GLOBAL REPORT

2021

Energistyrelsen

2021

Global Report 2021

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Preface - Vital that we reduce our climate footprint and intensify international efforts

Last year, I talked to the American economist and expert in the fight against poverty, Jeffrey Sachs. He had a clear message for politicians like myself, who work to combat the climate crisis: Forcing the world's 7.8 billion people to live as their forefathers did in the nineteenth century is not a realistic solution. We need a more intelligent way forwards, not backwards.

I agree. Particularly because the global population is increasing by millions of people every year. In 2050, there will be almost 10 billion of us. Furthermore, hopefully, fewer of the world's population at that time will be living in poverty. Instead, understandably, they are likely to consume more.

So lower growth is not the way to combat climate change. Growth will come whether we like it or not. The job ahead is to make growth more sustainable.

This is clearer to me now more than ever after reading Global Report 2021. With this report, as one of few countries in the world, we now for the first time have an overall picture of Denmark's global climate impact. The report is a strong reminder of the importance of a wealthy, Western country like Denmark demonstrating to the rest of the world's fast-growing populations that a green way forward to more prosperity is possible.

Denmark only accounts for 0.1% of total global emissions. Seen in isolation, what we do has no great significance for the climate. However, for a small country, with just 5.8 million inhabitants, we have an extremely deep climate footprint on the world. For better or worse.

Not surprisingly, as a wealthy country with a high standard of living, we have a large negative climate footprint on the world. We drive to work, stream series on our flat screens and eat meat for dinner. Furthermore, as a small, open economy, we depend on trade with other countries. As a result, it will hardly be news to anyone that we import a considerable volume of emissions. This means that the climate footprint of Danish consumption is 61 million tonnes CO_2 every year. That's 11 tonnes for every Dane. Is that a lot? It is compared with developing countries, for example. But not compared with countries we usually compare ourselves with.

This is not to say that we can accept things as they are. We politicians must make it easier to make sustainable choices. And in particular, we have to take action where the climate footprint is greatest: transport and food. We need more electric cars on our roads and fewer red steaks on our dinner plates. The green transport agreement and climate-friendly dietary guidelines are our first steps in this direction. The next is a green transition of the agricultural sector, an action plan against deforestation, and ideas for how to change behaviours.

But government policy is not the only answer. If we are to be a sustainable society that also takes its global responsibility seriously, we have to ensure that we Danes also make an effort as individuals. What mode of transport we choose, what we decide to eat, and how often we buy a new flat screen matter.

That doesn't mean we have to be a poorer country with a lower standard of living. On the contrary, the report confirms that growth is no obstacle to the green transition. The Danish climate footprint has fallen by 25% since 1990, even though Danish consumption has increased over the same period. In other words, one Danish crown spent on consumption in 2019 will cause fewer emissions than the same amount spent in 1990. This is because we have reduced our emissions dramatically through active, primarily political and collective, choices for the whole of Danish society.

This brings me to absolutely the most positive part of this story. The knowledge and technology that has made the green transition a Danish success with regard to jobs, growth and prosperity, has already greatly benefitted other parts of the world. Through exports of green technologies, energy consultancy to authorities in other countries, climate assistance and much more, we are contributing globally to reductions of a magnitude that far exceeds total Danish emissions.

More specifically, right now we are working with 16 countries that together account for more than 60% of the world's CO_2 emissions. One of them is China, the world's largest emitter of CO_2, and with a huge consumption of coal. We are helping with advice for projects that have contributed to annual reductions of 22 million tonnes, corresponding to 47% of total Danish emissions in 2019. Another country is India, one of the world's fastest growing economies with a ferocious fossil energy consumption. Up to 2040, Indian electricity consumption is expected to triple, corresponding to more than the total current electricity consumption in the whole EU. Therefore, we will be making a very tangible difference for the climate when, in the years to come, we will help India with offshore wind energy, energy planning and integration of renewable energy. As the Indian President Narenda Modi has highlighted on several occasions: "Denmark has the skills, and India has the scale."

That countries such as China and India listen to a small, Nordic country like Denmark, bears witness to the vital difference Denmark can actually make by showing a way forward that inspires other countries to follow along.

And actually we don't just show the way. We also have the technology. Denmark has a wide cluster of businesses which export Danish climate solutions such as wind turbines, district heating equipment and energy-efficiency technology to the entire world worth billions. It is hard to put figures on just how much the green technology supplied to the world by Danish businesses actually reduces climate emissions. But the Climate Partnership for Production Companies has estimated that it is several hundred million tonnes.

So Denmark's international efforts are firing on all cylinders and are directly helping our neighbouring countries, distant trading partners, large emitters and developing countries through the transition. But none of this would ring true if Denmark itself failed to take the lead. The synergy between our ambitious domestic initiatives and our global leadership is precisely what

makes Denmark a green front-runner. We will make the greatest impact on combatting climate change abroad by readying ourselves at home.

Danish climate action at home and abroad is already among the most ambitious in the world, but we must do even more. We need even more countries to set an end date for oil and gas extraction. We need to continue to put pressure on the EU for specific reductions. And we need to make sure that COP26 in Glasgow, the most important climate summit since the Paris Agreement, offers more than just toasts and speeches.

April 2021

Minister for Climate, Energy and Utilities

Dan Jørgensen

International efforts

National efforts with impacts outside Denmark

2019

September

Cool Coalition and Getting-to-Zero Coalition

· **Initiative for innovative green solutions within cooling and international shipping**

November

Denmark's first climate ambassador and 15 climate front posts

The Government establishes 13 climate partnerships with the business community

Investment fund for developing countries (IFU) adopts climate policy to phase-out financing fossil fuels

December

Danish climate assistance increased by around DKK 500 million relative to previous Finance Act

Agreement on Climate Act

2020

March

Recommendations from the climate partnerships

Denmark and the IEA launch global discussions on green recovery

April

Denmark initiates green recovery alliance for the EU

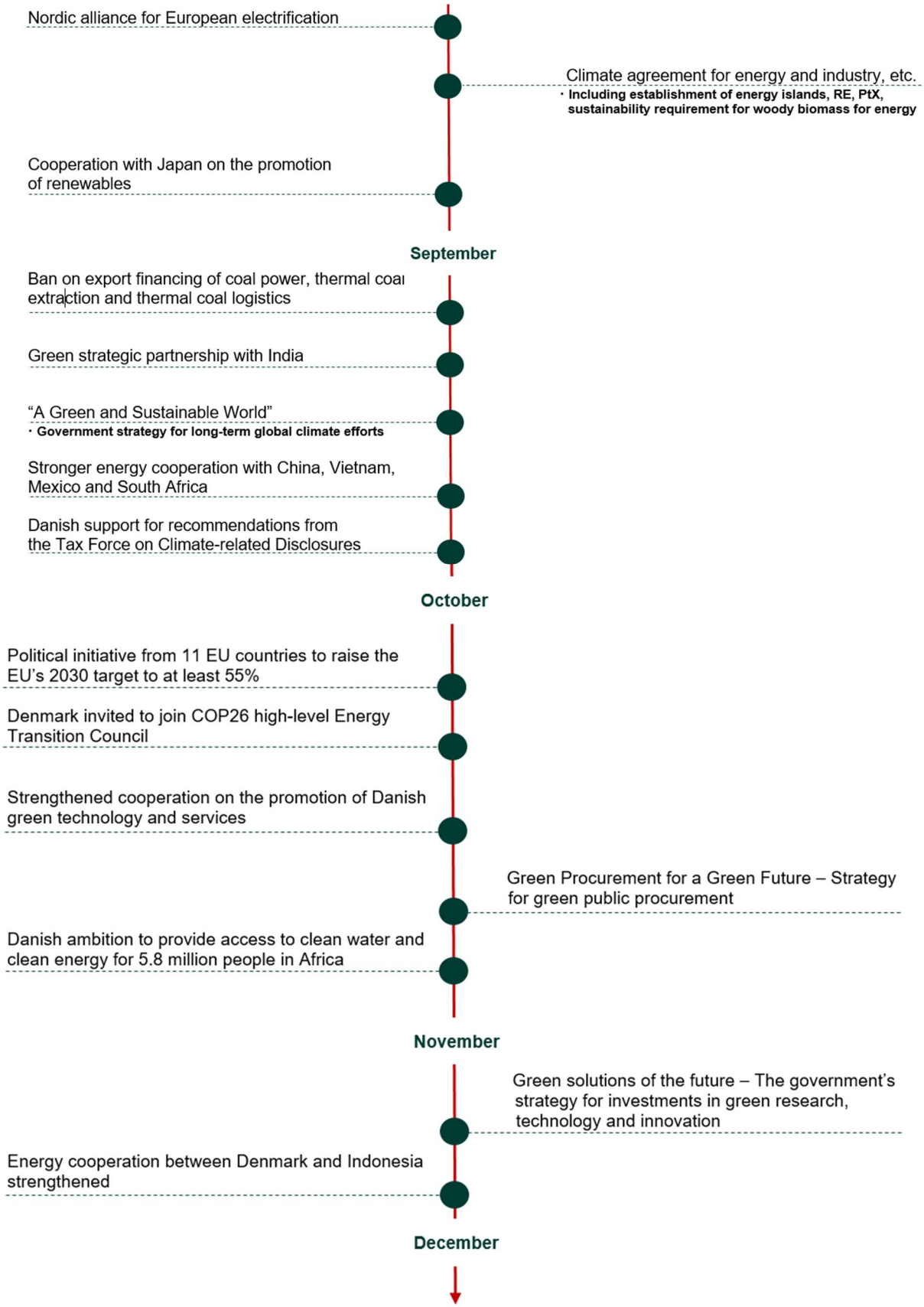
May

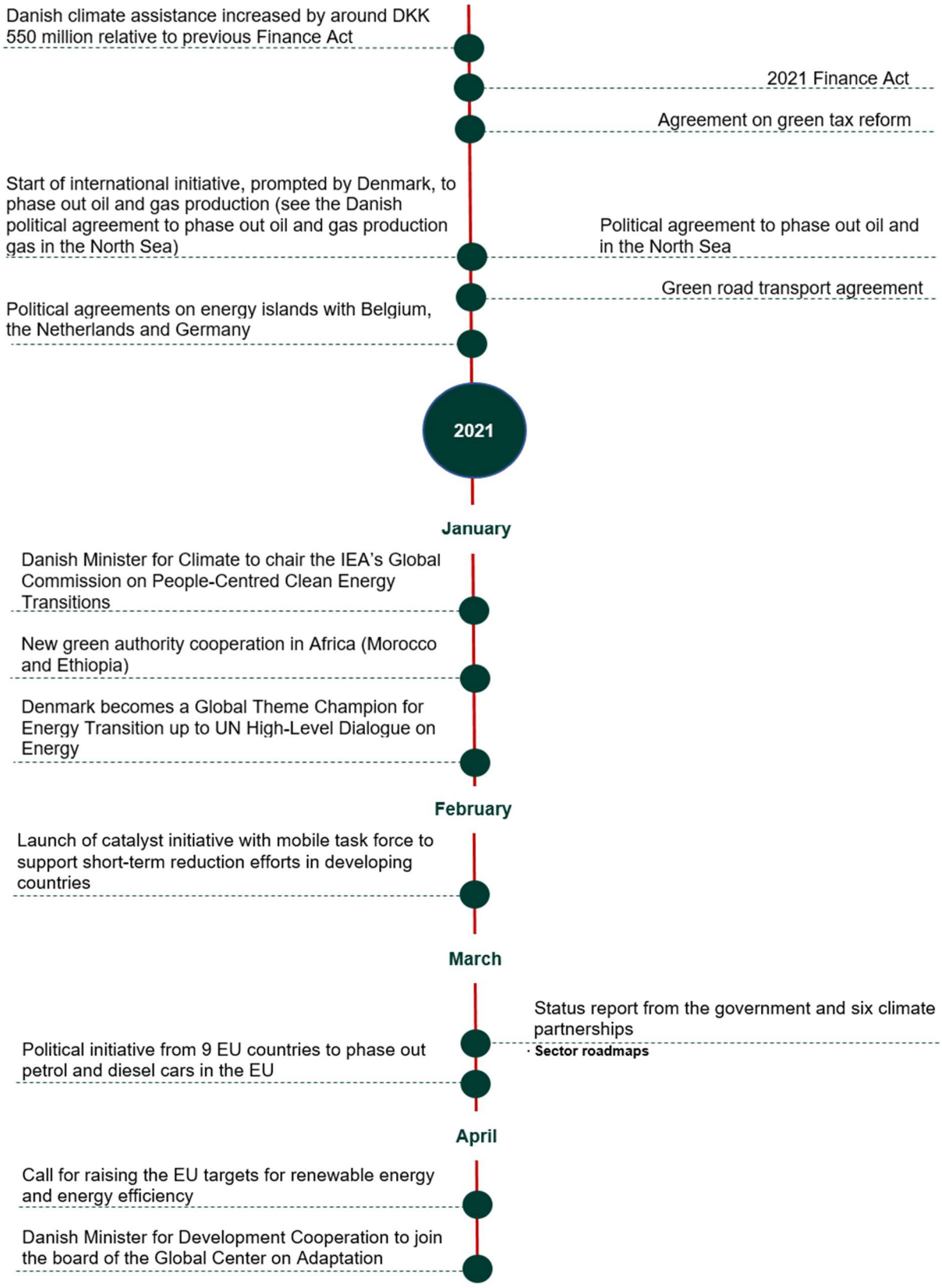
Green housing agreement

June

Climate plan for a green waste sector and circular economy

· **Including waste separation, plastic waste recycling strong recycling sector, less waste and more circular economy**


Nordic alliance for European electrification
Climate agreement for energy and industry, etc.
· Including establishment of energy islands, RE, PtX, sustainability requirement for woody biomass for energy
Cooperation with Japan on the promotion of renewables
September
Ban on export financing of coal power, thermal coal extraction and thermal coal logistics
Green strategic partnership with India
"A Green and Sustainable World"
· Government strategy for long-term global climate efforts
Stronger energy cooperation with China, Vietnam, Mexico and South Africa
Danish support for recommendations from the Tax Force on Climate-related Disclosures
October
Political initiative from 11 EU countries to raise the EU's 2030 target to at least 55%
Denmark invited to join COP26 high-level Energy Transition Council
Strengthened cooperation on the promotion of Danish green technology and services
Green Procurement for a Green Future – Strategy for green public procurement
Danish ambition to provide access to clean water and clean energy for 5.8 million people in Africa
November
Green solutions of the future – The government's strategy for investments in green research, technology and innovation
Energy cooperation between Denmark and Indonesia strengthened
December


Danish climate assistance increased by around DKK 550 million relative to previous Finance Act
2021 Finance Act
Agreement on green tax reform
Start of international initiative, prompted by Denmark, to phase out oil and gas production (see the Danish political agreement to phase out oil and gas production gas in the North Sea)
Political agreement to phase out oil and in the North Sea
Green road transport agreement
Political agreements on energy islands with Belgium, the Netherlands and Germany
2021
January
Danish Minister for Climate to chair the IEA's Global Commission on People-Centred Clean Energy Transitions
New green authority cooperation in Africa (Morocco and Ethiopia)
Denmark becomes a Global Theme Champion for Energy Transition up to UN High-Level Dialogue on Energy
February
Launch of catalyst initiative with mobile task force to support short-term reduction efforts in developing countries
March
Status report from the government and six climate partnerships
· Sector roadmaps
Political initiative from 9 EU countries to phase out petrol and diesel cars in the EU
April
Call for raising the EU targets for renewable energy and energy efficiency
Danish Minister for Development Cooperation to join the board of the Global Center on Adaptation

Contents

Summary

Global Report 2021 is the first official assessment of how Danish consumers, businesses and authorities affect the global climate in different ways. Climate change is a global challenge, and this report contributes an important examination of Denmark's role in global climate action, for better or for worse. The findings in the report will support Denmark's future climate action nationally and globally.

The report shows that Denmark's consumption-based climate footprint was approx. 61 million tonnes CO_2e[1] in 2019, and that Danish consumption contributes to global greenhouse gas emissions. This reflects the fact that Denmark is a wealthy country with high consumption comparable to that of other northern European countries, such as Sweden and the United Kingdom. However, the report also shows that Denmark's consumption-based climate footprint has fallen by 25% since 1990, even though Danish consumption has increased over the same period.

Furthermore, the report shows how, as a global green front-runner, Denmark helps reduce greenhouse gas emissions in other countries, both through the power of example and through global climate leadership. In addition to the considerable reduction initiatives that have been decided in Denmark within the energy and industry area, waste and transport, Denmark contributes globally through strong climate diplomacy and climate assistance, as well as through energy partnerships with China, Vietnam and the USA, for example. In these partnerships, Danish consultancy helps the respective countries with their green transition. Finally, there are extensive exports of Danish climate solutions, such as wind turbines, district heating equipment, energy-efficiency technology, as well as financing of green investments abroad.

[1] 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.

Global Report 2021 has its legal basis in the Climate Act. The report primarily provides a picture of global climate impacts that Danish consumers, businesses and authorities can help influence in different ways, but that are not covered by the Danish 70% target.

Purpose of global impact reporting according to the explanatory notes to 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 will 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 sectors, among other things.

The purpose of global impact reporting is to monitor progress and developments in Denmark's global climate action. Global Report 2021 describes a number of initiatives that are contributing to realising the government's strategy for global climate action launched in September 2020. This and future global impact reports can provide support for decisions about Denmark's continued international efforts.
Global Report 2021 has been published as a supplement to *Denmark's Climate Status and Outlook 2021* (ENS, 2021a), which contains Denmark's national inventory of greenhouse gas emissions from Danish territory, see the box below.

Denmark's Climate Status and Outlook reports

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: (ENS, 2021a).

Main results

Denmark's consumption-based climate footprint shows greenhouse gas emissions from the consumption of goods and services in Denmark. Emissions of greenhouse gases have been estimated to amount to about 61 million tonnes CO_2e in 2019 (excluding emissions from land-use change)[2].

Since 1990, emissions from consumption in Denmark have fallen by 25%. In the same period Danish consumption grew significantly and therefore one DKK spent on consumption in 2019 causes fewer emissions than the same amount spent in 1990.

47% of emissions in 2019 were from Danish territory, while the other 53% stemmed from consumption of imported goods and services. This demonstrates that Denmark is a small, open economy with extensive trade with other countries.

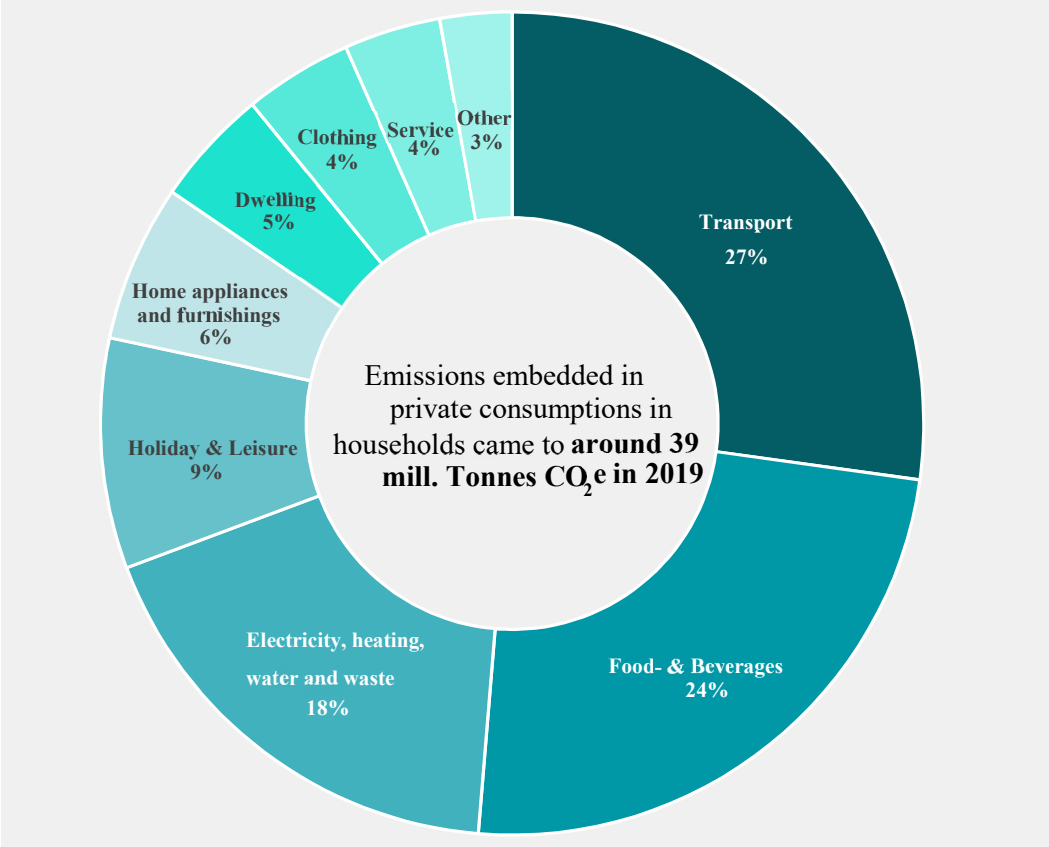
The climate footprint corresponds to 11 tonnes CO_2e per capita. This reflects the fact that Denmark is a wealthy country with high consumption, like many of the countries Denmark is usually compared with. Sweden has previously calculated its consumption-based climate footprint as approx. 8 tonnes per capita, while the United Kingdom came to around 12 tonnes per capita[3]. However, it is difficult to compare across countries since the methodologies used are not identical.

Danish private consumption accounts for more than 60% of the calculated consumption-based climate footprint for Denmark. In total, the climate impact from transport as well as food and drink accounts for more than one-half of the emissions related to average consumption in Denmark, see figure 2.

[2] Denmark has committed to reporting to the UN on its progress towards meeting its 70% target, and the emissions to be included in this reporting to the UN are emissions from within Danish borders; the so-called territorial emissions. The territorial emissions also form the basis for the international climate agreements, according to which each country has committed to cutting CO_2e emissions within its borders. The consumption-based climate footprint takes another perspective by focusing on the consumption of goods and services in Denmark. This means that both *emissions in Denmark* and *emissions abroad linked to Danish consumption* are calculated.

[3] There is a number of methodological differences between the countries, and this means that the calculations in these countries cannot currently be compared directly with the Danish calculation of its consumption-based climate footprint.

Figure 2: Greenhouse gas emissions linked to household consumption in 2019 by consumption categories.



Source: The categorisation was carried out by the Danish Energy Agency based on data from Statistics Denmark's Input-Output tables, emissions matrices and EXIOBASE emissions for imported goods. The category *Holiday and leisure* includes Danish consumption of package holidays (however not scheduled flights).

Goods consumption that leads to changes in the use of land and forests abroad can lead to greenhouse gas emissions. For example, this is the situation when the production of the goods consumed requires forests to be cleared or land to be cultivated, thus changing the amount of CO_2 that is removed from the atmosphere. Food, animal feed and textiles are examples of goods that can change the use of land and forests.

For methodological reasons, the climate impact of emissions from changes in land-use and forests embedded in Danish consumption is not included in the climate footprint. The climate impact of Danish consumption of goods that changes the use of land and forests abroad can be calculated separately (with significant uncertainty) as approx. 3 and 7 million tonnes CO_2e per year, respectively, based on two different methodologies and the latest available data.

Consumption of biomass for energy purposes and biofuels. Danish consumption of biomass for energy has been increasing since 2005. In the same period, consumption of coal at power plants has fallen. All else being equal, a higher consumption of biomass will increase the risk of a negative global climate impact. Among other things, the impact depends on the type of biomass, how the biomass is produced and what fuels it replaces.

The production of biofuels for the transport sector also entails emissions. However, emissions linked to consumption of biofuels in Denmark are estimated to have been falling. The climate impact of Danish consumption of biomass for energy purposes and biofuels has not been quantified and the knowledge and model base are currently not judged to be adequately robust.

International transport. Emissions from fuel refuelled abroad by Danish aircraft, amounted to about 2 million tonnes CO_2e in 2018. There is a slight increasing trend in emissions, primarily driven by an increase in passengers and goods. Greenhouse gas emissions related to international flights refuelling in Denmark (Danish and foreign aircraft) amounted to around 3 million tonnes CO_2e in 2018.

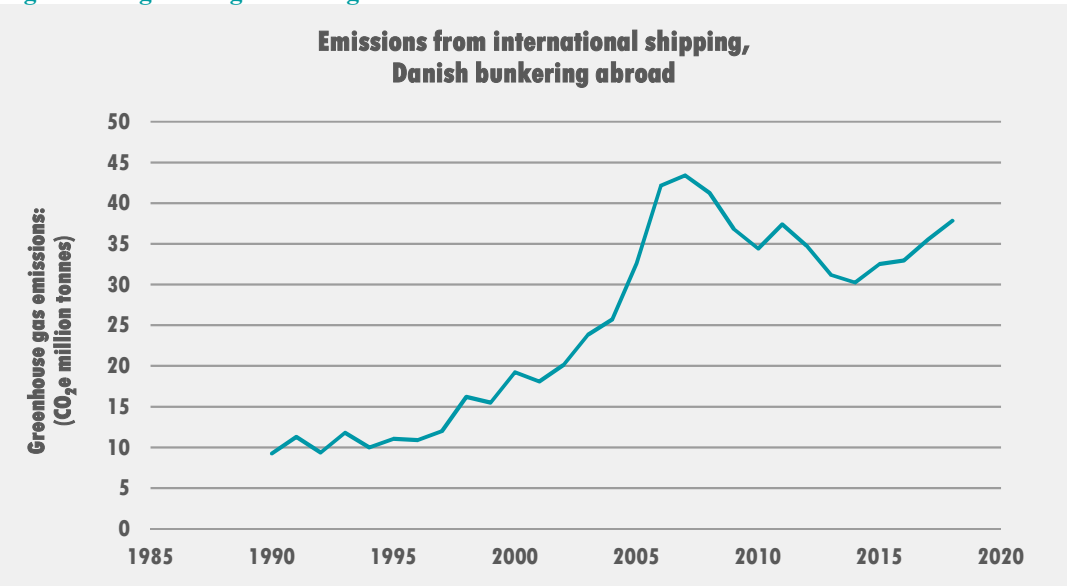
Examples of reduction efforts by aviation include SAS's target and initiatives to reduce CO_2 emissions, as well as a new consortium to construct a large-scale Power-to-X plant.

Refuelling by foreign ships in Denmark has been calculated at around 2 million tonnes CO2e and emissions from Danish operated ships abroad have been calculated at around 38 million tonnes CO2e, see figure 15. This reflects the fact that Denmark is the registered office of large players on the international shipping market, and just under 5% of the world fleet is operated by Danish businesses.

Emissions from Danish operated ships have grown by 25% since 2014. This trend follows developments in the total world fleet, and is driven by increasing international trade. A number of the major Danish commercial players within both aviation and shipping have set climate targets and launched reduction initiatives.

Examples of reduction initiatives by shipping include the establishment of a research and development centre for zero-emissions shipping and Mærsk's ambition to launch its first carbon-neutral ship in 2023.

Figure 15: Emissions from Danish operated ships abroad. These should be considered in light of the general growth in global trade since 2008.

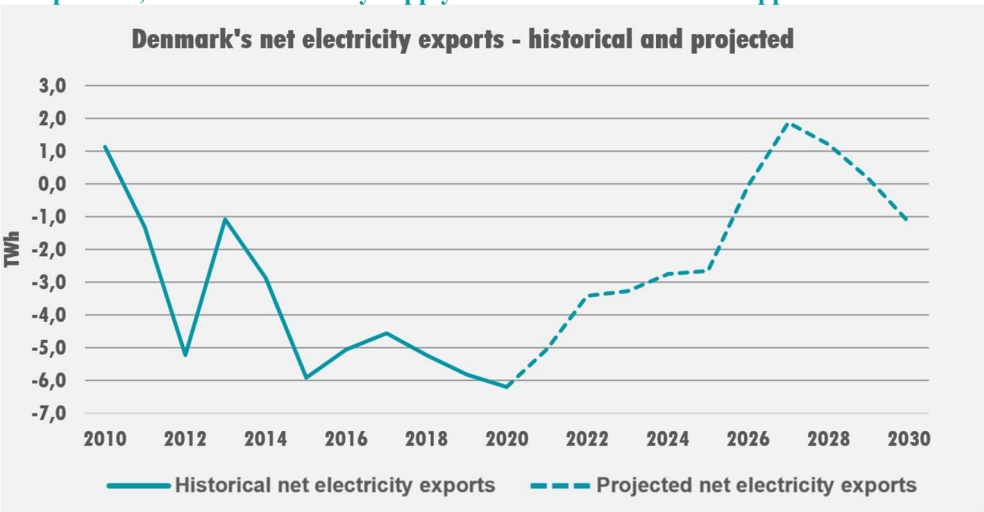


Source: Statistics Denmark, table: MRO2.

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 future, Denmark is expected to export more electricity produced from renewable energy sources, and this will help displace fossil-based electricity production abroad, see figure 16.

Calculations based on the same electricity consumption and the same mix of foreign electricity production plants, etc. as in 2030 show that, all else being equal and assuming that almost all electricity produced is exported, the energy islands have an annual reduction potential of up to 6 million tonnes CO_2.

Figure 16: Trends in Denmark's net electricity exports - historical and projected. In comparison, domestic electricity supply in Denmark in 2019 was approx.. 35 TWh.



Source: (ENS, 2021) for historical figures and (ENS, 2021a) for projected values

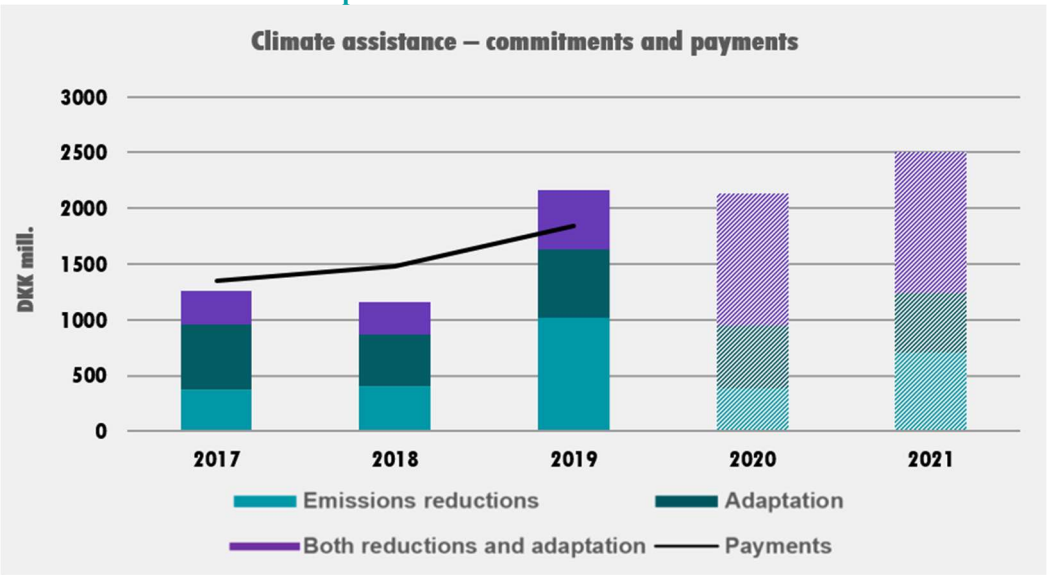
Denmark's international efforts

Denmark also contributes to tackling global climate challenges through the exchange of experience and the power of example, via bilateral and multilateral cooperation and via the EU in international initiatives underpinning a green and sustainable transformation. Through cooperation, dialogue and alliances with countries and non-governmental players, Denmark works to help and inspire other countries to raise their level of climate ambition. Furthermore, there is work by the Danish business community to promote the green transition, promote exports of green goods and services, and to finance green investments internationally. Finally there are the global effects of national policies and initiatives. Below is a review of the report's main results in this area.

Danish climate diplomacy. Denmark takes an active part and leadership in initiatives within the EU, the United Nations Framework Convention for Climate Change (UNFCCC), the International Energy Agency (IEA) and others. For example, Denmark took initiative to mobilise support among Member States to raise the EU's climate target for 2030 to at least a 55% reduction compared with 1990. Moreover, Denmark has a leading role in the IEA's new global high-level energy commission with focus on a socially just green transition.

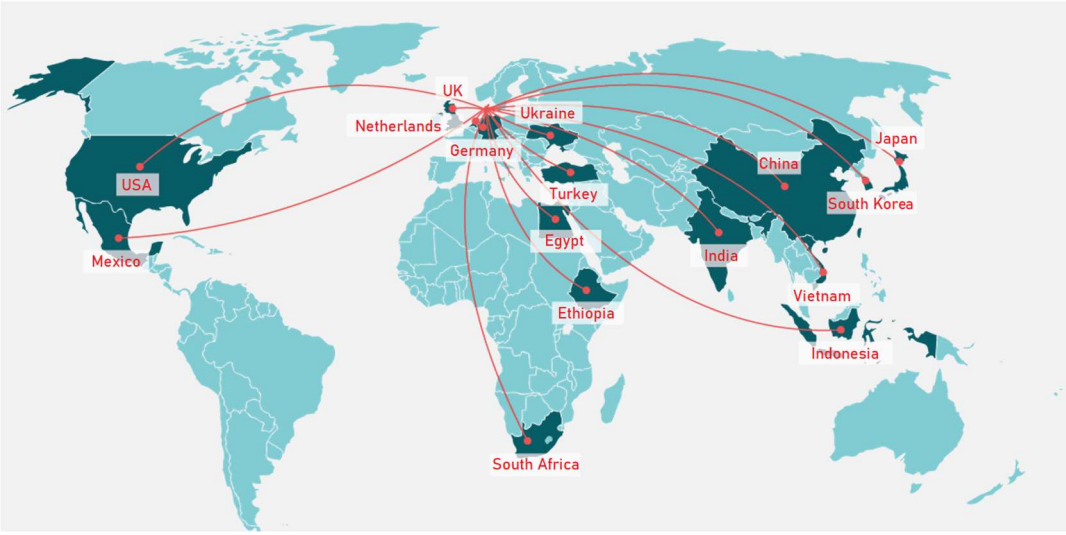
Danish climate assistance and climate finance support developing countries in the green transition and adaptation. In 2019, climate assistance amounted to DKK 2.2 billion and it is expected to rise to DKK 2.5 billion in 2021, see figure 23. Climate assistance is primarily to the world's poorest countries. Denmark also contributes bilaterally to mobilising financing of DKK 3-4 billion annually for climate projects in developing countries, e.g. through the investment fund for developing countries (IFU) and multilateral development banks.

Figure 23: Commitments of new grants for bilateral projects and contributions to dedicated climate funds in each year in the period and actual payments in the years. Figures for 2020 and 2021 are based on the respective Finance Bills.



Danish bilateral energy cooperation includes 16 countries that together account for more than 60% of the world's CO_2 emissions. Danish competences within long-term energy planning and effective integration of renewables, for example, contribute to well-founded outsets for policy-making for energy targets in cooperation countries. For example, in Vietnam, after implementing new methods, tools and incentives based on Danish experience, it is significantly more likely that energy-efficiency improvement potentials will be realised corresponding to 3 million tonnes CO_2 every year.

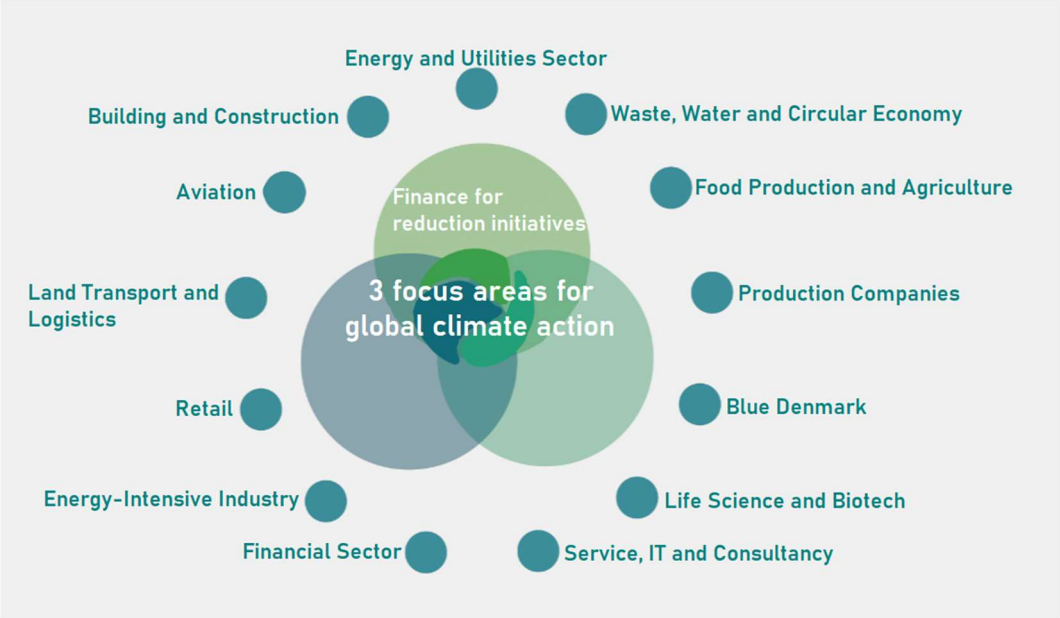
Illustration 13: Denmark's 16 partnership countries in bilateral energy cooperation



Danish bilateral environmental cooperation includes five authority cooperations in developing countries. The purpose of the five authority cooperation projects is to contribute to solving specific environmental problems and to build relationships and share knowledge with authorities in other countries. Focus is on ensuring synergy between environmental and climate action, particularly with regard to water resources management and waste management. In India, work is underway to secure a more energy-efficient water supply and wastewater sector.

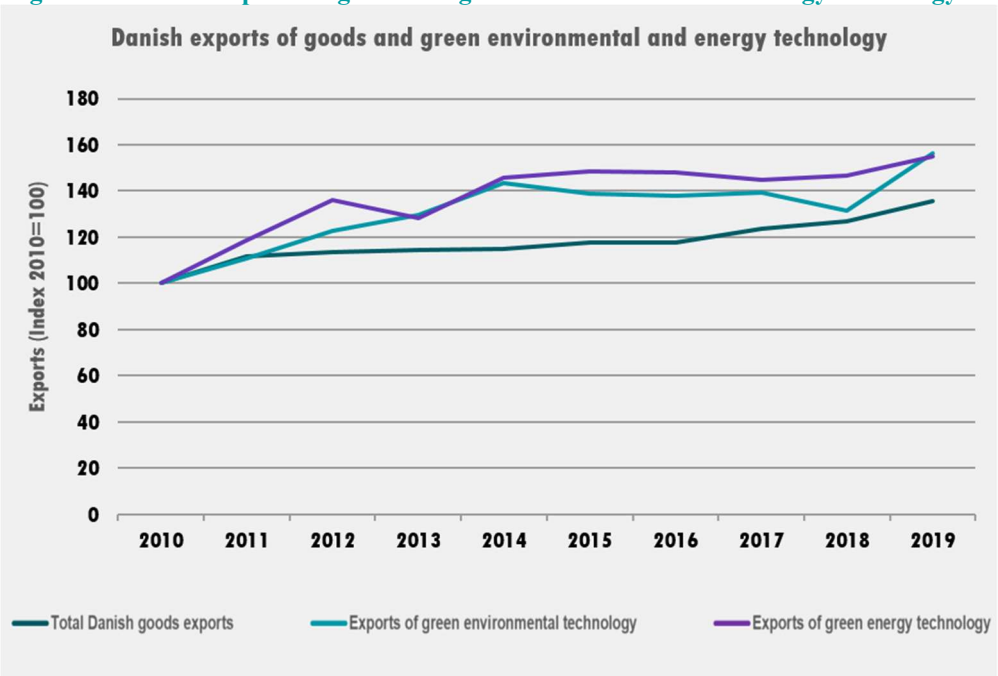
Danish business exports and global climate action contribute to greenhouse gas emission reductions outside Danish territory. Reports from the government's 13 climate partnerships in March 2020 reveal a clear global focus, in that the partnerships report they are addressing the emissions embedded in their global value chains, in their exports of green solutions, and in their financing of development, scale-up and use of green solutions, see illustration 9. The reports from the climate partnerships contain a number of initiatives which can contribute to reducing Denmark's global climate impacts.

Illustration 10: The climate partnerships' three focus areas with significance for the global climate



Green technologies comprise 77% and 79%, respectively, of total Danish goods exports of environmental and energy technology. Goods exports of green environmental and energy technology have risen by more than 50% since 2010, while total goods exports in the same period have risen by 35%, see figure 21. Moreover, Danish knowledge also contributes to global exports of green services such as consultancy for energy planning and water supplies.

Figure 21: Danish exports of goods and green environmental and energy technology



The climate impact of exports of green technologies is difficult to calculate and compare with a situation in which Danish exports did *not* occur. According to a rough estimate by the Climate Partnership for Production Companies in 2020, sales of green products from Danish production companies in 2018 are likely to displace about 350 million tonnes CO_2e globally over the products' lifetime. This corresponds to a reduction of 23 million tonnes CO_2e per year over the products' lifetime.

