



Why is it so challenging being the world's most competitive energy technology?

WINTERWIND, Åre, Sweden

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6. February 2018**

**DANMARKS
VINDMØLLEFORENING**



The onshore and offshore wind turbines of DV members produce electricity equivalent to 30% of Denmark's total power consumption

The association represents over 30.000 owners, co-owners and investors in wind energy

10 staff, including 4 technical consultants operating globally

Danish Wind Turbine Owners' Association

**Represents
30,318 owners
of and co-
investors in
wind turbines**

**3,862 MW
wind turbines**

**75 % of Danish
wind turbine
capacity**

**2,596 MW
onshore wind
in Denmark**

**1,266 MW
offshore wind
in Denmark**

**The members
produces more
than 30% of all
Danish
electricity**

**728 MW
Onshore
turbines
abroad**

**Established in
1978**

Low-cost energy

Summary Findings of Lazard's 2017 Levelized Cost of Energy Analysis⁽¹⁾

Selected Historical Mean LCOE Values⁽²⁾



Source: Lazard estimates.

Note: Reflects average of unsubsidized high and low LCOE range for given version of LCOE study.

(1) Primarily relates to North American alternative energy landscape, but reflects broader/global cost declines.

(2) Reflects total decrease in mean LCOE since the later of Lazard's LCOE—Version 3.0 or the first year Lazard has tracked the relevant technology.

(3) Reflects mean of fixed-tilt (high end) and single-axis tracking (low end) crystalline PV installations.

Low-cost energy

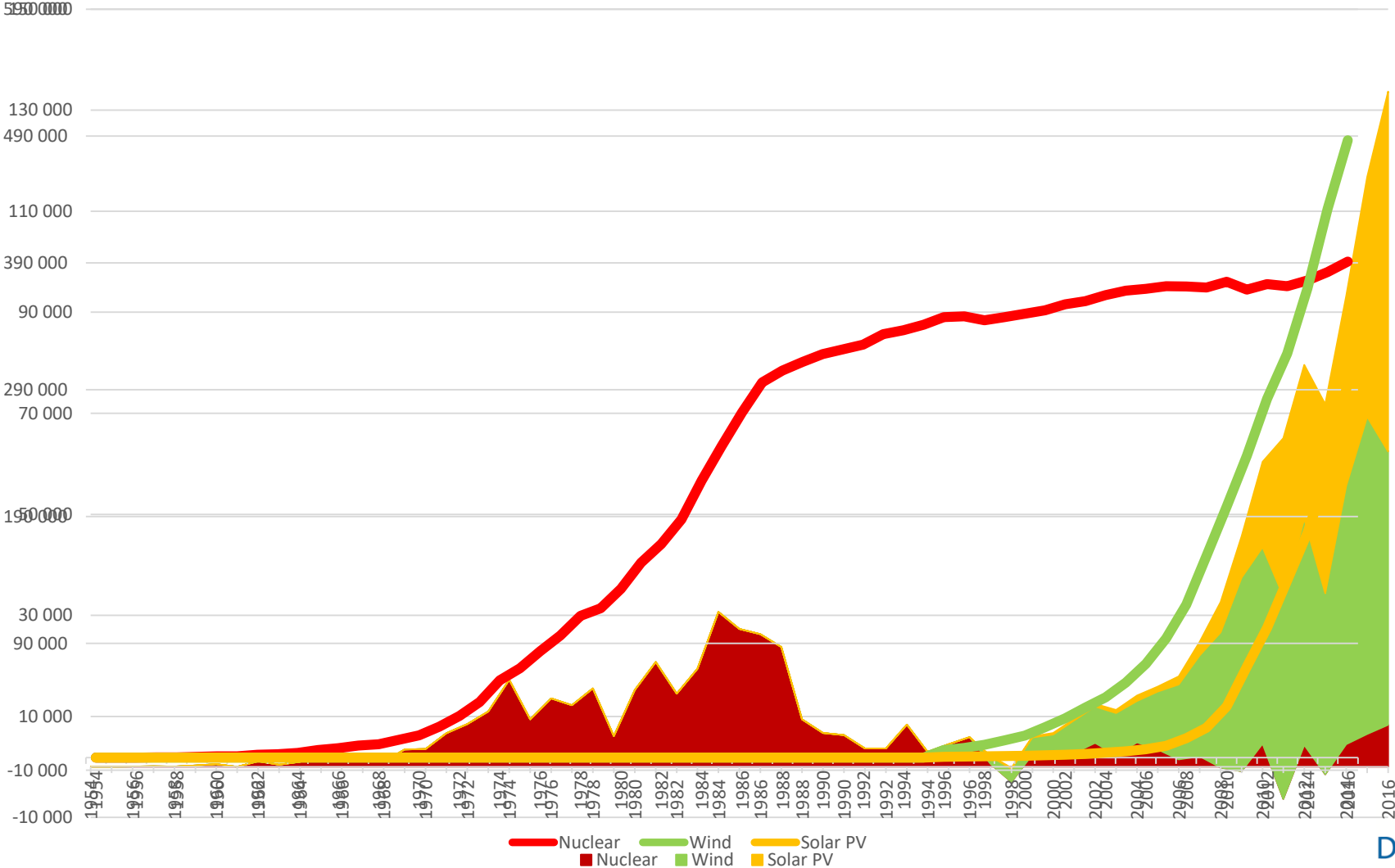
Unsubsidized Levelized Cost of Energy Comparison



‡ Denotes distributed generation technology.

