IEA-Advanced Motor Fuels ANNUAL REPORT 2021

Germany

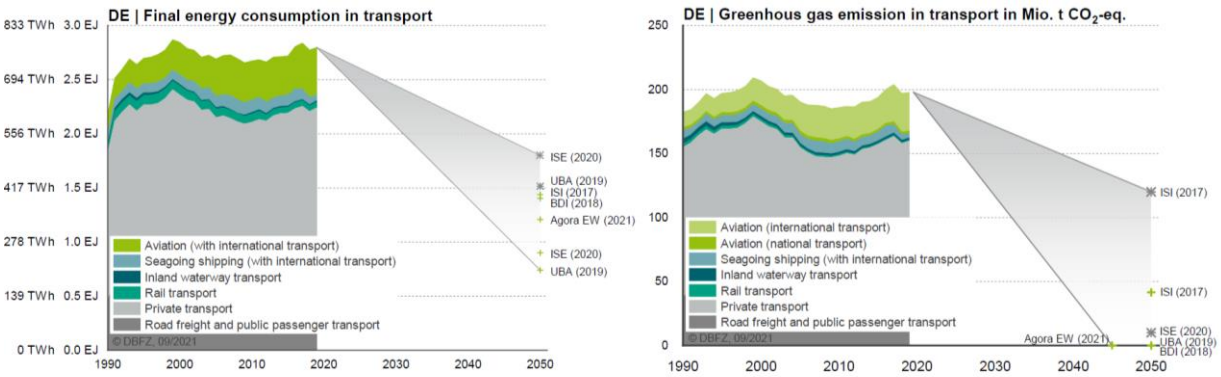
Technology Collaboration Programme
by iea

Germany

Drivers and Policies

Germany has set significant targets to reduce GHG emissions on the EU and national levels (e.g., European Green Deal and Federal Climate Change Act); the transition towards decarbonization is ongoing. Importantly, Germany's transport sector continues to be strongly affected by the COVID-19 pandemic in 2021. The Climate Change Act was amended in 2021, resulting in more ambitious climate targets for the years to come. In sum, Germany set binding target savings of at least 65% of GHG emission by 2030, compared to 1990, and aims to reach the ambitious goal of becoming carbon neutral by 2045.[1] The permissible annual emission budget for the transport sector is 85 Mt CO_2-eq in 2030.

While national and sector-wide GHG emission reduction targets for 2030 are in line with the German long-term strategy, they are not always reflected in sector-specific national contributions (i.e., EU energy efficiency target) and policies and measures (e.g., in the transport sector). These measures are specified in the Climate Action Programme 2030. These measures are only contributing a reduction of 41-42% GHG emissions in the transport sector by 2030[2]. This translates to 98 to 95 Mt CO_2-eq. GHG emissions in transport by 2030[3] Although Germany has already taken comprehensive climate measures, further efforts are required to achieve the set goal of CO_2 savings formulated in the Climate Change Act.[4] Figure 1 illustrates the massive gap between trends and targets in the transport sector; highlighting that significant action has to be taken quickly to reach the GHG emission target of 85 Mt CO_2-eq. by 2030.



Source DBFZ.

Fig. 1. The massive gap between trends and targets in transport 1990-2050

The main public drivers regarding policy in the transport sector remain the revised EU Renewable Energy Directive (RED II) and the Fuel Quality Directive (FQD), which are implemented by the Federal Emissions Control Act (BImSchG §37) and the GHG mitigation quota. The FQD is defined by EU Member States to implement GHG reduction targets for fuels placed on the market. By 2020, target reduction was set for 6% through renewable fuels, including the crediting of up to 1.2% upstream emission reductions per UER 2018. Fuel suppliers are obliged to report GHG emissions for the fuels they have placed on the market.[5] RED II formally became national law in September 2021 by continuing the GHG mitigation quota and increasing this quota incrementally from 7% in 2022 to 25% by 2030.[6] A summary is given in Table 1. The requirements outlined in the RED on sustainability and balancing GHG emissions are transposed into national law by the biofuel sustainability ordinance (Biokraft-NachV)).

