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## Annex 5. Description of existing actions and modelling platform (Denmark's energy and climate model)

The following policies and instruments are included in the Climate Status and Outlook 2024 (KF24), from which Denmark's National Energy and Climate Plan deducts data. Policies and instruments that are still in place have been taken forward from previous climate status and projection reports (KF21, CD22 and KF23).

- *Agreement on kilometre based tolls for trucks of 29 March 2023 – the agreement replaces the agreement on kilometer-based tolls of 24 June 2022, which was included in KF23.*
- *Addendum to the Agreement on Inflation Aid 2023 of 28 March 2023 – increase the decoupling scheme.*
- *“Adaptation of Høvsøre Testcenter” from the agreement on good framework conditions for testing of prototype and series 0 wind turbines of 15 December 2021 – The adaptation of the Høvsøre test centre was implemented in 2023 and is included in KF24.*
- *Agreement on Green Aviation in Denmark of 15 December 2023.*
- *Finance Act 2024:*
  - *Extension of the district heating pool*
  - *Increase in the basic allowance for electric cars*
  - *Reprioritisation of funds from the Building Pool to the Climate Forest Fund*
- *Climate agreement on greener solar and wind on land 2023 of 12 December 2023 – the action is financed, inter alia, by reprioritising funds from the scrapping pool. Other measures are not included in the KF24 as municipal media are still outstanding.*
- *Revision of the EU ETS:*
  - *Separate carbon trading system for road transport and heating of households and industrial installations (ETS2)*
  - *Accelerating phase-out of free allowances in ETS1*
  - *Inclusion of maritime transport in ETS1*
  - *Quick reduction in quota cap (ETS1)*
- *ReFuelEU Aviation – blending requirements for the aviation sector.*
- *FuelEU Maritime – displacement requirements for the maritime sector.*
- *Alternative Fuels Infrastructure Regulation (AFIR).*
- *Agreement on the partial implementation of the Green Fund of 15 April 2024 – agreement partially signed in KF24.*
- *Agreement on the implementation of the conversion aid from Green Tax Reform for Industry etc. of 2022 of 19 March 2024 – agreement partially included in KF24.*

### Continued from previous climate status and projection reports:

- *2022 agreement on green tax reform for industry, etc.:*
  - *High and more uniform CO2 tax.*
  - *Special rate of duty applicable to mineralogical processes, etc.*
  - *floor price for the CO2 tax.*
  - *Reconversion of energy taxes.*
  - *Elimination of existing basic allowance in the CO2 tax.*
  - *Reduction of the general electricity tax.*
  - *Cancellation of temporary energy tax increase.*
  - *Pulje for capture and storage of CO2 (CCS)*
  - *Pulje for testing offshore wind turbines*
- *Climate agreement on green power and heat 2022 – Denmark can more:*