Financing green investments internationally has seen increasing interest from the Danish financial sector. In 2019, Danish pension companies announced that they would invest a further DKK 350 billion in the green transition up to 2030. The pension sector has calculated that in 2020 the sector increased its green investments by DKK 50 billion It can be challenging to mobilise private financing for projects abroad, particularly for more risky markets. Therefore the government has a number of financial institutions that contribute public financing and therefore reduce the investment risk in climate-friendly projects.

Global climate impact of political agreements. Many political agreements with a primary aim to reduce emissions in Denmark have also contributed global effects. Since the adoption of the Climate Act, 10 political agreements and initiatives have been established which have been assessed to also affect greenhouse gas emissions outside of Danish borders, see the box below.

Examples of political agreements and initiatives with global climate impacts

Establishment of the world's first energy islands (*2020 climate agreement for energy and industry, etc*.)
When Denmark exports green electricity, emissions are reduced abroad because the countries around Denmark can scale down their fossil-fuel-based electricity production. The decision to build the world's first energy islands means that Denmark will be able to export more green electricity in the future.

More sustainable biomass (*agreement on sustainability requirements for woody biomass for energy)*.
Denmark must transit to a sustainable consumption of biomass. Therefore, requirements will be introduced to document the sustainability of biomass to ensure that all biomass used in Denmark is as sustainable and climate friendly as possible.

End date for oil and gas extraction (*agreement on the future for gas extraction in the North Sea)*.
An end date has been fixed for Danish oil and gas extraction in the North Sea. It has been decided to cancel the 8th licensing round and all future licensing rounds. The agreement may have a long-term global reduction impact, as it may encourage other countries to also phase out their extraction of fossil fuels.

Sustainability requirements for biofuels (*green road transport agreement).*
The new CO_2 displacement requirement is expected to promote more climate-friendly biofuels and electrofuels. The assessment of the global climate impact of green fuels (based on iLUC values or similar) will help reduce the use of biofuels with high global emissions, for example. The initiatives are expected to reduce emissions linked to soil and forests in other countries.

More sustainable public procurement (*strategy for green public procurement*).
Every year, the public sector buys goods for DKK 380 billion, and two-thirds of associated emissions are in countries outside Denmark. In future, public procurement will take more account of longer product lifetimes and higher recycling to reduce emissions from extracting and processing natural resources for new products in other countries. There are also requirements for procurement that does not entail deforestation, and this will reduce soil and forest emissions in other countries.

See chapter 7 for more details.

Methodological reservations

Global Report 2021 is the first official overall assessment of Danish global climate impacts. Only very few countries have calculated their global climate impacts, and no uniform methodological approach has yet been established. The calculations and comparisons across countries are therefore linked to uncertainty, and not all aspects of Denmark's climate impacts have been described. Methods and the data basis will be optimised in future reports.

Major, long-term changes in behavioural patterns and production methods as a consequence of the Covid-19 pandemic have not been reflected in assessments in this year's report. The most recent year included in calculations of the climate footprint is 2019 and any Covid-19-related impacts have therefore not been included. However, it is expected that the Covid-19 pandemic will have an impact on the consumption-based climate footprint in the years after 2019.

Key figures

Global Report 2021	
Denmark's consumption-based climate footprint[4]	Approx. 61 million tonnes CO_2e in 2019
Climate impact of land-use change	Calculated with significant uncertainty as approx. 3 and 7 million tonnes CO_2e per year, respectively, based on two different methods and the latest available data.
Climate impact of biomass and biofuels	Not calculated. The impact depends on the specific types of biomass used, etc.
International transport	
• *Refuelling with aviation fuel in Denmark*	Approx. 3 million tonnes CO_2e in 2018.
• *Refuelling Danish aircraft abroad*	Approx. 2 million tonnes CO_2e in 2018.
• *Refuelling with marine fuel in Denmark*	Approx. 2 million tonnes CO_2e in 2018.
• *Refuelling Danish ships abroad*	Approx. 38 million tonnes CO_2e in 2018
Exports of renewable electricity displace CO_2 abroad:	Future increasing net exports will provide CO_2 reductions in other countries
The energy islands will displace CO_2 abroad.	An example calculation assuming that almost all electricity produced is exported shows that the energy islands could displace up to 6 million tonnes CO_2 (calculated on the basis of expected electricity consumption and a mix of foreign electricity production plants etc. similar to that in 2030)[5]. The example can only serve to illustrate the reduction potential for 5 GW offshore wind capacity.

[4] Does not include emissions linked to land-use change due to methodological uncertainty.
[5] Partial calculation, i.e. the energy islands have been included but without changing anything else in the model (e.g. without deployment of PtX).

Green action by the business sector • *Exports of environmental technology*	DKK 25.4 billion in 2019 Of this, 77% comprises green exports
• *Exports of energy technology*	DKK 99.6 billion in 2019. Of this, 79% comprises green exports
• *Exports of services from the Danish energy sector*	DKK 21.5 billion in 2019.
• *Exports of services from the Danish water sector*	DKK 3.1 billion in 2019.
• *Exports from consulting engineers within the environment and energy area*	DKK 2.3 billion in 2019.
• *Climate impact of Danish exports of green technology*	Positive global climate impact, impact not estimated. The Climate Partnership for Production Companies has estimated that sales of green products from Danish production companies in 2018 could potentially displace around 350 million tonnes CO_2e globally over the products' lifetime.
Green investments	Positive global climate impact, impact not estimated.
Climate assistance • *Danish climate assistance*	Positive global climate impact, impact not estimated. Commitment of assistance of DKK 2.2 billion in 2019.
• *Danish climate finance*	Positive global climate impact, impact not estimated. Financing is mobilised bilaterally of DKK 3-4 billion annually.
Bilateral energy and environmental cooperation	Positive global climate impact, impact not estimated.
Other climate diplomacy initiatives (globally and in the EU)	Positive global climate impact, impact not estimated.
Political agreements with global climate impacts	Ten specific agreements and initiatives from and including December 2019 with national aims but judged to have global climate impacts.

Note: The individual quantitative calculations *cannot* be added together to reach a single figure for total Danish impacts on the global climate due to differences in time periods and methodologies, overlapping emissions calculations, and different perspectives on Danish impacts.

1. Focus and approach

1.1 Denmark's global climate footprint and Denmark's climate action

Global Report 2021 consists of four main parts that take stock of Denmark's global *climate footprint* and Denmark's *climate action in the following four selected areas* (see Illustration 1).

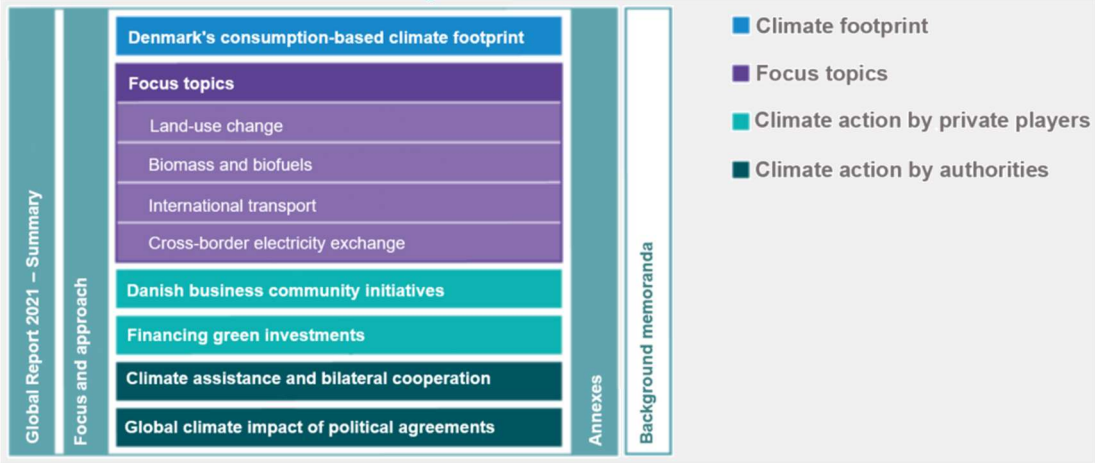
Denmark's consumption-based climate footprint (chapter 2) is a calculation of the total climate impact of Danish consumption of goods produced domestically and of imported goods. The consumption-based climate footprint therefore illustrates the total climate impact of the products and services that are consumed in Denmark.

Focus topics (chapter 3) can be regarded as a more detailed explanation of some of the themes addressed in chapter 2. Specifically, the following topics are described: Land-use change as a result of consumption; consumption of biomass and biofuels for energy purposes; international transport; and exports and imports of electricity.

Climate action by private players (chapters 4 and 5) describe initiatives by private players to reduce global greenhouse gas emissions. In Global Report 2021, this covers global efforts by the climate partnerships, exports of green technology and financing green investments.

Climate action by authorities (chapters 6 and 7) describe initiatives by Danish authorities to reduce global greenhouse gas emissions. Global Report 2021 covers Danish climate assistance, bilateral energy and environmental cooperation and other climate diplomacy initiatives. Furthermore, there is an overview of recently adopted Danish climate policies with a global climate impact. Among other things, the policy initiatives are assessed with regard to whether they contribute to carbon leakage, i.e. Danish climate regulation that reduces emissions of greenhouse gases in Denmark but increases emissions of greenhouse gases in other countries.

Illustration 1: Structure of Global Report 2021



1.2 Approach to preparation of Global Report 2021

Denmark's global climate footprint has been calculated using a model originally developed by Eurostat, and since further developed in the Swedish research project PRINCE (STE, 2018). The model has been adapted to Danish conditions and it uses data from Statistics Denmark combined with data from the global database, EXIOBASE (see box 1 in chapter 2). On the basis of this, the model calculates the greenhouse gas emissions caused by goods consumed in Denmark (including land use, transport, production and consumption). Methodologically, this is a difficult calculation and the method will be further developed in connection with future global impact reports.

The *focus topics* are based on data, statistics, calculations and case examples. *Land-use change as a result of consumption* is based on two different methodological approaches by NIRAS: *Consumption of biomass and biofuels for energy purposes* is based on (ENS, 2020) and (EEA, 2020), respectively. *International transport* is based on official statistics from the Danish Energy Agency and Statistics Denmark, and *cross-border electricity exchange* is based on calculations using the Danish Energy Agency's electricity system model.

Climate action by private players is reported as contributions from the Danish government's climate partnerships. Calculations of green exports are based on analyses of exports of energy technology, which the Danish Energy Agency publishes in cooperation with the Confederation of Danish Industry, the Danish Energy Association, Wind Denmark and the Danish District Heating Association, as well as the Danish EPA's analysis of exports of water technology and the EPA's data on exports of waste and clean-air technologies. The chapter on *green investments* is based on contributions from the Ministry of Industry, Business and Financial Affairs and Denmark's Export Credit Agency (EKF).

Climate action by authorities is reported as direct contributions from the players responsible for climate assistance (Ministry of Foreign Affairs of Denmark) and bilateral energy and environment cooperation (Danish Energy Agency and Ministry of the

Environment). 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 methodology approach was subject to consultation in December 2020, and the full Global Report 2021 was under external consultation in April/May 2021.

The plan is to continuously develop the global impact reports and to ensure methodological certainty and solid data. This is partly because the uncertainty of the calculations increases if there is a shift from examining greenhouse gas emissions within Danish borders, to looking at how activities in Denmark affect greenhouse gas emissions internationally. In Denmark, how building a new wind turbine in Denmark affects Danish territorial emissions of CO_2e can be calculated with relative certainty. For comparison, there are significantly more uncertain assumptions in estimating how Danish imports of beef and veal products from South America or Australia, for example, affect global emissions.

2. Denmark's consumption-based climate footprint

This chapter describes the greenhouse gas emissions linked to Danish consumption, also called Denmark's consumption-based climate footprint. Denmark has committed to reporting to the UN on its progress towards meeting its 70% target, and the emissions to be included in this reporting to the UN are emissions from within Danish borders; the so-called territorial emissions. The consumption-based climate footprint includes another element which focuses on consumption of goods and services in Denmark. This means that both emissions in Denmark and emissions abroad embedded in Danish consumption are calculated.

There is no widely recognised method to calculate a consumer-based climate footprint. On the other hand, there are a number of methodological choices which can have a major influence on the climate footprint. Furthermore, there is considerable uncertainty associated with the underlying data, which also influences the result of the calculation. This uncertainty is addressed later in this section, while the details about the methodological choices are in the background report on methodology.

Therefore, there is a need to further develop and possibly supplement the consumption-based calculation with further analyses in future global impact reports. The calculations in Global Report 2021 form the basis for further work.

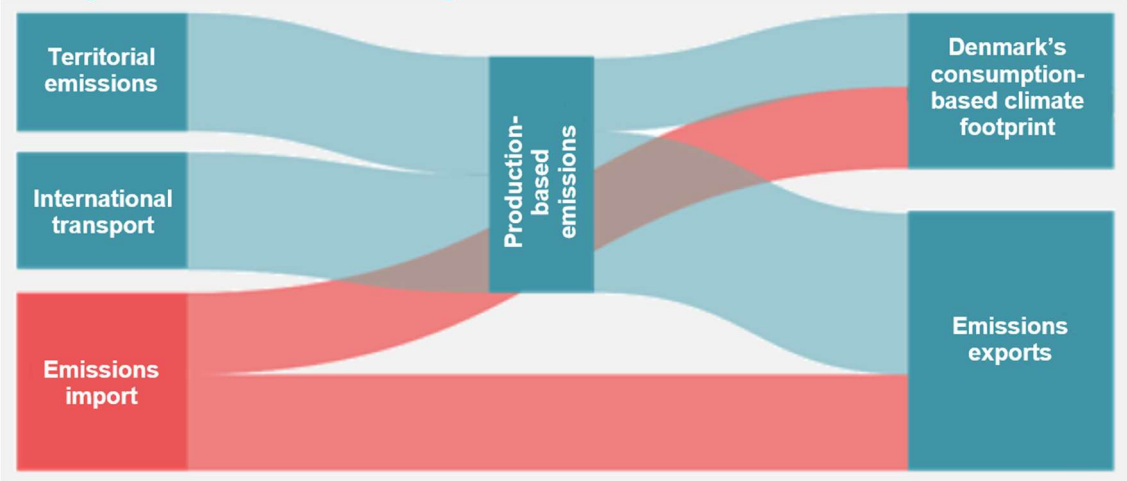
Based on the method used, consumption-based emissions were reduced from about 82 million tonnes CO_2e in 1990 to about 61 million tonnes CO_2e in 2019, corresponding to a reduction of approximately 25% over the period. As the most recent year for the calculations is 2019, the effects of the Covid-19 pandemic have not been included. However, it is likely that the Covid-19 pandemic will have an impact on the consumption-based climate footprint in the years after 2019.

Calculation of the consumption-based climate footprint

Denmark's Climate Status and Outlook 2021 focuses on territorial emissions, while this chapter focuses on Denmark's consumption-based climate footprint. The climate footprint is a calculation of the total climate impact of Danish consumption of goods produced domestically and imported goods, less emissions from exported goods. Illustration 2 shows the relationship between the territorial emissions (top left); emissions from Danish production, including international transport[6] (centre); and emissions embedded in Danish consumption (top right). Danish exports of goods are described in Box 3.

[6] International transport covers emissions abroad by Danish businesses within the 'shipping', 'aviation' and 'haulier and pipeline transport' sectors.

Illustration 2: Relationship between territorial emissions, emissions from Danish production and Danish consumption



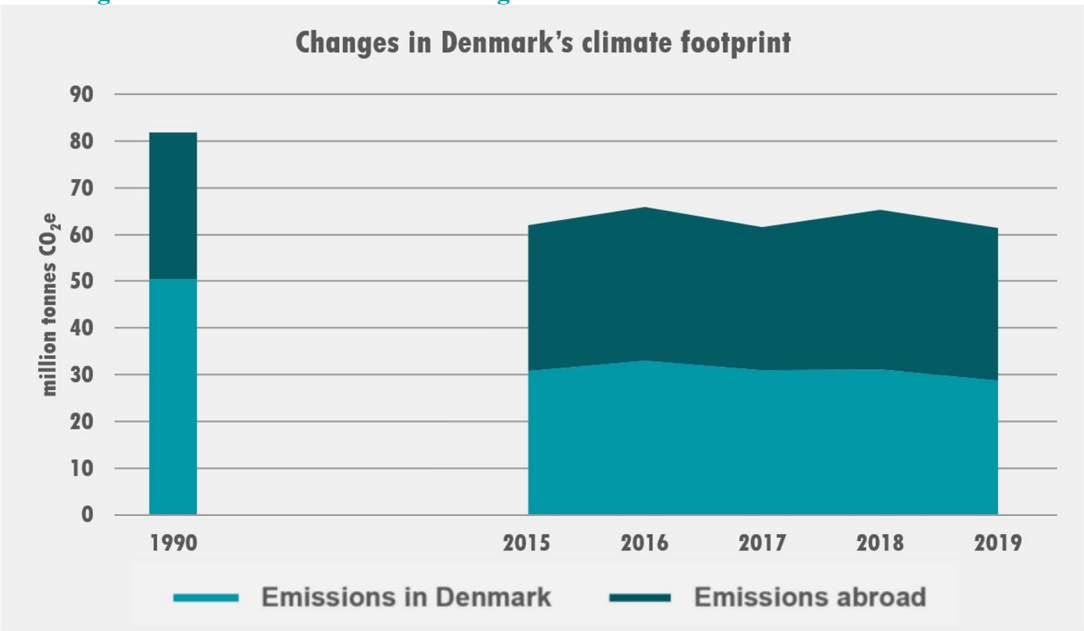
2.1 Results

Denmark's consumption-based climate footprint has fallen by about 25% since 1990

Denmark's consumption-based climate footprint has been reduced from about 82 million tonnes CO_2e in 1990 to about 61 million tonnes CO_2e in 2019, excluding emissions linked to land-use change, see Figure 1. This corresponds to a reduction of approx. 25% in the period. Consumption-based emissions have been calculated at around 11 tonnes CO_2e per capita in 2019.

Consumption-based emissions from abroad have been largely constant over the period, but they comprised a significantly larger percentage of the total emissions in 2019 (around 53%.) than in 1990 (around 38%). Among other things, this is because emissions in Denmark from production of goods and services consumed in Denmark fell drastically over the period. Emissions abroad cover goods produced abroad but which are subsequently imported to Denmark for consumption.

Figure 1: Changes in Denmark's consumption-based climate footprint, excluding emissions linked to land-use change



Note: Greenhouse gas emissions in Denmark include emissions related to consumption of transport abroad if the transport is supplied by Danish businesses.

The calculation of Denmark's consumption-based climate footprint seeks to include greenhouse gas emissions from the whole life cycle of goods and services consumed in Denmark.
The calculation includes impacts related to land use in agriculture[7], i.e. change in the soil carbon pools as a consequence of draining and cultivating agricultural land.

The climate footprint does not include all impacts linked to changes in soil and forest carbon pools. This is due to two factors in particular: Firstly, it is difficult to give a true and fair presentation of the extent of emissions. Secondly, there are several different methods to calculate some of the impacts. Therefore, an international "best practice" has yet to be developed for the area among the countries that calculate their consumption-based climate footprint.

Emissions from Danish imports and consumption associated with land-use change, for example if a forest is cut down to make space for agricultural production, are described separately in section 3.1. Emissions from forestry, for example when biomass is removed from forests for use in energy production, are described in more detail in section 3.1.
The method to calculate the consumption-based climate footprint is described in more detail in box 1, while the relationship between territorial emissions and consumption-based climate footprint is described and compared with results from other countries in Box 2.

[7] Data from EXIOBASE is used for other countries, while data from reports from the Danish Centre for Environment and Energy to the United Nations is used for Denmark. The reports only include impacts from the categories "Cropland" and "Grassland"

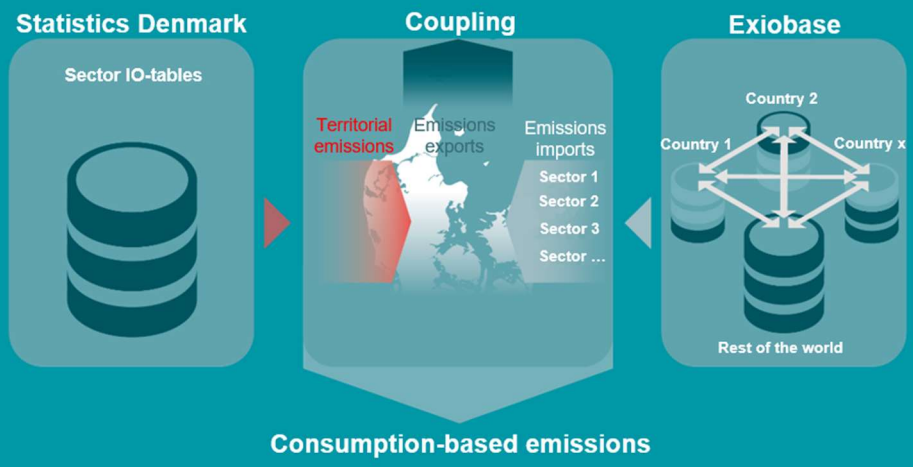
Box 1: How the climate footprint from Danish consumption is calculated

Denmark's consumption-based climate footprint is calculated on the basis of an approach in which all global emissions in a given year are distributed between all the countries in the world. The principle for the distribution is to attribute all emissions associated with a country's consumption to the country concerned, irrespective of where the emissions related to production, processing and transport of the goods actually physically took place.

As illustrated in the equation below, the climate footprint for Denmark is calculated by calculating emissions from production in Denmark plus emissions from consumption of imported goods and services. Emissions from exported Danish products and services consumed abroad are deducted correspondingly from emissions because they are attributed to the countries in which the goods are consumed.

$$Climate\ footprint_{DK} = emissions_{production\ in\ Denmark} + emissions_{imports} - emissions_{exports}$$

The calculation of Danish emissions associated with Danish production and exports is based on Statistics Denmark's national input-output (IO) tables and emissions accounts. The tables also calculate how much the individual sectors import and export, respectively. Emissions related to imports are based on the global IO database EXIOBASE[8]. Denmark's consumption-based climate footprint is thus calculated by coupling the national data with the global database. The Danish IO tables describe the production structures in Denmark, while the global EXIOBASE links all the IO tables for all the world's countries, and thus describes how the production structures throughout the world are connected, how countries trade with each other, and how emissions linked to production of products and services break down across sectors.



[8] EXIOBASE was originally developed by an international research consortium (FOR, 2021) and subsequently further developed through several research projects. Today the database is primarily being developed by the Danish consultancy company 2.0 LCA Consultants and the Norwegian University of Science and Technology (NTNU). The background report on methodology states why EXIOBASE was selected as the best database to calculate the Danish consumption-based climate footprint.

As the calculation is at sector level, it is not possible to calculate detailed climate impacts at product level.

For a more detailed outline of the method, see the background report on methodology.

The Danish Energy Agency follows the international development of calculation methods and the data basis very closely in order to ensure that the calculation of the consumption-based climate footprint is based on the latest knowledge and, as far as possible, carried out according to the same principles as in other countries, such as Sweden, the UK, the Netherlands and France. However, there are a number of methodological differences between the countries, and this means that the calculations in these countries cannot currently be compared 1:1. Differences in the relationship between territorial emissions and consumption-based climate footprint compared with other countries are described in Box 2.

Box 2: Country comparison and consumption-based climate footprint compared with territorial emissions

Denmark's territorial emissions in 2019 amounted to about 49 million tonnes CO_2e, while consumption-based emissions in 2019 in Global Report 2021 have been estimated to be about 61 million tonnes CO_2e (both figures are excluding emissions linked to changes in land-use and forests, but including land use in agriculture[9]). Thus, Danish consumption-based emissions have been estimated to be approx. 25% larger than Danish territorial emissions. Danish consumption-based emissions have fallen by 25% since 1990. That consumption-based emissions are greater than territorial emissions corresponds with the distribution seen for countries with which Denmark is normally compared.

An analysis has not been made of the comparability with the estimates of other countries, but the Swedish Environmental Protection Agency (*Naturvårdsverket*) has calculated **Sweden's** consumption-based climate footprint to be approx. 82 million tonnes in 2018 (corresponding to approx. 8 tonnes per capita), while the territorial emissions in the same year have been calculated at 52 million tonnes (corresponding to approx. 5 tonnes per capita) (NAT, 2020). Thus the Swedish consumption-based footprint is approx. 60% higher than the territorial emissions. Sweden has calculated its consumption-based climate footprint since 2008, and has reduced its footprint by 18% over the period.

The **United Kingdom** calculated its consumption-based climate footprint in 2017 to be approx. 772 million tonnes (corresponding to approx. 12 tonnes per capita), and the territorial emissions to be approx. 451 million tonnes (corresponding to approx. 7 tonnes per capita) (DOE, 2020). Thus the British consumption-based climate footprint is approx. 70% higher than the territorial footprint. The United Kingdom has calculated its consumption-based climate footprint since 1990 and in the period up to 2017 has reduced this by approx. 15%, although there are significant uncertainties in data for the period 1990-1997, and therefore only the period 1997-2017 are official figures. In this period, the consumption-based climate footprint in the United Kingdom fell by approx. 10%.

[9] Note that, according to Denmark's Climate and Status Outlook 2021, Danish greenhouse gas emissions in 2019 were 46.7 million tonnes CO_2e incl. LULUCF. The calculation of the consumption-based climate footprint only includes part of emissions from the LULUCF area. Therefore, a comparison between the consumption-based climate footprint and territorial emissions requires adjusting the territorial emissions as if they were calculated in the same way as the consumption-based emissions.

The United Nations Environment Programme states that there is a tendency for countries with high GDP per capita to have higher consumption-based emissions than territorial emissions. The same report estimates that the consumption-based emissions for the **EU** including the United Kingdom are approx. 15-20% higher than the territorial emissions (UNEP, 2020). In addition to the above countries, France and the Netherlands, for example, draw up consumption-based calculations. However, the methods they use are assessed to be less comparable with the Danish estimates.

Two approaches give different insight into the Danish consumption-based climate footprint

Denmark's consumption-based climate footprint of approx. 61 million tonnes CO_2e can basically be illustrated through two approaches: The *consumption approach* that shows who consumes the goods that cause the climate footprint, and the *supplier approach* that shows the level of emissions embedded in Danish and foreign sectors as a consequence of the ultimate consumption in Denmark. The two approaches therefore describe the same emissions; they merely categorise these emissions in two different ways.

The consumption approach

Denmark's consumption-based climate footprint shows the CO_2e emissions embedded in final domestic consumption broken down by private consumption by households (in the following referred to as private consumption), public-sector consumption, consumption by non-profit organisations, and investments[10]. There is no consumption for the corporate sector in this calculation because consumption by this sector is not defined as final consumption, but as input for production.

Of the Danish consumption-based climate footprint in 2019 of approx. 61 million tonnes CO_2e, the majority, 63% (around 39 million tonnes CO_2e), can be allocated to private consumption by households. [11] Figure 2 shows total private consumption by households by different consumption categories.

Within private consumption by households, transport contributes most to the Danish consumption-based climate footprint (27%), see Figure 2. The category covers fuel as well as purchases and maintenance of cars and purchases of transport services. Almost three-quarters of the emissions in the transport category come from petrol and diesel fuel used in household vehicles. Greenhouse gas emissions in other countries associated with production of the cars purchased by Danish households are therefore included in the transport category.

At 24%, emissions from food and beverages are the second-largest category of household private consumption. About half of this category is consumption of meat, costs of

[10] Investments are defined as only being in the public sector and in the corporate sector, and they include: housing, other buildings, installations, means of transport, information and communication technologies, other machinery and equipment, weapons systems, growth in agricultural breeding stock, software, research and development, original works for entertainment, culture and art, as well as exploration drilling. The common element for all investments is that they are used for more than one year. Corporate and public sector purchases of assets and changes in stocks are included in this overall classification of investments. Household purchases of long-term consumer goods are not defined as investments, but consumption.

[11] The break-down between consumption categories is on the basis of Statistics Denmark's input-output tables, which allocate consumption between consumption categories. Statistics Denmark bases its break-down on a sample of 2,166 private households (DST, 2020g).

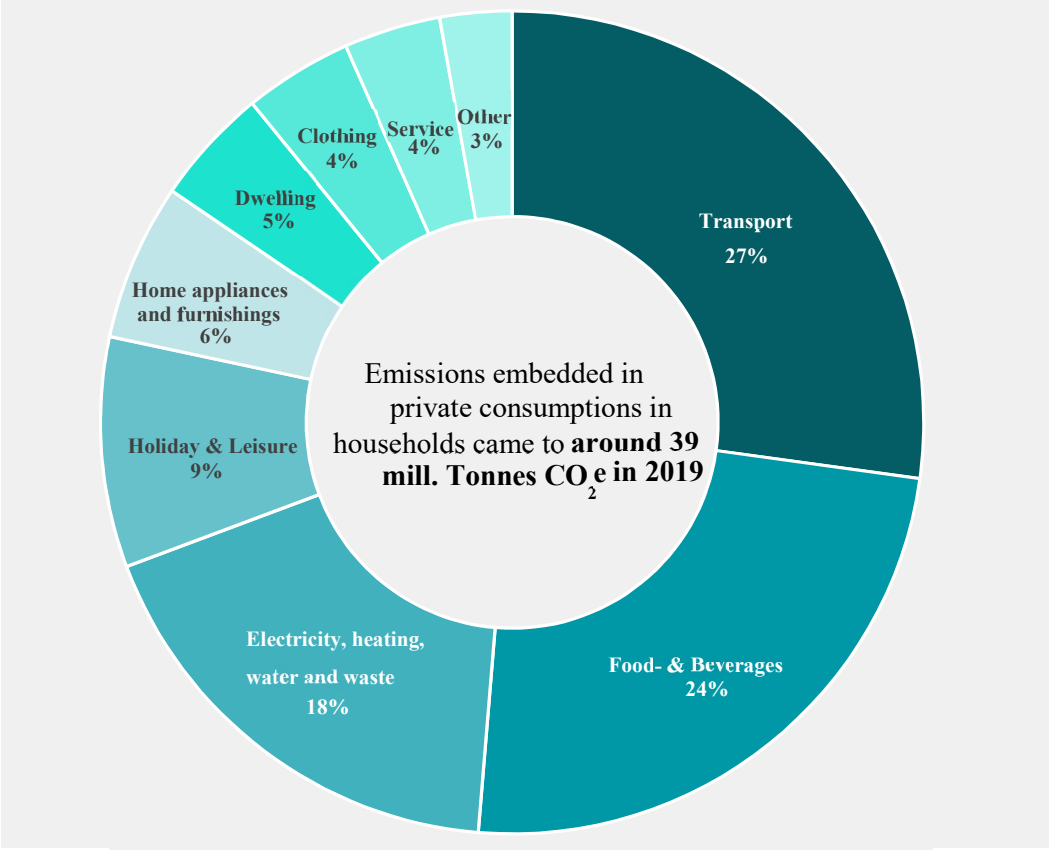
restaurant meals, as well as fruit and vegetables. Greenhouse gas emissions in other countries associated with production of the food and beverages imported into Denmark are therefore included in the food and beverages category.

Electricity, heating, water and waste collection account for 18% of emissions from private consumption by households. This category is dominated by electricity, gas and district heating consumption.

The remaining 31% of the emissions from household consumption comprise leisure and sport, electronics and household furnishings, housing, clothing and service[12].

Overall, across all household consumer categories, 45% of emissions linked to household end-use consumption are emitted in other countries, while the remaining 55% are Danish territorial emissions.

Figure 2: Greenhouse gas emissions linked to private consumption by households in 2019 by consumption categories



Source: The categorisation was carried out by the Danish Energy Agency based on data from Statistics Denmark's Input-Output tables, emissions matrices and EXIOBASE emissions for imported goods.

[12] 'Holiday and leisure': package holidays, sports equipment, toys, pets etc., entertainment and television licence etc.
'Electronics and household furnishings': Furniture and carpets, etc., toilet articles, shavers etc., household appliances.
'Housing': Repairs and maintenance, rent and calculated rent of own dwelling.
'Clothing': Clothing, footwear, suitcases, bags, etc.
'Service': Financial services, telephone services, service of kitchen appliances.
'Other': Medicine, vitamins etc., tobacco, glasses, hearing aids, etc.

The supplier approach

Figure 3 shows the consumption-based climate footprint by sector before the sector delivers the goods and services for final domestic consumption in Denmark. Note that this type of calculation differs from territorial calculations. Among other things, this is because consumption-based calculations do not show the direct emissions that take place in the individual sectors, but rather show the emissions *embedded* in the individual sectors, before final consumption of goods and services.

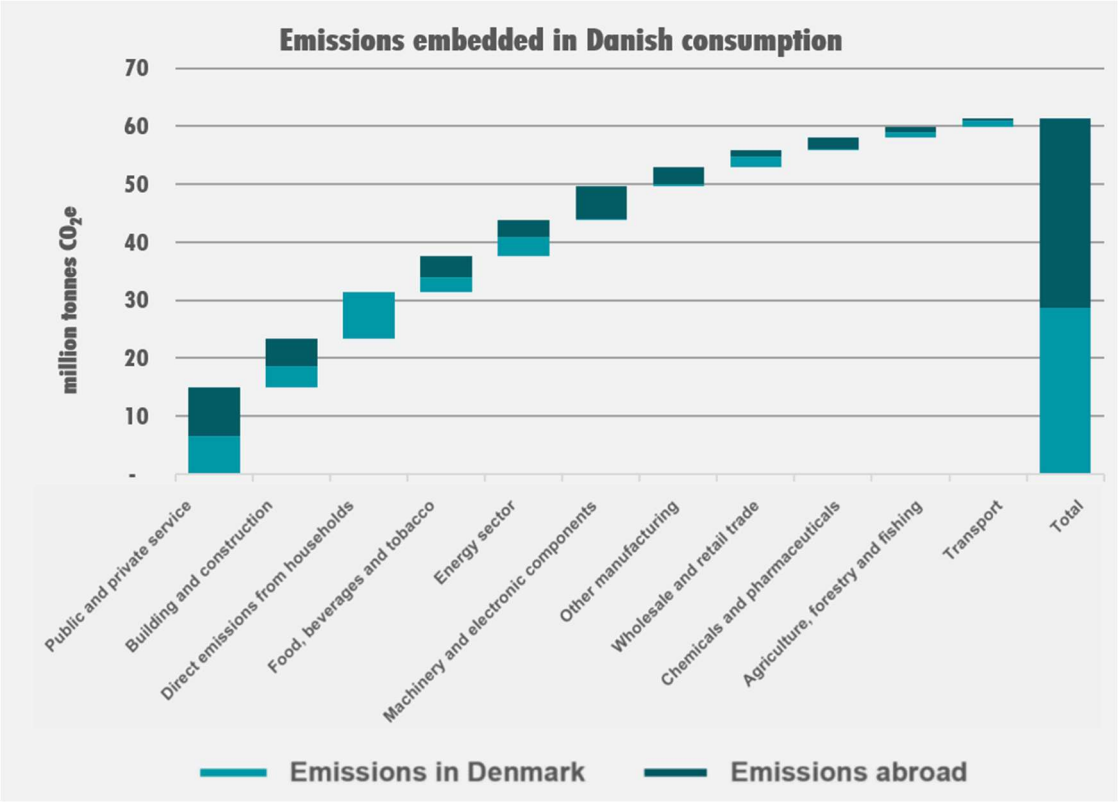
Specifically, this means that when a piece of meat, for example, is sold to a Danish consumer, the consumption-based calculation of emissions from the meat will include emissions from the entire value chain contributing to production of the meat (including any greenhouse gas emissions linked to imported animal feed, farming the animal, transporting the animal, processing and sale). Emissions from the meat will be attributed to the sector called 'Food, beverages and tobacco products', as this is the 'final stop' before final consumption.

The 'Public and private service' sectors deliver goods and services for final consumption that contributes about 15 million tonnes CO_2e to the consumption-based climate footprint, see Figure 3. This corresponds to about 25% of the total consumption-based climate footprint. Together with the emissions contributed to final consumption from the building and construction sectors and the direct emissions from households[13], the three sectors account for about half of the total consumption-based climate footprint.

Across all the sectors mentioned in Figure 3, 53% of emissions are in other countries, while the remaining 47% are Danish territorial emissions.

[13] Direct emissions from households include emissions linked to consumption of natural gas, liquid and solid fuels, as well as petrol and oil for vehicles. The reason why these are calculated separately, is that the emissions are primarily related to the consumption itself (i.e. combustion) and are not embedded in the sectors.

Figure 3: Denmark's consumption-based climate footprint in 2019 divided between sectors

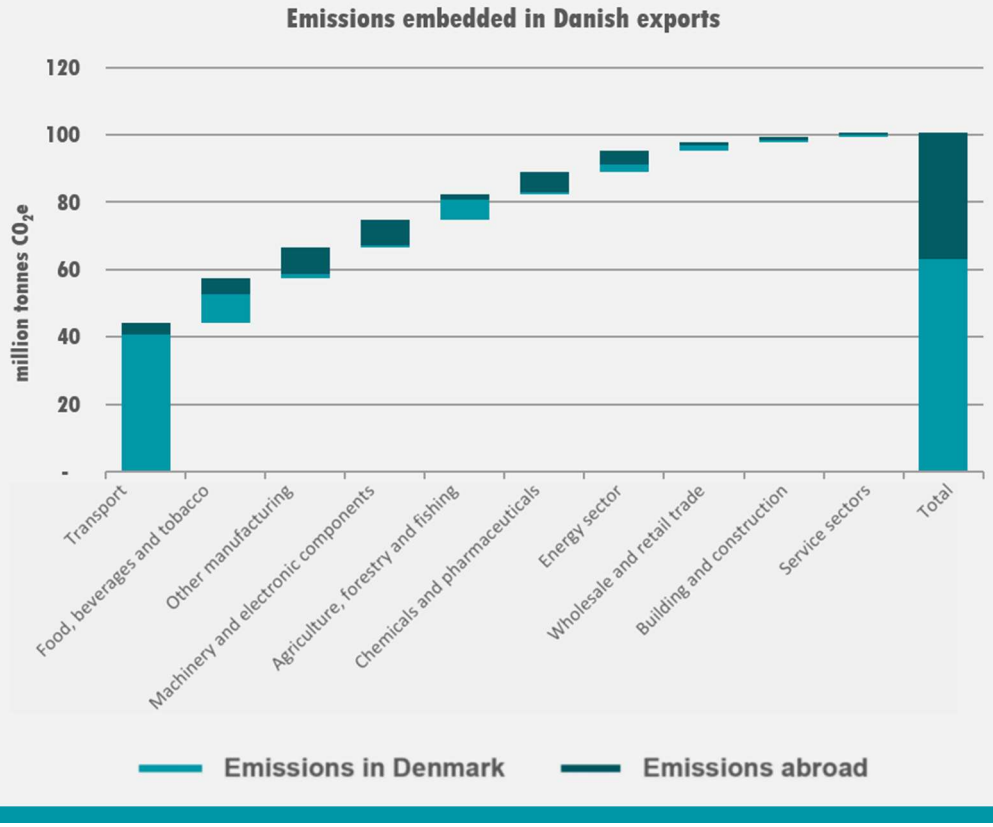


Box 3: Emissions linked to Danish exports are not included in the climate footprint

The consumption-based climate footprint includes embedded in Danish consumption. The footprint does not, therefore, include the part of the territorial and imported emissions linked to goods and services that are exported for consumption in other countries. Emissions related to the goods and services Denmark exports and which are therefore included in other countries' consumption-based climate footprint are illustrated in Figure 4.

Goods and services from the transport sector delivered for final consumption in other countries contribute emissions of about 44 million tonnes CO_2e, see Figure 4. This corresponds to about 44% of emissions related to exports. Most of these emissions, about 36 million tonnes CO_2e, come from shipping.

Figure 4: Emissions linked to exports in 2019



2.2 Methodology and uncertainty

Calculations of the Danish consumption-based climate footprint are associated with considerable uncertainty. This is partly due to uncertainty in the data basis and uncertainty in the methodological choices and assumptions.

The choice of method has a significant impact on the results of calculations

There are roughly two different approaches to calculating climate footprints. One is the attributive approach which allocates all the world's emissions between all the world's countries for a given year. Applying the attributive approach provides a picture of the share of global emissions for a given year that can be attributed to a specific country's consumption, for example Denmark. As the purpose of the report is to make visible Danish global impacts on the climate (see chapter 1), this is the approach applied in Global Report 2021.

The other approach is the *marginal* approach, which calculates the impacts of a specific change in our consumption. In other words, the marginal approach looks forward and describes the impacts of changed behaviour in the future, for example.

In addition to the choice of a marginal or attributive approach, there are a number of other methodological choices that can influence the result of the calculations. These include

choices within the calculation model (e.g. whether the global IO database is to be coupled with Danish data or is to stand alone), as well as limitations and boundaries (e.g. the extent to which impacts from changes in carbon balances are to be included). The background report on methodology describes these changes in more detail. See Box 4 for a description of the difference between calculations at product level and country level.

Significant uncertainty in the results due to the underlying data

In addition to the significance of the methodological choices, there are uncertainties associated with the underlying data. This is partly because of a lack of detailed data, and partly because the global database has made a large number of assumptions regarding how emissions distribute between products, sectors and cross-border trade. These uncertainties directly affect the result of the calculations.

