Global Report 2022

Danish Energy Agency

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Published April 2022 by:
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Design and production: The Danish Energy Agency

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Summary

Global Report 2022 (GR22) is an assessment of how Danish consumers, businesses and authorities affect emissions of greenhouse gases outside Denmark in different ways. Climate change is a global challenge, and this report contributes an important examination of Denmark's role in global climate action. The findings in the report will support Denmark's future climate action.

The report measures the Danish consumption-based climate footprint and emissions embedded in Denmark's total imports and exports. With regard to consumption by households, food and transport in particular give rise to most emissions. The shipping industry plays a large role in total Danish imports and exports. The report also shows Danish exports of green products, which help secure the green transition globally.

Furthermore, the report shows how Danish authorities are helping to reduce greenhouse gas emissions in other countries. In addition to the specific reduction initiatives that have been decided in Denmark within agriculture etc. Denmark contributes globally through strong climate diplomacy, promotion of green investments, and partnerships in which Danish consultancy helps partner countries with the green transition.

Main results

Consumption

GR22 provides an estimate of Denmark's overall consumption-based climate footprint. Furthermore, the report investigates Danish consumption-based emissions from three areas not included in full in the estimate of the consumption-based climate footprint. These are consumption-based emissions from land-use change, biomass and biofuels.

Denmark's consumption-based climate footprint is an estimate of greenhouse gas emissions in both Denmark and abroad linked to Danish consumption. Denmark's consumption-based climate footprint was **63 million tonnes CO_2e in 2020**. This corresponds to **11 tonnes CO_2e per capita**. This is the same level as in 2019. The majority of emissions were abroad. Consumption-based emissions are falling. This is due in particular to the green transition in the Danish energy sector, which also contributed to a halving of the greenhouse gas intensity of Danish consumption in the period 1990 and 2020.

A total of 61% of emissions were from consumption by Danish households and were related to the consumption of transport and food and beverages, in particular. The goods and services consumed are supplied by businesses. Public and private services is the industry group with the largest emissions embedded in the goods and services supplied for Danish consumption. This indicates that Danes are very much consumers of services, for example from hospitals, day-care centres and restaurants.

Land-use change. Forest clearing at global level can be due to expansion of the world's agricultural land area, which is driven by an increased global consumption of land-demanding products. Danish consumption of agricultural products, for example, can thus influence global land use and thereby the amount of carbon absorbed and released from forests and other land.

The size of Danish consumption-based emissions from land-use change depends on the method and scope applied. Thus, Danish consumption-based emissions from *direct* land-use change (dLUC) amounted to **about 1.9 mill. tonnes of CO_2e in 2018**, while emissions from *indirect* land-use change (iLUC) linked to Danish consumption amounted to **about 5.2 mill. tonnes of CO_2e in 2020**. The estimates show that consumption of goods from the food industry in particular contributes to emissions from land-use change.

Biomass. Wood pellets and wood chips dominate consumption of biomass fuels in Denmark. Combustion releases emissions earlier than they would otherwise have been released had the wood been left to rot naturally in the forest, or if it had been used in other wood products, for example. GR22 calculates net emissions from the consumption of wood pellets and wood chips used to produce electricity and district heating in Denmark in 2020. The results are subject to a number of assumptions linked to various uncertainties.

Net emissions include emissions from energy production, process and indirect impacts, and they depend on volumes consumed and the time perspective applied. In 2020, they amounted to **6.9 million tonnes CO_2**, but they fall exponentially after this over time. The quantity of CO_2 in the atmosphere linked specifically to consumption in 2020 will therefore, **after 10 years have *fallen* to 4.0 mill. tonnes CO_2, after 20 years to 2.5 million tonnes CO_2**, and **after 30 years to 1.6 million tonnes CO_2**.

Net emissions are also influenced by the type of biomass used. The amount of additional CO_2 in the atmosphere will fall more rapidly after incineration of small wood residues than after incineration of logs, for example. This is because small wood residues degrade faster than logs and, thus, release CO_2. Furthermore, the calculation of net emissions is influenced by assumptions about what would have happened with the woody biomass if it had not been used to produce energy.

Biofuels are added to petrol and diesel and thus replace fossil fuels. However, there are emissions linked with the production of biofuels. Danish consumption of biofuels increased from 2019 to 2020. The increased use of biofuels is the most important reason that emissions from biofuels have increased to around **306,000 tonnes CO_2e in 2020**. Despite the increase in emissions, the biofuels used in Denmark have gradually become more sustainable in terms of grams of CO_2e/MJ. Consumption of biofuels could be said to lead to emissions from land-use change. However, there is great uncertainty about how to calculate these emissions most accurately.

Imports and exports

Denmark is a small, open economy with considerable international trade. When Denmark imports and exports goods and services, the climate impacts extend beyond Danish borders. The value chain of a product most often goes across borders, and products leave a climate footprint in many countries on their way to being imported or exported by Denmark.

Imports. Denmark imports many goods and services, either for consumption in Denmark or for export onwards for consumption outside Denmark. Total emissions embedded in Danish imports were **97 mill. tonnes CO_2e in 2020**. **40%** of the emissions embedded in Danish imports were linked to consumption in Denmark, while the remaining **60%** of the emissions were linked to goods and services exported onwards from Denmark. The transport sector accounts for many emissions related to Danish imports. This is because the Danish transport fleet is relatively large, and therefore also accounts for a large proportion of Danish imports. Most transport emissions are not part of Danish consumption, but are exported onwards to other countries.

In 2020, most of the climate footprint of Danish imports was in Europe and Asia. China, 'the factory of the world', was the country where Danish imports made the biggest climate footprint.

Exports. Denmark exports many goods and services for consumption abroad. Total emissions embedded in Danish exports were **119 million tonnes CO_2e in 2020**. The Danish transport sector accounts for around one-half of emissions embedded in Danish exports. Shipping accounts for **93%** of emissions from the transport sector. This is because Denmark has a relatively large transport fleet and because shipping-related emissions include emissions throughout the entire value chain for fuels and also emissions from port activities linked to exports.

The majority of emissions from Danish exports were linked to goods and services exported to Europe. The USA and Germany were Denmark's two largest export markets in 2020, and Danish exports of goods and services to these two countries had most associated greenhouse-gas emissions.

However, some Danish exports reduce emissions abroad. In 2021, Denmark exported **green environmental technology worth almost DKK 20 billion and green energy technology worth DKK 65 billion** It has been assessed that Danish exports of green energy technology in 2021 have potential to reduce global emissions by between **119 and 215 million tonnes CO_2 over the lifetime of the technology**. This corresponds to a reduction of between **5 and 8 million tonnes CO_2 per year**.

Focus topics

GR22 focuses on a number of selected topics that are particularly relevant to describing Denmark’s impact on emissions outside Denmark. These topics include international transport, cross-border electricity trade, Danish imports and consumption

of soy, the global climate action of Danish business, and the global effects of Danish political agreements.

International transport (aviation and shipping). The past ten years have seen a steady increase in greenhouse gas emissions associated with air travel to and from Denmark. This increase in emissions reflects an increase in the demand for international air transport. Emissions were at around **6 million tonnes CO_2e** in 2019 but then fell significantly in 2020 to around **2 million tonnes CO_2e** due to the Covid-19 pandemic. The international increase in air transport up to and including 2019 is the result of rising passenger numbers and increased transport (measured as person-kilometres).

International aviation to and from Denmark has become more efficient, manifesting as a reduction in emissions from 2009-19 measured in terms of transport (for passenger transport as passenger-kilometres and for freight transport as tonne-kilometres).

Denmark is the world's sixth largest maritime nation measured in terms of operators, and Danish-operated ships (either owned or chartered by a Danish operator) make up around 4.4% of the world fleet. The Danish fleet helps meet the global demand for freight of goods, and most of the activity by the Danish-operated fleet is therefore not linked to imports and exports of goods to and from Denmark.

There was a significant increase in emissions outside Denmark from Danish-operated ships in the period 1990 to 2007, after which emissions stabilised, and in 2019 emissions were at around **35 million tonnes CO_2e**. The period 2011-2018 saw an uncoupling of emissions from the continued growth in freight volume globally, and this trend also applies to Danish emissions. Danish ships abroad therefore have fairly stable emissions, despite a general growth in freight volumes.

Imports and exports of electricity affect electricity production in countries neighbouring Denmark. Emissions from electricity production in neighbouring countries fall when Denmark exports renewable energy. There is the opposite effect when Denmark imports electricity based on fossil fuels. In the period 2018-2020, Danish net imports of electricity can be said to have contributed to additional emissions abroad, corresponding to **around 0.6 million tonnes CO_2 annually**.

In future, exports of electricity from Denmark will go primarily to Germany, Sweden and Norway. In general, the analysis shows that, when they are receiving electricity from Denmark, recipient countries will primarily be producing electricity from wind, hydro and solar power, whereas in Germany gas and coal power will also be in operation.

Increased electricity exports are also estimated to reduce emissions abroad in 2035. This will apply, even though electricity production outside Denmark is expected to become ever more renewables-based as a result of decommissioning conventional

power plants in Europe, amongst other things. Increased Danish electricity exports will therefore continue to reduce emissions abroad, although the impact will level off.

Imports and consumption of soy. In 2020, Denmark imported around 1.8 million tonnes soy products. Imports of soybean meal comprised **around 93%** of total imports of soy products, corresponding to **around 1.7 million tonnes**. Total emissions from direct land-use change (dLUC) linked to Danish imports of soybean meal in 2020 have been estimated at **3.8-4.3 million tonnes CO_2e**. Because of differences in methodology, the results for soy cannot be compared with the results for consumption-based emissions from land-use change.

The majority of Danish imports of soybean meal are used as pig, dairy cattle and poultry feed in agricultural production. Specifically, **65%** of total Danish imports of soybean meal is used exclusively in pig and dairy production.

In 2020, **around 911,000 tonnes** soybean meal were exported from Denmark embedded in products of animal origin, of which the most part (**68%**) was embedded in exported pig meat.

The global climate action of small and medium-sized enterprises. The majority of businesses in Denmark are small or medium-size enterprises (SMEs). In 2019, SMEs accounted for **63% of value creation** in the private sector. SMEs therefore play an important role in Denmark's green transition.

Many Danish businesses focus on what they can do to enhance their global climate action. However, studies show that SMEs are working less to reduce their total climate footprint, including their global emissions, than large businesses. SMEs that address climate issues, primarily work to limit their emissions from energy consumption.

Several initiatives have been launched to underpin the climate action of SMEs, for example initiatives to encourage more businesses to estimate their total greenhouse gas emissions, including their global emissions.

Global climate action by authorities

Denmark's international efforts to promote the green and sustainability transitions are through the exchange of experience and climate diplomacy initiatives, via bilateral and multilateral cooperation and via the EU. These efforts are in line with the ambitions in the government's long-term strategy for global climate action, A Green and Sustainable World, and the global strategy of the Climate Programme. Below is a review of main GR22 results in this area.

Global climate ambitions. Denmark is working actively through a large number of initiatives to influence countries and non-state players to commit to ambitious climate targets. For example, in 2021 Denmark contributed to the establishment of the EU's first climate law with binding climate targets. Denmark succeeded in putting its mark on the law, including the goal for **the EU to have negative emissions after 2050**. At COP26 in 2021, Denmark also helped **keep 1.5 degrees alive**. In 2021, with the launch of the Beyond Oil and Gas Alliance, Denmark also helped to bolster the global momentum in phasing-out coal and phasing-out oil and gas production.

Global reductions. Denmark is working to ensure that countries that emit the most reduce their emissions, and that developing countries follow sustainable development paths. Through its climate assistance in 2021, Denmark supported, in particular, multilateral initiatives that aimed at **supporting access to and promotion of clean energy**, **empowering developing countries to implement their national climate actions**, and **reducing energy sector emissions**.

In addition to energy cooperation, Danish authority cooperation in 2021 also contributed to reducing global emissions through sharing Danish experience with **sustainable water resources management, waste management** and **efficient and sustainable food systems**.

Global climate change adaptation action. Denmark is working to inspire and encourage climate resilience and adaptation to climate change initiatives globally through bilateral and multilateral channels. In 2021, Denmark supported, in particular, initiatives that support **increased resilience** to climate change among the most vulnerable population groups, initiatives that promote **access to clean water**, and initiatives that **incorporate climate, environment and biodiversity**.

Climate assistance, climate finance and investment. In 2020, Danish climate assistance amounted to a little over **DKK 2 billion**, of which **56% went to climate change adaptation efforts** and **44% to reduction efforts**. Furthermore, **DKK 378 million** provided as climate assistance through global instruments in 2020 can be attributed to Denmark. At the same time, Denmark has mobilised around **DKK 1.3 billion** in climate finance for developing countries through IFU (Investment Fund for Developing Countries), and around **DKK 3.5 billion** through multilateral development banks.

The Danish state is a co-owner of a number of financial institutions, including EKF (Denmark's Export Credit Agency), and IFU (Investment Fund for Developing Countries), which provide finance for projects throughout the world. **67%** of EKF's total investments in the period 2017-2021 went into renewable energy, while investments in fossil fuels accounted for less than **1%**. Furthermore, **21%** of IFU's total investments in 2020 went into renewable energy. In 2020, the climate footprint from IFU's total investment portfolio was just under **740,000 tonnes CO_2e**.

Cooperation with businesses on green solutions. Denmark works to include the Danish business sector in Denmark's global climate action. In 2021, Denmark established an **export scheme in the water area**. The purpose of the scheme is to underpin exports of green solutions in the water area. Furthermore, Denmark worked to promote the **EU Taxonomy Regulation**, the aim of which is to make it easier for businesses to make sustainable investments.

Political agreements with global impacts. Many political agreements with a primary goal of reducing emissions in Denmark also have global impacts. In 2021, as many as **24 energy- and climate-policy agreements** were adopted in Denmark. It is assessed that **12** of these could have a climate impact outside Danish borders.

1 Focus and approach

1.1 Denmark's global climate footprint

Denmark’s annual global impact reporting has its legal basis in the Danish Climate Act. The reports provide a picture of global climate impacts and climate action that Danish consumers, businesses and authorities can influence in different ways.

The purpose of drawing up annual global impact reports is to illustrate Denmark's negative as well as positive global impacts on the climate, see box 1 and annex 1.

Box 1: **Purpose of global impact reporting (the Danish Climate Act June 2020)**

The purpose of drawing up global impact reports is to make visible Denmark's global impacts on the climate. The reports include negative impacts, for example from Danish consumption, but also positive impacts, for example from Denmark's bilateral cooperation with other countries to help these countries convert their energy sector, among other things.

Denmark's global impact reports are published as a supplement to Denmark’s Climate Status and Outlook reports, which only look at Danish territorial greenhouse gas emissions, see boxes 2 and 3 below.

Box 2: **Denmark's Climate Status and Outlook**

Denmark's Climate Status and Outlook reports provide an annual status report on and projections of CO_2e emissions from Danish territory based on policies already adopted. The reports are prepared on the basis of the UN IPCC methodological principles, which are applied across countries, the EU and the rest of the world to assess progress with regard to internationally agreed targets. Similarly, the reports compare Denmark's 70% emission reduction target by 2030 to greenhouse gas emissions from Danish territory estimated in accordance with the UN IPCC methodological principles. Source: (ENSb, 2021).

Box 3: **UN requirements for greenhouse gas emissions estimates**

The international methodologies for estimating greenhouse gas emissions are based on guidelines from the UN Intergovernmental Panel on Climate Change (UN IPCC) (IPCC, IPCC 2006 Guidelines, 2022). Countries that are parties to the UN Framework Convention on Climate Change (UNFCCC) must estimate and report their greenhouse gas emissions according to the IPCC guidelines to ensure comparability across countries. The principles for estimating national emissions include estimating emissions on the basis of a territorial principle requiring emissions to be accounted for in the country where they occur. This also applies to land use, which means that feeling trees must be accounted for as CO_2e emissions in the country of origin, even though the resulting biomass may be exported and used for energy purposes in another country.

Denmark's annual global impact reports and Climate Status and Outlook reports, which are published each year in April, form part of the annual cycle described in the Danish Climate Act. The purpose of the annual cycle in the Climate Act is to ensure annual follow-up on whether Danish climate action is supporting fulfilment of the targets in the Climate Act.

1.2 The structure of GR22

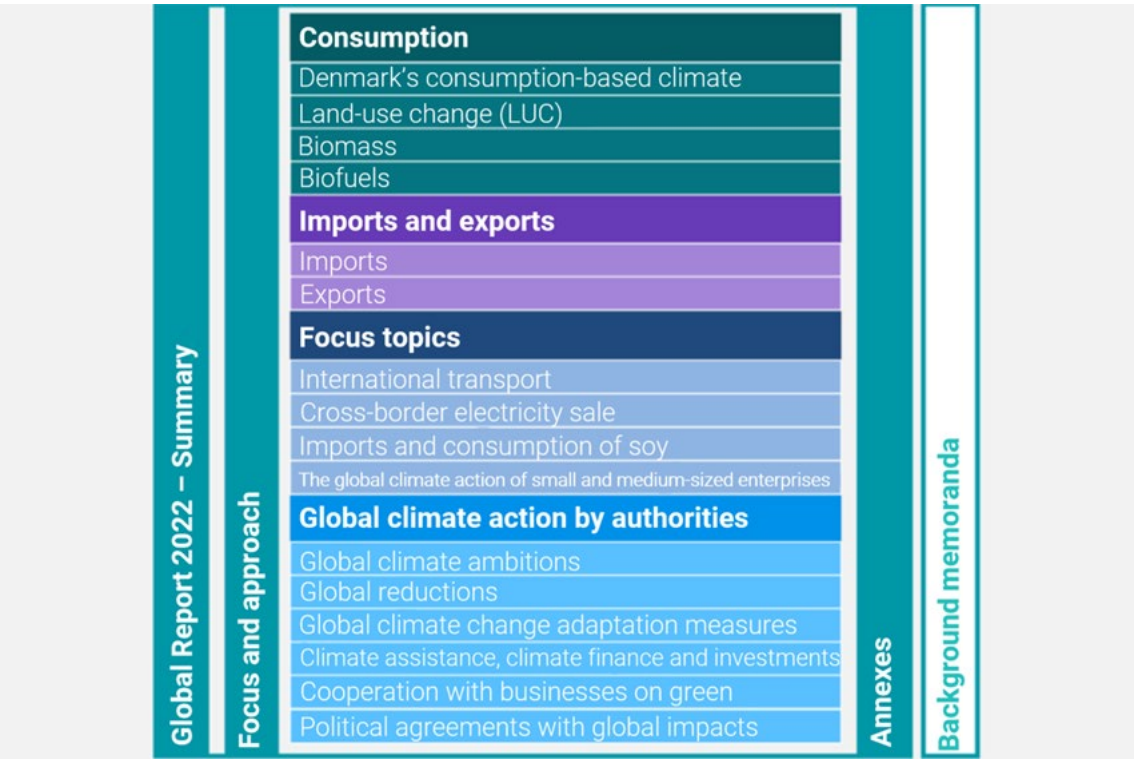
GR22 comprises a main report, including annexes, as well as 19 background memoranda that provide more detailed descriptions of the topics investigated in the main report. The main report primarily focuses on the main results. For descriptions of supplementary results, methodology approach, data basis, etc., consult the background memoranda.

Box 4: **Global climate action by the government**

The government has launched a series of initiatives to reduce global greenhouse gas emissions and Denmark's adverse impacts on these. Chapters 12-17 report on global climate action by Danish authorities. Furthermore, a leaflet about Denmark's global climate footprint (*Danmarks globale klimaaftryk,* only available in Danish) (KEFM, 2022) describes some of the policy measures aimed at reducing Denmark's global impact on the climate.

The main report falls into four overall parts: 1) Danish consumption, 2) Danish imports and exports, 3) Focus areas, and 4) Global action by authorities, see

Figure 1: Structure of GR22



The four parts of the report present different relevant perspectives on Denmark's global impacts on the climate. Part 1 on consumption spotlights emissions related to the products consumed in Denmark, of which many are produced outside Denmark. Thus, a large proportion of the greenhouse gas emissions related to products consumed by Danes occurs outside Denmark. Part 2 focusses on emissions related to total Danish imports and exports and on reductions that can be linked to Danish exports of green energy and environmental products. Part 3 presents a number of selected focus areas assessed to be particularly relevant to describing Denmark's global climate impact. Finally, part 4 outlines initiatives by Danish authorities to reduce global greenhouse gas emissions.

The traditional way to estimate a country's climate footprint is to estimate the country's territorial emissions. This stems from the approach anchored in the UN Framework Convention on Climate Change, which has existed since 1992. An internationally harmonised approach has yet to be established for the approach in Denmark's global impact reports. The calculations are therefore linked to uncertainty, and not all aspects of Denmark's climate impacts are covered. However, the methodology and data basis for Danish global impact reports will be optimised on a continuous basis.

1.3 How we estimated Denmark's climate footprint

The results in GR22 have been arrived at using a number of different data sources and methodologies:

Denmark's emissions related to consumption, imports and exports have been calculated using an input-output model. The basic model is the same used by the Danish Energy Agency for last year's global impact report. This method is based on a simplified SNAC approach (Tukker, 2018) and it combines data from Statistics Denmark and the global EXIOBASE database. The model calculates greenhouse gas emissions embedded in products and services that Denmark consumes, imports and exports.

Danish green exports are based on a number of different sources. Calculations of green exports are based on analyses of exports of energy technology published by the Danish Energy Agency in cooperation with the Confederation of Danish Industry; the Danish Energy Association; Wind Denmark; and the Danish District Heating Association. Furthermore the calculations are based on an analysis by the Danish Environmental Protection Agency of exports of water technology, as well as on data on exports of waste and clean-air technologies from the Danish Environmental Protection Agency. The estimate of potential greenhouse gas emission reductions related to Danish green exports is based on data from the Danish Energy Agency's Technology Catalogues.

Denmark's consumption-based emissions related to land-use change are based on calculations that use models developed by the Swedish Chalmers University of Technology[1] and the Danish consultancy firm 2.-0 LCA consultants, respectively.

Emissions related to Danish consumption of biomass and biofuels are based on reported data on the consumption of biomass and biofuels in Denmark, as well as on calculations by the Department of Geosciences and Natural Resource Management at the University of Copenhagen, Denmark.

The *focus topics* are based on data, statistics, calculations and case examples. *International transport* is based on official statistics from the Danish Energy Agency and Statistics Denmark, and *cross-border electricity trade* is based on calculations using the Danish Energy Agency's electricity system model. Imports and consumption of soy are primarily based on data from Blonk Consultants and the Department of Food and Resource Economics at the University of Copenhagen, Denmark. The global climate action of Danish business is based on a literary study of reports from the Danish Chamber of Commerce, SMVDanmark (sector organisation for Danish SMEs), and others. National measures with global effects are based on input from relevant Danish ministerial bodies and agencies.

Global action by authorities is reported as direct input from the players responsible for Danish climate assistance (the Ministry of Foreign Affairs of Denmark) and bilateral energy, food and environment cooperation (the Danish Energy Agency, the Danish Veterinary and Food Administration and the Ministry of the Environment). With regard to green investments, this part is based on input from the Ministry of Industry, Business and Financial Affairs, EKF (Denmark's Export Credit Agency) and IFU (Investment Fund for Developing Countries). Furthermore, several ministries have contributed to the overview of political agreements with global climate impacts affecting Denmark's global emissions.

Thus, contributions to the report have been obtained from a number of ministries and stakeholders. Furthermore, according to the Climate Act, global impact reports must be submitted for external consultation, see Annex 1. The overall methodological approach was under external consultation in November 2021, and the full GR22 was under external consultation in April/May 2022.

Most of the subject areas described in GR22 include data up to and including 2020 and, for some areas, up to and including 2021. This means that the effect of the Covid-19 pandemic is reflected in the figures, and the trends described should therefore be interpreted against this backdrop. The data basis currently available does not allow for an exact assessment of the effects of the Covid-19 pandemic on results within all of the areas addressed in the report.

[1] Chalmers Tekniska Högskola.

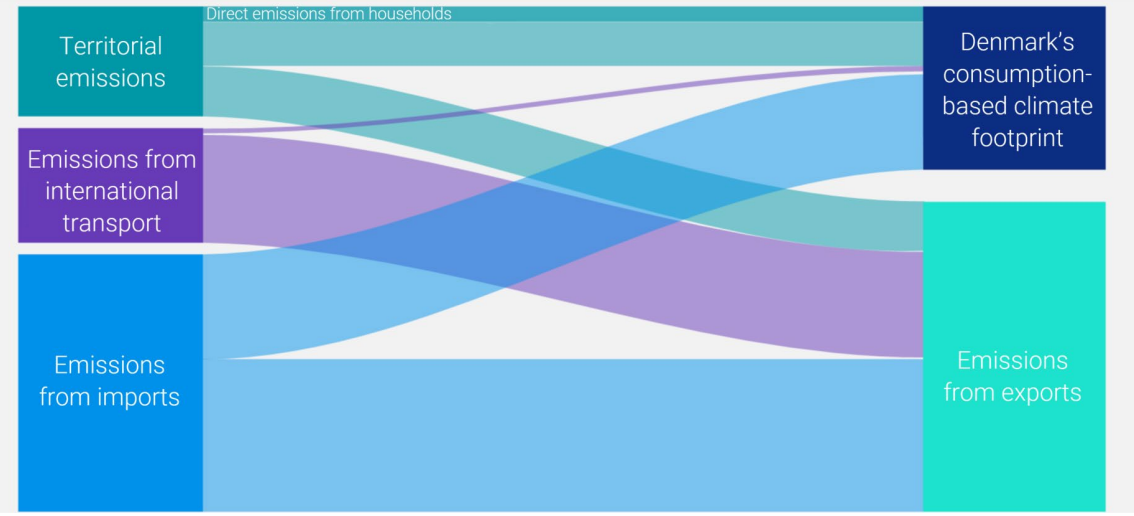
Consumption

The climate footprint of a country is usually estimated by considering greenhouse gas emissions generated domestically. The 70% reduction target that Denmark has committed to and its reporting to the UN therefore centre on Danish territorial greenhouse gas emissions.

However, many of the products consumed in Denmark are produced outside Denmark. Thus, a large proportion of the greenhouse gas emissions related to products consumed by Danes occurs outside Denmark. In order to estimate the climate footprint related to Danish consumption, it is therefore not enough to look just at Danish territorial emissions.

Figure 2 illustrates how territorial emissions, emissions from international transport and emissions from imports can be related to either Denmark's consumption-based climate footprint or to emissions from exports.

Figure 2: Illustration of the relationship between Denmark's consumption-based climate footprint, Danish territorial emissions, emissions from international transport and emissions from imports and exports



Contents of individual chapters

This part of GR22 investigates the global climate consequences of Danish consumption, divided into four chapters. The first chapter covers Denmark's consumption-based climate footprint, while the subsequent three chapters investigate additional consumption-related emissions that, however, are not reflected in full in the climate footprint because of a lack of consolidated methodologies: greenhouse gas emissions from land-use change (LUC), consumption of biomass and consumption of biofuels.

The results in the four chapters can therefore be compared but should not be summed. This is why the topics in the last three chapters are presented separately, even though

they each say something about emissions linked to Danish consumption. **Figure 3** below shows the relationship between the chapters.

