MINISTRY OF FINANCE

Kingdom of Denmark Green Bond Impact Report

July 2025

2021

Disclaimer

This report is a re-publication of the Kingdom of Denmark Green Bond Impact Report 2021 first published in March 2023. This edition of the report has been updated with a revised measure of the impact of expenditures related to Danish railways. The revision results from an updated methodology in Kingdom of Denmark Green Bond Impact Report 2022.

The content of the report reflects the information available to the Ministry of Finance at the time of initial publication. The Ministry of Finance cannot be held accountable if the information contained in the report is no longer up to date at the time of re-publication.

Kingdom of Denmark
Green Bond Impact Report
July 2025

Danish Ministry of Finance
Christiansborg Slotsplads 1
1218 Copenhagen K
Denmark

Photos: Colourbox and iStock. Page 19 Banedanmark, Robert Attermann

ISBN: 978-87-94088-55-8 (digital version)

The publication is available for download at fm.dk

Green bonds issued by: Danmarks Nationalbank on behalf of the Danish Ministry of Finance (LEI: 549300PTO6LS1PTM6607)

Name of bonds assigned by the issuer: DGB 0.00'2031 G

ISIN: DK0009924375

The Kingdom of Denmark applies a portfolio-based approach, reporting on impact on an aggregated level where most relevant and in correspondence with the Green Bond Framework, published on December 8, 2021.

The content of this document is not subject to any approval or endorsement from ESMA or any other competent authority. The impact report will to a certain extent seek to align with the requirements stated in annex III of the European Commissions' proposal for a European Green Bond Standard, but will not strictly follow the same structure. No external reviewer has assessed the content of this report.

Table of contents

Summary

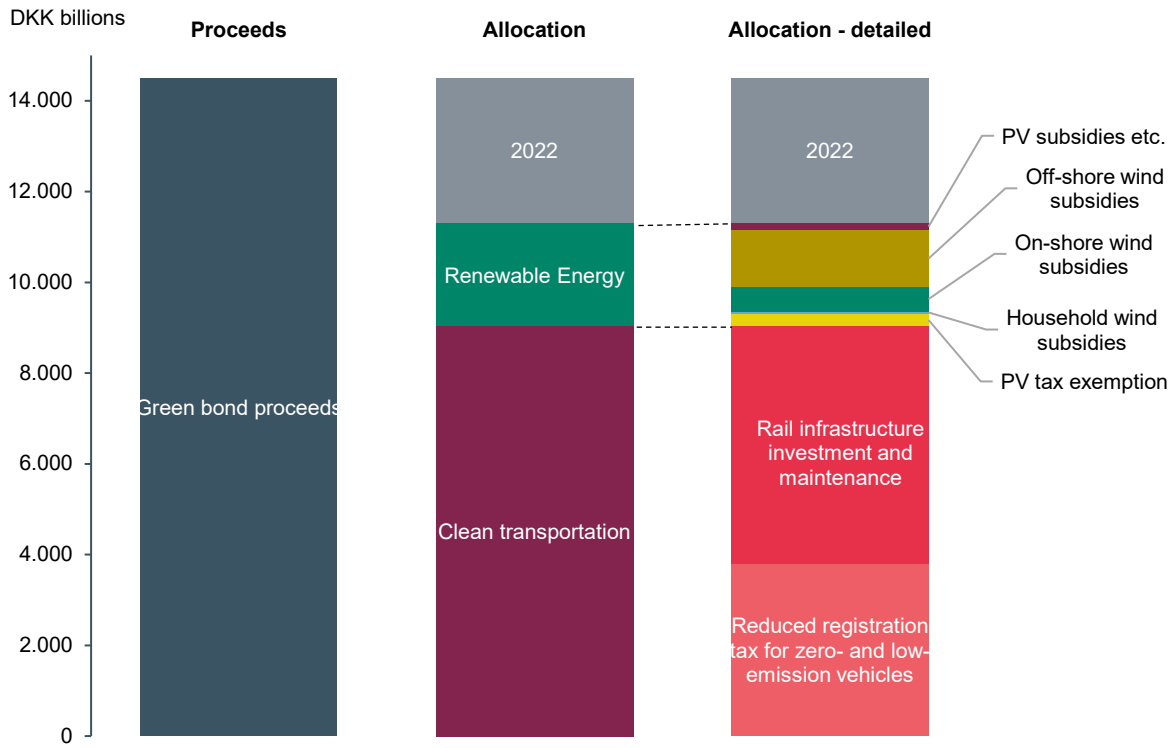
The Kingdom of Denmark successfully issued its inaugural green bond on 19 January 2022, and has since then issued a total volume of DKK 14.5 billion of green bonds in 2022.

Of these, DKK 11.3 billion have gone to finance eligible green expenditures from 2021. The remaining kr. 3.2 billion of the issuance will be allocated to eligible expenditures from 2022.

Of the allocated DKK 11.3 billion, about DKK 2.3 billion or 20 percent have been allocated to projects related to renewable energy, and about DKK 9.0 billion or 80 percent have been allocated to projects related to clean transportation.

By significantly contributing to reduce Danish CO_2e emissions, the projects have contributed to mitigate climate change.

Green bond proceeds and allocation

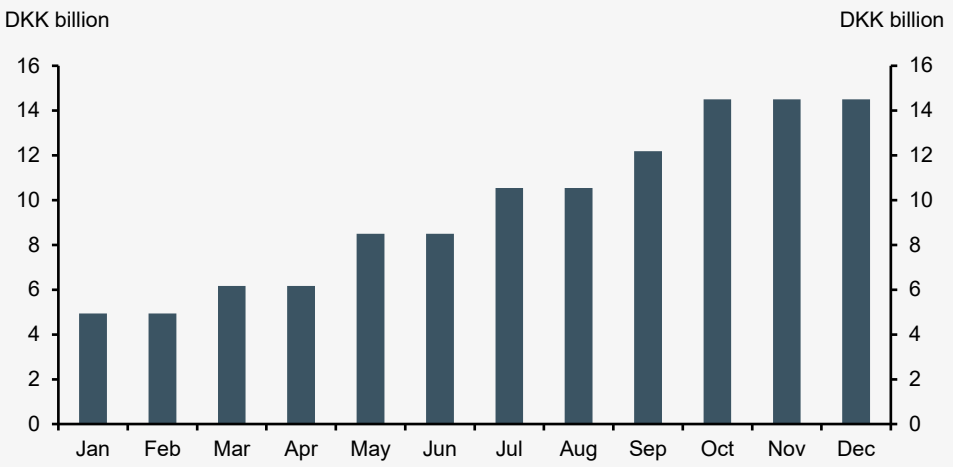


1. Introduction

To support the transition to a sustainable economy and the development of green capital markets dedicated to financing this transition, the Kingdom of Denmark decided to start issuing sovereign green bonds in 2022.

