

# IEA-Advanced Motor Fuels ANNUAL REPORT 2022

## Germany



## 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. The year 2022 was marked by the Russian invasion of Ukraine. As a response, the federal government is committed to ending Germany's reliance on Russian oil, coal, and gas as quickly as possible.<sup>1</sup> Overall, energy security was identified as the number-one priority, while also continuing to take strong action for climate change mitigation. High energy prices and a strong push for reliable and sustainable sources of energy affected Germany's transport sector to a large extent in the past year.

In the [Climate Change Act](#) 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.<sup>2</sup> The permissible annual emission budget for the transport sector is 85 Mt CO<sub>2</sub>-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 targeted to contribute a GHG emissions reduction in the transport sector of only 41-42% by 2030.<sup>3</sup> This translates to 98 to 95 Mt CO<sub>2</sub>-eq. GHG emissions in transport by 2030.<sup>4</sup> Although Germany has already taken comprehensive climate measures, further efforts are required to achieve the set goal of CO<sub>2</sub> savings formulated in the Climate Change Act.<sup>5</sup> 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<sub>2</sub>-eq. by 2030.

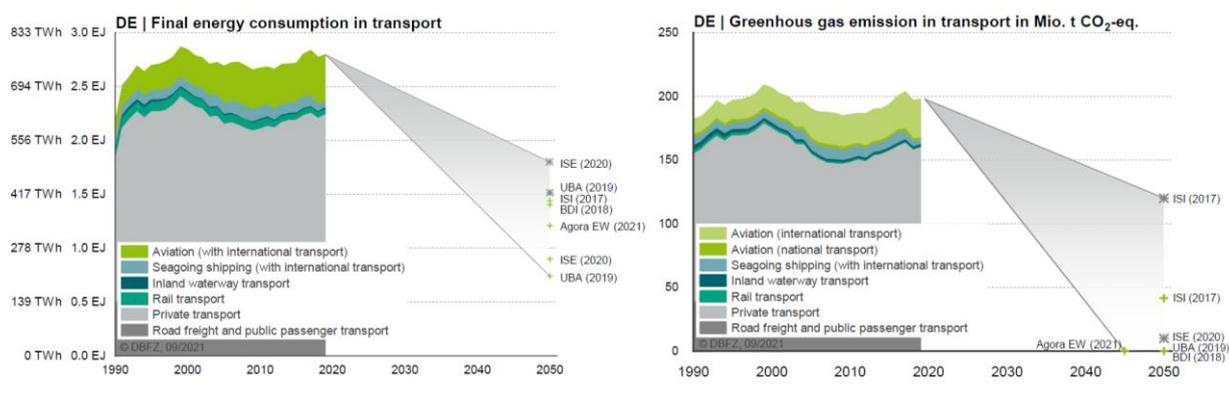


Fig. 1. The massive gap between trends and targets in transport, 1990-2050<sup>6</sup>  
Source: DBFZ.

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 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 (UER) ([UER 2018](#)). Fuel suppliers are obliged to report GHG emissions for the

<sup>1</sup> <https://www.bundesregierung.de/breg-de/themen/klimaschutz/energieversorgung-sicherheit-2040098>, last accessed 28.02.2023.

<sup>2</sup> <https://www.bundesregierung.de/breg-de/themen/klimaschutz/climate-change-act-2021-1936846>, last accessed 28.02.2023.

<sup>3</sup> <https://www.bundesregierung.de/breg-en/issues/climate-action/klimaschutzprogramm-2030-1674080>, last accessed 27.02.2023.

<sup>4</sup> <https://www.bundesregierung.de/resource/blob/974430/1679914/e01d6bd855f09bf05cf7498e06d0a3ff/2019-10-09-klima-massnahmen-data.pdf?download=1>, last accessed 28.02.2023.

<sup>5</sup> <https://www.dbfz.de/pressemediathek/publikationsreihen-des-dbfz/dbfz-reports/dbfz-report-nr-44>, last accessed 28.02.2023.

<sup>6</sup> DBFZ Report No.44, [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 28.02.2023.

fuels they have placed on the market.<sup>7</sup> 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.<sup>8</sup> A summary is given in Table 1. There are ongoing discussions on amending the GHG mitigation quota, for example, by including a phase-out of crop-based biofuels by 2030 as well as higher multipliers for e-mobility and efuels (as discussed in the Outlook). The requirements outlined in the RED on sustainability and balancing GHG emissions are transposed into national law by the biofuel sustainability ordinance (Biokraft-NachV)). Trilogue negotiations between the Parliament, the Council, and the Commission on the RED are still ongoing.<sup>9</sup> Once an agreement has been reached, the federal government will implement the measures nationally.

