

# IEA-Advanced Motor Fuels ANNUAL REPORT 2023

## GERMANY



## Germany

### Drivers and Policies

Germany has set significant targets to reduce greenhouse gas (GHG) emissions on both the European Union (EU) and national levels (e.g., [European Green Deal](#) and [Federal Climate Change Act](#)). The transition toward decarbonization progressed in 2023 despite a year marked by the ongoing Russian invasion of Ukraine. Overall, energy security and climate change mitigation remain the key priorities of the German government.<sup>1</sup> The government aims to accelerate the energy transition by ending reliance on Russian oil and gas, encouraging energy savings and costs reductions, building liquefied natural gas (LNG) terminals, creating a bridge to hydrogen utilization, and phasing out nuclear power.<sup>2</sup> Importantly, massive budget cuts for climate protection measures are expected for the upcoming years, due to a decision by the Federal Constitutional Court.<sup>3</sup>

In the [Climate Change Act](#), Germany set binding targets of at least a 65% decrease in GHG emissions by 2030 (compared to 1990 levels) and aims to reach the ambitious goal of becoming carbon neutral by 2045.<sup>4</sup> For the first time, Germany managed to reach its GHG emissions goals in 2023; the government is optimistic that the nation can also reach its goals for 2030.<sup>5</sup> Notably, achievement of the 2023 goal was partially due to a slow-down in the economy.<sup>6</sup> The permissible emission budget for the transport sector is 85 million tonnes (Mt) carbon dioxide equivalent (CO<sub>2</sub>-eq) in 2030. Moreover, the federal government forecasts a cumulative compliance gap of 180 Mt CO<sub>2</sub>-eq for the transport sector by 2030.<sup>7</sup>

While national and sector-wide GHG emissions 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, specified in the [Climate Action Programme 2030](#), target a GHG emissions reduction in the transport sector of only 41–42% by 2030,<sup>8</sup> which translates to 98 to 95 Mt CO<sub>2</sub>-eq GHG emissions in the transport sector by 2030.<sup>9</sup>

Although Germany has already taken comprehensive climate measures, further efforts are required to achieve the CO<sub>2</sub> savings goal formulated in the Climate Change Act.<sup>10</sup> Figure 1 illustrates the massive gap between trends and targets in the transport sector, highlighting that significant action must be taken quickly to reach the GHG emissions target of 85 Mt CO<sub>2</sub>-eq by 2030.

<sup>1</sup> The Federal Government, 2023, “Energy supply in Germany: Climate-friendly and crisis-proof,” <https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/energieversorgung-sicherheit-2040098>, last accessed: 04.03.2024.

<sup>2</sup> Ibid.

<sup>3</sup> The Federal Government, 2023, “The Climate and Transformation Fund 2024: Create relief, secure future investments, shape transformation,” <https://www.bundesregierung.de/breg-de/aktuelles/der-klima-und-transformationfonds-2024-2250738>, last accessed: 02.04.2024.

<sup>4</sup> The Federal Government, 2021, “Climate Change Act 2021: Intergenerational contract for the climate,” <https://www.bundesregierung.de/breg-de/themen/klimaschutz/climate-change-act-2021-1936846>, last accessed: 04.03.2024.

<sup>5</sup> Federal Ministry for Economic Affairs and Climate Action, 2024, “Germany is on track for the first time with its 2030 climate goals,” <https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2024/03/20240315-deutschland-bei-klimazielen-2030-erstmal-auf-kurs.html>, last accessed: 20.03.2024.

<sup>6</sup> Daily News, 2024, “Germany can achieve its climate target for 2030,” <https://www.tagesschau.de/inland/innenpolitik/deutschland-klimaziele-erreichbar-100.html>, last visited: 20.03.2024.

<sup>7</sup> Federal Ministry for Economic Affairs and Climate Action, 2024, “Germany is on track for the first time with its 2030 climate goals,” <https://www.bmwk.de/Redaktion/DE/Pressemitteilungen/2024/03/20240315-deutschland-bei-klimazielen-2030-erstmal-auf-kurs.html>, last accessed: 02.04.2024.

<sup>8</sup> The Federal Government, 2024, “Climate Action Programme 2030,” <https://www.bundesregierung.de/breg-en/issues/climate-action/klimaschutzprogramm-2030-1674080>, last accessed: 04.03.2024.

<sup>9</sup> The Federal Government, “Climate protection program 2030 to implement the climate protection plan 2050,” <https://www.bundesregierung.de/resource/blob/974430/1679914/e01d6bd855f09bf05cf7498e06d0a3ff/2019-10-09-klima-massnahmen-data.pdf?download=1>, last accessed: 04.03.2024.

<sup>10</sup> DBFZ (German Biomass Research Center), 2023, “Monitoring of renewable energies in transport,” <https://www.dbfz.de/pressemediathek/publikationsreihen-des-dbfz/dbfz-reports/dbfz-report-nr-44>, last accessed: 04.03.2024.