The inaugural issuance of green bonds took place on 19 January 2022. The opening was a great success with a total bid of DKK 23.5 billion, which was the highest bid amount at an opening auction for Danish government bonds in more than ten years. As planned, DKK 5 billion were sold at the opening auction and a total of DKK 14.5 billion at market value has been issued in 2022, *see figure 1.1*.

Figure 1.1
Proceeds from sale of green bonds in 2022, DKK billion



Source: Danmarks Nationalbank.

As documented by the allocation report published in March 2023, DKK 11.3 billion of the issuance have gone to finance eligible green expenditures from 2021[1]. The remaining DKK 3.2 billion will be allocated to eligible expenditures from 2022.

With its Green Bond Framework, the Kingdom of Denmark committed to publish an annual Impact Report explaining the positive environmental impact of the eligible expenditures. The present report refers to the financed eligible expenditures from 2021.

[1] The Allocation Report, the Green Bond Framework and the eligible green expenditures for 2021 and 2022 can be found here: https://fm.dk/arbejdsomraader/groenne-statsobligationer/

The headline targets of the Danish climate strategy and the state of play of their implementation are summarized below. In addition, the overall green bond governance setup and the process for selection of eligible expenditures are recapped. The full description of these can be found in the green bond framework. The rest and main part of the report adds detail to the financed green expenditures and to the estimates of their environmental impact.

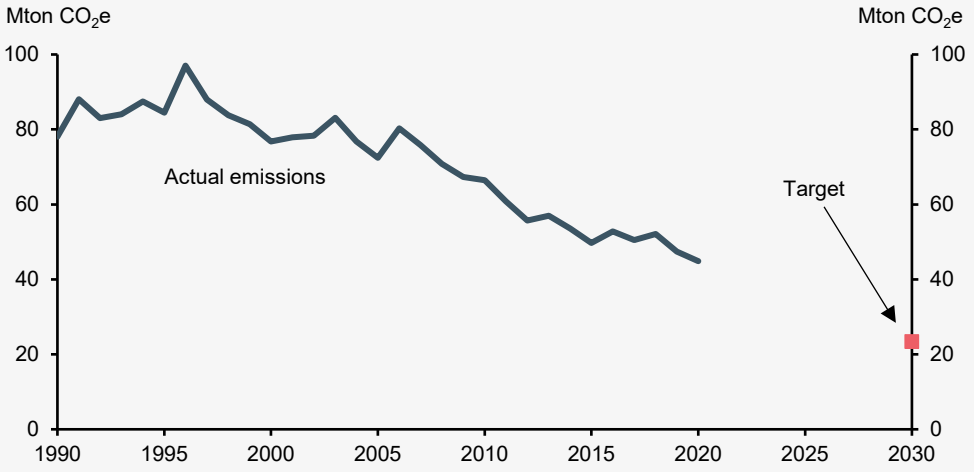
Denmark's climate strategy

Denmark has substantial green ambitions and strives to be a frontrunner, when it comes to mitigating climate change and implementing the necessary transition of our society. At the centre of the green ambitions is the Climate Act of 2019, according to which Denmark must reduce its greenhouse gas emissions by 70 per cent by 2030 compared to 1990 levels. In addition, the Climate Act also commits Denmark to achieve climate neutrality by 2050 at the latest, considering the Paris Agreement target of limiting the global temperature rise to 1.5 degrees Celsius.

In its coalition agreement, the new government in place since 15 December 2022 commits itself to maintain the ambitious existing climate targets and, on some points, to make them even more ambitious. Most notably the new government wants to advance the target date for climate neutrality from 2050 to 2045 and set a negative emission goal in 2050 by reducing emissions by 110 pct. compared to 1990.

Yearly greenhouse gas emissions have already decreased significantly since 1990, from around 78 Mton CO_2 equivalents to around 45 Mton in 2020, or by around 43 percent, *see figure 1.2*. The 70 percent reduction target for 2030 corresponds to about 23 Mton of CO_2e emissions.

Figure 1.2
Total net CO_2e emissions, Mton, actual 1990-2020 and 2030-target



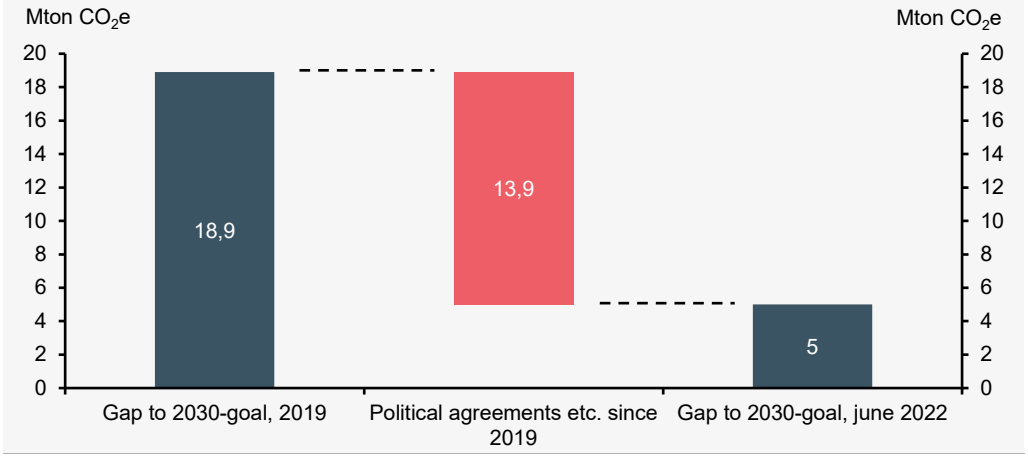
Note: The target of around 23 Mton CO_2e in 2030 constitutes a 70 percent reduction in CO_2e emissions compared to the level of emissions in 1990.
Source: Danish Energy Agency's Climate Projection 2022.

Since 2019 and the passing of the Climate law significant political agreements have been reached with the goal of achieving the climate targets, generally with a broad backing in the Danish Parliament. For example, in 2022 a green tax reform that notably introduces a tax on firm's CO_2 emissions was agreed.

