



Denmark's
Draft
Integrated
National Energy and Climate Plan

under the
REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
on the Governance of the Energy Union and Climate Action

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Part 1: General framework

SECTION A: NATIONAL PLAN



1. OVERVIEW AND PROCESS FOR ESTABLISHING THE PLAN

1.1 Executive Summary

(i) Political, economic, environmental, and social context of the plan

Denmark is a frontrunner within the green energy transition with a large share of renewable energy in the system, high security of supply and great focus on energy efficiency and research and innovation. The current Danish Government has in June 2018 reached a political energy agreement between the Government (the Liberal Party of Denmark, Liberal Alliance and the Conservative People's Party), and all other Parties of the Danish Parliament (Social Democrats, the Danish People's Party, the Red-Green Alliance, the Alternative, the Social Liberal Party and the Socialist People's Party) to further build Denmark's international positions of strength with a focus on renewable energy, energy efficiency improvements, research and development and energy regulation. The agreement establishes a professional and efficient energy sector as the basis for the transition to a sustainable green society. All of the political parties of the Danish Parliament thus agree to maintain the pace of the green transition.

The agreement aims to ensure a market-driven green transition. Technological advances and competition to deliver renewable energy have made it realistic to envision a scenario in the near future where green solutions can be delivered on commercial terms. This has served as a strong motivating factor in the efforts to establish Denmark's position as the world's leading offshore wind nation. Offshore wind is expected to be able to generate green electricity on market conditions without state subsidies within just a few years. On this basis, a decision has been made to establish three offshore wind farms by 2030, which will serve as a substantial contribution to the green transition.

To ensure that renewable energy becomes Denmark's predominant source of electricity within the foreseeable future, as well as an increasingly utilised primary energy source for heating, technology-neutral energy tender processes involving solar PV, land-based wind, offshore wind near coasts and other technologies will be conducted in the coming years. The expansion of renewable energy capacity will need to contribute to the cheapest possible future production of green energy, thus benefitting Danish society as a whole.

The green transition encompasses both the energy sector and climate policy. Therefore, there is agreement among all political parties that Denmark will work towards net zero emissions, in accordance with the Paris Agreement, and advocate for the adoption of a target of net zero emissions in the EU and Denmark by 2050 at the latest. During recent years, there have been announcements made



by energy companies in Denmark to phase out coal before 2030. It has been agreed between all political parties to phase out coal in electricity production between now and 2030.

The parties in the energy agreement have allocated funding that sets a course towards a RE (renewable energy) share of approximately 55% by 2030. The agreement also aims to give Denmark a RE share in electricity above 100% of consumption, and ensure that at least 90% of district heating consumption is based on energy sources other than coal, oil or gas by 2030. The parties agree to monitor developments closely throughout the agreement period (2020-2024).

Furthermore, the parties of the Energy Agreement agreed on the need to reduce energy taxes to encourage more people to choose green solutions such as heat pumps, which can also promote a more flexible and integrated energy system and better utilisation of surplus heat.

The Energy Agreement also represents an important step in an ambitious climate agenda, including the allocation of government funding to support green solutions in the transport sector.

Furthermore, on 9 October 2018 the government published its Climate and Air Proposal “Together for a greener future” with additional measures for reducing both greenhouse gas emissions and air pollution.

The Government is working for a climate-neutral society by 2050, which means that at least as much greenhouse gas as emitted will be absorbed.

This is a highly ambitious goal. A step towards achieving the goal will be a Denmark without cars driven by fossil fuels. All of the cars, busses and taxis in our city streets today must eventually be replaced by alternative vehicles with zero greenhouse gas emissions.

The government is taking a dual-track approach to achieving this goal by making it even more attractive to drive low-emission vehicles than at present, and by setting a clear political goal with end dates for the sale of new petrol and diesel vehicles. This sends an unequivocal signal to the car industry that the time has come to speed up the pace of technological advances.

Climate impacts and air pollution from the agricultural production must be reduced to even lower levels. The best existing solutions must be adopted and implemented as far and wide as possible, and research into new technologies, products and agricultural methods must be conducted. New solutions that targeted research efforts are capable of delivering is needed.



In the follow-up of the 2016 Government Platform and the announced climate strategy, the government published its Climate and Air proposal “Together for a greener future” on 9 October 2018.

The government’s aim is to keep Denmark at the global forefront of environmental policy. The government wants to ensure that Danes continue to enjoy access to clean air and a stable climate, while steering development towards green solutions in Denmark, Europe, and around the world. These aims will be pursued through a series of initiatives that put Denmark on course for reaching its climate goals in the EU by 2030. These initiatives also push towards the ambitious goal of a climate-neutral Denmark by 2050, where Denmark is absorbing at least as much greenhouse gas as it is emitting.

The climate and air proposal “Together for a greener future” calls on all Danes to come together and embrace a shared responsibility for our planet. The proposal takes shape through 38 concrete initiatives to ensure cleaner transport in cities and the countryside, efficient and modern agriculture, more environmentally-friendly shipping, and a green transition in housing and industry.

The climate and air proposal includes the following initiatives:

The last petrol and diesel car will be sold in 2030

- C1) Phase-out of sales of new petrol and diesel cars in 2030, and of new plug-in hybrid cars in 2035.
- C2) A commission for the transition to green cars must show the way.
- C3) No registration tax in 2019 and 2020 on green cars priced below 400,000 DKK.
- C4) Lower taxation on green company cars.
- C5) Charging a low-emission car must be faster.
- C6) Greater powers for municipalities to grant parking discounts for low-emission cars.
- C7) Ensuring parking spaces with charging stations for low-emission cars.
- C8) Denmark’s municipalities can grant low-emission cars permission to drive in bus lanes.
- C9) Research into the dynamics between electric cars and the energy system.

Cleaner transport in cities and the countryside

- C10) An end to carbon emissions and air pollution from busses in Denmark’s cities by 2030 – starting with the first step in 2020, where new buses must be CO₂-neutral.
- C11) Clean air in Denmark’s big cities – bringing environmental zones up to date.
- C12) Petrol and diesel out of taxi operations by 2030.
- C13) Benefits for green taxis.

- C14) Higher scrapping premium for old diesel cars.
- C15) Putting an end to NOx fraud.
- C16) All new asphalt on national roads must be climate-friendly, if an ongoing pilot project can confirm the expected effects and durability of the asphalt.
- C17) More biofuel in petrol and diesel.

More environmentally-friendly shipping at sea and in port

- C18) More environmentally-friendly cruise tourism in the Baltic Sea.
- C19) Monitoring of sulphur emissions in Danish waters.

An efficient and modern agricultural sector

- C20) Less ammonia in the air.
- C21) Improvement of biogas plants.
- C22) Air- and climate-friendly technology in pig farms.
- C23) Stronger research efforts in agriculture.
- C24) Promotion of precision agriculture.
- C25) Land distribution fund focused on environment, climate and nature.
- C26) Partnership with the agricultural sector.

Green transition of housing and industry

- C27) Old wood-burning stoves must be scrapped in connection with transfers of home ownership.
- C28) Scrapping premium for old wood-burning stoves.
- C29) Stricter regulation of climate-damaging gases in cooling systems.
- C30) Strategy for development of the natural gas system.

We can all play a part in helping the climate

- C31) Behavioural campaign with climate labelling.
- C32) Climate activities for Danes.

Towards a climate-neutral Denmark by 2050

- C33) Increased research into carbon dioxide removal and storage.
- C34) Use of carbon dioxide removal in climate efforts.
- C35) Analysis to improve the monitoring and accounting of carbon dioxide storage in soils and forests.

An impactful climate effort

- C36) Annulment of carbon dioxide allowances.
- C37) More funding for climate efforts in 2026-2030.
- C38) Ongoing follow-up on our efforts.

In households and industry, the government will continue the proud Danish tradition of ambitious environmental standards and gradually reduce environmental impacts.



The government will also introduce new initiatives in shipping that will contribute to a greener future.

The government will make it easier for ordinary Danes to choose climatefriendly solutions in their everyday lives. With a focus on good ideas and visionary initiatives, we will enable everyone to take part in climate efforts.

The aim of achieving climate neutrality by 2050 requires that we capture and store carbon currently in the atmosphere. Therefore, the government will undertake a targeted research effort that will enable Denmark to capture and store considerable amounts of atmospheric carbon.

“Together for a greener future” includes:

- Stop on the sale of new petrol and diesel cars in 2030, and plug-in hybrid cars in 2035.
- From 2020, all new busses must be climatefriendly powered by e.g. electricity, hydrogen, biogas or biofuels. From 2030, city busses and taxis may not be powered by fossil fuels, but by e.g. electricity or hydrogen.
- Concrete initiatives and targeted research will future-proof agriculture.
- Initiatives in housing, industry and shipping will also benefit the climate and air quality.
- Climate labelling and information will make it easier to be a climate-conscious consumer.
- Research in carbon capture and storage will pave the way for a climate-neutral Denmark.

1.2 Overview of current policy situation

(i) National and Union energy system and policy context of the national plan

All political parties reached an energy agreement in June 2018, setting the scene for the future Danish energy policy. The measures and policies decided in the agreement are now in the process of being implemented.

Furthermore, the Danish Government launched its Climate and Air Proposal “Together for a greener future” in October 2018, with 38 additional initiatives targeting both both greenhouse gas emissions and air polluting emissions of which some are already being negotiated with a view to be adopted in the near future



(ii) Current energy and climate policies and measures relating to the five dimensions of the Energy Union

The current energy and climate policies and measures will be elaborated on in chapter 3

(iii) Key issues of cross-border relevance

As a small country taking part in the integrated Nordic electricity market, cross-border aspects of the energy system has become more and more relevant for Denmark. Especially in light of the increasing amount of fluctuating energy in the energy system, Denmark sees an increased importance of a well-functioning and integrated energy market across borders. Thus, knowledge of the energy mix and policies, as well as co-operation with our neighbouring countries' is increasingly important.

(iv) Administrative structure of implementing national energy and climate policies

The implementation of energy and climate policy is done in the same way as other sector legislation and is implemented in the Ministry of Energy, Utilities and Climate.

1.3 Consultations and involvement of national and EU entities and their outcome

(i) Involvement of the Parliament

The Danish Parliament has been informed about the Danish draft plan, before the it was handed over to the Commission.

(ii) Involvement of local and regional authorities

There has not been a specific involvement of local or regional authorities, but the organisation representing the municipalities "Local government Denmark" has been involved in the hearing of the draft plan, as well as the organisation representing the different regions in Denmark, the so-called "Danish Regions".

(iii) Consultations with stakeholders, including social partners, and engagement of civil society and the general public

The Danish Ministry of Energy, Utilities and Climate has a structure in place where relevant stakeholders get the opportunity to take part in a hearing via the so-called EU Special Committee. The draft NECP was presented for the EU Special Committee in December 2018, where they had the opportunity to comment on the draft.



(iv) Consultations with other Member States

Cooperation, coordination and general dialogue is taking place with the Nordic countries via the Nordic Council of Ministers. There has been established an ad hoc networking group with participation of the NECP coordinators in the Nordic Countries. This networking group has had its first couple of meetings to discuss the work. Further, a Nordic modelling workshop has been arranged.

(v) Iterative process with the European Commission

Dialogue with the European Commission has taken place within the structure of the Technical Working Group on the National Energy and Climate Plans.

1.4 Regional cooperation in preparing the plan

(i) Elements subject to joint or coordinated planning with other Member States

Denmark is part of the wider North Seas region, which has a large renewable energy potential. The European Commission has estimated that offshore wind from the North Seas can cover up to 12 pct. of the electric power consumption in the EU by 2030.

Offshore wind generation and grid infrastructure projects may have cross-border effects on energy prices, security of supply and the environment, including availability of marine space as well as the pace of innovation. The North Seas countries therefore have great benefits to gain from cooperation.

The North Seas Energy Cooperation (NSEC) is a voluntary, bottom up, market-oriented, regional cooperation initiative established in 2016, which seeks to create synergies and to avoid incompatibilities between national policies and to foster joint strategies where possible and beneficial. The aim is to coordinate and facilitate further cost-effective deployment of offshore renewable energy, in particular wind, ensuring a sustainable, secure and affordable energy supply in the North Seas countries through increased and better coordinated offshore wind deployment as well as potential joint projects or cluster projects. The NSEC focuses on a step-by-step approach with the perspective of further integration and increased efficiency of wholesale electricity markets in the longer term, while contributing to a reduction of greenhouse gas emissions, in average wholesale price spreads and enhancing security supply in the region.

The North Seas Energy Cooperation consists of 10 countries with participation from the European Commission: Belgium, the Netherlands, Luxembourg, France, Germany, UK, Ireland, Norway, Sweden and Denmark.

The support groups under the cooperation focuses on the following subjects:

SG1: Maritime Spatial Planning

SG2: Development and regulation of offshore grids and other offshore infrastructure

SG3: Support framework and finance for offshore wind projects

SG4: Standards, technical rules and regulations in the offshore wind sector

As regards to preparing this plan, Denmark made use of the NSEC, in which experts in the support groups shared information and experiences on specific aspects, for example on offshore wind development and in particular development on aggregation of national renewable energy trajectories for offshore wind until 2030 (2.1.2) and market integration (2.4.1).

As regards to measures, Denmark benefits from the NSEC in several ways. The work in the NSEC provides a platform for exchange of best practice as regards to the design of support schemes and to exchange and work on new concepts tackling new challenges as regards support for offshore wind. The NSEC also serves as a platform to jointly work on concepts for potential joint wind offshore projects (3.1.2) and for coordinated electricity infrastructure including transmission infrastructure.

Furthermore, Denmark made use of the Nordic cooperation within the Nordic Council of Ministers, as mentioned above.

(ii) Explanation of how regional cooperation is considered in the plan

As regards to measures, Denmark benefits from the NSEC in several ways. The work in the NSEC provides a platform for exchange of best practice as regards to the design of support schemes and to exchange and work on new concepts tackling new challenges as regards support for offshore wind. The NSEC also serves as a platform to jointly work on concepts for potential joint wind offshore projects (3.1.2), for coordinated electricity infrastructure including transmission infrastructure (3.4.1 and 3.4.2) and renewable market integration measures (3.4.3)



2.0 NATIONAL OBJECTIVES AND TARGETS

2.1 Dimension Decarbonisation

2.1.1 GHG emissions and removals

(i) The Member State's binding national target for greenhouse gas emissions and the annual binding national limits pursuant to Regulation (EU) 2018/842¹, and the Member States's commitments pursuant to Regulation (EU) 2018/841². Where applicable to meet the objectives and targets of the Energy Union and the long-term Union greenhouse gas emissions commitments consistent with the Paris Agreement, other objectives and targets, including sector targets and adaptation goals.

In October 2014 the European Council agreed on the 2030 climate and energy framework on objectives regarding green house gas emissions, energy efficiency, renewable energy and interconnections. On green house gas emissions the EU endorse a binding EU target of at least 40% less greenhouse gas emissions by 2030, compared to 1990.

The agreement on the 2030 framework, specifically the EU domestic greenhouse gas reduction target of at least 40%, formed the basis of the EU's contribution to the Paris Agreement. The EU's so-called Intended Nationally Determined Contribution (INDC) was formally approved at an Environment Council meeting in March 2015.

In May 2018 the European Council adopted a regulation on the EU effort sharing of greenhouse gas emission reductions in the non-ETS sectors in the period 2021-2030 – the so-called Effort Sharing Regulation (ESR)³. Under this regulation Denmark is committed to a reduction in non-ETS emissions in the period 2021-2030, rising to 39% by 2030 relative to 2005. The flexibilities under the ESR include borrowing, banking and transfer of annual emission allowances between years and between member states (cf. Article 5), cancellation of EU ETS Allowances instead – in practice meaning that reductions are made under EU ETS instead of

¹ Effort sharing regulation, 2018/842 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0842&from=EN>

² LULUCF, 2018/841 <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0841&from=EN>

³ <https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018R0842&from=EN>



under ESR (cf. Article 6) and use of credits from LULUCF (cf. Article 7). Further details on the commitments under the ESR regulation are included below.

In May 2018 the European Council also adopted a regulation of emissions by sources and removals by sinks in the land sector – the LULUCF regulation, where LULUCF is “Land-Use, Land-Use Change and Forestry”). Credits obtained under this regulation can be used to reach the target for the non-ETS sector in accordance with the ESR up to a certain limit. The limit for Denmark is 14.6 million credits from LULUCF. Further details on the commitments under the LULUCF regulation are included below.

The EU is committed to reducing its ETS emissions by 43% from 2005 to 2030 to achieve the 40% below 1990 levels by 2030 in total greenhouse gas emissions. The EU has also set itself the target of increasing the share of renewables in energy use to 32% by 2030.

The Danish Energy Agreement from June 2018 includes a number of new initiatives that will set the path towards a 55 pct. renewables share in 2030 in Denmark.

Consistency with Denmark’s long-term low emission strategy is ensured as Denmark’s targets under the ESR regulation and the LULUCF Regulation are to be seen as steps in 2021-2030 towards the Government’s long-term objective to become a carbon neutral society by 2050. The targets 2021-2030 are consistent with the target for 2050. Further information will be included in Denmark’s long-term low emission strategy to be submitted to the European Commission by 1 January 2020 pursuant to Article 15 of the Governance Regulation.

Effort Sharing Regulation (ESR)

As regards the dimension "Decarbonisation", and with respect to greenhouse gas emissions and removals and with a view to contributing to the achievement of the economy wide EU greenhouse gas emissions reduction target in 2030, Denmark’s binding national target for greenhouse gas emissions and annual binding national limits pursuant to Regulation ESR are as follows:

2030: Limit Denmark’s non-ETS greenhouse gas emissions in 2030 at least by 39 percent in relation to Denmark’s emissions in 2005 determined pursuant to paragraph 3 of Regulation ESR⁴.

⁴ Taking into account the flexibilities provided for in Articles 5, 6 and 7 of Regulation 2018/842 [ESR] cf. the regulation’s Article 9 on compliance check (see footnote 5).



2021-2029: Taking into account the flexibilities provided for in Articles 5, 6 and 7 of Regulation ESR⁵, the adjustment pursuant to Article 10(2) of the regulation⁶ and any deduction resulting from the application of Article 7 of Decision No 406/2009/EC⁷, ensure that Denmark's non-ETS greenhouse gas emissions in each year between 2021 and 2029 do not exceed the limit defined by a linear trajectory, starting in 2020 on the average of Denmark's non-ETS greenhouse gas emissions during 2016, 2017 and 2018 determined pursuant to paragraph 3 of Article 4 of the ESR Regulation and ending in 2030 on the limit mentioned above.

LULUCF Regulation

As regards the dimension "Decarbonisation", and with respect to greenhouse gas emissions and removals and with a view to contributing to the achievement of the economy wide EU greenhouse gas emissions reduction target in 2030, Denmark's commitments pursuant to LULUCF Regulation are as follows:

2021-2030: Account for emissions and removals from land use, land use change and forestry ('LULUCF') in accordance with LULUCF Regulation and as reported pursuant to Article 7 of Regulation (EU) No 525/2013⁸ occurring in the following land accounting categories on the EU territory of Denmark:

(a) During the periods from 2021 to 2025 and from 2026 to 2030:

- (i) 'afforested land': land use reported as cropland, grassland, wetlands, settlements, and other land converted to forest land;

⁵ The flexibilities under the ESR include borrowing, banking and transfer of annual emission allowances between years and between member states (cf. Article 5), cancellation of EU ETS Allowances instead – in practice meaning that reductions are made under EU ETS instead of under ESR (cf. Article 6) and use of credits from LULUCF (cf. Article 7).

⁶ According to article 10(2) of the ESR certain member states can get extra annual emissions allowances for 2021. This is not the case for Denmark.

⁷ Application of Article 7 of the Effort Sharing Decision 406/2009 (the EU decision on EU member States' non-ETS targets for the period 2013-2020: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0136:0148:EN:PDF>) is a deduction of annual emissions allowances in the period 2021-2030 due to non-compliance in the period 2013-2020 (not relevant for Denmark as Denmark expects to be in compliance in the period 2013-2020).

⁸ MMR: Regulation(EU) No 525/2013 of the European Parliament and of the Council of 21 May 2013 on a mechanism for monitoring and reporting greenhouse gas emissions and for reporting other information at national and Union level relevant to climate change and repealing Decision No 280/2004/EC (<https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0013:0040:EN:PDF>)



- (ii) 'deforested land': land use reported as forest land converted to cropland, grassland, wetlands, settlements, and other land;
 - (iii) 'managed cropland': land use reported as:
 - cropland remaining cropland,
 - grassland, wetland, settlement, other land converted to cropland, and
 - cropland converted to wetland, settlement and other land;
 - (iv) 'managed grassland': land use reported as:
 - grassland remaining grassland,
 - cropland, wetland, settlement and other land, converted to grassland, and
 - grassland converted to wetland, settlement and other land;
 - (v) 'managed forest land': land use reported as forest land remaining forest land.
- (b) As of 2026: 'managed wetland': land use reported as
- wetland remaining wetland,
 - settlement, other land converted to wetland, and
 - wetland converted to settlement and other land.

2021-2025 and 2026-2030: Taking into account the flexibilities provided for in Articles 11-13 of the LULUCF Regulation⁹ Denmark will ensure that emissions do not exceed removals, calculated as the sum of total emissions and removals on Denmark's EU territory in the land accounting categories mentioned above combined and as accounted in accordance with the LULUCF Regulation.

(ii) Where applicable, other national objectives and targets consistent with the Paris Agreement and the existing long-term strategies. Where applicable for the contribution to the overall Union commitment of reducing the GHG emissions,

⁹ These flexibilities include transfer and banking of credits from LULUCF as well as eliminating the effect of net emissions in the LULUCF sector up to an amount that equals deleted emission allocations and the effect of net emissions from Managed Forest Land under conditions specified in Article 13 of Regulation 2018/841[LULUCF].



other objectives and targets, including sector targets and adaptation goals, if available

Denmark's early actions to achieve energy and climate targets in the past and until 2020 are to be seen as important steps in the continuous effort to limit and reduce Denmark's greenhouse gas emissions in the long-term. Since 1990 Denmark has undertaken or committed itself to several targets with respect to reducing greenhouse gas emissions and increasing the share of renewable energy:

2000: In accordance with the Climate Convention, to reduce total emissions of greenhouse gases in Denmark, Greenland and the Faroe Islands to the 1990 level by 2000. This target was achieved for total emissions excluding the land-use sector (LULUCF). Due to windfalls total emissions including LULUCF brought the realm to within 1% of the target. As a contribution to stabilization of GHG in the EU, Denmark committed itself to reducing CO₂ emissions in 2000 by 5% compared to the adjusted level for 1990. This target was fulfilled.

2008-2012: In relation to the Kyoto Protocol, for the period 2008-2012 the EU committed itself to reducing emissions of greenhouse gases on average to 8% below the level in the base year; 1990 for CO₂, methane, and nitrous oxide and either 1990 or 1995 for industrial greenhouse gases. Denmark committed itself to a reduction of 21% as an element of the so-called burden-sharing agreement within the EU. Both Denmark and the EU reached these targets.

2013-2020: In relation to the period 2013-2020, the EU reached an agreement in December 2008 on a climate and energy package and on a regulation on CO₂ from new vehicles. According to this package the EU is committed to reducing its overall emissions to at least 20% below 1990 levels by 2020. Under the EU burden sharing of the joint EU target for 2020, Denmark is committed to a reduction in non-ETS emissions in the period 2013-2020, rising to 20% by 2020 relative to 2005. The EU is also committed to reducing its ETS emissions to 21% below 2005 levels by 2020. The EU has also set itself the target of increasing the share of renewables in energy use to 20% by 2020. Under burden sharing for this EU target, Denmark is committed to



reaching a 30% share of renewables in energy use by 2020. Both Denmark and the EU are on track to reaching these emissions reduction and renewable energy targets¹⁰.

As a result of the Danish Energy Agreement in 2012 the following additional headline results expected to be achieved by 2020:

- More than 35% renewable energy in final energy consumption.
- Approximately 70% of electricity consumption to be supplied by renewable energy sources in total and about 50% of electricity consumption to be supplied by wind power.
- Approximately 8% reduction in gross energy consumption in relation to 2010.
- 34% reduction in greenhouse gas emissions in relation to 1990.

Denmark is well on track to meet these additional targets by 2020.

Beyond 2020

In 2016, the government's long-term objective for Denmark was to become a low-emission society by 2050 independent of fossil fuels and contributing to the EU's target of 80-95 percent reduction in greenhouse gas emissions by 2050 relative to 1990. The near-term targets – in addition to the EU targets for Denmark described above – were: (1) to pursue a target of at least 50 per cent of Denmark's energy needs to come from renewable sources by 2030 and (2) to implement the political agreement on the introduction of a blending requirement of 0.9 per cent advanced biofuels in fuel for land transport.

These ambitions have been stepped up in 2018 through the Energy Agreement of 29 June 2018 and the climate and air proposal "Together for a greener future" of 9 October 2018 so that the government has now (1) set the path towards reaching a share of approximately 55 per cent renewable energy by 2030 and (2) work towards net zero emissions in accordance with the Paris agreement and for a net-zero-emission target in the EU and Denmark by 2050 to push towards the government's goal of a climate-neutral Denmark by 2050.

As a result of the Danish Energy Agreement in 2018 the following additional headline results are expected to be achieved by 2030:

¹⁰ <https://www.eea.europa.eu/highlights/eu-still-on-track-to>



- The parties in the agreement have allocated funding that sets a course towards a share of renewable energy of approximately 55% by 2030.
- The agreement is expected to give Denmark a share of renewable energy in electricity above 100% of consumption by 2030, while ensuring that at least 90% of district heating consumption is based on energy sources other than coal, oil or gas by 2030.

The key initiatives in the 2018 climate and air proposal include:

- Phase out the sale of new petrol and diesel cars in 2030.
- Zero carbon emissions and zero air pollution from busses in Denmark's cities by 2030.
- A climate- and environmentally-efficient agricultural sector, with a strong focus on research.
- Clean air in big cities through stricter environmental zones.
- Lower emissions from industry and housing.
- Behavioral campaign with climate labelling.
- Research efforts to develop carbon capture and storage technologies for use in Denmark's fields and forests.

2.1.2 Renewable energy

(i) With a view to achieving the Union's binding target of at least 32 % renewable energy in 2030 as referred to in Article 3 of the Renewables Directive , a contribution to that target in terms of the Member State's share of energy from renewable sources in gross final consumption of energy in 2030, with an indicative trajectory for that contribution from 2021 onwards. By 2022, the indicative trajectory shall reach a reference point of at least 18 % of the total increase in the share of energy from renewable sources between that Member State's binding 2020 national target, and its contribution to the 2030 target. By 2025, the indicative trajectory shall reach a reference point of at least 43 % of the total increase in the share of energy from renewable sources between that Member State's binding 2020 national target and its contribution to the 2030 target. By 2027, the indicative trajectory shall reach a reference point of at least 65 % of the



total increase in the share of energy from renewable sources between that Member State's binding 2020 national target and its contribution to the 2030 target. By 2030, the indicative trajectory shall reach at least the Member State's planned contribution. If a Member State expects to surpass its binding 2020 national target, its indicative trajectory may start at the level it is projected to achieve. The Member States' indicative trajectories, taken together, shall add up to the Union reference points in 2022, 2025 and 2027 and to the Union's binding target of at least 32 % renewable energy in 2030. Separately from its contribution to the Union target and its indicative trajectory for the purposes of this Regulation, a Member State shall be free to indicate higher ambitions for national policy purposes;

The Danish Parliament has agreed on the energy policy post 2020 in the policy agreement of June 2018. With the agreement, the Parliament expects to reach an overall renewables share of approximately 55 pct. in 2030.

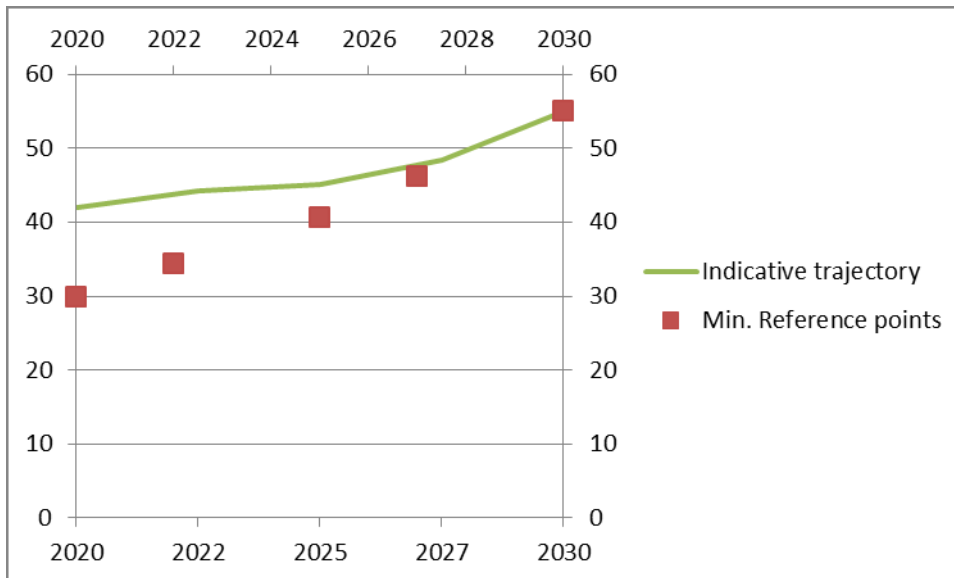
In 2020 Denmark expects to reach an overall renewables share of 42 pct, according to Denmark's Energy and Climate Outlook 2018 (DECO18)¹¹. The individual shares for electricity, district heating and transport are estimated to 79.6 pct., 73 pct. and 8.7 pct. respectively.

The Danish binding EU target for 2020 is 30 pct. Denmark plans to count the extra 12 percentage points as early effort towards the 2030 RES target. The new policy agreement includes a number of new initiatives, described below, that will set the path towards the approximately 55 pct. renewables share in 2030.

The indicative trajectory for the Danish contribution from 2020 and onwards is displayed in figure 1. The estimation is indicative and entails great uncertainty. Therefore, the actual renewables share may vary from this estimation.

¹¹ Based on the EU methodology

Figure 1. Indicative trajectory for the share of energy from renewable sources in gross final consumption compared to the minimum reference points



The indicative trajectory is based on the Danish energy agreement of 29 June 2018, in which funding has been allocated to set the course towards a Renewable Energy share of approximately 55 pct. by 2030. Consequently, this is the Danish expected contribution to the 2030 EU target, in accordance with Article 4 (a) 2 of the Governance Regulation. However, as shown in Table 7 on p. 86, current modelling of the consequences of the Energy Agreement, “only” leads to a RE share of 48 pct. by 2030 due to the fact that the modelling at this stage only includes known, specific policies and measures in the Energy Agreement, and where the effects can be quantified. Hence, figure 1 represents an indicative, possible trajectory, where the remaining 7 percentage points are reached through additional policies and measures that have not yet been specified and decided.

