversion types and production capacities, hours of operation and plant classification, and from official websites and publications advertised by the plant companies. Employment figures are primarily based on IRENA renewable energy employment data by country for liquid biofuels, published in 2017¹².

Each plant's performance and respective set of good practices is derived as a lesson for overcoming key barriers stated in D1.1 following stakeholder consultation¹³. The following analysis explores some of the ways in which these barriers are addressed or can be potentially overcome by good practices.

2.2.1. Thermochemical plants

I] Pilot Plants

The BioDME plant in Piteå, Sweden

The BioDME plant converts sulphate black liquor (which is the waste product from the kraft process of a paper and pulp mill) into methanol and dimethylether through gasification and

⁹ <https://www.icis.com/explore/commodities/energy/ethanol/?intcmp=mega-menu-explore-commodities-energy-ethanol>

¹⁰ <https://www.icis.com/explore/commodities/energy/biodiesel/?intcmp=mega-menu-explore-commodities-energy-biodiesel>

¹¹ Landalv, I., Maniatis, K., Waldheim, L., van den Heuvel, E. & Kalligeros, S. (2017) Building up the future: Technology status and reliability of the value chains, *Sub Group on Advanced Biofuels, European Commission*

¹² IRENA (International Renewable Energy Agency) (2018) Irena jobs database, Renewable Energy Employment by Country, <https://www.irena.org/ourwork/Knowledge-Data-Statistics/Data-Statistics/Benefits/Renewable-Energy-Employment-by-Country>, Last Visited on [13/03/2019]

¹³ Uslu, A., Detz, R. J. & Mozaffarian, H. (2017) Barriers to advanced liquid biofuels and renewable liquid fuels of non-biological origin, D1.1 Key barriers to advanced fuels, *ADVANCEFUEL*

syngas technology with pyrolysis oil. In 2013, the plant produced more than 500 tons of BioDME and trucks used for piloting the fuel accumulated more than 1 million km of operation¹⁴.

Environmental performance

The plant absorbs a part of the black liquor coming from an existing facility producing pulp, which according to the plant's company Chemrec, makes the BioDME plant one of the highest land-use efficiencies in second generation biofuels.

The plant states that DME produced via biomass gasification and black liquor as pulp mill residue having the same greenhouse gas and energy consumption as Fischer-Tropsch from biomass, i.e. around **10 g CO₂ eq/km for around 275 MJ/100 km**. By comparison, conventional fuels produce between 150 to 175 g CO₂ eq/km for 200 MJ/100km¹⁵.

As a reference point, according to RED II targets, if produced with no net carbon emissions from land use change, default value for greenhouse gas emissions saving from dimethylether (DME) from black-liquor gasification integrated with pulp mill and Methanol from black-liquor gasification integrated with pulp mill is 89%.

Additionally, the plant has reported positive feedback from driver perception from field tests due to locally produced fuel with good environmental properties and the absence of soot¹⁶¹⁷.

Economic performance

The full operational capacity of the pilot plant is 3MW which represents 20 tonnes of dry black liquor per day to produce **1.8MW of syngas** and **4 tonnes of DME per day**.

According to IRENA, installed capacity (MW) in 2017 for liquid biofuels in Sweden was 515.000 MW.

According to Eurostat Shares of Renewables, Sweden's share of compliant biofuels in transport in 2017 was 1,669.7ktoe. If operated every day of the year and not accounting for plant downtime or export/use in other countries, **the BioDME plant DME production represents 1ktoe** (total production in tonnes per year is multiplied by energy content [28 MJ/kg] of dimethylether cited in RED II).

There are no listed market prices for DME since the fuel for transport purposes is in nascent form. The fuel was tested on 10 Volvo trucks in the BioDME project and performed on an accumulated mileage of over 1 million km¹⁸.

Social performance

¹⁴ Landalv, I., Gebart, R., Marke, B., Granberg, F., Furusjo, E., Lownertz, P., Ohrman, O. G. W., Sorensen, E. L. & Salomonsson, P. (2014) Two Years Experience of the BioDME Project—A Complete Wood to Wheel Concept, *Environmental Progress & Sustainable Energy*, 33 (3)

¹⁵ Comparison of DME with other fuels with respect to emission of greenhouse gases and energy consumption, <http://www.biodme.eu/about-dme/>, Last Visited on [12/03/2019]

¹⁶ <http://www.biodme.eu/work-packages/veichle-field-test/>, Last Visited on [12/03/2019]

¹⁷ <http://www.biodme.eu/work-packages/vehicle-procurement/>, Last Visited on [12/03/2019]

¹⁸ <http://www.biodme.eu/work-packages/veichle-field-test/>, Last Visited on [25/03/2019]

The plant employs **19 full-time staff members** as researchers and technicians at the plant¹⁹. According to IRENA, there are 7,600 direct and indirect jobs in the liquid biofuels industry in Sweden.

II] Demonstration Plants

The Empyro plant in Hengelo, Netherlands

The Empyro plant converts wood residues into crude pyrolysis oil through liquid pyrolysis, oil being the main product and pyrolysis gases are used to generate additional steam and power. The end-product is designed to be compatible with diesel and gasoline.

The plant is located close to its raw material sources. This gives it the potential to overcome the following barriers: difficulties in mobilising various feedstocks (technical), lack of clarity on land availability and environmental constraints (environmental), lack of knowledge from farmers (social).

Environmental performance

Empyro plant uses clean woody biomass from local sources while local decentralized production of pyrolysis oil extracts minerals in the biomass and recycles them back into soil.

Pyrolysis oil can replace natural gas in the production of process steam and thus can contribute to eliminating greenhouse gas emissions from conventional fossil-based gas²⁰. According to the company's website, one dairy producer is saving 10 million m³ of natural gas when co-firing pyrolysis oil. **The CO₂-eq/year reduction reported from the plant data is 24,000 tonnes²¹.**

The BTG-BTL group has published a summary of greenhouse gas emissions savings from the Empyro pyrolysis plant: total emissions from production while using forest residues amount to 8.70 g CO₂-eq/MJ pyrolysis oil, after attribution of emissions to co-production of heat and electricity. When placed against fossil fuel comparators, this figure represents an emissions savings of 90.4% when replacing electricity, 88.7% when replacing heat and 89.9% when replacing Combined Heat and Power²².

According to the RED II targets, if produced with no net carbon emissions from land use change, default value for greenhouse gas emissions saving from waste wood Fischer-Tropsch diesel in free-standing plant is 85%.

¹⁹ Landalv, I., Gebart, R., Marke, B., Granberg, F., Furusjo, E., Lownertz, P., Ohrman, O. G. W., Sorensen, E. L. & Salomonsson, P. (2014) Two Years Experience of the BioDME Project—A Complete Wood to Wheel Concept, *Environmental Progress & Sustainable Energy*, 33 (3)

²⁰ https://www.btg-btl.com/media/cms_block/leafletempyro.pdf, Last Visited on [12/03/2019]

²¹ Fast pyrolysis based advanced biofuels, New Delhi, 8th March 2018, Rene Venendaal, https://ec.europa.eu/energy/sites/ener/files/documents/19_renevenendaal-btg.pdf

²² Btg-btl (2011) RED Greenhouse gas emission savings of pyrolysis oil produced by the Empyro pyrolysis plant: Summary, https://www.btg-btl.com/red_greenhouse_gas_emission_savings_of_pyrolysis_oil_produced_by_the_emypro_pyrolysis_plant.pdf

Economic performance

The demonstration/commercial plant operates at a capacity of 120 tonnes per day of clean wood residues to produce **77 tonnes per day or 20 million litres per year of crude pyrolysis oil**, as well as 8MW of by-product. In 2017 the plant reached 100% capacity and passed the 20 million litre mark for fast pyrolysis oil, a figure which represents the replacement of 12 million cubic meters of natural gas, or the equivalent annual consumption of 8,000 Dutch households²³. Pyrolysis oil can be stored for long periods of time and is therefore available when necessary.

According to Eurostat Shares of Renewables, Netherlands's share of compliant biofuels in transport in 2017 was 303ktoe. Not accounting for plant downtime or export/use in other countries, the **Empyro plant production represents 17ktoe, which represents almost 6% of the national share** (total production in tonnes per year is multiplied by energy content [36 MJ/l] of co-processed oil of biomass or pyrolysed biomass origin cited in RED II).

The indicative price of pyrolysis oil is listed by the plant as 18-20€/GJ²⁴, which signifies a **gross added value of between €13 and €14 million per year**.

Social performance

The project creates approximately **100** person-years of work in Overijssel.

According to IRENA, there are 400 direct and indirect jobs in the liquid biofuels sector of the Netherlands.

III] Commercial Plants

The Neste plants in Porvoo, Finland and Rotterdam, Netherlands

Neste operates two advanced biofuels plants which convert various vegetable oils and waste streams into renewable biodiesel through hydrogenated vegetable oil processing.

The Port of Rotterdam is the largest port in Europe, provides opportunities for collaborating with neighbouring chemical plants²⁵ and has an integrated infrastructure connecting companies²⁶ while the Kilpilahti industrial area contains over 11 companies²⁷, and enacts air, sea water and surface water quality monitoring. Additionally, the Porvoo port is the largest in Finland

²³ Btg World (2014) *Press Release: Empyro breaks ground on biomass pyrolysis oil production plant in The Netherlands*, <http://www.btgworld.com/en/news/press-release-empyro-breaks-ground-persbericht-eerste-paal-empyro.pdf>

²⁴ Fast pyrolysis based advanced biofuels, New Delhi, 8th March 2018, Rene Venendaal, https://ec.europa.eu/energy/sites/ener/files/documents/19_renevenendaal-btg.pdf

²⁵ <https://www.neste.us/about-neste/who-we-are/production/rotterdam-refinery>, Last Visited on [23/03/2019]

²⁶ Schouten, H. (2016) Site director of Neste Rotterdam, Port of Rotterdam, <https://www.youtube.com/watch?v=ra896e-6GTg>

²⁷ <https://www.kilpilahti.fi/in-english/>, Last Visited on [23/03/2019]

with approximately 1,100 to 1,400 ships passing every year²⁸. These advantages have the potential of overcoming two significant barriers elicited from the stakeholder consultation: Concerns on stability/security of the industry (regulatory) and manufacturers unwillingness to change (economic).

Environmental performance

The Neste plants produce low-emission biofuels (significant reductions in tailpipe emissions) and have celebrated 10 years of reducing emissions, representing more than 33 million tons of traffic emissions reduction. Their renewable diesel also reduces particle, hydrocarbon and nitrogen oxide emissions²⁹.

Neste claims its Renewable Diesel is made from 100% renewable raw materials which achieve between **50% to a 90% reduction in greenhouse gas emissions** over its lifecycle compared to conventional fossil diesel³⁰.

In terms of the RED II targets, if produced with no net carbon emissions from land use change, default value for greenhouse gas emissions saving from waste cooking oil biodiesel is 84%.

Neste procures 36% of palm oil from mills with methane recovery systems or systems to prevent its formation. In 2017, it verified a 50% methane emission reduction from application of a belt filter press at palm oil mills³¹.

According to RED II targets, pure vegetable oil made from palm oil (with a process with methane capture at oil mill) produces a default value of 57.2 g CO₂eq/MJ as total greenhouse gas emissions for cultivation, processing, transport and distribution.

Economic performance

Neste has invested approximately €1.5 billion in the renewable fuels production capacity in order to produce altogether some 2.7 million tonnes of renewables annually, which are suitable for high concentrations or even standalone products in all diesel engines, and have no special requirements for vehicles in terms of climates and storage³².

The commercial Neste plants in Porvoo and Rotterdam produce **200,000 tonnes a year and 1,000,000 tonnes a year of biodiesel**, respectively, from various vegetable oils and waste streams.

According to Eurostat Shares of Renewables, Finland's share of compliant biofuels in transport in 2017 was 390ktoe. Without being adjusted for plant downtime or export/use in other countries, **the Porvoo plant production represents 171ktoe, almost half of the national share.** (total production in tonnes per year is multiplied by energy content [36 MJ/kg] of biodiesel of biomass origin cited in RED II).

²⁸ <https://www.neste.us/about-neste/who-we-are/production/finnish-refineries/porvoo>, Last Visited on [23/12/2019]

²⁹ <https://www.neste.com/what-difference-between-renewable-diesel-and-traditional-biodiesel-if-any>, Last Visited on [12/03/2019]

³⁰ <https://www.neste.com/companies/products/renewable-fuels>, Last Visited on [12/03/2019]

³¹ <https://www.neste.com/neste-lead-project-verified-50-methane-emission-reduction-palm-oil-mills>, Last Visited on [12/03/2019]

³² <https://www.neste.com/what-difference-between-renewable-diesel-and-traditional-biodiesel-if-any>, Last Visited on [12/03/2019]

According to Eurostat Shares of Renewables, Netherlands's share of compliant biofuels in transport in 2017 was 303ktoe. Without being adjusted for plant downtime or export/use in other countries, **the Rotterdam plant production represents 859ktoe, almost triple the national share** (total production in tonnes per year is multiplied by energy content [36 MJ/kg] of biodiesel of biomass origin cited in RED II).

According to ICIS, EU fuel prices for FAME (fatty acid methyl ether) in January 2019 ranged between €737-754/tonne FOB Rotterdam³³. The Neste Porvoo plant production represents a **gross added value of approximately €149 million (FOB) Rotterdam per year in fatty acid methyl ester terms**, while the Rotterdam plant represents a **gross added value of approximately €746 million (FOB) Rotterdam per year in fatty acid methyl ester terms**.

Social performance

According to IRENA, there are 2,900 direct and indirect jobs in the liquid biofuels industry in Finland and 25,400 in the solid biomass renewable energy sector. The Porvoo refinery is situated in the Kilpilahti industrial area which **employs approximately 1900 workers**³⁴. This represents almost **half of the national sector total**.

The Rotterdam refinery is located in the largest port of Europe, which is a major hub for trade, employment and partnership opportunities.

According to IRENA, there are 400 direct and indirect jobs in the liquid biofuels sector of the Netherlands.

The UPM plant in Lappeenranta, Finland

The UPM plant utilises crude tall oil which it extracts initially within the pulp and paper mill production process and converts it into biodiesel and naphtha through a hydrotreatment process. UPM Lappeenranta is co-located with an industrial pulp and paper mill plant and benefits from strong feedstock sourcing thanks to managed nurseries, research and development, and trained forestry staff³⁵. This gives UPM the opportunity to overcome the following barriers elicited from the stakeholder consultation: difficulties in mobilising various feedstocks, from remote regions (technical), high pre-treatment storage and transportation costs and unavailability of investments necessary for feedstock harvesting (economic).

Environmental performance

UPM BioVerno diesel tests publish results of tailpipe emissions (particle mass, hydrocarbon, carbon dioxide, nitrogen dioxide and carbon monoxide) as reduced by up to dozens of per cent compared to conventional diesel fuel. The wood-based fuel was tested on a dredging

³³ Europe biodiesel prices mixed on seasonality, January 25th 2019, *ICIS NEWS*, <https://www.icis.com/explore/resources/news/2019/01/25/10311198/europe-biodiesel-prices-mixed-on-seasonality/>

³⁴ <https://www.neste.com/porvoo-refinery>

³⁵ <https://www.upm.com/responsibility/forests/our-forests/>, Last Visited on [23/12/2019]

vessel (maritime) as a 50% biofuel blend which represented a reduction of 600 tonnes in carbon dioxide emissions for the 6 months duration of the project. **UPM reports up to 80% lower greenhouse gas emissions than fossil diesel for both of its renewable biofuels**³⁶. Crude Tall Oil is part of Annex IX, part A and therefore classified by the European institutions as residue and eligible for double-counting and is part of the sub-target for advanced biofuels. The use of crude tall oil in biofuel production does not increase wood usage and has been awarded with RSB (Roundtable on Sustainable Biomaterials) low iLUC (indirect land use change) risk certification³⁷. According to RED II targets, if produced with no net carbon emissions from land use change, default value for greenhouse gas emissions saving Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill is 89%. Additionally, a bonus of 29 g CO₂eq/MJ shall be attributed if evidence is provided that the land: (a) was not in use for agriculture or any other activity in January 2008; and (b) is severely degraded land, including such land that was formerly in agricultural use. UPM manages 570,000 hectares of forestry land in Finland which are semi-natural boreal forests, however 255,00 hectares in Uruguay have been established on formerly degraded grasslands³⁸, thus earning the RED II carbon capture and consumption reduction bonus.

Economic performance

The commercial plant in Lappeenranta produces **100,000 tonnes per year** (or 120 million litres per year) of biodiesel and bio-naphtha from crude tall oil.

Biodiesel can be blended with fossil diesel or used on its own, and is compatible with vehicle engines and fuel distribution systems. Bio-naphtha can be used as a biocomponent in fossil gasoline.

According to Eurostat Shares of Renewables, Finland's share of compliant biofuels in transport in 2017 was 390ktoe. Not accounting for plant downtime or export/use in other countries, **Lappeenranta's production represents 105ktoe, over a quarter of the national share** (total production in tonnes per year is multiplied by energy content [44 MJ/kg] of hydrotreated oil of biomass origin cited in RED II). According to ICIS, EU fuel prices for FAME (fatty acid methyl ether) in January 2019 ranged between €737-754/tonne FOB Rotterdam³⁹. The UPM Lappeenranta plant production represents a **gross added value of approximately €74 million (FOB) Rotterdam per year in fatty acid methyl ester terms**.

Social performance

The UPM Lappeenranta plant employs **250 direct and indirect employees**⁴⁰.

³⁶ <https://www.upmbiofuels.com/products/upm-bioverno-diesel/>, Last Visited on [12/03/2019]

³⁷ Peters, D & Stojcheva V. (2014) Crude tall oil low ILUC risk assessment: Comparing global supply and demand, *Ecofys by order of UPM*, <https://www.upmbiofuels.com/siteassets/documents/other-publications/ecofys-crude-tall-oil-low-iluc-risk-assessment-report.pdf>

³⁸ <https://www.upm.com/responsibility/forests/our-forests/>, Last Visited on [12/03/2019]

³⁹ Europe biodiesel prices mixed on seasonality, January 25th 2019, *ICIS NEWS*, <https://www.icis.com/explore/resources/news/2019/01/25/10311198/europe-biodiesel-prices-mixed-on-seasonality/>

⁴⁰ <https://www.upmbiofuels.com/about-upm-biofuels/production/upm-lappeenranta-biorefinery/>, Last Visited on [12/03/2019]

According to IRENA, there are 2,900 direct and indirect jobs in the liquid biofuels industry in Finland. The plant's **share of employment in the national sector total is nearly 9%**. UPM employees and contractors who work along the wood sourcing and forestry chain must be familiar with the UPM Code of Conduct and certification schemes. UPM has its own e-learning platform helping employees to complete the requisite courses.

The Eni Green plant in Venice, Italy

Eni's Green Refinery Project converts vegetable oils, animal fats and greases into hydrocarbon fuels, naphtha and LPG and jet fuel through an eco-finishing process with deoxygenation, isomerization and product separation. This creates the Eni Diesel+ which comes from blending a 15% Green Diesel additive to a fossil diesel fuel.

Environmental performance

As a fuel which is 15 percent renewable (15% biodiesel added to conventional diesel), Eni Diesel **significantly reduces polluting emissions, and cuts unburnt hydrocarbons and carbon monoxide by up to 40 per cent**. In addition, a more sustainable production cycle helps to reduce CO₂ emissions by an average of 5 per cent⁴¹.

According to RED II targets, if produced with no net carbon emissions from land use change, default value for greenhouse gas emissions saving from waste cooking oil biodiesel is 84% and hydrotreated oil from waste cooking oil is 83%.

The Green Diesel formulation allows for improved detergency of the fuel injection system in engines, which provides savings in consumption equal to 800km for every 20,000⁴².

Economic performance

The Eni Green plant is projected to produce more than **420,000 tonnes per year of green diesel** from 11,575 barrels per day of feedstock. By 2021, Eni's Venice biorefinery will be able to process as much as 560,000 tonnes of feedstocks per year, using increasingly used cooking oils, vegetable oils and animal fats.

Green Diesel has higher heating value and energy density than fatty acid methyl ester, a very high cetane number, low aromatics content and can be blended with diesel without any limitation as a biocomponent⁴³.

According to Eurostat Shares of Renewables, Italy's share of compliant biofuels in transport in 2017 was 1,060.3ktoe. Not accounting for plant downtime or export/use in other countries, **the Eni Green plant production represents 441ktoe, which represents almost half of the national share** (total production in tonnes per year is multiplied by energy content [44 MJ/kg] of hydrotreated oil of biomass origin cited in RED II). According to ICIS, EU fuel prices

⁴¹ https://www.eni.com/en_IT/innovation/technological-platforms/bio-refinery/green-diesel.page, Last Visited on [12/03/2019]

⁴² Giammarco Gioco & Corrado Fittavolini: Eni Diesel, *Eni Video Channel*

⁴³ https://www.eni.com/docs/en_IT/enicom/publications-archive/company/operations-strategies/refining-marketing/eni_Green-Refinery_esecutivo.pdf

for FAME (fatty acid methyl ether) in January 2019 ranged between €737-754/tonne FOB Rotterdam⁴⁴. The Eni Green plant production represents a **gross added value of around €313 million (FOB) Rotterdam per year in fatty acid methyl ester terms.**

Social performance

Collaborative relationships have been established between the refinery and the academic community which have allowed several students to write theses on related topics, drawing on the experience and professionalism of the staff and the know-how of the company⁴⁵. According to IRENA, there are 6,500 direct and indirect jobs in the liquid biofuels industry in Italy.

2.2.2. Biochemical plants

I] Pilot Plants

The SEKAB plant in Domsjö, Sweden

The SEKAB plant utilises its own CelluAPP technology to pre-treat feedstock with heat and catalyst, steam explosion, batch enzyme hydrolysis with detoxing technology, separation of sugars, and fermentation with yeast or bacteria for the production of 99% ethanol with a final distillation process. SEKAB's technology is able to process a wide range of raw materials, from wood chips and switchgrass from energy crops to wheat, cottonwoods, corn stover, paper, corn and sugarcane, and extract cellulose, hemicellulose and lignin⁴⁶.

The plant recycles raw material residues to fields, which gives it the opportunity to overcome the following barriers: technical uncertainties regarding input required to turn marginal land types to productive (technical), lack of profitability of dedicated energy crops in relation to current investments for fertilisation and weed control (economic), lack of clarity about environmental constraints (environmental).

Environmental performance

The bioethanol produced at the SEKAB plant minimizes toxicological effects and climate impacts thanks to advanced in-house conversion technology and the use of waste products from forestry and agriculture⁴⁷. Outgoing process water is treated in an anaerobic wastewater

⁴⁴ Europe biodiesel prices mixed on seasonality, January 25th 2019, *ICIS NEWS*, <https://www.icis.com/explore/resources/news/2019/01/25/10311198/europe-biodiesel-prices-mixed-on-seasonality/>

⁴⁵ https://www.eni.com/docs/en_IT/enicom/publications-archive/publications/brochures-booklets/countries/eni_Venezia-ENG.pdf

⁴⁶ <http://www.sekab.com/biorefinery/>, Last Visited on [12/03/2019]

⁴⁷ <http://www.sekab.com/biofuel/>, Last Visited on [12/03/2019]

treatment process. The **chemical plant (both the ethanol plant and cellulose annex) utilises green bioenergy for its process from its lignin production and energy input** in the form of vapour from Övik Energy's biomass-fired power and heating plant, processes **which help contribute to a lower carbon footprint**⁴⁸.

SEKAB plant location allows for economies of scale in transportation as it has access to main railways, maritime and road transportation networks. Integration with a pulp mill of Domsjö Factories means wasted raw material (sulphite lye) is captured and transformed into a viable advanced biofuel instead of discarded in nearby waterways.

Pure ethanol degrades rapidly in the environment and has near-zero particle pollution and low nitrogen oxide emissions⁴⁹.

SEKAB created its own sustainability criteria through the Verified Sustainable Ethanol Initiative and was awarded the Sustainable Bioethanol Award by Green Power Conferences at the World Biofuels Markets Conference in Brussels. Sustainability criteria involves at least 85% reduction of fossil carbon dioxide as compared to petrol and Zero tolerance for the felling of rainforests. It has also obtained the ISO 14001-certificate as a testament to safeguarding its environmental impact⁵⁰.

The RED II targets list sugarcane ethanol a default value for greenhouse gas emissions saving of 70% if produced with no net carbon emissions from land use changes.

Economic performance

The SEKAB plant has been operating for over 50,000 hours and as a **pilot plant produces 3.5 MWh per day of ethanol** from 2 tonnes per day of dry feedstock (representing 10.6 MWh per day). Additionally, it produces by-products of 4 MWh per day of lignin and 1 MWh per day of biogas.

According to Eurostat Shares of Renewables, Sweden's share of compliant biofuels in transport in 2017 was 1,669.7ktoe. Not accounting for plant downtime, **the SEKAB plant ethanol production represented 0.1ktoe**. According to ICIS, EU fuel prices for ethanol in February 2019 ranged between €568-573/cbm FOB⁵¹. The SEKAB plant production represents a **gross added value of around €128,000 (FOB) Rotterdam per year**.

Social performance

Although there are no public figures available for the direct employment at the SEKAB plant, the **company collaborates extensively with research institutes, universities, government agencies, vehicle manufacturers and other companies with the forestry and chemical industries**, as well as forestry and processing industry within the Domsjö industrial area⁵².

⁴⁸ <http://www.sekab.com/sustainability/what-weve-done/plant-for-green-chemical-production/>, Last Visited on [12/032019]

⁴⁹ SEKAB Product Sheet: Premium Pure Technical Ethanol 95%, <http://www.sekab.com/wp-content/uploads/2013/10/Product-Sheet-Technical-ethanol.pdf>

⁵⁰ DNV GL (2016) Management System Certificate ISO 14001:2004, <http://www.sekab.com/wp-content/uploads/2012/11/SEKAB-BioFuels-and-Chemicals-AB.pdf>

⁵¹ EU fuel ethanol price range narrows as supply tightens, imports expected, February 14th 2019, *ICIS NEWS*, <https://www.icis.com/explore/resources/news/2019/02/14/10319052/eu-fuel-ethanol-price-range-narrows-as-supply-tightens-imports-expected/>

⁵² <http://www.sekab.com/about-us/cooperation-partners/>, Last Visited on [24/03/2019]

According to IRENA, there are 7,600 direct and indirect jobs in the liquid biofuels industry in Sweden.

II] Demonstration Plants

The Butamax plant in Hull, UK (closed)

The Butamax joint venture demonstration plant, constructed by BP and DuPont, developed modified genes to expand enzyme conversion of sugar to biobutanol in higher quantities and more efficiently. The combined expertise of BP and DuPont's renowned industrial biotechnology capabilities and partnerships contributed to better prospects for product development and market uptake⁵³, which has the potential to address two highly-ranked economic barriers from the stakeholder consultation: high feedstock and conversion start-up costs.

The Butamax demonstration has proven its technology testing without any barriers reported and the plant has since closed. It has been chosen as a good practice case due to the innovative and successful testing of producing isobutanol, and the significance for the international corporate partnership of BP and DuPont: the commercialisation of bio-isobutanol production within its Kansas facility in the US⁵⁴.

Environmental performance

Feedstocks used included corn, sugarcane, wheat, cellulose and macroalgae.

According to RED II, butanol made from renewable sources yields an energy content of 33 MJ/kg, compared to petrol which is 43 MJ/kg. Butanol is thus closer to gasoline than ethanol is in terms of energy content, thus having a higher potential of replacing fossil fuel energy.

According to Butamax, **bio-isobutanol can displace 16% of every gallon of hydrocarbon gasoline, which means saving 17 billion gallons of gasoline per year** and replacing it with a renewable fuel⁵⁵.

Biobutanol degrades relatively quickly under both aerobic and anaerobic conditions while bioaccumulation in food webs is not expected.

Economic performance

The Butamax demonstration plant was able to convert 0.2-0.3 tonnes per day of unmodified yeast into **0.057-0.068 tonnes per day of isobutanol** in a continuous batch process.

⁵³ <http://www.butamax.com/history.aspx>, Last Visited on [23/12/2019]

⁵⁴ "BP and DuPont joint venture, Butamax®, announces next step in commercialization of bio-isobutanol with acquisition of ethanol facility in Kansas", 2017, *Press Release*, <https://www.bp.com/en/global/corporate/news-and-insights/press-releases/bp-and-dupont-joint-venture.html>, Last Visited on [24/03/2019]

⁵⁵ <http://www.butamax.com/The-Bio-Isobutanol-Advantage/Higher-Value-Biofuel.aspx>, Last Visited on [12/03/2019]

Isobutanol has a higher energy content than ethanol and can be blended with gasoline at higher rates and directly at refineries and transported via existing fuel infrastructure. It does not require flex-fuel vehicle pipes and has about 4 percent less energy density than gasoline⁵⁶. According to Eurostat Shares of Renewables, the United Kingdom's share of compliant biofuels in transport in 2017 was 1,016ktoe.

Social performance

38 experts in technology scale-up and operations were based at the demonstration facility⁵⁷. This does not include the construction personnel needed.

According to IRENA, there are 10,000 direct and indirect jobs in the liquid biofuels industry in the United Kingdom.

The Inbicon plant in Kalundborg, Denmark (idle)

The Inbicon plant has demonstrated two process configurations: one converting wheat straw into second generation bioethanol, lignin and C5 molasses based on C6 fermentation and one based on C5 and C6 fermentation through biomass mechanical conditioning, hydrothermal pre-treatment and pre-enzymatic hydrolysis for continuous liquefaction.

Inbicon was co-located with an industrial plant, which gave it the opportunity to overcome the following barriers: difficulties in mobilising various feedstocks, from remote regions (technical), high pre-treatment storage and transportation costs and unavailability of investments necessary for feedstock harvesting (economic).

The Inbicon plant is currently idle however it was chosen as a good practice because of its location and role within the formation of a rapidly growing network of plants in Kalundborg. Inbicon received straw from Nordisk and Novozymes as an example of this industrial 'symbiosis'. Twelve (12) interconnected companies with 30 different waste streams turned into valuable inputs now populate the area, providing an innovative case for industrial-scale energy efficiency, circularity and emissions reduction⁵⁸. Furthermore, waste bioethanol from the plant was used by the energy company Statoil, which provides used cooling water to the Danish energy company Dong⁵⁹.

Environmental performance

⁵⁶ <http://www.butamax.com/The-Bio-Isobutanol-Advantage/Higher-Value-Biofuel.aspx>, Last Visited on [12/03/2019]

⁵⁷ <http://www.butamax.com/biofuel-technology.aspx>, Last Visited on [12/03/2019]

⁵⁸ Eine Symbiose von Gewinn und Gewissen, 2016, *Neue Zürcher Zeitung*, <https://www.nzz.ch/wirtschaft/wirtschaftspolitik/daenemarks-industrie-cluster-kalundborg-eine-symbiose-von-gewinn-und-gewissen-ld.82293>, Last Visited on [24/03/2019]

⁵⁹ "Circular cities are doing it for themselves", 2017, *Resource Magazine*, <https://resource.co/article/circular-cities-are-doing-it-themselves-11754>, [24/03/2019]

Feedstock used for the Inbicon plant was wheat straw as an agricultural by-product while lignin as a by-product was used as a biofuel to replace coal in power and heat generation. Finally, C5 molasses replaced oil in transportation. Integration of the plant with a power station permits usage of heat energy in the form of steam while the power plant reduces over 25,000 tonnes of CO₂ by using the biofuel and **the plant reported a CO₂ reduction from using all three products of 85%**⁶⁰.

According to RED II targets, if produced with no net carbon emissions from land use change, the default value for greenhouse gas emissions saving from wheat straw ethanol is 83%.

Economic performance

The first demonstration plant was able to produce **13 tonnes per day of ethanol** (plus 30 tonnes per day of lignin and 45 tonnes per day of C5 molasses) with 96 tonnes per day of dry raw material using C6 fermentation. In energy terms this represents **98 MWh/day of ethanol**, 167 MWh/day of lignin and 104 MWh/day of C5 molasses from 386 MWh/d of straw.

The second demonstration produced 4.5 tonnes per day of ethanol (plus 9 tonnes per day of lignin and 7 tonnes per day of C5 molasses) with 24 tonnes per day of dry raw material and using C5 and C6 fermentation. In energy terms this represents 34 MWh/day of ethanol, 50 MWh/day of lignin and 10 MWh/day of C5 molasses from 97 MWh/d of straw.

In 2010, the technology was proven to produce over **5.4 million litres of ethanol per year**, 13,100 tonnes per year of lignin pellets and 11,250 tonnes per year of C5 molasses from 30,000 tonnes of wheat straw⁶¹.

The Inbicon cellulosic ethanol process consumed less energy than it produced in the conversion of biomass, which resulted in energy efficiency and cost reduction for the plant.

According to Eurostat Shares of Renewables, Denmark's share of compliant biofuels in transport in 2017 was 218.4ktoe. Not accounting for plant downtime, **the Inbicon plant ethanol production represented 2.7ktoe** (total production in tonnes per year is multiplied by energy content [21 MJ/l] of ethanol produced from renewable sources cited in RED II).

According to ICIS, EU fuel prices for ethanol in February 2019 ranged between €568-573/cbm FOB⁶². The Inbicon plant production represents a **gross added value of around €3 million (FOB) Rotterdam per year**.

Social performance

30 employees worked at the demonstration plant, while Inbicon as a whole employed approximately 60 employees. As an example of integrated energy efficiency from a partnership, lignin pellets were sent to Dong Energy, which is Denmark's largest energy company transitioning to renewables and has more than 5,000 employees⁶³.

⁶⁰ Persson, M. (2010) Inbicon demonstration plant, *European Biofuels Technology Platform, 3rd Stakeholder Plenary Meeting*, http://www.etipbioenergy.eu/images/Michael_Persson_Inbicon.pdf

⁶¹ http://www.etipbioenergy.eu/images/Michael_Persson_Inbicon.pdf

⁶² EU fuel ethanol price range narrows as supply tightens, imports expected, February 14th 2019, *ICIS NEWS*, <https://www.icis.com/explore/resources/news/2019/02/14/10319052/eu-fuel-ethanol-price-range-narrows-as-supply-tightens-imports-expected/>

⁶³ European Bioethanol Technology Meeting (2010) Inbicon Kalundborg Large Scale Demonstration Plant, <http://www.agfdt.de/loads/bi10/stranabb>

According to IRENA, there are 200 direct and indirect jobs in the liquid biofuels industry in Denmark. The **Inbicon demonstration plant thus represented 15%** of Denmark's liquid bio-fuel sector employment.

III] Commercial Plants

Eni Versalis plant in Crescentino, Italy

The Eni Versalis plant produces cellulosic ethanol, green electricity and biogas from agricultural residues (rice and wheat straw), energy crops (reed, switchgrass and woody crops) and forestry residues through the Proesa technology which handles the pre-treatment of biomass before enzymatic hydrolysis and fermentation.

The plant operates close to its raw material sources and recycles raw material residues to fields. This opens the door to overcome the following barriers from stakeholder consultation: uncertainties regarding input required to turn marginal land types to productive and difficulties in mobilising various feedstocks (technical), lack of profitability of dedicated energy crops in relation to current investments for fertilisation and weed control (economic), lack of clarity about environmental constraints (environmental), and lack of knowledge from farmers (social).

Environmental performance

Wheat straw and giant reed is grown within 70 km of the factory and the plant ensures 100% water recycling, while generating lignin to obtain energy as well as biogas for further energy efficiency⁶⁴.

According to IEA, 20,000 tonnes of ethanol from the **biorefinery saves 72,000 tons of CO₂** through bioethanol production which represents a >70% greenhouse gas reduction compared to gasoline⁶⁵.

According to RED II targets, if produced with no net carbon emissions from land use change, default value for greenhouse gas emissions saving from wheat straw ethanol is 83%. Additionally, the default value for total greenhouse gas emissions for cultivating, processing, transport and distribution of wheat straw ethanol is 15.7gCO₂eq/MJ.

Economic performance

The plant has a capacity of **40,000 tonnes of bioethanol per year** converted from over 200,000 tonnes of biomass⁶⁶.

⁶⁴ Picciotti, P. (2017) GHG savings with 2G Ethanol Industrial Plant, *BetaRenewables*, <https://www.bio.org/sites/default/files/0830AM-Pierluigi%20Picciotti.pdf>

⁶⁵ IEA Bioenergy (2018) Bioenergy Success Stories: Crescentino Biorefinery – PROESA™, Italy, http://www.ieabioenergy.com/wp-content/uploads/2018/02/3-Crescentino-AdvancedEthanolBiorefinery_IT_Final.pdf

⁶⁶ European Biofuels Technology Platform, Biofuel Fact Sheet, Beta Renewables – commercial plant in Crescentino, Italy, http://www.etipbioenergy.eu/images/Factsheet_Beta%20Renewables_final.pdf

According to Eurostat Shares of Renewables, Italy's share of compliant biofuels in transport in 2017 was 1,060.3ktoe. Not accounting for plant downtime or exports to other countries, **the Eni Versalis plant ethanol production represents 25ktoe, which is 2.36% of the national sector total** (total production in tonnes per year is multiplied by energy content [26 MJ/kg] of ethanol produced from renewable sources cited in RED II). According to ICIS, EU fuel prices for ethanol in February 2019 ranged between €568-573/cbm FOB⁶⁷. The Eni Versalis plant production represents a **gross added value of around €29 million per year (FOB) Rotterdam**.

Social performance

Employment at the Eni plant is of approximately 100 direct staff members and generates more than 200 indirect jobs⁶⁸.

According to IRENA, there are 6,500 direct and indirect jobs in the liquid biofuels industry in Italy and 32,600 in the solid biomass renewable energy sector. Thus, a total of 300 direct and indirect jobs generated by **the Eni plant employment represents almost 5% of the national sector total**.

The LanzaTech plant in Ghent, Belgium

The LanzaTech plant process involves biological conversion of carbon to products through gas fermentation in the form of microbes that grow on gases. As such it is able to convert waste gases such as hydrogen and carbon monoxide into bioethanol.

Environmental performance

The process operates close to ambient temperature and atmospheric pressure, resulting in reduced CO₂ emissions and minimizing heating and cooling costs: ethanol produced via recycling waste streams is expected to **reduce emissions by over 80%**⁶⁹. **120,000 tonnes per year of CO₂ reductions were reported for the first phase of the plant**⁷⁰.

The project conducted a life cycle assessment in collaboration with the Roundtable on Sustainable Biomaterials and found a greenhouse gas emissions savings of over 60%.

The application of a microbial gas conversion system significantly advances the carbon capture, storage and utilisation potential.

Economic performance

⁶⁷ EU fuel ethanol price range narrows as supply tightens, imports expected, February 14th 2019, *ICIS NEWS*, <https://www.icis.com/explore/resources/news/2019/02/14/10319052/eu-fuel-ethanol-price-range-narrows-as-supply-tightens-imports-expected/>

⁶⁸ Picciotti, P. (2017) GHG savings with 2G Ethanol Industrial Plant, *BetaRenewables*, <https://www.bio.org/sites/default/files/0830AM-Pierluigi%20Picciotti.pdf>

⁶⁹ Summary of the context and overall objectives of the project, <https://cordis.europa.eu/project/rcn/195267/reporting/en>, Last Visited on [12/03/2019]

⁷⁰ <https://cordis.europa.eu/project/rcn/195267/results/en>, Last Visited on [12/03/2019]

The commercial demonstration facility integrated with a steel plant is expected to produce 143 tonnes per day or **47,000 tonnes per year of bioethanol** from 50,000 Nm³ per hour of waste gases such as hydrogen and carbon monoxide.

The resulting bioethanol will predominantly be used in gasoline blending and can also be further processed into other products such as drop in jet fuel. If scaled for a larger production, the technology can yield a production of 2.5 million tonnes of bioethanol in Europe⁷¹.

According to Eurostat Shares of Renewables, Belgium's share of compliant biofuels in transport in 2017 was 465.1ktoe. Not accounting for plant downtime or export/use in other countries, **the LanzaTech plant production represents 29ktoe, which represents 6% of the national sector share** (total production in tonnes per year is multiplied by energy content [26 MJ/kg] of ethanol produced from renewable sources cited in RED II). According to ICIS, EU fuel prices for ethanol in February 2019 ranged between €568-573/cbm FOB⁷². The LanzaTech plant production represents a **gross added value of around €34 million (FOB) Rotterdam per year**.

Social performance

The new installation created 500 construction jobs over a period of two years while there are between **20 to 30 new permanent direct jobs** at the biorefinery⁷³.

According to IRENA, there are 900 direct and indirect jobs in the liquid biofuels industry in Belgium and 1,000 in the solid biomass renewable energy sector. The amount of permanent jobs generated by **the LanzaTech represents between 2.22% and 3.33% of the national total**.

2.3. Transferability of findings

Plant practices can be transferred elsewhere and either scaled-up or scaled-down depending on logistics, geography, and biomass availability. In this report, replication and scalability (defined here as transferability) at regional, national and international level are ranked as low, medium or high.

⁷¹ <https://ec.europa.eu/inea/en/horizon-2020/projects/h2020-energy/biofuels/steelanol>, Last Visited on [12/03/2019]

⁷² EU fuel ethanol price range narrows as supply tightens, imports expected, February 14th 2019, *ICIS NEWS*, <https://www.icis.com/explore/resources/news/2019/02/14/10319052/eu-fuel-ethanol-price-range-narrows-as-supply-tightens-imports-expected/>

⁷³ "ArcelorMittal and LanzaTech break ground on €150million project to revolutionise blast furnace carbon emissions capture", 2018, <https://corporate.arcelormittal.com/news-and-media/news/2018/june/11-06-2018>, Last Visited on [24/03/2019]

This section provides an overview of initial lessons per key asset and development stage that can be transferred to other regions/ countries. The objective is to help national, regional and local authorities in designing strategies to develop a competitive advanced biofuel sector.

Transferability⁷⁴ in this section is defined as the process in which knowledge about developing and operating a plant is used in the development of other ones in another setting and geographical area.

Table 3 below provides an overview of the main lessons learnt so far from the reviewed advanced biofuel plants, as well as their degree of transferability. Additionally, barriers based on the interviews and consultation with key stakeholders conducted during the period November 2018 to February 2019 are included.

Table 3 Lessons learnt, degree of transferability, examples of good practices in plants they can be related to and barriers which they can help removing

Lessons	Development stage(s)	Supply chain stage	Degree of transferability	Example of good practice in plants	Barriers which lessons learned help to remove
Location close to raw material is a key success factor	Pilot, demonstration, commercial	Feedstock provision	Moderate to high depending on project planning and geographic area	Eni Versalis sources its feedstock within a 70km radius; Empyro sources woody biomass locally	Difficulties in mobilising various feedstocks (technical), Lack of clarity on land availability and environmental constraints (environmental), lack of knowledge from farmers (social)
The scale and nature of supply & logistics is complex; it is therefore very important that local industry and regional feedstock suppliers have strong collaborations	Pilot, demonstration, commercial	Feedstock provision	Moderate to high depending on amounts of feedstock required and the feedstock availability in the region	UPM's Lappeenranta plant obtains its crude tall oil from its pulp and paper mill which sources its feedstock from Finnish forests which it manages through nurseries and trained staff	Difficulties in mobilising various feedstocks (technical), Lack of market transparency across regions (economic), cultural barriers or lack of information about introducing new crops (social), lack of clarity about environmental constraints (environmental)

⁷⁴ PriceWaterhouseCoopers (2011), Regional Biotechnology: Establishing a methodology and performance indicators for assessing bioclusters and bioregions relevant to the KBBE area; via website: <http://ec.europa.eu/research/bioeconomy/pdf/regional-biotech-report.pdf>

Start up financing from the industry creates better prospects for product development and market uptake	Demonstration; commercial	Conversion	High depending on project planning and logistics	Butamax demonstration plant capital and operational formation benefited from a joint partnership between BP and DuPont	Access to project finance (economic); High production cost of RESfuels (economic)
Co-location with larger refinery	Demonstration; commercial	Conversion	Moderate to high depending on project planning and logistics	UPM is co-located with an industrial pulp and paper mill which supplies crude tall oil; Inbicon made use of heat energy generated by co-located coal-fired plant	Difficulties in mobilising various feedstocks, from remote regions (technical), high pre-treatment storage and transportation costs and unavailability of investments necessary for feedstock harvesting (economic)
Strengthen biorefinery concept, application and sustainability through integration and collaborations with neighbouring or partnering companies benefiting from or supplying energy and chemicals	Demonstration; commercial	Conversion End use	Moderate to high depending on project planning and logistics	Neste Porvoo and Rotterdam plants are located in their respective countries' largest port, offering integration and collaboration opportunities with neighbouring companies	Concerns on stability/security of the industry (Regulatory); Manufacturers unwillingness to change (Economic)
Applying energy or nutrient recycling for efficiency and emissions reduction	Pilot, demonstration, commercial	Conversion	High depending on project planning and logistics	SEKAB utilises green bio-energy for its process from its lignin production; Eni Versalis generates lignin to obtain energy as well as biogas for further energy efficiency	Technical uncertainties regarding input required to turn marginal land types to productive (technical), lack of profitability of dedicated energy crops in relation to current investments for fertilisation and weed control (economic), lack of clarity about environmental constraints (environmental)

2.4. Concluding remarks

The work performed has derived important highlights of European advanced biofuel plants as good practice cases, namely how they perform according to environmental, economic and social indicators.

10 (ten) plants, both thermochemical and biochemical, were presented as good practice cases for producing advanced biofuels through innovative conversion pathways, based on a set of environmental, economic and social performance measures. 6 (six) lessons were extracted from the described cases and placed against barriers elicited by stakeholders, as well as ranked in terms of their transferability to other regions. Nine (9) plant practices are included as examples of such lessons, drawing a link between practices and their performances. At the end of this document, in the **Annex** there are individual plant factsheets illustrating their respective value chains and summarising these performance indicators.

3. Good practices in policies

This section provides an overview of Good practices in policy leading to relative success in nurturing the production of RESfuels while committing to the principles of sustainability. The work provides a comparative analysis of their performance across a set of key assets and addresses how this is reflected across the different market development stages. This version of the deliverable focuses on biofuels and advanced biofuels.

The policies analysed in ADVANCEFuel refer to renewable fuel programs and strategies that have good performance in the following key assets:

- i) *Include a mix of policy mechanisms* (regulatory, financing and information provision) which are *integrated across the value chain*,
- ii) *Set ambitious targets* that evolve with market development and address sustainability and
- iii) *Sustain and continuously improve a strong network of key stakeholders* from policy and industry.

3.1. Overview of policy landscape for advanced biofuels

A set of twelve good practices in policy for advanced biofuels are presented in this report. They refer to ten countries (Denmark, Finland, Germany, the Netherlands, Italy, Slovakia, Sweden, United Kingdom, Brazil, Canada), the European Union and the state of California in the US, which have specific policy measures for advanced biofuels within their policy regimes.

Table 5 provides an overview in terms of the policy mechanisms employed and respective special provisions for aviation, marine and heavy-duty road transport.

Policy formation for new innovative market sectors and their sub-segments progresses through three main stages, typically taking a few years to reach maturity. The challenges at the initiation of the market development differ from those during the mature stage. Advanced fuels are a new sector that entails high innovation across the value chain development. Hence it makes sense for the analysis performed in this report to distinguish the phases and analyse the respective operational mechanisms that are in place for successful market development.

The considered development stages are:

1. Initial market development: Introducing advanced biofuels in transport, fuel and/ or energy policy for RESFuels.
2. Early markets: Advanced biofuels are produced and sold to the market. The value chains grow with the addition of new companies, regional infrastructure has improved, and the activities attract both private and public funding.
3. Mature markets: Advanced biofuels are produced at an extensive scale and operate with well-functioning market mechanisms. Policy steers their uptake to sub segments with fewer low carbon alternatives such as aviation, marine and heavy-duty road transport.

The individual policy mechanisms are grouped in regulatory, financing and information provision as described in Table 4 below.

Table 4 Policy mechanisms for advanced biofuels per value chain step, type of policy and market stage development

	Mechanism	Biomass supply	Conversion	End Use
Regulatory	Mandate		Early markets	Mature markets
	Quotas		Mature markets Sustain markets	Sustain markets
	Standards	Mature markets Sustain markets	Mature markets Sustain markets	
	Targets/ Obligations	Mature markets Sustain markets		Mature markets Sustain markets
	Green Procurement			
Financing	Carbon tax			Mature markets Sustain markets
	Subsidies	Early markets	Early markets	
	Carbon/ GHG certificates			Mature markets Sustain markets
	Tax exemptions		Mature markets	
	Research funds	Early markets	Early markets	
Information provision	Strategy		Early markets	Early markets
	Promotion	Early markets	Early markets	Early markets
	Capacity building	Early markets		Early markets
	Networking	Mature markets Sustain markets		Mature markets Sustain markets

Table 5 Policy instruments in the countries analysed

	Regulations					Financing					Information provision							
	Mandate	Quota	Standards	Targets	Green procurement	Carbon tax	Subsidies	Certificates	Tax exemption	Research funds	Strategy	Promotion	Capacity building	Networking	Aviation	Marine	Heavy duty	Development stage
Denmark	X	X	X	X		X	X		X	X	X			X				
Finland	X	X	X	X		X					X				X		X	
Germany	X		X	X		X		X	X		X							
Italy	X	X	X	X			X	X										
Netherlands			X	X				X			X				X		X	
Slovakia	X		X						X									
Sweden		X	X			X			X		X							
United Kingdom	X	X	X	X				X										
European Union	X		X	X							X							
Brazil						X	X				X							
California			X			X					X		X					
Canada			X			X					X		X					

Denmark

Liquid biofuels are exempted from the carbon tax as well as other energy taxes.

The carbon tax is operational in Denmark since 2012 and its 2018 value was equal to €23.2 per ton CO₂e⁷⁵.

From the time the tax started all fuel companies are obliged to have at least 5.75 percent of biofuels in their total annual fuel sales. They are also encouraged by the Danish Energy Agency to use the voluntary certification schemes.

Since 2012, biomethane has received an additional direct premium tariff, which is updated annually. In 2018, the tariff was equal to €0.6 per litre of diesel equivalent when injected into the natural gas grid or to €0.4 per litre of diesel equivalent when sold directly as a transportation fuel⁷⁶.

In 2016 Denmark transposed the EU iLUC Directive and introduced a 0.9% mandate for advanced biofuels starting in 2020⁷⁷. Following, the 2018 Energy Agreement⁷⁸ further disaggregates the strategic aims on widespread electrification for road transport, aiming at a long-term strategy where biofuels will be used mainly in heavy-duty vehicles and in aviation.

The Danish Biofuel Act is to be amended in order to enable mixes with 10 % biofuels by 2020, subject to an analysis of alternative methods of meeting the renewable energy target for transport.

Finland

Finnish policy promotes biofuels as a cost-effective way to reduce CO₂ and acts synergistically to the strong commitment of Finnish industries to low carbon economy and innovation as well as the domestic availability of raw materials.

Early in 2019, the Finnish Parliament approved a law that sets a gradually increasing 30% biofuels target for 2030. Furthermore, the law sets a world-leading advanced biofuel target of 10% in 2030, without double counting.

The Finnish policy framework has a variety of mechanisms that can ensure the successful delivery of the set targets but also efficient monitoring and updates when required. As a result, the country exhibits one of the longest and consistent renewable fuel programs in Europe and worldwide.

⁷⁵ "Carbon Pricing Dashboard", The World Bank, accessed November 8, 2018, https://carbonpricingdashboard.worldbank.org/map_data.

⁷⁶ Danish Energy Agency, "The Danish subsidy scheme for the use of biogas" (2018), https://ens.dk/sites/ens.dk/files/Bioenergi/the_danish_subsidy_scheme_for_the_use_of_biogas_and_current_subsidy_levels.pdf.

⁷⁷ Bekendtgørelse om biobrændstoffers bæredygtighed m.v. (Order on the sustainability of biofuels, etc.), BEK nr. 1044 af 07/09/2017, <https://www.retsinformation.dk/Forms/R0710.aspx?id=192647>.

⁷⁸ "New Danish energy agreement secured: 50 percent of Denmark's energy needs to be met by renewable energy in 2030," State of Green, accessed November 8, 2018, <https://stateofgreen.com/en/partners/state-of-green/news/new-danish-energy-agreement-a-green-focus-towards-2030/>.

There is strong, consistent and continuous collaboration across all governmental bodies that are involved in biomass supply, environmental protection, economy and energy.

Germany

In 2015, Germany moved from an energy mandate to a GHG reduction quota with the goal of achieving a 6% GHG reduction in the transportation fuel mix by 2025. Double-counting towards the mandate stopped. This gives HVO and UCO competitive advantages only based on their higher GHG reduction compared to first generation biofuels⁷⁹.

There is an advanced biofuel mandate and in 2017 legislation introduced a sub-target for advanced biofuels, increasing it from 0.05% of energy used in road and rail transportation (for companies supplying more than 20 PJ of fuels), up to 0.5% for all suppliers by 2025⁸⁰.

Italy

Italy has been the first Member State to mandate the use of advanced biofuels.

The Italian legislation has been consistently supporting biofuels since 2005 with a quota mechanism obliging fossil fuel producers to supply a minimum quota of biofuels annually based on the total amount of fuel supplied. The 2014 amendments⁸¹ established the trajectory from a 5% (2015) biofuel blending quota obligation to 10% in 2020, updating the provision of previous legislation.

The concept of “Advanced biofuels” has been introduced by a ministerial decree and a mandatory quota for “advanced biofuels” has also been introduced (2018 1.2%, 2019 1.2%, 2020 1.6%, 2022 2%).

The 2018 mandate includes an obligation for advanced biofuels starting at 0.6% in 2018 and rising to 1.85% in 2022. This target is further divided 75% must be met with advanced bio-methane and 25% by other advanced biofuels⁸².

In addition to the above, a support scheme has been introduced in March 2018⁸³, under EU State aid rule, dedicated to the production and distribution of advanced biofuels, including advanced methane, for use in the transportation sector. The scheme has an indicative budget of €4.7 billion and runs from 2018 through 2022.

⁷⁹ 37c (2) Federal Act on Protection against Air Pollution (Bundes-Immissionsschutzgesetz) <http://www.gesetze-im-internet.de/bimsg/37c.html>

⁸⁰ https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBL#_bgbl_%2F%2F%5B%40attr_id%3D%27bgbl117s3892.pdf%27%5D_1552823660323

⁸¹ Decreto 10 Ottobre 2014, Aggiornamento delle condizioni, dei criteri e delle modalità di attuazione dell'obbligo di immissione in consumo di biocarburanti compresi quelli avanzati (14A08212). (Updating the conditions, criteria and implementation modalities of the obligation to release biofuels, including advanced ones, for consumption), Gazzetta Ufficiale Serie Generale n.250 del 27-10-2014, http://www.gazzettaufficiale.it/atto/serie_generale/caricaDettaglioAtto/originario?atto.dataPubblicazioneGazzetta=2014-10-27&atto.codiceRedazionale=14A08212&isAnonimo=false&normativi=false&tipoVigenza=originario&tipoSerie=seriegenerale¤tPage=1.

⁸² Giuntoli. 2018. Advanced biofuel policies update in selected Member States: 2018 updates. ICCT policy updates

⁸³ http://europa.eu/rapid/press-release_IP-18-1441_en.htm

Netherlands

In 2018, the Dutch government raised the biofuel mandate to 16.4% by 2020, including double-counting⁸⁴. The country increased the advanced biofuels mandate from 0.6% in 2018 to 1% by 2020. The remaining quota of the mandate is expected to be filled by double-counted biofuels.

Aviation biofuels are not subject to the mandate, but bio-kerosene and bio-naphtha producers can opt in and be eligible to obtain renewable certificates⁸⁵.

The Dutch government signed the country's Climate Agreement in 2017 with the goal of reducing transportation CO₂ emissions by 7.3 million tons by 2030 compared to 1990⁸⁶. It includes a priority to use sustainable biomass for fuels in heavy road transportation, aviation and shipping, while favouring electrification and hydrogen for other transportation modes. Legislation to implement the Climate Agreement is still being discussed⁸⁷.

Slovakia

Slovakia amended its Act no. 309/2009 on Support of Renewable Energy Sources. The amendment no. 181/2017 came into force as of August 1, 2017.

It updated the overall blending percentage and introduced mandates for 2nd generation bio-fuels, as well as targets for 2020 – 2030.

Sweden

Sweden has no mandate for advance biofuels. The main support mechanism for biofuels has been exemptions from its energy and carbon taxes, which apply to fossil fuels⁸⁸. In 2018, the carbon tax was 1150 SEK per ton CO₂ (€109 per ton CO₂)⁸⁹.

⁸⁴ (Decision of 3 May 2018, containing rules relating to the annual obligation for renewable energy transport and the reporting and reduction obligation for transport emissions, for the implementation of Directive (EU) 2015/1513 [...]), Staatsblad, Nr. 134, 17 mei 2018, <http://wetten.overheid.nl/BWBR0041050/2018-07-01>

⁸⁵ Dutch Emissions Authority, "Brandstoffen in het REV – Augustus 2018). (Fuels in the register for transport energy – August 2018)" (2018), <https://www.emissieautoriteit.nl/onderwerpen/register-energie-voervoer/documenten/publicatie/2018/08/14/brandstoffen-in-het-rev---augustus-2018>.

⁸⁶ Official website of the Dutch climate agreement, accessed November 8, 2018, <https://www.klimaatakkoord.nl/>.

⁸⁷ Giuntoli. 2018. Advanced biofuel policies update in selected Member States: 2018 updates. ICCT policy updates

⁸⁸ Susanne Åkerfeldt, "How to design a cost-effective carbon tax on motor fuels and be in line with EU state aid rules," (Ministry of Finance of Sweden, 2017), <https://www.government.se/492fd9/contentassets/18ed243e60ca4b7fa05b36804ec64beb/170925-aakerfeldt-carbon-tax-on-motor-fuels-gcet-tucson.pdf>.

⁸⁹ "CarbonPricingDashboard, The World Bank, https://carbonpricingdashboard.worldbank.org/map_data.

Long term Swedish targets forecast that by 2030, 50% of passenger vehicles could be fuelled by biofuels and 20% by electricity⁹⁰.

United Kingdom

The UK introduced the Renewable Transportation Fuel Obligation (RTFO)⁹¹ in 2008, setting a biofuel mandate that started at 2.6% by volume in 2009 and increased up to 6% in 2018.

The RTFO has a market-based credit trading system. One Renewable Transport Fuel Certificate (RTFC) is allocated for each litre of liquid renewable fuel produced. Renewable fuels produced from specific wastes and other feedstocks listed by the UK government are counted double and awarded two RTFCs for each litre of fuel⁹².

New blend mandate legislation and accompanying policy came into force in the UK on April 15, 2018. This aims to double the use of renewable fuels in the transport sector in the next 15 years.

The 2018 amendment differentiates certificates into three categories of renewable fuels: relevant crop, development fuel, and general RTFCs.

Advanced biofuels are in the category of “development fuels”, have a sub-mandate and each litre is double-counted. A development fuel must be one of the following fuel types: hydrogen, aviation fuel, substitute natural gas (i.e. renewable methane) or a fuel that can be blended to give 25 percent or more renewable fraction in the final blend while still meeting fuel technical and quality standards.

European Union

The climate objectives of the European Union for 2030 include a target for greenhouse gas (GHG) reduction of at least 40% and a minimum of a 32% share of renewable energy consumption across all sectors⁹³. GHG emissions in the European transportation sector have declined by only 3.8% since 2008, compared to an 18% decrease, or more, in all other sectors, indicating that the decarbonization of transportation should be a priority for the future⁹⁴.

⁹⁰ Jacopo Giuntoli, Final recast Renewable Energy Directive for 2021-2030 in the European Union, (ICCT: Washington, DC, 2018), <https://www.theicct.org/publications/final-recast-renewable-energy-directive-2021-2030-european-union>

⁹¹ Department for Transport, “Renewable Transport Fuel Obligation (RTFO) order [Collection 2018]” (2018), <https://www.gov.uk/government/collections/renewable-transport-fuels-obligation-rtfo-orders>.

⁹² Department for transport, “RTFO Guidance – Feedstocks including wastes and residues” (2018), https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/731027/rtfo-guidance-feedstocks-including-wastes-and-residues-year-11.pdf

⁹³ Jacopo Giuntoli, Final recast Renewable Energy Directive for 2021-2030 in the European Union, (ICCT: Washington, DC, 2018), <https://www.theicct.org/publications/final-recast-renewable-energy-directive-2021-2030-european-union>

⁹⁴ EUROSTAT (Greenhouse gas emissions by source sector (env_air_gge), accessed November 2018), <https://ec.europa.eu/eurostat>.

Incentives for biofuels have been in place since 2009, with the Renewable Energy Directive (RED) mandating that by 2020, 10% of energy used in the transportation sector should come from renewable energy sources (RES)⁹⁵. In 2015, the RED was amended by the EU Indirect Land Use Change (ILUC) directive⁹⁶, which introduced a 7% cap on the contribution that conventional food and feed-based biofuels could make to the RES-transport target. The ILUC directive introduced a further a non-binding 0.5% target for advanced biofuels in 2020⁹⁷.

In 2018, the Renewable Energy Directive (REDII)⁹⁸ introduced a 14% RES-transportation energy target and a 3.5% advanced biofuels sub-target by 2030. Conventional food-based biofuels will be capped at each member state's 2020 level with a maximum of 7%. This implicitly creates a minimum 7% target for advanced, non-food-based alternative fuels⁹⁹. Similarly to the 2020 RED, advanced biofuels, as well as biofuels produced from used cooking oil and animal fats, can double-count towards the 14% RES-transport target.

The aviation and maritime sectors are excluded from the obligation, but if, in the future, they opt in, each unit of biofuel will count at 1.2 times toward the target.

Brazil

Brazil has a long history in policy for renewable fuels which started as a mechanism to support domestic production for energy security in the oil crisis of 1970. Since then it has been consistent and coherent with the economic challenges in the country including increased investment to create jobs and income.

The new Brazilian programme, RenovaBio, was introduced in 2017. The programme creates a system that allows the certification of biofuels by measuring the exact contribution of each biofuel producer to greenhouse gas emissions reductions, in relation to their fossil substitute.

The law also creates a decarbonization credit that combines the emissions reduction targets and the live cycle assessment of each biofuel producer. The credits are described as a financial asset that can be traded on a stock exchange. The credits are issued by the biofuel producer following the sale of product. Fuel distributors will meet required targets by acquiring these credits.