[1] https://www.bundesregierung.de/breg-de/themen/klimaschutz/climate-change-act-2021-1936846
[2] https://www.bundesregierung.de/breg-en/issues/climate-action/klimaschutzprogramm-2030-1674080
[3] https://www.bundesregierung.de/resource/blob/974430/1679914/e01d6bd855f09bf05cf7498e06d0a3ff/2019-10-09-klima-massnahmen-data.pdf?download=1
[4] https://www.dbfz.de/pressemediathek/publikationsreihen-des-dbfz/dbfz-reports/dbfz-report-nr-44
[5] https://www.dbfz.de/fileadmin/user_upload/Referenzen/Statements/Hintergrundpapier_Weiterentwicklung_THG-Quote.pdf
[6] https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBl&start=//*[@attr_id=%27bgbl121s4458.pdf%27]#__bgbl__%2F%2F*%5B%40attr_id%3D%27bgbl121s4458.pdf%27%5D__1646058705951

Table 1. Summary GHG mitigation quota until 2030 and compliance options in Germany.

	Explanation
Quota	
GHG mitigation quota	Minimum share of GHG mitigation (yearly increase): 7% in 2022 up to 25% in 2030
Advanced biofuels in road transport (RED II Annex IX A)	Minimum share of energy (yearly increase): 0.2% in 2022 up to 2.6% in 2030
PTL jet fuel in aviation	Minimum share of jet fuel energy: 0.5% by 2026, 1% by 2028 and 2% by 2030
Compliance Options	
Advanced biofuels (RED II Annex IX A)	Amounts above minimum share with two-fold counting for amount above minimum share
Biofuels from UCO and animal fats (RED II Annex IX B)	Maximum share of energy: 1.9%
Conventional biofuels from resources also relevant for food and feed	Maximum share of energy: 4.4% and from 2023 onwards opt out of palm oil
Green hydrogen and resulting products (PTX/e-fuels, RFNBO)	Use in refineries and as fuel with two-fold counting
Electricity	Three-fold counting, adjustment mechanism factor 0.5 to 1.5
Upstream Emission Reduction (UER)	GHG mitigation through UER with max. 1.2% until 2026

The number of electric vehicles and plug-ins has significantly increased since 2017 (see Advanced Motor Fuels Statistics below); today, 25% of newly purchased vehicles are either electric or plug-in.[7] Nevertheless, the restructuring of the transport sector continues to be very slow. It is predicted that 40 million vehicles with combustion engine will be used in 2030, and that by 2045 there will be a remainder of combustion engines, due to the difficulty of electrifying certain areas of transport.[8]

Germany's public debate has been focusing on electric mobility, battery-powered vehicles, PtX and hydrogen in recent years. To decarbonize the transport sector, high priority has recently been given not only to e-mobility for short-distance traffic and passenger cars, but also to the enforcement of hydrogen and liquefied natural gas (LNG) infrastructure along the most important middle- and long-distance road networks. The federal government strongly supported the use of liquefied natural gas (LNG) for heavy-duty transport and waterborne application in recent years.[9] At the same time, methane as CNG/LNG is discussed as controversial in expert groups such as the federal government-convened National Platform Future of Mobility (NPM). The application of hydrogen as transport fuel is one of the main strategies to reach GHG quotas, as outlined in the National Hydrogen Strategy from June 2020.

The federal government believes that e-mobility is an integral part of climate-friendly mobility, having supported measures since 2016.[10] As of February 2022, there are 70 electric vehicle models from German manufacturers on the market[11] which are charged with electricity at circa 47.111 "normal" and 8.094 high-speed publicly accessible charging points.[12] In order to make electric vehicles more attractive, the federal government has decided to provide additional impetus for e-mobility. The overall package consists of temporary purchase incentives until the end of 2025, additional funds for the expansion of the charging infrastructure, and additional efforts in the public procurement of electric vehicles and tax measures.[13] In 2020, the federal government decided to increase the incentive, making a clear commitment to strengthening national e-mobility.