Box 4: Climate footprint at product level (process LCA) compared with country level (input-output LCA)

There are great differences between calculating the climate footprint of an individual product and calculating the climate footprint of the consumption of an entire country. Calculations of the climate footprint for a single product usually apply a bottom-up approach (also called process LCA), which takes outset in a given product and then traces all emissions in the entire production chain for the specific product. The advantage of this approach is that it very accurately and in detail provides insight into emissions related to different parts of the production chain. The disadvantage is that it is difficult and resource-demanding to include emissions from the *whole* production chain.

Calculations of the climate footprint of an entire country (or a business or organisation) usually apply an input-output LCA. This approach uses input-output tables combined with emissions accounts to estimate emissions for individual sectors, see box 1. As the IO tables describe how sectors purchase and sell to and from each other, this approach will take into account all emissions in a given production chain. However, the method is less accurate, because emissions are aggregated at sector level.

The two methods in combination are called a hybrid LCA. This approach uses an IO LCA, but with some of the processes replaced with specific data for individual products.

2.3 Other calculations of Denmark's consumption-based climate footprint

Several other studies have attempted to calculate the Danish consumption-based climate footprint.

Table 1 shows that there are significant differences between the results of these calculations. The table also shows that the differences in results are linked to which underlying data sources are used, as well as to what is included in the calculation.

Table 1: Calculations of Denmark's consumption-based climate footprint

Published by	Climate footprint (tonnes CO_2e per capita)	Examples of differences compared with Global Report 2021

Global Report 2021	11	Calculated for the year 2019, excluding the impacts of land-use change
CONCITO[14]	17/19	• Does not use Danish IO tables and emissions multipliers • Includes LUC impacts • Uses a factor for emissions from aviation to take account of the larger climate impact of emissions at high altitude • Detailed calculations prepared in 2010 and roughly adjusted in 2014
Axcel Future[15]	12	• Does not use Danish IO tables and emissions multipliers • Uses another database for foreign emissions multipliers (the Eora database) • Calculated for the year 2015
The Danish climate council, *Klima og Omstillingsrådet*[16]	13	• Does not use Danish IO tables and emissions multipliers • Calculated for the year 2015

Note: The examples are not an exhaustive list of differences compared with the approach used in Global Report 2021.

[14] (CON, 2010).
[15] (AXC, 2020).
[16] (KOR, 2019).

2.4 Perspectives

A number of development potentials were identified during preparation of the consumption-based climate footprint.

One development potential is to have more data collected and to analyse this by categories of consumption that are likely to have a significant climate footprint. Another development potential in the longer term is to prepare *projections* of the consumption-based climate footprint in the same way as projections are prepared of territorial emissions in Denmark's Climate Status and Outlook reports. (ENS, 2021a).

Further detailing data and model assumptions – both import data and sector data – is another point for development in future reports, just as it will be considered whether to expand the boundaries for what to include in the consumption-based climate footprint (e.g. to take better account of the impact of carbon balances in soil and biomass).

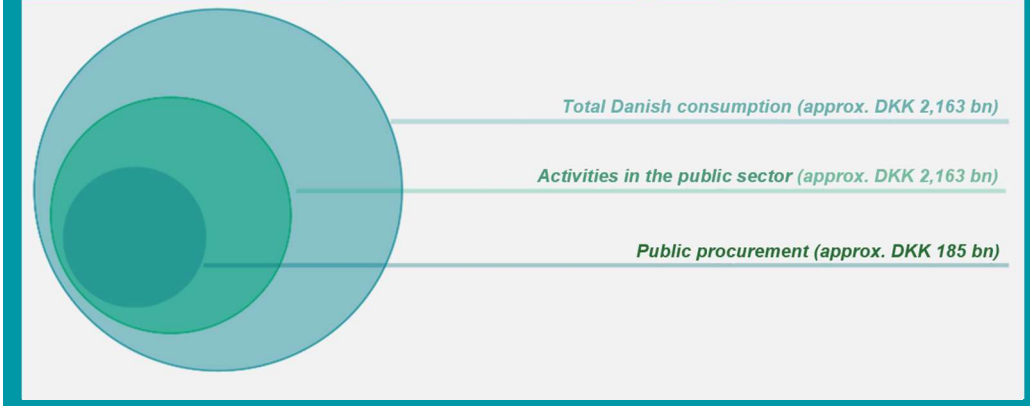
Finally, a key area of focus is to coordinate the Danish consumption-based climate footprint with the calculation of the climate footprint of public procurement, see Box 5.

Box 5: The climate footprint of public procurement

The climate footprint of public procurement is a subset of the climate footprint of all Danish public-sector activities, which again is a subset of total Danish consumption, see illustration 3. The calculation of the Danish climate footprint is based on all public-sector activities in the national accounts (around. DKK 380 billion) (FM, 2020). The climate footprint of public procurement, which is included in *Green Procurement for a Green Future - Strategy for green public procurement,* is based on public procurement (around DKK 185 billion in 2019) (FM, 2020), which is based on invoice data from central, regional and local government.

The climate footprint of public procurement has been estimated at about 12 million tonnes CO_2e,
covering the entire global value chain for procurement, from extraction of raw materials to disposal of the goods. Just as for Denmark's total consumption, calculation of the climate footprint of public procurement is based on EXIOBASE. However, calculation of the public procurement climate footprint has been supplemented by more detailed invoice data. The annual calculation and publication of the climate footprint of public procurement will be included in global impact reports from 2023.

Illustration 3: Relationship between total Danish consumption, public-sector activities and public procurement



Sources: (FM, 2020) and (DST, 2021)

3. Focus topics

This chapter examines a number of different topics with significant relevance for Denmark's impact on the global climate.

Each section takes stock of the climate impacts. The focus topics can be regarded as a more detailed explanation of some of the themes touched upon in chapter 2 concerning Denmark's consumption-based climate footprint. However, the data presented under the focus topics cannot be added to or deducted from the data presented in chapter 2. Instead, chapter 3 puts into perspective and explains various elements that either are included in the consumption-based climate footprint or serve as supplementary information about how Denmark is impacting the global climate.

The four focus topics are:

3.1 Land-use change resulting from consumption: Describes how changes in land use as a consequence of Danish consumption (e.g. when forests are felled to make space for agricultural land) impact the global climate.

3.2 *Consumption of biomass for energy:* Describes how Danish consumption of biomass for energy production and Danish consumption of biofuels for transport impact the global climate

3.3 International transport: Describes how Danish-related international transport impacts the global climate

3.4 *Cross-border electricity exchange:* Describes how Danish cross-border electricity exchange impacts electricity production in neighbouring countries and thereby the global climate

3.1 Land-use change resulting from consumption

Carbon from atmospheric CO_2 is released from as well as sequestered and stored in forests and other land areas, including cropland and grassland in agriculture. Management of forests, cropland and other land areas therefore plays a crucial role with regard to whether CO_2 is removed by, stored in or released from soils and forests. Danish consumption of food products, for example, can impact the way in which land is used globally and thereby also the amount of carbon removed from and released to the atmosphere.

The purpose of this section is to illustrate how changes in land use as a consequence of Danish consumption (e.g. when forests are felled to make space for agricultural land) impact the global climate.

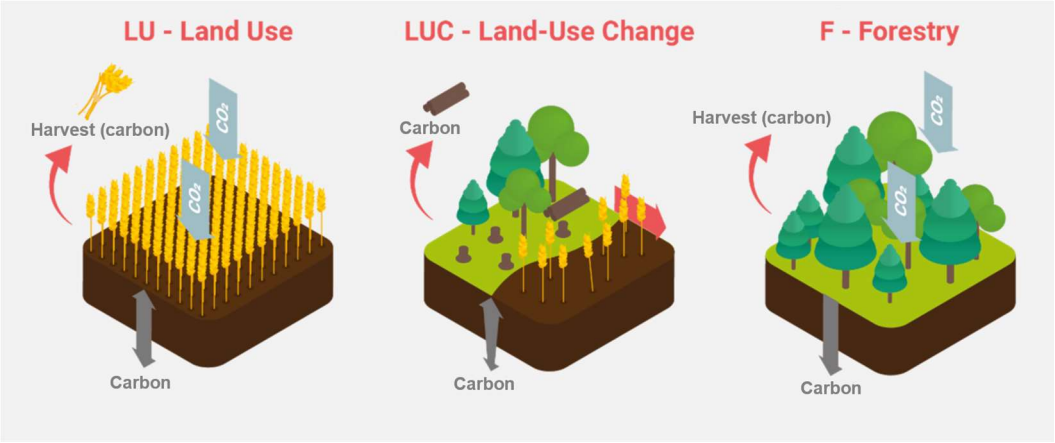
There are many different ways to calculate how changes in land use caused by a country's consumption impact the global climate. The methods are based on different approaches and different assumptions. This section therefore describes the impacts of emissions from land-use change embedded in Danish consumption using two different calculation methods. This is to illustrate how the choice of calculation methods is significant for the result when calculating these emissions.

Thus, based on the two different calculation methods used, Global Report 2021 shows that Danish consumption-based emissions linked to global land-use change can be estimated at about 3 million tonnes CO_2e per year and about 7 million tonnes CO_2e per year, respectively. The calculations are based on the most recent data available.

Approach to calculation of climate impacts from land-use change

LULUCF is an abbreviation for **l**and use, **l**and-**u**se **c**hange and **f**orestry, see illustration 4. Box 6 describes these categories and the size of the global emissions from the LULUCF sector in more detail, and also explains why it is difficult to estimate these emissions.

Illustration 4: Carbon balances in the three types of emissions linked to land use and forestry



Box 6: LULUCF emissions and removals

LULUCF covers the following categories:

Land use covers the changes in the carbon balances of an area caused by the specific *use of the area* in question. Examples of uses are drainage and cultivation of agricultural land.

Land-use change covers the changes in the carbon balances of an area that are caused by a specific *change in the use of the area*. An example of a change could be when a forest is cleared for farmland.

Forestry covers the changes in the carbon balances of an area caused by forest management. For example felling and replanting.

In accordance with the UN IPCC methodology, these changes in the carbon pools mentioned above are to be included when calculating emissions and removals in the countries in which the areas are managed.

LULUCF-related emissions and removals constitute a significant item in total global emissions accounting. At the same time, calculating these emissions and removals is associated with considerable uncertainty. This is partly because it is difficult to measure the emissions and removals and a number of estimates therefore have to be calculated, and partly because the amount of CO_2e removed and emitted by soils and forests fluctuates considerably from year to year.

Total LULUCF emissions across the Annex 1 countries under the UNFCCC Climate Convention[17] were estimated at –1,881 million tonnes CO_2e in 2018 (UNFCCC, 2020). These net removals mean that, in overall terms, more greenhouse gases are removed than are emitted in these countries

[17] 'Annex 1 countries' are all industrialised countries as well as countries in transition (in Central and Eastern Europe), see list here (UNF, 2021). In contrast, other countries are referred to as 'non-Annex 1 countries'.

The size of total global LULUCF emissions in the non-Annex 1 countries is more uncertain. This is because there is a lack of official figures. According to the IPCC's fifth evaluation report, the global LULUCF emissions amounted to net emissions of around 3,300 million tonnes CO_2e per year in the period 2002-2011 (IPCC, 2014).

As mentioned above, the method used to estimate Denmark's consumption-based climate footprint in Global Report 2021 does not cover all emissions in the LULUCF sector; it only includes emissions from use of agricultural areas (*land use*), i.e. emissions linked to the changes that occur in the soil carbon pools when agricultural land, including cropland and grassland, is drained and cultivated.

The impacts from Danish consumption and production causing *land-use change* (e.g. when a forest is cleared to make way for agricultural production) have therefore not been included in the calculation of Denmark's consumption-based climate footprint. This is because there are several different methods of calculating and accounting for these impacts and the calculations are associated with many uncertainties. Furthermore, an international 'best practice' has yet to be developed for the area among the countries that calculate their consumption-based climate footprint. However, as the topic is relevant, the impacts of land-use change will be described separately in the following.

Climate impacts of land-use change can be calculated directly and indirectly

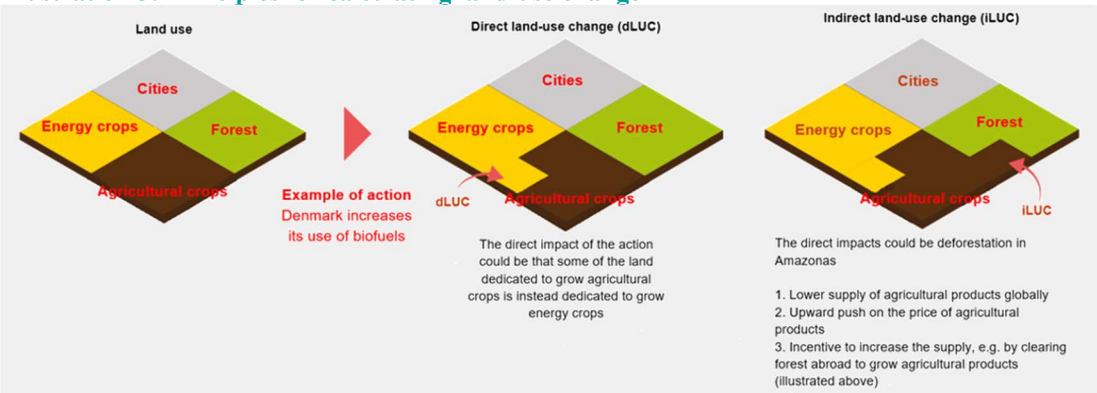
Two different concepts are often used in relation to the climate impact of land-use change:

1) *Direct land-use change - dLUC:* Covers the direct changes that occur on a given area. For example, when an agricultural area is converted to cultivate crops for use in energy production.

2) *Indirect land-use change - iLUC:* Covers 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. As a consequence, the conversion may therefore lead to land-use changes elsewhere, possibly entailing deforestation.

See Illustration 5 for an example related to consumption of biofuels.

Illustration 5: Principles for calculating land-use change



Note: The principles for calculating land-use change are shown here for one product (biofuels).

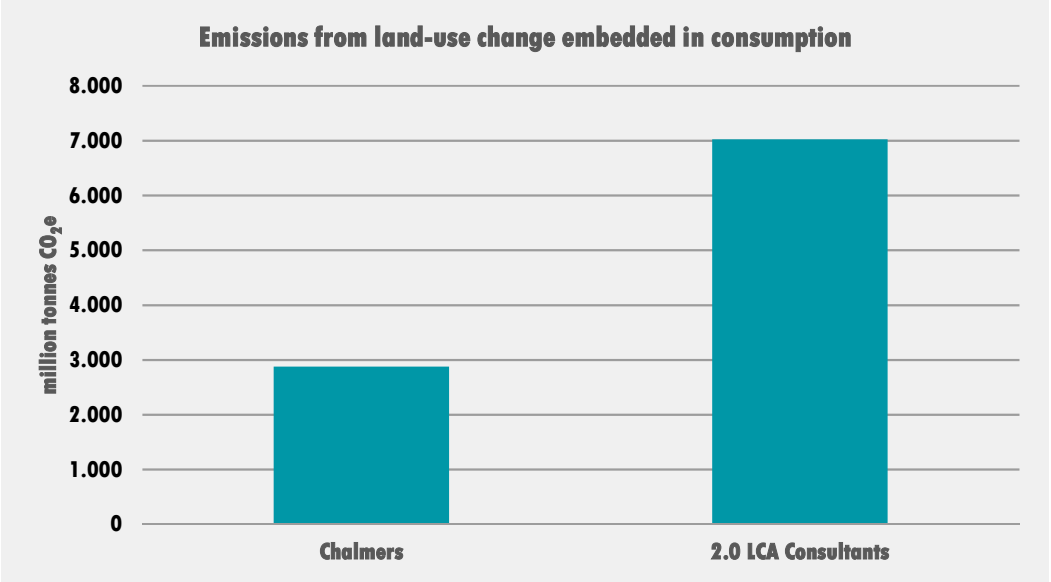
Climate impacts from Danish consumption linked to land-use change

There are a number of different methods to calculate consumption-based climate impacts linked to land-use change. The methods have different approaches to how emissions are calculated and whether only direct impacts are included or whether both direct and indirect impacts are included.

In the following, the climate impacts from Danish consumption linked to land-use change have therefore been calculated on the basis of different studies with different approaches to how emissions from land-use change can be calculated. This is to illustrate how the choice of calculation methods is significant for the result when calculating these emissions.

Denmark's consumption-based climate footprint from land-use change can be calculated at around 3 million tonnes CO_2e annually if method 1 (developed by Chalmers Tekniska Högskola – hereafter referred to as Chalmers) is applied, and at around 7 million tonnes CO_2e annually if method 2 (developed by 2.0 LCA Consultants) is applied, see Figure 5. The calculations are based on latest available data.

Figure 5: Impacts of land-use change related to Danish consumption calculated



Note: Method 1 (Chalmers) has been calculated for the average consumption in 2010-2014, and method 2 (2.0 LCA Consultants) has been calculated for 2011. The figures have then been projected to the 2019 level.

As there is some uncertainty regarding which method will be the most correct to use to calculate these emissions, neither of the two results can be considered as a final estimate of the extent of the impacts of Danish consumption linked to land-use change. The sole purpose of presenting the results is to illustrate the significance of using one or the other method to calculate these emissions.

The difference in impacts from land-use change related to Danish consumption is due to differences in the methods

The two methods used to describe the impacts of land-use change use fundamentally different approaches. Method 1 focuses exclusively on land-use change that *has* already occurred and that has been directly caused by consumption of agricultural products in Denmark. Method 1 also only focuses on land-use change defined as forest clearance in the tropics.

Method 2 assumes that all land-demanding consumption gives rise to emissions linked to land-use change, i.e. not only the consumption that directly causes land-use change, but also the consumption that indirectly leads to land-use change (see section 3.1 for an explanation of the difference between direct and indirect land-use change). Method 2 seeks to calculate what the global direct and indirect impacts would be in the form of land-use change globally, compared with a baseline that assumes that the land-demanding consumption had not taken place. The most significant differences between the two methods are described below. All the differences mentioned contribute to making the estimate in method 2 higher than in method 1.

1. *There are significant differences in how much land is included in the two methods.*
   Method 1 only includes land-use changes defined as deforestation in the tropics, and only about 60% of this deforestation is attributed to consumption, as the remaining

deforestation is assumed to be caused by other factors (e.g. forest fires). Method 2 assumes that all land-use changes globally can be linked with human consumption.

2. *Differences between what impacts of land-use change are included.* Method 1 only includes climate impacts from *direct land-use changes* (and, as mentioned, limits these to deforestation in the tropics), while method 2 considers impacts from both *direct and indirect land-use changes* (see section 3.1) and other indirect impacts, including intensification through increased fertiliser use.

3. *The two methods highlight two different issues*. Method 1 shows the share of the total climate impact from historical anthropogenic deforestation in the tropics that can be attributed to Danish consumption. Thus, this method applies what section 2.2 describes as an *attributive* approach. Method 2 describes the climate consequences of our consumption compared with a baseline scenario with *no consumption*, and highlights the significance of this in terms of land-use changes. Thus, this method applies what section 2.2 describes as a *marginal* approach.

The overall methodological differences are summarised in Table 2, whereas a detailed description of the two methods is in the background report on *LULUCF and iLUC*.

Table 2: Differences between method 1 and method 2:

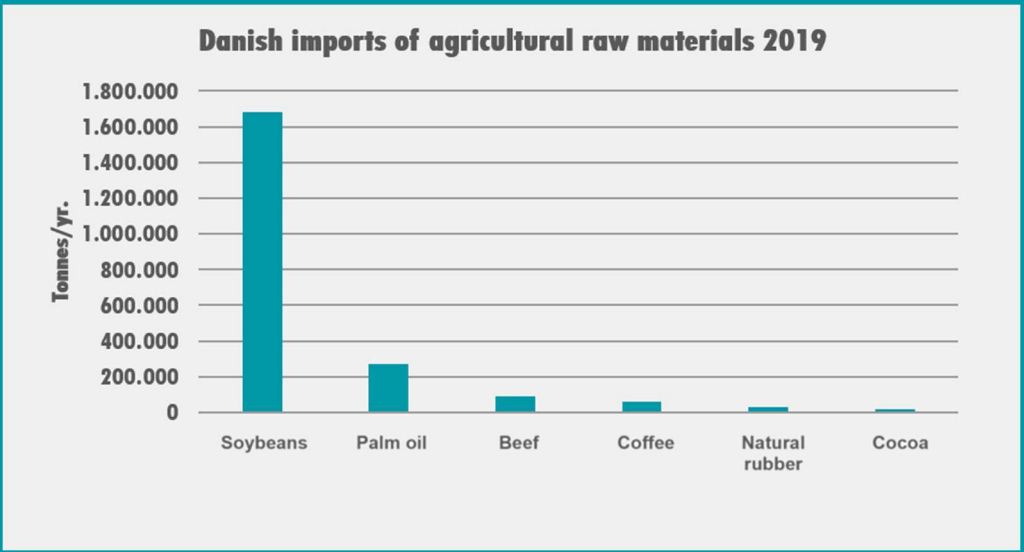
Methods	Method 1: Chalmers Tekniska Högskola	Method 2: 2.0 LCA Consultants
Marginal or attributive approach	Attributive (distribution of actual historical emissions from land-use change)	Marginal (estimates emissions compared with a hypothetical baseline with no consumption)
What emissions are included?	Only CO_2	All greenhouse gases
What land-use changes are included?	Only deforestation in the tropics that *has* occurred and that can be related directly to agriculture, grazing or plantation	All future land-use changes and land-use intensification in the world
What products are attributed with emissions?	Only products grown on an area which was previously forest	All products which require land.
How are emissions from land-use change amortised?	Emissions from deforestation are amortised over 10 years.	As this method is marginal, and thereby looks at future land-use change, it is not relevant to amortise the impacts.

In Box 7 are examples of Danish consumption of agricultural raw materials which is assessed to be linked to land-use change in other countries.

Box 7: Denmark's imports of agricultural raw materials can cause land-use changes

One of the areas assessed to contribute to emissions linked to land-use change is Danish imports of agricultural raw materials. In 2019, Denmark imported more than 2 million tonnes of agricultural raw materials that can be associated with deforestation, including soybeans, palm oil, beef and veal, natural rubber, coffee and cocoa. The largest imports to Denmark are soybeans and palm oil, see Figure 6. Soybeans are used in protein feed in agriculture, while palm oil is used in food, animal feed and non-food products such as cosmetics and soap.

Figure 6: Soybeans and palm oil top the list in imports of agricultural raw materials



Source: (BOS, 2020).

The University of Copenhagen has calculated that it requires an area of 838,000 ha. to produce the quantities of soybeans, palm oil, coffee, cocoa and natural rubber Denmark imports. Production of the soybeans and palm oil Denmark imports makes up more than 90% of this area. The University of Copenhagen also assesses that the largest individual source of greenhouse gases from Danish imports of soybeans and palm oil is land-use change in the form of forest clearance[18].

Source: (BOS, 2020).

Perspectives

Emissions from Danish imports and consumption linked to land-use change are considerable. There is a need to better understand how these emissions can be calculated more accurately for Denmark. This will be a focus area in work on future global impact reports.

[18] (BOS, 2020a)

One approach could be to enter into cooperation with relevant authorities in other countries (e.g. Sweden, the Netherlands, Norway, the United Kingdom, etc.), with a view to developing consistent methods across countries' consumption-based climate accounting.

Another possibility could be to enter into cooperation with the research institutes that develop the EXIOBASE database (or other global IO databases) and further develop this database so that it takes into account LULUCF emissions in the countries included in the database. This would take into account the emissions related to direct land-use change. Emissions related to indirect land-use change would not, however, be included in this approach.

3.2 Consumption of biomass for energy purposes and biofuels

Management of forests and land plays a crucial role with regard to whether atmospheric CO_2 is removed by, stored in or released from land and forests. Danish consumption of biomass for energy purposes affects the way forests and other land are managed and thus also how much carbon is removed from or released into the atmosphere.

The purpose of this section is to illustrate how Danish consumption of biomass for energy and biofuels for transport affects the global climate.

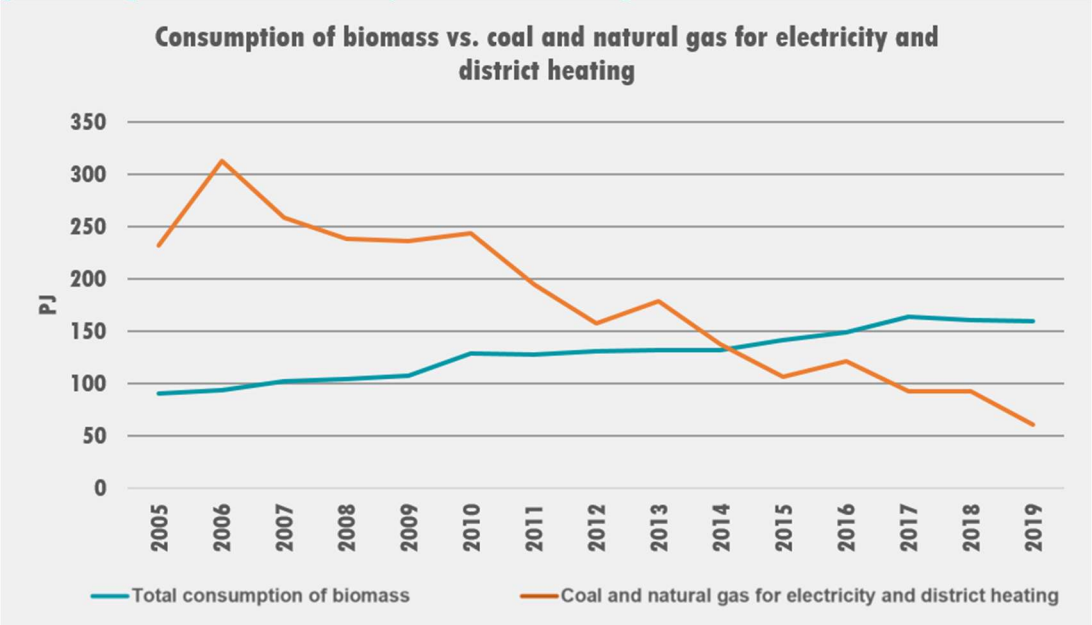
It is difficult to paint a true picture of how Danish consumption of biomass for energy production and biofuels for transport affects the global climate. A quantification of total emissions embedded in this consumption has therefore not been possible in connection with Global Report 2021.

Global Report 2021 shows that, all else being equal, higher consumption of biomass will increase the risk of a negative climate impact, but this climate impact will depend on the specific types of biomass used, among other things. For the most recent years, overall, a drop has been estimated in emissions from total consumption of biofuels in Denmark.

Emissions linked to Danish consumption of biomass for energy purposes

Danish consumption of biomass for energy purposes has been increasing steadily since 2005. In 2019 consumption of biomass totalled 159 PJ, see Figure 7. Amongst other things, the increased consumption follows from a number of large-scale CHP plants having been partly or fully converted to run on biomass in the production of electricity and heating, instead of natural gas and coal. The considerable reduction in consumption of coal and natural gas to produce electricity and district heating (in the transformation sector), see Figure 7, can therefore be explained in part by the conversion of these plants.

Figure 7: Danish consumption of biomass and consumption of coal and natural gas for the production of electricity and district heating



Source: (ENS, 2019)

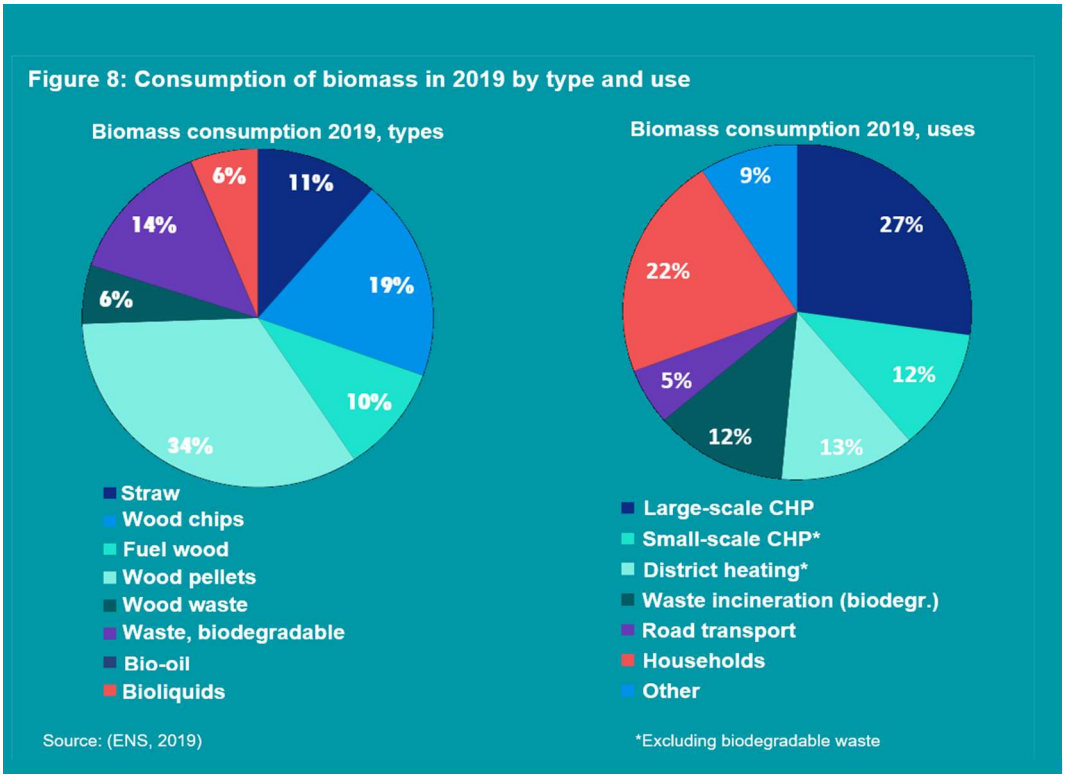
Danish consumption of biomass by various types and uses is described in Box 8.

Box 8: Denmark uses different types of biomass

Denmark uses the following types of biomass:

1. Fuel wood, wood chips and wood pellets from managed forests
2. Biodegradable waste and wood waste, e.g. from the construction sector
3. Bioliquids, for example in the form of ethanol and similar (either from dedicated energy crops or from crop residues where the primary purpose of cultivating the crops is not energy)
4. Crop residues (e.g. straw)

In 2019, Denmark had a total consumption of biomass of around 159 PJ. A breakdown by use and by type of biomass is available in figure 8. As can be seen, wood pellets and wood chips, which are used for both electricity and heat production, account for a major part of total consumption.



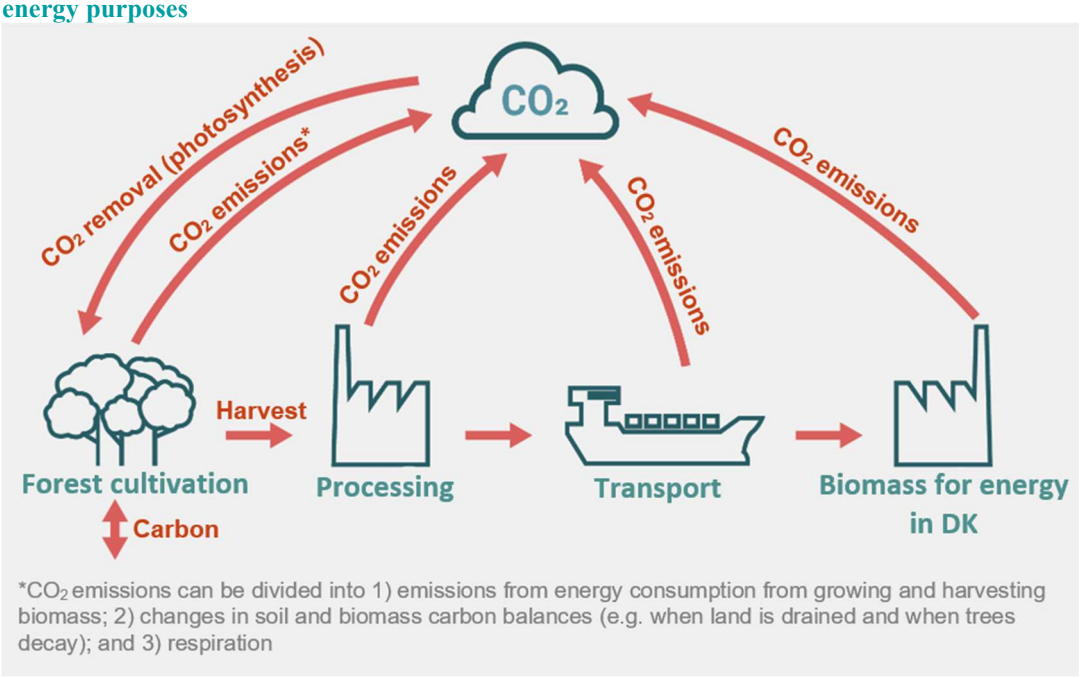
It is difficult to estimate emissions related to biomass for energy purposes. This is because it is not enough to look at the energy system; you also have to include the impact over time on the carbon cycle which the biomass is a part of, i.e. emissions and removals by forests and land. Calculations of climate impacts for biomass typically include the following factors (several factors may be included in the calculation depending on the use of the biomass, see also Box 9):

1. *Changes in the carbon pools* in soils and forests as a consequence of trees or energy crops being cultivated, felled and used for energy purposes.
2. *Emissions from energy consumption* in the production chain, i.e. emissions associated with the growing, harvesting, transport and processing of biomass before it is used for fuel.
3. *Emissions of biogenic CO_2* from burning the carbon stored in the biomass
4. *Indirect impacts* , for example from deforestation elsewhere in the world because the area is used to grow biomass.

The calculation of Denmark's consumption-based climate footprint in chapter 2 only includes climate impacts related to *changes in carbon pools* (item 1) for soils cultivated for agricultural purposes (i.e. excluding forests). *Emissions from energy consumption* (item 2) are also included, while *emissions of biogenic CO_2* (item 3) and *indirect impacts* (item 4) are not included in the consumption-based climate footprint in chapter 2. The reason for this approach is the methodological difficulties etc. described in more detail in this section, as well as in section 3.1 with regard to emissions linked to land-use change.

The direct climate impacts related to the use of biomass (items 1-3 above) are shown in Illustration 6.

Illustration 6: Climate impacts in the value chain from the use of biomass for energy purposes



Total climate impacts linked to the use of biomass are difficult to report

According to the UN IPCC methodology, the countries of the world must calculate and report changes in the carbon pools in soils and forests (item 1 above). Consequently, a net reduction in carbon stocks from felling trees, for example, must be accounted for as emissions in the countries where the trees are felled. In their calculations, countries should therefore not include the CO_2 emitted from burning biomass (item 3 above) if they import wood pellets, wood chips and bioliquids, for example. Biogenic CO_2 emissions from biomass burning, however, must be reported to the UN[19] as a so-called memo item, i.e. for information purposes.

In Denmark, the biogenic CO_2 emissions from biomass burning[20] increased from 4.4 million tonnes in 1990 to 18.5 million tonnes in 2019 (UNFCCC, 2021).

This increase in biogenic emissions from biomass burning is largely because Danish CHP plants have been converted to run on biomass instead of coal and natural gas. However, emissions of biogenic CO_2 do not tell us to what extent the consumption of biomass for energy purposes in Denmark has contributed to increasing emissions globally, as the emissions are often offset over time by CO_2 removals in the areas from where the biomass originated. According to (ENS, 2020), however, the higher the consumption of biomass for energy, the greater the risk that the use of biomass will have negative climate impacts, see Box 9.

One way to assess the extent to which Danish consumption of biomass has contributed to increasing emissions globally is to calculate total added global emissions linked to the use of biomass for energy purposes in all the world's countries, and then allocate these

[19] European Environment Agency GHG data viewer. (EEA, 2021).
[20] Reporting to the UN of biogenic emissions includes all stationary combustion (i.e. combustion of biofuels in cars is not included, for example) of biomass-based fuels (including solid biomass, bio-oil, biogas, etc.).

added emissions to the consumption in individual countries. The main difficulty with this methodology, however, is to identify the impacts that are linked to energy purposes and those that are linked to other uses of biomass (such as timber, food, etc.). The Danish Energy Agency is not aware of any studies that have attempted to fully accomplish this. Furthermore, there are certain circumstances that should also be taken into account when calculating emissions from biomass consumption. For example, cultivation of biomass takes up large areas of land and the carbon pools in and CO_2 removals by managed forests can change over time and are affected by the way the forest is managed.

It also makes a significant difference which type of biomass is used, what fuels the biomass replaces, and for what other purposes the area on which biomass is being cultivated could have been used.

On 22 June 2020, the parties behind the 2020 Climate Agreement for Energy and Industry concluded a follow-up agreement about green requirements on woody biomass for energy. Amongst other things, this agreement sets out requirements for cultivation methods and for the sustainability of the biomass used. These sustainability requirements are to ensure that all biomass used in Denmark is as sustainable and climate friendly as possible.

Box 9 and Box 10 summarise the main points from two different studies which examine the factors that affect the calculation of climate impacts from using biomass (Box 9) and estimate the climate impacts of converting to biomass at ten Danish power plants (Box 10).

Box 9: Examples of factors that affect the climate impact of using biomass for energy purposes

The Danish Energy Agency's Biomass analysis (ENS, 2020) examines the factors that can have significance for the climate impacts of using biomass for energy purposes. The analysis also sheds light on Danish and global biomass resources.

With regard to climate impacts, the analysis mentions that these impacts depend on a number of factors, including the extent of biomass consumption, in that higher consumption increases the risk of a negative climate impact. Other key factors include the type of biomass used, forest management practices, market effects and time perspective. Furthermore, the impact depends on the alternative use of land and biomass, as well as on the type of energy source replaced by biomass.

The analysis concludes that, in many cases, the use of biomass for energy benefits the climate, for example when residues are used instead of fossil fuels. In other situations, such as when large trees are felled for energy production without reforesting, the use of biomass can lead to more greenhouse gas emissions than if coal had been used instead.

The analysis also concludes that there is currently no data basis available for calculating the real, overall climate impact of using biomass for electricity and heating in Denmark.

Box 10: Example of calculation of additional emissions from use of biomass from managed forests

In 2020, the University of Copenhagen (IGN, 2020) published an estimate of the climate impact of converting ten Danish CHP plants from natural gas and coal to biomass. The report was based on data from the plants about biomass, etc.

Among other things, the report revealed that it will take some time before the conversion from coal to biomass contributes with any real reductions in the amount of greenhouse gases in the atmosphere. The carbon break-even point for the coal-based CHP plants was between 0 and 13 years. This means that it could take up to 13 years before the use of biomass as a replacement for coal in energy production contributes to reducing the amount of greenhouse gases in the atmosphere. More specifically, the report shows that after 30 years, emissions would be reduced by between 15% and 71% compared with a scenario in which the CHP plants continued to run on coal. The average coal-based CHP plant had a carbon break-even point of six years, and after 30 years it had saved the atmosphere from 31% of the CO_2 emissions that would have taken place if the plant had continued to run on coal.

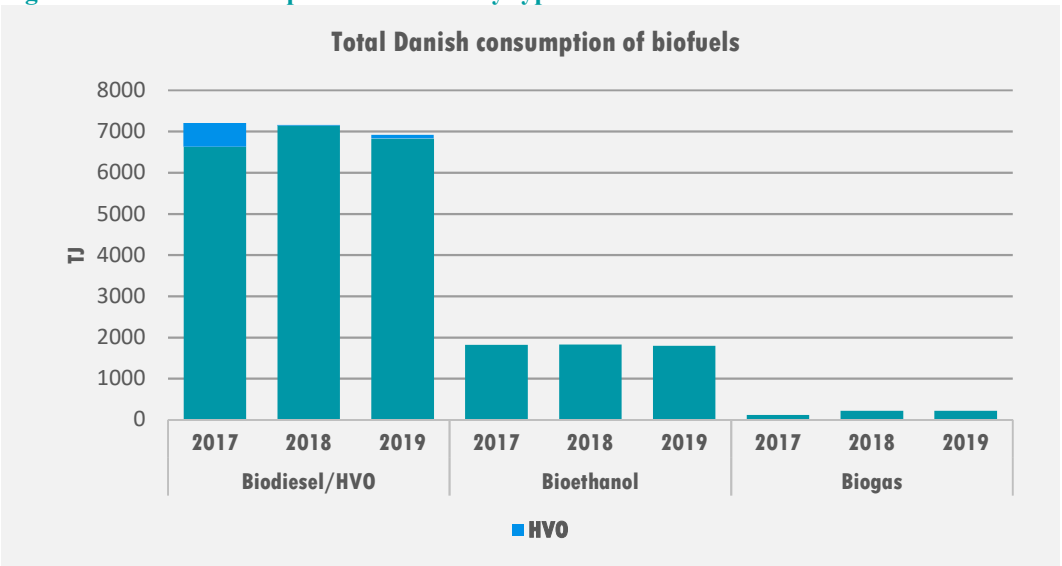
In the method used by the Department of Geosciences and Natural Resource Management, the expected, subsequent 'reabsorption' of CO_2 by the forests from where the biomass originated is deducted from the CO_2 emissions associated with burning the biomass. However, it can take many years for the forests to absorb the same amount of carbon that would have been absorbed by the trees that were felled. The method also considers factors such as the decaying time of residues (because part of the biomass of the felled trees would

probably have decayed had they not been used for biomass for energy) as well as indirect impacts, such as iLUC[21], iWUC[22] and iFUC[23].