Chapter 2 *Denmark's consumption-based climate footprint* focuses on greenhouse gas emissions embedded in Danish consumption, regardless of where in the world these emissions occur. The estimate therefore includes all emissions related to the production chain for products consumed by the Danish population.

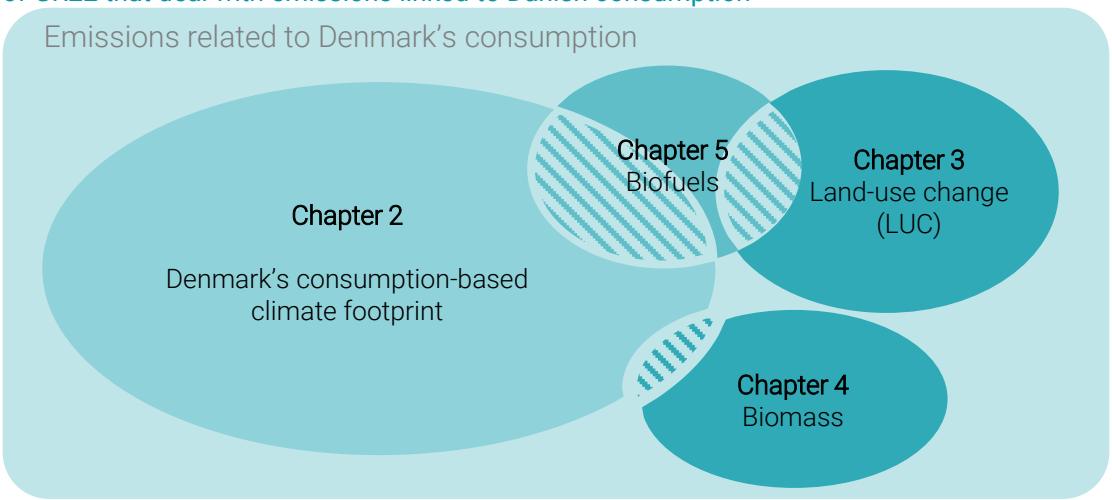
Chapter 3 *Land-use change (LUC)* spotlights greenhouse gas emissions from land-use change (LUC), focussing on the impact of Danish consumption on deforestation. These emissions are not included in the chapter on Denmark's consumption-based climate footprint.

Chapter 4 *Biomass* describes greenhouse gas emissions related to Danish consumption of biomass, focussing on electricity and district heating production. Whereas the first chapter only includes emissions from transport and processing of biomass, this chapter provides a more complete picture.

Chapter 5 *Biofuels* describes greenhouse gas emissions related to Danish consumption of biofuels for blending in petrol and diesel fuel. This chapter is based on Denmark's EU reporting on emissions from biofuels. The approach applied is therefore different, and a more complete picture is provided than in chapter 2, which also includes biofuels[2].

Descriptions of the methodologies applied, more detailed results, as well as a description of the uncertainties associated with the results of the analyses are available in the relevant background memoranda: on Denmark's consumption-based climate footprint, land-use change, and biomass and biofuels.

Figure 3: Illustration of the overlap between the emissions described in the chapters in the part of GR22 that deal with emissions linked to Danish consumption



[2] Denmark's consumption-based climate footprint does not include indirect land-use change (iLUC), but this is included in chapter 5 on biofuels. iLUC is also included in chapter 3 but based on an approach that is different from the one used for EU reporting and on which chapter 5 is based.

2 Denmark's consumption-based climate footprint

Denmark's consumption-based climate footprint is an estimate of Danish consumption-related greenhouse gas emissions. This estimate therefore covers emissions related to the consumption *in Denmark* of products imported to or produced in Denmark. Greenhouse gas emissions from Danish exports on the other hand *are not included*, because exported products and services are by definition consumed outside Denmark.

Estimating Denmark's consumption-based climate footprint is a fairly new exercise, and the development of methodologies in this area is still at a relatively early stage.

2.1 Main results

2.1.1 Denmark's consumption-based climate footprint was 63 million tonnes CO_2e in 2020

In 2020, Denmark had a consumption-based climate footprint of 63 million tonnes CO_2e. This corresponds to around 11 tonnes CO_2e per capita. This is the same level as in 2019[3]. Emissions linked to Danish consumption can occur both in Denmark and abroad. As much as 42% of Denmark's consumption-based climate footprint can be attributed to Danish emissions[4], whereas 58% can be attributed to emissions abroad. The size of Denmark's consumption-based climate footprint abroad is affected by what, and by how much, Denmark imports for consumption, but also by production methods and climate initiatives in the exporting country.

Box 5: **Danish territorial emissions and Denmark's consumption-based climate footprint**

Denmark's consumption-based climate footprint is almost 50% higher than Danish territorial greenhouse gas emissions. In 2020, Danish territorial emissions came to 45 million tonnes CO_2e, corresponding to almost 8 tonnes of CO_2e per capita (ENS, 2022). This means that Denmark has a higher climate footprint if we include the greenhouse gas emissions generated abroad as a result of Danish consumption, and, at the same time, subtract the greenhouse gas emissions that Denmark exports (i.e. the emissions embedded in Danish products consumed abroad).

2.1.2 Danish emissions linked to Danish consumption are falling

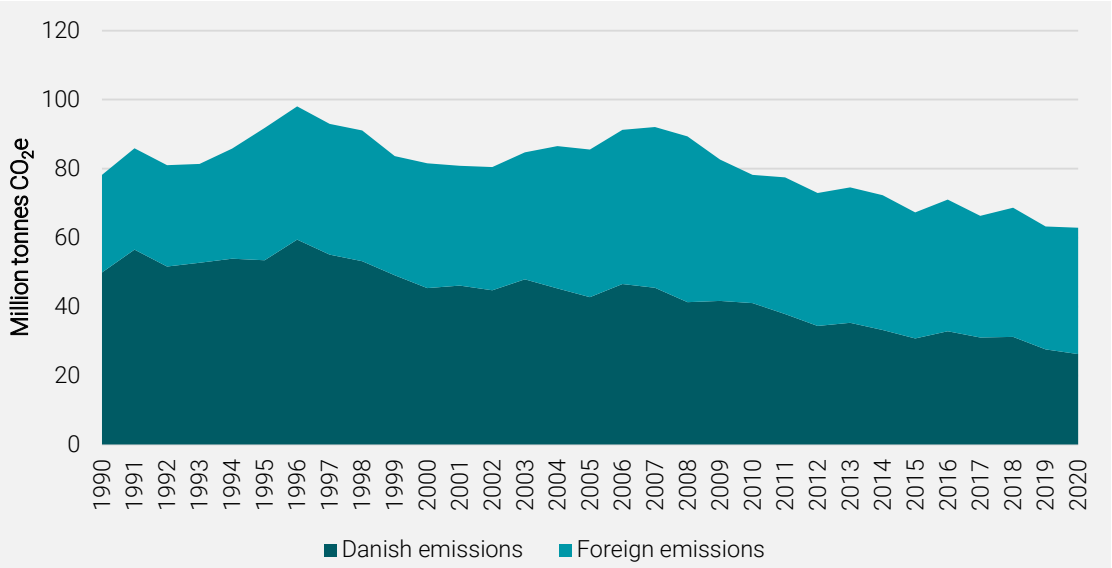
Denmark's consumption-based climate footprint peaked in 1996 and has since fallen, except in the period leading up to the 2008 financial crisis (see **Figure 4**). Danish

[3] Denmark's consumption-based climate footprint for 2019 reported in GR21 (61 million tonnes CO_2e) is different from the figure reported in GR22 (63 million tonnes CO_2e). This is due to improved data in GR22. Differences between GR21 and GR22 are described in more detail in the background memorandum on Denmark's consumption-based climate footprint.

[4] 'Danish emissions' means emissions from Danish "homes". Typically, this will be emissions generated within Danish territory, but can also be emissions from Danish vessels in international waters or caused by Danish tourists abroad, for example.

emissions linked to Danish consumption more than halved during the period from 1990 to 2020. In the same period, on the other hand, foreign emissions increased by one-third. Amongst other things, the fall in Danish emissions is because the Danish energy sector now has significantly less impact on the climate. Furthermore, the fall in Danish emissions and the increase in foreign emissions could be because some of the production has been moved abroad.

Figure 4: Denmark's consumption-based climate footprint broken down by Danish and foreign emissions



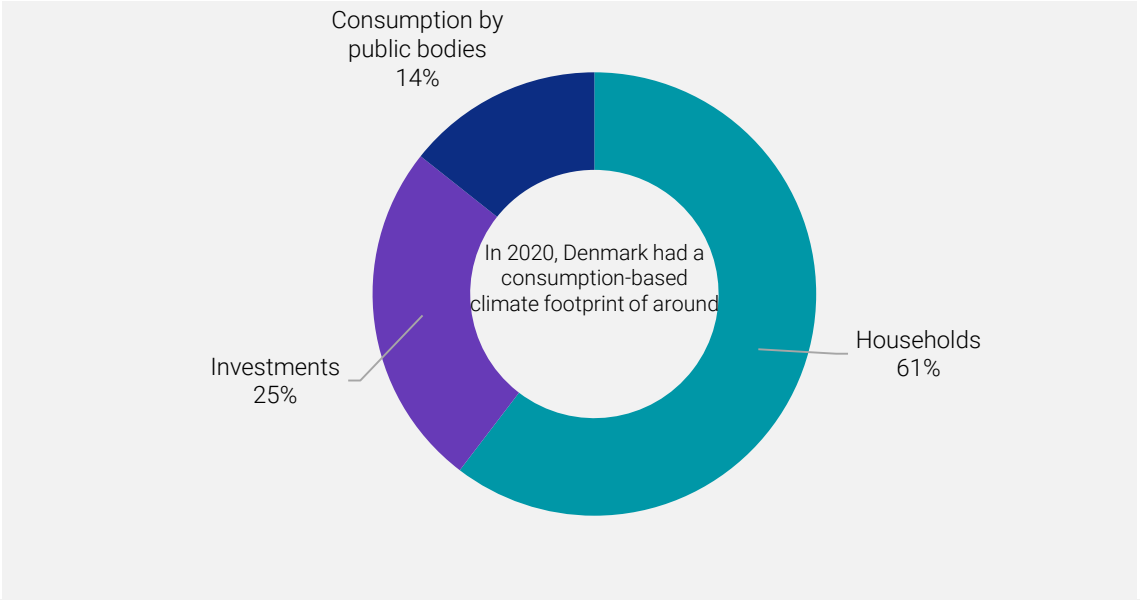
Source: The Danish Energy Agency. Note: Emissions related to imports and Danish production are included, whereas exports have been deducted. Danish emissions include emissions related to the products and services that are produced in Denmark.

2.1.3 Consumption by households accounted for 61% of emissions in 2020

Danish consumption can be divided into three consumption groups: 1) consumption by households, 2) consumption by public bodies, and 3) consumption related to investments[5]. By consumption is meant final consumption, which means that consumption by business has not been included, as consumption by business has been included in the products and services supplied to the three consumption groups. **Figure 5** shows that most of Denmark's consumption-based climate footprint (61%) related to consumption by households in 2020. Investments accounted for 25%, while consumption by public bodies accounted for 14%.

[5] Investments include procurements by public bodies and businesses that are used for more than one year. For example, this includes homes, transport vehicles, production plants, fixtures and equipment, and software.

Figure 5: Denmark's consumption-based climate footprint 2020 by consumption groups



Source: The Danish Energy Agency

Most of the emissions related to consumption by public bodies and investments occur abroad. Most of the emissions related to consumption by households, on the other hand, occur in Denmark.

Box 6: **Denmark's consumption-based climate footprint and green public procurement**

The Danish Energy Agency prepares an annual estimate of the climate footprint of Danish public procurement. A report on the results for the climate footprint of public procurement in 2020 is expected shortly.

The estimate of the climate footprint of public procurement cannot be compared with the estimate of the climate footprint of consumption by public bodies in Denmark's consumption-based climate footprint. This is because the two climate footprints are based on different calculation methods. The estimate of the climate footprint of public procurement is a procurement analysis based on invoice data at product level. In Denmark's global impact reports, on the other hand, the estimated climate footprint of consumption by public bodies is a subset of Denmark's consumption-based climate footprint and has been estimated on the basis of input-output tables at sector level.

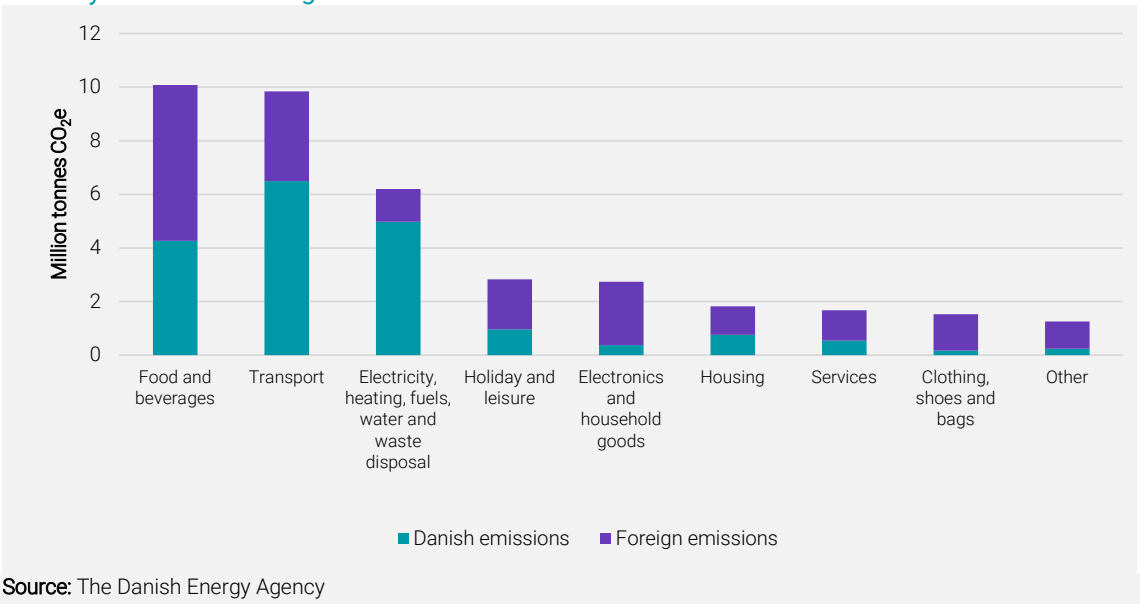
2.1.4 Household emissions are mostly related to transport, and food and beverages

A breakdown of household consumption by category of consumption provides important insight into the composition of consumption by this consumption group. **Figure 6** shows that the majority of emissions in 2020 stemmed from consumption by households for transport and for food and beverages. These two categories account for around 10 million tonnes CO_2e each. Transport services (air and train travel, for example)[6], buying petrol and oil, and buying vehicles comprise the largest items for

[6] International transport is described in more detail in chapter 13, although not through a consumption-based approach, which means that emissions related to Danish consumption of transport are not specified in detail.

transport. The largest source of household emissions within food and beverages was meat, which accounted for around 21% of emissions in this consumption category.

Figure 6: Greenhouse gas emissions arising from consumption by households in 2020, broken down by Danish and foreign emissions



Source: The Danish Energy Agency

2.1.5 Half of household emissions occur in Denmark

In 2020, half of emissions related to consumption by households occurred in Denmark in connection with the production, transport, consumption and disposal of goods and services. This applies in particular to transport, as well as to electricity, heating, fuels, water and waste disposal. This is because the combustion of petrol for transport and the production of electricity primarily occurs in Denmark. However, emissions from household consumption of electronics and household goods, as well as clothing, shoes and bags mainly occurred abroad. This is because most of the production for these consumption categories is located abroad.

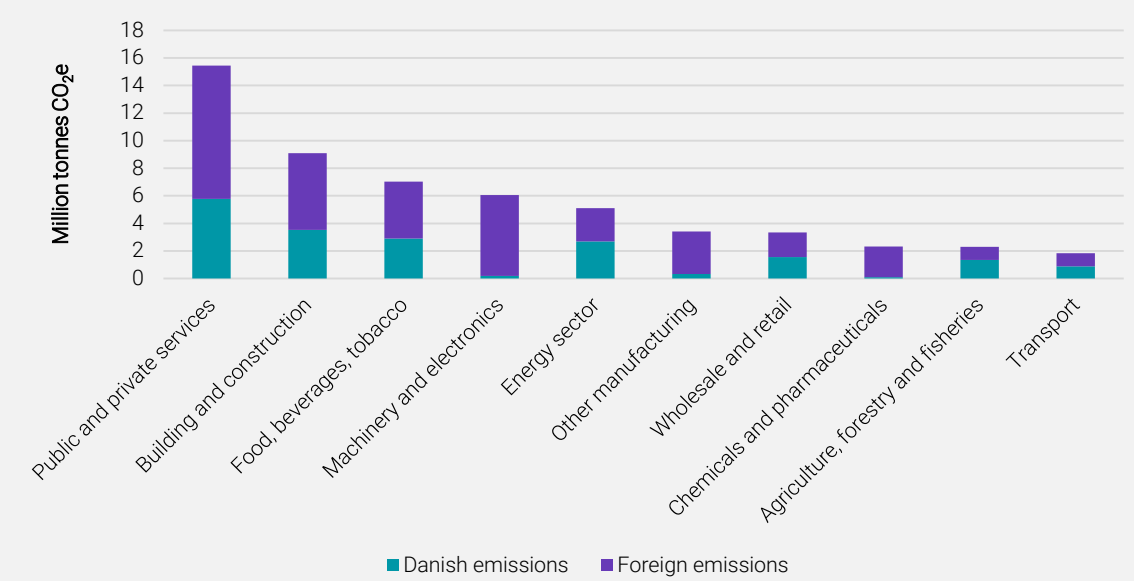
2.1.6 Public and private services accounted for most emissions

Around one-third of Denmark's consumption-based emissions in 2020 were related to services from the 'public and private services' industry group, see Figure 7. The 'public and private services' category includes private-sector travel agencies, restaurants and hotels and public-sector hospitals, day-care centres and upper secondary schools, for example. The breakdown by industry group hinges on 'the product' that is supplied for consumption in Denmark. For example, emissions related to the transport of clothes and shoes will not be included as transport sector emissions but rather as wholesale and retail emissions, because wholesale and retail is the industry group that sells the clothes and shoes.

With regard to the supply of products from the machine and electronics industry, other manufacturing, and the chemicals and pharmaceutical industry, almost all emissions occurred abroad as a result of the import of finished products and semi-finished products as input for Danish production. The majority of emissions in the energy

sector, and from products supplied by the agriculture, forestry and fisheries industry, were emitted in Denmark.[7] This is because the energy sector consumes a lot of energy in Denmark, and because Denmark has extensive agricultural production with associated emissions.

Figure 7: Denmark's consumption-based climate footprint broken down by industry groups that supply products and services for consumer use, and by Danish and foreign emissions, respectively, 2020



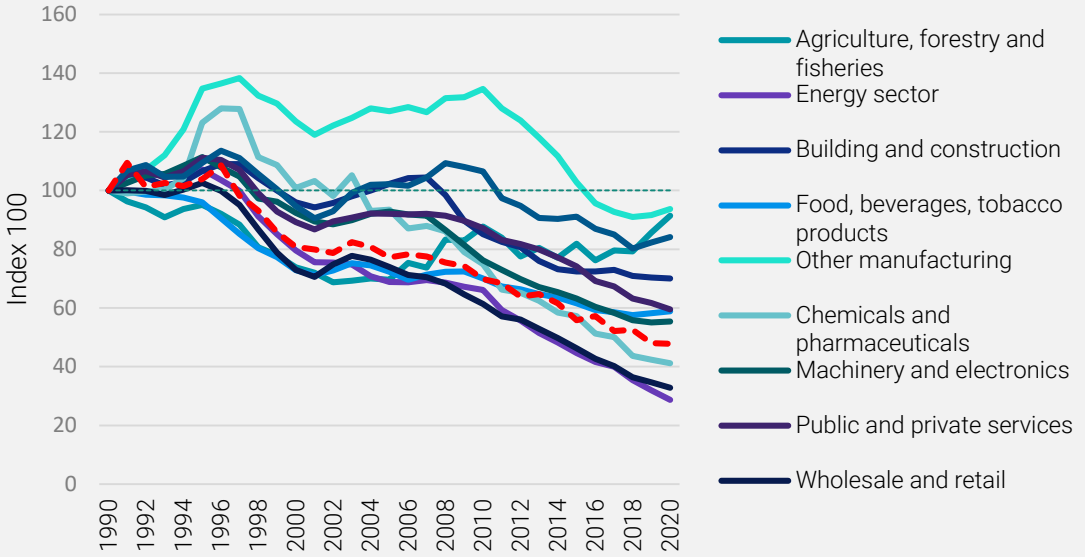
Source: Danish Energy Agency. Note: Direct emissions from households are not included the figure. Direct emissions by households arise from combustion of petrol in vehicles, for example, and accounted for around 7 million tonnes CO_2e. Direct emissions by households are, per definition, emissions that occur in Denmark.

2.1.7 Emissions per DKK spent have halved since 1990

The relationship between consumption-based greenhouse gas emissions (both Danish and foreign) and the size of Danish consumption can be calculated as kg CO_2e per DKK. **Figure 8** shows that, overall, half as many emissions were emitted per DKK spent in 2020 compared with in 1990. Danish consumption measured in DKK increased steadily during the period, while, at the same time, the Danish energy sector reduced its impact on the climate significantly. The supply of products and services from all ten industry groups caused lower emissions per DKK in 2020 than in 1990.

[7]As mentioned above, land-use change (LUC) is not included in Denmark's consumption-based climate footprint.

Figure 8: Developments in greenhouse gas intensity by industry groups and in total



Source: Danish Energy Agency. **Note:** Index year = 1990. The greenhouse gas intensities of the various industry groups have been calculated on the basis of the value of each industry group's supply of products and services for final Danish consumption, and are stated in current, chained 2010 prices. The total greenhouse gas intensity has been calculated as total final domestic use, and is stated in current, chained 2010 prices.

3 Land-use change (LUC)

Land-use change[8], particularly in the form of deforestation, is a significant source of anthropogenic greenhouse gas emissions. Emissions from land-use change made up 11% of total global greenhouse gas emissions in 2019 (UNEP, 2021). Forest clearing at global level can be due to expansion of the area of agricultural land, which in turn is driven by increasing global consumption of land-demanding products. When forest land in Brazil is converted from rainforest to agricultural land, this can be the consequence of increased demand for agricultural products or other land-demanding activity.

In this way, Danish consumption of agricultural products, for example, can have an impact on global land use, and, thus, on how much carbon is removed or released by forests and other land areas. Greenhouse gas emissions from land-use change related to Danish consumption are therefore an important element in Denmark's global impact reports.

GR22 includes both an estimate of emissions from *direct* land-use change (dLUC) embedded in Danish consumption and an estimate of emissions from *indirect* land-use change (iLUC) embedded in Danish consumption. Both estimates have been limited to include the effect of deforestation[9], and dLUC has been further limited to include deforestation in the tropics. Because there has been no deforestation in Denmark in recent years, estimates of dLUC and iLUC do not include emissions from land-use change in Denmark. Note, in general, that results for both dLUC and iLUC are based on model calculations and not on a concrete assessment of the consequences of consumption of individual actual products.

Chapter 10 looks at imports and consumption of soy to illustrate the problem concerning direct land-use change (dLUC).

Box 7: Direct and indirect land-use change (dLUC and iLUC)

dLUC includes the land-use change that takes place when forest land in the tropics is cleared and converted to agricultural land to directly meet demand for agricultural products in Denmark.

iLUC assumes that all land-demanding activities draw on a limited global area of agricultural land. This means that all land-demanding consumption in Denmark is attributed land-use change emissions. This attribution is regardless of whether use of the land has led directly to forest clearing or whether it has contributed to putting increased pressure on the already limited global area of agricultural land, and therefore, potentially, indirectly has led to forest clearing elsewhere in the world.

[8] See also the glossary, which includes an explanation for the two sub concepts iLUC and dLUC.

[9] The calculations in GR22 therefore do not include land-use change in the form of changing from one crop to another, or conversion from grassland to cultivated land. Deforestation is assessed to be the largest factor within iLUC emissions.

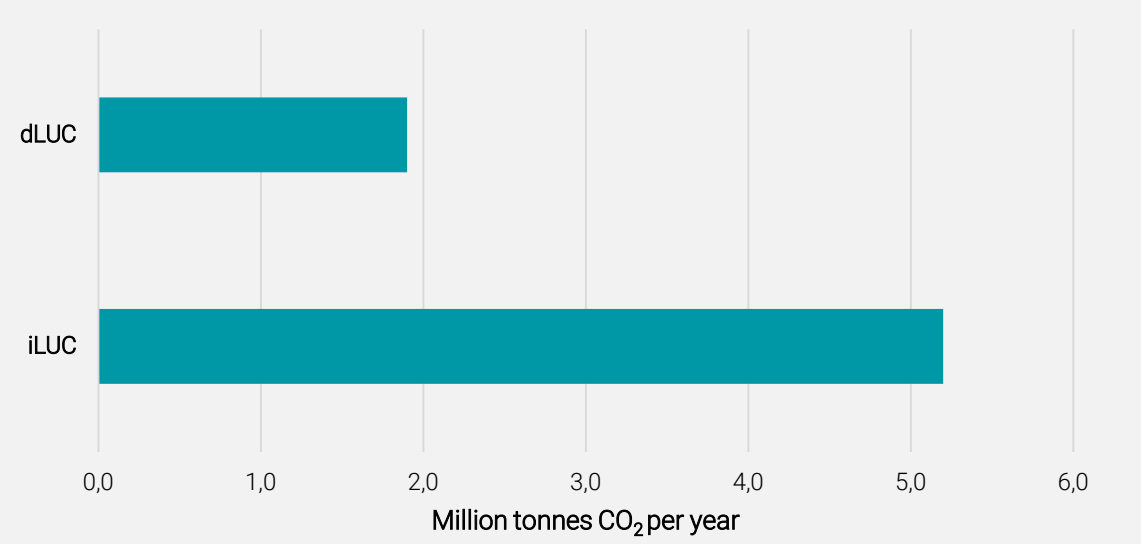
3.1 Main results

3.1.1 Land-use change estimates differ, depending on the approach applied

Denmark's consumption-based emissions from direct land-use change (dLUC) came to around 1.9 million tonnes CO_2e in 2018[10], see **Figure 9**. Emissions from indirect land-use change (iLUC) linked to Danish consumption came to around 5.2 million tonnes CO_2e in 2020.

In comparison, in GR22, Denmark's consumption-based climate footprint (excluding impacts from land-use change) has been estimated at around 63 million tonnes CO_2e in 2020 (see chapter 2). The estimated emissions from land-use change cannot be added directly to Denmark's consumption-based climate footprint. This is because there is a lack of consolidated methodologies in this area.

Figure 9: Emissions from land-use change embedded in Danish consumption, based on dLUC and iLUC, respectively



Source: (Pendrill, 2022), 2.-0 LCA consultants and the Danish Energy Agency. Note: Results for dLUC and iLUC should not be added together.