⁹⁵ Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC, Official Journal of the European Union, L 140/16, April 23, 2009, <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32009L0028>.

⁹⁶ Directive (EU) 2015/1513 of the European Parliament and of the Council of 9 September 2015 amending Directive 98/70/EC relating to the quality of petrol and diesel fuels and amending Directive 2009/28/EC on the promotion of the use of energy from renewable sources, Official Journal of the European Union, L 239/1, September 15, 2015, <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32015L1513&from=EN>

⁹⁷ Jacopo Giuntoli, Final recast Renewable Energy Directive for 2021-2030 in the European Union, (ICCT: Washington, DC, 2018), <https://www.theicct.org/publications/final-recast-renewable-energy-directive-2021-2030-european-union>

⁹⁸ Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources - Analysis of the final compromise text with a view to agreement, accessed November 2018. https://www.consilium.europa.eu/register/en/content/out?&typ=ENTRY&i=LD&DOC_ID=ST-10308-2018-INIT.

⁹⁹ Jacopo Giuntoli, Final recast Renewable Energy Directive for 2021-2030 in the European Union, (ICCT: Washington, DC, 2018), <https://www.theicct.org/publications/final-recast-renewable-energy-directive-2021-2030-european-union>

California (USA)

The Californian Low Carbon Fuel Standard (LCFS) programme has as primary target to reduce GHG emissions. It has been established in 2009, amended in 2011 and re-adopted 2015 due to legal challenge.

It is fuel neutral, accounts for Life Cycle and ranks fuels with Carbon Intensity (CI) scores according to the greenhouse gas emissions resulting from each fuel's production and consumption.

Flexible-Regulated parties can comply by: i) innovating to reduce the CI of their fuels, ii) buying lower-CI fuels from other producers, or iii) trading credits.

Current exempted fuels and applications are: i) aviation, ocean-going marine, locomotives, military tactical vehicles; ii) propane and other liquefied petroleum gas.

The government considers inclusion of propane, and aviation in 2019. California has also established carbon trading. Credit trading offers valuable flexibility, but it introduces the complexity of overseeing a multimillion-dollar environmental commodity market. 7.0 million credits produced in California's LCFS from Sept. 2016-August 2017. At a \$88/credit, that's \$616 million in credit value created annually. In Dec 2016 alone \$94 million in credits changed hands.

Canada

The Clean Fuel Standard (CFS) is the main legal framework for advanced biofuels. The goal is to reduce 30 Mt of GHGs by 2030 and it will be performance based requiring a percentage reduction in carbon intensity (based on lifecycle analysis).

Unlike a traditional low carbon fuel standard, the CFS will apply to liquid, gaseous and solid fuels used across the transportation, buildings and industrial sectors in Canada – the first of its kind. It will be a non-prescriptive, market-based approach that includes a crediting and trading system aiming to provide maximum flexibility to fuel suppliers.

3.2. Good practice performance in policies

This section describes the good practice performance of the policies included in the analysis. It is based on a preliminary assessment done jointly with the interviewed stakeholders.

This is measured against three key assets:

- i) policy mix which is well integrated in the national policy,
- ii) individual targets for advanced biofuels and special provisions/ strategic considera-

- tions for the use of advanced biofuels in transport market segments with low or limited available alternatives for decarbonization, and
- iii) active stakeholder engagement from industry and policy.

Why a policy mix?

Advanced biofuels form part of the energy products that derive from biomass within the overall biobased economy concept. As such they should be supported with policy frameworks that account for innovation and resource efficiency across the value chain. Individual sector targets which do not account for improved value chain efficiency and cross sector implications have been partly successful and, in many cases, have resulted in conflicts and market imbalances. A balanced approach for future policy formation at all governance levels is to ensure there is an appropriate policy mix that is integrated along the value chain components (biomass supply, conversion, end use).

Integration for developing an advanced biofuel policy framework can be based on a three-pillar approach¹⁰⁰:

- Integration of specific policy mechanisms in the RESfuel value chain components. The mechanisms have been selected, based on benchmarking previous policies and several consultations with national policy makers, so that they can work complementary to enhance resource efficient feedstock uptake and secure supply for efficient conversion technologies.
- Integration of various types of policy mechanisms by combining a set of regulatory, expenditure and information provision policy mechanisms that are applied across value chains and sectors to ensure resource efficient uptake, successful market development and maintenance of existing capacities in the country of analysis.
- Integration of sectorial policy which reflects both the upstream and downstream policies required within specific value chains to ensure both resource and energy efficiency.

The policy mix varies per development stage (see Table 7).

Why individual targets are essential for advanced biofuels and provisions for aviation, marine, heavy-duty?

The sector is relatively new, and most value chains are at pilot and pre-commercial stage. Their scale up and commercialisation implies high investment risks. Without a dedicated and consistent policy in place there industrial and investment confidence is reduced and this results in low market uptake. Future policy should have clarity, quantitative targets and trajectories for advanced biofuels. It should also be in line with the long-term decarbonisation plans that foresee a shift of their use from light duty vehicles to heavy duty vehicles, aviation and marine.

Why stakeholders' engagement and bottom up solutions work best?

¹⁰⁰ Panoutsou, C., Singh, A., Uslu, A., van Stralen, J., Kwant, K., Muisers, J., Pelkmans, L. & N. Devriendt. (2016) Lessons and recommendations for EU and national policy frameworks. Deliverable 4.4. Biomass Policies project.

Stakeholders are critical for the successful market uptake of advanced biofuels. Their active and continuous involvement, consultation and approvals during policy formation, implementation and monitoring is critical for the future of the sector.

The following issues have been examined per key asset:

Policy mix

- number and type of policy mechanisms (regulatory, financing and information provision)
- integration across the value chain (feedstock production, conversion, end use)

Target setting

- specific target for advanced biofuel
- steer and support for aviation, marine and heavy-duty road transport
- adequate sustainability targets

Network of stakeholders from policy and industry

- Information provision mechanisms
- Cross ministerial collaboration
- Industrial engagement

Table 6 illustrates the performance of each country in each of these issues.

In the policy mix category, all countries score high except Slovakia and European Union which have average performance as their policy has only one specific mechanism on advanced biofuels which is still not complemented with other ones across the value chain and this may limit the future market uptake. Italy has an average score in the integration of policy mechanisms across the value chain as well.

With regards to target setting all countries have individual targets for advanced biofuels and include sustainability in their legislation. Except Slovakia, all other countries have specific provisions for market sub-segments as aviation, marine and heavy duty.

Finally, in networking of stakeholders, all countries score high in information provision mechanisms except Slovakia and India that are at the initial market development stage. In terms of cross Ministerial collaboration only Italy, Slovakia, European Union and India have average performance which indicates their cross-sector collaborations at decision making level and is also reflected in the policy integration issue. Industrial engagement scores high across all the countries analysed.

Table 6 Good practice performance for the understudy countries, EU and California

	Denmark	Finland	Germany	Netherlands	Italy	Slovakia	Sweden	United Kingdom	European Union	Brazil	California	Canada
Policy mix												
Number & type	■	■	■	■	■	■	■	■	■	■	■	■
Integration	■	■	■	■	■	■	■	■	■	■	■	■
Target setting												
Advanced biofuels	■	■	■	■	■	■	■	■	■	■	■	■
Aviation, marine, heavy duty	■	■	■	■	■	■	■	■	■	■	■	■
Sustainability	■	■	■	■	■	■	■	■	■	■	■	■
Stakeholders												
Information provision	■	■	■	■	■	■	■	■	■	■	■	■
Cross ministerial	■	■	■	■	■	■	■	■	■	■	■	■
Industrial engagement	■	■	■	■	■	■	■	■	■	■	■	■

Green: high performance; yellow: average performance;

3.4. Transferability of findings

This section provides an overview of initial lessons per key asset and development stage that can be transferred to other regions/ countries. The objective is to help national, regional and local authorities in designing strategies to develop a competitive advanced biofuel sector.

Transferability¹⁰¹ in this analysis is defined as the process in which knowledge about policies in one political and administrative or geographic setting (past and present) is used in the development of policy in another setting and geographical area.

Table 7 below provides an overview of the main lessons learnt so far from policy formation in the field of advanced biofuels. These are based on the interviews and consultation with key stakeholders conducted during the period November 2018 to February 2019.

Table 7 Lessons learnt, degree of transferability, examples of good practice policies they can be related to and barriers which they can help removing.

Lessons	Key asset(s)	Development stage(s)	Degree of transferability	Example of good practice policies	Barriers which lessons learned helps to remove
Strategy and vision should be carefully discussed and analysed with the local community and the industrial actors who are likely to invest in advanced biofuels	Stakeholders	Initial	High since this is one of the first steps in the communication of policy makers and industries in order to agree on the focus of the strategy and introduce relevant policy mechanisms	Denmark has a €67 million plan for sustainable transportation development between 2020 and 2024 and a long-term strategy in place where biofuels will be mainly used in heavy-duty vehicles and aviation, this sends a positive message to the market players and security.	High capital costs, high risk investment and lack of long-term and unstable policy environment makes it difficult for the investors to invest. Difficulty to access the existing support schemes.
Policy must ensure wide acceptance and endorsement of the measures by local stakeholders	Stakeholders	Initial	Low to moderate as public acceptance is subject to change after certain periods of time so the process requires continuous attention, adaptation and communication of consistent messages.	Finnish policy has wide acceptance by the public as there is high awareness of biomass, bioenergy and biofuels.	Lack of policy mechanisms which bridges the gap between conventional and advanced biofuels. Not enough information provisions which raises the awareness and share information about the innovative technologies.

¹⁰¹ PriceWaterhouseCoopers (2011), Regional Biotechnology: Establishing a methodology and performance indicators for assessing bioclusters and bioregions relevant to the KBBE area; via website: <http://ec.europa.eu/research/bioeconomy/pdf/regional-biotech-report.pdf>

Quota have been a successful measure for the increase of the overall biofuels share in transport	Policy mix Target setting	Initial Early	High since this is one of the most applied mechanism in the biofuels sector and it has led to high market uptake	Obligatory biofuel quota system with tradable or non-tradable green certificates. DE, FI, DK, IT, SK, NL and UK.	Lack of dedicated policy support to promote biofuel share among all renewable sources.
Set up mechanisms to attract capital	Policy mix	Early	Low to moderate as it is strongly reliant to the economic situation and competitiveness of individual countries and regions as well as investment environment	Investment subsidies and support schemes. DK has subsidy schemes. NL has subsidy programmes targeted for market players and producers like IBB for innovative Biofuels and TAB for installing filling stations.	Lack of policy support to provide security for the industry
Policy must account for the local context under which the measures would be best suited and fit to local needs and infrastructures	Policy mix Target setting	Initial Early Mature	Moderate as local context is subject to many socio-political forces through time so careful planning and monitoring systems must be in place to ensure the successful longevity of a certain sectorial policy.	UK started a 'development fuels' mandate to promote the feedstocks which can contribute in second generation advanced biofuels. SK has legislative measures to promote the woody biomass resources from both agricultural and forestry sector. DE expired their double counting but increased their GHG mandate in 2014 to make more competitive environment for advanced biofuels.	Lack of harmonised regulations on sustainable farming practices for residual biomass, dedicated energy crops and forest management practices Lack of harmonised regulations throughout EU concerning fuel taxes, biofuel tax reductions, obligation systems, RESFuel Blends and fuel standards
Taxation of fossil fuels is considered a strong indirect support measure for the uptake of biofuels	Policy mix	Early Mature	Moderate as it depends on the overall taxation system and whether there is already a suitable mechanism from which advanced biofuels can be exempted	Energy and CO2 tax reduction mechanisms in place to subsidise the advanced biofuels compared to fossil fuels. SE, SK, DK, NL, FI and DE	Lack of policy mechanisms to make RES more competitive compared to the fossil fuels.
Tailored financing support allows for innovative and high efficiency technologies to be implemented.	Policy mix	Early Mature	Low to moderate as it is strongly reliant to the economic situation and competitiveness of individual	NL has training and certification facilities for new innovative technologies under their Clean and Efficient Strategy.	Lack of policy support to provide stability and security for the industry.

			countries and region and investment environment		
Policy should ensure long term consistency and high clarity of strategic messages	Policy mix Target setting	Mature	Moderate as long term policies are quite hard to implement and maintain; they require strong commitment from governments, regional authorities and administrative bodies.	All countries under study here have target set for the share of RES in transport sector in line with EU RES-T target. Some of the countries like NL, It, DE, DK, SK have national mandate for advanced fuel share by 2020 and 2030	Lack of harmonised policy support with dedicated targets for each sector.
Secure business commitment from industries	Stakeholders	Mature	Moderate as long term commitment requires economic and political stability, trust from investors and funding bodies as well as good success stories with high replication potential.	Finland and Sweden have a long collaboration with their advanced biofuel industries.	Lack of policy support to provide stability and security for the industry.

3.5. Concluding remarks

The work performed within ADVANCEFUEL has derived important highlights for future policy formation to support RESFuels market uptake.

All policies reviewed for the work under the task 5.2, show that the respective countries and regions are actively implementing sustainability provisions and have national mandates and targets in place to support the growth of advanced biofuels. However, their market shares are at different scale and countries need to introduce new financial and provisional measures to build and sustain their national capacity. This can be achieved by introducing tailored financial incentives to facilitate market uptake and provide security for industry and business investments.

Future policy agendas must be developed considering the development stage of the national markets as well as the existing and planned operational capacities.

The main remarks are summarised below:

- At initial market development, targets and policy must be discussed with all stakeholders and ensure wide acceptance and endorsement.
- At early market stage, all relevant policy mechanisms and tailored financing should be tailored to fit the national value chains and available infrastructures.
- At mature development stage, policy should ensure long term consistency, provide high clarity of strategic messages and secure long-term industrial commitment.

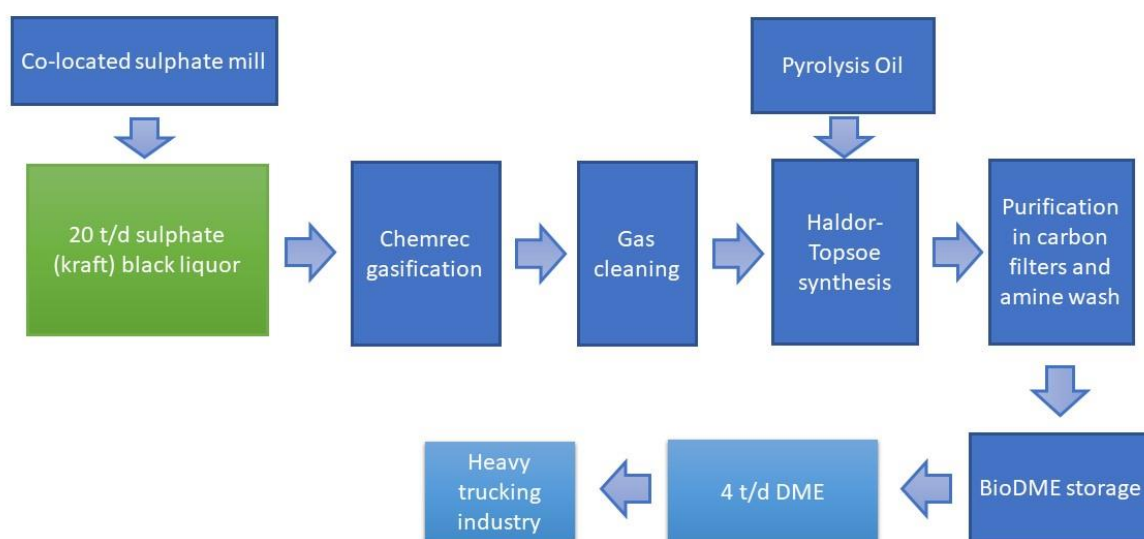
Annex I – Individual plant factsheets

BioDME

Thermochemical Pilot Plant Factsheet

Plant Description: The BioDME plant in Piteå, Sweden, converts sulphate (kraft) black liquor from a nearby sulphate mill into methanol and dimethylether (DME) through the Chemrec engineered gasification and Haldor-Topsoe syngas technology with pyrolysis oil. It is able to produce 4 tons per day with an investment cost of €20 million for the construction of the plant. DME has similar properties as LPG with very low particle emissions and has been tested a on 10 different Volvo trucks.

BioDME Piteå Value Chain



Environmental, Economic and Social Performance

- DME from black liquor produces 1 g CO₂ eq/km for around 275 MJ/100 km compared to conventional fuels with around 150 g CO₂ eq/km for 200 MJ/100km
- Field tests indicate fuel with good environmental properties, low PM matter and absence of soot
- Operational capacity of the pilot plant was 3MW which represents 20 tonnes of dry black liquor per day to produce 1.8MW of syngas and is now producing 4 tonnes of DME per day
- 19 full-time staff members as researchers and technicians at the plant

Environmental



Economic



Social



RED/National Indicators

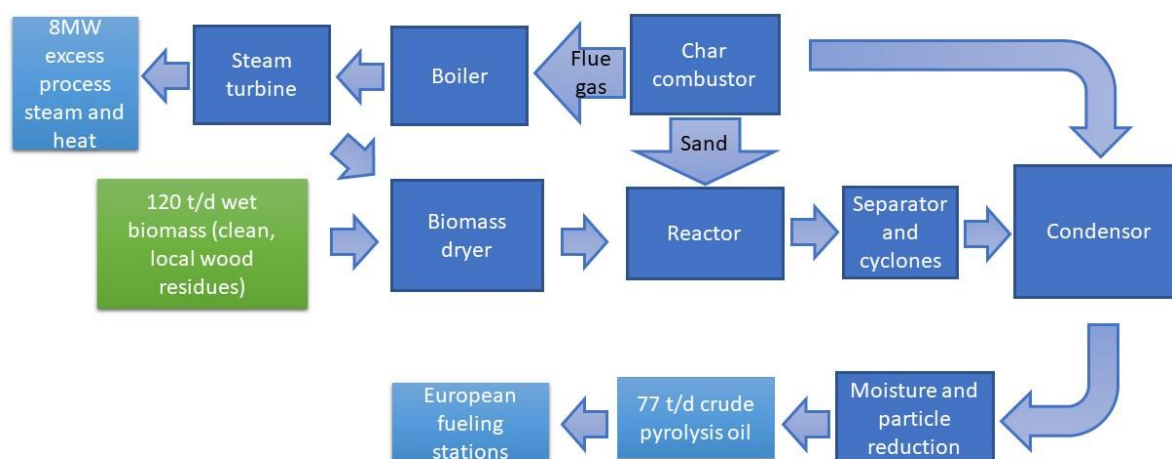
- According to RED II targets, dimethylether (DME) from black-liquor gasification integrated with pulp mill should reduce CO₂ emissions by 89%
- According to IRENA, installed capacity in 2017 for liquid biofuels in Sweden was 515.000 MW
- Sweden produces 7,600 direct and indirect jobs in the liquid biofuels industry

Empyro

Thermochemical Demonstration Plant Factsheet

Plant Description: The Empyro plant in Hengelo, Netherlands, converts wood residues into crude pyrolysis oil through liquid pyrolysis, oil being the main product and pyrolysis gases are used to generate additional steam and power. The end product is designed to be compatible with diesel and gasoline.

Empyro Hengelo Value Chain



Environmental, Economic and Social Performance

- The plant uses clean woody biomass from local sources recycles extracted minerals back into soil
- Total emissions from production while using forest residues amount to 8.70 g CO₂-eq/MJ pyrolysis oil, when placed against fossil fuel comparators, this figure represents an emissions savings of 90.4% when replacing electricity
- The demonstration/commercial plant operates at a capacity of 120 tonnes per day of clean wood residues to produce 77 tonnes per day of crude pyrolysis oil, as well as 8MW of by-product
- The project creates approximately 100 person-years of work

Environmental



Economic



Social



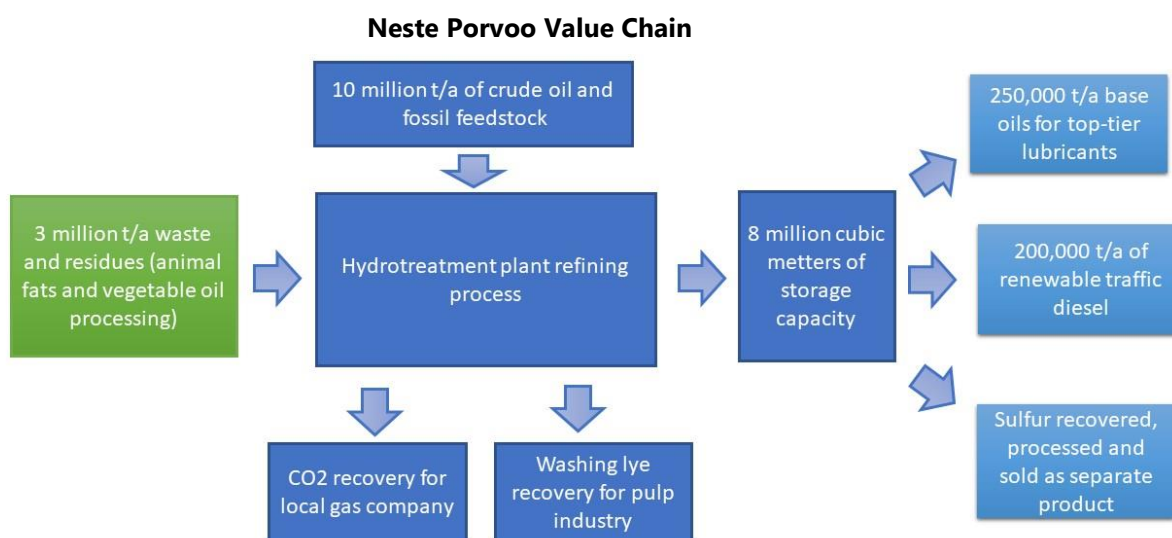
RED/National Indicators

- According to the RED II targets, greenhouse gas emissions saving from waste wood Fischer-Tropsch diesel in free-standing plant is 85%
- According to Eurostat Shares of Renewables, the Netherlands' share of compliant biofuels in transport in 2017 was 303 ktOE
- The Netherlands produces 400 direct and indirect jobs in the liquid biofuels industry

Neste

Thermochemical Commercial Plant Factsheet

Plant Description: The Neste Porvoo, Finland, and Rotterdam, Netherlands, plants convert various vegetable oils and waste streams into renewable biodiesel through hydrogenated vegetable oil processing.



Environmental, Economic and Social Performance

- Neste states that its Renewable Diesel is made from 100% renewable raw materials which achieve between up to a 50 to a 90% reduction in greenhouse gas emissions over its lifecycle compared to conventional fossil diesel
- The commercial Neste plants in Porvoo and Rotterdam produce 200,000 tonnes a year and 1,000,000 tonnes a year of biodiesel, respectively, from various vegetable oils and waste streams
- Both refineries are situated in industrial port areas which employ thousands and benefit collaborations and partnerships within the renewable energy sector

Environmental



Economic



Social



RED/National Indicators

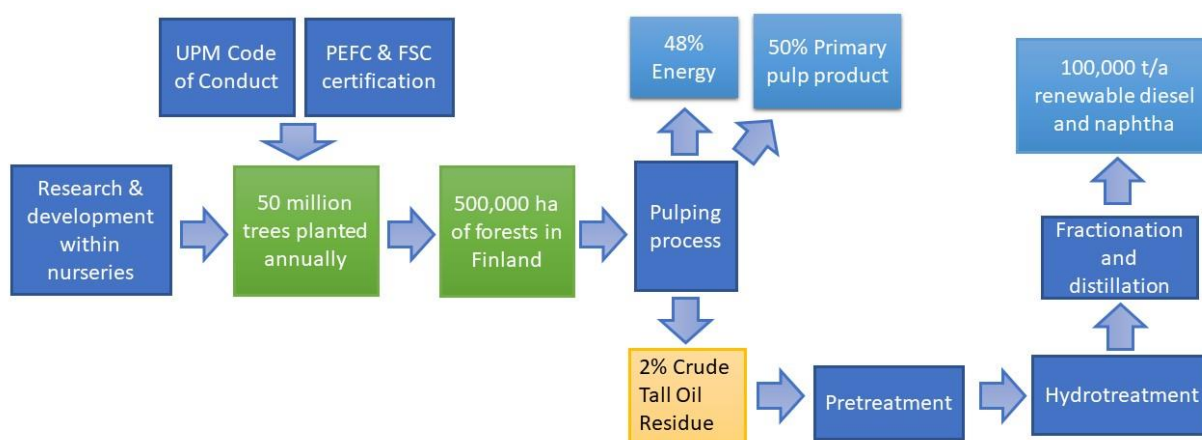
- According to the RED II targets, greenhouse gas emissions saving from waste cooking oil biodiesel is 84% and pure vegetable oil from palm oil (with a process with methane capture at oil mill) has a default value of 57.2 g CO₂eq/MJ for total CO₂ emissions
- According to Eurostat Shares of Renewables, Finland's share of compliant biofuels in transport in 2017 was 390 ktoe, while the Netherlands' was 303 ktoe
- Finland produces 2,900 direct and indirect jobs in the liquid biofuels industry, while the Netherlands produces 400

UPM

Thermochemical Commercial Plant Factsheet

Plant Description: UPM's biorefinery in Lappeenranta, Finland, produces 100,000 tonnes per year of renewable diesel and renewable naphtha, both drop-in fuels compatible within the existing European distribution network and without any limits to blending with either diesel or gasoline, respectively. The production pathway of these advanced biofuels is possible because of the plant's co-location with a pulp and paper mill factory, which produces a certain surplus amount of crude tall oil. The plant is at a commercial development stage thanks to a financing of €179 million and has been in operation for more than 10,000 hours.

UPM Lappeenranta Value Chain



Environmental, Economic and Social Performance

- 80% lower GHG emissions than fossil diesel
- Tailpipe emissions reduced by up to dozens of percent compared to conventional diesel fuel
- 50% biofuel blend in dredging vessel (maritime) yields a reduction of 600 tonnes in CO₂
- 255,00 hectares in Uruguay have been established on formerly degraded grasslands
- Operational capacity of 100,00 tonnes per annum of renewable diesel and renewable naphtha to be dropped-in or blended
- UPM Lappeenranta employs 250 direct and indirect employees

Environmental



Economic



Social



RED/National Indicators

- According to Renewable Energy Directive targets, default value for greenhouse gas emissions saving Fischer-Tropsch diesel from black-liquor gasification integrated with pulp mill is 89%
- Additionally, a bonus of 29 g CO₂eq/MJ is attributed when land was severely degraded land
- According to Eurostat Shares of Renewables, Finland's share of compliant biofuels in transport in 2017 was 390 ktoe
- Finland produces 2,900 direct and indirect jobs in the liquid biofuels industry

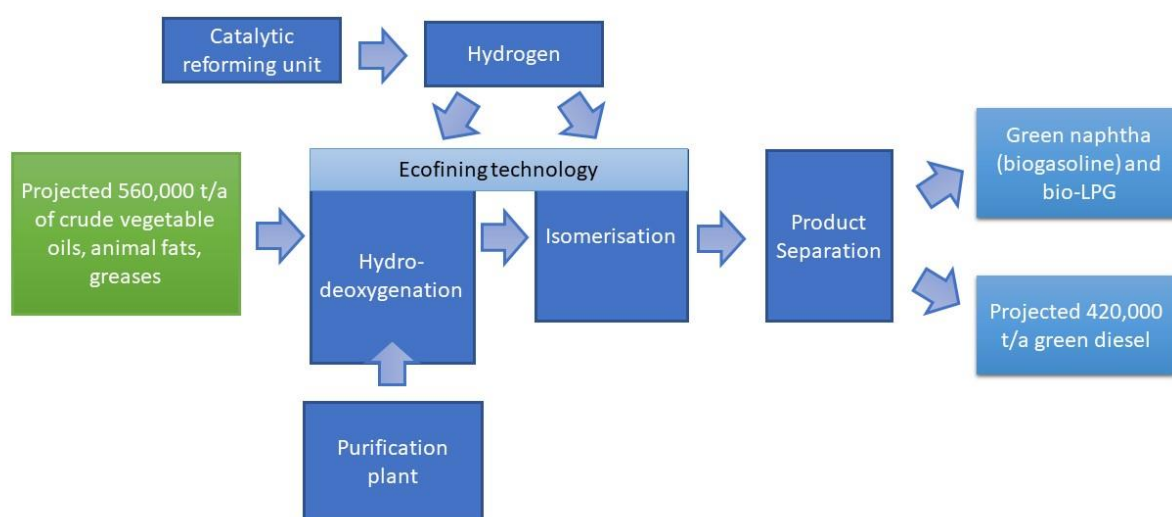


Eni Green Refinery

Thermochemical Commercial Plant Factsheet

Plant Description: Eni's Green Refinery Project in Venice, Italy, converts vegetable oils, animal fats and greases into hydrocarbon fuels, naphtha and LPG and jet fuel through an ecofining process which involves deoxygenation, isomerization and product separation. The produced green diesel is of high-quality, free of aromatic compounds and high cetane levels which makes it entirely compatible with diesel.

Eni Green Value Chain



Environmental, Economic and Social Performance

- Eni Diesel is 15 percent more renewable than regular diesel, and cuts unburnt hydrocarbons and carbon monoxide by up to 40 per cent.
- Production cycle helps to reduce CO₂ emissions by an average of 5 per cent
- The Eni Venice Green plant is projected to produce more than 420,000 tonnes per year of green diesel amount from 11,575 barrels per day of feedstock
- Eni Green Project has established collaborations with the academic community including the sponsorship of masters and PhD theses

Environmental



Economic



Social



RED/National Indicators

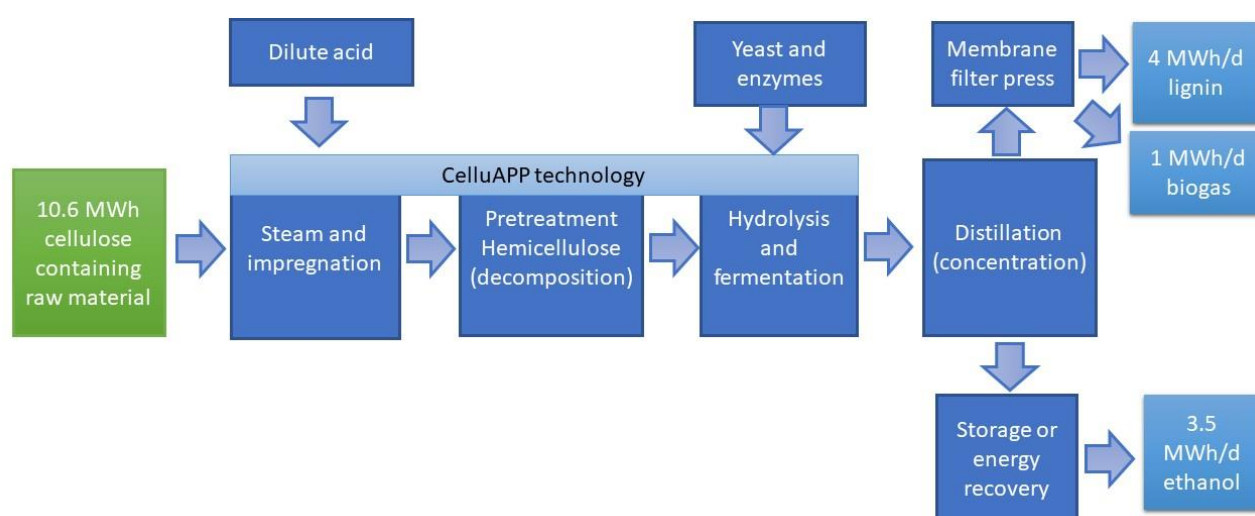
- According to RED II targets, if produced with no net carbon emissions from land use change, default value for greenhouse gas emissions saving from waste cooking oil biodiesel is 84% and hydrotreated oil from waste cooking oil is 83%
- According to Eurostat Shares of Renewables, Italy's share of compliant biofuels in transport in 2017 was 1,060 ktoe
- Italy produces 6,500 direct and indirect jobs in the liquid biofuels industry

SEKAB

Biochemical Pilot Plant Factsheet

Plant Description: The SEKAB plant in Domsjö, Sweden, utilises its own CelluAPP technology to pretreat feedstock with heat and catalyst, steam explosion, batch enzyme hydrolysis with de-toxing technology, separation of sugars, and fermentation with yeast or bacteria for the production of 99% ethanol with a final distillation process.

SEKAB Domsjö Value Chain



Environmental, Economic and Social Performance

- Pure ethanol represents a greenhouse gas emissions reduction of 87% compared to sugarcane-based ethanol and has near-zero particle pollution and low nitrogen oxide emissions
- SEKAB's own sustainability criteria involves at least 85% reduction of fossil carbon dioxide as compared to petrol and zero tolerance for the felling of rainforests
- The SEKAB plant produces 3.5 MWh per day of ethanol from 2 tonnes per day of dry feedstock.
- Additionally it produces by-products of 4 MWh per day of lignin and 1 MWh per day of biogas
- Extensive collaborations with research institutes, universities, government agencies, vehicle manufacturers and other companies with the forestry and chemical industries, as well as forestry and processing industry

Environmental



Economic



Social



RED/National Indicators

- According to RED II targets, default value for greenhouse gas emissions saving from sugarcane ethanol is 70%
- According to IRENA, installed capacity in 2017 for liquid biofuels in Sweden was 515.000 MW
- Sweden produces 7,600 direct and indirect jobs in the liquid biofuels industry

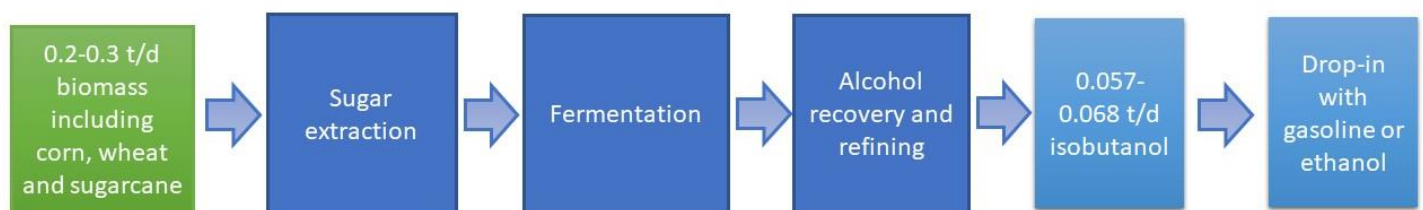


Butamax

Biochemical Demonstration Plant Factsheet

Plant Description: The Butamax joint venture pilot demonstration plant in Hull, UK, constructed by BP and DuPont, developed modified genes to expand enzyme conversion of sugar to biobutanol in higher quantities and less time, producing

Butamax Hull Value Chain



Environmental, Economic and Social Performance

- Total CO₂ reduction from using bioethanol, lignin and C5 molasses is 85%
- Integration of the plant with a power station permits usage of heat energy in the form of steam while the power plant reduces over 25,000 tonnes of CO₂ by using the biofuel
- The Inbicon plant produces a total of 5.4 million litres per annum of ethanol from 30,000 tonnes per annum of feedstock
- Additionally it produces 11,250 tonnes per annum of C5 molasses and 13,100 tonnes per annum of lignin
- 30 employees at the plant and 60 employed at Inbicon

Environmental



Economic



Social



RED/National Indicators

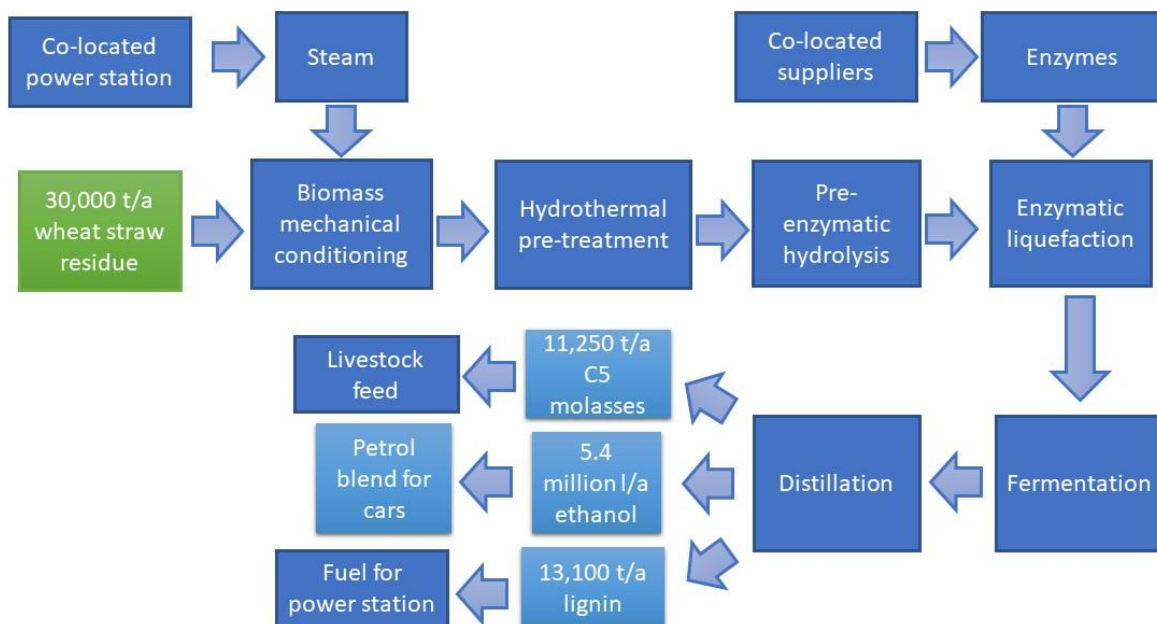
- According to RED II targets, default value for greenhouse gas emissions saving from wheat straw ethanol is 83%
- According to Eurostat Shares of Renewables, Denmark's share of compliant biofuels in transport in 2017 was 218 ktOE
- Denmark produces 200 direct and indirect jobs in the liquid biofuels industry

Inbicon

Biochemical Demonstration Plant Factsheet

Plant Description: The Inbicon plant in Kalundborg, Denmark, has demonstrated two process configurations: one converting wheat straw into second generation bioethanol, lignin and C5 molasses based on C6 fermentation and one based on C5 and C6 fermentation through biomass mechanical conditioning, hydrothermal pre-treatment and pre-enzymatic hydrolysis for continuous liquefaction.

Inbicon Kalundborg Value Chain



Environmental, Economic and Social Performance

- Total CO₂ reduction from using bioethanol, lignin and C5 molasses is 85%
- Integration of the plant with a power station permits usage of heat energy in the form of steam while the power plant reduces over 25,000 tonnes of CO₂ by using the biofuel
- The Inbicon plant produces a total of 5.4 million litres per annum of ethanol from 30,000 tonnes per annum of feedstock
- Additionally it produces 11,250 tonnes per annum of C5 molasses and 13,100 tonnes per annum of lignin
- 30 employees at the plant and 60 employed at Inbicon

Environmental



Economic



Social



RED/National Indicators

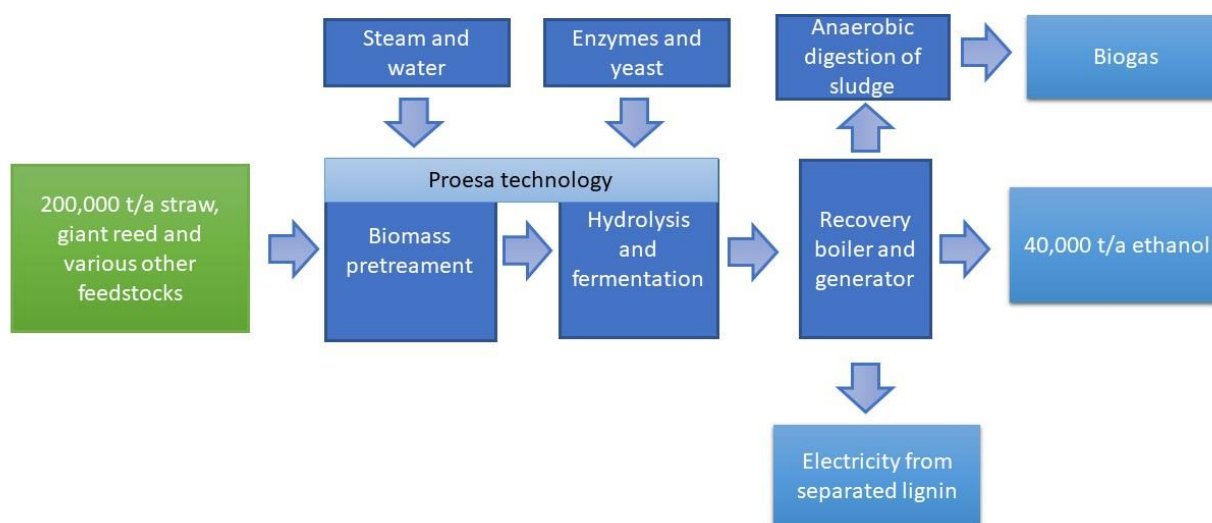
- According to RED II targets, default value for greenhouse gas emissions saving from wheat straw ethanol is 83%
- According to Eurostat Shares of Renewables, Denmark's share of compliant biofuels in transport in 2017 was 218 ktoe
- Denmark produces 200 direct and indirect jobs in the liquid biofuels industry

Eni Versalis

Biochemical Commercial Plant Factsheet

Plant Description: The Eni Versalis plant in Crescentino, Italy, produces cellulosic ethanol, green electricity and biogas from agricultural residues (rice and wheat straw), energy crops (reed, switchgrass and woody crops) and forestry residues through the Proesa technology which handles the pretreatment of biomass before enzymatic hydrolysis and fermentation.

Eni Versalis Crescentino Value Chain



Environmental, Economic and Social Performance

- 20,000 tonnes of ethanol from a biorefinery saves 72,000 tons of CO₂ through bioethanol production which represents a >70% GHG reduction compared to gasoline
- Wheat straw and giant reed grown within 70 km of the factory
- The plant converts over 200,000 tonnes of biomass to produce a capacity of 40,000 tonnes of bioethanol per year
- The Eni Versalis plant generates approximately 100 direct and 200 indirect jobs

Environmental



Economic



Social



RED/National Indicators

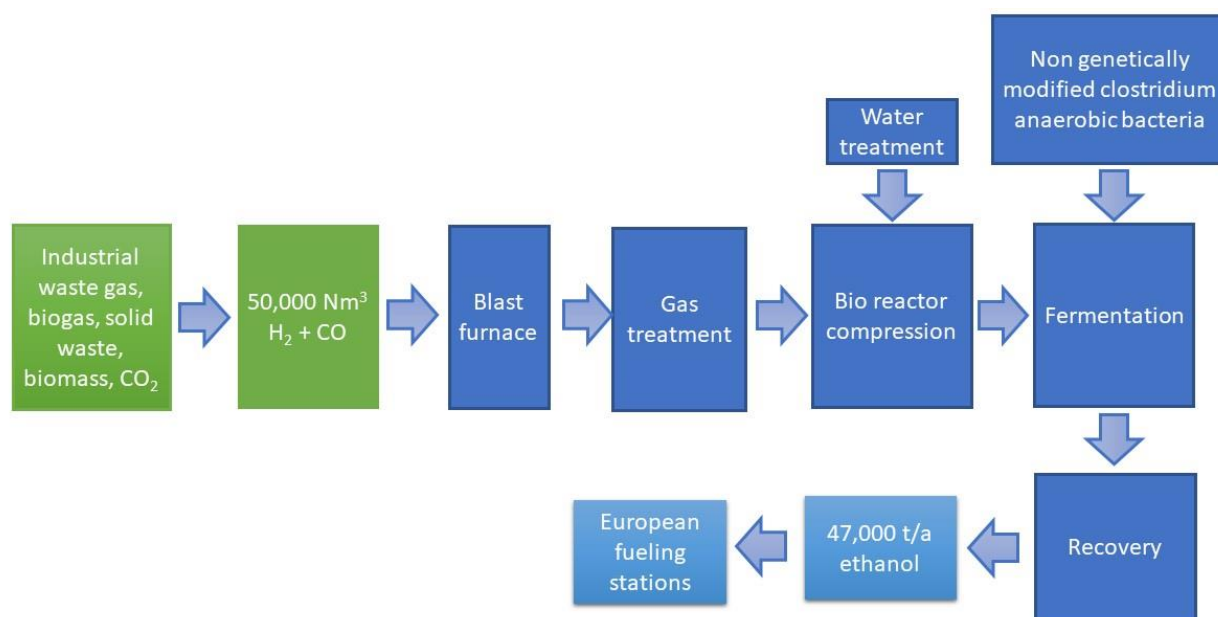
- According to RED II targets, if produced with no net carbon emissions from land use change, default value for greenhouse gas emissions saving from wheat straw ethanol is 83%
- According to Eurostat Shares of Renewables, Italy's share of compliant biofuels in transport in 2017 was 1,060 ktoe
- Italy produces 6,500 direct and indirect jobs in the liquid biofuels industry

Lanzatech

Biochemical Commercial Plant Factsheet

Plant Description: The LanzaTech plant in Ghent, Belgium involves a process of biological conversion of carbon to products through gas fermentation in the form of microbes that grow on gases. As such it is able to convert waste gases such as hydrogen and carbon monoxide into bioethanol, ready for blending with gasoline or drop in jet fuel.

Lanzatech Ghent Value Chain



Environmental, Economic and Social Performance

- 120,000 tonnes per year of CO₂ reductions were reported for the first phase of the plant
- LCA found GHG emissions savings of over 60%
- The commercial demonstration facility integrated with a steel plant is expected to produce 143 tonnes per day, or 47,000 tonnes per annum of bioethanol from 50,000 Nm³ per hour of waste gases including hydrogen and carbon monoxide
- The new installation created 500 construction jobs over a period of two years while there are between 20 to 30 new permanent direct jobs at the biorefinery

Environmental



Economic



Social



RED/National Indicators

- No RED targets specific to converting waste gases into ethanol
- According to Eurostat Shares of Renewables, Belgium's share of compliant biofuels in transport in 2017 was 465 ktoe
- Belgium produces 900 direct and indirect jobs in the liquid biofuels industry

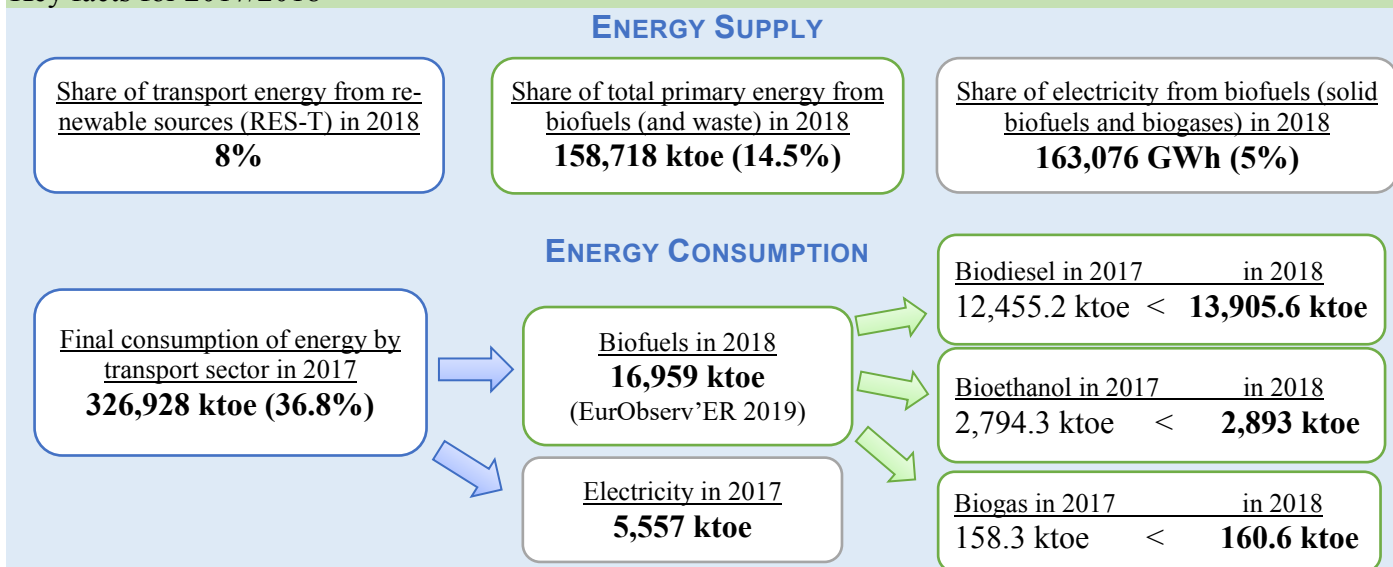
Annex II – Policy and Plant Factsheets (EU-28) – Supplementary country information

EU-28

Policy and Plant Factsheet on Advanced Renewable Fuels

Current State of Affairs:

Key facts for 2017/2018



The 28 Member State-European Union (including the UK) demonstrates significant growth for biofuels in recent years. While these are still dwarfed by oil products in energy consumption, as well as coal, nuclear and natural gas in electricity provision, their supply has been steadily growing, having tripled in less than 20 years. Overall biofuel consumption has increased by more than 1,500 ktoe in one year, the majority of which complies with sustainability requirements defined by the European Commission, with biodiesel largely dominating. Growth in biofuel consumption can be attributable to the increase in quotas and incorporation targets. The transport sector remains the most important in terms of energy consumption.

Targets for renewable energy (RES), climate change mitigation and energy efficiency

TARGETS	2020		2030
RES (renewable energy sources) ¹	20%		32%
GHG emissions reduction (effort sharing) ²			40% (1990 BASE)
Energy efficiency improvement	20%		32.5% (2007 BASE)
Electricity interconnection			15%
RES-T (renewable energy in transport)			14%
Cap on first generation (conventional) biofuels	7%		
Share of advanced biofuels ³	2022	2025	3.5%
	0.2%	1%	

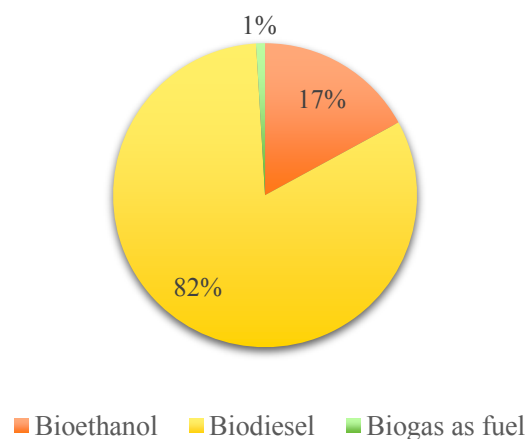
¹ Eleven EU members have already reached their 2020 targets, including Sweden, whose 54.5% rate was the highest in the EU. Luxembourg at 6.4% and the Netherlands at 6.6% were the lowest.

² ETS sectors (energy industries, energy-intensive industrial sectors and aviation) 43% reduction and non-ETS (transport, residential, tertiary, industry not included in the ETS sector, agriculture and waste) 30% compared to 2005

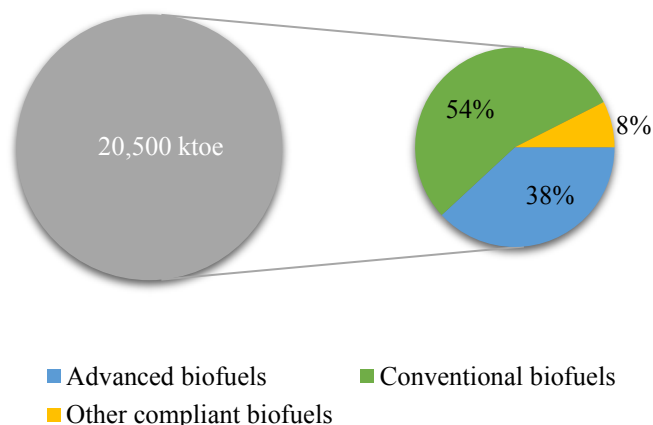
³ Advanced biofuels are defined as liquid or gaseous biofuels made from materials listed in Part A of the Annex IX of the Renewable Energy Directive (2018/2001) and Part B of the Annex IX includes used cooking oil and animal fats (category I and II) and it is subject to a cap at 1.7% of transport energy.



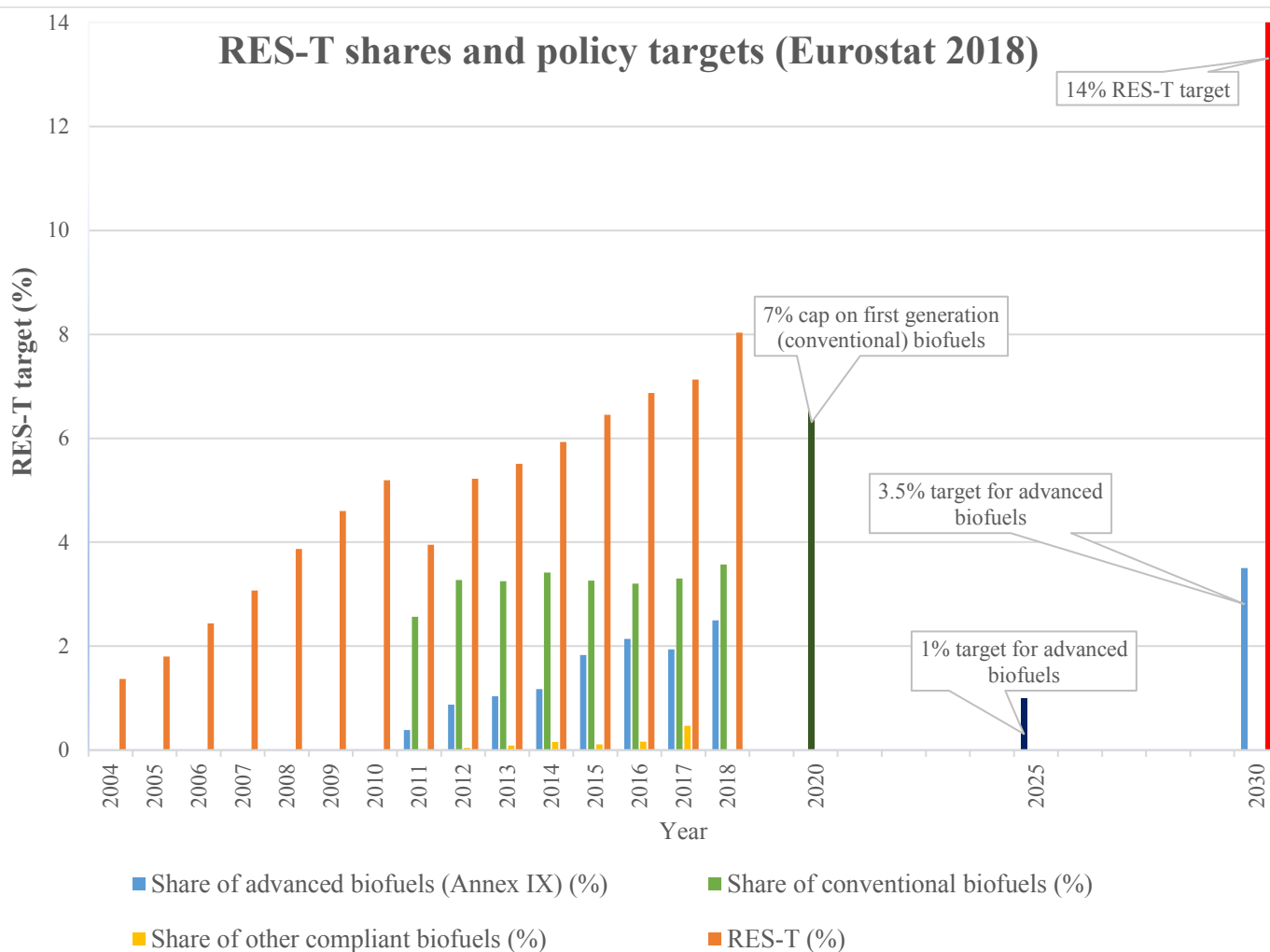
Biofuel consumption share for transport in 2018 (EurObserv'ER 2019)



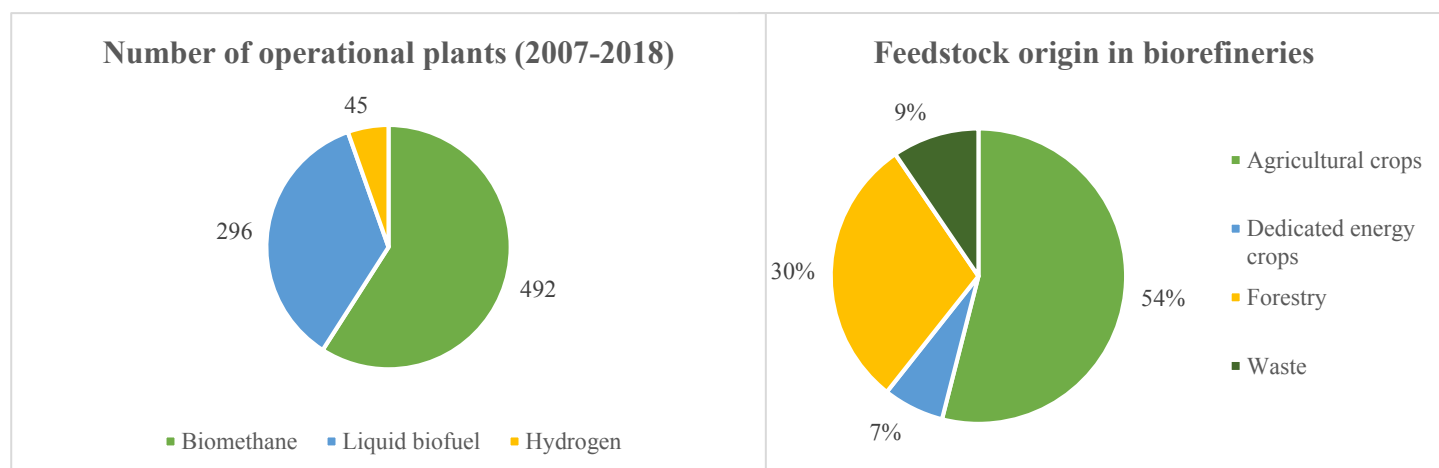
Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



RES-T shares and policy targets (Eurostat 2018)



Number of operational biorefineries and hydrogen production projects between 2007 and 2018⁴



key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁵
Biomass production	Do they address sustainability of feedstock?	- RED II - Forest Law - CAP - LULUCF - Fuel Quality Directive	High
Conversion of feedstock	Do they have financing for innovative conversion technologies?	'Green technology investment programme' supports scale-up companies whose activities are directed towards developing and bringing to market new products, services and technologies for reducing or capturing greenhouse gas emissions. The Climate Change Fund - European Strategic Energy Technology Plan initiatives (the SET plan) - The European Agricultural Fund for Rural Development (EAFRD) - Modernization Fund - Just Transition Fund - Structural Funds - Cohesion Fund	
Distribution and End-use	Do they address specifically advance fuels/ RES fuels?	- Directive 2014/94/EU on the deployment of alternative fuels infrastructure - Directive on renewable energy sources - Renewable Energy Directive (2018/2001)	
Distribution and End-use	Do they include targets for aviation,	- No specific targets - Fuels used in the aviation and maritime sectors are excluded from the 14% obligation but these sectors can opt to contribute to the target.	Low

⁴ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

⁵ High score=Green; Medium Score=Yellow; Low score=red

marine, heavy
duty?

Transport policies and measures supporting the 5 dimensions of the energy union⁶

Sector	Decarbonisation	Energy Efficiency	Energy Security	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission reduction targets from ETS and non-ETS sectors Targets for the share of RES in transport Incentive the purchase of green vehicles Public procurement for greening transport EU Trading System Taxation	Reduction in energy consumption from transport sector by promoting public transports Financial incentives from Energy Efficiency Fund to promote efficient means of transport	Diversification of the RES sources for production of alternative fuels Reduction of imports dependency Phase out fossil based fuels Promote regional cooperation	Improve gas and electricity transmission networks internationally Improve interconnectedness of Trans-European network by building necessary infrastructures		Mobilise funding support to fund the RIC activities which can upscale the pilot stage green technologies.

Biomass policies which support the mobilisation of advance renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP-Rural development Programmes		Regulation of the European Parliament and of the Council on car emission standards	
EU climate targets for 2030			Public Procurement
LULUCF Regulation	Fuel Quality Directive		
Forest Strategy; EU Action Plan for Forest Law; EU Forest Information System Timber Regulation		Biofuel targets; Targets for share of RES; Blending share of bio-diesel and bioethanol	
Emission standards from agriculture and forest management activities		Support for modal share switch- Directive 2014/94/EU on the deployment of alternative fuels infrastructure	
		Urban planning and infrastructure investment to support RES-T share	
Directive on the promotion of the use of energy from renewable sources - Directive on renewable energy sources - including the ILUC amendment (Directive 2009/28/EC as amended by Directive (EU) 2015/1513); □			
Renewable Energy Directive (2018/2001			
EU ETS Directive 2003/87/EC amended by Directive 2004/101/EC (international credits), Directive 2008/101/EC (air transport			
EU Landfill Directive	EU Energy Efficiency Directive		
EU Waste Package	Vehicles Fuel Efficiency Standards EU proposal 2017	EU Emission standards for vehicles	
EU Circular Economy Package		Urban planning and infrastructure investment to minimize transport needs	
Sustainability standards for biomass use in biofuel production		Eco-design Framework Directive Directive on the energy labelling of products	
State Aid for Environmental Protection			
Effort Sharing Decision (annual GHG targets for non-ETS sectors in the period 2012-2030			
		Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA)	
Regulation (EU) 2018/842 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 (ESR)			
Modernisation Fund; Cohesion Fund; Gas Package 2020 (feed-in of renewable gases into the gas grid) ; Clean Energy Package (CEP); Trans-European Transport Network; Inland Waterway Transport Agenda for Europe (2021-2027); Connecting Europe Facility (CEF); Decarbonised electricity in Penta by 2050- The Pentilateral Energy Forum; Roadmap to a single European transport			

area Strategy and MRV on emissions from maritime transport; EU Biofuels strategy; Intermodal Freight Transport; The European Hydrogen and Fuel Cell Technology Platform; Alternative Fuels for Transport European Union; Bioeconomy Strategy

Climate Change Fund; European Strategic Energy Technology Plan initiatives (the SET plan); The European Agricultural Fund for Rural Development (EAFRD); Modernization Fund; Just Transition Fund; Structural Funds; Cohesion Fund



Current State of Affairs⁷:

Key facts for 2017/2018

ENERGY SUPPLY

Share of transport energy from renewable sources (RES-T) in 2018
9.8%

Share of total primary energy from biofuels (and waste) in 2018
6,227 ktoe (19%)

Share of electricity from biofuels (solid biofuels and biogases) in 2018
4,570 GWh (6.7%)

ENERGY CONSUMPTION

Final consumption of energy by transport sector in 2017
8,782 ktoe (32%)

Biofuels in 2018
481 ktoe
(EurObserv'ER 2019)

Biodiesel in 2017 in 2018
411 ktoe < **423 ktoe**

Bioethanol in 2017 in 2018
56 ktoe < **58 ktoe**

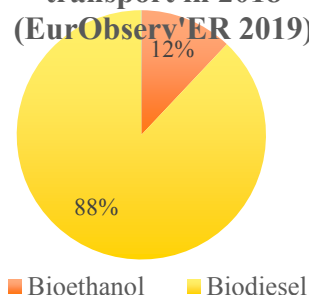
Electricity in 2017
277 ktoe

Austria biofuels consumption for transport has increase both for biodiesel and bioethanol from 2017 to 2018. Meanwhile, its transport sector continues to grow, having the highest market share in total energy consumption. While oil and natural gas dominate energy supply and consumption, biofuels have grown strongly since 1990. Electricity production remains led by hydro.