(ii) Estimated trajectories for the sectorial share of renewable energy in final energy consumption from 2021 to 2030 in the electricity, heating and cooling, and transport sector

Denmark has not at present set any individual objectives or targets for sectorial shares of renewable energy. Subsequently, no policy based trajectories have been set for individual renewables shares in various sectors.

However, as a result of the policy agreement from June 2018 – that includes new investment for renewables as well as a decision to phase out coal in the electricity production sector in 2030 – the renewables share in electricity consumption is expected to exceed 100 pct. in 2030.



As for the district heating sector, it is the projection that at least 90 pct. of the heating in the district heating sector will be based on other sources than fossil fuels in 2030. Included in the policy package is annually 13.4 million EUR earmarked for promotion of use of waste heat.

In addition, a reservation on an amount of 500 million DKK has been agreed for the years 2020-2024 – 100 million DKK a year for the transport sector. The pool is described to support green solutions in the transport sector. For the present there is no further information on the pool.

(iii) Estimated trajectories by renewable energy technology that the Member State projects to use to achieve the overall and sectorial trajectories for renewable energy from 2021 to 2030 including expected total gross final energy consumption per technology and sector in Mtoe and total planned installed capacity (divided by new capacity and repowering) per technology and sector in MW

Denmark has not at present set any individual objectives or targets for individual technologies to use to achieve the overall and sectorial trajectories. Denmark is planning multi technology tenders for wind power and solar PV, and aim for renewable energy without support well before 2030. With this approach targets cannot be set for each technology.

The political framework for 2020 to 2030, agreed upon in June 2018, include 3 new offshore wind parks of a total of 2,400 MW. The three parks will each be minimum 800 MW. The first is to be tendered in 2019 or 2020 and will have a capacity of approximately 800 MW– the next two in 2021 and 2023 will each have a capacity of at least 800 MW.

Since the cost of off-shore wind is expected to continue falling in the coming years, it is agreed to gradually reduce the number of land based wind turbines from approx. 4,300 today to maximum 1,850 in 2030. The production from land based wind turbines is however still expected to increase since smaller existing turbines will be replaced with larger ones with higher capacity.

Denmark has shared and discussed in the NSEC the estimated offshore renewable trajectory, information on its national offshore deployment plans and best practices in the design of offshore wind tenders.

Aggregating national offshore wind objectives and corresponding trajectories amongst all NSEC countries results in an overall offshore wind trajectory of approx. XX GW in the greater North Seas region for the year 2030.

(iv) Estimated trajectories on bioenergy demand, disaggregated between heat, electricity and transport, and on biomass supply, by feedstocks and origin



(distinguishing between domestic production and imports). For forest biomass, an assessment of its source and impact on the LULUCF sink

Denmark has not at present set any individual objectives or targets on bioenergy demand, aggregated or disaggregated on sectors, imports etc. Therefore, no trajectories have been set for the use of bioenergy.

(v) Where applicable, other national trajectories and objectives, including those that are long-term or sectoral (e.g. share of renewable energy in district heating, renewable energy use in buildings, renewable energy produced by cities, energy communities and self-consumers, energy recovered from the sludge acquired through the treatment of wastewater)

As for the district heating sector, it is the projection that at least 90 pct. of the heating in the district heating sector will be based on other sources than fossil fuels in 2030.

Denmark has not at present set any individual objectives or targets on bioenergy demand, aggregated or disaggregated on sectors, imports etc. Therefore, no trajectories have been set for the use of bioenergy.

2.2 Dimension Energy efficiency

(i) The elements set out in point (b) of Article 4

(1) The indicative national energy efficiency contribution to achieving the Union's energy efficiency target of at least 32,5 % in 2030 as referred to in Article 1(1) and Article 3(4) of Directive 2012/27/EU, based on either primary or final energy consumption, primary or final energy savings, or energy intensity; expressed in terms of absolute level of primary energy consumption and final energy consumption in 2020, and in terms of absolute level of primary energy consumption and final energy consumption in 2030, with an indicative trajectory for that contribution from 2021 onwards; including the underlying methodology and the conversion factors used)

Reduction of energy consumption through increased energy efficiency and energy savings has been an important part of Danish energy policy since the 1970s, when the oil crisis first focused on security of supply and import dependence. In the meantime, climate change has also played a role in the desire to streamline and reduce energy consumption in Denmark.

Denmark has therefore developed a great expertise in energy efficiency, which has made it possible to keep energy consumption largely unchanged in spite of significant economic growth over the last three decades.



Indicative national target for 2020

The indicative national target for the Danish gross energy consumption (primary energy) and final energy consumption in 2020 corresponds to the energy consumption in 2020 in the Danish Energy Agency's 2018 Energy and Climate Outlook published in April 2018.

The Danish Energy and Climate Outlook 2018 is based on a frozen policy scenario, where instruments and actions from the latest energy policy agreement of March 2012 and subsequent adjustments therein as well as new initiatives are included.

The Danish Energy Agency's Energy and Climate Outlook is based on a number of overall economic assumptions (the production of the companies, private consumption, fuel prices, etc.), a number of technology-specific assumptions (what is the cost of different types of installations, what is their efficiency, etc.) and assumptions as to what the energy market players will do when acting on market terms.

The Danish gross energy consumption by 2020 is defined in the outlook as the gross energy consumption excluding non-energy consumption of 707.2 PJ (16.89 Mtoe). This is a reduction of gross energy consumption by 16.9 per cent in 2020 compared to 2006.

The corresponding indicative target for final energy consumption (excluding consumption for non-energy purposes) by 2020 is 615.5 PJ (14.70 Mtoe). This is a reduction of 7.7 per cent compared to 2006.

Indicative national energy efficiency contribution to achieving the Unions energy efficiency targets in 2030

The indicative national contribution for the Danish gross energy consumption (primary energy) and final energy consumption in 2030 corresponds to the energy consumption in 2030 in the Danish Energy Agency's 2018 Energy and Climate Outlook published in April 2018 as well as the energy efficiency measures included in the Energy Agreement from June 2018. The Energy Agreement from June 2018 includes energy efficiency measures in the period 2021-2024. An updated contribution for the indicative national contribution for the Danish gross energy consumption (primary energy) and final energy consumption in 2030 will be included as a revised draft NECP and final NECP for the period 2021-2030 has to be submitted in 2023 and 2024. An indicative trajectory for the contribution from 2021 and onwards will be included in the first NECP together with a more detailed explanation of the underlying methodology and the conversion factors used.



The Danish gross energy consumption by 2030 is estimated to approx. 780 PJ (18,6 Mtoe).

The corresponding indicative contribution for final energy consumption (excluding consumption for non-energy purposes) by 2030 is approx. 660 PJ (15,8 Mtoe).

(2) Cumulative amount of end use energy savings to be achieved over the period 2021-2030 under point (b) of Article 7(i) on the energy saving obligations of Directive 2012/27/EU

The following is an outline of the Danish energy savings obligation based on the current EED as well as the Danish energy policy agreement from 2012 as well as the estimated end-use savings for 2021-2030 under Article 7 in the Directive 2012/27/EU

Energy Efficiency Obligation Scheme

Denmark will fulfil the obligations set out in Article 7 of Directive 2012/27/EU exclusively by an energy efficiency obligation scheme. Since 2006, the network and distribution companies in Denmark have been subject to energy saving commitments via the obligation scheme. The latest agreement on the obligation is from 16 December 2016 and sets out the overall savings obligation for 2020. In 2016-2020, network and distribution companies will ensure energy savings of 10.1 PJ per year of the final consumption of energy excl. transport.

According to Article 7 (1) in Directive 2012/27/EU, the Danish targets are calculated as:

- An annual target of 1.5%: 6.18 PJ
- Savings by 2020 (7 x 1.5%): 43.23 PJ
- Cumulative Savings 2014-2020 (28 x 1.5%): 172.93 PJ

The basis for calculations of the Danish target for 2020 pursuant to Article 7 is the official Danish energy statistics 2012 published in November 2013. These data are the basis for reporting to Eurostat.

According to Article 7 (1)(b) in , Directive 2012/27/EU [Version as amended in accordance with proposal Com(2016)761] the Danish targets are calculated as:

- An annual target for end use savings of 0.8%: 4.94 PJ
- Savings by 2030 (10 x 4.94%): 49.4 PJ
- Cumulative Savings 2021-2030 (55 x 4.94%): 271.7 PJ



The basis for calculations of the Danish estimated cumulative amount of energy savings to be achieved over the period 2021-2030 pursuant to Article 7 in the revised Directive is the consumption in 2016 in the official Danish energy statistics and the forecasted consumption for 2017 and 2018.

(3) The indicative milestones for 2030, 2040 and 2050, the domestically established measurable progress indicators and their contributions to the Union's energy efficiency targets as included in the roadmaps set out in the long-term renovation strategies for the national stock of residential and non-residential buildings, both public and private, in accordance with Article 2a of Directive 2010/31/EU on the Energy Performance of Buildings

As far as buildings are concerned the energy agreement from June 2018 defines the principle for setting the milestones rather than indicating the actual milestones. The agreement specifies that the long term marginal cost of reducing energy consumption in buildings should be seen in relation to the cost of expanding the renewable energy supply. Setting the indicative milestones should therefore be based on balancing long term cost of energy efficiency with the cost of expanding renewable energy supply. This needs to be prepared before the indicative milestones can be included in the NECP.

(4) The total floor area to be renovated or equivalent annual energy savings to be achieved from 2021 to 2030 under Article 5 of Directive 2012/27/EU on the exemplary role of public bodies' buildings

The energy savings to be achieved from 2021-2030 under article 5 of the EED are expected to be calculated in 2019.

Below ,the energy savings to be achieved from 2014-2020 under article 5 of the EED will be outlined.

Denmark has notified the Commission that Article 5 of the EED has been implemented using the alternative approach involving the establishment of an energy savings target expressed in MWh. The calculation of the target is based on relevant extracts of the area from the Central Register of Buildings and Dwellings (BBR) and the energy performance from the energy labeling scheme for central government buildings. The energy savings to be achieved in 2020 is 148,192 MWh in the period 2014-2020.

The actual energy consumption of the Danish ministries and the government's own institutions, etc. is reported to a central database each year. Furthermore the central database is divided into consumption of electricity, heat and water for the Danish government building portfolio. The building area and number of full time



employees are also entered into the database hence displaying the absolute as well as relative (to building area and employees) energy savings in institutions at all levels within central government and affiliated institutions.

The database in addition covers energy consumption in buildings covered by the circular on energy efficiency in state institutions No 9477 of 2 July 2014. In this circular buildings that are not within the scope of Article 5 of the Energy Efficiency Directive are also included (e.g. rented buildings and buildings belonging to independent institutions).

In Denmark, there is a tradition of using a broad range of energy saving and energy efficient methods, including behaviour modification. The alternative approach is therefore closest to the methods that have previously been used for central government buildings. Under the circular, the ministries are at liberty to pursue the instruments most cost effective in their particular circumstances, including deep renovations, behavioural measures etc., thus meeting their energy savings target.

In 2016, a midway evaluation was carried out of the energy efficiency measure. In the ministries and institutions all types of energy improvements are carried out, such as:

- Lighting and appliances
- Building envelope
- Installations
- Energy supply
- Water savings
- Other measures, including the relocation or reduction of activities, energy screening, behavioural campaigns and night energy consumption measuring.

(iii) Where applicable, other national objectives, including long-term targets or strategies and sectorial targets and national objectives in areas such as energy efficiency in the transport sector and with regard to heating and cooling

Energy-efficient public procurement (EED Article 6)

Danish circular on energy efficiency in state institutions No 9477 of 2 July 2014 impose a requirement for energy efficient public sector procurement including the procurement of services where this is profitable based on an assessment of socio-economic and environmental factors, etc. Furthermore, the government provides

general information on energy efficient procurement through the following websites:

<https://spareenergi.dk/offentlig/vaerktoejer/indkoebsanbefalinger>

<http://www.csr-indkob.dk>

<http://www.gronneindkob.dk/>

2.3 Dimension Energy security

(i) National objectives with regard to:

- *increasing the diversification of energy sources and supply from third countries, the purpose of which may be to reduce energy import dependency,*
- *increasing the flexibility of the national energy system, and*
- *addressing constrained or interrupted supply of an energy source, for the purpose of improving the resilience of regional and national energy systems, including a timeframe for when the objectives should be met;*

Stable and reliable energy supply is considered a prerequisite for the Danish society. The effectiveness and functioning of the economy, public organizations and private households depend on a reliable energy supply. The transition of the energy sectors towards increasing integration of renewable energy sources demands integration of energy systems, increased international connections and precise control of energy production and consumption. The development of interconnection between subsectors and cross borders is an objective targeting an efficient use of fluctuating energy sources. Therefore both legislative and governance measures are being implemented in order to promote further integration internationally and intra sectorially. The international dimension is vital to a small country like Denmark, linking Scandinavia to the continent, and the North Sea to the Baltic Sea. The geographic situation gives Denmark extraordinary conditions for import and export of energy, whether it is fossil fuels, biomass transported by sea or electricity. Denmark supports further international cooperation in regards to energy supply and further development of an open market for electricity and natural gas.



Conventional power plants are being decommissioned or transformed into bio-fueled plants, and diversification in both production and consumption is being improved with an impact on both the natural gas and electricity systems. This development demands further integration between subsectors and direct control over local plants in order to balance the integrated systems. Therefore, cybersecurity forms a priority in the energy sectors. Denmark recognises the importance of cybersecurity in the energy sector as a strategic important issue to address in the coming years.

Within both the natural gas sector and the electricity sector Denmark has the objective to further develop the international cooperation on security of supply by increasing physical interconnections and ensuring common understanding on risks to supply. The Danish electricity system is undergoing a development comprising an increasing amount of renewable energy production from mainly intermittent wind and solar power sources, together with a decreasing central and decentral power plant production capacity. This leads to an increasing dependency on interconnectors to the neighbouring countries. The potential security issues are being mitigated through regional cooperation in the Nordic region on authority and TSO level. This cooperation aims at enhancing the operational cooperation in case of crises by common exercising and knowledge sharing .

The Minister of Energy, Utilities and Climate has the overall responsibility for the security of supply of electricity and natural gas in Denmark. The Minister also determines the level of security of supply of electricity according to a law that entered into force in 2018. The technical monitoring and maintenance of the security of supply is ensured by the national TSO (Energinet). The TSO is responsible for ensuring the presence of sufficient production or import and maintaining security of supply together with the efficient utilization of the coherent electricity supply system and natural gas system. The TSO is the custodian for the national emergency plans within both the electricity and natural gas sectors. These plans are coherent with the respective EU-Regulation 2017/1938 concerning measures to safeguard security of gas supply and sectorspecific EU regulation.

In regards to the electricity security of supply, existing and planned interconnectors contribute to an increased security of supply in Denmark. An expansion of the electricity market to include greater overall consumption as well as a wider portfolio of production technologies will ensure an increased security of supply across borders.

Within the oil sector, Denmark is dependent on free movement of shipping in the North Sea and the Baltic Sea and the international market. It is an objective for



Denmark to ensure international cooperation within this field. Therefore Denmark is participating in international cooperation within the EU and the IEA with regards to ensure sufficient oil-stocks

(ii) National objectives with regard to increasing: the diversification of energy sources and supply from third countries for the purpose of increasing the resilience of regional and national energy systems

Denmark does not have national objectives for reducing the energy import dependency of third countries, since these dependencies are limited due to the diversification of energy sources and the production of oil and gas within Denmark. The dependency on import of coal is decreasing as a result of integration of more renewable energy. However, the transition towards integration of renewables leads to an increasing dependency on a well-functioning market for electricity across the Nordic region. In regards to natural gas, Denmark has been a net exporter of natural gas since the introduction of natural gas in 1984. The importance of natural gas in the Danish energy supply has been decreasing in the last decade. This development is expected to continue in the following years as natural gas is expected to cover respectively about 15 % in 2023, 14 % in 2023 and 12 % in 2030 of the total Danish energy mix. The figures include biogas injected into the gas pipeline system.

Historically, Denmark has been dependent on third countries like China, India, the United States, Australia, Indonesia, Russia and South Africa in regards to coal. The power plants have been able to produce full load substituting coal with oil, making the dependency of coal less critical. In recent years the political decision on moving towards an energy system with an increasing part of renewable energy has made the energy system increasingly independent of coal.

(iii) Where applicable, national objectives with regard to reducing energy import dependency from third countries, for the purpose of increasing the resilience of regional and national energy systems

Denmark currently does not have such objectives.

(iv) National objectives with regard to increasing the flexibility of the national energy system, in particular by means of deploying domestic energy sources, demand response and energy storage

Denmark currently does not have such objectives. However, the Danish Government has announced that by 2030 Denmark can have more than 1 million green cars, a new gas strategy and a roadmap for smart energy, as well as



significant increase of heat pumps in heating sectors of Denmark. This is expected to provide a basis for increasing flexibility through increased demand response and energy storages.

2.4 Dimension Internal energy market

2.4.1 Electricity interconnectivity

The level of electricity interconnectivity that the Member State aims for in 2030 in consideration of the electricity interconnection target for 2030 of at least 15%, with a strategy with the level from 2021 onwards defined in close cooperation with affected Member States, taking into account the 2020 interconnection target of 10% and the following indicators of the urgency of action:

- (1) Price differential in the wholesale market exceeding an indicative threshold of 2€/MWh between Member States, regions or bidding zones;*
- (2) Nominal transmission capacity of interconnectors below 30% of their peak load;*
- (3) Nominal transmission capacity of interconnectors below 30% of installed renewable generation.*

Each new interconnector shall be subject to a socioeconomic and environmental cost-benefit analysis and implemented only if the potential benefits outweigh the costs;

Denmark's current interconnectivity is at 50.6 pct. based on the "Energy Union Factsheet Denmark" from the European Commission. The interconnectivity level is calculated as a ratio between import interconnection and net generation capacities of the country (i.e. the 2017 value is the ratio between simultaneous import interconnection capacity and net generating capacity in the country at 11 January 2017, 19:00 pm as resulted from ENTSO-E Winter Outlook 2016/2017)

Given the high interconnectivity level, Denmark has no specific objectives for a certain future level and consequently no strategy for reaching any targets that are way below Denmark's interconnectivity level. Potential new interconnectors are considered in coordination with other Member States taking into account the overall socioeconomic value.

Denmark is involved in the NSEC work on concrete concepts for joint offshore projects or cluster projects. The NSEC has identified a list of potential areas and projects in the region, where joint projects could be most beneficial. These include: (1) IJmuiden Ver offshore wind farm to UK, (2) CGS IJmuiden Ver – Norfolk, (3) COBRA Cable, (4) DE offshore wind farm connected to NL and (5) North Seas Wind Power Hub.



The NSEC is working on developing concrete concepts for the implementation of selected projects from the above list.

2.4.2 Energy transmission infrastructure

(i) Key electricity and gas transmission infrastructure projects, and where relevant, modernisation projects, that are necessary for the achievement of objectives and targets under the five dimensions of the Energy Union Strategy

There are no specific projects necessary for a certain interconnectivity target. However, 5 projects are currently on the list of Projects of Common Interest, based on their positive socio-economic value and are about to be established.

- Viking Link – Interconnector between Denmark and UK
- Endrup – Niebüll – Interconnector between Denmark and Germany
- Kassø – Audorf – Upgrading of existing interconnector between Denmark and Germany
- Kriegers Flak Combined Grid Solution – Interconnector between Denmark and Germany which combines an interconnector with the grid connection of offshore wind farms.
- Baltic Pipe – Gas interconnector between Denmark and Poland

With regards to gas infrastructure, the Danish TSO -Energinet - and the Polish TSO - Gaz-System – have in 2018 taken the final investment decision to establish the Baltic Pipe Project. The project will make it possible to transport up to 10 BCM Norwegian gas to Poland through the Danish gas infrastructure and connect the Danish and Polish gas markets.

These projects are important in terms of fulfilling the dimensions of the Energy Union such as a fully-integrated internal energy market with security, solidarity and trust. The majority of projects is based upon the need to ensure well-functioning energy markets, while the need for a number of projects is also based upon the need for security of supply.

(ii) Where applicable, main infrastructure projects envisaged other than Projects of Common Interest (PCIs)

The Nordic TSOs are currently investigating several cross-border investments in the Nordics. Corridors between Western Denmark and Norway as well as Eastern Denmark and Sweden are under investigation. In both cases some of the



interconnectors are about to reach the end of their expected lifetime and decisions about reinvestments have to be made.

The Dogger Bank project is currently a development project being investigated jointly by the Danish TSO, Energinet, and the Dutch-German TSO, TenneT, along with its project partners. The Dogger Bank project would consist of an artificial island which could serve as a hub for offshore wind power production and then connect the island to the European mainland using interconnectors.

2.4.3 Market integration

(i) National objectives related to other aspects of the internal energy market such as increasing system flexibility in particular related to the promotion of competitively determined electricity prices in line with relevant sectoral law, market integration and coupling, aimed at increasing the tradeable capacity of existing interconnectors, smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, re-dispatching and curtailment, and real-time price signals, including a timeframe for when the objectives shall be met;

Market coupling in the wholesale day-ahead and intraday timeframe is well-advanced in Denmark. There is also a common Nordic market for manual Frequency Restoration Reserves (mFRR). Denmark continuously works on developing markets for ancillary services. These markets are partly integrated with neighbouring countries or are in the process hereof, as part of the implementation of the electricity balancing guideline and the corresponding timeframe.

With regards to real-time price signals, Denmark has just updated a national law¹², specifying that the Danish TSO shall, as far as possible, procure all energy and non-energy services that are necessary for security of supply through market-based mechanisms. The demand for all services has to be published annually. In cases with limited competition, the TSO shall analyse whether changes to the product definitions and procurement process could increase competition. The law aims at increasing transparency, creating price signals for all services, including non-frequency ancillary services, and thus enabling more market participants, including DER, to participate in the delivery of these services.

(ii) Where applicable, national objectives related to the non-discriminatory participation of renewable energy, demand response and storage, including via

¹² **LOV nr 704 af 08/06/2018**



aggregation, in all energy markets including a timeframe for when the objectives should be met

The Danish electricity market is open for participation from renewable energy, demand response and storage, including via aggregation. The Danish TSO is by law required to contribute with its activities to the best possible conditions for competitions in the electricity market.

Renewable energy producers (except for household-scale plants) are obliged to sell their production into the market via balancing responsible parties. The ancillary services markets are open to participation from renewable energy as well. Many wind power plants, for example, offer downward regulation into the market.

Denmark foresees an increasingly important role for demand-side resources in contributing to an integrated, market-based and flexible energy system. A large number of electrical boilers are already installed and may offer their service in all markets from spot to primary reserves. To encourage the participation of aggregated demand response, Denmark is constantly seeking to improve market regulations with the aim to reduce barriers for decentralised market participants.

(iii) Where applicable, national objectives with regard to ensuring that consumers participate in the energy system and benefit from self-generation and new technologies, including smart meters

Denmark has an overall objective of rolling out smart meters to all consumers by 2020. In the future, this will enable consumers to participate in the energy markets through aggregation. The energy agreement of 2018 also underlines the objective to increase the utilisation of data and digital solutions and create a smart energy system. This is also in line with the Danish Governments smart grid strategy of 2013.

It is possible for consumers to self-generate electricity under defined rules for net metering. As such, however, self-generation is no particular objective for Denmark, as the goal is to provide consumers with an overall efficient and secure electricity system.

(iv) National objectives with regard to ensuring electricity system adequacy, as well as for the flexibility of the energy system with regard to renewable energy production, including a timeframe for when the objectives are to be met

Denmark has one of the highest security of supply levels in Europe. It is the government's clear ambitions to keep a high level of security of supply also in the



future when integrating more renewable energy into the Danish electricity system.

(v) Where applicable, national objectives to protect energy consumers and improve the competitiveness of the retail energy sector

In general, Denmark aims at highly competitive retail markets. Danish Utilities are obliged to roll-out remotely readable smart meters by the end of 2020 to all end users. The full roll-out of smart meters is expected to change the retail business over the coming years, and Denmark will closely monitor the development. Although Denmark does not have specific national objectives, consumer protection and competitiveness of the retail sector are addressed in many policies and measures as described below.

2.5 Dimension Research, innovation and competitiveness

(i) National objectives and funding targets for public and, where available, private research and innovation relating to the Energy Union including, if appropriate, a timeframe for when the objectives are to be met.

As a participant in the international cooperation “Mission Innovation” Denmark has committed to double its public funding to research and development to 580 mio. DKK in 2020. The Danish parliament has recently reached a new energy agreement with the target of spending 1 billion DKK on energy research and development by 2024.

Denmark does not have any funding targets for private research and innovation relating to the energy union.

(ii) Where available, national 2050 objectives related to the promotion of clean energy technologies and, where appropriate, national objectives including long-term targets for the deployment of low-carbon technologies, including for decarbonising energy- and carbon-intensive industrial sectors and, where applicable, for related carbon transport and storage infrastructure

The Danish Government along with all political parties of the Parliament will work towards net zero emissions by 2050 at the latest, in accordance with the Paris Agreement. This has to be achieved in a cost-effective way.

Denmark does not have any target for deployment of specific technologies.

(iii) Where applicable, national objectives with regard to competitiveness

Denmark does not have any formal national objectives with regard to competitiveness.



However, the Danish Government has published a national export strategy for the energy sector. The aim is to double the exports of Danish energy technology and services from 2015 to 2030. In order to achieve this, Danish solutions has to be innovative and competitive on the growing global market for new energy solutions.

3. POLICIES AND MEASURES

3.1 Dimension Decarbonisation

3.1.1 GHG emissions and removals

(i) Policies and measures to achieve the target set under Regulation (EU) 2018/842¹³ as referred to in point 2.1.1 and policies and measures to comply with Regulation (EU) 2018/841¹⁴, covering all key emitting sectors and sectors for the enhancement of removals, with an outlook to the long-term vision and goal to become a low emission economy and achieving a balance between emissions and removals in accordance with the Paris Agreement

Existing policies and measures (implemented or adopted)

Denmark's implemented and adopted as of 1. January 2018¹⁵ (cf. the definition of "existing") policies and measures with effect on greenhouse gas emissions reported in 2018 in Denmark's Seventh National Communication and Third Biennial Report under the United Nations Framework Convention on Climate Change (UNFCCC)¹⁶ and under the EU Monitoring Mechanism Regulation (MMR)¹⁷ are shown in Table 1.

The policies and measures listed in Table 1 include policies and measures, which will contribute to the achievement of the target set under Regulation 2018/842 [ESR: Effort Sharing Regulation]¹⁸ as referred to in 2.1.1, and policies and measures, which will contribute to compliance with Regulation 2018/841 [LULUCF: Land-Use, Land-Use Change and Forestry]¹⁹. Most of the policies and measures

¹³ Effort Sharing Regulation

¹⁴ LULUCF

¹⁶ NC7/BR3: https://unfccc.int/sites/default/files/resource/8057126_Denmark-NC7-BR3-2-NC7-DNK-Denmarks-NC7-and-BR3_1January2018-12MB.pdf

¹⁷ MMR: <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2013:165:0013:0040:EN:PDF>

¹⁸ ESR or Effort Sharing Regulation: REGULATION (EU) 2018/842 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013

¹⁹ LULUCF-regulation: REGULATION (EU) 2018/841 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and



related to energy consumption (names starting with TD, EN, BU, TR or HO²⁰) will have an effect on both greenhouse gas emissions under Regulation 2018/842[ESR]²¹ and CO₂ emissions under Directive 2003/87/EC[EU ETS²²]²³. The list covers all key emitting sectors and sectors for the enhancement of removals. Further information on Denmark's climate policy in general and the policies and measures listed in Table 1 is included in Annex 1

The effects of the existing measures as of April 2018 are included in the “with existing measures” greenhouse gas projection scenario, the so-called WEM-projection scenario, reported in Chapter 4.

forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU

²⁰ TD: Taxes and Duties, EN: Energy sector (except BU, TR and HO), BU: Business sector (energy consumption), TR: Transport sector (energy consumption), HO: Household sector (energy consumption).

²¹ In the period 2013-2020 the measures will also have an effect on greenhouse gas emission under Decision 406/2009 [ESD: Decision No 406/2009/EC of the European Parliament and of the Council of 23 April 2009 on the effort of Member States to reduce their greenhouse gas emissions to meet the Community's greenhouse gas emission reduction commitments up to 2020].

²² EU ETS: Directive 2003/87/EC of the European Parliament and of the Council of 13 October 2003 establishing a scheme for greenhouse gas emission allowance trading within the Community

²³ For example TR-10 (Electrification of parts of the infrastructure), which will – everything else being equal - decrease emissions from the use of diesel under ESR, but potentially increase emissions under ETS, if not counteracted by an increase in the use of renewable energy in electricity production.