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 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 (PTX/e-fuels, 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 liquefied natural gas (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 at a later stage will be used to refuel ammonia.<sup>10</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. Four additional LNG terminals will be available by winter 2023/2024.<sup>11</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 the main strategies to reach GHG quotas, as outlined in the [National Hydrogen Strategy](#) from June 2020. By 2030, a total hydrogen demand of 90 to

<sup>7</sup> [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 28.02.2023.

<sup>8</sup> [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](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), last accessed 27.02.2023.

<sup>9</sup> <https://www.europarl.europa.eu/legislative-train/spotlight-JD21/file-revision-of-the-renewable-energy-directive>, last accessed 27.02.2023.

<sup>10</sup> <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 27.02.2023.

<sup>11</sup> <https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2022/12/20221217-first-german-lng-terminal-inaugurated-in-wilhelmshaven.html>, last accessed 27.02.2023.

110 TWh (approximately 2.7 to 3.3 million metric tons) shall be met, of which about 14 TWh (0.4 million metric tons) are to be produced in Germany.<sup>12</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 advanced biofuel in line with the RED II. This is different from the EU hydrogen strategy, which includes biomass as a renewable hydrogen source.<sup>13</sup> The strategy highlights the overall critical stance of the federal government towards using biomass for renewable fuel production.

The [PtL-Roadmap](#) was published in May 2021 and outlines Germany's efforts to expand the production of sustainable aviation fuel from renewable energy sources.<sup>14</sup> 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. 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>15</sup> The country intends to achieve the target through technological development, establishing uniform sustainability criteria, and supporting the market ramp-up.

On the contrary, when it comes to on-road vehicles, 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 toward electric vehicles.<sup>16</sup> The federal government supports the agreement and believes that it will give the German industry the necessary planning security.<sup>17</sup> 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.<sup>18</sup> Nevertheless, the restructuring of the transport sector continues to be very slow. It is predicted that 40 million vehicles with combustion engines will still be in use in 2030, and that the year 2045 will continue to see vehicles with combustion engines, due to the difficulty of electrifying certain areas of transport.<sup>19</sup>

In early 2023, 115 electric car series are available on the German market.<sup>20</sup> More than 80 of those models come from German manufacturers.<sup>21</sup> As of December 2022 there are 63,806 "normal" and 12,755 high-speed publicly accessible charging points in Germany.<sup>22</sup> To make electric vehicles more attractive, the federal government 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.<sup>23</sup> In 2020, the federal government decided to increase the incentive until 1 January 2023, making a clear commitment to strengthening national e-mobility.

While the political direction is clear, consumers offer various reasons for being hesitant to invest in non-combustion engine vehicles. Mile coverage and prices for refueling are the most important factors when purchasing a vehicle, hence limiting consumers' willingness to purchase a vehicle running on renewable fuels.<sup>24</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

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<sup>12</sup> <https://www.dbfz.de/pressemediathek/publikationsreihen-des-dbfz/dbfz-reports/dbfz-report-nr-46>, last accessed 28.02.2023.

<sup>13</sup> Ibid.

<sup>14</sup> [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 27.02.2023.

<sup>15</sup> Ibid.

<sup>16</sup> <https://www.europarl.europa.eu/news/en/press-room/20221024IPR45734/deal-confirms-zero-emissions-target-for-new-cars-and-vans-in-2035>, last accessed 27.02.2023.

<sup>17</sup> <https://dserver.bundestag.de/btd/20/050/2005047.pdf>, last accessed 27.02.2023.

<sup>18</sup> [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 27.02.2023.

<sup>19</sup> Ibid.

<sup>20</sup> <https://www.adac.de/rund-ums-fahrzeug/elektromobilitaet/kaufen/elektroautos-uebersicht/>, last accessed 27.02.2023.

<sup>21</sup> <https://www.bmwk.de/Redaktion/DE/Dossier/elektromobilitaet.html>, last accessed 27.02.2023.

<sup>22</sup> [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 27.02.2023.

<sup>23</sup> <https://www.bundesregierung.de/breg-de/themen/energiewende/kaufpraemie-fuer-elektroautos-erhoeht-369482>, last accessed 27.02.2023.