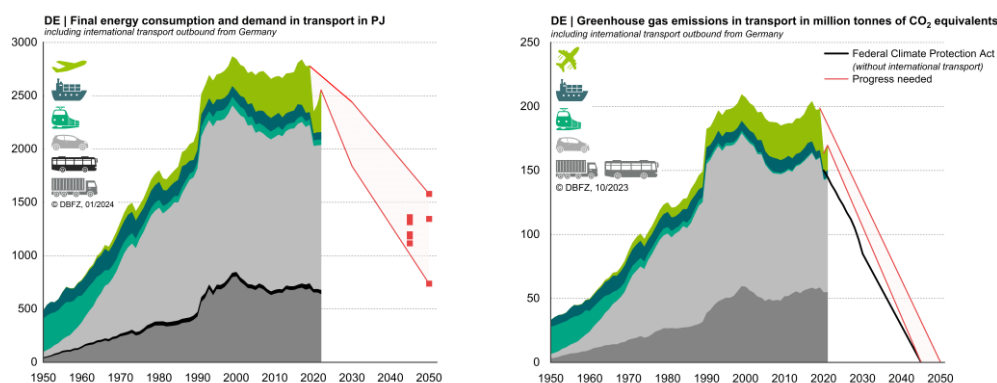


Figure 1. The massive gap between trends, targets, and scenarios in transport, 1990–2050<sup>11</sup> (Source: DBFZ).

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 on the market. By 2020, the target reduction was set for a 6% reduction, achieved through renewable fuels and including crediting of up to 1.2% upstream emission reductions ([UER 2018](#)). Fuel suppliers are obligated to report GHG emissions for the fuels they have introduced into the market.<sup>12</sup> RED II formally became national law in September 2021, continuing the GHG mitigation quota and increasing this quota incrementally from 7% in 2022 to 25% by 2030<sup>13</sup> (Table 1 provides a summary).

The requirements outlined in the RED on sustainability and balancing GHG emissions are codified into national law by the biofuel sustainability ordinance (Biokraft-NachV). The RED was revised in 2023, and took effect on 20 November 2023.<sup>14</sup> The revised RED sets an overall binding *renewable energy target* of at least 42.5% at the EU level by 2030 — but aiming for 45%, requiring Germany to codify most of the directive’s provisions into national law within an 18-month period.<sup>15</sup>

Importantly, the German government does not consider nuclear power a viable option; the last nuclear power plants were closed on 15 April 2023.<sup>16</sup> Germany’s position on nuclear power is unlike that of many European countries, where nuclear power is considered an essential energy source.<sup>17</sup> Similarly the National Energy and Climate Plan (NECP) is an instrument of the EU to ensure that all EU Member States jointly work toward reaching EU climate goals. The national plans are monitored closely to ensure that every Member State is on the right track.<sup>18</sup> Germany submitted a first draft of the updated NECP to the Commission in November 2023.<sup>19</sup>

<sup>11</sup> DBFZ Report No.44, “Monitoring renewable energies in transport,” [https://www.dbfz.de/fileadmin/user\\_upload/Referenzen/DBFZ\\_Reports/DBFZ\\_Report\\_44\\_EN.pdf](https://www.dbfz.de/fileadmin/user_upload/Referenzen/DBFZ_Reports/DBFZ_Report_44_EN.pdf), last accessed: 04.03.2024.

<sup>12</sup> DBFZ, 2021, “Further development of the German greenhouse gas reduction quota,” [https://www.dbfz.de/fileadmin/user\\_upload/Referenzen/Statements/Hintergrundpapier>Weiterentwicklung\\_THG-Quote.pdf](https://www.dbfz.de/fileadmin/user_upload/Referenzen/Statements/Hintergrundpapier>Weiterentwicklung_THG-Quote.pdf), last accessed: 04.03.2024.

<sup>13</sup> Federal Ministry of Justice, “Law to protect against harmful environmental effects caused by air pollution, noise, vibrations and similar processes.” [https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger\\_BGBI&start=//:\\*\[\\*\]@attr\\_id=%27bgbl121s4458.pdf%27#\\_bgbl\\_%2F%2F%2F%5B%40attr\\_id%3D%27bgbl121s4458.pdf%27%5D\\_1646058705951](https://www.bgbl.de/xaver/bgbl/start.xav?startbk=Bundesanzeiger_BGBI&start=//:*[*]@attr_id=%27bgbl121s4458.pdf%27#_bgbl_%2F%2F%2F%5B%40attr_id%3D%27bgbl121s4458.pdf%27%5D_1646058705951), last accessed: 04.03.2024.

<sup>14</sup> European Commission, Renewable Energy Directive,” [https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive\\_en](https://energy.ec.europa.eu/topics/renewable-energy/renewable-energy-directive-targets-and-rules/renewable-energy-directive_en), last accessed: 04.03.2024.