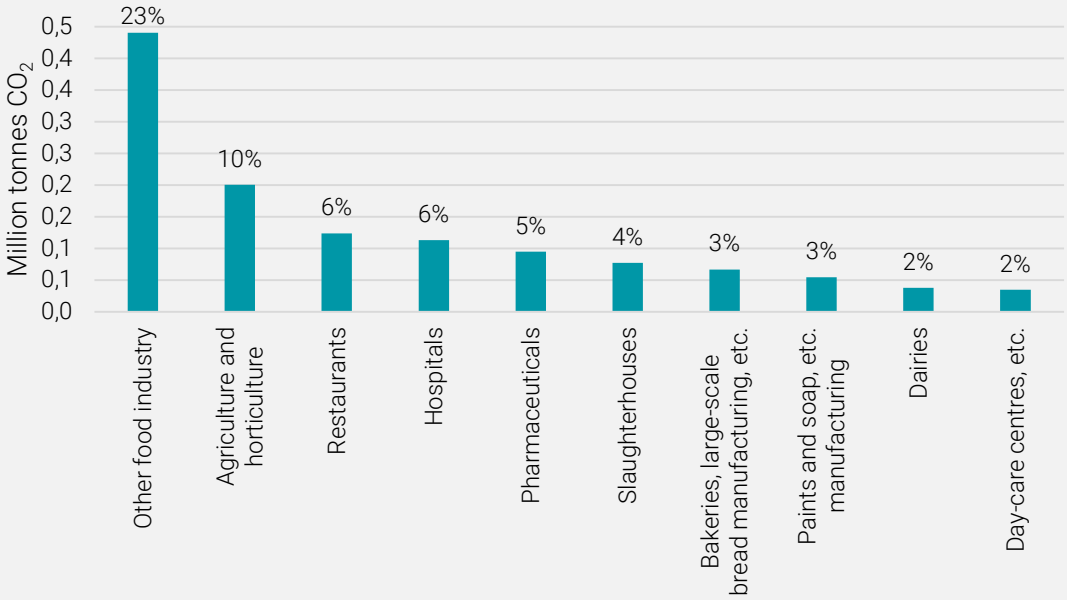
Note that the results for emissions from land-use change based on dLUC and iLUC, respectively, should not be added together. Nor should they be interpreted as a range. The estimates of dLUC and iLUC allocate the same emissions but in different ways.

3.1.2 Products from the food industry are the largest contributor to direct land-use change

Figure 10 shows that emissions linked to the supply of products and services from 'Other food industry' for Danish consumption constitute the largest contributor to consumption-based dLUC emissions. 'Other food industry' includes processing of vegetable oils and fats, as well processing of food products, for example. Palm oil processing in the production of food products is a particularly important contributor.

[10] 2018 is the most recent historical year in the model used to calculate dLUC. This means that emissions from dLUC have not been calculated for the same historical year as emissions from iLUC. Nor have they been calculated for the total consumption-based climate footprint.

Figure 10: Emissions from dLUC linked to Danish consumption in 2018, broken down by the ten industry groups with most dLUC emissions embedded in their products and services



Source: Based on data from (Pendrill, 2022), used by the Danish Energy Agency in the coupled input-output model.

On the basis of the model and data used, it can also be established that an important part of emissions from dLUC allocated to Danish consumption stems from deforestation in Indonesia. No further details can be provided on the basis of the data available.

3.1.3 Danish consumption can cause indirect land-use change

The consumption-based emissions from iLUC correspond to emissions related to production in Denmark and imported products, respectively, but deducted emissions related to exported products. This is in accordance with the approach for calculating Denmark's consumption-based climate footprint (chapter 3).

Emissions from iLUC related to production in Denmark were 4.2 million tonnes CO_2e in 2020. This means that all land use in Denmark, e.g. land used for agricultural production, can indirectly lead to land-use change globally[11]. Emissions from iLUC linked to imported and exported goods have been estimated at 8.2 million tonnes CO_2e and 7.2 million tonnes CO_2e, respectively, in 2020. Consumption-based emissions from iLUC can therefore be estimated at around 5.2 million tonnes CO_2e - emissions related to production plus emissions embedded in imported products, minus emissions embedded in exported products.

[11] Although no deforestation is taking place in Denmark, production on Danish land is ascribed emissions, because the premise for the calculation of iLUC (see box 7) is that all land-demanding activity can lead to afforestation elsewhere in the world. Production on Danish land is therefore ascribed emissions because the use of land in Denmark also contributes to limiting the global agricultural land area available, and any increased demand will therefore have to be met elsewhere, through deforestation, for example.

4 Biomass

Since 1990, Denmark has replaced a significant part of its fossil fuel consumption in electricity and heating production with solid biofuels (biomass) (ENS, Biomasseanalyse , 2020).

This chapter describes emissions from wood pellets and wood chips used to produce electricity and district heating in the collective supply system[12], because wood is one of the most dominant biofuels. Most of the wood is imported[13]. Emissions from burning biomass can be calculated in two ways[14].

The climate impact of biomass in a global perspective is assessed by describing the total global net emissions of consumption in 2020, as well as the development in net emissions over time. The results depend on the data basis, the choice of methodology, market conditions and assumptions, including the various associated uncertainties. Of these assumptions, assumptions about what would have happened with the woody biomass had it not been used to produce energy are particularly important. The specific impact on the atmospheric content of CO_2 will also depend on the time perspective chosen[15].

Because of the partial overlap and different methods of calculation, the results in this chapter cannot be directly added to Denmark's consumption-based climate footprint in chapter 1.

4.1 Main results

Danish demand for woody biomass for energy production increases the atmospheric content of CO_2. The primary effect is that burning biomass brings forward the biogenic CO_2 emissions which would otherwise occur at a later stage. The net biogenic emissions from one year's consumption of wood pellets and wood chips used to produce electricity and district heating falls exponentially over time when the woody biomass stems from long-term managed forests. As global warming is gradual, the temporary displacement of the carbon pool from forests to the atmosphere has an impact on the climate.

When bioenergy is produced from woody biomass, trees are removed from the forest and burned in a heating plant, for example and the content of CO_2 in the wood is released to the atmosphere. Without demand for bioenergy production, the woody

[12] Household and industry consumption of woody biomass for electricity and heat production has not been included in the calculations.

[13] Imports account for 61% of total Danish consumption of wood pellets, wood chips, firewood and wood waste in energy production (ENS, 2021). See figure 2 in the background memorandum.

[14] In the UN national emissions inventories, biomass fuels are counted as zero emissions when used in energy production because changes in carbon stocks are included in the forest sector in the country that produced the biomass fuels (IPCC, IPCC Guidelines for National Greenhouse Gas Inventories, 2006).

[15] Consumption of wood for energy production also affects forest biodiversity. This has not been accounted for in GR22, but see, for example, (JRC, 2021).

biomass would have been left in the forest to rot, burned locally without energy utilisation, used in other wood products, or not harvested at all.

The net emissions are the increased content of CO_2 in the atmosphere caused by consumption of the biomass fuels. The calculation of the total net emissions from consumption of woody biomass includes biogenic emissions from energy production, process emissions and emissions from indirect impacts, see box 8.

Box 8: **Net emissions from woody biomass**

The results of net emissions associated with Danish consumption of woody biomass for the production of electricity and district heating are based on an analysis from the Department of Geosciences and Natural Resource Management at the University of Copenhagen[16]. Total net emissions have been calculated considering the alternative fates of the wood. The following three emissions elements are included:

- *Biogenic emissions from energy production*: The carbon, in the form of CO_2, released to the atmosphere from chimneys when wood is burned, so that this carbon is no longer bound up in the forest's carbon pool of dead and live wood, etc.
- *Process emissions:* Emissions from production and transport of biomass. Can be both fossil and biogenic.
- *Emissions from indirect impacts:* Emissions linked to land use change, including tree felling for energy production, or the use of wood as a result of the consumption of biomass for energy production[17].

Net emissions from consumption of biomass for electricity and district heating have been calculated excluding other parts of the energy system. So emissions from possible alternative energy sources have not been deducted.

The results are based on data on biomass consumption and assumptions about forest management, the wood market, etc. (IGN, 2022). Based on the best available knowledge, it has been assumed that almost the entire Danish consumption of wood pellets and wood chips for Danish electricity and district heating production comes from trees felled for other reasons than energy production (at least 95%). The trees are felled because the most valuable parts of the tree can be sold for building materials, paper and other timber products. The woody biomass used primarily consists of branches, tops and poor-quality parts of the trunk, as well as residues from the timber industry. It is also assumed that additional felling with the sole purpose of energy

[16] *"CO_2 emissions from biomass use in district heating and combined heat and power plants in Denmark"*. Department of Geosciences and Natural Resource Management, University of Copenhagen 2022

[17] See box 1 of the background memo on biomass for a description of emissions due to indirect impacts.

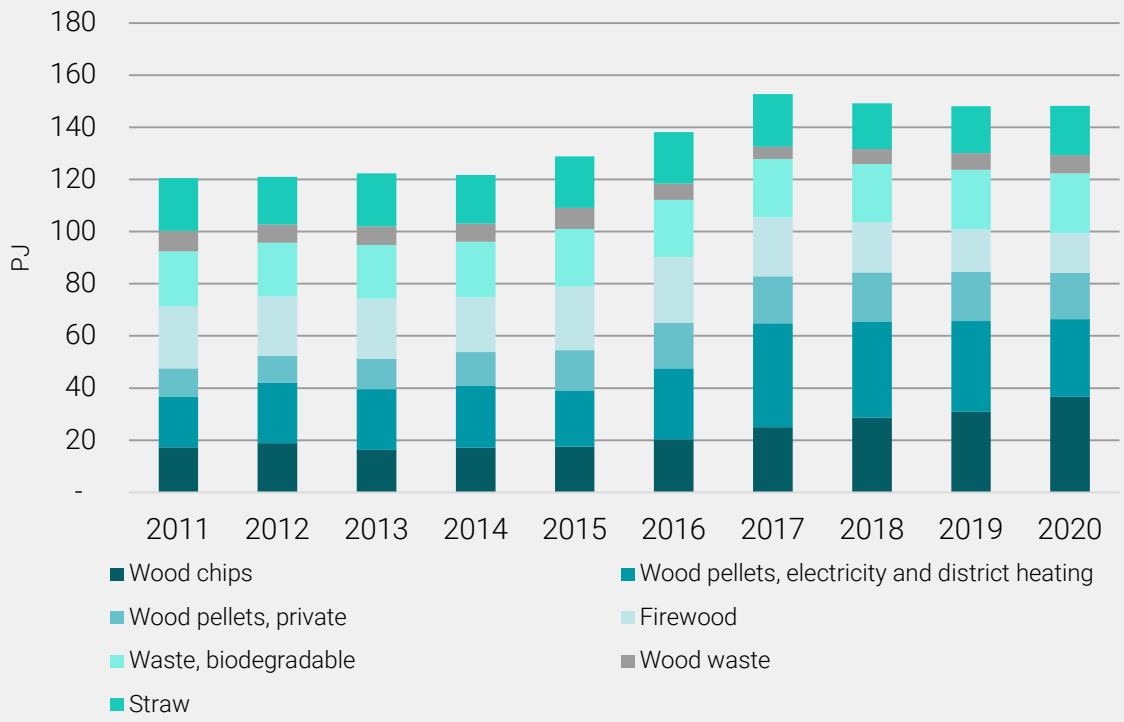
production covers a maximum of 5% of consumption, and that the forest (stand) is restored after felling, so that new trees grow[18].

4.1.1 Wood pellets and wood chips dominate consumption of solid biofuels

Figure 11 shows that Danish consumption of biomass fuels for production of electricity and heating in the period 2011-2020 rose from 120 PJ to 148 PJ.

Wood-pellets and wood chips together accounted for the largest part the consumption of solid biomass fuels in 2020. Of this, 76% was used to produce electricity and heating. This corresponds to a consumption of 64 PJ. The emissions described in the following sections relate to this consumption.

Figure 11: Danish consumption of biomass fuels for electricity and heating 2011-2020



Source: (ENS, Energistyrelsens Energistatistik 2020, 2021). Note: Wood chips are not divided in the figure into consumption for electricity and district heating and private consumption (households and manufacturing industries). Consumption for electricity and district heating makes up 93%.

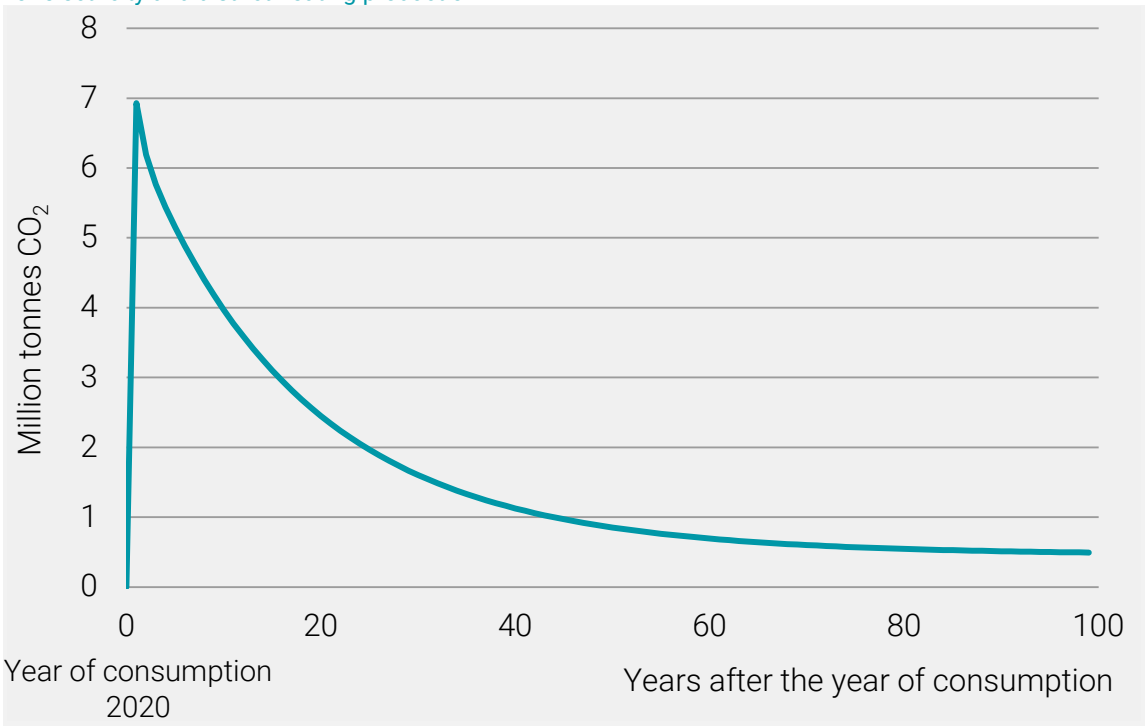
4.1.2 Net emissions from a single year's consumption of wood pellets and wood chips for electricity and district heating fall over time

Seen in isolation, Danish consumption of wood pellets and wood chips for electricity and district heating in 2020 led to net emissions initially of 6.9 million tonnes CO_2, of which fossil emissions amounted to 0.3 million tonnes CO_2. Gross biogenic emissions of 6.6 million tonnes CO_2 correspond to the carbon content in the wood removed from

[18] Re-establishment of forests after felling is a requirement in the voluntary sector agreement of 2016 (Danish Energy Association, 2016) and since 30 June 2021 it has been a statutory requirement in the Danish sustainability criteria for woody biomass for the production of electricity and heat (Executive Order no. 1352).

the forest carbon stock. **Figure 12** illustrates the trends in overall net emissions more than 100 years after the year of consumption 2020. After ten years, the amount of CO_2 in the atmosphere linked to specific consumption in 2020 will be 4.0 million tonnes (a drop of 43%), after 20 years to 2.5 million tonnes (a drop of 65%), and 30 years after consumption year 2020, net emissions will have dropped to 1.6 million tonnes (a drop of 77%).

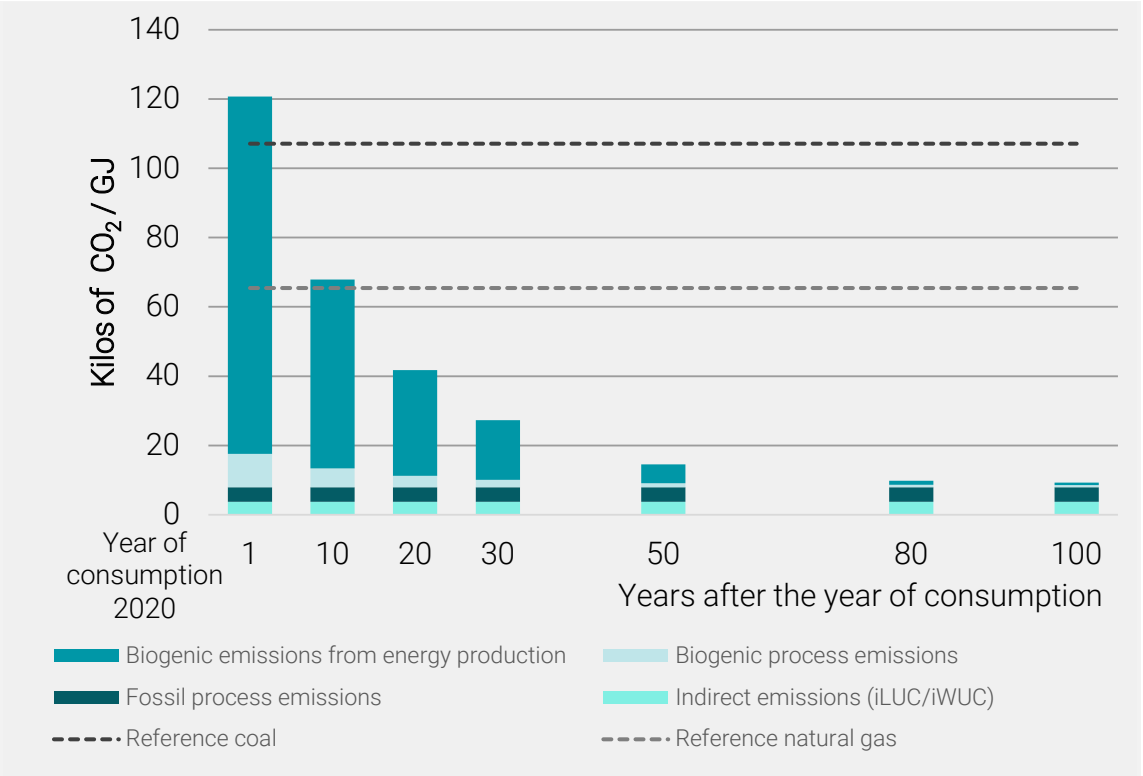
Figure 12: Total net emissions over time from consumption in 2020 of 64 PJ wood pellets and wood chips for electricity and district heating production



Source: (Nielsen, Bentsen, & Nord-Larsen, 2022). Note: The figure illustrates net emissions from the volume and consumption mix of wood pellets and wood chips used specifically to produce electricity and district heating in Denmark in year of consumption 2020.

Net emissions from biomass also drop over time when calculated per unit of energy in the biomass, i.e. as an emissions factor, see Figure 13. Initially, the total net emissions in year of consumption 2020 are 121 kg CO_2 per GJ. After 10 years, net emissions from the biomass consumption in 2020 measured per unit of energy are 68 kg CO_2 per GJ which is at a par with emissions from fossil natural gas. After 80 years, the total remaining net emissions from consumption in 2020 are almost exclusively fossil emissions that do not fall over time.

Figure 13: Net emissions per unit of energy in the biomass (emissions factor) over time from consumption in 2020 of 64 PJ wood pellets and wood chips for electricity and district heating production



Source: (Nielsen, Bentsen, & Nord-Larsen, 2022). Note: The figure illustrates net emissions from the consumption mix of wood pellets and wood chips used to produce electricity and district heating in 2020.

4.1.3 The amount of additional CO_2 in the atmosphere is affected by the type of biomass input

Net emissions associated with consumption of biomass are very much dependent on the type of biomass used. The amount of additional CO_2 in the atmosphere from burning small wood residues such as branches and tree tops falls quicker than amounts from logs, for example. This is because the alternative rotting is faster for branches than for logs.

Overall, net emissions from woody biomass for energy production are determined by quantities, alternative fates for the wood, the type of woody biomass, local growth conditions and transport distances[19].

[19] See tables 3 and 4 in the background memo on biomass for a review of the conditions affecting net emissions from biomass, including the various types of biomass, their origins and their alternative fates as well as indirect impacts.

5 Biofuels

Biofuels are added to petrol and diesel and thus replace fossil fuels. Biofuels are included in the UN calculation of national emissions as climate-neutral when they are used, but they give rise to emissions of greenhouse gases in connection with production. Emissions occur in the countries where biofuels are produced, as well as in connection with transport of the biofuels. The size of the emissions depends on what types of biomass are used to produce biofuels, as well as how they are produced. The calculations in this chapter include emissions from cradle to grave for biofuels used in Denmark.[20] Furthermore, the chapter investigates indirect land-use changes (iLUC) related to biofuels. This is also included in chapter 3 on direct land-use change (LUC) related to Danish consumption but comparison is not possible different approaches and models have been used.

5.1 Main results

5.1.1 Consumption of biofuels has increased due to the requirements for increased blending.

Since 2012, there has been a requirement in Denmark for 5.75% blending of biofuels in diesel fuel, petrol and gas for transport. In 2020, the requirement for biofuel blending increased to 7.6%, which has resulted in increasing use of biofuels in Denmark, see **Table 1**. This increased consumption has led to a reduction in emissions from the Danish transport sector, but greater climate impacts from biofuel production. Use of bioethanol increased significantly from 2019 to 2020 as the higher biofuel blending requirement caused the sector to double blending in petrol[21].

Table 1: Consumption of biofuels (in TJ)

	2017	2018	2019	2020
Biodiesel and HVO	7,208	7,159	6,920	7,201
Bioethanol	1,822	1,832	1,796	3,371
Biogas	121	219	217	357
Total	9,151	9,210	8,933	10,929

Source: Danish Energy Agency on the basis of reports from suppliers of fuel for Danish consumption

Biofuels can be based on different types of biomass such as oilseed rape, maize, sugar beet, residue biomass and waste biomass. Palm oil is regarded as particularly problematic because of deforestation and the associated climate impacts. Consumption of palm oil has been largely phased out, and in 2020 it accounted for less than 0.2% of total Danish consumption of biofuels. Because of the risk of high global

[20] Cradle to grave includes emissions linked to cultivation, production and transport of biofuels excluding indirect land use change (iLUC).

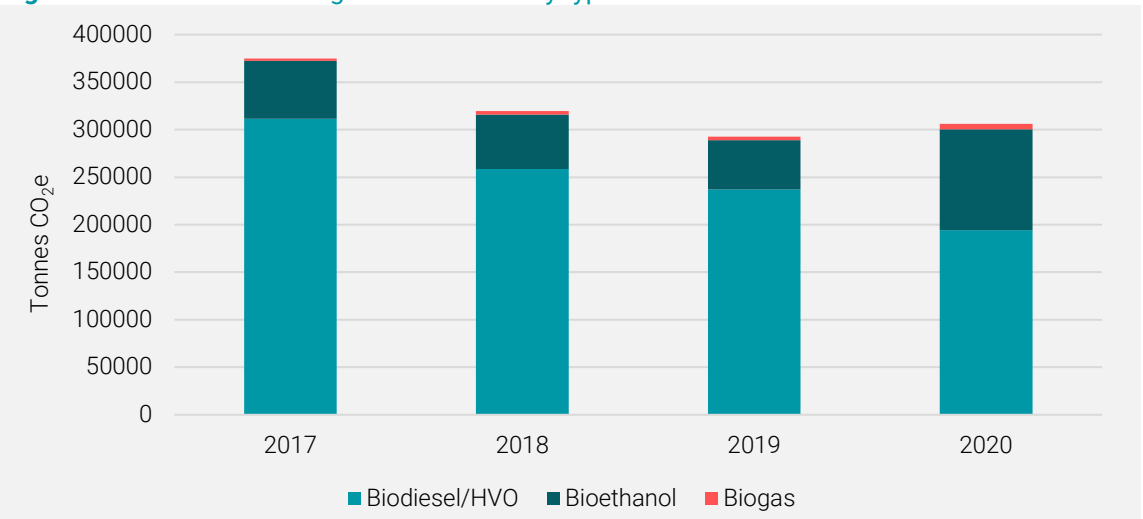
[21] The higher biofuel blending requirement has meant a change in the standard for petrol from E5 to E10, which specifically means that blending has increased from 5% to 10%.

emissions, implementation of the CO_2 displacement requirement means that palm oil and soybean oil have been [22] excluded from use as biofuels in Danish road transport.

5.1.2 Emissions from Danish consumption of biofuels have increased

The increased use of biofuels is the most important reason for the increase in cradle-to-grave emissions of CO_2e from biofuels from around 290,000 tonnes CO_2e in 2019 to approx. 306,000 tonnes CO_2e in 2020, see figure REF _Ref99466463 \h 14.

Figure 14: Danish cradle-to-grave emissions by type of biofuel



Source: Danish Energy Agency on the basis of reports from suppliers of fuel for Danish consumption

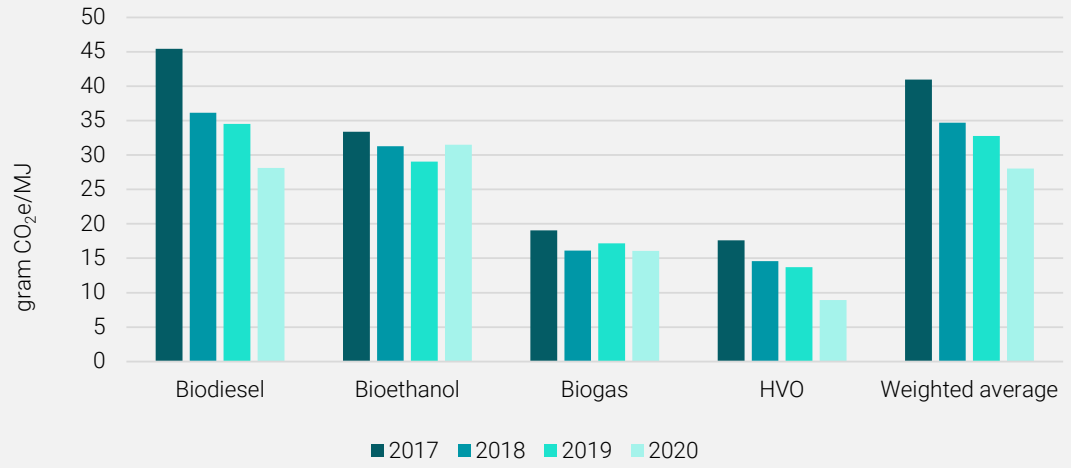
5.1.3 Biofuels in Danish consumption emit less per unit of energy

Figure 15 shows that, despite the increase in emissions of greenhouse gases from total consumption of biofuels, the biofuels used in Denmark have gradually become more sustainable in terms of grams of CO_2e/MJ. There has been increasing focus on the CO_2e intensity of biofuels used, and for this reason fuel suppliers are seeking more sustainable biofuels within, for example, 1st generation biodiesel or bioethanol.

