DENMARK

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Pathway Narratives

	A) CURRENT TRENDS	B) NATIONAL COMMITMENTS	C) GLOBAL SUSTAINABILITY	JUSTIFICATION
General description	**We do not act differently than the past decade / today**	**National actions/policies are aligned with national commitments**	**National actions/policies are aligned with global sustainability targets**	
Country Narrative - the main elements that have guided the selection of the assumptions under each pathway	In this scenario we assume that Denmark will continue down the same path as today. This means that we will have the same growth in productivity (crops) as seen in 2000-2010, and only a slightly smaller agricultural area. Afforestation will be slightly increasing, and peatlands will not be taken out of production on a large scale. However, 25,000 ha of agricultural land will be transformed into parks with solar panels. There will be no increase in protected areas.	In this scenario it is assumed that all the agreements and commitments made by the politicians are fullfilled. This means that the agricultural area will decrease; 100,000 ha of peatlands will no longer be used for agriculture, increased rate in afforestation etc. The diets will change according to the national dietary guidelines. This should lead to the fullfillment of the Danish Climate Act stating a 70% reduction of GHG's in 2030 compared to the level in 1990, Net zero in 2045 and 110% in 2050.	In this scenario Denmark increases its crop productivity, so we can produce the same amount (or more) on less land. This ensures that we can convert agricultural land into forest and other protected areas which is good for biodiversity. Danes' diet will follow the EAT Lancet guidelines and the intake of meat and dairy products will be markedly reduced. To ensure negative emissions we have a bigger production of non-food biomass which is used for biochar.	

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Pathway Assumptions

		Today	A) CURRENT TRENDS	B) NATIONAL COMMITMENTS	C) GLOBAL SUSTAINABILITY	JUSTIFICATION
1. Macroeconomics	**1.1)** GDP per capita	68,008 US$ (2021)	1,4 % (SSP3)	1,4 % (SSP3)	1,4 (SSP3)	Low speed of economic growth because DK is a developed country
	1.2) Population	5,941,388	UN_medium 6,3 mio people	UN_medium 6,3 mio people	UN_medium 6,3 mio people	Danmark Statistik
	1.3) Inflation	+5.3% (April 2022-April 2023)	Not able to implement in calculator and cannot find data	Not able to implement in calculator and cannot find data	Not able to implement in calculator and cannot find data	
	1.4) Inequalities	8% of the differences in income are due to inequality in possibilities	BAU from 2021 to 2050 an increase of 25 %	BAU from 2021 to 2050 an increase of 25 %	BAU from 2021 to 2050 an increase of 25 %	BAU: Statistikbanken
2. Land	**2.1)** Constraints on agricultural expansion / deforestation	Reduce emissions from the agricultural sector by 1.9 mio. Tons CO2e	No expansion of agricultural land Constraints: 25,000 ha of approx. agricultural land for solar panels (2030 target).	No expansion of agricultural land Constraints: 25,000 ha of approx. agricultural land for solar panels (2030 target). 100,000 ha of peatland out of agricultural production. Only due to afforestation: 265.000 ha agricultural land out of production.	No expansion of agricultural land Constraints: 25,000 ha of approx. rural land for solar panels (2030 target). 100,000 ha of peatland out of agricultural production. Only due to afforestation: 265.000 ha agricultural land out of production.	Agreement-on-the-green-transformation-of-Danish-agriculture A broad majority in the Folketing agree that by 2030, Denmark will quadruple the production of solar and wind energy on land