<sup>15</sup> Ibid.

<sup>16</sup> The Federal Government, 2022, “Energy supply security is key,” <https://www.bundesregierung.de/breg-de/schwerpunkte/klimaschutz/ausstieg-aus-der-kernkraft-2135796>, last accessed: 04.03.2024.

<sup>17</sup> EuroNews, 2023, “Nuclear energy in Europe: Who is for and against it and why?” <https://www.euronews.com/business/2023/12/23/nuclear-energy-in-europe-who-is-for-and-against-it-and-why>, last accessed: 04.03.2024.

<sup>18</sup> Federal Ministry for Economic Affairs and Climate Action, “National Energy and Climate Plan,” <https://www.bmwk.de/Redaktion/DE/Textsammlungen/Energie/necp.html>, last accessed: 20.03.2024.

<sup>19</sup> Federal Ministry for Economic Affairs and Climate Action, [https://www.bmwk.de/Redaktion/DE/Downloads/M-O/necp-entwurf-2023.pdf?\\_blob=publicationFile&v=2](https://www.bmwk.de/Redaktion/DE/Downloads/M-O/necp-entwurf-2023.pdf?_blob=publicationFile&v=2), last accessed: 20.03.2024.

Table 1. Summary GHG Mitigation Quota until 2030 and Compliance Options in Germany

	Explanation
<b>Quota</b>	
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
<b>Compliance Options</b>	
Advanced biofuels (RED II Annex IX A)	Amounts above minimum share with twofold counting for amount above minimum share
Biofuels from used cooking oil (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 onward; opt out of palm oil
Green hydrogen and resulting products (Power-to-X [PTX]/e-fuels, renewable fuels of non-biological origin [RFNBO])	Use in refineries and as fuel with twofold counting
Electricity	Threefold counting, adjustment mechanism factor 0.5 to 1.5
Upstream Emission Reduction (UER)	GHG mitigation through UER with maximum 1.2% until 2026

To decarbonize the transport sector, high priority has recently been given to the enforcement of hydrogen and LNG infrastructure along the most important middle- and long-distance road networks and the expansion of the charging infrastructure for electric vehicles. The Federal Ministry for Economic Affairs and Climate Action (BMWK) invested EUR 62 million in the construction of three bunker vessels (refueling ships) for LNG, which will later be used to refuel ammonia.<sup>20</sup> The project's aim is to build a modern and sustainable infrastructure for maritime vessels. Likewise, the first German LNG terminal was inaugurated on 17 December 2022 in Wilhelmshaven. Overall, three LNG terminals are currently in use, while three LNG terminals are still under construction.<sup>21</sup> The capacities of these three terminals will initially enable import of around 13.5 billion cubic meters of LNG to Germany in 2023.<sup>22</sup> Overall, the federal government is sowing the seeds for a transition in the maritime sector.

The application of hydrogen as a transport fuel is one of Germany's main strategies to reach GHG quotas, as outlined in the [National Hydrogen Strategy](#) dated June 2020. By 2030, the EU expects to have capacity to meet a total hydrogen demand of 90 to 110 terawatt hours (TWh) (approximately 2.7 to 3.3 million metric tons), of which about 14 TWh (0.4 million metric tons) will be produced in Germany.<sup>23</sup> The strategy includes a strong focus on green hydrogen from electrolysis based on renewable electricity; biomass-based hydrogen is only considered on biotechnological routes or even as

<sup>20</sup> Federal Ministry for Economic Affairs and Climate Action, "Habeck hands over funding notices: €62 million for the construction of three innovative LNG bunker vessels," <https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2022/12/20221223-habeck-hands-over-funding-notices-eur62-million-for-the-construction-of-three-innovative-lng-bunker-vessels.html>, last accessed: 04.03.2024.

<sup>21</sup> Federal Ministry for Economic Affairs and Climate Action, "The Federal Ministry for Economic Affairs and Climate Action presents a report on the plans for floating and fixed LNG terminals and their capacities", <https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2023/03/20230303the-federal-ministry-for-economic-affairs-and-climate-action-presents-a-report-on-the-plans-for-floating-and-fixed-lng-terminals-and-their-capacities.html>, last accessed:08.05.2024

<sup>22</sup> Ibid.

