

Denmark at a Glance

eXtremOS

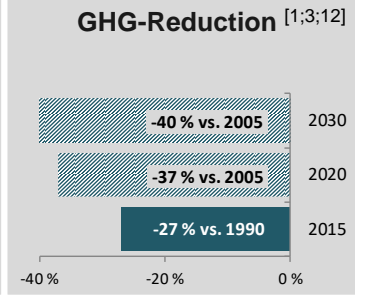
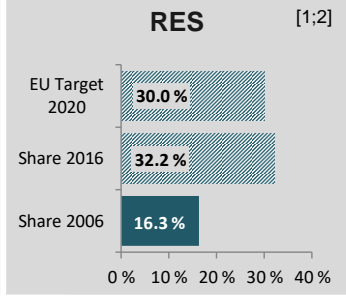
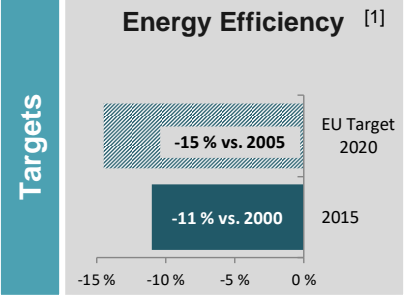
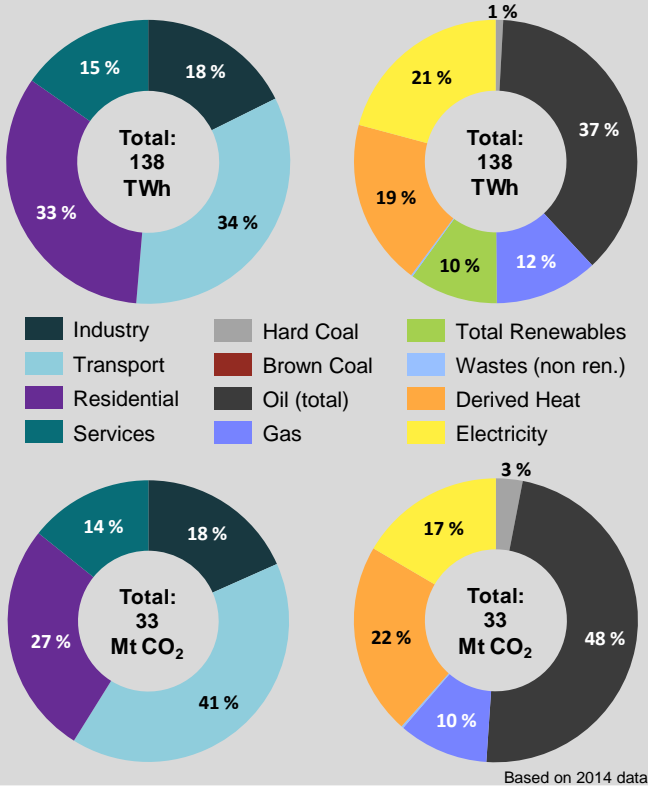


Denmark at a Glance



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Final Energy Consumption | CO₂-Emissions | Key-Indicators



Current Topics [4;23]

- 48 % of electricity generation from wind energy in 2017
- Danish government supports integration of heat pumps to increase district heating with DKK 23 m
- By end of 2018 subsidies for natural gas fired CHP phased out
- Households in Denmark pay one of the highest electricity prices in EU (due to taxes)
- 537 MW of onshore wind farms were commissioned in the period 2017-2018 as part of onshore wind subsidy scheme

Key Facts [1;12;13;14;15]

- Ambitious targets for renewable energies (100 % by 2050) will significantly change the Danish energy system
- Interconnections to neighboring countries 6.4 GW, whereby peak load in DK only 6 GW
- Coal phase out planned, established partly by replacement with biomass)
- High share of CHP and district heating (60 % of heat supply, currently 44 % based on hard coal)
- Since 2013 banning of oil and as fired boilers in new buildings, and since 2016 in renovated buildings (condition: connection to district heating or gas infrastructure)
- Flexibility: Interconnections, electrification of all sectors (PtH, Electromobility, Flexible CHP)

Population ^{[2016;5]:}	5.73 million	Size ^{[5]:}	42 922 km ²
Net EI. Consumption ^{[2016;2]:}	31 TWh _{el}	Peak-Load ^{[6]:}	5.6 GW _{el}
Trade-Balance ^{[6]:}	-4.7 TWh _{el}	RES-Share EI. ^{[2016;2]:}	53.7 %
GDP per Capita ^{[5]:}	\$56 308	GDP per Capita-Ranking ^{[5]:}	10/185