In addition, and recognising that all sectors must contribute to the transition of the economy, agreements on climate initiatives in all major emission sectors have been made. As part of the agreements, revisits are planned for the sectors to ensure implementation, take account of technological developments and evaluate the need for new initiatives. Among the sectors covered are the energy and utilities sector and the transport sector, which are the focus of the green bond expenditures.

By the latest estimates, Denmark has thus in the past few years almost gone three quarters of the way to achieving the goal of 70 percent reduction in 2030, *see figure 1.3*. The goal is therefore in sight.

Figure 1.3
Almost three quarters of the way to achieving the target of 70 pct. reduction in 2030



Note: 'Gap' indicates the expected emissions in 2030 minus the targeted emissions level (around 23 Mton). By june 2022 the gap has been reduced by almost three quarters since 2019, from almost 19 Mton to around 5 Mton. This primarily reflects the different political agreements etc. since 2019, notably a green tax reform, but also e.g. international developments and adjustments to projections for technical reasons etc.
Source: Danish Energy Agency's Climate Projection 2022, Danish Government's 2030-plan, september 2022.

Governance and green bond expenditures

The proceeds from the sale of the green bonds finance a set of eligible green expenditures, that have been identified, assessed and approved by an Inter-Ministerial Working Group (IMWG)[2]. The IMWG has done this in accordance with the criteria in the green bond framework.

The chosen expenditures can be classified into two categories: Renewable Energy and Clean Transportation. The expenditures in the renewable energy category support the production and development of renewable energy, thereby contributing to climate change mitigation. The expenditures related to clean transportation support sustainable modes of personal and mass public transportation and the development and maintenance of infrastructure required for these.

The eligible green expenditures have been evaluated according to, and to the extent possible, aligned with the criteria in the EU classification system for sustainable economic activities (the "EU Taxonomy"). A detailed taxonomy assessment of the eligible green expenditures can be found on the Ministry of Finance's webpage. Further, it is intended that all the eligible green expenditures adhere to minimum social safeguards.

In this selection and evaluation process, a range of potential expenditures have been excluded from the list of eligible green expenditures. Economic activities not currently covered by the EU Taxonomy have thus been excluded, as have expenditures related to e.g., weapons, gambling, alcohol and tobacco.

Following market standards, the firm Cicero Shades of Green was engaged to provide a second party opinion on the Green Bond Framework. The framework was rated Dark Green and the governance structure was rated as Excellent. Deloitte has audited the allocation report for 2021. The second party opinion and the allocation report can both be found on the Ministry of Finance's webpage.

The Finance Ministry hopes you enjoy reading this first impact report regarding green bonds issued by the Kingdom of Denmark, and welcomes any feedback.

[2] The IMWG consists of the Ministry of Finance, Ministry of Transport, Ministry of Climate, Energy and Utilities, Ministry of Taxation and has The Debt Management Office at Danmarks Nationalbank as observer.

2. Impact Table

Table 2.1 below gives an overview of the impact of the eligible green expenditures incurred in 2021 in accordance with the Kingdom of Denmark's Green Bond Framework. The table presents the impact in terms of avoided CO_2 for each of the expenditures. In addition to the impact metric, *table 2.1* also provides an overview of other relevant result indicators for the expenditures. In section 3 and 4 the methodology used for each of the expenditure types are presented in more detail.

An excel sheet with further details, notably a breakdown of expenditures into the shares allocated to the different programs and categories can be found on the Ministry of Finance's webpage dedicated to green bonds.

Table 2.1 Detailed overview of impact metrics for eligible green expenditures in 2021
All expenditures have the Primary EU Environmental Objective of *Climate Change Mitigation*

Category	Description	Expenditure Category	Impact metric avoided CO_2	Result Indicators	Impact metric other	Amount allocated[1] (million DKK)
	Ministry of Climate, Energy and Utilities					
Renewable Energy	Subsidies for renewable energy (PV systems and other small WE systems)	Renewable energy related subsidies	0.2 Mton	609 MW subsidized production capacity	568 GWh production of renewable energy	155.9
	Disbursements for PSO-subsidies (Off-shore wind)	PSO-subsidies	2.3 Mton	1,696 MW subsidized production capacity	7,191 GWh production of renewable energy	1,253.3
	Disbursements for PSO-subsidies (On-shore wind)	PSO-subsidies	1.2 Mton	1,197 MW subsidized production capacity	3,662 GWh production of renewable energy	531.5
	Subsidies for renewable energy (Household wind systems)	Renewable energy related subsidies	0.01 Mton	19 MW subsidized production capacity	44 GWh production of renewable energy	58.4
	Ministry of Taxation					
	Taxation of electricity (Exemption of PV-cells)	Tax expenditures[2]	0.2 Mton	108,000 PV-systems	450 GWh of production of renewable energy	273.0
Clean Transportation	**Ministry of Transport**					
	Rail infrastructure – replacing the railway signalling system and other rail infrastructure investment projects	Railroad investment projects, renovation and maintenance	0.2[3] Mton	1,998 km railway track maintained 27 km electrified railway track added		5,232.4
	Ministry of Taxation					
	Registration tax (Tax expenditure for zero- and low-emission vehicles' reduced registration tax))	Tax expenditures[2]	1.4 Mton	65,000 newly registered cars in 2021		3,801.4
	In total:					**11,305.9**

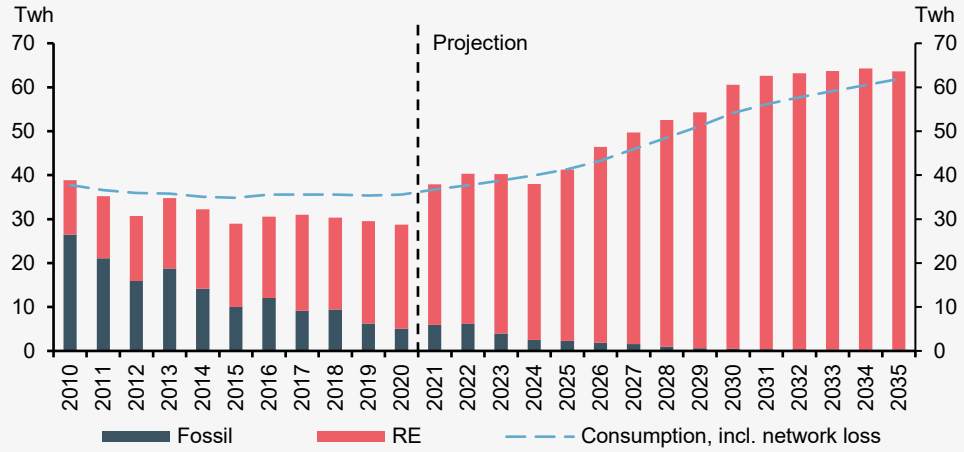
Note: All expenditures are in million DKK.
1) For more descriptions on the allocation of bond proceeds, see the Kingdom of Denmark Allocation Report, published in March 2023.
2) The two tax expenditures are calculated separately from the Budget Act and the Governments Annual Financial Report and are based on estimates from the Ministry of Taxation.
3) The estimate of the impact has been revised in accordance with the updated method described section 4.1 in the Green Bond Impact Report 2022 (link)
Source: Danish Ministry of Finance.