<sup>23</sup> DBFZ, 2022, "Hydrogen from biomass," <https://www.dbfz.de/pressemediathek/publikationsreihen-des-dbfz/dbfz-reports/dbfz-report-nr-46>, last accessed: 04.03.2024.

an advanced biofuel in line with the RED II. In this respect, Germany's strategy differs from the EU hydrogen strategy, which includes biomass as a renewable hydrogen source.<sup>24</sup> The strategy highlights the overall critical stance of the federal government toward using biomass for renewable fuel production. The strategy was revised in July 2023 and takes into account the increased level of ambition on the path to climate neutrality and the changing demands and challenges that have resulted from the Russian war of aggression.<sup>25</sup> The main points of the strategy include accelerating the market ramp-up of hydrogen, ensuring sufficient availability of hydrogen and its derivatives, development of an efficient hydrogen infrastructure, and establishment of hydrogen applications in the sectors.<sup>26</sup> In addition, the federal government aims to become the leading supplier of hydrogen technologies by 2023 and to create the right conditions to support the introduction of hydrogen.<sup>27</sup>

The power-to-liquid ([PtL Roadmap](#)), published in May 2021, outlines Germany's efforts to expand the production of sustainable aviation fuel (SAF) from renewable energy sources.<sup>28</sup> The federal government, federal states, and industry representatives agreed in particular that electricity-based PtL kerosene from renewable energy sources will play a key role in making the aviation sector carbon-neutral and sustainable. Germany has set a goal of a minimum of 200,000 tonnes of PtL kerosene used in German aviation by 2030; this target is linked to the [National Hydrogen Strategy](#).<sup>29</sup> The country intends to achieve the target through technological development, establishing uniform sustainability criteria, and supporting the market ramp-up.

When it comes to on-road vehicles, on the other hand, all eyes are on electrification. The Trilogue's October 2022 agreement to ban the sale of new combustion engine cars after 2035 illustrates a strong commitment to electric vehicles.<sup>30</sup> The federal government supports the agreement and believes that it will provide German industry the necessary planning security.<sup>31</sup> The number of electric vehicles and plug-ins has significantly increased since 2017: today, 25% of newly purchased vehicles are either electric or plug-in,<sup>32</sup> although the restructuring of the transport sector continues to be slow. This trend was particularly apparent when electric vehicle purchases increased by only 11.4% compared with the previous year.<sup>33</sup> Experts predict that 40 million vehicles with combustion engines will still be in use in 2030, and that 2045 will continue to see vehicles with combustion engines, due to the difficulty of electrifying certain areas of transport.<sup>34</sup>

As of the end of 2023, 99 electric car series are available on the German market.<sup>35</sup> Interestingly, there is a wide selection of different electric models in the luxury segment,<sup>36</sup> indicating that car manufacturers are mostly aiming at consumers from a high socioeconomic class. As of October 2023,

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<sup>24</sup> Ibid.

<sup>25</sup> DENA, 2023, "Update of the National Hydrogen Strategy: What's in

it?," <https://www.dena.de/newsroom/fortschreibung-der-nationalen-wasserstoffstrategie/>, last accessed: 04.03.2024.

<sup>26</sup> Federal Ministry for Economic Affairs and Climate Action, 2023, "Update of the National Hydrogen strategy" [https://www.bmwi.de/Redaktion/DE/Wasserstoff/Downloads/Fortschreibung.pdf?\\_\\_blob=publicationFile&v=4](https://www.bmwi.de/Redaktion/DE/Wasserstoff/Downloads/Fortschreibung.pdf?__blob=publicationFile&v=4), last accessed: 04.03.2024.

<sup>27</sup> Ibid.

<sup>28</sup> The Federal Government, "PtL roadmap: Sustainable aviation fuel from renewable energy sources for aviation in Germany," [https://bmdv.bund.de/SharedDocs/DE/Anlage/G/ptl-roadmap-englisch.pdf?\\_\\_blob=publicationFile](https://bmdv.bund.de/SharedDocs/DE/Anlage/G/ptl-roadmap-englisch.pdf?__blob=publicationFile), last accessed: 04.03.2024.

<sup>29</sup> Ibid.

<sup>30</sup> News of the European Parliament, 2022, "Deal confirms zero-emissions target for new cars and vans in 2035," <https://www.europarl.europa.eu/news/en/press-room/20221024IPR45734/deal-confirms-zero-emissions-target-for-new-cars-and-vans-in-2035>, last accessed: 04.03.2024.

<sup>31</sup> German Parliament, "Answer of the federal government to the small question from the CDU/CSU faction," <https://dserver.bundestag.de/btd/20/050/2005047.pdf>, last accessed: 04.03.2024.

<sup>32</sup> DBFZ, "Monitoring of renewable fuels in the transport sector," [https://www.dbfz.de/fileadmin/user\\_upload/Referenzen/DBFZ\\_Reports/DBFZ\\_Report\\_44\\_DE.pdf](https://www.dbfz.de/fileadmin/user_upload/Referenzen/DBFZ_Reports/DBFZ_Report_44_DE.pdf), last accessed: 04.03.2024.

<sup>33</sup> Tagesschau, 2024, "The number of electric cars in Germany is increasing more slowly," <https://www.tagesschau.de/wirtschaft/verbraucher/autos-zulassungszahlen-100.html>, last accessed: 04.03.2024

<sup>34</sup> Ibid.

<sup>35</sup> ADAC, 2024, "Overview: Which electric cars are currently available to buy?" <https://www.adac.de/rund-ums-fahrzeug/elektromobilitaet/kaufen/elektroautos-uebersicht/>, last accessed 27.02.2024.