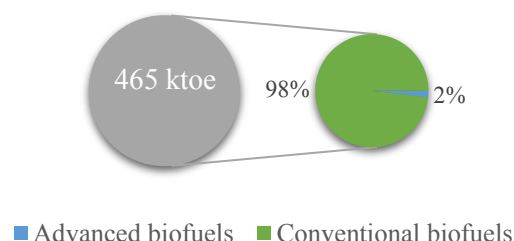
Targets for renewable energy (RES), climate change mitigation and energy efficiency⁸

TARGETS	2020		2030
RES (renewable energy sources)	34%		46-50%
Energy efficiency improvement			25-30% (2015 BASE)
GHG emissions reduction (non-ETS)			36% (2005 BASE)
RES-E (renewable energy in electricity)			100%
RES-T (renewable energy in transport)			14%
Biofuels blend obligation	5%		7-10%
Cap on first generation (conventional) biofuels	7%		
Advanced biofuels	2022	2025	3.5%
	0.2%	1%	

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



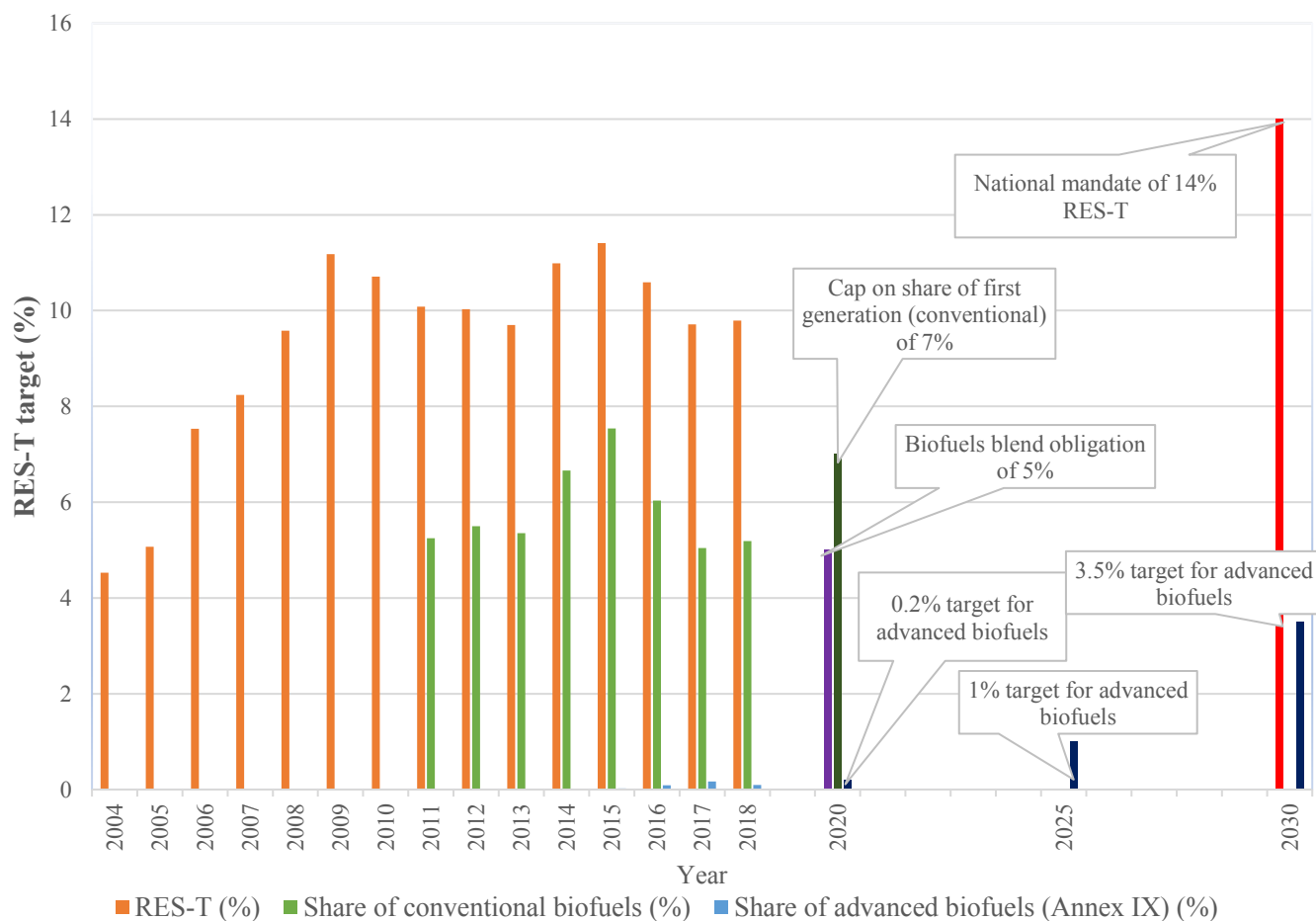
Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



⁷ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

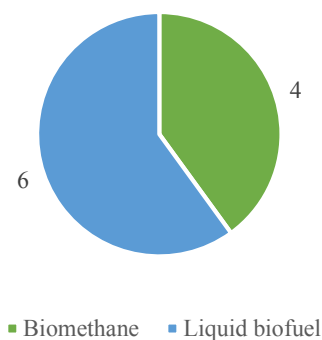
⁸ Integrated National Energy and Climate Plan 2021-2030, Austria, https://ec.europa.eu/energy/sites/ener/files/at_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

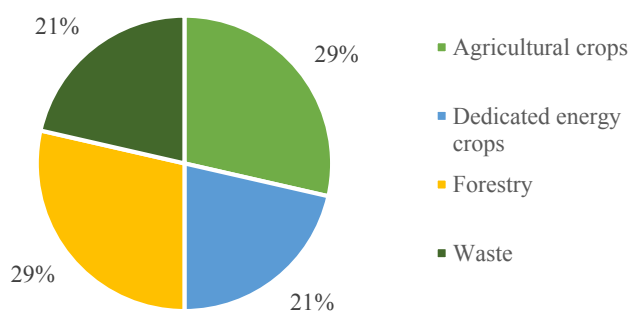


Number of operational biorefineries between 2007 and 2018⁹

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



⁹ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁰
Biomass production	Do they address sustainability of feedstock?	• Ordinance on agricultural raw materials in 2010 for solid and liquid biofuels • CAP RDPs and LULUCF Regulation transposing – biomass is harvested under principles of sustainable forest management and preservation of agricultural land	Green
Conversion of feedstock	Do they have financing for innovative conversion technologies?	• Mission Innovation Austria' programme: the Austrian Government aims to invest up to €120 million by 2021 in three model regions: WIVA P&G (hydrogen/methane), NEFI (100% renewable energy supply for domestic industry) and GreenEnergyLab (smart grids/demand side management/demand response). • Model energy regions (Climate and Energy Fund 2018-2025)¹¹; 'Energie.Frei.raum' support programme¹²	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	• Renewable Energy Expansion Act- Incentives for renewable energy - by promoting e-mobility with electricity and hydrogen from renewable sources, biofuels and advanced biofuels • Australian Transport Policy- focus on promoting the switch to alternative fuels (hydrogen from renewable energy, bio-CNG/bio-LNG and biofuels) in transport and electromobility using renewable energy under new fleet targets. • Austrian strategy on hydrogen	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	• No specific sub-sector targets • Eurovignette Directive for heavy goods vehicles • Measures (subsidies) and investment support to switch freight transport to the environmentally friendly railway • €120 million a year allocated for subsidies.	Yellow

¹⁰ High score=Green; Medium Score=Yellow; Low score=red

¹¹ Three model regions (in place between 2018 and 2025) are already up and running. The Federal Government's Climate and Energy Fund, which is financed by the Ministry for Transport, Innovation and Technology, will invest up to EUR 120 million by 2021 in three model regions: WIVA P&G (hydrogen/methane), NEFI (100 % renewable energy supply for domestic industry) and GreenEnergyLab (smart grids/demand-side management/demand response).

¹² https://ec.europa.eu/energy/sites/ener/files/documents/ec_courtesy_translation_at_necp.pdf



Transport policies and measures supporting the 5 dimensions of the energy union¹³

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emissions reduction targets from non-ETS by 36% compared to 2005 base level Low-emission mobility strategies Fossil-free mobility by 2050 Renewable Energy Expansion Act Tax advantage for biogas and hydrogen	Austria is involved in Projects of Common Interests (PCI)-electricity and gas sector projects are designed to meet challenges such as increasing energy demand, ensure security of supply or overcome bottlenecks	Subsidy support for the establishment and/or certification of an energy management system in SMEs	Austria - Baumgarten hub plays an important hub role for electricity sector Network Development Plan (NDP) Grid development with focus on RE		The BMVIT energy and mobility research programmes and the Climate and Energy Fund represent €2 to 2.5 billion of private investment in energy and mobility innovation in Austria by 2030 Austrian Energy Research and Innovation Strategy European cooperation on the SET Plan Transnational and global cooperation – ‘Mission Innovation’ membership

Biomass policies which support the mobilisation of advanced renewable fuels

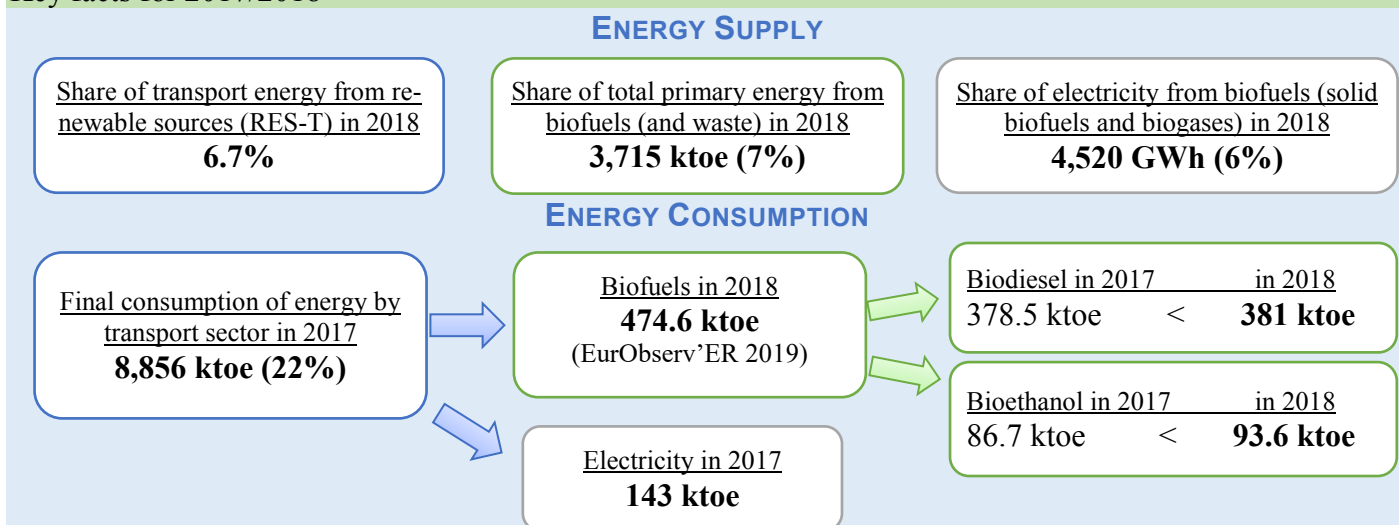
Biomass Production	Conversion	Distribution	End-use
CAP -Austrian Rural Development Programmes		Biofuel quota obligation	
The Domestic Env Support Scheme -investments in non-ETS sector; Climate and Energy Fund			
Sustainable forest management	Schemes for electricity from RES	Tax reform act 2020- tax exemption for sustainable biogas, hydrogen, LNG, self-produced electricity; Greening of the standard fuel consumption tax; Electric vehicle and e-mobility tax breaks, grants and subsidies	
NEC Directive for Austria- emissions reductions			
National Waste Management Act 2002		Funding for e-mobility infrastructure	
Austrian Climate Protection Act; Renewable Energy Expansion Act; Green Electricity Act			
Austria’s Climate and Energy Strategy; The Austrian bio-economy strategy; Bioeconomy R&D Strategy; Sustainability Regulation 2014 (BGBl Nr. 157/2014); The National Environmental Promotion Programme (UFI); Klimaaktiv Mobil Programme (EAFRD the Climate and Energy Fund); Climate Protection Act (emission ceilings for emitting sectors); National 2050 strategies for promoting ‘clean energy technologies; National policy framework: clean energy for transport			

¹³ Integrated National Energy and Climate Plan 2021-2030, Austria, https://ec.europa.eu/energy/sites/ener/files/at_final_necp_main_en.pdf



Current State of Affairs¹⁴:

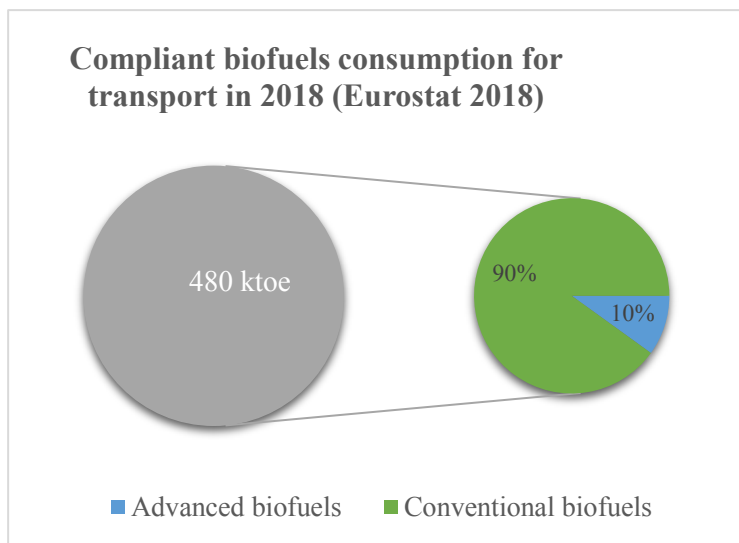
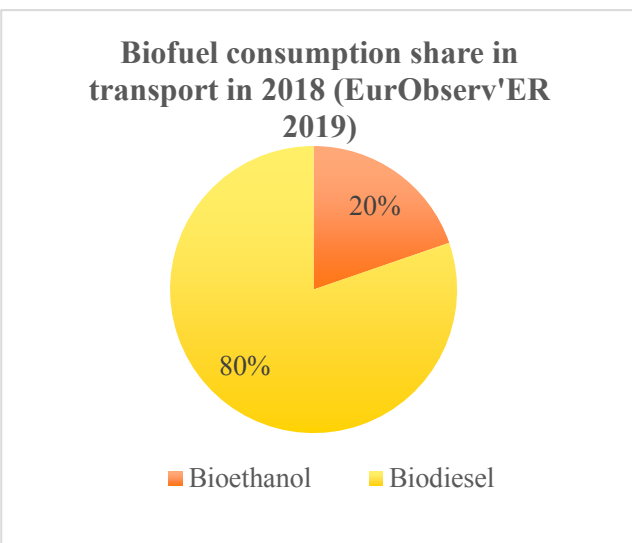
Key facts for 2017/2018



Belgium biofuels consumption for transport has increased both for biodiesel and bioethanol from 2017 to 2018. While its energy supply and consumption is still dominated by oil and natural gas, biofuels have been increasing steadily since 1990. Its energy portfolio for electricity production is seeing significant fluctuations in nuclear power, however only marginal increase in biofuel shares. Its transport sector is the second biggest consumer of energy.

Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁵

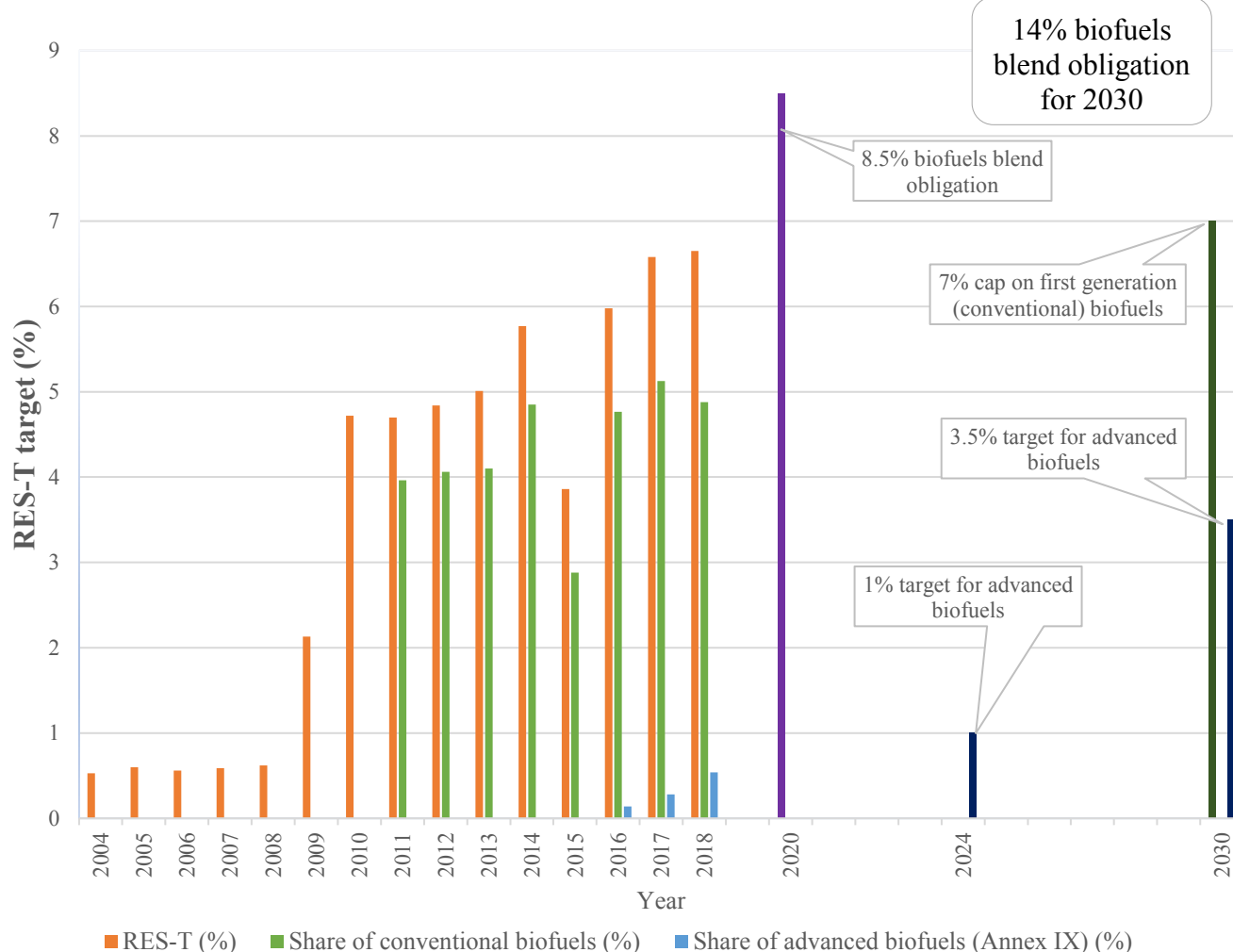
TARGETS	2020	2030	2050
RES (renewable energy sources)		32.5%	
GHG emissions reduction	30%		80-95% (1990 BASE)
Biofuels blend obligation	8.5%	14%	
Cap on first generation (conventional) biofuels	7%		
Share of advanced biofuels	2024	7%	
	1%		



¹⁴ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries/united-kingdom>), Eurostat, SHARE tool, 2018; EurObserv'ER-Biofuels-Barometer-2019, The draft NECP UK (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774235/national_energy_and_climate_plan.pdf)

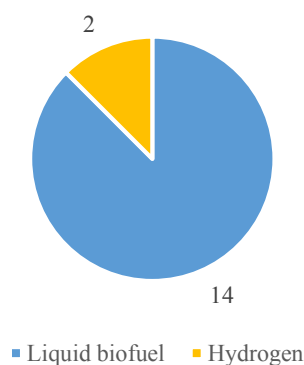
¹⁵ Integrated National Energy and Climate Plan 2021-2030, Belgium, https://ec.europa.eu/energy/sites/ener/files/documents/be_final_necp_parta_fr.pdf

RES-T shares and policy targets (Eurostat 2018)

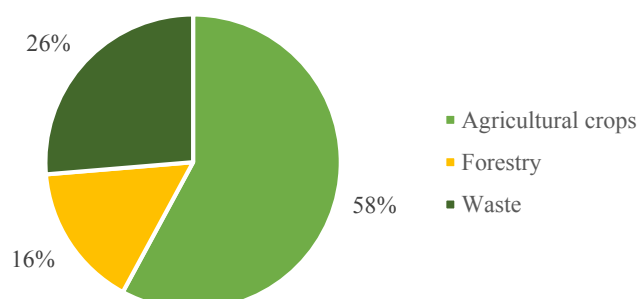


Number of operational biorefineries and hydrogen production projects between 2007 and 2018¹⁶

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



¹⁶ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁷
Biomass production	Do they address sustainability of feedstock?	•	Green
Conversion of feedstock	Do they have financing for innovative conversion technologies?	• Freight Transport Infrastructure Investment (Flanders)	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	• Yes	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	• No sub-sector targets in transport • Provisions for heavy duty transports	Yellow

Transport policies and measures supporting the 5 dimensions of the energy union¹⁸

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	National Energy and Climate Plan FAST Vision (to reduce travel time) aim for a 24% emissions reduction	Promoting stock-age and flexibility projects including sectoral integration via Power-to-X, hydrogen and transport Pentalateral Energy Forum and the Gas Platform to support regional collaboration Enforcing national objectives and increasing level of inter-connectivity by 30% by 2030	National Energy and Climate Plan	Reinforce energy supply links with France and the Netherlands Deployment of meters	National Pact for Strategic Investments covers energy and mobility

¹⁷ High score=Green; Medium Score=Yellow; Low score=red

¹⁸ Integrated National Energy and Climate Plan 2021-2030, Belgium, https://ec.europa.eu/energy/sites/ener/files/documents/be_final_necp_parta_fr.pdf

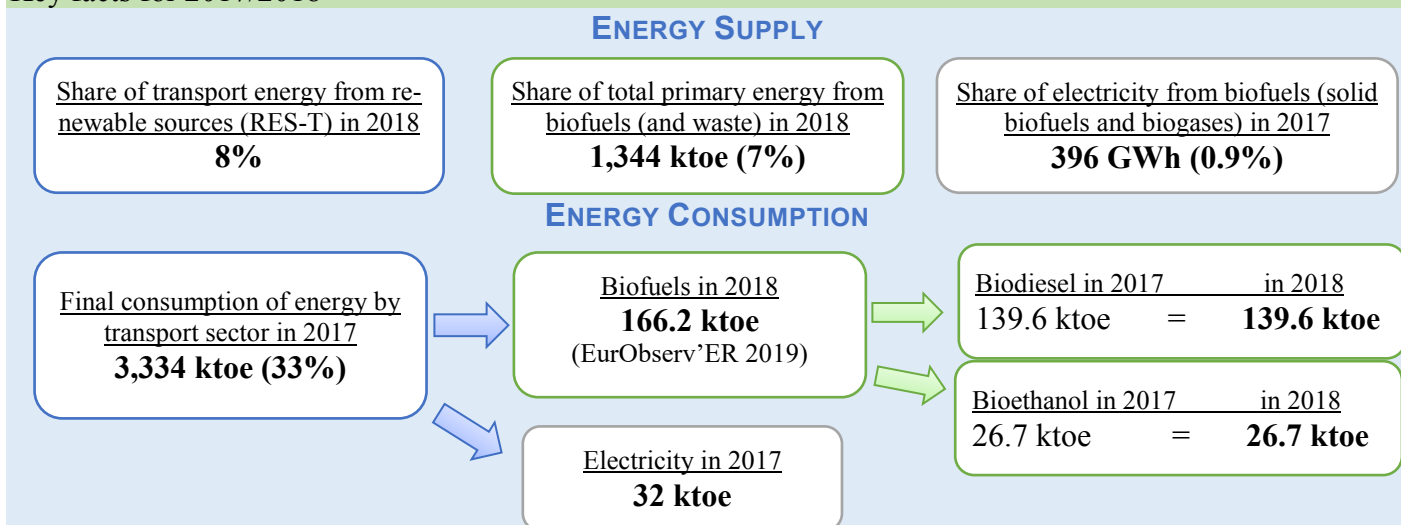


Biomass policies which support the mobilisation of advanced renewable fuels

Promissory policies which support the mobilisation of advanced Renewable Fuels			
Production	Conversion	Distribution	End-use
CAP: Belgium Rural Development Programme	Industrial Emissions limitations		Biofuel Quota; Tax regulation mechanism (Tax reduction for biofuels); Tax benefits for EVs. PHEVs
Sustainable Management for Forest; Forest code; Wood Pellets Standards	Eco-Investment subsidies for energy savings and production from RES, eco-products to improve environmental requirement		Blending mandate; Green Certificates
			Low Emission Zone
Prevention and Management of Waste; Decree of Waste; VLAREMA (sustainable management of waste)		Integrated Transport strategy by 2030	
Nitrates Directive (PGDA)		Freight Transport Infrastructure Investment (Flanders)	
Regulation on sustainability of Ag. raw materials for biofuels			
Sustainability criteria for biofuels			
Decree Climate (Emissions budgets for different sectors); Vision 2050; National Energy and Climate Plan 2030			

Current State of Affairs¹⁹:

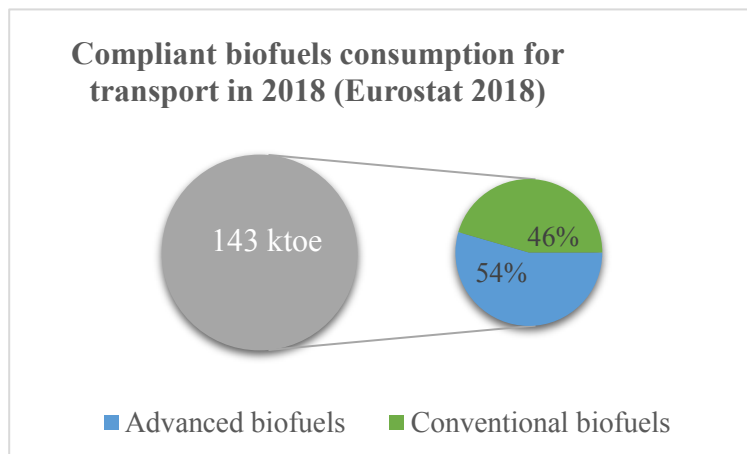
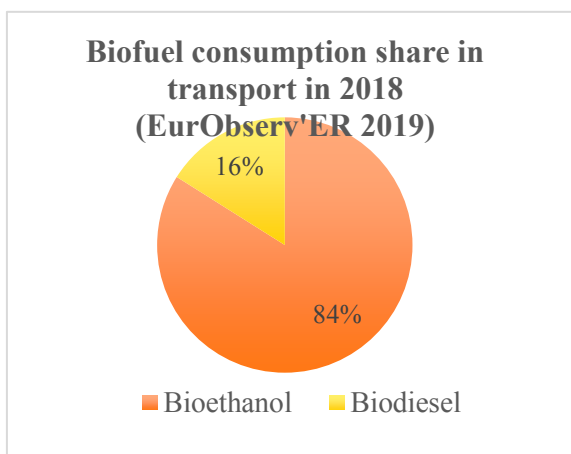
Key facts for 2017/2018



Bulgaria has seen no changes in its biofuels consumption in the transport sector between 2017 and 2018. Its transport sector dominates in terms of final energy consumption. While oil products, electricity and natural gas lead final consumption, biofuels have been rising significantly since 1990. Equally for energy supply, coal has a much larger market share, yet this has decreased since 1990 while biofuels are steadily rising.

Targets for renewable energy (RES), climate change mitigation and energy efficiency²⁰

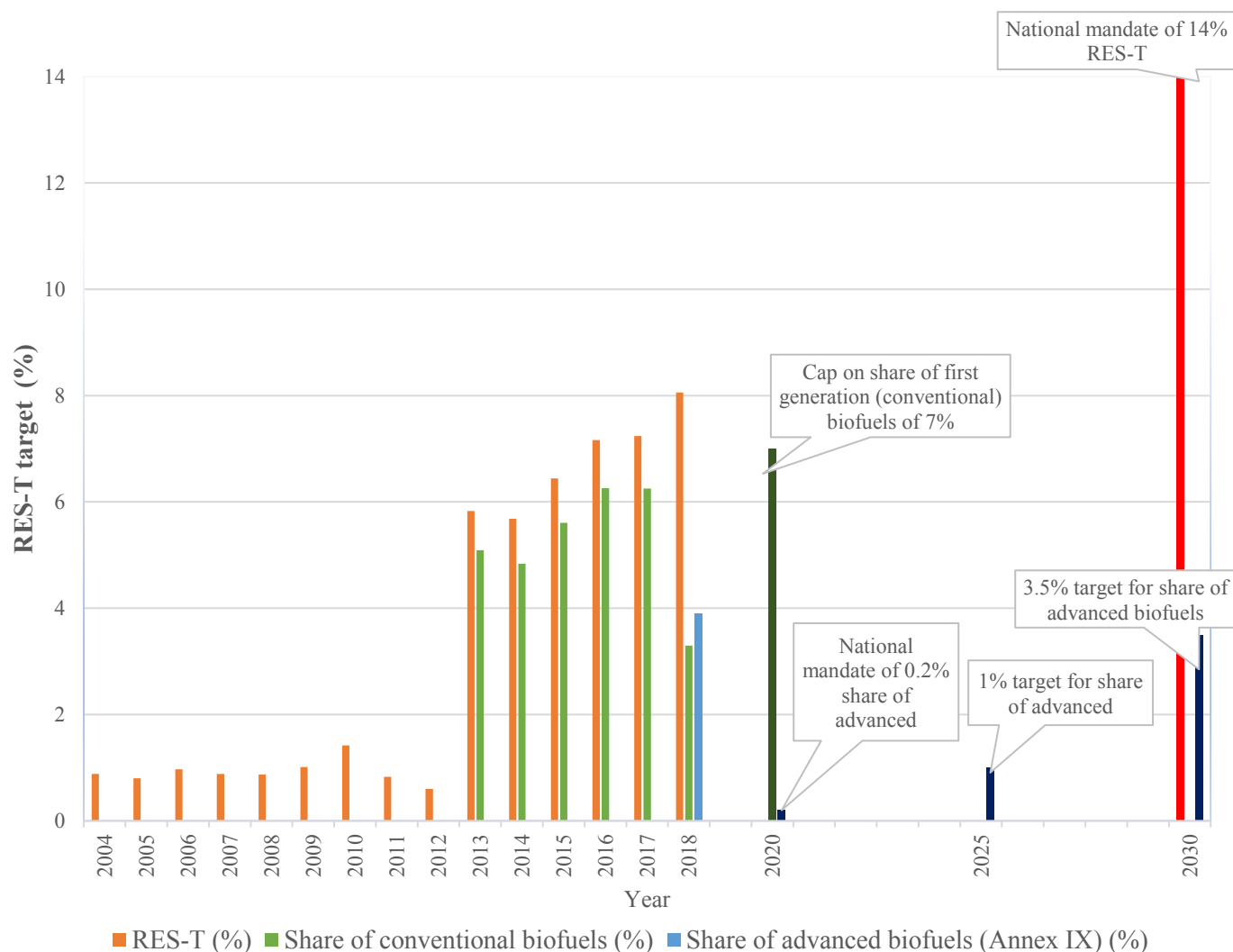
TARGETS	2020	2030
RES (renewable energy sources)	20%	27% (1990 BASE)
Energy efficiency improvement		32% (2007 BASE)
GHG emissions reduction		49% (1990 BASE)
RES-E (renewable energy in electricity)		30.3%
RES-T (renewable energy in transport)		14%
Cap on first generation (conventional) biofuels	7%	
Advanced biofuels	2022	3.5%
	0.2%	
	2025	
	1%	



¹⁹ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

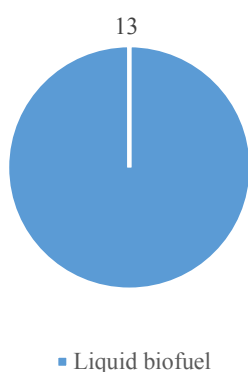
²⁰ Integrated National Energy and Climate Plan 2021-2030, Bulgaria, https://ec.europa.eu/energy/sites/ener/files/documents/bg_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

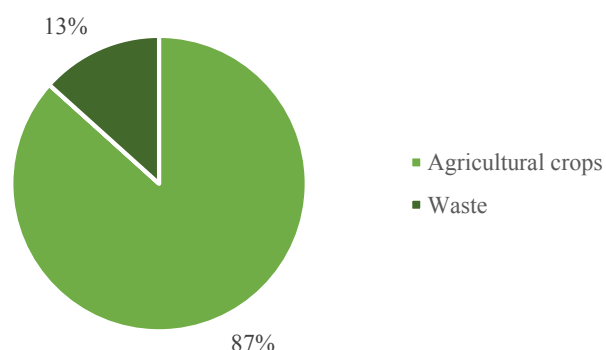


Number of operational biorefineries between 2007 and 2018²¹

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



²¹ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ²²
Biomass production	Do they address sustainability of feedstock?	- The National Action Plan for Energy from Forest Biomass (NPDEGB) 2018-2027 - Sustainable source of biomass is regulated using the National forest Inventory (Forest Reference Levels) for forest harvest between 2021-2025 - The Agricultural Producers Support Act (ZPZP) - Provisions in national law transposes the RED II requirements of sustainability criteria when using biofuels from biomass	Green
Conversion of feedstock	Do they have financing for innovative conversion technologies?	EU Structural Funds and the Cohesion Fund under different operational programmes funds the green public transport. E.g. are the Modernisation Fund.	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	Plan to introduce financial incentives (through tax relief, support schemes, etc.) for the consumption of alternative renewable fuels and advanced biofuels and for electric mobility deployment. During 2020-2030 energy from renewable sources used in transport is expected to diversify through biofuels and hydrogen. The consumption of renewable electricity is also expected to double. Increase in biomass use in transport sector is expected to rise by 2.3-2.6% in 2030 compared to 2020 level.	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No specific transport sub-sector targets - National Climate Change Action Plan 2020 and beyond aims to decrease the volume of freight transport by road. - Aviation sector energy consumption is expected to increase by 35% compared to 2020 and road transport by 7%.	Yellow

²² High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures which support the 5 dimensions of the energy union²³

Sector	Decarbonisation	Energy Security	Energy efficiency	Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission targets Support schemes for renewable electricity generated from power plants of <1MW in 2021-2030	Diversification of sources and routes of supply Improvement of gas and electricity interconnection hubs	National mechanism for financing energy efficiency (NMFEE)- to mobilise private financing and use grant assistance from European Economic Area (EEA) Financial Mechanisms		Transport Connectivity 2021-2027 will create financial programmes to improve transport infrastructure		EU Structural Funds and the Cohesion Fund under different operational programmes funds the green public transport. E.g. are Modernisation fund.

Biomass policies which support the mobilisation of advanced renewable fuels

Biomass production	Conversion	Distribution	End-use
CAP: Bulgarian Rural Development Programme			Biofuel Quota; Tax regulation mechanism (Tax reduction for biofuels)
The Agricultural Producers Support Act (ZPZP)	Clean Ambient Air Act		
National Air Pollution Control Programme 2020-2030			
The Farm Land Protection Act		Integrated Transport strategy by 2030	
National Waste Management Plan			
National Energy Efficiency Action Plan (in compliance with EU Directive 2012/27/EU, Article 7)			Low-emission zones (LEZ)
Forestry Act (ZG):		Climate Investment Programme- Electric Vehicles Scheme, EVS	
The Energy from Renewable Sources Act (ZEVI)			
Programme for accelerated gasification of Republic of Bulgaria until 2020			
Integrated Transport strategy by 2030 ²⁴			
Strategic Plan for the Development of the Forestry Sector (SPRGS) 2014—2023; National emissions target under the EU Effort Sharing Decision (406/2009/EC) Bulgaria 2009; National Climate Change Adaptation Strategy and Action Plan 2021-2030; National Climate Change Action Plan (NCCAP) 2013—2020; National Waste Management Plan 2012-2020; Common Action Plan for Danube Region; Spatial Planning Act (National Concept for Spatial Development)			

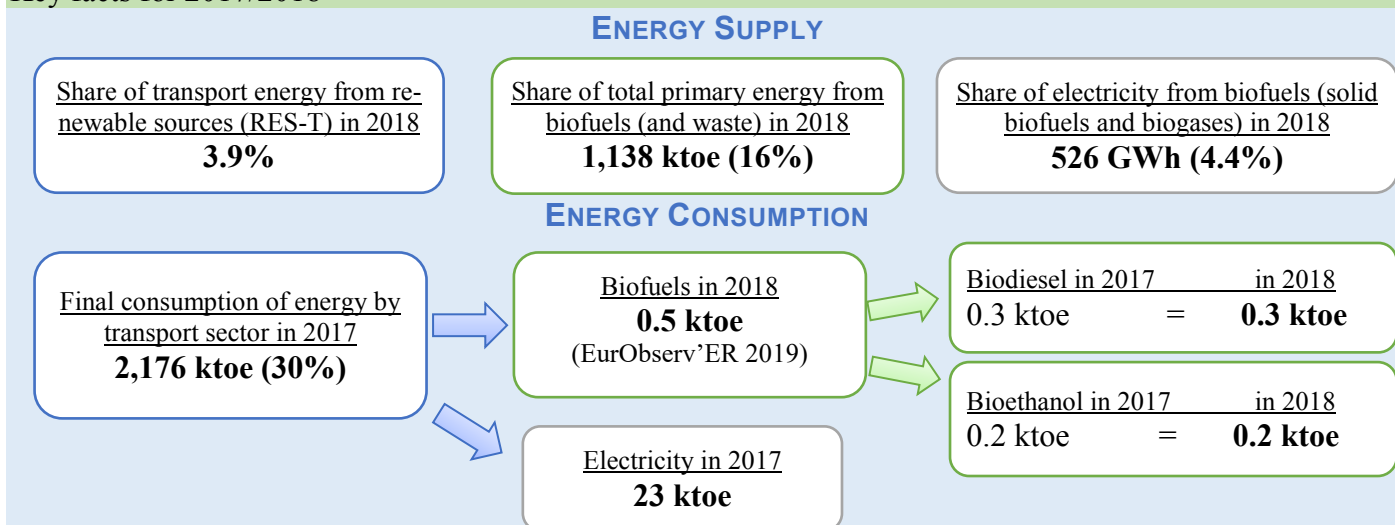
²³ Integrated National Energy and Climate Plan 2021-2030, Bulgaria, https://ec.europa.eu/energy/sites/ener/files/bg_final_necp_main_en.pdf

²⁴ <https://www.mtict.government.bg/en/category/42/integrated-transport-strategy-period-until-2030>



Current State of Affairs^{25;26}:

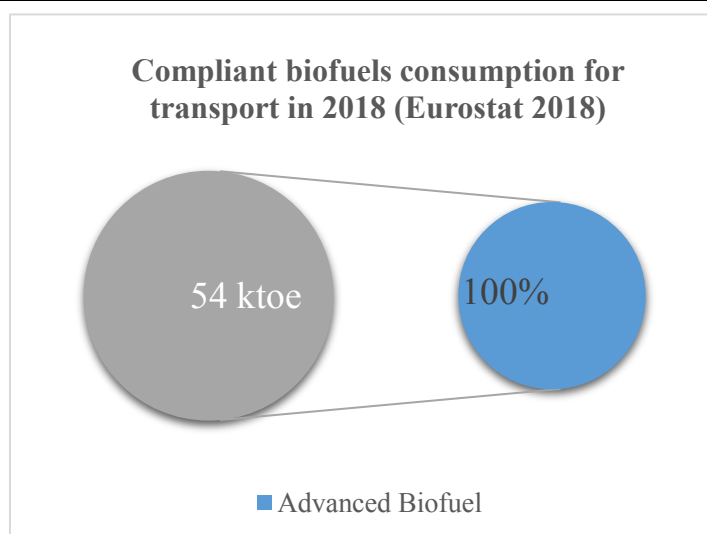
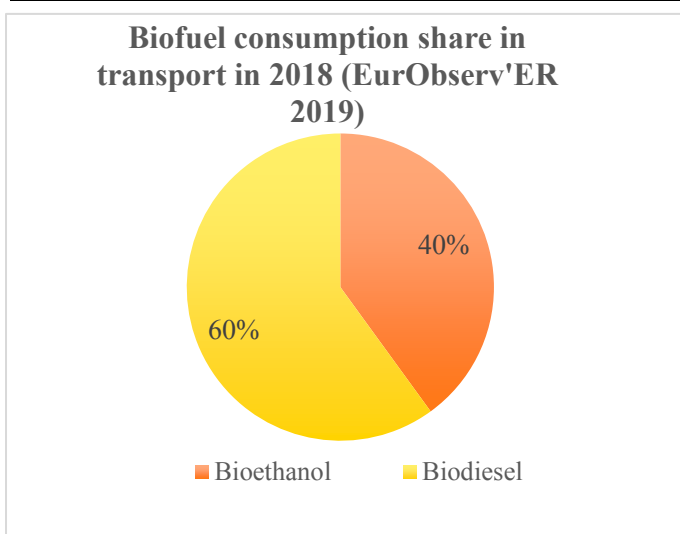
Key facts for 2017/2018



Croatia has not seen any increase in its biodiesel or bioethanol consumption shares between 2017 and 2018. While its transport sector continues to grow as a major energy consumer, overall biofuel supply and consumption have remained stable in the last two decades, representing around a fourth of energy shares. Finally, electricity generation is largely driven by hydro power.

Targets for renewable energy (RES), climate change mitigation and energy efficiency²⁷

TARGETS	2030
RES (renewable energy sources)	36.4%
GHG emissions reduction	43% ETS 7% NON-ETS (2005 BASE)
Energy efficiency improvement	32.5% (2015 BASE)
RES-T (renewable energy in transport)	13.2%

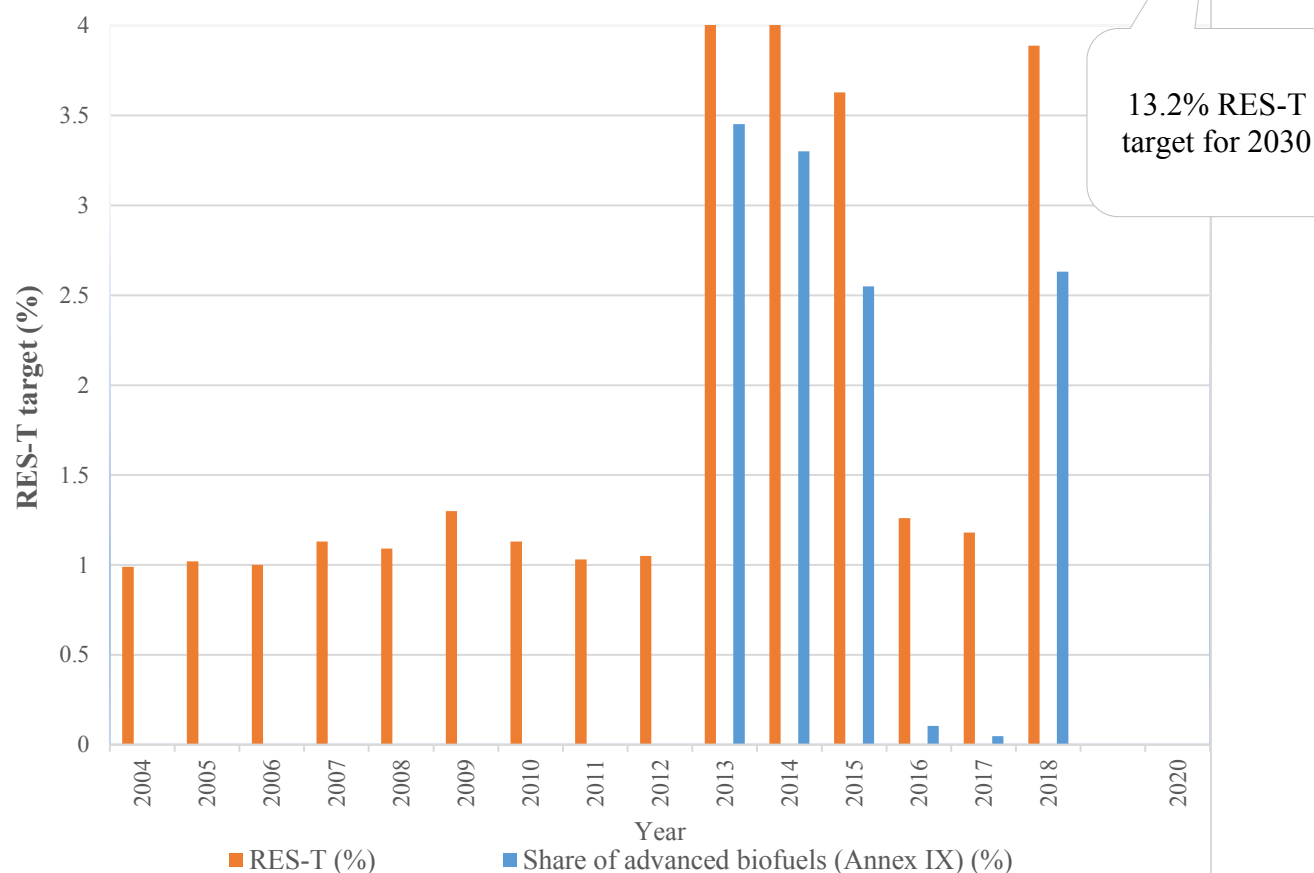


²⁵ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

²⁶ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

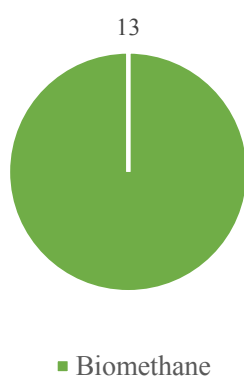
²⁷ Integrated National Energy and Climate Plan 2021-2030, Croatia, https://ec.europa.eu/energy/sites/ener/files/documents/hr_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

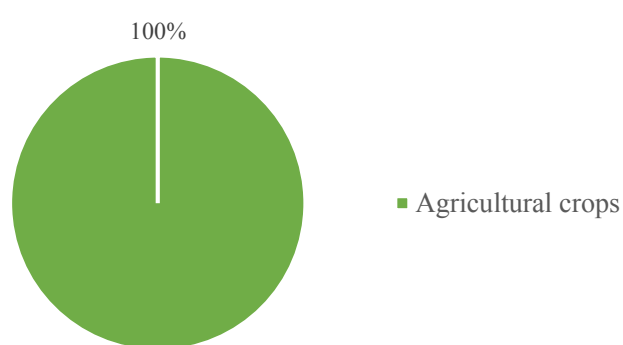


Number of operational biorefineries between 2007 and 2018²⁸

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



²⁸ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database; Petravić-Tominac, V., Nastav, N., Buljubašić, M. et al. Current state of biogas production in Croatia. Energ Sustain Soc 10, 8 (2020). <https://doi.org/10.1186/s13705-020-0243-y>

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ²⁹
Biomass production	Do they address sustainability of feedstock?	Sustainability of biomass production and use will be promoted under measure MS-11 (Establishing in bioeconomy platform)	
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Advanced biofuel market development plan: anticipated budget is HRK 1 million. State funding and EU funds include: Rural Development Programme, HAMAG-BICRO, BBI JU which support the promotion of advanced biofuels by improving the existing or developing new technologies for production of advanced biofuels. Under the plan review and assessment of the state of the biofuels market, new business models, stakeholders, measures to promote increased production and use of advanced biofuels in transport will be provided - Plan to support knowledge and technology transfer from science to economy with focus on low-carbon technologies 2021-2030. Estimated budget requirement is HRK 5 million/ year	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Under the regulatory framework development for cleaner transport 2021-2030, Croatia is planning to do an analysis of potential capacity of domestic raw materials and the development of technological capacity for advanced biofuel production, as well as to develop regulatory framework and financial mechanism to transpose RED II and to meet the 3.5% advanced fuels by 2030 target - TR-13 Advanced biofuel market development plan - POLJ-15 Collection and treatment) of agricultural plantations and residues for energy use - POLJ4 Anaerobic manure decomposition and biogas production	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	No sub-sector targets	

Transport policies and measures supporting the 5 key dimensions of the energy union

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation, competitiveness
Transport	Financial instruments like CO2 tax, feed-in tariffs, premiums to support the use of RES in electricity generation and high efficient co-generation Obligation for biofuels in transport Cost-effectiveness of new passenger cars Preventing generation of waste and improvement in waste separation to use of biodegradable waste Promotion of integrated freight transport-incentives to use combined transport of goods Promotion of clean and energy efficient vehicles	Development of advanced biofuels market Integrated planning of energy security	Energy efficiency fund to support energy efficient vehicles Information provisions about cost effectiveness and CO2emission of new passenger cars Integrated freight transport Promotion of boat transport using alternative fuels	Electricity transmission network development- 10-Year Transmission Grid Development Plan 2019—2028 Gas transport network- 10-Year Gas Transmission Grid Development Plan of the Republic Croatia 2018-2027	Development of advanced biofuels market

²⁹ High score=Green; Medium Score=Yellow; Low score=red



Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP- Croatian Rural Development Programmes	Fund for Environmental Protection and Energy Efficiency -Incentives for energy-efficient vehicles		
Nitrates of Agriculture Origin	Excise Duty Act (OG 1/19)		
Agricultural Land Act	Regulation on biofuels production stimulation	Act on the Promotion of Clean and Energy-Efficient Vehicles in Road Transport (OG 127/13	
Forest Act Timber Regulation	Energy Efficiency Act ((OG Nos. 127/14, 116/18)		
		Act on the deployment of Alternative Fuel Infrastructure	
Sustainability requirements in biofuel production and usage (OG 83/13)			
Law on Woody Short Rotation Coppice	Regulation on biofuels production stimulation (OG 1/14); Requirements in biofuel production and usage (OG 83/13; National Biofuel Action Plan; Regulation for biofuel quality;		
Law on sustainable waste management (OG Nos. 94/13, 73/17, 14/19, 98/19); Waste Management Plan 2017-2022 (OG 3/17)		National Policy Framework for Deployment of Alternative Fuel Infrastructure of the Republic of Croatia (OG No. 34/17)	
Waste water treatment sludge use in Agriculture		Ordinance on measures for promotion of use of biofuels in transport (OG 42/ Act on Biofuel	
		Ordinance on availability of information on fuel consumption cost effectiveness and CO 2 emissions from new passenger cars (OG No. 7/15)	
		Ordinance on ways and conditions for implementation of sustainability	
	HBOR Act (Act on the Croatian Bank for Reconstruction and Development)		
	RES Promotion Decree (Decree on the promotion of electricity production from renewable energy sources and highly-efficient co-generations); RES Act (Act on Renewable Energy Sources and High-efficiency Cogeneration)		
	Air Protection Act (OG Nos. 130/11. 47/14, 61/17, 118/18); Air emission from stationary source		
Regulation on the manner of GHG emissions trading (OG No 69/12. 154/12): EU-ETS-The Effort Sharing legislation			
CO2 emission tax for the non-ETS stationary sources			
Ordinance on thermal treatment of waste	Environmental Protection Act (OG Nos. 80/13, 153/13, 78/15, 12/18, 118/18)		
Ordinance on waste oil management			
Landfill Directive; Waste Framework Directive; Energy Act; Air Protection Act			
Croatian National Energy Strategy 2009-2020 and 2030; Energy Development Strategy up to 2030 outlook to 2050; Industrial Strategy of the Republic of Croatia 2014.-2020; Biofuel Act ; Ordinance on measures for promotion of use of biofuels in transport (OG 42/10); National Biofuel Action Plan; Regulation for biofuel quality; RES Promotion Decree; HBOR Act (Act on the Croatian Bank for Reconstruction and Development); GHG emissions trading regulation (OG No 69/12. 154/12); National Waste Management Plan 2017-2022			

Cyprus

Policy and Plant Factsheet on Advanced Renewable Fuels

Current State of Affairs^{30;31}:

Key facts for 2017/2018

ENERGY SUPPLY

Share of transport energy from renewable sources (RES-T) in 2018
2.7%

Share of total primary energy from biofuels (and waste) in 2018
83 ktoe (3.7%)

Share of electricity from biofuels (solid biofuels and biogases) in 2017
52 GWh (1%)

ENERGY CONSUMPTION

Final consumption of energy by transport sector in 2017
672 ktoe (43%)

Biofuels in 2018
9 ktoe
(EurObserv'ER 2019)

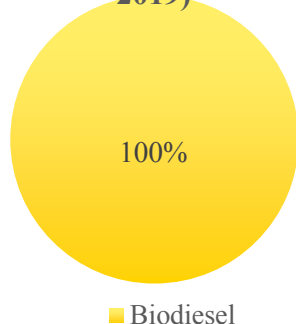
Biodiesel in 2017 in 2018
8.7 ktoe < **9 ktoe**

Cyprus has seen a slight increase in its biofuels consumption in the transport sector between 2017 and 2018. Its energy supply and consumption markets are largely dominated by oil, however biofuels and waste have grown tenfold over the last two decades. The transport sector represents the most important market share for energy consumption.

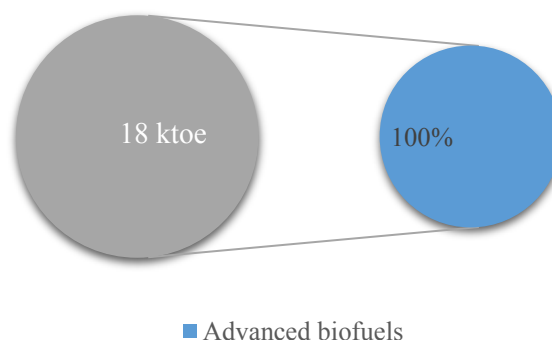
Targets for renewable energy (RES), climate change mitigation and energy efficiency³²

TARGETS	2020		2030
RES (renewable energy sources)			23%
GHG emissions reduction (non-ETS)			21% (2005 BASE)
Energy efficiency improvement			13%
RES-E (renewable energy in electricity)			26%
RES-T (renewable energy in transport)			14%
Biofuels blend obligation	5%		7-10%
Cap on first generation (conventional) biofuels	7%		
Advanced biofuels	2022	2025	3.5%

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



³⁰ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

³¹ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

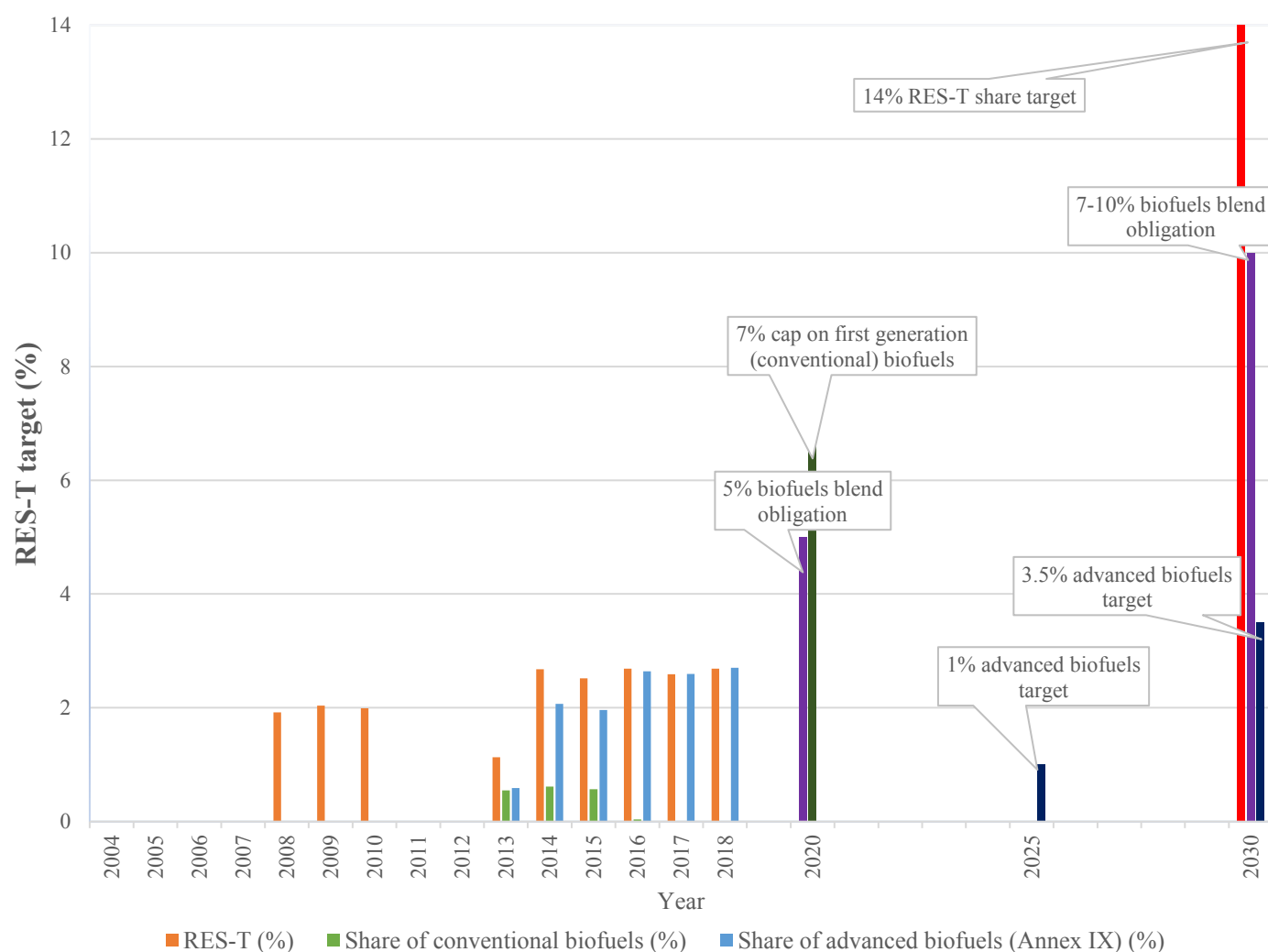
³² Integrated National Energy and Climate Plan 2021-2030, Cyprus, https://ec.europa.eu/energy/sites/ener/files/documents/cy_final_necp_main_en.pdf



0.2%

1%

RES-T shares and policy targets (Eurostat 2018)



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ³³
Biomass production	Do they address sustainability of feedstock?	No specific measure until examination	Red
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- New Industrial Policy focuses on upgrade energy efficiency and integration of RES- they seek to improve industrial R&U infrastructure, support cooperation to develop new innovative commercial products and services - European Structural and Investment Funds in the new Programming Period 2021 – 2027: Under the "Greener low carbon Europe" thematic priority, actions to promote energy efficiency and the use of renewable energy sources	Green

³³ High score=Green; Medium Score=Yellow; Low score=red

		National Energy and Climate Fund (NECF)- low levels of co-funding to support technologies which are in pre-commercialization stage	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Biofuels were only RES fuels in transport until 2018 (2.6%) - Promotion of electric vehicles with deployment of new charging stations - Diesel vehicles are reduced and replaced by modern vehicles to support the penetration of alternative fuels technologies	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	No transport sub-sector targets	

Transport policies and measures supporting the 5 dimensions of the energy union³⁴

Sector	Decarbonisation	Energy efficiency	Efficiency	Energy Security	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission reduction, RES share, energy efficiency targets in transport Support to create synergies between sectors to promote energy efficiency and to promote RES Support measures for RES-T- alternative fuels, gas, biofuels	Action plan to increasing energy efficiency the road transport. Vehicle excise duty based on CO2 emissions Excise tax on road transport		LNG imports and development of infrastructure for natural gas development	Promote electricity interconnectivity and investment for transmission improvements		New Industrial Policy European Structural and Investment Funds in the new Programming Period 2021 – 2027 Refocusing national funds like National Energy and Climate Fund (NECF) toward research and innovation in energy

Biomass policies which support the mobilisation of advanced renewable fuels

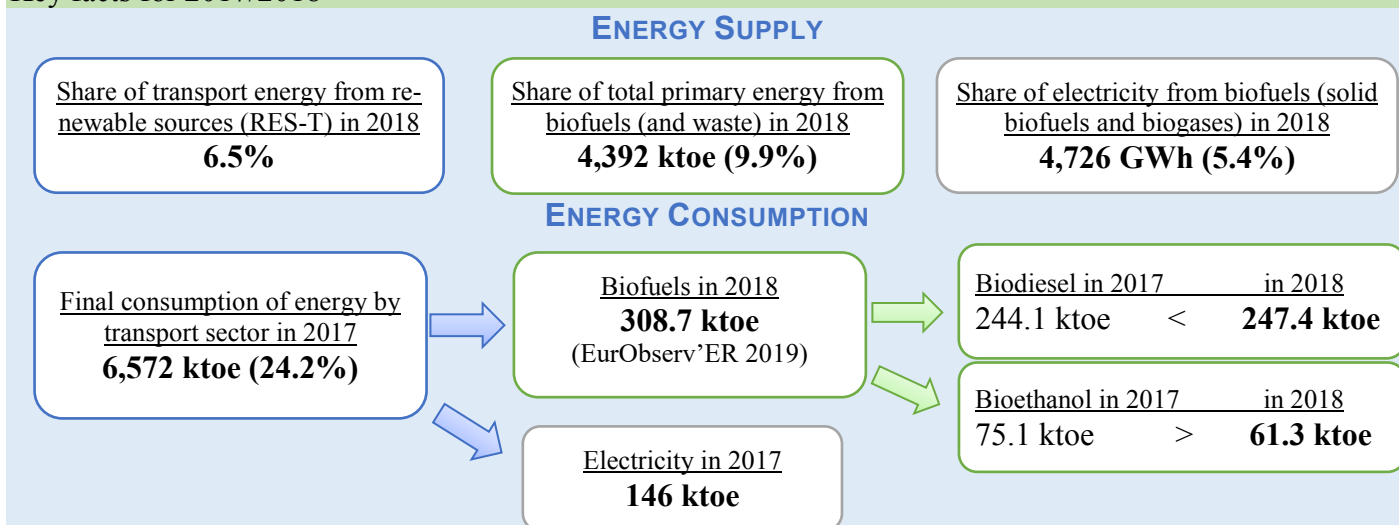
Biomass Production	Conversion	Distribution	End-use
CAP- Cyprus Rural Development Programmes	Grand Schemes for Energy Efficiency and Renewable Energy Sources		
National emission targets-Effort Sharing Decision (for non-ETS sectors in the period 2012-2030			
Support Scheme Biomass/ Biogas 2017		Tax reduction and exemption	
Support Scheme for the Production of Electricity from Renewable Energy Sources f		Integrated Fleet Management System	
National Municipal Waste Management Strategy, 2021-2030- waste prevention and management schemes, obligation of collection system, landfill tax	Premium tariff for promotion of RE and EE	Amendment of the Motor Vehicles and Road Traffic Law- vehicles tax based on CO2 emissions, incentives to purchase low/zero emission vehicles	
	Energy Efficiency in transport sectors-integrated transport systems		

³⁴ Integrated National Energy and Climate Plan 2021-2030, Cyprus
https://ec.europa.eu/energy/sites/ener/files/documents/cy_final_necp_main_en.pdf



Current State of Affairs³⁵:

Key facts for 2017/2018

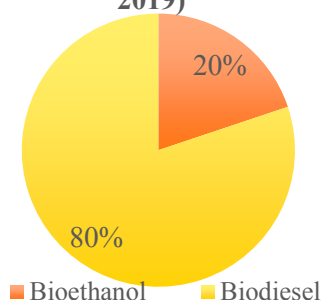


Czech Republic has seen an increase in biodiesel and a decrease in bioethanol consumption in its transport sector between 2017 and 2018. Overall biofuels and waste have increased fourfold as a market share of energy supply since 1990, and increased threefold as energy consumption.

