



"Erfahrungen Dänemarks mit dem strategischen Systemumbau"

**AWES Windenergiesymposium
Vienna**

**Christian Kjaer
CEO, Danish Wind Turbine Owners' Association
14. March 2018**

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

The association represents 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**

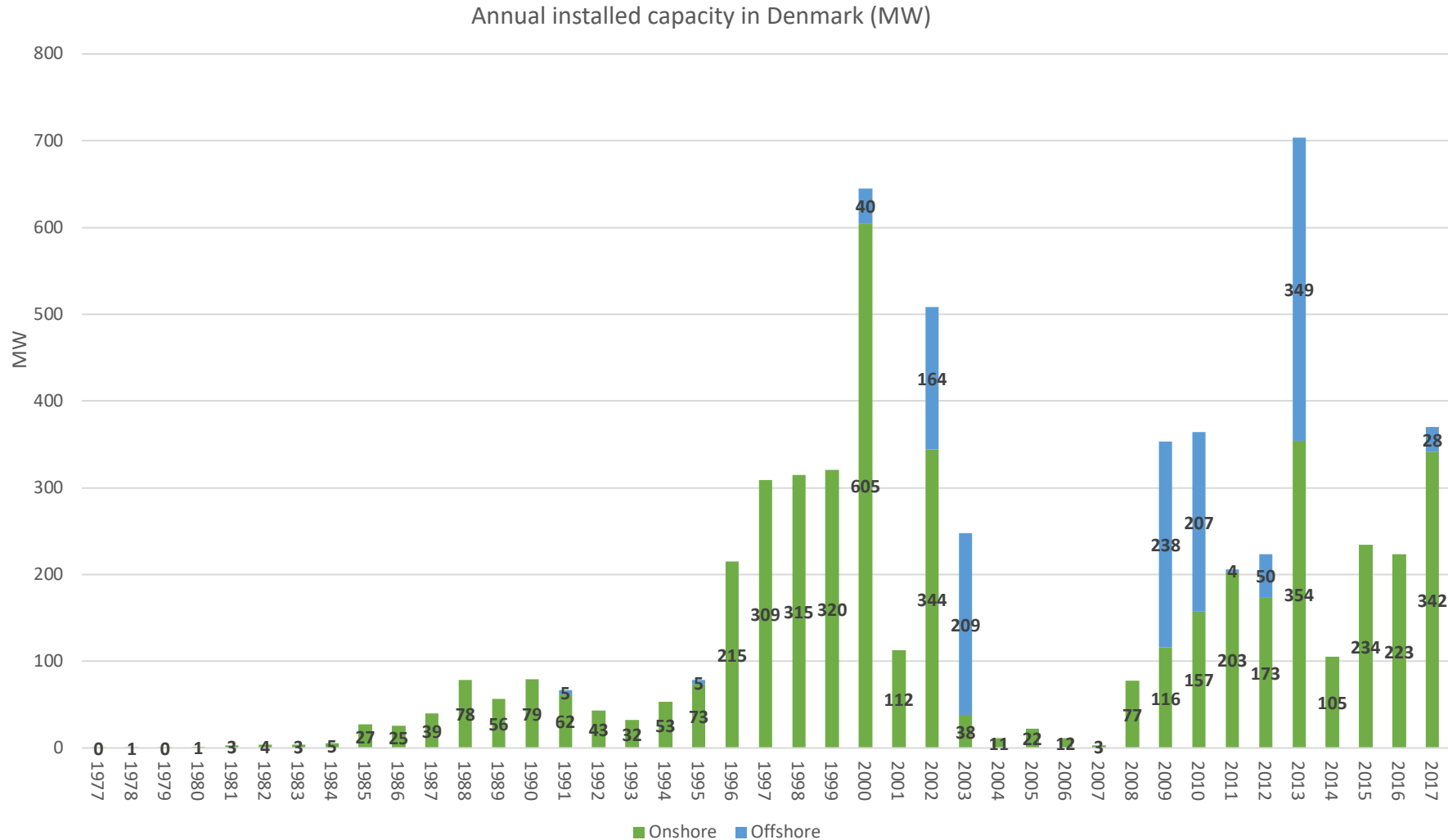
**1,266 MW
offshore wind
in Denmark**

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