<sup>36</sup> Ibid.

there are 87.155 “normal” and 21.111 high-speed publicly accessible charging points in Germany.<sup>37</sup> To make electric vehicles more attractive, the federal government introduced additional impetus for e-mobility. The overall package consisted 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, which ended in December 2023 — earlier than planned, due to shortages in the Climate Transformation Fund (KTF).<sup>38</sup>

While the political direction is clear, consumers offer various reasons for being hesitant to invest in non-combustion engine vehicles. Vehicle range and prices for refueling are the most important factors when purchasing a vehicle, thus limiting consumers’ willingness to purchase a vehicle that runs on renewable fuels.<sup>39</sup> Interestingly, in a study conducted by German Aerospace Center (DLR), the majority of respondents stated that every second service station in their region would need to offer renewable fuels for them to consider these fuels; in reality, 69% of respondents refuel at only 2–3 gas stations, revealing a discrepancy between their expectations and actual mobility behavior.

With regard to public transport, the federal government implemented measures including the introduction of a €49 monthly public transport ticket on 1 May 2023 (“Deutschlandticket” or “Germany Ticket”), on buses, tramways, and metro and regional trains throughout Germany.<sup>40</sup> The ticket is a follow-up to the popular €9 ticket, which was available from June to August 2022, but is now only available through a subscription. After heavy debates about financing the ticket, it was decided that the ticket would be kept at the same price for 2024.<sup>41</sup> Of the 11 million subscribers, 8% are new subscribers who have never used public transport before.<sup>42</sup> Thus, the ticket has not led to a major change in mobility behavior, but rewards those who already use public transport by making the monthly ticket a significantly less expensive.

#### **Advanced Motor Fuels Statistics**

The consumption of biofuels in Germany — primarily low-level blends of biodiesel, hydrotreated vegetable oil (HVO), bioethanol, and biomethane — totaled 52.2 Mt in 2022 (Figure 2).<sup>43</sup> To a minor extent, biomethane is used for compressed natural gas (CNG). The absence of incentives results in 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.

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<sup>37</sup> Federal Network Agency, “Electromobility: Public charging infrastructure,” [https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen\\_Institutionen/E-Mobilitaet/start.html](https://www.bundesnetzagentur.de/DE/Sachgebiete/ElektrizitaetundGas/Unternehmen_Institutionen/E-Mobilitaet/start.html), last accessed 27.02.2024.

<sup>38</sup> Federal Office of Economics and Export Control, [https://www.bafa.de/DE/Energie/Energieeffizienz/Elektromobilitaet/Neuen\\_Antrag\\_stellen/neuen\\_antrag\\_stellen.html](https://www.bafa.de/DE/Energie/Energieeffizienz/Elektromobilitaet/Neuen_Antrag_stellen/neuen_antrag_stellen.html), last accessed: 20.03.2024.

<sup>39</sup> Dr. Jipp, DLR, Presentation at “Fuels of the Future Conference” in Berlin on 23 January 2023.

<sup>40</sup> The Federal Government, “One ticket for all of Germany,” <https://www.bundesregierung.de/breg-de/aktuelles/deutschlandticket-2134074>, last accessed: 04.03.2024.

<sup>41</sup> Ibid.

<sup>42</sup> VDV, “Deutschland Ticket: the biggest fare revolution in public transport,” <https://www.vdv.de/deutschlandticket.aspx#:~:text=Mehr%20als%2011%20Millionen%20verkaufte%20Deutschland%20Ticket%20Abos&text=In%20den%20Sommerferienmonaten%20Juli%20und,Nutzerinnen%20und%20Nutzer%20weiter%20gestiegen>, last accessed: 04.03.2024.

<sup>43</sup> FNR, “Fuel consumption in Germany,” <https://mediathek.fnr.de/grafiken/daten-und-fakten/bioenergie/biokraftstoffe/kraftstoffverbrauch-in-deutschland.html>, last accessed: 04.03.2024.