- Turbo on the roll-out of district heating to be completed by 2028
  - Transformation of support model for pilot onshore wind turbines and new support for offshore test wind turbines.
  - Pulje for renewable energy in less accessible areas.
  - Accelerating the expansion of biogas.
  - Introduce regulation of methane losses from biogas production
  - Regulating methane losses from biogas plants (special case, read Climate status and projection 23, Chapter 2.3 for more information)
  - Weightings in the Business Pool.
- A new reform package for the Danish economy – Reduction of the general electricity tax by 2030.
- Supplementary agreement on energy island of Bornholm 2022 dated 29 August 2022 – Bornholm Energie was part of KF23 baseline but not in KF24.
- Agreement on Targeted Heat Check and DelAgreement on the allocation of funds from agreement on targeted hot check and phase-out of black heat – Increase of the pool for the decoupling scheme is included.
- Agreement on Winter Aid – The scrapping scheme is extended to wood pellet pine in KF23. In addition, the increased funds for the roll-out of district heating are estimated to be included in the overall projection. The other actions of the Agreement are mainly temporary in nature and are therefore not explicitly reflected;
- Agreement on the greening of Danish agriculture – The “Frequency requirements” will enter into force from January 2023 and has already been implemented as part of KF22. The requirement is further specified in 2022 and is therefore adjusted in KF23.
- Extended Producer Responsibility Agreement on packaging and single-use products
- Follow-up agreement on Climate Plan for a green waste sector and circular economy:
  - Strengthening waste supervision and streamlined practices.
  - Determination of deadline for the collection of textile waste.
- Agreement on the development and promotion of hydrogen and green fuels (Power-to-X strategy) – Actions included in KF23 in an overall overall assessment. It should be noted that many actions are considered to be supportive measures awaiting clarification. Method unchanged for CD24.
- Agreement on Danish participation in an “Important Project of Common European Interest” (IPCEI) on hydrogen of 18 June 2021 – IPCEI, aid for installations of major importance. (DKK 850 million will be provided in the period 2021-2026 to support Danish projects participating in IPCEI for hydrogen).
- Agreement on the temporary maintenance of the Energy Crop Limit – Supporting Framework Conditions. CCS.
- Agreement on framework conditions for CO<sub>2</sub> storage in Denmark – biocovers at landfills: As there are biocovers in the course of construction, these are likely to have a reducing effect on emissions. Therefore, the KF23 report will make a partial correction in relation to the missing figures for 2025 and 2 030 in relation to a preliminary best estimate for the impact biocovers.
- Finance Act 2016, cf. Order on subsidies for the establishment of biocover at landfills and landfills
- The effect of biocover on discharges from landfills. (special case, read Climate status and projection 23, Chapter 2.3 for more information)
- Gas leak from Nordstream 1 and 2 pipelines. (special case, read Climate status and projection 23, Chapter 2.3 for more information)
- Agreement on stricter CO<sub>2</sub> emission performance standards for new cars and vans, which will lead to adjustments in the regulation setting CO<sub>2</sub> emission performance standards for new passenger cars and new light commercial vehicles. Part of the European Climate Law ‘Fit for 55’ – the Regulation’s actions on CO<sub>2</sub> requirements for new light-duty vehicles are taken into account.
- .
- Agreement on National Strategy for Sustainable Construction of 5 March 2021 – Step phase-in and tightening of CO<sub>2</sub> requirements for buildings.
- Follow-up agreement ifm. Climate Agreement for Energy and Industry, etc. of 7 September 2021 – Further promoting the use of surplus heat in implementation of a model for price regulation of surplus heat (both fiscal and other surplus heat), de minimis threshold and an energy efficiency scheme.
- Climate agreement for energy and industry, etc. 2020 – in the Climate Agreement for Energy and Industry, etc. In 2020, DKK 202 million was reserved for experimental turbines in 2022-2024 and decided to initiate an analysis. The analysis was finalised and published in October 2021, following which the energy conciliation community decided to extend the current support schemes for experimental wind turbines;
- FL22: Investing in a continued greening of Denmark – Extension of an additional 2 GW of marine wind