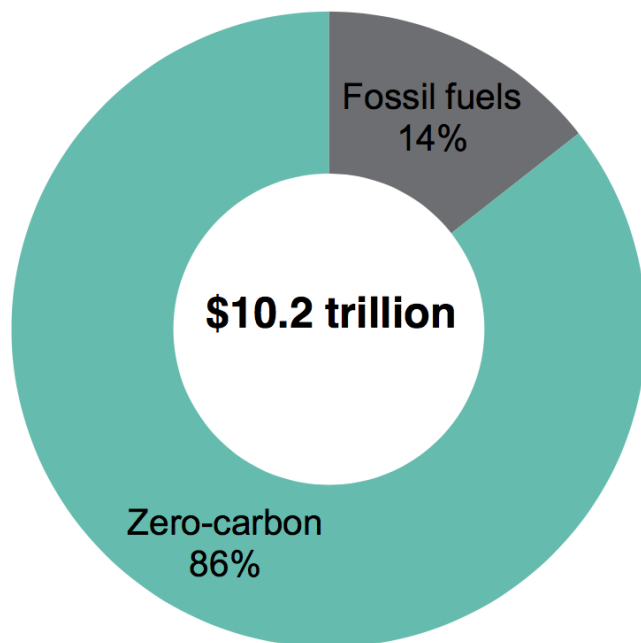
Low-carbon energy

Global installed capacity 1954-2016
 Nuclear wind and Solar PV (TWh)