[7] https://www.dbfz.de/pressemediathek/publikationsreihen-des-dbfz/dbfz-reports/dbfz-report-nr-44
[8] Ibid.
[9] https://www.bundesfinanzministerium.de/Monatsberichte/2017/12/Inhalte/Kapitel-3-Analysen/3-5-Novellierung-Energie-Stromsteuergesetzes.html
[10] https://www.bmwi.de/Redaktion/DE/Artikel/Industrie/rahmenbedingungen-und-anreize-fuer-elektrofahrzeuge.html
[11] https://www.adac.de/rund-ums-fahrzeug/elektromobilitaet/kaufen/elektroautos-uebersicht/
[12] https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/E-Mobilitaet/start.html
[13] https://www.bundesregierung.de/breg-de/themen/energiewende/kaufpraemie-fuer-elektroautos-erhoeht-369482

The PtL-Roadmap was published in May 2021. The roadmap outlines Germany's efforts to expand the production of sustainable aviation fuel from renewable energy sources.[14] The federal government, federal states and industry representatives agreed in particular that electricity-based, power-to-liquid (PtL) kerosene from renewable energy sources plays a key role in making the aviation sector carbon-neutral and sustainable. A minimum of 200,000 tonnes of PtL kerosene used in German aviation by 2030 is for a goal; the target is linked to the National Hydrogen Strategy.[15] The target is intended to be reached by technological development, establishing uniform sustainability criteria and supporting the market ramp-up.

The election and formation of a new federal government in September/December 2021 was the most significant political change in recent years.[16] Importantly, the Green Party gained control over various key ministries focusing on climate action (Federal Ministry of Food and Agriculture; Federal Ministry for the Environment, Nature Conservation, Nuclear Safety and Consumer Protection; Federal Ministry for Economic Affairs and Climate Action). Whilst Germany will continue to commit to reaching EU and global climate change goals, the newly elected government announced that they would commit even further to climate mitigation with their 2030 targets.[17] For instance, the new federal government aims that 80% of the power supply will come from renewable resources. Additionally, Germany aims to have 15 million electric vehicles on the road. The new federal government continues to prioritize electricity and hydrogen for the transport sector. This is outlined in the Coalition Treaty of the new government from Dec. 10, 2021.[18]

Advanced Motor Fuels Statistics

The consumption of biofuels in Germany totaled 3.4 Mt in 2020,[19] primarily low-level blends of biodiesel, HVO, bioethanol and biomethane. See Figure 2. Moreover, to a minor extent, biomethane is used for CNG. Due to lacking incentives, there is no market demand for E85 and pure biodiesel. Overall, energy crops and their use as fuel are limited and need to be expanded in order to meet the climate goals.

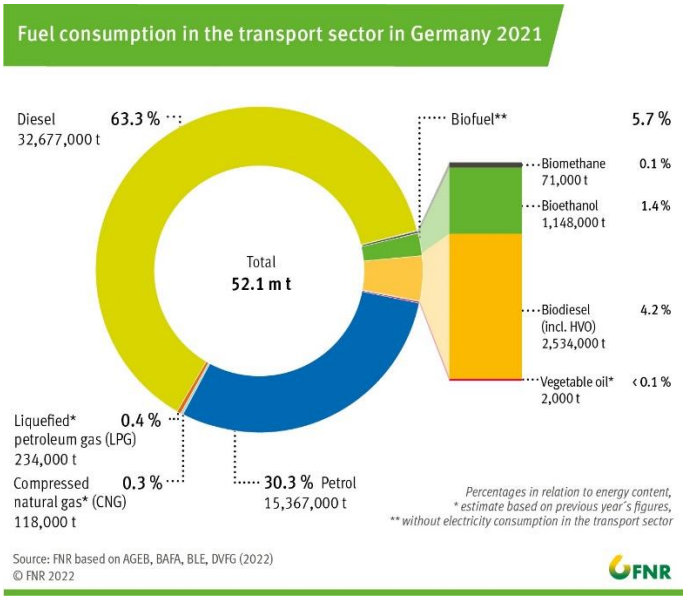


Fig. 2. Fuel Consumption in the Transport Sector in Germany in 2021 [20]