<sup>24</sup> Dr. Jipp, DLR, Presentation at "Fuels of the Future Conference" in Berlin on 23. January 2023.

renewable fuels for them to consider these fuels, while in reality 69% of respondents refuel at only 2-3 gas stations.<sup>25</sup> This shows a discrepancy between what is expected and actual mobility behavior. It can also be noted that electric vehicles are purchased mostly by consumers of a high socioeconomic class, as Tesla models Y and 3 ranked first and second among electric car models sold in 2022.<sup>26</sup>

With regard to public transport, the federal government implemented measures including the introduction of a 9-euro public transport ticket, which ticketholders could use during June, July, and August 2022 on buses, tramways, and metro and regional trains throughout Germany. The ticket was introduced to make public transport more attractive and to counter the high energy prices; approximately 52 million tickets were sold.<sup>27</sup> Although heavily criticized by the opposition and public transport providers, the government called the ticket a success and announced that a follow-up ticket will be introduced in 2023.<sup>28</sup>

### Advanced Motor Fuels Statistics

The consumption of biofuels in Germany totaled 52, 2Mt in 2022, primarily with low-level blends of biodiesel, hydrotreated vegetable oil (HVO), bioethanol, and biomethane (Figure 2).<sup>29</sup> Moreover, to a minor extent, biomethane is used for compressed natural gas (CNG). Due to the absence of 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.

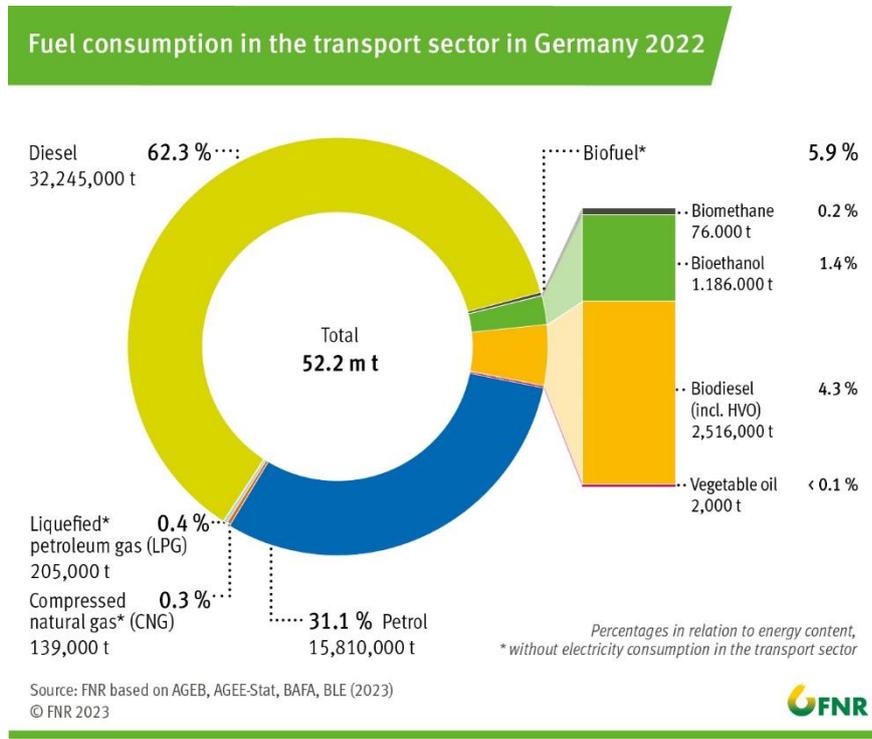


Fig. 2. Fuel Consumption in the Transport Sector in Germany in 2022<sup>30</sup>

<sup>25</sup> Ibid.

<sup>26</sup> [https://www.now-gmbh.de/wp-content/uploads/2023/01/KBA\\_Report\\_12-2022.pdf](https://www.now-gmbh.de/wp-content/uploads/2023/01/KBA_Report_12-2022.pdf), last accessed: 27.02.2023.

<sup>27</sup> <https://www.vdv.de/bilanz-9-euro-ticket.aspx>, last accessed: 28.02.2023.

<sup>28</sup> <https://bmdv.bund.de/SharedDocs/DE/Artikel/K/9-euro-ticket-beschlossen.html>, last accessed: 27.02.2023.