Global power sector investment to 2040

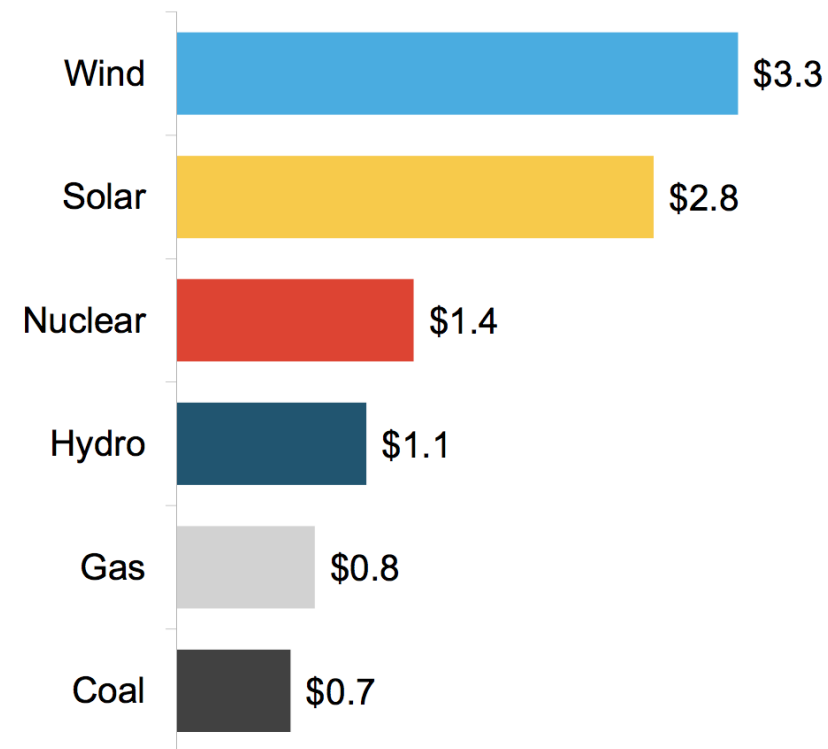
Investment, by technology, 2017-2040



Source: Bloomberg New Energy Finance

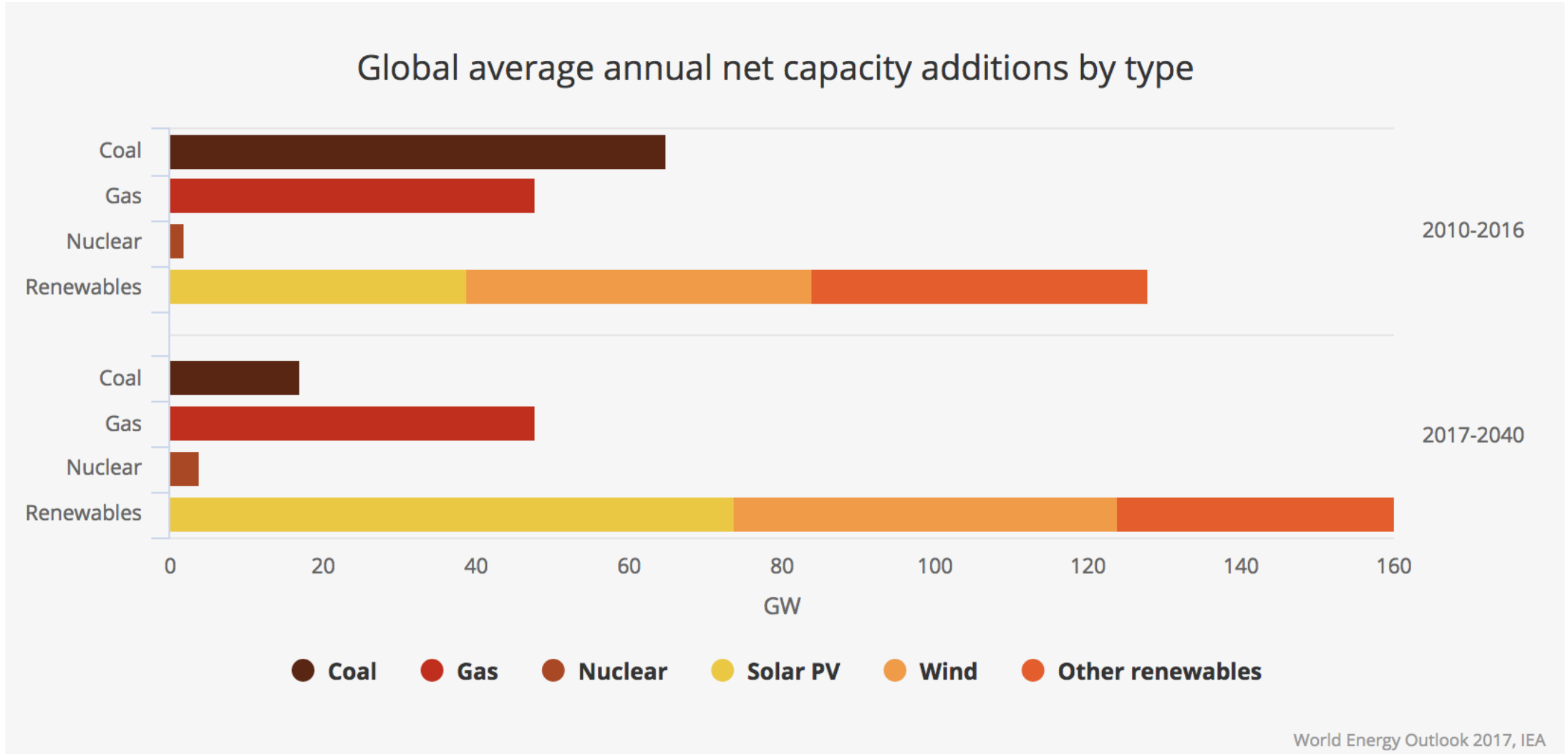
Investment, by technology, 2017-2040

(\$ trillion - 2016 real)