Table 1 Overview of Denmark's portfolio of existing climate relevant policies and measures (implemented and adopted)

Overview of Denmark's portfolio of climate relevant policies and measures			
EEA PAMs Database no.	Name of mitigation action	Single PAM or Group of PAMs	PAMs included in Groups of PAMs
2	TD-1b: Mineral-oil Tax Act	Single	
3	TD-2: Gas Tax Act	Single	
4	TD-3: Coal Tax Act	Single	
5	TD-4: Electricity Tax	Single	
6	TD-5: CO2 tax on energy products	Single	
7	TD-6: Green Owner Tax - a fuel-efficiency-dependent annual tax on motor vehicles	Single	
8	TD-7: Registration Tax - a fuel-efficiency-dependant registration tax on passenger cars and vans	Single	
9	TD-8: Tax on HFCs, PFCs and SF6 - equivalent to the CO2 tax	Single	
10	TD-9: Tax on methane from natural gas fired power plants - equivalent to the CO2 tax	Single	
11	EN-1: EU-CO2-emission trading scheme for electricity and district heat production and certain industrial processes (incl. Business) and aviation from 2012	Single	
12	EN-2: Biomass Agreement (Agreement on the use of biomass in electricity production)	Single	
13	EN-3: Price supplement and subsidies for renewable energy production	Single	
14	EN-4: Tenders for offshore wind turbines	Single	
15	EN-5(expired): Scrapping scheme for old wind turbines	Single	
16	EN-6: Energy development and demonstration	Single	
17	BU-1: Agreements on energy efficiency with business	Single	
18	BU-2: Savings activities by elec. grid, gas, oil and district heating companies (consump. of final energy excl. Transp.)	Single	
19	BU-6: Circular on energy-efficiency in state institutions	Single	
20	BU-7(expired): Campaigns and promotion of efficient appliances (including elec. heating, conversion and efficient appliances in households)	Single	
21	BU-8(expired): Renewables for the Industry	Single	
22	BU-9: Mandatory Energy Audit for large Enterprises	Single	
23	BU-10: The center for energy savings in enterprises	Single	
24	TR-1a: EU demands on vehicle manufactures to deliver fuel efficient cars and vans	Single	
25	TR-1b(expired): Information campaign on fuel consumption of new cars	Single	
26	TR-2(expired): Energy-correct driving technique	Single	
27	TR-3(expired): Initiative on enforcing speed limits	Single	
28	TR-4(expired): Establishment of intermodal installations	Single	
29	TR-5(expired): Promotion of environmentally friendly goods transport	Single	
30	TR-6(expired): Reduced travel times for public transport	Single	
31	TR-7: Spatial planning	Single	
32	TR-8: EU requirements regarding biofuels	Single	
33	TR-9(expired): Transport infrastructure projects in the fields of electric vehicles, gas and hydrogen	Single	
34	TR-10: Electrification of parts of the rail infrastructure	Single	
35	TR-11(expired): Investments in a new metro line and bicycle transport facilities.	Single	
36	TR-12: Investment in a tunnel under the Femern Belt	Single	
37	HO-1: Energy labelling of small and large buildings (incl. public sector and business)	Single	
38	HO-2: Energy labelling of electric appliances	Single	
39	HO-3: Substitution of individual oil-based furnaces	Single	
40	HO-4: Better Houses	Single	
41	HO-5: Strategy for Energy renovation of buildings	Single	
64	HO-6 (new): Heat pumps as an energy service	Single	
42	IP-1: Regulation of use of HFCs, PFCs and SF6 (phasing out most of the uses)	Single	
43	AG-1(expired): Action Plan for the Aquatic Environment I+II and Action Plan for Sustainable Agriculture	Single	
44	AG-2(expired): Action Plan for the Aquatic Environment III	Single	
45	AG-4a/4b/4c/4d/4e: Reduced emissions of ammonia	Single	
46	AG-4f: Environmental Approval Act for Livestock Holdings	Single	
47	AG-6: Biogas plants	Single	
48	AG-9(expired): Agreement on Green Growth	Single	
65	AG-11(new+expired): Agreement on Green Growth 2.0	Single	
66	AG-12(new): Political Agreement on a Food and Agricultural Package	Single	
67	AG-13(new): Agreement on Nature (the Nature Package)	Single	
49	LU-1: Ban on burning straw on fields	Single	
50	LU-2: Planting of windbreaks	Single	
51	LU-3: Subsidies scheme for private afforestation on agricultural land (increase the forest area in Denmark)	Single	
52	LU-4: Public afforestation (state and municipalities)	Single	
53	LU-5: Subsidy for conversion of arable land on organic soils to nature	Single	
54	WA-1: A ban of landfill of combustible waste.	Single	
55	WA-2: The waste tax	Single	
56	WA-3: Weight-and-volume-based packaging taxes	Single	
57	WA-4: Subsidy programme – Enterprise Scheme (special scheme for businesses)	Single	
58	WA-5: Increased recycling of waste plastic packaging	Single	
59	WA-6: Implementation of the EU landfill directive	Single	
60	WA-7(expired): Support for (construction of facilities for) gas recovery at landfill sites	Single	
61	WA-8(expired): Subsidy programme for cleaner products	Single	
62	WA-9: Subsidy programme for biocovers on landfills	Single	
63	G1 (changed): Group of all policies and measures except in the LULUCF sector	Group	TD-b1, -2, -3, -4, -5, -6, -7, -8, -9; EN-1, -2, -3, -4, -5, -6; BU-1, -2, -6, -7, -8, -9, -10; TR-1a, -1b, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11, -12; HO-1, -2, -3, -4, -5, -6; IP-1; AG-1, -2, -4a-f, -6, -9, -11, -12, -13; WA-1, -2, -3, -4, -5, -6, -7, -8, -9
1	G2 (former TD-1a): Energy taxes except on mineral oil	Group	TD-2, TD-3 and TD-4
68	G3: All RE mitigation actions (Renewable Energy) since 1990	Group	EN-2, EN-3, EN-4, EN-5, BU-8 and TR-8
69	G4: All EE mitigation actions (Energy Efficiency) since 1990	Group	TD-b1, -2, -3, -4, -5, -6, -7; EN-1; BU-1, -2, -6, -7, -9, -10; TR-1a, -1b, -2, -3, -4, -5, -6, -7, -10, -11, -12; HO-1, -2, -3, -4, -5, -6
[70]	G5 (new G.): Energy efficiency in transport by passenger cars	Group	TD-6, TR-1a, TR-1b, TR2 and TR-3
[71]	G6 (new G.): F-gas taxes and regulation	Group	TD-8 and IP-1
[72]	G7 (new G.): LULUCF activities	Group	LU-1, -2, -3, -4 and -5

Additional policies and measures (planned as well as adopted, but not yet implemented)

Denmark's additional²⁴ policies and measures with effect on greenhouse gas emissions are shown in Table 2. The list of additional measures includes both the additional measures adopted with the Energy Agreement of 29 June 2018 (i.e. adopted, but not yet implemented and not yet included in the WEM-projection scenario²⁵) and the additional measures proposed by the government in its Climate and Air Proposal of 9 October 2018 (i.e. planned until adopted, allocation of financial resources and/or mobilisation of human resources²⁶). Chapter 5 elaborates and reports on the ex-ante estimated effects of additional decided and planned measures. On the basis of the ex-ante estimated effects of the additional measures, under the planned policies and measures, a projected development of the green house gas emissions and removals ("PDP-PAMs")²⁷ has been elaborated and reported in chapter 5. Further information on the 2018 Energy Agreement and the 2018 Climate and Air Proposal is included in Annex 1.

²⁴ As of 9 October 2018 in the Government's Climate and Air proposal

²⁵ WEM: With Existing Measures

²⁶ 'planned policies and measures' are options under discussion and having a realistic chance of being adopted and implemented after the date of submission of the national plan or progress report;

²⁷ "PDP-PAMs": Projections of the Development of the GHG emissions and removals under the Planned Policies And Measures cf. Governance Regulation, Annex I, Part 1, Section 5.1(i). It should be noted that in addition to the measures planned with the Climate and Air Proposal of 9 October 2018 also the measures adopted with the Energy Agreement of 29 June 2018 are included in the PDP-PAMs-scenario as the effects of these measures are not included in the April 2018 WEM-scenario.



Table 2 Overview of Denmark's portfolio of additional and planned climate relevant policies and measures

Name of mitigation action	Single PAM or Group of PAMs	PAMs included in Groups of PAMs
[a: additional (adopted, but not yet implemented)/ p: planned (options under discussion and having a realistic chance of being adopted and implemented)/ G: Group of measures/ TD: Taxes and Duties/ EN: Energy/ BU: Business/ HO: Households/ TR: Transport/ IP: Industrial Processes/ AG: Agriculture/ LU: LULUCF/ WA: Waste/ "x" in the numbering means that the measure is an update, extension or expansion of an existing measure previously reported under the number shown]		
a-EN-4x [E1]: World class offshore wind	Single	
a-EN-3-x1 [E2]: Renewable energy on market conditions	Single	
a-TD-4x [E3]: Reduction of taxes on electricity and restructuring of surplus heat utilisation	Single	
a-BU-1x&HO-1x [E4a]: Targeted energy savings	Single	
a-HO-3x [E4b]: Funding for scrapping oil-fired boilers	Single	
a-EN-7 [E5]: Modernisation of the heating sector and mitigating impacts of eliminating the base subsidy	Single	
a-EN-6x [E6]: Strengthened energy and climate research	Single	
a-TR-11 [E9]: Funding for green transport	Single	
a-EN-3-x2 [E10]: Reserve for additional investments in RE as from 2025	Single	
p-TR-13 [C1]: Phase-out of sales of new petrol and diesel cars in 2030, and of new plug-in hybrid cars in 2035.	Single	
p-TD-5-x/6-x1/7-x1 [C2]: A commission must show the way.	Single	
p-TD-7-x2 [C3]: No registration tax in 2019 and 2020 on green cars priced below 400,000 DKK.	Single	
p-TD-6-x2 [C4]: Lower taxation on green company cars.	Single	
p-TR-9-x1 [C5]: Charging a low-emission car must be faster.	Single	
p-TR-9-x2 [C6]: Greater powers for municipalities to grant parking discounts for low-emission cars.	Single	
p-TR-9-x3 [C7]: Ensuring parking spaces with charging stations for low-emission cars.	Single	
p-TR-9-x4 [C8]: Denmark's municipalities can grant low-emission cars permission to drive in bus lanes.	Single	
p-TR-9-x5 [C9]: Research into the dynamics between electric cars and the energy system.	Single	
p-TR-14 [C10]: An end to carbon emissions and air pollution from busses in Denmark's cities by 2030.	Single	
p-TR-15 [C12]: Petrol and diesel out of taxi operations by 2030.	Single	
p-TR-16 [C13]: Benefits for green taxis.	Single	
p-TR-17 [C14]: Higher scrapping premium for old diesel cars.	Single	
p-TR-18 [C16]: All new asphalt on national roads must be climate-friendly.	Single	
p-TR-8x [C17]: More biofuel in petrol and diesel.	Single	
p-TR-19 [C18]: More environmentally-friendly cruise tourism in the Baltic Sea.	Single	
p-AG-4a/4b/4c/4d/4e-x [C20]: Less ammonia in the air.	Single	
p-AG6x [C21]: Improvement of biogas plants.	Single	
p-AG-14 [C22]: Air- and climate-friendly technology in pig farms.	Single	
p-AG15 [C23]: Stronger research efforts in agriculture.	Single	
p-AG-16 [C24]: Promotion of precision agriculture.	Single	
p-LU-5x [C25]: Land distribution fund focused on environment, climate and nature.	Single	
p-AG-17 [C26]: Partnership with the agricultural sector.	Single	
p-IP-1x [C29]: Stricter regulation of climate-damaging gases in cooling systems.	Single	
p-EN-8 [C30]: Strategy for development of the natural gas system.	Single	
p-CS-1 [C31]: Behavioural campaign with climate labelling.	Single	
p-CS-2 [C32]: Climate activities for Danes.	Single	
p-LU-1/2/3/4/5-x1 [C33]: Increased research into carbon dioxide removal and storage.	Single	
p-LU-1/2/3/4/5-x2 [C34]: Use of carbon dioxide removal in climate efforts.	Single	
p-LU-1/2/3/4/5-x3 [C35]: Analysis to improve the monitoring and accounting of carbon dioxide storage in soils and forests	Single	
p-CS-3 [C36]: Annulment of carbon dioxide quotas.	Single	
p-CS-4 [C37]: More funding for climate efforts in 2026-2030.	Single	
p-G8 [E]: The 2018 Energy Agreement of 29 June (ETS and non-ETS)	Group	E1, E2, E3, E4a, E4b, E5, E9 and E10
p-G8a [E(ETS)]: All actions in the 2018 Energy Agreement with effects in the ETS sector	Group	E1, E2, E3, E4a, E5 and E10
p-G8b [E(non-ETS)]: All actions in the 2018 Energy Agreement with effects in the non-ETS sectors	Group	E1, E2, E3, E4a, E4b, E5, E9 and E11
p-G9 [C]: The 2018 Climate and Air Proposal of 9 October	Group	C1, C10, C12, C16, C17, C21, C29
p-G8b&G9 [total non-ETS]: Non-ETS of The 2018 Energy Agreement and The 2018 Climate og Air Proposal	Group	G8b, G9
p-G8&G9 [total E+C]: The 2018 Energy Agreement and The 2018 Climate and Air Proposal	Group	G8, G9

Outlook to the long-term vision

As an outlook to the long-term vision and goal to become a low emission economy and achieving a balance between emissions and removals in accordance with the Paris Agreement, Denmark's targets under Regulation 2018/842 (ESR) and Regulation 2018/841 (LULUCF) are to be seen as steps in 2021-2030 towards the Government's long-term objective for Denmark in 2050, which is to become a climate-neutral society by 2050, which means that Denmark will absorb at least as much greenhouse gas as it emits.

The Energy Agreement outlining Denmark's energy policy, reached by the government with all political parties in the Parliament on 29 June 2018, includes the following long-term elements until 2050:



1. Following from the agreement significant investments to reach the ambition of a low-emission society by 2050 will be made.
2. The green transition takes place in the energy sector and through the Danish climate policy. In this context, the parties agreed that Denmark will work towards net zero emissions in accordance with the Paris agreement and for a net-zero-emission target in the EU and Denmark by 2050.
3. Finally, the parties note that a long-term renovation strategy for existing buildings is being developed. This strategy will include indicative milestones for building renovation for 2030, 2040 and 2050.

As highlighted in the government's climate and air pollution proposal "*Together for a greener future*" from 9 October 2018, it was also agreed in the Energy Agreement to increase funding for energy and climate research to DKK 1 billion in 2024 in support of the course towards a climate-neutral society by 2050.

Specifically, the government will initiate research into carbon sequestration and storage. This creates the basis for even more reductions.

Further information will be included in Denmark's long-term low emission strategy to be submitted to the European Commission by 1 January 2020 pursuant to Article 14 of the Governance Regulation.

ii) Where relevant, regional cooperation in this area

One fora in where Denmark participates in regional cooperation is the Nordic Council of Ministers. The Nordic Council of Ministers was founded in 1971. Despite the generic name, it actually consists of several councils. Regional cooperation in the area of climate change takes place through the Nordic Council of Ministers for the Environment and Climate (MR-MK)²⁸. The Council of Ministers for the Environment and Climate (MR-MK) is responsible for the Nordic inter-governmental co-operation on environmental issues, including on climate change. Its remit includes preserving and enhancing the quality of the environment and of life in the Region and exerting influence on regional and international co-

²⁸ <http://www.norden.org/en/nordic-council-of-ministers/council-of-ministers/nordic-council-of-ministers-for-the-environment-and-climate-mr-mk/nordic-council-of-ministers-for-the-environment-and-climate>



operation²⁹. Currently, in MR-MK Denmark is represented by the Minister for Environment and Food when environment is on the agenda and by the Minister for Energy, Utilities and Climate when climate is on the agenda.

The Nordic Council of Ministers for the Environment and Climate (MR-MK) has a Committee of Senior Officials for the Environment and Climate (EK-MK), which prepares and follows up on the work of the council and is responsible for ensuring that the Environmental Action Plan is implemented. The Nordic Committee of Senior Officials for the Environment and Climate (EK-MK) has set up a Working Committee (AU) consisting of representatives of national environment agencies, to plan and co-ordinate its activities. Currently, the Danish Environmental Protection Agency represents Denmark in MR-MK and AU.

Working Groups under MR-MK/EK-MK/AU relevant to regional cooperation on climate change and greenhouse gas emissions reduction are:

- Climate and Air Pollution Group (KoL): The work of the Climate and Air Pollution Group supports the Nordic objectives of reducing serious climate change and preventing the impact of air pollution on the environment, ecosystems and human health. The outcome is a series of publications³⁰.

The Nordic Council of Ministers' Environmental Co-operation funds projects whose aims are in keeping with the Nordic Environment Action Plan 2013–2018³¹ and/or the programme of the annual Presidency. At least three Nordic countries must take part in the project, which must generate clear Nordic synergy. The Climate and Air Pollution Group (KOL) invites applications for contributions to Nordic projects that support the implementation of the Nordic Environmental Action Programme and the priorities of the Climate and Air Pollution Group. The Climate and Air Pollution Group is working to limit and prevent serious climate change and transboundary air pollution, as well as to limit and prevent air pollution from causing harm to human health³².

²⁹ The most recent outcomes are available here: <http://www.norden.org/en/nordic-council-of-ministers/council-of-ministers/nordic-council-of-ministers-for-the-environment-and-climate-mr-mk/strategy>

³⁰ <http://www.norden.org/en/nordic-council-of-ministers/council-of-ministers/nordic-council-of-ministers-for-the-environment-and-climate-mr-mk/institutes-co-operative-bodies-and-working-groups/working-groups/climate-and-air-pollution-group-kol/publications-and-reports>

³¹ <http://norden.diva-portal.org/smash/get/diva2:701877/FULLTEXT01.pdf>

³² <http://www.norden.org/en/nordic-council-of-ministers/council-of-ministers/nordic-council-of-ministers-for-the-environment-and-climate-mr-mk/institutes-co-operative-bodies-and-working-groups/working->



- The Nordic working group for global climate negotiations (NOAK): The group's overarching goal is to contribute to an ambitious and effective implementation of the UNFCCC and its Paris Agreement, with a Nordic perspective. The outcome is a series of publications³³.

In addition there are also Working Groups under the Nordic Council of Ministers for Sustainable Growth (MR-VÆKST)³⁴ and its Committee of Senior Officials, which are relevant to regional cooperation on climate change and greenhouse gas emissions reduction. Information on the cooperation through these working groups is included under the relevant sections on the other dimensions of the Energy Union.

(iii) Without prejudice to the applicability of state aid rules, financing measures, including Union support and the use of Union funds, in this area at national level, where applicable

Renewable energy sources are promoted with economic measures, including use of energy and CO₂ taxes on fossil fuels and through the Public Service Obligation

Schemes (PSO), which have been a supplement to the price of electricity paid by all consumers until 2017. The Danish PSO levy will be phased out during a period of 5 years (2017-2022), and the financing of support to renewables will gradually shift to the State Budget.

3.1.2 Renewable energy

(i) Policies and measures to achieve the national contribution to the binding 2030 Union target for renewable energy and trajectories as referred to in point (a)(2) Article 4, and, where applicable or available, the elements referred to in point 2.1.2 including sector- and technology-specific measures³⁵.

[groups/climate-and-air-pollution-group-kol/the-climate-and-air-pollution-group2019s-project-funding-in-2018](#)

³³ <http://www.norden.org/en/nordic-council-of-ministers/council-of-ministers/nordic-council-of-ministers-for-the-environment-and-climate-mr-mk/institutes-co-operative-bodies-and-working-groups/working-groups/the-nordic-working-group-for-global-climate-negotiations-noak/publications-and-reports>

³⁴ The Nordic countries work together on business, energy and regional policies in order to promote continued positive growth in the Region. The Nordic Council of Ministers for Sustainable Growth consists of ministers responsible for business, energy and regional policy.

³⁵ When planning these measures, Member States shall take into account the end of life of existing installations and the potential for repowering.



Denmark will in the coming period from 2020 to 2030 continue the path towards a climate neutral society by 2050. With the new initiatives outlined in the June political agreement, Denmark has allocated funding that sets a course towards a RE share of approximately 55 % by 2030.

Denmark will in the coming years significantly expand its capacity of renewable energy. In the electricity sector new capacity is primarily expected to be solar PV and wind, but also solid biomass will play an important role in the conversion of the remaining central power plants still operating on coal.

New technology neutral tenders for wind and solar PV will be conducted in 2018 and 2019, whereas further RES technologies will be added in the technology neutral tenders conducted from 2020-2024. Tenders for offshore wind has been conducted and contracts signed for the first 400 MW to start production in 2019, and 350 MW to start production in 2020 and 600 MW to start production in 2021. Additional tenders for three offshore wind parks of a total of at least 2,400 MW have also been decided. The decision rests upon the prerequisites mentioned in section 1.1.

To support the continuant renewable capacity increase, Denmark will implement new financial support schemes for a range of technologies as described under point iii) below.

The production and consumption of renewables go hand in hand. Therefore Denmark wants to ensure better incentives for use of renewable energy over fossil alternatives. Denmark is phasing out the public service obligation originally put on the electricity bill to finance support for renewables. At the same time, the parties of the 2018 Energy Agreement agreed to reduce the electrical heating tax by .152 DKK/kWh (2018 prices), effective from 2021. Thus the electricity heating tax will be reduced from .307 DKK/kWh to .155 DKK/kWh (2018 prices). The tax reduction constitutes a follow-up on the *Agreement on Business and Entrepreneur Initiatives*.

This initiative will make the tax on electrical heat more balanced in relation to the tax on fossil fuels for space heating. The reduction of the electrical heating tax promotes the green transition in the heating sector by increasing the use of individual heat pumps and heat pumps in district heating systems. It also increases the incentive for utilising surplus heat.

As a result of the shift from fossil heating to electrical heating, the tax reduction contributes to reducing carbon emissions in non-quota sectors. It will also make



electrical heat more attractive than wood-burning stoves, thereby lowering particle emissions

. This means that electricity produced on RE-sources will become more competitive with other energy sources.

The parties of the 2018 Energy Agreement agree to work for a modernised heating sector where district heating plants and consumers have the freedom to make their own decisions on future investments, thereby improving access to green and cheap heating for businesses and consumers. The regulatory bindings for producers of district heating on the choice of fuels will be terminated in the smaller district heating areas from 1 January 2019. It is expected to leave way for more renewable heating as a substitute for natural gas. As well a planned stop to new consumer commitments in the form of e.g. connection obligations will give individual consumers freedom to choose their own heating solution, which as well is expected to lead to more consumers choosing renewable options, as these have been made more competitive.

In transport, according to present Danish legislation, suppliers must blend at least 5.75 pct. of biofuels in the transport fuel they put on the market. From January 1, 2020, they must blend in at least 0.9 pct. of advanced biofuels.

(ii) Where relevant, specific measures for regional cooperation, as well as as an option, the estimated excess production of energy from renewable sources which could be transferred to other Member States in order to achieve the national contribution and trajectories referred to in point 2.1.2

Denmark has entered a cooperation agreement with Germany which will result in statistical transfers from Denmark to Germany, corresponding to the electricity production from 50 MW solar PV financially supported by Germany.

Denmark cooperates with other European and non-European countries on renewable energy in a number of fora. The European policy fora include CA-RES (RES in EU), BEMIP (RES and other topics in countries around the Baltic Sea), North Seas Energy Cooperation (Offshore wind in the North Sea), and Nordic council of ministers (RES and other topics in the Nordic countries).

On cooperation regarding renewable gas, the Danish TSO, Energinet, issues so-called biomethane certificates for every MWh of biomethane injected into the natural gas grid. Upon request, certificates are issued to biogas producers serving as documentation for the amount of biogas fed into the grid. In order to receive certificates, each producer must register with a specific database operated by



Energinet. Certificates can be traded across member states, but at present, the renewable share is counted towards the national Danish renewables target.

Denmark works in the NSEC to coordinate the timing of tenders, to exchange best practices on the design for offshore wind support schemes and to identify, where possible, common principles as well as possible options for alignment of support.

As regards timing of tenders, Denmark regularly shares information regarding its national tender schedule with the other NSEC countries. NSEC countries collect and regularly update each other on their respective national tender schedules with the aim to identify possible overlaps in time and to enable for a most continuous tender pipeline across the North Seas region. Denmark is ready to take into account, amongst other criteria and where possible, this overview of tender schedules in its future tender planning to avoid unnecessary overlaps and to provide a steady capacity pipeline to involved stakeholders without stop and go cycles.

(ii) Where relevant, specific measures for regional cooperation, as well as, as an option, the estimated excess production of energy from renewable sources which could be transferred to other member States in order to achieve the national contribution and trajectories referred to in point 2.1.2

Nordic co-operation on Renewable Energy

The Nordic countries make considerable efforts to develop and increase the use of renewable energy, aiming to diversify the energy system and to be less dependent on import of energy sources such as fossil fuels, and to reduce the CO₂ emissions. The Working Group for Renewable Energy (AGFE) – consisting of experts from the Ministries and energy authorities in the five Nordic countries – supports the Nordic countries' policy and development work in renewable energy sector by exchanging information and enhancing the collaboration between Nordic countries. In addition, AGFE disseminate information about relevant projects commissioned by AGFE tackling different issues on renewable energy in the Nordics. Most recently AGFE has looked at: renewable energy system support in the Nordics, how new EU sustainability criteria for biomass will affect the Nordics and finally, an assessment of the emerging trend of distributed electricity production and self-consumption.

AGFE aims to strengthen Nordic added value through projects that would usually occur nationally, but where positive effects are created through a Nordic joint effort. The group works to develop and manifest Nordic collaboration, and



thereby increase Nordic competencies and competitiveness. AGFE also strives to develop Nordic perspectives on emerging policies and regulations within EU. Some of AGFE's recent activities are listed below:

In 2018, AGFE initiated a study on Distributed energy production and self-consumption in the Nordics. The aim of the study is to review the current situation and future prospect of decentralized energy production and the transition where consumers such as households are becoming also producers. The regulations and policies in the Nordic countries concerning distributed electricity production and self-consumption will be discussed, and barriers to a sound development will be identified. This study will provide useful information for policy makers and other stakeholders and will contribute to fulfil coming requirements according to the revised EU directive on renewable energy (REDII).

AGFE works for enhanced Nordic co-operation on implementing the current EU renewable energy directive (REDI) to 2020 as well as preparing for the revised directive (REDII) that take effect from 2020.

As a set of new forest biomass sustainability criteria were proposed in RED II, AGFE in 2017 commissioned a study on the emerging Bioenergy Sustainability Policy and its possible impacts entitled; "A Nordic analysis of the proposed EU policy for bioenergy sustainability". This work contributed to the process of revising the Directive and increasing the knowledge of its impact on the bioenergy sector in the Nordic region.

In 2016 AGFE commissioned a study; "New Gameplan – RES Support in the Nordics" with the purpose to investigate the impact of the revised State Aid Guidelines on current Nordic support schemes designed to promote renewable energy. The study contributed to the discussions regarding the design of Nordic support schemes.

(iii) Specific measures on financial support, where applicable including Union support and the use of Union funds, for the promotion of the production and use of energy from renewable sources in electricity, heating and cooling, and transport

Electricity from wind power and solar PV

Denmark has conducted tenders of support for offshore wind parks and signed contracts for 400 MW to start production in 2019, 350 MW to start production in 2020 and 600 MW to start production in 2021. Additional tenders for three offshore wind parks of at least 800 MW each have been decided in the policy agreement of June 2018.



Denmark will arrange technology neutral tenders of support for wind power and solar PV in 2018 and 2019, where the installations are expected to start production in 2020 and 2021, and a tender in 2018 for solar PV installations smaller than 1 MW. The policy agreement of June 2018 includes further technology neutral tenders in the period 2020-2024, which among other things also include wave and hydropower technologies.

The June 2018 political agreement also include a reserve of 400 million DKK in 2025 and 500 million DKK annually for further efforts from 2026 to promote renewable energy.

Denmark is also preparing specific support schemes for wind turbines with a testing purpose from 2018-2024.

In the NSEC, Denmark also contributes to the work of analysing and developing options for further mobilisation of investment capital for joint projects, for instance through EU funds such as EFSI and CEF as well as institutional investors. Such joint projects could be cross-border projects for renewable energy in accordance with the CEF proposal.

Promotion of the use of electricity

Denmark has some of the highest consumption taxes on electricity in the EU. As the renewables share in electricity steadily increases, the Danish Parliament wishes to improve incentives for the use of electricity over other types of energy, especially in the heating sector. For that purpose it is agreed gradually to reduce the electricity taxes in the period from 2019-2025.

The tax on electricity for heating purposes will be reduced from 4.1 EUR cent/kWh to 2.1 EUR cent/kWh from year 2021. The general electricity tax will be reduced from 12.3 EUR cent/kWh today to 10.4 EUR cent/kWh in 2025. For certain types of businesses the electricity tax will be reduced to the EU-minimum level.

Going forward, a special task force will be set up with the purpose to analyze if the present tariffs and tax regime can be optimized to better support demand side management.

Biogas

The use of biogas for certain purposes is supported financially. More specifically, end-users are eligible for different types of direct grants when biogas is used to produce electricity or heat, upgraded to biomethane, used as a fuel in the transport sector or used in industrial processes.



Under current national legislation, the support schemes do not contain a specific expiry date. Approval by the EU under EU state aid legislation is, however, limited to 2023 for the support schemes covering electricity generation and upgrading, and 2026 for the schemes covering the remaining purposes.

The policy agreement of June 2018 include funding for 32 million EUR per year over 20 years to continue support for biogas and other types of green gas.

Electricity and heat from solid biomass

The electricity production from the use of solid biomass is supported with a fixed premium of 2 EUR cent/kWh. The scheme runs for 10 years until 2019 and covers existing and new biomass CHP plants. The fixed premium scheme, in combination with tax exemption on biomass fuels for heat production, has been a strong driver in recent years for the fuel switch from coal and gas.

The policy agreement of June 2018 establishes the future support system after April 1, 2019.

There are in total 3 support schemes:

- 1) Existing non depreciated installations will continue with a fixed premium of 2 EUR cent/kWh in the entire depreciation period.
- 2) Depreciated installation will be supported by a fixed premium calculated on basis of the difference in operating cost in using biomass compared to an alternative fossil reference.
- 3) For new installations after April 1, 2019 a grant pool is established, which would give the possibility of aid for new capacity for the production of electricity using biomass, biogas and other green gasses after application.

The latter two new schemes are to be notified to the European Commission.

Transport

In the Energy policy agreement from June 2018 there has been made a reservation on an amount of 500 million DKK for the years 2020-2024 – 100 million DKK a year for the transport sector. The pool shall be used to support green solutions in the transport sector. The specific initiatives will be developed further.

Furthermore, as an element in the Agreement on business and entrepreneurial initiatives of 12 November 2017, there has been made a reservation on 140 million DKK to support the production of advanced biofuel. It is yet to be decided how these 140 million DKK can support the production of advanced biofuel.

Heating and Cooling

From 2020 13.4 million EUR/year is earmarked for promotion of use of waste heat.

(iv) Where applicable, the assessment of the support for electricity from renewable sources that Member States have to carry out pursuant to Article 6 (4) of the Directive (EU) 2018/? on the promotion of the use of energy from renewable sources.

The assessment has not yet been made in Denmark.

(v) Specific measures to introduce one or more contact points, streamline administrative procedures, provide information and training, and facilitate the uptake of power purchase agreements

Summary of the policies and measures under the enabling framework Member States have to put in place pursuant to Articles 21(6) and Article 22(5) of Directive (EU) 2018/X on the promotion of the use of energy from renewable sources] to promote and facilitate the development of renewable self-consumption and renewable energy communities

The administrative procedures regarding permit granting for off-shore wind has been simplified in recent years by the establishment of a single contact point handled by the Danish Energy Agency. The agency acts as a one stop shop and is responsible for delivering the final permission regarding feasibility studies, construction and production. The Agency is also responsible for coordinating input from other relevant authorities.

Denmark is in the preparation for the national implementation of article 15 and 16 regarding streamlining administrative procedures and the set-up of national contact points for renewable energy projects.

Electricity used for self-consumption is supported by an exemption from electricity tax. At present, the tax on electricity for private consumers is 12.3 EUR cent/kWh. This gives a clear economic incentive for self-consumption in buildings.

In Denmark there is a long tradition for establishing of renewable energy communities especially in the district heating sector and renewable electricity production.



Denmark is in the preparation for the national implementation of article 21 and 22 regarding an enabling framework for renewable self-consumption and renewable energy communities.

(vi) Assessment of the necessity to build new infrastructure for district heating and cooling produced from renewable energy sources

Denmark is rapidly phasing out fossil fuels for the production of heat and power. The latest Energy Agreement from June 2018 is expected to give Denmark a RE share in electricity above 100 % of consumption, while ensuring that at least 90 % of district heating consumption is based on energy sources other than coal, oil or gas by 2030. It is a political priority to achieve the increase through market mechanisms. For the coming year an analysis will be conducted to assess the expected transition path. This analysis will allow for further assessment of the possible need for new infrastructure. And is expected finalized in the first half of 2019.