Total Danish consumption of biofuels

In 2019, Danish consumption of liquid biofuels only accounted for 6% of total Danish consumption of biomass (ENS, 2019). The biofuels were used primarily in the transport sector. Consumption of biofuels by the transport sector broken down by categories is shown in Figure 8.

Figure 8: Danish consumption of biofuels by type



Source: (EEA, 2020).

A different biomass type is used for each fuel category, see Box 11.

Box 11: Types of biomass for biofuels

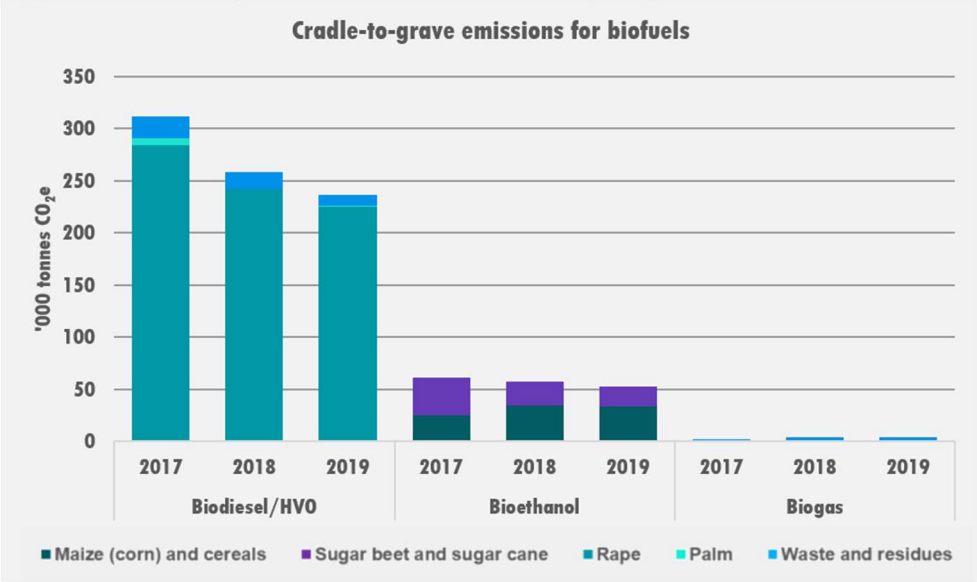
Oil-containing biomass is used for biodiesel and for HVO (Hydrotreated Vegetable Oil) that is either based directly on agricultural crops (rapeseed, soybean, sunflower and palm, etc.) or on waste and residues (slaughterhouse waste products, used cooking oil and residue fractions from vegetable oil production). In principle, other biomass types can be used for HVO. Bioethanol is based on sugar and starch crops but can also be produced from lignocellulose such as straw. Biogas is typically based on a range of wastes and residues, including household waste, slurry and deep litter. In principle, biogas can also be produced directly from food crops.

Biofuels based on crops (food or feed) are first generation biofuels. Biofuels based on waste and residues are second generation biofuels.

[21] Land-use change, e.g. from natural forest to production forest
[22] Changes in use of the tree, e.g. from chipboard to energy
[23] Changes in use of the fuel, e.g. from CHP production to heat-only production

According to the UN IPCC methodology, changes in soil and forest carbon pools must be accounted for in the national inventories of the countries in which the biomass is grown. As Denmark imports a large part of the biofuels used in Denmark, the climate impacts from this are not included in the Danish inventories submitted to the UN. However, the EU requires Member States to calculate the 'cradle-to-grave' emissions of the biofuels they use. Cradle-to-grave emissions associated with the production of biofuels include emissions from growing and processing biomass, as well as from production and transport across national borders[24]. Emissions broken down by categories of biofuel and raw materials (feedstocks) are shown in Figure 9. Total cradle-to-grave emissions dropped from around 375,000 tonnes CO_2e in 2017 to just under 300,000 tonnes CO_2e in 2019 (EEA, 2020). Part of this drop is due to reduced consumption of biofuels but also to gradually increasing use of sustainable biofuels. Thus, average cradle-to-grave emissions dropped from around 41g/MJ in 2017 to around 33 g/MJ[25] in 2019. The reductions are for biodiesel in particular.

Figure 9: Cradle-to-grave emissions from biofuels by crop



Source: (EEA, 2020).

Note: Emissions are excluding ILUC

ILUC impacts linked to the use of biofuels

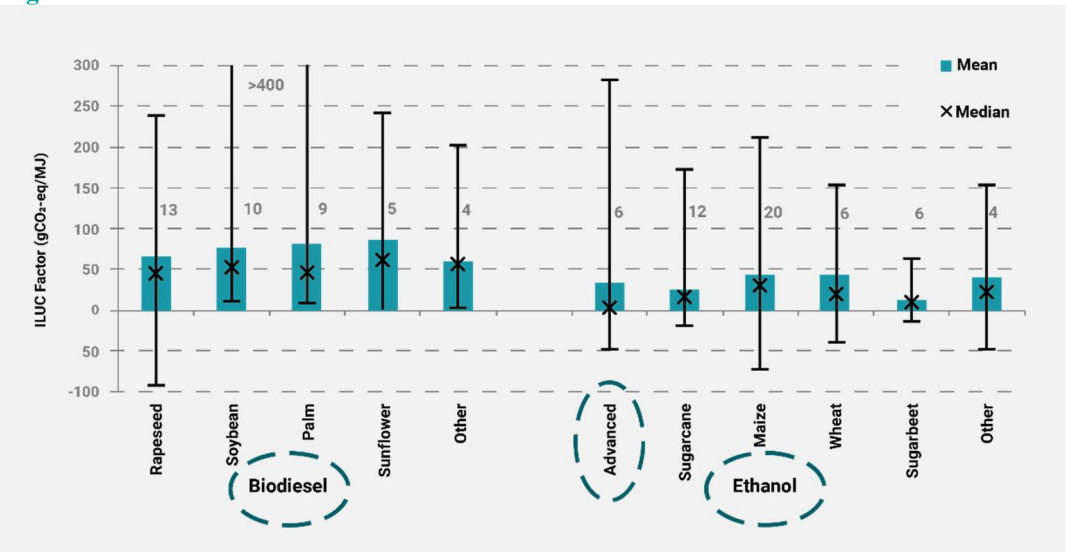
When biomass for biofuels is grown in an area previously used for food production, the food production displaced might be transferred to new land if the demand for food products is assumed to remain the same. ILUC emissions are the emissions that occur when previously unfarmed land is converted to cropland for food production as a result of such indirect relationships (see also section 3.1).

With the iLUC Directive from 2015 (EU, 2015), there is now a requirement to report iLUC values for the biofuels used. A number of research projects etc. have aimed to determine the impact linked to various types of biomass. The projects use different

[24] Impacts from changes in soil carbon balances have not been included in cradle-to-grave emissions.
[25] It should be noted that there is uncertainty linked to these figures, as not all figures are based on reported observed values. The figures could therefore be lower than indicated.

approaches to mapping iLUC impacts, including the degree of detail. Not all of the projects put a value on the impacts, and those which do, group the biofuels differently. In 2017, the European Commission commissioned a report to summarise the larger, known studies, their methodological approach and their immediate results. The large variation in the values arrived at in different studies of iLUC impacts is illustrated in Figure 10. The columns indicate the number of studies that have put values on the relevant biofuel categories, and that have therefore been included in the range. As a rule, second generation biofuels do not have iLUC impacts, as they are based on waste and residues. However, a few studies do indicate a small impact.

Figure 10: ILUC values arrived at in different studies



Note: 'Advanced' refers to second generation biofuels, i.e. biofuels made from residues from agriculture and forestry, for example.

Although the outcomes of the iLUC studies vary considerably (COM, 2017), the EU has indicated three (four) values which, according to the Renewable Energy Directive (RED, 2018), should be considered a 'weighted average', see Table 3.

Table 3: ILUC values in the RED II Directive

Feedstocks	ILUC value (gram CO_2e/MJ)
Oil seed crops (rape, palm, etc.)	55
Starch crops (cereals, maize (corn), etc.)	12
Sugar crops (sugar cane and sugar beet)	13
(Waste and residues)	(0)

Source: (RED, 2018).

According to the EU's calculation, the iLUC value is thus considered to be the same for all types of first-generation biodiesel, regardless of whether these are based on rapeseed oil, palm oil or a third alternative. This is the case even though some studies point at very high iLUC values for palm oil and soybeans, in particular, see Figure 10. The values listed in Table 3 have been used in conjunction with Danish reporting to the EU in the

period 2017-2019 and the reported figures are shown in Table 4 broken down by feedstock and fuel categories.

Table 4: Reported iLUC impacts for total Danish consumption of biofuels

Fuel	Feedstock	2017		2018		2019	
		TJ	'000 tonnes CO_2	TJ	'000 tonnes CO_2	TJ	'000 tonnes CO_2
Bioethanol	Maize (corn) and cereals	1,060	13	1,130	14	1,170	14
	Sugar beet and sugar cane	760	10	700	9	620	8
Biogas	Waste and residues	90	0	220	0	220	0
	Maize (corn) and sugar beet	30	0	0	0	0	0
Biodiesel and HVO	Rapeseed	6,040	332	6,320	348	6,190	340
	Palm oil	310	17	10	1	30	2
	PFAD[1]	270	0	0	0	0	0
	Waste and residues	600	0	830	0	700	0
Total		9,150	372	9,210	370	8,930	364

1: PFAD was re-categorised from a waste product to a by-product in 2018, and is therefore now included with the same iLUC impact as palm oil (and has presumably been reported with this impact).
Note: Calculated for the period 2017-2019.

The reported iLUC impact has thus remained almost unchanged when also taking account of the total consumption of biofuels, see Table 4. This is because the values in RED II are fixed standard values, and because there has only been a limited shift towards biofuels which, according to RED II, have lower iLUC impacts. The fixed iLUC standard values mean that biofuel producers, for example, do not have the option to influence the values by using initiatives to optimise the global footprint of biofuels (e.g. better utilisation of residues for animal feed or through more efficient exploitation of farmland).

In the *green road transport agreement* of 4 December 2020, it was decided to establish a set of iLUC values or similar values that better reflect the differences between the various biofuels and where they are produced. This agreement also included a decision not to allow biofuels based on palm oil and soybean oil to count towards meeting the CO_2 displacement requirement.

Perspectives

At present, it is possible to calculate part of the climate impacts linked to consumption of biomass in Denmark, but it is difficult to calculate the total impacts. An area for development for the Danish Energy Agency is therefore to ensure methodological

development and more solid data, so that the area can be described in more detail in future global impact reports.

3.3 International transport

International transport is the source of major emissions in an international perspective and accounts for an increasing share of global emissions.

The calculation of Denmark's consumption-based climate footprint only includes emissions from international transport that stem from goods and services consumed in Denmark.

This section takes a broader perspective and looks not only at transport emissions linked to Danish consumption but also describes emissions from operations by Danish businesses in overall terms. Choice of calculation method and sectoral division affects both the magnitude of emissions and the historical trends. In particular, there is no single approach to defining Danish-related international emissions.

The report shows that CO_2e emissions related to international flights refuelling in Denmark (Danish and foreign aircraft) amounted to around 3 million tonnes CO_2e in 2018. Emissions from fuel bunkered abroad by Danish operated aircraft amounted to about 2 million tonnes CO_2e in 2018. For both emission figures, there is a slight increasing trend, primarily driven by more passengers and more cargo.

Similarly for Danish-related shipping, the greenhouse gas emissions for bunkering by foreign ships in Denmark are around 2 million tonnes CO_2e, and for bunkering by Danish operated ships abroad they are 38 million tonnes CO_2e. Emissions from Danish operated ships have increased by 25% since 2014. This is a trend that is also seen for the total world fleet and that is driven by a general growth in global trade, amongst other things.

The special regulation applicable to international transport is described in Box 12.

Box 12: Emissions from international transport and regulation in the area

In 2017, CO_2 emissions from international air and maritime transport accounted for 4% of global CO_2 emissions from energy consumption (2017). Emissions from international air and maritime transport have increased over the past 30 years by more than emissions from other energy consumption. While global CO_2 emissions in general have increased by 60% since 1990, emissions from international air and maritime transport have increased by 126.4% and 87.8%, respectively. (IEA, 2019).

CO_2 emissions from international air and maritime transport are not included in the territorially based calculations. This is because of the international regulations in the area, which stem from the United Nations Framework Convention for Climate Change, under which, already in 1995, it was decided that emissions from so-called 'bunker fuels' be regulated by the intergovernmental organisations for air and maritime transport, respectively (UNFCCC, 2021): the International Civil Aviation Organisation (ICAO) and the International

Maritime Organisation (IMO).[26] Furthermore, international aviation is covered by the EU emissions trading system (ETS)[27,28]. On the basis of the international regulations, international air and maritime transport are also not covered by the 70% target set out in the Danish Climate Act. Aviation, however, is included in the EU's NDC (EUR, 2020) and the 2030 climate target which Denmark is obligated to meet.

See the background memorandum on international transport in Global Report 2021 for a more detailed description of sectors, climate measures, data sources and a methodology discussion.

3.3.1 International aviation

Global Report 2021 aims to shed light on the global climate impacts of Danish aviation activities. By Danish activities is understood international activities in Denmark as well as activities abroad with links to Denmark, including to Danish businesses. As there is no sufficient data basis available to describe all relevant aspects within these boundaries, this calculation of international aviation has instead been based on publicly available data with the following boundaries (see also Illustration 7):

1. Emissions from all fuel bunkered in Danish airports by aircraft (Danish as well as foreign) subsequently leaving Denmark.
2. Emissions from fuel bunkered abroad by Danish aircraft, regardless of their subsequent flight destination. The definition of Danish aircraft in this context is described in the methodology section.

Illustration 7: In Global Report 2021, emissions from international aviation have been limited to bunkering in Denmark and bunkering of Danish aircraft abroad

[26] Emissions from international aviation, domestically in the EU and departures to third countries are covered by EU's commitment to the Paris Agreement under the Climate Convention, the so-called Nationally Determined Contribution (NDC). This is a huge difference from shipping, which is currently only regulated within the framework of the IMO.
[27] Air carriers have to buy CO_2 allowances in the EU Emissions Trading System (ETS) to offset their emissions. However, they receive around 82% of their allowances free of charge. In 2021, the European Commission is expected to propose a gradual reduction in the number of free allowances allocated to aviation from 2023 and onwards to 2030 in conjunction with implementation of the international CORSIA programme in the EU ETS.
[28] Currently, only intra-EU flights are covered by the ETS. (COM, 2021c).

Results

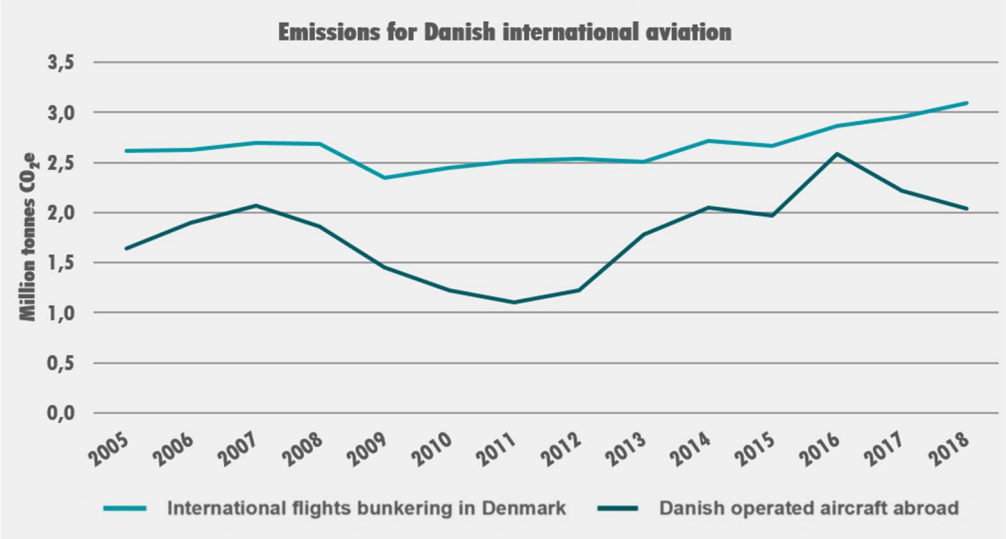
CO_2 emissions from Danish aircraft and bunkering in Denmark are increasing slightly

CO_2e emissions related to *international flights bunkering in Denmark* were between 2.5 million and around 3 million tonnes CO_2e annually from 2005 to 2018, see Figure 11. Decisions by aircraft operators about in which country or city to refuel depend on flight paths and the day price of fuel at airports along the flight path.

Throughout the period starting in 2005, emissions from *Danish operated aircraft abroad* have been in the range of 1.1-2.6 million tonnes annually, see Figure 11. For both calculations, the past ten years have seen an overall slightly increasing trend in CO_2 emissions.

Other climate impacts from aircraft are discussed in Box 13.

Figure 11: Emissions related to Danish international flights.



Source: Bunkering: (ENS, 2019); International flights: (DST, 2020b) sector code: 51000, 1994.

Box 13: Other climate impacts from aircraft

When an aircraft burns aviation fuel at high altitudes, the aircraft's other greenhouse gas emissions in addition to CO_2, namely NOx, soot, water vapour, etc. also have an impact on the climate. Among other things, emissions from aircraft form clouds (contrails). There is still some scientific uncertainty as to the degree of impact and how to measure it. This is because, in addition to altitude and flight path, the climate impact of non-CO_2-related emissions depends on fuel consumption, fuel type, temperature and time of day. The climate impact can be considerable, and according to the European Union Aviation Safety Agency, the climate impact of air transport can be between 1.7 and 3 times higher than the impact of CO_2 emissions alone (EASA, 2020). This report also suggests that sustainable fuels can be an important source of reducing this impact.

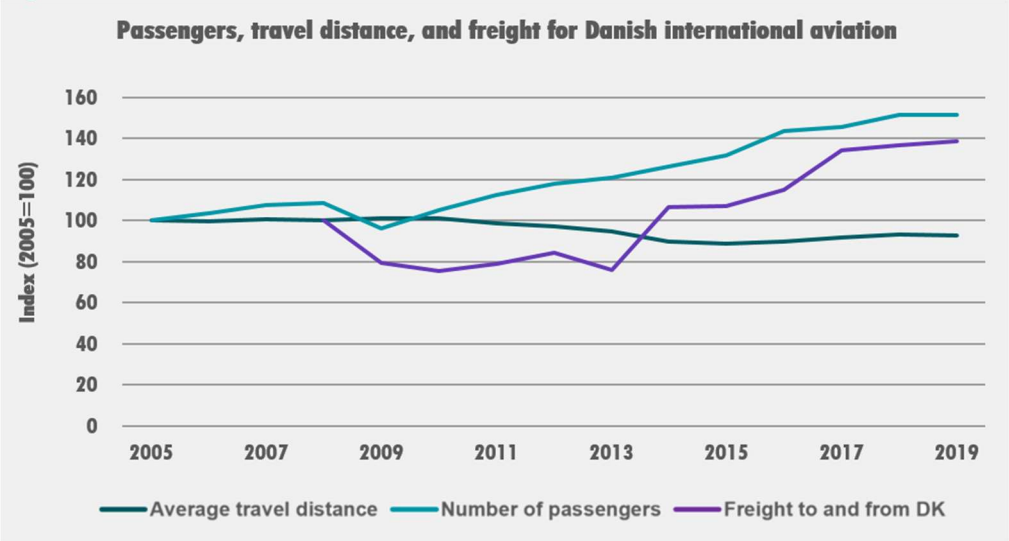
International reporting of emissions for aviation includes only CO_2 emissions.

Trends in emissions from international bunkering in Denmark are due to an increase in the number of passengers and cargo.

The number of passengers on international flights to and from Denmark was about 31 million in 2019[29] (DST, 2020c). The number of passengers on international flights have thus grown by 50% since 2005, see Figure 12. In the same period, the average travel distance per passenger fell slightly, suggesting that the increase in number of passengers is a contributing factor to the increased activity in international aviation over the past ten years. The aviation sector has achieved fuel efficiency improvements (KPL, 2020) over the past 15 years in the form of lower fuel consumption per passenger. (ENS, 2019) and (DST, 2020c).

Air freight to and from Denmark was about 270,000 million tonnes in 2019 (DST, 2020d). Freight volumes fell by 20% from 2008 to 2013 but have since grown by 40% relative to the 2008 level, see Figure 12. After 2013, increased freight volumes are therefore another contributing factor to increased activity in international aviation.

Figure 12: International aviation to and from Denmark



Note: For freight, the index year is 2008 (=100) due to incomplete data for earlier years.

Source: (DST, 2020c) and (DST, 2020d).

For an example of a specific initiative to reduce emissions from aviation, see Box 14.

Box 14: International aviation - examples of initiatives

The airline SAS is the largest aircraft operator in Denmark. SAS has an objective to reduce its total climate-impacting CO_2 emissions by 25% by 2025 and by more than 50% by 2050, compared to the level in 2005 (SAS, 2021). Up to 2050, according to (SAS, 2021), SAS's objective is to over-achieve the International Air Transport Association's (IATA) 2050 target to halve emissions compared to 2005. These objectives will be realised through investments in new types of aircraft and increased use of sustainable aviation fuels with lower climate impact (SAS, 2021).

[29] A flight is defined as a journey on the same aircraft (number) from departure airport to final destination, i.e. including intermediate landings. All flights, regardless of national affiliation are included.

SAS will invest in new and more fuel-efficient aircraft for its aircraft fleet up to 2025 (SAS, 2021) and (FLY, 2021). In addition, in 2019, SAS entered into cooperation with Airbus on a joint research and development programme to promote the development of electric aircraft, hybrid aircraft (aircraft powered by electricity and fuels) and hydrogen-powered aircraft. The programme is not expected to lead to the manufacture of aircraft for commercial use until after 2030 (KPL, 2020).

SAS has engaged in similar cooperation partnerships with the production companies Preem and Air BP, amongst others, (CHE, 2021) on the production of sustainable fuels, which will ensure SAS access to biofuels that emit around 80% less CO_2 than fossil aviation fuels (SAS, 2021). SAS aims for its use of sustainable fuels in 2030 to cover at least what corresponds to all of its intra-Scandinavian flights (SAS, 2021).

SAS and Copenhagen Airport are behind a new consortium to construct a large-scale Power-to-X plant in the Greater Copenhagen area. The plant will produce green hydrogen and so-called electro fuels for road, maritime and air transport at full capacity in 2030, the plant will be able to produce more than 250,000 tonnes of sustainable fuels per year (BRI, 2020). For comparison, domestic and international aviation bunkering in Denmark was calculated at around 30,000 tonnes and 1 million tonnes of fuel, respectively, in 2018[30].

SAS is also working to achieve CO_2 reductions through a number of minor initiatives, such as initiatives to reduce the weight on flights, including using lighter materials for interior furnishings and lighter cargo containers, and to optimise flights through better decision-making support on the ground and in aircraft. SAS is a partner in the Danish Government's Climate Partnerships for Aviation.

Methodology

The calculations in this section are based on official, publicly available statistics from Statistics Denmark. CO_2 emissions have been calculated from fuel consumption data reported to Statistics Denmark. Statistics Denmark also has data on passengers, transport activities and freight volumes (ENS, 2019) (DST, 2020b).

The definition of bunkering abroad by 'Danish aircraft' is based on Statistics Denmark's green national accounts (DST, 2020). In this publication, 'Danish aircraft' are defined as aircraft operated by Danish airlines, i.e. airlines registered in Denmark (DST, 2021a). This is the same definition as is used in the calculation of GDP (DST, 2020a). Denmark's largest aircraft operator, SAS, is actually a Danish-Swedish-Norwegian-owned company. Therefore, only two-sevenths of SAS's flight activity, and thus of its emissions, are included as Danish emissions in Denmark's green national accounts[31].

[30] Calculated on the basis of (ENS, 2019)

[31] Flight activities by SAS are operated by a consortium consisting of SAS Norway A/S, SAS Sweden AB and SAS Denmark A/S. In statistical contexts, SAS is considered to be a partial resident in all three countries. The companies have distributed the shares between them so that Denmark and Norway each have two-sevenths and Sweden has the remaining three-sevenths. Statistics Denmark therefore ascribes two-sevenths of the consortium's activity to Denmark. Statistics Denmark has agreed this with the statistics bureaus of the other two countries, and Statistics Denmark receives data on the activities of the consortium from Statistics Sweden.

In general, it is difficult to accurately define what constitutes 'Danish-related' activities and, thus, emissions. However, since the activities are performed by Danish companies and are part of the Danish economy, this report has used one of these two calculation methods. The other calculation method measures fuel bunkered on Danish territory.

See also the background memorandum on international transport for more details on methodology, definitions and boundaries.

Perspectives
This section accounted for Danish-related emissions based on international aviation bunkering in Denmark and Danish operated aircraft bunkering abroad.

To validate future reporting, it will be relevant to explore more closely how 'Danish-related' activities, and thus emissions, are best defined. Furthermore, for the analysis part, there are a number of options:

1. Better data, which is more consistent across categories, would allow for less uncertainty and a more complete calculation of emissions, including for passengers and freight. Moreover, it would make it possible to carry out analyses in the area.

2. Development of specific indicators (e.g. for CO_2 per passenger) to illustrate correlations and shed further light on sector trends.

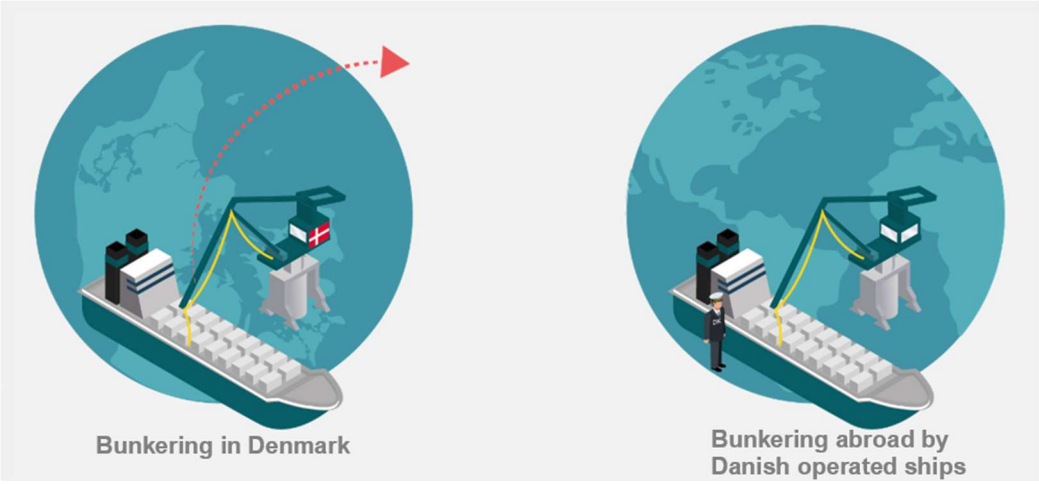
3. Methodological considerations about the possibilities of describing the impacts from reduction efforts by the players in the area.

3.3.2 International shipping

Global Report 2021 aims to shed light on the global climate impacts of Danish activities within international shipping. By Danish activities is understood international activities in Denmark as well as activities abroad with links to Denmark, including to Danish businesses. As there is no sufficient data basis available to describe all relevant aspects within this context, this calculation of international shipping has instead been based on publicly available data with the following boundaries (see also Illustration 8):

1. Emissions from all fuel bunkered in Danish ports by ships (Danish as well as foreign) subsequently leaving Denmark.
2. Emissions from fuel bunkered abroad by Danish ships, regardless of their subsequent destination.

Illustration 8: In Global Report 2021, emissions from international shipping have been limited to bunkering in Denmark and bunkering of Danish ships abroad



Statistics are available describing the first part of this definition, whereas for the second part, a more detailed definition of the concept of 'Danish ships' is needed, based on a sector description, see below under the section on methodology. In Global Report 2021, Danish ships have been defined as *Danish operated* ships. This includes ships which for shorter or longer periods are operated, but not necessarily owned, by Danish shipping companies. Thus, these definitions also include emissions linked to transport of non-Danish goods consumed outside Denmark and with no shipping destination in Denmark.

Results

Bunkering in Denmark by international shipping constant for ten years

The Danish Energy Agency, in cooperation with the Danish Centre for Environment and Energy at Aarhus University, annually estimates the emissions related to international bunkering in Denmark. In this context, international bunkering includes ships (regardless of national ownership) reporting that the fuel is for international shipping purposes.

The estimated emissions associated with international bunkering vary from year to year, see
Figure 13. The increase leading up to the financial crisis and the subsequent drop are consistent with developments within international shipping traffic. A new trend is evident after 2010, when emissions vary between 1.5 million and 2.5 million tonnes annually.

Figure 13: Emissions from bunkering in Denmark linked to international shipping

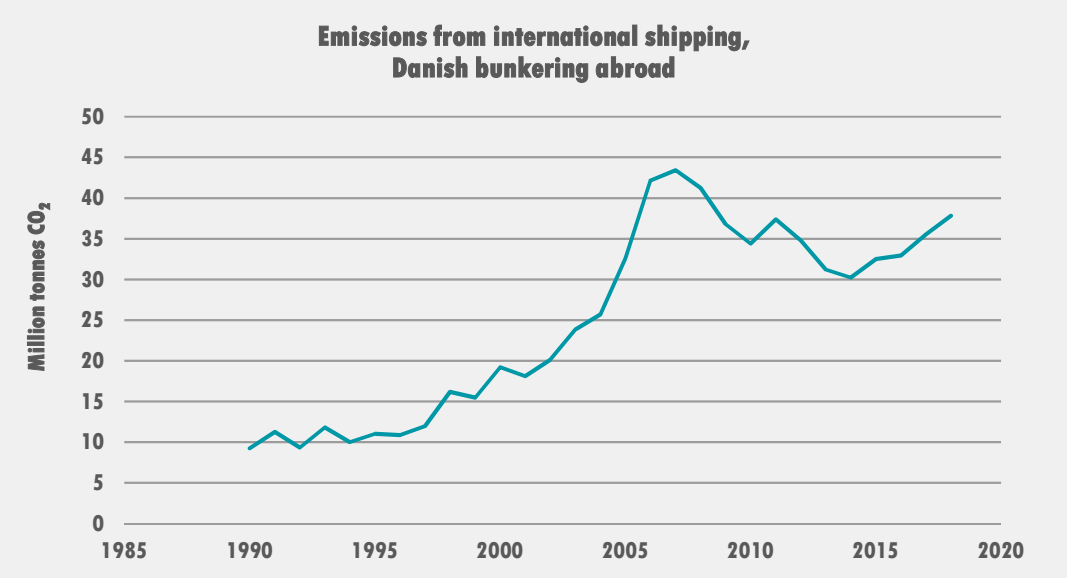
Source: Calculated on the basis of (ENS, 2019)

It is difficult to determine the reason for trends in
. Amongst other things, this is because several factors influence the refuelling patterns of ships. Ships do not necessarily refuel every time they are at port, and ships are not necessarily fully emptied or refuelled when they call at a port. They can refuel when it is most appropriate, including where it is cheapest, irrespective of the freight. Some ships refuel at fixed ports, while others refuel at sea, etc.

Emissions from the Danish merchant fleet on the rise

As can be seen from figure 15, greenhouse gas emissions from Danish operated ships abroad increased from a level of around 25 million tonnes CO_2e in 2004 to almost 44 million tonnes CO_2e in 2007, after which emissions fell to around 30 million tonnes in 2014, but then increased again to around 38 million tonnes in the most recent statistical year, 2018.

Figure 14: Emissions from Danish operated ships abroad



Note: The figures should be considered in light of the general growth in global trade since 2008.
Source: (DST, 2020b).

This development in emissions follows the emissions trend for the world fleet, which the UN's International Maritime Organization estimates every five years (SAF, 2020). The IMO's estimate shows that the world fleet's emissions and freight volumes went hand in hand up to around 2009, after which efficiency in shipping increased and emissions decoupled from growth in freight volumes (see background memorandum). This decoupling between growth in freight volumes and emissions is due to efficiency improvements, more specifically better utilisation of ships, refitting of ships, new and more efficient ships, speed optimisation, fuel savings, and optimisation of technical elements, operations and routes. However, according to the sector itself, improvements are reaching a point of saturation KPBD, 2020), and new technological solutions are required for the continued reduction of the sector's emission intensity.

The world fleet has grown since 2008. The Danish operated fleet's share of the world fleet tonnage has been at around the same level of just under 5% since 2014 (SØF, 2020a).

See Box 15 for examples of specific initiatives to reduce emissions from shipping.

Box 15: International shipping - examples of initiatives

Research and development centre for zero carbon shipping

The *Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping* was established in November 2020 (MAE, 2020). The centre was established with a donation of DKK 400 million from the A.P. Møller Foundation. So far, ten global companies, including A.P. Møller Mærsk, have become partners in the centre. The objective of the centre is to accelerate the development of future solutions to realise a global zero carbon shipping industry. The centre is to support strategic planning by businesses by providing a better overall picture and understanding of the road to zero carbon shipping. Work in the centre will be collaborative and will include relevant organisations, NGOs and consortia across various sectors, and the knowledge obtained will be shared widely to help reduce the climate footprint of international shipping (MAE, 2020).

The world's first carbon-neutral liner vessel

Mærsk's ambition for decarbonisation includes the launch of its first carbon-neutral liner vessel by 2023 (MAE, 2021). The vessel will have a capacity of around 2,000 TEU and will be deployed in one of Mærsk's intra-regional networks, for example between two ports in mainland Europe. The ship will operate on carbon-neutral e-methanol or sustainable bio-methanol but will also be able run on standard very low sulphur fuel oil (VLSFO). Mærsk aims for all of its new ships to run on either carbon-neutral fuels or VLSFO in future (MAE, 2021), (SØF, 2021a) and (SØF, 2021a).

World's largest fleet of hybrid ferries

Scandlines has been operating hybrid ferries (electricity and diesel) on its link between Denmark and Germany since 2013. In 2016, two of the world's largest hybrid ferries, *M/F Copenhagen* and *M/F Berlin,* were introduced on the route (able to carry 460 passenger cars and 1,300 passengers) (SCA, 2021. Today, Scandlines has a total of six hybrid ferries and thus owns the world's largest fleet of hybrid ferries. Scandlines' ultimate goal is emissions-free navigation, for example ferries operating exclusively on batteries (SCA, 2021a).

Methodology

International shipping is characterised by being regulated internationally, and it is an industry in which there is not necessarily a direct relationship between the owner of the ship, the operator of the ship, and the nationality (flag) of the ship.

Global Report 2021 defines Danish ships as *Danish operated* ships; that is, ships with a Danish operator who procures customers and cargo for the ship, decides how and when the ship sails and, possibly, pays the owner of the ship for having the ship at their disposal. Statistics Denmark defines Danish operated ships as ships operated by shipping companies registered in Denmark. This approach approximates to the method used in statistics about the Danish economy, including GDP. Statistics Denmark's approach to calculating emissions from Danish operated ships abroad is described in Box 16.

In the context of the government's Climate Partnership for Blue Denmark, Danish shipping companies have calculated emissions abroad caused by Blue Denmark at 52.8 million tonnes CO_2 (KPBD, 2020). This calculation is based on reports from the members of Danish Shipping and includes 29.2 million tonnes CO_2 from own ships and 23.6

million tonnes CO_2 from chartered ships. Furthermore, the figures include ships flying Danish as well as foreign flags.

The 52.8 million tonnes CO_2 is quite different from the figure referred to in this section of 38 million tonnes CO_2 from Danish operated shipping abroad. This considerable difference, which illustrates the sensitivity associated with emissions calculation methods for this sector, could be due to the inclusion in the calculation from Blue Denmark of the foreign subsidiaries of Danish shipping companies.

As with aviation, it is key but also difficult to define what constitutes 'Danish-related' activities and, thus, emissions. For example, part of the maritime transport bunkering taking place in Denmark relates to refuelling foreign ships, although it must be assumed that these ships are in Denmark because at least some of their cargo is Danish. At the same time, emissions from activities that are not related to Danish goods or to Danish consumption are embedded in bunkering by Danish operated ships abroad.

Box 16: Calculation of emissions from Danish operated ships abroad

In their green national accounts publication, Statistics Denmark estimates the consumption of bunker fuels by Danish operated ships abroad. The calculation is based on information in the balance of payment statistics on the fuel expenses of businesses (DST, 2020e), (DST, 2020f). Statistics Denmark estimates the physical quantities of fuel on the basis of relevant unit prices in the external trade statistics. The calculation of greenhouse gas emissions is based on the so-called residence principle (DST, 2020h). According to this principle, a company is considered to be registered in a country if it is domiciled within said country's economic area and carries out, or plans to carry out, economic activities and transactions to a considerable extent and for a period of at least one year (DST, 2020h).

This method of calculation ensures consistency between economic aspects and emissions because it includes the emissions that are caused by foreign activities included under the Danish economy, including GDP. Emissions from activities by Danish subsidiaries of foreign businesses have been included.

Perspectives

In future reports, it will be relevant to examine different methods of defining boundaries for Danish-related international shipping, as well as to examine more data sources. In 2018 and 2019, respectively, the EU and IMO started collecting data on emissions from shipping, and this data will be included in future reports.

Furthermore, there are several possibilities to examine international shipping in more detail in future:

- Better data and data more consistent across categories will facilitate less uncertainty and will provide a more complete picture, including for transport activities, freight volumes and fuel consumption. Moreover, it will be possible to carry out analyses in the area.

- Development of specific indicators (e.g. for CO_2 per tonne-kilometre) to illustrate correlations and shed further light on sector trends.

- Methodological considerations about the possibilities of describing the impacts from reduction efforts by the players in the area.

3.4 Cross-border electricity exchange

By its nature, electricity requires hourly balancing of production and consumption. For Denmark, cross-border electricity exchange is crucial to ensure this balance. In future years, Denmark will be exporting ever more renewables-based electricity to a number of countries in Europe. All else being equal, increased exports of electricity from offshore wind in Denmark will lead to a corresponding reduction in the production at foreign electricity production plants.

Danish cross-border electricity exchange therefore has a climate impact because it affects electricity production in neighbouring countries. The objective of this section is to examine these impacts more broadly than in the calculation of Denmark's consumption-based climate footprint (chapter 2), which only focused impacts from the electricity consumed in Denmark.

Global Report 2021 shows that Denmark is likely to have increasing net electricity exports until 2027, after which exports are expected to fall. Danish export of 1 TWh extra electricity based on renewables is estimated to displace about 0.3 million tonnes CO_2 abroad in 2030.

An example calculation without deploying PtX, for example, and assuming that almost all electricity produced is exported, shows that, all else being equal, the reduction potential of the energy islands is up to 6 million tonnes CO_2 a year (calculated on the basis of expected electricity consumption and the mix of foreign electricity production plants etc. in 2030). However, note that this example calculation can only serve to illustrate the reduction potential for 5 GW offshore wind capacity.

Results

Balancing electricity production with demand takes place on the northern European electricity market. Denmark's most important partners in electricity trade are Germany, Norway and Sweden. The electricity systems of Norway and Sweden have a high share of hydropower, which functions as an electricity storage. This means that production can be postponed and the water saved for electricity production when demand is high and the price of electricity is therefore also high. For example, this could be during periods with low wind power production.

Germany's electricity system is expected to have a high share of electricity from wind power and solar PV in future. However, it is expected there will still be production at German coal plants after 2030, although at a reduced level compared with today. In future, the fossil (gas-based and coal-based) share in electricity in Germany will be used more extensively to meet peak-load demand in periods when solar-based and wind-based production in Germany is low. Therefore, the displacement of coal-based electricity production in Germany as a consequence of exports from Denmark will eventually only be possible outside periods with peak production from solar and wind. At the same time, the electricity Denmark imports from Germany will continue to be based extensively on coal in the future. The reason for this is that Danish demand for electricity imports will be greatest during those periods when German production of wind-based electricity is low.

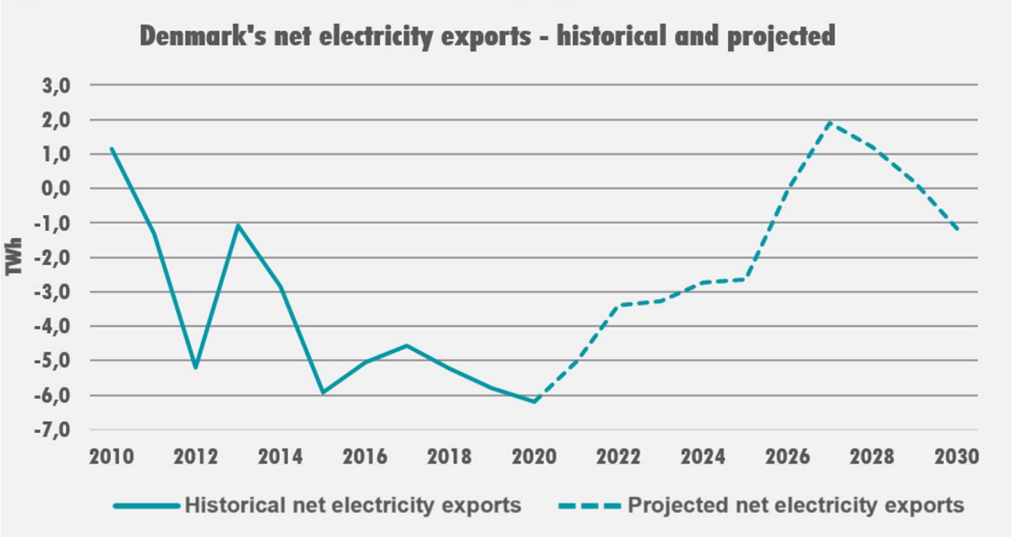
This is because Denmark and Germany will have offshore-wind-based electricity production during the same periods.