<sup>29</sup> <https://mediathek.fnr.de/grafiken/daten-und-fakten/bioenergie/biokraftstoffe/kraftstoffverbrauch-in-deutschland.html>, last accessed: 27.02.2023.

<sup>30</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 Nachhaltende Rohstoffe e.V., or FNR]), 2021.

### 3 THE GLOBAL SITUATION: GERMANY

Tables 1 and 2 show the 2013–2022 trends for biofuels and biofuel blends sales. 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.<sup>31</sup> 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 Sales (FAME, HVO, FT-BtL), 2013–2022 (in Mt)<sup>32</sup>

Sale	2015	2016	2017	2018	2019	2020	2021	2022
Blend	1.978	1.987	2.183	2.296	2.301	3.025	2.559	2.301
Pure biodiesel	0.003	0.001	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

Table 2. Trends in German Bioethanol Sales, 2013–2022 (in Mt)<sup>33</sup>

Sale	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
E85	0.014	0.010	0.007	n/a						
Ethanol	1.041	1.082	1.049	1.047	1.045	1.077	1.055	0.972	0.995	0.966
ETBE	0.154	0.139	0.119	0.129	0.111	0.110	0.088	0.126	0.157	0.120
Total	1.209	1.231	1.177	1.176	1.156	1.187	1.177	1.098	1.152	1.086

A total of 67.7 million vehicles were registered in Germany as of January 1, 2022 (+1.3 %), including 48.5 million passenger cars, 3.5 million trucks, 2.3 million towing vehicles, and 80,225 buses.<sup>34</sup>

Table 3 shows the number of passenger cars in Germany by fuel type for 2016–2022. The number of hydrogen-powered cars increased from 808 (2021) to 1,211 (+49.9%). A total of 346,765 LPG-powered cars were registered: a share of 0.7%. CNG-powered cars had a share of 0.2%. Interestingly, bigger and heavier cars are becoming more popular, with a 12.2% increase in SUVs. On average, Germany has 717 cars per 1,000 inhabitants.<sup>35</sup> For comparison, Austria has 566 cars per 1,000 inhabitants.<sup>36</sup>

Table 3. Number of Passenger Cars in Germany by Fuel Type on January 1, 2016–2022

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

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 2022.<sup>37</sup>

<sup>31</sup> [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: 27.02.2023.

<sup>32</sup> Bafa Official Mineral Oil Data, 2022 Data from November 2022, [https://www.bafa.de/SiteGlobals/Forms/Suche/Infothek/Infothek\\_Formular.html?nn=8064038&submit=Senden&resultsPerPage=100&documentType=type\\_statistic&templateQueryString=Amtliche+Daten+Mineral%20C3%B6daten&sortOrder=dateOfIssue\\_dt+desc](https://www.bafa.de/SiteGlobals/Forms/Suche/Infothek/Infothek_Formular.html?nn=8064038&submit=Senden&resultsPerPage=100&documentType=type_statistic&templateQueryString=Amtliche+Daten+Mineral%20C3%B6daten&sortOrder=dateOfIssue_dt+desc), last accessed 27.02.2023.

<sup>33</sup> Ibid.

<sup>34</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 21.03.2023.

<sup>35</sup> [https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/bestand\\_node.html](https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/bestand_node.html), last accessed 28.02.2023.

<sup>36</sup> <https://www.statistik.at/statistiken/tourismus-und-verkehr/fahrzeuge/kfz-bestand>, December 2022, last accessed 28.02.2023.

<sup>37</sup> [https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahresbilanz\\_Bestand/2022/2022\\_b\\_jahresbilanz\\_tabellen.html?nn=3532350&fromStatistic=3532350&yearFilter=2022&fromStatistic=3532350&yearFilter=2022](https://www.kba.de/DE/Statistik/Fahrzeuge/Bestand/Jahresbilanz_Bestand/2022/2022_b_jahresbilanz_tabellen.html?nn=3532350&fromStatistic=3532350&yearFilter=2022&fromStatistic=3532350&yearFilter=2022), last accessed 27.02.2023.