[14] https://www.bmvi.de/SharedDocs/DE/Anlage/G/ptl-roadmap-englisch.pdf?__blob=publicationFile
[15] Ibid.
[16] https://www.bundesregierung.de/breg-en/news/federal-chancellor-election-1989862
[17] https://www.bundeskanzler.de/bk-en/news/government-statement-1991614
[18] https://www.bundesregierung.de/resource/blob/974430/1990812/04221173eef9a6720059cc353d759a2b/2021-12-10-koav2021-data.pdf?download=1
[19] https://mediathek.fnr.de/grafiken/daten-und-fakten/bioenergie/biokraftstoffe/biokraftstoffe-in-deutschland.html
[20] Federal Office for Economic Affairs and Export Control; BAFA et al. (Federal Statistics Office [Destatis], DVFG [German LPG Association], the Federal Ministry of Finance [or BMF], Agency for Renewable Resources [Fachagentur Nachwachsende Rohstoffe e.V., or FNR]), 2021.

Tables 1 and 2 show the 2013-21 trends for biofuels and biofuel blends. The overall savings in GHG emissions of all biofuels (pure) was 83% compared to fossil fuels and the prediction is that number will remain at this high level.[21] The increasing GHG savings of biofuels demonstrate that the physical demand for biofuels to comply with the GHG quota decreased.

Table 1. Trends in German Biodiesel (FAME, HVO, FT-BtL) Sales, 2013–2021, in Mt[22]

Sale	2013	2014	2015	2016	2017	2018	2019	2020	2021
Blend	1.741	1.970	1.978	1.987	2.183	2.296	2.301	3.025	2.347
Pure biodiesel	0.030	0.005	0.003	0.001	n/a	n/a	n/a	n/a	n/a
Total	1.772	1.975	1.981	1.988	2.183	2.296	2.301	3.025	2.347

Table 2. Trends in German Bioethanol Sales, 2013–2021, in Mt[23]

Sale	2013	2014	2015	2016	2017	2018	2019	2020	2021
E85	0.014	0.010	0.007	n/a	n/a	n/a	n/a	n/a	n/a
Ethanol	1.041	1.082	1.049	1.047	1.045	1.077	1.055	0.972	0.906
ETBE	0.154	0.139	0.119	0.129	0.111	0.110	0.088	0.126	0.147
Total	1.209	1.231	1.177	1.176	1.156	1.187	1.177	1.098	1.053

Table 3 shows the number of passenger cars in Germany by fuel type for 2016-21. A total of 59 million vehicles, including 4.7 million motor bikes, were registered in Germany as of January 1, 2021, along with 48.2 million passenger cars, 3.4 million trucks, 2.3 million towing vehicles and 75,548 buses.[24] At a share of 0.2%, 83,067 CNG-powered cars were registered. Another 346,765 LPG-powered cars were registered, which is a share of 0.6%. The number of hydrogen-powered cars increased from 507 (2010) to 808 (+59.4%).

Table 3. Number of Passenger Cars in Germany by Fuel Type on January 1, 2016–2021

Year	Gasoline	Diesel	LPG	CNG	EV	Hybrid	Plug-in
2016	29,825,223	14,532,426	475,711	80,300	25,502	130,365	X
2017	29,978,635	15,089,392	448,025	77,187	34,022	165,405	20,975
2018	30,451,268	15,225,296	421,283	75,459	53,861	236,710	44,419
2019	31,031,021	15,153,364	395,592	80,776	83,175	341,411	66,997
2020	31,464,680	15,111,382	371,472	82,198	136,617	539,383	102,175
2021	31,435.340	15,060,124	346,765	83,067	309,083	1,004,089	279,861

LPG = liquefied petroleum gas according to European fuel quality standard EN 589.
CNG = compressed natural gas according to German fuel quality standard DIN 51624.
EV = electric vehicle. X = values not comparable *Source: KBA 2021*[25]

Research and Demonstration Focus

Public funding for alternative motor fuels on the national scale is supported by the Federal Ministry for Digital and Transport (BMDV, previously BMVI) in the areas of National Innovation Programme Hydrogen and Fuel Cell Technology, NIPII, infrastructure, e-mobility, LNG, CNG, and jet fuel. Likewise, the Federal Ministry of Education and Research (BMBF) funds research through the

[21] https://www.ble.de/SharedDocs/Downloads/DE/Klima-Energie/Nachhaltige-Biomasseherstellung/Evaluationsbericht_2019.pdf?__blob=publicationFile&v=4

[22] Bafa Official Mineral Oil Data, November 2021 https://www.bafa.de/SiteGlobals/Forms/Suche/Infothek/Infothek_Formular.html?nn=8064038&submit=Senden&resultsPerPage=100&documentType_=type_statistic&templateQueryString=Amtliche+Daten+Mineral%C3%B6ldaten&sortOrder=dateOfIssue_dt+desc

[23] Ibid.