3. Renewable energy

Denmark is transforming its energy infrastructure to further increase the production of renewable energy, thereby contributing to climate change mitigation. The Green Bond Framework includes three subsidy schemes and one tax exemption scheme to incentivize this transformation, notably by providing long-term economic security for operators of renewable energy generation plants.

As a result of past decisions, renewable energy today already constitutes a very high share of Danish electricity production and consumption. In 2020 electricity production by renewable energies constituted around 65 percent of electricity consumption, and this share is expected to increase rapidly in the coming years, *see figure 3.1.*

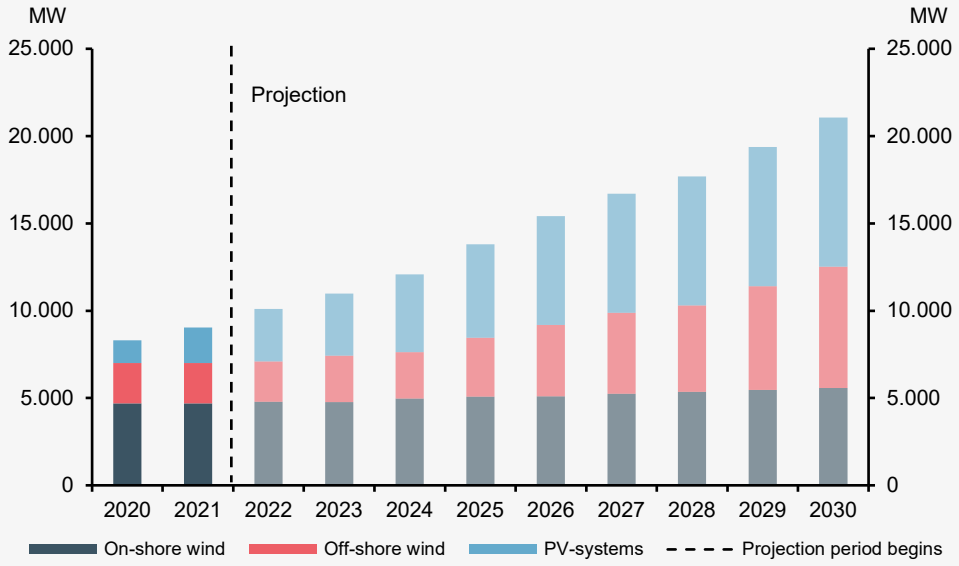
Figure 3.1
Danish electricity production and consumption incl. network loss, Twh



Note: RE-production was around 65 percent of electricity consumption in 2020, and is expected to be of around 94 percent of both electricity consumption and production in 2025.
Source: Danish Energy Agency's Climate Projection 2022.

In terms of capacity, PV, on-shore wind and off-shore wind represented 2.0 GW, 4.7 GW and 2.3 GW respectively in Denmark in 2021. A broad majority of the Danish parliament has in recent years agreed to expand the production of renewable energy towards 2030. Production capacity is expected to increase from 9 GW in 2021 to 21 GW by 2030. The main drivers for these ambitious projections are the expected increase in capacity from off-shore and on-shore wind systems and solar (photo-voltaic/PV) energy, *see figure 3.2.*

Figure 3.2
Projection of sustainable energy capacity, by production technology



Note: 2020 and 2021 are actual data, 2022 and onwards are projections. The basis for projections in the Climate Projection 2022 ended Q1 of 2022, but since then further renewable production capacity has been agreed upon in parliament. Consequently, next year's Climate Projection (Danish Energy Agency's Climate Projection 2023) will contain higher projected amounts of renewable production capacity.
Source: Danish Energy Agency's Climate Projection 2022.

3.1 Subsidies for renewable energy (PV systems, household wind systems and other WE systems) and PSO-subsidies for wind power (on- and off-shore)

Subsidies have played an important role in the development of renewable energy production
The very high share of renewable electricity in Denmark can, to a great extent, be attributed to the subsidies for producers of renewable electricity introduced in 1992. The aim was to increase the competitiveness of renewable energy sources compared to fossil fuel-based sources, and thereby to promote renewable energy production.

The subsidies for renewable energy were transformed to a tariff programme for utility bills, more precisely the PSO-tariff (Public Service Obligation). Utility users would pay a PSO-tariff, based on their power consumption, which was used to finance renewable energy subsidies (wind, solar, biomass, biogas), as well as R&D for environmentally friendly energy technologies and subsidies for decentralized cogeneration (small-scale combined heat and power (CHP)).

In 2016, the Danish parliament (Folketinget) decided to gradually phase out the PSO as a tariff on the consumer's bill. Therefore, subsidies were partly financed by the PSO-tariff and partly financed by the state budget from 2017-2021, with

the share of the state budget increasing gradually. By 2022, the tariff has been fully phased out, and the subsidies for renewable energy are financed entirely from the state budget.

According to the Danish Climate Council (Klimarådet), the subsidy has been a key driver of the green transition, and the large share of renewable energy in Denmark.

Renewable energy subsidies in the Green Bond Framework
The Green Bond Framework only includes wind and solar energy related subsidies. However, subsidies are also given to other types of renewable energy. The share of installed capacity that has been subsidized, and thus provides the basis for the impact metric, is listed in *table 2.1*.

The three renewable energy subsidies are estimated to have mitigated climate change by avoiding 3.5-3.7 Mton of CO_2e emissions in 2021, by producing fossil free energy.

There is some overlap in the impact estimate, as some smaller non-commercial PV systems can in principle both receive direct subsidies and the tax exemption for own consumption described below. 3.5 Mton is thus a lower bound estimate.