(vi) Where applicable, specific measures on the promotion of the use of energy from biomass, especially for new biomass mobilisation taking into account:

- biomass availability, including sustainable biomass: both domestic potential and imports from third countries

- other biomass uses by other sectors (agriculture and forest-based sectors); as well as measures for the sustainability of biomass production and use

Denmark currently has no specific measures that promote the production of electricity from new biomass installations after 2020. Considerations regarding the promotion of new installations are currently undergoing.

Biomass for heating is promoted by the absence of energy taxes on heat from renewable sources.

In 2014, the Danish energy sector laid down principles for a set of sustainability criteria for the use of solid biomass in energy production. The purpose and principles are set up as a voluntary industry agreement, to encourage the industry's members and branches to the purchase of sustainable biomass.

As mentioned, in the present setup the electricity production from the use of solid biomass in existing installations is supported with a fixed premium of 2 EURcent/kWh. This fixed premium scheme has been a supplement to tax exemption on biomass fuels for heat production.

3.1.3 Other elements of the dimension

(i) Where applicable, national policies and measures affecting the EU ETS sector and assessment of the complementarity and impacts on the EU ETS

Not applicable. Although most of Denmark's policies and measures related to energy consumption mentioned in Table 1 (names starting with TD, EN, BU, TR or HO) will have an effect on both CO₂ emissions under Directive 2003/87/EC [EU ETS] and greenhouse gas emissions under Regulation 2018/842 [ESR] as mentioned in chapter 3.1.1, assessments of the separate effect on the EU ETS sector have not been carried out.

(ii) Policies and measures to achieve other national targets, where applicable

Among Denmark's policies and measures with effect on greenhouse gas emissions reported in 2018 in Denmark's Seventh National Communication and Third Biennial Report under the United Nations Framework Convention on Climate Change (UNFCCC) and under the EU Monitoring Mechanism Regulation (MMR) cf. Table 1, there are several policies and measures, which will also contribute to the achievement of the expected national share on renewable energy in 2030. Directly this includes EN-2, EN-3, EN-4, EN-5, BU-8 and TR-8 in Table 1 and indirectly TD-1b, TD-2, TD-3, TD-4, TD-5, TD-6 and TD-7 in Table 1.

(iii) Policies and measures to achieve low-emission mobility (including electrification of transport)

Among Denmark's policies and measures with effect on greenhouse gas emissions reported in 2018 in Denmark's Seventh National Communication and Third Biennial Report under the United Nations Framework Convention on Climate Change (UNFCCC) and under the EU Monitoring Mechanism Regulation (MMR) cf. Table 1, there are policies and measures, which will also contribute to the achievement of low-emission mobility and/or electrification of transport. This includes TR-1a, TR-8, TR-10 and TR-12 in Table 1.

The following policies and measures in the Climate and Air proposal "Together for a greener future" of 9 October 2018, will also contribute to the achievement of low-emission mobility (including electrification of transport):

- C1) Phase-out of sales of new petrol and diesel cars in 2030, and of new plug-in hybrid cars in 2035.
- C2) A commission for the transition to green cars must show the way.
- C3) No registration tax in 2019 and 2020 on green cars priced below 400,000 DKK.



- C4) Lower taxation on green company cars.
- C5) Charging a low-emission car must be faster.
- C6) Greater powers for municipalities to grant parking discounts for low-emission cars.
- C7) Ensuring parking spaces with charging stations for low-emission cars.
- C8) Denmark's municipalities can grant low-emission cars permission to drive in bus lanes.
- C9) Research into the dynamics between electric cars and the energy system.
- C10) An end to carbon emissions and air pollution from busses in Denmark's cities by 2030 – starting with the first step in 2020, where new buses must be CO2-neutral.
- C11) Clean air in Denmark's big cities – bringing environmental zones up to date.
- C12) Petrol and diesel out of taxi operations by 2030.
- C13) Benefits for green taxis.
- C14) Higher scrapping premium for old diesel cars.
- C16) All new asphalt on national roads must be climate-friendly, if an ongoing pilot project can confirm the expected effects and durability of the asphalt.
- C17) More biofuel in petrol and diesel.
- C18) More environmentally-friendly cruise tourism in the Baltic Sea.

(iv) Where applicable, national policies, timelines and measures planned to phase out energy subsidies, in particular for fossil fuels

In general, Denmark does not have a tradition for subsidizing fossil fuels. Thus, Denmark currently does not have policies, timelines and measures to phase out fossil fuels.

Further, Denmark is member of the coalition Friends of Fossil Fuel Subsidy Reform, together with Sweden, Norway, Finland, Switzerland, New Zealand, Ethiopia, Costa Rica and Uruguay. The coalition works for promoting the phase out of ineffective fossil fuel subsidies.

3.2 Dimension Energy efficiency

Planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2, including planned measures and instruments (also of financial nature) to promote the energy performance of buildings, in particular with regard to the following:

(i) Energy efficiency obligation schemes and alternative policy measures under Article 7a and 7b and article 20(6) of Directive 2012/27/EU and to be prepared in accordance with Annex II to this Regulation



As previously mentioned, Denmark has had an energy efficiency obligation scheme since 2006. The obligations are defined in the Acts concerning electricity supply, natural gas supply and heat supply and sets out the commitments of the electricity, natural gas and district heating network and distribution companies. Denmark thus has the legal authority to impose an annual energy saving obligation. However, the obligation is determined through a voluntary agreement between the Minister for Energy, Utilities and Climate and the obligated companies.

The companies included are:

- Approx. 44 electricity distribution companies
- 3 natural gas distribution companies
- Approx. 400 district heating companies
- The Oil Industry which carries out the activity on behalf of 6 oil companies

The latest voluntary agreement on the obligation scheme is from 16 December 2016. The new energy savings agreement outlines the companies' energy saving target until the end of 2020 as described under section A.

With the new energy agreement from June 2018 there is a political agreement to replace the current Energy Savings Obligation scheme beyond 2020. The new model is now being developed and it is expected that more details on the new model to fulfill Article 7 beyond 2020 will be presented in the first NECP to be prepared.

(ii) Long-term renovation strategy to support the renovation of the national stock of residential and non-residential buildings, both public and private, including policies, measures and actions to stimulate cost-effective deep renovation and policies and actions to target the worst performing segments of the national building block, in accordance with article 2a of EPBD³⁶

The energy agreement defines that the main instruments to stimulate investments etc. should be market based and oriented towards providing maximum benefit for society and consumers. The precise definition of measures and the interplay between them now has to be defined.

³⁶ In accordance with Article 2a of Directive 2010/31/EU [version as amended in accordance with proposal COM(2016)765].



(iii) Description of policy and measures to promote energy services in the public sector and measures to remove regulatory and non-regulatory barriers that impede the uptake of energy performance contracting and other energy efficiency service models³⁷

The Danish Government has implemented the following measures to promote energy services in the public sector:

The Government has developed a general concept for OPP (= Public/Private Partnerships), which encourages public authorities to enter into partnerships with private partners in order to reduce costs and increase efficiency in the public sector. OPP-projects play an important role in construction and renovation of buildings in the public sector. The core of the concept is that construction or renovation and maintenance of public buildings is carried out by private partners, while the public pays an agreed rent for the use of the buildings based on a long term contract. ESCO-projects can be considered as a special class of OPP-projects with focus on energy renovation.

It is compulsory for local authorities to consider the use of OPP whenever they decide to carry out new construction or renovation of buildings.

OPP-projects are supported by standard contracts and manuals, which have been developed by the Government for local authorities.

Furthermore, the Government is disseminating information on ESCO and how to use the ESCO-model in relation to energy performance contracting as a tool to improve the energy efficiency in buildings owned by local and regional authorities.

It is estimated that there are no regulatory barriers to the use of energy performance contracting. This is documented by the fact, that there has been an increase in the use of ESCOs in the public sector. Over the last years 22 pct. of all municipalities have chosen to carry out energy efficiency projects using energy performance contracting with private partners.

To overcome non-regulatory barriers, the Government is disseminating information on ESCOs to regional and local authorities.

(iv) Other planned policies, measures and programmes to achieve the indicative national energy efficiency contributions for 2030 as well as other objectives referred to in point 2.2 (for example measures to promote the exemplary role of public buildings and energy-efficient public procurement, measures to promote

³⁷ In accordance with Article 18 of Directive 2012/27/EU.



energy audits and energy management systems³⁸, consumer information and training measures³⁹, and other measures to promote energy efficiency⁴⁰)

As regards energy audits and management systems (EED Article 8) Act No 345 of 8 April 2014 contains the overarching requirements for energy audits of large enterprises, which entails an obligation for large enterprises to carry out a mandatory energy audit every four years on their total energy consumption, including processes, buildings and transport. The enterprises can also fulfil their obligation by using and maintaining a certified energy management system or a certified environmental management system that includes an energy audit as part of the management system. The minimum requirements for energy audits are stipulated in the Executive Order 1212 of 19 November 2014 on energy audits in large enterprises, which was issued pursuant to the Act.

As regards consumer information and training and with a reference to Articles 12 and 17 in the EED, the Danish Energy Agency has drawn up an action plan and strategy for the information campaign on energy efficiency at end-user level. The aim of this information campaign is to promote energy efficient solutions and purchasing and energy efficient behaviour among end-users. The information campaign focuses on end users with home owners, the public sector, and commercial enterprises as specific focus areas.

Improving the energy efficiency of buildings and modifying behaviour in connection to the use of buildings is a priority in the Danish public and consumer information campaign. This involves preparing material on energy efficient solutions, information on building regulations, and better access to information and knowledge about energy renovation. The Danish Energy Agency's website www.spareenergi.dk is the backbone of the Agency's communication with the end users concerning energy efficient solutions both in private households and in public and private enterprises.

In addition to SparEnergi.dk the Danish Energy Agency offers private households free phone and email advice regarding energy efficient solutions and arrange public meetings together with local authorities with focus on energy refurbishment and particular replacement of oil boilers into heat pumps.

BedreBolig is a scheme offering advice, which was launched in autumn 2014. There is no longer financial support to the building owner via the scheme, but the scheme is still being administered. The aim of the scheme is to make it easier and

³⁸ In accordance with Article 8 of Directive 2012/27/EU.

³⁹ In accordance with Articles 12 and 17 of Directive 2012/27/EU

⁴⁰ In accordance with Article 19 of Directive 2012/27/EU.

more clear for home owners how to renovate their homes by offering comprehensive, expert advice throughout the energy renovation process.

Training and awareness-raising about energy efficiency are also important elements in the Danish Energy Agency's work to improve energy efficiency. The BedreBolig scheme contains a large element of training. In connection with the scheme, a training course for tradesmen has been set up where tradesmen, construction engineers, engineers, architects etc. can train to provide advice from the start of a renovation project to the completion (one-stop shop).

The Knowledge Centre for Energy Savings (Videncenter for Energibesparelser - VEB) is a service for tradesmen and educational institutions concerning energy efficiency improvements. The centre has worked with industry organisation within the area of mediating knowledge to its members, and VEB provides on regular basis courses to support the general further education of tradesmen. Furthermore, educational efforts are carried out via a campaign run by the labour market training centres.

The energy agreement from June 2018 includes measures to improve the use of data and digitalisation to promote energy efficiency. Special emphasis is put on using data to improve the quality and use of the Energy Performance Certificates, which are produced in accordance with the Directive Energy Performance of Buildings Directive.

Furthermore the agreement includes measures to improve consumer information and awareness targeted at end-users and energy service companies with the view of improving energy efficiency and the market for energy services.

(v) Where applicable, a description of policies and measures to promote the role of local energy communities in contributing to the implementation of policies and measures in points I, ii and iv

Not applicable

(vi) Description of measures to utilise energy efficiency potentials of gas and electricity infrastructure⁴¹

In 2015 The Danish Energy Agency together with the Danish TSO Energinet, The Danish Energy Association and the Danish DSO, HMN Natural Gas published the report "*Potentiale vurdering for energieffektivitet i el- og gasinfrastruktur i*

⁴¹ In accordance with Article 15(2) of Directive 2012/27/EU.



Danmark” (The potential for energy efficiency in the Danish electricity and gas infrastructure).

The report was published to meet the obligations in directive 2012/27/EU, art. 15(2). The report both addresses the energy efficiency potentials for transit and distribution in the electricity and gas sector and gas storage.

For the **electricity** infrastructure, Energinet works on concrete projects on automatic voltage control and reactive power control that among other things will have a positive effect on energy efficiency. Energy efficiency is generally a parameter that is considered by Energinet in infrastructure projects in Denmark.

Energinet is now also implementing procedures to support the use of excess heat to district heating from Energinet’s facilities on a non-profit basis, where it is socioeconomically viable. While not directly decreasing the efficiency of Energinet’s electricity transmission activities, the utilization of the heat generated through electricity losses, decreases the loss of value for the Danish society as a whole.

The energy loss in the Danish **gas** net is very low and is approximately 0,06 pct. of the total gas consumption. Efficiency potentials are primarily related to the choice of components; compressors and boilers and the choice of pressure and temperature. There is no measurable loss of gas from storage. As an example, all compressor drives in the Danish system are electrical powered.

The gas net is continuously optimized and components are renewed with more energy efficient components, when the grid is maintained.

Because of the very low net loss it is not possible to point to significant efficiency potentials, which is not being taken care of in the continuous maintenance of the grid

(vii) Regional cooperation in this area, where applicable

Nordic Co-operation on Energy Efficiency

The Nordic cooperation on energy efficiency is conducted in the networking group on energy efficiency (NGEE). The group consists of experts from the Ministries and energy authorities in the Nordic countries.

The main objectives of the co-operation in this area are to promote Nordic co-operation on energy efficiency initiatives and to implement EU/EEA directives and programmes.



The co-operation is conducted in a network co-operation where specific ad hoc is discussed within the group especially in relation to the 'Clean energy for all' package. In addition to this the group is facilitating analysis and seminars on specific issues.

Below is some recent examples of Nordic energy efficiency co-operation.

- "A Nordic Approach to the EU's Heating and Cooling Strategy"

The project had two goals: 1) to present a survey on Heating and Cooling "to generate information which will help Nordic politicians, government officials and other interest groups to further develop the market for these solutions and as a key objective to identify the common interest of Nordic countries" and 2) to arrange a workshop in Brussels to "present the good practices from the Nordic countries, further development areas, and serve as a starting point for discussions concerning the different options for regulatory approaches in the heating and cooling market".

- *Mainstreaming energy services and EPC in the Nordic countries*

The objective of the project is to strengthen the Nordic market for energy services and EPC by

- *creating networks among local authority clients and facilitators in the Nordic countries,*
- *increasing exchange of information and mutual capacity building, and by*
- *mainstreaming the way of conducting energy efficiency projects.*

Nordic cooperation ecodesign and energy labelling

The Nordic cooperation on market surveillance and policy work on ecodesign and energy labelling is conducted in the Nordsyn working group. It is a cooperation among Nordic market surveillance authorities (MSAs) and policy agencies.

Ecodesign and energy labelling supplies nearly half the energy savings target set by the EU in 2020. Effective regulations and efficient market surveillance is essential if this is to be realized and Nordsyn aim to improve the efficiency of Nordic market surveillance and policy input. Nordic authorities, producers and consumers benefit from Nordsyn while green growth and energy efficiency are supported. The results and structure of Nordsyn can be used to improve market surveillance also in other EU countries.



Nordsyn sub projects:

In 2018 Nordsyn focus on 1) the strategic Nordic product heat pumps with two studies on how the products work in reality in Nordic climate; 2) an information film on the new product database and coming revised energy labelling; 3) a Nordcrawl2 project in which the previous developed Nordcrawl web crawling tool will be applied to give valuable input to market surveillance and policy work.

Earlier projects: Barriers for market surveillance cooperation (2012 and 2013-2015), Working methods (2013-2015), Information material (2013), Strategic Nordic products – Heat pumps (2014), Challenges for market surveillance – difficult products (2015-2017), Effects of market surveillance (2013-2014), Cooperation with customs (2013-2014), How small counties work with ecodesign and energy labelling (2013-2014), Energy labelling online information film (2016), Heat pump list prospect (2016), Strategic Nordic products - Windows (2017-2018), Heat pump reality studies phase 1 and 2 (2017-2018), Recycler interview study (2017-2018).

Results from Nordsyn

The most appreciated result of Nordsyn is that the Nordic countries now regularly share questions, commission answers, discussions, test results and plans on email and skype. Even though the core of Nordsyn is continuous contact and exchange of market surveillance results, Nordsyn has also given the possibility to perform a number of projects that improve Nordic market surveillance and knowledge of legislation among producers, retailers and consumers. The Nordsyn steering group communicate on monthly skype meetings, emails and two physical meetings/workshops per year.

Effects-project: this study showed a prevented energy loss worth 28 million Euro for a market surveillance cost of around 2 million Euro in the Nordic countries, and an overall rate of 6.3% non-compliance. These results show that the market surveillance is cost efficient, especially when countries cooperate.

Strategic Nordic products Heat pumps-project: the project resulted in an overview of legislation, national work and recommendations. Some of these recommendations are further studied in the 2017 and 2018 heat pump projects.

Challenges-project: the project contains a number of product studies on how to perform market surveillance on complex products (ventilation units, transformers, professional refrigeration etc).



(viii) Financing measures, including Union support and the use of EU funds, in the area at national level

An updated list of financing measures will be included in the first NECP for the period 2021-2030.

3.3 Dimension Energy security

(i) Policies and measures related to the elements set out in 2.3⁴²

The general movement of the Danish Energy sectors go towards further diversification as a result of a political ambition to increase the amount of renewables in the energy mix and the technical challenges with the fluctuation of wind and solar power. At the moment the Danish Government invests in a variety of energy technologies focused on increasing the variation of possibilities in production, distribution and consumption.

Denmark has developed legislation to ensure that the electricity and natural gas sector adapt to new digitally enabled threats and vulnerabilities. This legislation is adapted into the existing framework for risk assessment and mitigation. A specific strategy for cybersecurity in the energy sectors has been developed in cooperation with the companies in the recognition of the complexity of the area and demand for corporation between authorities and companies.

The electricity sector

In Denmark the probability of electricity being available to the consumer, when it is demanded, is better than 99.99% and there has been no historic lack of electricity supply due to insufficient generation capacity or interconnector. In the year 2020 Denmark will have more interconnector capacity than the maximum Danish electricity consumption and together with the domestic installed electricity production capacity, Denmark is solidly based in the matter of security of electrical supply.

⁴² Consistency shall be ensured with the preventive action and emergency plans under Regulation [as proposed by COM(2016) 52] concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010, as well as the risk preparedness plans under Regulation [as proposed by COM(2016) 862] on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC.



The matter of sufficient generation capacity is being monitored and analyzed regularly by Energinet and the Danish Energy Agency, in order to take any required pre-emptive measures needed to meet the level of security of supply.

The natural gas sector

The producer in the North Sea has announced that the main gas production facility in the North Sea – Tyra – will be shut down from November 2019 to July 2022 in order to renovate the facility. The decision has been taken due to security reasons, as the platform has sunk since the facility came on stream in 1984, and the fact that the waves are becoming higher and more powerful. During the shut-down, gas flows on shore to Denmark will be reduced to about 10 % of the gas delivered in 2018. The oil production in the southern part of the North Sea is expected to continue during the period of renovation and the associated gas production can be evacuated to the Netherlands through the NOGAT pipe line system. However, it is expected that the export to the Netherlands will not exceed 1 BCM per year.

The Tyra shut-down period represents a new challenge for the Danish as well as the Swedish security of gas supply, as the gas markets will be almost fully relying on supplies from Germany and the two Danish storage facilities. Thanks to the former expansion of the transmission system in the Northern part of Germany and in the southern part of Jutland, the import capacity from Germany in combination with the storage capacity should be sufficient to ensure gas supply to the Danish and Swedish customers. However, the gas system will be significant less flexible and more vulnerable during the reconstruction of the Tyra gas facility.

When the Tyra facility comes on stream again, Denmark will return to be a net exporter of gas. It is expected that the degree of self-sufficiency of gas will be about 160-170 % and that Denmark will continue to be self-sufficient to at least 2035.

*(ii) Regional cooperation in this area*⁴³

Denmark is promoting regional cooperation by participating in the Nordic risk-preparedness cooperation group (NordBER) and by facilitation the operational coordination between the Nordic Electricity TSOs in the Nordic Regional Security Coordinator (RSC) stationed in Denmark.

⁴³ Consistency shall be ensured with the preventive action and emergency plans under Regulation [as proposed by COM(2016) 52] concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010, as well as the risk preparedness plans under Regulation [as proposed by COM(2016) 862] on risk-preparedness in the electricity sector and repealing Directive 2005/89/EC.



The natural gas sector

The Danish TSO (Energinet) and the Polish TSO (Gaz-System) have taken the final investment decision to establish the Baltic Pipe project. The project will make it possible to transport up to 10 BCM Norwegian gas to Poland from October 2022 through the Danish gas infrastructure. The project will connect the Danish and Polish gas markets including the possibility for Denmark to import gas from Poland

With regard to the implementation of Regulation 2017/1938 concerning measures to safeguard the security of gas supply, Denmark participates in the risk groups Norway, Baltic Sea and Denmark. Denmark leads the risk group and a final report has been prepared and notified to the Commission. Furthermore, Denmark will have to make agreements with Germany and Sweden in technical, legal and financial arrangements in order to ensure that gas can be supplied to solidarity protected customers in one of the Member States in case of a request. A dialog with Germany and Sweden on these arrangements is ongoing.

(iii) Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

Not applicable

3.4 Dimension Internal energy market

3.4.1 Electricity infrastructure

(i) Policies and measures to achieve the targeted level of interconnectivity as set out in point (d) of Article 4

Denmark has no specific target regarding interconnectivity, but it remains to be a priority. In Denmark new interconnectors are approved based on their socio economic value, see 2.3.1. It is the Danish TSO, Energinet's, responsibility to propose new interconnectors to the relevant ministry.

(ii) Regional cooperation in this area⁴⁴

The North Seas Energy Cooperation aims to facilitate the further cost-effective deployment of offshore renewable energy with the aim of ensuring a sustainable, secure and affordable energy supply in the North Seas countries, thereby also facilitating further interconnection, further integration and increased efficiency of wholesale electricity markets in the longer term.

⁴⁴ Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.



Denmark works together with the other North Seas Energy Cooperation countries on the possibilities for concrete cooperation projects. Besides joint offshore wind projects that would be connected to and supported by several Member States (see 3.1.2), this includes the work on possible 'hybrid' solutions that would use a grid connection cable for evacuating offshore wind as well as interconnection capacity between countries, and on the corresponding market arrangements.

Denmark is therefore contributing to the development of a regional study looking at the possibilities for cooperation on hybrid projects and identifying and addressing possible legal, regulatory and commercial barriers. Further work is planned on synergies between offshore wind and offshore oil and gas installations.

By coordinating on increased interconnection among the countries in the North Seas Energy Cooperation, an increasing amount of excess production of energy could flow across borders in a well-functioning internal energy market.

Since the establishment of the North Seas Countries' Offshore Grid Initiative (NSCOGI) in 2009, the cost of offshore wind energy has decreased with technologies used to generate it have matured, and in 2016 the countries in the North Seas Region signed a political declaration to reaffirm their commitment to cooperation.

Furthermore, nordic TSOs work closely together on Nordic grid development and have developed a Nordic Grid Development plan 2017. The report is intended to be renewed every two years.

The Nordic Council of Ministers and the underlying Committee of Senior Officials for Energy and the Electricity Market Group also coordinate on energy issues and monitor for example the TSO cooperation (also on grid development).

3.4.2 Energy transmission infrastructure

(i) Policies and measures related to the elements set out in point 2.4.2, including, where applicable, specific measures to enable the delivery of Projects of Common Interest (PCIs) and other key infrastructure projects

Infrastructure projects are developed by the Danish TSO and approved by the Danish Energy Agency and the Ministry for Energy, Utilities and Climate.

No specific measures have been implemented relating to the elements set out in 2.3.2. The Danish TSO, Energinet, is the sole developer of electricity and gas transmission projects and these projects are assessed in terms of the need for the project. The need is assessed in terms of whether it complies with any of the following topics



- Wellfunctioning energy markets
- Security of supply
- Risk preparedness
- Integration of renewable energy sources

In addition interconnectors are also assessed in terms of their socio-economic benefit.

No specific measures in addition to the TEN-E regulation have been implemented

(ii) Regional cooperation in this area⁴⁵

Denmark participates in the relevant fora that are established under the TEN-E regulation, such as the North Seas Energy Cooperation and the Baltic Energy Market Interconnection Plan.

(iii) Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

In general infrastructure projects are financed through tariffs. The Danish TSO, Energinet, has made use of the Connecting Europe Facility for feasibility studies and pre-lay investigation of cable routes etc. and the Baltic Pipe project

3.4.3 Market integration

(i) Policies and measures related to the elements set out in point 2.4.3

With regards to system adequacy and level of security of supply, in 2018 a new law is envisaged giving the relevant minister the possibility to set a specific standard for the level of security of supply. The intention is to enable a political discussion of the desired level for security of supply as well as transparency of related costs and benefits. The Danish TSO is responsible for living up to the desired level.

Denmark finds that system adequacy should be secured through market based solutions in the electricity markets, not by capacity markets. However, Energinet is empowered to implement a strategic reserve, if necessary, and given the necessary approvals on EU level.

(ii) Measures to increase the flexibility of the energy system with regard to renewable energy production, such as smart grids, aggregation, demand response, storage, distributed generation, mechanisms for dispatching, redispatching and curtailment, real-time price signals, including the roll-out of intraday market coupling and cross-border balancing markets

⁴⁵ Other than the PCI Regional Groups established under Regulation (EU) No 347/2013.



Implicit Intra-day market coupling in the Nordic Market and between East Denmark and Germany via Kontek-interconnector has been in place for many years and from June 2018 the former explicit allocation of capacity on the interconnector between West Denmark and Germany has been replaced by implicit intra-day market coupling (also known as XBID).

Cross-border markets and products are developed in line with the electricity balancing and Capacity Allocation and Congestion Management guidelines and the corresponding timeframe.

In Denmark, new renewable energy production cannot receive subsidies in hours with negative market prices. This is one measure to ensure the right incentives for market participants and reaction to price signals.

(iv) Policies and measures to protect consumers, especially vulnerable and, where applicable, energy poor consumers, and to improve the competitiveness and contestability of the retail energy market

These include an obligation for electricity suppliers to supply any household customer, upon the customer's request, in areas where the supplier offers its products. It is not allowed to enter into time-limited supply agreements with household customers. If there is particular reason to expect a lack of payment ability or willingness to pay, that is if the customer is or has been in arrears with payments, the supplier can request a guarantee from the customer. Only if the request for a guarantee is not fulfilled, the supplier is allowed to cancel the agreement.

A supplier centric model has been implemented in 2016 with the aim of ensuring that suppliers have the primary customer contact, and all costs related to electricity are summed up in one bill sent to the customer by their supplier. In addition, a regulation on electricity companies' invoicing of costs to electricity consumers⁴⁶ has been passed to ensure that electricity bills are more easily understandable. The regulation sets a minimum standard on the content of electricity bills.

Denmark has also introduced a datahub that enables all transactions related to the retail and wholesale market to be managed through one central system operated and owned by the TSO. This also creates more transparency and ensures a level playing field regarding access to data.

⁴⁶ BEK nr 1400 af 03/12/2015



Denmark has established an online price comparison tool, elpris.dk, operated by the Danish regulatory authority that facilitates easier comparison between different suppliers and a trustworthy source of information on the quality and terms of different products offered in the market.

A recent change in Danish law⁴⁷ requires stricter rules regarding the separated identity of monopoly and commercial activities in vertically integrated companies. Monopoly companies have to clearly distinguish themselves (name and logo) in public appearance, including all sorts of customer contact. The new rules are effective as of 1 July 2018.

Denmark generally addresses energy poverty through social policy, which is not specifically targeted towards energy. There are specific subsidies targeting energy efficiency, particularly in buildings. Low-income pensioners, however, receive specific financial support for their heating bill.

(v) Description of measures to enable and develop demand response including those addressing tariffs to support dynamic pricing⁴⁸

By 2020 all Danish customers will have smart meters installed. Simultaneously, the TSO and distribution grid operators implement a new hourly settlement model, named 'flexafregning', for small consumers (<100.000 kWh/year). This is the basic precondition for the access to dynamic pricing products that make it possible to benefit from demand response activities.

Besides the dynamic electricity price, DSOs can choose to apply a time-differentiated tariff model, and 3 DSOs have chosen that model to date. Currently, the tariff is based on a static time-of-use model consisting of two different tariff levels for small consumers. DSOs and TSO are further developing their tariff models including coordination between transmission and distribution levels. The 2018 energy agreement also includes an initiative to address potential regulatory barriers in relation to tariffs, in particular how they affect demand response.

A large share of the electricity price for Danish household consumers is made up of levies and taxes. Measures have been put into force that over several years remove the levy for public service obligations from the electricity bill. Moreover, the 2018 energy agreement contains a substantial reduction of the electricity tax. As a result wholesale prices may be reflected onto consumers more directly and with less distortions in the future.

⁴⁷ LOV nr 662 af 08/06/2017

⁴⁸ In accordance with Article 15(8) of Directive 2012/27/EU.



Just as reducing the general electricity tax rate, it is also planned to cut the tax on electricity used for heating by almost half over the coming years. Primarily, this aims at a further electrification of the heating sector. At the same time, the new pricing- and tariff regimes shall ensure the flexible operation of such units.

The energy agreement also includes an initiative to explore the possibilities of a dynamic electricity tax. A dynamic electricity tax can for example increase demand in periods with low electricity prices where production of renewable electricity is high.

There are no specific barriers in Danish law that inhibit independent service providers to enter into a contract with a customer or an aggregator, or aggregators from offering demand flexibility. No difference is made between bids in the market coming from a single source or an aggregated source. Nonetheless, Denmark seeks to further develop its market model to facilitate demand response, including through aggregation, and support the utilisation of flexibility at the distribution level. Therefore, market models are being revised to define and accommodate aggregators as a stand-alone role in its own right.

3.5 Dimension Research, innovation and competitiveness

(i) Policies and measures related to the elements set out in point 2.5

As a participant in the international cooperation “Mission Innovation” Denmark has committed to double its public funding to research and development to 580 mio. dkr. in 2020. The funding will be earmarked energy research and development on the annual state budget.

The Danish government has proposed to earmark appr. 60 mio. DKK to new test facilities in smart energy.

(ii) Where applicable, cooperation with other Member States in this area, including, where appropriate, information on how the SET Plan objectives and policies are being translated to a national context

Nordic energy research co-operation

Nordic Energy Research (NER) is the platform for cooperative energy research and analysis in the Nordic region under the auspices of Nordic Council of Ministers. It funds research of joint Nordic interest that supports these ambitions by expanding knowledge on sustainable energy and contributing to the development of new, competitive energy solutions. Denmark is an active member of Nordic Energy Research.



According to its strategy for the period 2018-2021 the vision of NER is to create the knowledge basis for the Nordic countries to become global leaders in smart energy. The mission is progressed through Nordic collaboration.