Fuel consumption in the transport sector in Germany 2023

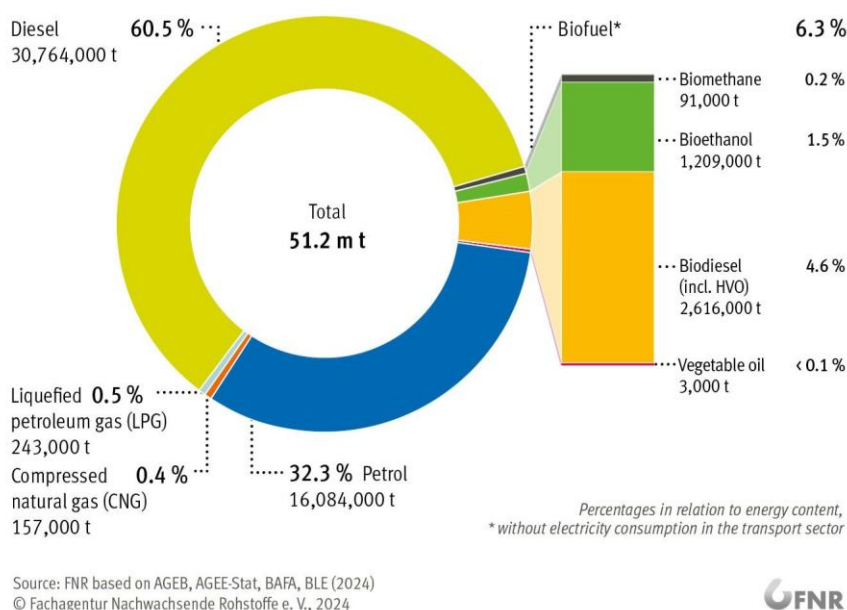


Figure 2. Fuel Consumption in the Transport Sector in Germany in 2022<sup>44</sup>

Tables 2 and 3 show the 2013–2023 sales trends for biofuels and biofuel blends. The overall savings in GHG emissions resulting from the use of all biofuels (pure) was 83% compared with fossil fuels; experts predict that number will remain at this high level.<sup>45</sup>

Table 2. Trends in German Biodiesel Sales (FAME, HVO, FT-BtL), 2013–2022 (in Mt)<sup>46</sup>

Sale	2015	2016	2017	2018	2019	2020	2021	2022	2023
Blend	1.978	1.987	2.183	2.296	2.301	3.025	2.559	2.301	2.380
Pure biodiesel	0.003	0.001	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Total	1.981	1.988	2.183	2.296	2.301	3.025	2.559	2.301	2.380

Table 3. Trends in German Bioethanol Sales, 2013–2022 (in Mt)<sup>47</sup>

Sale	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
E85	0.010	0.007	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
Ethanol	1.082	1.049	1.047	1.045	1.077	1.055	0.972	0.995	0.966	1.000
ETBE	0.139	0.119	0.129	0.111	0.110	0.088	0.126	0.157	0.120	0.124
Total	1.231	1.177	1.176	1.156	1.187	1.177	1.098	1.152	1.086	1.124

<sup>44</sup> 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.

<sup>45</sup> Federal Agency for Agriculture and Food “2019 Evaluation and Experience Report,” [https://www.ble.de/SharedDocs/Downloads/DE/Klima-Energie/Nachhaltige-Biomasseherstellung/Evaluationsbericht\\_2019.pdf?\\_\\_blob=publicationFile&v=4](https://www.ble.de/SharedDocs/Downloads/DE/Klima-Energie/Nachhaltige-Biomasseherstellung/Evaluationsbericht_2019.pdf?__blob=publicationFile&v=4), last accessed: 04.03.2024.

<sup>46</sup> Bafa Official Mineral Oil Data, 2023 Data from November 2023, [https://www.bafa.de/SiteGlobals/Forms/Suche/Infothek/Infothek\\_Formular.html?nn=8064038&submit=Senden&resultPerPage=100&documentType=type\\_statistic&templateQueryString=Amtliche+Daten+Mineral%20C3%B6l+daten&ortOrder=dateOfIssue\\_dt+desc](https://www.bafa.de/SiteGlobals/Forms/Suche/Infothek/Infothek_Formular.html?nn=8064038&submit=Senden&resultPerPage=100&documentType=type_statistic&templateQueryString=Amtliche+Daten+Mineral%20C3%B6l+daten&ortOrder=dateOfIssue_dt+desc), last accessed 27.02.2024.

<sup>47</sup> Ibid.

A total of 60.1 million vehicles were registered in Germany as of January 1, 2023 (+1% compared with 2022), including 48.8 million passenger cars, 3.6 million trucks, 2.4 million towing vehicles, and 3.6 million buses.<sup>48</sup> Table 4 shows the number of passenger cars in Germany by fuel type for 2016–2023. The number of electric vehicles increased by 63.8% compared to 1 January of the previous year.<sup>49</sup> Interestingly, bigger and heavier cars are becoming more popular, with an 11.22% increase in sport utility vehicles (SUVs). On average, Germany has 722 cars per 1,000 inhabitants.<sup>50</sup> For comparison, Austria has 566 cars per 1,000 inhabitants.<sup>51</sup>

Table 4. Number of Passenger Cars in Germany by Fuel Type on January 1, 2016–2023

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
2022	31,005,134	14,824,262	331,481	82,309	618,460	1,669,051	565,956
2023	30,556,538	14,437,489	326,853	80,630	1,013,009	2,337,897	864,712

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 2023.<sup>52</sup>

## 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) 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 “Kopernikus Projects” (P2X and SynErgie).<sup>53</sup> In 2022, the BMBF funded three lighthouse projects with a total funding of EUR 700 million (USD 764 million): H2Giga, H2Mare, and TransHyDE.<sup>54</sup> The [H2Giga](#) flagship project aims to mass-produce electrolyzers for the production and scaleup of hydrogen, while the [H2Mare](#) flagship project intends to produce hydrogen on the high seas, and the [TransHyDE](#) flagship project aims to develop a hydrogen transport infrastructure. The CARE-O-SENE project, funded with EUR 40 million, develops catalysts for green kerosene.<sup>55</sup>

<sup>48</sup> [https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahresbilanz\\_Bestand/fz\\_b\\_jahresbilanz\\_node.html](https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahresbilanz_Bestand/fz_b_jahresbilanz_node.html), last accessed: 04.03.2024.