Avoided CO_2e emissions are calculated on basis of the expected production from the included subsidized electricity production as reported in *table 2.1*. The applied emission factor is derived from a combined build margin and operating margin for the Nordic energy market, as suggested by the Nordic Public Sector Issuers (NPSI) in 2020[3]. The baseline emission factor for electricity suggested by NPSI is 315 g CO_2/kWh.

Due to the surge of energy prices in 2021, the allocated subsidies diminished significantly and only accounted for approximately DKK 2.0 billion in 2021.

As technology has evolved, production costs have fallen, and as learning has taken place on the regulatory and planning side, renewable energy is increasingly being generated under market conditions, without the need for subsidies. In fact, most of the newly installed wind- and solar energy capacity in Denmark is not subsidized. The total amount paid out in wind- and solar related subsidies is therefore generally expected to decrease in the coming years.

The gradual phasing out of subsidies for renewable energy technologies that can function under market conditions contributes to an efficient energy system and frees up resources for other uses, notably to promote the green transition.

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[3] https://www.kuntarahoitus.fi/app/uploads/sites/2/2020/02/NPSI_Position_paper_2020_final.pdf

An energy system well equipped to face geopolitical and climate risks

The military conflict in Ukraine and the resulting reduction of energy supply from Russia has underlined the strong connections between energy and security policy, and further improved the case for increasing renewable energy production and making Europe independent from Russian gas.

The conflict has increased the risk of oil and gas shortages in the short term. Due to its extensive energy infrastructure from sources such as bioenergy, wind and district heating, Denmark is relatively well prepared to accommodate possible shortages. For example, district heating is the main heating form for more than fifty percent of residential buildings, *see figure 3.3*. The electricity- and district heating sector functions largely on renewable energy sources, as witnessed by its very low CO_2e emissions, *see figure 3.4*.

Figure 3.3
Main heating form of residential buildings, 2020

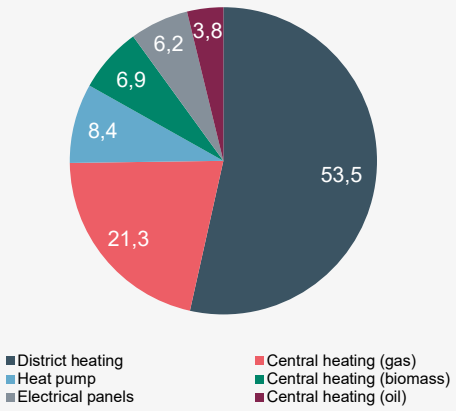
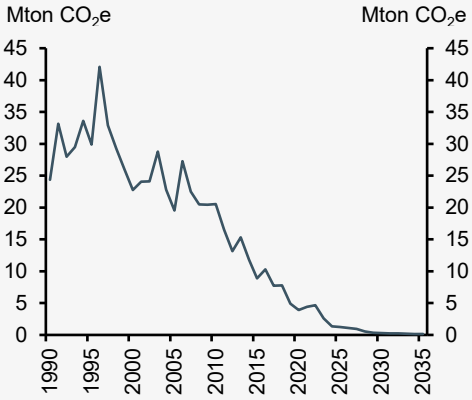


Figure 3.4
CO_2e emissions from the electricity- and district heating sector



Note: Left: Primary heating form of residential buildings. Right: 2021-2035 are projections.
Source: Danish Energy Agency's Climate Projection 2022.

Another risk is climate change leading to more extreme weather, e.g. stronger wind and changing precipitation (hail/ice/snow). The Danish energy sector and infrastructure is generally considered well equipped for such changing climatic conditions, even though there may be a need to secure some facilities even further.

The consequences of more extreme weather are generally assessed to be limited for PV-panels and wind turbines in Denmark. Specifically, the wind turbines are already secured against high wind speeds. In case of storm and high wind speeds, the wind turbines are designed to shut down, and electricity production ceases. More extreme weather with stronger wind may lead to the need to secure some facilities even further. The vulnerable power supply network is largely made up of underground cables, that are mostly unaffected by more extreme weather.

Important efforts to ensure that renewables do not significantly harm other environmental goals
Denmark makes important efforts to ensure that renewable power installations etc. do not significantly harm other environmental goals. For example, all Danish wind farms require an Environmental Impact Assessment (EIA).[4] During the tendering process of a wind farm in Denmark, an exhaustive EIA of the designated area, the export cable route, and the grid connection is completed by the Danish Transmission System Operator (TSO), Energinet, and fully consented before the bidding date.[5]

In terms of recycling, wind turbines are generally highly recyclable and easy to dismantle, with exception of the blades. There are unfortunately still only limited recycling and refurbishing options for the composite materials that make up a large part of the wind turbine blades. The blades are therefore either incinerated, co-incinerated in a cement kiln, or more likely buried in landfills.

The European wind turbine industry is committed to end the landfilling of wind turbine blades and to reuse, recycle, or incinerate all the blades from 2030. The industry is currently developing and commercializing technologies to make wind turbine blades recyclable in the future, which will make wind power an even more attractive source of green energy.

The underlying conditions for recycling PV installations are good, as these generally use equipment and components that are recyclable. About 56 percent of waste from electrical and electronic equipment (WEEE) was separately collected in Denmark in 2019, and the WEEE Directive[6] requires that a minimum of 80 percent of separately collected waste from PV panels shall be prepared for re-use and be recycled. In general, Denmark is still a relatively new market for PV installations, and end-of-life panels and the corresponding PV waste is therefore still very limited.[7]

[4] And the EU EIA-directive (Directive 2014/52/EU) is implemented in Denmark.
[5] https://ens.dk/sites/ens.dk/files/Globalcooperation/Short_materials/environmental_impacts_of_offshore_wind_farms.pdf
[6] Waste from Electric and Electronic Equipment 2019/290/EU
[7] https://mim.dk/media/223007/handlingsplan-for-cirkulaer-oekonomi.pdf

3.2 Taxation of electricity (Exemption for own consumption of electricity from solar energy)

Danish solar energy capacity is expected to increase significantly in the coming years, from about 2.0 GW in 2021, to 8.5 GW in 2030, as can be seen in *figure 3.2*. While much of this increase in capacity is expected to come from commercial solar parks installed in fields etc., the capacity from solar panels on rooftops is also expected to increase significantly, from about 0.8 GW to 1.4 GW in 2030.