NER manages a number of projects and facilitates in various fields, ranging from compilation of results from ongoing studies, to technical research. As an illustration, in 2015 NER selected three ambitious projects to serve as "Flagships" for Nordic research cooperation in energy for the coming 4-year period, covering such diverse areas as flexible electricity market design to allow for more wind and solar energy; modelling how to achieve an energy-efficient and low carbon transport system; and enabling negative CO₂-emissions through new combustion-related technologies.

With regard to the regional aspects linked to the national energy and climate plans, two projects are of particular significance:

Nordic Energy Technology Perspectives (NETP) is a Nordic edition of the International Energy Agency's (IEA) global Energy Technology Perspectives. The report has been published twice (2013 and 2016) and offers a detailed scenario-based regional analysis of how the Nordic countries can achieve a near carbon-neutral energy system. At present, the possibility of an updated report (with the working title Nordic Energy Outlook) is discussed within the Board of NER and with the IEA.

The Nordic Electric Vehicle Outlook 2018 (NEVO 2018) has been developed in cooperation between the International Energy Agency (IEA) and Nordic Energy Research. It aims to identify and discuss recent developments of electric mobility in the five Nordic countries: Denmark, Finland, Iceland, Norway and Sweden. The report assesses the current status of the electric car market, the deployment of charging infrastructure, and the integration with the electricity grid at country level. It analyses the role of European, national, and local policy frameworks in supporting these developments. The analysis also provides insights on consumer behaviour and includes an outlook on the progress of electric mobility in the Nordic region up to 2030.

SET-plan

The overarching criteria of the Danish energy research and demonstration program are applicability to global trends and challenges, and business potential, in line with the objectives of the SET-plan. When it comes to specific technology areas Denmark has taken a neutral approach, but favor areas where Denmark already has a stronghold.



Denmark is committed to the work on both the regional and the European level, and has opened its national research program for international participation so as to facilitate international cooperation in the area.

(iii) Where applicable, financing measures in this area at national level, including Union support and the use of Union funds

As a participant in the international cooperation “Mission Innovation” Denmark has committed to double its public funding to research and development to 580 mio. dkr. in 2020.

Denmark has received approximately 94,6 mio. € to energy related projects under the Horizon2020-programme (from 2014 to March 2018).

Part 1: General framework

SECTION B: ANALYTICAL BASIS⁴⁹

⁴⁹ See Part 2 for a detailed list of parameters and variables to be reported in Section B of the Plan.



4. CURRENT SITUATION AND PROJECTIONS WITH EXISTING POLICIES AND MEASURES ^{50,51}

4.1 Projected evolution of main exogenous factors influencing energy system and GHG emission developments

The projections and assumptions presented below were published in April 2018, mainly as part of Denmark's Energy and Climate Outlook 2018 (DECO18). Thus, projection results include existing measures as of April 2018. On June 29th 2018, the Danish Government and all parties in Parliament agreed to a new set of measures to be introduced from 2020 to 2024. On 9 October 2018 the government published its Climate and Air Proposal "Together for a greener future" with additional measures for reducing both greenhouse gas emissions and air pollution. Preliminary projected effects of the Energy Agreement and the Climate and Air proposal are included where stated – especially in chapter 5 (trends with additional measures). However, in general, measures decided upon after March 2018 are not included in the projections in this chapter (chapter 4: trends with measures implemented or adopted when the projection was elaborated), but will be included in the next Denmark's Energy and Climate Outlook, which will be published in 2019.

(i) Macroeconomic forecasts (GDP and population growth)

GDP forecast from DECO18:

	2017-2020	2021-2025	2026-2030	2017-2030
GDP	1,78	1,55	1,22	1,48

⁵⁰ Current situation as of April 2018

⁵¹ The selection of exogenous factors may be based on the assumptions made in the EU Reference Scenario 2016 or other subsequent policy scenarios for the same variables. Besides, Member States specific results of the EU Reference Scenario 2016 as well as results of subsequent policy scenarios may also be a useful source of information when developing national projections with existing policies and measures and impact assessments.

Population growth:

No explicit population growth assumptions are used in projections. However, population growth assumptions are implicitly taken account of in the projections, since they are part of the underlying assumptions, e.g. as part of assumptions on development of square metres in housing (i.e. more people, more square metres for heating). Official population growth statistics are publicised by Statistics Denmark here:

<http://www.statistikbanken.dk/statbank5a/default.asp?w=1920>

(ii) Sectorial changes expected to impact the energy system and GHG emissions

As the basis for this chapter's description of the projected key sectorial changes expected to impact the energy system and GHG emissions, is the latest energy and GHG emission projection published in the DECO18⁵².

Some of the information is from the related GHG projection documentation report for the DECO18⁵³.

The effects of the Energy Agreement of 29 June 2018⁵⁴ and the Climate and Air proposal of 9 October 2018⁵⁵ on GHG emissions are therefore not included in this chapter. This information is included in Chapter 5.

The energy sector

The total renewable energy (RE) share is expected to be 39.8 per cent by 2030 in the absence of new initiatives, giving a gap of 10.2 per cent point to the government's target of at least 50 per cent RE in 2030. The RE share increases until 2021, reaching 43.6 per cent with a decrease thereafter due to increasing electricity consumption and declining domestic RE expansion. The RE share is expected to reach 42.0 per cent by 2020, whereby the EU's commitment to a RE share of 30 per cent by 2020 is exceeded.

In 2020, Denmark's total greenhouse gas emission is expected to be 38-39 per cent below the UN base year 1990. The reduction continues until 2021 where it is expected to be 39 per cent below the UN base year. In the absence of new

⁵² <https://en.efkm.dk/energy-and-raw-materials/energy-proposal/>

⁵³ <http://envs.au.dk/videnudveksling/luft/emissioner/projection/greenhouse-gases/>

⁵⁴ <https://presse.ens.dk/news/basisfremskrivning-2018-nu-paa-engelsk-316511>

⁵⁵ <https://en.efkm.dk/news/news-archive/2018/oct/together-for-a-greener-future/>



initiatives the emissions are expected to increase thereafter. This development is especially due to the development in energy-related emissions. Denmark's EU commitment for the non-quota sectors for the period 2013-2020 is fulfilled with an overachievement. The non-quota-related emissions for the period 2021-2030 are expected to give a gap between 32 and 37 million tonnes of CO₂ eq. with an uncertainty of +/- 10 million tonnes of CO₂ eq.

Electricity consumption (excluding grid losses) rises from 31.3 TWh in 2017 to 42.2 TWh by 2030, which is mainly due to increasing electricity consumption by data centers representing 65 per cent of the increase and by 2030 is expected to amount to 16.7 per cent of electricity consumption (excluding grid losses). There is considerable uncertainty about future electricity consumption by data centers. Increasing electricity consumption combined with new electrical connections to high-priced areas is expected to entail that domestic electricity production will increase until 2023 and that Denmark is expected to become a net exporter of electricity in the period 2020-2024. Thereafter, imports are projected to increase due to the absence of new measures. Net imports are expected to reach 8.6 TWh by 2030, corresponding to 19 per cent of electricity consumption (including grid losses).

The proportion of electrified vehicles (electric cars and plug-in hybrid cars) is expected to rise steadily and will be 7 per cent of the fleet of passenger cars and vans in 2030 and account for 1.2 per cent of electricity consumption (excluding grid losses). There is considerable uncertainty about the share of electrified vehicles in new car sales by 2030. The commitment of 10 per cent RE in transport by 2020 will not be achieved in the absence of new measures.

Consumption of bioenergy stabilize from 2021 and is expected to remain the largest share of the RE consumption amounting to 67 per cent by 2030. The contribution to RE consumption from large and small heat pumps, which utilizes heat in ambient air, is projected to increase by 7.3 per cent annually and amount to 8 per cent by 2030. Heat pumps will increasingly replace the use of wood pellets, natural gas and oil in households. Oil for heating is expected to account for less than 2 per cent of the households' energy consumption in 2030.

The business sector's energy consumption is projected to decrease 0.4 per cent annually by 2020, after which it is expected to increase by 2.2 per cent annually until 2030 – partly due to an increase in electricity consumption from new data centers and partly due to the cease of energy companies' energy-saving efforts from 2021 in the absence of new initiatives.

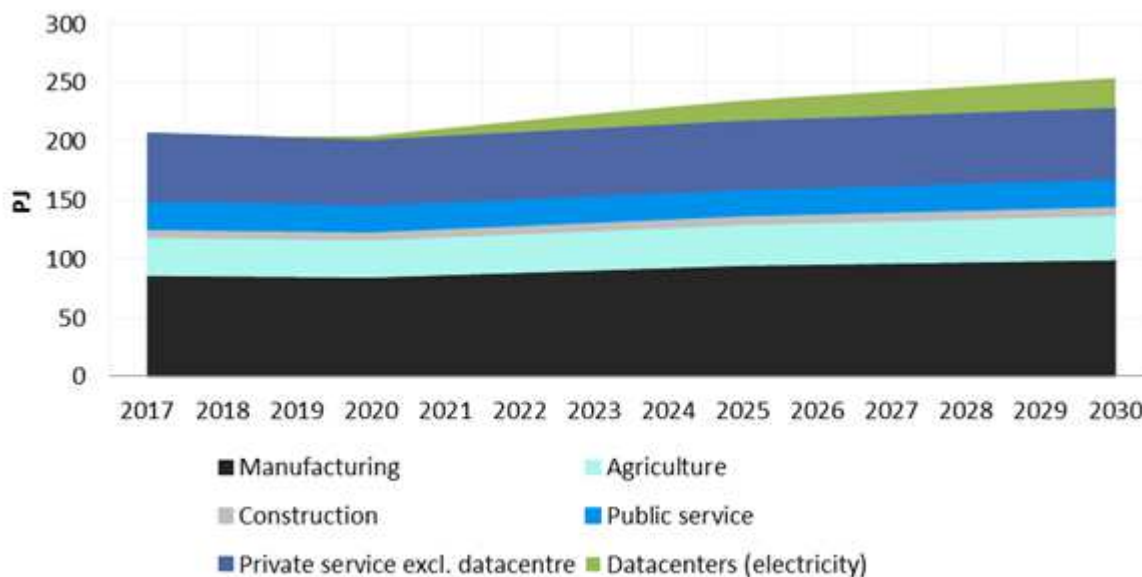
Sensitive assumptions and uncertainties affect key results. Eg. in the energy consuming sectors there is uncertainty associated with the projection of electricity consumption from data centers, as well as the assumptions about the CO2 quota price, fossil fuel prices, traffic work, the number of dairy cows, the disposal of coal-fired power generation capacity and the distribution of vehicle types in the sale of new cars.

The possible introduction of a number of Hyper Scale Data Centres in Denmark is a significant sectoral change which will impact the Danish energy system. This phenomenon is described in detail in DECO18 as well as in a special report on data centres, s available here:

https://ens.dk/sites/ens.dk/files/Analyser/temaanalyse_om_store_datacentre.pdf

The consequences for the energy system, and in particular the electricity consumption of the business sector, are described in DECO18's projection of the future final energy consumption 2017-2030 (Figure 14 in DEO18)

Figure 2. Projections of final energy consumption





The industrial processes sector

Industrial processes and product use includes mineral industries, chemical industries, metal industries, non-energy products from fuels and solvent use, electronics industry, product use as substitutes for ozone depleting substances and other product manufacturing and use.

Total greenhouse gas emissions (GHG) in the industrial processes sector have decreased 9 per cent from 2344 kt CO₂eq. in 1990 to 2124 kt CO₂eq. in 2016.

A range of greenhouse gas emission sources are covered within each of these categories with different characteristics influencing the projected sectorial changes expected to impact the emission of CO₂, nitrous oxide (N₂O), methane (CH₄), non-methane volatile organic compounds (NMVOC) and the so-called fluorinated gases or F-gases including substitutes for ozone depleting substances (HFCs, PFCs and SF₆). The predominant sources within industrial processes and product use are CO₂ from the production of cement (these emissions are included under EU ETS) and F-gases from their use in refrigerators and other appliances.

The emission projections are for some of the industrial sources based on projected production values for the energy and production industries. These production value projections are available for steel-, glass- and cement industry. For HFCs, PFCs and SF₆, also known as F-gases, emission projections are based on expert knowledge about historic consumption and technological developments and substitutes in the future. As none of the F-gases are produced in Denmark, the emissions of these gases are associated only with their use. For the remaining sources, emission projections are based on historical emissions.

Cement production is the major CO₂ source within industrial processes. Information on the emission of CO₂ until 2016 is based on the 2017 company report to EU ETS.

F-gases are powerful GHGs with global warming potentials (GWPs) between 124 and 22,800. F-gases therefore, receive a great deal of attention in connection with GHG emission inventories. For many F-gas applications, the gases can be controlled and/or replaced, which has been, and continues to be, the case in Denmark. Data for the projections take this into consideration. EU legislations are already covered by different existing Danish legislation. Exemptions from the Danish bans on e.g. refrigeration equipment have been taken into account in the projections.

Sensitive assumptions and uncertainties affect key results. Eg. also in the future cement production will be sensitive to the general economic development as



could be seen during the economic downturn in 2008-2010 and the use and emission of F-gases will be sensitive to the development of alternative refrigerants and technologies.

The agricultural sector

Methane emissions (CH₄) in agriculture have decreased slightly from 223 kt CH₄ in 1990 to 222 kt CH₄ in 2016. The projection shows an increase in methane emission from the enteric process enteric, while the methane emission from manure management decrease.

The historical emission related to the enteric fermentation shows a decrease, which is due to a fixed EU milk quota. Because of higher milk yield per cow, a lower number of dairy cattle are needed to produce the amount of milk, corresponding to the EU milk quota. The AGMEMOD model indicates that Denmark, in the future, can be expected to increase both the milk production and the number of dairy cattle. A growing number of dairy cattle, a continued increase in milk yield, followed by an increase of feed intake, all leads to an increase of the methane emission from enteric fermentation.

The methane emission from manure management has increased from 1990 to 2016, which is a result of change in housing systems towards more slurry based systems. In the future, the emission from manure management is expected to decrease due to more housing systems with acidification of manure and manure cooling, and because of more manure delivered to biogas production.

Nitrous oxide emissions (N₂O) in agriculture have decreased 17 per cent from 18.8 kt N₂O in 1990 to 15.6 kt N₂O in 2016. The reduction is primarily driven by a decrease in use of inorganic N-fertilisers as a consequence of improved utilization of nitrogen in manure, forced by environmental requirements. The situation for the projected emission is opposite. The increased emission is due to the expectation of higher consumption of inorganic N-fertilisers caused by the political agreement on a Food and Agricultural package, which allowed increased nitrogen application on agricultural land. An increase of nitrous oxide emission is also occurring from animal manure applied on soil due to the growing number of dairy cattle.

Sensitive assumptions and uncertainties affect key results. Eg. in the agricultural sector there is uncertainty associated with the number of dairy cows, the use of fertilizer etc.

The LULUCF sector



The emission of GHGs from the LULUCF sector (Land Use, Land Use Change and Forestry) primarily includes the emission of CO₂ from land use, small amounts of N₂O from disturbance of soils not included in the agricultural sector and CH₄ emission from Grassland, Wetlands and wild fires in the LULUCF sector. The projections are made based on the best available knowledge of the past development in the land use in Denmark and expectations for the future.

Total GHGs in the LULUCF sector, estimated in the format under the United Nations Framework Convention on Climate Change (UNFCCC), have increased 13 per cent from 4789 kt CO₂eq. in 1990 to 5413 kt CO₂eq. in 2016. From 2016 to 2040, the GHG emissions are expected to decrease to 3625 kt CO₂eq., corresponding to a decrease of 33 per cent. The accounting quantities estimated under the Kyoto Protocol and under the EU LULUCF regulation are different from the UNFCCC estimates.

The Danish forests are expected to be a steady sink in the coming years, which is primarily due to the expectations of an increase of forest area with the related increase in Carbon (C) stock. No data has been projected for the Danish forest for year 2040, hence these data should be taken with concern, as the figures are not validated.

In total from 1990 to 2040, an afforestation of 135 309 hectares is expected (excl. Christmas trees), while the deforestation is only expected to include 10 990 hectares (excl. Christmas trees). The total area with Christmas trees is around 35 000 hectares of which 10 000 are inside the forest and the remaining planted in agricultural fields. The area is assumed to be fairly constant. The deforestation area is due to conversion to settlements and new roads, or more open areas in the forests. Forest land remaining forest land is expected to be a small sink in the near future.

Cropland (CL) and grassland (GL) are major sources, primarily due to the large area with cultivated organic soil in Denmark. The steady extensification of the CL area on organic soil towards permanent GL and the conversion to wetlands leads to a decrease in emission until 2040. Currently, the agricultural mineral soils are near a carbon balance, but in the future the carbon stock in mineral agricultural soils is expected to increase, as a general increase in the harvest yield of 5 % is expected, because the Danish farmers are allowed to increase the fertilization rate from 2016 and onwards. In the projection of the emission from mineral soils is used a dynamic temperature modelling tool (C-TOOL ver. 2.3.). The projected temperature is based on an expected temperature increase combined with a naturally temperature variability (observed data from 1994 to 2017) as recommended by the Danish Meteorological Institute. The emissions from CL are



expected to decrease over time but still be a major source due to large emissions from organic soils.

The area reported under GL is assumed stable with only minor changes.

For wetlands (WE), only emissions from managed WE are reported and not naturally occurring moors and other wetlands. The overall trend for WE is a decreasing emission from WE remaining WE, caused by a decreasing peat excavation in Denmark. Peat excavation is expected to cease completely by 2029. Land converted to WE is expected to increase due to the current ongoing program running from 2016 to 2020, for conversion of agricultural organic soil to WE.

Settlements (SE) are expected to have increasing emissions, because of the steady land-use change to SE and especially from CL. The increasing emissions are caused by a loss of Soil Organic Carbon (SOC), because the default carbon stock in SE is lower than for the land, from which it is converted.

Harvested Wood Products (HWP) is estimated to be a small sink due to an increased logging in the Danish forests.

Sensitive assumptions and uncertainties affect key results. Eg. in the LULUCF sector there is uncertainty associated with assumptions regarding the harvest of crops and wood, the sample based methodology used in the National Forest Inventory, temperature in the modelling of soil carbon etc.

The waste sector

The waste sector primarily includes methane emissions from solid waste disposal (SWDS) at landfills and from biological treatment of solid waste (composting and biogas plants) as well as methane and nitrous oxide emissions from waste water treatment and discharge.

Total greenhouse gas emissions (GHG) in the waste sector have decreased 30 per cent from 1816 kt CO₂eq. in 1990 to 1271 kt CO₂eq. in 2016.

The estimation of methane emissions from landfills are based on national statistics and projections regarding the landfill waste categories reported in the national waste statistics. The total amount of waste deposited at landfills are fluctuating, while a continuous decrease in the amount of organic degradable waste reaches a constant level in the period 2005 to 2016. The high value for total waste in 2010-2012 is caused by changes to the data system and registration of more inert waste than in preceding or following years. For the future, the Danish EPA projects the total amount of primary waste to increase to 13400 kt in 2030. Of this amount, 4.4



%, i.e. 590 kt, is deposited at landfills. The projected waste amounts are excluding sludge and stones.

In the present projection of methane emissions from SWDSs, the characteristics of waste type distributions have been set constant throughout the projection period. The waste type soil and stone does not influence the modelled methane emissions as soil and stone are characterized as inert waste fractions.

The reason for the sharp decrease in historical data on deposited amounts of organic waste in the period 1990-2009, is to be found in a combination of the Danish waste strategies and action plans including goals for a continued minimising of the amount of deposited waste in favor of an increased reuse and combustion for energy production. Even though the percentage of waste being deposited at landfills is decreasing to 4.4 % in 2030, the total amount of waste is increasing from 10 600 kt in 2012 to 13 400 kt in 2030, which causes the absolute amount of waste being deposited at landfills to increase slightly.

The impact of implementing the biocover instrument has also been included in the projected methane emissions, but not in the November 2018 GHG projection report.

Methane emissions from anaerobic treatment processes are estimated on the basis of the historical and projected gross energy production. For the projection results presented in this report from the DECO18, a leakage rate of 2.2 per cent in biogas plants has been assumed.

The direct and indirect nitrous oxide emission from wastewater treatment processes is calculated based on country specific and process specific emission factors and the amount of nitrogen in the influent and effluent wastewater, respectively.

For the total nitrogen content in the effluents, the contribution from separate industries, rainwater conditioned effluents, scattered settlements and aquaculture, a decreasing trend followed by a close to constant level is observed and the 2016 effluent level are kept constant throughout the projection period. The total N content in the influent and effluent from waste water treatment plants is increasing according to population statistics for the projection period.

Sensitive assumptions and uncertainties affect key results. Eg. in the waste sector there is uncertainty associated with the amount of biodegradable waste going to landfills in the past (before 1997), effects of biocovers, leakage rates in biogas plants (included under the waste sector's category biological treatment of waste such as slurry, manure and other waste products used in biogas plants) etc.

(iii) Global energy trends, international fossil fuel prices, EU ETS carbon price

Danish projections in DECO18 use the scenarios of ENTSO-E as a means to include expectations of future infrastructure, including the development of the electricity market in neighbouring countries. Such scenarios are described in ENTSO-E's so-called TYNDP plans.

Table 3. Assumptions regarding fuel prices

	Import prices (US\$)			Central Power Plants				Industry & Decentral Power Plants	Households			Airports
	Coal	Crude oil	Gas	Coal	Fuel oil	Gas/ Diesel oil	Natural gas	Gas/ Diesel oil	Petrol	Diesel	Heating oil	JP1
2017	23,0	62,2	39,5	24,3	48,8	83,5	42,0	95,3	113,1	111,7	111,7	81,5
2018	23,9	67,6	42,1	25,2	54,3	88,9	44,6	100,8	118,6	117,1	117,1	86,9
2019	22,0	68,3	39,7	23,3	55,0	89,6	42,1	101,5	119,3	117,9	117,9	87,7
2020	20,2	69,3	35,4	21,5	55,9	90,5	37,9	102,4	120,2	118,8	118,8	88,6
2021	20,1	71,0	36,3	21,4	57,7	92,3	38,8	104,2	122,0	120,5	120,5	90,3
2022	19,9	72,8	37,7	21,2	59,4	94,1	40,2	105,9	123,8	122,3	122,3	92,1
2023	19,6	74,4	39,0	20,9	61,1	95,7	41,4	107,6	125,4	124,0	124,0	93,8
2024	19,8	76,1	40,2	21,1	62,8	97,4	42,6	109,3	127,1	125,6	125,6	95,4
2025	19,9	77,7	41,3	21,2	64,4	99,0	43,8	110,9	128,7	127,2	127,2	97,0
2026	20,2	80,4	42,9	21,5	67,0	101,7	45,3	113,5	131,3	129,9	129,9	99,7
2027	20,3	82,4	44,2	21,6	69,1	103,7	46,7	115,6	133,4	132,0	132,0	101,8

2028	20,5	84,4	45,5	21,8	71,1	105,7	48,0	117,6	135,4	134,0	134,0	103,7
2029	20,7	86,3	46,8	22,0	73,0	107,6	49,2	119,5	137,3	135,8	135,8	105,6
2030	20,8	88,2	48,0	22,1	74,8	109,4	50,5	121,3	139,1	137,7	137,7	107,5

Table 4. Assumptions, CO2 prices (in DKK):

	CO2-kvotepris
2017	43,5
2018	44,7
2019	46,3
2020	48,1
2021	50,5
2022	53,0
2023	55,7
2024	58,8
2025	62,3
2026	66,1
2027	70,0
2028	74,2
2029	78,6
2030	83,3

(iv) Technology cost developments



The Danish Energy Agency and Energinet (the Danish TSO) in cooperation regularly issue reports on the cost development of energy technologies. These reports contain information about technological, economic and environmental factors for a range of energy installations, and are, inter alia, used as a basis for the annual Danish Energy and Climate Outlook (DECO) projections.

More details can be found here (in Danish)

<https://ens.dk/service/fremskrivninger-analyser-modeller/teknologikataloger>

Key assumptions for electricity and district heating technologies used in the most recent report from March 2018 can be found here:

https://ens.dk/sites/ens.dk/files/Analyser/technology_data_for_energy_plants_el_and_dh_2016_updated2018marts.xlsx

4.2 Dimension Decarbonisation

4.2.1 GHG emissions and removals

(i) Trends in current GHG emissions and removals in the EU ETS, Effort Sharing Regulation and LULUCF sectors and different energy sectors

The trends in current Danish GHG emissions and removals 1990-2016 as reported under UNFCCC in April 2018 are shown in Table 5 and Figures 3[a], -[b], -[c], -[d] and -(e).

The trends are shown by gas, by IPCC sectors, in the EU ETS sectors (for the period before the EU ETS, i.e. 1990-2004, non-ETS proxy-estimates are shown), in the non-ETS sectors (a proxy for emissions in the ESR sectors⁵⁶ as reporting of these emissions will not start until 2023), the LULUCF sector (as reported under the United Nations Framework Convention on Climate Change and as the quantities to be accounted for under the Kyoto Protocol and the EU LULUCF-regulation⁵⁷) and different energy sectors.

⁵⁶ ESR or Effort Sharing Regulation: REGULATION (EU) 2018/842 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013

⁵⁷ LULUCF-regulation: REGULATION (EU) 2018/841 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU

The latest inventory for Denmark in the EU reported in April 2018 under the United Nations Framework Convention on Climate Change (UNFCCC) shows a 28 per cent decrease in total Danish greenhouse gas emissions (without LULUCF, with indirect CO₂) from 70.4 MtCO₂eq. in 1990 to 50.5 MtCO₂eq. in 2016.



Table 5 Trends in current Danish GHG emissions and removals 1990-2016 as reported under UNFCCC in April 2018 - by gas, by IPCC sectors, in the EU ETS, in EU non-ETS (ESD/ESR), the LULUCF sector and different energy sectors

GREENHOUSE GAS EMISSIONS	1990	1995	2000	2005	2010	2015	2016
	CO2 equivalent (kt)						
CO2 emissions without net CO2 from LULUCF	53601	61628	54308	51532	49292	35315	37117
CO2 emissions with net CO2 from LULUCF	58346	65064	57774	56059	48415	39446	42437
CH4 emissions without CH4 from LULUCF	7629	8060	7920	7683	7362	6907	7022
CH4 emissions with CH4 from LULUCF	7645	8084	7953	7725	7412	6964	7082
N2O emissions without N2O from LULUCF	7972	7236	6976	5507	5223	5231	5346
N2O emissions with N2O from LULUCF	8000	7263	7003	5534	5250	5265	5379
HFCs	NO,NA	242	704	933	951	639	611
PFCs	NO,NA	1	23	19	19	5	4
Unspecified mix of HFCs and PFCs	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
SF6	42	102	56	20	36	103	92
NF3	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
Total (without LULUCF)	69245	77269	69986	65694	62883	48200	50191
Total (with LULUCF)	74033	80756	73512	70290	62083	52421	55605
Total (without LULUCF, with indirect CO2)	70408	78345	70783	66321	63342	48502	50478
Total (with LULUCF, with indirect CO2)	75196	81833	74309	70917	62542	52724	55892
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	1990	1995	2000	2005	2010	2015	2016
	CO2 equivalent (kt)						
1. Energy (with indirect CO2)	53574	61675	54341	51405	49679	34950	36549
2. Industrial processes and product use	2344	2883	3636	2794	2036	1998	2124
3. Agriculture	12673	12135	11262	10818	10408	10392	10534
4. Land use, land-use change and forestry	4789	3487	3526	4596	-801	4222	5413
5. Waste	1816	1653	1543	1304	1218	1162	1271
6. Other	NO	NO	NO	NO	NO	NO	NO
GREENHOUSE GAS EMISSIONS in EU ETS and non-ETS SECTOR CATEGORIES	1990	1995	2000	2005	2010	2015	2016
	CO2 equivalent (kt)						
EU ETS (CO2 emissions from stationary installations also included in the inventory) [1990-2004: PROXY estimates]	29356	36239	29733	26476	25266	15796	17220
EU ETS (CO2 emissions from domestic aviation also included in the inventory)	251	246	194	177	179	130	133
EU ETS (Total CO2 emissions in ETS also included in the inventory) [1990-2004: PROXY estimates]	29607	36485	29927	26653	25445	15926	17354
Non-ETS GHG emissions, without LULUCF, with indirect CO2 (2013-2020: ESD / 2021-2030: ESR) [1990-2004: PROXY estimates]	40801	41861	40856	39668	37897	32576	33125
GREENHOUSE GAS NET EMISSIONS in the LULUCF SECTOR in the inventory under the UNFCCC	1990	1995	2000	2005	2010	2015	2016
	CO2 equivalent (kt)						
LULUCF under the UNFCCC (net emissions from "4. Land use, land-use change and forestry")	4789	3487	3526	4596	-801	4222	5413
LULUCF accounting quantities (net credits if negative): KP1(2008-2012), KP2(2013-2020), EU/LULUCF(2021-2030)	NA	NA	NA	NA	-1405	-1353	-203
GREENHOUSE GAS EMISSIONS in the different ENERGY SECTORS	1990	1995	2000	2005	2010	2015	2016
	CO2 equivalent (kt)						
1. Energy (with indirect CO2)	53574	61675	54341	51405	49679	34950	36549
A. Fuel combustion (sectoral approach) (with indirect CO2)	53058	60975	53252	50529	49112	34559	36130
1. Energy industries (with indirect CO2)	27414	33637	26848	23796	24539	13202	14335
2. Manufacturing industries and construction	5436	5924	5934	5453	4442	3862	3938
3. Transport	10775	12103	12491	13619	13407	12696	12987
4. Other sectors	9261	8989	7779	7282	6514	4600	4661
5. Other	170	323	201	379	209	199	209
B. Fugitive emissions from fuels	517	699	1090	877	568	391	419
1. Solid fuels	NO	NO	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	517	699	1090	877	568	391	419
C. CO2 transport and storage	NO	NO	NO	NO	NO	NO	NO

NO = Not Occurring, NA = Not Applicable



CO₂ emissions in the EU ETS sectors included in the Danish GHG inventory (i.e. primarily from stationary installations) have decreased with 35 per cent from 26.7 MtCO₂ in 2005 to 17.4 MtCO₂ in 2016. The verified emissions from stationary installations for 2017 show a further decrease to 15.1 MtCO₂ equal to 44 per cent decrease from 2005..

From 2005 to 2016 Danish greenhouse gas emissions in the non-ETS sectors have been reduced by 17 percent from 39.7 MtCO₂eq. in 2005 to 33.1 MtCO₂eq. in 2016. Reporting of greenhouse gas emissions under the EU ESR will not start until 2023 for 2021, which is the first emission year in the ESR period 2021-2030.