	2.2) Afforestation, and forest plantations targets	13.3% (11% is production forest)	38.000 more ha of forest compared to 2023. All planted forest.	265.000 ha more forest than in 2023	265.000 ha more forest than in 2023	Forest Statistics 2021, publication by the Department of Geosciences and Nature Management, University of Copenhagen. Nord-Larsen, T., Johannsen, VK., Riis-Nielsen, T., Thomsen, I. M., & Jørgensen, B. B. (2021). Skovstatistik 2020. Institut for Geovidenskab og Naturforvaltning, Københavns Universitet.
	2.3) Urban and settlements area	14% (Buildings 8% and roads etc. 5%)	18% increase between 1989 and 2050	18% increase between 1989 and 2050	12% increase between 1989 and 2050	Scenarios for Current trends and National commitments are based on a linear projection of the settlement area, drawing on Denmark's National Inventory Report 2022. The scenario for the Global sustainability pathway is our own assumption based on CONCITO's the building's climate analysis report, which underlines the need to reduce the space used for housing and infrastructure.
	2.4) Protected areas	9 % (nature 2000 areas)	9 % of DK area – 310.000 ha (Natura 2000 areas) EPA data	9 % if DK area – 310.000 ha (Natura 2000 areas) EPA data	12% of DK area – 515,200 ha protect agricultural and forest area	The Global sustainability assumption is based on these reports: • The potential to reserve 30% of the land area for protected and strictly protected areas in Denmark • Natura 2000
3. Productivity and management	**3.1)** Crop productivity for the key crops	Key crops: Top 3 in 2022: Vårbyg (68 hkg/ha), vinterhvede (87 hkg/ha) og vinterraps (45 hkg/ha)	Low growth: "At least 30% closure of yield gap"	No growth	High growth	Global sustainability scenario: We assume more biomass production pr ha pr year due to shifting to more high yielding crops, such as grass and integrated use of cover crops. Less restrictions on GMOs and CRISPR link. Source: Bioresources for green

					transition - The National Bioeconomy Panel. For the assumption in the 'National commitments' pathway, there is a high target for organic production (25 % of agricultural land). Source: Agreement on the green reformulation of Danish farming.
3.2) Cropland under agroecological practices	Key crops: Top 3 in 2022: Vårbyg (68 hkg/ha), vinterhvede (87 hkg/ha) og vinterraps (45 hkg/ha)	25 % more than in 2010	50 % more than 2010	75 % more than in 2010	The agroecological practices are not all implemented by the same amount. It is difficult to quantify, since many practices are already mainstream. E.g., a Projection about cover crops.
3.3) Livestock productivity for the key livestock products	Cattle: 11.1 mio. Ton (March 2023), Pork: 144.1 mio. Ton (March 2023), Egg: 80 mio. Tons (2021), Milk (that leaves the farms and gets weighed at the dairy): 5.721,87 mio kg (2021)	BAU: Same productivity growth as over 2000-2010	No growth	BAU: Same productivity growth as over 2000-2010	National commitments pathway assumption: there is a high target for organic production (25 % of agricultural land). Source: here.
3.4) Pasture stocking rate		NoGrowth	NoGrowth	NoGrowth	Today farmers use the economic optimum for pasture stocking rates, and we believe that this will continue. Source: here.
3.5) Forest management	Naturnær skovdrift: Måldiameterhugst (de største træer fældes og ikke alle på en gang). Fældes sjældent store, sammenhængende arealer. Vedvarende skovdække. Reducere	Close-to-nature forest management in public forests (4approx. 1/4 of all Danish forests), more "untouched"/"wild	In 2040, 10% of the Danish forests must have nature and biodiversity as their primary purpose.	Approx. 75 % of all forest is highly protected	Current trends assumption. Source: Action plan for near-natural forestry in the state forests. National commitments pathway assumption. Source: Denmark's national forest programme.