#### **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>38</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>39</sup> The [H2Giga](#) flagship project aims to mass-produce electrolyzers for the production and scale-up 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>40</sup>

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 Climate and Transition Fund (KTF) and the National Hydrogen Strategy.<sup>41</sup> Importantly, EUR 640 million (USD 698 million) will be used for R&D projects.<sup>42</sup> This funding program scope also includes advanced biofuels. In 2022 a call on renewable fuels for the maritime sector (electric and bio-based) was published.<sup>43</sup> Funding is also available at the state level; for example, Baden-Württemberg funds various R&D projects through its renewable fuels strategy.<sup>44</sup>

#### **Outlook**

With RED II currently under revision, more ambitious GHG mitigation quotas can be expected in the future.<sup>45</sup> Nevertheless, when it comes to implementing the directive nationally, 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>46</sup> So far, biofuels account for 4% of German transport fuel consumption. To meet the 2030 climate target, GHG emissions of the transport sector will have to be reduced by 43% in 2030, in relation to 2022.<sup>47</sup> It seems inevitable that all types of fuels are needed.<sup>48</sup>

As incentives for purchasing electric cars decreased in 2023 compared to previous years, electricity prices have increased strongly. With the ban on purchasing new combustion engine cars going into effect only as of 2035, no major increase in the sales of electric cars can be expected in the near future. After the success of the 9-euro ticket, a follow-up ticket is expected to be introduced in 2023. Whether this will lead to a change of mobility habits is questionable.

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. Guaranteeing energy security while continuing to implement ambitious climate targets will be a mammoth task.

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<sup>38</sup> <https://www.bmbf.de/bmbf/shareddocs/pressemitteilungen/de/2021/10/111021-Ariadne.html>, last accessed 27.02.2023.

<sup>39</sup> <https://www.wasserstoff-leitprojekte.de/home>, last accessed 27.02.2023.

<sup>40</sup> <https://care-o-sene.com/en/>, last accessed 27.02.2023.

<sup>41</sup> <https://bmdv.bund.de/DE/Themen/Mobilitaet/Klimaschutz-im-Verkehr/Alternative-Kraftstoffe/alternative-kraftstoffe.html>, last accessed 27.02.2023.

<sup>42</sup> <https://bmdv.bund.de/SharedDocs/DE/Artikel/G/Klimaschutz-im-Verkehr/neues-foerderkonzept-erneuerbare-kraftstoffe.html>, last accessed 27.02.2023.

<sup>43</sup> <https://www.now-gmbh.de/wp-content/uploads/2022/12/Foerderaufuf-strombasierte-Kraftstoffe-fuer-maritime-Anwendungen.pdf>, last accessed 27.02.2023.

<sup>44</sup> <https://www.baden-wuerttemberg.de/de/service/presse/pressemitteilung/pid/internationale-zusammenarbeit-bei-klimaneutralen-kraftstoffen>, last accessed 27.02.2023.

<sup>45</sup> [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 27.02.2023.

<sup>46</sup> <https://www.euractiv.com/section/biofuels/news/food-vs-fuel-german-ministries-clash-over-role-of-conventional-biofuels/>, last accessed 28.02.2023.

<sup>47</sup> Ibid.

<sup>48</sup> i.e. 11,1 Million Tons CO<sub>2</sub>-eq. was saved in 2021 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 27.02.2023.

### **Additional Information Sources**

- Bundesverband der deutschen Bioethanolwirtschaft, <https://www.bdbe.de>
- Bundesverband Bioenergie, <https://www.bioenergie.de/>
- Bundesverband Regenerative Mobilität, [www.brm-ev.de/en](http://www.brm-ev.de/en)
- Verband der Deutschen Biokraftstoffindustrie, [www.biokraftstoffverband.de](http://www.biokraftstoffverband.de)
- Fachagentur Nachwachsende Rohstoffe e.V., <https://biokraftstoffe.fur.de/>
- Nationale Organisation Wasserstoff- und Brennstoffzellentechnologie, <https://www.now-gmbh.de/>
- Deutsches Biomasseforschungszentrum gemeinnützige GmbH, [www.dbfz.de](http://www.dbfz.de)<sup>49</sup>
- eFuel Alliance, <https://www.efuel-alliance.eu/de/>

#### **Major changes**

- Energy security and climate change mitigation identified as the main priority by the federal government.
- New research and innovation funding schemes started in 2022. A major focus on hydrogen, as three hydrogen lighthouse projects were funded.
- Reignition of debate about biofuels (“food vs. fuel”).

#### **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>49</sup> DBFZ Report No. 44 <https://www.dbfz.de/en/press-media-library/publication-series/dbfz-reports>, last accessed 27.02.2023.