- *Agreement on Infrastructure Plan 2035 of 28 June 2021 – Agreement to invest and initiate initiatives for the development of road infrastructure, the development of railway infrastructure and the deployment of battery trains, as well as a number of other initiatives and pools*
- *Implementation of a pool for green transport (from the Energy Agreement 2018 and the Climate Agreement for Energy and Industry, etc.) 2020) of 19 April and 25 June 2021 and Supplementary Agreement to the agreement of 25 June on the implementation of a pool for green transport (from the Energy Agreement 2018 and the Climate Agreement for Energy and Industry, etc.) 2020) of 23 September 2021*
- *Agreement on the regulation of the recharging point market of 28 October 2021 – New legislation on alternative fuels infrastructure.*
- *Agreement on the greening of Danish agriculture of 4 October 2021 – Measures aimed at digestion of livestock, slurry disposal, nitrogen action, etc.*
- *FL20, FL21, FL22, Agreement on the greening of Danish agriculture 2 021 mm. — Set-aside, extensification, etc.*
- *FL 20, FL21, FL22, CAP funds from the EU, Agreement on the greening of Danish agriculture 2 021 mm. — Afforestation*
- *Agreement on the greening of Danish agriculture 2 021 mm. — Reduction of harvesting in forests by 20 % in 2026-31*
- *FL22: Investing in a continued greening of Denmark – technology-neutral supply of negative emissions. It should be noted that it will only be a partial impact assessment.*
- *CAP (EU agricultural support scheme) – Miscellaneous support measures in agriculture*
- *Cap (EU agricultural support scheme) – Afforestation*
- *Horizon 2020 EU support of EUR 30 million until 2026 for the first 6 MW of Green Hyscale hydrogen project in Skive. The plant concerns the KF sector “production of oil, gas and renewable fuels” and the expected installation of the plant is included in the projection.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Continuation of current experimental wind turbine scheme: DKK 33 million (2020 prices) will be prioritised for the continuation of the current experimental mill schemes in 2020 and DKK 35 million (2020 prices) in 2021. In the period 2022-24, DKK 202 million (2020 prices) will be allocated to experimental wind turbines to strengthen research and development activities in the field of wind energy.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – postponement of the date by which the onshore wind turbine ceiling under the 2018 Energy Agreement is to be reached from 2030 to 2040*
- *Climate agreement for energy and industry, etc. 2020 (dated 22 June 2020) – The payment to Green Pulje is increased to DKK 125.000 per MW*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Changes in the identity requirement for self-consumption of renewable electricity so that companies can invest in more solar energy*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – the compensation scheme covering the costs incurred by grid operators in connection to the grid of renewable energy installations and subsequent network losses, operation and maintenance will be abolished from 2023 onwards.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Framework conditions for the continued development of electricity infrastructure to allow for the introduction of a geographically differentiated connection contribution and feed-in tariffs for generators at both distribution and transmission levels, as well as a modification of Energinet's compensation obligation.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Establishing a technology-neutral, market-based pool to help promote capture and storage of CO<sub>2</sub> (CCS) and catch and use (CCU).*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Pulje for the green transition of industry (Business Pool) 2020-30.*
- *Green Tax Reform Agreement (8th dec. 2020) – an extension of the Danish Business Pool by DKK 315 million in 2022-2025 (including derived tax losses) – inter alia for the purposes of energy efficiency and greening of horticulture.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Regulation to reduce the use of HFC gases harmful to the climate*
- *Green Tax Reform Agreement (8th dec. 2020) – the introduction of an investment window for enterprises, where the depreciation base is temporarily increased by 16 % of the investment expenditure for investments in operating assets (machinery, furniture, etc.) made between 23 November 2020 and the end of 2022.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Pulje for the promotion of biogas and other green gases 2024-30.*

- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Pulje for targeted energy efficiency improvements 2021-30.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Reduction of the rate of the electricity heating tax from 15,5 øre/kWh to 0,4 øre/kWh for industries and 0,8 øre/kWh for households*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – The surplus heat tax is removed if the waste heat is certified or subject to an equivalent contractual arrangement ensuring energy efficiency improvements at the level of the surplus heat supplier.*
- *Climate agreement for energy and industry, etc. 2020 (dated 22 June 2020) – DKK 35 million extra for the scrapping scheme in 2020 (calculated in 2020 prices and including derived tax losses)*
- *Climate agreement for energy and industry, etc. 2020 (dated 22 June 2020) – DKK 245 million extra for the Building Pool in 2020 (calculated at 2020 prices and including derived tax losses)*
- *Budget Act 2021 – A further DKK 300 million will be allocated to the Building Pool for 2021 and DKK 25 million annually in 2022 to 2025 (including derived tax losses)*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Elimination of consumer bonds to the natural gas network*
- *Climate agreement for energy and industry, etc. 2020 (22 June 2020) – grant pools for phasing out oil and gas furnaces, including a pool for decoupling from the natural gas grid and for the deployment of district heating 2021-2030.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Extension of the RES permit scheme, which gives installer or installer companies paper to install high quality renewable energy installations.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Modernisation of the production ties in the district heating sector with a view to giving district heating producers a more free choice over their own investments.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – New model for regulating the district heating sector to ensure a cost- and climate-efficient transition of the sector – including a new framework for geothermia.*
- *Climate agreement for energy and industry, etc. 2020 (of 22 June 2020) – Legal requirements for the sustainability of woody biomass for energy as well as documentation and verification requirements*
- *Budget Act 2021 – Puljer to support the phasing out of oil and gas furnaces is increased by DKK 810 million (including derived tax losses)*
- *Agreement on the green transition of road transport (4th dec. 2020) – the rescheduling of the registration tax for cars and vans to be based on the value of the car and CO2 emissions.*
- *Agreement on the green transition of road transport (4th dec. 2020) – consequential adjustment of taxes on vans, motorcycles, caravans, veteran cars, etc.*
- *Agreement on the green transition of road transport (4th dec. 2020) – extension of the special scheme for low electricity tax on electricity for charging zero- and low-emission cars up to and including 2030*
- *Agreement on the green transition of road transport (4th dec. 2020) – introduction of a national CO2 displacement requirement covering emissions from fossil fuels petrol, diesel and gas, replacing the current blending requirement.*
- *Agreement on the green transition of road transport (4th dec. (2020) – national ILUC values or equivalent taking into account global effects in the production of biofuels shall be included in the national regulation of biofuels as soon as possible and no later than when the displacement requirement is increased in 2025;*
- *Agreement on the green transition of road transport (4th dec. 2020) – the sustainability of biofuels used in Denmark is strengthened.*
- *Agreement on the green transition of road transport (4th dec. 2020) – adjustments to the taxation of free cars*
- *Act amending the Planning Act and the Nature Conservation Act (June 2020) – Prohibition of fertilisation and spraying on section 3 areas – comes into cancer on 1 June 2022*
- *Nitrate Action Programme of Aug 1. 2020 – reduced nitrogen standards for humus soils*
- *Nitrate Action Programme of Aug 1. 2020 – increased use requirements for livestock manure*
  - *Budget Act 2020 – DKR 100 million has been allocated to the Danish Climate Forest Fund. The fund aims to promote and finance cost-effective afforestation through the creation of forest brewers and the set-aside of low-lying land.*
  - *Climate plan for a green waste sector and circular economy of 16 June 2020 – Streamlining the sorting and collection of household type waste in the industry*
  - *Climate plan for a green waste sector and circular economy of 16 June 2020 – behavioural changes due to*