To promote the acquisition of solar panels and use of renewable energy sources, typically smaller non-commercial solar panel installations (typically on rooftops etc.) receive public support, as electricity consumed by the owner of solar panels (who can be households, firms, municipalities etc.) is exempt from taxation. This is one amongst other benefits of self-consumption from solar panels.

The Ministry of Taxation estimates and reports on the tax expenditure based on estimates using data regarding the capacity of privately owned solar panels from the Danish Energy Agency, as the self-consumed production is not registered.

There are different owner categories of solar panels and for each, the Danish Energy Agency have standard assumptions about production and the share of self-consumed production along with assumptions about source of heating in the related building. The assumptions regarding the source of heating rely on estimates from 2014, and thus the resulting estimate is uncertain.

Based on these assumptions, it is estimated that in 2021, self-consumed production from solar panels was approximately 450 GWh distributed on 108,000 PV systems. The production and number of solar cells is expected to increase towards 2030, where self-consumed production is expected to be approximately 600 GWh.

The level of the tax expenditure is estimated using the relevant levels of taxation for electricity, electricity used for heating and electricity tax on businesses. The electricity tax as of 2021 is 0.9 DKK per kWh, albeit it has been politically agreed to reduce the tax over the coming years. In 2021, the heating tax was set at 0.008 DKK per kWh, and the electricity tax on businesses was 0.004 DKK per kWh.

Of the estimated DKK 273 million in tax exemption for 2021, the electricity tax contributed with close to 100 per cent, while the heating tax contributed minimally, and the electricity tax on businesses even less.

The estimates are quite uncertain, as the produced GWh cannot be fully attributed to the subsidy as it is to be expected that some individuals would install solar energy without the exemption. This is not accounted for in the estimates. In addition, there is some overlap in the impact estimate, as some smaller non-commercial PV systems can in principle both receive direct subsidies and the tax exemption for own consumption.


5.273-2
5.273-1

4. Clean Transportation

Making the Danish transportation network more sustainable is a key objective as this sector is central in the green transition and the main source of eligible green expenditures in the Kingdom of Denmark's Green Bond Framework. The framework includes operating and capital expenditures for the rail network infrastructure and a tax expenditure to incentivize consumers to buy zero- and low-emission vehicles.

4.1 Developing and managing the Danish railways

The Kingdom of Denmark's railway infrastructure manager Banedanmark is building new attractive railway networks for modern and climate-friendly electric trains, while simultaneously maintaining and renewing the existing infrastructure.

Maintaining a green mode of transport

Even today, with a combination of electrified trains and diesel trains in operation, the Danish railway system is far more climate friendly than the average Danish fleet of cars and trucks. Maintaining and improving the railway network will improve the performance and attractiveness of this mode of transportation as well as the operation of it, and is a precondition for avoiding a significant increase in CO_2-emissions from road traffic.

Of all railway renewal and maintenance costs included in the Green Bond Framework, approximately 70 per cent are estimated to benefit railway lines that will be electrified before 2030, while 30 per cent of costs are estimated to benefit lines that will be operated by battery trains by 2030.

Investing in full electrification by 2030

By 2030, less than 10 years from today, 100 per cent of the Danish state's railway trackside infrastructure and associated subsystems are planned (and financed) to be either electrified or readied for battery train operation, with electrified line tracks taking up approximately 80 per cent of the state network length, and battery-operated line tracks taking up the remaining 20 per cent.

Benefits from electrification include:

1. Reduced CO_2 emissions and particle pollution
2. Reduced travel time, as electric trains can travel at higher speeds (160-250 km/h) and accelerate and brake faster
3. Reduced operation and maintenance costs, thereby improving the business-case of investing in green transportation
4. Increased stability of the overall train service operations, thereby improving the performance and attractiveness of this mode of transportation

Investing in full implementation of digital signals by 2030
The targets of the European Green Deal require a significant increase in rail transport capacity, both for cargo and passenger, which cannot be obtained without a large-scale acceleration of the roll-out of the European Rail Traffic Management System (ERTMS) throughout the European Union. Denmark is the first European country replacing existing signalling systems on the entire railway network. The new signalling system, which is planned for full implementation in 2030, ten years before the official EU deadline, will provide a digital foundation for better centralized traffic control, energy optimization, and real-time passenger information.

Benefits from a digital signalling system include:
1. Higher speeds and much fewer delays
2. Improved headway (i.e., shorter distance between trains measured in time)
3. Improved energy optimisation
4. The creation of a digital European railway area that is better at competing with other modes of transport

The digital signalling system thus improves the attractiveness of railway transport for cargo and passenger transport. The investments in the system also pave the way for other EU-countries and the transition to more sustainable modes of transportation in the EU.

Mitigating climate change and transitioning to a circular economy
Banedanmark is working in accordance with the Climate Act's goal of a climate-neutral society by 2050 and a green transformation of the transport sector. Specifically, the national Climate Act commits Denmark to a 70 per cent reduction in CO_2 emissions in 2030, compared to 1990. Within this framework, Banedanmark will reduce its own CO_2 emissions by 20-30 per cent by 2030, compared to 2019. This reduction will be possible with measures within energy efficiency; materials optimization, selection, and substitution; waste management and recycling. Finally, Banedanmark performs systematic screenings of all procurement with respect to its environmental impact. These initiatives carried out by Banedanmark ensures, that expenditures in the Green Bond Framework are used as sustainably as possible.

The Green Taxonomy's circular economy criteria states that at least 70 per cent of the non-hazardous construction and demolition waste must be prepared for reuse, recycling, or other material recovery. Banedanmark, however, recycles more than 99 per cent of its total waste volumes[8]. Banedanmark uses techniques within optimization, selection, and substitution of materials; resale of surplus goods; waste

[8] In 2021, 99.5 per cent was recycled, 0.1 per cent was incinerated, and 0.4 per cent ended in landfills.

management, handling of hazardous substances and high-quality recycling by selective removal of materials, using available sorting systems to achieve these results.

Impact of railway expenditures
The impact of investing in railways is two-fold: On the one hand, investment in the upkeep of the greenest form of transport and on the other hand, investment in making it even greener by reducing CO_2-emissions.