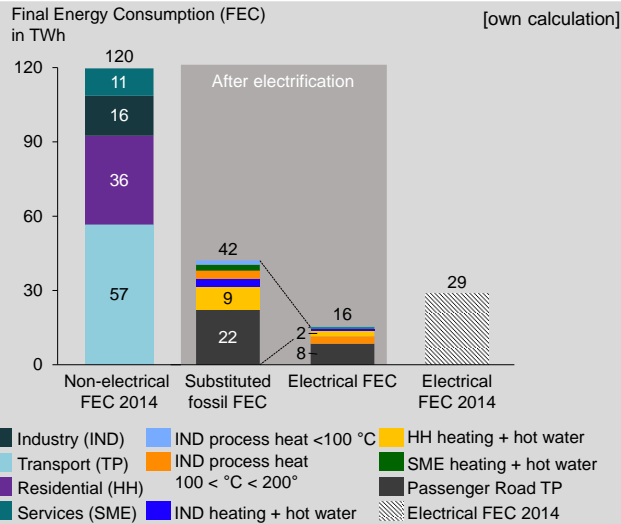
Denmark's Electricity Sector



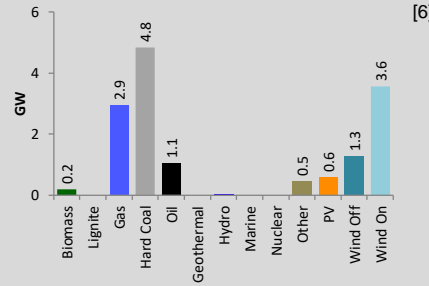
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Electrification Potential

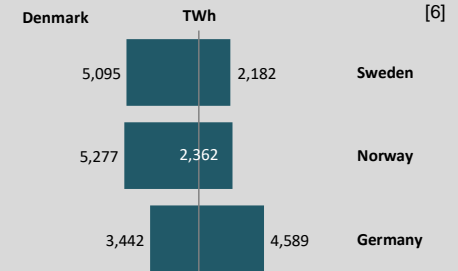
"Low hanging fruits" case 2014



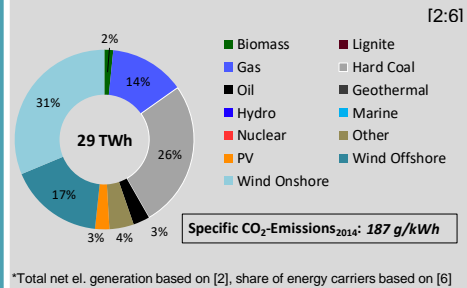
Installed Capacity



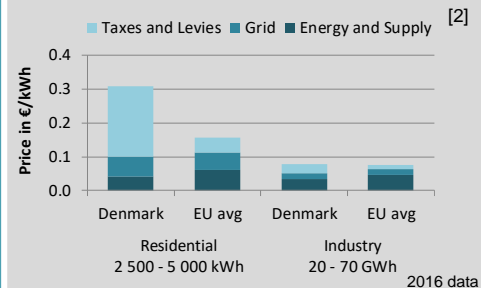
Import-Export



Net El. Generation

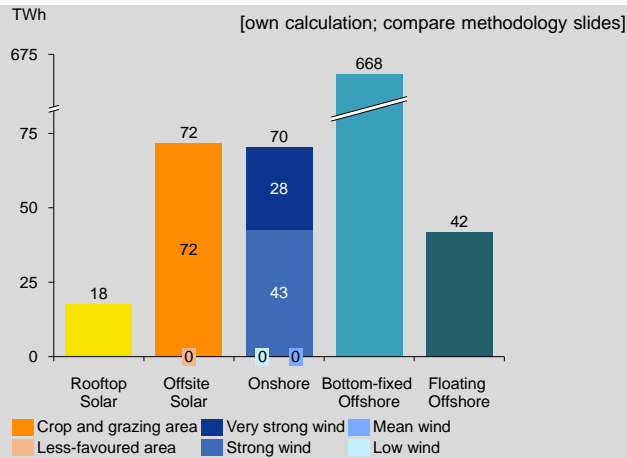


Customer Prices



vRES Potential

Renewable Energies



Wholesale Market

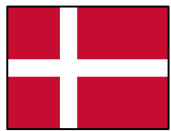
- Main power market:** Nord Pool Spot AS [8]
- Divided into two market areas (DK1/DK2)
- Capacity Market:** No
- Additional CO₂-Pricing:** carbon tax 22.8 EUR/tCO₂
- Day-Ahead-Market:**