*household waste flow*

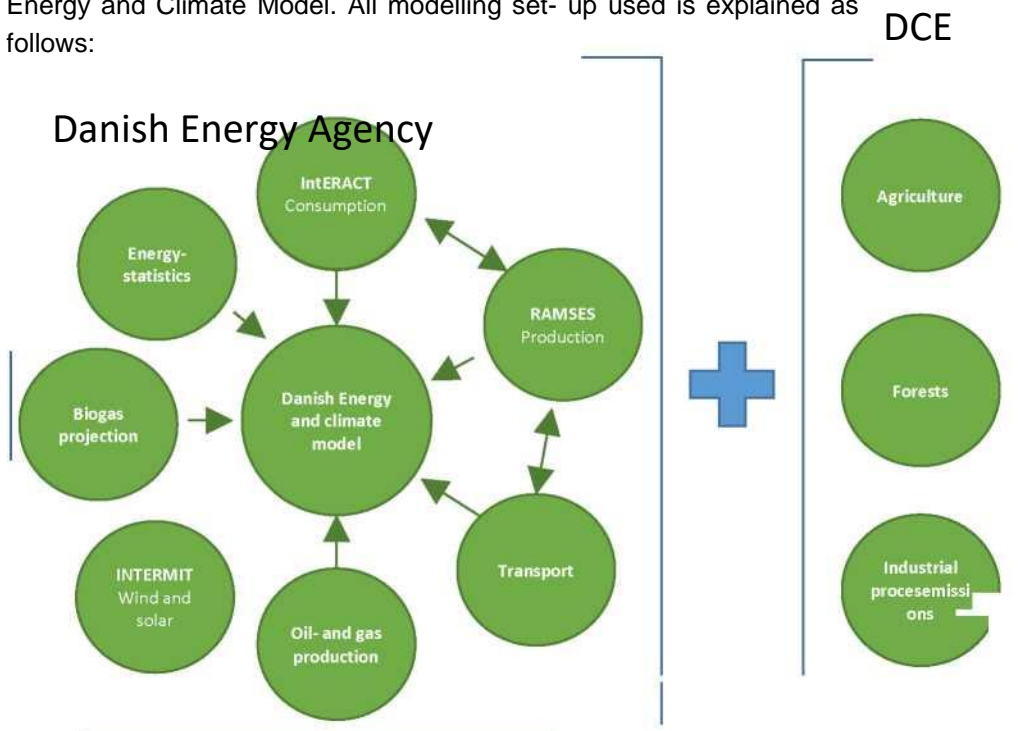
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – Streamlining mandatory household textile waste retrieval scheme*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – Waste sorting in public spaces*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – bulky waste from waste incineration*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – More direct reuse and clear framework for municipal recycling sites*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – Requirements for reduced loss rates in plastic recycling*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – Target of a 50 % reduction in certain plastic takeaway packaging by 2026*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – National implementation of extended producer responsibility for packaging*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – Increasing plastic recycling from the agricultural sector*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – Increasing recycling of plastics from the construction sector*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – Synergies on plastic waste in terms of market and technology development*
- *Single Plastic Directive (adopted in the EU 18th dec. 2018 – formally entered into force on 3 July 2019)*
- *Budget Act 2020 – tripling the packaging tax*
- *Climate plan for a green waste sector and circular economy of 16 June 2020 – Limit values for nitrous gas emissions from purification plants*
- *The 2020 Green Housing Agreement – The National Building Fund will in future also prioritise support for energy-saving cases, together with cases involving remediation of building damage and healthy housing. Today, priority is given to the trans criterion, assessing which projects have the most urgent need. In the future, hardship and greening must go hand in hand, and the assessment is that 85-90 % of new projects will contain green measures.*
- *The 2020 Green Housing Agreement – A guarantee scheme is established in the National Building Fund to guarantee profitable energy investments of up to a further DKK 6 billion. This will increase the incentive for residents to carry out energy renovations.*
- *The 2020 Green Housing Agreement – Pulje totalling DKK 200 million in 2021-2026 in experimental funds for a more green and sustainable and digital public housing sector, for example for experimentation with heat pumps in larger buildings. Of this, DKK 50 million will be ring-fenced for digitisation.*
- *Circular on energy efficiency in state institutions (9th dec. 2020) – energy saving targets for central government*
- *Regulation of the European Parliament and of the Council setting a framework for energy efficiency labelling and repealing Directive 2010/30/EU*
- *Directive of the European Parliament and of the Council amending Directive 2003/87/EC to enhance cost-effective emission reductions and low-carbon investments ('ETS Directive')*
- *Regulation of the European Parliament and of the Council on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 for a resilient Energy Union and to meet commitments under the Paris Agreement and amending Regulation No 525/2013 of the European Parliament and of the Council on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change ('Effort Sharing Proposal')*
- *Regulation of the European Parliament and of the Council on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry into the 2030 climate and energy framework and*

amending the European Parliament and Council Regulation (EU) No 525/2013 on a mechanism for monitoring and reporting greenhouse gas emissions and other information relevant to climate change (LULUCF)

- Directive of the European Parliament and of the Council amending Directive 2012/27/EU on energy efficiency ('the Energy Efficiency Directive')
- Regulation of the European Parliament and of the Council on the internal market for electricity
- Directive of the European Parliament and of the Council concerning common rules for the internal market in electricity
- Regulation of the European Parliament and of the Council on the Governance of the Energy Union, amending Directive 94/22/EC, Directive 98/70/EC, Directive 2009/31/EC, Regulation (EC) No 663/2009, Regulation (EC) No 715/2009, Directive 2009/73/EC, Council Directive 2009/119/EC, Directive 2010/31/EU, Directive 2012/27/EU, Directive 2013/30/EU and Council Directive (EU) 2015/652 and repealing Regulation (EU) No 525/2013
- Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (RES) Directive "
- Regulation of the European Parliament and of the Council setting performance standards for new heavy-duty vehicles CO2 emissions
- Fuel Quality Directive

### Denmark's Energy and Climate Model

All the projections are based on constant prices 2022, specific selection of Exogenous factors and the Denmark's Energy and Climate Model. All modelling set- up used is explained as follows:



*Figure 1. Overall elements in the model platform with inputs on the left and outputs on the right. (Danish Energy Agency, 2019a).*

**Inputs include:** Projection of emissions based on, among other things, DECO's energy balance and on emissions from e.g. agriculture in collaboration with the Danish Centre for Environment and Energy (DCE) at Aarhus University; projections by the Danish Ministry of Finance and the Ministry of Economic Affairs and the Interior of economic and demographic developments, business productivity and CO2 allowances; the International Energy Agency's (IEA's) projection of world market prices of fossil fuels adapted to a Danish level; tailed plant data on Danish energy plants, based, among other things, on the Danish Energy Agency's energy production statistics and master data register; Statistics Denmark's input output matrices for changes between sectors; the Danish Energy Agency's technology Catalogues; and the projection of the electricity demand, energy production capacity and Interconnectors of 23 European countries, based on data from the European Network of Transmission System Operators, ENTSO-E.

**Outputs include:** (year-by-year and hour-by-hour up to 2035) energy consumption by sector, by use and by technology; energy balances for supply facilities and for district heating areas; greenhouse gas emissions; key indicators as shares of renewals in accordance with the requirements of the RE Directive (Eurostat, 2018); electricity exchange and the electricity price for each of the 15 European electricity market areas included in the electricity market model; security of electricity supply; fiscal revenue lags; socio-economic and corporate financial performance; as well as developments in the energy intensities of businesses.

#### **THE MODEL PLATFORM INTEGRATES THE FOLLOWING SUB MODELS:**

- The **summary model “Denmark’s Energy and Climate Model”**, which integrates the two sector models considered below as well as results from the DCE’s emissions model such as to provide an overall projection result at system level. Further, the summary model forms the basis for the comparative analyses of projection scenarios vs. vis impact assessments at system level.
- **RAMSES**, which models electricity and district heating supply. RAMSES is a technical-economic model for operations optimisation, which is based on a detailed description of all energy-producing facilities and district heating areas in the Danish energy system as well as on an aggregated description of the electricity production plants in the European electricity markets included in the model, including Interconnectors between those markets. RAMSES simulate operations in the interlinked European energy system on an hosted basis. RAMSES does not automatically take account of new investments. RAMSES includes Denmark as well as 23 countries broken down by 15 European electricity market areas. Trends in new production capacity are defined directly based on specific knowledge as well as on capacity development models, e.g. for wind power and solar PV, and partly based on a coupling to DH- Invest, which is a new investment model for narrow-scale district heating areas.
- **INTERACT**, which models energy consumption by the corporate sector and households. The model comprises two sub models: An economic model which describes the macroeconomic correlations using a neoclassical, general equilibrium model and a technical energy system model based on the IEA 's TIMES model (IEA- ETSAP, 2018). The model of describes fundamental energy technology, thermal and physical relationships on a theoretical energy economics basis. The model uses output data from RAMSES on electricity prices and district heating prices.
- **DH-INVEST**, which is an investment model for narrow-scale district heating areas. This investment model simulates operations and investments for each district heating area in order to determine investment scenarios that are optimal from the perspective of corporate economics. The investment scenarios include the commissioning of existing facility units. The investment model is integrated

with RAMSES and uses a common assessments based, after which the calculated changes in capacity for the individual district heating area are included in the basis used by RAMSES in its modelling of the overall Danish electricity and district heating system.

- **Forward**, which models energy consumption in the transport sector. Amongst other things, FREM is based on input from the Danish Transport, Construction and Housing Authority, which uses the National Transport Model (LTM) (Technical University of Denmark, 2018) to describe developments in road traffic and energy consumption by rail. Projects road transport based on projections for growth in transport volume, developments in the energy efficiency of vehicles by 44 vehicle categories and survival rates, updates as a function of the age of vehicles, as well as as choice of vehicle. Projects energy consumption in air transport based on developments in GDP and population numbers, as well as expected developments in energy efficiency in aviation.
- **Technology Deployment Models** for offshore wind, onshore wind, solar PV and biogas use, which model the profitability of technology investments in terms of corporate finances against the profitability requirements of relevant investors, which means the models model the most probable capacity deployment scenario against the current investment and operating conditions.