CO_2-reductions primarily stems from the continued electrification of the railway-services in Denmark. This is due to the fact that electrification of railways leads to them being used by electric trains instead of diesel-driven trains. Thus, it must be underlined that the reduction in CO_2-emissions comes from the transition from diesel-driven trains to electric trains. The body responsible for the trains is not a state institution, and is therefore not included in the Danish Green Bond Framework. Only expenditures related to the electrification, investments and maintenance in the railways are included. The investments are thus, as described above, a determining factor for the CO_2-emissions, but not the triggering factor. The CO_2-emissions caused by a transition into electric trains are described below.

Table 4.1 summarizes the estimated contribution of the 2021 railway expenditures in the green bond program on some selected impact metrics. The expenditures have contributed among other things to the renovation, maintenance and development of almost 2,000 km of railways and to the electrification of 730 km of railways.

Table 4.1 – Clean Transportation Impact Metrics
2021

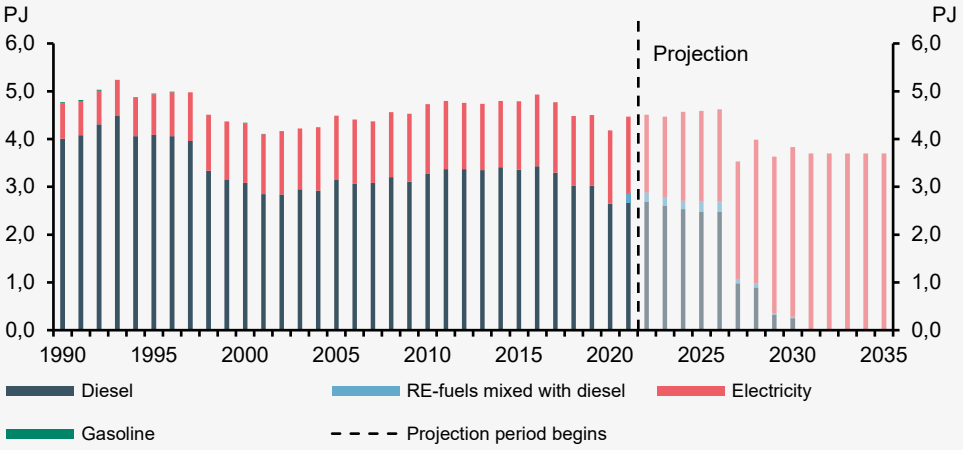
	Kilometres of railway track	Amount allocated
Expenditure		
Renovation, maintenance, and development (rail infrastructure investment projects; rail infrastructure renovation and maintenance; and rail infrastructure operation)	1 998 km	4,391.5 million DKK
Electrification of the rail infrastructure (rail infrastructure investment projects)	803 km*	840.9 million DKK

Note.: Electrification amounting to 840.9 million DKK concerns the lines Køge Nord-Næstved, Aarhus-Lindholm, Fredericia-Aarhus, and Roskilde-Kalundborg as well as a more general modernization of the catenary system. For more descriptions on the allocation of bond proceeds, check out the Kingdom of Denmark Allocation Report for 2021.
* Total length of electrified railway track under Banedanmark primo 2022. Up from 776 km primo 2021.
Source: Danmarks Statistik, table Bane41, Banedanmark årsrapport 2021, Statsregnskab 2021.

Energy consumption

Even as the amount of transport by rail increases in years to come, the associated energy consumption is expected to decrease, due to electrification. *Figure 4.1* shows energy consumption by fuel source from 1990-2035. In 2030, 93 per cent of the energy consumption is expected to come from electricity, and after 2030 it will reach 100 per cent, as the use of diesel trains is being phased out.

Figure 4.1
Rail transport's energy consumption by fuel source, PJ

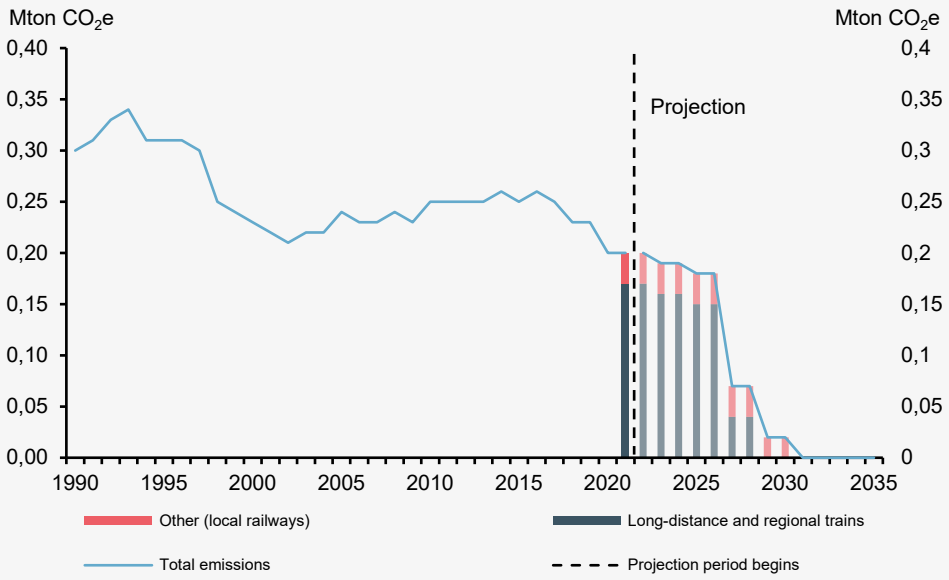


Note: The numbers from 2021 and onwards are projections.
Source: Danish Energy Agency's Climate Projection 2022.

Emissions

Figure 4.2 shows rail transport's total emissions from 1990-2035. From 2021 onwards, the emissions are divided into those attributed to long-distance/regional service (red) or local service (purple).

Figure 4.2
Emissions from rail transport sorted by train types (2021-2035)



Note: The numbers from 2021 and onwards are projections.
Source: Danish Energy Agency's Climate Projection 2022.

The total emissions from rail transport were 0.23 million tonnes of CO_2 in 2019, corresponding to approx. 2 percent of the transport sector's emissions in 2020 and 2021 (during covid-19 the emissions decreased further to 0.2 million tonnes of CO_2, which also outlines the scarce potential for CO_2-emissioins in the rail-transportation). In 2030, the emissions from the railway are expected to be just 0.02 million tonnes of CO_2, and in 2035 there will be no emissions at all.

The above assessment of the potential CO_2 reduction is consistent with the observed reduction in emissions in previous years. E.g., since 2016, DSB (the largest railway operator on the Danish network) has had an annual reduction from diesel train operation of 54,000 tonnes of CO_2.