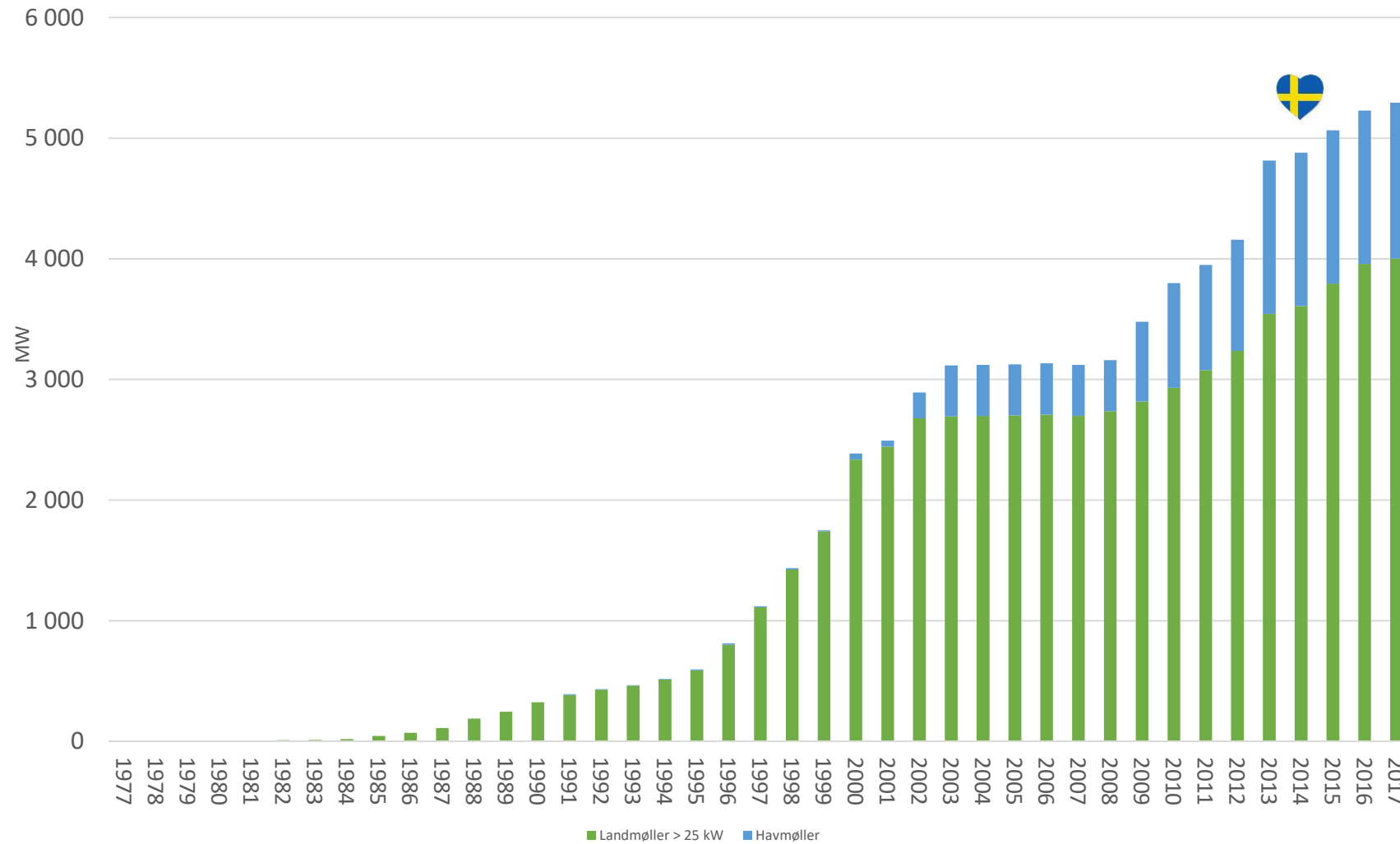


Source: Bloomberg New Energy Finance

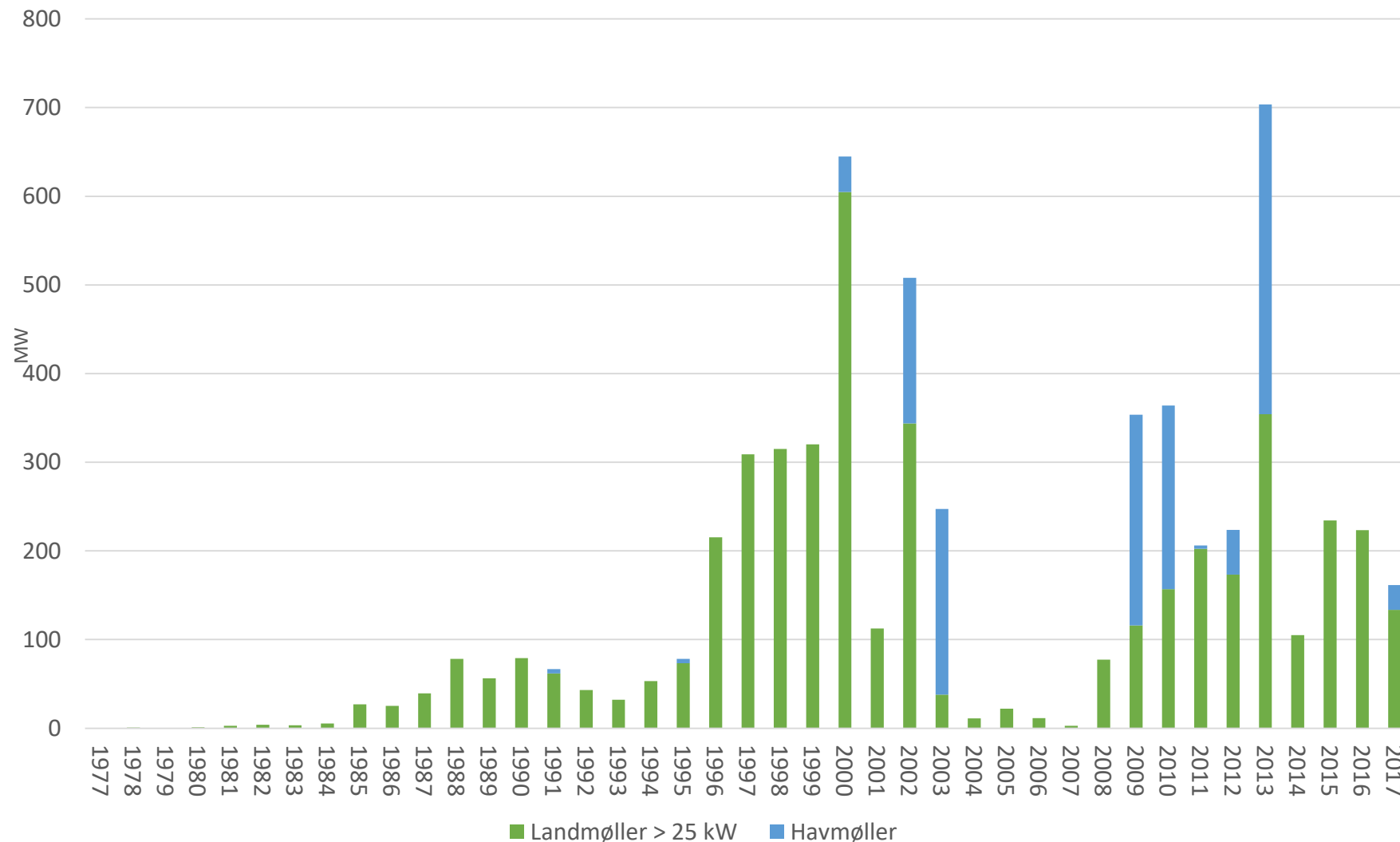
Even the IEA acknowledge the change to renewables