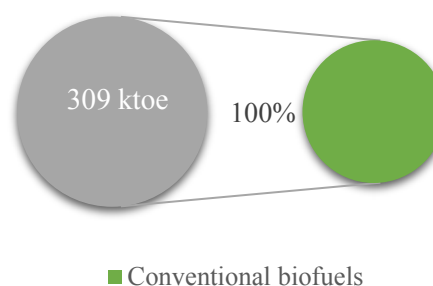
Targets for renewable energy (RES), climate change mitigation and energy efficiency³⁶

TARGETS	2020	2030
RES (renewable energy sources)	13%	22%
Energy efficiency improvement		32.5% (2007 BASE)
GHG emissions reduction		NON-ETS: 30% ETS: 43% (2005 BASE)
Electricity interconnection level	PRESENTLY AT 30%, SURPASSING EU TARGET OF 15%	
RES-T (renewable energy in transport)	8.8%	14%
Cap on first generation (conventional) biofuels	7%	
Advanced biofuels	2025	4.5%
	1%	

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



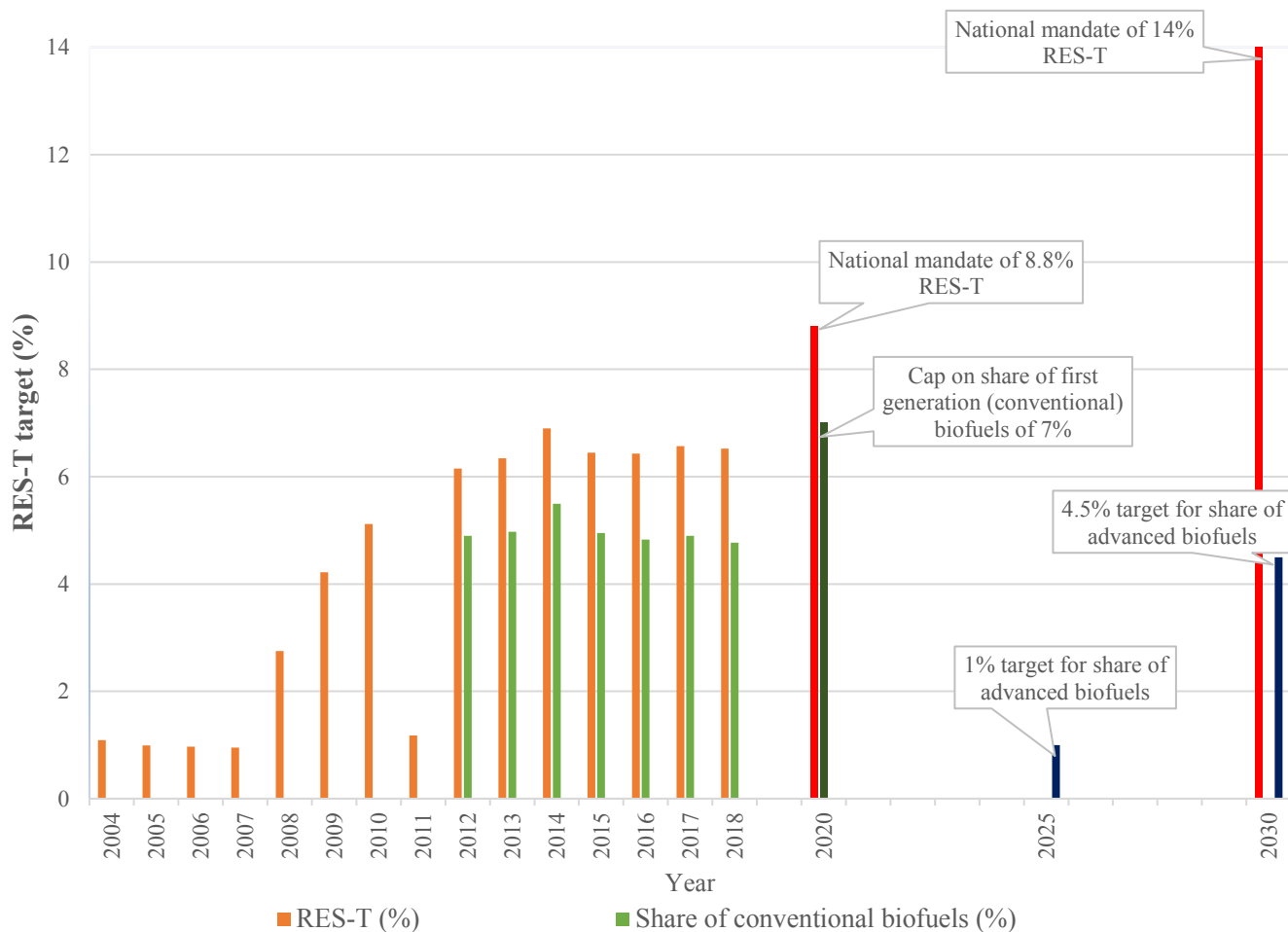
Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



³⁵ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

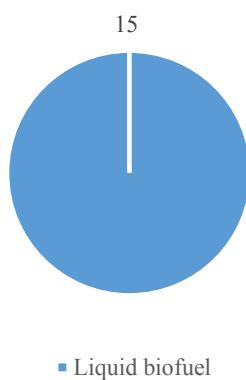
³⁶ Integrated National Energy and Climate Plan 2021-2030, Czech Republic, https://ec.europa.eu/energy/sites/ener/files/documents/cs_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

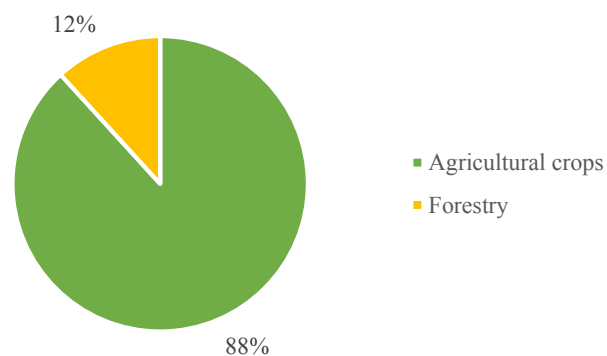


Number of operational biorefineries between 2007 and 2018³⁷

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



³⁷ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ³⁸
Biomass production	Do they address sustainability of feedstock?	- National Priorities for Research, Experimental Development and Innovation identify ‘Sustainability of energy and material resources’³⁹ - Ministry of Agriculture of the Czech Republic with a view to 2030 permits an increase in the energy use of agricultural biomass by 2030 by 20%, but only on condition of maintaining the strategic level of agricultural production for food use - Czech Republic’s adaptation strategy and the National Action Plan for Adaptation to Climate Change propose measures to reduce the potential conflicts in biomass production and energy use to maintain sustainability criteria	
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Under the National Action Plan for Clean Mobility, which focuses on alternative fuels – support is primarily provided to technologies which are on the brink of commercialisation. Research, technological development and demonstration is one of many thematic areas of focus under the Plan. - Investment support under ‘New Green Savings’, Operation programme Enterprise and innovative for competitiveness (OP E) can be used to finance innovative conversion technologies	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- They fall under focus priority areas of Research, Development and Innovation under the State Energy Policy - A plan to introduce support which will initiate the production of advanced biomethane and its supply to the transport sector - Proposed a mandatory auction bonus to support electricity from RES facilities of >1MW - Integrated Plan with a forecast for 2021–2030- support for bio-methane generating facilities commissioned from Jan 2021	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No transport sub-sector targets - Heavy duty (Freight Transport Strategy 2017–2023)	

³⁸ High score=Green; Medium Score=Yellow; Low score=red

³⁹ <https://www.vyzkum.cz/FrontClanek.aspx?idsekce=653383>

Transport policies and measures supporting the 5 dimensions of the energy union⁴⁰

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	GHG reduction targets Alternative fuels promotion and development of related infrastructure Electrification of transport Integrated freight transport	Diversification of energy sources Development of infrastructure for storage facilities	Reduction in the energy consumption and savings targets by sectors EU Energy Efficiency Directive	Investment plan to improve the inter-connectedness of gas and electricity transmission	RES is priority area of RD& I under the State Energy Policy- Development and efficient use of biomass, development of advanced biofuels made from non-food biomass and waste, energy use of hydrogen including fuel Increase in efficiency of transport systems is another priority area

Biomass policies which support the mobilisation of advanced renewable fuels

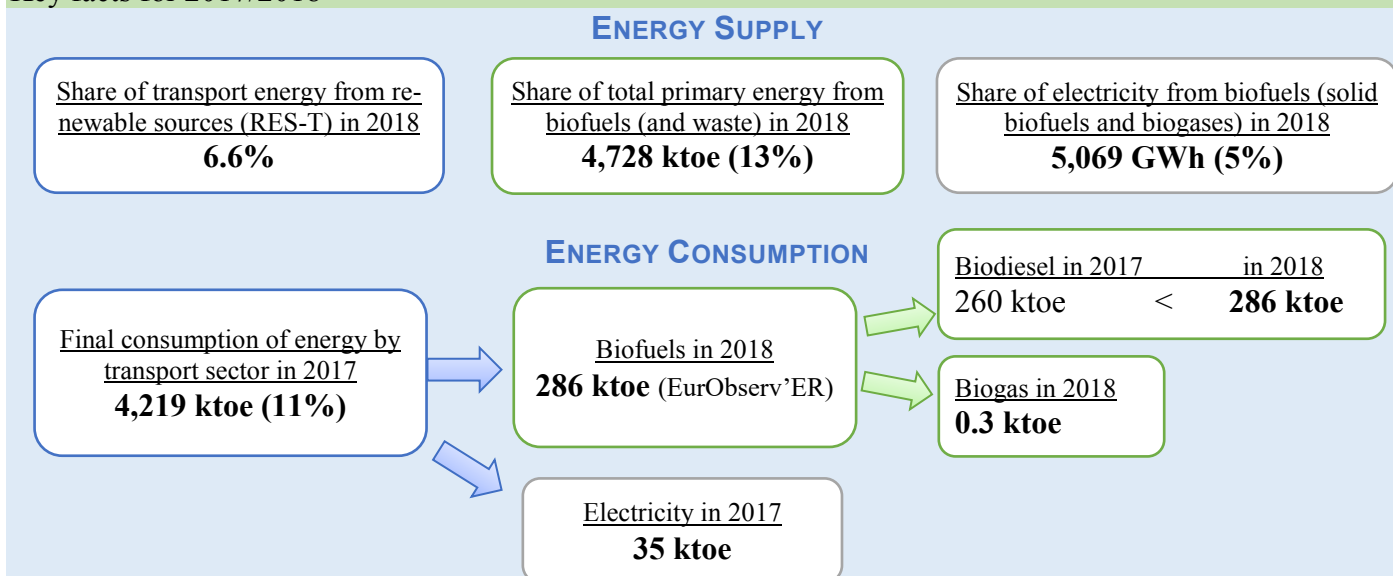
Production	Conversion	Distribution	End-use
CAP- Czechian Rural Development Programmes	Operational Programme Environment (ESIF 2014- 2020)		Act No. 201/2012 Coll., on the protection of atmosphere (Clean Air Act: Biofuel Quota)
Act on converting agricultural and forest lands	Aid for biofuels – mandatory blending and support for high-percentage and pure biofuels, advanced biofuels		
Act on plant protection	Eco-energy programme		Ownership tax benefits
Act on trade in the reproductive material of forest woody plants		Act 165/2012 on promoted energy sources: Feed in tariffs, premiums	
Act on the protection of nature and the landscape		Act No. No. 353/2003 consumption tax/Excise tax	
Water Act		Transport Policy 2014-2020	
Forest Act		Act No. 406/2000 Coll. on Energy Management	
Examination of agricultural lands and soils of forest lands	Act on Environmental Impact Assessment	Act No. 226/2013 Coll., on placing timber and timber products on the market	
Fertilisers Act	Carpathian Convention		Act No. 311/2006 Coll., on Fuels
Law on Agriculture	Air Protection Act		
CAP: Czech Rural Dev Programme	Act No. 338/1992 Coll. on the Property Tax		Exemption of road tax for vehicles using alternative fuels
Subsidies for forestry-env measures			
Forest Inventory	Act No 262/2000 amending Energy Act No. 458/2000		
Sustainability criteria for biofuels			
Water Act	Act No. 338/1992 Coll. on the Property Tax		
Wastes Act <i>No. 185/2001 Coll., on waste</i>			
Waste Management Act 2014-2020; Solid alternative fuels produced from waste (SAF Decree			
Action Plan for Biomass in the Czech Republic; Secondary Raw Materials Policy of the Czech Republic (2019-2022); Strategic Framework for Sustainable Development of Czech Republic 2030; State Energy Policy of the Czech Republic; National Climate and Energy Action Plan 2030; Circular Czechia 2040 Strategy; Climate Policy in CS; Transport Policy of the Czech Republic for 2014–2020 with the Prospect of 2050; State Environmental Policy; National Action Plan for Clean Mobility; National Emission Reduction Programme of the Czech Republic; Freight Transport Strategy 2017–2023 with a view to 2030			

⁴⁰ Integrated National Energy and Climate Plan 2021-2030, Czech Republic, https://ec.europa.eu/energy/sites/ener/files/documents/cs_final_necp_main_en.pdf



Current State of Affairs⁴¹:

Key facts for 2017/2018

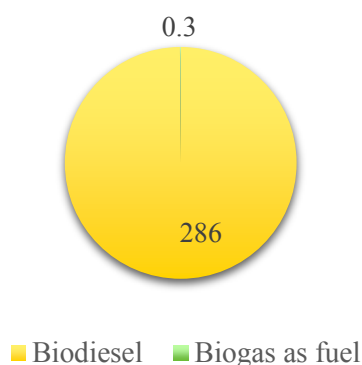


Denmark has seen an increase in its biodiesel consumption between 2017 and 2018, however it still does not have a market for bioethanol. It has the opportunity to continue supporting a tripling of biofuels consumption since 1990 and take advantage of its transport sector, which is close to being the largest sector in terms of energy consumption. Coal-produced electricity has decreased substantially since the two last decades, and the supply of biofuels and waste has equally tripled since 1990.

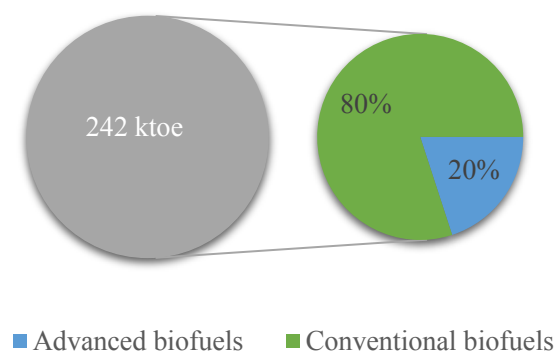
Targets for renewable energy (RES), climate change mitigation and energy efficiency⁴²

TARGETS	2020	2030
RES (renewable energy sources)		55%
GHG emissions reduction (effort sharing)		70% (1990 BASE)
RES-E (renewable energy in electricity)		100%
Biofuels blend obligation	5.75%	
Cap on first generation (conventional) biofuels	7%	
Share of advanced biofuels	0.9%	

Biofuel consumption for transport in 2018 (ktoe) (EurObserv'ER 2019)



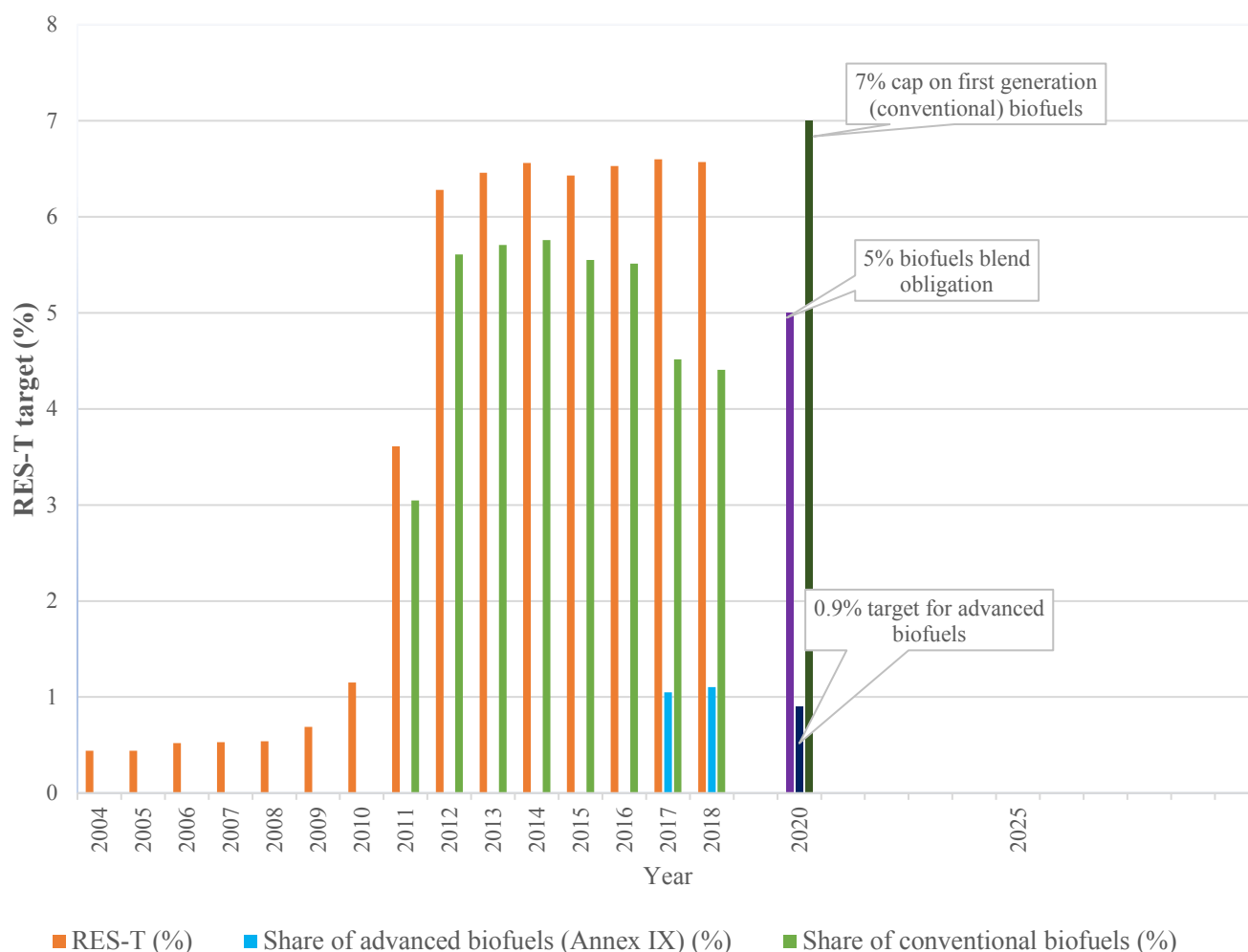
Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



⁴¹ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObservER-Biofuels-Barometer-2019

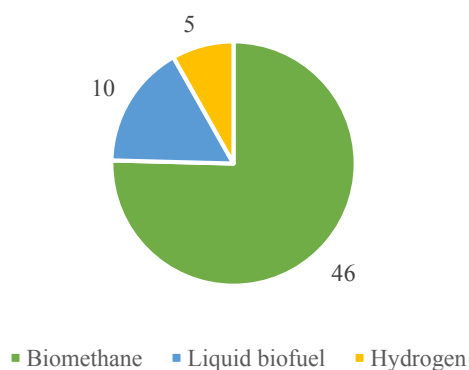
⁴² Integrated National Energy and Climate Plan 2021-2030, Denmark https://ec.europa.eu/energy/sites/ener/files/documents/dk_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

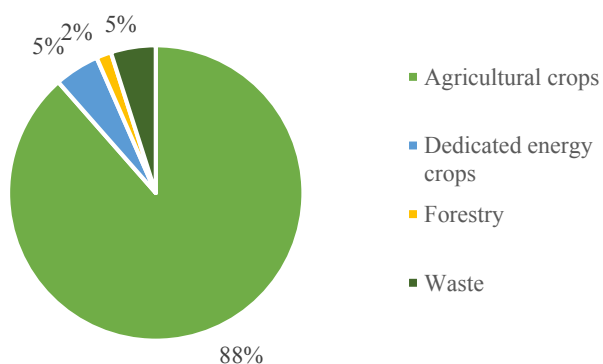


Number of operational biorefineries and hydrogen production projects between 2007 and 2018⁴³

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



⁴³ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁴⁴
Biomass production	Do they address sustainability of feedstock?	Denmark's energy sector laid down principle of sustainability in 2014. The Working Group for Renewable Energy (AGFE) aims to strengthen the sustainability criteria for biomass in Nordic countries⁴⁵ based on the new EU sustainability criteria.	High score=Green; Medium Score=Yellow; Low score=red
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Innovation Fund Denmark established in 2014 supports strategic research projects (TRL 2-4). In 2018 206 million DKK was allocated for R&D projects in energy sector. Approx. 923 million DKK to energy related project under Horizon2020. - Energy Agreement by 2024 Denmark will spend at least 1 billion DJJ on RD&D of new technologies related to energy and climate.	
Distribution and End-use	Do the address specifically advance fuels/ RES fuels?	- As a part of Energy Agreement from June 2018 an agreement made on November 2017 on business and entrepreneurial initiatives of Budget of 140 million DKK has been reserved to support the production of advance biofuel - Low-emission mobility (electrification of transport) - Investment in bioenergy and waste-to-energy projects have increased but investment in biofuels have declined over last five years. In 2017, bioenergy consumption is approximately 75% of the total renewables and industry and transport use is approximately 15%. The consumption is expected to increase in transport subsectors like heavy goods, ships and aircraft by introduction of biogas in natural gas system.	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No transport sub-sector targets. - Programme for Nordic Co-operation on Environment and Climate 2019-2024, Danish presidency focuses on sustainable aviation. - Denmark in leading a shipping coalition in Mission Innovation energy research initiative.	

⁴⁴ High score=Green; Medium Score=Yellow; Low score=red

⁴⁵ AGFE in 2017 commissioned a study on the emerging Bioenergy Sustainability Policy and its possible impacts entitled; "A Nordic analysis of the proposed EU policy for bioenergy sustainability". This work contributed to the process of revising the Directive and increasing the knowledge of its impact on the bioenergy sector in the Nordic region. https://ec.europa.eu/energy/sites/ener/files/documents/denmark_draftnecp.pdf

Transport policies and measures supporting the 5 dimensions of the energy union⁴⁶

Sector	Decarbonisation	Energy Security	Energy efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission reduction targets Phase out coal in electricity production and sales of new diesel and petrol cars by 2030. Climate Action Plans and 2018 Energy Agreement 2018 have allocated funding to increase the share of renewable energy by 55% by 2030	Under Climate Action plan Denmark has a strategy for electrification of transport sector. Denmark invests in a variety of energy technologies focused on increasing the variation of possibilities in production, transmission, distribution and consumption.	National Climate Action Plan has energy efficiency measures to energy saving obligations in transport sector.	The Danish TSO, Energinet is focusing on developing infrastructure projects to increase the interconnectivity and they work in cooperation with Nordic TSOs under Nordic Grid Development Plan 2017.		Denmark committed to spend 580 million DKK in 2020 and 1 billion DKK in 2024 on R&D of new technologies related to energy and climate. Mission Innovation- out of many innovation challenges- Denmark is active in 4 challenges and 'sustainable bio-fuels' is one them.

Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: Denmark Rural Development Programmes		Biofuels quota obligation	
		Phase out of sales of fossil fuel cars in 2030	
Environmental Protection Act	Energy Aid Scheme; Premium for RES-E	Biofuels Act; Biomass Agreement (Use of biomass for electricity production)	
Act on Nature Conservation; Contaminated Soil Act	Premium Tariff to support RE		
Waste Tax; Weight and volume based packaging taxes	Subsidy for gas recovery at landfill sites	Tax regulation- Coal Tax Act; Mineral Oil Tax Act product, CO2 tax on energy products; Green Owner tax (fuel efficiency dependent annual tax on motor vehicles); Reduced tax on green company cars	
Landfill Directive; Ban of Landfill of combustible waste	Subsidies for RE production using biomass, biogas and other green gases)	Energy Efficiency in transport by passenger cars	
Climate Action Plans; Agreement on Green Growth; Denmark's Green Future Fund; Energy Strategy 2050 Sustainable Transport- Better Infrastructure Strategy; 2030 Framework for climate and energy policies; Danish bio-economy strategy.			

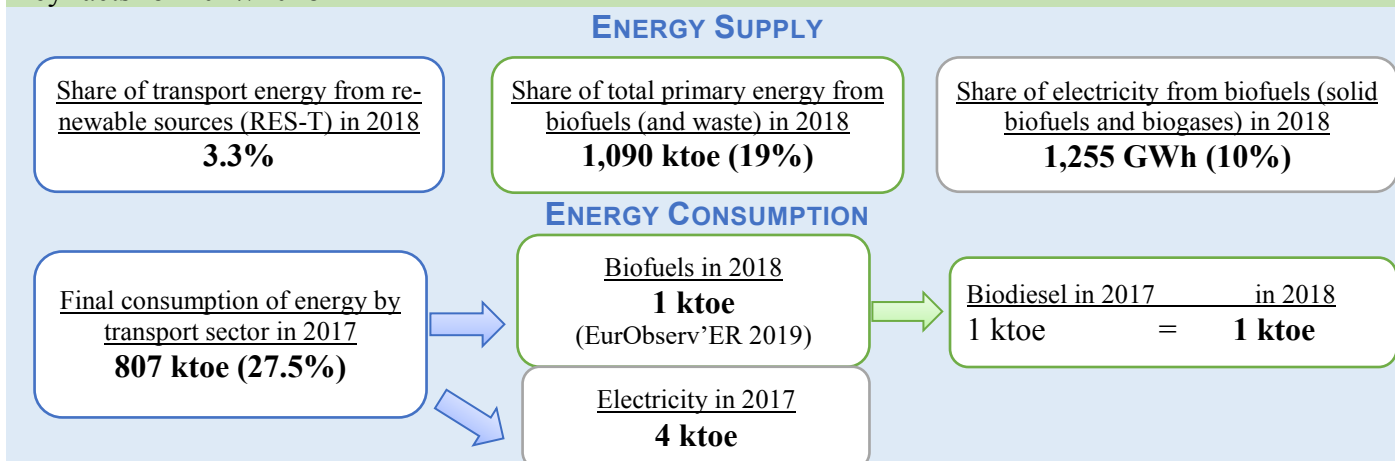
⁴⁶ Integrated National Energy and Climate Plan 2021-2030, Denmark https://ec.europa.eu/energy/sites/ener/files/documents/dk_final_necp_main_en.pdf

Estonia

Policy and Plant Factsheet on Advanced Renewable Fuels

Current State of Affairs^{47;48}:

Key facts for 2017/2018

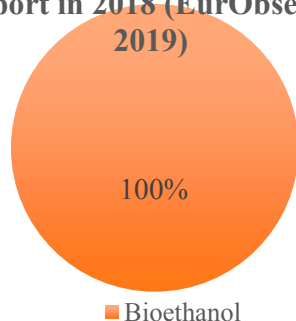


Estonia has not seen a change in biofuels consumption for transport for biodiesel between 2017 and 2018. However, since 1990, overall energy consumption of biofuels and waste has more than doubled, while supply has steadily grown over tenfold. Coal and oil continue to dominate these market shares and have remained steady in the last decade.

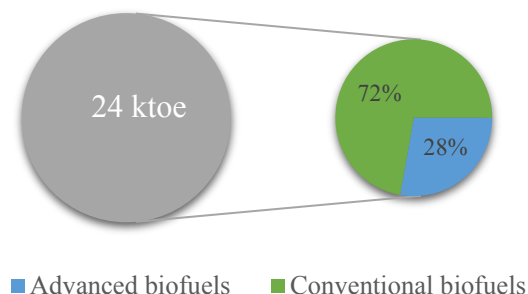
Targets for renewable energy (RES), climate change mitigation and energy efficiency⁴⁹

TARGETS	2020	2030
RES (renewable energy sources)		42%
Primary energy consumption reduction		14% (2015 BASE)
GHG emissions reduction		70% (2005 BASE) 13% NON-ETS
RES-E (renewable energy in electricity) ⁵⁰		40%
RES-T (renewable energy in transport)		14%
Biofuels blend obligation	5%	7-10%

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



⁴⁷ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

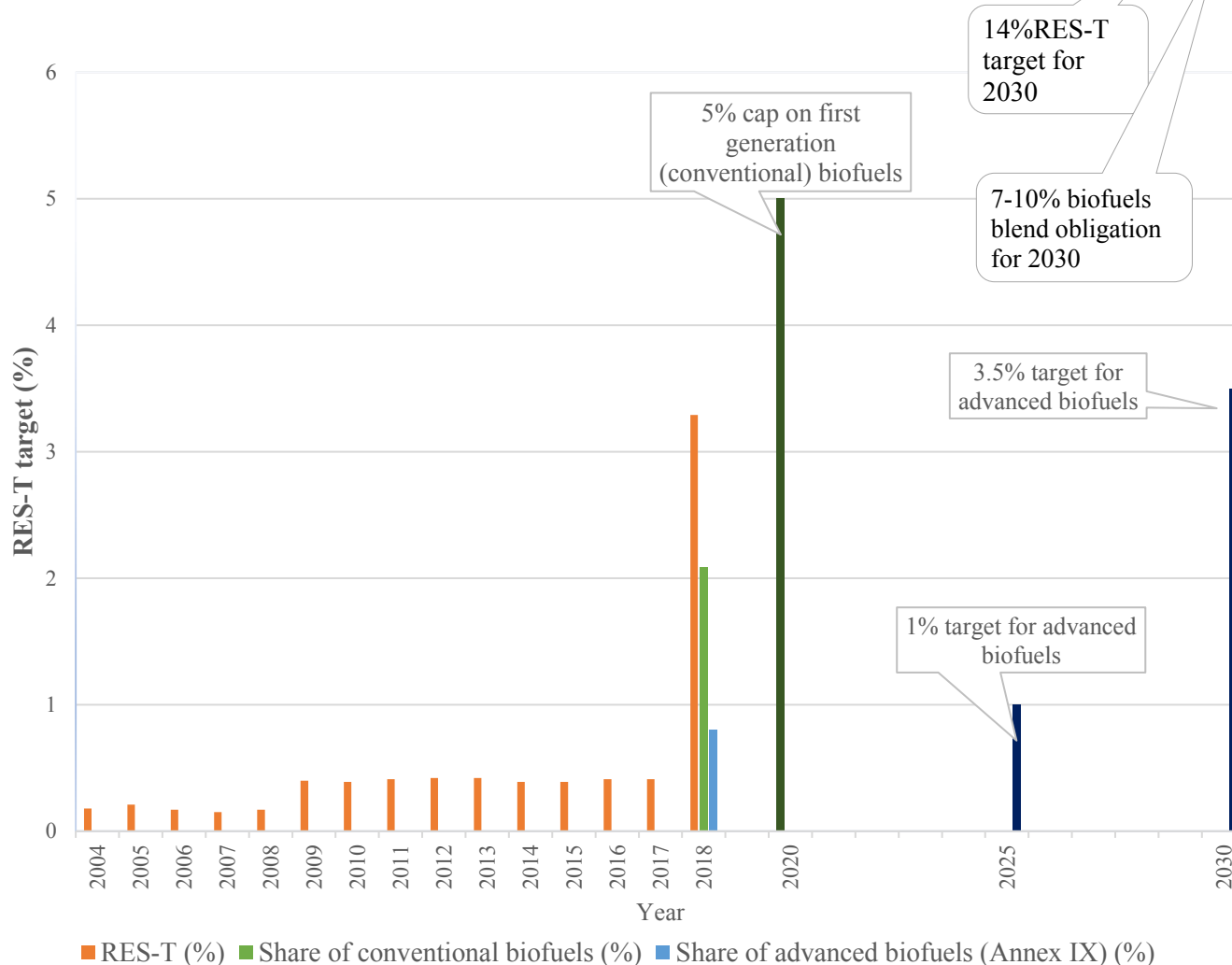
⁴⁸ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC – as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

⁴⁹ Integrated National Energy and Climate Plan 2021-2030, Estonia, https://ec.europa.eu/energy/sites/ener/files/documents/ee_final_necp_main_en.pdf

⁵⁰ Electricity interconnection level was at 63% in 2019 which has already surpassed the EU's 15% target by 2030.

Cap on first generation (conventional) biofuels	7%		
Share of advanced biofuels	2022	2025	3.5%
	0.2%	1%	

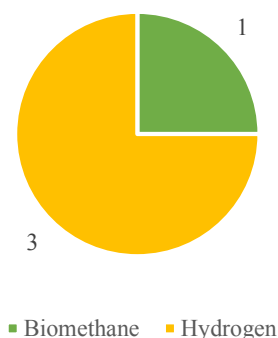
RES-T shares and policy targets (Eurostat 2018)



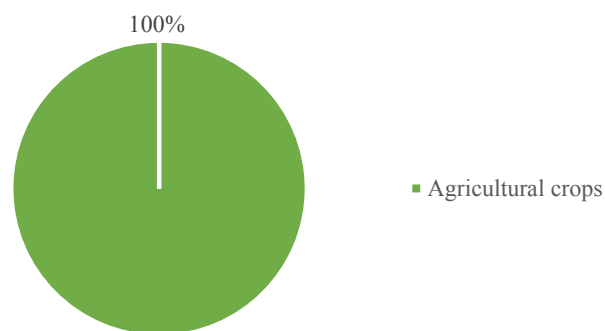
Number of operational biorefineries and hydrogen production projects between 2007 and 2018⁵¹

⁵¹ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database;

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁵²
Biomass production	Do they address sustainability of feedstock?	Biomass sustainability criteria under the RED is used as a tool to verify the sustainable forest management and production of wood fuels	Yellow
Conversion of feedstock	Do they have financing for innovative conversion technologies?	National level development document 'General Principles of Climate Policy until 2050' outlines activities which will attract development of innovative technologies, products and services that reduce GHG emissions	Yellow
Distribution and End-use	Do they address specifically advance fuels/ RES fuels?	NDPES 2030 proposes to increase the introduction of alternative fuels in transport, create an efficient transport fleet, and increase energy efficiency	Yellow
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	No transport sub-sector targets	Red

Transport policies and measures supporting the 5 dimensions of the energy union⁵³

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Market	Energy Research, Innovation, competitiveness
Transport	EE's NECP developed these policy measures: Increasing use of electric transport, biofuels share in	Diversification of gas supply and mobilisation of local energy sources Increasing the fuel efficiency	Support for purchasing electric vehicles Increasing fuel efficiency in the transport sector	Synchronisation of the electrical system Estonia participates in regional cooperation of energy and climate policy -Baltic Energy	State budget strategy 2019-2022'- energy related research and development for four subsequent years to a

⁵² High score=Green; Medium Score=Yellow; Low score=red

⁵³ Integrated National Energy and Climate Plan 2021-2030, Estonia, https://ec.europa.eu/energy/sites/ener/files/documents/ee_final_necp_main_en.pdf

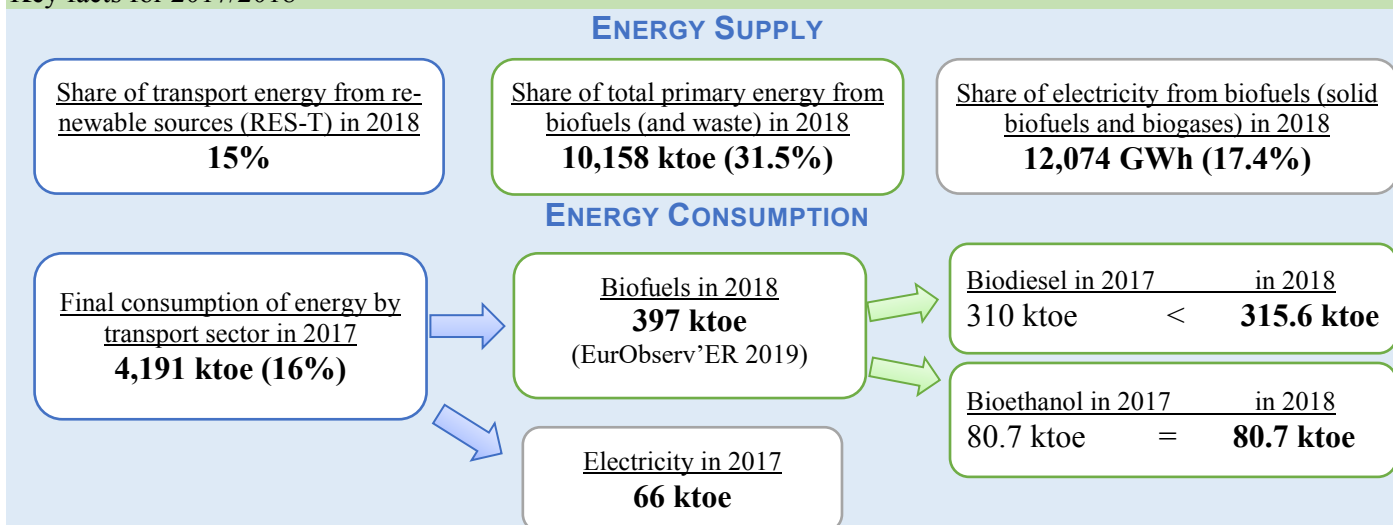
transport and soft mobility Increasing affordability, energy and fuel efficiency of vehicles Electrification of transport (railways and ferries) Green technology investment programme	of transport sector Spatial and land use measures in cities to increase the fuel-efficiency of transport and enhancement of the transportation system	Establishment of road charges for heavy-duty vehicles Spatial and land use measures in cities to increase the fuel-efficiency of transport and the efficiency of the transportation system	Market; Interconnection Plan; Baltic-Nordic Energy Research Programme; Baltic Assembly Baltconnector relates to all 5 dimensions of the energy union	total of EUR 1.6 million, i.e. EUR 400 000 a year. Development plan for Estonian research, development, innovation and entrepreneurship 2021-2035 Planned activities for the development of convenient transport
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Biomass policies which support the mobilisation of advanced renewable fuels

Production	Conversion	Distribution	End-use
CAP: Estonia Rural Development Programme		Electromobility Programme (ELMO) infrastructure	
	Enhancing resource efficiency of Estonian companies		
	Estonia feed-in premium for the renewable electricity generation	EV Support Policy	
		Clean Vehicles Directive	
		Aid for purchase for	
Energy efficiency target declared by Estonia under the EU Directive (2012/27/EU)			
National emissions target under the EU Effort Sharing Decision (406/2009/EC) Estonia			
Electricity Market Act			
Estonia’s National Energy and Climate Plan (NECP) 2030; National Development Plan of the Energy Sector 2030; Estonian Low carbon technologies- Climate Policy 2050; Estonian National Energy Technology Development Plan 2030 (NDPES 2030); Forestry development plan for the period 2021-2030 ; Infrastructure and mobility development plan for the period 2021-2030 (under development); Development plan for Estonian research, development, innovation and entrepreneurship 2021-2035(under development); General Principles of Climate Policy until 2050;Increasing international competitiveness of Estonian R&D and participating in pan-European science initiatives			

Current State of Affairs^{54;55}:

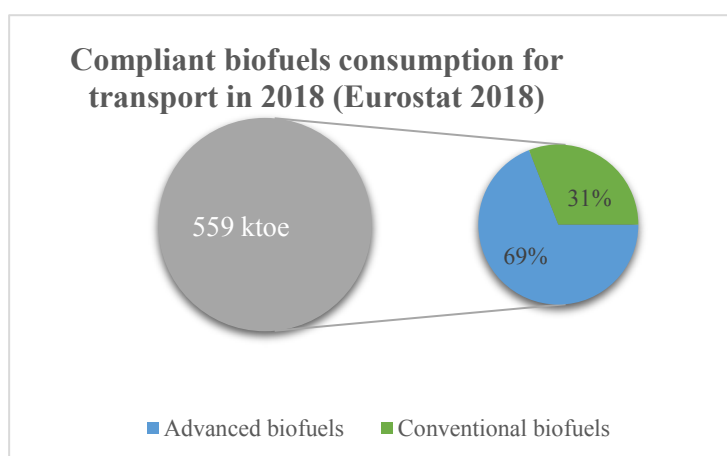
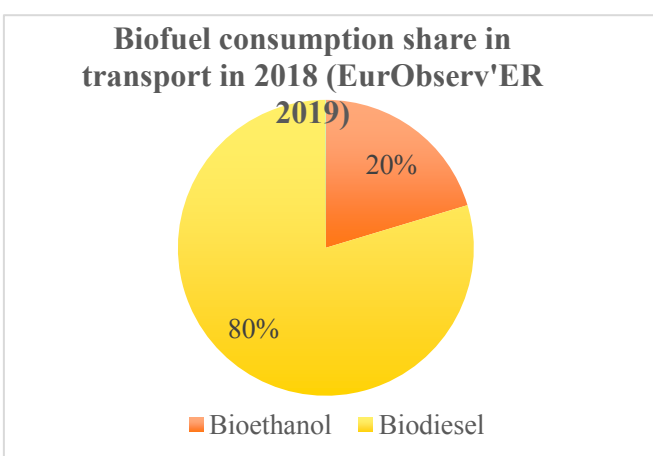
Key facts for 2017/2018



Finland has seen an increase in biodiesel, however no progress has occurred for bioethanol between 2017 and 2018. Yet overall, both supply and consumption of biofuels and waste have doubled since 1990. The Finnish transport sector remains significantly behind industry in terms of energy consumption and does not show any significant growth. Meanwhile, nuclear power steadily remains a dominant producer of electricity.

Targets for renewable energy (RES), climate change mitigation and energy efficiency⁵⁶

TARGETS	2020	2030
RES (renewable energy sources)	38%	51%
GHG emissions reduction (ETS)		39% (2005 BASE)
Primary consumption reduction of fossil fuels		50% (2005 BASE)
RES-T (renewable energy in transport)		30%
Biofuels blend obligation		30%
Cap on first generation (conventional) biofuels	7%	
Share of advanced biofuels	0.5%	10%

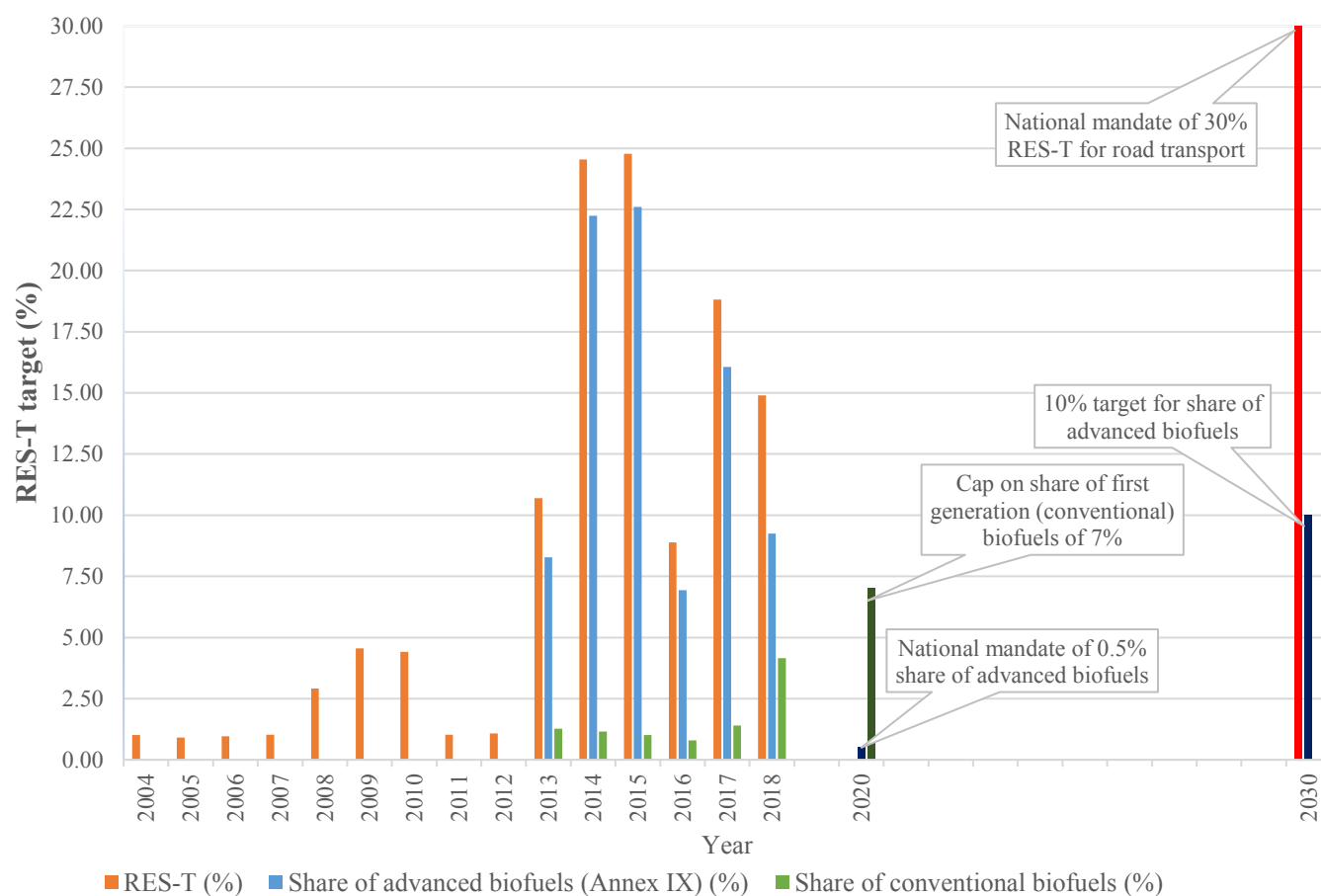


⁵⁴All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

⁵⁵ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

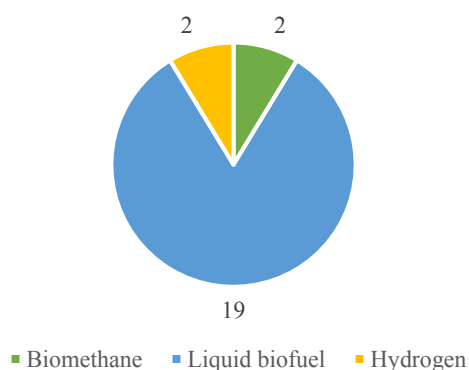
⁵⁶Integrated National Energy and Climate Plan 2021-2030, Finland https://ec.europa.eu/energy/sites/ener/files/documents/fi_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

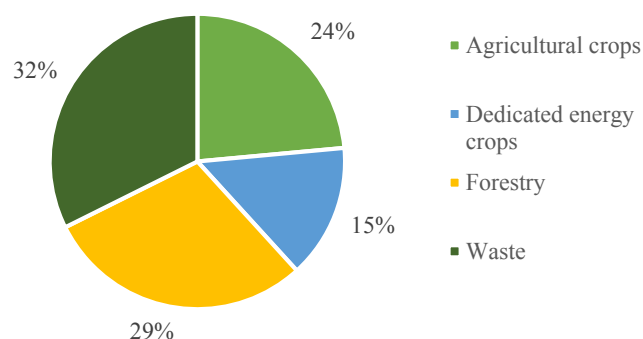


Number of operational biorefineries and hydrogen production projects between 2007 and 2018⁵⁷

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



⁵⁷ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁵⁸
Biomass production	Do they address sustainability of feedstock?	Finland will implement RED II sustainability measures for biomass production by June 2021. Forest Act, Forest Damages Prevention Act, The Timber Management Act have legislations and monitoring system to reduce the risk of unsustainable forest biomass production and to ensure sustainability. Act on the Financing of Sustainable Forestry promotes the sustainable management and provide public funding of around EUR 50-60 million per year	High
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Energy Aid Scheme Renewable Energy provides investment subsidies for commercialisation of new technologies in the non-ETS sector (advanced biofuels for transport, and non-ETS electricity). Aid pays 30 % for mature technologies and up to 40 % for new technology projects. Annual budget is EUR 30–40 million - EUR 90 million has been planned for the early phase out of coal use in energy production and if approved the aid scheme will be in force 2021–2023 - Business Finland is a Finnish funding organisation for innovation, promoting low-carbon businesses under funding programme ‘Growth engines’ which bring together companies, research organisations and public actors. Growth Engines currently focuses on carbon compensation, small port and marine services, and new solutions for a societal scale model of renewable energy production	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Energy Aid Scheme promotes advanced biofuels - Investment needs for advanced fuels and electric vehicles infrastructure are assessed and national objective to increase the share of transport biofuels to 30% by 2030 and 250,000 electric cars by 2030	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	No specific targets for sub-sectors	Low

⁵⁸ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union⁵⁹

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission reduction targets Primary energy consumption reduction measures Phasing out coal by 2030 50% reduction of use of fossil fuels by 2030 compared to 2005 base level Financial support for buying EVs and conversion of old cars to biofuel cars: government budget EUR 6 million per year for 2018–2021	National Energy Efficiency Target for 2030: different sectors have different voluntary energy efficiency measures and agreements In total energy savings: 80,159 GWh/year aimed by 2030 Number of electric vehicles at least 250,000 by 2030 Biogas is the major source of gas used in transport	National target energy self-sufficiency by 55%. Focus on decentralisation and small-scale production and incentives and tax reduction for electricity production	Finland exceeds EU’s interconnectedness targets. Interconnectivity with other countries at 22% at the beginning of 2017 will fall to 18% by 2020 Government budget of EUR 3 million allocated to promote infrastructure for biogas use in transport and EVs Additional EUR 1.5 million to promote infrastructure for EVs in residence houses	Public research and development funding targeted for energy sector in 2018 was EUR 42.2 million, a large decline compared to EUR 177.5million Mission Innovation project, Nordic Energy Research (NER) is cooperative energy research, aim is to expand knowledge on sustainable energy and contribute to the development of new competitive energy solutions	

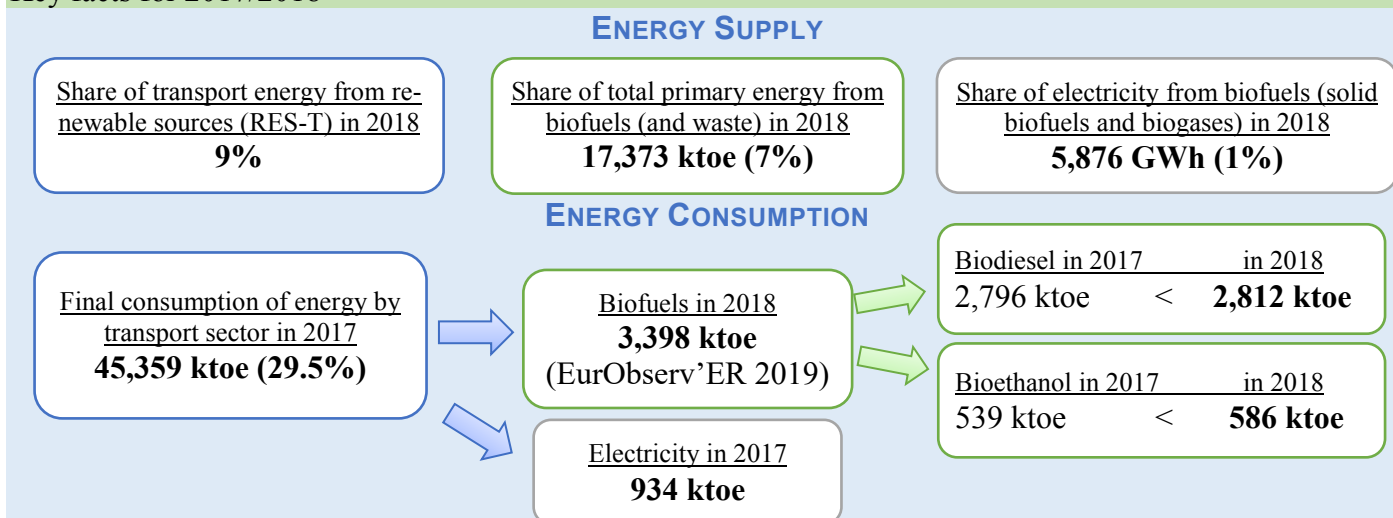
Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: Finnish Rural Development Programmes		Biofuels quota obligation	
Waste Act; Wood Waste Act	Energy Aid Scheme; Premium for RES-E	The Act on Promoting the Use of Biofuels in Transport	
Sustainability criteria for biofuels and bioliquids		Tax regulation (tax reduction on biofuels- Excise duty, Act on biofuels and bioliquids); Energy and Carbon dioxide taxes;	
Decree on Landfills; Classification of wood waste		Directive on deployment of alternative fuels infrastructure (AFI Directive)	
National Forest Strategy 2025; Forest Act; Forest Damages Prevention Act; The Timber Management Act	Air Quality Decree Emission Regulations for combustion plants	National obligation for EVs charging station at petrol station	
Act on Financing of Sustainable Forestry	Energy Efficiency Act	Public Procurement Rules	
	Production subsidies for RES-E		Financial support for buying EVs and conversion of cars to biofuel cars
	Energy Aid Investment (Subsidies)		
Act on regional development (Investment subsidies); Law on promotion of renewable energy; National Climate and Energy Strategy 2030; Transport 2030; Energy and Climate Roadmap 2050; Finnish Bioeconomy Strategy; Smart Mobility Program; Circular Economy Roadmap			
Finnish Innovation Policy Guidelines; The Climate Change Act			

⁵⁹ Integrated National Energy and Climate Plan 2021-2030, Finland https://ec.europa.eu/energy/sites/ener/files/documents/fi_final_necp_main_en.pdf

Current State of Affairs^{60;61}:

Key facts for 2017/2018

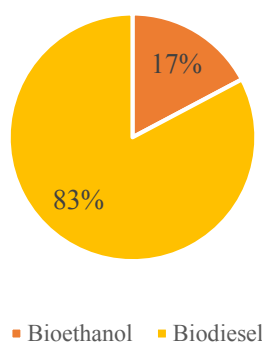


In 2018 France was the highest consumer of biofuels in Europe with significant growth for bioethanol consumption. The transport sector retains the highest share of energy consumption and consumption of biofuels and waste has been steadily growing since 1990, while oil is dropping. Electricity production remains strongly driven by nuclear power.