In 2016 the net emissions from the LULUCF sector - as reported under the UNFCCC - were 13 per cent above the net emissions in 1990. From the detailed LULUCF inventory it can be seen that the most significant change in absolute net emissions is in the category Forests Land, which has changed from a net sink of 0.553 MtCO₂eq. in 1990 to a net source of 0.913 MtCO₂eq. in 2016. However, this cannot be seen as a general trend in this sector. The reporting of annual values cannot be considered statistically significant, as the sampling error on reporting annual changes exceeds the magnitude of the change. This goes even if the error estimates are small compared to the total stock (1.6-1.7 %). This is due to the size of the carbon stocks and the small changes between subsequent years. Trends should be evaluated at larger time frames, minimum 5 year time spans. Applying models may reduce the apparent uncertainty, but do not reflect observed values. Increasing sample size would be highly costly and may still not provide statistically significant change estimates on annual basis.

The LULUCF accounting quantities (negative numbers: net credits / positive numbers: net debits) reported under the Kyoto Protocol are also shown for the years 2008-2016 in Table 5 and Figure 3(d).

(ii) Projections of sectorial developments with existing national and Union policies and measures at least until 2040 (including for the year 2030)

The trends in projected Danish GHG emissions and removals (without/with LULUCF, without/with indirect CO₂) 2020-2040 with the effects of existing national and EU policies and measures as of April 2018 (i.e. the WEM-scenario) are shown in Table 6 and Figures 3 [a], [b], [c], -[d] and -[e]. In table 6 and Figures 3 [a], [b], [c] and [e] greenhouse gas emissions after 2030 are projected to be on the same level as in 2030 as the April 2018 projection ends in 2030. Consolidated projections until 2040 will be elaborated in 2019 and included in the final integrated national energy and climate plan.



The trends are shown by gas, by IPCC sectors, in the EU ETS sectors, in the EU non-ETS sectors (as proxy for the ESR sectors), in the LULUCF sector in the UNFCCC format, as projected LULUCF accountin quantities to be accounted for under the EU LULUCF-regulation (and presumably also under the Paris Agreement⁵⁸), and different energy sectors.

⁵⁸ The so-called Paris Agreement rule-book has not yet been adopted.



Table 6 *Projections of sectorial developments in Danish greenhouse gas emissions 2020-2040 with the effects of existing national and EU policies and measures as of April 2018 (the WEM-scenario) - by gas, by IPCC sector, in the EU ETS, in EU non-ETS (ESD/ESR), the LULUCF⁵⁹ sector and different energy*

⁵⁹ A minor update of the LULUCF projection, published in October 2018, has been included.



GREENHOUSE GAS EMISSIONS	2020	2025	2030	2035	2040
CO2 equivalent (kt)					
CO2 emissions without net CO2 from LULUCF	31218	34133	39172	39172	39172
CO2 emissions with net CO2 from LULUCF	33685	35903	40991	40991	40991
CH4 emissions without CH4 from LULUCF	6516	6600	6627	6627	6627
CH4 emissions with CH4 from LULUCF	6588	6678	6711	6711	6711
N2O emissions without N2O from LULUCF	5340	5393	5464	5464	5464
N2O emissions with N2O from LULUCF	5371	5425	5497	5497	5497
HFCs	418	197	104	104	104
PFCs	3	2	1	1	1
Unspecified mix of HFCs and PFCs	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
SF6	57	32	33	33	33
NF3	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
Total (without LULUCF)	43130	45968	51048	51085	51092
Total (with LULUCF)	45694	47841	52976	53013	53021
Total (without LULUCF, with indirect CO2)	43553	46357	51401	51401	51401
Total (with LULUCF, with indirect CO2)	46116	48230	53329	53329	53329
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2020	2025	2030	2035	2040
CO2 equivalent (kt)					
1. Energy (with indirect CO2)	30115	32858	37793	37793	37793
2. Industrial processes and product use	2077	2038	1999	1999	1999
3. Agriculture	10383	10516	10706	10706	10706
4. Land use, land-use change and forestry	2563	1873	1928	1928	1928
5. Waste	978	945	903	903	903
6. Other	NO	NO	NO	NO	NO
GREENHOUSE GAS EMISSIONS in EU ETS and non-ETS SECTOR CATEGORIES	2020	2025	2030	2035	2040
CO2 equivalent (kt)					
EU ETS (CO2 emissions from stationary installations also included in the inventory) [1990-2004: PROXY estimates]	11558	14648	20300	20300	20300
EU ETS (CO2 emissions from domestic aviation also included in the inventory)	138	142	148	148	148
EU ETS (Total CO2 emissions in ETS also included in the inventory) [1990-2004: PROXY estimates]	11696	14790	20448	20448	20448
Non-ETS GHG emissions, without LULUCF, with indirect CO2 (2013-2020: ESD / 2021-2030: ESR) [1990-2004: PROXY estimates]	31857	31567	30953	30953	30953
GREENHOUSE GAS NET EMISSIONS in the LULUCF SECTOR in the inventory under the UNFCCC	2020	2025	2030	2035	2040
CO2 equivalent (kt)					
LULUCF under the UNFCCC (net emissions from "4. Land use, land-use change and forestry")	2563	1873	1928	1928	1928
LULUCF accounting quantities (net credits if negative): KP1(2008-2012), KP2(2013-2020), EU/LULUCF(2021-2030)	-3059	-1378	-1286	NE	NE
GREENHOUSE GAS EMISSIONS in the different ENERGY SECTORS	2020	2025	2030	2035	2040
CO2 equivalent (kt)					
1. Energy (with indirect CO2)	30115	32858	37793	37793	37793
A. Fuel combustion (sectoral approach) (with indirect CO2)	29888	32522	37546	37546	37546
1. Energy industries (with indirect CO2)	9237	11609	16915	16915	16915
2. Manufacturing industries and construction	3493	3835	4049	4049	4049
3. Transport	13019	13126	12938	12938	12938
4. Other sectors	3934	3747	3439	3439	3439
5. Other	205	205	205	205	205
B. Fugitive emissions from fuels	226	336	247	247	247
1. Solid fuels	NO	NO	NO	NO	NO
2. Oil and natural gas and other emissions from energy production	226	336	247	247	247
C. CO2 transport and storage	NO	NO	NO	NO	NO

NO = Not Occurring, NA = Not Applicable, NE: not estimated

The latest baseline projection with the effects of existing national and EU policies and measures as of April 2018 (the 2018 WEM scenario) shows a 37 percent decrease in total Danish greenhouse gas emissions from 1990 to 2020 (without LULUCF, with indirect CO₂). As new national and policies and measures with a view to reaching Denmark's EU ESR target for 2030 and the reduction path 2021-2029



was not yet adopted at the time of the elaboration of the 2018 baseline projection, no further reductions until 2030. An increase at approximately 9 percent was projected from 2020 to 2030 (9.0 percent).

Regarding CO₂ emissions in the EU ETS sectors included in the Danish GHG inventory (i.e. primarily from stationary installations) a 55 per cent decrease from 26.7 MtCO₂ in 2005 to 12.0 MtCO₂ in 2020 was projected in April 2018. Also in the EU ETS sectors no further reductions until 2030 were projected as the projection was elaborated before the adoption of additional policies and measures. On the contrary increases were projected from 2020 to 2030 (35 per cent).

From 2005 to 2020 Danish greenhouse gas emissions in the non-EU ETS sectors were projected in April 2018 to decrease 19 percent from 39.7 MtCO₂eq. in 2005 to 32.1 MtCO₂eq. in 2020. In the EU non-ETS sectors further reductions from 2020 until 2030 (0.8 percent) were projected before the adoption of additional policies and measures.

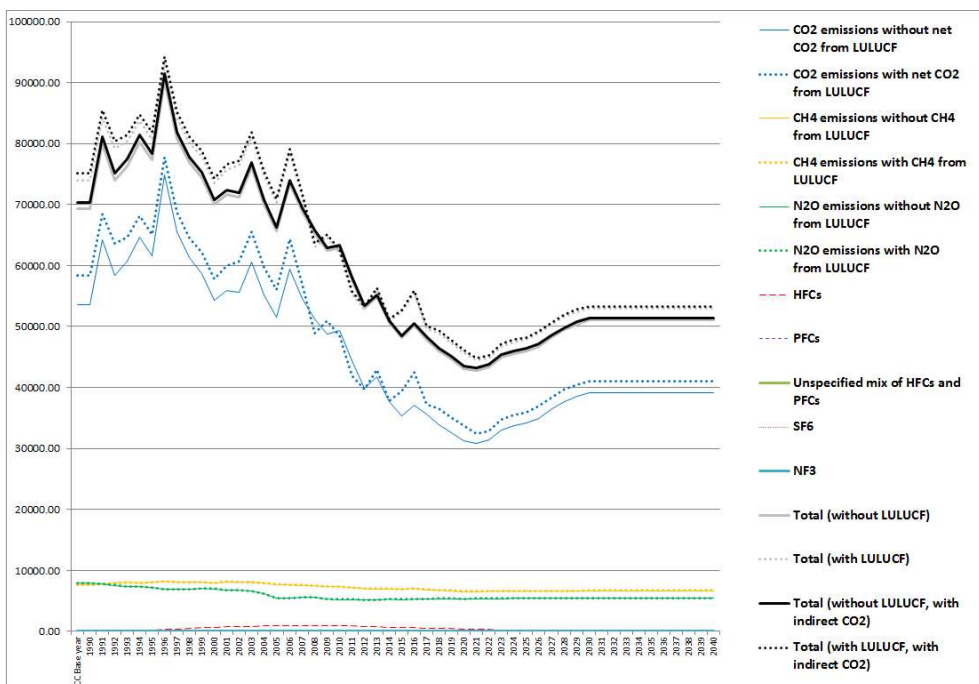
The net emissions from the LULUCF sector – in the UNFCCC-format – are projected to have decreased 46 percent in 2020 compared to 1990 in the updated LULUCF projection from October 2018. A further 14 percent point decrease is projected from 2020 to 2030. The LULUCF accounting quantity is projected to stabilize around 1.3 MtCO₂eq. in annual net credits until 2030. The accounting quantities have not been projected beyond 2030 as future rules for the accounting of LULUCF after 2030 is uncertain.



Figures 3 [a], [b],-[c], -[d] and -[e]]

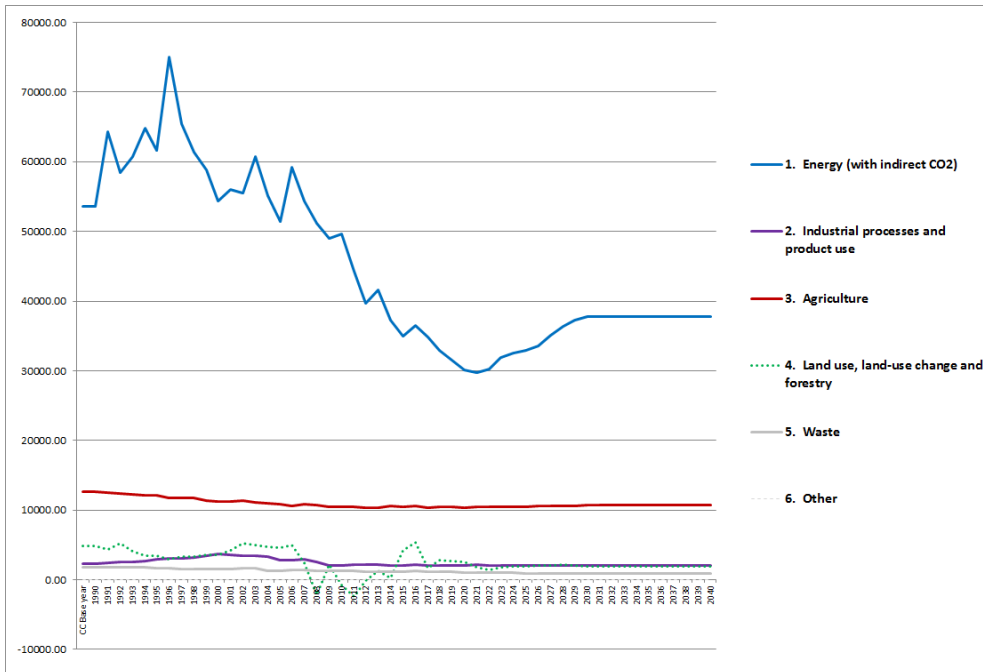
Trends in current (1990-2016 as reported under UNFCCC in April 2018) and projected (2017-2040 from the latest baseline projection with the effects of existing national and EU policies and measures as of April 2018– i.e. the WEM-scenario) - by gas [a], by IPCC sectors [b], in the EU ETS and in EU non-ETS (ESD/ESR) sectors [c], the LULUCF sector [d] and different energy sectors [e]

[a] Total greenhouse gas emissions – by gas (ktCO₂eq.)

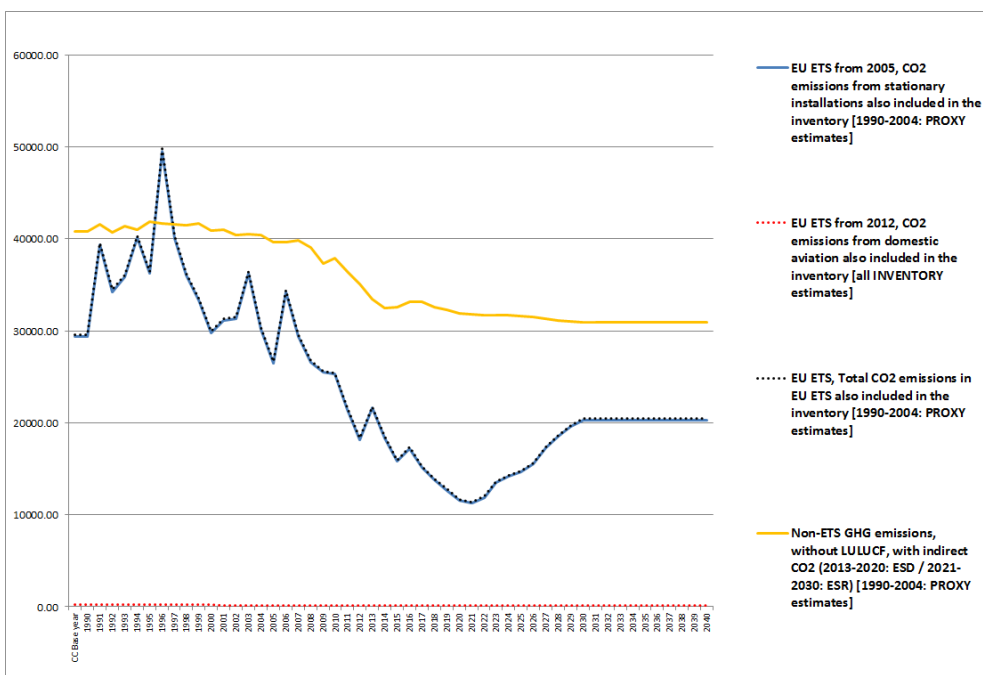




[b] Total greenhouse gas emissions – by IPCC sector (ktCO₂eq.)

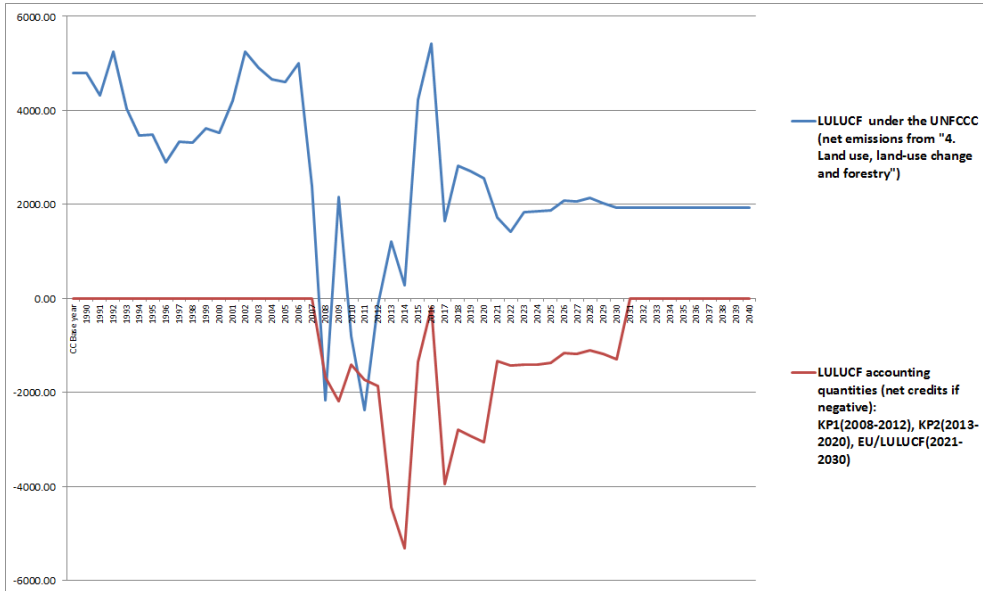


[c] Greenhouse gas emissions in the EU ETS and in EU non-ETS (ESD/ESR) sectors (ktCO₂eq.)

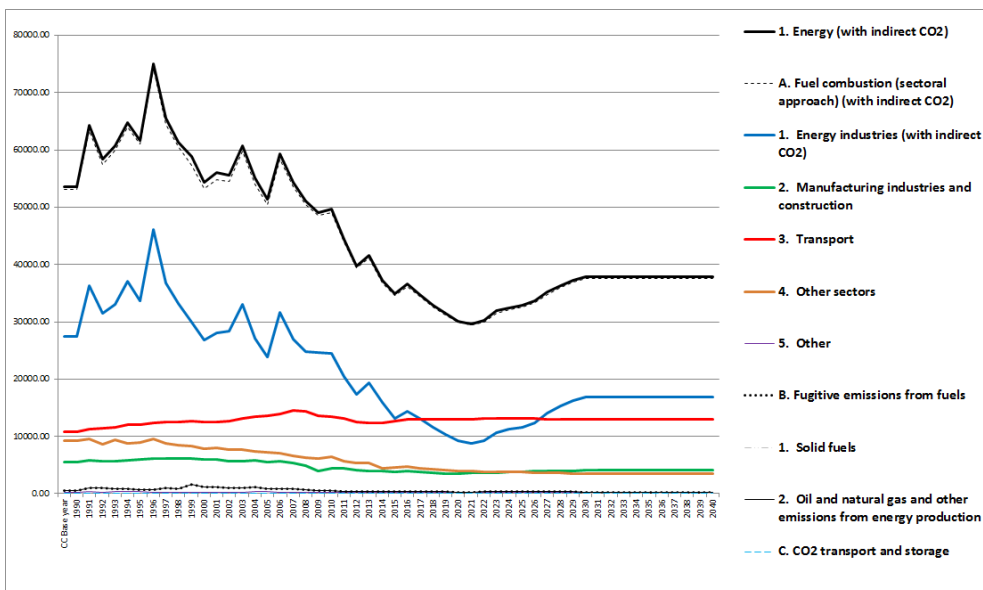




[d] Greenhouse gas emissions and accounting quantities in the LULUCF (ktCO₂eq.)



[e] Greenhouse gas emissions in different energy sectors (ktCO₂eq.)



4.2.2 Renewable energy

(i) Current share of renewable energy in gross final energy consumption and in different sectors (heating and cooling, electricity and transport) as well as per technology in each of these sectors



*(ii) Indicative projections of development with existing policies for the year 2030
(with an outlook to the year 2040)*

Table 1 shows current as well as projected (I & ii) RE shares (total, electricity, district heating, and transportation). Projections are based on the Danish Energy and Climate Outlook 2018, DECO18, adjusted for effects of the Energy Agreement of 29 June 2018 where policies and measures have been defined. Projections going beyond 2030 are currently not available, but will be considered as part of the final National Energy and Climate Plan in 2019.

Table 2 shows a breakdown of the overall RE share (RES) projection by RE source / technology to the extent this is possible. Some of the RE deployment will take place through technology neutral tenders, hence it is not possible to project shares for this part. Projections for 2030-40 are currently not available.

The Danish Government has, in its Political Platform 2016, a goal of covering at least 50 pct. of Danish energy consumption by renewable energy by 2030. The implementation of the Energy Agreement of 29 June 2018, adopted by all Parties of the Danish Parliament, is expected to lead to a RE deployment which will bring the RE share to approximately 55 pct. in 2030. As shown in Table 1, some policies and measures are still to be defined to achieve this.

Integration of renewable energy in the energy supply sector and energy efficiency are both cornerstones in the Governments long-term target for making the Danish energy system independent of fossil fuels by 2050 as well as the 2050 low-emission society framework of the 29 June Energy Agreement

The Danish Energy and Climate Outlook 2018 (DECO18) shows how energy consumption and production, as well as greenhouse gas emissions develop towards 2030, based on existing policies and measures, i.e. a “frozen policies” approach. The renewables share is expected to be 42.0% in 2020, whereby Denmark will have met, and exceeded, its EU obligation for a 30% renewables share by 2020.

The new Energy Agreement of 29 June 2018 covers the period 2020-2024, but will have significant effects of the development beyond this period, shown in Table 1 and Table 2 below.



Table 7. RE Shares, projections 2020-2030 (with statistics from 2016) with existing policies and measures and effects of Energy Agreement of 29 June 2018, except where policies and measures in the agreement which cannot be quantified currently.

	RE Share (RES)	RES Electricity (RES-E)	RES District Heating (RES-DH)	RES Transport (RES-T)
2016	31%	55%	54%	7%
2020	42%	80%	73%	9%
2021	44%	85%	74%	9%
2022	44%	85%	74%	9%
2023	44%	85%	74%	9%
2024	44%	85%	74%	10%
2025	45%	85%	74%	10%
2026	45%	85%	74%	11%
2027	46%	85%	74%	12%
2028	46%	85%	75%	12%
2029	47%	90%	75%	13%
2030	48%	90%	75%	13%

*Note: Red data is statistics, Black data is model projections

According to the Energy Agreement, funds are allocated that sets a course towards a Renewable Energy share of approximately 55 pct. by 2030, and a RE share in electricity above 100% consumption. Numbers in Table 1 “only” reach 48 pct. and 90 pct. respectively, due to the fact that that it is currently not possible to quantify the effects of the implementation of all Policies and Measures in the Energy Agreement, notably the “Reserve for additional investments in RE from 2025”.

Table 8. RE shares (RES) projections 2017-2030 by source / technology with existing policie and measures, including effects of Energy Agreement of 29 June 2018.

	RES	MSW	Solid Biomass	Biofuels	Biogas	Wind	PV	Solar heating	Heat pumps & Geothermal	Tender - technology to be decided
2017	35,40%	3%	19%	1%	2%	8%	1%	1%	2%	0%
2018	38,50%	3%	20%	1%	2%	9%	1%	1%	2%	0%
2019	40,30%	3%	21%	1%	3%	10%	1%	1%	2%	0%
2020	42,00%	3%	21%	1%	3%	10%	1%	1%	2%	0%
2021	43,80%	3%	21%	1%	3%	12%	1%	1%	2%	0%
2022	44,30%	3%	21%	1%	3%	12%	1%	1%	3%	0%
2023	44,40%	3%	20%	1%	3%	12%	1%	1%	3%	1%
2024	44,50%	3%	20%	1%	3%	12%	1%	1%	3%	1%
2025	44,70%	3%	20%	1%	3%	12%	1%	1%	3%	1%
2026	45,30%	3%	19%	1%	3%	12%	1%	1%	3%	2%
2027	46,20%	3%	19%	2%	3%	13%	1%	1%	3%	2%
2028	46,40%	3%	19%	2%	3%	13%	1%	1%	4%	2%
2029	47,20%	3%	19%	2%	3%	14%	1%	1%	4%	2%
2030	47,60%	3%	19%	2%	3%	14%	1%	1%	4%	2%

See the above

4.3 Dimension Energy efficiency

(i) Current primary and final energy consumption in the economy and per sector (including industry, residential, service and transport)

Table 9. Primary and final energy consumption

		2016
Total primary energy consumption ¹	Adjusted, PJ	770
Total final energy consumption	Adjusted, PJ	629
Final energy consumption – industry (manufacturing)	Adjusted, PJ	86
Final energy consumption – transport	PJ	214
Final energy consumption - households	Adjusted, PJ	196
Final energy consumption – services	Adjusted, PJ	83

These figures include 10,5 PJ non-energy use.

Source: Danish Energy Statistic 2016

(ii) Current potential for the application of high-efficiency cogeneration and efficient district heating and cooling⁶⁰

A comprehensive assessment of the potential for the application of high efficiency cogeneration and efficient district heating and cooling in Denmark was delivered to the Commission in December 2015 in accordance with article 14, 1 in Directive 2012/27/EU.

(iii) Projections considering existing energy efficiency policies, measures and programmes as described under 1.2. ii) for primary and final energy consumption for each sector at least until 2040 (including for the year 2030)⁶¹

It is currently not possible to report on point 4.3 (iii). We aim at reporting on this matter in the first Danish National Energy and Climate Plan.

(iv) Cost-optimal levels of minimum energy performance requirements resulting from national calculations, according to Article 5 of Directive 2010/31/EU

⁶⁰ In accordance with Article 14(1) of Directive 2012/27/EU.

⁶¹ This reference business as usual projection shall be the basis for the 2030 final and primary energy consumption target which is described in 2.3 and for conversion factors.



Denmark has submitted the latest cost-optimal report to the Commission on March 23, 2018. The cost-optimal report shows the following overall conclusions: In general, the overall level for requirements for new buildings is a little tighter than what is required by the Energy Performance of Buildings Directive (EPBD). The weighted average for new buildings shows that the Danish requirements are 21 percent tighter than the cost-optimal level. However, there are variations between different types of buildings.

For building elements that are subject to a renovation, the requirements are also near the cost-optimal point. The calculations show variations for different types of constructions depending on the starting point of the insulation levels of the existing constructions.

For buildings undergoing major renovation, the building regulations include renovation classes that can be used. The levels in these classes have been evaluated in the cost-optimal report, and the report showed that the level was not sufficiently tight. The weighted average showed that the requirement in average was 30 percent from the cost-optimal point. After the cost-optimal report was published, the levels of the renovation classes have been lowered. The renovation classes, therefore, are now within the cost-optimal range.

Overall, the report shows that Denmark fulfills the requirements of cost-optimal levels in building regulations.

4.4 Dimension Energy security

(i) Current energy mix, domestic energy resources, import dependency, including relevant risks

Stable and reliable energy supply is considered a prerequisite for the Danish society. The effectiveness and functioning of the economy, public organizations and private households depend on a reliable energy supply. In Denmark the transition forces a change in domestic energy mix towards a more flexible use of energy sources and an increase in interconnective capacity. Different biofuels are integrated in thermal heat and power plants while fluctuating electricity producers are integrated in the electricity system, both in large scale as offshore wind farms and in small scale in household solar panels. The development of interconnection between subsectors combined with cross borders enables an efficient use of fluctuating energy sources. Therefore both legislative and governance measures are being implemented in order to promote further integration international and intra sectorial. The international dimension is vital to a small country like Denmark, linking Scandinavia to the continent, and the North Sea to the Baltic Sea. The geographic situation gives Denmark extraordinary conditions for import and export of energy, whether it is fossil fuels, biomass transported by sea or

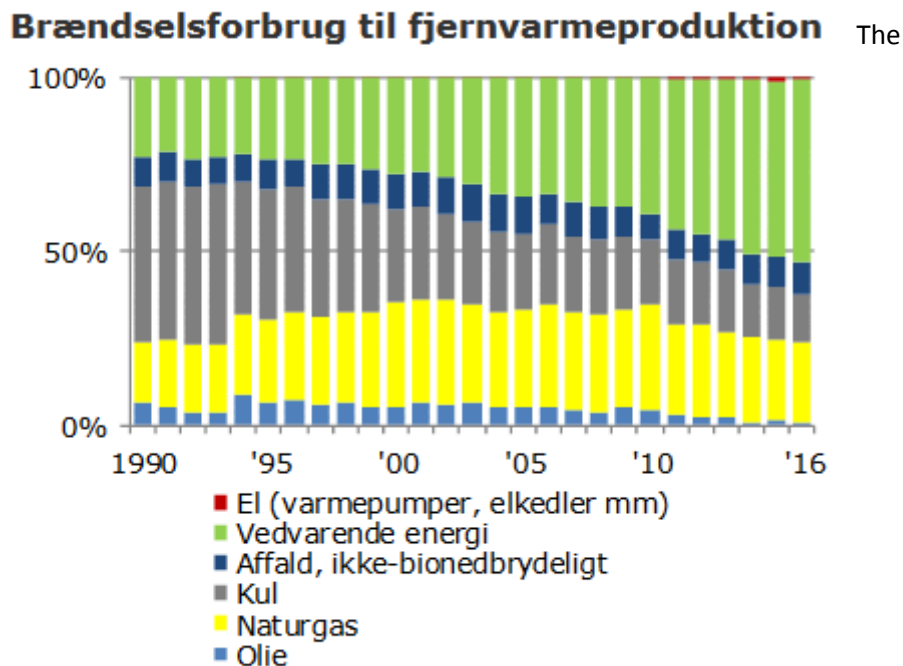


electricity. Denmark supports further international cooperation in regards to energy supply and further development of an open market for electricity and natural gas. Denmark is a netexporter of natural gas and oil from offshore fields in the North Sea. The importance of natural gas in the Danish energy supply has been decreasing in the last decade. This development is expected to continue in the following years as natural gas is expected to cover respectively about 15 % in 2023, 14 % in 2023 and 12 % in 2030 of the total Danish energy mix. The figures include biogas injected into the gas pipeline system.

The present Danish energy mix consists of multiple energy sources for thermal production facilities, injection in the gas system and for integration in the electricity system. The district heating sector is interconnected with the electricity sector since most production plants have dual purpose in producing both heating and electricity as well an increasing capacity to consume electricity in the district heating sector by introducing heating boilers.

The heating is increasingly being produced by renewables primarily biomass whereas the consumption of Coal in the heating sector is decreasing and the consumption of natural gas is almost stable:

Figure 4. Fuel consumption for district heating production



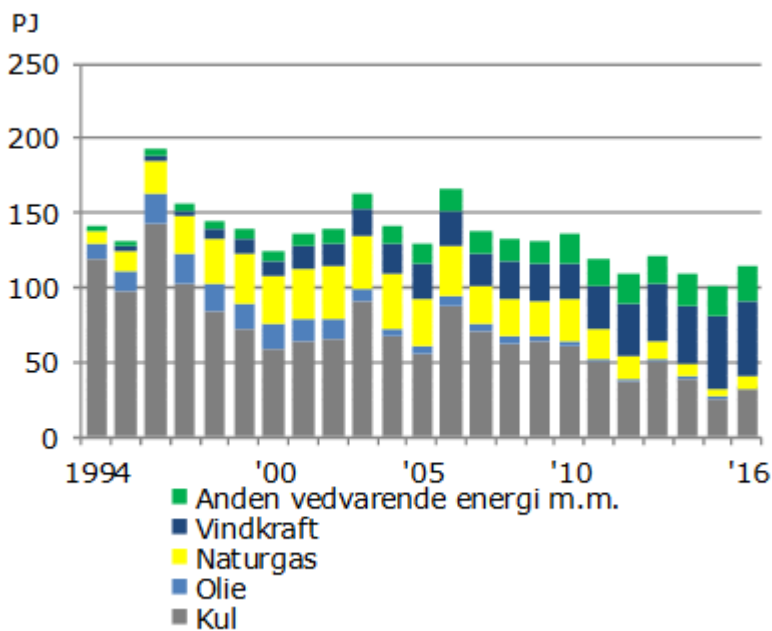
production of Electricity also has an increasing amount of biomass as is shown in



[table 2]. However thermal heat and power plants typically have the ability to shift between different sources, so that both biomass and coal can be consumed, this reduces the import dependency of single fuels. Since coal has to be imported and some biofuels are domestic produced the import dependency is reduce in general. Historically Denmark have bought coal on the international marked, which includes import of coal from China, India, the United States, Australia, Indonesia, Russia and South Africa. The powerplants have been able to produce full load substituting coal with oil, making the dependency of coal less critical.