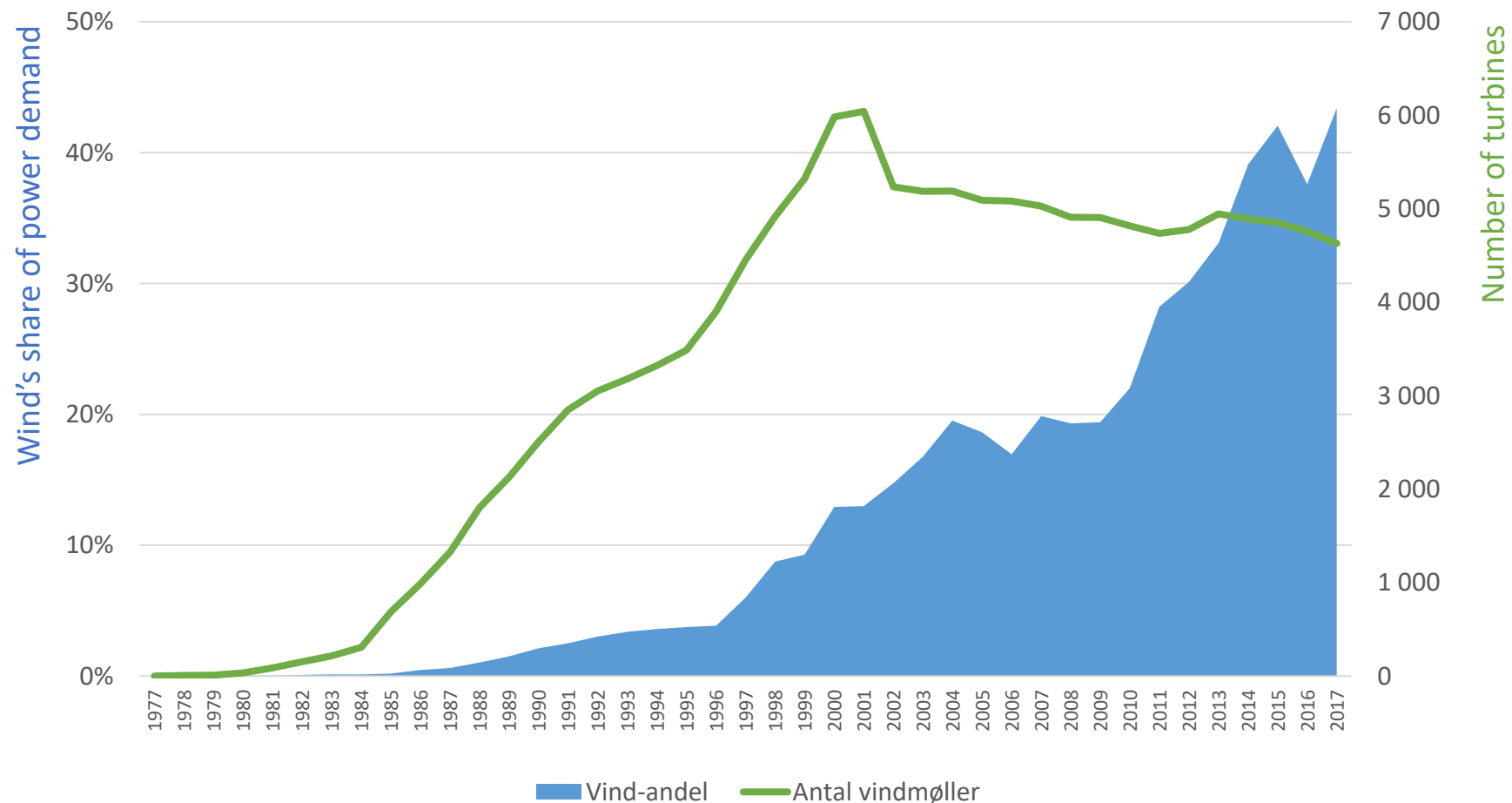
Total installed wind power capacity in Denmark 1977-2017