		hugst med 20% i 2026-31.	" forest. More uncertainty in the private forests – maybe more logging due to increased demand			Global sustainability: our own assumption.
4. Trade	**4.1)** Share of consumption which is imported for key imported products (%)		Reduced import of oil seeds and protein crops. Slow rise in imports of beef.	Reduced import of oil seeds and protein crops. Slow rise in imports of beef.	Reduced imports of oil seeds and protein crops. Slow rise in imports of beef.	EU agricultural outlook 2022-32
	4.2) Evolution of exports for key exported products (1000 tons)		Increase of exports of dairy products, decrease of pig meat exports.	Increase of exports of dairy products, decrease of pig meat exports.	Increase of exports of dairy products and decrease of pig meat exports.	EU agricultural outlook 2022-32
5. Food	**5.1)** Average dietary composition	Current dietary habits, including a high intake of meat as well as sweet, salty and fatty foods, and a low intake of legumes may be a major challenge. The dietary habits have to change significantly to apply to the **Food Based Dietary Guidelines.** **Food Based Dietary Guidelines**: constituting a healthy diet from a sustainable food system. By	SSP2	SSP2	We assume the EAT-*Lancet* diet which is close to the DK official dietary guidelines: 75 g wholegrain pr day, 600 g fruit and vegetables (50% must be vegetables) pr day, 100 g legumes (prepared) pr day, 350 g meat (pr week) (reduce the intake of beef and lamb), 30 g nuts pr day, 350 g fish pr week, low-fat dairy	Current trends as well as national commitments is SSP2, as there are no policies driving the change in diets, only voluntary guidelines. For the Global sustainability pathway assumption, we assume the adoption of the Danish dietary guidelines (similar to EAT-*Lancet* diet) guidelines.

		following these Food Based Dietary Guidelines the **climate food print of food consumption can be reduced with more than 1/3**.			products 250 ml milk and 20 g cheese pr day, less sweets and salty products	
	5.2) Share of food consumption which is wasted at household level	36%	36%	EU reduction target on food waste: 50%	SDG: Reduce food waste pr person by 50%	The Commission is committed to halve the per capita food waste from retail and consumption by 2030 to live up to the SDG 12. At the moment there is no legally binding target, but a target will be defined by the end of 2023. Source: here.
6. Biofuels	**6.1)** Targets on biofuel and/or other bioenergy use	Energistatistik 2021	Biomass for heating is projected to decrease from 48 pct in 2020 to 29 pct. by 2035. The consumption of biofuels is more or less projected to stay stable until 2025. Biogas production is expected to increase from 2022-2035 by 25%.	Energy crops is phase down in biogas production to a level of 4 % by 2026/27 of the biomass weight percent	Consumption of bio resources is expected to be 29 GJ pr capita	National commitment: Source: Danish Energy Agency is part of the Ministry of Climate, Energy and Supply. .

Scenario for Global sustainability pathway is based on CONCITO's report Denmark's climate neutrality scenarios 2040. |
| | **6.2)** Targets on other non-food use | | 24,298 hectares used to production of Christmas trees; 9,010 hectares used to production | 24,298 hectares used to production of Christmas trees; 9,010 hectares used to production | 4.8 mio ton extra biomass in dry matter to use for biochar to spread on agricultural soils | We assume that the percentage used for christmas trees and grass seeds for lawns will stay the same even though the total agricultural area is reduced in the future. Denmark produces app. |

			of seeds for grass to lawns = 1.3% of the total agricultural land	of seeds for grass to lawns = 1.3% of the total agricultural land	- result in negative emissions of 3 mio. ton in 2040. Bigger use of non-food biomass production is needed but does not affect food production as a lot of it would come from higher straw yields.	50% of EU's grass and clover seeds and our climate is well suited for the production (Landbrug & Fødevarer F.m.b.A). The agricultural area used for production of seeds has been increasing the last decade and yields are rising, big export – good business (Landbrug & Fødevarer F.m.b.A, 2022). The area used to produce Christmas trees has on average been 21,347 ha with minor fluctuations according to Statistics Denmark (Statistikbanken). In 2021 Denmark exported 11.7 million Christmas trees which is the record. Since the early 2000's the export of Christmas trees has been relatively stable around 10 million trees pr. Year (Danske Juletræer - træer & grønt)
7. Water	**7.1)** Irrigated crop area	17% in 2012 - 500.000 m3 of groundwater allowed every year - FAOAQUASTAT: avrg: 231.000 ha	Stable. Irrigation is allowed on 17% of Denmark's arable land (465,000 ha)	Stable	Reduce to 15 % of arable land	Some places will increase, and some places will decrease. The overall trend is reduction. Gertz, Flemming & Hvid, Søren & Nielsen, Janne. (2012). Landbrugets behov for afvanding og markvanding. Vand & Jord. 49. According to FAO AQUASTAT the actual irrigated area is smaller than the area allowed for irrigation.