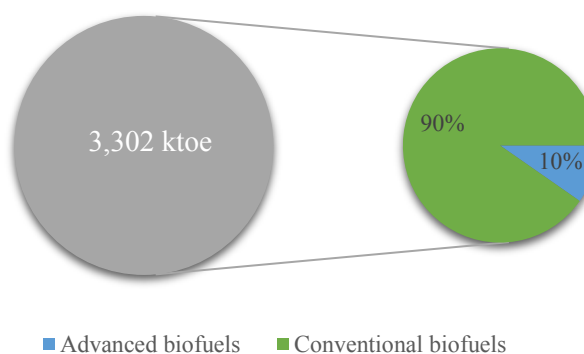
Targets for renewable energy (RES), climate change mitigation and energy efficiency⁶²

TARGETS	2020	2030
RES (renewable energy sources)	23%	33%
GHG emissions reduction		40% (1990 BASE)
Fossil fuel reduction	PHASE OUT COAL BY 2022	40% (2012 BASE)
RES-T (renewable energy in transport)		15%
Biofuels blend obligation	8.2%	
Cap on first generation (conventional) biofuels	7%	
Share of advanced biofuels	2023	2028
	1.6%	6.6%

Biofuel consumption share for transport in 2018 (EurObserv'ER 2019)



Compliant Biofuels consumption for transport in 2018 (Eurostat 2018)

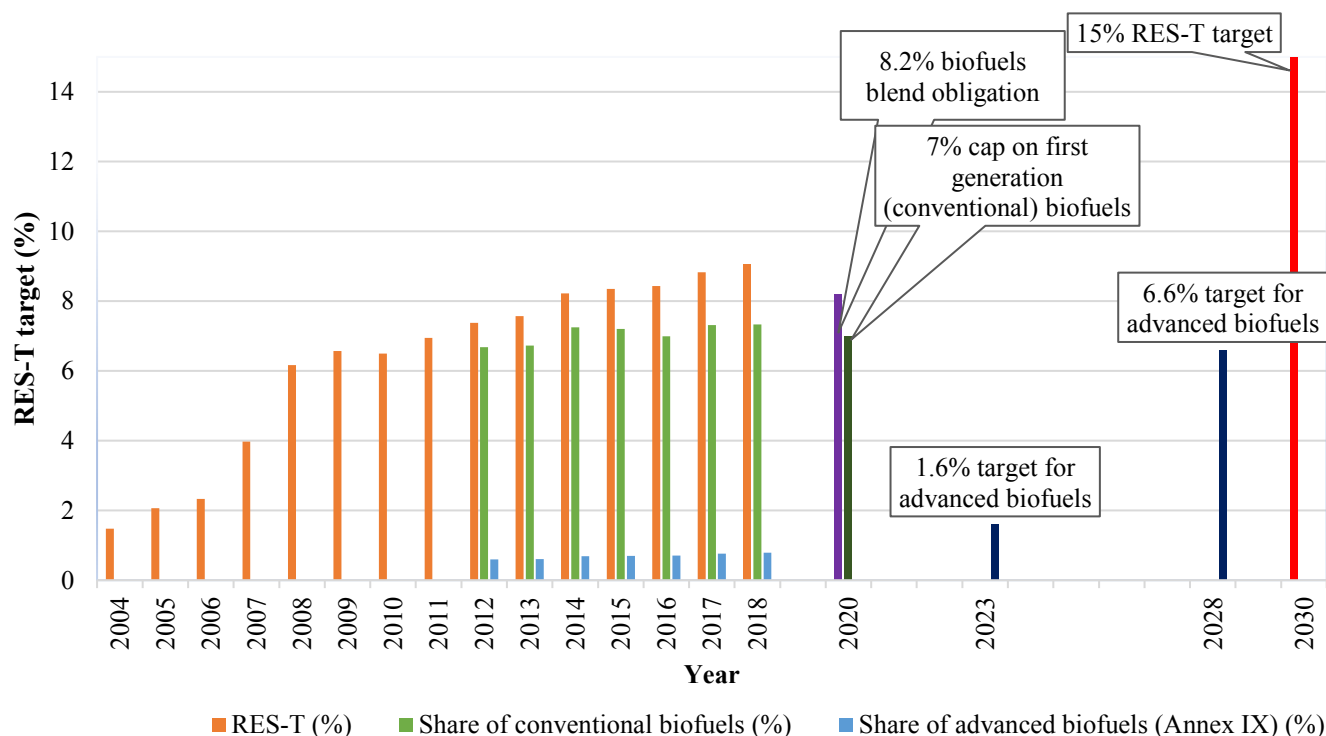


⁶⁰ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

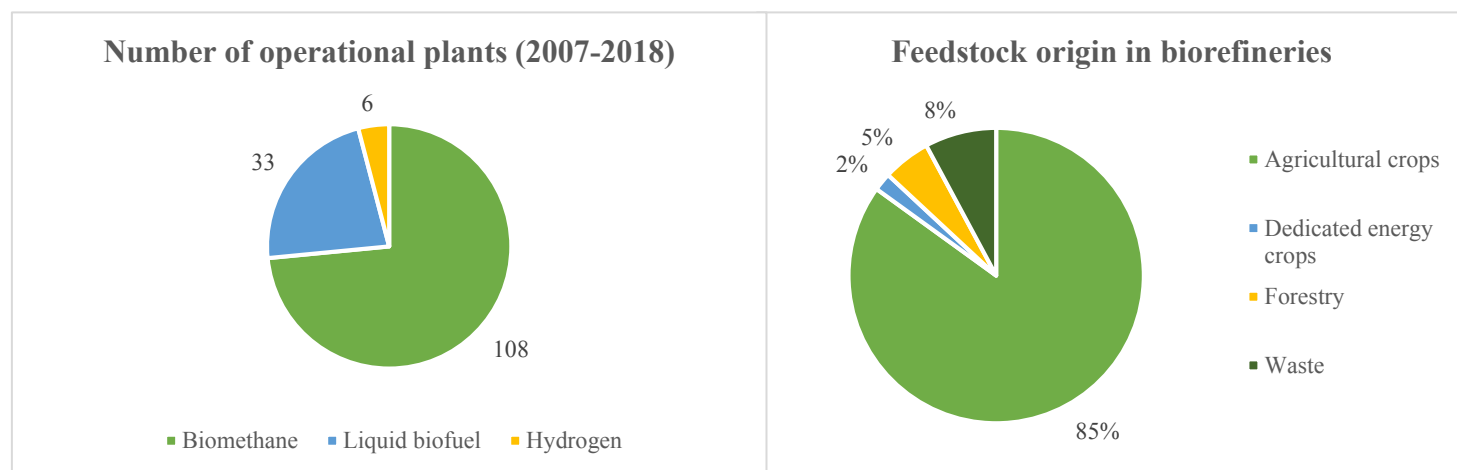
⁶¹ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

⁶² Integrated National Energy and Climate Plan 2021-2030, France, https://ec.europa.eu/energy/sites/ener/files/documents/fr_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)



Number of operational biorefineries and hydrogen production projects between 2007 and 2018⁶³



⁶³ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁶⁴
Biomass production	Do they address sustainability of feedstock?	- Ensuring sustainable biomass mobilisation through food security and soil protection - Agroforestry Development Plan	:
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Green Innovation Funding - Law governing the Energy Transition for Green Growth aims to further develop alternative fuels with lower carbon emissions	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Multi-annual Energy Programme support the development of advanced biofuels - Advanced biofuel targets set for 2023 and 2028 with a distinction between gasoline and diesel streams - A growing network of service stations offering E10 and E85 fuel, flex-fuel vehicle registrations and E-85 fuel conversion kits legalisation for gasoline vehicles has helped achieved this growth⁶⁵	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No specific sub-sector targets - National Alliance for the Coordination of Energy Research has evaluated the country's potential in producing aviation biofuels - Grenelle 2 programme's one of the objective is to upgrade transport infrastructure and behaviour which encourages freight and shipping sector to reduce energy consumption and carbon emissions	

Transport policies and measures supporting the 5 dimensions of the energy union⁶⁶

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	Imposition of emissions standards for automobile manufacturers (including 95g CO ₂ EU-wide mandate in 2020)	Preventing energy scarcity or inaccessibility Ensuring the right to access all sources of energy without added costs within	Certification system for energy efficiency Ecodesign and labelling of energy-related products	Development of bio-fuels mainly through fiscal measures Multi-annual Energy Programme setting action priorities for governmental interventions	Program for Future Investments to support R&D and innovation for the energy transition Supporting research centres

⁶⁴ High score=Green; Medium Score=Yellow; Low score=red

⁶⁵ EurObservER-Biofuels-Barometer-2019

⁶⁶ Integrated National Energy and Climate Plan 2021-2030, France, https://ec.europa.eu/energy/sites/ener/files/fr_final_necp_main_en.pdf



Carbon accounting in energy financing	household income	Credit financing for energy transition including funding for upgrading vehicle performance	Ministry for a Solidary Ecological Transition supports the functioning of energy markets and the development of renewable technologies, as well as the market roll-out of sustainable vehicles	including Institute for the Energy Transition
National Research Agency supporting the decarbonisation and market roll-out of new vehicles				€500m/year dedicated to funding public research for energy technologies

Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: French Rural Development Programme		Biofuel Quota	
Nitrates Act	Feed-in Tariff, Premium Tariff or RES-E		Low Emissions Zone
		Local Government fleet renewal mandate (2025 onwards public transport vehicles must be low-emission vehicles)	
Forest Subsidies	Tenders for RES-E	Energy Subsidies and Grant	
Waste classification Decree	Tax reduction for RES-E/ RES-H		Grenelle Fund: Zero percent interest loan
			Investment Subsidies for Thermal renovation
Water Policy		Law on Housing (ELAN)	
Law on Energy Transition for Green Growth (LTECV)			
			Energy Renovation in Buildings Plan
		Investment for future infrastructure -Charging Infrastructure target 2030	
Energy Transition for Green Growth Act 2015; Law on energy transition for a green growth			
The national emission target for France under the EU Effort Sharing Decision (406/2009/EC) France 2009			
Bioeconomy Action Plan; Bioeconomy Strategy of Grand Est ⁶⁷ ; The National Strategy for the Use of Biomass ⁶⁸ ; Circular Economy Roadmap 2019; Low Carbon Strategy ⁶⁹ ; The Climate Plan 2013; Law on Energy and the Climate; National Climate Change Adaptation Plan 2018-2022; Law on Energy Transition for Green Growth Act 2015 ; National Climate Change Adaptation Plan 2018-2022; Law on Energy and the Climate The National Strategy for the Use of Biomass ⁷⁰ ; Low Carbon Strategy ⁷¹ ; Nation commitment to environment -Grenelle 2			

⁶⁷ <https://www.grandest.fr/etats-generaux-bioeconomie/>

⁶⁸ <https://www.actu-environnement.com/media/pdf/news-30869-strategie-nationale-biomasse.pdf>

⁶⁹ <https://www.ecologique-solidaire.gouv.fr/feuille-route-economie-circulaire-frec>

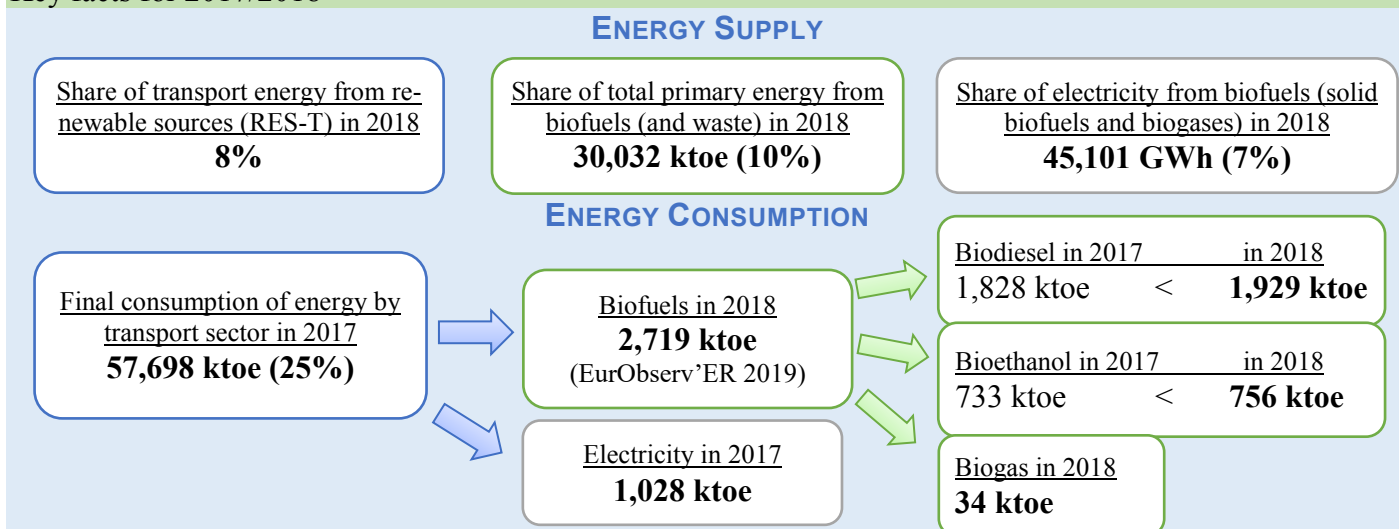
⁷⁰ <https://www.actu-environnement.com/media/pdf/news-30869-strategie-nationale-biomasse.pdf>

⁷¹ <https://www.ecologique-solidaire.gouv.fr/feuille-route-economie-circulaire-frec>



Current State of Affairs^{72;73}:

Key facts for 2017/2018

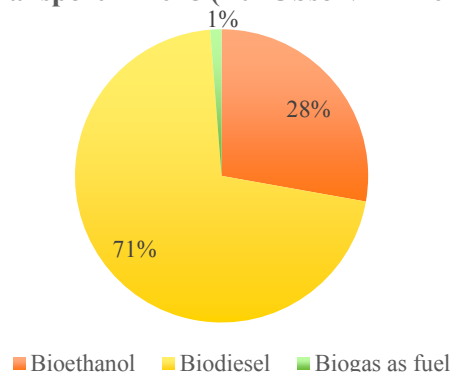


Germany displays a stable growth increase of biofuels from 2017 to 2018. Almost all of Germany's consumption of biofuels has been certified as sustainable. The transport sector has recently become the largest in terms of energy consumption, while overall biofuels and waste supply and consumption have been growing steadily since 1990, the former increasing 6 times over. The electricity generation market is still heavily dominated by coal.

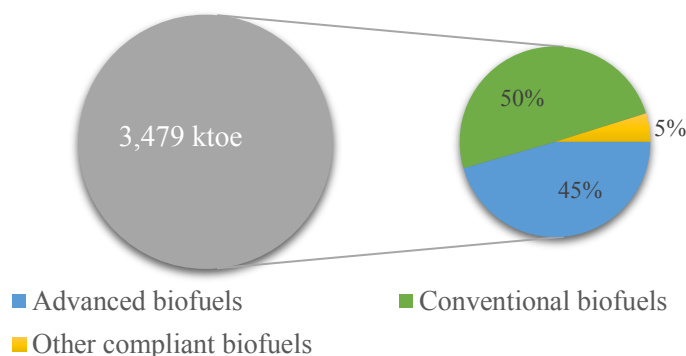
Targets for renewable energy (RES), climate change mitigation and energy efficiency⁷⁴

TARGETS	2020	2025	2030	2050
RES (renewable energy sources)	18%		30%	
GHG emissions reduction			55% (1990 BASE)	
Primary energy consumption reduction			30% (2008 BASE)	50% (2008 BASE)
Cap on first generation (conventional) biofuels	6.5%			
Advanced biofuels	0.05%	0.5%		

Biofuel consumption share for transport in 2018 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)

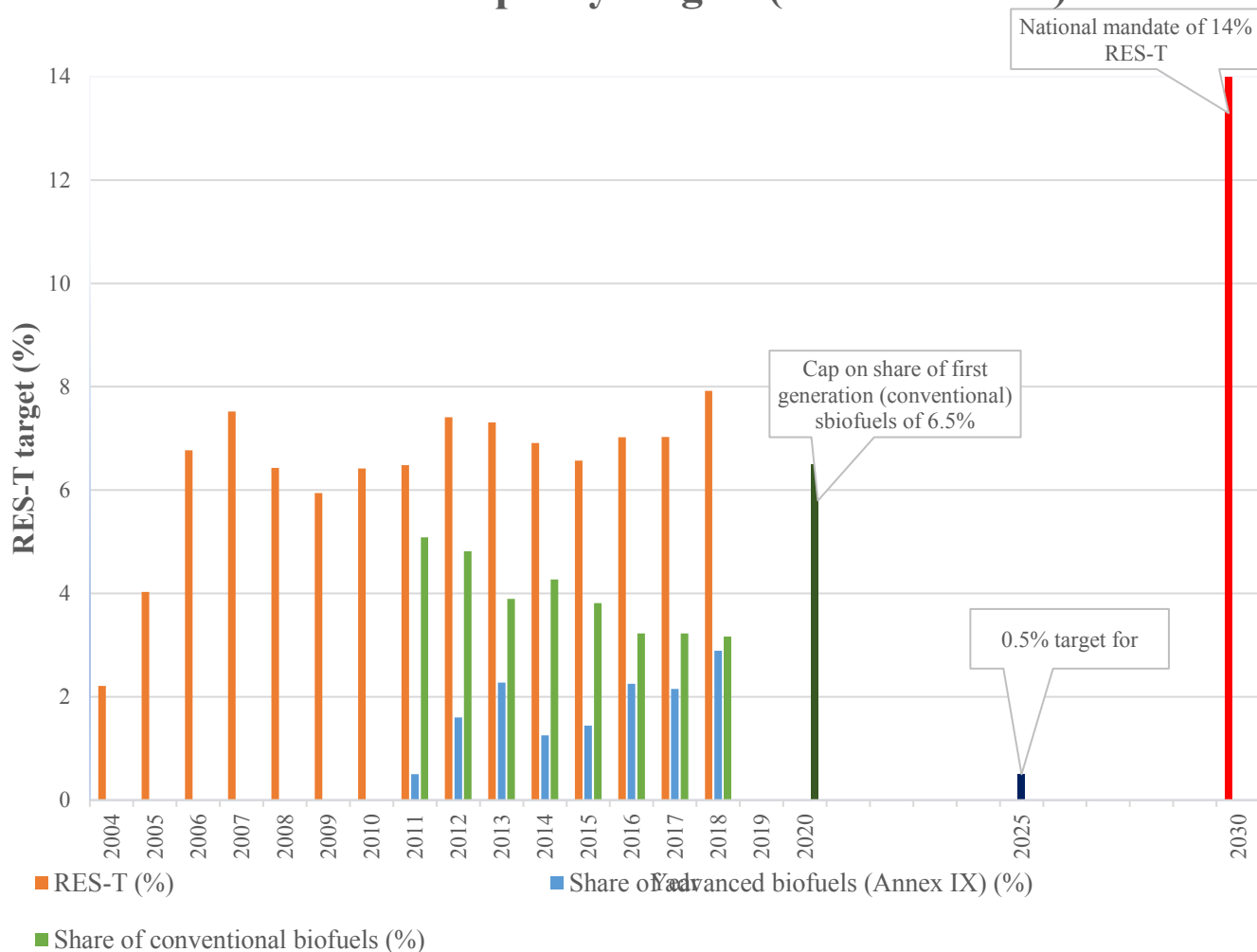


⁷² All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

⁷³ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

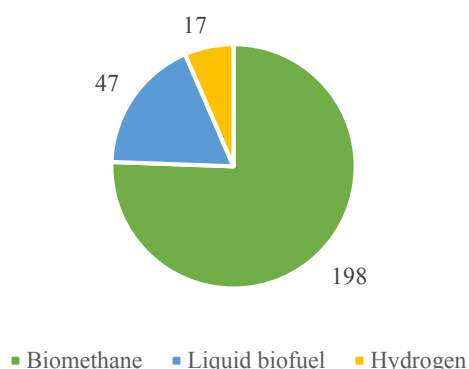
⁷⁴ Integrated National Energy and Climate Plan 2021-2030 Germany, https://ec.europa.eu/energy/sites/ener/files/documents/de_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

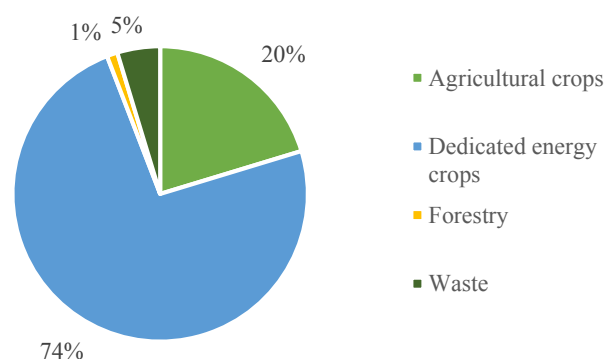


Number of operational biorefineries and hydrogen production projects between 2007 and 2018⁷⁵

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



⁷⁵ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/cba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁷⁶
Biomass production	Do they address sustainability of feedstock?	Domestic biomass available for bioenergy is 1000-1200 PJ, therefore, focus is on advanced biofuels to mobilise waste and residues by putting additional efforts in R&D. Germany aims to use biomass in aviation, maritime transport where feasible and for the rest use green electricity	Green
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- National decarbonisation programme is focusing on possible reduction of GHG emissions in the production of emission-intensive good and optimisation of process chain and conversion processes to use renewable sources and raw materials and conversion technologies for hydrogen and use of CO₂ - Mission Innovation - SINTEG programme (Smart Energy Showcases – Digital Agenda for the Energy Transition program)- SINTEG Regulation, which entered into force on 21 June 2017 provides opportunity to try out new technologies, procedures and business models (e.g. those relating to digitalisation and sectoral coupling)	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Support for advanced renewable fuels by focusing on waste and residues and providing no additional support for first generation biofuels from food and fodder crops - A sub-quota for advanced biofuels will be introduced to implement RED II - Tradable Green Certificates and Tax regulation mechanism II (BioKraftQuG) for biofuels used in transport - The Federal Government's National Hydrogen Strategy - The Federal Government of Germany aims to establish framework for development of large-volume electrolysis and refinery processes for the production of green electricity- which will enable the use of green energy in aviation, maritime and heavy duty vehicles - The Federal Government also aims to develop national hydrogen strategy - European Union's Industrial Policy Initiative to develop e-fuel supply will also be supported	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	Germany does not transport sub-sector targets. However, it does have 1.2 multiplier factor for aviation and marine transport sectors to calculate their share towards 14% renewable share	Yellow

⁷⁶ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union⁷⁷

Sector	Decarbonisation	Energy Security	Energy Efficiency	Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	Climate Action Plan 2050 -Decarbonise energy sector entirely by 2050. Under this action plan the transport sector is expected to reduce 95-98 m.t. CO₂ (40-42% reduction compared to 1990)⁷⁸ Funding Programme 'Use of Biomass for Generation of Energy' Subsidies for electrically powered vehicles Expansion of renewable energy sources and grid expansion and phasing out of coal subsidies by the end of 2027 Funding for low- carbon passenger cars, heavy goods vehicles	Act on the Security of the Electricity and Gas Supply Transport Services Act	Energy Efficiency Strategy 2050 has goals to reduce energy consumption by 30% compared to 2008 level Carbon Pricing in transport sectors to increase energy efficiency		Smart Border Initiative, Pentilateral Energy Forum to increase in the electricity interconnectors and strong regional cooperation Trans-European Energy Networks Focus on grid expansion for electricity and increased integration for electricity market- Improve sectoral coupling- electricity, heat and transport sectors		The Federal Government is focusing on energy research between 2020-2030 and allocated EUR 1.3 billion of funds per annum in the years 2020-2022 for energy research. 7th Energy Research Programme- Innovations for the Energy Transition Cross-system Issues (sectoral coupling, digitalisation)

Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: German Rural Development Programmes		The Federal Transport Infrastructure Plan 2030 (FTIP)	
Ordinance on generation of electricity from Biomass		GHG reduction Quota	E-mobility tax incentives
Biomass Sustainability Regulation		Energy Tax Act; Income Tax Law; Eco-tax reform	
National Forest Act		Green Certificates and Tax regulation mechanism II	
Forest Strategy 2020		Incentive Programme for EV charging infrastructures; Electric vehicle support for public transport	
Material Act	Federal Emission Control Act		
Regulation on recovery and disposal of wood waste		Energy Consumption Labelling Act	
Waste Management Act			Energy Efficiency standards for EVs
Fertiliser Ordinance		National Strategic Framework for the Expansion of Alternative Fuel Infrastructures	
	EU Effort Sharing Regulation 2021-2030		

⁷⁷ Integrated National Energy and Climate Plan 2021-2030 Germany, https://ec.europa.eu/energy/sites/ener/files/documents/de_final_necp_main_en.pdf

⁷⁸ https://www.bmu.de/fileadmin/Daten_BMU/Pool/Broschueren/klimaschutzplan_2050_en_bf.pdf

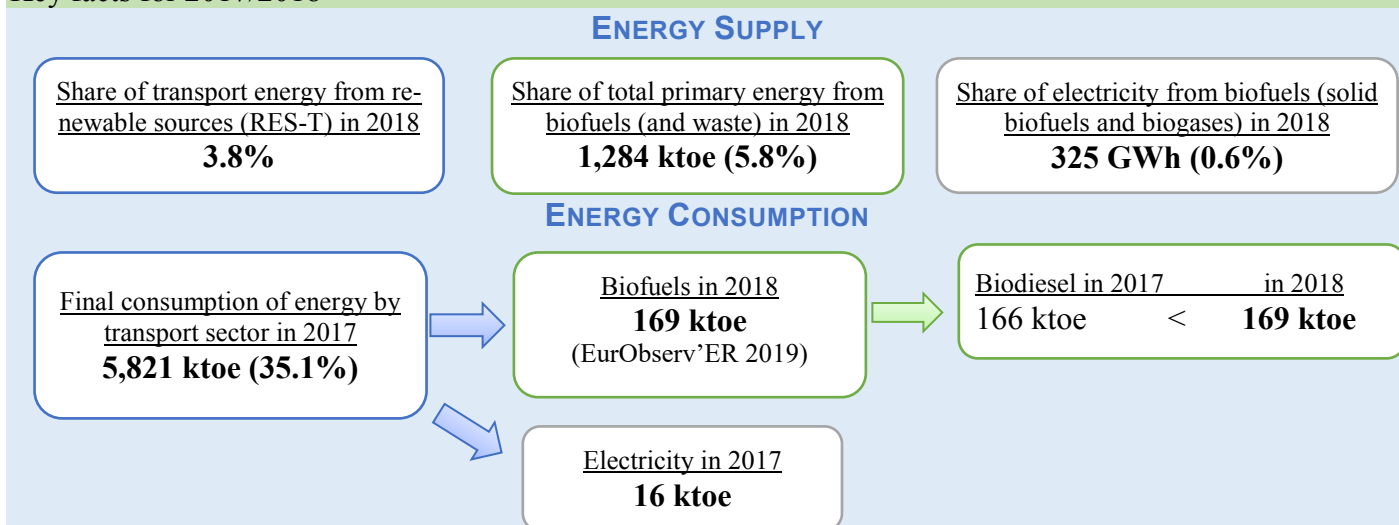


Mobility and Fuels Strategy 2013; Climate Action Plan 2050; Renewable Energy Act (EEG 2017); Integrated Climate and Energy programme (IKEP) Germany 2007; Integrated national energy and climate plan; New Bioeconomy Strategy; Energy Efficiency Strategy 2050; Energy Security Act; Renewable Energy Sources Act



Current State of Affairs⁷⁹:

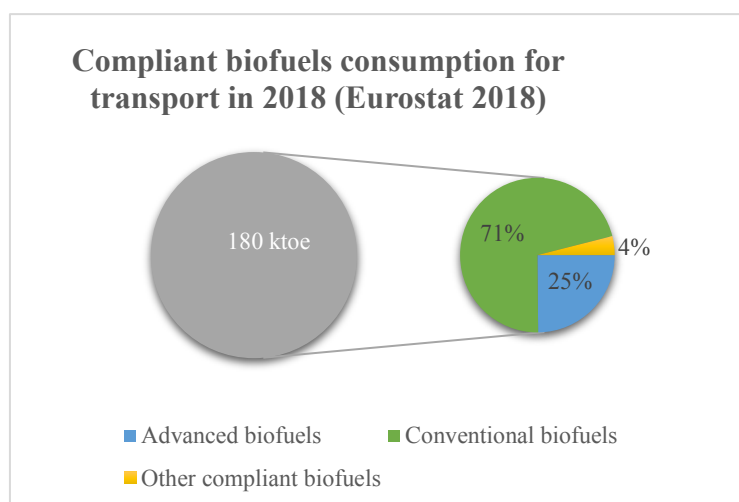
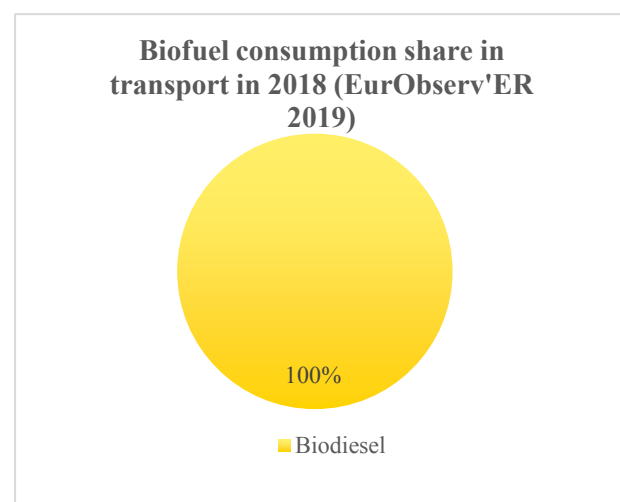
Key facts for 2017/2018



Greece has seen an increase in its biodiesel consumption for the transport sector between 2017 and 2018. No bioethanol consumption is reported. Biofuels have been relatively stable in the energy supply and consumer markets, maintaining around a 6% share since 1990. The transport sector in Greece remains a dominant energy consumer.

Targets for renewable energy (RES), climate change mitigation and energy efficiency⁸⁰

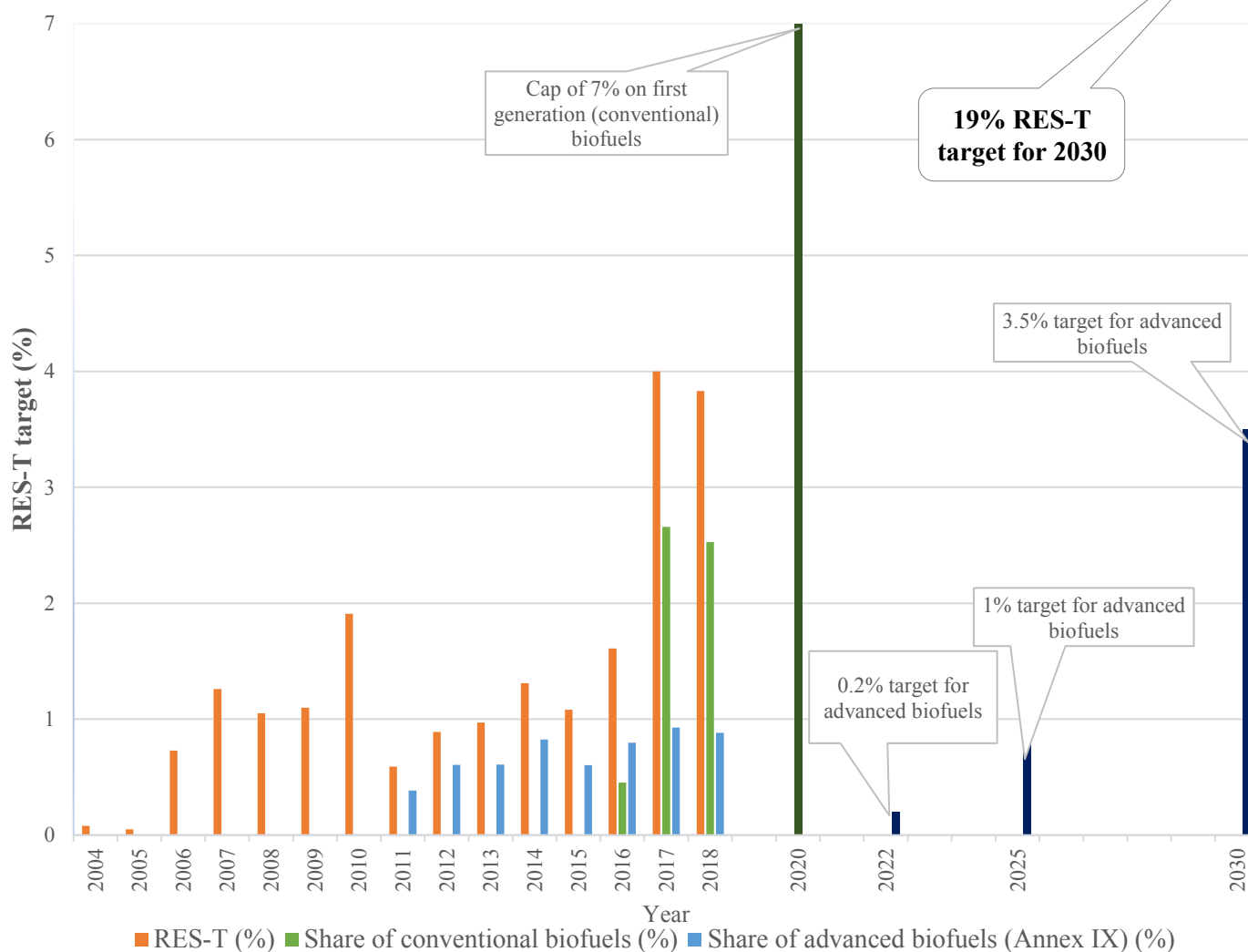
TARGETS	2020	2025	2030
RES (renewable energy in final consumption)			40%
Energy efficiency			38% (2015 BASE)
GHG emissions reduction			56% (2005 BASE) 40% (1990 BASE)
RES-E (renewable energy in electricity)			60%
RES-T (renewable energy in transport)			19%
Cap on first generation (conventional) biofuels	7%		
Advanced biofuels	2022 0.2%	1%	3.5%



⁷⁹ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

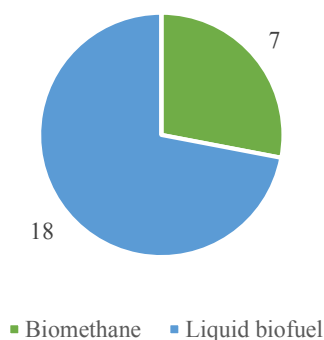
⁸⁰ Integrated National Energy and Climate Plan 2021-2030, Greece, https://ec.europa.eu/energy/sites/ener/files/documents/el_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

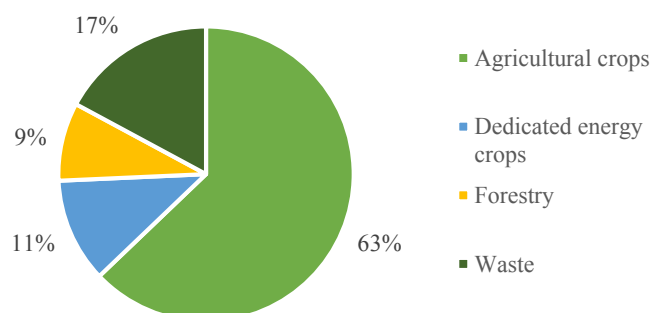


Number of operational biorefineries between 2007 and 2018⁸¹

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



⁸¹ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database; <https://ibbk-biogas.com/biogas-in-greece-status-quo-and-opportunities/>

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁸²
Biomass production	Do they address sustainability of feedstock?	• Sustainability certification schemes for biofuels, bioliquids and solid fuels -to reduce waste and increase RES share • Sustainable forest management	High
Conversion of feedstock	Do they have financing for innovative conversion technologies?	• Just Transition Fund • Greece has invested in scientific investigation and research in the field of hydrogen production from RES but it is at early stage of development and there is need of further research	
Distribution and End-use	Do they address specifically advance fuels/ RES fuels?	• Measures are proposed to promote the use of biomass for energy production ○ Priority in use of domestic raw materials - developing domestic production of advanced biofuels and supply chains and promoting the use of agricultural and livestock residues ○ Maintain sustainability certification scheme for biofuels, bioliquids and solid fuels ○ Development and enhancement of domestic bio-ethanol market • Promoting infrastructure for the use of RES – increase 30% share of electric passenger vehicles registration by 2030 • Financial instruments (investments, tax incentives) to help development of gas port infrastructure for production of small and medium-scale coastal LNG gas. Reduction of fees and costs for ships to use LNG	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	• No transport sub-sector targets • Greece participates in the European programme Poseidon Med II, to introduce LNG gas into the shipping industry as primary fuel and to develop a necessary infrastructure for network	Medium

Transport policies and measures supporting the 5 dimensions of the energy union ⁸³

Sector	Decarbonisation	Energy security	Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
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⁸² High score=Green; Medium Score=Yellow; Low score=red

⁸³ Integrated National Energy and Climate Plan 2021-2030, Greece, https://ec.europa.eu/energy/sites/ener/files/el_final_necp_main_en.pdf



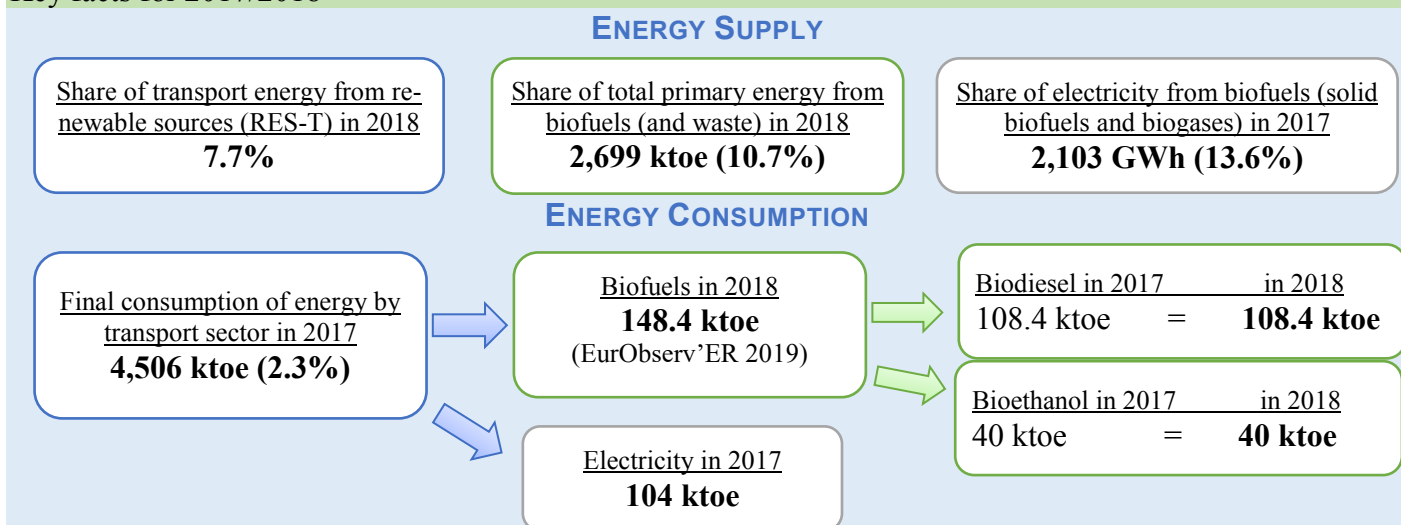
Transport	GHG reduction and renewable energy sector targets to enable transition to climate neutral economy by 2050 Phase out lignite power plants by 2028 Electrification of international ports and Promote the use of LNG and regulate the emission control (sulphur content of fuel) Regulatory tools to boost consumption of bio-fuels	Policy measures to increase diversification of energy sources and route, reduce dependency on imports Financial instruments for creation and strengthening of domestic bioethanol market Emphasis on National Interconnected Island (NII)-reduce energy dependence EL is part of EU initiative 'Clean Energy for EU Islands'	Reduce final energy consumption by 38% Electrification of energy consuming installations at ports Promoting electrification in tourist areas and promote active modes of transport	Strengthen energy interconnections of the islands Promote electromobility, new technologies and use of advanced biofuels in transport sector Coupling the energy sectors to mobilise domestic RES potential and promote new technologies	Economic measures for -development of innovative energy saving, decarbonisation technologies - development of smart grids and network and innovative energy storage application and use of technologies for micro mobility -development, demonstration and scaling up of bio-fuels and advanced biofuels from sustainable biomass
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Biomass policies which supports the mobilisation of advanced renewable fuels

Production	Conversion	Distribution	End-use
CAP: Greek Rural Development Programme			Biofuel Quota
Good Agricultural Practices	RES-E support Schemes: Feed-in tariff, feed-in premium, subsidies, income tax relief, subsidies for deployment of RE technologies		
	Biofuel Sustainability Criteria		
National Strategy for Forests	RES-T Support schemes		RES-H building obligations
		Tax Incentives to promote RES alternatives fuels	
National waste management and recycling programmes		Circulation tax exemption for EHVs Registration tax benefits	
	Investment Law		Labelling and Eco-design Directive
	National Emissions Ceilings (NEC) Directive 2016/2284 -2021-2030		
	Biomass Heating Regulation		
		Energy Efficiency Obligation Programme	
	Law on income tax		
	National Energy Efficiency Fund or the Structural Funds		
Special Fund for Forests (Green Fund)			
National emissions target under the EU Effort Sharing Decision (406/2009/EC) Greece			
National Energy and Climate Plan (NECP); National Strategy for Adaptation to Climate Change (NSACC)			

Current State of Affairs^{84;85}:

Key facts for 2017/2018

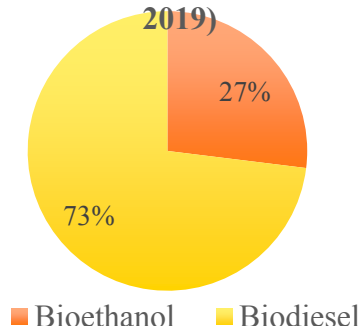


Hungary has seen no changes in biodiesel and bioethanol consumption in the transport sector between 2017 and 2018. Oil and natural gas remain dominant energy providers and consumers, however biofuels have been rising since 1990.

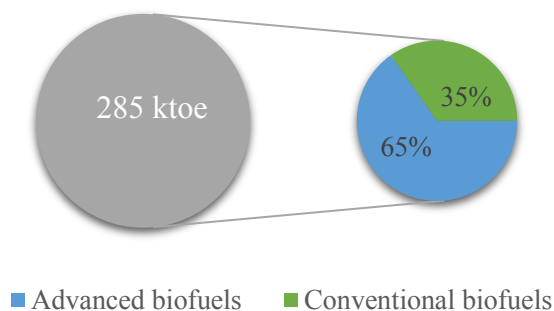
Targets for renewable energy (RES), climate change mitigation and energy efficiency⁸⁶

TARGETS	2020	2030	2040
RES (renewable energy in final consumption)		21%	22.4%
Energy efficiency		<i>MAINTAIN 2005 LEVEL (785 PJ)</i>	
GHG emissions reduction		NON-ETS: 7% (2005 BASE) ETS: 40% (1990 BASE)	
Electricity interconnection		60%	
RES-T (renewable energy in transport)		16.9%	
Biofuels blend obligation	8.2%		
Cap on first generation (conventional) biofuels	7%		
Advanced biofuels		3.5%	

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)

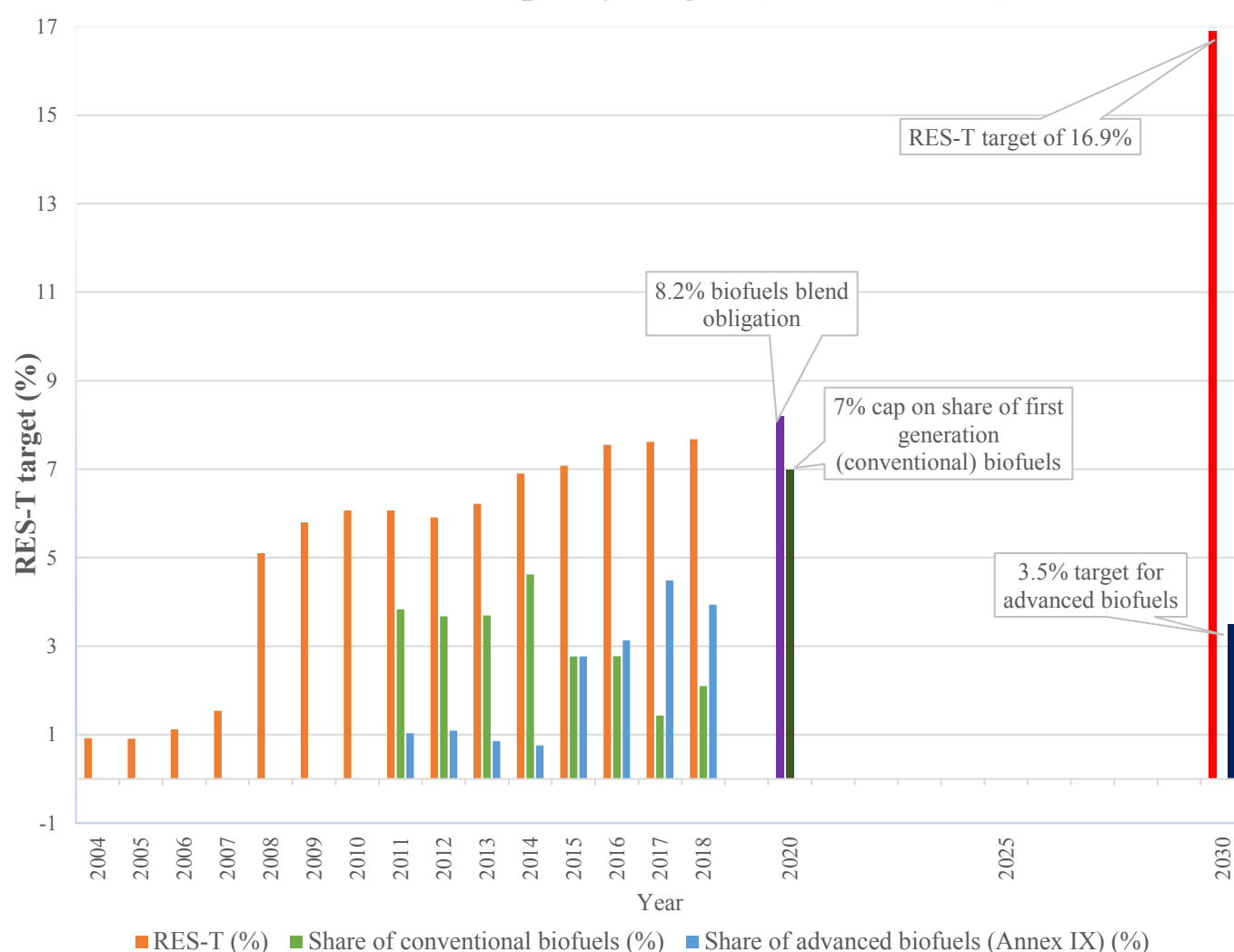


⁸⁴ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

⁸⁵ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

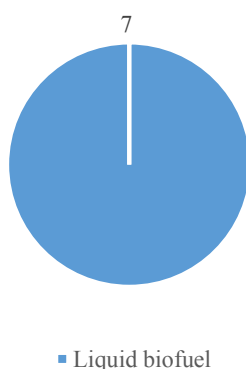
⁸⁶ Integrated National Energy and Climate Plan 2021-2030, Hungary, https://ec.europa.eu/energy/sites/ener/files/documents/hu_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

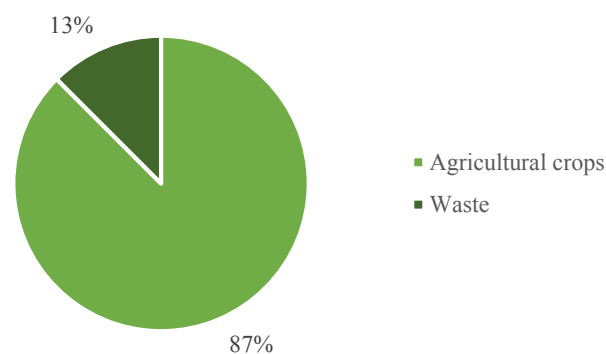


Number of operational biorefineries between 2007 and 2018⁸⁷

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



⁸⁷ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁸⁸
Biomass production	Do they address sustainability of feedstock?	Forest Act ensures the sustainability of forest biomass and HU forest management system complies with RED II Directive	Green
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- The National Research, Development and Innovation Fund (NRDI Fund) is an important Hungarian RDI financing which promotes pilot projects in energy innovation. Financing is also supported using funds of operational programmes in the 2021-2027 period and the Modernisation Fund - Hungary spent EUR 29.9 million/year on RD&D activities. 1/10th of the funding was spent on electricity generation, storage technologies	Green
Distribution and End-use	Do they address specifically advance fuels/ RES fuels?	- Aid scheme to incentivize RES-E (REAS) launched in 2017 - Support to Hydrogen fuel for greening of the natural gas - Reducing the cost of electric and hydrogen fuel cell vehicles to support the advance/RES fuels - Swiss-Hungarian Cooperation Programme II 2021-2027	Green
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	No specific RES targets for aviation, marine or heavy duty vehicles	Yellow

Transport policies and measures supporting the 5 dimensions of the energy union⁸⁹

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	Under Electromobility Act, Green Economy Financing Scheme are implemented –to build charging infrastructures, reduction and exemption in taxes for zero-emission cars; excise tax for combined goods transport Green Bus Programme	Tax incentives for investments made to improve energy efficiency under ESCO-type financing schemes Diversification of energy imports and infrastructure development- biogas/biomethane production with the feed-in system	Targets to reduce imports and increase national production capacity under 20% by 2040	Strengthen market by increasing market coupling to improve efficiency of operating interconnected markets	The Energy Innovation Council has defined -encouraging RESs, innovative energy supply solutions, transport greening among key intervention areas.

⁸⁸ High score=Green; Medium Score=Yellow; Low score=red

⁸⁹ Integrated National Energy and Climate Plan 2021-2030, Hungary, https://ec.europa.eu/energy/sites/ener/files/documents/hu_final_necp_main_en.pdf



Biomass policies which support the mobilisation of advanced renewable fuels

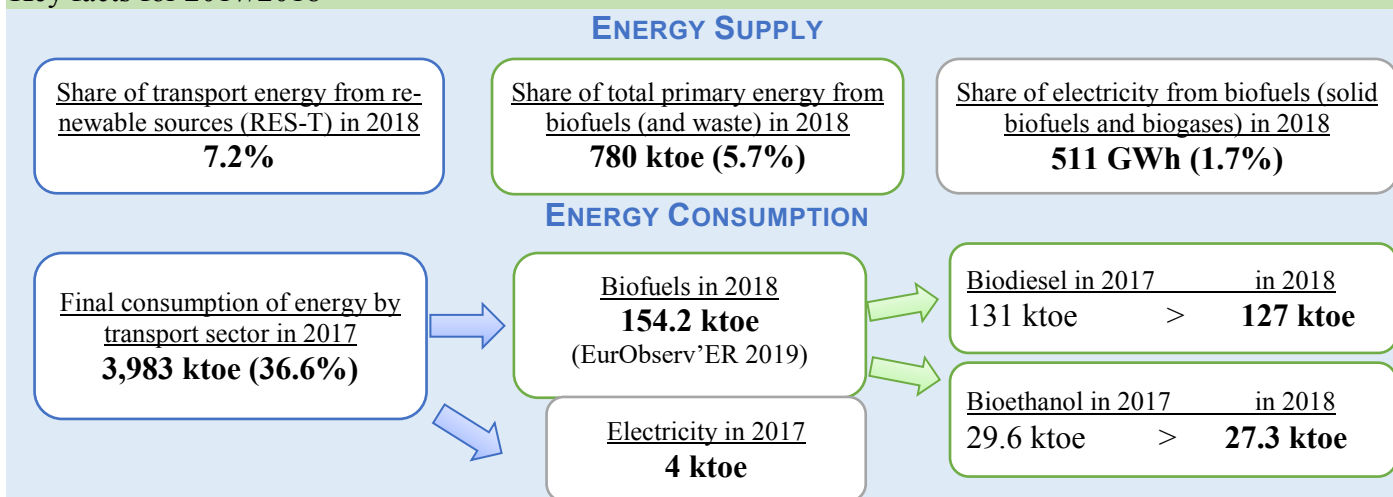
Production	Conversion	Distribution	End-use
CAP: Rural Development Programmes		Policy Framework for Alternative Fuel Infrastructure Development	
Carpathian Convention	Operational Programme Environment and Energy (KEOP)		
Nitrate		Green Bus Programme	
Forest Act	Hungary's first National Environmental Technology Innovation Strategy-NETIS		
	Energy Efficiency financial instruments- tax incentives		
Act expropriation - National Land Fund	Act on Sustainable biofuels; Biofuel quota		
Waste Management Act			Excise duty
National waste management plan 2014-2020			Territorial and Settlement Development Operational Programme (TOP) Competitive Central Hungarian Operational Programme (CCHOP)
			Act on the sustainability criteria and certification for biofuels and liquid bio-energy carriers; Bio-fuel Quota
		Training programme for RES Installers	
		RES-H building obligations	
		Certification programmes for RES Installation	
Decree on Air protection			
Environmental Protection Act			
Electromobility Act; The National Energy Strategy 2030 (NES 2030); The National Climate Change Strategy 2018-2030; The National Renewable Energy Action Plan; Hungary adopted the National Adaptation Strategy (NAS)			

Ireland

Policy and Plant Factsheet on Advanced Renewable Fuels

Current State of Affairs^{90;91}:

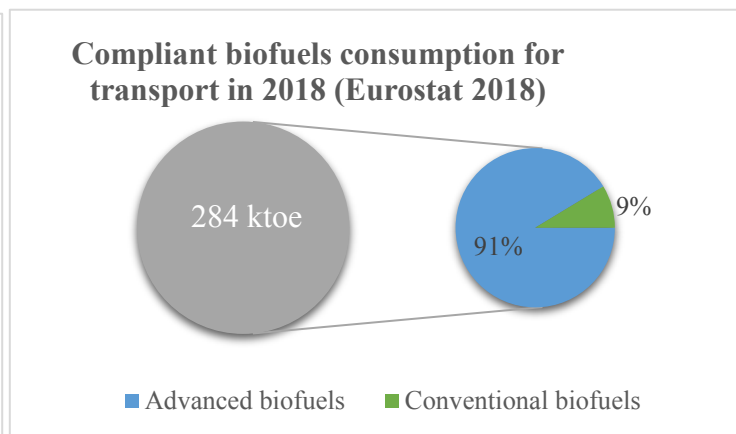
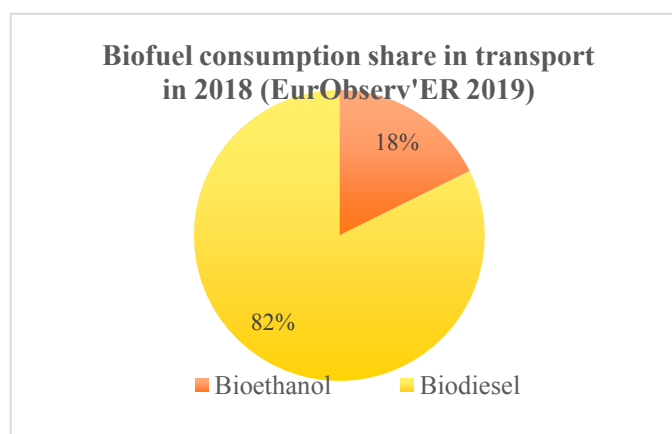
Key facts for 2017/2018



Ireland has seen a decrease in biofuels consumption for transport both for biodiesel and bioethanol between 2017 and 2018. While its transport sector largely dominates final energy consumption, overall energy supply and consumption remain largely driven by oil and gas. Biofuels and waste have seen a steady increase in these markets since 1990.

Targets for renewable energy (RES), climate change mitigation and energy efficiency⁹²

TARGETS	2020	2025	2030
RES (renewable energy sources)	16%		34.1%
Energy efficiency			32.5% (2015 BASE)
GHG emissions reduction			30% (2005 BASE)
RES-E (renewable energy in electricity)			34%
Electricity interconnection			70%
RES-T (renewable energy in transport)			33.5%
Biofuels blend obligation			12%⁹³
Cap on first generation (conventional) biofuels	7%		



⁹⁰ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries/united-kingdom>), Eurostat, SHARE tool, 2018; EurObservER-Biofuels-Barometer-2019, The draft NECP UK (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774235/national_energy_and_climate_plan.pdf)

⁹¹ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC – as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

⁹² Integrated National Energy and Climate Plan 2021-2030, Ireland, https://ec.europa.eu/energy/sites/ener/files/documents/ie_final_necp_main_en.pdf

⁹³ Both for biodiesel and biogasoline



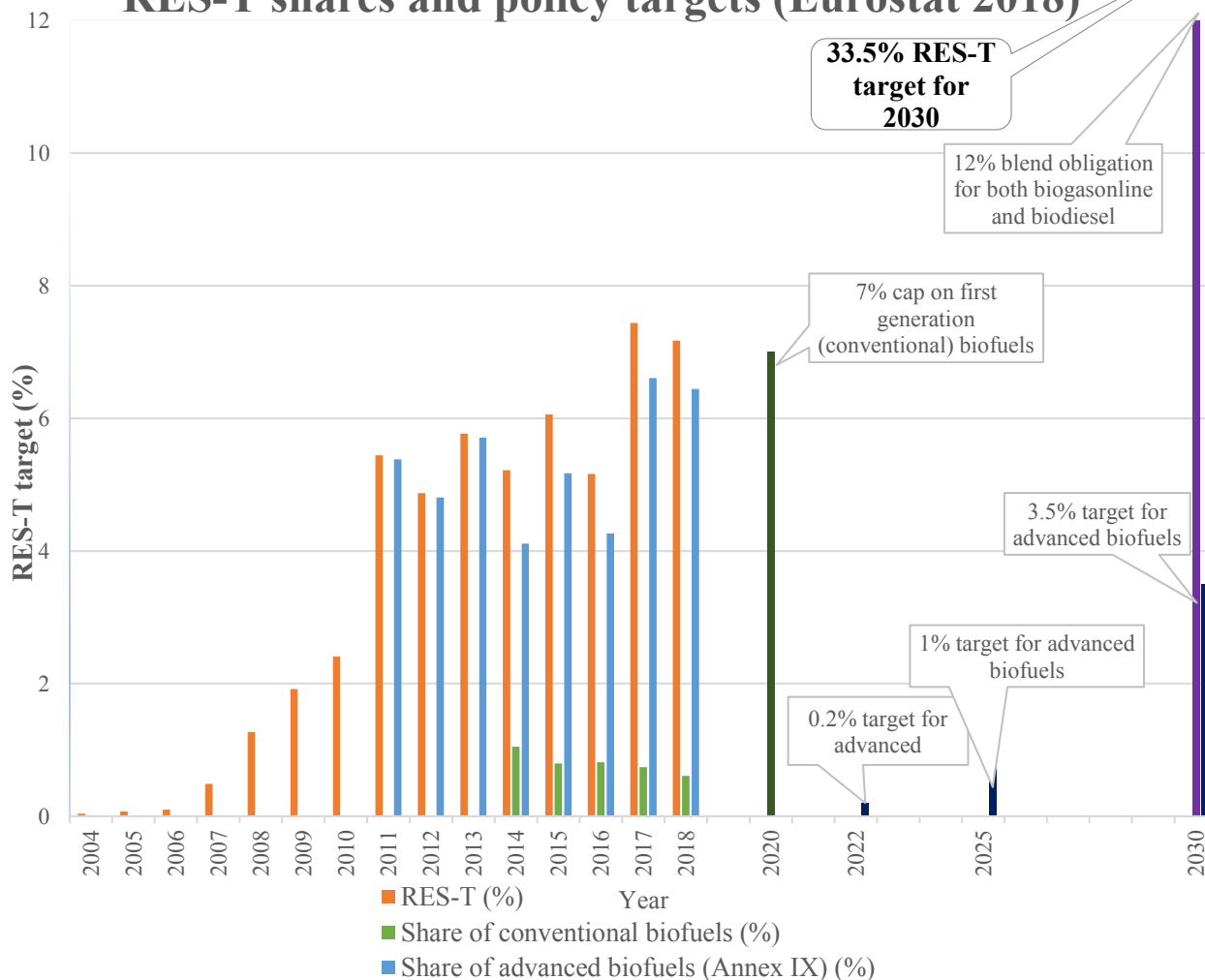
Advanced biofuels

2022
0.2%

1%

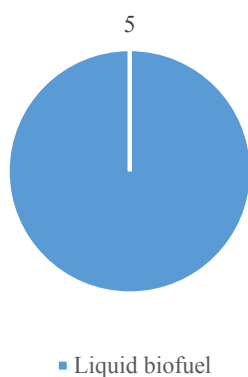
3.5%

RES-T shares and policy targets (Eurostat 2018)

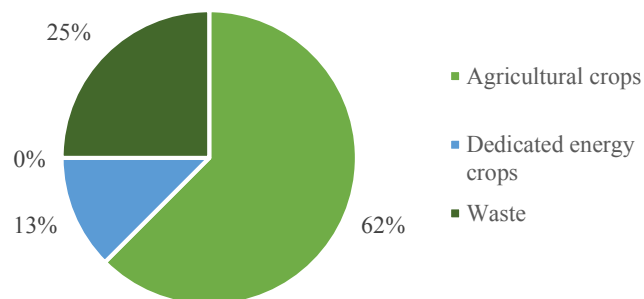


Number of operational biorefineries between 2007 and 2018⁹⁴

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



⁹⁴ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database; https://www.iea-bioenergy.task42-biorefineries.com/upload_mm/3/8/c/31855d97-0de8-4082-94d5-0e87b929fa0e_Ireland%20Country%20report%5D_01.pdf



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ⁹⁵
Biomass production	Do they address sustainability of feedstock?	- The Support Scheme for Renewable Heat incentivises the installation and use of biomass and transposes the sustainability criteria in line with RED II - Forestry Act 2014 transposes the sustainability requirements and biodiversity protection requirement of EU timber regulation and Habitats Directive	High score=Green; Medium Score=Yellow; Low score=red
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Funding supports for new technologies with a research priority focusing on Energy, Climate Action and Sustainability, and two priority areas concentrating on decarbonising - Carbon tax (EUR 26 per tonne) is expected to raise EUR 90 million in 2020 which will fund climate action measures	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	Develop regulatory and market system to allow biogas/biomethane to inject in natural gas grid and to improve renewable electricity integration	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	No transport sub-sector targets	

Transport policies and measures supporting the 5 dimensions of the energy union⁹⁶

Sector	Decarbonisation	Energy Security	Energy efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emissions reduction targets Support diversification within agriculture and land use to develop sustainable and circular value chains Carbon Budget for 5 years with sectoral targets RES-E support schemes (RESS) Support EVs 936,0004	Support indigenous RE sources and facilitate infrastructure projects to enhance Ireland's security supply	Shift in public transport use modal Public Transport Investment - investment in Sustainable Mobility Green Line Capacity Enhancement Project Charging station for electric vehicles and Low-emission vehicles	Integration of electricity market to improve the interconnection by 70% Develop regulatory and market to allow biogas/biomethane to inject in natural gas grid		Increase funding support for SEAI National Energy Research Development and Demonstration Funding Programme Research priority focusing on Energy, Climate Action and Sustainability, and two priority areas concentrating on decarbonising

⁹⁵ High score=Green; Medium Score=Yellow; Low score=red

⁹⁶ Integrated National Energy and Climate Plan 2021-2030, Ireland

https://ec.europa.eu/energy/sites/ener/files/documents/ie_final_necp_main_en.pdf



Biomass policies which support the mobilisation of advanced renewable fuels

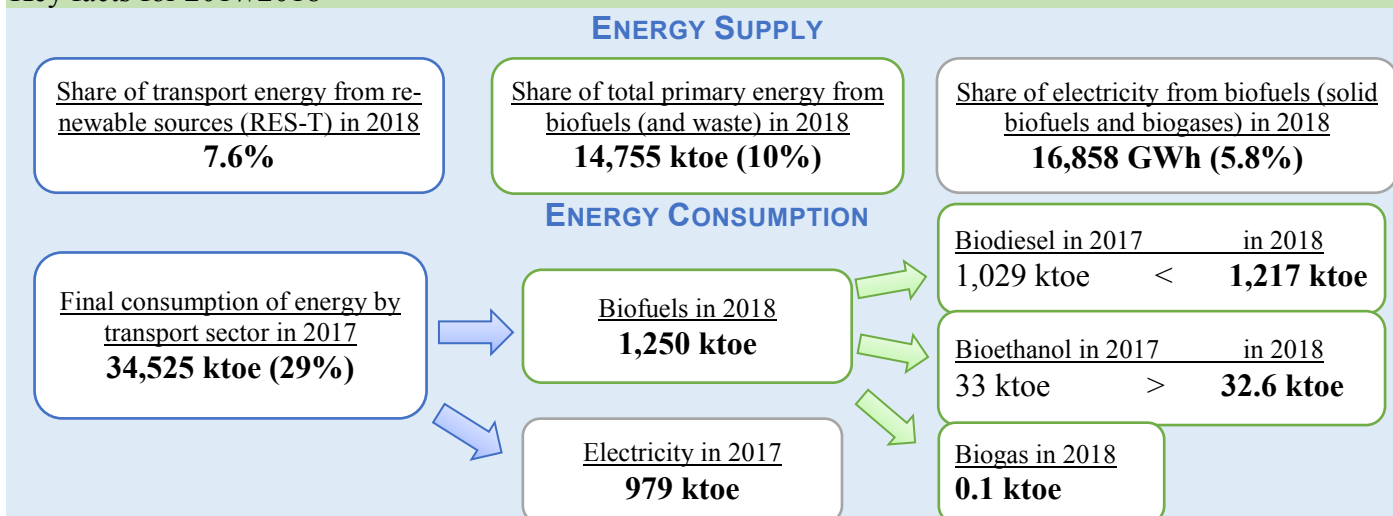
Production	Conversion	Distribution	End-use
CAP- Irish Rural Development Programmes Good Agricultural Practice for protection of waters	Industrial Emissions Regulations	The National policy framework on alternative fuels infrastructure for transport 2017-2030	
		Environmental Aid scheme- Investment subsidies	
	Renewable Electricity Support Scheme (RESS).		
Forestry Act 2014 Forestry Programme 2014-2020	Tax consolidation act Green Tenders	Renewable Energy Feed-in Tarriff	
Waste Management Act Waste Action Plan for Circular Economy	Wood Fuel Quality Assurance Scheme	Carbon Tax – GHG reduction Biofuel blending mandate; Biofuel Obligation Scheme	
Household food waste and biowaste regulations 2015	EXEED (Excellence in Energy Efficiency Design Services and Industry)	CORSIA (Carbon offsetting Scheme for International Aviation)	
		EXEED (Excellence in Energy Efficiency Design Services and Industry)	
	Renewable Electricity Support Schemes (REFIT) 1 and 2- Support wind, hydro and biomass/landfill gas projects and REFIT 3 support additional biomass technologies.		
		Support to EVs (Purchase grant, relief on VRT, reduced motor tax for battery electric vehicle) Vehicle registration Tax	
The Irish Government 2019 Climate Action Plan; Sustainable Transport Future; Fossil Fuel Divestment Act 2016; National Development Plan 2018-2027 ;National Mitigation Plan; National Energy Efficiency Action Plan; SEAI (Research, Development and Demonstration Programme)- Support for Deployment of Low-Carbon Technologies in Ireland; Community Energy Grant Scheme;IEA Technology Collaboration Programmes and the SET plan; The Energy Policy Framework 2007-2020; Nation Policy Framework- Alternative Fuels for Infrastructure for Transport 2017-2030;Climate Action and Low Carbon Development 2015; The National Development Plan (NDP) 2018-2027- Project Ireland 2040; Integrated National Energy and Climate Plan ⁹⁷ ; EU Effort Sharing Regulation			

⁹⁷ <https://www.dccae.gov.ie/en-ie/energy/consultations/Documents/42/consultations/Draft%20NECP%20Ireland.pdf>



Current State of Affairs^{98,99}:

Key facts for 2017/2018

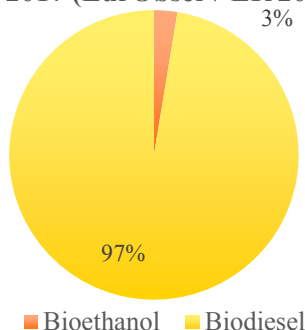


Italy has seen an increase in its biodiesel consumption between 2017 and 2018, while bioethanol, which has a much smaller market share, appears to be decreasing. Its transport sector is still dominating in terms of energy consumption and overall biofuels and waste have shown a tenfold increase both in terms of supply and consumption since 1990. Regarding electricity supply, natural gas is still dominant, however biofuels have again shown a major increase in the last 20 years.