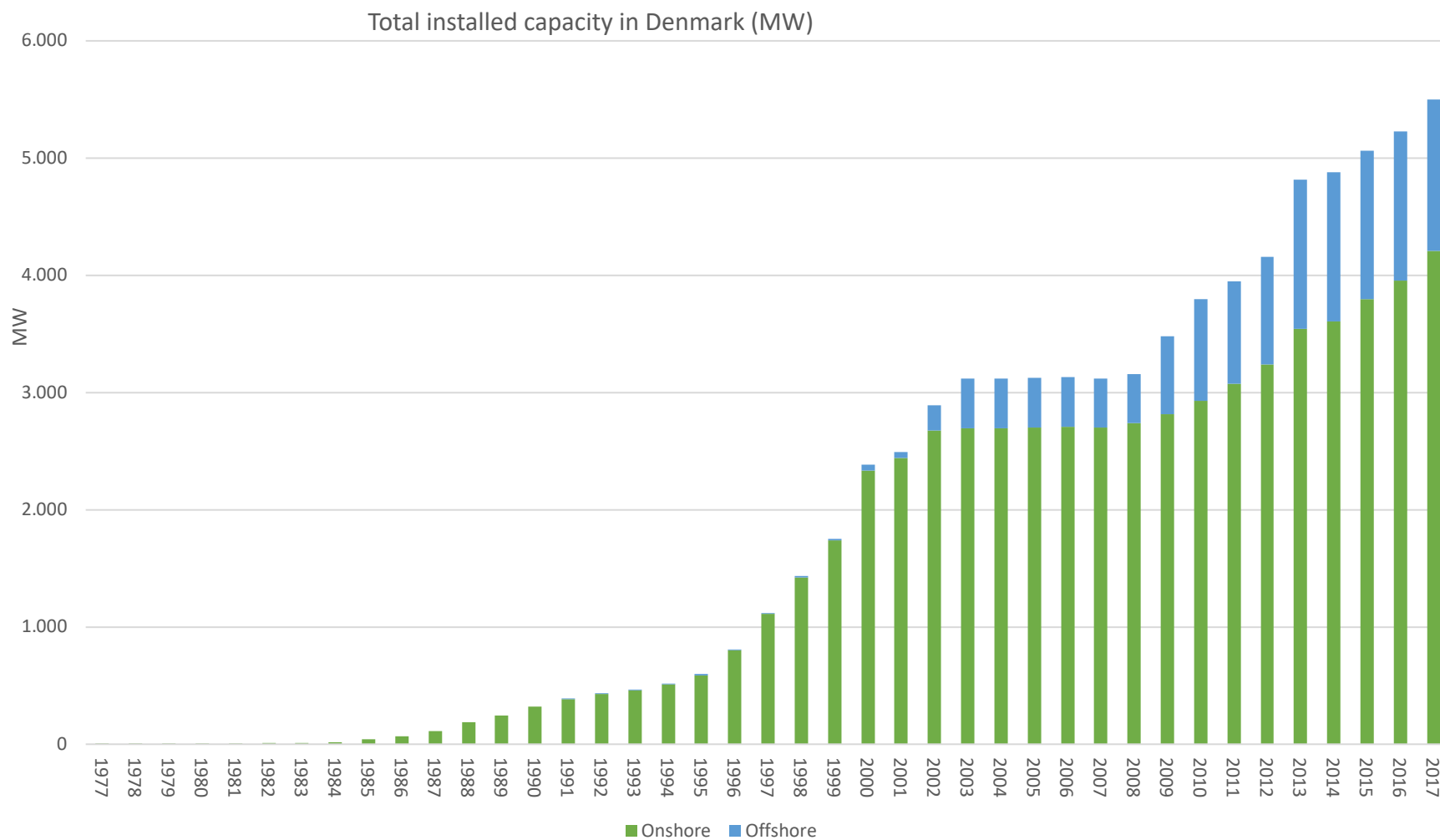
**728 MW
Onshore
turbines
abroad**

**Established in
1978**

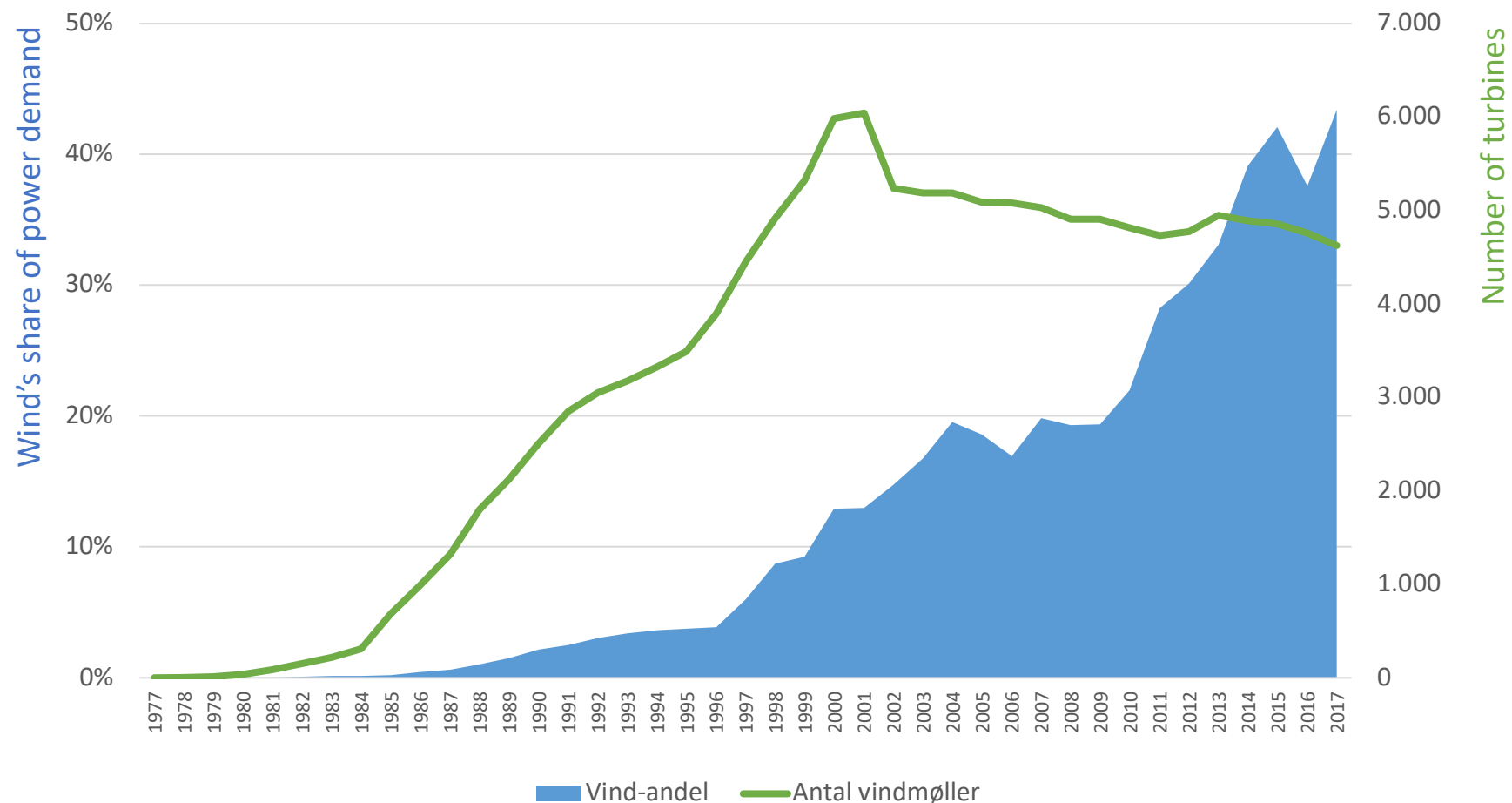
Annual installed wind energy capacity in Denmark 1977-2017