For bioethanol, average emissions increased in 2020 due to the relatively short period of time to procure sufficient quantities of bioethanol with a low CO_2e intensity as the biofuel blending requirement was raised at the end of 2019. A lower CO_2e footprint from bioethanol is expected in the years to come, after the sector has been able to adapt to the stricter regulation of the area by entering into contracts with suppliers to supply more sustainable biofuels.

[22] From 2022, a new CO_2 displacement requirement will be introduced to replace the current biofuel blending requirement, see Act amending the biofuel act (Authorisation to realise national CO_2 displacement requirements) from May 2021. The CO_2 displacement requirement entails that fuel suppliers have to reduce their CO_2e emissions from fuels through blending greenhouse-gas-reducing fuels such as renewable energy and biofuels.

Figure 15: Cradle-to–grave emissions from biofuels per energy unit



Source: Danish Energy Agency on the basis of reports from suppliers of fuel for Danish consumption

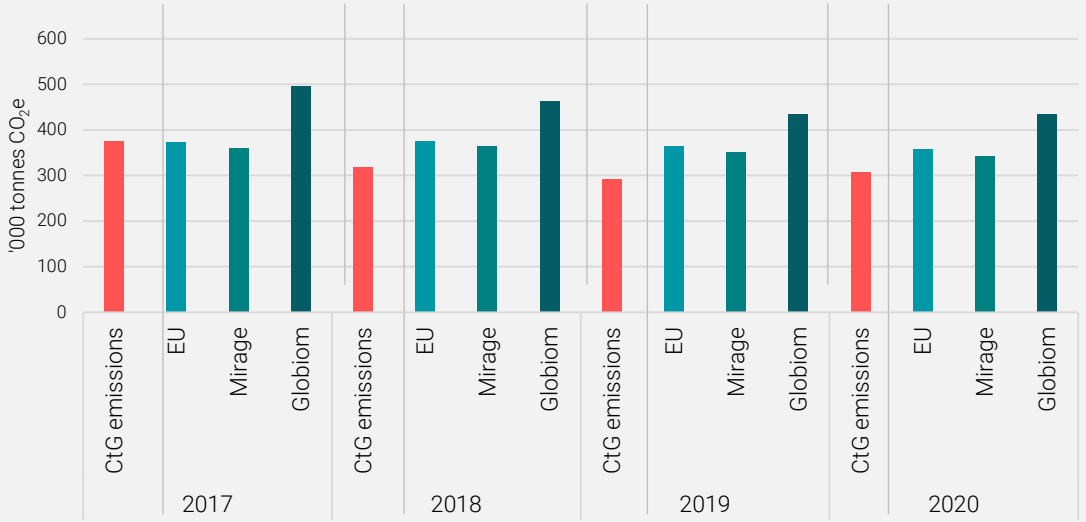
5.1.4 Biofuels cause indirect land-use change

If biomass for biofuels is grown in an area that was previously used for food production, then this food production will be transferred to new land if the demand for food products remains unchanged. This means that new areas are cultivated and therefore greenhouse gases are released, especially if deforestation is involved. These greenhouse-gas emissions are referred to as emissions from indirect land-use change (iLUC), see also chapter 3[23], and can be attributed to biofuels in addition to cradle-to-grave emissions[24]. There is great uncertainty regarding iLUC impacts, and there is no consensus across different studies about CO_2e emissions for the individual types of biofuels.

The level of the emissions from iLUC linked to Danish consumption of biofuels therefore depends on which studies are applied, and in turn which iLUC impacts are included, see Figure 16.

[23] Emissions from iLUC related to biofuels cannot be compared with emissions from iLUC related to Danish consumption (chapter 3), as different approaches and models have been used.
[24] The EU sets requirements that, besides the cradle-to-grave emissions, iLUC impacts must also be reported according to a set of values stipulated by the EU: 55 g/MJ for 1 g biodiesel, 12 g/MJ for bioethanol based on starches and 13 g/MJ for sugar. This data need only be reported and has no regulatory consequences. It has also been decided that biofuels with high iLUC risk are to be phased out up to 2030 throughout the EU.

Figure 16: Emissions from iLUC linked to Danish consumption of biofuels compared with cradle-to-grave emissions



Note: The figure shows figures based on three different studies: the EU values as well as the Mirage and Globiom models[25].

Emissions from iLUC in 2017 were at the same level as cradle-to-grave emissions (except for when the Globiom values are applied). As the cradle-to-grave emissions from biofuels have fallen, the estimated emissions from iLUC now account for a larger percentage of total of CO_2e emissions from production of biofuels. It is therefore assessed that iLUC now accounts for the majority of emissions linked to biofuels.[26] Cradle-to-grave emissions are expected to continue falling in the future, as there is still a considerable potential for reduction, for example by enhanced production methods, and by changing to waste-based biofuels and PtX-fuels. Changing to these fuels may also give rise to a drop in emissions from iLUC.[27]

[25] Mirage and Globiom are economic models designed to analyse emissions associated with land-use change. The annex to background memorandum 6 accounts for the methodological approaches to calculate iLUC impacts.
[26] Note also that the values from the EU forming the basis for the calculation of iLUC have been constant in the period, and for this reason any actual changes in iLUC emissions have not been reflected.
[27] This is because there are no iLUC impacts associated with the use of waste-based biofuels or synthetic fuels.

Imports and exports

Denmark is a small, open economy with much international trade. When Denmark imports and exports goods and services, the climate impacts extend beyond Danish borders. The value chain of a product most often goes across borders, and products leave a climate footprint in several countries on their way to being imported or exported by Denmark.

The climate impacts linked to Danish imports and exports are therefore imperative elements when identifying Denmark's global impact on the climate. This part of GR22 investigates the global climate impacts of Danish imports and exports of goods and services in two chapters. The part of imports going to Danish consumption is also included in Denmark's consumption-based climate footprint (chapter 2), while exports are not included in the climate footprint, as they go to foreign consumption.

Chapter 6 *Imports* presents an estimate of greenhouse gas emissions embedded in Danish imports. This includes foreign production and carriage of goods and services to the point where they are transferred to Danish hands in the form of imports. Danish imports can either be consumed in Denmark or be exported onwards for consumption abroad. The calculation includes all imports and is thus broader than the foreign emissions included in the calculation of the consumption-based climate footprint as imports.

Chapter 7 *Exports* investigates the global climate impact of Danish exports from three different angles. The chapter includes greenhouse gas emissions from production and carriage of goods and services to the point where they are transferred from Danish to foreign hands in the form of exports. Denmark also exports relatively large quantities of green environmental and energy technologies, and therefore the chapter also investigates the size of exports of green solutions and the potential CO_2e reductions from them in the countries to which they are exported.

The background memoranda on imports and exports contain a description of the methods, more detailed results and a description of the uncertainties associated with the results of the analyses.

The calculations of greenhouse gas emissions linked to imports and exports are excluding emissions from land-use change or from burning of biomass and biofuels[28].

[28] These three elements are covered in separate chapters with focus on Danish consumption and not imports and exports.

6 Imports

This chapter investigates the greenhouse gas emissions embedded in Danish imports. The estimate includes the entire life cycle of imported goods and services up to the point where they transfer from foreign to Danish hands. If a person in Denmark buys a German car, there will emissions embedded in this linked to production and transport of the car. For example, this could be emissions from production of electronics in Taiwan or emissions from the manufacture of tyres in India. The consumption phase and disposal of the car are not included in the estimate of emissions from imports, because these emissions occur after the car has been transferred to Danish hands.

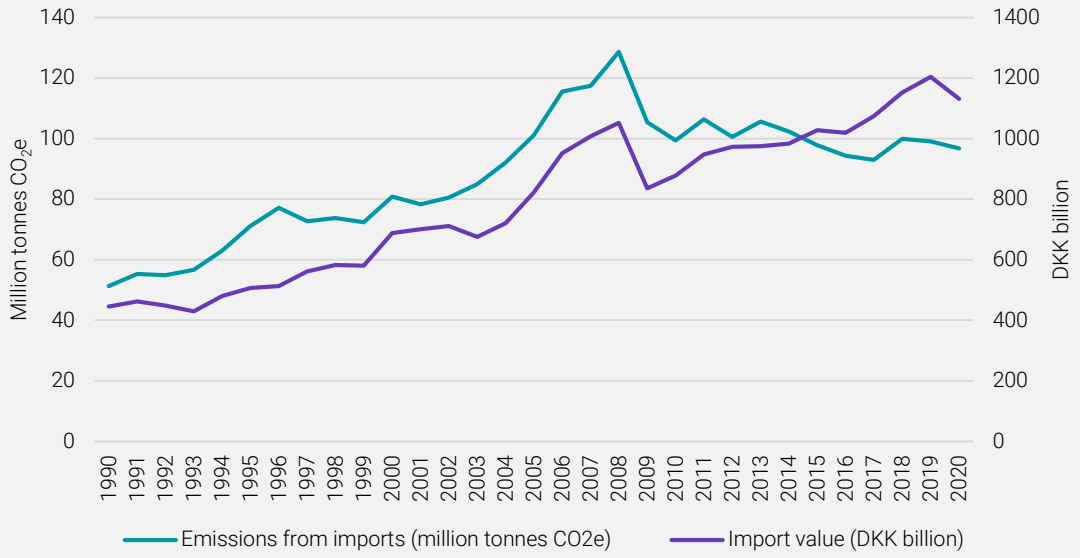
6.1 Main results

6.1.1 Emissions linked to Danish imports were 97 million tonnes CO_2e in 2020

The goods and services imported by Denmark have a climate footprint abroad. Emissions linked to Danish imports were 97 million tonnes CO_2e in 2020. This corresponds to 1.5 times Denmark's consumption-based climate footprint. In other words, Danish imports are associated with more emissions than Danish consumption, which is because some imports are later exported. Emissions embedded in Danish imports have almost doubled since 1990 Figure 17 shows that emissions from Danish imports increased up to the Financial crisis and then dipped abruptly to a level where they have remained stable since.

Danish imports include all situations in which goods and services are transferred from foreign to Danish hands. This means that imports also include situations in which Danish shipping companies, for example, pay foreign shipping companies to transport goods. Even if the goods are not consumed in Denmark but transported between other countries, fuels for the ships doing the transport will be included in the figure for imports under shipping. Chapter 8 describes emissions from international transport in more detail.

Figure 17: Developments in emissions embedded in Danish imports in DKK



Source: Danish Energy Agency. Note: Imports in DKK are stated in 2020 prices

6.1.2 Danish imports have become less climate-impacting per DKK imported

The value of Danish imports puts emissions from imports into perspective. Figure 17 shows that the value of Danish imports has been following an upward trend since the financial crisis, while emissions have remained almost constant during the same period. Thus, over the past ten years, Danish imports have become less climate-impacting per DKK imported.

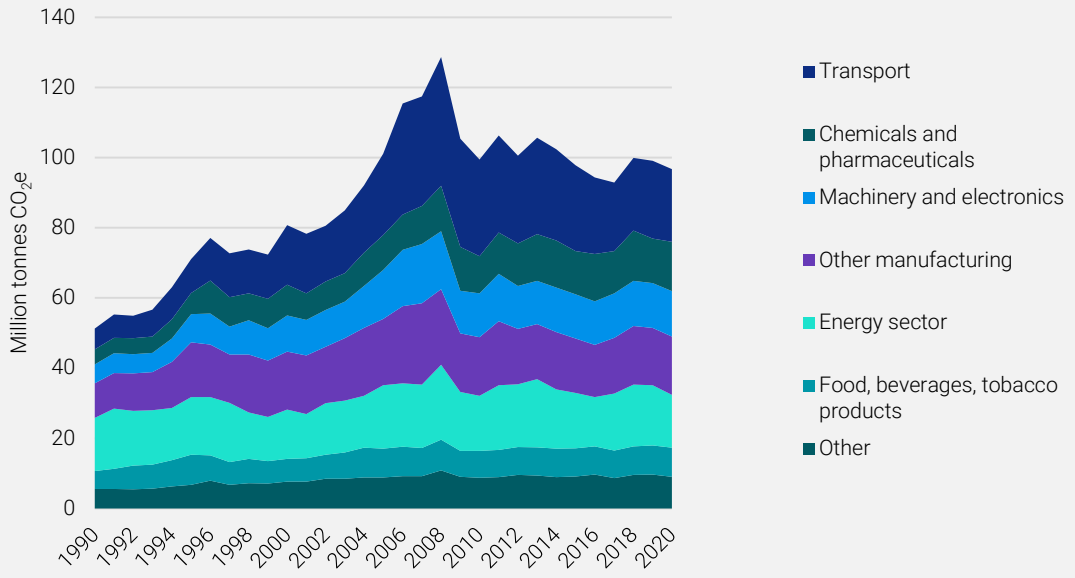
6.1.3 Emissions from Danish imports in 2020 were primarily related to consumption abroad

In 2020, around 40% of emissions embedded in Danish imports were related to Danish consumption. The remaining 60% of emissions were related to goods and services imported to Denmark and then exported onwards for consumption abroad.

Emissions from Danish imports related to consumption in Denmark (i.e. goods and services consumed by households, public bodies or in connection with investments) increased by 9 million tonnes CO_2e in the period 1990 to 2020. During the same period, emissions from Danish imports related to consumption abroad increased by almost four times that figure. This development could be because some of the production has been moved abroad and because a larger share of exports is based on imports rather than on goods and services produced in Denmark.

The imports emissions of six out of seven industry groups have gone up since 1990Figure **18** shows that six of seven industry groups have seen an increase in emissions related to the goods and services they import. The transport sector has seen the largest increase in emissions, from 6 to 21 million tonnes CO_2e in the period 1990 to 2020, and this is due in particular to an increase in Danish shipping abroad. The chemicals and pharmaceutical industry saw the second-largest increase, with emissions increasing from 4 to 14 million tonnes CO_2e in the same period. Emissions related to imports of electricity are covered in chapter 9.

Figure 18: Emissions from Danish imports by industry groups



Source: The Danish Energy Agency.

6.1.4 The transport sector accounted for the largest share of emissions in 2020

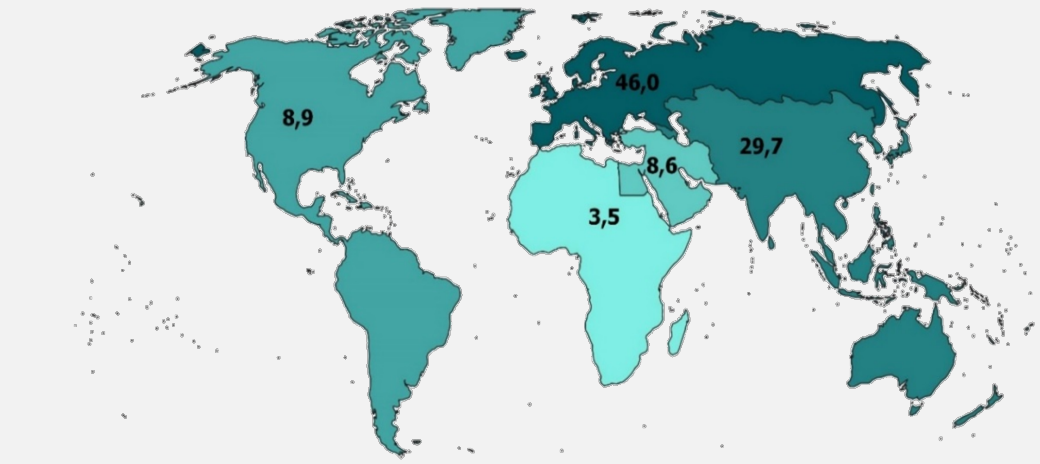
In 2020, 21% of emissions embedded in Danish imports were related to imports by the transport sector Two-thirds of emissions related to shipping, while the last one-third related to auxiliary services for transport and aviation. Auxiliary services for transport include harbours and transport terminals. The large share attributable to shipping is a consequence of the relatively large size of Denmark's transport fleet. The majority of emissions from Danish imports related to the transport sector are not attributable to Danish consumption but rather to goods and services exported onwards to other countries (see chapter 7 on exports).

The 'other manufacturing' industry group (which includes the clothing industry and the concrete industry, for example) accounted for the second-largest share of imports emissions in 2020; i.e. 17%.

6.1.5 The majority of Danish imports emissions occurred in Europe

Denmark imported goods and services from large parts of the world in 2020. Figure 19 shows that the majority of emissions from Danish imports occurred in Europe and Asia; with shares of 46% and 30%, respectively.

Figure 19: Emissions from Danish imports by five regions in 2020 (million tonnes CO_2e)



Source: Danish Energy Agency. Note: The breakdown into regions is based on EXIOBASE.

The largest climate footprint from Danish imports was in China and corresponded to around 14 million tonnes CO_2e. The largest share of emissions from Danish imports from China is linked to the Danish chemicals and pharmaceuticals industry (25%). The second-largest climate footprint was in Russia and corresponded to around 11 million tonnes CO_2e. More than half (57%) of emissions embedded in imports from Russia related to the Danish oil and gas industry. Germany is currently the only country from which Denmark can receive natural gas. Through Germany, Danish gas supply is closely connected to the European gas market, which is largely supplied with natural gas imported from Russia.[29] The emissions linked to imports stem from energy consumption when extracting the gas, as well as from general operation and development of oil and gas fields in Russia. Emissions from actual burning of the imported goods are not included in emissions from Danish imports.

[29] Similar to the other calculations of imports, emissions in Russia embedded in Danish imports have been calculated on the basis of the monetary IO tables in the Danish national accounts and figures from the EXIOBASE on inter-industry and inter-state trade. The calculations are therefore not based on an estimate of physical import volumes, and the figures concerns both oil and gas.

7 Exports

This chapter investigates the climate-related aspect of Danish exports from three approaches: 1) greenhouse gas emissions from Danish exports, 2) the DKK value of Danish exports of green solutions, and 3) the potential for CO_2 emissions reductions from Danish green exports.

For example, in the case of exports of Danish wind turbines, the first approach estimates the emissions related to producing and transporting the wind turbine to the point it is transferred into foreign hands, including foreign emissions linked to components imported for use in the production of the wind turbine in Denmark. The second approach looks at the DKK value of Danish exports of wind turbines and other green solutions. The third approach follows the wind turbine and other green exports to their destination abroad and investigates the potential CO_2 emissions reductions abroad from Danish wind turbine technology, etc. in the use phase.

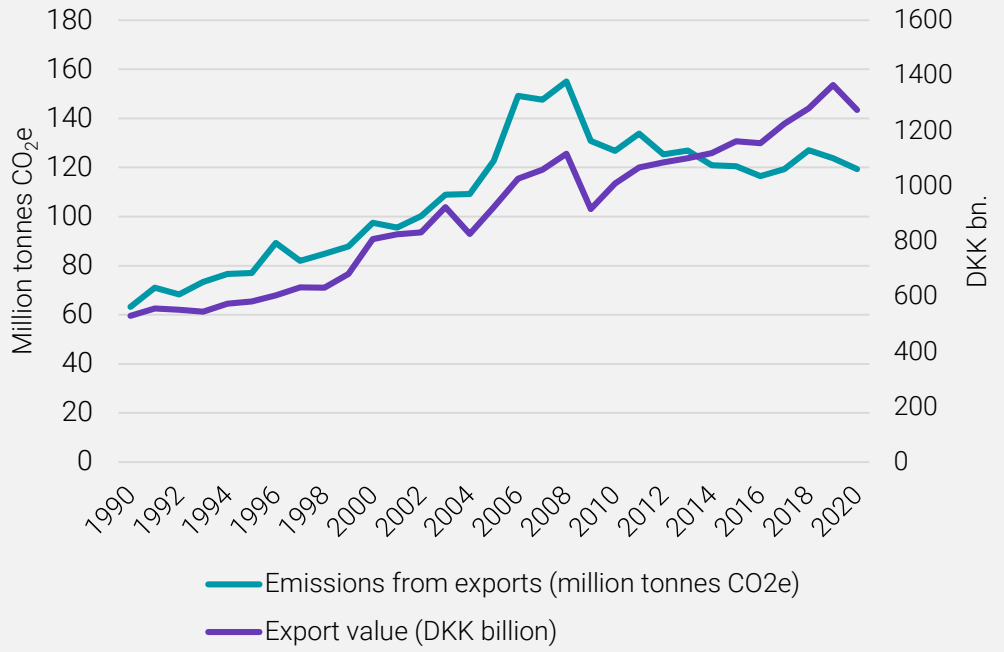
7.1 Main results - greenhouse gas emissions from Danish exports

7.1.1 Greenhouse gas emissions from Danish exports were 119 million tonnes CO_2e in 2020

Emissions from Danish exports were 119 million tonnes CO_2e in 2020. This corresponds to almost two-times Denmark's consumption-based climate footprint. In other words, Danish exports are associated with more emissions than Danish consumption, which is because Denmark has an open economy and extensive trade with the world. Figure 20 shows that emissions have doubled since 1990, and this is partly due to increased exports. A large share of the emissions stems from the international freight of goods by Danish shipping companies.

Danish imports are related to exports, because imports are often included as semi-finished products in the production of Danish goods subsequently exported from Denmark. Another share of Danish imports is exported onwards directly without any processing in Denmark. An example of this is foreign maritime transport, which is a service bought by Danish shipping companies for shipping goods between countries outside Denmark, and which therefore leads to foreign consumption.

Figure 20: Developments in emissions from Danish exports and export value



Source: Danish Energy Agency. **Note:** The export value is stated in fixed 2020 prices.

7.1.2 Danish exports have become less climate-impacting per DKK exported

The value of Danish exports puts emissions from exports into perspective. Figure 20 shows that the development in the DKK value of Danish exports previously followed the development in emissions, but this DKK value has resumed an upward trend since 2009, while greenhouse gas emissions have remained at the same level during the same period. Thus, over the past ten years, Danish exports have become less climate-impacting per DKK exported.

7.1.3 The transport sector accounts for around one-half of emissions from Danish exports

In 2020, the Danish transport sector accounted for around half of emissions from Danish exports. Of these emissions, 93% came from shipping, including foreign auxiliary services in the form of harbours and transport terminals, for example. Next after the transport sector, the food, beverages and tobacco industry accounted for 11%.

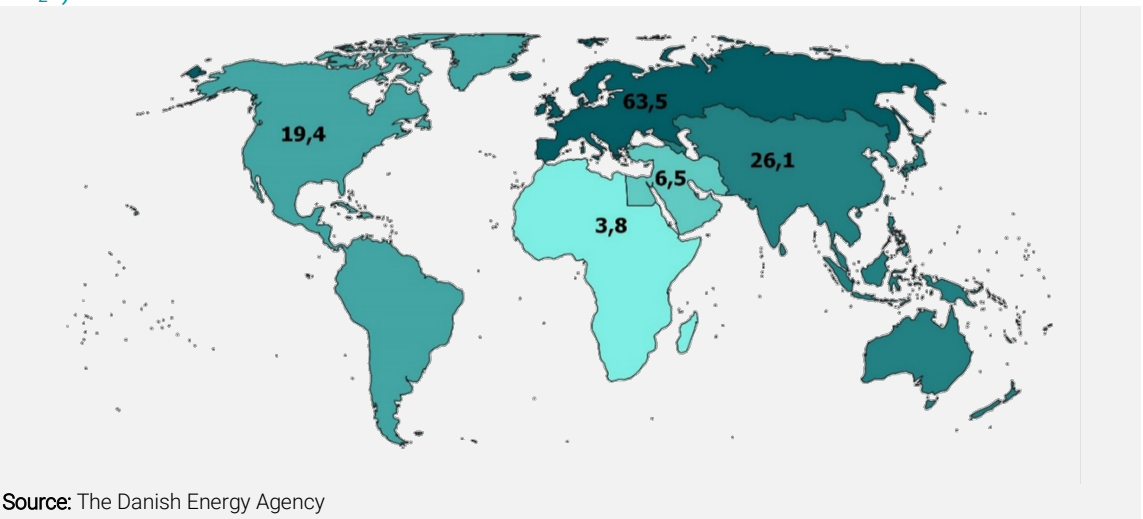
The reason that shipping accounts for a large share of Danish exports is partly that Denmark has a relatively large transport fleet, and partly because the freight and freight procurement of Danish shipping companies around the world are categorised as Danish exports when the freighted goods are not consumed in Denmark. As mentioned in the previous chapter, the transport sector also accounts for a considerable share of imports emissions, of which the major part is related to onward export.

7.1.4 Half of Danish exports emissions were embedded in products exported to Europe

In 2020, Denmark exported goods and services to more than 150 different countries. The emissions embedded in these goods and services are shown in Figure 21, broken down by five world regions. The estimate includes the countries that *first receive* the

products and their embedded emissions; that is, the countries that receive Danish exports, regardless of whether these countries subsequently export the goods and services onwards to other countries. Around half of emissions embedded in Danish exports related to exports to Europe. The second-largest recipient was Asia, followed by North and South America.

Figure 21: Emissions from Danish exports by five regions of the world in 2020 (million tonnes CO_2e)



Source: The Danish Energy Agency

The USA and Germany received Danish exports with the highest amounts of embedded emissions in 2020. They accounted for 13 and 12 million tonnes CO_2e, respectively. Furthermore, they are the two countries to which Denmark exported the most in terms of DKK. Transport by ship constitutes a major part of emissions from Danish exports, and this also applies to exports to the USA and Germany. More than half of emissions from exports to the USA were linked to transport services from Danish shipping (66%). Shipping also accounted for the largest share of emissions embedded in exports to Germany (around 20%).

7.2 Main results - the value of Danish exports of green solutions

Green exports cover green energy technology and green environmental technology and related green services[30], all of which can be said to contribute positively to reductions in global emissions or to environmental and resource savings.

7.2.1 Green exports worth DKK billions in 2021

In 2021, Denmark exported green environmental technology worth almost DKK 20 billion and green energy technology worth DKK 65 billion, corresponding to around 2%

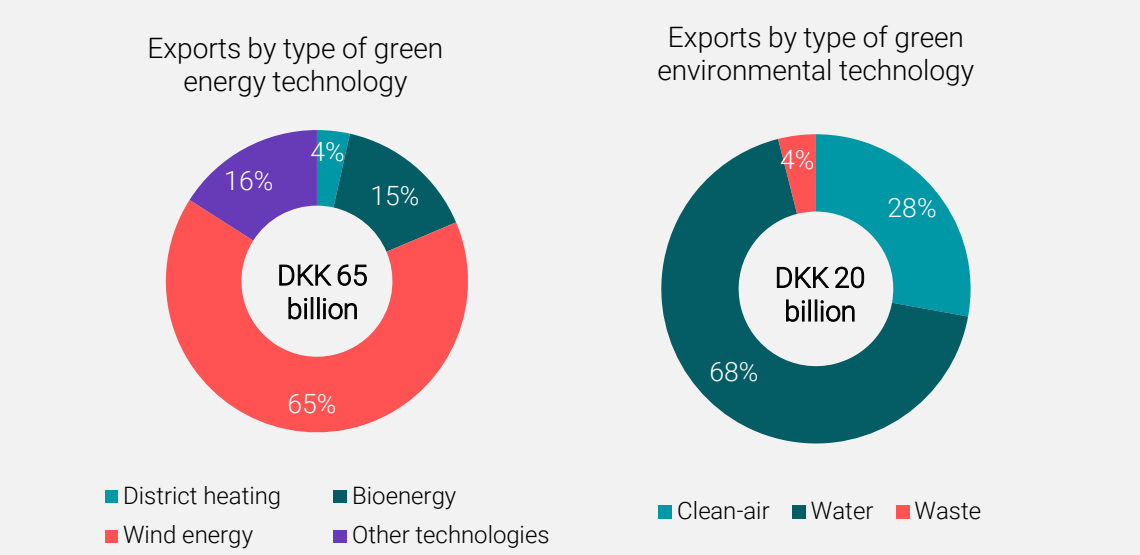
[30] Green services cover services such as consultancy or auxiliary services for products within green energy and environmental technologies. 'Green' in this context means Eurostat's definition of green products and all products within bio and wind technology.

and 8%, respectively, of total Danish goods exports[31]. Exports of both green energy technology and green environmental technology have been increasing since 2010.