Annual installed wind energy capacity in Denmark 1977-2017



Number og wind turbines and wind's share of power demand 1990-2016

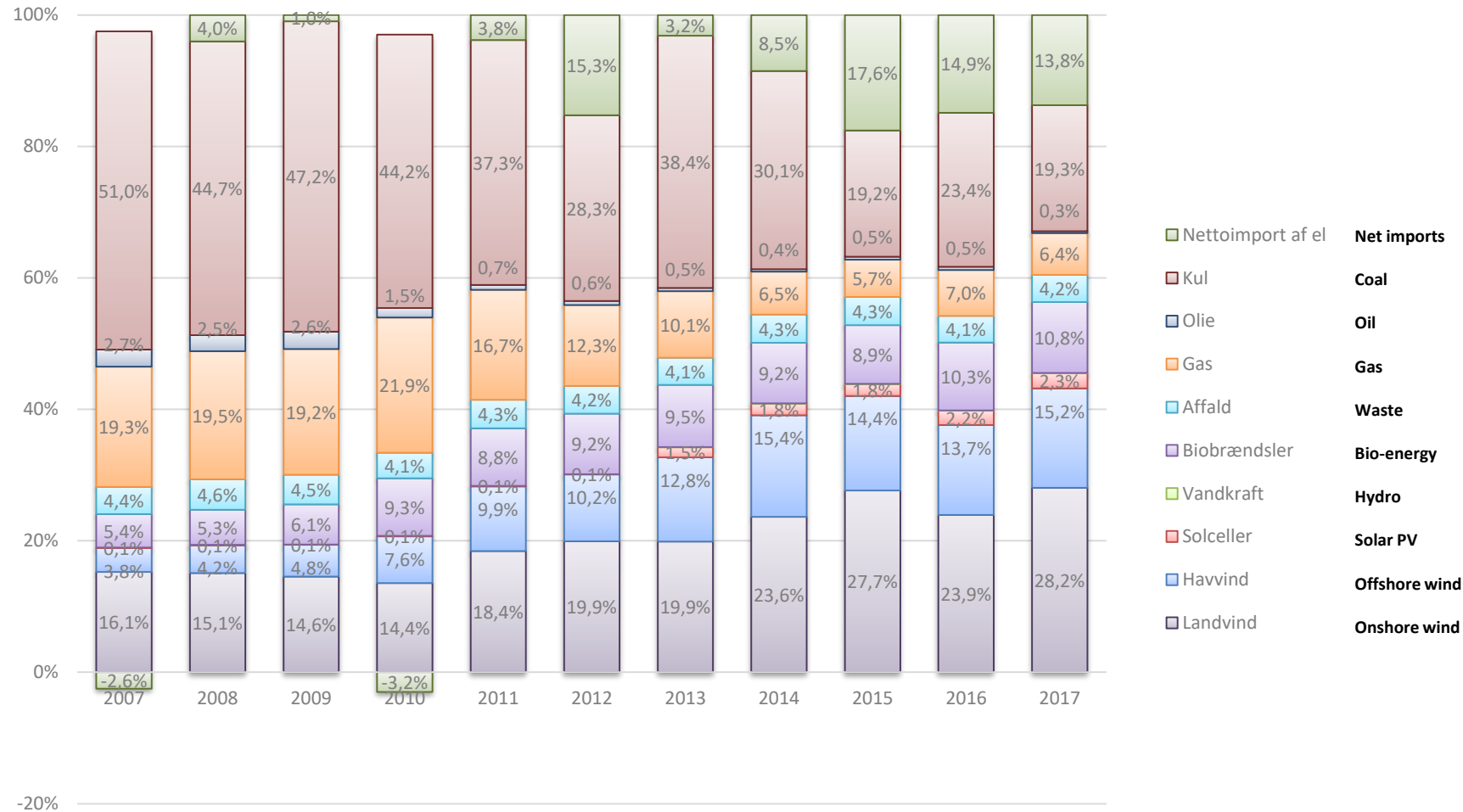


Wind Power in Denmark 2017

	TWh	% of DK's wind energy	% of DKs electricity consumption
Onshore	9.6 TWh	65%	28.3%
Offshore	5.2 TWh	35%	15,3%
Wind energy	14.7 TWh	100%	43,4%
Total demand	33.9 TWh		100%

Danish electricity supply

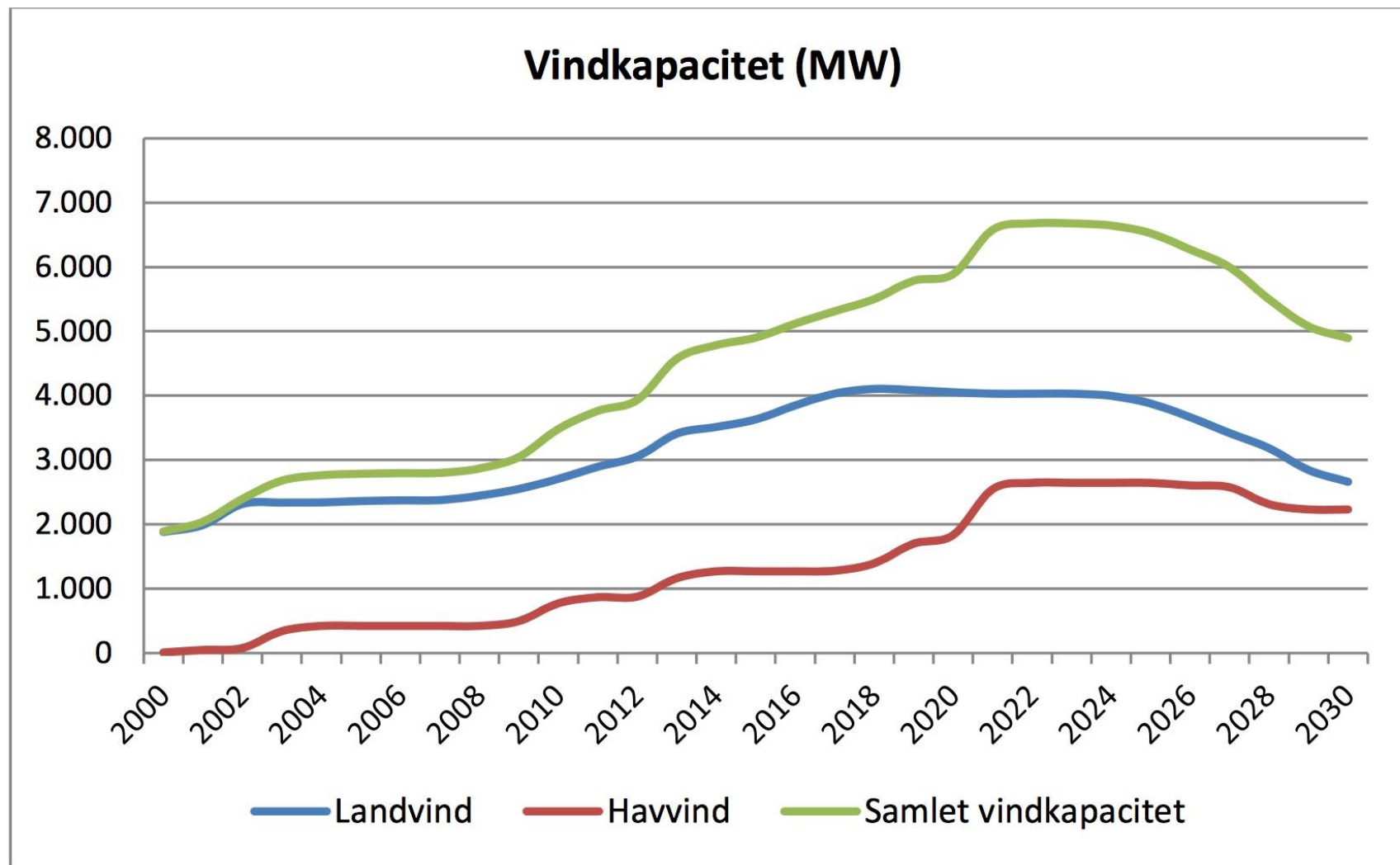
Elforbrugets sammensætning fordelt på brændsler



