Denmark

Denmark's targets are mainly found in 'Klimaaftale om grøn strøm og varme 2022,' which translates to 'Climate accord for green electricity and heat 2022.' This will be supplemented by the Integrated National Energy and Climate Plan (NECP) where necessary.

Targets

Denmark has set an ambitious target of reducing greenhouse gas emissions by 70% from 1990-levels by 2030.[1] And then achieve climate neutrality by 2050. Another goal is that by 2030, at least 55% of gross final energy consumption should be produced by renewables.[2]

Denmark has concrete targets for what they want to achieve by 2030, before they become more nebulous in the run-up to 2050. The main targets are as follows: The Danish government has decided to realise 4 GW of offshore wind power by 2030.[3] This comes in addition to the 2.3 GW of offshore wind already being produced.[4] There are also talk of building out offshore wind farms to 16 GW, but no date is given for this.[5] Denmark plans to build out 35 GW of offshore in the North Sea by 2050, which is equivalent to the Danish potential for offshore wind there.[6] Additionally, if demand is there, build out might even surpass this.[7] Plans for solar and onshore wind are less concrete, but the main target is a quadrupling of the 2022 capacity.[8] In the Climate Accord, an example is given where PV installations increase tenfold and onshore wind is doubled. This would give a respective capacity of about 20 GW of PV and 8.2 GW of onshore wind.[9] By 2040, a considerable amount of onshore wind turbines is expected to be decommissioned and replaced by newer turbines. This is expected to halve the number of turbines, even when doubling capacity.[10] There is also a possibility that the onshore wind maximum will be dropped.[11] The Danish government wants to further increase building roof mounted solar. There are no specific targets, but the potential is estimated to be 5.5 GW, and the government wants to subsidise build out.[12] Denmark does not seem to have plans for building out nuclear power. Denmark has a 40-year-old

[1] The Government of Denmark, 'Integrated National Energy and Climate Plan Denmark', 5. Sea and air transport is not included in the 70% target; however, green fuels will be encouraged by the government in these areas as well (NECP, page 16)
[2] The Government of Denmark, 'Integrated National Energy and Climate Plan Denmark', 6.
[3] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 2.
[4] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 2.
[5] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 2.
[6] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 2.
[7] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 2.
[8] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 6.
[9] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 6.
[10] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 6.
[11] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 6.
[12] Klima-, Energi- og Forsyningsministeriet, 'Klimaaftale Om Grøn Strøm Og Varme 2022', 9.

ban on nuclear power; however, the government has recently begun pondering its development.[13]

Energy demand projections

The NECP only includes data for total energy consumption, not on electricity consumption, and only in graphic format. These numbers are included in Table 1. Additionally, the Danish Energy Agency's (*Energistyrelsen*) projections put electricity demand in 2030 at 46.4 TWh.[14] This is up from 32.4 TWh (43% increase) in 2018. This development is generally driven by large scale datacentres.[15]

Table 1: Energy demand projections according to the NECP [WEM] (ktoe)[16]

ktoe	**2017**	**2020**	**2025**	**2030**	**2035**	**2040**
Transportation	5 202	5 350	5 400	5 350	5 150	5 050
Residential	4 607	4 600	4 450	4 300	4 200	4 100
Tertiary	1 932	2 200	2 550	2 900	3 200	3 400
Industry	2 229	2 250	2 300	2 350	2 370	2 430
Agriculture	743	750	750	750	750	770
Construction	148	150	170	170	170	170
Other	~ 180	180	180	180	180	180
Total (Final Energy Consumption)	14 863	15 000	15 050	15 060	15 070	15 100
Primary Energy Consumption	18 131	17 260	17 300	17 350	17 320	17 300

**Rounding errors might occur, numbers after 2017 are estimates and guessed from a plot, the numbers will therefore not be perfect.*

[13] DR, 'Regeringen vil undersøge mulighederne for atomkraft'.
[14] Energistyrelsen, *2020 Basisfremskrivning*, 50.
[15] Energistyrelsen, *2020 Basisfremskrivning*, 50.
[16] The Government of Denmark, 'Integrated National Energy and Climate Plan Denmark', 153.

Transportation

The definition of the transport sector seems to include all types of transport. However, this is not stated clearly but only inferred.[17] The Danish Energy Agency estimates that there will be about 380 000 EV and plug-in hybrids by 2030. The large majority of which, a little over 350 000 will be pure EV.[18] The projections for electric vehicle are summarised in Table 2.

Table 2: Electrification of road transport[19]

		2018	**2025**	**2030**
Number of vehicles	*EV*	9 000	72 000	351 000
	Hybrids	10 000	21 000	29 000
	Total	19 000	93 000	380 000
Electricity and renewables demand	*Electricity*	1.3 PJ	3.0 PJ	8.1 PJ
	Energy crops	9.2 PJ	8.4 PJ	8.2 PJ
	Biogas	~ 0 PJ	~ 0 PJ	0.1 PJ
	Total	10.5 PJ	11.4 PJ	16.4 PJ

Heat pumps

There is a push by the Danish government to install large electric heat pumps. The expected installed heating capacity is a little under 700 MW by 2025 and a little bit over 800 GW by 2030.[20] In addition, the Danish Energy Agency expects there to be an installed heating capacity of electric boilers to the tune of a little under 1 GW by 2025 and a little bit over 1 GW by 2030.[21] The energy used on heat pumps are estimated to be about 0.8 PJ in 2025 and about 1 PJ in 2030.[22]

[17] The Government of Denmark, 'Integrated National Energy and Climate Plan Denmark', 29.
[18] Energistyrelsen, *2020 Basisfremskrivning*, 37.
[19] Energistyrelsen, *2020 Basisfremskrivning*, 37–38.
[20] Energistyrelsen, *2020 Basisfremskrivning*, 18.
[21] Energistyrelsen, *2020 Basisfremskrivning*, 18.
[22] Energistyrelsen, *2020 Basisfremskrivning*, 25.

Hydrogen and batteries

Denmark has a target of 4-6 GW of electrolysis capacity by 2030, produced by renewable energy sources.[23]Battery storage is barely mentioned. The NECP expects roof-top PV installations to be accompanied by battery storage,[24] and that it expects battery storage to play a significant role in an electricity dominated by renewables.[25]

[23] Jørgensen, 'Aftale Om Udvikling Og Fremme Af Brint Og Grønne Brændstoffer', 2.
[24] The Government of Denmark, 'Integrated National Energy and Climate Plan Denmark', 131. Though this expectation is for the world at large.
[25] The Government of Denmark, 'Integrated National Energy and Climate Plan Denmark', 131.