4.2 Registration tax (Reduced registration tax for zero- and low-emission vehicles)

Zero- and low-emission vehicles receive a tax advantage in the registration tax compared to conventional vehicles. The tax advantage incentivizes consumers to purchase zero- and low-emission vehicles instead of conventional vehicles.

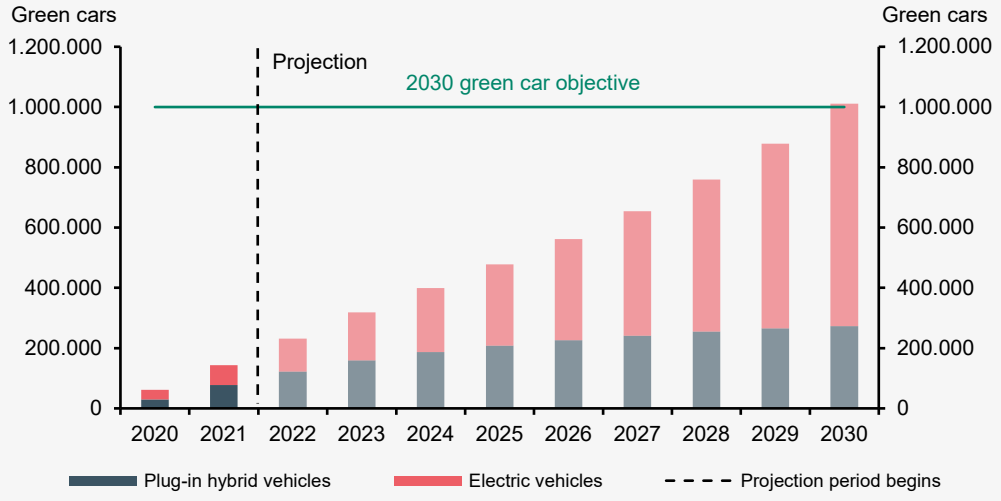
Box 4.1
Definition of green cars (zero- and low-emission vehicles)
Electric cars emit 0 grams CO_2 pr. km driven. Thus, they are classified as zero-emission vehicles. Plug-in hybrid vehicles are cars that fuel on electricity as well as either gasoline or diesel. Plug-in hybrid vehicles can be charged using an electric cable as opposed to regular hybrid cars. With the political agreement on the green transition of road transportation from December 2020 (Aftale om grøn omstilling af vejtransport),) low-emission cars are defined as cars with a maximum emission of 50 gram CO_2 pr. km driven. This definition is also used by the EU Clean Vehicle Directive (EU/2019/1161) and in the EU Taxonomy.

Source: Skatteøkonomisk Redegørelse, 2021.

Kick-starting the green transformation of car ownership
With the political agreement on the green transition of road transport (Aftale om grøn omstilling af vejtransporten) from December 2020, the Danish government put forward an ambition to reach 1,000,000 zero- and low-emission cars on the roads by 2030. An important initiative to reach this target is the reduced registration tax for zero- and low-emission cars. The sale of 65,000 zero- and low-emission passenger cars in 2021 was a record high, and corresponded to 35 percent of the total sale of new passenger cars in that year.

In the latest climate projection (Klimafremskrivning) from 2022, the Danish Energy Agency estimates that by 2030 there will be 740,000 electric and 270,000 plug-in hybrid passenger cars on the Danish roads, corresponding to a share of 31 percent of the total passenger car stock, *see figure 4.3*. Thus, the ambitious target of 1,000,000 zero- and low-emission cars by 2030 is within reach.

Figure 4.3
Projection of electric and plug-in hybrid cars in the danish car stock



Note: The horizontal line displays the Danish Governments' goal for zero- and low-emission cars by 2030. Numbers for 2020 and 2021 are actual numbers, from 2022 and onwards they are projections.
Source: Danish Energy Agency's Climate Projection 2022.

Measuring the climate impact
It should be noted that the sale of zero- and low-emission vehicles cannot be fully attributed to the tax advantages. However, it is estimated that without the tax advantages the sale of these vehicles in 2021 would have been close to zero.

The sale of zero- and low-emission vehicles contributes to reduce the CO_2-emissions from the road transport sector to the extent that it represses the sale of conventional vehicles. Based on the Ministry of Taxation's so-called *car-model* that models the changes in the sale of cars based on changes in the taxation of cars, the expected reduction in CO_2 attributed to the tax advantages is estimated at 1.4 million ton CO_2.

The expected reduction in CO_2 is calculated as the accumulated effect over the life expectancy of 15 years of the sold zero- and low-emission vehicles in 2021. The calculations are made based on data for the actual sales of vehicles in 2021, including data on CO_2-emissions of conventional vehicles. It is then assumed that the sale of zero- and low-emission cars replaces the sale of conventional vehicles with an expected CO_2-emissions equivalent to the average CO_2-emissions of similar sold conventional vehicles in 2021. Further, it is assumed that low-emission vehicles drive 50 percent of the time on electricity and 50 percent of the time on gasoline.

The IMWG is aware that other Danish issuers of green bonds include tax advantages on zero- and low-emission vehicles to limited degrees in their program. It is not possible for the IMWG to distinguish potential double counting of possible impact metrics. The potential overlap is deemed to be extremely limited.

Preventing significant harm from vehicles on other environmental goals
In Denmark, it is a requirement that end-of-life vehicles must be handled by approved auto scrapers. However, it is estimated that the illegal market for car scrapping (including illegal exports etc.) accounts for 20-25 per cent of all scraps in Denmark. Measures are however in place to ensure that end-of-life vehicles are handled by approved auto scrapers. These include a scrapping allowance scheme, where car owners can receive a scrapping allowance, when the scrapped car is handed over to an approved and registered car wrecker.

The reduced registration tax for low-emission and zero-emission vehicles could in theory lead to an increased number of vehicles instead of more efficient use of a reduced number of vehicles.

The Ministry of Environment in Denmark does not possess data on the reusability, recyclability or recoverability of the subsidised vehicles specifically. However, due to the weight and slightly lower recyclability of batteries, it is likely that these vehicles will be slightly less recyclable than other vehicles. It is likely that the subsidised vehicles will have the same level of recoverability as other vehicles.

A range of European regulations and directives relevant to preventing and controlling vehicle pollution are applicable and implemented in Denmark. Further details on this aspect can be found in the detailed taxonomy assessment of the eligible green expenditures on the Ministry of Finance's webpage.

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