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Expected market development to 2030



New Danish tenders 2018 and 2019

- **Technology neutral**
Onshore wind, nearshore wind and solar PV
- **Two tenders**
2018 and 2019

Max premium paid: DKK 0.13/kWh (€ct 1.7/kWh)

App 140 MW (onshore equivalents), assuming DKK 0.11/kWh (€ct 1.5/kWh) premium.

German tenders for onshore wind

May 2017

807 MW contracts awarded in the first German onshore tender

Winner bids: €ct 4.2-5.78/kWh (31,2-43 øre/kWh)

August 2017

1,031 MW contracts awarded in second German onshore tender.

Winner bids: €ct 3.5-4.29 (26-31,9 øre/kWh)

Avg bid: €ct 4.28 (31,8 øre/kWh)

November 2017

1,000 MW contracts awarded in second German onshore tender.

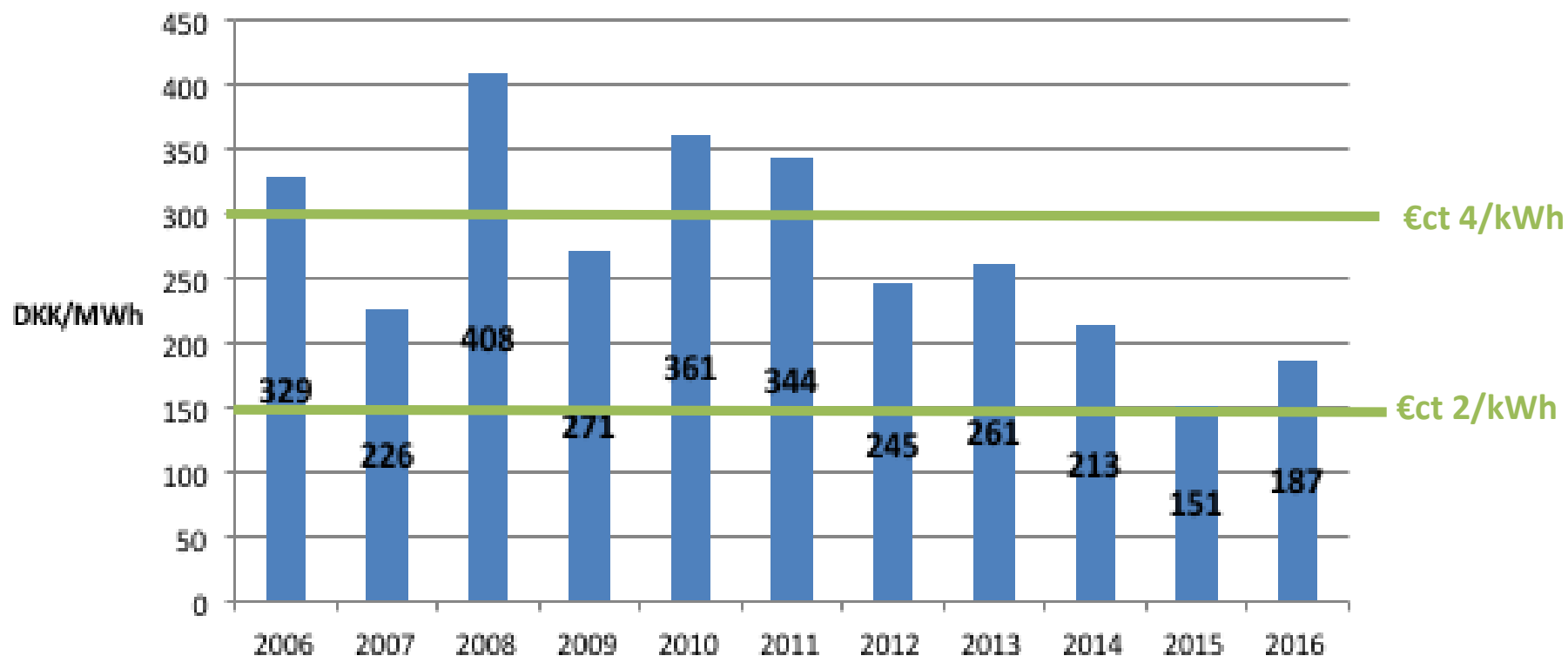
Winner bids: €ct 2.2-3.82 (16,4-28,46 øre/kWh)