Increased exports of electricity up to 2030 will result in a reduction in foreign electricity production

According to the baseline scenario in Denmark's Climate Status and Outlook 2021 (ENS, 2021a), Denmark is expected to have increasing net electricity exports up to 2027, see Figure 15. After 2027, net electricity exports are expected to drop. The baseline scenario does not include expected impacts from the planned energy islands. The expected increase in net electricity exports up to 2027 marks a divergence from the trend over the past ten years with net electricity exports falling. The drop from 2027 is due to a levelling off in wind power deployments combined with increasing electricity consumption in Denmark.

All else being equal, exports of electricity up to 2030 mean that foreign plants will produce a correspondingly smaller amount of electricity. This reduction in foreign electricity production will result in global reductions in CO_2 emissions as the countries to which Denmark exports electricity still, to some extent, base their production on fossil fuels.

Figure 15: Trends in Denmark's net electricity exports



Note: In comparison, domestic electricity supply in Denmark in 2019 was approximately 35 TWh.
Source: (ENS, 2021) for historical figures and (ENS, 2021a) for projected values

Increased Danish electricity exports reduce CO_2 emissions from fossil-fuels-based electricity abroad

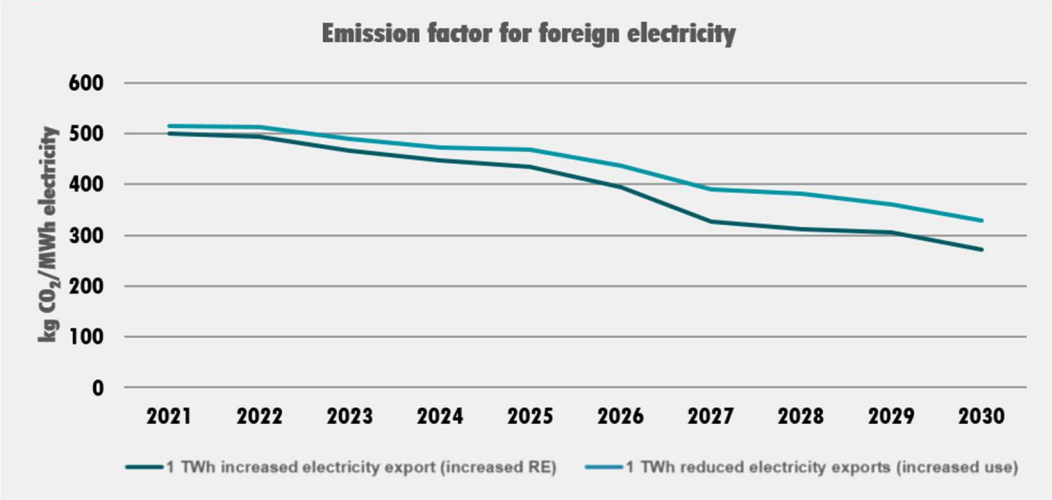
Using model calculations it is possible to examine how increased (approx. +1 TWh) and reduced (approx. -1 TWh) net electricity exports from Denmark affect CO_2 emissions from electricity production abroad up to 2030. See Annex 2 for a description of the method.

Increased net electricity exports from Denmark due to increased deployment of offshore wind capacity result in reduced electricity production in the remainder of Europe, and thus to reduced CO_2 emissions globally. On the other hand, all else being equal, reduced

net electricity exports due to increased Danish electricity consumption will result in an increase in CO_2 emissions from electricity production abroad. The electricity market ensures that the changes occur at the plant where changing electricity production is cheapest, i.e. at the so-called marginal plant. At some points, this will be at plants based on coal and natural gas, and over time, at other points, it will be at plants based on wind and solar[32].

Figure 16 shows the marginal emission factor for the electricity abroad that is displaced or added to production up to 2030 in the two scenarios. The emission factor for displaced electricity is positive throughout the period, which means that, for the next ten years, increased Danish electricity exports are expected to displace CO_2 emissions abroad. The emission factor for added production is also positive, which means that increased Danish electricity production without a corresponding renewable energy deployment in Denmark will lead to increased CO_2 emissions abroad.

Figure 16: Marginal emission factors for foreign electricity displaced or added to production



Note: The emission factor has been arrived at by comparing with the baseline scenario in Denmark's Climate Status and Outlook 2021. (ENS, 2021a).

In overall terms, we see a picture up to 2030 in which increased exports of renewables-based electricity from Denmark displace fossil-fuel-based electricity production abroad and thus have a positive impact on the global climate. 1 TWh extra electricity exported in 2030 will displace about 0.3 million tonnes CO_2 abroad[33], whereas reduced exports will have the opposite effect.

[32] Electricity based on solar and wind is less flexible but *can* serve as marginal plants as downward regulation is possible. In periods when all electricity is produced from solar and wind, production based on solar and wind will be regulated downwards if the demand for electricity falls or if electricity production at cheaper plants is activated.
[33] 271 kg CO_2/MWh electricity, see Figure 16, for 1 extra TWh of net electricity exports relative to the baseline scenario in Denmark's Climate Status and Outlook 2021. (ENS, 2021a). For other changes in net electricity exports, including if there are no exports at all, the climate impact per TWh will be different because the electricity mix displaced will be different (see the section on uncertainties).

Example calculation shows that energy islands have the potential to reduce CO_2 emissions abroad

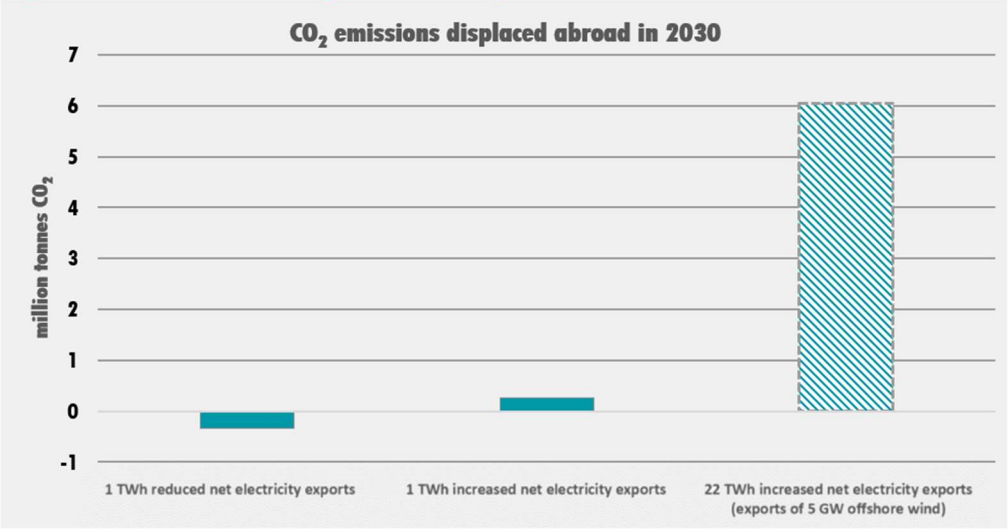
In the 2020 Climate Agreement for Energy and Industry, it was decided that Denmark is to establish 5 GW offshore wind power and associated electricity transmission links. Commonly referred to as the Danish energy islands. The energy islands are not included in the baseline scenario in Denmark's Climate Status and Outlook 2021 (ENS, 2021a). However, Denmark's Climate Status and Outlook 2021 includes a series of supplementary calculations concerning the energy islands. More specifically, one of these example calculations looks at how, all else being equal, implementation and commissioning of the energy islands at the beginning of 2030 will affect the Danish energy system with respect to domestic emissions, the renewables share in electricity consumption, and the electricity import-export balance.

The calculation example shows that establishing the agreed energy islands will increase Danish net electricity exports by about 22 TWh. However, this assumes that there is no further deployment of PtX or heat pumps, for example, compared with the baseline scenario. The 22 TWh constitute a significant increase in Danish net electricity exports which could potentially occasion a substantial reduction in foreign electricity production.

Figure 17 shows the level of CO_2 emissions displaced abroad in 2030 according to the partial calculations[34] for a change in net electricity exports of 1 TWh. Furthermore, Figure 17 shows the level of CO_2 emissions that potentially, and according to an example calculation, could be displaced abroad as a consequence of establishing the energy islands. In the first phase, the energy islands include 5 GW offshore-wind-based electricity in the North Sea and the Baltic Sea, respectively, as well as electricity transmission links to the Netherlands and Germany, for example, although the latter is still undecided. Based on expected demand for energy and a foreign electricity mix etc. similar to that in 2030, and assuming that almost all the electricity produced is exported, the reduction potential is assessed to be up to 6 million tonnes CO_2 annually. However, note that this example calculation can only serve to illustrate the reduction potential for 5 GW offshore wind capacity.

[34] That is, a calculation in which the change (e.g. the energy islands) has been included in the model without changing anything else (such as foreign countries changing their deployment plans in electricity production as a consequence of the establishment of the energy islands).

Figure 17: Calculation example, climate impact abroad



Note: The emissions have been arrived at by comparing with the baseline scenario in Denmark's Climate Status and Outlook 2021. (ENS, 2021a).

The global climate impact of increased electricity exports will decrease over time

The global climate impact of Denmark exporting green electricity will decrease over time. This is illustrated in Figure 16. The figure shows that the emission factor for foreign electricity displaced or added to production will fall up to 2030. The drop in the emission factor is because, even though demand for electricity is assumed to increase abroad, the green share of electricity production abroad is also assumed to increase and to gradually account for an ever-greater share of the electricity production. As a consequence, looking forward, Danish exports of green electricity are not expected to replace the same amount of electricity based on coal and gas as is the case today, but will gradually also replace electricity based on solar and wind.

The global climate benefit of exports of green electricity from Denmark is therefore expected to fall in step with European countries phasing out their conventional electricity production technologies. However, it also means that Denmark will be able to import greener electricity from its continental neighbours sometime during the next decade. Overall, however, it is expected that increased Danish electricity exports will have a positive global climate impact, also in 2030. This expectation is due to increasing electricity demand abroad, among other things.

Methodology

In order to examine the global climate impact of electricity exports from Denmark, a marginal approach has been used in this calculation. The marginal approach is useful for examining impacts and consequence of changes in electricity trade. The marginal approach looks at shifts in the European electricity system as a consequence of changes in Danish electricity imports/exports. The methodology is described in more detail in Annex 2.

The approach is markedly different from the approach used to calculate Denmark's consumption-based climate footprint in chapter 2. In the calculation of Denmark's climate footprint, all historical emissions, including from electricity production, are allocated to Danish consumption based on average emissions from electricity production (i.e. including the share that is imported and excluding the share that is exported). This section does not look at an average figure but at the consequence of a future change in electricity exports (marginal approach). In other words, this section considers the climate impact of changed future production at the marginal plant abroad.

The effect of the emissions trading market on any added production/displacement of production abroad has not been considered. However, it is the assessment that there will be no effect from the emissions trading market up to and including 2023. After 2023, it is uncertain how the emissions trading market will be regulated and so it is also uncertain how best to consider the emissions trading market in this type of calculation (see Box 17).

Box 17: Reductions within the ETS sector provide a real climate impact

The electricity sector in the EU is covered by the EU Emissions Trading System (ETS), and fewer emissions from coal power plants mean a larger surplus of emissions allowances in the EU ETS. However, it has been assessed that this larger surplus will only modestly lower the allowance price and thereby lead to increased emissions elsewhere in the ETS sector. Thus, when Danish exports of green electricity reduce coal-based electricity production abroad, there will be a real climate impact.

This is because, each year, the ETS 'absorbs' 24% of the surplus in the market. When new allowances are transferred to the reserve, they will be annulled in 2023. The effect is more uncertain after 2024, however, as these dynamics in the emissions trading market may change when the EU ETS is reformed as a step in implementing the adopted increase in the EU greenhouse gas emission reduction target in 2030.

Uncertainty

The calculation of the climate impact of Danish cross-border electricity exchange up to 2030 is associated with considerable uncertainty. This is partly because the results depend on the scenario used for trends in electricity production capacity abroad and in Denmark, respectively[35]. A greener scenario for electricity production abroad will result in a lower CO_2 displacement potential for Danish electricity exports, whereas a more conservative scenario will accentuate a larger potential for CO_2 displacement abroad. However, it is also partly because the projection of fuel prices influences which plants will change operation as a response to changes in Danish electricity exports.

Furthermore, the size of the change in electricity exports may also influence the results. With twice the increase in electricity exports, several plants will reduce their production and this could result in another mix of electricity being displaced.

The sensitivity calculations show that the results are robust with regard to where in Denmark there will be a change (eastern or western Denmark) and with regard to the size

[35] For a more detailed description of the scenarios chosen for Denmark and abroad, see the relevant memoranda on assumptions in (ENS, 2021a).

of the change in net electricity exports. Furthermore, the sensitivity calculations also show that the results are sensitive to changes in wind and precipitation relative to a normal year. See Annex 2 for more details on the sensitivity calculations.

Perspectives

The section on cross-border electricity exchange examined the impact of a minor change in net electricity exports up to 2030. A broader picture of the total global climate impact of Danish net electricity exports could be obtained by comparing the expected net electricity exports with a situation in which the net electricity exports are equal to zero. Future global impact reports will focus on moving closer to such a more comprehensive calculation.

The results in this section could be supplemented with an average approach as an alternative to the chosen marginal approach. This would provide a broader perspective on the results. Where the marginal approach examines the significance of a change in net electricity exports at the marginal plant abroad, an average approach shows the significance of calculating such a change in terms of average electricity production abroad. In addition to this, more sensitivity analyses would be a relevant area for development. Additional sensitivity analyses could cover various scenarios for developments in electricity capacity abroad over time.

4. Danish business community initiatives benefiting the global climate

This chapter looks at the climate action of Danish businesses to reduce greenhouse gas emissions globally. Businesses can have a positive impact on the climate, partly by reducing their own direct emissions (production) and partly by reducing their indirect emissions at the supplier stage (consumption) and the customer stage (sales/exports). This chapter therefore provides insight into an agenda engaging more and more businesses and that they are actively addressing. The chapter describes three concrete examples of climate action by businesses:

1) An outline of what businesses (through the Danish Government's climate partnerships)[36] have reported they are doing, or intend to do, to reduce greenhouse gas emissions in their respective sectors, in their own value chains and through sales of green solutions. The March 2020 reporting by all 13 climate partnerships shows a clear global focus, as partnerships report that they are addressing the emissions in their global value chains.

2) A status report on the extent of Danish exports of green environmental and energy technologies and services. These exports help to deploy the use of more green products and services and are thereby expected to displace greenhouse gases globally. Green technologies comprise 77% and 79%, respectively, of total Danish goods exports of environmental technology and energy technology. The shares of green goods exports of environmental and energy technology have increased by 55% and 57%, respectively, since 2010.

3) A description of an attempt to map the extent of the climate impact of Danish businesses through green exports. There is currently no standard method for determining the climate impact of a country's exports compared with a scenario with no exports. However, the Climate Partnership for Production Companies has estimated that sales of green products from Danish production companies in 2018 could potentially displace about 350 million tonnes CO_2e globally over the products' lifetime.

The areas described in this chapter far from represent the entire global climate impact of Danish businesses. However, they represent the impact from the Danish businesses that account for the production and export of environmental and energy technology solutions. So, this is a first step towards based on accessible data. The global climate action Danish businesses is an area that will be developed upon and covered in more depth in future global impact reports.

[36] As part of Danish climate action, in autumn 2019, the Danish government established 13 climate partnerships with the business community. The purpose of the partnerships is to get input from the business community about how to meet the Danish 70% reduction target. (EM, 2019).

4.1 The global focus and initiatives of the Danish Government's climate partnerships

The outline of what businesses *are doing* or *intend to do* to reduce global CO_2e emissions is based the Danish government's 13 climate partnerships' reports from March 2020 (KEFM, 2020a). The reports include a description of the ambition of the partnerships with regard to CO_2e reductions up to 2030, as well as specific initiatives and any perceived barriers to these. The partnerships could also report additional initiatives launched since March 2020.

Danish businesses can help reduce global greenhouse gas emissions both directly and indirectly as shown in Illustration 9 and further outlined in Box 18. The *direct impact* is through the individual business' own production activities. Here, businesses can improve their energy- and resource-efficiency. The *indirect impact* takes places when businesses direct their suppliers and customers towards more climate-friendly behaviour. For example, businesses can choose more climate-friendly materials from their suppliers, convert to greener energy sources, or develop and produce more climate-friendly products and services. Examples of the latter could be products that use less energy, have longer lifetimes or can be reused, recycled or disposed of in more climate-friendly ways than alternative products.

Illustration 9: The opportunity of businesses to positively impact global CO_2e emissions

Note: The direct impact is in the green box, and the indirect impact is in the blue boxes

Box 18: Greenhouse Gas Protocol usually the basis for climate accounts

The Greenhouse Gas Protocol (GHG Protocol) is a voluntary accounting standard for calculating greenhouse gases. The standard is globally recognised, especially by businesses. The purpose of the protocol is to help define the direct and indirect greenhouse gas emissions of businesses, and to ensure a uniform approach to calculating the overall climate footprint. The GHG Protocol distinguishes between three 'scopes' when categorising a business' greenhouse gas emissions.

Scope 1: Contains the direct greenhouse gas 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.

Scope 2: Contains the indirect greenhouse gas emissions associated with the production of electricity and district heating consumed by the business. These emissions are indirect because they are not being emitted by the energy-using business itself but by the producer of electricity or district heating.

Scope 3: Contains all other indirect greenhouse gas emissions arising from the business' activities in the value chain. These emissions stem from sources which are neither owned nor controlled by the business. For example, this could be emissions from suppliers due to extraction, production and transport of the materials the business has bought. Or it could be emissions associated with use by customers of products or services sold by the business.

If the climate accounts of businesses follow to the GHG Protocol, reporting emissions under scopes 1 and 2 is mandatory, whereas reporting emissions under scope 3 is optional.

In chapter 4.3 in this report is a description of the concept of 'avoided emissions', which, in the GHG Protocol, are considered an optional additional element for businesses to calculate. Most businesses which draw up climate accounts focus on scopes 1, 2 and 3.

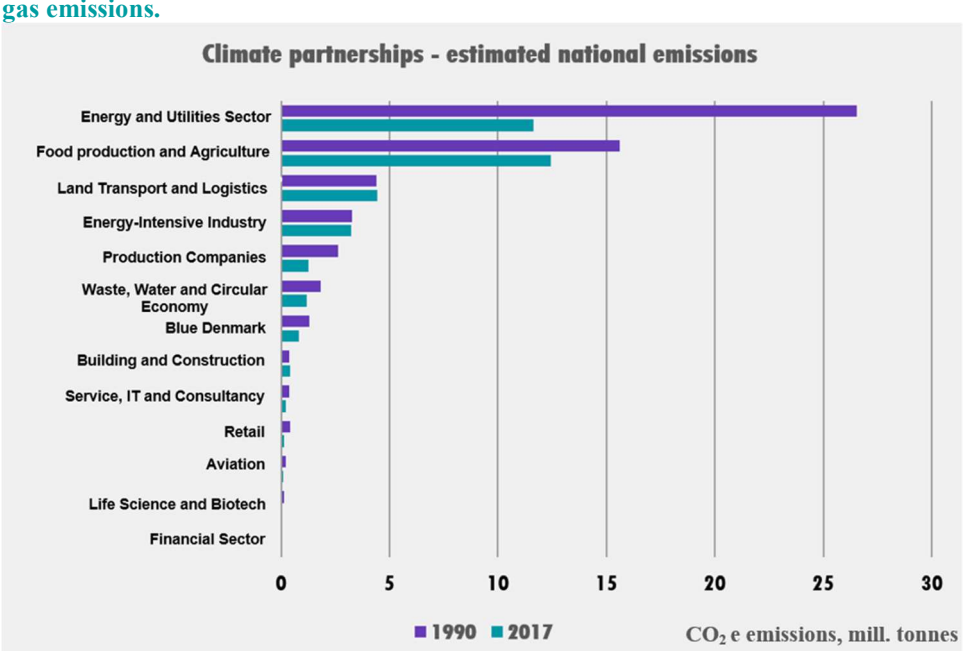
Source: (GHG, 2020) and (GHG, 2019).

For most climate partnerships, territorial direct greenhouse gas emissions have fallen

A total of 11 of the 13 climate partnerships have reduced their estimated territorial direct greenhouse gas emissions since 1990, see Figure 18. For the Climate Partnership for **the Financial Sector**, the Climate Partnership for **Retail**, the Climate Partnership for **Aviation**, the Climate Partnership for **the Energy and Utilities Sector**, the Climate Partnership for **Life Science and Biotech**, and the Climate Partnership for **Production Companies**, the reduction in direct emissions from 1990 to 2017 was in excess of 50%. According to the partnerships themselves, the fall is attributable, in particular, to optimisation of operations, efficiency improvements and shifting to greener energy sources.

Emissions from the Climate Partnership for **Land Transport and Logistics** have increased by 2%, which according to the partnership is because more efficient goods transport has not been enough to offset an increased demand for goods. The Climate Partnership for **Building and Construction** has seen an increase of 10% in greenhouse gas emissions over the period. According to the partnership, the increase is due to an increase in building activity, which has led to increased use of diesel for machinery, generators and drying, etc.

Figure 18: The climate partnerships' estimated direct territorial greenhouse gas emissions.



Source: (EM, 2019).

Several climate partnerships affect global emissions more than they affect territorial emissions

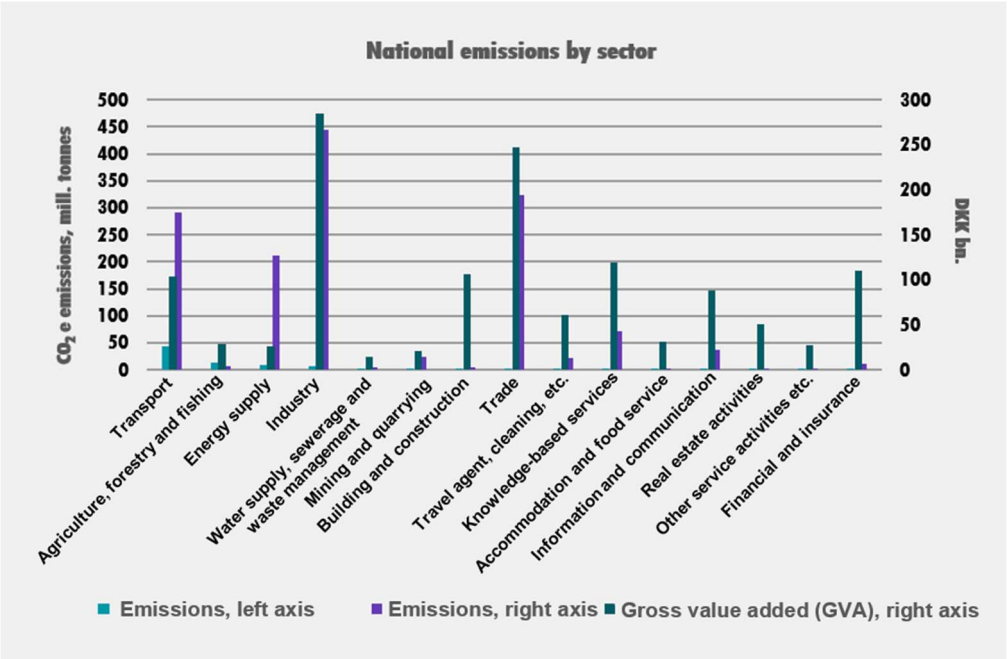
The size of direct territorial emissions by the climate partnerships (from their own production activities) is illustrated in Figure 18. The sizes shown do not necessarily indicate the scope of influence the sector has on reducing global greenhouse gas emissions. This is because, although the direct emissions are small, the individual sector may affect the indirect emissions at the supplier and customer stages. For example, the Financial Sector, which has limited direct emissions, could be contributing indirectly to very considerable emission reductions through financing activities. Perhaps through financing offshore wind farms internationally that displace fossil electricity production, or through financing building projects and building renovation projects that contribute to the integration of green energy, lower energy consumption, and increase the use of more climate-friendly building materials.

Figure 19 shows that, if the greenhouse gas emissions for the individual sectors are compared with the sectors' gross value added and exports, several sectors with relatively small direct territorial emissions have great significance for the Danish economy and considerable exports. Figure 19 also shows that emissions from the transport sector are particularly significant, which is due in part to considerable international activity by Danish transport companies. Furthermore, in Figure 19, the transport sector includes all the three transport partnerships.[37] For example, the Climate Partnership for **Blue Denmark** assesses that more than 95% of Danish shipping activity, and thus the related greenhouse gas emissions, takes place outside Denmark. This partnership also highlights that global shipping as a whole accounts for 2% of the world's greenhouse gas emissions

[37] **Blue Denmark, Aviation** and **Land Transport and Logistics**, but excluding private motoring.

(around 700 million tonnes CO_2e). A similar picture is seen for **Aviation**, and to some extent also for **Land Transport and Logistics**.

Figure 19: Direct emissions, gross value added (GVA) and exports by sector, 2017



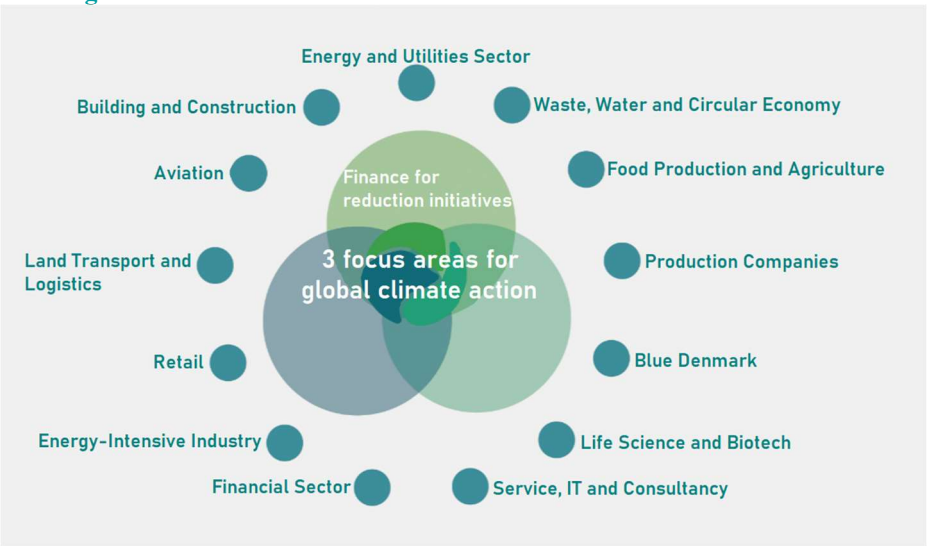
Note: The sectoral division is based on sector statistics and, therefore, the sectors in this figure are not comparable to the partnerships. This is because there is no data on GVA and exports for the 13 climate partnerships. Emissions from transport include Danish operated transport vehicles, see section 3.3. Real estate activities and renting includes only real estate activities and renting of non-residential buildings. The emissions include greenhouse gases in total, excluding CO_2 from biomass burning.
Source: Danish Energy Agency's calculations based on Statistics Denmark's tables DRIVHUS, NABP19 and FIKS22.

The climate partnerships focus on the global dimension of the climate challenge

The March 2020 reports from the climate partnerships focus primarily on the contribution of the partnerships to Denmark's 70% target, although the importance of the global dimension is also given much weight in many of the reports. For example, in their joint preamble, the partnerships emphasize that Danish initiatives should serve to inspire action internationally to ensure global emission reductions and to enhance the development of Danish green technology that Danish businesses can export to the rest of the world.

Across partnerships, there is considerable focus on impacts within three areas of significance for global emissions: 1) Suppliers, 2) Customers domestically and abroad through sales/exports of greener solutions, and 3) access to financing. The three areas are described in Illustration 10.

Illustration 10: The climate partnerships' three focus areas with significance for the global climate



The Climate Partnership for **Life Science and Biotech**, the Climate Partnership for **Production Companies** and the Climate Partnership for **Energy-Intensive Industry**, for example, are increasingly requiring their suppliers to be climate-friendly etc. The following climate partnerships are also focusing on their value chains, including their influence on suppliers and customers: **Building and Construction, Retail, Service, IT and Consultancy, Food Production and Agriculture, Aviation, Land Transport and Logistics**, and **Waste, Water and Circular Economy.** The Climate Partnership for Waste, Water and Circular Economy stresses that a potential exists in all value chains for transitioning to a circular economy.

The partnerships also pinpoint increased product lifetimes, reduction of waste, as well as increased reuse and recycling as possible action areas. For example, businesses can choose products and materials with long lifetimes, they can extend the lifetime of buildings by renovating them, or choose greener products such as sustainable aviation fuels. Reduction of food waste and of empty haulage are also mentioned. Initiatives like these can have a positive climate impact nationally as well as internationally, as is also stressed by several of the partnerships.

> *"The clothing and textile sector accounts for around 8-10% of global CO_2e emissions. If the current level of production is maintained, global textile production will increase by 63% up to 2030, which will lead to a considerable increase in global CO_2e emissions. Transitioning to a circular system with longer use and increased recycling of textiles, and thus reduced textile waste, will therefore be significant for efforts to reduce global CO_2e emissions."* The Climate Partnership for **Retail**

Another major focus area in efforts to reduce global greenhouse gas emissions is to raise demand, domestically as well as internationally, for greener products and services. This is an area highlighted to some extent by all of the partnerships. The specific greener

solutions range widely across all sectors, which is also reflected in the recommendations from the partnerships. From an overall perspective, the recommendations from the partnerships can be divided into 1) promoting the sale of greener solutions directly and 2) indirectly promoting such sales.

One example of a recommendation to directly increase green sales is the recommendation to expand the export infrastructure for electricity and establish Power-to-X production proposed by the Climate Partnership for **the Energy and Utilities Sector**, which could then sell more green electricity abroad.

Examples of recommendations for how to indirectly promote sales include greater climate disclosure such as expanding existing labelling schemes with additional climate requirements or developing global reporting standards for climate, environment and sustainability. This was proposed by the Climate Partnership for **Retail**, the Climate Partnership for **Service, IT and Consultancy**, and the Climate Partnership for the **Financial Sector**.

"The water sector can increase its exports of Danish water technology and consultancy. Exports of water technology to Europe have been assessed to be able to reduce European emissions by 1.7 million tonnes CO_2e through lower energy consumption. The global climate impact could be as much as 30 million tonnes CO_2e."
Climate Partnership for **Waste, Water and Circular Economy**

The third major focus area preoccupying several of the partnerships is access to financing. The Climate Partnership for the **Financial Sector**, for example, stresses that technological development, scaling up of production and export of products and services require access to financing. Similarly, the Climate Partnership for **Food Production and Agriculture** stresses the importance of subsidising, in particular, new technology with greenhouse gas emission reduction potentials both nationally and globally, such as green biorefining and climate optimisation of livestock feed.

Furthermore, several partnerships have proposals for how climate action financing can be supported at both sector level and individual business level. For example, the Climate Partnership for **Production Companies** is encouraging initiatives to help small and medium-sized enterprises to raise money to carry out energy-efficiency improvements etc.

The Climate Partnership for **Aviation** proposes establishing a foundation for the reduction of the sector's additional costs of buying sustainable fuels in step with an increasing blending ratio. The foundation would be financed through a small climate charge paid by passengers departing Danish airports.

The background memorandum on the climate partnerships contains a more detailed description of the sectors covered by the individual partnerships, as well as what the partnerships have reported the sectors are doing or intend to do to reduce greenhouse gas emissions globally.

3.4 Danish exports of green environmental and energy technology solutions

Danish exports of products and services contribute to greenhouse gas emission reductions abroad if the total climate footprint of the products is lower than the climate footprint of the products that would otherwise have been used. This section looks at Danish exports of green environmental and energy technology solutions. With regard to green energy technology exports, Danish products are displacing fossil energy and are therefore contributing to improved energy utilisation, while Danish exports of environmental technology are contributing to reductions in greenhouse gas emissions from the water and waste sectors.

This section is based on 2019 data from (ENS, 2021b) (MST, 2020) and (MST, 2020a). The primary focus of this section is on technology exports that are 'green' according to Eurostat's definition[38]. Because 2019 data has been used, the effects of the Covid-19 pandemic are not reflected in the results. Furthermore, note that 2019 was an extraordinarily good year for exports of wind energy technology (DKK 54.5 billion) and saw substantially higher exports than 2018 (DKK 43.1 billion).

The resulting exports exclusively cover exports from businesses located in Denmark. This means that sales from Danish businesses which have production in other countries, and which export green solutions from these countries, are not included in the statistics.

Danish exports of green environmental and energy technology are increasing

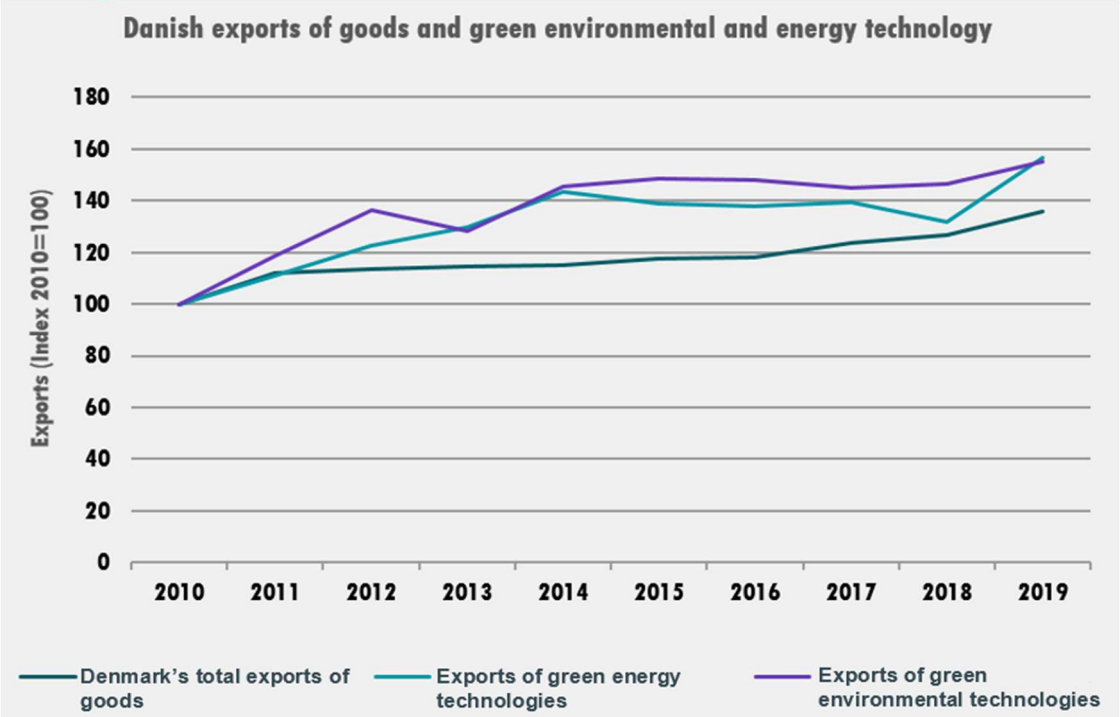
Total goods exports of environmental technology and energy technology came to DKK 25.4 billion and DKK 99.6 billion, respectively, in 2019. Green technologies comprise 77% of total Danish goods exports of environmental technology and 79% of total goods exports of energy technology. The green share of total exports has been increasing since 2010, the first year included.

Over the past decade, exports of both environmental and energy technology have increased considerably, see Figure 20. Since 2010, exports of green environmental and energy technologies have increased by 55% and 57%, respectively. Total goods exports increased by only 36% over the same period. Note that there could be an overlap in exports of environmental and energy technologies, and therefore these cannot be aggregated without the risk of double counting. Exports of green solutions, including within the areas of environment and energy, are subsidised through the EUDP, a public subsidy scheme, (see also Box 19), and are included in the government's long-term strategy for global climate action, "A Green and Sustainable World" (KEFM, 2020b).

[38] The definition of 'green' builds on Eurostat's assessment of which product codes can be considered 'green', i.e. linked to products that exploit renewable energy and green solutions or entail better resource exploitation, (DIE, 2017). This is why total exports in the present calculation are smaller than total exports in the Danish Environmental Protection Agency's analysis of exports of water technologies as well as in the analysis of exports of energy technologies, because both these analyses include product codes that are not 'green' according to the definition. Note also that Statistics Denmark's calculation of exports of green goods and services uses another methodology and includes green exports from more sectors than the present calculation. For example, Statistics Denmark includes green services, some elements from agriculture, forestry and fishing, as well as products produced extensively from recycled materials.

Appendix 3 contains details breaking down exports of environmental and energy technologies between technologies and the largest recipient countries.

Figure 20: Danish exports of goods and green environmental and energy technology



Source: (ENS, 2021b), (MST, 2020) and (MST, 2020a).

Box 19: The EUDP and the MUDP support green environmental and energy technology exports by businesses

Research and development is a prerequisite for continued exports, also for environmental and energy technology solutions.

By far the majority of Danish investments in research, development and demonstration (RDD) in 2020 (DKK 500 million) was realised through the state Energy Technology Development and Demonstration Programme (EUDP). This programme provides funding for new energy technology that can help meet Danish energy and climate targets. The EUDP focusses on the development, demonstration and scale-up of these technologies in Denmark, with a view to exporting the technologies. A similar programme exists for environmental technologies, called the Environmental Technology Development and Demonstration Programme (MUDP). The primary focus of the MUDP is to promote environmental technologies within areas such as water and climate change adaptation, waste and circular economy, air and noise, chemicals, and sustainable building and construction. In 2021, around DKK 140 million was available for the promotion of environmental technologies as a whole.

The EUDP and the MUDP support environmental and energy technology exports by Danish businesses.

According to the most recent evaluation of the EUDP from April 2019, 50% of the businesses had exports before participating in an EUDP programme, while this figure had risen to 75% after participation. Furthermore, the evaluation highlights how the EUDP has helped put climate-friendly technologies on the market that are helping reduce fossil energy. More specifically, the evaluation shows that 75% of the projects have or are expected to result in energy-related impacts such as impacts related to energy efficiency, CO_2 emissions, security of supply, and/or cost-effectiveness.

The most recent evaluation of the MUDP from 2017 concluded that one in three MUDP projects also aims to reduce CO_2e. This is because CO_2e reductions can be realised by projects within most technology areas through more efficient use of resources and energy. For example, many water projects focus on energy optimisation of infrastructure and water treatment. MUDP participants expect that as much as 56% of their increased turnover three years after MUDP participation will be exported on the global market.

Exports, case example: Frequency converters from Danfoss

Danfoss is an example of a company that exports energy and environmental technologies. Danfoss develops energy-efficient products and services such as frequency converters to electronically control motors.

Danfoss assesses that its sales of frequency converters to the global market for water and wastewater products alone contribute with CO_2e savings of about 1.1 million tonnes CO_2e annually. The service life of frequency converters is typically 20 years, according to Danfoss.

Frequency converters are a key (but not the sole component) to an energy-neutral and climate-neutral water sector. If sales of frequency converters to other business areas such as the agri-food sector and heating, ventilation and air conditioning are included, according to Danfoss the savings can be multiplied by a factor of 10, which results in CO_2e savings of 11 million tonnes of CO_2e annually, compared with a scenario without the use of frequency converters.

Danfoss is a part of the Climate Partnership for Waste, Water and Circular Economy and the Climate Partnership for Production Companies.

Denmark also exports knowledge about green solutions

In addition to exports of green technologies, Danish knowledge also contributes to exports of global green services. In 2019, the Danish energy sector exported services worth DKK 21.5 billion, while services exports from the water sector were DKK 3.1 billion. [39] Furthermore, consulting engineers exported environment and energy services amounting to DKK 2.3 billion. Exports by consulting engineers within the two areas pertain to energy planning, renewable energy, other energy consultancy, water utilities, and sewerage and drainage.

[39] The calculation includes service exports from goods-producing businesses in the areas of energy and the environment. (DIE, 2017) and (MST, 2020). Note that water technology alone is a subset of total exports of environmental technologies. There is currently no calculation of exports of services for other environmental technologies. (MST, 2020) and (MST, 2020b).

Exports, case example: Vestas' wind turbines

Vestas develops, manufactures and installs wind turbines and also sells servicing and maintenance for their own wind turbines. Vestas has installed 132 GW wind turbines in more than 83 countries, and these wind turbines together displace 186 million tonnes CO_2e a year, according to Vestas. The wind turbines are serviced and optimised regularly throughout their 25-year service life to ensure optimal electricity production.

In addition to manufacturing and servicing products that displace CO_2e emissions, Vestas has committed itself to achieving carbon neutrality by 2030. Vestas is therefore planning to phase out their use of vehicles with traditional combustion engines by 2025, and to electrify 5,000 vehicles and service transports.