Figure 5. electricity production after used fuel

Elproduktion fordelt efter anvendt brændsel



<https://ens.dk/sites/ens.dk/files/Statistik/estat2016.pdf>

In general the increasing diversity and the increasing flexibility of the electricity production and heating production systems have increased energy independency. However the interconnectors with neighbouring countries have an increasing importance in balancing the electricity system. The balancing of the electricity system is a delicate matter relying on digital solutions for real time data, function markets and available control systems. Manipulation, disturbance and breakdown in vital digital systems is an increasing risk for the security of supply as a result. Denmark

(ii) Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Denmark does not have national objectives for reducing the energy import dependency of third countries, since these dependencies are limited due to the diversification of energy sources and the production of oil and gas within Denmark. The dependency on import of coal is decreasing as result of integration of more renewable energy, however the transition towards integration of renewables leads to that Denmark is however increasingly dependent on interconnectors for electricity and natural gas from neighbouring countries and increasing dependent on a functioning market for electricity across the Nordic region. This increased dependency is therefore a result of ongoing transformation of the Danish energy system.

In recognition of the importance of digital solutions for ensuring the security of supply and the risk that the vast use of digital systems pose to the system, Denmark has developed a strategy for cybersecurity that has a specific focus on systems in the energy sector.

4.5 Dimension Internal energy market

4.5.1 Electricity interconnectivity

(i) Current interconnection level and main interconnectors⁶²

The current interconnection level in Denmark is at 50,6%. The level is calculated as a ratio between import interconnection and net generation capacities of the country. The current interconnectors are listed below in table 10

Tabel 10. Current interconnectors

⁶² With reference to overviews of existing transmission infrastructure by Transmission System Operators (TSOs).



Name	Price areas connected	Capacity [MW]
Skagerrak 1-4	DK1 ⁶³ -NO1	1700
Konti-Skan 1-2	DK1-SE3	740
Kassø-Audorf ⁶⁴	DK1-DE	2500
Bornholm-Sweden	DK2 ⁶⁵ -SE4	60
Storebælt	DK1-DK2	600
Øresund	DK2-SE4	1300/1700 ⁶⁶
Kontek	DK2-DE	585

Furthermore the interconnectors listed below are under construction

Tabel 11. Future interconnectors

Name	Price areas connected	Capacity [MW]	Commissioning year
CobraCABLE	DK1-NL	700	2019
Kriegers Flak CGS	DK2-DE	400	2019
Viking Link	DK1-UK	1400	2023
Endrup-Niebuß	DK1-DE	1000	2023

(ii) Projections of interconnector expansion requirements (including for the year 2030)⁶⁷

Currently Energinet is undertaking an analysis on the future level of security of supply in DK2 given that more and more thermal power plants will be closing in the near future. In ENTSO-E's Ten-Year Network Development plan 2016 a third interconnector (Kontek 2) between DK2 and DE is also mentioned. On the longer horizon Energinet and TenneT along with several other project partners launched the North Sea Energy Hub in 2017. The projects concerns the construction of island in the North Sea which will serve as a hub for offshore wind power production in the North Sea and the island will be connected to the Netherlands, Denmark and Germany and possibly other countries as well. However the project

⁶³ DK1 consists of Jutland and Funen

⁶⁴ The present interconnector capacity is 1500 MW from Germany and 1780 MW towards Germany, however the interconnector is currently being upgraded to a capacity 2500 MW in both directions.

⁶⁵ DK2 consists of Zealand, Lolland, Falster and Bornholm

⁶⁶ 1700 MW export capacity to Sweden and 1300 MW import capacity from Sweden

⁶⁷ With reference to national network development plans and regional investment plans of TSOs.



is still in the initial stage where feasibility studies on a wide range of topics are being conducted to determine whether or not to take the project to the next stage. The project is part of ENTSO-E's Ten-Year Network Development Plan 2016, however the project will probably only be realised after 2030. On top of this a number of interconnectors are approaching their end-of-life, and so a decision has to be made whether or not extend the life of these or built a brand new interconnector or whether some other solution might be more viable. However no decision has been made in terms of realisation of the interconnectors mentioned above.

4.5.2 Energy transmission infrastructure

(i) *Key characteristics of the existing transmission infrastructure for electricity and gas*⁶⁸

Electricity

Denmark is divided into 2 price areas, Western Denmark and Eastern Denmark separated by Storebælt. Western Denmark is connected and is operated in synchrony with the continental European grid and Eastern Denmark runs in synchrony with the Nordic grid. Western and Eastern Denmark are only connected through the Storebælt-interconnector.

Table 12. Length of overhead lines and cables per voltage level

Tracé-km	Overhead lines	Cables	Sum
132 kV	753	476	1.228
150 kV	1.216	605	1.822
220 kV	40	84	124
400 kV	946	114	1.061
Sum	2.956	1.279	4.235

Table13. Number of substations and transformers

Number	Substations	Transformers
132 kV	75	112

⁶⁸ With reference to overviews of existing transmission infrastructure by TSOs.



150 kV	78	107
220 kV	5	5
400 kV	26	30
Sum	184	254

Gas

The Danish gas transmission system (80 bar) is owned and operated by Energinet, the Danish TSO. The gas grid is connected to natural gas fields in the North Sea and the international gas market through three entry points (Nybro, Ellund and Dragør) where all natural gas enters Denmark. Natural gas can be supplied to domestic consumers using the transmission and distribution grid. The transmission tariff varies depending on where shippers book entry and/or exit capacity. Energinet currently expects the network code on harmonised transmission tariff structures for gas (TAR NC) to be fully implemented by June 2019.

- 900 km gaslines
- 42 M/R stations
- 4 metering stations

(ii) Projections of network expansion requirements at least until 2040 (including for the year 2030)⁶⁹

Onshore wind along with solar power are constituting a more and more substantial part of the energy mix in Denmark, hence the growing need for the integration of these energy sources is also reflected in the need for expansion of the transmission grid. However also the increasing electrification of the transport sector, and the growing number of data centres across Denmark will increase the electricity consumption in Denmark significantly over the coming decades. In terms of domestic heating the expected large scale implementation of heat pumps is also expected to have a major impact on the requirements of the future transmission grid. The maps below show some of the possible future transmission grids as imagined by Energinet, however these possible grid structures have not received approval, only represents how the Danish TSO imagines the transmission grid.

⁶⁹ With reference to national network development plans and regional investment plans of TSOs.

Figure 6 - Possible electricity transmission grid structure by 2027 drafted by the Danish TSO, Energinet

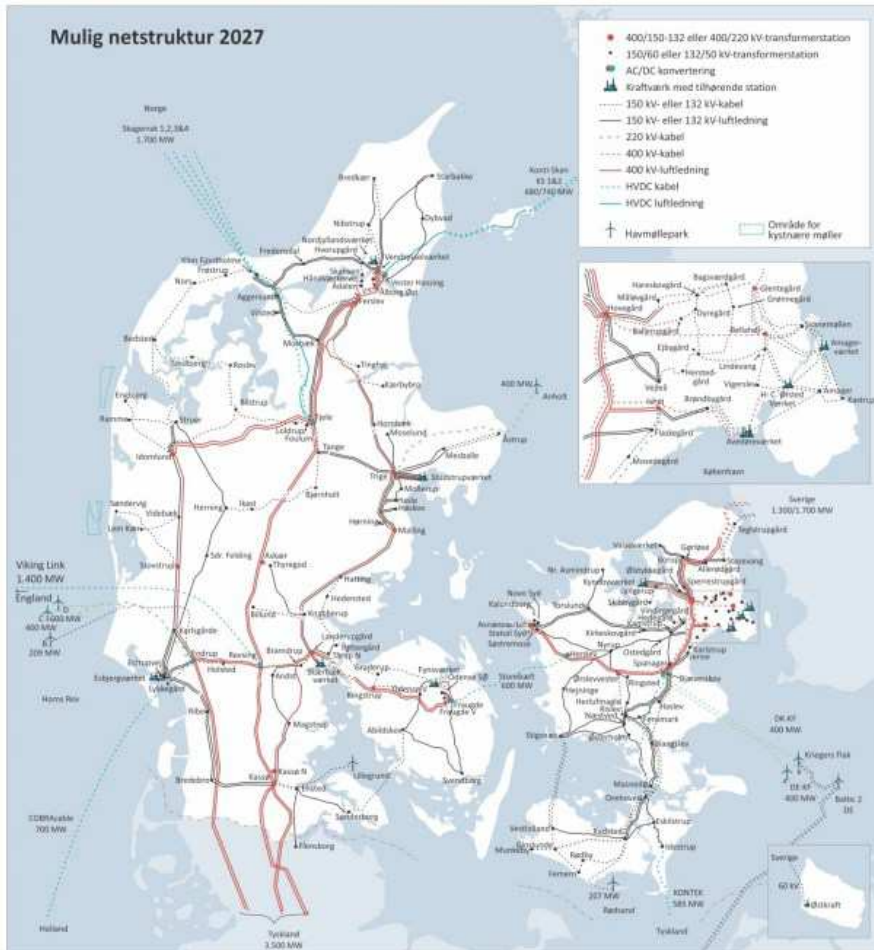
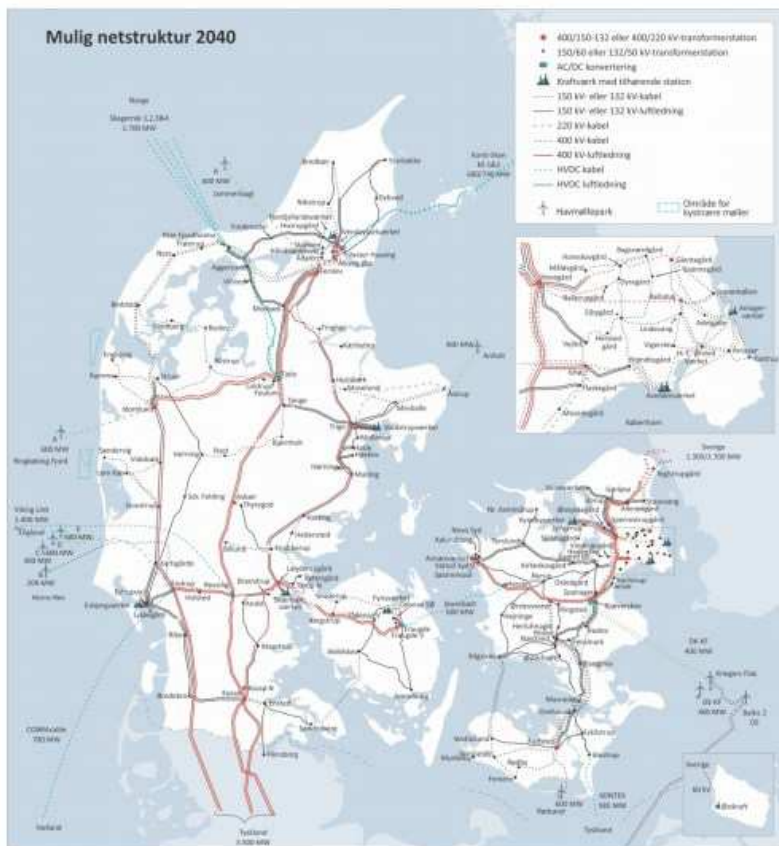


Figure 7. Possible electricity transmission grid structure by 2040 drafted by the Danish TSO, Energinet



4.5.3 Electricity and gas markets, energy prices

(i) Current situation of electricity and gas markets, including energy prices

Electricity

Electricity wholesale markets are generally well-functioning and integrated across borders in the Nordic region as well as towards Germany.

In the day-ahead market, the basis for wholesale prices are formed, market-coupling is implemented in the most of Europe, including Denmark.

Denmark is split into two bidding zones, leading to potentially different prices in DK1 (Western Denmark) and DK2 (Eastern Denmark). Prices can vary and there can be big differences in the hourly spot prices. On average prices are relative close to each other, with a typically higher price in DK2.

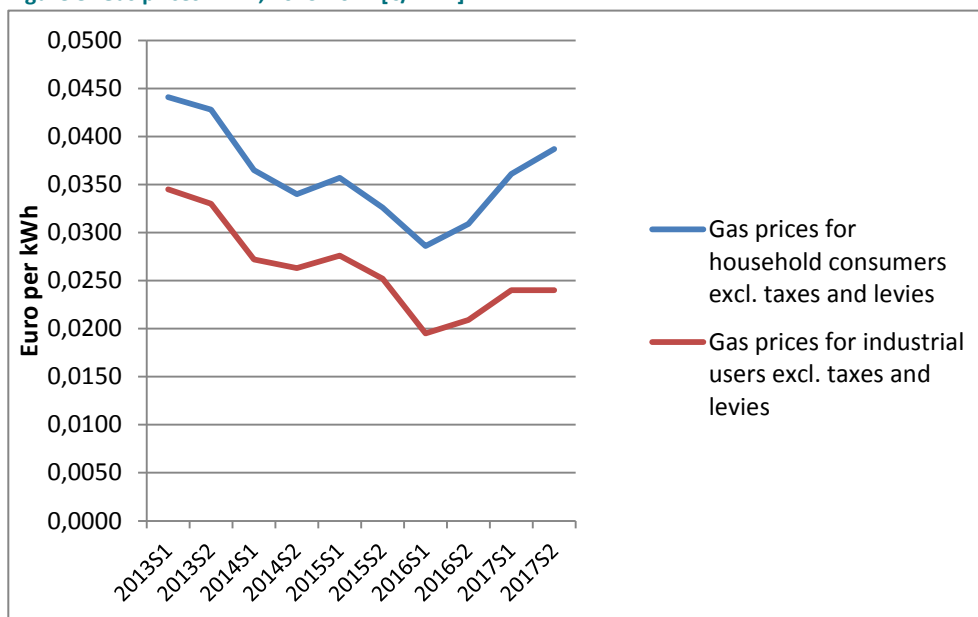
For the winter period 2017/2018 (october 2017 – march 2018) the average price for the whole of Denmark was 32,8 EUR/MWh, while respectively for DK1 and DK2 it was 31,4 and 34,2 EUR/MWh⁷⁰.

Gas

The Danish gas market is based on a entry-exit model where commercial shippers trade and move the gas in and out of Denmark. The gas market is generally characterized by a high degree of operational reliability and security of supply, as well as a growing share of biomethane in the pipeline network.

Gas prices for consumers averaged 37,4 EUR/MWh in 2017, while prices for industrial users were 24,0 EUR/MWh on average during the same period.

Figure 8: Gas prices in DK, 2013-2017 [€/kWh].



Source: Eurostat [nrg_pc_202] and [nrg_pc_203]

⁷⁰ Energitilsynet - Overvågning af det danske

Engrosmarked for elektricitet

http://energitilsynet.dk/fileadmin/Filer/Information/Diverse_publicationer_og_artikler/Halvaars_rapport_for_Vinterhalvaaret_2017.pdf

(ii) Projections of development with existing policies and measures at least until 2040 (including for the year 2030)

Electricity

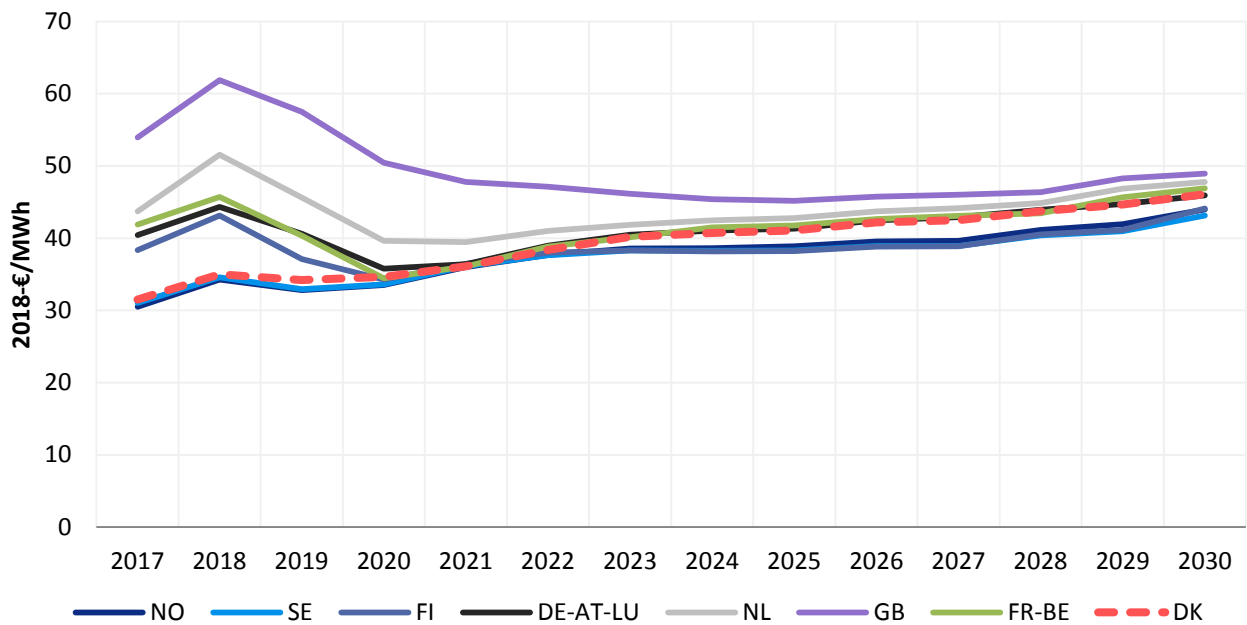
According to the DECO18 scenario, with existing policies and measures, the Danish Energy Agency calculates and publishes expected future price electricity market prices.

The calculations are based on the mid-term adequacy report 2017, the ENTSO-E TYNDP 2018 as well as agreed national policies and measures.

Based on these assumptions, see also the paragraphs on Electricity interconnectivity and Energy Transmission infrastructure, the Danish Energy agency published expected developments of wholesale prices until 2030 which are shown in the figure below. There are no published prices for the period 2030-2040.

The future expected electricity price for Denmark is increasing from 30,5 €/MWh in 2017 to 46,08 €/MWh in 2030. This increase of 46 pct. over 13 years is mainly due to increased interconnectivity and higher price convergence with markets with higher prices, higher expected coal and gas prices as well as an expected increasing CO2 price.

Figure 9: Electricity wholesale prices for DK and selected influential other market areas 2017-2030 [2018-€/MWh].



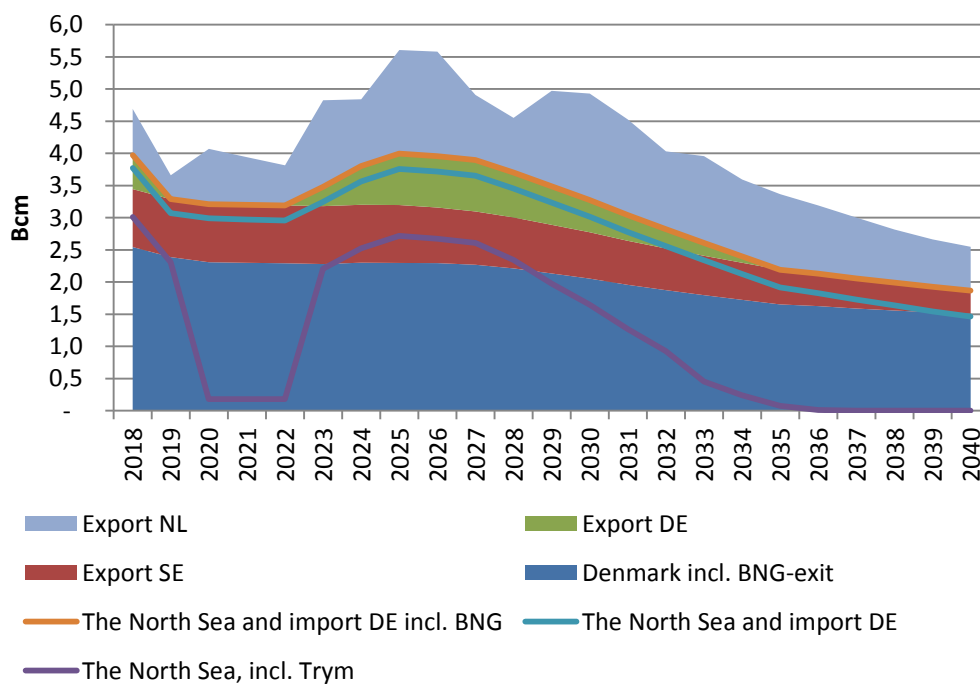
Source: Danish Energy and Climate Outlook 2018 (DECO18). Prices are modelling results. For more info see

https://ens.dk/sites/ens.dk/files/Analyser/basisfremskrivning_2018.pdf

Gas

The total consumption of natural gas, biogas and biomethane (synthetic natural gas) in Denmark is expected to fall to about 2.3 bcm in 2030 (see figure below). The natural gas consumption is expected to fall to about 1.8 bcm in 2030. Consumption of biogas and bio natural gas is expected to grow from the present level of approx. 0.3 bcm to approx. 0.5 bcm in 2030.

Figure 10: Forecasted demand and supply of natural gas in Denmark, 2018-2040.



Source: Danish Energy Agency

The Danish gas pipeline network is well developed and there are currently no plans for further network expansion besides the ongoing Baltic Pipe Project. Baltic Pipe (BP) is a project between the Polish TSO – GazSystem – and the Danish TSO – Energinet – with the objective to transport gas from Norway to Poland via Denmark. In order to ensure sufficient transport capacity, the Danish transmission system needs to be expanded as part of the project.

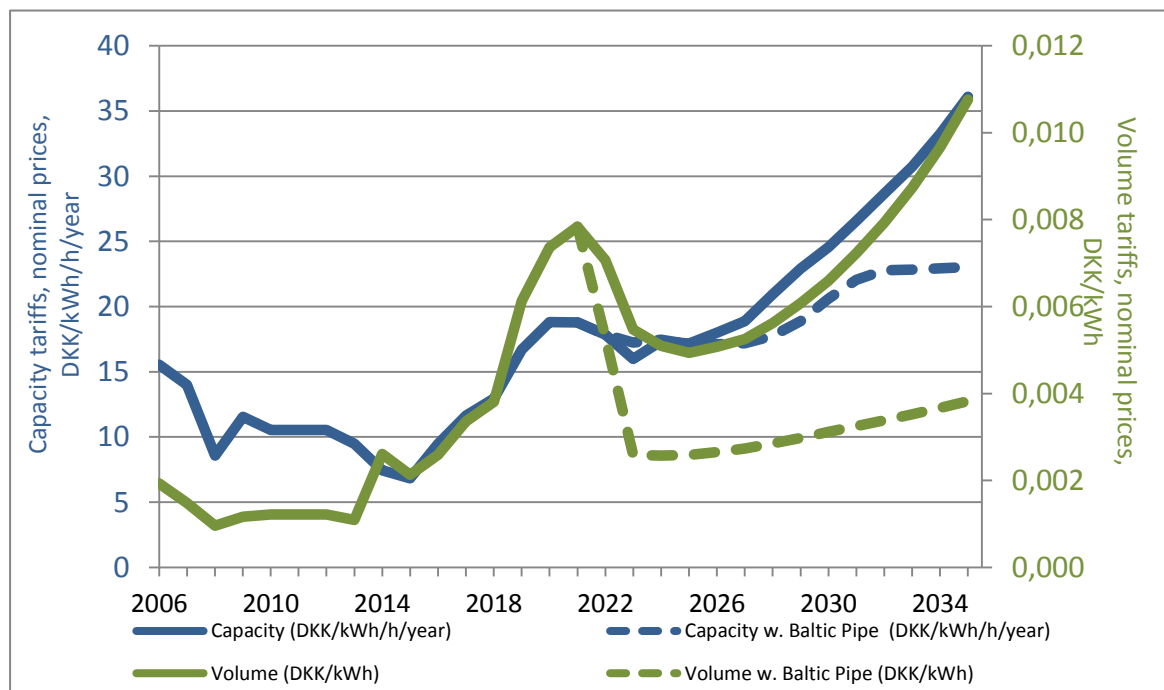
Baltic Pipe will include the following technical systems and installation:

- A 105-110 kilometer long, new offshore gas pipeline from Norway's pipeline Europipe II in the North Sea to a receiving terminal located on shore in Denmark.
- Expansion of the Danish transmission system with a new gas pipeline, approximately 210-230 km long.
- A compressor station in the South-eastern part of Zealand.
- A 260-310 km long offshore gas pipeline in the Baltic Sea between Denmark and Poland. The Polish TSO - GAZ-SYSTEM - is in charge of establishing and operate the gas pipeline across the Baltic Sea between Denmark and Poland.
- Expansions of Poland's transmission system.

The final investment decision has been taken in 2018, and the pipeline is scheduled to come on stream by October 2022.

Because BP would increase the overall capacity of the Danish transmission system by a significant amount, capacity and volume tariffs are projected to fall if the project is realized, as illustrated in the figure below.

Figure 11: Historic and expected gas transmission tariffs for DK 2006-2035 [2018-DKK/kWh].



Source: Energinet. Note: The projected tariffs are non-binding and only an indication of Energinets overall expectation with regards to future gas transmission tariffs.

4.6 Dimension Research, innovation and competitiveness

(i) Current situation of the low-carbon-technologies sector and, to the extent possible, its position on the global market (that analysis is to be carried out at Union or global level)

The low-carbon technology sector in Denmark employs around 67.000 full-time workers. 44% of these jobs are in the industrial sector. The low-carbon industry is more active within research and innovation, with an average of 9 out of 100 employees working in the field of research and innovation compared to on average 5 out of 100 employees in traditional Danish companies.⁷¹

Denmark has in the years 2010-17 seen an increase in the export of energy technology of 31,5%, compared to an on average increase in EU15 of 9,9%⁷²

Denmark mainly exports to other EU countries, but export of energy technology to the US and China are on the rising.

In 2017 Denmark developed a strategy for the export of energy technology with the aim of strengthening its position on the global market. The export strategy is part of building a coherent approach to the development of the low-carbon technologies sector from research and innovation to deployment, and works closely together with the research and innovation communities in building international relations.

(ii) Current level of public and, where available, private research and innovation spending on low-carbon-technologies, current number of patents, and current number of researchers

Denmark has spent appr. 500 mio. Dkr. in public funding on research and development on low-carbon technologies in 2018.

Private companies spent appr. 4 billion dkr. on research and development in low-carbon technologies in the energy sector in 2015, which is the latest accessible figure.

It is not possible to estimate the current number of patents or researchers working with research in low-carbon-technologies.

(iii) Breakdown of current price elements that make up the main three price components (energy, network, taxes/levies)

See Annex 3 for further details on the price elements that make up the main price components.

iiia. Description of energy subsidies, including for fossil fuels

⁷¹ Danmarks Statistik

⁷² Eurostat

Denmark provides subsidies for renewable energy technologies, e.g. onshore wind, offshore wind, solar PV, biomass and biogas. Subsidies are given as production subsidy per kWh, normally for a limited number of years. Subsidies for onshore renewable electricity is normally provided as a fixed premium to the market price of electricity. The level of subsidy for the individual technologies is determined by government. Subsidies for offshore wind is in term of Contract for Difference, and the level of subsidy is determined through the tendering of offshore wind parks.

The future subsidy system for new renewable energy plants in Denmark is currently being considered. Subsidy systems for renewable energy will increasingly be market oriented and include competition through tendering, in accordance with the EU state aid guidelines.

The 2018 energy agreement states that the more of the future renewable energy development shall be offered through tendering procedures. As of 2018 the subsidies for future offshore wind and solar PV will be offered through a tendering procedure, allowing these technologies to compete against each other and provide a downward pressure on the subsidy level. Later more technologies will be included in the tenders and allow these to compete for support.

The costs of renewable technologies is steadily declining, and becoming competitive with fossil fuel sources. It is a strong political objective to promote future electricity production from renewable energy on market conditions free of subsidies.

5. IMPACT ASSESSMENT OF PLANNED POLICIES AND MEASURES⁷³

5.1 Impacts of planned policies and measures described in section 3 on energy system and greenhouse gas emissions and removals including comparison to projections with existing policies and measures (as described in section 4).

(i) Projections of the development of the energy system and greenhouse gas emissions and GHG emissions and removals as well as, where relevant, of emissions of air pollutants in accordance with Directive 2016/2284/EU under the planned policies and measures at least until ten years after the period covered by the plan (including for the last year of the period covered by the plan), including relevant EU policies and measures.

The projections and assumptions presented in chapter 4 were published in April 2018, mainly as part of Denmark's Energy and Climate Outlook 2018 (DECO18). Thus, GHG projection results in chapter 4 include existing measures as of April 2018. On June 29th 2018, the Danish Government and all parties in Parliament agreed on a new Energy Agreement, with a new set of measures to be introduced from 2020 to 2024.

Moreover, the Government on 9 October 2018 launched its proposal for a Climate and Air Proposal, "Together for a greener future", covering the non-ETS sectors .

Thus, in this chapter preliminary projected effects of the Energy Agreement and estimated impacts of the policies and measures inherent in the Climate and Air Proposal are included, bearing in mind that the former includes adopted policies and measures and the latter includes planned policies and measures as proposed by the Government in October 2018 and of which some have been adopted for implementation with the agreement on the 2019 State Budget reached on 30 November 2018. With the agreement on the 2019 State Budget financial support for the implementation of the following measures is provided.

- C21) Improvement of biogas plants.
- C31) Behavioural campaign with climate labelling.
- C35) Analysis to improve the monitoring and accounting of carbon dioxide storage in soils and forests.

An overview of the estimated effects is included in Table 14. The results of combining DECO18 with these effects are shown Figure 12

⁷³ Planned policies and measures are options under discussion and having a realistic chance of being adopted and implemented after the date of submission of the national plan. The resulting projections under section 5.1.i shall therefore include not only implemented and adopted policies and measures (projections with existing policies and measures), but also planned policies and measures.