<sup>49</sup> KBA (Federal Motor Transport authority), “Annual balance 2024,” [https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahresbilanz\\_Bestand/fz\\_b\\_jahresbilanz\\_node.html](https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahresbilanz_Bestand/fz_b_jahresbilanz_node.html), last accessed: 04.03.2024.

<sup>50</sup> KBA, “Duration,” [https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/bestand\\_node.html](https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/bestand_node.html), last accessed: 04.03.2024.

<sup>51</sup> <https://www.statistik.at/statistiken/tourismus-und-verkehr/fahrzeuge/kfz-bestand>, December 2023, last accessed: 04.03.2024.

<sup>52</sup> KBA, 2023, “Passenger cars on January 1, 2023 according to selected characteristics,” [https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahresbilanz\\_Bestand/2023/2023\\_b\\_jahresbilanz\\_tabellen.html?n=3532350&fromStatistic=3532350&yearFilter=2023&fromStatistic=3532350&yearFilter=2023](https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahresbilanz_Bestand/2023/2023_b_jahresbilanz_tabellen.html?n=3532350&fromStatistic=3532350&yearFilter=2023&fromStatistic=3532350&yearFilter=2023), last accessed: 04.03.2024.

<sup>53</sup> Federal Institute for Education and Research, 2021, “Karliczek: Research shows concrete paths to climate neutrality in Germany for the first time,” <https://www.bmbf.de/bmbf/sharedocs/pressemitteilungen/de/2021/10/111021-Ariadne.html>, last accessed: 04.03.2024.

<sup>54</sup> Federal Institute for Education and Research, “Welcome to Hydrogen Flagship Projects,” <https://www.wasserstoff-leitprojekte.de/home>, last accessed: 04.03.2024.

<sup>55</sup> CARE-O-SENE, “Research for a green future: CARE-O-SENE – Catalyst Research for Sustainable Kerosene,” <https://care-o-sene.com/en/>, last accessed: 04.03.2024.



The BMDV funds research on renewable fuels, with EUR 1.54 billion (USD 1.68 billion) available for 2021–2024, consisting of resources from the KTF and the National Hydrogen Strategy.<sup>56</sup> EUR 640 million (USD 698 million) will be used for research and development (R&D) projects.<sup>57</sup> This funding program scope also includes advanced biofuels. The [InnoFuels](#) project intends to promote networking, further development of framework conditions for the ramp-up of electricity-based fuels, and advanced biofuels. In 2022, a call on renewable fuels for the maritime sector (electric and bio-based) was published and closed in April 2023.<sup>58</sup> Funding is also available at the state level; for example, Baden-Württemberg funds various R&D projects through its renewable fuels strategy.<sup>59</sup> For 2024, budget cuts in the KTF will be in place, resulting in less funding for R&D projects.<sup>60</sup> For example, R&D for electromobility will no longer be funded — a move that has been heavily criticized by universities and research institutes.<sup>61</sup>

## Outlook

With the revision of the RED, Germany now has to codify the provisions of the directive into national law. Nevertheless, no major adaptation is expected as ambitious targets are already in place. The ongoing debate on biofuels (“food vs. fuel”) has been reignited by the Green party with a proposal by the Ministry of Environment in January 2023 to phase out crop-based biofuels by 2030.<sup>62</sup> Similarly, the intention of the federal government to cut subsidies for diesel used for agriculture and forestry caused major protests by farmers throughout the country.<sup>63</sup> Biofuels account for 4% of German transport fuel consumption. To meet the 2030 climate target, GHG emissions from the transport sector will have to be reduced by 43% in 2030, relative to 2022 levels.<sup>64</sup> It seems inevitable that all types of fuels will be needed.<sup>65</sup>

The incentives to purchase electric vehicles decreased in late 2023 compared with previous years. Following this trend, the market share of battery electric vehicles (BEVs) is expected to be only 15% in 2024.<sup>66</sup> Importantly, the federal government had to revise its national budget based on a decision by the Federal Constitutional Court in November 2023 that resulted in budget cuts for R&D funding and subsidies for the transport sector in the upcoming year.<sup>67</sup> This ultimately makes accelerating the energy

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<sup>56</sup> Federal Agency for Digital Affairs and Transport, “Climate protection in transport – alternative fuels,” <https://bmdv.bund.de/DE/Themen/Mobilitaet/Klimaschutz-im-Verkehr/Alternative-Kraftstoffe/alternative-kraftstoffe.html>, last accessed: 04.03.2024.