Vestas is a part of the Climate Partnership for the Energy and Utilities Sector and the Climate Partnership for Production Companies.

3.5 Climate impact of Danish exports of green technology

In continuation of green exports of green environmental and energy technology dealt with in section 4.2., this section looks at the possible climate impact of Danish exports of green technologies.

Chapter 2 calculated Denmark's consumption-based climate footprint. The was by allocating the world's total emissions to individual countries by looking at international trade patterns and consumption in each country. Emissions associated with the production of Danish export goods were therefore allocated to the country where the goods are consumed and were thus included in the consumption-based climate footprint of the destination country. See section 2.1 for a more detailed description of Denmark's consumption-based climate footprint.

This section, however, presents another type of analysis, which looks at the possible climate impact in the recipient countries following from exports of green solutions from Danish businesses. The focus in this section is therefore on a *what-if* scenario in which Danish businesses did *not* sell green solutions. In other words, focus is on the CO_2e *not* emitted, hypothetically speaking, because of Danish exports. Whereas the methodology in chapter 2 allocates the calculated emissions to the consuming country, the methodology in this section uses a baseline scenario to calculate the possible climate impact. There is currently no standard method for determining the climate impact of a country's exports compared with a scenario with no exports.

Businesses can use the Greenhouse Gas Protocol when calculating the climate impacts of their products

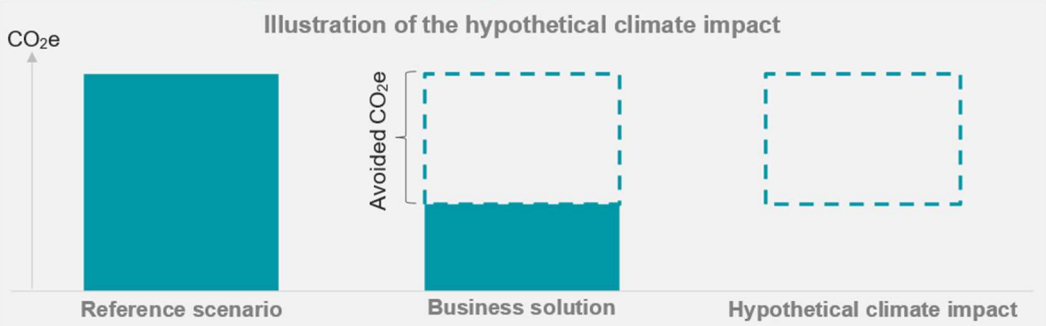
When a business calculates the climate impacts of its goods and services, they usually calculate the amount of CO_2e emissions displaced. Displaced emissions are expected 'avoided emissions'; that is, the hypothetical CO_2e reduction brought about by a climate-

efficient product. The Greenhouse Gas Protocol includes a standard for how to calculate displaced emissions (GHG, 2019). This calculation method compares the climate impacts of a business' product with a defined baseline scenario. Basically, two baseline scenarios can be used according to this method, and the choice of scenario is decisive for the calculation of the climate impact:

- Baseline scenario A, in which the product *does not exist*, and the existing, already installed technologies are assumed to continue in unchanged operation.
- Baseline scenario B, in which the reference is the climate impact from alternative products with a similar function.

Regardless of the scenario chosen, common for all results is that the climate impact can be either positive or negative, depending on the product being analysed. A positive climate impact is often referred to as 'avoided emissions'. When choosing a baseline scenario, the most important thing is to ensure the scenario represents the current alternative being sold in the market. The method for calculating the climate impact of a product can be illustrated as shown in Illustration 11.

Illustration 11: The hypothetical climate impact



An ideal calculation of the climate impact of Danish exports of green technology is currently not practicable

In order to calculate the potential climate impact following from Danish green exports, life cycle analyses should ideally be made for each and every product exported by Denmark[40]. These life cycle analyses would reveal the climate impact of the individual products throughout the product's lifetime. The result of the life cycle analysis would be compared with each of the two baseline scenarios A and B described above in order to arrive at two respective estimates of the hypothetical climate impact of the specific product. The climate impacts would then be aggregated, for each of the baseline scenarios, across all of the products Denmark exports. The result would be two figures indicating the displacement hypothetically caused by Danish exports.

The challenge with finding the climate impact of exports via life cycle analyses, for example, is that it requires comprehensive analyses of each and every product and service a country exports. It also requires similar analyses of each and every competing product and service. Furthermore, there is no data available with regard to what the exported

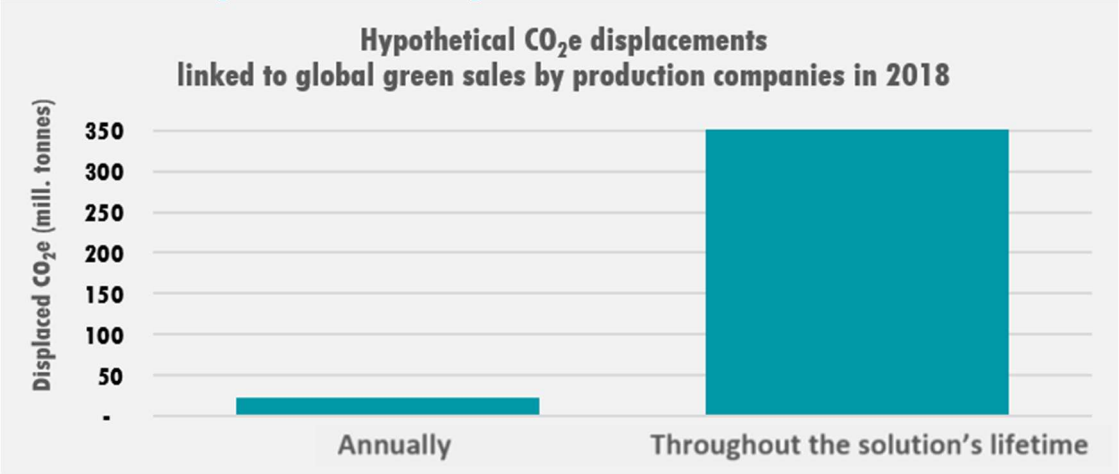
[40] A similar method should ideally be used if the climate impact of Danish exports is to be calculated, whether for Danish exports in general or with regard to certain focus areas within Danish exports.

products and services are specifically used for and, thus, what the individual product or service displaces in the individual countries to which Danish businesses export. For example, there is a significant difference between whether Danish photovoltaic solar modules are installed in countries where a major part of electricity demand is already being met by green energy or in countries where electricity is primarily produced from fossil fuels. Finally, there is the time perspective. How can calculations be made consistent, when the sale of one product in one year potentially causes CO_2e reductions over many years depending on the product's lifetime? In practice, it is currently not considered possible to make a consistent calculation of such climate impacts.

The Climate Partnership for Production Companies has estimated the climate impact of global sales by their businesses

The Climate Partnership for Production Companies has developed a possible method for calculating the hypothetical climate impact from global sales (the calculation does not distinguish between sales in Denmark and exports) (KPPV, 2020). This method of calculation developed by the climate partnership is based on selected relevant businesses (step 1) and analyses of the climate footprint of the green products based on a life-cycle perspective or analyses of the energy-saving potential of the products (step 2). Finally, the result is scaled up to represent total green exports (step 3). See Box 20 for a more detailed description of the calculation method. The Climate Partnership for Production Companies estimates that sales of green products from Danish production companies in 2018 could potentially displace about 350 million tonnes CO_2e globally over the products' lifetimes (see Figure 21).

Figure 21: Hypothetical CO_2e displacements linked to global green sales by the Climate Partnership for Production Companies in 2018



Note: The annual displacements have been calculated by the Danish Energy Agency on the basis of the calculation from the Climate Partnership for Production Companies.
Source: (KPPV, 2020).

Calculation of the climate impact of Danish exports will be described in more detail in future reports

In conjunction with Global Report 2021 it has not been possible to calculate the climate impact, in the form of displaced emissions, underpinned by Danish exports. However, this is an area that will be examined in more detail in future global impact reports, possibly including the impacts of Danish exports on other areas than green technology. The Danish Energy Agency intends to develop a calculation model for this purpose in the years to come.

Box 20: Estimate of global greenhouse gas emission displacements following from sales by Danish production companies in 2018

The Climate Partnership for Production Companies has estimated the hypothetical climate impact from global sales by Danish production companies to be 350 million tonnes CO_2e globally over the products' lifetimes (KPPV, 2020). The calculation shows *hypothetical* CO_2e displacements, in which the CO_2e emissions avoided by erecting a wind turbine, for example, are compared with the emissions from electricity production had the wind turbine *not been erected*.

Step 1: Selection of relevant companies

In consultation with the Confederation of Danish Industry and Boston Consulting Group, the Climate Partnership selected the companies Vestas, Grundfos and Danfoss to represent CO_2e displacements from the green products sold by Danish production companies.

Step 2: Calculation of a global CO_2e displacement factor per DKK turnover

The specific basis of the calculation is the global turnover of the three companies from sales of green products in 2018. The global CO_2e displacement potential over the products' lifetimes is estimated in cooperation with the companies for the respective 2018 sales of each company. The figure is then divided by the 2018 turnover to get the displacement factor (CO_2e per DKK turnover).

Determination of the displacement factor is based on wind turbines, energy-efficient pumps and frequency converters, respectively, and data was obtained from the companies.

Step 3: Scaling up to Danish production companies

The global displacement factor is multiplied by the turnover of sales of green goods and services from Statistics Denmark's green national accounts for the sectors under the Climate Partnership for Production Companies. Scaling up to the remaining companies under the climate partnership is based on the lowest of the estimated displacement factors. Read more about the types of companies and sectors included under the Climate Partnership for Production Companies in the background memorandum on the Danish government's climate partnerships.

Source: (BCG, 2021).

5. Financing green investments internationally

This chapter looks at initiatives to promote green investments that can help reduce greenhouse gas emissions globally. Specifically, the financial sector can influence the climate positively by ensuring that the funds managed by banks, mortgage-credit institutions, pension funds and insurance companies, etc. are used to finance green projects such as wind farms.

Meeting the global climate goals will require considerable investment and financing. According to an assessment by IRENA (International Renewable Energy Agency), annual global investment in renewables will have to triple and thus reach USD 800 billion if the goal of the Paris Agreement to keep the global temperature increase to 1.5 degrees Celsius is to be met (IRE, 2020). The EU has assessed that, at European level, at least EUR 1 trillion worth of sustainable investments are needed over the coming decade to reach the 2030 targets set out in the European Green Deal (EU, 2019).

Denmark is therefore working to accelerate green, climate-friendly investment by both public and private sources and in all groups of countries. This is in line with the goal of the Paris Agreement to increasingly redirect financial flows towards supporting the green transition and climate change adaptation.

This chapter is about financing and initiatives that, more broadly, contribute to increasing green investments internationally, while section 6.1 addresses climate cooperation and partnerships with, and climate finance for, developing countries.

Note that a total statement of all Danish, private green investments internationally is not available, and that it has therefore not been possible to quantify the positive climate impact of such investments in the context of Global Report 2021.

3.1 The role of the financial sector in promoting green investments

The financial sector plays a key role in raising equity and external financing for corporate investment, both nationally and internationally. The financial sector includes banks, mortgage-credit institutions, pension companies, life-assurance companies, non-life insurance companies, and investment brokers, including investment associations. The sector accounts for around 5% of the Danish economy. (EM, 2019).

The Climate Partnership for the Financial Sector describes the size of the financial sector in the following way: *The financial sector in Denmark is relatively large. For example, Danish pension and life-assurance companies hold assets worth around two-times the Danish gross domestic product (GDP). The capital markets are around three-times the size of the Danish gross domestic product (GDP).* (EM, 2019).

Increased focus on enhancing access to financing green investments

Investment and financing for the green transition has seen increasing interest from the Danish financial sector in recent years. Danish pension companies today have considerable investments in green infrastructure such as wind farms, although mainly abroad. Furthermore, Danish commercial banks are increasingly offering loans or financing for green projects. The ambition of the Danish financial sector to boost financing for the green transition is described in Box 21.

The increasing interest from the financial sector is because technological and market developments are turning renewable energy into an ever more competitive alternative to fossil energy. This is leading to growing interest in the business potentials in the green energy transition.

Furthermore, expectations of more ambitious climate policies and increased regulation to reduce greenhouse gas emissions are also drivers of greater interest in investing in green transition and less interest in fossil energy, for example. There is even a fear of 'stranded assets', i.e. investing in assets that will lose their value. The assets could lose value as a consequence of the trend towards a more fossil-fuel-free economy and/or because investors no longer trust the long-term potentials of businesses.

Similarly, there are several physical risks associated with climate change that investors and financial players need to consider. Such physical risks include extreme weather events like flooding and storms, but also more permanent changes in the climate. The physical risks can have huge negative consequences for certain types of investment, but can also mean new business opportunities.

Box 21: Climate goals and climate reporting by the financial sector

Pension companies

In 2019, Danish pension companies announced that they would invest a further DKK 350 billion in the green transition in Denmark and abroad up to 2030. In November 2020, the Danish Insurance Association published a follow-up status report on the announced ambition, which showed that the sector had increased its green investments by around DKK 50 billion in one year. According to the sector's own calculations, in 2020 Danish pension companies thus made green investments worth DKK 176 billion as opposed to DKK 126 billion in 2019. This figure includes green infrastructure projects, green bonds, climate-friendly investments in property and equities. Around DKK 62 billion was invested in green infrastructure such as wind farms, solar PV and transmission facilities. Of this amount, around DKK 50 billion was invested in OECD countries, including Denmark, while around DKK 12 billion was invested in growth economies and developing countries. (F&P, 2020).

Investment associations

In 2020, the Danish Investment Association, which represents Danish asset managers, set a goal that CO_2e emissions from Danish investment funds are to be 75% lower than the CO_2e emissions in the world stock market index in 2030 compared with 2020. Specifically, this means that investment portfolios up to 2030 must have more investments in green energy and fewer investments in CO_2e-emitting sectors. This is expected to contribute with a total

reduction in CO_2e emissions of around 4.3 million tonnes CO_2e from 2020 to 2030 (FID, 2021).

Banks and mortgage-credit institutions
In 2019, banks and mortgage-credit institutions financed DKK 400 billion worth of green activities. In 2019, the sector estimated that its total loans, etc. for green activities would increase by DKK 300 billion up to 2030, as the green transition of the Danish economy gains momentum. In 2020, financing for green activities had increased by DKK 60 billion, totalling DKK 460 billion and, thus, well on the way to reaching the estimated DKK 700 billion in 2030. The banks and institutions are pushing developments by launching special loan products for green projects and by having a stronger focus on sustainability in their dialogue with corporate and private customers (KPF, 2020).

5.1 Initiatives to promote private green investments

Denmark is working to ensure international conditions for businesses and the financial sector that promote green and sustainable investments. One way to increase green investment is to establish a common language and standards for sustainable investment. This would help to identify more clearly the investments that contribute to realising green ambitions, and it would counteract *greenwashing*. Another way is to improve and support climate-related reporting by businesses and the financial sector through requirements and through developing methodologies and tools. Better climate-related reporting would reduce the risk of double counting CO_2e reductions.

Recent years have seen the launch, at EU and international levels, of several initiatives to improve conditions and tools for increasing sustainable investments and climate-related reporting. At national level, in 2020 the Green Business Forum has instigated cross-sector cooperation to develop a common methodology for calculating the greenhouse gas emissions linked to businesses, see Box 22.

Box 22: Green Business Forum's project to measure CO_2e emissions

Reporting on greenhouse gas emissions etc. is increasingly a requirement in both the financial and non-financial sectors of the economy. However, no globally adopted standards for climate-related reporting exist today. International standards are under development, but businesses may still have difficulties knowing how best to approach greenhouse gas emission calculations. Furthermore, there are several data-related challenges linked to calculating greenhouse gas emissions. In their recommendations, several of the Danish government's climate partnerships have called for a common methodology for calculating greenhouse gas emissions. In 2020, the Green Business Forum instigated cross-sector cooperation to develop such a common methodology, based on international standards. The methodology will reflect the climate-footprint disclosure requirements imposed in the upcoming international standards. The financial sector will demand these same disclosure requirements of customers/businesses when assessing loans or investments. The project is expected to submit its report in spring 2021.

A common European agenda for sustainable finance

In recent years, the EU has focussed on mobilising the financial sector to help promote the green transition. Thus, the EU as set a common European agenda for sustainable finance. As a main initiative under this agenda, in 2018, the EU instigated a process to define what is 'sustainable investment'. The process includes development of a taxonomy (i.e. a classification system) for environmentally sustainable economic activities. This taxonomy is to make it easier for investors to identify sustainable investments and financial products, both nationally and internationally (see Box 23). Furthermore, the EU has adopted rules for two new types of financial benchmarks for emissions of CO_2e, as well as increased disclosure requirements for financial businesses offering sustainable financial products. The European Commission is expected to present a new sustainable finance strategy sometime during 2021. It is expected the strategy will announce a number of new measures.

The development of the taxonomy and a series of other international standards and methodologies will help to develop data, etc. to describe the importance of investments in promoting the green transition. It will also help to develop data to describe how Danish businesses are contributing to promoting the green transition, nationally as well as internationally. Among other things, the taxonomy includes a requirement to report on how the activities of the largest financial and non-financial businesses are meeting the taxonomy's criteria for environmental sustainability. Whether to include the taxonomy in future global impact reports will be considered once the screening criteria, reporting requirements and reporting methodologies have been finalised by the European Commission, and once the largest businesses have started reporting in accordance with the Taxonomy Regulation.

Box 23: EU taxonomy for sustainable investment

A new classification system (a so-called taxonomy) for environmentally sustainable economic activities was adopted by the EU in June 2020 as part of the European Commission action plan on sustainable finance. The objective of the action plan is to have the financial sector take greater part in the sustainability transition, so as to support attainment of the EU 2030 climate, environment and sustainable development targets and implementation of the European Green Deal. The taxonomy is to make it easier for investors to identify sustainable investments and financial products, both nationally and internationally.

In order to classify as environmentally sustainable, an economic activity must contribute actively and substantially to at least one out of a total of six environmental objectives (including climate change mitigation and adaptation), without negatively affecting other environmental targets. The taxonomy includes economic activities in many different sectors such as energy, industrial production, transport and buildings.

Businesses offering sustainable financial products must disclose information about the extent to which the product meets the criteria in the taxonomy. Furthermore, in future, the largest businesses will have to report how, and to what extent, their activities qualify as environmentally sustainable according to the taxonomy. The taxonomy therefore introduces a common EU classification system for what is considered sustainable investments, and also allows for common product standards such as green bonds.

The taxonomy enters into force for all EU Member States from 1 January 2022 with regard to the elements related to climate change mitigation and climate change adaptation. The European Commission is expected to specify in mid-2021 how the largest businesses are to carry out reporting in accordance with the taxonomy from 2022.

Growing international attention to the need for financial reporting on climate

The greater awareness among financial businesses to consider the risks and opportunities from climate change in their risk management, has increased the demand for information about climate risks of investing in various companies. However, no globally adopted standards for climate-related reporting exist today.

In addition to the EU initiatives to promote sustainability-related reporting among European financial and non-financial businesses, there is also the international initiative: Task Force on Climate-related Financial Disclosures (TCFD). The TCFD has prepared a number of recommendations for a common, voluntary framework for corporate climate reporting (TCFD, 2017). The TCFD's recommendations aim to help businesses understand the climate-related risks and opportunities entailed in their business and investment activities. A number of Danish businesses and financial players have joined the initiative.

5.2 The role of the public sector in attracting financing for the green transition

Businesses can face obstacles obtaining financing for green transition projects etc., including financing for investments abroad. For example, this applies to venture capital for large projects, particularly projects with long investment horizons requiring loans with

long maturities, as well as on riskier markets such as markets in growth economies and developing countries. Both newly established and existing businesses may also face obstacles obtaining financing for the development of new technologies and other products or services that promote the green transition.

In order to tackle these obstacles, the Danish state has a number of financial institutions that can offer financing where the private financial sector shies away. In this way, public financing helps reduce the risk of projects and mobilises private financing, so that the investment can be realised. The most important of these public financial institutions with an international outlook are EKF, Denmark's Export Credit Agency; IFU (investment fund for developing countries);[41] and the international financial institutions that Denmark is a member of[42]. Furthermore, in 2020, Denmark's Green Future Fund was established, the funds of which will support green projects, also internationally.

EKF, Denmark's Export Credit Agency, promotes Danish exports of green solutions

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 this way, EKF helps to facilitate and mobilise international investments and projects. A major share of EKF export financing goes to supporting climate-related exports. Guarantees for green projects, primarily wind turbine projects, therefore account for more than 70% of all EKF's transactions. This makes EKF the world's greenest export credit agency.

As can be seen from Table 5, EKF's climate-related export credits are primarily concentrated in wind energy, but credits were also provided for solar PV and biomass, as well as for electrification of transport and for electricity infrastructure. EKF's guarantees often only make up a small share of the total financing needed in the relevant investments and projects. EKF is therefore an essential element in mobilising private investments in climate-related projects.

[41] See chapter 6.1 about IFU.
[42] See chapter 6.1 about multilateral development banks with a focus on developing countries.

Table 5: EKF's climate-related export credits by technology, DKK million

Breakdown by technology	2017	2018	2019	2020*
Wind power	5,772	23,511	10,252	9,265
Solar PV	0	0	223	0
Biomass	0	69	0	0
Rail (electricity)	1,782	0	0	6,797
Transmission links, electricity (RE)	0	1,841	0	0
District heating	0	59	0	0
Waste management	0	0	6	0
Agriculture, aquaculture	0	0	516	0
LED lighting	0	20	10	0
Total	**7,554**	**25,501**	**11,007**	**16,061**

Note: The figures show export credits with terms of more than two years. The definition of 'climate-related' is based on a methodology used in the OECD Group on Export Credits. There may be deviations from EKF's official financial statements due to currency conversions.
*Data for 2020 are preliminary figures.
Source: Figures calculated by EKF, Denmark's Export Credit Agency, for Global Report 2021 and based on EKF's 2020 annual report.

Around 20% of EKF's climate-related export credits in the period 2017 to 2020 went to projects in the EU, see Table 6. The remaining share of EKF's climate-related export credits, around 80%, went to exports outside the EU. Of this remaining 80%, around 40% went to projects in developing countries.

Table 6: EKF's climate-related export credits, geographical distribution, DKK million

Geographical distribution	2017	2018	2019	2020*
EU	248	6,876	210	4,252
Remainder of world	7,306	18,625	10,796	11,810
- of which, developing countries	4,281	6,622	1,467	6,930
Total	**7,554**	**25,501**	**11,007**	**16,061**

Note: The figures show export credits with terms of more than two years. The definition of 'climate-related' is based on a methodology used in the OECD Group on Export Credits. There may be deviations from EKF's official financial statements due to currency conversions. The definition of 'developing countries' is based on DAC's ODA list.
*Data for 2020 are preliminary figures.
Source: Figures calculated by EKF, Denmark's Export Credit Agency, for Global Report 2021 and based on EKF's 2020 annual report.

EKF did not issue guarantees for fossil energy production in 2019, nor in 2020. The most recent financing of fossil energy production was therefore in 2018. EKF supports projects on fossil fuel production and fossil-fuel-fired power plants worth around DKK 4.1 billion, distributed across five projects. These are projects in the oil and gas industry, storage of gas, diesel-fuel-fired power plants and oil-fired power plants. EKF's engagement in three of these projects, at a total of DKK 3.4 billion, expires at the end of 2022. The remaining

DKK 0.7 billion will remain in EKF's portfolio for most of the coming decade. These long-term activities are related to oil-fired power plants.

In 2020, the Danish government decided an explicit ban on export financing of coal power, thermal coal extraction and thermal coal logistics. If the climate impact of export financing is to gain traction in earnest, the matter must be dealt with internationally. Internationally, within the context of export credits, for the last 15 years, Denmark has been advocating for improved conditions for export financing of green technologies in the EU and the OECD, see Box 24.

Box 24: OECD agreements about public export credits

Common international conditions for public export financing have been established within the OECD (Organisation for Economic Co-operation and Development) through a number of sector agreements, of which two in particular are significant for the climate area. These two agreements are: 1) a renewable energy/climate-sector agreement aiming to create financial incentives to choose green technologies etc., and 2) a coal-sector agreement limiting public export financing of coal-fired power plants.

Both agreements are being revised during 2021. Denmark holds the opinion that export financing related to thermal coal should be stopped. The European Commission presently holds the same opinion but there is disagreement among the EU Member States. Agreement within the EU is necessary if the EU is to make proposals within the OECD.

Denmark's Green Future Fund will support the green transition both nationally and internationally

Denmark's Green Future Fund was established in 2020 and has as its objective to finance and invest in businesses and projects that contribute to a national and global green transition. The fund has at its disposal more than DKK 25 billion distributed across four state-owned institutions: EKF, Denmark’s Export Credit Agency; IFU (investment fund for developing countries); the Danish Green Investment Fund; and Vaekstfonden (growth fund). According to the experience and calculations (EMF, 2020) of these four institutions, Denmark's Green Future Fund is expected to leverage up to DKK 85 billion in private financing. Denmark's Green Future Fund could therefore facilitate up to a total of DKK 110 billion in financing of green businesses and projects.

The majority the DKK 25 billion, more precisely DKK 15 billion, has been earmarked to support green projects and businesses internationally through EKF (DKK 14 billion) and IFU (DKK 1 billion). The remaining DKK 10 billion has been earmarked for the Danish Green Investment Fund (DKK 6 billion) and Vaekstfonden (DKK 4 billion) mainly to support the green transition and innovation in Denmark. However, such support could lead to the development of new green products and services that are subsequently deployed globally.

The EU taxonomy for sustainable investment and other assessment criteria of relevance to national and global green transition efforts will be included when projects and businesses financed under Denmark's Green Future Fund are to be assessed with regard to their potential to contribute to the green transition (DGF, 2020).

The legal basis for Denmark's Green Future Fund was laid down in September 2020. At the moment therefore, there is no basis for actual reporting on the fund's international investments in Global Report 2021. However, it is expected that future reports will be based on the report submitted to the Advisory Board for Denmark's Green Future Fund[43].

Greater focus on the climate in international banks co-owned by Denmark

Denmark is co-owner of several international banks. Part of the mandate of these banks is to finance the global sustainability transition. International banks help to finance specific projects at private businesses and in countries, regions and local governments. They also help set the direction for the green transition in general. Furthermore, international banks are important for the development of the financial markets for sustainable financing, including the market for green bonds. Some international banks have a clear focus on developing countries (for a description of the multilateral development banks, see section 6.1 on Danish climate assistance), while others offer loans and financing to a broader group of countries. See Box 25 for an overview of these banks and their climate focus.

Box 25: Overview of international banks with Danish engagements

The European Investment Bank (EIB) is owned by the EU Member States and the European Commission and primarily provides loan financing to countries and private businesses. The objective of the bank is to promote Europe's job and growth potentials, support climate change mitigation initiatives, and promote EU's policies outside of the EU. Around 90% of the bank's activities are within the EU. The EIB's ambition is to be a climate bank and it aims to ensure that, from 2025, half of its lending goes to environmentally sustainable investments, and that, from 1 January 2021, its financing of new projects aligns with the goals of the Paris Agreement. The EIB will stop its financing of fossil fuels by the end of 2021.

The Nordic Investment Bank (NIB) is owned by the five Nordic and the three Baltic countries, and, like the EIB, the bank provides financing to both public authorities (local, regional and central governments) and private businesses. The overarching mandate of NIB is to boost productivity and the green transition in the Nordic and Baltic countries.

The European Bank for Reconstruction and Development (EBRD) is a development bank owned by 61 countries and two international institutions. The bank's objective is to finance the construction of market economies in 30 countries in Central Europe and Central Asia. The EBRD aims to have most its investments in the green transition before 2025. Among other things, this will be through its Green Economy Transition (GET) initiative, which is to support a green, inclusive and resilient economic recovery from the Covid-19 pandemic.

[43] An advisory body in the form of an Advisory Board will be established to ensure the best possible conditions for future work by Denmark's Green Future Fund. More specifically, the board will be tasked with reporting on progress and total green impacts. (FM, 2020a).

6. Danish climate assistance and bilateral energy and environment cooperation

Denmark is among the world's green transition pioneers, but only accounts for 0.1% of global greenhouse gas emissions itself[44]. Denmark therefore seeks to contribute further to the global green transition and climate change adaptation through climate assistance and authority cooperation throughout the world.

This chapter describes the impacts of Danish climate assistance and authority cooperation aiming at supporting the green transition. The chapter presents sections on *climate cooperation and climate finance for developing countries*, on *bilateral energy cooperation,* and on *bilateral environmental cooperation*. Finally, there is a section on *other climate diplomacy initiatives.*

Denmark provides support to promote a green transformation in developing and cooperation countries through a wide range of diverse measures intended to help accelerate green ambitions and facilitate a more climate-adapted trajectory in the countries in general. Danish contributions to reducing greenhouse gas emissions, etc. cannot be determined with any precision, because, in practice, the cooperation countries themselves decide and implement any changes. The impacts of Danish climate assistance and bilateral energy and environmental cooperation are therefore illustrated here through specific country examples. For each country example, there is a description of how Danish initiatives are contributing to promoting the green transition and climate change adaptation, and how Danish efforts are providing support for general development in these countries towards greener and more climate-adapted societies in line with the goals of the Paris Agreement.

6.1 Climate cooperation and climate finance for developing countries

Denmark supports developing countries in their green transition and climate change adaptation efforts. The support is delivered as climate assistance in conjunction with development cooperation and by facilitating climate finance through the development banks and IFU (investment fund for developing countries). Development cooperation actively supports the Paris Agreement *and* helps to promote the UN Sustainable Development Goals. Danish climate finance supports higher climate ambitions globally. Furthermore, it ensures that Denmark honours its international obligations under the United Nations Framework Convention for Climate Change to support the climate

[44] Based on IEA Data Services, see Table 9.

ambitions of developing countries, and to mobilise finance for climate projects in developing countries, including contributing to the collective goal with regard to developing countries of mobilising USD 100 billion annually from 2020 (KEFM, 2021).

The need for support differs considerably from developing country to developing country, and so there is also a great difference with regard to the best way for Denmark to deploy its strongholds and competences to help the individual countries. This is reflected in the strategic prioritisations of climate assistance and choices of policy instruments in different types of country. The poorest countries, e.g. in Africa, have the greatest need for support in their efforts to tackle the consequences of climate change. For example, this could be help to tackle water and food scarcity and help to become more resilient to climate change. In the poorest countries, there is also an enormous potential for positive synergies between a green energy revolution and attainment of other sustainable development goals that will be important for reducing emissions levels in the countries in the longer term. In contrast, greenhouse gas emission reductions initiatives in large growth economies have the greatest impact on global emissions in the short term.

Overview of Danish climate assistance and climate finance for developing countries

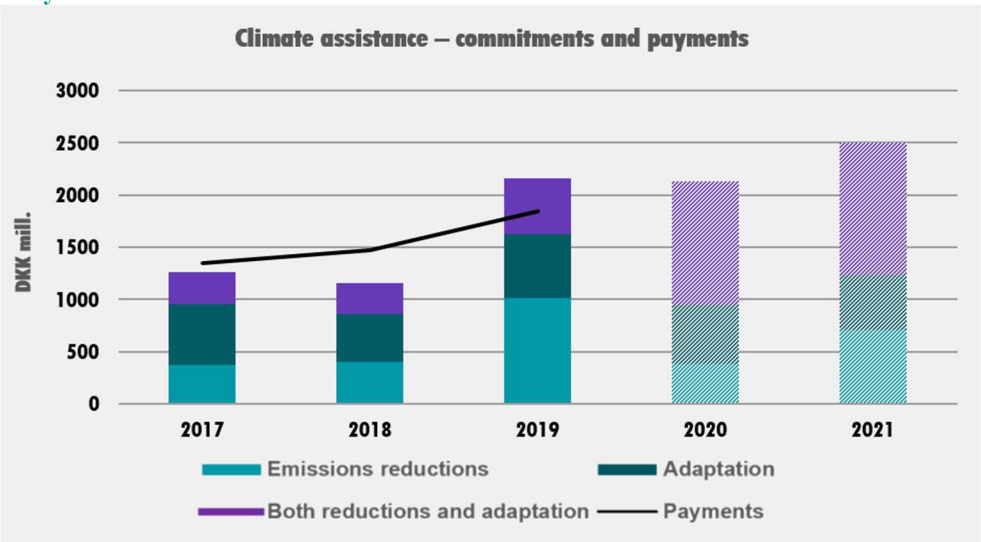
Danish bilateral climate assistance and contributions to multilateral climate funds have increased in recent years

Total Danish climate assistance during the development framework period 2017-2021[45] is shown in Figure 22. Danish climate assistance increased considerably from around DKK 1.3 billion in 2017 to around DKK 2.2 billion in 2019. Assistance in 2020 is expected to be at the same prominent level as in 2019 and to increase to around 2.5 billion in 2021.

There has been an appropriate balance between initiatives underpinning climate change adaptation and initiatives aimed at reducing emissions in the longer term. In 2019, a few large energy projects, e.g. a large wind turbine project, Assela, in Ethiopia, shifted the balance towards emission reductions Such fluctuations are bound to occur when calculating climate assistance as annual commitments. Figure 22 also shows the scope of initiatives that support *both* climate change adaptation and emission reductions. In particular, these initiatives entail contributions to international climate foundations and programmes such as the Green Climate Fund.

[45] Climate assistance during the development framework period 2017-2019 has been calculated on the basis of notified commitments. For the period 2020-2021, climate assistance has been calculated on the basis of expected new commitments on the basis of the respective Finance Bills.

Figure 22: Commitments of new grants for bilateral projects and contributions to dedicated climate funds in each year in the period and actual payments in the years.



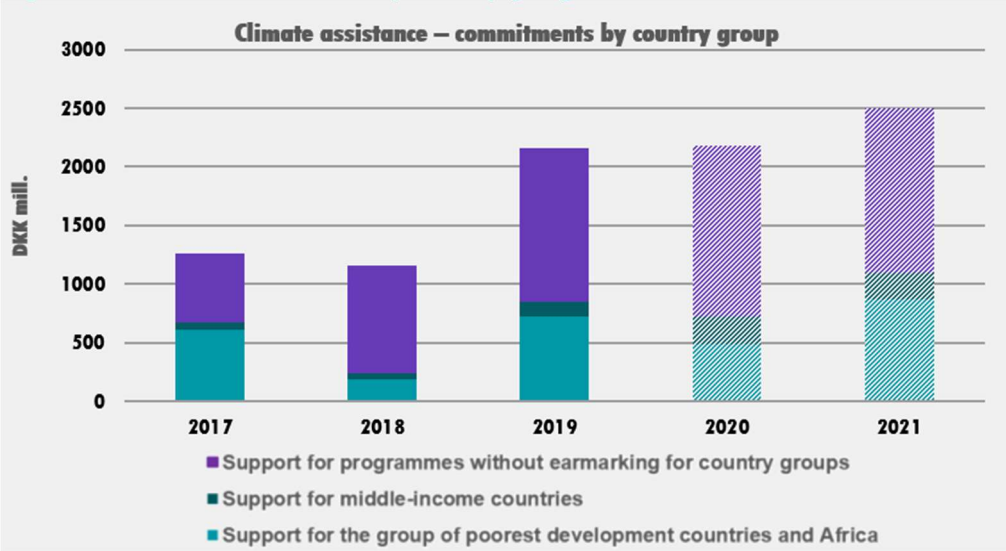
Note: Figures for 2020 and 2021 are based on the respective Finance Bills.

Many new projects have been launched in 2020 on topics ranging from climate change adaptation to green transition. See Annex 4 for examples.

Danish climate assistance focussed on the poorest countries

Total Danish climate assistance by country group is shown in Figure 23. With regard to the share of climate assistance that goes directly to specific developing countries, there is a clear overweight of support for the poorest developing countries, in Africa in particular. A relatively large share of support is channelled through various multilateral or regional programmes and climate funds, and this share of support cannot readily be broken down by country groups. However, like with the bilateral support, the programmes that Denmark chooses to support will typically focus on the poorest developing countries.

Figure 23: Annual commitments by country group



Note: Figures for 2020 and 2021 are based on the respective Finance Bills.

Denmark mobilises climate finance through development banks and from the private sector

In addition to bilateral climate assistance and support to dedicated climate funds and programmes, Denmark also contributes to mobilising climate finance through its engagement in the multilateral development banks and through a series of bilateral instruments, such as IFU (investment fund for developing countries).

Denmark has been a forerunner with regard to instigating and testing new instruments to mobilise climate finance for developing countries from institutional investors. IFU, which is owned by the Ministry of Foreign Affairs of Denmark, manages the Danish Climate Investment Fund and the Danish SDG Fund. Private investors, primarily Danish pension funds, have contributed 60% of IFU's total capital of near to DKK 5 billion. The investment partnerships between public and private players (known as blended finance) contribute to attracting private investors and to realising projects in developing countries that would otherwise not have been financed, because large investments in unknown markets are often considered risky.

In the period 2017 to 2019, IFU mobilised DKK 1,332 million in private co-finance for climate projects, see Table 7. There are considerable year-to-year fluctuations because the total amount depends on a few large projects.

Table 7: Bilaterally mobilised climate finance (DKK mill.)

	2017	2018	2019
IFU investments (IFU's own funds)	449	299	408
Co-finance mobilised from private investors	750	315	267
Total	**1,199**	**614**	**675**

Source: Calculated by IFU.

The multilateral finance institutions and the EU's global programmes are essential instruments for Denmark in mobilising both public and private climate finance for

developing countries. More than half of the climate finance that the OECD countries mobilise for climate investments in developing countries takes place through the multilateral development banks (OECD, 2020). According to information from the development banks, Denmark's share in the banks' mobilisation of investments was in excess of DKK 3.5 billion in 2018, see Table 8. Figures for 2019 are not yet available. Initiatives to promote a climate focus in multilateral development banks are described in Box 26.

Denmark also contributes to climate finance for developing countries via EU climate assistance[46]. EU climate assistance has increased steadily in recent years, and made up around 20% the EU's total international cooperation budget in the period 2013 to 2020. In the upcoming long-term EU budget, climate finance is expected to account for at least 30% of the international cooperation budget (EU, 2021). In addition to the instruments and sources mentioned above, Denmark contributes to mobilising climate finance for developing countries through EKF, Denmark's Export Credit Agency, for example. See chapter 5 for further information.

Table 8: Multilaterally mobilised climate finance (DKK mill.)

	2017	2018	2019
Mobilised public finance in development banks (attributed to Denmark) [47]	Around 2,500	Around 2,500	*
Mobilised private finance in development banks (attributed to Denmark) [48]	Around 1,000	Around 1,000	*
Climate finance through the EU's global instruments (attributed to Denmark) [49]	409	384	362

Note: * Figures for 2019 are not yet available.

Box 26: Multilateral development banks should support the Paris Agreement

In cooperation with other countries, Denmark has been pushing for multilateral development banks like the World Bank and the African Development Bank to support the targets of the Paris Agreement. An important priority for Denmark is that the development banks stop all new investments in fossil fuels and increase their investments in renewable energy. Recent years have seen a positive development in this area in most of the banks. In future, it will be important to ensure that development banks improve their reporting and monitoring with regard to their climate commitments, including that they document their contribution to reducing greenhouse gas emissions across their portfolios and activities. Already today, the World Bank is able to report its contribution to global greenhouse gas emission reductions based on measuring its investments that go specifically to emission reduction initiatives. For each of the fiscal years 2019 and 2020, the World Bank's emission reductions were thus 133 million tonnes CO_2e (WB, 2020).

[46] In the table, Denmark's share in EU climate finance has been calculated on the basis of Denmark's share of the total EU budget and the European Development Fund.
[47] The share attributed to Denmark has been calculated on the basis of Denmark's ownership share and annual contribution to the individual banks as indicated by the OECD.
[48] The share attributed to Denmark has been calculated on the basis of Denmark's ownership share and annual contribution to the individual banks as indicated by the OECD.
[49] In the table, Denmark's share in EU climate finance has been calculated on the basis of Denmark's share of the total EU budget and the European Development Fund.