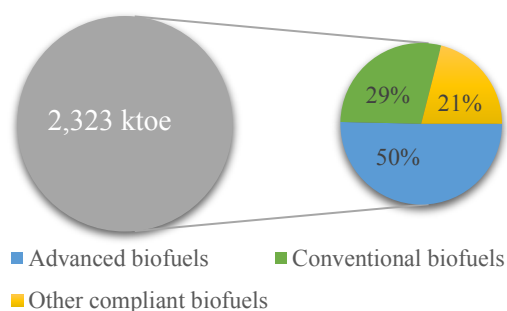
Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁰¹

TARGETS	2020		2030
RES (renewable energy sources)			30%
GHG emissions reduction (ETS and non-ETS)			40% (1990 BASE)
Sorted waste collection			60%
RES-E (renewable energy in electricity)			55%
RES-T (renewable energy in transport)			22%
Biofuels blend obligation	2020	2021	
	9%	10%	
Cap on first generation (conventional) biofuels		6.7%	3%
Share of advanced biofuels ¹⁰⁰	2020	2022	8%
	0.2%	1.85%	

Biofuel consumption share in transport in 2017 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



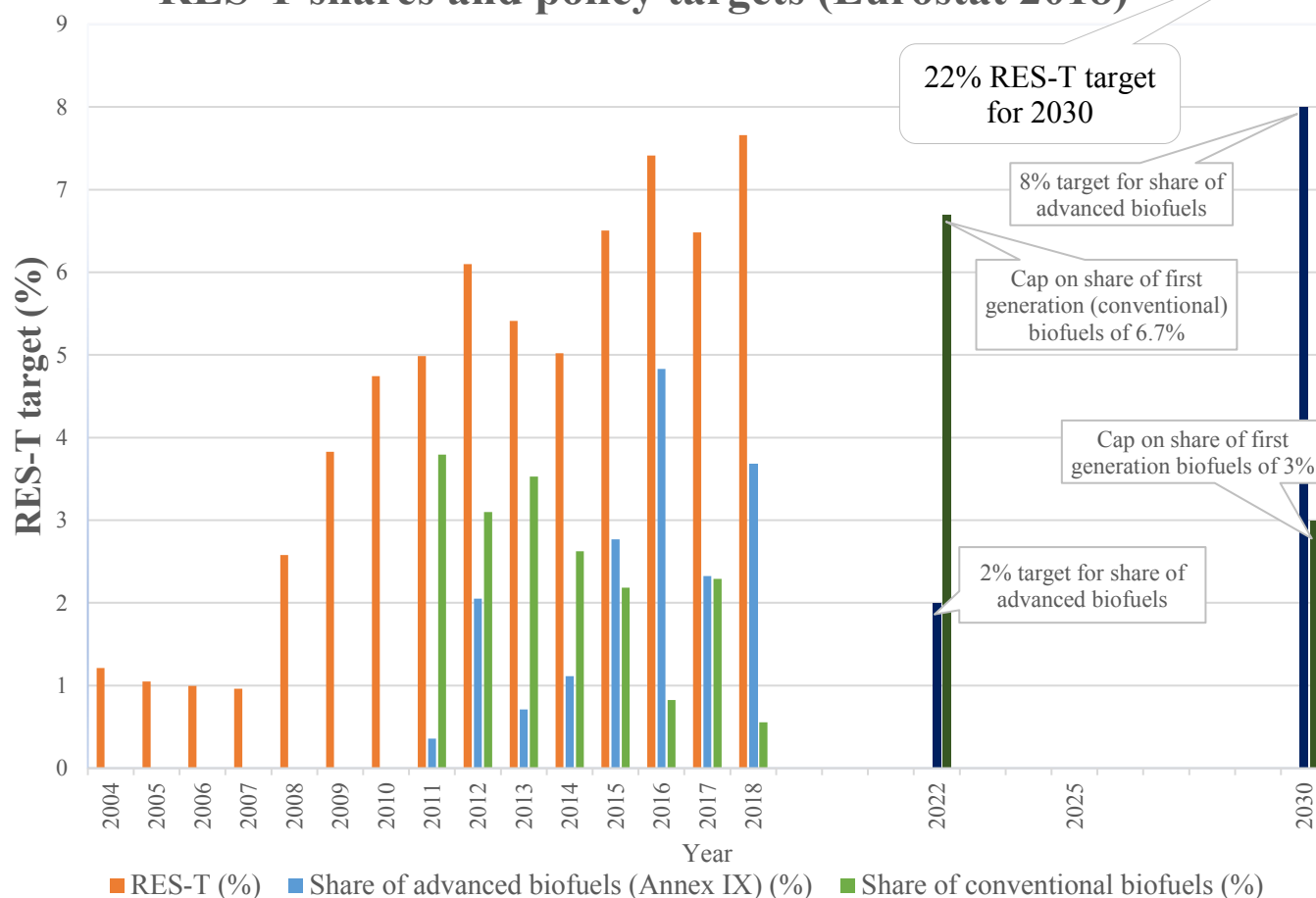
⁹⁸ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

⁹⁹ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC – as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

¹⁰⁰ It is estimated that 75% of the advanced biofuels target will be achieved by advanced biomethane and 25% by other advanced biofuels.

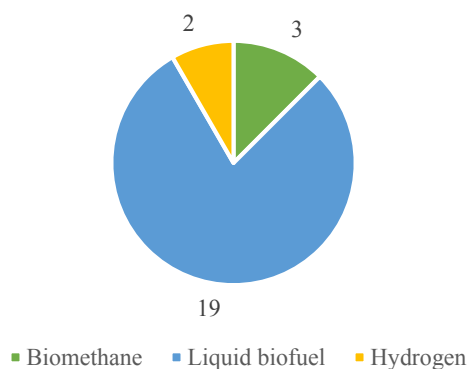
¹⁰¹ Integrated National Energy and Climate Plan 2021-2030, Italy, https://ec.europa.eu/energy/sites/ener/files/documents/it_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

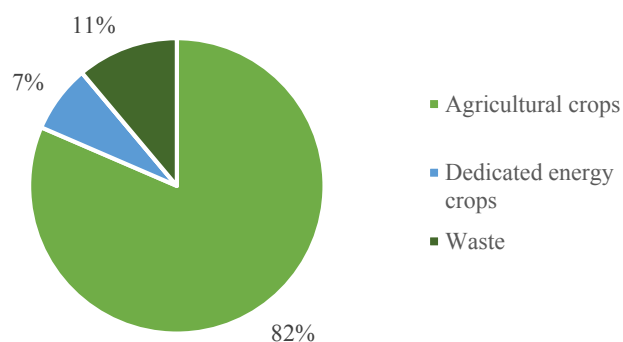


Number of operational biorefineries and hydrogen production projects between 2007 and 2018¹⁰²

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



¹⁰² https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁰³
Biomass production	Do they address sustainability of feed-stock?	• Transposing the RED II sustainability criteria and establish link with European database for monitoring sustainability • Law on Forests and Forest Supply Chains which implements sustainable forestry management tool	High
Conversion of feedstock	Do they have financing for innovative conversion technologies?	• Italy is part of the SET-Plan, Mission Innovation. Italy focuses on i) product and process technologies vital for energy transition and ii) promotes the introduction of technologies, organisation and operational models and systems used for the energy transition and for safety. Italy is taking a lead in smart grid development • Tariffs as instruments to support the new plants based on innovative technologies which have the potential to be economically viable • Contracts for difference: tenders for construction of new plants, renovation and improvements to existing plants • Dedicated funding for prototype stage innovative projects • Fund for the development of intangible capital: fund technological challenges set out by Mission Innovation • Tax credit for companies – to stimulate private investments in R&D in order to innovate processes and products and guarantee future competitiveness	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	• Mandatory biofuel mixing up to 2022: additional bonus for advanced biofuels and biofuels from waste oils and animal fats and support for transposing the end-of-waste provisions and promoting the advanced bioethanol segment • Incentives to use biomethane and advanced biofuels for 2018-2022 • Biofuels obligations: transposing RED II 2022-2030 • Agricultural production efficiency will be improved to reduce costs of the supply chain of recovering and fertilising unfarmed areas to make advanced biofuels competitive. Building and operation of biomethane production plants will be promoted encouraging investment in this area. • Support to convert Italian marginal refineries to biorefineries to meet advanced biofuels demand • Focusing on plants to produce raw materials needed for preparing biofuels and biorefineries	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	• No specific subsector targets • Heavy duty- Financial and strategic measures in place to promote the efficiency in freight transport. Development of LNG in heavy duty (planning stage) • Aviation- Cooperation agreement for biofuels in aviation sector (Planning stage) • Marine- Development of LNG in maritime (planning stage)	Medium

¹⁰³ High score=Green; Medium Score=Yellow; Low score=red



Transport policies and measures to support the 5 dimensions of the energy union¹⁰⁴

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	GHG emission reduction targets under RED II and LULUCF INCEP Scenario (2005-2030) analysis for Italy based on historical GHG emissions shows that 36% of the GHG reduction will be due to electrification of transport and infiltration of biofuels	Preventive Action Plan for the Italian natural gas system Diversification of supply sources Increasing the use of LNG by maritime transport vessels and port infrastructure	White Certificates scheme Tax deductions for energy-efficient measures The National Fund for Energy Efficiency Energy efficiency measures under Cohesion policies 2021-2027 Sustainable mobility measures	Development plan to improve interconnectivity with South-East Europe, where there is a diversified and competitive production capacity that will increase in the medium to long term, which provides an alternative to fossil fuels. Development of plan for the national transmission network Development of LNG network- As a part of the TEN-T programme developing the LNG system for heavy-duty road and maritime transport in cooperation with member states	Electric system research fund Fund for the development of intangible capital: fund technological challenges set out by Mission Innovation. Tax credit for companies to stimulate private investments in R&D for innovative processes and products and guarantee future competitiveness Incentives for sustainable mobility in Metropolitan areas (€140 million for 2020-2021, €100 million for 2022- 2023 and €10 million for 2024.) National Innovation Fund

Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: Italian Development Programmes		Biofuels quota obligation – Tradable Certificates	
Forest Management Plan; National Forestry Strategy (NFS)	Energy Efficiency Certificates	RES-E Support schemes; Incentives to meet the emissions quota using advanced and RES fuels 2018-2022	
Nitrates Directive; Decree on atmospheric pollutants	Incentives for RES-E from biomass, biogas and bioliquids	Sustainability of biofuels	
Climate Decree			
Exemption on excise duty on fuels for drainage and remediation of waterlogged soils in flooded area.	Stability Law 2017- Funding to support the transition in local transport for 2019-2033 Decree Law- Energy Efficiency target implementation fund		
Reduction in excise duty on fuels for lifting of water to promote the cultivation of rural lands on reclaimed land.		Premium Tariff to advanced biofuels; Incentives for sustainable mobility- Fund	
Growth Decree- Law- reduce the production of waste -Green Corners		Incentive to purchase more efficient vehicles with low emissions	
Decree on Growth -provisions on waste and packaging		National Action Plan for Green Public Procurement (GPP NAP)	
National code- good agricultural practices to control ammonia emissions		Refuelling points for alternative fuels (DAFI)	
		White Certificate Trading for end-use energy efficiency	

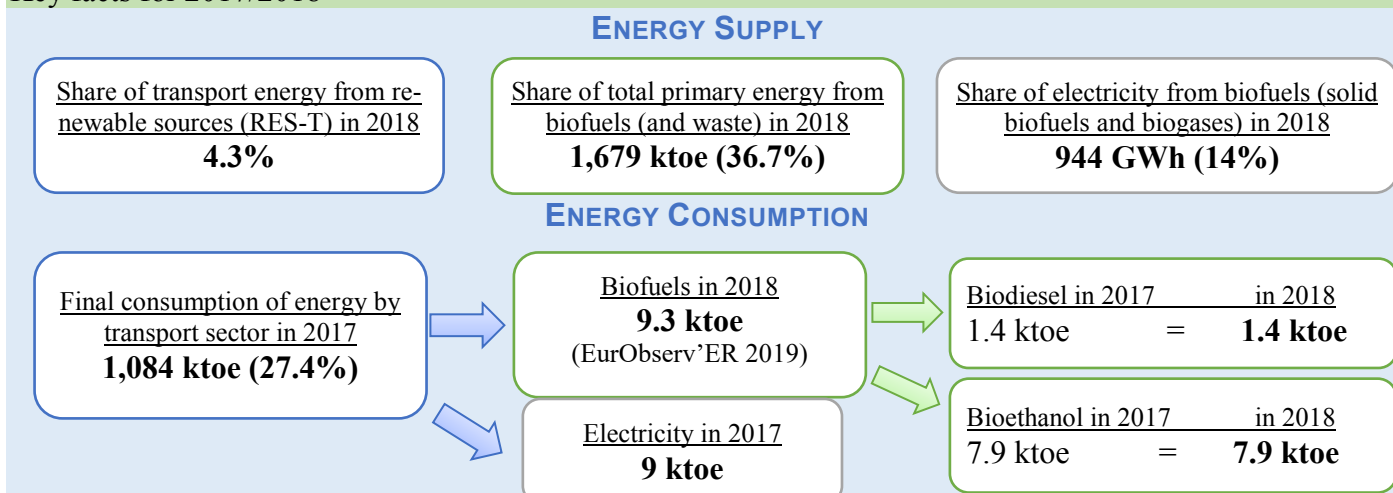
¹⁰⁴ Integrated National Energy and Climate Plan 2021-2030, Italy
https://ec.europa.eu/energy/sites/ener/files/documents/it_final_necp_main_en.pdf

National Strategy for Bioeconomy 2017-2030; National Infrastructure plan for charging EVs (PNIRE); Sustainable Urban mobility Plans; Integrated National Plan for Energy and Climate 2030; National Plan for Biofuels and Biomass; National Energy Strategy 2030; National Strategic action plan on innovation and research in agriculture, food and forestry sector; National Strategy on Adaptation to Climate Change; National energy efficiency information and training plan (PIF)



Current State of Affairs¹⁰⁵:

Key facts for 2017/2018

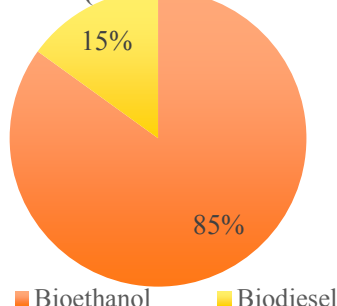


Latvia has seen no changes in its biofuels consumption in transport for either biodiesel or bioethanol between 2017 and 2018. Its transport sector holds a major market share in terms of energy consumption. Energy supply is led by biofuels and waste, with strong growth over the last decades. Regarding energy consumption, oil dominates the market, however biofuels are only second in line and have been steadily growing since 1990.

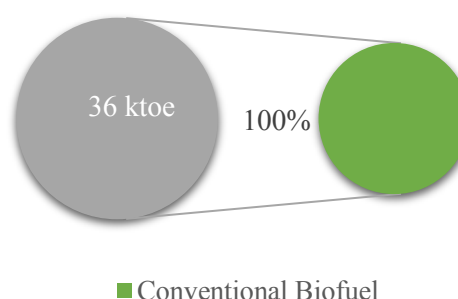
Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁰⁶

TARGETS	2020		2030
RES (renewable energy sources)	40%		50%
GHG emissions reduction (non-ETS)			6% (2005 BASE)
Electricity interconnection level ¹⁰⁷	10%		60%
RES-T (renewable energy in transport)			7%
Biofuels blend obligation	5%		7-10%
Cap on first generation (conventional) biofuels	7%		
Share of advanced biofuels	2022	2025	3.5%
	0.2%	1%	

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)

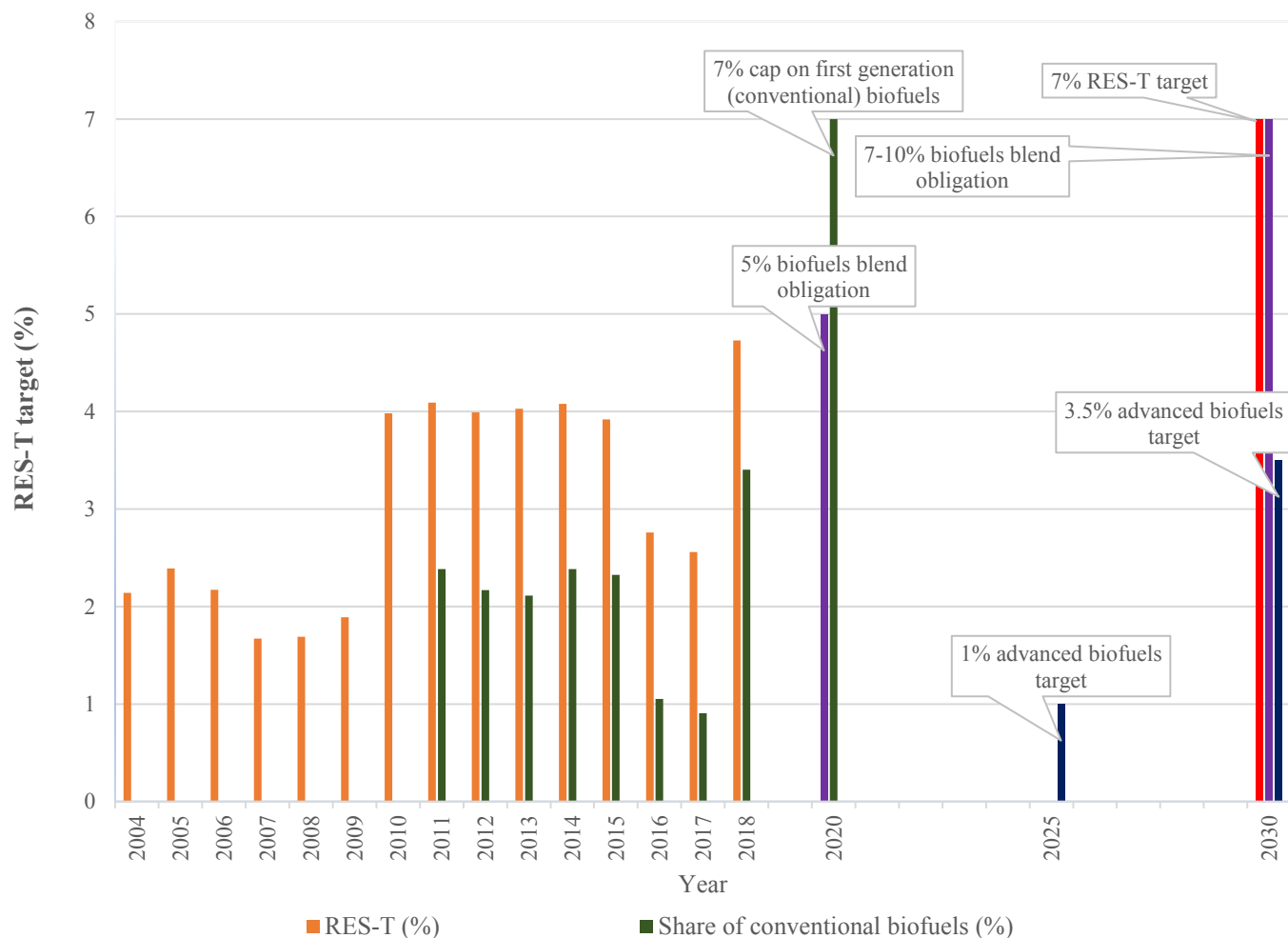


¹⁰⁵ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

¹⁰⁶ Integrated National Energy and Climate Plan 2021-2030, Latvia, https://ec.europa.eu/energy/sites/ener/files/documents/lv_final_necp_main_en.pdf

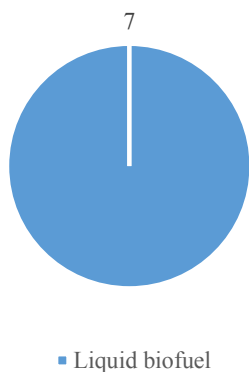
¹⁰⁷ RES-E share is 1.5% in 2019 and all is consumed in rail transport, trams and trolley buses, but its volume is in decline. EV charging network along the main roads.

RES-T shares and policy targets (Eurostat 2018)

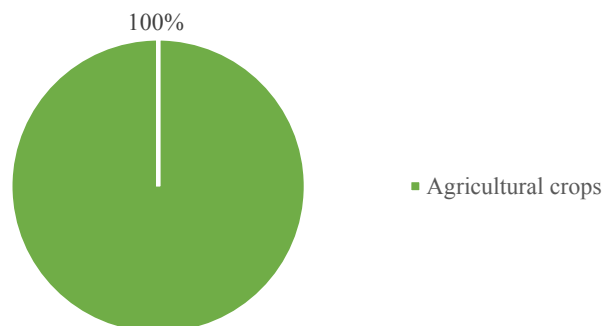


Number of operational biorefineries between 2007 and 2018¹⁰⁸

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



¹⁰⁸ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database; https://ec.europa.eu/energy/sites/ener/files/documents/ec_courtesy_translation_lv_necp.pdf

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁰⁹
Biomass production	Do they address sustainability of feedstock?	There are no specific policies, however Latvia has identified 12 core action lines to achieve objectives of the plan and ‘Sustainable use of resources and reduction of GHG emissions and increasing carbon sequestration in the sectors of land use, land-use change and forestry’ is one of them.	
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Funding legislation and operational programmes for EU structural funds will be developed for Latvia by January 2021. Proposed allocations which can finance the conversion technologies: - Promoting the use of zero-emission technologies in electricity generation – EUR 1,057.05 million; - Improving energy efficiency, promoting the use of alternative fuels and RES technologies in transport – EUR 988.77 million; - Energy security, reducing energy dependency, full integration of energy markets and modernisation of infrastructure –EUR 830.06 million; - Improving the efficiency of waste and wastewater management and reducing GHG emissions – EUR 595 million;	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Proposed measures to increase the volume of RES used in vehicles by promoting advanced biofuels and biogases - Plans to modernise the gas and electricity infrastructure. Focus on action plan to develop hydrogen infrastructure and market conditions	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	No transport sub-sectors targets	

¹⁰⁹ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union¹¹⁰

Sector	Decarbonisation	Energy efficiency	Efficiency	Energy security	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	Tax reliefs are for energy efficiency improvement measures or to performers of RES technology Improve energy efficiency in road transport for the wider use of alternative fuels and to increase share of RES	Policy action proposed to improve energy efficiency and promoting use of alternative fuels and RES technologies Increase the number of vehicles using RES Promoting emission technologies with negative emissions Proposals for 'greenings' of tax system		Proposals to reduce energy dependency and diversify the energy sources. Modernisation of infrastructure to use EVs	Proposals to develop electricity and gas interconnections with Baltic states. Regional cooperation in synchronisation of European electricity grid, interconnection projects		RIC activities are supported by EU structural funds, Horizon 2020, Invest EU, Cohesion Fund, ERDF and other Latvian national funds Latvian Innovation and Technology Development Fund

Biomass policies which support the mobilisation of advanced renewable fuels

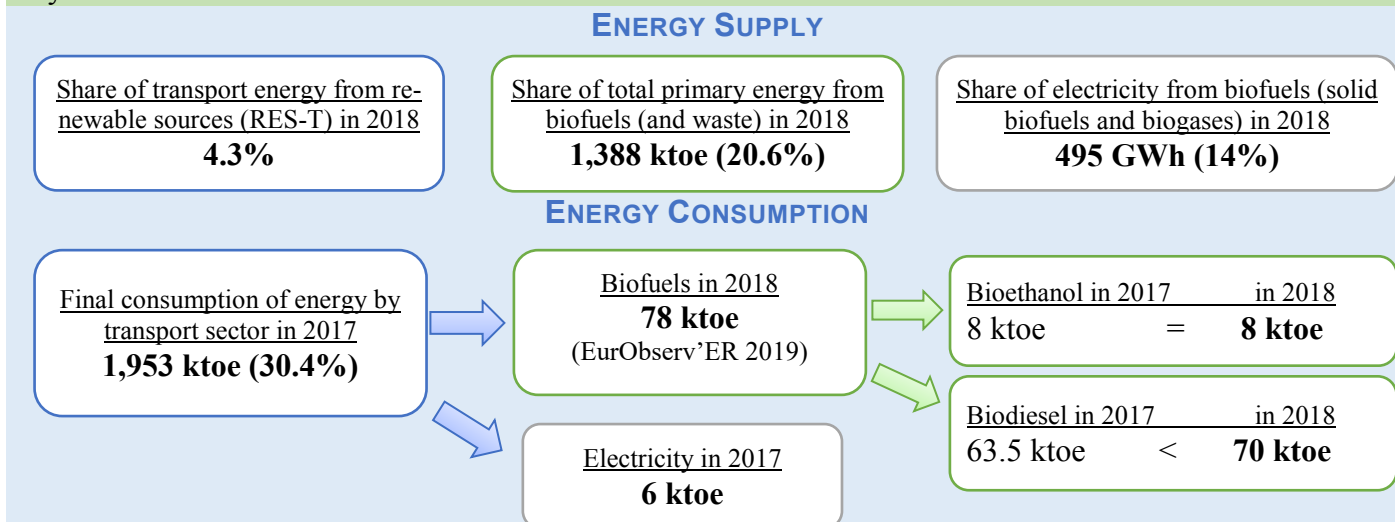
Biomass Production	Conversion	Distribution	End-use
CAP- Latvia Rural Development Programmes	Vehicle operation tax; Feed-in tariffs; Greening of Tax system		
National emission targets-Effort Sharing Decision (for non-ETS sectors in the period 2012-2030)			
Action Plan of the Republic of Latvia in the Field of Renewable Energy for implementing RED II			
Latvian waste management policy		Tax reduction and exemption on biofuels	
The Law on Pollution			
	Tax exemption for electricity from RES		
National Renewable Energy Action Plan; National Action Plan for Energy Efficiency; Latvia's National Energy and Climate Plan 2021–2030; Sustainable Development Strategy Latvia 2030;			
National Development Plan of Latvia 2021–2027 (Under Development); Latvian Plan for Adaptation to Climate Change until 2030			

¹¹⁰ Integrated National Energy and Climate Plan 2021-2030, Latvia
https://ec.europa.eu/energy/sites/ener/files/documents/lv_final_necp_main_en.pdf



Current State of Affairs¹¹¹:

Key facts for 2017/2018

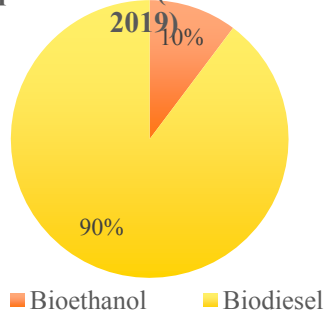


Lithuania has seen an increase in biodiesel consumption and no changes for bioethanol consumption between 2017 and 2018. Its transport sector holds the largest market share for energy consumption. Oil and natural gas still lead both energy supply and consumption, however biofuels have steadily increased since 1990, especially in the supply market.

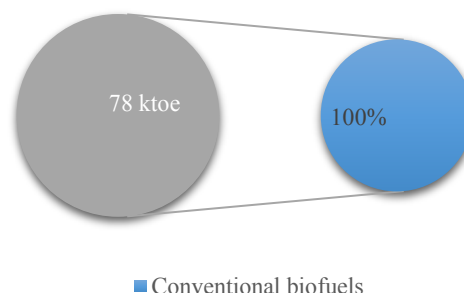
Targets for renewable energy (RES), climate change mitigation and energy efficiency¹¹²

TARGETS	2020	2030
RES (renewable energy in energy consumption)	30%	45%
GHG emissions reduction (non-ETS)		9% (2005)
Energy efficiency improvement		1.5x LOWER ENERGY INTENSITY (2017 BASE)
RES-E (renewable energy in electricity)		45%
RES-T ¹¹³ (renewable energy in transport)	10%	15%
Biofuels consumption in target		5.9% (5.67 BIODIESEL AND 0.23% BIOETHANOL)

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



¹¹¹All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

¹¹² Integrated National Energy and Climate Plan 2021-2030, Lithuania, https://ec.europa.eu/energy/sites/ener/files/documents/lt_final_necp_main_en.pdf

¹¹³ LT, like other Member States, is struggling to achieve the RES-T target for 2020 due to relatively high investment in the renewal of the vehicle fleet, which consists mainly of almost 1.5 million cars, 69% of which are diesel cars, with an average age of 15 years

RES-T shares and policy targets (Eurostat 2018)



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹¹⁴
Biomass production	Do they address sustainability of feedstock?	- Proposed policy measure to promote the use of advanced biofuels which meets sustainability criteria - Plan to promote and support the sustainable bio-methane supply chain with financial and regulatory	Yellow
Conversion of feedstock	Do they have financing for innovative conversion technologies	- Support schemes (premium price, priority transmission) for production of RES-E 2020-2025- energy generation is incentivized so that the new technology is economically and technically viable in market - Plan to develop finance mechanisms for RES generation and storage and support integration to distribution networks	Green
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Sustainable Development Strategy – long-term objective is to promote effective development of biofuel production - Existing policy measure supports the restoration of forests and cultivation of SRC - Waste sector policy measure - recovery of methane gas from landfills for energy production - Proposed plan to promote the use of RES in the transport sector, plan to developing recharging stations - Proposed plan to support the investment to establish alternative fuel plants and support the operating costs of mandatory blending	Green
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No transport sub-sector targets - Excise duty exemption- aircraft fuel. The exemption also applies to marine fuels supplied for the purpose of navigation in European Union waters (including fishing) - Policy plan in place to replace highly polluting cargo and passenger vessels with new vessels which is fueled by LNG, electricity and renewables - Plan to establish and implement tax incentives for inland waterway transport to use advanced and cleaner technologies and advanced fuels	Yellow

¹¹⁴ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union¹¹⁵

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission reduction and RES share targets Renewal of public vehicles running on alternative fuels and electricity 2021-2030 Develop modern infrastructure and sustainable urban mobility plans Incentives for electric vehicles Charging points are developed in trans-European road network Sustainable Mobility Fund	Plan to improve the share of alternative fuels in transport	Higher excise duties and taxes on fuel consumption Energy saving agreements with companies Urban mobility plan to reduce use of fossil-based vehicles	Improve infrastructure interconnection with national and local transport networks Gas interconnection between Poland and Lithuania and Synchronisation Project		The Ministry of Economy and Innovation supports support eco-friendly, energy efficient and green RDI activities to produce and sell high added value products. LT biofuel exchange forum, the Baltpool model ensures the competitiveness of the biofuels market and a consistent quality of biofuels. LT has industrial niche in the production of biomass combustion equipment

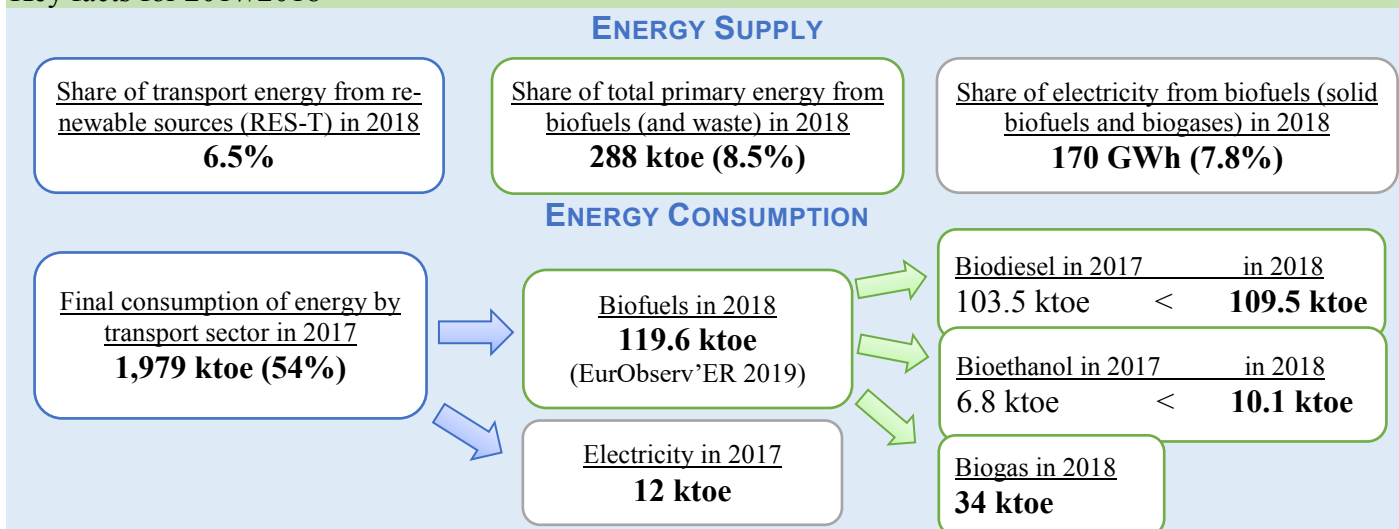
Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP- Lithuanian Rural Development Programme		Law of the Republic of Lithuania on Heat Sector	
		Biofuels blending obligations	
Regulations on private forest management and use		Environment Pollution Tax	
Forest Law		Excise Duty Act	
Reducing Landfilling		Law on Energy from Renewable Sources -Feed-in Tariffs for Electricity	
Law on Water			
		Environmental pollution tax	
	Lithuanian Environmental Investment Fund (LEIF)		Guarantees of origin for gases produced from RES.
	Law on Energy from Renewable Sources (FiTs, FiPs, Tender)		
Law on taxes on state natural resources			
		Renewable Energy Act	
	Law on Environment Protection (EPL);		
	Fund for Climate Change Mitigation		
	National Energy Independence Strategy		
	The Strategy for the National Climate Change Management Policy; Sustainable Development Strategy; National Transport Development Programme 2014-2022		
	National emissions target under the EU Effort Sharing Decision (406/2009/EC) Lithuania		

¹¹⁵ Integrated National Energy and Climate Plan 2021-2030, Lithuania, https://ec.europa.eu/energy/sites/ener/files/documents/Lt_final_necp_main_en.pdf

Current State of Affairs^{116;117}:

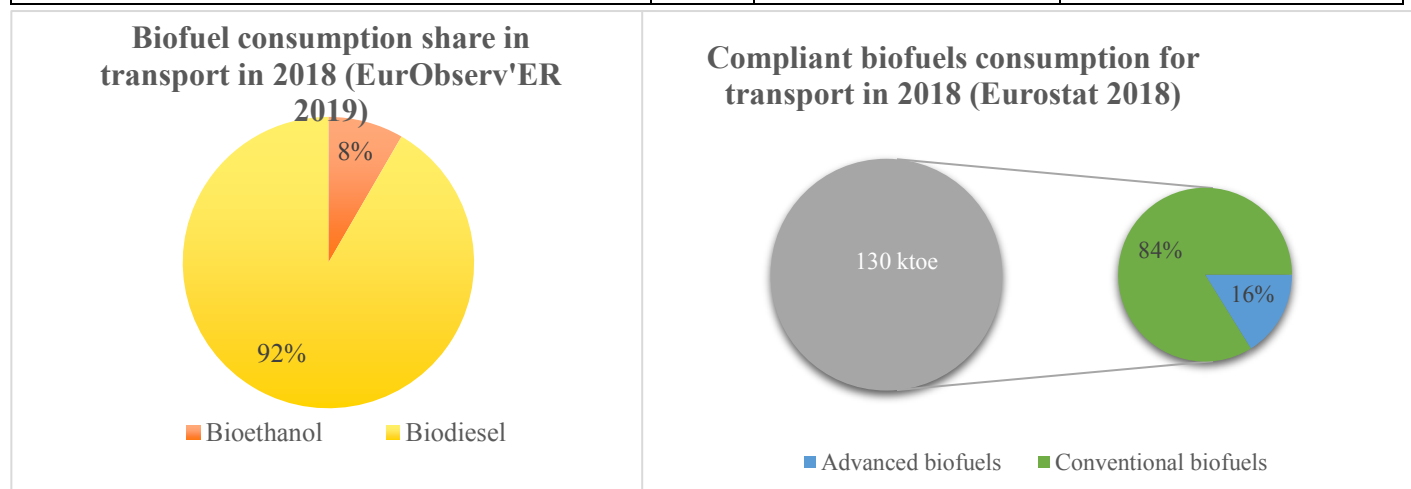
Key facts for 2017/2018



Luxembourg has seen an increase of biodiesel and bioethanol from 2017 to 2018. Its transport largely dominates final energy consumption, however so does oil as its major energy source.

Targets for renewable energy (RES), climate change mitigation and energy efficiency¹¹⁸

TARGETS	2020		2030
RES (renewable energy sources)			25%
GHG emissions reduction (non-ETS)			55% (2005 BASE)
Energy efficiency improvement			40-44% (2007 BASE)
RES-E (renewable energy in electricity)			33.6%
RES-T (renewable energy in transport)			25.6%
Biofuels blend obligation	5%		7-10%
Cap on first generation (conventional) biofuels	5%		
Share of advanced biofuels	2022	2025	3.5%
	0.2%	1%	

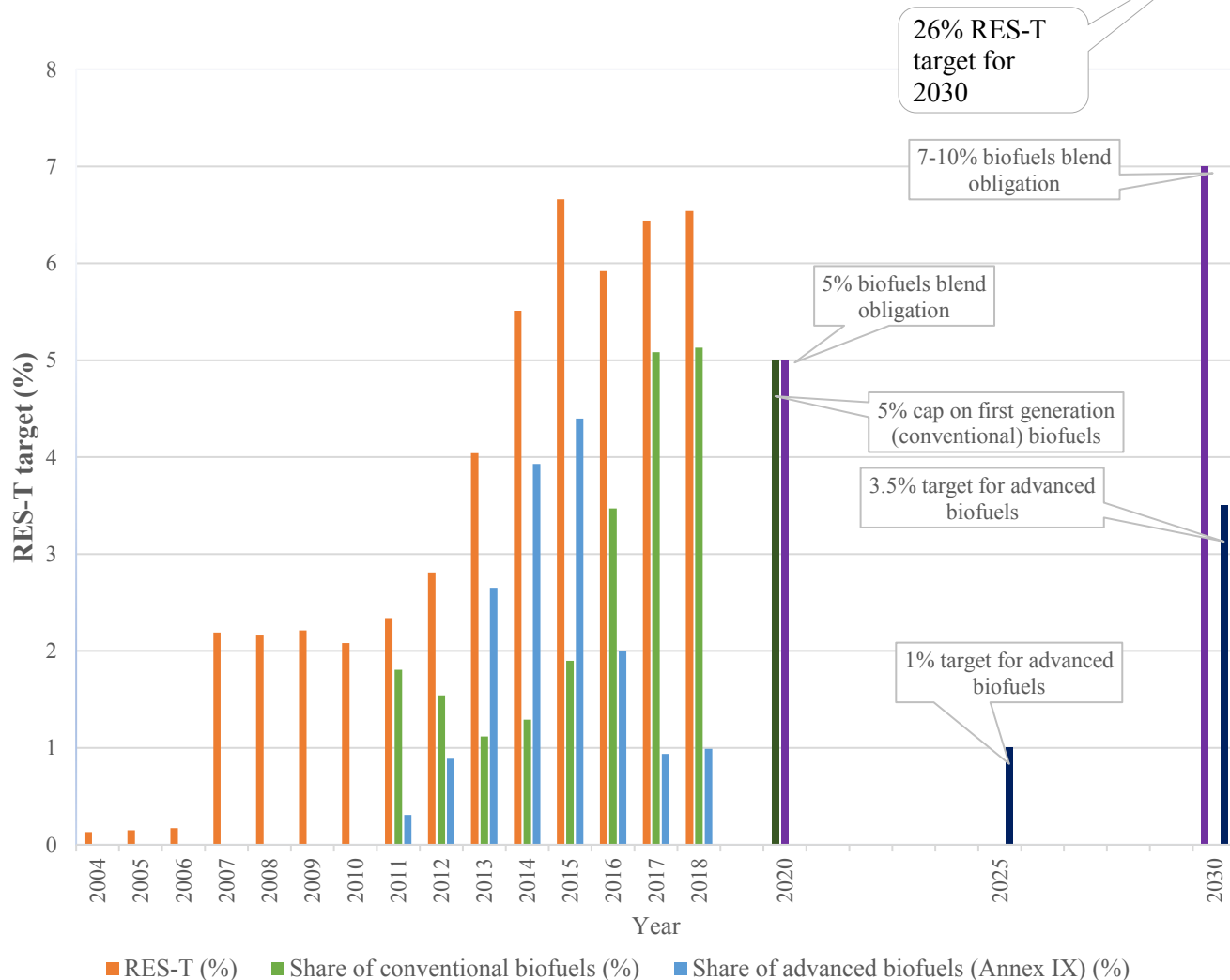


¹¹⁶ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

¹¹⁷ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

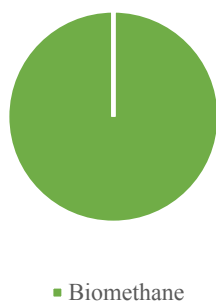
¹¹⁸ Integrated National Energy and Climate Plan 2021-2030, Luxembourg, https://ec.europa.eu/energy/sites/ener/files/documents/lu_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

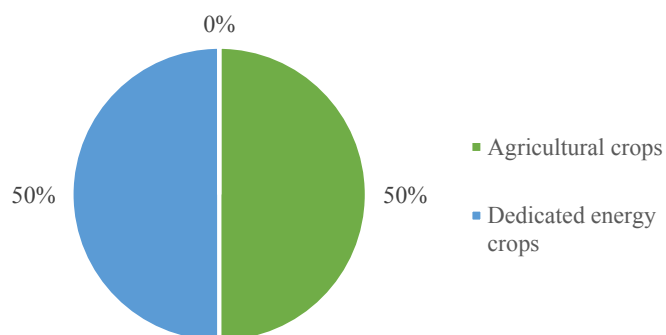


Number of operational biorefineries between 2007 and 2018¹¹⁹

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



¹¹⁹ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹²⁰
Biomass production	Do they address sustainability of feedstock?	• LU Government plans to set stricter requirements for sustainability criteria for biomass use in new plants to transpose EU sustainability criteria for biomass use in cogeneration plants • Planning to develop sustainability label for locally sourced wood biomass- 'Holz vun hei' and develop forestry code to set sustainability criteria for national forestry • Climate support schemes for improving the protection and sustainable management of forest ecosystems ensure sustainable timber production, improve the condition of forests	Green
Conversion of feedstock	Do they have financing for innovative conversion technologies?	• Environmental technologies are among the priorities of the LU's national economic diversification strategy. There are also several EU funds which could support innovative technologies in climate and energy impacts ○ LU- European Investment Bank- Climate Finance Platform ○ The International Climate Finance Accelerator ○ The Forestry and Climate Change Fund • Planning to develop 'Lets make it happen' strategy which will focus on green tech and climate solutions	Green
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	• Plan to develop strategy for the use of sustainable biofuels- cap on first generation of 5% to promote advanced fuels • Climate support schemes like 'Clever fueren' scheme to support purchase of electric vehicles, electric motorcycles	Yellow
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	• No transport sub-sector targets	Red

¹²⁰ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union¹²¹

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	GHG emission reduction and share of RES targets in transport CO2 taxation on fossil based products and programme to phase out fossil Vehicle taxes Electromobility, second-generation biofuels, green hydrogen	Transnational joint projects and establishing cooperation with other EU Member States- Pentalateral Energy Forum Participation in the new	Increasing energy efficiency in transport through traffic avoidance, Increase electromobility and built fast charging network Findel Green Airport within 'Fourth National Energy Efficiency Action Plan Luxembourg -plan to implement energy-saving measures and the use of renewable energy.	Support gas distribution companies in setting up green gas infrastructure (collection of biogas from decentralised biogas plants, biogas and sewage sludge washing plants Member of the North Seas Energy Cooperation- regional cooperation-	Programmes under climate and energy fund, environmental fund, EU Renewable Finance Platform Establishing new research infrastructure involving all relevant research and innovation stakeholders Plan to increase investment in research and development in the energy sector

Biomass policies which support the mobilisation of advanced renewable fuels

Production	Conversion	Distribution	End-use
CAP: Luxembourg Rural Development Programme		Biofuel blend Obligation	
Waste and Resources Management Plan	Feed-in tariffs for renewable energy		Fuel Taxation; Vehicle taxation
	Feed-in tariffs for biogas production, remuneration and commercialisation		Tax allowance for ownership of electromobility
	National energy efficiency action plan		Organisation of electricity market
	Energy Efficiency Obligation Scheme- 'Lean & Green' programme		
	Grants for energy efficiency and renewable energy investments		
		Combined Rail/Road Transport	
National emissions target under the EU Effort Sharing Decision (406/2009/EC) Luxembourg			
National Renewable Action Plan (NREAP) Luxembourg 2010; National Strategy to Reduce Emissions; Climate Framework Law; Climate Pack; National Mobility Plan			
The Strategy for Adapting to Climate Change in Luxembourg (2018-2023); National Plan of Sustainable Development			

¹²¹ Integrated National Energy and Climate Plan 2021-2030, Luxembourg
https://ec.europa.eu/energy/sites/ener/files/documents/lu_final_necp_main_en.pdf

Current State of Affairs^{122;123}:

Key facts for 2017/2018

ENERGY SUPPLY

Share of transport energy from renewable sources (RES-T) in 2018
8%

Share of total primary energy from biofuels (and waste) in 2018
12 ktoe (3.3%)

Share of electricity from biofuels (solid biofuels and biogases) in 2018
10 GWh (2.8%)

ENERGY CONSUMPTION

Final consumption of energy by transport sector in 2017
209 ktoe (42.5%)



Biofuels in 2018
9 ktoe
(EurObserv'ER 2019)



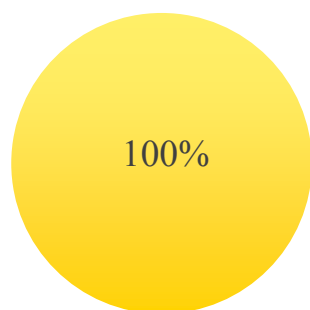
Biodiesel in 2017 in 2018
7.3 ktoe < **9 ktoe**

Malta has seen an increase in its biodiesel consumption in the transport sector between 2017 and 2018. Bioethanol and biogas markets remain non-existent; however oil products have seen a significant drop in recent years while the transport sector as a dominant energy consumer continues to grow.

Targets for renewable energy (RES), climate change mitigation and energy efficiency¹²⁴

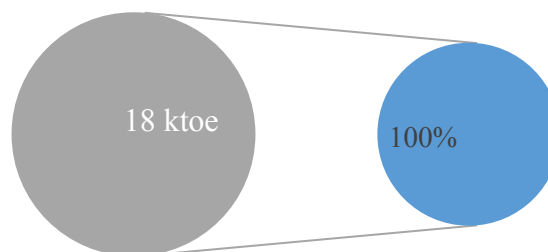
TARGETS	2020		2030
RES (renewable energy sources)			11.5%
GHG emissions reduction			19% (2005 BASE)
Electricity interconnection level			15%
RES-T (renewable energy in transport)			14%
Cap on first generation (conventional) biofuels	7%		
Share of advanced biofuels	2022	2025	3.5%
	0.2%	1%	

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



■ Biodiesel

Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



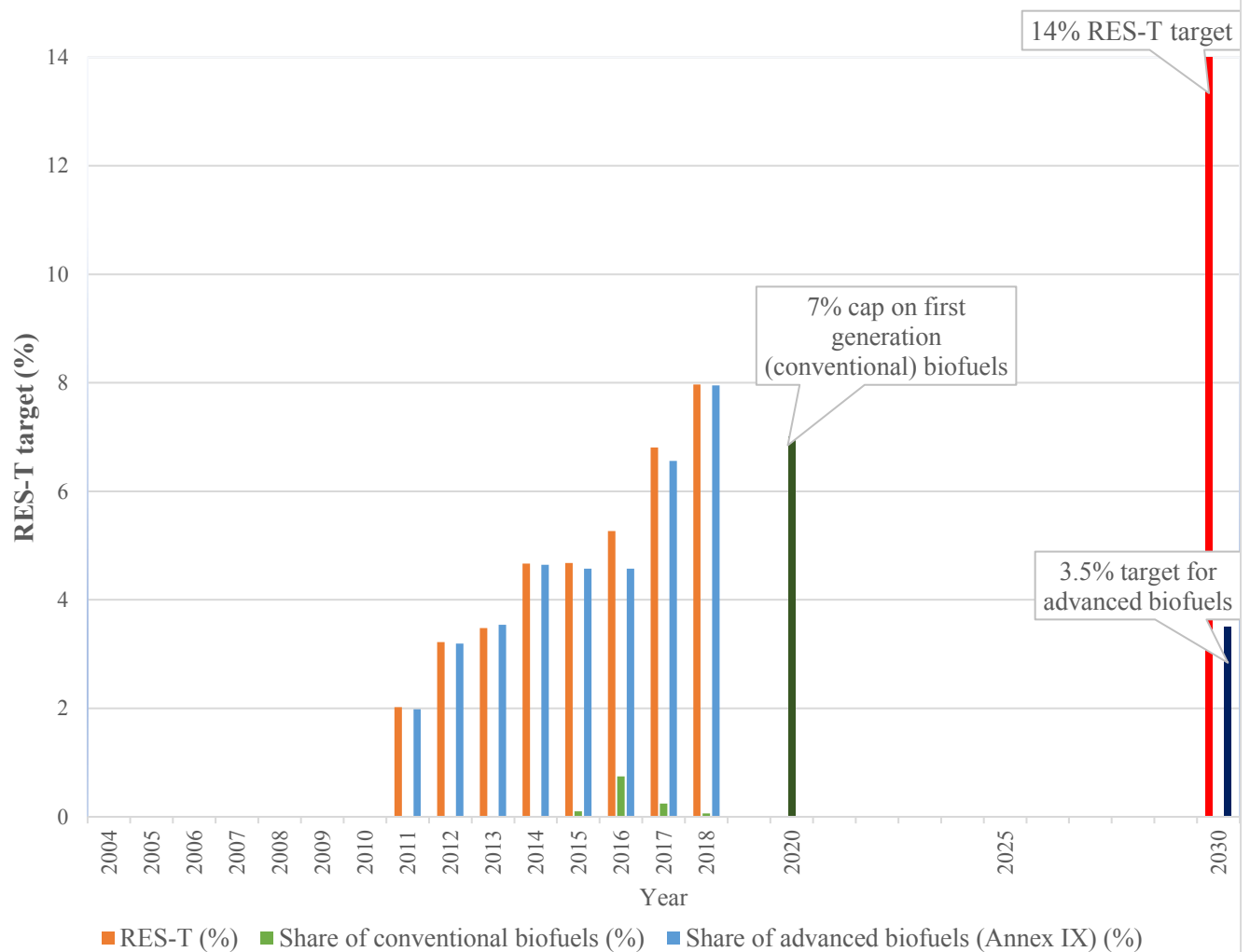
■ Advanced biofuels

¹²² All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

¹²³ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

¹²⁴ Integrated National Energy and Climate Plan 2021-2030, Malta, https://ec.europa.eu/energy/sites/ener/files/documents/mt_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹²⁵
Biomass production	Do they address sustainability of feedstock?	RES-T share is predominantly met by biofuel consumption. Advanced biofuels are expected to contribute to 25% of the total consumption of biofuels by 2030. However Malta does not have sustainable sources of biomass due to lack of land available for energy crops. 49% of the total imports of biomass comes from EU and the rest 51% comes from non-EU	Red
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- There are some funding programmes which could support low-carbon conversion technologies- FUSION Programme, The Research Innovation and Development Trust - TAKEOFF-Collaboration of Malta Marittima and the University of Malta offers €100,000 in support on an annual basis to finance researchers and entrepreneurs moving towards commercialisation of their maritime-related technologies - The Technology Development Programme (TDP) aims to support the actual development of innovative projects proposed by public and industrial entities - National Strategy for Research and Innovation in Energy and Water plans one of the priority areas is research and -testing of advanced low-carbon technologies	Green
Distribution and End-use	Do they address specifically advance fuels/ RES fuels?	- Green transport support for the purchase of electric vehicles, extensive charging points, scrappage incentives for old inefficient vehicles - Transport Malta is conducting feasibility of CNG and LNG in road transport. There are 5 fuel stations	Yellow
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No transport sub-sector targets 55% of the final energy consumption comes from transport and 40% of transport share from aviation	Red

¹²⁵ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union¹²⁶

Sector	Decarbonisation	Energy Security	Energy efficiency	Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission reduction and RES share targets Sustainable mobility measures Waste-to-Energy Facility Waste Management Plan Mobilise the indigenous sources Biofuel substitution obligation	Diversification of energy sources- gas pipeline, invest on energy storage and demand management	Tariffs to support energy efficiency Support schemes to improve energy efficiency		Gas pipeline project between Malta and Sicily- (MTGP-Melita Trans Gas Pipeline project) Electricity interconnectivity target		National Strategy for R&I in Energy & Water (RINEW) to support R&I activities Transport Malta (TM) is working on a pilot project to demonstrate hydrogen propulsion.

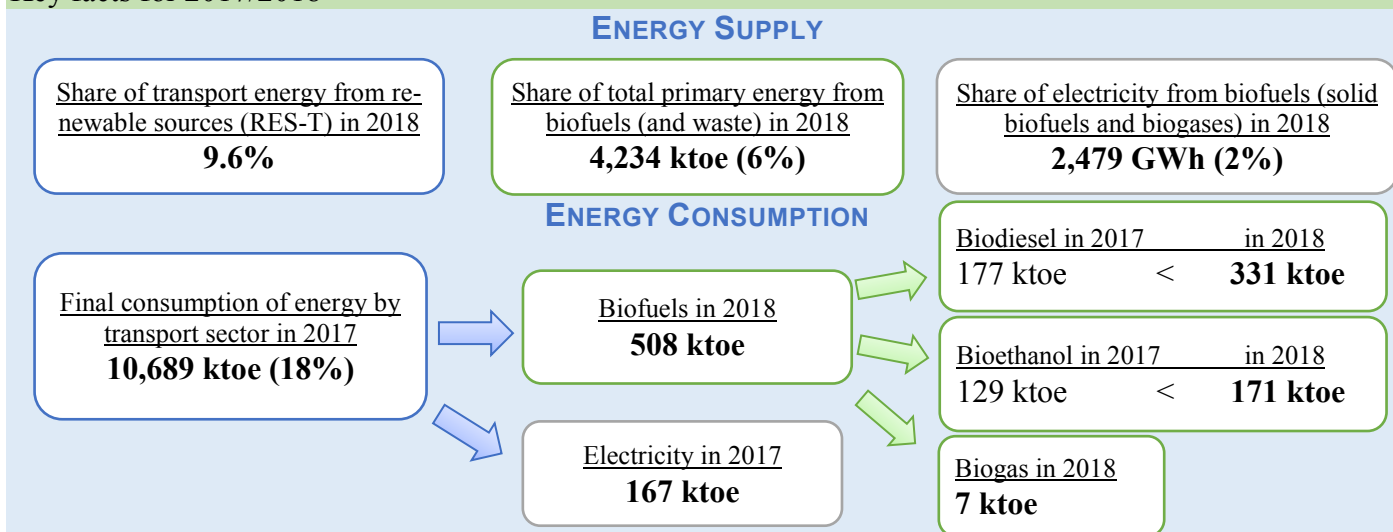
Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: Malta Rural Development Programme		Biofuel substitution Obligation	
Waste Management Plan 2020-2030	Development of Waste-to-Energy Facility	Low-emission zones	
		EV Charging Infrastructure Installation Incentives Malta	
	Feed-in tariffs for renewable energy		Tax allowance for ownership of electric vehicles Registration tax benefits
	National energy efficiency action plan		
	Grants for energy efficiency and renewable energy investments		
	Setting specifications for approved technologies	Combined Rail/Road Transport	
National emissions target under the EU Effort Sharing Decision (406/2009/EC) Malta			
National Renewable Action Plan (NREAP) Malta; National Transport Strategy; Sustainable Urban Mobility Plans (SUMP); Energy Law; National Energy Policy; Malta’s National Energy and Climate Plan; National Energy Efficiency Action Plan; National Strategy for Research & Innovation in Energy and Water (2021-2030); Malta’s Low Carbon Development Vision; Malta’s National Electromobility Action Plan (MNEAP) -under review			

¹²⁶ Integrated National Energy and Climate Plan 2021-2030, Malta
https://ec.europa.eu/energy/sites/ener/files/documents/mt_final_necp_main_en.pdf

Current State of Affairs^{127,128}:

Key facts for 2017/2018

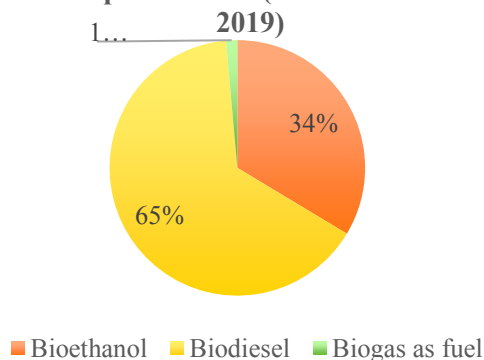


Netherlands has potential to increase its renewable energy share in gross final energy consumption as it lags behind next to its Member State counterparts. Total consumption of biofuel and biogas for transport has demonstrated significant growth between 2017 and 2018. This can be attributed to a government-imposed doubling of a mandate of incorporating sustainable biofuels, including a target specific to advanced biofuels and concordantly a cap on food crop-based biofuels. Almost all of the Netherlands' consumption of biofuels has been certified as sustainable.

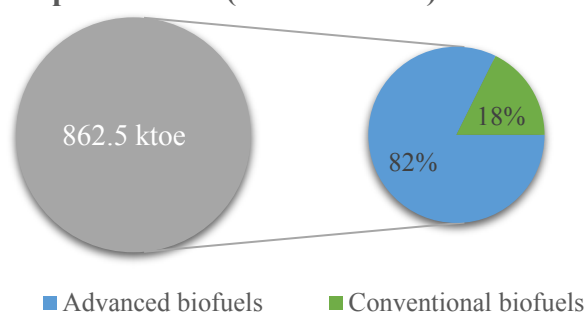
Targets for renewable energy (RES), climate change mitigation and energy efficiency¹²⁹

TARGETS	2020	2030
RES (renewable energy sources)	14%	27%
GHG emissions reduction (non-ETS)		49% (1990 BASE)
Energy efficiency		32.5% (2015 BASE)
RES-E (renewable energy in electricity)		100%
RES-T (renewable energy in transport)		14%
Biofuels blend obligation	10%	
Cap on first generation (conventional) biofuels	5%	
Advanced biofuels	1%	

Biofuel consumption share for transport in 2018 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)

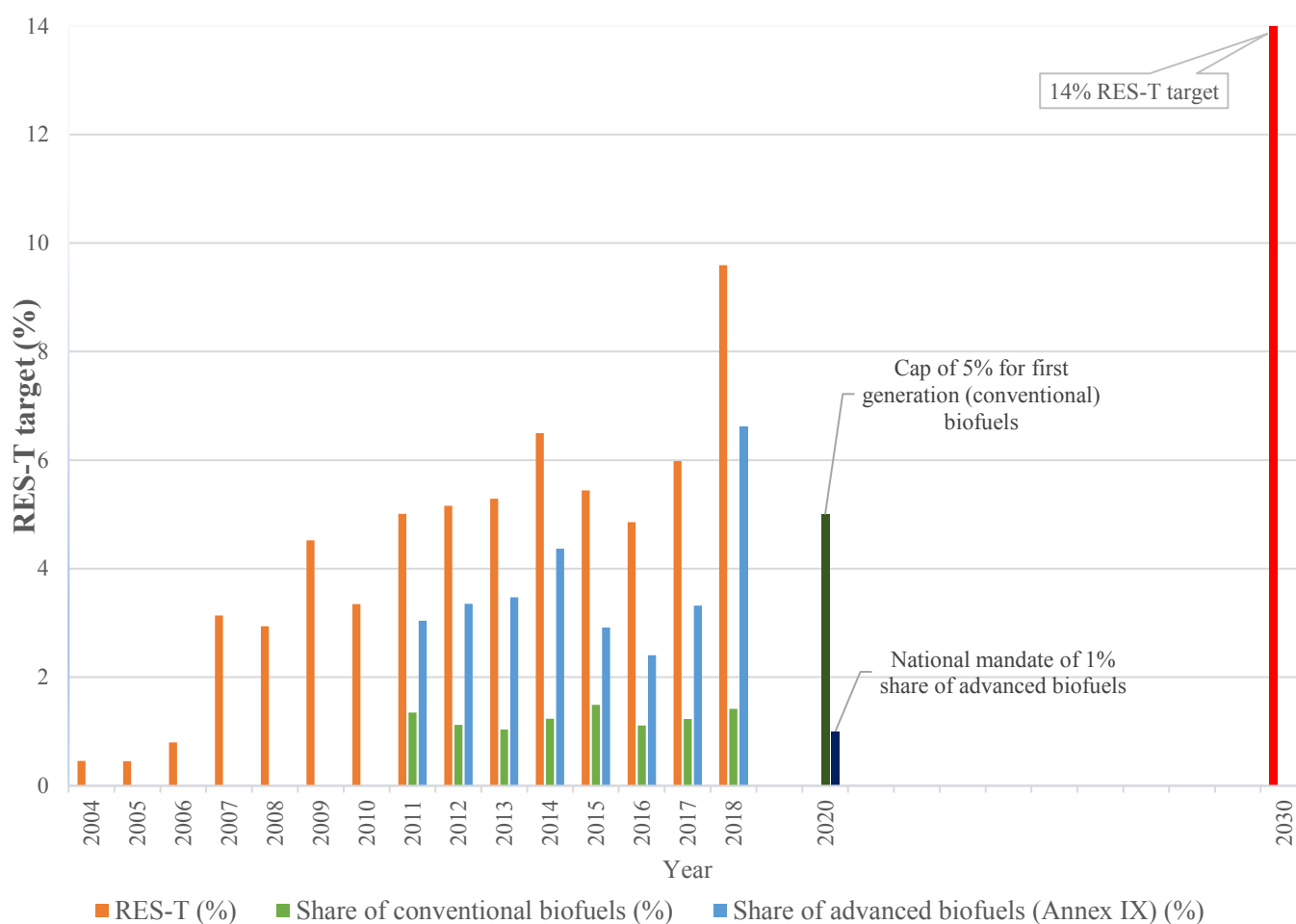


¹²⁷ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

¹²⁸ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

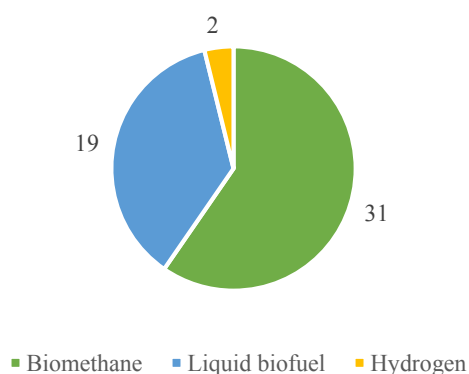
¹²⁹ Integrated National Energy and Climate Plan 2021-2030 The Netherlands, https://ec.europa.eu/energy/sites/ener/files/documents/nl_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

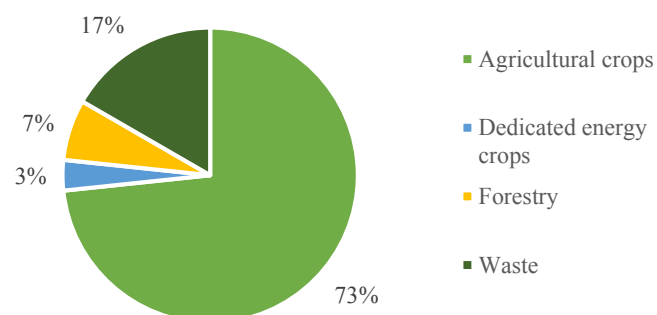


Number of operational biorefineries and hydrogen production projects between 2007 and 2018¹³⁰

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



¹³⁰ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Level ¹³¹
Biomass production	Do they address sustainability of feedstock?	• Sustainable Biomass Vision towards 2030¹³² • Complies with RED II Sustainability criteria	
Conversion of feedstock	Do they have financing for innovative conversion technologies?	• Netherlands aims to invest 2.5% of GDP in R&D in medium to long-term future. ○ Sustainable Energy Production Incentive (SDE++), ○ Renewable Energy Scheme (HER), ○ Climate and Energy Innovation Demonstration grant scheme (DEI+), ○ Energy top sector tender scheme (TSE), ○ Climate, Technologies and Innovations Demonstration Scheme (DKTI) ○ R&D Tax Credit and Innovation Credit and focus on targeted low-carbon energy and innovation policies	
Distribution and End-use	Do they address specifically advance fuels/ RES fuels?	• Biofuel Quota Scheme • National Agenda on infrastructure for alternative fuels, charging stations • Subsidies for commercial Electric Vehicles (EVs) • Incentives to purchase EVs	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	• ‘A vision on sustainable fuels for transport’¹³³ has targets of GHG emissions for freight (33%), maritime shipping (24%) and aviation (17%). • Tax for freight traffic from 2023, flight tax from 2021 Green deal agreements on maritime transport sector, in land waterways shipping and sustainable aviation platform.	