2017	DK1 & DK2 Buy	DK1 & DK2 Sell
Volume	33 TWh	26.6 TWh
Avg. Price	31 €/MWh	

Support Schemes

- Costs** [7]
- PV tender 2016: 10-13 €/kWh
 - Offshore Wind 2016: 5-14 €/kWh
 - Onshore Wind 2016: guaranteed bonus: 3 €/kWh + market price plus bonus < 8 €/kWh + 0.2 €/kWh for covering balancing costs

- Policies** [7]
- Training programmes for installers of RES plants:
 - Quality Assurance Scheme
 - Danish Certification Scheme for wind energy plants
 - Plant type certification
 - Project certification of individual installations



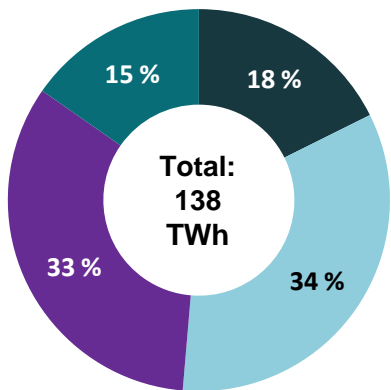
Denmark's Energy Consumption & Emissions by Sectors and Energy Carriers - 2014



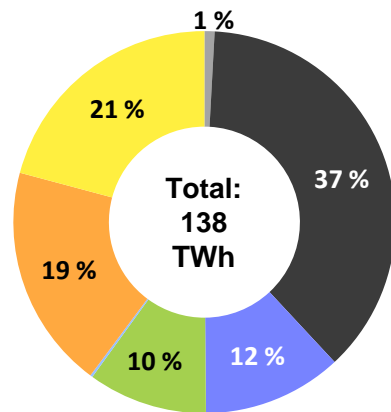
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Final Energy Consumption

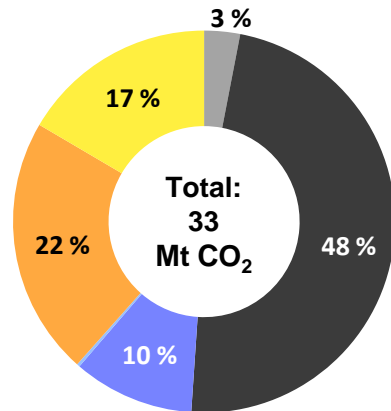
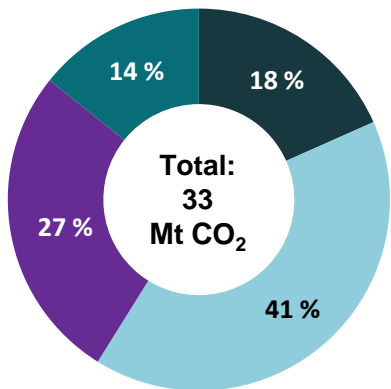
All Sectors



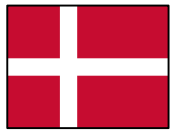
All Energy Carriers



CO₂ - Emissions



- Industry
- Transport
- Residential
- Services
- Hard Coal
- Oil (total)
- Total Renewables
- Derived Heat
- Lignite
- Gas
- Waste (non. ren.)
- Electricity



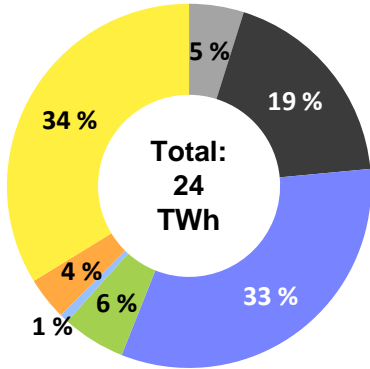
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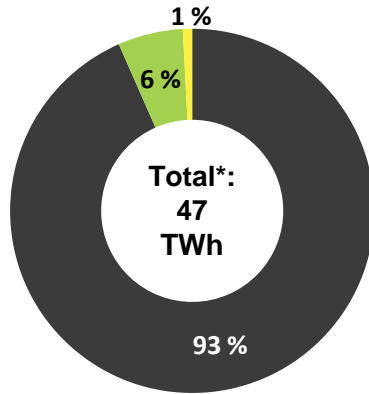
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Final Energy Consumption