7.2.2 Wind and water technologies dominate exports of energy and environmental technologies

Figure 22 shows the breakdown by type of technology within green energy and environmental technologies in 2021. With exports at a value of almost DKK 43 billion, wind technology makes up by far the largest share of total Danish green energy technology exports. Within green environmental technology exports, Denmark exported sustainable water technologies at a value of around DKK 15 billion in 2021.

Figure 22: Exports of green energy technology and green environmental technology in 2021 by type of energy



Source: Calculations by Eurostat and the Danish Energy Agency

7.2.3 Danish exports of green energy services and green environmental services are increasing

In 2010, Danish green environmental services had an export value of DKK 2.2 billion. In 2021, the export value had increased to DKK 4.8 billion, corresponding to a 116% increase. Similarly, Danish green energy services had an export value of DKK 7.7 billion in 2010 and this figure increased to DKK 11.9 billion in 2021, corresponding to a 55% increase. Green environmental and energy services include auxiliary services delivered in conjunction with green goods and consultancy services.

7.3 Main results - the CO_2 emissions reduction potential related to Danish green exports

Further to the green export of environmental and energy technology dealt with in section 7.2 above, this section investigates the CO_2 emissions reductions potential

[31] There may be overlap between exports of green environmental technology and exports of green energy technology, and these figures can therefore not be added together without risking double counting.

outside Denmark of Danish green exports. This analysis looks at the use phase of exported Danish green energy technologies. The analysis entails a comparison with a hypothetical reference scenario in which no exports took place, which means the analysis shows the *potential* for CO_2 emissions reductions; not an estimate of actual CO_2 emissions reductions.

7.3.1 Potential for CO_2 emissions reductions from exports of up to 215 million tonnes CO_2 in 2021

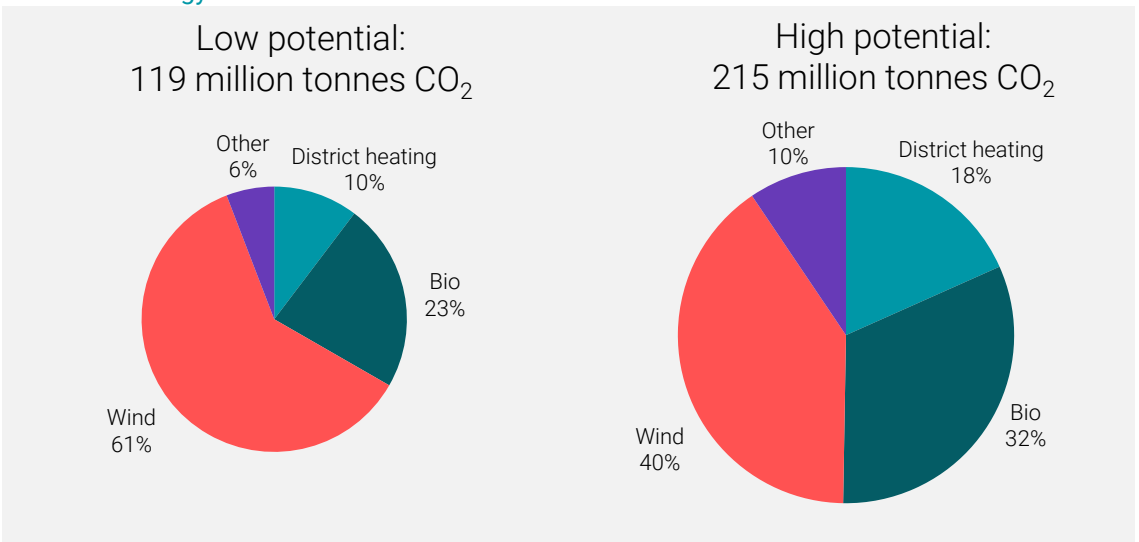
In *a single* given year within the lifetime of the technologies, Danish green energy technologies exported in 2021 have potential to reduce global emissions by between 5 and 8 million tonnes CO_2. Over the entire lifetime of the technologies, the potential is greater, because there are new reductions year by year. Over the entire lifetime of the individual technology, it is estimated that Danish green energy technologies exported in 2021 have potential to reduce emissions outside Denmark by between 119 and 215 million tonnes CO_2, depending on what technology the exported Danish technology replaces.

Other technologies than energy technologies can lead to reductions abroad. See box 9 for examples.

7.3.2 Wind technologies account for the largest share of the potential for CO_2 emissions reductions from exports

Figure 23 shows the CO_2 emissions reduction potential over the full lifetime of the technology, broken down by four green energy technology categories (see section 7.2): district heating technologies, wind technologies, biotechnologies and other technologies. The diagram on the left shows the lower range of the potential (119 million tonnes CO_2), while the diagram on the right shows the upper range (215 million tonnes CO_2). As can be seen from the figure, wind technologies are the predominant technology category in both diagrams. This is because wind technologies account for by far the majority of Danish green exports. Bioenergy also accounts for a large share, in particular in the upper range (the diagram on the right). This is because the figure includes biomass-based CHP that replaces coal-based CHP.

Figure 23: Breakdown of CO_2 emissions reductions by type of technology over the full lifetime of the technology



Note: The diagram on the left shows the percentage distribution of the four categories of technology at the lower range of the potential and the diagram on the right shows the upper range of the potential.

Box 9: **Other green exports than energy technologies can lead to reductions abroad**

Besides green energy technology exports, there are other Danish exports which can be categorised as being green and have the potential to reduce greenhouse gas emissions abroad. Two specific examples are[32]:

- Reducing food waste
  The pharmaceutical company Chr. Hansen estimates that the company prevented waste corresponding to 200,000 tonnes of yoghurt globally in 2019/20 through sales of FreshQ®, a product that extends the shelf life of yoghurt. Chr. Hansen further estimates that the yoghurt production avoided corresponds to up to 260,000 tonnes of CO_2e emissions avoided globally.

- Optimising breeding programmes for dairy and beef cattle
  The breeding programme by VikingGenetics optimises the relationship between high milk yields and low methane emissions from dairy cows and beef cattle. VikingGenetics estimates that, replacing an average European cow with a VikingGenetics cow could reduce emissions pr. litre of milk by around 0.1 kg CO_2e. Replacing cows from outside Europe would increase the reduction potential even more.

[32] Unless stated otherwise, the examples are based on data and assessments by the relevant business.

Focus topics

This part of GR22 focuses on a number of selected topics that are particularly relevant to describing Denmark's global climate impact. These topics include international transport, cross-border electricity trade, imports and consumption of soy, the global climate action of Danish business, and the global effects of Danish political agreements.

Chapters 8, 9 and 10 on *international transport, cross-border electricity trade* and *imports and consumption of soy* focus on a product or sector with a considerable climate impact outside Danish borders. These chapters are a supplement to the estimates of consumption, imports and exports in parts 1 and 2, which described Denmark's total climate footprint.

Chapter 11 *The global climate action of business* takes a closer look at whether and how Danish small and medium-sized enterprises (SMEs) in general are working to reduce their global climate footprint.

The background memoranda related to these chapters include descriptions of the methodologies applied, more detailed results, as well as a description of the uncertainties associated with the results of the analyses.

8 International transport

International aviation and shipping account for around 1.5% and just under 2%, respectively, of total global CO_2e emissions ((ICCT, 2019)/ (Crippa, et al., 2019)/ (IMO, 2021)). These emissions are not included in the estimates of the territorial emissions of countries reporting to the UN. Reduction targets for international aviation and shipping are therefore generally not included in the national targets of individual countries under the Paris Agreement[33]. Instead, it is assumed that efforts to reduce these emissions are managed under the auspices of the UN International Maritime Organization (ICAO) (for aviation) and the International Maritime Organization (for shipping), as well as at European level through the EU.

This chapter of GR22 focuses on how Denmark adds to global emissions from international aviation and shipping. The chapter pinpoints emissions implicating Danish activity but which are not part of the Danish reduction target for 2030[34].

The results presented in this chapter depend on the definition applied as to what part of aviation and shipping can be attributed to Denmark, and they depend on whether there are any data registers available to specify this.

8.1 Main results - international aviation

This chapter focuses on the climate impacts associated with the global activity of Danish air carriers and on flights to and from Denmark by Danish as well as by foreign air carriers.

Box 10: **Regulation of greenhouse gas emissions from aviation**

Regulation of greenhouse gas emissions from aviation at global level is through the CORSIA mechanism under the ICAO and at EU level through the EU Emissions Trading System (EU ETS). In 2021, as part of the 'Fit for 55' package, the European Commission presented a series of proposals for increased regulation of the sector's emissions, including a revision of the EU ETS, a tax on aviation fuels, as well as a sustainable fuels blending requirement.
At the same time, in Denmark and internationally, there are ongoing efforts to develop and produce sustainable aviation fuels, new aircraft technologies and optimised flight paths and airport logistics.

[33] However, emissions of CO_2 from aviation internally in the EU are covered by the EU ETS Directive, and these emissions are therefore also reported as being part of the EU reduction target under the Paris Agreement, (see the EU's so-called Nationally Determined Contributions, NDCs).

[34] International transport is included in several of the chapters in GR22 and there are certain overlaps. For a more detailed description of international transport in GR22, including regulation, initiatives, key figures and indicators, see the background memorandum on international transport.

8.1.1 Greenhouse gas emissions from international flights related to Denmark increased until 2020, then dropped

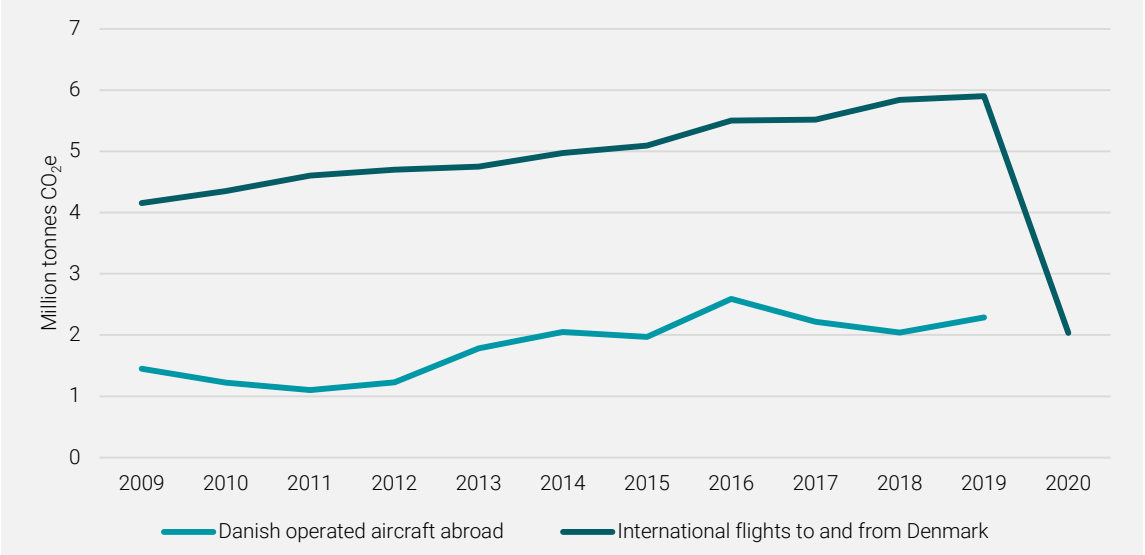
The climate footprint of aviation with links to Denmark described in this section only covers direct emissions of CO_2 from burning fuels. The climate impact related to flights is however higher than that attributed to these emissions, see the background memorandum for an explanation of why.

As can be seen from Figure 24, the past ten years have seen a steady increase in greenhouse gas emissions associated with air travel to and from Denmark. This increase in emissions reflects a general international increase in the demand for air transport. Emissions were at around 6 million tonnes CO_2e in 2019 but then fell significantly in 2020 to around 2 million tonnes CO_2e due to the Covid-19 pandemic.

The estimate includes international passenger and/or cargo flights, regardless of airline and ownership details, on flight legs between a Danish airport and the next airport, or from an international airport to Denmark. The emissions cannot be linked specifically to the nationality of the passengers on the flight or to the country of production/end consumption of the freighted goods.

The overall trend in emissions of greenhouse gases from Danish operated aircraft bunkering abroad also increased over the period.[35] Besides general economic growth, these emissions are affected by changes in Danish market shares.

Figure 24: Greenhouse gas emissions associated with international flights to and from Denmark and from bunkering abroad by Danish operated aircraft, for passenger as well as freight transport



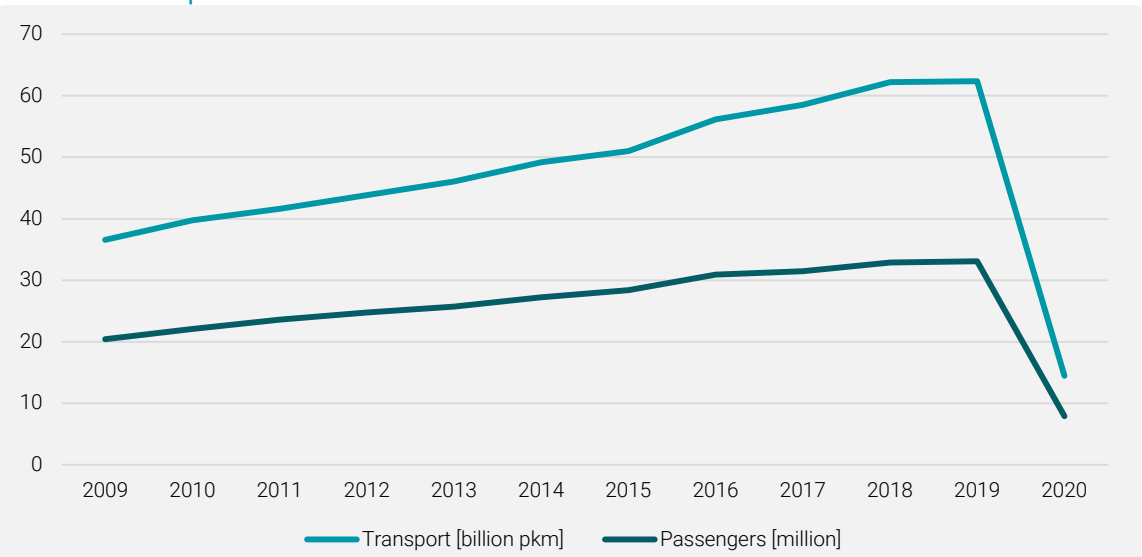
Source: (Danmarks Statistik, Data udtrukket via Statistikbanken november 2021 fra Danmarks Statistiks database, der løbende opdateres., 2021), (Trafikstyrelsen, 2021)

[35] As most bunkering abroad by Danish operated aircraft is in connection with flights to Denmark, there will be an overlap with the calculation of emissions related to flights to and from Denmark. The two figures can therefore not be added together.

8.1.2 Passenger numbers to and from Denmark increased until 2020, then dropped

The international increase in the demand for air transport is reflected in rising passenger numbers and increased transport[36] (measured as person-kilometres). The number of passengers on international flights to and from Denmark increased from around 20 million in 2009 to around 33 million in 2019, while transport increased from around 37 billion person-kilometres to around 62 billion person-kilometres, see Figure 25. The Covid-19 pandemic had a significant effect in 2020, when passenger numbers fell to around 8 million and transport fell to around 12 billion person-kilometres.

Figure 25: Passenger numbers and transport related to international flights to and from Denmark in the period 2009-2020



Source: (Trafikstyrelsen, 2021) Note: Note that the Y axis units differ for the individual indicators, see the text above the figure.

Similar to the increase in passenger flights, there has also been an increase in the volume of air cargo transported to and from Denmark. The total volume of air cargo (cargo freighted by either passenger or cargo flight) doubled in the period 2009 to 2019, from around 0.15 million tonnes to around 0.3 million tonnes, but dropped again to 0.23 million tonnes in 2020. In comparison, transport (by cargo flight) measured in tonne-kilometres doubled during the same period.

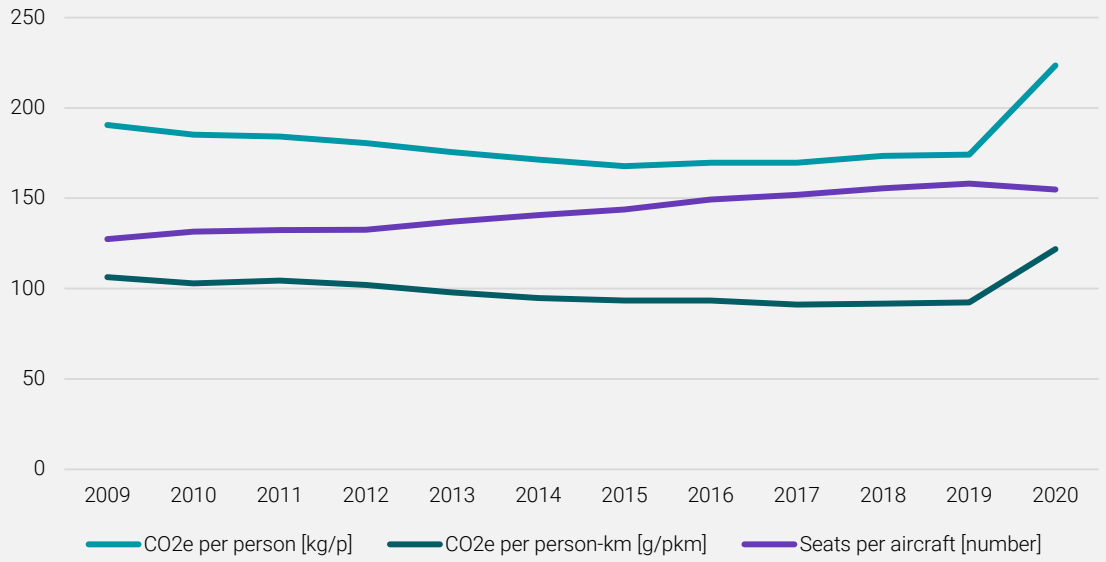
8.1.3 International aviation to and from Denmark has become more efficient

To investigate the overall efficiency developments in international aviation, a number of indicators for flights to and from Denmark has been set up to compare emissions with transport. In the past decade, aircraft have generally become larger and relatively more efficient. At the same time, the number of seats per aircraft and passenger seat occupancy rates have gone up. This gives rise to overall emissions reductions measured per passenger and per transport work, as shown in Figure 26. Emissions per passenger travelling to and from Denmark in the period 2009-2019 fell from 189 to 172

[36] Transport is defined as passenger numbers/tonnes of cargo relative to the total number of kilometres the passengers/cargo are/is carried.

kg CO_2e, corresponding to a drop of around 9%. Emissions per person-kilometre fell by around 13% over the same period, from 105 g CO_2e in 2009 to 91 g CO_2e in 2019. The increase in 2020 should be considered in light of the Covid-19 pandemic, which led to lower occupancy rate.

Figure 26: Developments in indicators of developments in efficiency in international aviation (passenger flights) to and from Denmark in the period 2009-2020



Source: (Trafikstyrelsen, 2021). Note: Note that the Y axis units differ for the individual indicators, see the explanations of data series.

8.2 Main results - international shipping

Denmark is the world's sixth largest maritime nation in terms of operators, and Danish-operated ships (either owned or chartered by a Danish operator) make up around 4.4% of the world fleet. (Danske Rederier, 2022). International shipping is a global industry, and a large part of Danish operations takes place far from Europe, with the USA, China and Japan comprising some of the largest markets.

This chapter focuses on the climate impacts associated with fuel bunkering in Denmark by Danish and foreign ships, as well as the global operations of Danish operated ships.

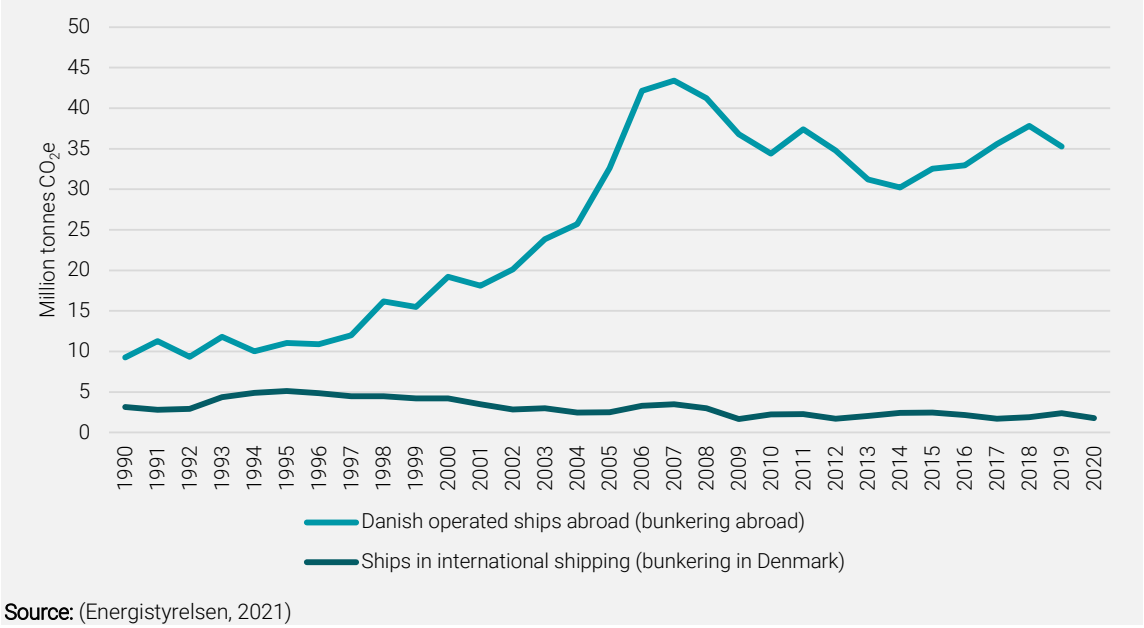
Box 11: **Regulation of greenhouse gas emissions from shipping**
Regulation of greenhouse gas emissions from shipping at global level is through the UN International Maritime Organization, IMO. In 2018, the IMO adopted a strategy to reduce greenhouse gas emissions from shipping, including a goal that emissions per transport work be reduced by at least 40% by 2030 compared to the 2008 level. With its 'Fit-for-55' package, the EU has also taken steps to reduce emissions by the sector. This package includes a proposal to include shipping in the EU Emissions Trading System (EU ETS).

Danish businesses are spearheading a number of important initiatives to transition the shipping industry - both in terms of buying carbon-neutral ships, developing and establishing production plants for alternative fuels, and developing engines for new technologies.

8.2.1 Danish ships abroad have stable emissions, despite a general growth in freight volumes

Since 2010, emissions from bunkering in Denmark by ships in international shipping (Danish and foreign-owned ships) have been between 1.7 million and 2.5 million tonnes CO_2e, see figure 27[37]. There was a significant increase in emissions from bunkering outside Denmark by Danish-operated ships in the period 1990 to 2007, after which emissions evened out, and in 2019 emissions were at around 35 million tonnes CO_2e[38], see **Figure 27**. The increase up to 2007 can generally be ascribed to global economic growth and the demand for transport services. Note that emissions from Danish operated ships are also affected by changes in the market shares of the Danish merchant fleet.

Figure 27: Developments in emissions linked to bunkering Danish operated ships abroad, as well as emissions linked to bunkering in Denmark by international shipping.



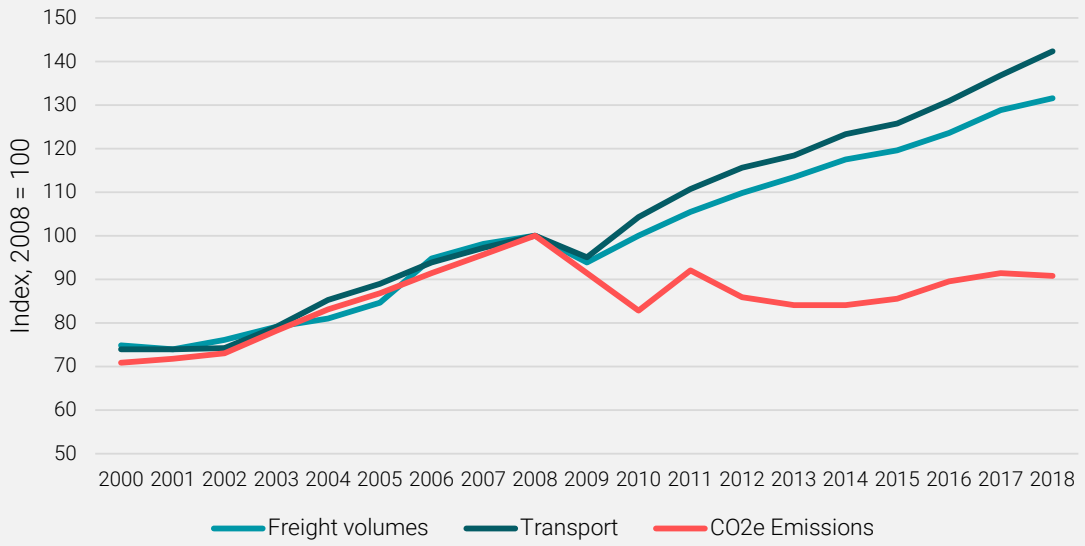
Source: (Energistyrelsen, 2021)

The period 2011-2018 saw a decoupling of growth in emissions from the continued growth in freight volumes globally, see Figure 28. This trend also applies to Danish emissions. The increased efficiency is due primarily to better utilisation of ships; optimisation of speed, operations and routes; new designs and new technologies; as well as larger and more efficient ships.

[37] In this context, emissions from bunkering only include emissions associated with burning the fuels bunkered. The estimate of emissions by shipping in the chapter on exports includes emissions from the entire value chain for fuels as well as port activities linked to the exports.

[38] In comparison, in connection with the government's Climate Partnership for Blue Denmark, Danish Shipping estimated emissions by Blue Denmark in international waters to be 52.8 million tonnes CO_2 in 2018. The reason for the difference relative to GR22 could be because Danish Shipping includes foreign subsidiaries of Danish shipping companies in its estimate.