¹³¹ High score=Green; Medium Score=Yellow; Low score=red

¹³² https://ec.europa.eu/knowledge4policy/sites/knowledge4policy/files/92465_visie_biomassa_engels_def.pdf

¹³³ <https://www.ser.nl/nl/thema/energie-en-duurzaamheid/energieakkoord>

Transport policies and measures supporting the 5 dimensions of the energy union¹³⁴

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission reduction targets for all transport sectors. Overall RES-T increase target	Diversification of energy sources and conversion technologies (promote domestic biomass sources)	Energy efficiency targets	Policies and measures in place to support the market. 15% of interconnected target achieved and will continue to expand.		Funds, targets and long term objectives for deployment of low-carbon technologies
	Integrated Mobility System- Focus on sustainable energy carriers- renewable electricity, biofuels and green hydrogen	Investment in infrastructure to support alternative fuels (e.g. electric vehicle charging stations)	Energy consumption trajectories	Connected electricity market with 5 neighbouring countries (Pentalateral).		Mission-oriented Innovation Programmes (MMIPs) 9 and 10 focuses on -In innovative propulsion and use of sustainable energy carriers for mobility and efficient transport movements for people and goods.
	Biofuel quota scheme	Sustainable energy transition scheme	Energy tax and surcharge for sustainable energy (ODE)			
	National CO2 industry tax from 2021 – target of 14.3 Mton emission reduction by 2030.		Energy Investment deduction (EIA)			MMIP 12 focuses on land and water optimal use for production of biomass as a raw materials for biofuels.

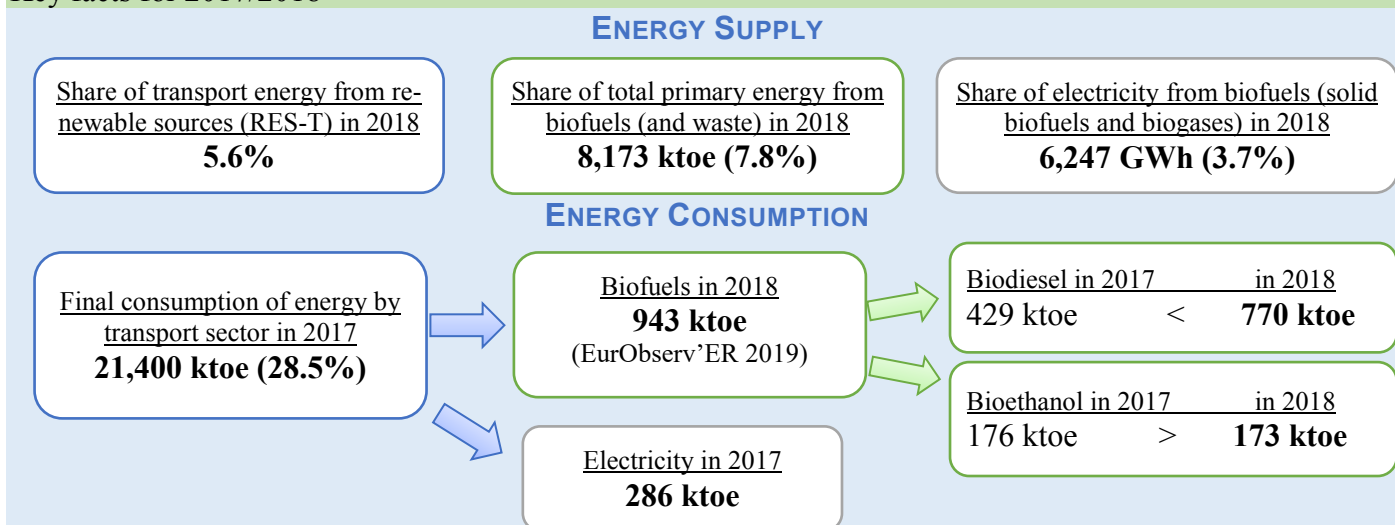
Biomass policies which support the mobilisation of advanced renewable fuels

Production	Conversion	Distribution	End-use
CAP: Dutch Rural Development Programme		Taxation of passenger cars and motorcycles (BPM)	
Decree on use of manure	Act on Income Tax		Energy Investment Tax Deduction Scheme (WEM)
Forestry Act	RES-E schemes: Loans, Tax regulation, Premium Tariff		National Agenda on infrastructure for alternative fuels
National waste management plan	Sustainable Energy Transition Scheme (SDE++)		Investment for charging stations
	RES-H schemes: tax credits, loans, premiums		Subsidies for commercial EVs
	RES-H schemes: biofuel quota and tax regulations		
	Environmental Protection Act		
	Vision Biomass 2030		
	Biofuel Quota		
	Environmental Management Act		
	National Energy Efficiency Action Plan		
		RES-H infrastructure: Tax credits, Premiums	
		Heat Act	
		Green Deal on Maritime transport	
Climate Act; Climate Agreement (Mobility Sector Platform)			
The National Climate Agenda for 2030; National Energy Efficiency Action Plan; National Energy and Climate Action Plan 2030; Alternative Fuels Infrastructure Directive (AFID).			
New Energy for Climate Policy: The Clean and Efficient Programme (CEP)			
The Energy Agenda 2050; Vision Biomass 2050			

¹³⁴ Integrated National Energy and Climate Plan 2021-2030, The Netherlands https://ec.europa.eu/energy/sites/ener/files/documents/nl_final_necp_main_en.pdf accessed on 19th August, 2020

Current State of Affairs¹³⁵:

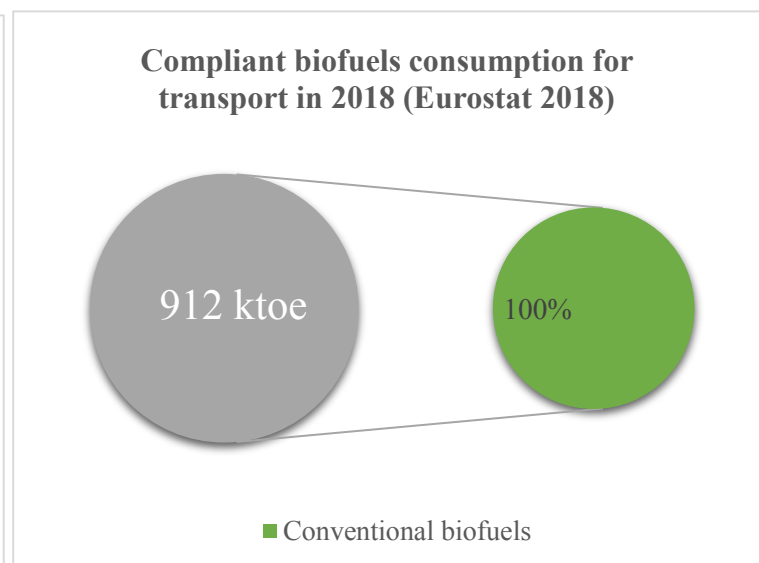
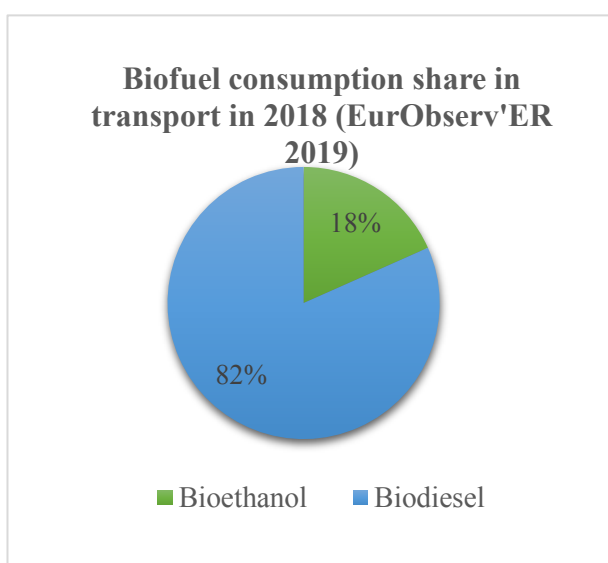
Key facts for 2017/2018



Poland biofuels consumption for transport has increased for biodiesel, however decreased for bioethanol from 2017 to 2018. The transport sector in recent years has grown to become the dominant sector for total energy consumption. While oil remains largely dominant in energy consumption, overall biofuels and waste have increased fourfold since 1990. Additionally, coal dominates both energy supply and electricity generation: biofuels have seen a steady increase and growing market share only in the former.

Targets for renewable energy (RES), climate change mitigation and energy efficiency¹³⁶

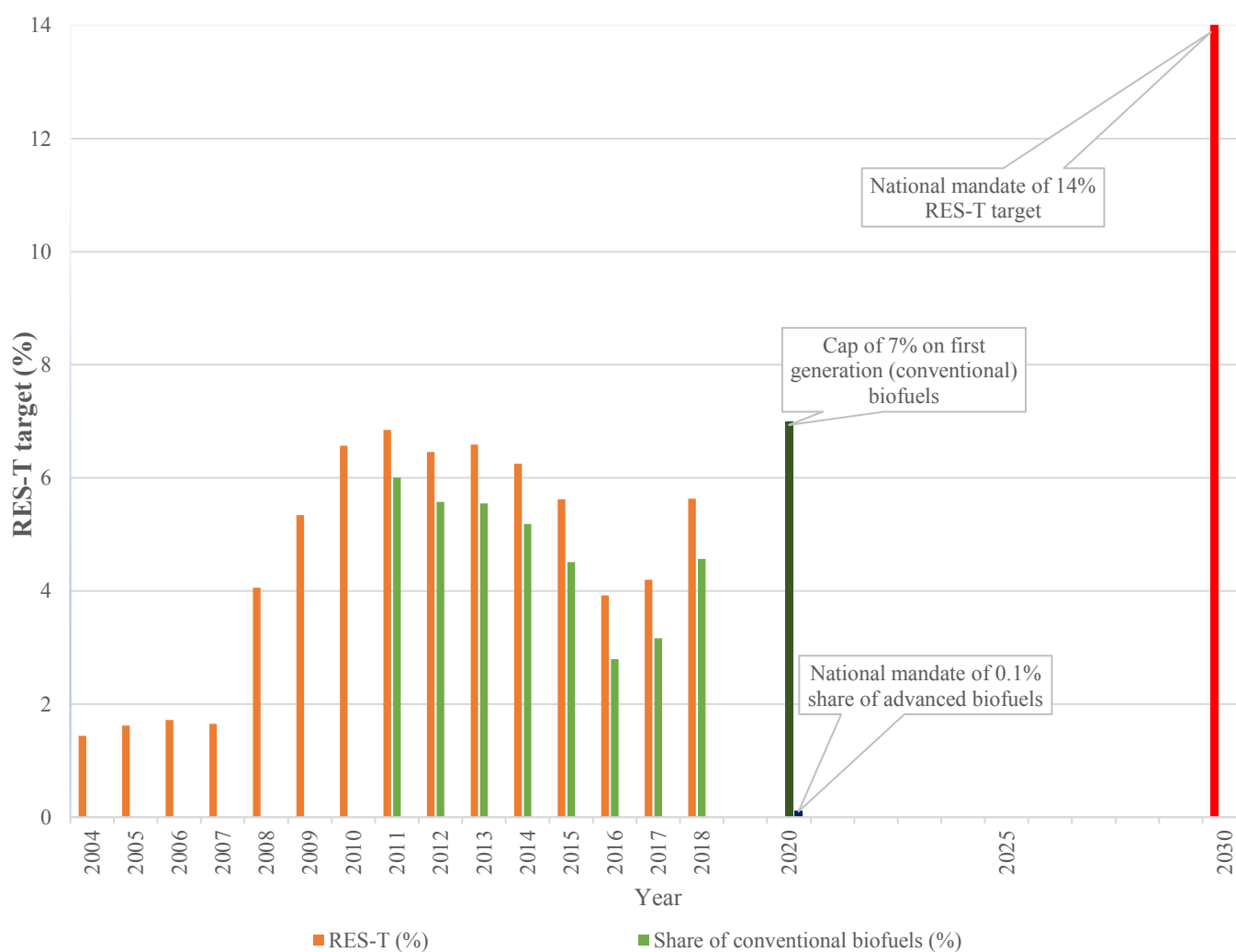
TARGETS	2020	2030
RES		14%
GHG emissions reduction (non-ETS)		7% (2005 BASE)
Energy efficiency improvement		23% (2007 BASE)
RES-E (renewable energy in electricity)		56%-60% COAL AND LIGNITE REDUCTION
RES-T (renewable energy in transport)		14%
Cap on first generation (conventional) biofuels	7%	
Advanced biofuels	0.1%	



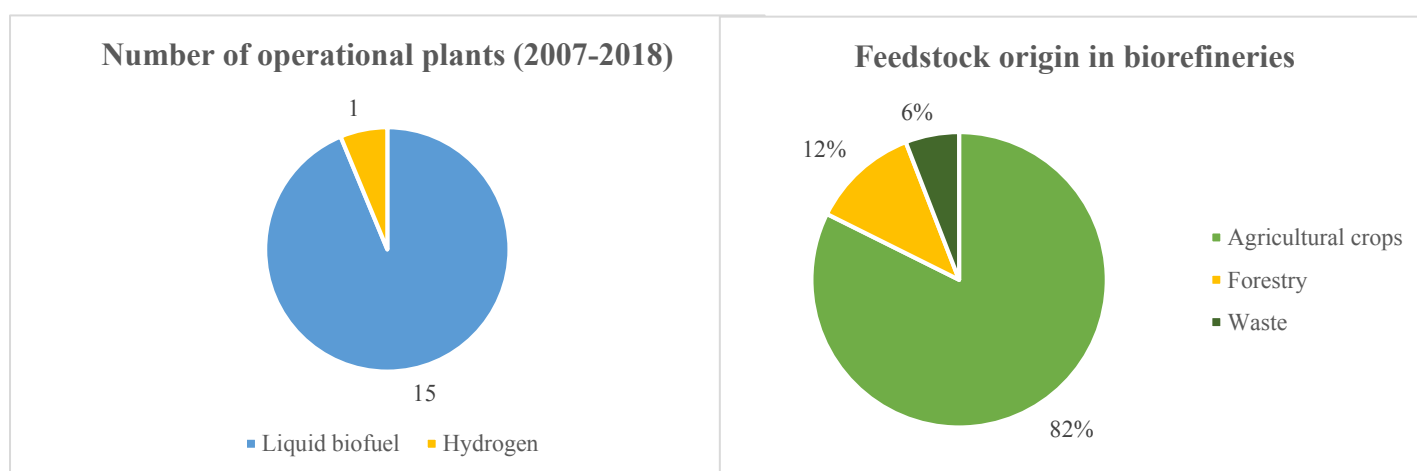
¹³⁵ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

¹³⁶ Integrated National Energy and Climate Plan 2021-2030, Poland, https://ec.europa.eu/energy/sites/ener/files/documents/pl_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)



Number of operational biorefineries and hydrogen production projects between 2007 and 2018¹³⁷



¹³⁷ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹³⁸
Biomass production	Do they address sustainability of feedstock?	As per environmental protection requirements under CAP, 13% of the domestic biomass potential is allocated for energy purposes to reduce adverse effects on soil degradation	Green
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- There are aid mechanisms targeted for special technologies which needs support to scale-up. National Research Programme (NRP) have 7 strategic priorities areas for R&D and 'new energy technologies' is one of them. Poland increased their R&D budget from 1.7% of GDP in 2020 to 2.5% of GDP in 2030. E.g. The GreenEvo- Green Technology Accelerator Project. - Poland is focusing on supporting business entities to improve their competitiveness through high efficiency, low-carbon and integrated energy generation, storage transmission and distribution systems; smart and energy-efficient building technologies and environment-friendly transport solutions; minimisation of waste generation, use of waste for materials and energy production.	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	Proposed support mechanisms to address advanced fuels are: grants, subsidies, repayable instruments. The production of biofuels is possible within the framework of seven Regional Operational Programmes (ROPs), as part of measures dedicated to RES. Potential of financial support is for development of alternative fuels under financial period of 2021-2027 and 2028-2034. Support for renewable energy sources is also envisaged by the National Fund for Environmental Protection as part of national funds	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No transport sub-sector targets - Proposals to manage demand for freight transportation by combining transport volumes and switching to clean vehicles	Yellow

¹³⁸ High score=Green; Medium Score=Yellow; Low score=red



Transport policies and measures to support the 5 dimensions of the energy union¹³⁹

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	GHG emission reduction. renewable energy share increase targets Sustainable Transport Development Strategy 2030 -Low-carbon vehicles, sustainable mobility patterns, zero-emission public transport programme. Just Energy Transition towards decarbonisation Increase use of advanced biofuels and RES-based micro installations between 2020-2030 Financial mechanisms to regulatory support RES- priority access to the network, feed-in tariff and feed-in premium, grants and aids for special technologies and guarantees of origin	Construction of Baltic Pipe and extension of LNG terminal- which will enable PL to establish gas transmission and trading hub. Construction and operation of LNG bunkering infrastructure in the Baltic Sea- LNG Bunkering Vessel Gas and electricity transmission system of Poland and Ukraine	Energy efficiency obligation scheme Reducing congestion, delimitation of low-emission zones, promote energy efficient means of transport which are low-carbon and energy efficient vehicles (e.g. using fuel cells and hydrogen, or the following drives: electric, gas, hybrid, compressed air) and develop network of recharging or replacement points and natural gas or hydrogen refueling stations, environment-friendly low-noise and low-carbon airplanes, maritime vessels fuelled by compressed or liquid natural gas, new generation inland waterway vessels (including energy-efficient and low-carbon inland waterway container vessels), use sustainable advanced fuels.	Increase connectivity of electricity market, develop smart grids to create synchronised power systems for cross-border transmission	National smart specialisations have some key priority areas for R,D&I – Innovative technologies processes and products of agricultural and forest products; Environment friendly transport solution; High-efficiency, low-carbon and integrated energy generation, storage, transmission and distribution systems and Innovative maritime technologies for specialised vessels, marine and coastal structures

¹³⁹ Integrated National Energy and Climate Plan 2021-2030, Poland, https://ec.europa.eu/energy/sites/ener/files/documents/pl_final_necp_main_en.pdf

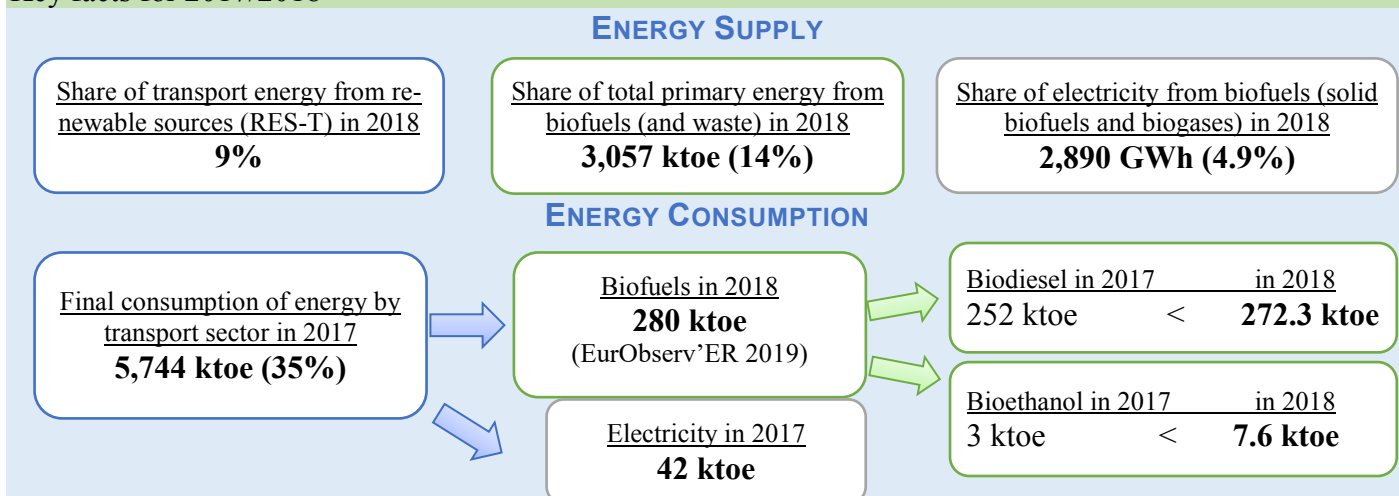


Biomass policies which support the mobilisation of advanced renewable fuels

Production	Conversion	Distribution	End-use
	National Air protection Programme		
CAP-Polish Rural Development Programmes			
Protection of agricultural and forest land	BOCIAN, POISEFF2, PROSUMER		
Agricultural System Act	Energy efficiency certificates -White Certificates	Capacity Market Act 2017	
Nitrate Programme		Excise Duty Act	
Forest act	Act of 25 August 2006 on Biocomponents and Liquid Biofuels		
Water Law		Electromobility Development Plan	
Renewable Energy Act; Renewable Energy 2030 Framework target			
National Fund for Environmental Protection and Water Management		Carbon Free Public Transport Programme	
		Low carbon transport fund -Construction of charging/refuelling infrastructure and purchase of electric vehicles	
	Act on Thermo-Modernisation and Refurbishments		
	Infrastructure and Environment Operations Programme and the Regional Operations Programme		Feed-in tariff and Feed-in premium, grants for promotion of RES
	Renewable Energy Act		
Environment Protection Law (EPL); National Air Protection Programme			
National emissions target under the EU Effort Sharing Decision (406/2009/EC) Poland			
Poland National Energy and Climate Plan 2021-2030; State Environmental Policy 2030; Energy Law; Energy Policy for Poland 2040; National Energy Efficiency Plan; National Development Strategy; Strategy for Innovation and Efficiency; Strategy for Sustainable Rural Development, Strategy for Energy Security; Transport Development Strategy 2020 (outlook to 2030)			

Current State of Affairs^{140;141:}

Key facts for 2017/2018

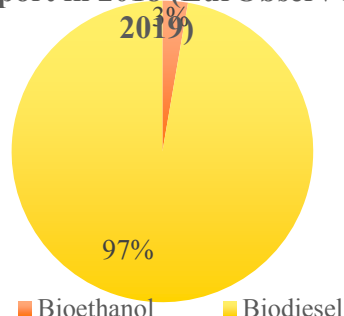


Portugal biofuels consumption for transport has increased both for biodiesel and bioethanol from 2017 to 2018. Oil still dominates both the energy supply and consumption markets, however it is decreasing with growing RES, including biofuels. The potential to exploit the transport sector remains large as this sector overtakes all others in terms of energy consumption. Regarding electricity production, biofuels have shown a steady fourfold increase since 1990.

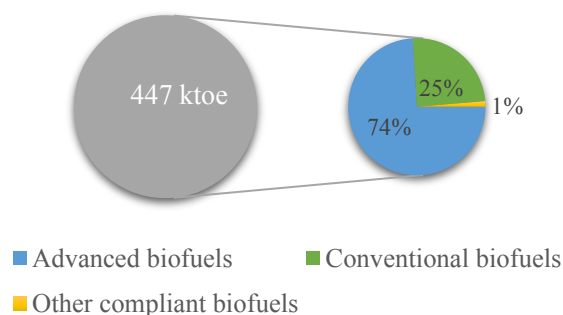
Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁴²

TARGETS	2020	2030
RES (final energy consumption)	31%	47%
GHG emissions reduction (non-ETS)		41% (2005)
Energy efficiency improvement		35% (2007 BASE)
Electricity interconnection		15%
RES-E (renewable energy in electricity)		80%
RES-T (renewable energy in transport)		20%
Biofuels blend obligation	5%	7-10%
Cap on first generation (conventional) biofuels	7%	
Share of advanced biofuels	2022	2025
	0.2%	1%
		3.5%

Biofuel consumption share in transport in 2018 (EurObserv'ER)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)

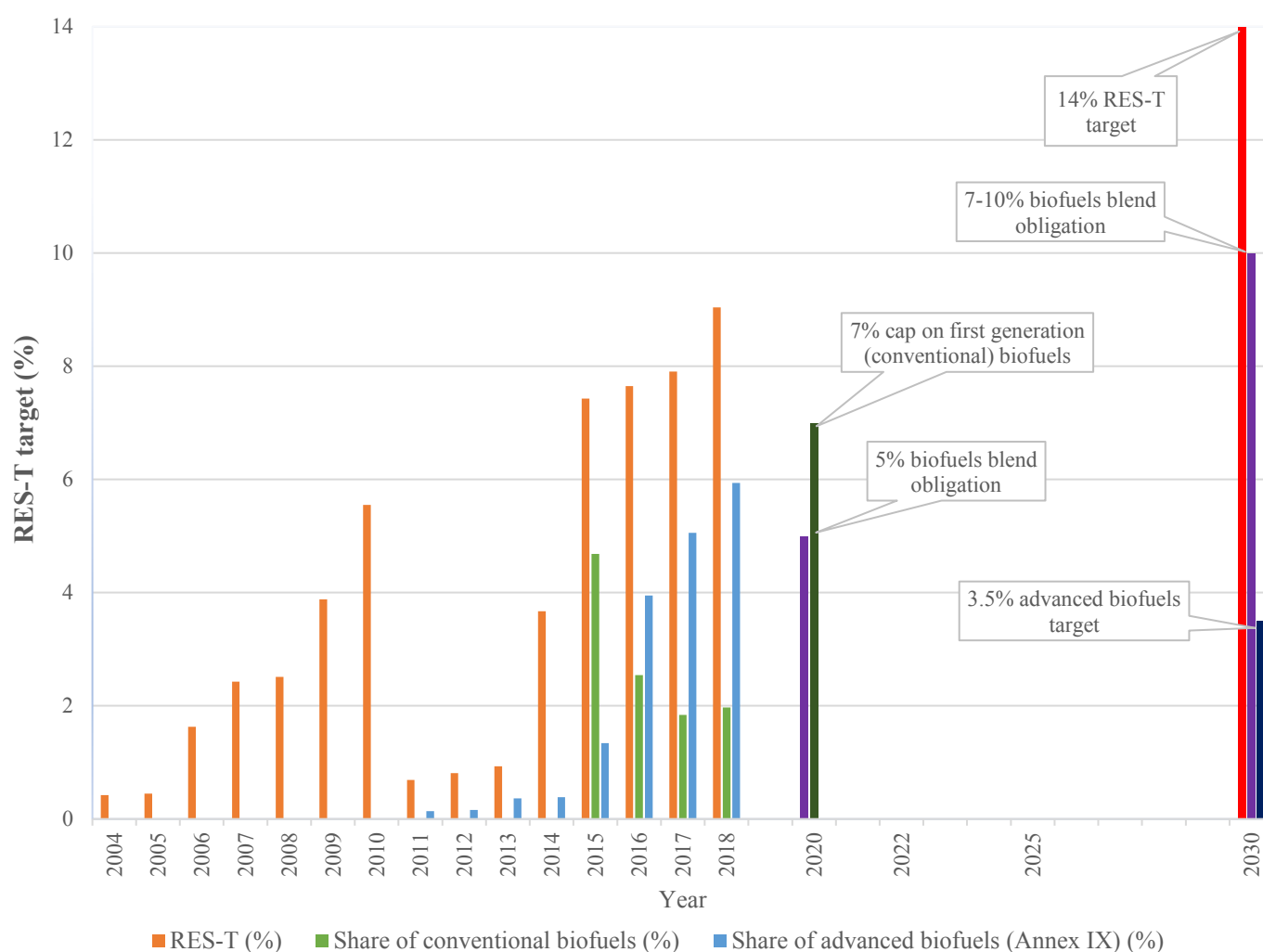


¹⁴⁰ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

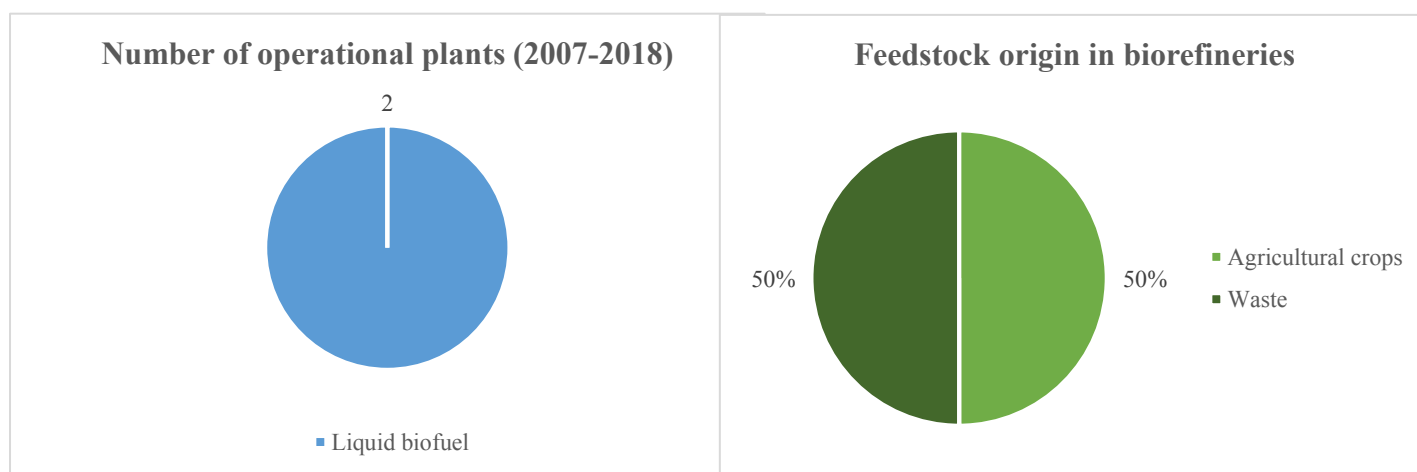
¹⁴¹ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

¹⁴² Integrated National Energy and Climate Plan 2021-2030, Portugal, https://ec.europa.eu/energy/sites/ener/files/documents/pt_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)



Number of operational biorefineries between 2007 and 2018¹⁴³



¹⁴³ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁴⁴
Biomass production	Do they address sustainability of feedstock?	Strategy in place to promote sustainable mobilisation of forest biomass value chains – mapping availability of biomass, establish a system to quantify biomass, technological solutions for the use of biomass, investment support	High
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Promote the installation of technologies to produce electricity from biomass and biogas - Promote and support installation of green hydrogen supply points	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Promote the production of advanced biofuels using local resources - Reduce production of waste and direct deposit of waste in landfills and promote recycling chains to promote electricity generation from waste management plants - Promote the use of residual biomass, establishment of crops for energy purposes, use agricultural and forestry biomass	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No transport sub sector targets - Strategy in place to promote the production and consumption of alternative RES fuels- for aviation and heavy-duty sector - Create sustainable market for maritime LNG, enabling the use of LNG in ships- Strategy in place to increase the Competitiveness of the Mainland Commercial Ports Network - Promote the installation of supply points for RES fuels	Medium

Transport policies and measures supporting the 5 dimensions of the energy union¹⁴⁵

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	Phase out coal based electricity and conventional biofuels Low-emission zones and vehicles, smart mobility	Promote more efficient technologies Promote storage in the is-	Improve management of energy consumption Promote the use of low-	North-South Electricity Interconnections in Western Europe (NSI West Electricity- promote	Promote national R&D programme to support technological development

¹⁴⁴ High score=Green; Medium Score=Yellow; Low score=red

¹⁴⁵ Integrated National Energy and Climate Plan 2021-2030, Portugal

https://ec.europa.eu/energy/sites/ener/files/documents/pt_final_necp_main_en.pdf



Promote the production and consumption of alternative fuels -renewable electricity and gases, improved use of biomass for energy purposes Support installation of green hydrogen supply points Green taxation	lands and improve electricity networks Create sustainable market for maritime LNG, enabling the use of LNG in ships	emissions vehicles and sustainable mobility Ecological public procurement	interconnections between Portugal and Spain
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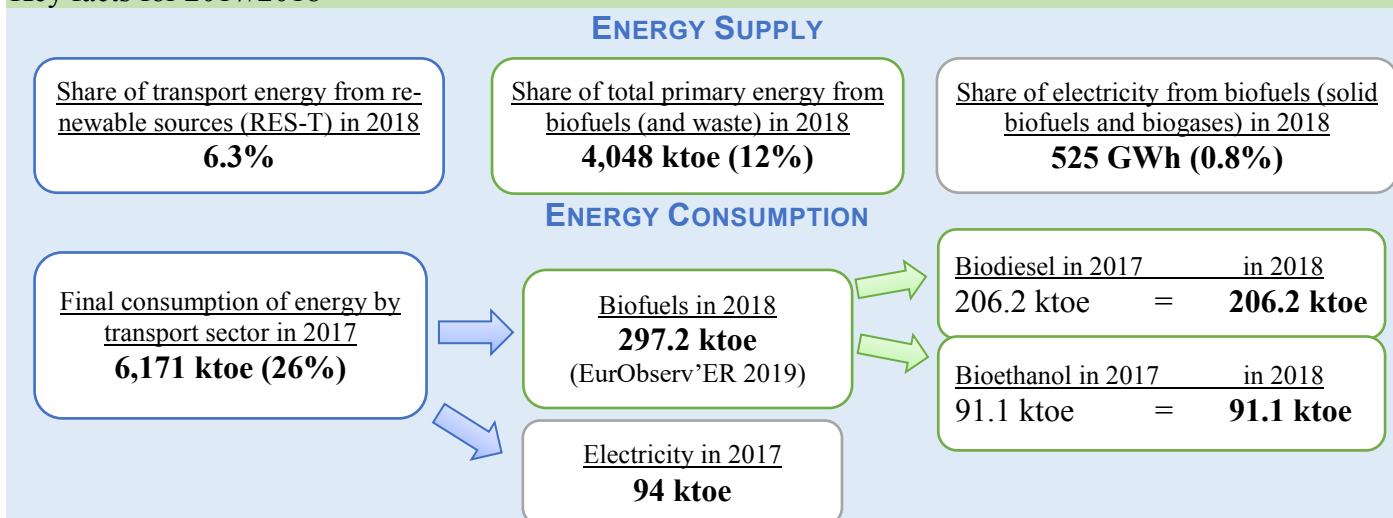
Biomass policies which support the mobilisation of advanced renewable fuels

Production	Conversion	Distribution	End-use
CAP: Portuguese Rural Development Programme			
Decree on Discharge of Dangerous substances in Agriculture		Biofuel quota and petrol product tax (ISP); Carbon Tax; Green Taxation Reform; Tariff Reduction Support Programme (PART)	
Nitrates Act	Funds to support Innovation		
Water Act		Financial support for electromobility and low emission vehicles for public transport	
Forest Act; Decree on National Forest Protection System. National Forestry Strategy	GHG emission trading system		Biofuel Sustainability Criteria The Decree-Law No. 117/2010
Decree to establish measure to promote production and exploitation of forest biomass	Industrial emissions		Removal of tax exemptions on coal by 2030
National Waste Management Plan	Decree-law 23/2010 introduced the legal framework for cogeneration		National Strategy for Ecological Public Procurement Incorporate
National strategy for the management of sludge	Decree on RES-E generation by small power installations or plants-Feed-in tariff		
Urban waste strategic plan	Energy Efficiency Fund		
Srategic Waste Document 2020-2030.			
Decree-Law No. 351/2007 on air quality; National emissions target; National Forestry Strategy			
Roadmap for Carbon Neutrality 2050; National Plan for Promotion of the Biorefineries; Thematic Agendas for Research and Innovation ¹⁴⁶ ; Transport and Infrastructure Strategic Plan; National Investment Programme (NIP 2030)			

¹⁴⁶Bioeconomy related strategies, https://ec.europa.eu/knowledge4policy/bioeconomy/country/portugal_en

Current State of Affairs¹⁴⁷:

Key facts for 2017/2018

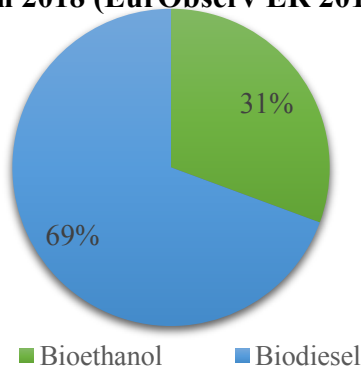


Romania has not seen any changes in its biofuels consumption for the transport sector between 2017 and 2018, however both its energy consumption share by the transport sector as well as overall biofuels and waste supply and consumption have grown steadily since 1990. This indicates a potential to continue accelerating this trend. Electricity from biofuels remains underdeveloped next to all other energy sources.

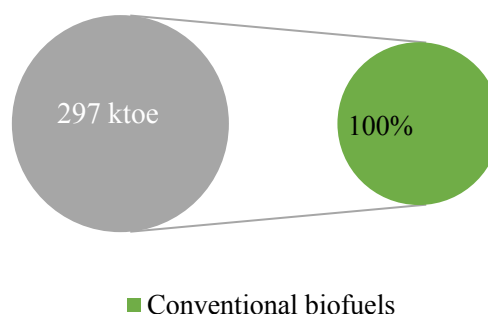
Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁴⁸

TARGETS	2020		2030		
RES (renewable energy sources)			30.7%		
GHG emissions reduction			43.9% ETS	2% NON-ETS	2005 BASE
Energy efficiency improvement			40-45% (2007 BASE)		
Electricity interconnection			15%		
RES-E (renewable energy in electricity)			49.4%		
RES-T (renewable energy in transport)			14.2%		
Cap on first generation biofuels	7%				
Advanced biofuels	2022	2025	3.5%		
	0.2%	1%			

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



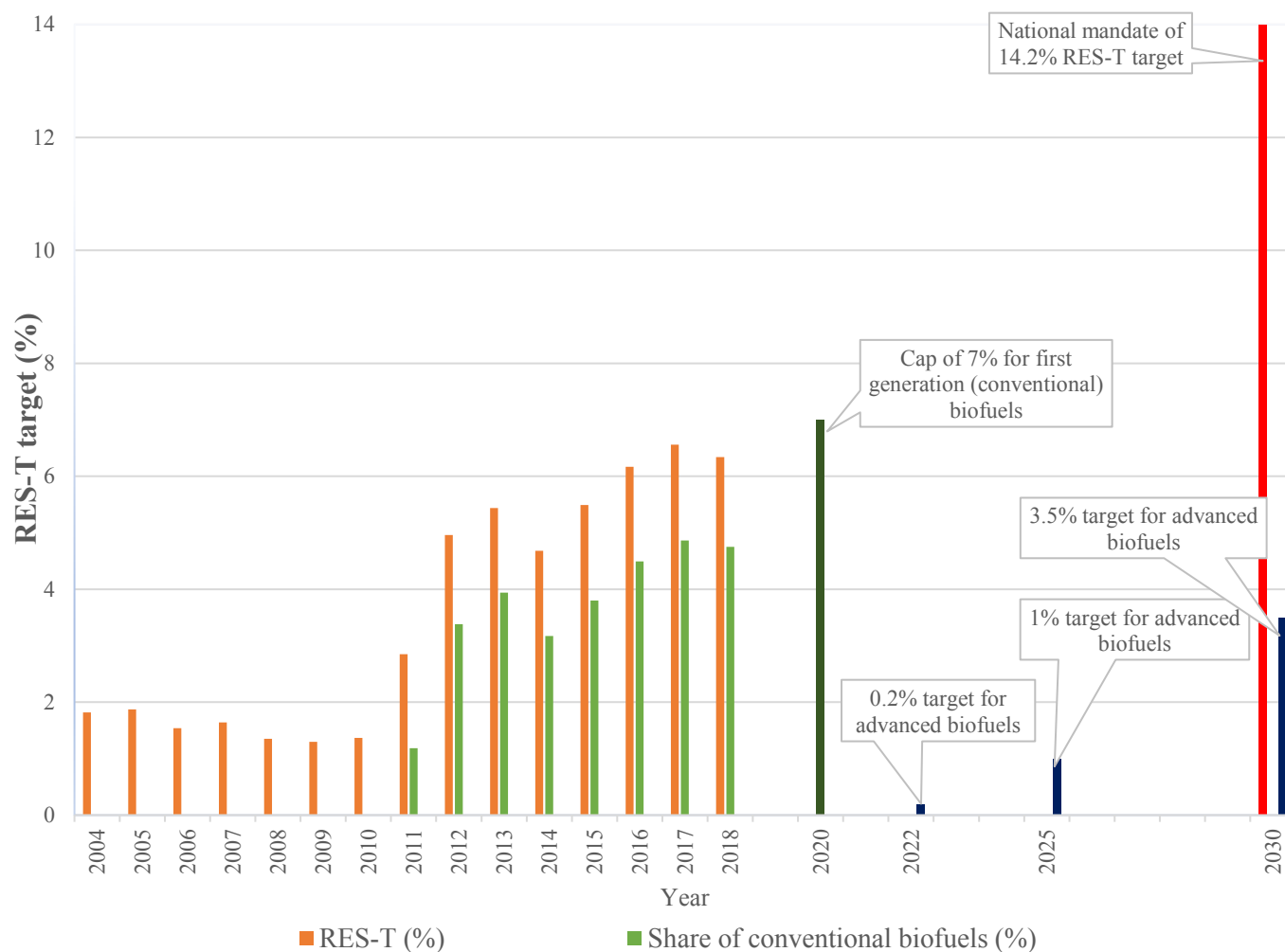
Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



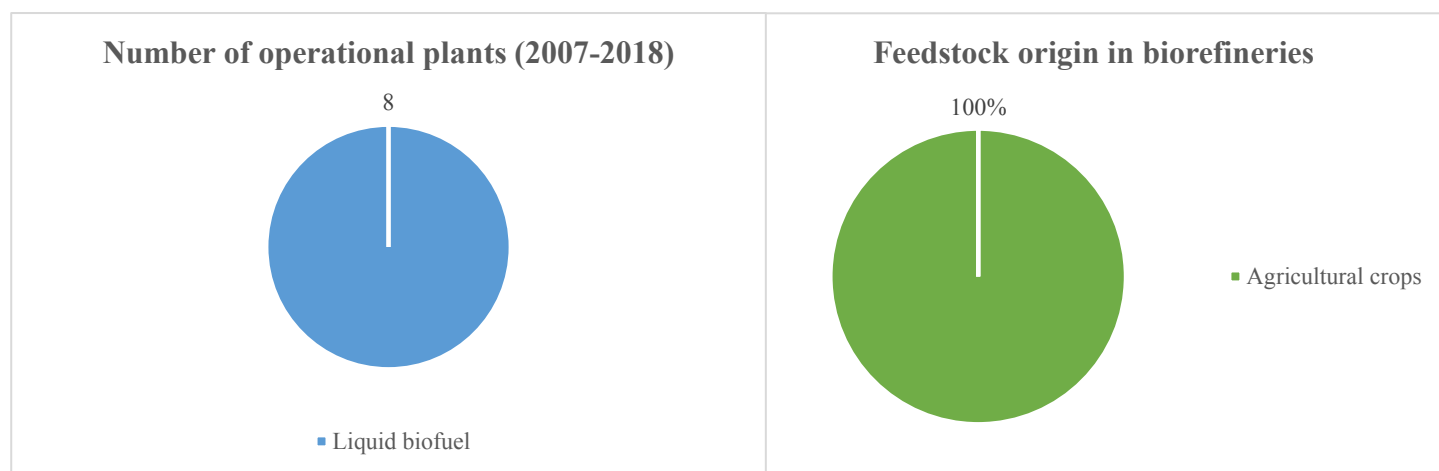
¹⁴⁷ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

¹⁴⁸ Integrated National Energy and Climate Plan 2021-2030, Romania, https://ec.europa.eu/energy/sites/ener/files/documents/ro_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)



Number of operational biorefineries between 2007 and 2018¹⁴⁹



¹⁴⁹ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁵⁰
Biomass production	Do they address sustainability of feedstock?	- Minister for Agriculture and Rural in 2012 established a procedure to release of the certificate of origin for the biomass sourced in agriculture and related industries, which is used as fuel or feedstock for production of electricity to maintain the sustainability of feedstock. The procedure for the release of certificates of origin for the biomass sourced in forestry and related industries, which is used in the production of electricity from renewable energy sources (as approved by Ministerial Order No 1534/2016), was introduced in 2016. - Certificate the compliance with the biofuels and bio liquids durability criteria, voluntary schemes recognized by the European Commission to demonstrate compliance with the sustainability criteria under RED II	Green
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Modernization Fund, The Structural Funds 2021-2027, Just Transition Mechanism co-funds RES projects to achieve 2030 targets - Best available technologies (BAT) also funds most efficiency and advanced stage of development activities which reduces GHG emission and increases energy efficiency - There are other programs which are running in European and International cooperation to support the research and innovation in Romania. E.g. Horizon 2020, Europe Horizon, ALFRED (R&D and Innovation program for the 4th generation reactors).	
Distribution and End-use	Do the address specifically advance fuels/ RES fuels?	- Developing a regulation to establish obligation regarding vehicle of public institution to use alternative fuels and to establish rules for the joint procurement of motor vehicles on alternative fuels - Promotion of electromobility- Incentives to foster private infrastructure development to install public charging networks - Policy strategy to foster investment in co-processing installation in biorefineries for production of sustainable biodiesel in compliance with RED II and EN 590 standard	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No transport sub-sectors targets - Different CO2 emissions standards in transport: - Passenger cars (reduction by 37.5 % in 2030 compared to 2021) - Utility vehicles (reduction by 31 % in 2030 compared to 2021) - Heavy vehicle stock (reduction by 15 % in 2020 and by 30 % in 2030) both compared to the EU average in the reference period between June 2019-June 2020.	

¹⁵⁰ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union¹⁵¹

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	Promoting electromobility in road transport; use of biofuels in transport Restrictions on conventionally fuelled vehicles (implementing standards of emissions by sectors) Development of infrastructure for alternative fuels	Implementation of decarbonization plan Develop high efficiency cogeneration project	Developing and promoting alternative mobility Increase energy efficiency in industrial sectors Maintaining efficient motor vehicles Incentives for green transport system	Promoting development and production of the infrastructure required for penetration of alternative fuels, including LPG, CNG and LNG Extending smart transport systems in large cities		Adopting advanced technologies in the energy sector- implementing pilot and demonstration projects promoting use of hydrogen in production of electricity.

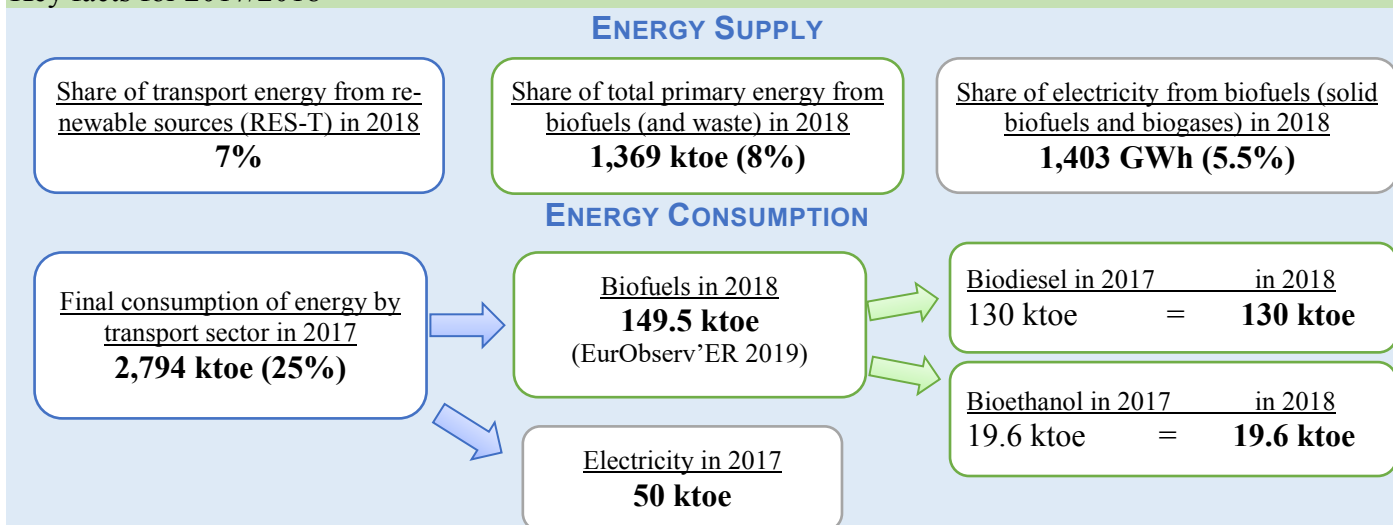
Biomass policies which support the mobilisation of advanced renewable fuels

Production	Conversion	Distribution	End-use
CAP: Romanian Rural Development Programme			RES-E subsidies
Forest Certification	Quota (Green Certificates)		Biofuel Quota
National Forest Strategy 2018-2027			
Law on Energy efficiency 121/2014 Romania 2014			
RES-E: State Aid schemes			
	RES-H building recommendation: Law on energy performance of the new building		
		RES-E Gris Access	
		RES-H infrastructure- subsidy	
	Law on industrial emissions 278/2013 Romania 2013		
Law no 220/2008 for the promotion of energy production from renewable energy sources			
National emissions target under the EU Effort Sharing Decision (406/2009/EC) Romania			
Low Carbon Green Growth Strategy 2016 -2020; Romania Energy Strategy 2016-2030; Romanian Sustainable Development Strategy 2030			

¹⁵¹ Integrated National Energy and Climate Plan 2021-2030, Romania, https://ec.europa.eu/energy/sites/ener/files/documents/ro_final_necp_main_en.pdf

Current State of Affairs¹⁵²:

Key facts for 2017/2018

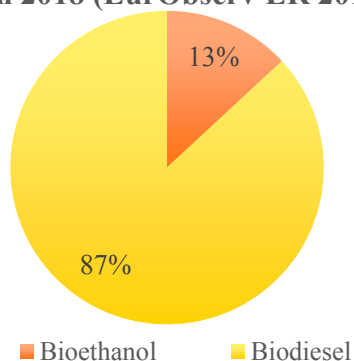


Slovakia biofuels consumption for transport has not progressed from 2017 to 2018, however overall biofuels and waste supply has increased over ten times in the last two decades, while consumption has increased over four times. The transport sector continues to grow and is likely to become the largest consumer of energy. Finally, electricity production remains largely driven by nuclear power.

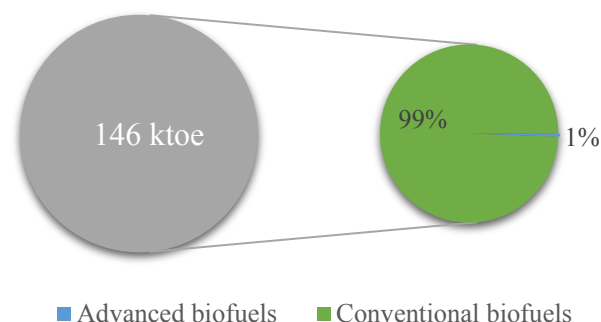
Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁵³

TARGETS	2020	2030
RES (renewable energy sources)	14%	19.2%
GHG emissions reduction		20% (2005 BASE)
Energy efficiency improvement		28.36%
RES-T (renewable energy in transport)	10%	14%
Biofuels quota obligation		8.2%
Cap on first generation (conventional) biofuels	7%	
Advanced biofuels	2022	2025
	0.2%	1%
		3.5%

Biofuel consumption share in transport in 2018 (EurObserv'ER 2019)



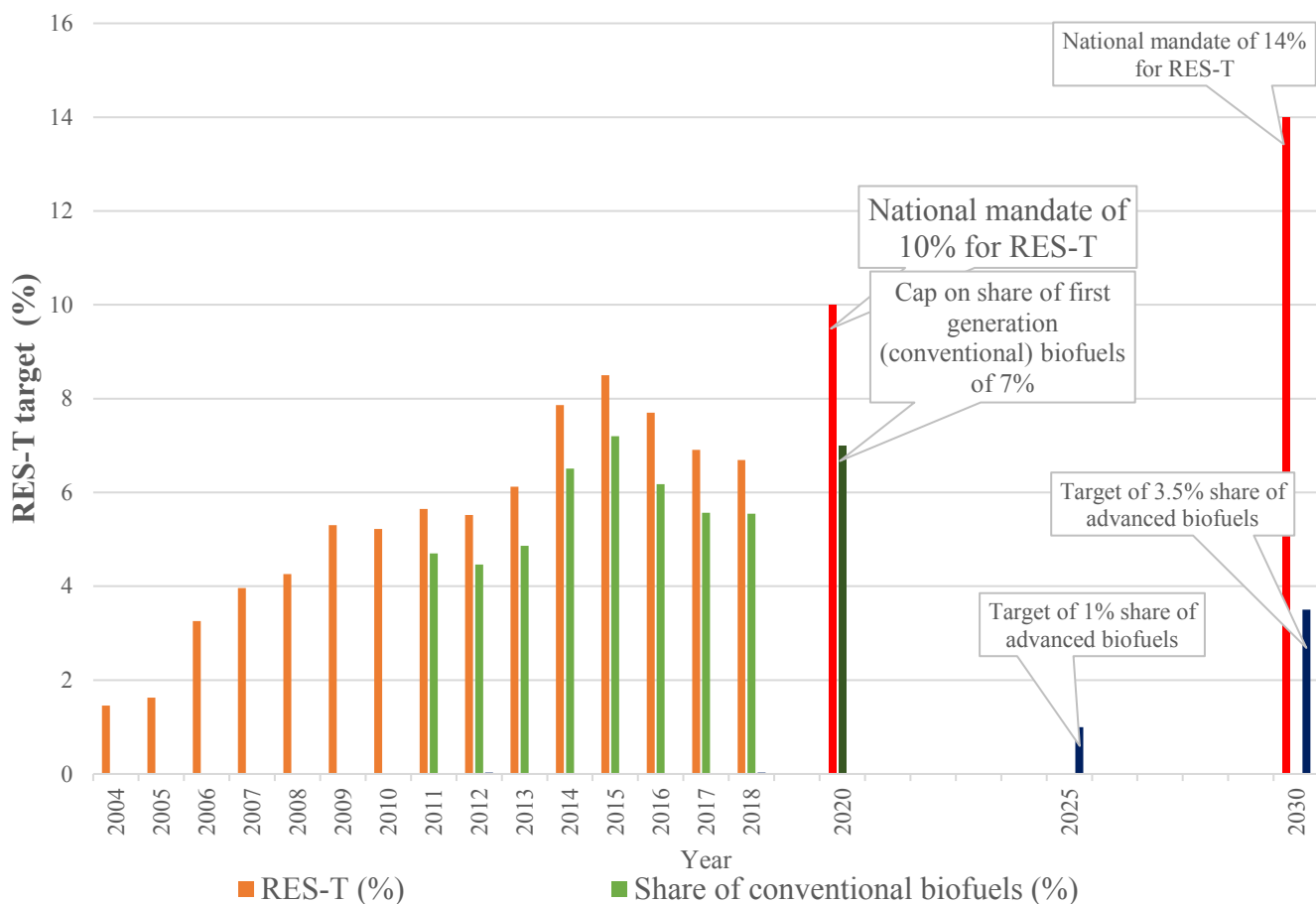
Compliant biofuels consumption for transport in 2018 (Eurostat 2018)



¹⁵²All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

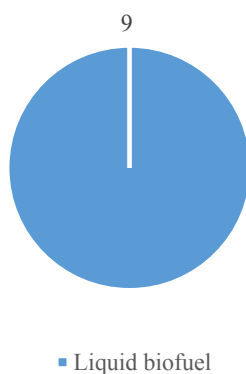
¹⁵³ Integrated National Energy and Climate Plan 2021-2030, Slovakia, https://ec.europa.eu/energy/sites/ener/files/sk_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)

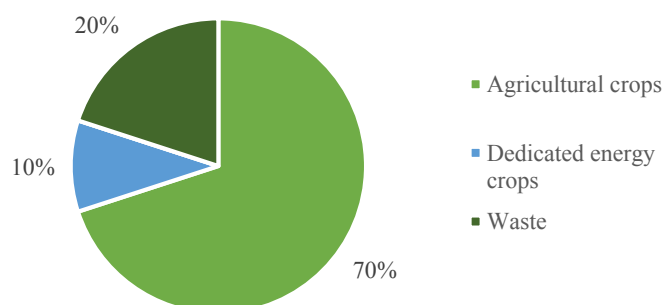


Number of operational biorefineries between 2007 and 2018¹⁵⁴

Number of operational plants (2007-2018)



Feedstock origin in biorefineries



¹⁵⁴ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., *Distribution of the bio-based industry in the EU*, Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁵⁵
Biomass production	Do they address sustainability of feedstock?	- Ministry of Economy and Ministry of Environment of the Slovak Republic transposes RED II Directives- Voluntary schemes have been established to assess compliance with sustainability criteria throughout the biofuel and bioliquids production chain - Sustainable Biomass Utilization Criteria in Slovakian Region - National Forest Inventory and Monitoring for the Slovakia	High
Conversion of feedstock	Do they have financing for innovative conversion technologies?	SlovSEFF III programme, State Environmental Protection Aid Scheme for the reduction of GHG. Slovak state R&D programme 20219-2023 with outlook to 2028 focuses on deployment of low-carbon technologies and greater energy efficiency	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Electrification of transport- Increase share of electric vehicles and replacement of combustion engine vehicles - Blending obligation for advanced biofuels and biofuels - Promoting electricity generation through redemption prices 2009- 2030 - Promoting the transition from biogas to biomethane and production of hydrogen from RES or low-carbon hydrogen to be used in transport, industry or high-efficiency cogeneration - Support for waste recovery - Subsidies to promote alternative-fuel vehicles - EUR 5 000 for BEV and EUR 3 000 for PHEV to 2020. - Research and development targets in energy sector focuses (RIS3 strategy) on RES fuels- technologies for generation of electricity from renewable sources - Ministry of Economy of the Slovak Republic compensates industries with system operation tariff (SOT) to reduce electricity costs and allocated EUR 40 million in 2019 for this purpose.	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	No specific subsector targets	Medium

¹⁵⁵ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union¹⁵⁶

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	Act on air pollution to reduce emissions Environmental design and use of products- Eco Design to reduce CO2 emission in transport sector Emission standards from passenger cars and efficiency standards for trucks Call for construction of AC charging stations for municipalities and local government	Diversification of sources and transport routes Member of Visegrad Group which promotes energy security Interconnection with Ukrainian and Polish transmission network	Obligations on energy efficiency laid down by binding legislation Measures to support energy efficiency and the use of RES supported through ESIF funds in the new programming period 2021-2027 Monitoring and information system for energy efficiency support mechanism	National Plans to build single markets will focus on infrastructure projects. SK has surpassed 15% target for EU Member states to reach transmission interconnectivity by 2030. They are at 59% interconnection level in 2020 and will maintain it to 54% in 2030.		Operational Programme Quality of Environment State Environmental Protection Aid Scheme for the Reduction of GHG and Pollutants

Biomass policies which support the mobilisation of advanced renewable fuels

Biomass policies which support the mobilisation of advanced renewable fuels			
Biomass Production	Conversion	Distribution	End-use
CAP: Slovakia Rural Development Programme		Biofuel Quota Obligation	
New fertiliser management for handling and processing	RES Act - Act No. 309/2009 on the Support for promotion of Renewable Energy Sources and High -Efficiency Cogeneration		Support for businesses to use RES- subsidies, Feed-in Tariffs Subsidy programme to support RES and alternative fuel vehicles
Act No. 342/2014 Agricultural Land- efficient use of nitrogen and mineral fertilisers	Support for decentralised electricity generation= Operating aid	Tax Regulation Mechanism (Excise duty act)	
Nitrate Directive	RES Support Act- Promote Advanced biofuels production and use		
Act No. 57/2013 Agricultural soil- cultivation of fast growing trees	Act on Air Pollution CO2 emission standards for new passenger cars and commercial vehicles		
Forestry Act 326/2005 Forest Strategy/ Forestry Action Plan	The Slovak Energy Efficiency and Renewable Energy Finance Facility (SlovSEFF III)		
Waste Act	Decree on Biofuel Sustainability Criteria and transport fuel GHG targets		
Waste Management Programme 2019-2025	ICAO agreement to reduce CO2 emissions from aircraft		
Landfill Directive	Energy Act		
Strategic Roadmap for Transport Development to 2030; Energy Policy (2035 and 2050 Horizon); Preparation of the low-carbon strategy of Development of the Slovak Republic; The Environmental Strategy 2030; The National Policy Framework for the Development of the Alternative Fuels Market (No 504/2016); Strategic Transport Infrastructure Develop-			

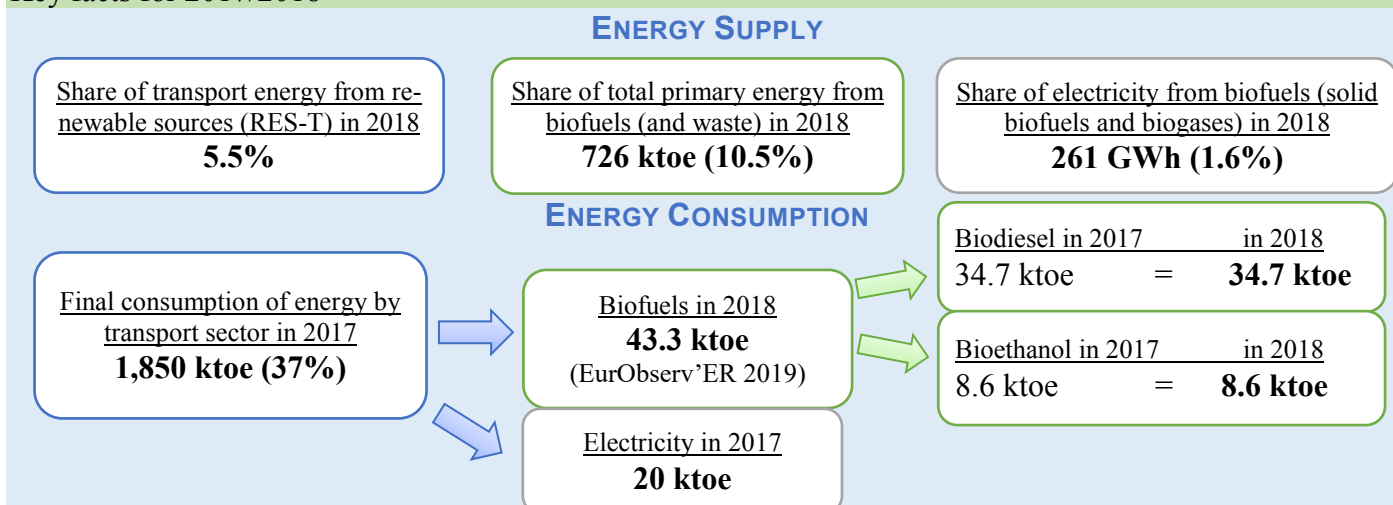
¹⁵⁶ Integrated National Energy and Climate Plan 2021-2030, Slovakia
https://ec.europa.eu/energy/sites/ener/files/sk_final_necp_main_en.pdf

ment Plan 2030 (No. 13/2017); Action Plan for the Development of Electromobility (in preparation); Strategy of the Environmental Policy of the Slovak Republic until 2030; Economic Policy Strategy 2030; Carpathian Convention; National Action Plan for Renewable Energy



Current State of Affairs^{157;158}:

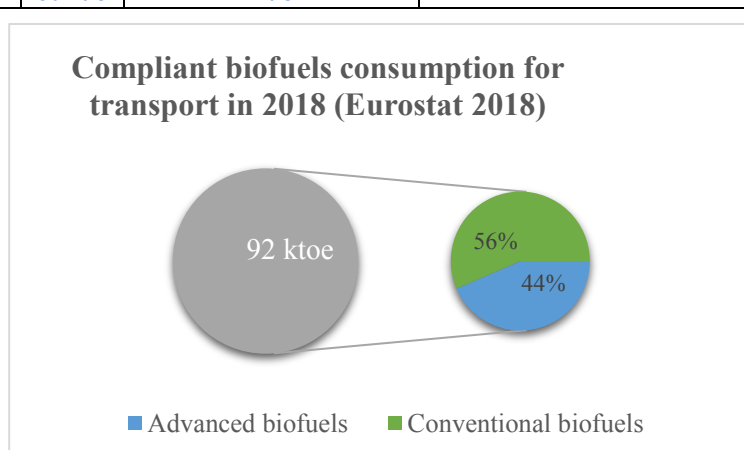
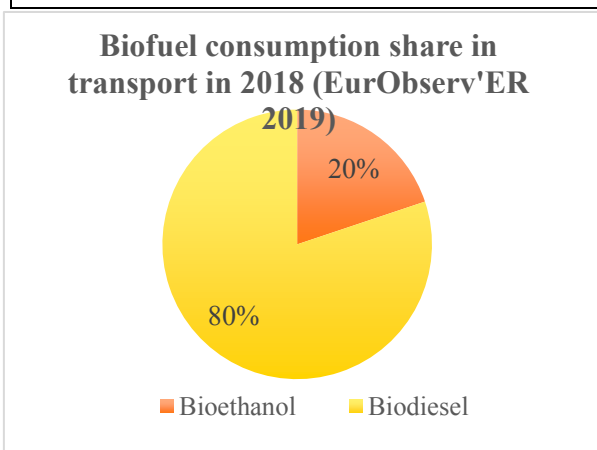
Key facts for 2017/2018



Slovenia has not seen a change in its biodiesel and bioethanol consumption in the transport sector between 2017 and 2018. Its transport sector dominates in terms of final energy consumption, and while oil dominates both the supply and consumption of energy, biofuels have been rising steadily in both markets since 1990.

Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁵⁹

TARGETS	2020		2030
RES (final energy consumption)			27%
GHG emissions reduction (non-ETS)			36% (2005 BASE)
Energy efficiency improvement			35% (2015 BASE)
Electricity interconnection			75%
RES-T ¹⁶⁰ (renewable energy in transport)			25%
Biofuels blend obligation	5%		7-10%
Cap on first generation (conventional) biofuels	7%		
Share of advanced biofuels	2022	2025	3.5%
	0.2%	1%	



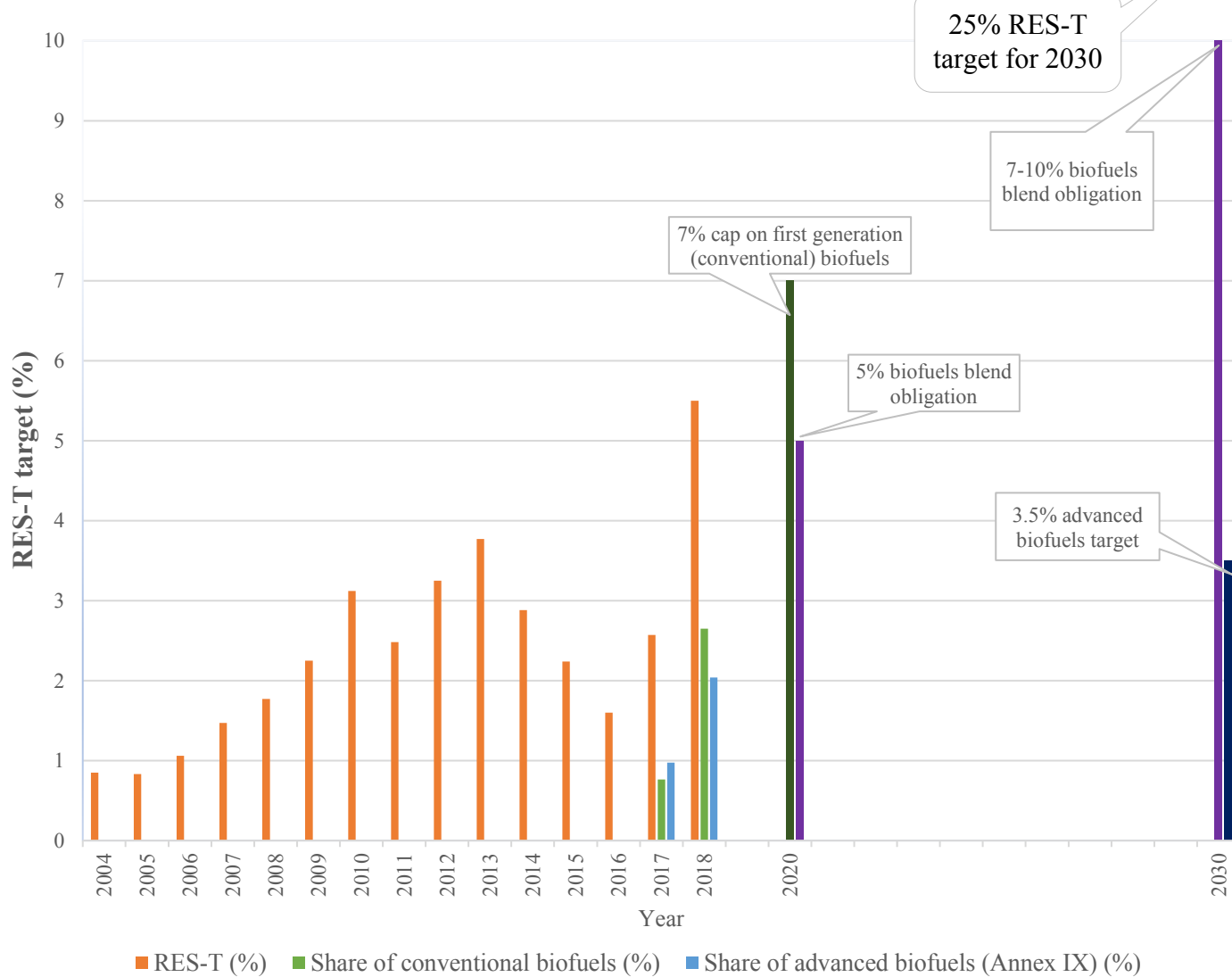
¹⁵⁷ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

¹⁵⁸ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

¹⁵⁹ Integrated National Energy and Climate Plan of the Republic of Slovenia, https://ec.europa.eu/energy/sites/ener/files/documents/si_final_necp_main_en.pdf

¹⁶⁰ Slovenia has a very ambitious target compared to EU recommended target of 14%. Slovenia ranks fourth in the EU in terms of the share of energy consumption in transport in the end-use of energy

RES-T shares and policy targets (Eurostat 2018)



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁶¹
Biomass production	Do they address sustainability of feedstock?	• Wood biomass will be used in line with LULUCF objectives • Under Forest Management Plans (2021-2030) appropriate targets for timber stock, felling and accumulation will be set. Similarly as a mitigation measure in the waste sector, assessment of the energy potential and promotion of the use for energy purposes of biodegradable waste with a view to producing biogas and advanced biofuels will be conducted	High
Conversion of feedstock	Do they have financing for innovative conversion technologies?	• Financial incentives for demonstration projects – priority given to low-carbon fuels • Proposal to increase R&D support for low-carbon technologies ◦ Slovenia plans to develop financial incentives measures to reduce process emissions in industry - preparation of support scheme for demonstration projects ◦ Slovenia plans to prioritise the development, production and use of advanced sustainable biofuels and plans to advantage of development opportunities with respect to the raw materials available and stimulate the necessary technological development with development incentives	Medium
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	• Financial incentives for alternative fuels and e-mobility infrastructure • Mandatory share of renewable energy in motor transport • Activities in place to remove barriers for sustainable mobilisation of advanced biofuels, hydrogen fuels, biogases • Standardise connection standards and the development of advanced charging services for distribution of renewable electricity • Proposed a plan to develop incentive in the next financial period for the production of advanced renewable fuels	High
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	• No sub-sector targets • Instruments to improve the efficiency of road freight transport • Plan to provide support for alternative fuels use in freight transport	Medium

¹⁶¹ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting the 5 dimensions of the energy union¹⁶²

Sector	Decarbonisation	Energy efficiency	Efficiency	Energy Security	Internal Market	Energy	Research, Innovation and Competitiveness
Transport	GHG emission reduction and RES share targets, bio-fuels mandates in transport sector-regulations and financial incentive Taxation based on carbon intensity Reduction of incentives for fossil fuels Regulations for upgrading green public procurement -improvement to green technologies	Promotion of energy efficiency and renewable sources Incentives to use sustainable and modern mobility Instruments to improve the efficiency of road freight transport Tax policies to improve the efficiency of vehicles		Diversification of energy sources and appropriate cross-border supply routes-transmission links between Slovenia and Hungary	Improvement of transport connectivity and development of electricity distribution network		Financial incentives for demonstration projects-priority given to low-carbon fuels

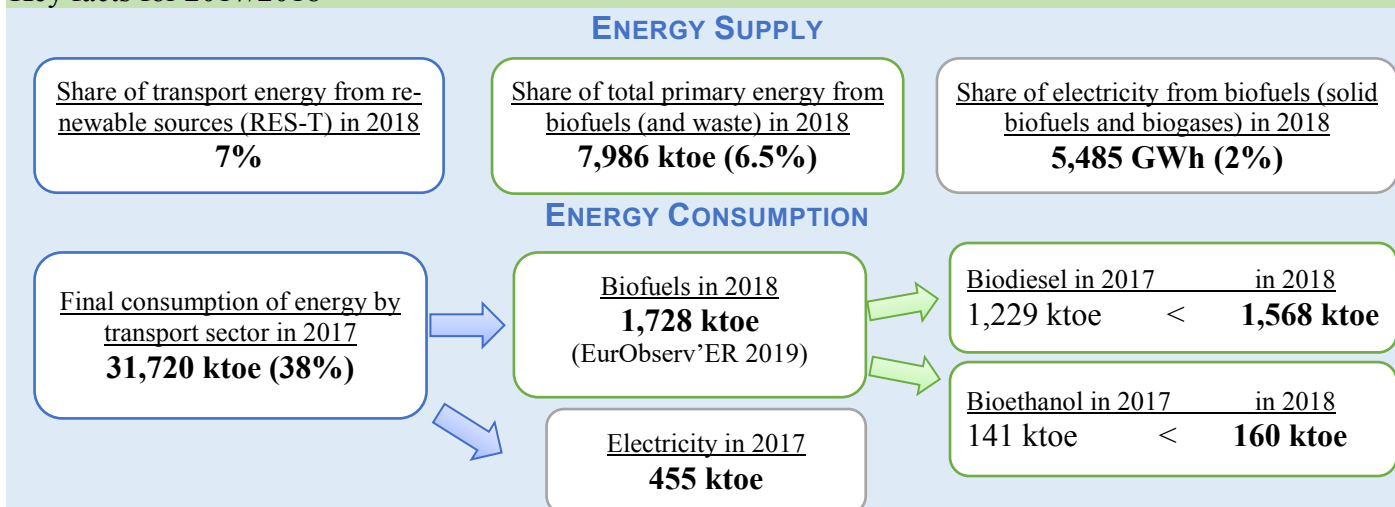
Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: Rural Development Programmes	Energy efficiency target declared by Slovenia under the EU Directive (2012/27/EU); Energy Efficiency Obligation Scheme (EEOS)		
Forest Act	Act on Sustainable biofuels; Biofuel quota (RTFO)		
National Forest Programme		Decree on support for RES-E	
Decree on Waste		Eco-Fund: Loan, subsidy and tender for RES-E	
Decree on the recycling of non-hazardous waste into solid fuel and on its use			Decree on Green Public Procurement
	Training programme for RES-installations		
Waste Management Program and the Waste Prevention Program programme- Energy waste utilisation	Certification Programmes for RES Installations		
			Decree on energy savings to customers
			RES-H new building obligation
		Excise Duty Act: Tax exemption on biofuel	
Operational programme on elimination of wastes with objective to reduce the quantity of biodegradable disposal wastes			Eco-Fund: subsidies for environment friendly vehicle; investments for RES-H in residential house;
Environmental Protection Act; Energy Act			
National emissions target under the EU Effort Sharing Decision (406/2009/EC) Slovenia			
Action Programme for alternative fuels in transport			
National Program for the Development of Transport in Slovenia; Slovenia's Development Strategy 2030; National Energy and Climate Plan (NEPN); Slovenian Industry Policy 2014-2020 ; Research and Innovation Strategy of Slovenia (2011- 2020)			

¹⁶² Integrated National Energy and Climate Plan of the Republic of Slovenia, https://ec.europa.eu/energy/sites/ener/files/documents/si_final_necp_main_en.pdf

Current State of Affairs¹⁶³:

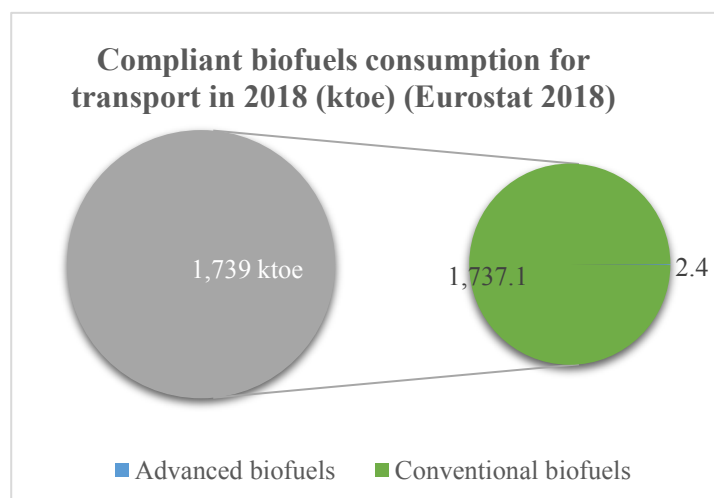
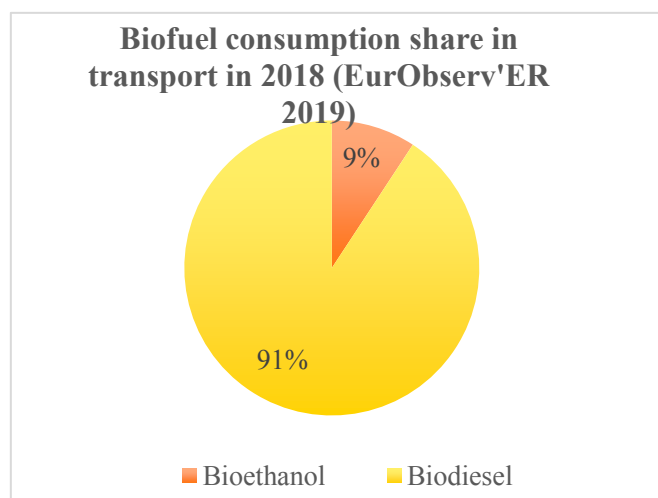
Key facts for 2017/2018



Spain biofuels consumption for transport has increase significantly both for biodiesel and bioethanol from 2017 to 2018. While oil products strongly dominate both the energy supply and consumption markets, overall biofuels and waste have seen a steady increase since 1990. The transport sector largely dominates energy consumption. Biofuels are still underperforming next to the variety of renewable and non-renewable sources producing electricity.

Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁶⁴

TARGETS	2020		2030
RES (final energy consumption)	20%		42%
GHG emissions reduction (non-ETS)			23% (1990 BASE)
Energy efficiency improvement			39.5% (2007 BASE)
RES-E ¹⁶⁵ (renewable energy in electricity)			74%
RES-T (renewable energy in transport)			28%
Biofuels blend obligation	5%		7-10%
Cap on first generation (conventional) biofuels	7%		
Share of advanced biofuels	2022	2025	3.5%
	0.2%	1%	

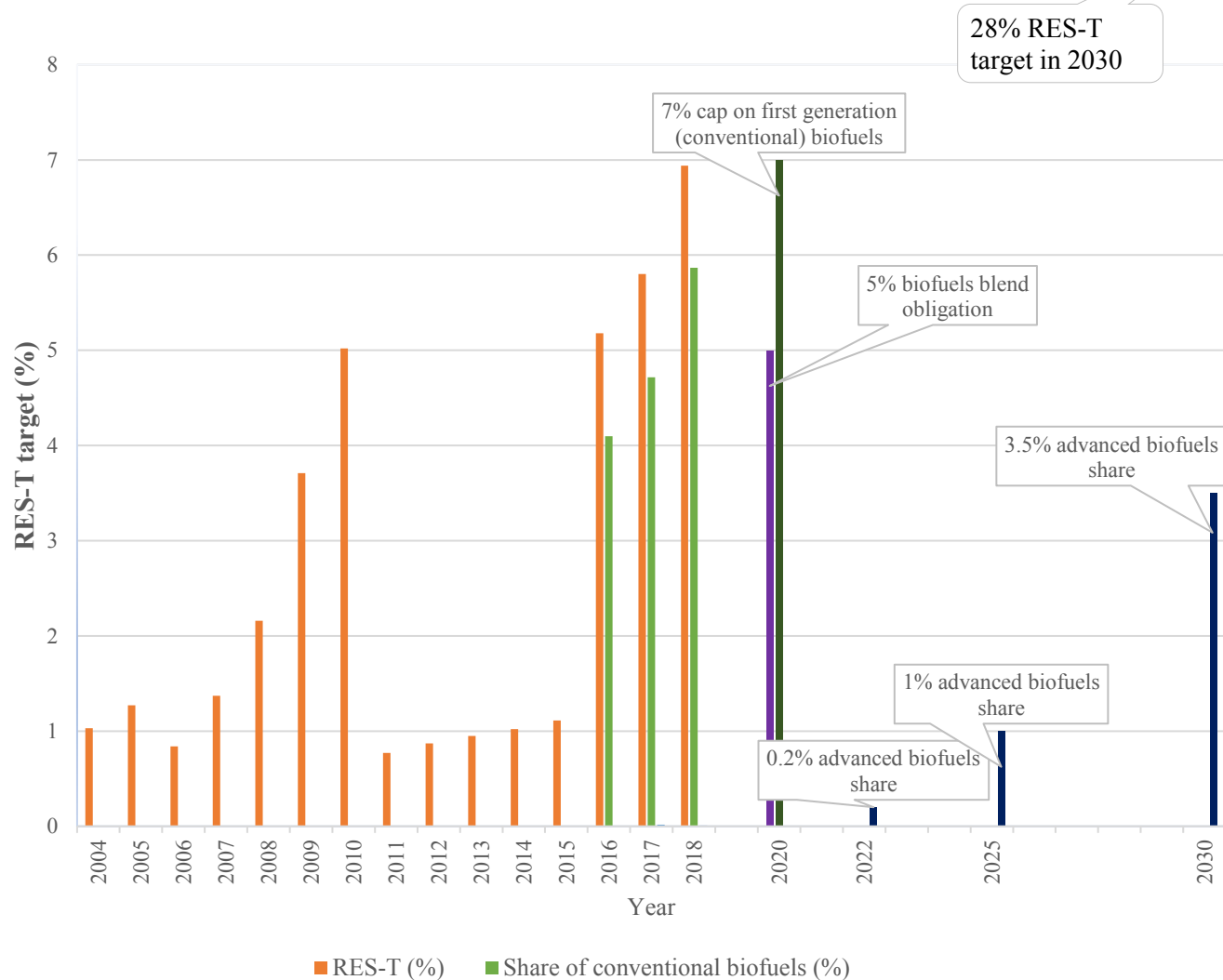


¹⁶³ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

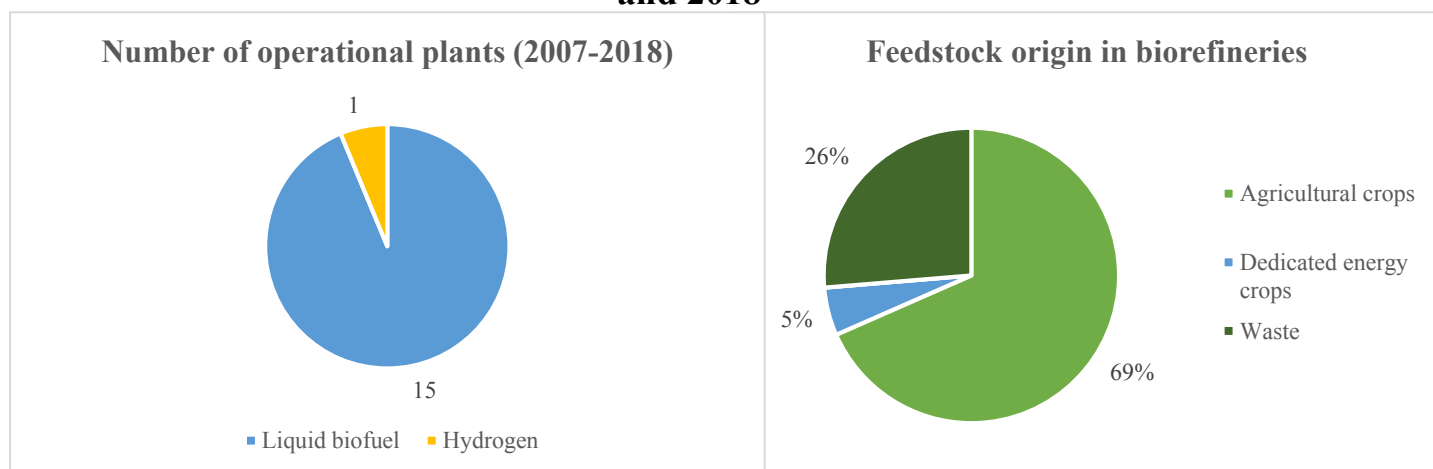
¹⁶⁴ Integrated National Energy and Climate Plan 2021-2030, Spain, https://ec.europa.eu/energy/sites/ener/files/documents/es_final_necp_main_en.pdf

¹⁶⁵ Spain is the only country whose electricity interconnection is below 10% EU target.

RES-T shares and policy targets (Eurostat 2018)



Number of operational biorefineries and hydrogen production projects between 2007 and 2018¹⁶⁶



¹⁶⁶ https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10->

Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁶⁷
Biomass production	Do they address sustainability of feedstock?	- Policies like these Strategy for the Development of Energy Use from Forest Biomass, Strategy for Conservation and Sustainable use of Genetic Forestry Resources, National forest accounting plan promote the sustainable mobilisation of the forest biomass for energy purposes - Legislative development throughout the biomass value chains to promote biomass with sustainability criteria and strengthen the certification	
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- Financial support for research and innovation comes from SET plan which focuses on renewable energy technologies- renewable fuels for transport sector with the development of advanced biofuels and energy efficiency with technological improvements - The INECP plan total investment budget amounts to EUR 241.412 billion of which 38% investment is for RE, 24% for networks and electrification - Co-investment fund and Technology Transfer fund will invest in business innovation and early-stage science and technology-based companies	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	There are policy measures which focus on alternative energy vehicles, advanced biofuels and hydrogen production using renewable sources	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No specific transport sub-sector targets - Special objectives of use of biofuels in aviation industry - Renewal of heavy goods vehicles	

Transport policies and measures supporting 5 dimensions of the energy union¹⁶⁸

Sector	Decarbonisation	Energy Security	Energy efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	Develop new facilities for RES-E, promote renewable gases, reduction of GHG emissions Development of advanced biofuels using sustainable raw materials and promote use in transport Tax reduction on low-carbon fuels and vehicles	Lower dependency on imported fuels, Low-emission zones and renewal of vehicle fleet and promote electric vehicles Transition to high efficiency cogeneration zones and energy efficient public procurement	Reduce dependency on carbon in islands Build alternative fuel charging points	Increase gas and electricity transmission by building infrastructure Focus on reducing energy poverty	Funding comes from Horizon2020 SET plan for RIC activities- Relevant activities are renewable energy technologies- renewable fuels for transport sector with the development of advanced biofuels and energy efficiency with technological improvements, electric vehicles, optimization of charging points, hydrogen fuel cell.

7723-4435-9f5e-806ab63faf37 ; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

¹⁶⁷ High score=Green; Medium Score=Yellow; Low score=red

¹⁶⁸ Integrated National Energy and Climate Plan 2021-2030, Spain, https://ec.europa.eu/energy/sites/ener/files/documents/es_final_necp_main_en.pdf

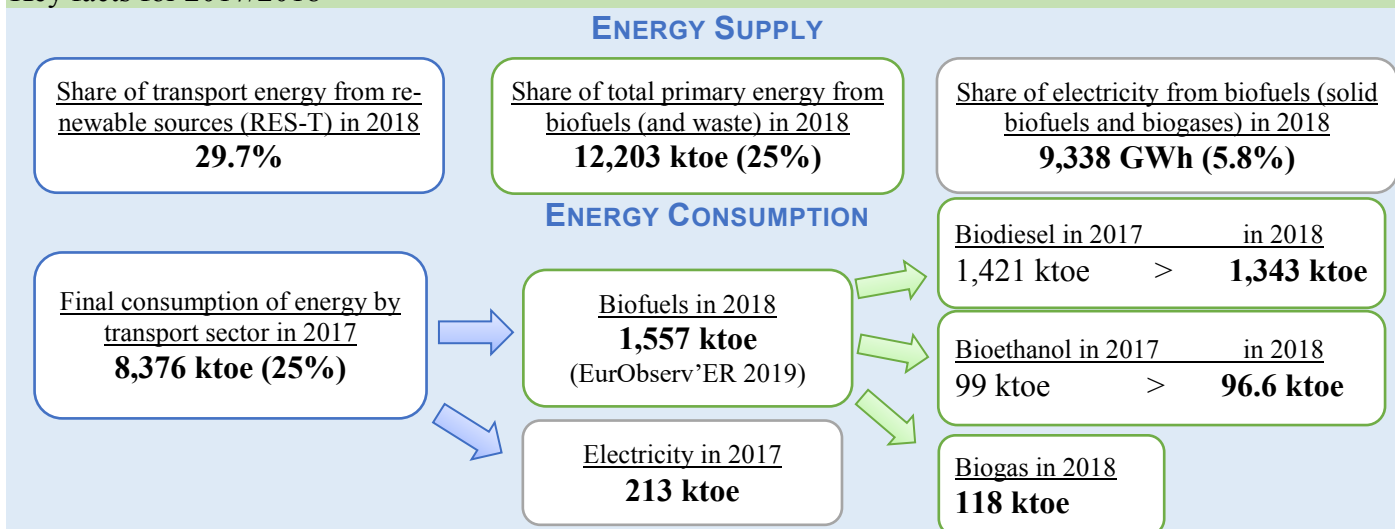


Biomass policies which support the mobilisation of advanced renewable fuels

Biomass policies which support the mobilisation of advanced renewable fuels			
Biomass Production	Conversion	Distribution	End-use
CAP: Spain Rural Development Programme		Programme for Large Thermal Plants (GIT)	
Fertilizers Act; Nitrates Act		Biofuel quota	Excise Duty Tax
Forest Law Spanish Forestry Plan 2002-2032	Industrial Emissions	BIOMCASA II: Funding for Efficiency Biomass use	Biofuel Sustainability Criteria
National forestry accounting plan for Spain (2021-2025)	Support for housing heating systems removal		Royal Decree of Technical Building code
Strategy for Conservation and Sustainable use of Genetic Forestry Resources Water Law		Royal Decree on Electricity and Gas Distribution	Support for housing heating systems removal
		Regulating the guarantee of origin system for electricity from renewable sources and high efficiency cogeneration	
Guarantee of Origin for RE and CHP		Public procurement in green innovation	
Law on sustainable economy			
National Programme for Emission Reduction National Air Quality Plan			
Spanish Strategy for the Development of Energy Use from Forest Biomass ; Spanish Sustainable Mobility Strategy (EEMS); Sustainable Mobility and Public Transport Financing Act; National Action Framework for Alternative Energy in Transport; Strategy for promoting alternative energy vehicles; Plan for Infrastructure, Transport and Housing (PITVI) 2012-2024			
Spanish Strategy for Climate Change and Clean Energy 2007-2020; National Strategy against Energy Poverty; National Energy Efficiency Action Plan; 2021-2027 State Strategy on Science, Technology and Innovation; 2021-2024 State Plan on Scientific and Technical Research and Innovation; Climate Change and Energy Transition Act, State Plan of Scientific and Technical Research and Innovation 2017 – 2020			

Current State of Affairs^{169;170}:

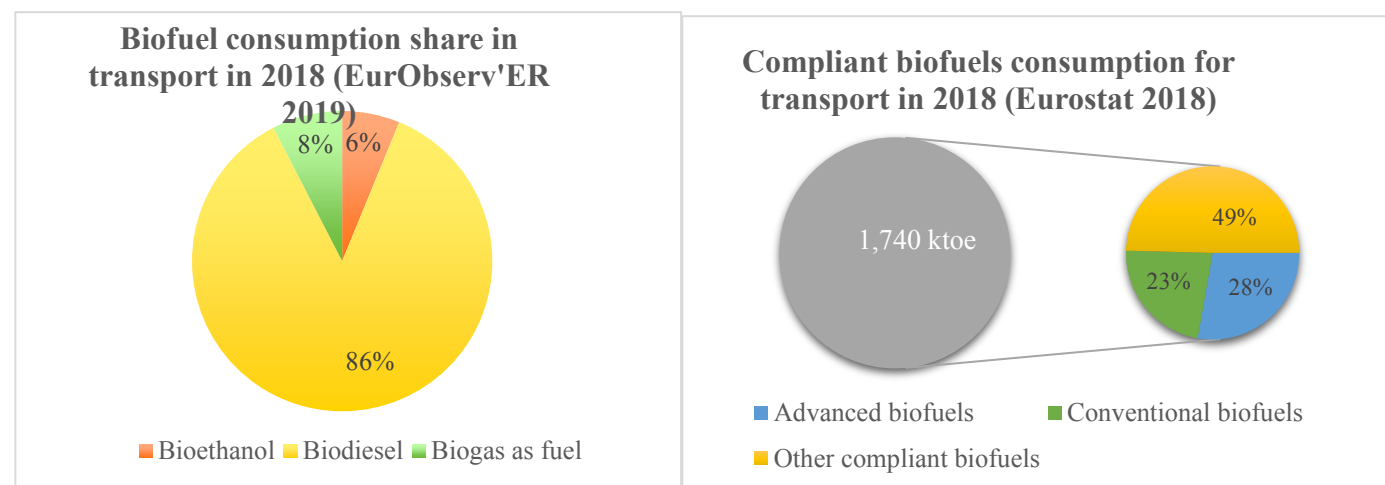
Key facts for 2017/2018



Sweden has seen a decrease in both biodiesel and bioethanol consumption from 2017 to 2018, however overall biofuels and waste have been growing steadily, with an over 2,000 ktoe increase since 1990. Meanwhile, supply of biofuels and waste has equally grown more than twofold since 1990. Nuclear power is a major source of energy in the country, while oil has been decreasing.

Targets for renewable energy (RES), climate change mitigation and energy efficiency¹⁷¹

TARGETS	2020	2030	2040
RES (renewable energy sources)	50%		
RES in gross energy consumption	49%	65%	
GHG emissions reduction (transport, excluding national flights)		70% (2010 BASE)	
Overall GHG emissions reduction		20% (2005 BASE)	
Energy efficiency improvement		50% (2005 BASE)	
RES-E (renewable energy in electricity)			100%
Cap on first generation (conventional) biofuels	7%		

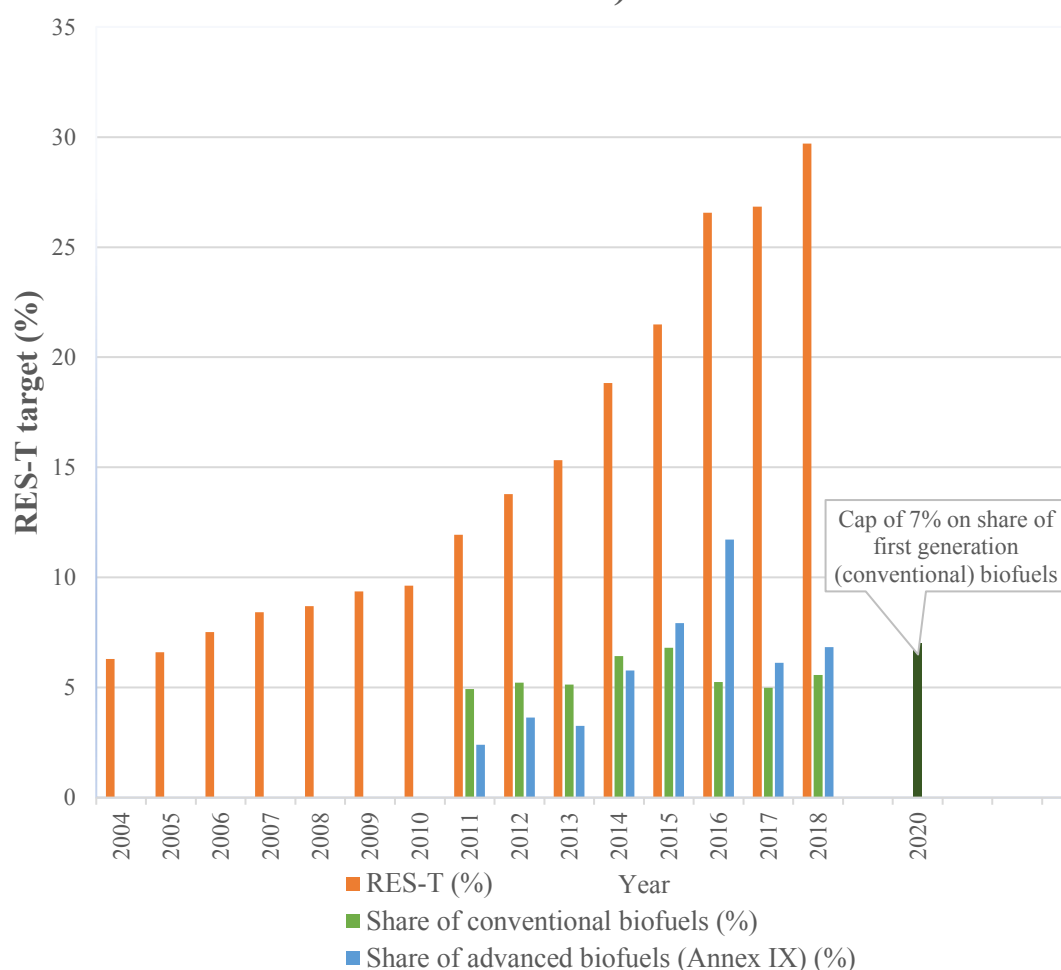


¹⁶⁹ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries>), Eurostat, SHARE tool, 2018, <https://ec.europa.eu/eurostat/web/lfs/Data/database>, accessed on: [26/08/2020]; EurObserv'ER-Biofuels-Barometer-2019

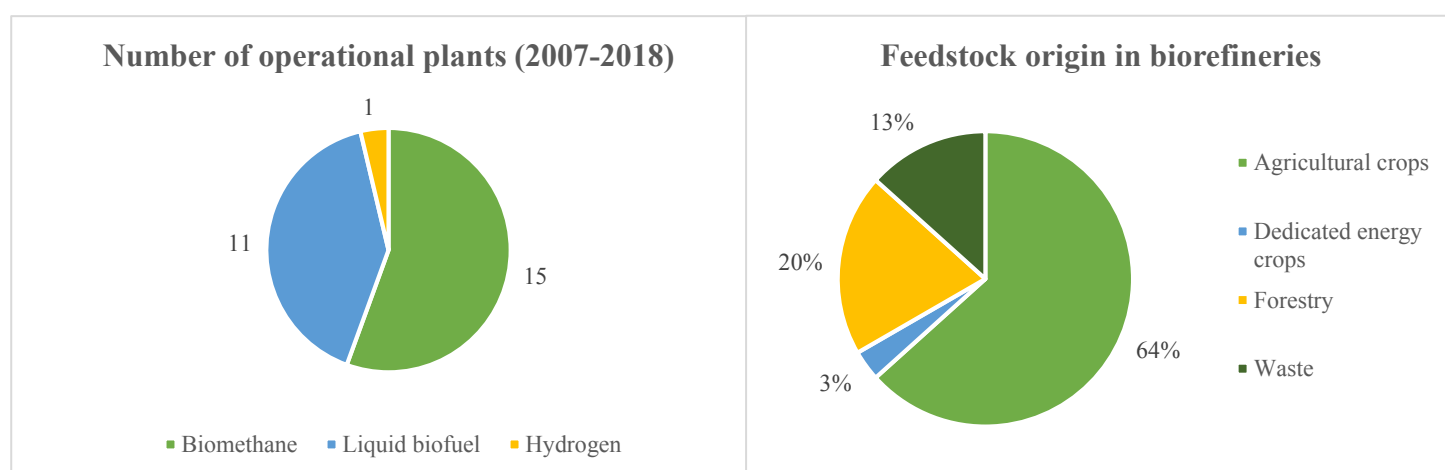
¹⁷⁰ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

¹⁷¹ Integrated National Energy and Climate Plan 2021-2030, Sweden https://ec.europa.eu/energy/sites/ener/files/documents/se_final_necp_main_en.pdf

RES-T shares and policy targets (Eurostat 2018)



Number of operational biorefineries and hydrogen production projects between 2007 and 2018¹⁷²



Key policy questions by value chain stages and existing policy support

¹⁷² https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37> ; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/cba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

Value chain Stage	Key Policy Questions	Existing Policy support	Score ¹⁷³
Biomass production	Do they address sustainability of feedstock?	- Sweden imports a relatively large share of biofuel feedstocks for all three major sectors (heating, cooling and transport). There is no policy to promote the domestic production of feedstock though there is national potential and is mainly controlled by market. Biofuels account for the largest share of renewable energy in Sweden and largest increase has been in transport sector, without double counting the share of renewable in transport sector was 22% in 2017 - Swedish Rural Development Programme and Swedish Forest Policy emphasizes on the sustainability of the biomass	High
Conversion of feedstock	Do they have financing for innovative conversion technologies?	- The Swedish National Energy Research and Innovation Programme focuses on 9 core themes and transport system and bioenergy are one among them. Programme has allocated approximately 130 million SEK for every year between 2019 and 2026. - The Klimatklic Initiative support investment - Swedish Government allocated SEK 5 million a year until 2022 for an electrification commission to accelerate work on the electrification of the transport sector	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	- Reduction Obligation System in Sweden is expected to increase the share of advanced renewable fuels - Ordinance (2016:836) on Electric Bus Incentive Payments, Budget of SEK 120 million in 2020 - The Swedish Transport Administration is currently preparing to build the first permanent electric road with an aim to increase the efficiency of goods transported and reduce greenhouse gas emissions - The Swedish aviation industry is working to develop hybrid or fully electric aircraft with support from the ELISE (Electric Air Transport in Sweden) initiative	
Distribution and End-use	Do they include targets for aviation, marine, heavy duty?	- No targets for maritime and heavy-duty sectors - GHG emissions from national transport, excluding national flights, must be at least 70% lower than they were in 2010 Support measures like: - Eco-bonus for heavy transports- allocated funding of SEK 50 million a year until 2022 to encourage transfer of goods from roads to shipping - No energy and carbon tax on fossil fuel used in commercial shipping and aviation	Medium

¹⁷³ High score=Green; Medium Score=Yellow; Low score=red

Transport policies and measures supporting 5 dimensions of the energy union¹⁷⁴

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	GHG emission reduction targets Primary energy consumption reduction targets 'Fossil free transport' is one of the key five sectors identified by the Swedish Energy Agency	National objectives to diversify the energy sources and reduce import dependency by improving energy system's flexibility and resilience. Risk-Preparedness Regulation Promote smart grids, energy storage and demand response of electricity system	Target of reduction in energy intensity by 20% between 2008-2020. Energy consumption efficiency be 50% more by 2030 compared to 2005 level.	Aims to increase electricity interconnectivity with other countries, 19% at the beginning of 2019 which exceeds the EU's target of at least 15% to achieve by 2030. National objectives to improve competitiveness of energy sector. Swedish Environmental Protection Agency under the Klimakliv initiative coordination work, developing plans for the renewable fuels infrastructure, rapid charging stations.	National 2050 Objectives related to the promotion of clean energy technologies, long-term targets for low-carbon technologies, carbon transport and storage infrastructure.

Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: Sweden Rural Development Programmes		The Federal Transport Infrastructure Plan 2030 (FTIP); Urban Environment Agreement	
Act on Sustainability criteria for biofuels and bioliquids		Act on regulation of GHG emissions by mixing biofuels with fossil fuels	
The Swedish National Forest Programme; Forest Act; Forest Policy		Public Procurement Act-promote innovative and climate smart solutions	
Land use and the Environmental Code		Reduction Obligation Act- switching fuels. Increasing the blend in slow increment.	
Waste Plan Landfill Directive; Landfill tax (Swedish Ordinance of the Landfill Waste)		Pump Act- requirements for biofuels at the filling station which make sales of >1500 m3 of petrol or diesel.	
		Fuel Ordinance; Swedish Energy Agency under the Fuels Act	
		National Emission Ceilings Directive	
		Tax Regulation- Energy and CO2 tax for fossil fuels; Tax exemption for pure biofuels; Tax exemption for fuel used to generate electricity; Aviation tax; Differentiated vehicle tax (Lower taxable value for vehicles with environmental technology); Tax on air travel	
		Fuel consumption and CO2 labels for new cars	
		State aid for the installation of charging stations for EVs	
		The Klimatklic Initiative for charging infrastructure; biogas plants; switching from fossil to biofuel etc.	
		Emission requirements for new vehicles	
		Ordinance (2016:836) on Electric Bus Incentive Payments.	Eco-bonus for heavy transports

¹⁷⁴ Integrated National Energy and Climate Plan 2021-2030 Sweden, Integrated National Energy and Climate Plan 2021-2030 Germany,

The Swedish Climate Policy Framework 2017; Integrated national energy and climate plan¹⁷⁵; Mission Innovation¹⁷⁶; Bio innovation¹⁷⁷; Fossil Free Sweden¹⁷⁸; Nation Bioenergy Programmes; National Transport Infrastructure Plan 2018-2029;

¹⁷⁵ <https://www.government.se/48ee21/contentassets/e731726022cd4e0b8ffa0f8229893115/swedens-draft-integrated-national-energy-and-climate-plan>

¹⁷⁶ <http://mission-innovation.net/our-members/sweden/>

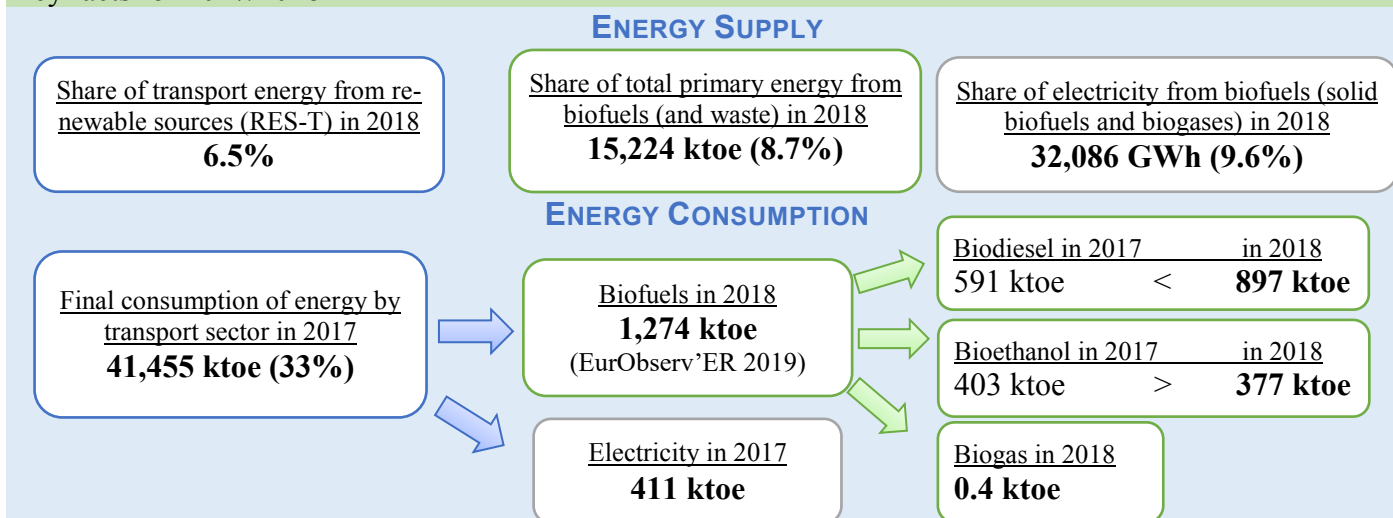
¹⁷⁷ <https://www.e-magin.se/paper/sjljqgh/paper/1#/paper/sjljqgh/1>

¹⁷⁸ <http://fossilfritt-sverige.se/in-english/>



Current State of Affairs^{179;180}:

Key facts for 2017/2018

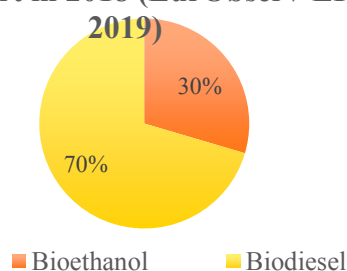


The UK transport remains the highest in terms of energy consumption, and while oil and natural gas consumptions appear to be stabilising, biofuels are growing. Biofuel consumption in 2018 is 100% compliant and 2543 million Renewable Transport Fuel (RTFCs) were granted, of which 2076 million (68%) were for fuels derived from waste, residues and raw materials which benefited from double counting. Aviation fuel, hydrogen and renewable methane also qualify for development fuel RTFCs.

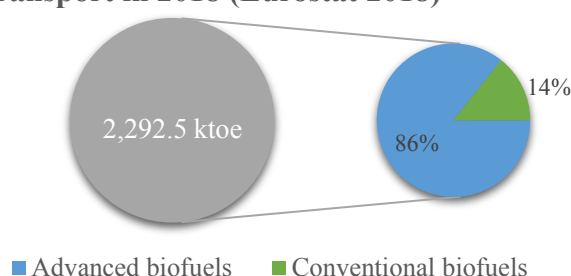
Targets for renewable energy (RES), climate change mitigation and energy efficiency

TARGETS	2020	2032	2050
RES (renewable energy sources)	15%		
GHG emissions reduction			80%
Renewable Transport Fuel Obligation (by volume)	9.75%	12.4%	
Cap on first generation (conventional) biofuels	4%	2%	
Share of development ¹⁸¹ or advanced fuels		2.8%	

Biofuel consumption share for transport in 2018 (EurObserv'ER 2019)



Compliant biofuels consumption for transport in 2018 (Eurostat 2018)

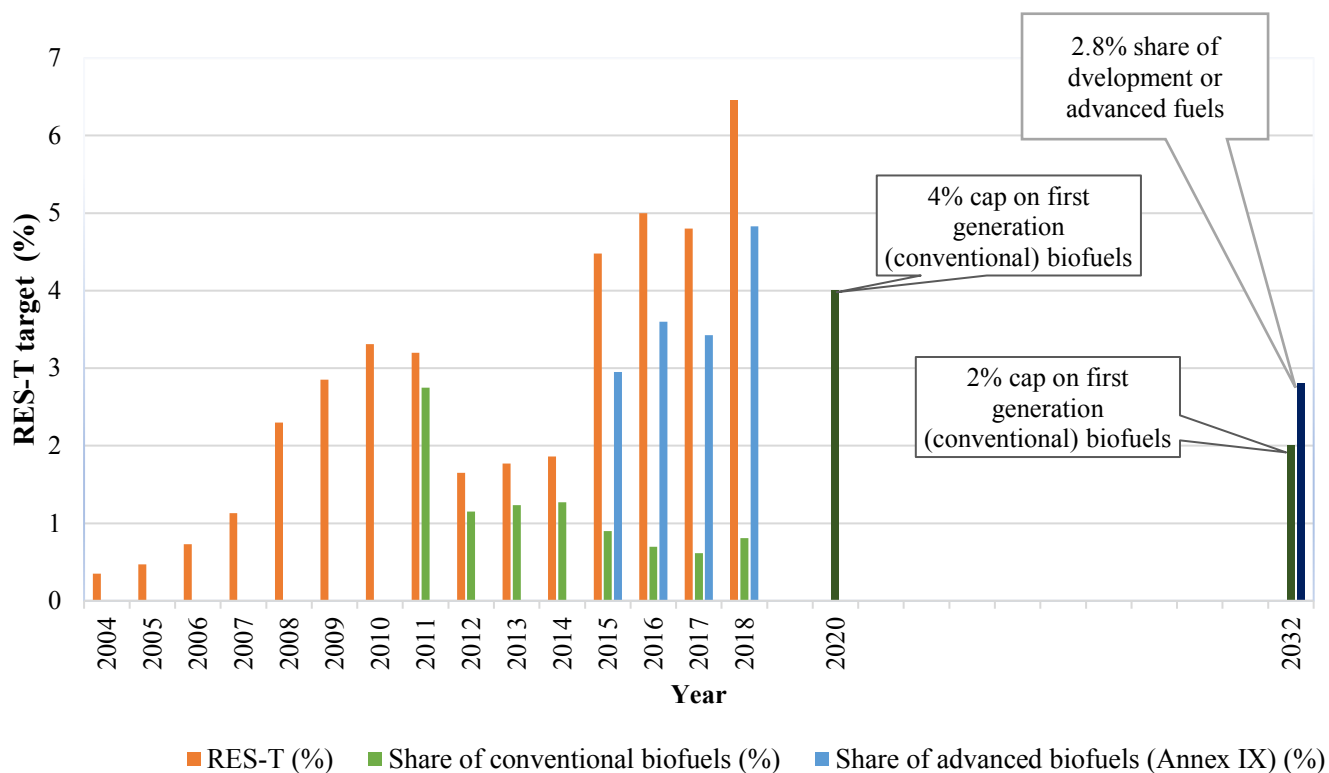


¹⁷⁹ All the number and facts in this section on factsheets are from IEA (<https://www.iea.org/countries/united-kingdom>), Eurostat, SHARE tool, 2018; EurObserv'ER-Biofuels-Barometer-2019, The draft NECP UK (https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/774235/national_energy_and_climate_plan.pdf); accessed on: [27/08/2020]

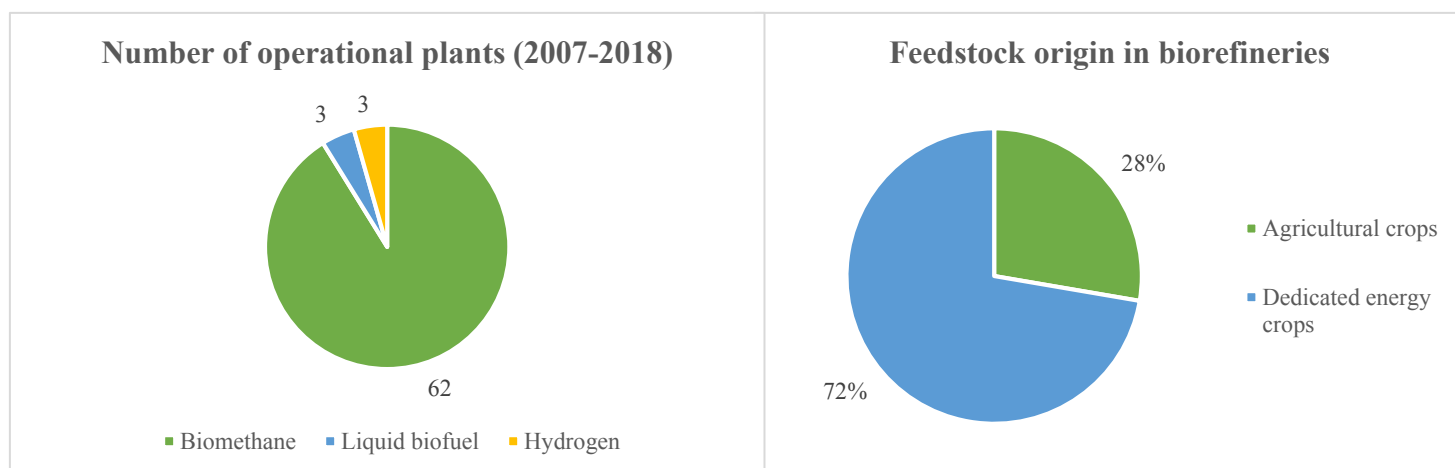
¹⁸⁰ Results will vary between Eurostat and EurObserv'ER shares of biofuels consumption in transport as the former includes a disaggregation of feedstock type in order to classify biofuels as conventional or advanced following the Directive 2009/28/EC— as such, advanced biofuels are 'double counted' due to their sustainability advantage and will increase the total share biofuels consumption.

¹⁸¹ Development fuels are produced from sustainable waste and residues (exception of separated oils and fats) and renewable fuels of non-biological origin (RFNBO). A development fuel must also be one of the following fuel types: hydrogen, aviation fuel, substitute natural gas (i.e. renewable methane) or a fuel that can be blended to give 25 percent or more renewable fraction in the final blend while still meeting fuel technical and quality standards. (From the Renewable Transport Fuels and Greenhouse Gas Emissions Regulations 2018)

RES-T shares and policy targets (Eurostat 2018)



Number of operational biorefineries and hydrogen production projects between 2007 and 2018¹⁸²



Key policy questions by value chain stages and existing policy support

Value chain Stage	Key Policy Questions	Existing Policy support	Level ¹⁸³
Biomass production	Do they address sustainability of feedstock?	Compliance of biomass with land use sustainability criteria Sustainable harvest level of forest biomass	
Conversion of feedstock	Do they have financing for innovative conversion technologies?	Under UK Industrial Clean Growth Strategy – Renewable Transport Fuel Obligation (RTFO) -Future Fuels for Flight and Freight Competition to develop proposals for advanced fuels production plants (£22 million). -Low carbon innovation (2015-2021) investment amount £2.5 billion in RDD of low carbon transport, agriculture and waste.	
Distribution and End-use	Do they address specifically advanced fuels/ RES fuels?	Biofuel quota, RTFO certification for biofuels including aviation fuels Double counting for advanced biofuels Public Investment in economic infrastructure will be doubled by 2022-2023.	
Distribution and End-use	Do they include targets for aviation,	Public innovation funding (£841 million) to drive down emission from aviation and shipping under decarbonisation. ¹⁸⁴	

¹⁸² https://ec.europa.eu/knowledge4policy/visualisation/bio-based-industry-eu_en (Parisi, Claudia; Baldoni, Edoardo; M'barek, Robert; European Commission, Joint Research Centre (2020): Bio-based industry and biorefineries. European Commission, Joint Research Centre (JRC) PID: <http://data.europa.eu/89h/ee438b10-7723-4435-9f5e-806ab63faf37>; Parisi, C., [Distribution of the bio-based industry in the EU](#), Publications Office of the European Union, 2020, ISBN 978-92-76-16408-1, doi:10.2760/745867, JRC119288); Alberici, S. & Toop, G. (2014) Overview of UK Biofuel Producers, *Ecofys*; EBA-GiE biomethane map 2020 <https://www.europeanbiogas.eu/eba-gie-biomethane-map/>; IEA (2020) Hydrogen Projects Database

¹⁸³ High score=Green; Medium Score=Yellow; Low score=red

¹⁸⁴ Clean Growth Strategy 2017 <https://www.gov.uk/government/publications/clean-growth-strategy>

	marine, heavy duty?	Aviation fuels is incentivised through RTFO HGV Fuel Efficiency Policies to reduce freight emissions Pathway to Aviation 2050¹⁸⁵ to support Climate Change Act 2050 targets of reduced emissions. Office of Low Emission Vehicles (OLEV and Innovate UK) funding (£20 million) demonstration of electric heavy duty vehicles. UK Industry and the UK Government made £3.9 billion commitment 2013-2026 to develop new aircraft technology Funding to improve rail and water freight by investing £235 million in Strategic Freight Network.¹⁸⁶ Investigation for alternative fuels like hydrogen fuel cells to reduce emissions.	
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Transport policies and measures supporting the 5 dimensions of the energy union¹⁸⁷

Sector	Decarbonisation	Energy Security	Energy Efficiency	Internal Energy Market	Research, Innovation and Competitiveness
Transport	GHG emission reduction targets Overall RES-T increase target Renewable Transport Fuel Obligation (RTFO)	Diversification of energy sources (promote domestic sources) Investment in infrastructure Electricity Interconnectedness targets	Energy efficiency targets Energy consumption trajectories Building renovation strategy Technology Innovation and Development	Scottish Government committed to phase out the fossil fuel based cars and vans by 2032 Increase procurements of ultra-low emission vehicles (ULEV) Financial support mechanisms to support the increase in RES-T	Funds, targets and long term objectives for deployment of low-carbon technologies Exploring pathways like electricity, hydrogen and negative emission

Biomass policies which support the mobilisation of advanced renewable fuels

Biomass Production	Conversion	Distribution	End-use
CAP: British Rural Development Programmes CAP England; CAP Northern Ireland; CAP Scotland; CAP Wales		Vehicle tax based on CO2 emissions	Products Policy
Woodlands Grant Scheme		Biofuel quota (RTFO)	
Woodland Planning Grant (WPG)	Energy Act		Tax exemption for RES_E
Waste Act	Feed-in Tariffs for Electricity		Fuel Efficiency Policies
Waste Incineration Directive	CfD (Contract for Difference) scheme		
LULUCF	Renewable Heat Incentive		
	Industrial Emissions Directive		

¹⁸⁵ https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/769695/aviation-2050-web.pdf

¹⁸⁶ UK Government's Rail Freight Strategy 2016, https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/552492/rail-freight-strategy.pdf

¹⁸⁷ NECP UK



		Renewable Obligation for England, Wales, Northern Ireland and Scotland
	Microgeneration Certification Scheme (MCS) for RES Installations	
	Clean Air Act	
	National Energy Efficiency	
	Energy Savings opportunity Scheme (ESOS)	
	EU Effort Sharing Regulation 2021-2030	
UK Renewable Energy Strategy; UK Clean Growth Strategy; Climate Change Act 2050(target amendment); Carbon Plan; National emissions target under the EU Effort Sharing Decision (406/2009/EC) The United Kingdom; Low carbon transport strategy; Waste Prevention Programme; Bioenergy Strategy; Energy Innovation programme		
Biorefinery Roadmap for Scotland; National Plan for Industrial Biotechnology		
Climate Change (Scotland) Bill 2018; The Scottish Climate Change Plan; Scottish Energy Strategy		