Full model-based projections of the development of the energy system and GHG emissions and removals will be carried out as part of the upcoming energy and GHG projection, Denmark's Energy and Climate Outlook 2019, scheduled to be publicized in the spring of 2019. These projections will be included in the final Danish integrated Energy and Climate Plan, to be submitted to the Commission by the end of 2019

Table 14. Overview of estimated GHG emission reduction effects of measures adopted in the 2018 Energy Agreement and planned with the 2018 Climate and Air proposal

Name of mitigation action	ETS, ESD/ESR, TOTAL	Estimate of mitigation impact (not cumulative reductions, in kt CO ₂ eq)	Estimate of mitigation impact (cumulative reductions, in kt CO ₂ eq)
	2019-2030	2030	2021-2030
[a: additional (adopted, but not yet implemented)/ p: planned (options under discussion and having a realistic chance of being adopted and implemented)/ G: Group of measures/ TD: Taxes and Duties/ EN: Energy/ BU: Business/ HO: Households/ TR: Transport/ IP: Industrial Processes/ AG: Agriculture/ LU: LULUCF/ WA: Waste/ "x" in the numbering means that the measure is an update, extension or expansion of an existing measure previously reported under the number shown]			
ts.			
a-EN-4x [E1]: World class offshore wind	ETS ⁵	5400	
a-EN-3-x1 [E2]: Renewable energy on market conditions	ETS ⁵	1900	
a-TD-4x [E3]: Reduction of taxes on electricity and restructuring of surplus heat utilisation ^{1, 2}	ETS ⁵ /ESD/ESR	-100	
a-BU-1x&HO-1x [E4a]: Targeted energy savings	ETS ⁵ /ESD/ESR	680	
a-HO-3x [E4b]: Funding for scrapping oil-fired boilers	ESD/ESR	20	
a-EN-7 [E5]: Modernisation of the heating sector and mitigating impacts of eliminating the base subsidy	ETS ⁵ /ESD/ESR	100	
a-EN-3-x2 [E10]: Reserve for additional investments in RE as from 2025 ⁴	ETS	2000	
p-TR-13 [C1]: Phase-out of sales of new petrol and diesel cars in 2030, and of new plug-in hybrid cars in 2035.	ESR	662	3500
p-TR-14 [C10]: An end to carbon emissions and air pollution from busses in Denmark's cities by 2030.	ESR	284	1500
p-TR-15 [C12]: Petrol and diesel out of taxi operations by 2030.	ESR	76	400
p-TR-18 [C16]: All new asphalt on national roads must be climate-friendly.	ESR	114	600
p-TR-8x [C17]: More biofuel in petrol and diesel.	ESR	100	1000
p-AG-6x [C21]: Improvement of biogas plants.	ESR	110	1100
p-IP-1x [C29]: Stricter regulation of climate-damaging gases in cooling systems.	ESR	133	800
p-LU-1/2/3/4/5-x2 [C34]: Use of carbon dioxide removal in climate efforts.	ESR	{1290}	{12900}
p-CS-3 [C36]: Annulment of carbon dioxide quotas.	ESR	{800}	{8000}
a-G8 [E]: The 2018 Energy Agreement of 29 June (ETS and non-ETS) ³	ETS ⁵ /ESD/ESR	11000	
a-G8a [E(ETS)]: All actions in the 2018 Energy Agreement with effects in the ETS sector ³	ETS ⁵	10754	
a-G8b [E(non-ETS)]: All actions in the 2018 Energy Agreement with effects in the non-ETS sectors	ESD/ESR	246	1300
p-G9 [C]: The 2018 Climate and Air Proposal of 9 October	ESD/ESR	1497	8900
a/p-G8b&G9 [total non-ETS]: Non-ETS of The 2018 Energy Agreement and The 2018 Climate og Air Proposal	ESR	1743	10200
a/p-G8&G9 [total E+C]: The 2018 Energy Agreement and The 2018 Climate and Air Proposal ³	TOTAL ⁵	12497	
Total GHG emissions		2030	
WEM projection scenario (BF, April 2018): Total GHG emissions	TOTAL ⁵	51401	
WAM projection scenario (Energy Agreement and Climate and Air proposal, October 2018): Total GHG emissions	TOTAL ⁵	38904	

Notes: The impact assessments are based on an overall assessment of the individual elements and their interaction. The partial impact assessments should therefore be taken with a reservation, especially if adjusted for the total package of initiatives. These are corrected emissions for the EU ETS related emissions. Effects of CO₂ reductions are indicated by a negative sign. Effects of the allocated funds for green transport and the allocated funds for climate have not been taken into account.

1) The energy agreement achieves a RE share in electricity consumption of 100 per cent, which means that sufficient green electricity is produced to cover electricity consumption. However, electricity produced on fossil fuels will continue to exist, which means that increased electricity consumption, as a result of a reduced electricity tax, if considered partially, could lead to a slight increase in total CO₂ emissions.

2) The effect depends on how the concrete implementation is designed.

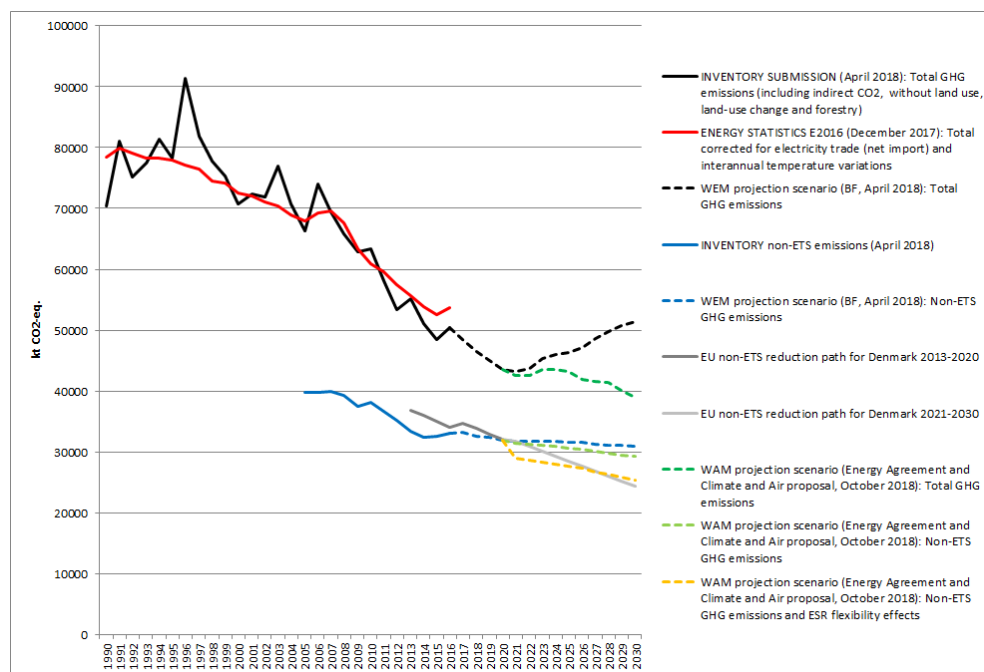
3) Including derived effects on coal consumption estimated to give up to an additional 1 million tonnes of CO₂ reduction in 2030.

4) With the energy agreement, funding has been allocated, which indicates the way to reach a RE share of approx. 55 pct. in 2030. In this example, extra RE electricity production has been included in the estimate to reach 55 per cent RE in 2030. This implies a RE electricity production that exceeds electricity consumption. Potential reductions in CO₂ emissions in neighboring countries from this initiative have not been taken into account here.

5) Greenhouse gas emissions from the majority of the energy sector in Denmark are covered by the EU Emission Trading System (ETS). Denmark does not have separate reduction targets in the ETS sector. In a quota system, increased emissions

from an area will be offset by a similar lesser discharge elsewhere in the EU, which is why, in principle; there is no climate effect of national energy policy in the quota sector. With the new agreement on the framework for the quota trading system for 2021-30, surplus quotas in the system will be transferred to the market stabilizing quota reserve from which a portion of the quotas will be canceled. This will lead to lower greenhouse gas emissions from the EU quota sector. When the system is in balance again, the dynamics of the system will be the same as before the new agreement.

Figure 12 Trends in current (1990-2016 as reported under UNFCCC in April 2018) and projected (2017-2030) total greenhouse gas emission with existing policies and measures (as of April 2018) and with effects of the energy agreement as well as planned policies from the Climate and Air Proposal.



(ii) Assessment of policy interactions (between existing and planned policies and measures and planned policies and measures within a policy dimension and between existing policies and measures and planned policies and measures of different dimensions) at least until the last year of the period covered by the plan, in particular to establish a robust understanding of the impact of energy efficiency/energy saving policies on the sizing of the energy system and to reduce the risk of stranded investment in energy supply

This will be described in the final energy and climate plan once the modelling of the energy agreement in the Danish Energy and Climate Outlook 2019 has been completed.

(iii) Assessment of interactions between existing policies and measures and planned policies and measures, and between those policies and measures and Union climate and energy policy measures

Existing policies and measures and planned policies and measures interact as the latter, in most cases, are building on the former with a view to extend or strengthen existing measures. This is particular the case within the Decarbonisation (GHG emissions reduction and renewable energy) and Energy efficiency dimensions, where Denmark has a long tradition of efforts cf. Annex 1.

In Denmark both existing policies and measures and planned policies and measures interact with Union climate and energy policy measures.

Information on the interaction between existing policies and measures and Union climate and energy policy measures is reported biennially under the Monitoring Mechanism Regulation (MMR, Regulation (EU) No 525/2013) and is available in the EEA database on existing policies and measures in Denmark (under the column with the title “Union policy which resulted in the implementation of the PaM”).

Information on the interaction between planned policies and measures and Union climate and energy policy measures is included in Annex 1, where the tables on additional policies and measures also include a column with information on the “Union policy which resulted in the implementation of the PaM”.

5.2 Macroeconomic, and to the extent feasible, the health, environmental, employment and education, skills and social impacts including just transition aspects (in terms of costs and benefits as well as cost-effectiveness) of the planned policies and measures described in section 3 at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

Neither information on the macroeconomic impact nor impacts on the health, environmental, employment, education, skills, social, transitional, costs, benefits and cost-effectiveness until 2030 of the planned policies and measures are currently available.

5.3 Overview of investment needs

(i) existing investment flows and forward investment assumptions with regard to the planned policies and measures

Future state budget laws that will implement the additional policies and measures adopted with 2018 Energy Agreement is expected to follow the multi-annual budget included in the agreement and reproduced in table 15.

Table 15. *Prioritised budgets 2018-2025 in the 2018 Energy Agreement. The agreement prioritises approximately 0.5 billion DKK in 2019, increasing to approximately 2.8 billion DKK in 2025.*

Budgetary impacts – priorities								
2018 prices, DKKm	2018	2019	2020	2021	2022	2023	2024	2025
World class offshore wind	2	10	17	16	105	117	220	376
Renewable energy on market conditions	0	0	0	6	291	346	392	429
- <i>Technology-neutral RE subsidies</i>	0	0	0	6	51	111	161	202
- <i>New biogas and other green gasses</i>	0	0	0	0	240	235	231	227
Reduction of taxes on electricity and restructuring of surplus heat utilisation	0	325	375	675	650	1,200	1,250	1,575
- <i>of which reduction of the electrical heating tax</i>	0	0	0	325	325	350	350	350
- <i>of which reduction of the electricity tax</i>	0	325	275	250	225	400	450	775
- <i>of which abolishment of Annex 1 of the Electricity Tax Act</i>	0	0	0	0	0	375	350	325
- <i>of which restructuring of the regulations for surplus heat</i>	0	0	100	100	100	100	100	100
Targeted energy saving effort	20	35	35	545	550	550	555	10
- <i>of which subsidies for energy saving initiatives</i>	0	0	0	500	500	500	500	0
- <i>of which energy saving – data and information</i>	19	33	34	44	44	44	44	0
Modernisation of the heating sector and mitigating impacts of eliminating the base subsidy	2	38	235	255	120	110	50	50
- <i>of which modernisation of the heating sector</i>	0	10	40	60	60	50	50	50
- <i>of which base subsidy initiatives</i>	2	28	195	195	60	60	0	0
Analyses, policy development and export promotion	3	53	64	52	47	44	42	0
- <i>of which export promotion</i>	0	20	31	31	31	31	31	0
- <i>of which gas strategy</i>	0	2	2	1	0	0	0	0
- <i>of which electricity market and security of supply</i>	3	4	5	3	3	3	3	0
- <i>of which smart energy and storage</i>	0	3	3	3	3	3	0	0
- <i>bioenergy task force</i>	0	2	2	2	0	0	0	0
- <i>digitised public servicing of the utility sector</i>	0	6	5	5	2	0	0	0
- <i>task force for digitisation-ready legislation and smart energy - pilot phase</i>	0	7	7	0	0	0	0	0
- <i>of which analysis and model development</i>	0	7	7	5	5	5	5	0
- <i>Samsø Energy Academy</i>	0	3	3	3	3	3	3	0
Funding for green transport	0	0	100	100	100	100	100	0
Funding for scrapping oil-fired boilers	0	0	0	20	20	20	20	0
Reserve for additional investments in RE as from 2025	0	0	0	0	0	0	0	400
Administrative costs	10	45	45	50	50	40	40	0
Priorities, total	25	500	875	1,700	1,925	2,525	2,675	2,825

Note: Due to rounding, there may be deviations between the sum of the components and the total sum.

The tax reductions are listed in 2018 prices and calculated according to reversals and behavior. “Targeted energy saving effort” also includes derived lower tax revenue.

As stated in the Climate and Air proposal the concrete initiatives in the proposal will be funded through the following allocations:

- Funds from the allocated budget for green initiatives in the proposed 2019 State Budget Law
- The Fund for Green Transport as set out in the Energy Agreement from June 2018
- Remaining funds in the National Green Climate Fund from the Agreement on the abolition of the PSO tax
- Advanced biofuel allocation from the Agreement on Enterprise and Entrepreneurship Initiatives
- A minor share of the allocation for energy storage projects from the implementation of successive funds

In addition, the government will apply reserves allocated in the Finance Act 2019 proposal and funding allocated in the energy field.

Finally, the Government considers that necessary funding in addition to the above mentioned can be provided by prioritizing part of the fiscal space. The government will convene the parties to the Energy Agreement for discussions on the government's proposal for the implementation of the Fund for Green Transport, as agreed in the Energy Agreement from June 2018.

On 30 November 2018 an agreement on the 2019 Finance Act was reached. With the agreement on the 2019 Finance Act financial support for the implementation of the following measures is provided:

C21) Improvement of biogas plants: DKK 5 million annually in 2019 and 2020. In addition, DKK 10 million annually in 2020-2022 to finance derived financial consequences of the initiative.

C31) Behavioural campaign with climate labelling: DKK 6 million annually in the period 2019-2022.

C35) Analysis to improve the monitoring and accounting of carbon dioxide storage in soils and forests: DKK 3 million in 2019. In addition, the government will seek support to implement the concrete initiatives in climate and air proposal over the coming years as part of the ordinary legislative process. The government will also seek support for financing some of the initiatives in the annual budget negotiations for the coming fiscal year.

(ii) Sector or market risk factors or barriers in the national or regional context

Being a subsection of section 5.3 it is assumed the information to be reported here is information on sector or market risk factors or barriers in the national or regional context in relation to investment needs.

As mentioned in chapter 5.3(i) only information on public investments is available for this reporting. The risk factors or barriers in the national context in relation to the investment needs are that the budgets for achieving the objectives in the 2018 Energy Agreement and the objectives in the 2018 Climate and Air proposal have been underestimated.

However, as announced both in the 2018 Energy Agreement and in the 2018 Climate and Air proposal, progress with implementation of adopted measures will be closely monitored through frequent stock-takes and follow-ups.

The risk factors or barriers in the national context in relation to the investment needs will be minimized as any gaps in the need for additional public finance support or resources will be identified well in advance through the frequent stock-takes and follow-ups

(iii) analysis of additional public finance support or resources to fill identified gaps identified under point (ii)

With the Energy Agreement being adopted in 2018 and the Climate and Air proposal put forward in 2018 analyses with a view to identify gaps in the need for additional public finance support or resources have not yet been relevant.

It is the objective of the government that Denmark in 2050 is a low-emission society independent of fossil fuels. A crucial prerequisite for fulfilling the ambition is that the transport sector will be transformed well in advance. It is also the objective of the government that Denmark in the transport sector - as in the energy sector – is in the front as a green pioneer country in an economically responsible manner. The government has therefore set an ambition for a green transition of passenger cars in Denmark while simultaneously providing alternative sources to ensure the fiscal revenue.

Regarding the green conversion of passenger cars, it is the government's ambition that all newly registered passenger cars by 2030 are low-emission cars and from 2035 zero-emission cars.

A commission will be set up to deliver a concrete strategy for how the government's objective can best be achieved and the state revenue can be maintained.

5.4 Impacts of planned policies and measures described in section 3 on other Member States and regional cooperation at least until the last year of the period covered by the plan, including comparison to projections with existing policies and measures

(i) Impacts on the energy system in neighbouring and other Member States in the region to the extent possible

As impacts of planned policies and measures described in section 3 on the energy system in neighboring and other Member States in the region have not been analysed, it is not possible to include information on such impacts.

(ii) Impacts on energy prices, utilities and energy market integration

As impacts of planned policies and measures described in section 3 on energy prices, utilities and energy market integration have not been analysed, it is not possible to include information on such impacts

(iii) Where relevant, impacts on regional cooperation

As impacts of planned policies and measures described in section 3 on regional cooperation have not been analysed, it is not possible to include information on such impacts

Part 2: List of parameters and variables to be reported in Section B of National Plans ^{74, 75,}
^{76, 77}

The following parameters, variables, energy balances and indicators are to be reported in Section B 'Analytical Basis' of the National Plans:

⁷⁴ For the plan covering the period from 2021 to 2030: for each parameter/variable in the list, trends over the years 2005-2040 (2005-2050 where appropriate) including for the year 2030 in five year intervals shall be reported both in section 4 and 5. Parameter based on exogenous assumptions vs. modelling output shall be indicated.

⁷⁵ As far as possible, reported data and projections shall build on and be consistent with EUROSTAT data and methodology used for reporting European statistics in respective sectorial legislations, as European statistics are the primary source of statistical data used for reporting and monitoring, in accordance with Regulation (EC) No 223/2009 on European statistics.

⁷⁶ Note: all projections are to be performed on the basis of constant prices (2016 prices used as base year)

⁷⁷ The Commission will provide recommendations for key parameters for projections, at least covering oil, gas, and coal import prices as well as EU ETS carbon prices.

Part 2

1. General parameters and variables

The following parameters, variables, energy balances and indicators are to be reported in Section B “analytical basis” of the National Plans, if used:

See the following parameters under Part 2, (“General parameters and variables”, “Energy balances and indicators”, “Electricity and heat”, “Transformation sector”, “Energy consumption”, “Prices”, “Investments and Renewables”) in the attached Annex 2

(1) Population [million]

See Annex 2a

(2) GDP [euro million]

See Annex 2a

(3) Sectorial gross value added (including main industrial, construction, services, and agriculture sectors) [euro million]]

See Annex 2a

(4) Number of households [thousands]

See Annex 2a

(5) Household size [inhabitants/households]

See Annex 2 a

(6) Disposable income of households [euro]]

See Annex 2a

(7) Number of passenger-kilometres: all modes, i.e. split between road (cars and buses separated if possible), rail, aviation and domestic navigation (when relevant) [million pkm]

See Annex 2a

(8) Freight transport tonnes-kilometres: all modes excluding international maritime, i.e. split between road, rail, aviation, domestic navigation (inland waterways and national maritime) [million tkm]

See Annex 2a

(9) International oil, gas and coal fuel import prices [euro/GJ or euro/toe] – based on the Commission's recommendations

See Annex 2a

(10) EU-ETS carbon price [euro/EUA] – based on the Commission's recommendations

See Annex 2a

(11) Exchange rates to euro and to US Dollar (if applicable) assumptions [euro/ currency and USD/currency]

See Annex 2

(12) Number of Heating Degree Days (HDD)

See Annex 2a

(13) Number of Cooling Degree Days (CDD)

See Annex 2a

(14) Technology cost assumptions used in modelling for main relevant technologies

See Annex 2a

2. Energy balances and indicators

2.1 Energy supply

(1) Indigenous Production by fuel type (all energy products that are produced in significant quantities) [ktoe]

See Annex 2a

(2) Net imports by fuel type (including electricity and split into intra- and extra EU net imports) [ktoe]

See Annex 2a

(3) Import dependency from third countries [%]

See Annex 2a

(4) Main import sources (countries) for main energy carriers (including gas and electricity)

See Annex 2a

(5) Gross Inland Consumption by fuel type source (including solids, all energy products: coal, crude oil and petroleum products, natural gas, nuclear energy, electricity, derived heat, renewables, waste) [ktoe]

See annex 2a

2.2 Electricity and heat

(1) Gross electricity generation [GWh]

See Annex 2a

(2) Gross electricity generation by fuel (all energy products) [GWh]

See Annex 2a

(3) Share of combined heat and power generation in total electricity and heat generation [%]

See Annex 2a

(4) Capacity electricity generation by source including retirements and new investments [MW]

See Annex 2a

(5) Heat generation from thermal power generation

See Annex 2a

(6) Heat generation from combined heat and power plants, including industrial waste heat

See Annex 2a

(7) Cross-border interconnection capacities for gas and electricity [Definition for electricity in line with outcome of ongoing discussions on basis for 15% interconnection target] and their projected usage rates

See Annex 2a

2.3 Transformation sector

(1) Fuel inputs to thermal power generation (including solids, oil, gas) [ktoe]

See Annex 2aa

(2) Fuel inputs to other conversion processes [ktoe]

See Annex 2a

2.4 Energy consumption

(1) Primary and final energy consumption [ktoe]

See Annex 2a

(2) Final energy consumption by sector (including industry, residential, tertiary, agriculture and transport (including split between passenger and freight transport, when available)) [ktoe]

See Annex 2a

(3) Final energy consumption by fuel (all energy products) [ktoe]

See Annex 2a

(4) Final non-energy consumption [ktoe]

See Annex 2a

(5) Primary energy intensity of the overall economy (primary energy consumption per GDP [toe/euro]

See Annex 2a

(6) Final energy intensity by sector (including industry, residential, tertiary and transport (including split between passenger and freight transport, when available))

3 See Annex 2a

2.5. Prices

(1) Electricity prices by type of using sector (residential, industry, tertiary)

See Annex 2a

(2) National retail fuel prices (including taxes, per source and sector) [euro/ktoe]

4 See Annex 2a

2.6 Investments

Investment costs in energy transformation, supply, transmission and distribution sectors.

See Annex 2a

2.7 Renewables

(1) Gross final consumption of energy from renewable sources and share of renewable energy in gross final energy consumption and by sector (electricity, heating and cooling, transport) and by technology

See Annex 2a

(2) Electricity and heat generation from renewable energy in buildings (as defined in Article 2(1) of Directive 2010/31/EU); this shall include, where available, disaggregated data on energy produced, consumed and injected into the grid by solar photovoltaic systems, solar thermal systems, biomass, heat pumps, geothermal systems, as well as all other decentralized renewables systems)

See Annex 2a

(3) If applicable, other national trajectories, including long-term or sectorial ones (the share of food-based and advanced biofuels, the share of renewable energy in district heating, as well as the renewable energy produced by cities and energy communities as defined by Article 22 of [recast of Directive 2009/28/EC as proposed by COM(2016) 767])

See Annex 2a

3.0GHG emissions and removals related indicators

(1) GHG emissions by policy sector (EU ETS, Effort Sharing Regulation and LULUCF)

Denmark's total greenhouse gas emissions 2005-2040, including indirect CO₂-emissions, are shown in table 3.1 with and without LULUCF under the United Nations Framework Convention on Climate Change (UNFCCC)⁷⁸.

For the period 2005-2016 the estimates shown are from Denmark's 2018 inventory reporting. For the period 2017-2040 the estimates shown are from the 2018 baseline projection (DECO18)⁷⁹. For the period after 2030 estimates are projected to be on the same level as in 2030 as the April 2018 projection ends in 2030. Consolidated projections and updated GHG emissions and removals related indicators until 2040 will be elaborated in 2019 and included in the final integrated national energy and climate plan.

Information on the split between ETS and non-ETS emissions is also included in table 3.1.

For the period 2005-2016 verified CO₂ emissions from stationary installations under the EU ETS with the addition of CO₂ emissions from domestic aviation⁸⁰ are shown together with

⁷⁸ LULUCF under the Kyoto Protocol differs from LULUCF under the UNFCCC.

⁷⁹ The Danish Energy and Climate Outlook 2018, April 2018 [https://ens.dk/sites/ens.dk/files/Analyser/basisfremskrivning_2018.pdf], except for LULUCF where updated estimates published in October 2018 are shown (<http://envs.au.dk/videnudveksling/luft/emissioner/supporting-documentation/greenhouse-gases-nir/lulucf/>).

⁸⁰ In addition to CO₂ emissions from stationary installations also CO₂ emissions from domestic aviation should be seen as emissions under the EU ETS, although CO₂ emissions from aviation verified under the EU ETS are different from the inventory estimates for domestic and international aviation as the former is based on aviation entities registered in Denmark and the latter is based on jet fuel sold in Denmark.

the differences between total emissions and ETS emissions as a proxy for non-ETS greenhouse gas emissions⁸¹. For the period 2017-2040 the split is from the 2018 baseline projection.

See Annex 2 (a and b) for further details.

Table 16 Denmark's greenhouse gas emissions 2005-2040 - by policy sector (EU ETS, Effort Sharing Regulation and LULUCF)*

GREENHOUSE GAS EMISSIONS in EU ETS and non-ETS SECTOR CATEGORIES	2005	2010	2015	2020	2025	2030	2035	2040
	CO2 equivalent (kt)			CO2 equivalent (kt)				
Total (without LULUCF, with indirect CO2)	66321	63342	48502	43553	46357	51401	51401	51401
EU ETS (CO2 emissions from stationary installations also included in the inventory)	26476	25266	15796	11558	14648	20300	20300	20300
EU ETS (CO2 emissions from domestic aviation also included in the inventory)	177	179	130	138	142	148	148	148
EU ETS (Total CO2 emissions in ETS also included in the inventory)	26653	25445	15926	11696	14790	20448	20448	20448
Non-ETS GHG emissions, without LULUCF, with indirect CO2 (2013-2020: ESD / 2021-2030: ESR)	39668	37897	32576	31857	31567	30953	30953	30953
GREENHOUSE GAS NET EMISSIONS in the LULUCF SECTOR in the inventory under the UNFCCC	2005	2010	2015	2020	2025	2030	2035	2040
	CO2 equivalent (kt)			CO2 equivalent (kt)				
LULUCF under the UNFCCC (net emissions from "4. Land use, land-use change and forestry")	4596	-801	4222	2563	1873	1928	1928	1928
LULUCF accounting quantities (net credits if negative): KP1(2008-2012), KP2(2013-2020), EU/LULUCF(2021-2030)	NA	-1405	-1353	-3059	-1378	-1286	NE	NE

* 2005-2015: From Denmark's annual EU and UNFCCC inventory reporting (March/April 2018),

2020-2040: From DECO18 (April 2018) and updated LULUCF projection (October 2018) - the so-called WEM-projection scenario with effects of existing policies and measures (existing as of April 2018).

(2) GHG emissions by IPCC sector and by gas (where relevant split into EU ETS and Effort Sharing sectors) [tCO₂eq]

Denmark's total greenhouse gas emissions 2005-2040 by IPCC sector and by gas are shown in table 3.2. The split into EU ETS and Effort Sharing sectors (non-ETS) are shown in table 3.1.

⁸¹ Due to improvements in methodologies, activity data, emission factors these non-ETS emissions differs slightly from non-ETS emissions previously reported under the Effort Sharing Decision (ESD) for 2013-2020.

Table 17 Denmark's greenhouse gas emissions 2005-2040 - by gas and by IPCC sector*

GREENHOUSE GAS EMISSIONS	2005	2010	2015	2020	2025	2030	2035	2040
by gas:	CO2 equivalent (kt)				CO2 equivalent (kt)			
CO2 emissions without net CO2 from LULUCF	51532	49292	35315	31218	34133	39172	39172	39172
CO2 emissions with net CO2 from LULUCF	56059	48415	39446	33685	35903	40991	40991	40991
CH4 emissions without CH4 from LULUCF	7683	7362	6907	6516	6600	6627	6627	6627
CH4 emissions with CH4 from LULUCF	7725	7412	6964	6588	6678	6711	6711	6711
N2O emissions without N2O from LULUCF	5507	5223	5231	5340	5393	5464	5464	5464
N2O emissions with N2O from LULUCF	5534	5250	5265	5371	5425	5497	5497	5497
HFCs	933	951	639	418	197	104	104	104
PFCs	19	19	5	3	2	1	1	1
Unspecified mix of HFCs and PFCs	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
SF6	20	36	103	57	32	33	33	33
NF3	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA	NO,NA
Total (without LULUCF)	65694	62883	48200	43130	45968	51048	51085	51092
Total (with LULUCF)	70290	62083	52421	45694	47841	52976	53013	53021
Total (without LULUCF, with indirect CO2)	66321	63342	48502	43553	46357	51401	51401	51401
Total (with LULUCF, with indirect CO2)	70917	62542	52724	46116	48230	53329	53329	53329
GREENHOUSE GAS SOURCE AND SINK CATEGORIES	2005	2010	2015	2020	2025	2030	2035	2040
by IPCC sectors:	CO2 equivalent (kt)				CO2 equivalent (kt)			
1. Energy (with indirect CO2)	51405	49679	34950	30115	32858	37793	37793	37793
2. Industrial processes and product use	2794	2036	1998	2077	2038	1999	1999	1999
3. Agriculture	10818	10408	10392	10383	10516	10706	10706	10706
4. Land use, land-use change and forestry	4596	-801	4222	2563	1873	1928	1928	1928
5. Waste	1304	1218	1162	978	945	903	903	903
6. Other	NO	NO	NO	NO	NO	NO	NO	NO

* 2005-2015: From Denmark's annual EU and UNFCCC inventory reporting (March/April 2018),

2020-2040: From DECO18 and updated LULUCF projection (October 2018) – the WEM scenario.

(3) Carbon intensity of the overall economy [tCO₂eq/GDP]

See Annex 2a

(4) CO₂ emission related indicators

(a) GHG intensity of domestic power and heat generation [tCO₂eq/MWh]

See Annex 2 a

(b) GHG intensity of final energy consumption by sector [tCO₂eq/toe]

See annex 2a

(5) Non-CO₂ emission related parameters

(a) Livestock: dairy cattle [1000 heads], non-dairy cattle [1000 heads], sheep [1000 heads], pig [1000 heads], poultry [1000 heads]

See annex 2a

Further reporting on Article 7 in the Energy Efficiency Directive

Member States shall notify to the Commission their proposed detailed methodology pursuant to Annex V(5) to Directive 2012/27/EU for the operation of the energy efficiency obligation schemes and alternative policy measures referred to in Articles 7a and 7b and Article 20(6) of that Directive.

It is currently only possible to report on Annex III, 1 (a), since article 7 of the revised EED is not yet implemented.

(a) the annual final energy consumption, averaged over the most recent three year-period prior to 1 January 2019 [in ktoe];

Based on the final energy consumption in 2016 in the official Energy Statistic and the final energy consumption in 2017 and 2018 in the latest forecast (BF2018) is the annual end-use saving requirements at 0,8 pct. equal to 4,94 PJ.