[24] https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahrebilanz_Bestand/fz_b_jahresbilanz_node.html

[25] https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Umwelt/2021/2021_b_umwelt_zeitreihen.html?nn=3525028&fromStatistic=3525028&yearFilter=2021&fromStatistic=3525028&yearFilter=2021

"Kopernikus Projects" (P2X and SynErgie).[26] The Federal Ministry for Economic Affairs and Climate Action (BMWK) focuses on eFuels in the "Energiewende im Verkehr" program, including a total funding of EUR 130 million (USD 141 million). As a central measure, "real laboratories of energy transition" were established; in 2022, a roadmap will be presented.[27]

The BMDV launched a new supporting program for renewable fuels in 2021, with EUR 1.54 billion (USD 1.67 billion) available for 2021-24, consisting of resources from the Energy and Climate Fund (EKF) and the National Hydrogen Strategy.[28] Importantly, EUR 640 Million (USD 695 million)[29] will be used for R&D projects. This funding program scope also includes advanced biofuels. Due to a challenging European and German framework for biomass-based fuels, the biofuel share in activities to be funded is uncertain.

Outlook

Renewable fuels are important for achieving the future climate targets in transport. Those are required, especially for shipping and aviation, but also for road transport. Electric mobility is in the fast lane, but reaching climate and energy targets will not be possible without the use of all available options, including hydrogen, eFuels, market-introduced biofuels and advanced biofuels. With the new federal government, a stronger focus on climate mitigation can be expected. Overall, further R&D activities, such as reducing the GHG emissions of biofuels to make them compatible with the RED II limits, are needed to meet persistent challenges for the near future.

Additional Information Sources

- Bundesverband der deutschen Bioethanolwirtschaft, https://www.bdbe.de
- Bundesverband Regenerative Mobilität, www.brm-ev.de/en
- Verband der Deutschen Biokraftstoffindustrie, www.biokraftstoffverband.de
- Fachagentur Nachwachsende Rohstoffe e.V., https://biokraftstoffe.fnr.de/
- Deutsches Biomasse Forschungszentrum, www.dbfz.de[30]

Major changes

- The national Climate Change Act was amended; Germany aims for a 65% GHG emissions reduction by 2030 and carbon neutrality by 2045. For transport, emissions have to be reduced to max. 85 MMT CO_2-eq by 2030.
- The GHG mitigation quota will be continued from 7% in 2022, to 25% by 2030 to be realized by different compliance options.
- A new federal government was elected at the end of 2021; more and faster climate action with reference to their coalition agreement can be expected.
- The PtL-Roadmap for the aviation sector was introduced in May 2021, with a target of 200,000 t introduced kerosene in 2030.
- Increased political interest in hydrogen continues.
- New research & innovation funding scheme started in 2021, to help bring renewable fuels to market.

Benefits of participation in AMF

Access to global information and expertise with regard to advanced transport fuels; exchange of experience on implementation of solutions in AMF member countries.

[26] https://www.bmbf.de/bmbf/shareddocs/pressemitteilungen/de/2021/10/111021-Ariadne.html
[27] https://www.energieforschung.de/forschung-und-innovation/energiewende-im-verkehr
[28] https://www.bmvi.de/DE/Themen/Mobilitaet/Klimaschutz-im-Verkehr/Alternative-Kraftstoffe/alternative-kraftstoffe.html
[29] https://www.bmvi.de/SharedDocs/DE/Pressemitteilungen/2021/045-scheuer-fr-entwicklung-erneuerbarer-kraftstoffe.html
[30] https://www.dbfz.de/pressemediathek/publikationsreihen-des-dbfz/dbfz-reports/dbfz-report-nr-44