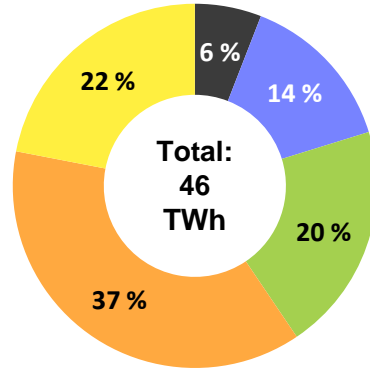
Industry



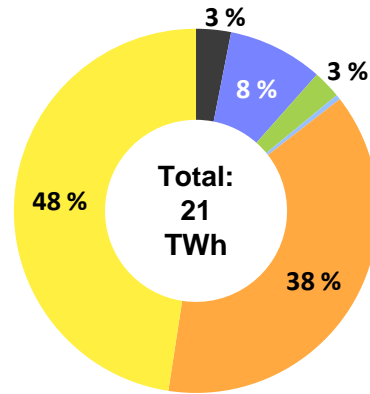
Transport



Residential

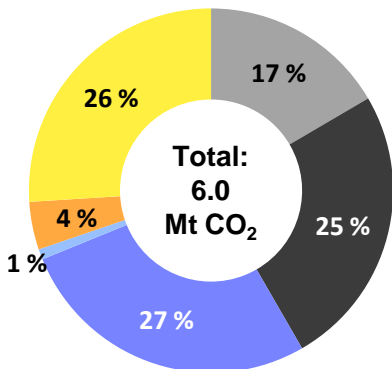


Services

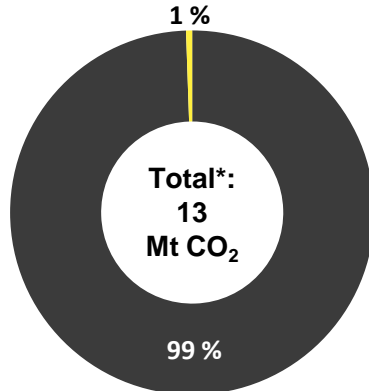


CO₂ - Emissions

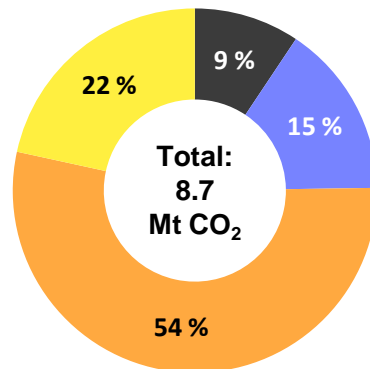
Industry



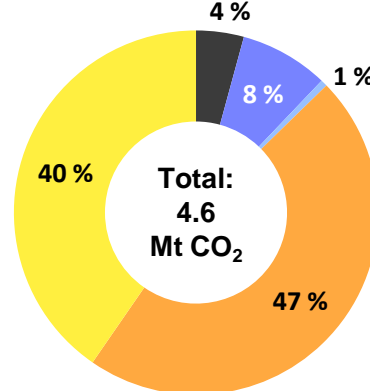
Transport



Residential

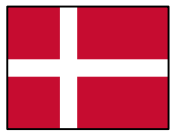


Services



Hard Coal
 Lignite
 Oil (total)
 Gas
 Total Renewables
 Waste (non. ren.)
 Derived Heat
 Electricity

*excluding international aviation



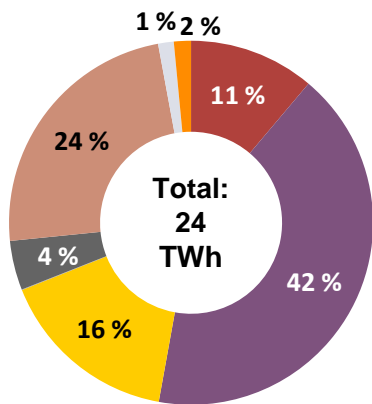
Denmark's Energy Consumption & Emissions by Application & Sectors - 2014



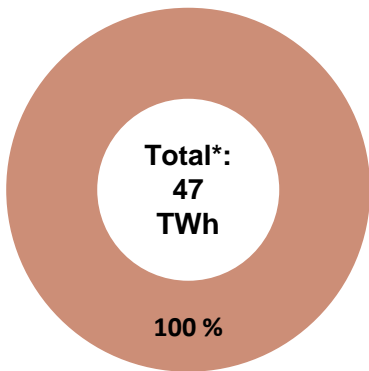
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Final Energy Consumption