Figure 28: Growth in freight volumes and emissions in global shipping



Source: Based on the International Maritime Organization's (IMO) 4th GHG study (IMO, 2021). Note: Data on freight volumes and emissions has been indexed relative to 2008; the baseline year for the international maritime organization's (IMO) 2018 strategy. Freight volumes are shown in both tonnes and tonnes/km. Emissions are from the IMO's international shipping emissions inventory.

International shipping is characterised by having a very large number of players and by being extremely diverse with regard to types of vessel and transport tasks. For this reason, it is difficult to compare the climate footprint of Danish ships with that of other countries. Even a comparison of emissions within a certain type of vessel will depend on such factors as size of vessel, capacity utilisation, speed, climatic conditions, navigation routes, number of ports visited, waiting time at anchor, cooling and heating of load, how the ship is loaded (self-loading or using loading equipment), etc.

Denmark has particularly large activity for container carriers. Container carriers flying the Danish flag[39] account for around 7.3% of total world fleet transport work [40] by container carriers, but only 5.5% of total world fleet container carrier emissions. This is because container carriers flying the Danish flag are among the largest in the world, and this contributes to lowering transport emissions. Initiatives to promote technological development, such as optimised ship design and functionalities, new engine technologies and fuels, can potentially have a significant effect on total CO_2e emissions if targeted at Danish container carriers, because they constitute such a large and significant segment of the world fleet.

[39]Vessels flying the Danish flag and that navigate in Danish and international waters under Danish supervision (registered in the Danish Shipping Register (SRG)).
[40] Transport work is defined as distance navigated (measured in nautical miles) times deadweight tonnage (which is a measure of a ship's cargo capacity or capacity (cargo plus fuel)). The data is from the International Maritime Organization's GISIS Ship Fuel Oil Consumption database, which does not contain data for capacity utilisation. This means that the transport figure indicates the potential maximum transport activity rather than the actual transport.

9 Cross-border electricity trade

Electricity requires hourly balancing of demand and capacity because of the limited possibilities for storing it. This balance is achieved across country borders through the electricity system. Thus, when there is an imbalance between electricity production and electricity demand in Denmark, the electricity system is used to balance out the imbalance through cross-border exchange (trade) of electricity.

Electricity imported for domestic use will often reduce the territorial greenhouse gas emissions of the importing country, because the electricity is then produced in another country. The opposite applies for electricity exports. For example, when Denmark exports electricity at hours with extensive offshore wind, this can help reduce coal-based electricity production in Germany and, thus, emissions in Germany.

This chapter only describes the impact on foreign emissions as a consequence of changes in electricity production abroad as a result of cross-border electricity trade with Denmark. Any increased emissions on Danish territory (in connection with Danish electricity exports, for example) have not been included, but these are described in Denmark's Climate Status and Outlook 2022 (CSO22).

This chapter provides emissions for historical years. Furthermore, the projection of electricity production and demand presented in CSO22 has been used to estimate the future impact on foreign emissions following from Danish cross-border electricity trade[41].

9.1 Main results

9.1.1 Foreign emissions embedded in Danish electricity trade estimated at 0.6 million tonnes CO_2

Denmark had higher electricity imports than electricity exports in the period 2018 to 2020. Danish net electricity imports corresponded to between 12-20% of domestic electricity consumption. Looking at average foreign emissions,[42] Danish net electricity imports contributed to additional emissions outside Denmark corresponding to around 0.6 million tonnes CO_2 in the period 2018-2020, see **Table 2**.

In 2020, Denmark had relatively high net electricity imports of about 7TWh, corresponding to around 20% of domestic electricity consumption. Note that 2020 was an unusual year because of the Covid-19 pandemic and with surplus capacity in the

[41] Thus, the estimate is based on a frozen-policy scenario. A frozen policy describes a scenario in which no new policy measures are introduced in the climate and energy area other than those decided by the Danish Parliament before 1 January 2022 or arising out of binding agreements. The estimate therefore does not reflect an expected effect on developments in foreign emissions, as the political agreements concerning energy islands and Power-to-X, for example, have not been included in CSO22. Furthermore, foreign development trends are based on data from 2020. This means that the estimate of future impacts in CSO22 is based on significant delimitations.

[42] The average emission factor for electricity production is stated for each hour and for the countries with which Denmark has electricity trade (Norway, Sweden, Germany and the Netherlands).

hydro reservoirs of Norway and Sweden due to mild weather and large quantities of snow during winter 2019-2020. The surplus in hydro reservoirs may have given rise to the higher Danish electricity imports from hydropower in Norway and Sweden.

Table 2: Electricity imports and exports in Denmark and estimated impact on emissions abroad: historical

Key figures	Type	2018	2019	2020
Net imports TWh	Imports of electricity	6.3	6.3	8.4
	Exports of electricity	2.1	1.9	1.3
	Net imports	**4.2**	**4.4**	**7.2**
Average foreign emission factor g CO_2/kWh	When Denmark imports	130	115	100
	When Denmark exports	115	80	175
Key indicators: Impact on foreign emissions Million tonnes CO_2	Danish electricity imports, increased emissions	0.8	0.7	0.9
	Danish electricity exports, reduced emissions	0.2	0.1	0.2
	Net emissions	**0.6**	**0.6**	**0.6**

Note: The key indicator for impacts on foreign emissions is arrived at as follows: imports (or exports) times the emission factor when Denmark imports (or exports) = impact on emissions.

9.1.2 Denmark primarily exchanges electricity with Norway and Sweden.

In 2020, Denmark primarily imported electricity from Norway and Sweden, but also a smaller amount from Germany and the Netherlands, and this was also the situation in the two previously years. Overall, around 70% of electricity imported to Denmark came from Norway and Sweden in 2020, and the large increase in electricity imports (including in net electricity imports) was due to higher imports from Norway compared to 2019. Electricity production in Norway is largely based on hydropower, and for this reason the higher Danish net imports did not cause higher foreign emissions.

The analysis also shows that Danish electricity exports mainly went to Germany and Sweden in 2020. This is a change compared to preceding years when Denmark had net exports of electricity to Norway and Sweden. However, because of the surplus in hydro power capacity in Norway and Sweden as mentioned above, the demand for Danish electricity was smaller in 2020 than in previous years. In general, Denmark had smaller electricity exports in 2020 than in the two previous years due mainly to a drop in electricity exports to Norway and Sweden.

9.1.3 Denmark imported electricity when renewable energy-based electricity was plentiful

Overall, in 2020 Denmark imported electricity during hours when hydropower was dominant in the countries exporting hydropower. With regard to electricity exports, Denmark exported electricity during hours when the recipient countries had high shares of hydro, wind and nuclear power. However, the recipient countries also had coal-based and natural gas-based electricity production when Denmark exported electricity. The

increased foreign emissions embedded in Danish electricity trade are estimated to have totalled 0.6 million tonnes CO_2 in 2020, see table 2.

9.1.4 Developments in Denmark's Climate Status and Outlook point to increased electricity exports in the years to come

Denmark's Climate and Outlook 2022 (CSO22) projects a higher percentage increase in Danish electricity production than in Danish electricity demand up to 2030. The primary reason is that more offshore wind farms are expected to be put into operation before the end of 2030. The analysis in GR22 shows that Danish electricity exports will increase and Danish net electricity imports will fall up to 2030. Thus, according to the analysis, Denmark will go from being a net importer to being a net exporter of electricity, under the assumptions about production and consumption in CSO22. CSO22 does not include the political agreements concerning energy islands and Power-to-X, and these are expected to increase Danish electricity production and consumption, respectively.

9.1.5 According to the analysis, Danish cross-border electricity trade will reduce emissions outside Denmark up to 2030

The impact of electricity trade between Denmark and other countries is expected to change up to 2030. In recent years, foreign emissions have increased as a result of Danish electricity trade, because there have been more Danish imports than exports. The analysis in GR22 shows that foreign emissions will be reduced in future. This is partly because of increasing Danish electricity exports (and thus falling Danish net electricity imports), and partly because Denmark will import electricity in hours when foreign electricity is more sustainable than it is in hours when Denmark exports electricity.

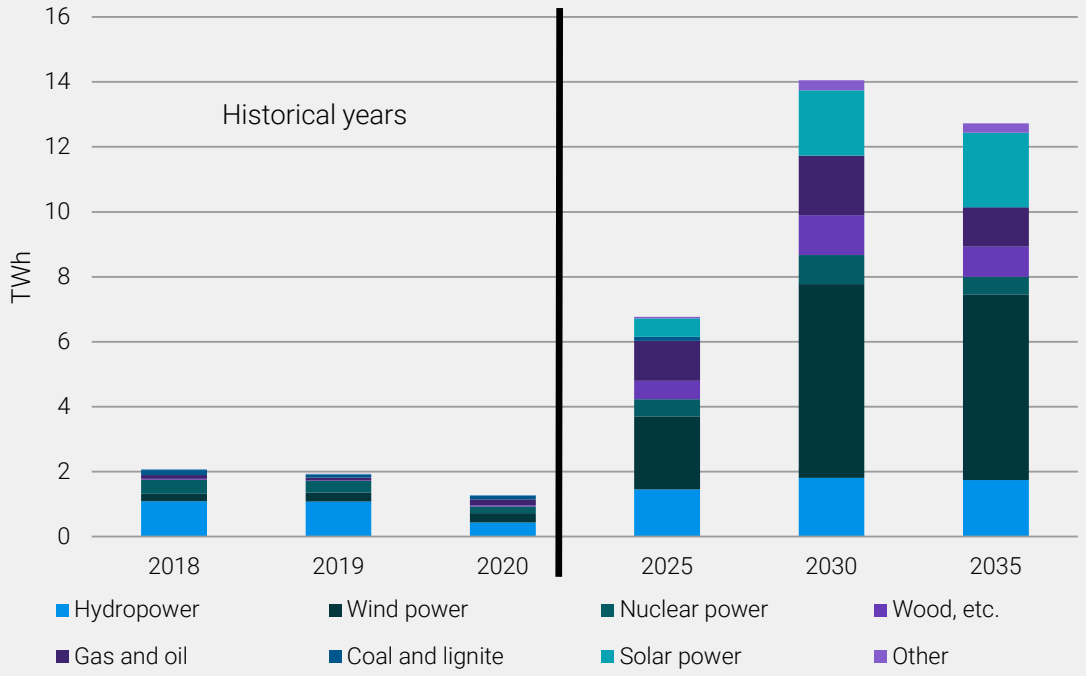
Although Denmark could be said to have contributed to *further* emissions corresponding to around 0.6 million tonnes CO_2 in 2020, it is estimated that future Danish electricity trade will contribute to *reducing* foreign emissions by around 0.6 million tonnes CO_2 in 2030[43].

9.1.6 Increasing electricity exports in future during hours with hydro, solar and wind in foreign electricity mix

In the projection period, exports of electricity from Denmark will go primarily to Germany, Sweden and Norway, but in the long term also to the Netherlands. Figure 29 shows that the types of technology generally in operation in the electricity production of recipient countries when Denmark exports electricity are wind, hydro and solar power. The only exception is Germany, which will still have electricity production based on coal and gas, and the results therefore indicate that electricity exports from Denmark will still contribute to emissions reductions abroad in future.

[43] Calculated on the basis of CSO22 and foreign average emissions.

Figure 29: Electricity exports from Denmark based on the electricity mix in the countries to which Denmark exports, during the hours when Denmark exports electricity.



Source: The Danish Energy Agency. Note: Compared with today, in future Denmark will increasingly be exporting electricity when there is a higher share of wind in the electricity production mix abroad , see assumptions in CSO22.

9.1.7 Increased Danish electricity exports are also estimated to reduce emissions abroad in 2035

The analysis shows that additional Danish electricity exports will lead to further reductions in emissions abroad, as other countries, Germany in particular, will continue use coal and gas. However, electricity production outside Denmark is expected to become ever more renewables-based as a result of decommissioning conventional power plants in Europe, amongst other things. Increased Danish electricity exports will therefore continue to reduce emissions abroad, although the impact will level off, not least due to Germany phasing out its coal-and-gas-based CHP plants.

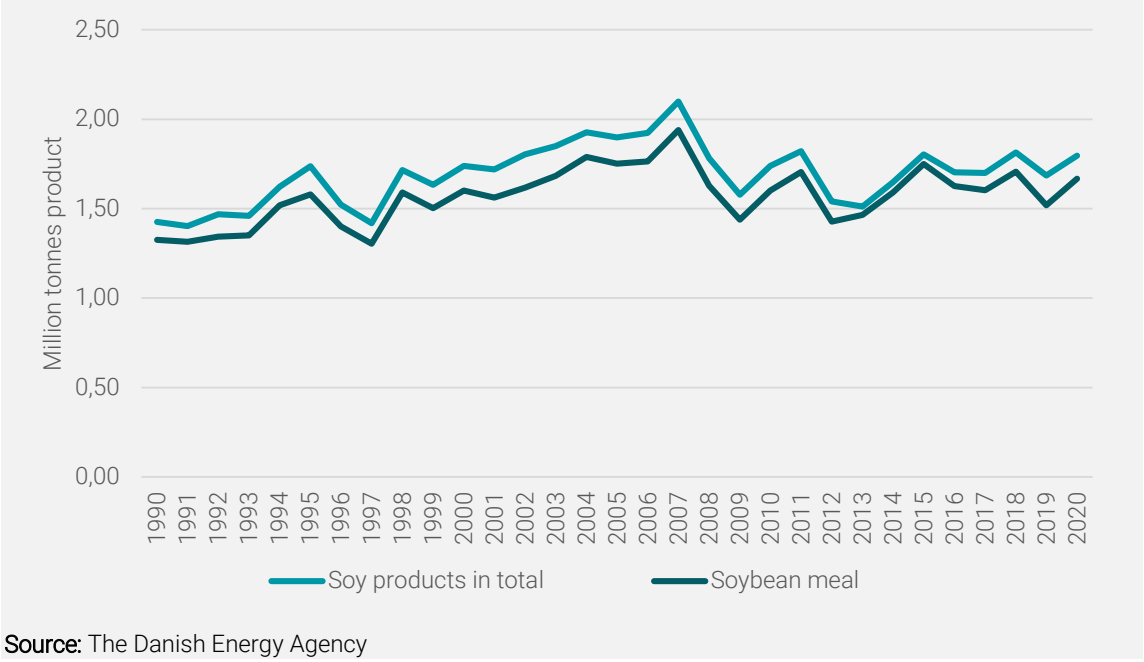
Additional Danish electricity imports will lead to increased electricity production abroad and will therefore lead to increased emissions abroad to the extent that the increased production is based on fossil fuels. However, in future, foreign electricity production is expected to become ever more renewables-based, and Danish electricity imports will therefore also become more renewable over time.

10 Imports and consumption of soy

This chapter spotlights Danish imports and consumption of soy, as imports and consumption of soy have a considerable impact on global greenhouse gas emissions, not least through indirect land-use change, for example in the form of deforestation as a result of demand for agricultural land for soy production. However, the results in this chapter cannot be compared with the results for emissions from land-use change in chapter 3[44].

Denmark imports soy in the form of soybean meal, in particular[45]. **Figure 30** shows Denmark's total imports of soy products[46] from 1990 to 2020 and reveals that imports of soybean meal accounted for by far the largest share (over 90%) of total imports of soy products in all years. Danish imports of soybean meal remained relatively stable over the period, see **Figure 30**.

Figure 30: Time series of total Danish imports of soy products, including soybean meal, from 1990-2020



Source: The Danish Energy Agency

The majority of Danish imports of soybean meal come from Brazil and Argentina, where the production of this raw material can be associated with land-use change, deforestation in particular (Callesen, 2020). Soy is therefore typically considered a

[44] This is because the calculations are based on different methodologies and data which cannot be directly compared. Different methodologies have been chosen to facilitate comparability with other analyses and estimates. See the background memorandum on imports and consumption of soy for an in-depth explanation of the consequences for the results of using the two different methodologies.
[45] Soybean meal is a residue product from the process of extracting soybean oil. Soybean meal is used for animal feed. Soybean oil is used to produce margarine and industrial products such as soap and paint.
[46] Soy products include soybeans, soybean meal, soy sauce, refined soybean oil, raw soybean oil and soybean meal.

'forest risk commodity' (EU-Kommissionen, 2018). In other words, a product associated with a high risk of deforestation, particularly deforestation in the tropics.

In 2020, Denmark imported around 1.8 million tonnes soy products. Imports of soybean meal comprised around 93% of total imports of soy products, corresponding to around 1.67 million tonnes. This chapter therefore focusses on Danish imports of soybean meal, of which 70% is used as pig, dairy cattle and poultry feed in agricultural production.

10.1 Main results

10.1.1 Danish imports of soybean meal cause annual greenhouse gas emissions of around 4 million tonnes CO_2e

Total emissions from direct land-use change (dLUC) linked to Danish imports of soybean meal in 2020 have been estimated at 3.8-4.3 million tonnes CO_2e. A majority of emissions from Danish soybean meal imports can be linked to land-use change in Argentina and Brazil. A considerable decline in the forest area has been observed in these countries over the past 20-30 years, while the area for soybean production has increased (Consultants, 2021) based on data from (FAOSTAT, 2021)). Danish imports of soybean meal from Argentina have been estimated at 1.95 million tonnes CO_2e, while imports from Brazil have been estimated at 1.67 million tonnes CO_2e in 2020.

10.1.2 Consumption of soybean meal in agricultural production

The majority of Danish imports of soybean meal are used as pig, dairy cattle and poultry feed in agricultural production. As shown in **Table 3** 65% of total Danish imports of soybean meal are used in pig and dairy production, of which the majority (51%) is in pig production. In comparison, consumption of soybean meal in broiler chicken production has been estimated at 78,655 tonnes per year, corresponding to 5% of total imports.

Table 3: Estimated consumption of soybean meal in agricultural production in 2020

	Consumption of soybean meal, tonnes in 2020	Percentage share of total soy imports	Million tonnes CO_2e from dLUC
Slaughter pigs	713,515	42%	1.6-1.8
Piglets	150,002	9%	0.3-0.4
Dairy cows	232,719	14%	0.5-0.6
Broiler chickens	78,655	5%	0.2-0.2
Total	1,174,912	70%	2.7-3.0

Source: CSO22, (Danmarks Statistik, ANI5: Slagtninger og produktion af svin efter kategori og enhed. (tilgået februar 2022)., 2022), (Fødevarer, 2021a), (Bosselmann, 2022b) and Danish Energy Agency calculations. Note: The calculations are based on standard feed plans from 2020. When allocating emissions, it is not possible to detail where and for what purpose imports from specific producer countries are used in Denmark. Emissions have therefore been calculated on the basis of a simple approach in which the percentage share is multiplied by an estimated figure for total emissions linked to Danish imports of soybean meal.

10.1.3 Pig meat, cheese and piglets account for the main part of embedded soy exports

A total of 65% of soybean meal imported to Denmark is subsequently exported out of Denmark embedded in products of animal origin and in live animals in the form of piglets. A small share is exported directly onwards.

In 2020, around 911,000 tonnes soybean meal were exported from Denmark embedded in products of animal origin. Most of the soybean meal was embedded in exported pig meat, which accounts for 68% of these exports, followed by cheese, which accounts for 17%[47].

Similarly, in 2020, Denmark exported around 14.8 million piglets, primarily to Germany and Poland. It is estimated around 150,000 tonnes soybean meal were embedded in these exports.

On the basis of the total volume of soybean meal exported, corresponding to around 1.09 million tonnes, emissions from direct land-use change embedded in the exports can be estimated at 2.5-2.8 million tonnes CO_2e.

[47]The analysis does not include all products of animal origin embedded with soy - see a more detailed explanation for this in the background memorandum on imports and consumption of soy.

11 The global climate action of small and medium-sized enterprises

The majority of businesses in Denmark are small or medium-size enterprises (SMEs). Two out of three employees in the private sector are employed in an SME, and in 2019, SMEs accounted for 63% of value creation in the private sector in Denmark (HSB, 2021). Danish SME's are therefore an important factor in the green transition.

Many SMEs are part of the global market, and their production depends extensively on foreign trade, for example when they buy or sell goods and services across national borders. The operations of SMEs therefore have an impact outside Danish borders, including on the climate. For this reason, GR22 investigates initiatives by SMEs to limit their global climate footprint. These initiatives include SMEs placing requirements for climate action on their foreign suppliers as part of their own climate action. By doing this, Danish businesses can indirectly affect emissions outside Denmark.

The analysis of the climate action of businesses takes a closer look at whether and how Danish SMEs in general are working to reduce their global climate footprint. The analysis is based on a number of reports and analyses on the topic. Read about the specific climate footprint of Danish imports and exports, and about Danish exports of green technologies and their potential climate impact in chapters 2, 6 and 7.

11.1 Main results

A number of analyses and data point to considerable interest among Danish businesses to reduce their global climate footprint. This is because Danish businesses are experiencing ever more demands regarding their work on sustainability and climate action. Similarly, Danish businesses themselves believe they will have to focus more on the climate in future (DI, Bæredygtighed – en vigtig konkurrenceparameter, DI analyse, 2021), (DE, 2021).

11.1.1 Work by SMEs to reduce their total climate footprint is less intensive that work by large businesses

Many Danish businesses focus on what they can do to enhance their global climate action. This is revealed in a survey conducted by Advice (Advice, 2020). In this survey, around 62% of the respondents said they are working to reduce their negative global climate footprint. However, the survey also showed that large businesses are crucial for this high percentage figure. SMEs are lagging behind large businesses both with regard to their efforts and their documentation.[48]

[48] The reason that large businesses in particular are working to reduce their climate footprint is that the CSR Directive contains requirements for annual climate reporting. Climate reporting entails that companies report on their climate action, however the required scope and format of this reporting is not specified in detail in the directive.

There are several reasons why SMEs are not working more to reduce their domestic and global climate footprint. Many of them do not see how this work creates value for their business, and lack of resources is also an important barrier. With regard to reporting on climate parameters, businesses mention challenges with data from suppliers and data about their own business, as well as challenges regarding lack of knowledge and competences (DE, 2021), (DEFB, 2021a).

Furthermore, a survey conducted by the Danish Board of Business Development showed that only 12% of Danish SMEs are working very intensely or intensely on the green transition and circular economy. (HSB, 2021).

Many of the sector roadmaps from the Danish government's climate partnerships[49] also point out that SMEs, in particular, need help in the form of specific and user-friendly guidelines for how to determine their CO_2e emissions[50].

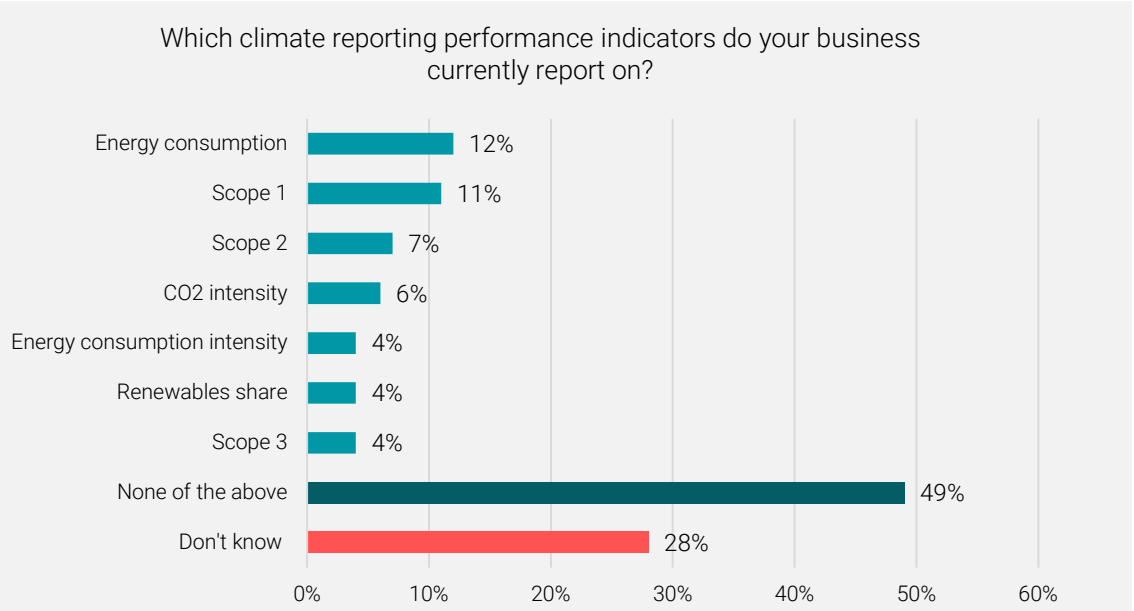
11.1.2 Only a small share of businesses determine their CO_2e emissions

Businesses working with their climate footprint primarily work with the climate footprint of their own energy consumption (i.e. Danish domestic emissions), and work less to report the total emissions linked to their production.

In a survey conducted by Advice, only 11% of businesses in the survey said they estimate the *total* CO_2e emissions of their business (Advice, 2020). A survey among members of the Danish Chamber of Commerce revealed a similar result. This survey showed that only a limited number of businesses report on all climate parameters. The survey further showed that 49% of businesses do not prepare climate reports; that 28% are unable to answer the question; and that 23% report on one or more indicators of climate performance, see Figure 31, (DE, 2021).

[49] The Danish government's climate partnerships were launched end 2019, when the government, in cooperation with the Danish business community, established a series of partnerships with the objective of collaborating on measures to reduce business sector greenhouse gas emissions and bolster the sustainable competitiveness of businesses.
[50] See the sector roadmaps for manufacturing companies and for trade.

Figure 31: Climate reporting responses from businesses



Source: Member survey by the Danish Chamber of Commerce, February 2021. Note: Definitions and more information about Scopes 1, 2 and 3 are available in the background memorandum on the climate action of SMEs.

An estimate of the total emissions of a business can inspire businesses to look more broadly at their possibilities for reducing their emissions, including by demanding more climate-friendly products from their suppliers, thus helping to reduce emissions outside their own business and outside Danish borders.

11.1.3 Need for more focus on global emissions

Several initiatives have been launched to underpin the climate action of SMEs, including the *Klimaklar SMV* (climate ready SMEs) project[51]. The objective of the project is to communicate the experience and knowledge of the 50 participating businesses with regard to CO_2e footprint, climate plans and communication to other businesses in Danish manufacturing industries.

Experience from the project underlines the importance of SMEs enhancing their focus on reporting on the total emissions linked to their production, including global emissions. Thus, the project showed that 90% of emissions caused by SMEs are so-called Scope 3 emissions; that is, greenhouse gas emissions from sources that are neither owned nor controlled by the business. For example, this could be emissions from suppliers stemming from extracting, producing and transporting materials bought by the business (DI, Klimaklar SMV, 2022). Furthermore, a survey of members of the Danish Chamber of Commerce (both SMEs and large businesses) showed that only around 4% of the members asked reported on their Scope 3 emissions, see figure 31.

[51] The Manufacturing Industry, the Confederation of Danish Industry and the Danish Industry Foundation are behind the project.

Global climate action by authorities

The government's long-term strategy for global climate action "A Green and Sustainable World" (Regeringen, 2020) sets the direction for Denmark's total international climate action. The Paris Agreement and the UN Sustainable Development Goals form the framework for Danish efforts. The global climate action strategy falls in to five tracks, reflecting the government's targets:

1. Raise Denmark's global climate ambitions
2. Reduce global greenhouse gas emissions through spearheading the green transition
3. Drive adaptation and resilience initiatives to combat climate change
4. Make black global financing green
5. Cooperate with businesses on green solutions that make a difference

The five strategic targets are realised as concrete annual initiatives in the global strategy in the government's Climate Programme. The five tracks form the framework for the chapters in this part of GR22, which provides a status report on a selection of international climate actions by the authorities, focussing on initiatives realised in 2021.