<sup>57</sup> Federal Ministry for Digital and Transport, “From development to market ramp-up: Ministry launches new funding concept for renewable fuels,” <https://bmdv.bund.de/SharedDocs/DE/Artikel/G/Klimaschutz-im-Verkehr/neues-foerderkonzept-erneuerbare-kraftstoffe.html>, last accessed: 04.04.2024.

<sup>58</sup> “Funding call for Directive on the promotion of development measures for renewable fuels” <https://www.now-gmbh.de/wp-content/uploads/2022/12/Foerderaufruf-strombasierte-Kraftstoffe-fuer-maritime-Anwendungen.pdf>, last accessed: 04.03.2024.

<sup>59</sup> Baden-Wuerttemberg “International cooperation on climate-neutral fuels,” <https://www.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/internationale-zusammenarbeit-bei-klimaneutralen-kraftstoffen>, last accessed: 04.03.2024.

<sup>60</sup> Federal Ministry for Economic Affairs and Climate Action, 2023, “The Climate and Transformation Fund 2024: Create relief, secure future investments, shape transformation,” <https://www.bmwk.de/Redaktion/DE/Meldung/2023/20231221-haushalt-einigung-ktf-2024.html>, last accessed: 04.03.2024.

<sup>61</sup> “Continue practice-oriented research on electromobility,” [https://www.oeko.de/fileadmin/oekodoc/Offener-Brief\\_Bundesregierung\\_Haushaltskuerzungen\\_Elektromobilitaet.pdf](https://www.oeko.de/fileadmin/oekodoc/Offener-Brief_Bundesregierung_Haushaltskuerzungen_Elektromobilitaet.pdf), last accessed: 04.03.2024, 04.03.2024

<sup>62</sup> Euroactiv, “Food vs fuel: German ministries clash over role of conventional biofuels,” <https://www.euractiv.com/section/biofuels/news/food-vs-fuel-german-ministries-clash-over-role-of-conventional-biofuels/>, last accessed: 04.03.2024.

<sup>63</sup> Top Agrar Online, “Agricultural diesel,” <https://www.topagrar.com/themen/agrardiesel-13465883.html>, last accessed: 04.03.2024.

<sup>64</sup> Ibid.

<sup>65</sup> Ministry of Agriculture and Food, “11.6 Million Tons CO<sub>2</sub>-eq.was saved in 2022 due to biofuels,” [https://www.ble.de/DE/Themen/Klima-Energie/Nachhaltige-Biomasseherstellung/Informationsmaterial/informationsmaterial\\_node.html](https://www.ble.de/DE/Themen/Klima-Energie/Nachhaltige-Biomasseherstellung/Informationsmaterial/informationsmaterial_node.html), last accessed 04.03.2024.

<sup>66</sup> KBA, 2023, “Monthly Report,” [https://www.now-gmbh.de/wp-content/uploads/2024/01/KBA\\_Monatsreport\\_12-2023.pdf](https://www.now-gmbh.de/wp-content/uploads/2024/01/KBA_Monatsreport_12-2023.pdf), last accessed: 20.03.2024.

<sup>67</sup> The Federal Government, “Create relief, secure future investments, shape transformation,” <https://www.bundesregierung.de/breg-de/aktuelles/der-klima-und-transformationsfonds-2024-2250738>, last accessed: 2.04.2024.

transition increasingly difficult. Finally, the Russian invasion of Ukraine was a wake-up call for the federal government, not just with regard to territorial security but also energy security. Ensuring energy security while continuing to meet ambitious climate targets remains a mammoth task.

#### **Additional Information Sources**

- [Bundesverband der deutschen Bioethanolwirtschaft](#)
- [Bundesverband Bioenergie](#)
- [Bundesverband Regenerative Mobilität](#)
- [Verband der Deutschen Biokraftstoffindustrie](#)
- [Fachagentur Nachwachsende Rohstoffe e.V.](#)
- [Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie](#)
- [Deutsches Biomasseforschungszentrum gemeinnützige GmbH](#)<sup>68</sup>
- [eFuel Alliance](#)

#### **Major changes**

- Revision of the National Hydrogen Strategy, illustrating the emphasis of the federal government on hydrogen as an energy carrier.
- End of subsidies for purchasing electric vehicles.
- Introduction of new subscription for public transport (“Deutschlandticket”).
- Revision of the RED, leading to the need for Germany to codify the directive’s provisions into national law.

#### **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.

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<sup>68</sup> DBFZ Report No. 44, “Monitoring renewable energies in transport,” <https://www.dbfz.de/en/press-media-library/publication-series/dbfz-reports>, last accessed 04.03.2024.