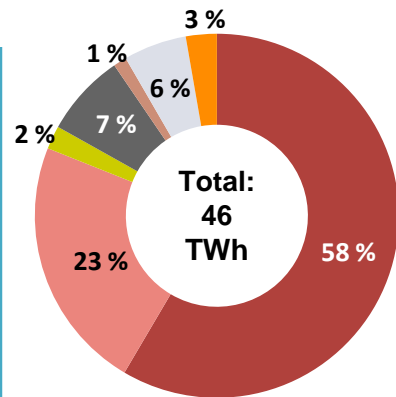
Industry



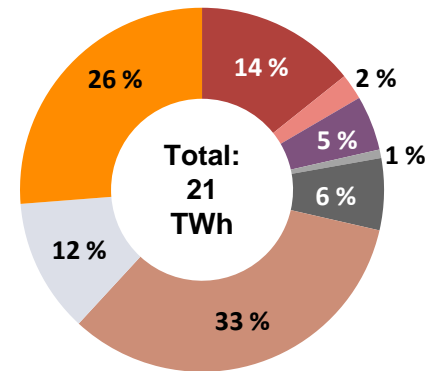
Transport



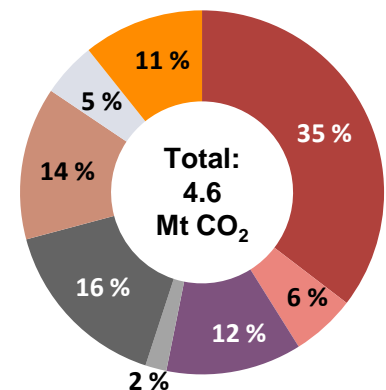
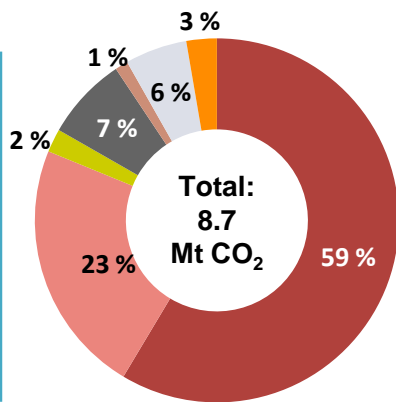
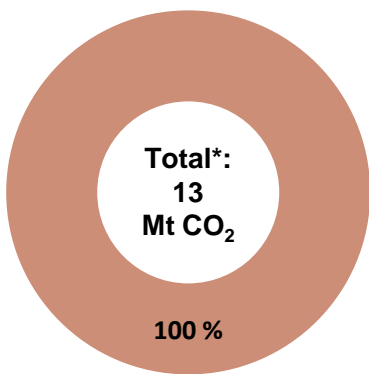
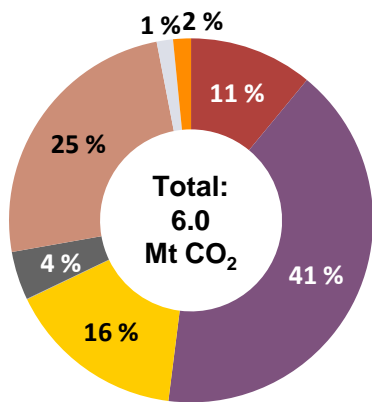
Residential



Services



CO₂ - Emissions



- Space Heating
- Process Heat < 500 °C
- Cooking
- Other Process Cold
- ICT
- Warm Water
- Process Heat > 500 °C
- Climate Cold
- Mechanical Energy
- Lighting

*excluding international aviation



Denmark: Sources



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Institutions

Ministry of Energy, Utilities and Climate		http://old.efkm.dk/en/
Energy Agency	Danish Energy Agency	https://ens.dk/en
TSO	Energinet	https://energinet.dk/
Regulator	Danish Energy Regulatory Authority (DERA)	http://energitilsynet.dk/
Main Power Market	Nord Pool AS	https://www.nordpoolgroup.com/

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- [18] AG Energiebilanzen e.V., 2018, Energiebilanz der Bundesrepublik Deutschland 2018
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- [22] Fleiter, Tobias et al.: Mapping and analyses of the current and future (2020 - 2030) heating/cooling fuel deployment (fossil/renewables) - Work package 2: Data Annex 2 Industrial processes for publication
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Main Studies

- **Denmarks Energy and Climate Outlook 2017** (Danish Energy Agency), https://ens.dk/sites/ens.dk/files/Analyser/denmarks_energy_and_climate_outlook_2017.pdf
- **Denmark 2017 Review** (International Energy Agency), <http://www.iea.org/publications/freepublications/publication/EnergyPoliciesofIEACountriesDenmark2017Review.pdf>
- **Denmark's National Energy Efficiency Action Plan (NEEAP)** (European Commission), https://ec.europa.eu/energy/sites/ener/files/dk_neeap_2017_en.pdf