Contents of individual chapters

The chapters in this part of GR22 investigate the following:

Chapter 12: *Global climate ambitions* investigates examples of Danish climate diplomacy initiatives to raise global climate ambitions.

Chapter 13: *Global reductions* investigates examples of Danish initiatives under the auspices of Danish climate assistance, as well as Danish authority cooperation aimed at reducing CO_2 emissions globally.

Chapter 14: *Global climate change adaptation action* investigates examples of initiatives under the auspices of Danish climate assistance that aim to underpin climate change adaptation in particularly vulnerable countries.

Chapter 15: *Climate assistance, climate finance and green investment* provides a quantitative account of Danish climate assistance and mobilised climate finance, as well as of public co-financing of green projects internationally, for example wind and solar PV farms.

Chapter 16: *Cooperation with businesses on green solutions* investigates examples of authority initiatives to promote the use of climate solutions developed by Danish businesses in the global green transition.

Descriptions of supplementary initiatives, explanation of data, etc. are in the following background memoranda: climate diplomacy, reduction efforts supported through

Danish climate assistance, bilateral energy cooperation, bilateral environmental cooperation, bilateral food cooperation, climate change adaptation, climate finance and finance for international investments.

Chapter 17: *Political agreements with global impacts* investigates the global effects of national political agreements concluded in 2021. This chapter provides a qualitative assessment of the possible effects outside Denmark of Danish climate- and energy-policy agreements with a national aim.

Difficult to quantify the climate impacts of global climate action by authorities

It is difficult to quantify the climate impacts of global climate action by authorities. This is due in particular to two factors which characterise Danish efforts to influence the global climate agenda.

1. *Denmark can influence partners, but does not make the decisions:* The purpose of Danish global climate action is often to influence relevant stakeholders, such as foreign governments, to make more ambitious policy decisions with regard to their climate agenda. For example, this could be through capacity-building cooperation with partners or through negotiations. At all times, it will be the cooperation partners (e.g. a specific country) who *decide* in practice whether they want to raise their ambitions, implement new legislation and/or reduce their national emissions.

2. *Denmark cooperates with others:* Many global climate initiatives initiated by Denmark are implemented in cooperation with other countries, for example the EU, the other Nordic countries, or alliances and coalitions such as the High Ambition Coalition and the Powering Past Coal Alliance. Because it is a collective effort, it is difficult to demonstrate a direct correlation between Danish initiatives and any raised global ambitions, but by cooperating, Denmark adds momentum to efforts to influence the countries that Denmark wants to influence.

12 Global climate ambitions

According to the government's long-term strategy for global climate action, Denmark is working to influence countries and non-state players to commit to ambitious climate targets that contribute to limiting global temperature rise, as well as initiatives within climate change adaptation, resilience and sustainable development. At EU level, this work is taking place through climate diplomacy initiatives, and multilaterally through partnerships and global initiatives, and includes a large number of concrete initiatives. Below is a description of examples of initiatives in 2021[52].

12.1 Main results

12.1.1 Denmark contributed to the establishment of the EU's first climate law

In 2021, the European Climate Law, the first in the history of the EU, saw the light of day. With the introduction of the European Climate Law, the EU's climate target of at least 55% by 2030 and its 2050 climate neutrality goal have been made legally binding. At the same time, the law establishes the framework that will ensure the EU realises its goals. In addition to the climate target, Denmark succeeded in putting its mark on negotiations in many other areas. For example, Denmark helped push for negative emissions after 2050[53]; for a process for setting an intermediary greenhouse gas emissions target for 2040; as well as for the establishment of European climate partnerships between governments and businesses following Denmark's example.

12.1.2 Denmark helped keep 1.5 degrees alive at COP26

In autumn 2021, COP26 was held under the informal headline: *Keeping 1.5 degrees alive*. Up to and under COP26, several countries announced their ambitions. Analyses before COP26 pointed towards a global temperature rise of 2.2°C towards the end of this century if all pre-COP26 targets are met. Analyses after COP26 pointed towards a global temperature rise of 1.8°C towards the end of this century according to optimistic scenarios if all post-COP26 targets and pledges are met (IEA, www.iea.org, 2022), (climateactiontracker, 2021).

Denmark was active both up to and during COP26, for example through pushing for ambitious common EU positions, including with regard to phasing-out coal. The aim was to ensure adoption of the final pending aspects of rules under the Paris Agreement and, thus, establish the framework for global climate action. Denmark was also active through informal coalitions with vulnerable, poor countries and small island states, for example the High Ambition Coalition. Together with Grenada, the Danish

[52] This chapter is based on the background memoranda on climate diplomacy and on reduction efforts through climate assistance. These background memoranda provide a more in-depth description of the government's international initiatives to raise global climate ambitions and reduce global emissions through climate assistance.
[53] The EU has set a goal of climate neutrality by 2050. This means there must be a balance between atmospheric emissions and removals of greenhouse gases. The target concerning negative emissions by 2050 therefore means that the EU must reduce its emissions additionally after 2050.

Minister for Climate, Energy and Utilities served as co-facilitator in the ministerial debate on the reductions section in the Glasgow Climate Pact[54]. The parties agreed to concede to the 1.5°C target.

12.1.3 Danish action for the global phase-out of fossil fuels

On the basis of the North Sea Agreement, in 2021 Denmark, together with Costa Rica, launched the Beyond Oil and Gas Alliance (BOGA). The alliance will put pressure on governments to phase out oil and gas production and leave the Earth's oil reserves buried. BOGA was launched at COP26 by the 11 BOGA members that, together, have oil and gas reserves totalling 5 billion barrels oil equivalents (UCube, 2022), corresponding to 73 times Denmark's annual oil and gas consumption (BP, 2019).

Denmark has also worked in various fora and collaboration partnerships to strengthen the global momentum to phase out coal, for example by establishing a mandate for a common EU position on coal phase-out and by supporting the UK COP26 Presidency in its campaign to make coal history, as well as through the Energy Transition Council, in which Denmark was a co-lead on dialogues before COP26 on the transition from coal to clean energy, for example in Egypt and Indonesia. The push for coal phase-out had a prominent place at the G7 Summit in 2021, where the G7 countries agreed to stop all international financing of coal. Furthermore, the climate challenges associated with coal and fossil fuels were included in the declaration that was one of the outcomes from COP26. These results are in line with Danish efforts in the area.

12.1.4 Climate neutral shipping by 2050 at Denmark’s initiative

In September 2021, the Danish government decided to work for a global goal of climate-neutral shipping by 2050. Further to this decision, in collaboration with the USA, the UK, the Marshall Islands and more, Denmark took initiative to gather support for a declaration of support for the UN International Maritime Organization (IMO) to set a target for zero emission shipping by 2050. The initiative was presented at COP26 and the declaration is now being backed by 31 countries across five continents. This declaration will be followed up by climate diplomacy efforts leading up to future IMO meetings. The declaration falls within the context of a call to action of more than 200 ambitious businesses and organisations, including the Danish shipping giant, Mærsk.

12.1.5 Denmark's involvement in the IEA and Sustainable Development Goal 7 (SDG7)

Because of Denmark's involvement in the International Energy Agency (IEA), the Danish Minister for Climate, Energy and Utilities has filled various important roles in the context of the IEA. In January 2021, the Danish Minister for Climate, Energy and Utilities was appointed chair of the IEA's Global Commission on People-Centred Clean Energy Transitions. In October 2021, the commission presented its recommendations and examples to support global efforts for a socially and economically just transition of the

[54] The UN holds an annual climate conference under the UN Framework Convention for Climate Change (UNFCCC). As an outcome of the conference, the parties (i.e., UN and EU Member States) agree on a political declaration on assessing progress and setting the direction for future efforts. The Glasgow Climate Pact is the name of the declaration from the 26th Conference of the Parties (COP26) under the UNFCCC.

energy sectors. At the UN High-Level Dialogue on Energy in September 2021, Denmark was declared a SDG7 champion. At this event, Denmark took initiative to the Green Hydrogen Compact Catalogue [55].

[55] A public-private partnership aimed at creating a commercial sustainable hydrogen value chain and an increased sustainable hydrogen production.

13 Global reductions

According to its long-term strategy for global climate action, Denmark is working for a green transition and to ensure that the world's largest emitters reduce their emissions, and that developing countries follow sustainable development paths.

Danish efforts to promote green transition and global emissions reductions are multilateral, primarily through support for multilateral funds and energy associations, and bilateral, through authority cooperation, for example. This chapter investigates examples of multilateral initiatives and initiatives through Danish authority cooperation[56].

13.1 Main results

13.1.1 Danish multilateral initiatives support global emissions reductions

Danish climate assistance is realised according to the reduction targets in Denmark's new development cooperation strategy, the government's long-term strategy for global climate action, Sustainable Development Goal 7 (SDG7) concerning access to sustainable energy and Sustainable Development Goal 13 (SDG13) concerning climate action. Danish climate assistance for reduction efforts in multilateral organisations can be grouped under four topics specifying the targets, see **Table 4**.

Table 4: Presentation of the four topics and examples of results

Topic	Examples of results
National capacity building, NDCs, energy transition and an inclusive green transition: Ambitions in the area of emissions reductions hinge on the Nationally Determined Contributions (NDCs). Developing countries need support to get the full potential from work with the NDCs. The support contributes to raising ambitions in the areas of energy and emissions reductions, and the ability to meet these ambitions.	**Support for work with NDCs through the NDC Partnership (NDCP)** In 2021, Denmark contributed DKK 13.2 million to the NDCP, which belongs under the World Resources Institute (WRI). The NDCP has assisted 67 developing countries in improving their NDCs. A total of 40 countries have updated their NDCs (NDC-Partnership, 2022). **Support for the green transition through the International Energy Agency (IEA)** Denmark has granted DKK 50 million to the IEA for the period 2021-2025 to accelerate the energy transition in Brazil, China, India, Indonesia, Mexico and South Africa, with a focus on energy efficiency.
Access to clean energy at national and household levels Danish climate assistance has been instrumental in underpinning access to clean energy in some of the least developed countries in Africa and elsewhere.	**Support for the Sustainable Energy Fund for Africa (SEFA)** In 2021, Denmark contributed DKK 100 million to SEFA's work to help African countries make the most of new opportunities for green energy (ESI Africa, 2022). SEFA's objective is to contribute to a green energy transition in Africa, as well as to ensure that all people have access to electricity. Today almost 600 million people have no access to an electricity grid. In 2021, SEFA contributed to several renewable energy projects, including a project to ensure electricity in rural areas through solar-driven mini electricity grids, and a financing platform for Covid-19 pandemic recovery focused

[56] The chapter takes its point of departure from the following background memoranda: reduction efforts supported through Danish climate assistance, bilateral energy cooperation, bilateral environmental cooperation and bilateral food cooperation.

	on decentralised energy systems. Finally, SEFA entered into agreements for the establishment of solar energy farms in Chad and Lesotho (AfDB, 2021b).
Sustainable energy for climate change adaptation plays a central role in climate change adaptation in developing countries, where efforts in this area help to ensure access to weather information services, water and cooling.	**Solar-driven water pumps in Tanzania** In 2021, Denmark granted around DKK 45 million through the Energy Sector Management Assistance Programme (ESMAP) to a World Bank project for solar-driven water pumps in Tanzania (UM, 2021d). The project involves the use of new technology solutions, and the solar energy can contribute to increased productivity and climate change adaptation.
Decarbonisation and emissions reductions across sectors addresses initiatives that help to reduce emissions in sectors such as agriculture, building and construction, transport and industry, as well as initiatives to help stop deforestation and remove more CO_2e[57] from the atmosphere.	**CO_2e removals through the Global Environmental Facility (GEF)** Denmark donated DKK 450 million to the GEF in the period 2018-2022. Since 2018, GEF projects have facilitated the removal of 874.7 million tonnes CO_2e by agriculture, forestry and other land use (GEF, 2022). In 2021, GEF approved a project that mobilises private finance to reduce emissions and soil deterioration in Argentina, as well as projects that introduce electric transportation systems and other means of electric transport in, for example, Cote d'Ivoire, the Seychelles and Sierra Leone.

Source: Ministry of Foreign Affairs of Denmark

13.1.1.1.1 Bilateral initiatives in three areas underpinning sustainability transitions

Denmark's bilateral cooperation focusses on sharing Danish experiences with partnership countries to underpin acceleration of sustainability transitions. The partnership countries will achieve better results and robust outcomes through a focus on capacity building and improved framework conditions. By building the knowledge and capacity of national authorities in partnership countries on the basis of their individual needs, Denmark can help support policymakers to make sustainable and cost-effective policy decisions.

Denmark is cooperating with China, India, Vietnam, South Korea, Japan, South Africa and Turkey, for example. Between COP25 and COP26 these countries raised their 2030 ambitions and/or announced targets for climate neutrality by the middle of the twenty-first century.

This section contains information on cooperation projects within energy, the environment and food.

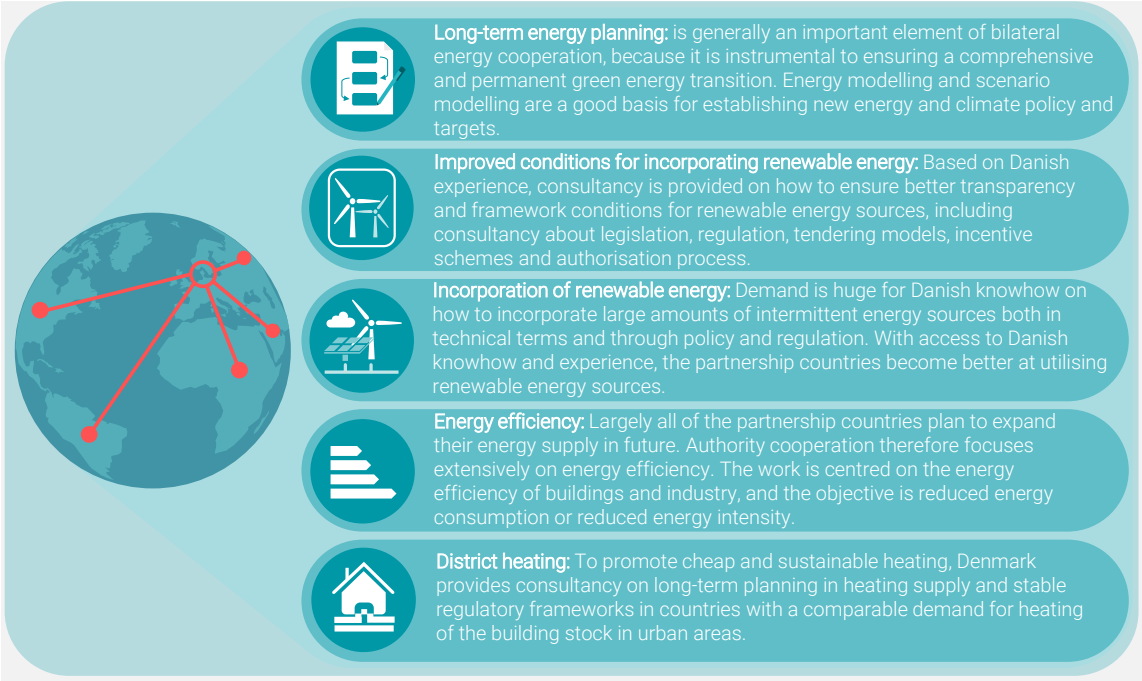
13.1.1.2 Authority cooperation in the energy field

The Danish Energy Agency has established authority cooperation partnerships between Denmark and central, regional and local governments in a total of 19 countries, which, together, emit more than 60% of the world's CO_2.[58] More short-term cooperation projects have also been established.

[57] Initiatives in this area can take the form of nature-based solutions such as forest and other nature conservation and restoration, electric mobility/transport, decarbonisation of cement, shipping/maritime transport, artificial fertilisers, and promotion of green value chains in general.
[58] See previous footnote.

Denmark is considered a green energy transition pioneer.[59] Because of its considerable experience with the energy transition process, Denmark can guide and assist other countries in their efforts to reduce emissions linked to the production and consumption of energy. These authority cooperation projects focus in particular on areas in which the Danish Energy Agency has core competences, see Figure 32.

Figure 32: Danish core competences within energy transition



Box 12: **New offshore wind centre to support India's path towards realising its goal for 30 GW offshore wind by 2030**

India is the third largest consumer of energy, and today the country gets most of its energy from fossil energy sources. This makes India the world's third largest emitter of CO_2 (IEA, India Energy Outlook 2021, 2021). However, India has high ambitions for renewable energy and has set itself a target for 30 GW offshore wind by 2030 (MNRE, 2021).

To help realise India's 2030 target, in September 2021 the Danish Energy agency and India's Ministry of New and Renewable Energy launched a joint virtual offshore wind knowledge centre called Centre of Excellence for Offshore Wind and Renewable Energy[60]. Drawing on Danish experience in the field, the centre will contribute to the establishment of the best legislative framework for tendering procedures and offshore wind deployment to help India reach its 2030 target.

If India realises its ambition for 30 GW offshore wind by 2030, as much as around 47 million tonnes CO_2 emissions could be avoided annually (IEA, India Energy Outlook 2021, 2021)[61]. This corresponds to more than 1.5 times Denmark's annual CO_2 emissions from energy consumption in 2020.

[59] For example, Denmark ranks at the top of the Climate Change Performance Index (CCPI) and ranks third in the World Energy Council's Trilemma Index.
[60] Read more at: https://coe-osw.org/
[61] Based on a comparison with the expected Indian electricity mix in 2030 in the IEA's Stated Policies Scenario (STEPS) in the IEA India Energy Outlook 2021.

13.1.1.3 Authority cooperation in the environment field

Denmark has more than 35 years of experience with sustainable water resources management, waste management and pollution abatement. This experience is used proactively by the Danish Environmental Protection Agency in its authority cooperation with India, China and South Africa in the water field, and in Indonesia and Kenya in the fields of waste and circular economy. Furthermore, in 2021, the Danish Environmental Protection Agency entered into cooperation agreements with Ethiopia and Morocco.

Authority cooperation in the environment field primarily contributes to the reduction of greenhouse gas emissions globally through support for reductions in energy consumption from water resources management and by ensuring increased recycling and less resource consumption through initiatives aimed at sustainable waste management.

Box 13: **Case - Optimised water resources management in South Africa**

Water resources management in South Africa has been characterised by considerable water losses, large revenue losses and inadequate revenue funding within water utilities and wastewater treatment. All of these factors have an exacerbating effect and lead to poor and unviable services with considerable resource wastage and an unnecessarily high climate footprint due to the unnecessarily large energy consumption of water utilities.

The authority cooperation between South Africa and Denmark therefore focusses on breaking this vicious cycle. The first phase (2019-2022) initially focused on improving the efficiency of the regulatory instrument of the South African Ministry of Water and Sanitation, which is used by local government to identify ways to reduce water wastage. This work was continued in 2021, when a number of local governments in South Africa received support to implement solutions and identify and develop investment projects to help them reduce their water and revenue losses.

13.1.1.4 Authority cooperation in the field of food production

Food production accounts for around 31% of the world's anthropogenic greenhouse gas emissions (FAO, 2021). It is therefore crucial to make the world's food systems more sustainable and more efficient. The Danish agrifood sector has achieved important results with regard to innovative and sustainable food product solutions. Promoting the deployment of these solutions to other countries constitutes a huge potential. Denmark is working to realise this potential through bilateral authority cooperation in the food area with China, Kenya, Vietnam, Mexico, Nigeria, Columbia and Indonesia[62].

[62] Many of the cooperation projects have been ongoing since 2014. Denmark has cooperated with Indonesia and Mexico since 2018 and 2019, respectively, and with Nigeria since 2020.

The work to reduce greenhouse gas emissions in partnership countries focuses on breeding and genetics, ingredients, food losses and food waste, as well as on knowhow about biogas, manure management, feed optimisation, animal health and animal welfare.

Box 14: **Case - Sustainable growth in Columbia's pig farming industry**

Columbia is a growing economy with an economic growth of 5% and a population of more than 50 million people. The growth of the middle class and a rising demand for pig meat have meant a doubling of pig meat production over the past decade.

In the period 2005-2016, Danish farmers reduced their greenhouse gas emissions from pigs and pig meat production by 25%. (L&F, 2020). Now, Denmark is sharing its experience with sustainability in pig production with Columbia through a Danish-Columbian authority cooperation project.

The project was launched in 2016 and has focussed on
animal welfare, antibiotic resistance, and establishing a national food inspection plan to improve food safety.
In 2021, the health and food safety authorities in Columbia developed common principles for food inspection to improve food safety and, thus, avoid food product losses. Also in 2021, all regional food authorities in Columbia conducted African swine fever emergency response drills. African swine fever can have catastrophic implications for pig meat production, and robust emergency preparedness measures can therefore prevent considerable production losses and associated greenhouse gas emissions.

14 Global climate change adaptation measures

According to the long-term strategy for global climate action, Denmark is working to inspire and encourage climate resilience and adaptation to climate change through development cooperation and export promotion.

GR22 focuses on Denmark's contribution to climate change adaptation action, which is supported through bilateral and multilateral channels as part of Danish climate assistance in 2021. The following describes important results from Danish climate change adaptation action in 2021.[63]

14.1 Main results

Danish climate assistance for climate change adaptation initiatives[64] is realised according to the climate change adaptation targets in Denmark's new development cooperation strategy (The world we share) and the government's long-term strategy for global climate action. Danish climate assistance for climate change adaptation can be grouped under four topics specifying the targets. Three of these topics are described in this chapter, see Table 5, while the fourth topic, export promotion, is described in the chapter 16.

Table 5: Examples of adaptation initiatives funded through Danish climate assistance

Topic	Examples of results
Increased resilience to climate change among the most vulnerable people and groups in the least developed countries: Poor and marginalised people and groups in the least developed countries are hit harder by climate change and environmental degradation (IPCC, Special Report on the Ocean and Cryosphere in a Changing Climate, 2019). Denmark therefore has a clear ambition to strengthen efforts to promote climate change adaptation and resilience to the benefit of these groups, in particular. This is through contributions to a number of funds that combine consideration for the climate	**Support for the Green Climate Fund (GCF)** Denmark has donated DKK 555 million to the GCF. The GCF is the world's largest fund dedicated to emissions reduction and climate change adaptation initiatives. Almost 60% of the fund's funding for climate change adaptation goes to the most vulnerable countries. The climate change adaptation initiatives of the GCF focus on support for the development of national climate change adaptation plans, for example. **Support for the Least Developed Countries Fund (LDCF)** Denmark is among the six largest donors to the LDCF. At COP26, Denmark donated an additional DKK 100 million to the LDCF. The grant came from the DKK 100 million extra climate assistance that was adopted as part of agreements under the 2021 Finance Act. The LDCF is dedicated to climate change adaptation in the world's least developed countries, most of which are in Africa.

[63] This chapter is based on the background memoranda on climate change adaptation action supported through Danish climate assistance and export promotion.

[64] Climate change adaptation is a process for adapting to current and expected climate change and the consequences of climate change. Climate change adaptation is therefore about preventing and mitigating the consequences of climate change. Resilience is a concept closely related to climate change adaptation. In this context resilience refers to the capacity of people or systems to adapt to, or undergo transformation in response to, risks arising from, or amplified because of, climate change. These definitions have been developed by the IPCC.

with consideration for the most vulnerable people and groups.	
Access to clean water is a human right and a fundamental prerequisite for adequate living conditions and resilience to climate change. Improved access to clean water in Africa is therefore an important focus area for Denmark. With the 2021 Finance Act, the government earmarked DKK 625 million to water initiatives, which is more than twice the amount earmarked the year before.	**Bilateral initiatives for better access to water** Denmark has launched bilateral initiatives with several partnership countries, including Burkina Faso and Uganda[65]. These initiatives are expected to provide 1.4 million new or improved water access points in Africa up to 2025. **Support for the African Water Facility (AWF)** 2021 saw the launch of an important initiative through AWF under the African Development Bank, to which Denmark contributed DKK 199.5 million. The initiative is expected to result in new or improved access to clean drinking water and sanitation for around 1 million people in Sahel and Horn of Africa.
Promotion of initiatives that incorporate climate, environment and biodiversity. Through support for multilateral development banks and civil society organisations, Denmark is seeking to promote nature-based solutions to address development challenges such as poverty, food insecurity, access to clean water, climate change, natural disasters, and loss of biodiversity through vital ecosystem conservation and restoration.[66] There is already widespread hunger and poverty today which the world's existing food systems are unable to address. At the same time, there is a huge pressure on Earth's resources. And with an ever-growing world population, the situation is only getting worse.	**Restoring mangroves in Indonesia** Denmark has provided DKK 35 million to support the conservation and restoration of mangroves in Indonesia, amongst others through the World Bank. The project in Indonesia is a nature-based solution protecting against flooding and storm surges, reducing greenhouse gas emissions and strengthening biodiversity, while also improving the livelihood of the local population. **First UN food summit** In 2021, the UN held its first Food Systems Summit. Denmark was particularly active within the fields of healthy diet/climate-positive dietary guidelines, deforestation, antimicrobial resistance, food loss/food waste, as well as hunger prevention and school lunch programmes. Follow-up on the summit will primarily be through the implementation of National Food Systems Transformation Pathways. An important ambition in the years to come is to establish healthy food systems able to sustain the world's growing population and at the same time make consideration for the climate and ensure the livelihoods of food producers.

Source: Ministry of Foreign Affairs of Denmark

Promoting climate change adaptation in the countries with which Denmark is involved can include various initiatives. The background memorandum on climate change adaptation action includes examples of efforts in Uganda and Burkina Faso. Below are some examples of initiatives in the two countries.

Box 15: **Case concerning increased resilience through funding for agriculture**
Denmark is working in northern Uganda to increase resilience to climate change for 200,000 small-scale farmers and refugees through funding for agricultural development, focussing on climate change adaptation and teaching climate-resilient cultivation practices. As a result of the Danish-funded intervention, use of drought-resistant seed increased from 5% to 70%. In 2021, the initiative has reached out to 114,000 farmers. Every farmer has received at least 20 teaching sessions annually, and many of the programme's agricultural consultants are locals living in the same villages. An analysis by a consultancy firm in 2020 showed that crop yields have gone up and that the living standards and nutrition of the local population and refugees have improved because of the programme.

[65] Several Danish-funded activities in Burkina Faso have been set on hold due to the coup d'état in January 2022.
[66] Initiatives to protect, sustainably manage and restore natural or modified ecosystems; to handle societal challenges efficiently and at the same time adaptively; and to provide benefits for people and biodiversity (IUCN).