Avg winner bid: €ct 3.4/kWh (25,33 øre/kWh)



Low Danish power prices – wind at a 10-15% discount

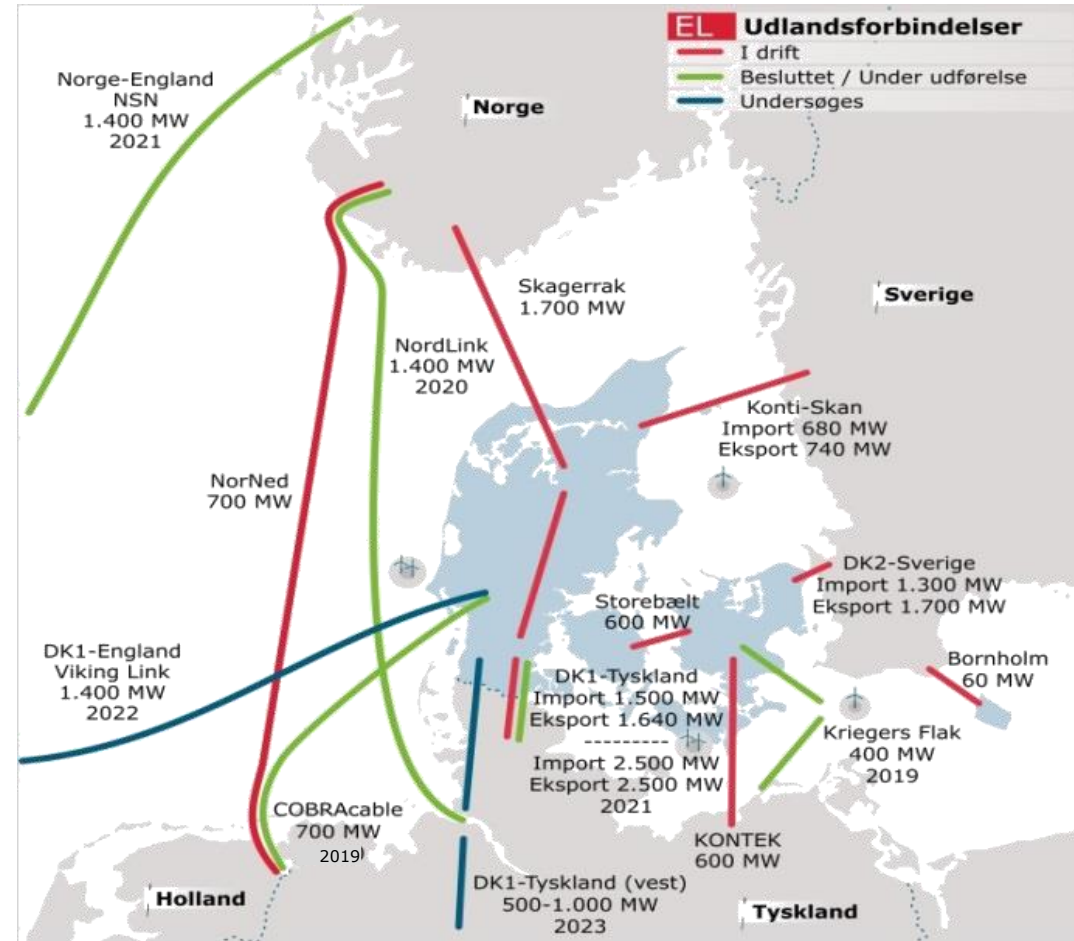
Vægtet gennemsnit afregningspriser for vindenergi i Danmark



Denmark: Lowest power prices in Europe



Strong interconnectors needed to harmonise prices across Europe



CHALLENGES



- No incentive at local level to plan for new sites (DK)
- Offshore wind is perceived to be as cheap as onshore
- Lack of long-term power contracts – NordPool and PPAs
- Banks / EIB increasingly reluctant to finance new projects due to insecure revenue streams
 - Low certificate and power prices (S)
 - Uncertainty from auction model (DK)
- Reversal of the polluter pays principle, i.e. subsidies are removed for renewables while new subsidies are invented for fossil / nuclear

From Polluter-pays to Polluter-benefits principle

- CO2 market collapse: allowances are given for free to polluters and external credits disrupt the price signal
- Allowance surplus of 3 bn. tonnes (app 2 years of emissions)
- Meanwhile EU is busy inventing fossil fuel subsidies (the Commission calls them capacity payments)
- The average price for electricity in Denmark is 10-15% below the average Danish pool price.



MORE CHALLENGES

- Existing wind power capacity challenged by low income, technology issues (e.g. icing / welding) and rising costs
- Heavy tax penalties for using electricity for heating (DK)
- Need for effective de-icing / anti-icing technology and production guarantees from the manufacturers
- More innovation in cold-climate technology

Political objective

Independence from coal, oil and gas by 2050

49,5% wind power by 2020

20% reduction in GHG by 2020 compared to 1990

30% RE by 2020; 51,9% renewable electricity

Status

31,3% RE (2016)

43,4% wind power i 2016

19,3% reduction in GHG in 2016 (EEA, dec 2015)

2016: 31,3% RE / 52,4% Renewable electricity



www.dkvind.dk