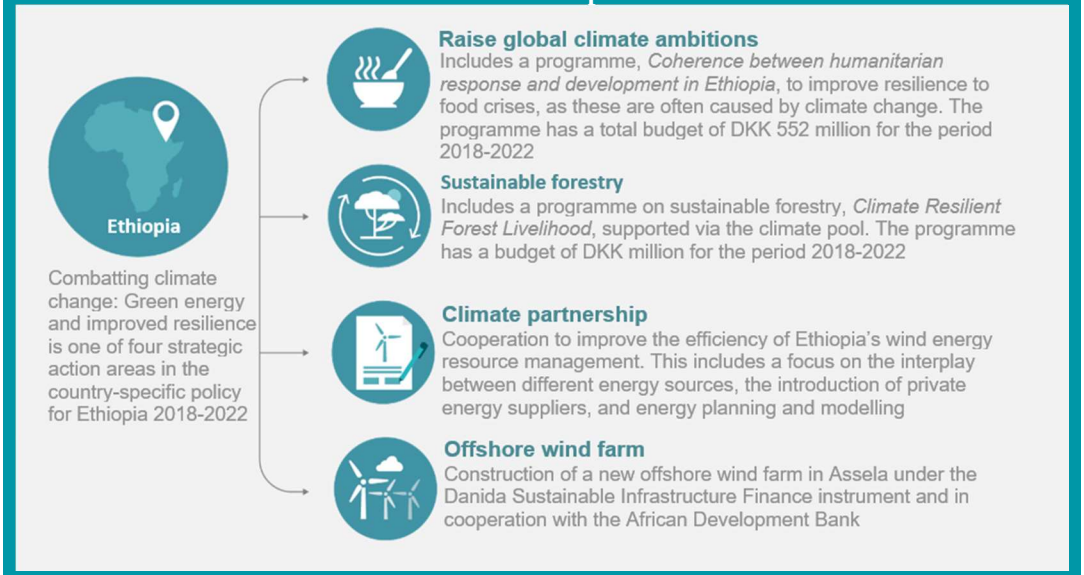
Results of climate assistance

Climate assistance supports the partnership countries in transitioning to a trajectory that conforms with the targets of the Paris Agreement. This is illustrated through case descriptions of Danish climate action in two partnership countries, Kenya and Ethiopia, and through the Green Climate Fund, Denmark's central multilateral climate finance institution, see boxes 27-29. The cases presented in the annual global impact reports will change from year to year, and all important partnership countries and multilateral players will therefore be presented over the years.

Box 27: Case describing the results of Danish climate assistance in Ethiopia

Ethiopia is experiencing climate change in the form of changes in precipitation patterns and periods with drought, for example. Denmark is helping Ethiopia to adapt to climate change and to achieve emission reductions through several initiatives, see illustration below.

Illustration 12: Danish climate assistance to Ethiopia



Danish activities interact with Ethiopia's strategy for a climate resilient green economy by 2025. Ethiopia focusses not only on greenhouse gas emission reductions, but also on safeguarding sustainable and poverty-reducing growth with no increase in greenhouse gas emissions. In addition to the bilateral activities, the strategy is being supported multilaterally through activities in the context of the Global Green Growth Institute (GGGI).

Through the Productive Safety Net Program (PSNP), Denmark supports efforts to combat climate-related food insecurity for eight million Ethiopians in areas affected by drought.

The agriculture programme supported by Denmark is involved in developing climate-smart agriculture through better management and exploitation of water resources, enhanced cultivation techniques, and climate alerts for farmers.

Sustainable forestry is another adaptation focus. In this context, Denmark supports work to secure an income for populations in and around forest areas, while also helping improve natural resources management so that the carbon removals by forests is preserved and increased.

Furthermore, since 2017, Denmark has supported authority cooperation efforts between the Danish Energy Agency and Energinet and their Ethiopian counterparts. These efforts focus on energy planning and energy modelling, as well as on deployment of wind power through tendering procedures. They also focus on integrating wind into the energy system. Finally, complementary to authority cooperation initiatives, a wind farm is being established in Ethiopia through Danida Sustainable Infrastructure Finance (DSIF).

Box 28: Case describing the results of Danish climate assistance in Kenya

KENYA

The Kenyan economy is extremely vulnerable to climate change because it depends extensively on natural resources and agricultural production. Natural disasters such as drought and flooding, in particular, but also more long-term changes in precipitation patterns and rising temperatures are threatening the livelihood of millions of Kenyans. The effects of climate change are exacerbated by a steep population growth and non-sustainable exploitation of natural resources.

Against this background, a green transition and climate change adaptation are key to Denmark's strategy for authority cooperation with Kenya in the period 2021-2025. More specifically, the strategic goals are to promote green, sustainable growth benefiting all the population, and to promote resilience, peace and stability by supporting access to water and local sustainable job opportunities in vulnerable local communities in northern Kenya. This includes focus on innovative climate solutions, de-carbonising the economy, safeguarding ecosystems against natural disasters, green jobs and a circular economy.

Danish cooperation with Kenya builds on a number of different instruments, including the bilateral country programme, authority cooperation, cooperation with businesses and NGOs, as well as support to multilateral organisations including UNEP. Three elements in Danish climate assistance are particularly worth highlighting:

1) Denmark supports climate change adaptation in the agricultural sector through assistance to the Kenya Climate Innovation Centre, for example, which offers consultancy and support to small and medium-sized businesses developing climate-smart solutions.
2) Denmark supports the Northern Rangelands Trust (NRT), a member organisation for, currently, 39 local communities in protected habitat sites in the dry, northern regions of Kenya. The NRT covers 42,000 km^2 and a population of around 320,000 (UM, 2021). The project helps increase resilience to climate change and to conflicts caused by ever decreasing natural resources. Furthermore, it helps the populations to more sustainable lifestyles and livelihoods.
3) Climate change is causing insufficient water supplies in cities and structural water scarcity and intermittency in dry and partially dry rural areas. For millions of Kenyans this means lack of access to clean drinking water and water for livestock and agricultural production. Denmark is working to improve access to water and sustainable water resources management. More specifically, since 2016, the project has helped to give around 90,000 people better access to water. A new, large project under Danida Sustainable Investment Finance (DSIF) will provide access to clean drinking water for up to 250,000 people in urban areas.

Box 29: Green Climate Fund (GCF) case

Establishment of the Green Climate Fund was decided at the UN climate summit in Copenhagen (COP15) in 2009. Since 2015, the GCF board has approved 173 projects in more than 100 countries with a total budget of USD 30.2 billion, of which GCF funds account for USD 8.3 billion. The projects that have been approved distribute equally across emissions reduction and climate change adaptation projects and are expected to lead to reduced vulnerability to climate change for 498 million people, and a total of 1.8 billion tonnes CO_2e avoided (in comparison, Denmark emits around 50 tonnes CO_2e annually GCF, 2021)). In 2019, Denmark and 29 other countries pledged to contribute more funds to the fund to guarantee climate change action. The countries pledged to contribute almost USD 10 billion up to 2023, of which DKK 800 million was pledged by Denmark, doubling Denmark's previous contribution.

The fund is an important player in efforts to mobilise climate finance for the poorest and most vulnerable developing countries, and the fund is therefore instrumental in increasing the ambitions of the nationally determined contributions (NDCs), when these are to be revised and notified to the United National Framework Convention on Climate Change during 2020 and 2021.

Examples of projects supported by the GCF:

- Climate change adaptation and protection of Uganda's wetlands: The project aims to improve wetlands management in Uganda. Through nature-based solutions, the project contributes to climate change adaptation by protecting important ecosystems, by supporting the local population with alternative sources of income and by increasing the potential for greater greenhouse gas removals by wetlands. The project is expected to provide improved resilience to climate change for around 4 million people.
- Energy efficiency in Vietnam: The project aims to increase investments in energy efficiency in Vietnam's industrial sector. Through guarantees and technical assistance, the project contributes to removing some of the market barriers impeding large investments in energy efficiency improvements. The project also helps build capacity at relevant authorities.

Improved resilience to drought in Ethiopia: The project aims to provide access to clean water and irrigation for rural populations so as to increase their resilience to drought and other climate change. The project will support solar-driven water pumps and small irrigation systems, and ensure improved soil and land management near water sources. The project is expected to provide improved resilience to drought and climate change for around 1.3 million people.

6.2 Bilateral energy cooperation

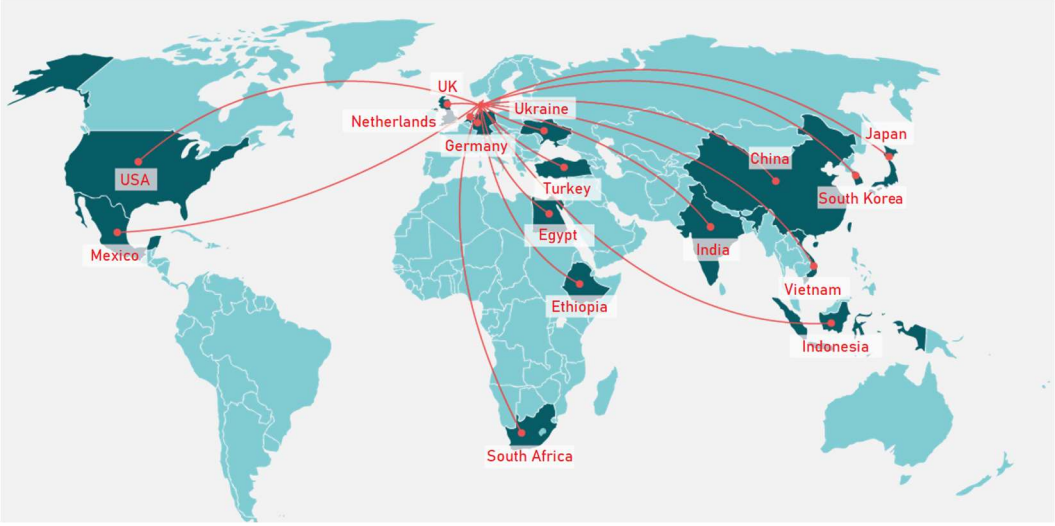
Drawing on Danish public authority experience, and in cooperation with a number of partnership countries, the Danish Energy Agency is committed to identifying and developing visionary energy planning as well as effective instruments to meet the temperature targets of the Paris Agreement and ensure good conditions for green growth. Since 2012, Denmark has entered into partnerships with 16 countries (see Illustration 13), which together represent more than 60% of global CO_2 emissions (see Table 9.)

Denmark contributes the following core competences to bilateral energy cooperation:

- Long-term energy planning

- Integration of renewable energy
- Wind energy (offshore wind, in particular)
- Energy efficiency
- District heating

Illustration 13: Denmark's 16 partnership countries in bilateral energy cooperation



The bilateral energy cooperation in which the Danish Energy Agency participates can roughly be divided into two overall categories: cooperation financed through development assistance[50] and cooperation primarily focusing on export promotion[51]. Both categories of cooperation have a twofold purpose: The overarching focus of all cooperation is to help with the green and sustainable transformation of the energy sector in the relevant partnership countries and to ensure greenhouse gas emissions reductions. In addition to this, assistance-financed programmes focus on development perspectives in the cooperation countries, while programmes in the OECD countries focus on promoting Danish exports of green-energy technology and services. In general, all of the programmes build on authority cooperation that aims to inspire and build authority competences through a high degree of technical and specialist support and development. Sector consultants stationed at embassies play a key role in ensuring cohesion between technical initiatives concerning a green transition, foreign policy and economic diplomacy.

CO_2 emissions, energy indicators and political targets in partnership countries[52]

Need to speed up long-term green transition in partnership countries

[50] This applies to the programmes in China, South Africa, Mexico, Indonesia, Vietnam, Ethiopia, Egypt, India, Ukraine and Turkey.
[51] This applies to the programmes in the US, South Korea, the Netherlands, Germany, the UK and Japan.
[52] Quantitative data collected about the partnership countries suggests a number of trends. The quantitative calculations are based on figures from the International Energy Agency (IEA) and the International Renewable Energy Agency (IRENA), The quantitative data is supplemented by an overview of currently notified climate targets under the United Nations Framework Convention on Climate Change (also referred to as nationally determined contributions (NDCs)) and political targets for renewable energy and for climate neutrality from national political plans and agreements.

Since 1990, the partnership countries have seen a general trend of increasing emissions of CO_2 coupled with increasing population numbers and increasing wealth, see Table 9. The primary aim of cooperation between the Danish Energy Agency and the partnership countries is to ensure fewer emissions from these countries than would otherwise be the case, and to support the countries' possibilities of a future comprehensive green transition. Through bilateral energy cooperation, Denmark therefore provides consultancy on increased use of renewable energy and on energy planning, and at the same time helps to build capacity in the partnership countries to improve their possibilities for implementing and possibly even raising their NDC reduction targets[53], and to make a long-term goal of carbon neutrality realistic, see Box 30 and Annex 5.

Table 9: Trend in CO_2 emissions in cooperation countries

	CO_2 emissions (million tonnes CO_2)[54]					CO_2 emissions per capita (tonnes CO_2/capita)		
	1990	2018	Percentage change (1990-2018)	Share of global CO_2 emissions (1990)	Share of global CO_2 emissions (2018)	1990	2018	Percentage change (1990-2018)
Denmark (reference)	51	32	-37%	0.2%	0.1%	9.9	5.5	-44%
Egypt	78	224	+187%	0.4%	0.7%	1.4	2.3	+64%
Ethiopia	2	13	+550%	0.01%	0.04%	0.05	0.12	+140%
India	530	2,308	+335%	2.6%	6.9%	0.6	1.7	+183%
Indonesia	131	543	+315%	0.6%	1.6%	0.7	2.0	+186%
Japan	1,054	1,081	+3%	5.1%	3.2%	8.5	8.6	+1%
China	2,089	9,528	+356%	10.2%	28.4%	1.8	6.8	+278%
Mexico	257	449	+75%	1.3%	1.3%	3.0	3.6	+22%
Netherlands	148	151	+2%	0.7%	0.5%	9.9	8.8	-11%
United Kingdom	549	352	-36%	2.7%	1.1%	9.6	5.3	-45%
South Africa	244	428	+75%	1.2%	1.3%	6.6	7.4	+12%
South Korea	232	606	+161%	1.1%	1.8%	5.4	11.7	+117%
Turkey	129	374	+190%	0.6%	1.1%	2.3	4.6	+100%
Germany	940	696	-26%	4.6%	2.1%	11.8	8.4	-29%
Ukraine	689	182	-74%	3.4%	0.5%	13.3	4.1	-69%
USA	4,803	4,921	+2%	23.4%	14.7%	19.2	15.0	-22%
Vietnam	17	227	+1235%	0.08%	0.7%	0.3	2.4	+700%
Total for all cooperation countries	11,892	21,819	+83%	58.0%	65.1%	94.6	92.9	-1.8%
The entire world (reference)	20,516	33,513	+63%	100%	100%	3.9	4.4	+12.8%

Phasing in renewable energy is key

The world's total final energy consumption increased by 58.6% between 1990 and 2018 (IEA, 2020a). Global energy demand is expected to continue to increase by around 9% between 2019 and 2030, driven by increased energy demand in South-East Asia, Africa

[53] Nationally determined contributions (NDCs) include the climate targets notified by the countries under the UNFCCC.
[54] Figures for CO_2 emissions are generally based on IEA Data Services (13 April 2021), i.e. figures for CO_2 emissions from fuel combustion. The figures are therefore excluding non-energy-based CO_2 emissions. such as CO_2 emissions from industrial processes and waste management.

and Central and South America in particular (IEA, 2020). Table 10[55] provides an overview of renewable energy (RE) and coal use in the 16 partnership countries.

The general trend in the renewable energy share in electricity has been positive since 2010. South Africa, the United Kingdom, South Korea and Ethiopia in particular have seen high percentage increases in their RE shares in electricity production, while China and the USA lead the way in the absolute increase of RE electricity production. Meeting the continued increasing demand for energy requires an energy-efficient system that can support the massive phase-in of renewables, because otherwise part of the increased growth in energy demand is likely to be met by coal and other fossil fuels in line with historical trends.

Table 10: Trends in coal consumption and renewable energy production in cooperation countries

	Final coal consumption (PJ)[56]			RE electricity production (TWh) (IRE, 2020)		
	1990	2018	Percentage change (1990-2018)	2010	2018	Percentage change (2010-2018)
Denmark (reference)	18.2	5.6	-69%	12.4	20.8	+68%
Egypt	14.8	130.4	+781%	14.4	15.9	+10%
Ethiopia	N/A[57]	16.0	N/A	5.0	13.3	+166%
India	1,601.2	4,463.6	+179%	140.4	235.7	+68%
Indonesia	63.8	616.1	+866%	33.7	40.4	+20%
Japan	1,133.5	889.3	-22%	112.0	176.7	+58%
China	13,037.9	26,624.0	+104%	780.0	1,811.2	+132%
Mexico	45.5	136.3	+200%	45.7	54.8	+20%
Netherlands	62.5	34.7	-44%	11.2	18.9	+69%
United Kingdom	465.3	87.4	-81%	26.2	108.1	+313%
South Africa	684.4	773.7	+13%	2.2	12.8	+482%
South Korea	490.6	393.8	-20%	6.2	23.1	+273%
Turkey	328.6	442.5	+35%	55.7	97.8	+76%
Germany	2,335.3	279.0	-88%	105.2	224.8	+114%
Ukraine	1,024.5	244.3	-76%	12.9	13.8	+7%
USA	2,330.2	704.9	-70%	440.7	743.2	+69%
Vietnam	55.6	593.3	+967%	36.7	86.0	+134%
Total for all cooperation countries	23,673.8	36,429.3	+54%	1,828.1	3,676.2	+101%
The entire world (reference)	31,316.3	41,598.1	+33%	4,202.0	6,586.1	+57%

Differentiated political targets across partnership countries

[55] The statistics on renewable energy are based on trends from 2010 and onwards, as IRENA's Renewable Energy Statistics Report 2020 is based on the period 2010-2018. (IRE, 2020a).

[56] **Final coal consumption is based on the IEA indicator *"Total Final Consumption (TFC) by source"* (13 April 2021). Oil equivalents (ktoe) have been converted to petajoules (PJ) using the IEA's own conversion tool**

[57] The IEA does not have data on Ethiopian coal consumption before 2008. For this reason there is no data reporting for 1990 and therefore a percentage change cannot be calculated.

The partnership countries differ with regard to the basis for, and wording of, their political targets. Annex 5 shows an overview of the various political targets of the countries broken down into three categories:

1. The countries' NDC reduction targets notified under the United Nations Framework Convention for Climate Change (UNFCCC). For all EU Member States, the EU's total climate target of at least 55% reduction in greenhouse gas emissions in 2030 relative to the 1990 level applies. For comparison, Box 30 shows the NDC reduction targets of selected non-EU partnership countries.
2. Official target for renewable energy.
3. Political announcements about climate neutrality or net zero emissions in a given year.

Several of the reduction targets of the developing countries entail a conditional target that can be realised through adequate financial and technical assistance from the industrialised countries. This is where Denmark can contribute with technical assistance, capacity building and knowledge and technology transfer to raise the probability of the conditional reduction targets being realised and possibly raising the unconditional reduction targets in future. Furthermore, Danish core competences within long-term energy planning and effective integration of renewables, for example, can contribute to greater certainty and stronger outsets for policy-making for energy targets.

Box 30: The NDC reduction targets of selected partnership countries

China
China has set an unconditional reduction target that its CO_2 emissions peak no later than in 2030 and that its carbon intensity of GDP be reduced by 60-65% compared with the 2005 level.

India
India has set an unconditional reduction target that its emission intensity of GDP be reduced by 33-35% by 2030 compared to 2005.

Japan
Japan has set an unconditional reduction target for a 26% reduction in greenhouse gas emissions in 2030 compared to the 2013 level.

Indonesia

Indonesia has set an unconditional reduction target of 29% CO_2 emissions in 2030 compared with a 'business-as-usual' scenario[58]. This target could be increased to 41% assuming international support (conditional reduction target).

Examples of initiatives in partnership countries

The examples in boxes 31-33 illustrate the results of Danish bilateral energy cooperation. The examples have been selected to reflect the diversity of bilateral energy cooperation across Danish core competences, partnership countries and types of programme. However, authority cooperation only serves to inspire and guide the relevant authorities' work on a green transition. There is therefore no guarantee that authority cooperation will actually be realised in the form of emissions reductions in the partnership countries. Denmark contributes to improving the basis for reducing emissions, but the partnership countries themselves are responsible for political and regulatory decisions that lead to emissions reductions.

Box 31: Energy cooperation with China

CHINA: More flexible coal plants benefit the green transition

China is the world's largest emitter of CO_2 but is also the country investing the most in renewable energy. Transitioning towards a fossil-fuel-free society, increasingly reliant on intermittent wind energy requires Chinese coal plants that are able to react quickly to changes in wind energy production. Because wind energy, just as the wind itself, is changeable, advanced planning is needed to incorporate wind energy into a country's energy system to make sure the green energy is used optimally. This requires major changes to national energy planning and this is a challenge to many of the world's largest emitters of CO_2, including China. In 2016, 17% of China's total wind energy production never made it to consumers because the energy system was unable to manage the electricity optimally (LUC, 2018). This would be equal to more than 80% of the EU's offshore-wind-based electricity production in 2016 never reaching consumers.

Danish experience shows the way

Among other things, the Danish-Chinese energy partnership supports increasing the flexibility of Chinese coal plants. This has led to more green energy in the electricity system. The most recent figures show that the total renewable energy wasted has been reduced from 17% in 2016 to 7% in 2018. This corresponds to 22 million tonnes CO_2 per year[59]. Denmark has built strong competences for ensuring optimal integration of wind energy in energy systems, e.g. through the right incentives to make power plants more flexible and able to quickly adjust biomass and coal burning according to changing wind conditions.

Through cooperation with the China National Energy Administration, the Danish Energy Agency has shared Denmark's experience on how authorities and coal plants alike can help spur development towards more flexible plants. Through capacity building and experience sharing with Chinese key players, the unique system concept of the Danish energy model has been transferred to the world's largest energy system.

[58] A business-as-usual scenario is a scenario for future activity patterns that assumes no significant changes in technology, finances or policy.
[59] Calculations performed by the Danish Energy Agency on the basis of statistics from China's National Energy Administration.

Authority cooperation boosts attractive green investment
Investing in the green transition requires long-term policy aims and stable framework conditions for renewable energy. In China, greater exploitation of wind energy production means that, on average, Chinese wind energy producers benefit from 93% of their electricity production instead of just 83%.[60] Along with technological advancements, which mean that onshore wind is now the cheapest new electricity production technology in China, flexibility at coal plants has been instrumental in making investment in Chinese wind projects far more attractive.

Box 32: Energy cooperation with Vietnam

VIETNAM: Danish experience with energy efficiency can contribute to large CO_2 emissions reductions in industry
Vietnam is the fourteenth most populous country in the world. In recent years, the country has experienced an enormous increase in energy consumption, with annual growth rates of around 5%. (EREA, 2019). This has led to a massive increase in the consumption of fossil fuels; coal in particular. The industrial sector is one of the most energy-intensive sectors in Vietnam. The sector emits around 75 million tonnes CO_2 annually[61], corresponding to more than one and a half times Denmark's total emissions (CO_2e) in 2019.

Vietnam has extensive and ambitious legislation in place to promote energy efficiency in industry, but an enormous potential remains for cost-effective CO_2 savings from energy efficiency improvements. The energy-efficiency improvement potential of the Vietnamese industrial sector is assessed to be at least 8% annually[62] if existing legislation is enforced. And with new methods, tools and incentives based on Danish experience, the likelihood of this potential being realised is now significantly higher. The annual CO_2 emissions reductions are expected to be at around 3 million tonnes.

The Vietnamese Ministry for Industry and Trade (MOIT), two partnership provinces (Dong Nai and Bac Giang) and the Danish Energy Agency have jointly developed procedures, guidelines and tools to support the implementation and enforcement of existing legislation throughout all 63 provinces in Vietnam. Furthermore, possibilities have been improved to map the effect of legislation on energy-efficiency improvements in all sectors, as well as to harvest the large energy-efficiency improvement potentials in energy-intensive industry. Vietnam is also achieving other major societal benefits, such as reduced air pollution, improved security of supply and fewer fuel imports.

Long-term partnership shows the way for Vietnam's green transition
In addition to underpinning industry regulation with regard to energy efficiency, Danish energy cooperation with Vietnam focuses on long-term future energy scenarios, integration of more renewable energy in the electricity system, and system and framework conditions for offshore wind. There is a considerable offshore wind potential in Vietnam, and Danish experience with

[60] Calculations performed by the Danish Energy Agency on the basis of statistics from China's National Energy Administration.
[61] Based on calculations performed by Viegand Maagøe for the Danish Energy Agency.
[62] Based on calculations performed by Viegand Maagøe for the Danish Energy Agency.

smoother approval procedures and stable long-term framework conditions is another element in the partnership with Vietnam.

Vietnam Energy Outlook 2019 (EOR19), which the Danish Energy Agency prepared in close cooperation with the Vietnamese energy authorities, identifies energy-efficiency improvements in industry up to 2030 and 2050 as a particularly cost-effective action area for Vietnam, rather than deployment of power plant capacity based on coal and imported fuels, for example. EOR19 also identifies the cheapest technology investments for Vietnam in renewable energy and energy efficiency in the short term and long term.

Box 33: Energy cooperation with the USA

USA: Improved framework conditions for offshore wind benefit the green transition
The USA is the second-largest emitter of greenhouse gases in the world and therefore plays a significant role in a global green transition. Many American states have ambitious climate targets that contribute to a green transition. Along the east coast alone, American states have pledged to establish more than 30 GW offshore wind up to 2035. If these ambitions are realised, 18 million American households will be supplied with green power. Furthermore, it will displace what amounts to 36 million tonnes of CO_2 emissions annually from energy consumption, corresponding to around 80% of total Danish emissions (CO_2e) in 2019.[63] During the next five years, the USA is expected to increase its offshore wind capacity to almost three-times Denmark's current capacity of just under 2.3 GW. For the USA to realise its ambitious deployment plans, there is a need for smooth and well-designed approval procedures and framework conditions.

Danish authority experience implemented in the USA
In recent years, the Danish Energy Agency has been working closely with the federal Bureau of Ocean Energy Management (BOEM), which is part of the U.S. Department of the Interior, and the states of New York, New Jersey and California. The main objective of the cooperation is to streamline and deregulate vital processes in the development of offshore wind projects so as to minimise risks for developers, investors and financial partners. The lower risk is helping to reduce the costs of establishing offshore wind farms. The results of Danish authority cooperation with the USA include more clearly defined and less voluminous material for environmental assessments, and case-processing times that have been reduced by half, from six to three years.

Authority cooperation supports Danish exports of green technologies
Authority cooperation between the USA and Denmark is not only expected to support a green transition in the USA, but also to indirectly support exports of Danish energy technology and knowhow to an attractive growth market. A study prepared by AWEA (American Wind Energy Association) in 2020 estimates that around DKK 350 billion will be invested in the American offshore wind sector up to 2030 (AWEA, 2020). Feedback from several Danish cooperation partners stresses that close cooperation between Danish authorities, organisations and businesses has been instrumental in expediting offshore wind deployment in the USA.

[63] Based on calculations performed by the Danish Energy Agency and the Danish Embassy in Washington D.C.

6.3 Bilateral environmental cooperation

The Danish Ministry of the Environment is participating in bilateral environmental cooperation with five developing countries[64]. The cooperation is being financed by Danish development assistance. The purpose of the five authority cooperation projects is to build relationships and share knowledge with authorities in other countries and through this contribute to solving specific environmental and climate problems.

Cooperation in the area of water and the environment is helping solve climate and environmental problems both directly and indirectly through capacity building (transfer of regulatory experience). In general, the projects do not entail commitments to specific results in terms of reducing climate impacts. However, it is expected that this authority cooperation will contribute considerably to reducing pollution and greenhouse gas emissions, and to increased environmental and nature protection.

Environmental regulation can be designed to stimulate synergies with climate action

Within water resources management, an efficient water supply, reduced water wastage, an energy-neutral and climate-neutral wastewater sector, recovery of nitrous oxide and methane in treatment processes, etc. could reduce energy consumption and greenhouse gas emissions. With the traditional water technologies, around 4% of a country's electricity consumption goes to the water sector (IEA, 2016), and in many countries throughout the world up to 50% water is wasted from catchment to consumer. Danish wastewater treatment plants today produce on average 88% of the energy they consume (MST, 2019), and Danish experience and technologies are expected to contribute to transforming an energy-using water sector into an energy-producing water sector in cooperation countries.

In the areas of waste and circular economy, waste collection, reduced consumption, improved recycling, etc. will reduce the need for energy to produce new products and resources, and will reduce the degasification of methane from landfills, biogas plants and composting facilities. Similarly, nature protection, land management and protection, and restoration of forests will contribute to emissions reductions and removals of greenhouse gases. A recent evaluation of reduction efforts in developing countries financed by Denmark (PAR, 2021) and (PAR, 2021a) suggests that initiatives to avoid deforestation, for example, can potentially have significant climate benefits. including many spin-off benefits such as biodiversity protection.

The examples in boxes 34-36 illustrate the results of Danish multilateral and bilateral environmental cooperation.

Box 34: Multilateral environmental cooperation: The Amsterdam Declarations Partnership

Denmark is part of the Amsterdam Declarations Partnership (ADP), the objective of which is to promote responsible, deforestation-free commodity chains for agricultural products such as

[64] The five cooperation partnerships are with India, China, South Africa in the area of water, and Indonesia and Kenya in the areas of waste and circular economy.

soybeans, palm oil and cocoa. The ADP was established in 2015 and, in addition to Denmark, includes Norway, the Netherlands, the United Kingdom, France, Italy, Belgium, Germany and Spain. Denmark joined the partnership from the start, and by doing so it also ratified the Amsterdam Declarations on Deforestation and Palm Oil.

Box 35: Environmental cooperation with India

India: Water efficiency

Denmark's upcoming sector cooperation with India in the water area is expected to focus primarily on reduction of water losses. For many years, the Danish water sector has been successfully reducing water losses in the piping system and Denmark's average water loss has therefore been reduced to 5.6%. (MiM, 2020). In addition to water losses globally constituting an enormous loss of resources, the energy used to treat and transport the water is also wasted when the water never reaches the consumer.

In the Indian capital of Delhi, it is estimated that up to 40% of the drinking water is lost before it reaches the consumer (THI, 2016). This is primarily due to leaking pipe systems and water theft. Average water loss is more than 40% in most large cities in India (WB, 2014). Practical and administrative experience from Denmark will be brought into play in the Danish-Indian cooperation in order to reduce Indian water losses locally and also to provide results that can form the basis for positive developments at national level.

The Danish Ministry of the Environment has estimated that the water loss in Delhi means additional emissions in the region of 270,000 tonnes CO_2e per year[65] in the form of wasted energy, and therefore, Danish initiatives to reduce water losses in India may have an extremely positive climate impact.

Box 36: Environmental cooperation with Indonesia

Indonesia: Waste and the circular economy

Indonesia is one of the world's largest emitters of greenhouse gases. It has been estimated that in 2015 the country emitted 2.4 billion tonnes of greenhouse gases, including emissions caused by changes in land and forest use. Although Indonesia has ratified the Paris Agreement, the country is expected to increase emissions over the coming decades. (CB, 2019).

Waste is the fourth largest contributor to emissions in Indonesia and contributes 5-7% of total emissions for the country (CB, 2019). The Indonesian Ministry of Environment and Forestry assesses that half of the 65 million tonnes of waste generated every year ends in over-filled landfills, while the remaining is dumped in nature, the sea and inland waterways, or incinerated locally.

The Danish Ministry of the Environment's cooperation with Indonesia is both at national level, with focus on the national frameworks for waste management and the circular economy, and at a more regional level. Together with the Danish Energy Agency, the Danish Ministry of the

[65] Calculated on the basis of information in the article. (THI, 2016).

Environment is supporting the green transition and reduction of CO_2e emissions on the islands of Lombok and Riau by introducing solutions that couple effective waste management with energy production based on waste.

6.4 Other climate diplomacy initiatives

In addition to Danish initiatives globally through promoting green investments, promoting green exports, climate assistance, climate finance and bilateral authority cooperation, Denmark also participates actively in a number of climate-diplomacy contexts to increase climate ambitions and reduce global emissions. Among other things, this work is through bilateral cooperation (see Denmark's energy and environment cooperation), within the EU, through the EU, multilaterally and in partnerships and global initiatives.

This section provides a brief overview of selected larger climate-diplomacy activities in which Denmark has participated since the launch of the climate programme in the EU and globally. Global greenhouse gas emission reductions as a consequence of these activities cannot be quantified, but together they contribute to enhancing *a green agenda* globally.

Climate diplomacy initiatives in the EU

Denmark works for more ambitious and cost-effective climate and energy policy in the EU. Presentation of the European Commission's flagship project, the European Green Deal, in December 2019, set the direction for European cooperation. The direction can drive the green transition both in Denmark and in the EU, and at the same time function as a lever for global action, where the EU can put pressure on other countries to increase their contributions to the Paris Agreement. Common EU regulation also secures equal competition, and reduces the risk that businesses and jobs move out of a country and thus move emissions from one country to another. The Danish Government is working for ambitious implementation of the European Green Deal to help ensure that we reach the goal of a climate-neutral EU by 2050.

As part of the European Green Deal, in spring 2020, the European Commission presented a proposal for the first European Climate Law to make the EU's climate target for 2030 of at least 55%, as well as the 2050 goal of climate neutrality legally binding, and to establish the framework to ensure that the EU meets its goals. Denmark is working to ensure that, as soon as possible, we reach an ambitious agreement for the European Climate Law. Denmark has also made its mark in negotiations such as those to secure a good process for the mid-term goal in 2040, that the EU is to have negative emissions after 2050, and to transfer the Danish model for climate partnerships to European level.

The European Green Deal also included that the EU's 2030 climate target is to be increased from at least 50% up to 55%. With a group of like-minded countries, Denmark has worked for an ambitious increase in the EU's climate target for 2030 to at least 55% compared with the 1990 level. The European Council meeting on 11 December 2020 agreed to raise the EU's 2030 climate target from at least 40% to at least 55%. Denmark was also ready to support an even higher target of 65%, but it turned out that it was not possible to form an alliance with other Member States at this level of ambition.

In summer 2021, the European Commission is expected to present the "Fit for 55" package to realise the EU's higher climate target of at least 55% in EU climate and energy regulation, see Box 37. Up to the launch of the "Fit for 55" package in summer 2021, Denmark will work to ensure that the EU's 2030 target is implemented as ambitiously and cost-effectively as possible. In particular, there will be work to enhance the EU emissions trading system and extend it to road transport and heating for buildings, and to secure significantly stronger sector regulation by raising the CO_2 standards for light-duty vehicles. Work is also addressing possibilities to phase out petrol and diesel cars from 2030 at the latest.

The energy sector is pivotal in relation to ensuring fulfilment of the EU climate targets. In the energy area, there are efforts to raise the EU target for promotion of renewable energy (RE target) to 45% and the target for energy efficiency (EE target) to 40%.

Box 37: The European Commission's legislation package "Fit for 55" to revise EU climate and energy policy

In summer 2021, the European Commission is expected to present a legislation package to help realise a higher EU climate target of at a least 55% reduction compared with the 1990 level and set a course towards climate neutrality by no later than 2050. The Commission anticipates a bigger role for common European instruments and market-based regulation within all sectors up to 2030 and 2050 with regard to promoting a more cost-effective transition. The package is expected include legislation in the following areas:

- EU emissions trading system (ETS)
- Burden-sharing agreement for the non-ETS sectors
- Emissions and removals of CO_2 from land and forests (LULUCF)
- CO_2 requirements for cars and vans
- Carbon border adjustment mechanism
- Energy taxation directive
- Expansion of infrastructure for alternative motor fuels
- Renewable energy (RE)
- Energy efficiency (EE)
- Reductions in methane emissions from the energy sector
- Energy performance of buildings
- Third energy package for gas

Source: (EC, 2020).

Global climate diplomacy initiatives

As a consequence of Covid-19, the international climate negotiations under the United Nations Framework Convention on Climate Change (UNFCCC) and COP26 were deferred to 2021. However, many countries, including Denmark, continued to carry out global climate diplomacy to encourage parties, particularly major emitters, to submit updated nationally determined contributions (NDCs) and submit long-term development strategies for low emissions under the Paris Agreement. Denmark submitted its long-term low-emissions strategy at the end of 2020. A number of large emitters such as Japan, China and South Korea announced ambitious climate targets in 2020. Among other things, this climate diplomacy work takes place through the EU, which bilaterally pushes for more ambitious NDCs from a number of large emitters. Denmark contributes positively to EU work through its bilateral energy cooperation, in which Denmark can use its technical knowledge to implement any higher NDC ambitions. Furthermore, Denmark has worked actively to realise the EU's climate and energy diplomacy through focus on phasing out coal as part of strengthened global action to ensure a fair green transition. Moreover, Denmark has urged the EU to stronger climate cooperation with China; the world's largest emitter of greenhouse gases.

In January 2021, the Minister for Climate, Energy and Utilities was appointed to chair the International Energy Agency's new global commission on a just transition to green energy in the world. Furthermore, in January 2021 Denmark was appointed to a leading role in this work on the energy transition up to the UN High-Level Dialogue on Energy (Sustainable Development Goal 7) to take place under the UN General Assembly in September. In a number of fora, Denmark is also supporting the British presidency of COP26, including through participation in a British-led campaign for energy transition in a number of key countries in Africa and Asia. Denmark is also participating in technical and diplomatic

dialogues with partnership countries concerning Danish support for the transition of their energy sectors.

With the agreement to stop oil and gas exploration in the North Sea, 2020 also saw renewed momentum for a global debate on phasing out fossil production. In 2020, Denmark began work to take leadership in establishing an international initiative to phase out fossil production in cooperation with alliance partners. Denmark is also an active member of the Powering Past Coal Alliance to phase out coal globally. In 2020, Denmark worked actively to secure higher climate ambitions in the multilateral development banks, including that multilateral development banks' COVID-19 recovery funds should be invested in green solutions as part of the Nordic Build-Back-Better-and-Greener (BBBG) initiative.

Moreover, through a number of important multilateral climate and energy organisations and climate funds, Denmark is working to promote the green agenda. There is systematic work to ensure that Danish initiatives multilaterally supplement Danish bilateral climate action and interests. Examples of current Danish support for climate-change adaptation and reduction through international programmes and green multilateral organisations are listed in Annex 6.

In 2020, Denmark worked further on Danish-facilitated energy transition initiatives from the UN Climate Summit in September 2019, including the Cool Coalition on energy-efficient cooling and the private-sector-led Getting-to-Zero Coalition to launch CO_2e-neutral ships in 2030 and climate-neutral shipping in 2050. Denmark has subsequently prepared an initiative concerning an international shipping mission in the context of Mission Innovation, which will support cooperation between governments and the private sector on innovative green solutions in international shipping.

The significance of climate diplomacy for the other authority initiatives is described in Box 38.

Box 38: Climate diplomacy supports other authority initiatives

Climate diplomacy supports and complements technical bilateral cooperation, so that all instruments come into play in order to ensure a higher level of ambition and new policy decisions on the green transformation of cooperation countries. A number of Danish embassies have appointed climate front posts[66]. Climate front posts play a key role as the front line in Danish climate diplomacy, and they help realise the ambition of global Danish leadership in the green area. Climate front posts i) increase focus on climate and green issues across areas, from export promotion to development assistance, authority cooperation and public diplomacy, ii) put climate on the political agenda, including by raising Danish authority cooperation and development initiatives from the technical level to crucial decision fora, iii) integrate local climate action across sectors and instruments, making Danish-financed multilateral initiatives more visible and utilised in host countries, and iv) strengthen export promotion for green Danish technology and services.

[66] The following embassies have been appointed as climate front posts: Abu Dhabi, Addis Ababa, Beijing, Berlin, Brasilia, Cairo, the EU representation in Brussels, Hanoi, Jakarta, London, Mexico City, Nairobi, New Delhi, New York, Paris, Pretoria, Rome, Seoul, Tokyo, and Washington.

7. Political agreements with global climate impacts

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This chapter describes the possible effects of national political agreements and initiatives on global greenhouse gas emissions.

The 70% target in the Climate Act includes the territorial emissions, i.e. Danish emissions from Danish territory. When national political agreements are established and initiatives with climate impacts are implemented, the climate impacts are therefore only calculated for territorial emissions. Since the Agreement on a Climate Act was decided in December 2019, a number of national political agreements have been concluded. A national, partial reduction effect in 2030 from these agreements has been calculated at a total of 7.2 mill. tonnes CO_2e (including the decision to stop using coal at Fynsværket, which it has been estimated will reduce emissions by about 0.5 mill. tonnes CO_2e in 2030). These political agreements and initiatives may, however, also have a global climate impact, i.e. an impact which affects other countries' territorial emissions or the part of the shipping and aviation that is not included in the territorial emissions.

When developing national political agreements and initiatives with climate impacts, there is a requirement to estimate the national climate impacts. On the other hand, there are no requirements to estimate the global climate impacts. The guidelines from the Ministry of Climate, Energy and Utilities on climate impact assessments (KEFM, 2020) recommend, however, supplementing national impact assessments of initiatives with qualitative assessments of the global impacts of these initiatives.

Since the adoption of the Climate Act, 10 specific political agreements and initiatives have been decided that have been assessed also to have climate impacts outside of Danish borders.

6.5 Assessment of political agreements and initiatives

Several of the climate policy agreements and initiatives decided since December 2019 have been assessed to have global climate impacts in addition to the positive Danish territorial climate impacts. Table 11 summarises the direct qualitative assessments of the global climate impacts of national agreements and initiatives. The assessments are based on market theory and knowledge of the market at direct level, as it has not been possible to carry out specific calculations within the framework of Global Report 2021. The table is based on agreements and initiatives decided since adoption of the Agreement on the Climate Act in December 2019.

The initiatives in Table 11 have been assessed according to the following five criteria; 1) changes in the CO_2e footprint abroad, 2) LULUCF or iLUC impacts, 3) carbon leakage

effects, 4) the effects of EU regulation, and 5) changes in the price of renewable energy technology.