Box 16: **Case concerning water initiatives in Burkina Faso**

In 2021 and until the coup d'état in January 2022, Denmark worked with the Ministry of Water and Sanitation in Burkina Faso to optimise their water management. The project supported the national water strategy, the purpose of which is to ensure sustainable access to water and sanitation to all. The project aimed to integrate water resources management with mechanism to prevent conflict linked to the use of water resources. The project also focussed on adapting water resources management to climate change. A total of 220 villages and 675,757 people got access to clean water in the period 2016-2020, among other things as a result of Danish funding for the project. In addition to this, more than 600 km of riverbank was protected, and various initiatives, such as planting vegetation and building stone barriers, were launched as steps to protect surface waters.

15 Climate assistance, climate finance and investments

This chapter accounts quantitatively for the scope of Danish climate assistance, as well as the scope of climate finance mobilised by Denmark through multilateral development banks, for example. The chapter also reports on Danish public financing for international investments and projects with both positive and negative climate impacts[67].

Reporting on international investments includes reporting on the part of the long-term strategy for global climate action that determines Denmark's work to accelerate the shift to green and climate-friendly investments at all levels and in all groups of countries.

15.1 Main results

15.1.1 Danish climate assistance and mobilised climate finance on the rise

In 2020, Danish climate assistance amounted to a little over DKK 2 billion, of which around 56% went to climate change adaptation initiatives and 44% to emissions reduction initiatives, see **Table 6**. Furthermore, DKK 378 million in climate assistance awarded through global instruments in 2020 can be attributed to Denmark. Furthermore, Denmark mobilised around DKK 1.3 billion in climate finance for developing countries through IFU (Investment Fund for Developing Countries), and around DKK 3.5 billion through the multilateral development banks, see **Table 6**.

Table 6: List of total Danish climate assistance and mobilised climate finance 2018-2020

DKK mill.	2018 (DKK mill.)	2019 (DKK mill.)	2020 (DKK mill.)
Climate assistance in total	1,154	2,161	2,036
Climate assistance as a percentage of development assistance[68]	8.4%	15.1%	13.7%
Adaptation as a percentage of climate assistance	53%	41%	56%
Climate finance mobilised through the EU's global instruments[69]	384	362	378
Climate finance mobilised through IFU	614	675	1,269

[67] This chapter is based on the background memoranda on climate finance and finance for international investments.

[68] Section 06.3 of the Finance Act

[69] Denmark also provides funding for climate activities in development countries through EU climate assistance. EU climate assistance is awarded through the EU's neighbourhood, development and international cooperation instrument - Global Europe (NDICI – Global Europe)

Climate finance mobilised through multilateral development banks	3,500	3,500	3,500
Total	**5,652**	**6,698**	**7,183**

Source: Ministry of Foreign Affairs of Denmark 2022. Note: Actual new pledges for climate projects in developing countries given in the period are in the background memorandum on climate finance.

Total Danish climate assistance increased from DKK 493 million in 2009 to a little over DKK 2 billion in 2020; however, there are large variations across the years. Historically, a balance has been sought between initiatives underpinning climate change adaptation and initiatives aimed at reducing emissions in the longer term. On average, around 45% of funding has gone to climate change adaptation and 55% to emissions reductions in the longer term.

In 2021, Denmark decided that, from 2023, Danish climate assistance will make up at least 25% of total Danish development assistance[70] to developing countries through Section 06.3 of the Finance Act. At least 60% of this funding must go to climate change adaptation projects aimed at the poorest and most vulnerable developing countries. On the basis of this decision, it is expected that, from 2023, Denmark's total contribution to mobilising climate investment in developing countries will make up at least 1% to the common goal of developed countries to mobilise USD 100 billion per year.[71] Denmark announced its new political goal for financing, including for climate change adaptation financing, prior to COP26. Furthermore, with a number of donor countries, Denmark helped to found Champions Group for Adaptation Finance, the aim of which is to push more financing for climate change adaptation.

15.1.2 The Danish State is providing financing for green projects internationally

The Danish state owns or co-owns a number of financial institutions that can provide finance for projects that are often difficult to finance solely through private sources, typically due to uncertainties in the projects. Public financing helps reduce the risks associated with a given project and, thus, helps mobilise private financing, so that the investment can be realised.

The most important Danish public financial institutions with an international outlook are EKF (Denmark's Export Credit Agency); IFU (Investment Fund for Developing Countries); and the multilateral banks that Denmark is co-owner of. In 2021, the Danish government decided to stop public financing and export promotion subsidies for fossil fuels in the energy sector abroad. The ban entered into force in early 2022[72].

Activities in EKF and IFU are described in more detail in the following. Denmark is working to advance and define the sustainability ambitions of multilateral development

[70] Through Section 06.3 of the Finance Act

[71] At COP15 in 2009, Denmark pledged to contribute to the collective goal of the developed countries to raise the mobilisation of climate financing from various sources, including private investors, to at least USD 100 billion per year by 2020. In connection with the Paris Agreement, the goal was extended to apply until 2025.

[72] However, certain natural gas-related projects have been exempted from the ban until 2025, provided several requirements are met.

banks through increased financing for renewable energy and energy efficiency, and by phasing out the banks' fossil fuel financing. Several multilateral banks tightened their policies in 2021. This includes the World Bank, the Asian Development Bank and the European Bank for Reconstruction and Development (EBRD).

15.1.2.1 Largest share of export financing through EKF goes to renewable energy

EKF (Denmark's Export Credit Agency) supports Danish exports and internationalisation by issuing export credit guarantees and, thus, contributing to safeguarding Danish businesses against the potential financial and political risks associated with export activities.

In the period 2017-2021, EKF had considerable activities aimed at renewable energy, see Table 7.

Table 7: EKF's total international activities by sector, DKK millions

Breakdown by technology	2017	2018	2019	2020	2021
Energy production	6,398	22,438	11,135	8,948	9,593
- **Renewable energy**	6,284	21,879	11,135	8,948	9,593
- **Fossil fuels**	114	558	-	-	-
Industry	338	887	227	816	1,102
Infrastructure	1,990	4,955	710	6,919	4,487
Agriculture	522	77	305	338	96
Other	173	288	193	560	2,290
Total	**9,421**	**28,645**	**12,570**	**17,581**	**17,568**

Note: The numbers show EKF's total international activities. There may be deviations from EKF's official financial statements. Source: EKF (Denmark's Export Credit Agency)

Renewable energy accounted for the largest share (67%) of EKF's total activities in the period 2017-2021, while infrastructure also accounted for a large share. Fossil fuels accounted for only a limited share (<1%).

EKF is working to develop a method to quantify the climate footprint of their activities. EKF expects to finalise this project during 2022, and it will then be ready to carry out quantitative measurements of the climate footprint of its activities.

15.1.2.2 For the first time, IFU has estimated the climate footprint of its investments

IFU provides risk capital to financially sustainable businesses that contribute to the green transition and to economic and social development in the countries invested in.

IFU manages the Danish Climate Investment Fund and the Danish SDG Fund, for example. Both these funds are examples of public-private investment partnerships contributing to realising projects in developing countries.

In 2020, IFU's total portfolio comprised investments worth DKK 5,070 million.[73] In 2021, for the first time, IFU estimated the total climate footprint of its investments for its 2020 portfolio. The estimate shows that IFU's total climate footprint was 740,000 tonnes CO_2e in 2020, and that investments in cement and agriculture, in particular, contributed to the emissions, see **Table 8**. The climate footprint from investments in renewable energy stems from emissions linked to production and construction of plant facilities. Overall, 21% of IFU's total investments in 2020 went to renewable energy, 16% went to funds[74] and another 16% to financial institutions[75], while 2% went to cement production facilities and 1.3% went to energy plants based on fossil fuels.

Table 8: IFU's total investments by sector, based on climate footprint estimates

Breakdown by sector	Percentage distribution of IFU's outstanding capital in 2020 by sector (in %)*	Climate footprint 2020 (tCO_2e/year)**	Percentage distribution of climate footprint by sector (2020)	Intensity (tCO_2e/DKK)
- Energy Renewable energy	21.3%	16,701	2.3%	21
- Energy Fossil fuels	1.3%	14,610	2%	218
Fertiliser	0.8%	77,469	10.5%	1993
Cement	2.2%	175,473	23.7%	1587
Agriculture (livestock)	8.3%	77,183	10.4%	229
Agriculture (other)	4.6%	2,659	0.4%	11
Hotels, restaurants and property	0.9%	21,680	2.9%	39
Other industries	13.9%	69,898	9.5%	100
Funds (besides those managed by IFU)	16.2%	114,910	15.5%	140
Microfinance funds	5.6%	96,155	13%	340
Financial institutions	16.2%	72,604	9.8%	95
Total	100%	739,340	100%	151

Source: IFU. Note: *The distribution of IFU's outstanding capital for the total portfolio broken down by sectors. Note: **The climate footprint including Scope 1, 2 and 3 emissions and calculated relative to IFU's share of the investment.

[73] Subtracted investments in inactive companies and investments in development projects.
[74] IFU's investments in funds, for example, include investments in funds with a specific industry focus or a specific geographical focus.
[75] IFU's investments in financial institutions are investments in banks, for example.

16 Cooperation with businesses on green solutions

Pursuant to the long strategy for global climate action, Denmark is working to engage Danish businesses in Denmark's global climate action and to ensure that Danish solutions deliver results in Denmark and elsewhere in the world. This is through supporting Danish businesses in selling their green products globally and through establishing framework conditions and regulation that underpin a sustainable focus among Danish businesses in general. Below is a description of examples of initiatives[76].

16.1 Main results

16.1.1 The government's export scheme will facilitate opportunities for Danish businesses

In 2021, Denmark established an export scheme in the water area. The objective of the scheme, which runs from 2021-2023, is to implement Denmark's export strategy for water[77], influence local framework conditions and facilitate opportunities for Danish businesses. Furthermore, Denmark has established bilateral cooperation in the fields of water and the environment with seven developing countries, including India, China and South Africa, and from 2021 up to 2023, with five OECD countries, including the USA and Germany[78].

16.1.2 Easier for businesses to invest sustainably

The purpose of the EU Taxonomy Regulation is to ensure uniform classification of environmentally sustainable activities across the European market and, thus, make it easier for investors to identify sustainable investments and financial products. From the very beginning, Denmark has backed the development of the taxonomy, because it will help facilitate important sustainable investments in the green transition.

In 2021, the European Commission approved the technical screening criteria for climate-related economic activities set out in the taxonomy. The screening criteria define when economic activities can be considered environmentally sustainable. A total of 88 different economic activities are covered which contribute significantly to climate change mitigation, and 95 activities pertaining to climate change adaptation. In early 2022, the European Commission proposed to include activities within nuclear power and natural gas in the Climate Delegated Act. The Danish government pushed to

[76] This chapter is based on the background memoranda on climate diplomacy, on climate change adaptation action supported through Danish climate assistance, and on finance for international investments. The global climate action of small and medium-sized enterprises is described in chapter 11.
[77] The government's export strategy for water, which sets the framework for Danish export initiatives in the water area in the years to come.
[78] See the background memorandum on bilateral environmental cooperation for an explanation of Danish bilateral initiatives in the water and environment area.

prevent this. With regard to nuclear power, this is because of the issue with radioactive waste and security; with regard to natural gas, it is because natural gas is a fossil fuel.

As part of implementation of the Taxonomy Regulation, in 2021 the European Commission also stipulated a number of reporting requirements. These requirements are to allow businesses covered by the Taxonomy Regulation to assess how and to what extent their activities meet the taxonomy. The reporting requirements enter into force from 1 January 2022 and will be phased in gradually in future years. The reporting requirements in the Taxonomy Regulation are expected to affect around 60 large non-financial, listed companies in Denmark, as well as around 21 financial companies and around 1,300-1,400 financial products. Whether to include the taxonomy in future global impact reports will be considered once the largest businesses have started reporting in accordance with the Taxonomy Regulation.

16.1.3 Tighter requirements for sustainability reporting for businesses

In April 2021, the European Commission submitted a proposal for a Corporate Sustainability Reporting Directive (CSRD). Denmark backs the proposal to strengthen sustainability reporting, which is an important step in transitioning the European business sector to a sustainable economy. The CSRD will mean that more European businesses will be covered by the rules on sustainability reporting. According to the proposed directive, the standards will specify the information about environmental issues, including climate change, that businesses are required to report on.

16.1.4 Help for businesses to promote sustainable supply chains

In September 2021, the government granted DKK 7.2 million to a new knowledge centre for sustainable value chains under the Danish Ethical Trading Initiative. The knowledge centre for sustainable value chains will support efforts to make the value and supply chains of Danish businesses more sustainable and more responsible through knowledge building, market analyses and consultancy services. The grant focusses in particular on providing support for existing sector-specific Danish alliances within sustainable production and trade in soy and palm oil, respectively.

16.1.5 Focus on exports of sustainable food products

In autumn 2021, the Ministry of Foreign Affairs of Denmark and the Danish Minister for Food, Agriculture and Fisheries prepared a new strategic action plan for the future exports of Danish food clusters. The work is being carried out in close partnership with the industry, which is taking active part. It is expected the action plan will be launched mid-2022. The action plan will have a sustainable focus. In spring 2022, a task force was set up to examine the possibilities for strengthening Danish sales of plant-based food products.

17 Political agreements with global impacts

National political agreements can potentially have significant climate impacts outside Denmark, i.e. global impacts, even though they have been designed for a domestic context. Examples of such positive (i.e. climate impact reducing) global impacts include investments in new green technology that promote the global market for sustainable solutions, or green energy exports. However, the effect of Danish political agreements may also lead to increased global emissions following from higher demand for, and therefore increased production of, climate-impacting products abroad.

17.1 Main results

In 2021, 24 energy- and climate-policy agreements[79] were adopted in Denmark. It is assessed that 12 of these could have a climate impact outside Danish borders.

The 12 climate- and energy-policy agreements from 2021 are assessed to have both positive and negative impacts on greenhouse gas emissions outside Danish borders. Where an agreement is considered to have significant conflicting impacts (both positive and negative), these impacts have been described. Below is a description of four political agreements which, in each their way, are assessed to have global climate impact impacts. The remaining eight political agreements with global impacts are presented in the background memorandum on national political agreements with global impacts.

Table 9: Assessment of political agreements with global climate impacts

Description of agreement	Assessment of global climate impacts
Infrastructure plan 2035 (28.06.2021)	
The agreement earmarks DKK 105.8 billion for the period 2022-2035 to initiatives in the transport area. This includes initiatives contributing to the green transition of the transport sector; for example initiatives to improve the Danish car recharging infrastructure and Danish public transport. The agreement also contains other initiatives such as initiatives to restore and renew the Danish road network.	The agreement can lead to increased emissions abroad because it is assumed the agreement will increase Danish demand for materials such as cement, steel and asphalt for the construction of roads and other works. Road construction requires many materials, and some of these have to be imported from other countries. Activities to extract and transport these relatively heavy materials are associated with increased greenhouse gas emissions abroad.

[79] Climate- and energy-policy agreements are defined as agreements with considerable national climate impacts or agreements the text of which includes climate considerations. The agreements that have been considered are the ones in the government's 2021 report on climate impacts (*Redegørelse for klimaeffekter 2021*).

Agreement on new requirements for the use of energy crops to produce biogas (30.06.2021)	
The agreement lowers the cap for the share of energy crops allowed in the production of biogas. The cap is lowered from 12% to 8% in 2022, and then gradually to 4% by 2024. Furthermore, maize (corn) as an energy crop is phased out completely by 2025.	The agreement means that biogas will be produced increasingly from residual materials such as slurry rather than from energy crops or food products such as maize or beets. The agreement could also lead to greenhouse gas emissions reductions abroad, in particular emissions linked to maize production. By reducing Danish demand for maize for biogas production, the maize can instead be used for other purposes, thus reducing the global demand for agricultural land for maize production. The agreement could therefore lead to global greenhouse gas emissions reductions through land-use change.
Agreement-in-principle for a carbon storage roadmap (first part of an overall CCS strategy (30.06.2021)) and agreement on a roadmap for carbon capture, transport and storage (second part of an overall CCS strategy (14.12.2021))	
Sub-agreement 1: The sub-agreement stipulates the principles for storage of CO_2 in Denmark. The agreement also launches further surveys of new CO_2 storage locations in Denmark. *Sub-agreement 2:* The agreement deals with long-term regulation of CCS deployment on market terms and with the promotion of CCS in the short term via the CCUS pool, etc.	Both agreements can have significant global reduction effects. If there is international demand for CO_2 storage and the agreements lead to Denmark being able to expand its international capacity, then the agreements will support storage of CO_2 globally and nationally, thus reducing the content of CO_2 in the atmosphere. Construction of CCS facilities in Denmark can lead to increased greenhouse gas emissions from the import of construction materials. This is because extraction, processing and transport of the materials are associated with greenhouse gas emissions. However, compared to the global reduction effects, the impact from construction of CCS facilities is assessed to be minor. All in all, it is assessed the agreements could potentially reduce greenhouse gas emissions outside Denmark.
Agreement on a green transition of the agricultural sector (04.10.2021)	
The agreement aims to support the green transition in the agricultural and forestry sectors, as well as to improve the aquatic environment in Denmark and make more room for nature in agriculture. The agreement hinges on the principle that agriculture should be able to produce at the same level as today but with a lower climate impact. The agreement contains important initiatives concerning set-aside of organogenic soils, more ecology, development initiatives within new technologies, plant-based food products and an improved aquatic environment.	The set-aside of Danish agricultural land can lead to reduced production in Denmark. This, in turn, could lead to land-use changes abroad as a result of increased agricultural production outside Denmark. Aarhus University points out that organic production is more land-demanding (Kristensen, 2021), and the promotion of organic production could therefore lead to reduced agricultural production in Denmark. The Danish Minister for Food, Agriculture and Fisheries assesses that, if Danish organic products displace conventional products abroad, this will lead to carbon leakage. However, if Danish organic products displace organic products abroad, there will be no leakage. The development track of the agreement sets aside funds for the development and demonstration of technologies with reduction potential within agriculture. If green agricultural technologies become cheaper and implementable, this will also benefit the transition abroad. The development track could therefore reduce greenhouse gas emissions outside Denmark through changes in the price of, and possibilities in general within, green agricultural technologies.

Source: Danish Energy Agency. Note: The table only presents examples of political agreements. The remaining eight political agreements that have been assessed are presented in the background memorandum on national political agreements with global impact.

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Glossary and abbreviations

Glossary

Biofuels: Fuels produced from biomass. If biofuels are produced from crops that could alternatively be used for food or animal feed (e.g. rape, palm oil, soybeans, etc.), then they are called first generation biofuels, and if they are produced from waste, residues or energy crops (e.g. willow, elephant grass, etc.), they are called second generation biofuels.

Biogenic CO_2 emissions: CO_2 emissions arising from burning biomass.

Biomass: An umbrella term for all organic material formed by photosynthesis in plants using the sun as the energy source. The most common products in an energy context are straw, fuel wood, wood chips, wood pellets, wood waste, biodegradable waste, etc. In global impact reports, biofuels are also defined as biomass.

Bunkers: Bunker: To bunker/Bunkering = to refuel/refuelling an aircraft or ship - derived from the word for the fuel for international transport: bunker fuels.

CO_2e emissions: Greenhouse gases include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O) and fluorinated greenhouse gases (F gases). The gases have different greenhouse effects but are converted into **CO_2 equivalents** (abbreviated **CO_2e**) based on their Global Warming Potential (GWP) over a 100-year time period relative to CO_2. CO_2e emissions are therefore a way in which to estimate greenhouse gas emissions that allows for adding up different greenhouse gases with different impacts on the greenhouse effect with regard to the potency of the gas and the time it is in the atmosphere. With the CO_2e unit, the climate impact of the individual gas is converted to the corresponding impact in units of CO_2.

Denmark's consumption-based climate footprint: The CO_2e emissions that can be ascribed to Danish consumption of goods and services. The calculation includes emissions in Denmark and emissions in other countries.

Danish operated aircraft/ships: An aircraft or ship operator (not necessarily the owner) determines the crew, specific routes, speed, bunkering, etc.

The financial sector: Includes banks and mortgage-credit institutions, pensions and life-assurance companies, non-life insurance companies, investment associations and private equity funds.

Direct emissions (from a business perspective): CO_2e emissions from sources which are owned or controlled by the business. For example, emissions from burning fuel in boilers or vehicles that are owned or controlled by the business.

Direct land-use change - dLUC: Changes in the use of an area directly caused by consumption of a given product. For example, forest clearance to grow agricultural crops on a given area.

Greenhouse Gas Protocol (GHG Protocol): A voluntary and globally recognised standard for how to calculate greenhouse gases. Used in particular by businesses. The purpose of the protocol is to help define the direct and indirect CO_2e emissions of businesses, and to ensure a uniform approach to calculating the overall climate footprint.

Emission factor for foreign electricity: Emission factor (kg CO_2/MWh electricity) for the electricity abroad that is marginally displaced or added to production up to 2030 if Denmark increases or reduces net exports of electricity.

Energy services exports: Export of consultancy/knowhow from consulting engineers and other technical advice from manufacturers of energy technology. Includes, for example, energy planning, renewable energy and other energy tasks.

Energy technology: Products used in connection with the energy sector, e.g. within district heating, bioenergy, wind energy or energy-saving equipment.

Energy islands: 'islands' where the electricity from many offshore wind farms are consolidated and transmitted directly from the energy island to several countries. In the 2020 Climate Agreement for Energy and Industry, it was decided that Denmark is to establish 5 GW offshore wind power and associated electricity transmission links.

Global emissions: The sum of emissions from all countries in the world according to the UN IPCC methodology, including emissions from international transport.

Green energy technology: Two green business areas defined by Eurostat: 1) Use of renewable energy, i.e. goods and technologies linked to onshore and offshore wind power, conversion of biomass for bioenergy, geothermal energy, wave power and solar energy. 2) Better exploitation of energy, i.e. goods and technologies associated with electricity-saving technologies, energy management and storage, green transport technologies and practices, cogeneration technologies, heat pumps, etc.

Green investments: Investments in businesses or projects, the purpose of which is to promote the green transition. This could be in wind farms or in businesses that produce green energy technology or other technologies, products or services which contribute to the green transition.

The hypothetical climate impact: The climate impact that can potentially come from the use of a given (climate) solution. It is therefore possible avoided emissions.

iLUC impact: The climate effect linked to indirect land-use change. The climate effect arises because the carbon balances in the soil and vegetation are affected when the land use is changed. Influencing these balances has climate consequences.

Indirect emissions (from a business perspective) CO_2e emissions emitted by suppliers or customers of a business as a consequence of the activities of the business.

Indirect land-use change - iLUC): The land-use change that occurs indirectly, for example when an agricultural area is converted to cultivate crops for use in energy production. Since global demand for agricultural products is assumed to remain the same after conversion of the area, in theory, it will be attractive to cultivate agricultural crops elsewhere. Therefore, this may cause land-use change, for example forest clearing.

IO tables (input-output tables): Statistical tables in monetary units that describe how the sectors in a given economy, e.g. the Danish, buy and sell goods and services from and to each other.

Climate impact: The change in CO_2e emissions from a specific action.

Climate neutrality: When there is a balance between emitting CO_2 and absorbing CO_2 from the atmosphere in carbon sinks; i.e. when global greenhouse gas emissions are counterbalanced by carbon sequestration.

The Danish government's 13 climate partnerships were established by the government in 2019 as part of Danish climate action. Partnerships were established within 13 business sectors. Through their trade organisations, the respective business communities are to submit input on how the Danish 70% reduction target can be achieved. Climate partnerships have been established for the following business sectors: Waste, Water and Circular Economy; Building and Construction; Blue Denmark; Energy and Utilities Sector; Energy-Intensive Industry; Financial Sector; Food Production and Agriculture; Retail; Land Transport and Logistics; Life Science and Biotech; Aviation; Production Companies; and IT and Consultancy.

Carbon sinks: Systems that absorb more CO_2 than they emit. The ocean, soil and forests are the most important carbon sinks.

Environmental technology: Products used in connection with the environment, including within clean air, water and waste.

Net electricity exports: Exports of electricity (usually over a period of one year) less imports of electricity. If net electricity exports are negative, there have been more imports than exports in the period.

Respiration: Biochemical process whereby living cells extract chemical energy from oxygen and organic compounds. CO_2 and water are the products formed by respiration.

Taxonomy: In GR22, the word taxonomy refers to the taxonomy that the European Commission has prepared as part of the Commission's work to put focus on sustainable investments. This taxonomy is a classification system for environmentally sustainable economic activities.

Territorial direct CO_2e emissions (from a business perspective): CO_2e emissions from sources which are owned or controlled by the business and which are emitted in Denmark.

Territorial emissions: The greenhouse gas emissions calculated according to the UN IPCC methodology emitted within a country's national borders. Also called the national emissions.

Goods exports: Sales of products by a business to other countries.

Land-Use Change - LUC: An overall term covering changes in land use. For example, this could be when an agricultural area is converted to grow energy crops or when rainforest is cleared to grow agricultural crops. The term does not relate to the cause of the change in land use. Land-use change can be both directly and indirectly linked to a specific consumption.

Abbreviations

GDP	Gross domestic product
CO_2e	CO_2 equivalents
DCE	Danish Centre for Environment and Energy, Aarhus University
DGIF	Danish Green Investment Fund
EKF	Denmark's Export Credit Agency
EUDP	Energy Technology and Demonstration Programme
RDD	Research, development and demonstration
GR22	Global Report 2022
HVO	Hydrotreated vegetable oil
IFU	Investment Fund for Developing Countries
IRENA	The International Renewable Energy Agency
LULUCF	Land Use, Land-Use Change and Forestry
MUDP	Environmental Technology Development and Demonstration Programme
NDC	National Determined Contribution (reduction commitment under the Climate Convention)

OECD	Organisation for Economic Co-operation and Development
PJ	Peta Joule, 1,000,000 GJ or 277,778 MWh
PtX	Power-to-X
TCFD	Task Force on Climate-related Financial Disclosures
TWh	Terawatt-hours, 1,000,000 MWh.
USD	US dollars
RE	Renewable energy

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Annex 1: Legal basis for global impact reporting

In addition to the annual Denmark's Climate Status and Outlook report, the Climate Act also sets out a requirement for annual reporting on the international impacts of Danish climate action. According to the Climate Act, the purpose of this reporting is to make Denmark's global impact on the climate visible, positive as well as negative impacts (KLI, 2020).

According to section 6 of the Climate Act, the Minster for Climate, Energy and Utilities must annually prepare a Climate Status and Outlook report, which must include global impact reporting on the international impacts of Danish climate action. According to the explanatory notes to the Act, the Danish Energy Agency should draw up the annual Climate Status and Outlook report.

The Climate Act does not lay down the exact content of global impact reports, but according to the explanatory notes, the reports should include information on reductions within international shipping and aviation and reductions from exports of electricity from renewable energy sources. Moreover, the impacts of Danish bilateral energy cooperation with large CO_2 emitters can be included, and the impacts of Danish imports and consumption should be described. Furthermore, there should be an account of Danish climate assistance.

The areas highlighted in the explanatory notes have therefore all been described in this report. The areas mentioned are not an exhaustive list with regard to mapping Denmark's global impacts on the climate. GR22 describes further areas such as green investments.

The Climate Act also states that global impact reports are to be submitted for external consultation, so that external players can comment on assumptions, etc. The Climate Act stipulates that, in connection with the consultation, a meeting is to be held at which the assumptions underlying the projections are presented.