- *Changes in the CO_2e footprint* refer to direct changes in other countries' emissions. For example, this applies to reduced emissions abroad as a consequence of increased recycling in Denmark.
- The *LULUCF effects*, including iLUC, refers to both direct and indirect impacts within the LULUCF sector (i.e. carbon pools in soil and plants), which are calculated separately according to the UN definition.
- *Carbon leakage* refers to the situation in which Danish climate regulation that reduces emissions of greenhouse gases in Denmark can increase emissions of greenhouse gases in other countries.
- *The effects of EU regulation* refers to mechanisms following from EU regulation in the area, such as the EU Emissions Trading Scheme or the EU CO_2 requirements for the transport sector.
- *Changes in the price of renewable energy technology* refers to climate impacts as a result of changes in prices of renewable energy as a consequence of Danish policy such as promoting green technologies. If Danish initiatives reduce the price of renewable energy, all else being equal, this will increase use of renewable energy abroad, and this in turn will lead to greenhouse gas emission reductions.

Note that other countries' reduction commitments (e.g. under the Paris Agreement) can influence the global impacts of Danish political initiatives. Where other countries have binding reduction targets, any carbon leakage effect from Denmark, for example, will in principle not lead to a permanent increase in emissions abroad. This is because the increase is likely to be offset by political initiatives abroad to reduce emissions and thus meet their own reduction targets. For example, all EU Member States have set annual reduction pathways in the non-ETS sector.

Several of the initiatives have conflicting impacts. A comprehensive review of the direct assessed impacts is in Table 11.

Table 11: Political agreements and initiatives with global climate impacts since adoption of the Agreement on a Climate Act

Description of initiative	Overall assessment
Green road transport agreement (04.12.20)	
Change in the registration fee for cars and vans, and low electricity tax on recharging.	As a consequence of EU requirements for motor manufacturers, it has been assessed as possible that motor manufacturers will sell more conventional vehicles (and fewer green vehicles) to other EU countries in the event of larger sales of green vehicles in Denmark. On the positive side, the agreement is likely to support the phase-out scheme for conventional vehicles in the EU, as well as stronger CO_2 requirements for light-duty vehicles
CO_2 displacement requirement for fuel produced with renewable energy.	It is generally assessed that the initiative will lead to more demand for sustainable biofuels instead of the more conventional biofuels, and this may have a global reduction effect in the LULUCF sector. However, it has also been assessed that the CO_2 displacement requirement will increase the overall price of the fuels, and, all else being equal, this may have a derived effect on behaviour through increased cross-border trade. Moreover, the initiative may contribute to promoting use of fuels produced from renewable energy based on PtX, which will support global reductions in the LULUCF sector. Due to its badge value, it has also been assessed that the CO_2 displacement requirement could have a positive global climate impact, as it introduces technology-neutral

	regulation of fuels that focuses on reducing fuel emissions in a cradle-to-grave perspective and it takes into account the global impacts from biofuel production.
Kilometre-based and CO_2-differentiated road tax for heavy-duty vehicles.	It has been assessed that, to a limited degree, the initiative could promote demand for greener lorries, as differentiated road pricing will affect high-emission transport services the most. In addition to the effect on the Danish fleet of lorries, there may also be a derived, though little, effect on the fleet in Denmark's neighbouring countries, even though road pricing in Denmark will only mean little in relation to the total costs of a lorry. However, it is likely that differentiated road pricing will primarily have an effect on the use of the lorries, e.g. through efficiency improvements in transport (increase in load factors), or opting for new shorter routes. On the other hand, green lorries bought in Denmark will also have an impact on transport outside Denmark. Finally, the initiative could have a badge value, as it strongly reflects the 'polluter pays' principle, as the tax will be CO_2 differentiated. However, in this context it is crucial that those who utilise transport services also demand greener transport.
Agreement on the future for gas extraction in the North Sea (03.12.20).	
An end date has been fixed for Danish oil and gas extraction in the North Sea in 2050, and the 8th licensing round as well as all future licensing rounds have been cancelled.	The direct CO_2e impact is likely to be marginal. On the other hand it has been assessed that the agreement may have a long-term global reduction effect, as it may encourage other countries to also phase out their extraction of fossil fuels.
Green Procurement for a Green Future - Strategy for green public procurement (29.10.20)	
Every year, the public sector buys goods for DKK 380 billion.	It has been estimated that the initiatives in the strategy will have a reduction effect abroad, as they will contribute to more climate-friendly public procurement, of which two-thirds of emissions today are in other countries. For example, this applies to requirements regarding the overall economics of procurement, which will lead to longer product durability and requirements for ecolabelled procurement, which in turn will lead to higher recycling. Both of these will reduce extraction of natural resources abroad and the associated climate impact. The strategy also contains an initiative to require procurement that does not entail deforestation, and this will reduce emissions from land use (the LULUCF sector).
Climate agreement for energy and industry, etc. 2020 (22.06.2020) and Agreement on green tax reform (08.12.20)	
Increase in taxes on fossil fuels.	Higher taxes on Danish production will make foreign goods relatively cheaper and potentially lead to relocation (carbon leakage), increasing production in other countries. This can be avoided if Danish businesses are able to make themselves independent of the tax increase, for example by converting production to renewable energy or introducing energy-efficiency improvements in some other way.
Climate agreement for energy and industry, etc. 2020 (22.06.2020).	
Establishment of the world's first energy islands and other initiatives to promote electricity produced with renewable energy.	The deployment of renewable energy included in the agreement, and the associated exports of electricity, are likely to displace consumption of fossil energy in other countries (see section 3.4) and help place PtX products on the market. The climate impact of PtX products will depend on whether they displace biofuels or fossil fuels. How prices of renewable energy will be affected by the energy islands is as yet unknown. The energy islands are likely to have a long-term global reduction effect, as they may encourage other countries also to deploy further offshore wind capacity.
Promotion of future green technologies (PtX).	It has been assessed that this initiative will make production of green hydrogen cheaper. The initiative is generally assessed to support the development and use of the PtX technology area. If the technology gains ground abroad (e.g. through exports of technology or fuel), the initiative may lead to a reduction effect beyond Danish borders. However, note that the climate effect of PtX depends on whether PtX fuels displace fossil fuels. It has been assessed that targeted efforts could make Denmark a front-runner in the area.

Sustainability requirement for woody biomass for energy.	It has been assessed that this initiative could lead to a direct reduction effect in the LULUCF sector as a consequence of requirements for carbon savings in the production chain compared with fossil energy.
Climate plan for a green waste sector and circular economy (16.06.20)	
Increased and more streamlined waste separation, more recycling of plastic waste, a strong recycling sector, less waste and more circular economy.	More recycling means that the initiative is likely to reduce emissions from extracting and processing natural resources for new products. Products made from recycled raw materials have a significantly lower CO_2e footprint than products made with virgin raw materials.
Less incineration and lower imports of waste for incineration.	Denmark currently receives the majority of its imported waste from the UK and Germany, and since analyses suggest that there may be overcapacity in northern Europe at some time, it is likely that waste that is not incinerated in Denmark can be incinerated at other installations in northern Europe. The EU Waste Framework Directive and the European Commission's action plan for the circular economy entail stricter requirements for recycling in all EU countries.
An energy-neutral and climate-neutral water sector	It is generally assessed that following Danish examples may lead to reductions at global level. The Confederation of Danish Industry has previously assessed that this could lead to reductions of approx. 30 million tonnes CO_2e.
Pool for sustainable construction (Finance Act 21)	
The pool can be used to promote the development of sustainable building materials and machinery, promote more eco-labelling of products, etc.	It has been assessed that the initiative could increase demand for sustainable building materials, which are also produced abroad. This may lead to reduced emissions from extracting and processing natural resources for new products because of increased recycling and reuse as well as longer lifetimes and reduced consumption of materials.
Green housing agreement (19.05.20): Sustainable and digital social housing	
Promoting climate-friendly building materials and recycling building materials through a pool within the renovation budget of DKK 200 mill. in the period 2021-2026.	It has been assessed that the initiative could increase demand for sustainable building materials, which are also produced abroad. This may lead to reduced emissions from extracting and processing natural resources for new products because of increased recycling and reuse as well as longer lifetimes and reduced consumption of materials.
New green research strategy (28.09.2020) and an agreement on the distribution of the research reserve for 2021 (30.10.2020)	
Four missions: - Capture and storage or use of CO_2e (carbon capture) - Green fuels for transport and industry (Power-to-X) - Climate and environmentally friendly agriculture and food production - Recycling and reduction of plastic waste - Circular economy with focus on plastic and textiles	It is generally assessed that research into renewable energy technologies will make them cheaper, and, all else being equal, will enhance their competitiveness relative to fossil fuels. This could lead to reductions nationally and globally.
Decision to cancel allowances (non-ETS flexibility mechanism) (December 2019)	
Eight million allowances have been reported cancelled through the non-ETS flexibility mechanism. Overall, 8 million allowances have been cancelled for 2021 to 2030. How the cancellation will be used to meet targets has yet to be decided.	Removing the allowances from the EU Emissions Trading Scheme reduces the supply of allowances and the total emissions from the ETS sector will fall. The climate impacts will be phased in over a relatively long time, because there is a large surplus of allowances and because businesses can save up allowances and use them at a later stage. The climate impact will therefore take place as the surplus diminishes. The Danish Economic Councils and the Climate Council have calculated that cancelling the allowances will give rise to accumulated CO_2e reductions in the long term (after 2050) of 12 and 9 million tonnes, respectively. (KLR, 2018) and (DØR, 2018). These estimates are based on a number of uncertain assumptions, and they should be interpreted with caution.

Climate impact of changes in consumption

In addition to the initiatives mentioned in Table 11 a global climate impact is likely to result from changes in consumption because of reductions in growth during the Covid-19 pandemic. Similarly, a global climate impact is likely from the growth-promoting initiatives launched because of the Covid-19 pandemic. These impacts have not been assessed. Furthermore, global emissions arising as a consequence of major construction projects have not been assessed. Global emissions caused by Danish consumption are covered in chapter 2 on Denmark's consumption-based climate footprint.

Climate diplomacy and assistance

The political agreements and initiatives in Table 11 do not cover Danish EU efforts that underpin and contribute to the development of policies with positive climate impacts in EU Member States and thus have a global climate impact. Neither does Table 11 cover initiatives relating to climate diplomacy and assistance, but there is a detailed review of the area in chapter 6.

6.6 Perspectives

This section provides a qualitative description of the global climate impact of Danish policy initiatives. In the future, it may be advisable to work more meticulously and methodically with regard to quantifying the impacts. This will be a step on the way towards a method to calculate the global climate impacts of specific policy initiatives. This will require a more detailed definition of what is to be included, including with regard to the direct and indirect climate impacts, development of methods, as well as data collection. Furthermore, ensuring consistency and synergy will also require close coordination on the development of calculations of the consumption-based climate footprint (chapter 2). There are currently no specific plans for such method development.

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9. Glossary and abbreviations

Glossary

Biofuels: Fuels produced from biomass. If the biofuels are produced from crops that could alternatively be used for food or animal feed (e.g. rape, palm oil, soybeans, etc.) 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.

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) are 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: Covers 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.

The GHG Protocol is a voluntary and globally recognised standard to calculate greenhouse gases. It is used by businesses in particular. 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.

Export of energy services includes exports by consulting engineers and other technical advice from manufacturers of energy technology, for example energy planning, renewable energy and other energy tasks.

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

Energy islands: In the 2020 Climate Agreement for Energy and Industry, it was decided that Denmark is to establish 5 GW offshore wind power and supporting electricity transmissions links. Commonly referred to as the Danish energy islands. Energy islands mean that electricity from many offshore wind farms can be consolidated and transmitted directly from the energy island to several countries.

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

Greenwashing: When marketing uses words to convince the public on that an organisation's products, goals and policies are more green or sustainable than is actually the case.

Green energy technology covers 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, 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.

Hypothetical climate impact is the climate impact that can 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) are CO_2e emissions arising as a consequence of a business' activities related to its suppliers or customers.

Indirect land-use change - iLUC): Covers the land-use change that occurs indirectly, for example when an agricultural area is converted to cultivate crops for use in energy production. Since it is assumed that the global demand for agricultural goods following this conversion will remain unchanged, theoretically it would be attractive to cultivate agricultural crops elsewhere. Therefore, this may cause land-use change that could entail felling forests.

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 is the change in CO_2e emissions from a specific action.

Climate partnerships: 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.

Environmental technology constitutes 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.

Baseline scenario shows the amount of CO_2e emissions that would have been emitted if an energy-saving product had not been sold, for example.

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 the global impact reporting, the word taxonomy refers to the taxonomy that the European Commission has prepared as part of the Commission's work to set focus on sustainable investments. Taxonomy is thus a classification system for environmentally sustainable economic activities.

Territorial direct CO_2e emissions (from a business perspective) are 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 are 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 (see below).

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
GR21	Global Report 2021
HVO	Hydrotreated vegetable oil
IFU	Investment Fund for Developing Countries
IRENA	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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- Background memorandum for international transport in Global Report 2021
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Appendix 1
Legal basis for global impact reporting

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. Global Report 2021 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

Appendix 2
Cross-border electricity exchange – method and sensitivity analysis

Methodology
The climate impact of cross-border electricity exchange can be estimated on the basis of a marginal approach. The marginal approach entails examining the displacements in the European electricity system as a consequence of a marginal variation in Danish electricity imports/exports. For example, the approach examines what increased electricity exports from Denmark could entail in the form of reduced electricity production in Denmark's neighbouring countries. This can be assessed by using an electricity market model such as the Danish Energy Agency's Ramses model. Electricity exports can usually be increased with more deployment of electricity generation based on renewable energy in Denmark. With this adjustment, the model will re-optimise electricity production patterns at all installations in Denmark and abroad, and then calculate the total production of all installations. This makes it possible to see how production at foreign plants has changed as a consequence of the increased Danish exports. On the basis of this, the climate impact of the Danish exports can be calculated. The climate benefit arises when the increased exports from Denmark contribute to reducing electricity production from a less climate-friendly production unit abroad.

Global Report 2021 applies the marginal approach to calculating cross-border electricity exchange, as it is considered that the marginal approach is best suited to represent impacts and consequences of electricity trade. For example, the approach examines what increased electricity exports from Denmark could entail in the form of reduced electricity production in Denmark's neighbouring countries. The results have been produced with model calculations in the Danish Energy Agency's Ramses model and by using Denmark's Climate Status and Outlook 2021 (ENS, 2021a) as the baseline scenario. It has been attempted to illustrate the climate impact of Danish cross-border electricity exchange by modelling with the following variations compared with the baseline scenario:

- Danish electricity production capacity based on renewable energy is changed in the model by what corresponds to + 1 TWh of electricity production from offshore wind power relative to the baseline scenario in Denmark's Climate Status and Outlook 2021 (ENS, 2021a), equally distributed between western and eastern Denmark. The impact of the geographical location of the changed capacity as well as the size of the change is examined using sensitivity calculations.

- Danish electricity consumption is changed in the model by + 1 TWh relative to the baseline scenario in Denmark's Climate Status and Outlook 2021 (ENS, 2021a), equally distributed between western and eastern Denmark. The impact of the geographical location of the changed electricity consumption as well as the size of the change is examined using sensitivity calculations.

The changes are made annually from 2020 to 2030.

Results are stated in the form of hourly series for displacement of CO_2 emissions abroad in kg CO_2 per MWh net exports from Denmark (referred to as the emission factor in the main report).

The method differs from the adjustment for trade in electricity in the Danish Energy Agency's energy statistics and the 2018 Energy Agreement. Where these methods seek to describe how Denmark would change its electricity production if net cross-border electricity exchange were zero (which can be perceived as an internalisation of the global impact of Danish net electricity exports), the method in Global Report 2021 looks at how electricity abroad will adapt if Danish net electricity exports are changed.

Boundaries

The method used for the period up to 2030 assumes that electricity production capacity abroad is likely to develop over time, but that development will take place in the same way in all calculations, irrespective of changes in Danish exports. If Danish net electricity exports increase significantly, this may have an impact on the rate of coal phase-out in the continental electricity system. It may also mean that the planned deployment of renewable energy will be postponed. These impacts have not been included. For example, an increase in electricity consumption as a result of deployment of Power-to-X technologies provides a derived effect in the form of fuel saved elsewhere in the energy system. Moreover, it has not been taken into account that an increase in electricity consumption may be accompanied by corresponding deployment of renewable energy, so that the additional consumption can satisfied in a climate-friendly manner.

Calculation of energy islands

Energy islands agreed in Climate Agreement 2020 have not been included in the baseline scenario in Denmark's Climate Status and Outlook 2021 (ENS, 2021a). Denmark's Climate and Energy Outlook 2021 has calculated how, all else being equal, the implementation and commissioning of the energy islands at the beginning of 2030 will affect the Danish energy system with respect to domestic emissions, the renewables share in electricity consumption, and the electricity import-export balance. Global Report 2021 uses the calculation in Denmark's Climate and Energy Outlook 2021 to illustrate the global climate impact of the energy islands. Without any other changes in the model (i.e.

all-else-being-equal calculations) the energy islands have been included as fully established and connected on 1/1 2030 and only calculated for 2030 (see the sector memorandum under Denmark's Climate and Energy Outlook 2021 for more details):

- Energy island North Sea: 3 GW offshore wind power, 1.5 GW transmission link to Denmark, 1.5 GW transmission link to the Netherlands.
- Energy island East: 2 GW offshore wind power, 1 GW transmission link to Denmark, 1 GW transmission link to Germany.

Sensitivity analysis

A number of sensitivity analyses have been carried out regarding the central scenario to test the robustness of the results. The sensitivity calculations are based on the following six variations:

- Variation A: The entire change occurs in western Denmark (no change in eastern Denmark)
- Variation B: The entire change occurs in eastern Denmark (no change in western Denmark)
- Variation C: The size of the change is doubled
- Variation D: The size of the change is halved
- Variation E: More wind and precipitation Electricity production in all areas in the model is 110% for wind power and 115% for hydropower compared with the normal year.
- Variation F: Less wind and precipitation Electricity production in all areas in the model is 85% for wind power and hydropower compared with the normal year.

All variations are performed on each scenario (1 TWh increased net electricity exports and 1 TWh reduced net electricity exports). The results are shown in Table 12 below as the percentage of the CO_2 emission factor relative to the central scenario in 2030.

Table 12: The results of the sensitivity calculations for the variation increased net electricity exports (1 TWh more electricity production based on renewable energy (RE))

Variation	Emission factor in 2030 (kg CO_2/MWh electricity)	Variation relative to the central scenario
1 TWh more renewable energy (central scenario)	271	-
Variation A (only western Denmark)	277	+2%
Variation B (only eastern Denmark)	258	-5%
Variation C (2 TWh more RE)	267	-2%
Variation D (½ TWh more RE)	281	+4%
Variation E (more wind and precipitation)	163	-40%
Variation F (less wind and precipitation)	378	+40%

Table 13: The results of the sensitivity calculations for the variation reduced net electricity exports (1 TWh less electricity consumption)

Variation	Displacement factor in 2030 [kg CO_2/MWh electricity]	Variation relative to the central scenario
1 TWh more electricity consumption (central scenario)	330	-
Variation A (only western Denmark)	337	+2%
Variation B (only eastern Denmark)	333	+1%
Variation C (2 TWh more electricity consumption)	335	+1%
Variation D (½ TWh more electricity consumption)	333	+1%
Variation E (more wind and precipitation)	163	-50%
Variation F (less wind and precipitation)	378	+15%

On the basis of the sensitivity calculations, it has been concluded that the central scenarios (1 TWh increased net electricity exports and 1 TWh reduced net electricity exports, respectively) are robust with regard to whether the change is only in either eastern or western Denmark or in both, and with regard to the size of the change (variations A, B, C and D).

On the other hand, the sensitivity calculations show that the results are sensitive to weather conditions. More wind and precipitation give more wind and hydro power production abroad, and this will make the electricity Denmark displaces abroad greener, thereby reducing the CO_2 reduction significantly. However, if Denmark increases its electricity imports, the electricity imported from abroad will be greener, thereby reducing the climate impacts significantly. The opposite applies for less wind and precipitation.

Appendix 3
Danish exports of green environmental and energy technology

This annex contains details breaking down exports of environmental and energy technologies between technologies and the largest recipient countries. A more detailed description of the data basis for tables 14 and 15 below is in section 4.2.

As shown in Table 14 there was an increase in exports of green technology in the period 2017 to 2019. Exports of *environmental technology* increased from DKK 18.4 bn. in 2017 to DKK 19.6 bn. in 2019, while in the same period, exports of *energy technology*, increased from DKK 69.7 bn. to DKK 78.7 bn. The increase in exports of green environmental and energy technology is particularly due to advances in exports of wind power technology, which rose significantly in 2019 after a drop in 2018.

Table 14: Exports of environmental and energy technologies by technology

(DKK bn./yr.)	2017	2018	2019
Exports of green environmental technology total [A]	**18.4**	**18.6**	**19.6**
Of which, clean-air technology	6.1	6.3	6.9
Of which, water technology	13.9	14.0	14.8
Of which, waste technology	0.8	0.8	0.9
Exports of green energy technology total	**69.7**	**64.3**	**78.7**
Of which, district heating technology	2.2	2.2	2.5
Of which, bioenergy technology	9.4	9.3	9.5
Of which, wind power technology	48.2	43.1	54.5
Of which, other energy technology	10.0	9.8	12.2

[A] Because of overlaps in exports of clean air technology, water technology and waste technology, these do not add up to the total exports of environmental technology. The same applies for environmental and energy technology, for which there can also be an overlap in exports. The export figures for the sub-categories do not add up to total exports of environmental and energy technology because of these overlaps and due to rounding.

Germany is by far the largest recipient of Danish green environmental and energy technology, as seen in Table 15. In second and third places come China and Sweden, respectively for environmental technology and the United Kingdom and the Netherlands for energy technology. Generally, there is a large overlap between the top ten recipient countries for energy technology and the 16 countries that the Danish Energy Agency's

Centre for Global Cooperation works with on the green transition of the energy system (see section 4.2 for more details).

Table 15: Top 10 recipient countries for Danish green environmental and energy technology

	Exports of environmental technology [A]				Exports of energy technology [A]		
(DKK bn./yr.)	2017	2018	2019	(DKK bn./yr.)	2017	2018	2019
Germany	1.9	2.1	2.2	Germany	11.3	14.2	15.7
China	1.3	1.3	1.8	United Kingdom	16.3	8.7	10.5
Sweden	1.8	1.7	1.6	Netherlands	1.1	2.4	6.2
USA	1.4	1.4	1.6	USA	4.3	4.0	5.5
Netherlands	0.6	0.8	1	Sweden	3.1	3.9	5.2
Norway	0.8	0.9	0.9	Norway	3.0	2.8	4.3
France	0.7	0.6	0.7	China	3.1	3.0	3.2
United Kingdom	1.2	0.7	0.7	France	2.7	2.6	2.7
Italy	0.5	0.6	0.6	Poland	1.3	1.3	1.8
Poland	0.5	0.5	0.5	Ireland	0.6	0.7	1.4
Total	**10.2**	**10.1**	**11.1**	**Total**	**46.8**	**43.6**	**56.5**

[A] There is an overlap in exports of environmental and energy technologies and therefore these cannot be aggregated. Rounding is also a reason that the columns do not add up to "Total."

Appendix 4
Examples of new projects within climate assistance in 2020

Source: Ministry of Foreign Affairs of Denmark

Extension of authority cooperation in the field of energy
New phase in the Danish Energy Partnership Programme in Vietnam, South Africa, China, and Mexico, with a budget of DKK 250 million over five years. Furthermore, a new five-year programme in Indonesia of DKK 60 mill. These projects are being implemented by the Danish Energy Agency and contribute to the green transition with work on long-term planning, modelling and scenarios, further renewable energy deployment and energy efficiency improvements. The initiatives will be part of realisation of the ambition in the global climate strategy to strengthen energy cooperation with the largest emitters among the larger growth economies.
Uganda (Danida Sustainable Infrastructure Finance, DSIF), water for 1 mill. people powered by solar energy
With a grant of DKK 669 mill., Danida Sustainable Infrastructure Finance (DSIF) is supporting water utility and sludge treatment deployment in and around Kampala in Uganda. When the project is completed in 2025, the facility will be able to produce clean water for about 1 million people. The project will introduce solar energy to power the waterworks and secure energy efficiency in transporting drinking water. Two sludge treatment plants will ensure adequate treatment of 130,000m^3 sludge per year, which today is discharged directly into rivers and Lake Victoria.
NGO adaptation projects in Africa
Five NGO projects in Ethiopia, Niger and Uganda with total funding of DKK 45 mill. These projects focus on innovative approaches to climate change adaptation, development of climate resilience locally and creation of green jobs and earnings possibilities.
New contribution to the Least Developed Countries Fund
The LDCF was set up as a mechanism to support climate change adaptation in the world's poorest countries under the United Nations Framework Convention on Climate Change. With a new grant of DKK 210 mill. in 2020, Denmark's total contribution since the establishment of the fund amounts to DKK 737.4 mill. The fund has special focus on support to formulate and implement national climate change adaptation plans. Projects aim at making agriculture and food production more robust to climate change, for example, or improving management of water resources, nature and coastal areas.
IFU investment in solar energy in Africa
In 2020, IFU decided to invest around DKK 100 mill. in a solar energy development company which, through a leasing scheme, finances and operates large roof solar installations for businesses in several countries in Africa. The solar installations will secure stable and clean energy supplies, in contrast to the current situation in which the majority of electricity demand is covered by private small diesel generators because of inadequate and unstable grid supplies.
The International Union for Conservation of Nature (IUCN) nature-based climate change adaptation
Denmark is supporting work by the IUCN to stimulate wealth and welfare for people and nature with DKK 80 mill. from 2020-2024. The contribution is particularly to support the IUCN's initiatives for effective

climate change adaptation through the use of nature-based solutions, as well as work by the IUCN to ensure equal access to water resources and related ecosystem services.

Covid-19 package - green energy for health clinics in Africa

A Danish grant for the World Bank Energy Sector Management Assistance Program (ESMAP) of DKK 40 mill. will secure green energy for health clinics in Africa. More than 70% of health clinics in Africa, south of the Sahara currently have no access to a stable electricity supply, and 25% have no electricity installed at all. Electricity is important to keep Covid-19 vaccines cool and in the treatment of infected patients. The project is an example of how initiatives for the green transition and management of the Covid-19 health crisis can be combined.

Appendix 5
List of energy and climate-policy targets in countries where the Danish Energy Agency has established bilateral energy cooperation

Based on national climate and energy plans

	Nationally determined contributions (NDCs) (unconditional and possibly conditional) (UNFCCC, 2021)	*Official target for Renewable energy (RE)*	*Target of climate neutrality or net zero emissions*
Denmark (reference)	Part of the EU overall NDC.	100% RE in electricity consumption by 2030	Yes, EU target (2050)
Egypt	No specific reduction target. Focus on policies and sector action.	Target for RE share of the total electricity supply is 42% in 2035, measured as a percentage of the installed generation capacity.	No
Ethiopia	Conditional reduction target of 220.59 mill. tonnes CO_2e[67] greenhouse gas emissions in 2030, corresponding to a 53.5% reduction compared with a BAU scenario[68].	Already 100% renewable energy in the electricity grid today. Goal of 2500 MW wind in 2030.	Yes (no year)
India	Reduce emission intensity of GDP by 33–35% in 2030 compared with the 2005 level.	175 GW renewable energy in 2022 450 GW renewable energy in 2030	No
Indonesia	Unconditional reduction target of 29% of CO_2 emissions compared with a BAU scenario in 2030. Conditional reduction target of up to 41% with international support.	A renewables share in the primary energy mix of 23% in 2025 and 31% in 2050.	No
Japan	26% reduction in greenhouse gas emissions in 2030 compared to the 2013 level.	RE share of 22–24% in electricity supply in 2030	Yes (2050)
China	CO_2 emissions peak no later than 2030 and reduce carbon intensity of GDP by 60-65% compared with the 2005 level.	No targets at the present time. Targets expected in the 14th five-year plan (2021-2025) and 2035 vision.	Yes (2060)
Mexico	Unconditional reduction target for 2030 of 22% of greenhouse gas emissions compared with BAU. Conditional reduction target for greenhouse gases of up to 36% provided there is international support.	Target for *Clean Energy* share in electricity supply: 35% in 2024, increasing to 39.9% in 2033 and 50% in 2050.[69]	No
Netherlands	Part of the total EU NDC.	Renewable energy share in electricity supply of 70% in 2030	Yes, EU target (2050)
United Kingdom	68% reduction of greenhouse gases in 2030 compared to 1990 level	Target of 40 GW offshore wind power (including 1 GW floating) in 2030	Yes (2050)
South Africa	Limit annual greenhouse gas emissions in 2025-2030 to between 398-614 mill. tonnes CO_2e.	30,630 MW installed renewable energy capacity (38.89% of the total installed capacity) in 2030.	No
South Korea	37% reduction in greenhouse gas emissions compared to a BAU scenario in 2030.	Renewable energy share of 20% before 2030 and 30-35% before 2040. Including 12 GW installed offshore wind power by 2030	Yes (2050)
Turkey	21% reduction in greenhouse gas emissions compared to a BAU scenario in 2030.	Renewable energy share (in addition to hydropower) in electricity supply of 38.8% in 2023.	No

[67] CO_2 equivalents.
[68] A BAU scenario (business-as-usual) is a scenario for future activity patterns that assumes no significant changes in technology, finances or policy.
[69] 'Clean energy' in a Mexican context includes renewable energy sources, nuclear power and high-efficiency cogeneration.

Germany	Part of the total EU NDC	RE share in electricity supply of 65% in 2030	Yes, EU target (2050)
Ukraine	40% reduction in greenhouse gas emissions in 2030 (compared to 1990 level).	RE share of total primary energy supply (TPES) of 25% in 2035	No
USA	Acceded to the Paris Agreement again in 2021. NDC pending.	No targets at federal level.	Yes (2050)
Vietnam	Unconditional reduction target of 9% of CO_2e emissions compared with a BAU scenario in 2030. Conditional reduction target of up to 27% assuming international support.	Primary energy consumption: 32% in 2030 and 44% in 2050. Electricity production: 32% in 2030 and 43% in 2050.	No

Appendix 6
Examples of current Danish support for adaptation to and reduction of climate change through international programmes and green multilateral organisations

Programme	Description	Geographical focus	DK contribution	Timeframe
C40	C40 is a global network of the world's largest cities that have undertaken ambitious leadership and action to address climate change. The Danish contribution is to enable C40 to improve support for the cities' implementation of climate initiatives with focus on selected member cities in developing countries in Africa and Asia.	Focus on C40 member cities in Africa and in selected cities in Asia	DKK 67 million	2020-2024
Climate Technology Centre & Network (CTCN)	The CTCN is the operational arm of the UNFCCC Technology Mechanism operated by the UNEP. Demand-driven promotion of accelerated technological development and transfer, as well as stronger policy and regulatory environments on the basis of requests from developing countries in their efforts to achieve the climate targets in the Paris Agreement and the Sustainable Development Goals. The CTCN helps more	All developing countries	DKK 28 million	2020-2022

	than 100 countries with targeted reduction and adaptation interventions.			
Cool Coalition UNEP-Technical University of Denmark (DTU)	The Cool Coalition is a multi-stakeholder coalition connecting the Kigali Amendment to the Montreal Protocol, the Paris Agreement on Climate Change and the UN Sustainable Development Goals. UNEP is the secretariat. The Cool Coalition takes a holistic cross-sectoral approach to reducing emissions in the cooling sector by examining a wide range of solutions ranging from district cooling to nature-based solutions for high-efficiency and climate-friendly cooling technologies that use low or zero-GWP refrigerants and cooling chains to reduce food waste and to secure supplies of medicines and vaccines.	All developing countries	DKK 5 million	2019-2020
Energy Sector Management Assistance Programme (ESMAP)	The programme involves two components: 1) a core contribution and earmarked financing for the Clean Cooking Fund as well as priority areas, such as offshore wind power, and 2) prevention of Covid-19 and strengthening of the health infrastructure with sustainable energy.	Component 1: all developing countries, component 2: Africa	DKK 90 million DKK 40 million	2020-2024
Energy Sector Management Assistance Programme (ESMAP)	Financing targeting the Clean Cooking Fund and water supplies powered by solar modules in rural areas in Tanzania.	Tanzania	DKK 90 million	2021-2025
Global Climate Partnership Fund (GCPF)	The GCPF uses public funds to support private capital to mitigate climate change and create sustainable growth in developing and growth markets. The GCPF invests primarily through local financing institutions, but also directly.	The GCPF prioritises developing countries with the largest greenhouse gas emissions and the largest potentials to increase efficiency.	DKK 40 million (2011) DKK 25 million (2014)	2011/2014 - unlimited

Global Environment Facility (GEF)	The GEF was established in 1992 and it is used as financing mechanisms for the Rio Conventions. GEF funds are available for developing countries with transition economies to meet international environment conventions and agreements. GEF support is granted to national authorities, civil-society organisations (CSOs), businesses in the private sector, research institutes to implement projects and programmes in recipient countries.	All developing countries (max. 10% for other countries, in particular small island states)	DKK 450 million	2018-2022
Global Green Growth Institute (GGGI)	The GGGI is an intergovernmental organisation which supports developing countries to adjust their economies to a green growth model through strategies focused on poverty reduction, social inclusion, environmental sustainability and economic growth. Danish support is composed of a core contribution (DKK 45 million) and programme-earmarked contributions (DKK 35 million) to renewable energy and resilience in selected countries in Africa and Asia.	Regional GGGI member states + earmarked focus on Burkina Faso, Ethiopia, Uganda, India, Indonesia, Thailand	DKK 80 million	2020-2022
Global Water Security and Sanitation Partnership (GWSP)	The Global Water Security and Sanitation Partnership (GWSP) is a multi-donor management fund administered by the World Bank. The GWSP was launched in 2017 to help governments to achieve sustainable development goal 6 and other water-related goals, driven by the overall vision of a world with secure water supplies for all.	All developing countries	DKK 70 million	2018-2022
Green Climate Fund (GCF)	The largest international climate fund, dedicated to supporting developing countries with emissions	All developing countries	DKK 800 million	2020-2022

	reductions and adaptation to climate change, with insight into the needs of developing countries that are particularly vulnerable to the negative impacts of climate change.			
IEA Clean Energy Transitions Programme (CETP)	Under the CETP, the IEA uses its unique expertise across all types of energy and technologies to accelerate the energy transition in larger developing economies. The CETP's activities include analytical work, technical assistance, training and capacity building, as well as strategic dialogue with cooperation countries. Danish support has special focus on energy efficiency and the Energy Efficiency in the Emerging Economies programme (E4).	Brazil, India, Indonesia, China, Mexico and South Africa	1) DKK 25 million	1) 2018-2020
International Renewable Energy Agency (IRENA) long-term energy planning	This programme supports partnership countries and regions, including the rapidly growing ASEAN region, where energy demand is expected to double by 2025, to increase their ambitions regarding renewable energy and targets for the energy transition. The energy transition will be accelerated through increased awareness of the socio-economic benefits (such as jobs, welfare, growth in GDP and Nexus benefits in other sectors, e.g. water) from increasing deployment of renewable energy.	ASEAN (Brunei, Cambodia, Indonesia, Laos, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam)	DKK 40 million	2019-2021
International Renewable Energy Agency (IRENA) Small Island Developing States (SIDS) Lighthouse 2.0	IRENA supports the Small Iceland Developing States (SIDS) in their green energy transition that will reduce greenhouse gas emissions, strengthen resilience through adaptation to climate change, as well as enhance energy security. The support thus helps the SIDS meet their NDC targets and realise the UN SDGs.	Small island states that are also developing countries	DKK 50 million	2019-2022

International Union for the Conservation of Nature (IUCN)	Danish support for the IUCN aims to contribute to the development of low-carbon, inclusive, climate-resilient societies based on transforming and inclusive green growth. Specifically, support is for the IUCN programme for 2021-24 to collectively mobilise to deliver a clear and inspirational contribution to the UN Sustainable Development Goals, the global post-2020 framework for biodiversity, and the Paris Agreement in developing countries.	All developing countries	DKK 80 million	2020 - 2024
Least Developed Countries Fund (LDCF)	The fund was established in 2001 and it is administrated by the Global Environmental Facility. It supports the world's most exposed countries in their efforts to adapt to the impacts of climate change. The LDCF is the only fund dedicated to supporting climate change adaptation with focus on the least developed countries. The LDCF supports preparation and implementation of the National Adaptation Programme of Action (NAPA) and the National Adaptation Plans (NAPs). Denmark is the sixth-largest contributor to the fund.	Active portfolio in 2019 in 43 of the world's poorest and the least developed countries	DKK 150 million DKK 210 million	2019-2020 2020 -2021
NDC Partnership	The NDC Partnership supports developing countries to raise their ambitions and improve implementation of their NDCs in line with the long-term development plans for the UN Sustainable Development Goals. This includes reduction as well as adaptation/resilience.	All developing countries	DKK 35 million	2020 - 2022
Nordic Development Fund (NDF)	Refinancing the Nordic Development Fund 2021-2030. Support for low-carbon adaptation to climate change in developing countries.	All developing countries	DKK 568.5 million	2021 - 2030

OECD Clean Energy Finance and Investment Mobilisation Programme	The programme addresses important shortcomings which restrict the mobilisation of urgent investments in clean energy to achieve the climate targets in the Paris Agreement. Interventions at national level have been designed to meet national demand, policy conditions and capacity limitations.	Vietnam, India, Indonesia, Colombia, Thailand	DKK 35 million	2019-2023
Partnering for Green Growth and the Global Goals (P4G)	P4G is a global initiative with a mission to become the world's leading forum for the development of public-private partnerships at large scale in order to achieve the UN Sustainable Development Goals and the Paris Agreement. P4G contributes to the SDG agenda with focus on five SDGs: food and agriculture (SDG 2), water (SDG 6), energy (SDG 7), cities (SDG 11) and the circular economy (SDG 12). P4G has 12 member countries and six partner organisations, including the Global Green Growth Institute (GGGI), the Cities Climate Leadership Group (C40), the World Economic Forum (WEF), the UN Global Compact, the International Finance Corporation (IFC), and the World Resources Institute (WRI).	Bangladesh, Colombia, Ethiopia, Indonesia, Kenya, Mexico, South Africa, Vietnam	DKK 265 million	2018-2020
Sustainable Energy for Africa (SEFA)	Additional financing to support green energy investment, small electricity grids and energy efficiency in Africa.	Africa	DKK 100 million	2021 - 2025
Sustainable Energy for All (SEforALL)	SEforALL is an international NGO whose CEO is the Special Representative of the UN Secretary-General for Sustainable Energy for All and co-chair of UN Energy. Focuses on promoting the SDG 7 agenda at international and national levels, which entails access to energy,	All developing countries, particularly in Africa	DKK 10 million	2019-2021

	renewable energy, energy efficiency, and the overall energy transition as well as SDG 7 financing and the role as agent for SDG 7 interventions, particularly concerning access to energy and energy efficiency. SEforALL is the co-founder of the Climate Investment Platform in cooperation with the GCF, IRENA and UNDP.			
The International Institute for Sustainable Development (IISD) - the Global Subsidies Initiative (GSI) support for Fossil Fuel Subsidy Reform and Clean Energy Transition	The IISD Global Subsidies Initiative (GSI) supports international processes, national authorities and civil society organisations with a view to ensuring that subsidies are in accordance with the principle of sustainable development. The GSI has been at the forefront of initiatives to support subsidy reforms since 2005.	Selected developing countries, including poor countries such as Bangladesh and Mali.	DKK 20 million	2019-2023
UN Environment Programme	Core contribution	Global	DKK 90 million	2019-2021
UNEP-DHI Partnership	The UNEP-DHI centre on Water and Environment is a United Nations Environment Programme (UNEP) centre of expertise, dedicated to improving the management, development and use of fresh water from local to global level.	All developing countries	DKK 32 million	2018-2022
UNEP-DTU Partnership (UDP)	Technical assistance (TA) to help developing countries improve their NDCs with regard to both reduction and adaptation, as well as technology needs assessments (TNAs) linked to the NDCs. UNEP-DTU also draws up the emission gap and the adaptation gap reports for UNEP before COPs and develops a measurement, verification and reporting (MVR) framework to increase transparency of contributions from the private sector to NDCs for use in selected regions. The partnership is an	All developing countries	DKK 78 million	2018-2021

	anchor for energy efficiency for SEforALL's energy efficiency accelerators and it contributes to the three percent club.			
World Bank Climate Investment Fund's Technical Assistance Facility for Clean Energy Investment Mobilization	Technical Assistance (TA) Facility for Clean Energy Investment Mobilization under CIF. Focus areas: 1) Renewable electricity production; 2) Energy efficiency improvements in buildings and industry; 3) System integration of renewable electricity. The TA facility supports technical assistance and institutional capacity building to assist developing countries to attract investment and mobilise private capital for clean energy.	Developing countries, focus on countries and interventions with a high reduction potential.	DKK 95 million	2019-2022
World Resources Institute	The WRI is a leading international think tank with focus on the climate-development nexus and the green transition. Danish support focuses on progress in attaining the climate goals in the Paris Agreement and the UN Sustainable Development Goals through strong analytical work and knowledge-based solutions that create global results, with particular focus on Africa.	Global - Danish support focuses on Africa.	DKK 75 million	2018-2022