Total installed wind power capacity in Denmark 1977-2017



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



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

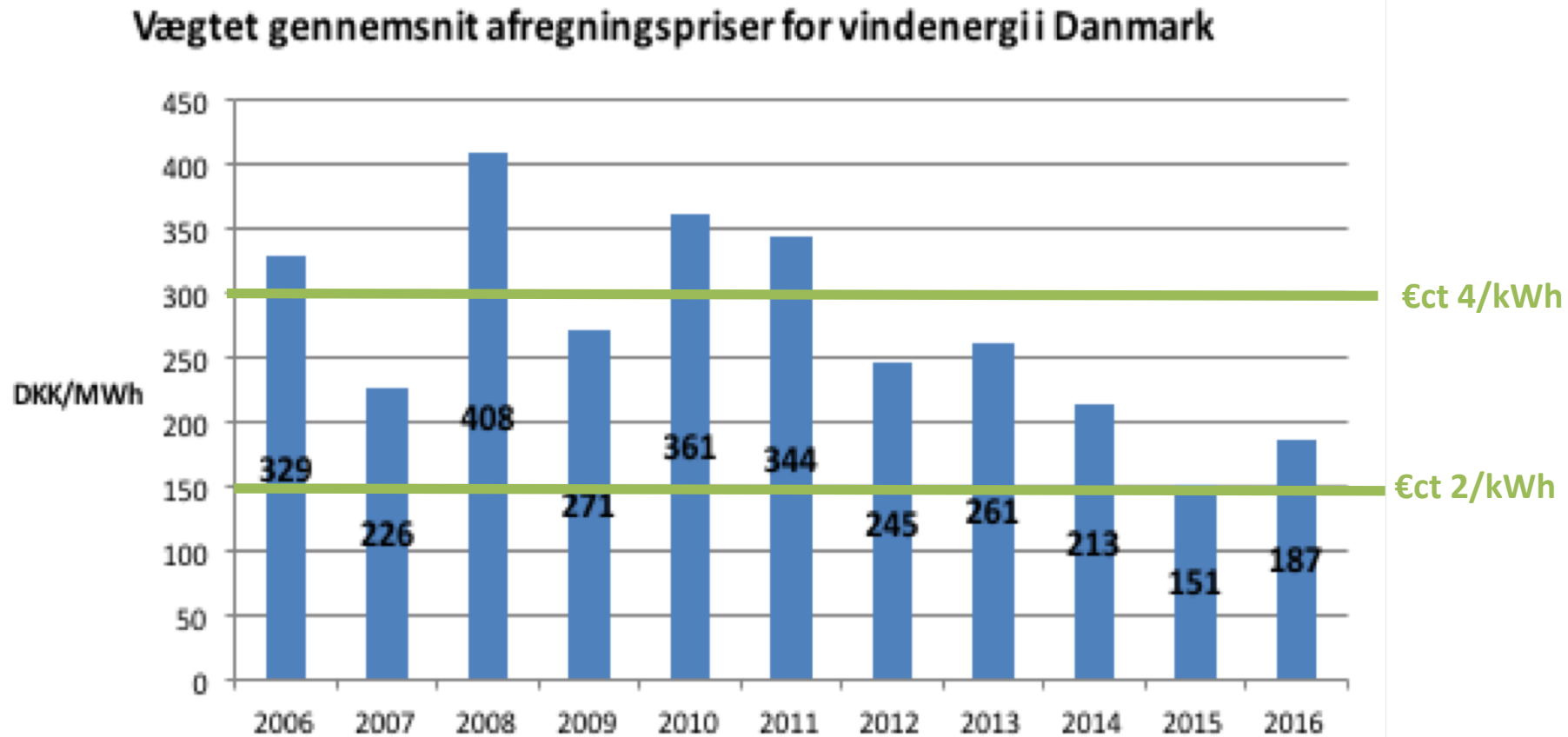
1,000 MW contracts awarded in second German onshore tender.

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

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



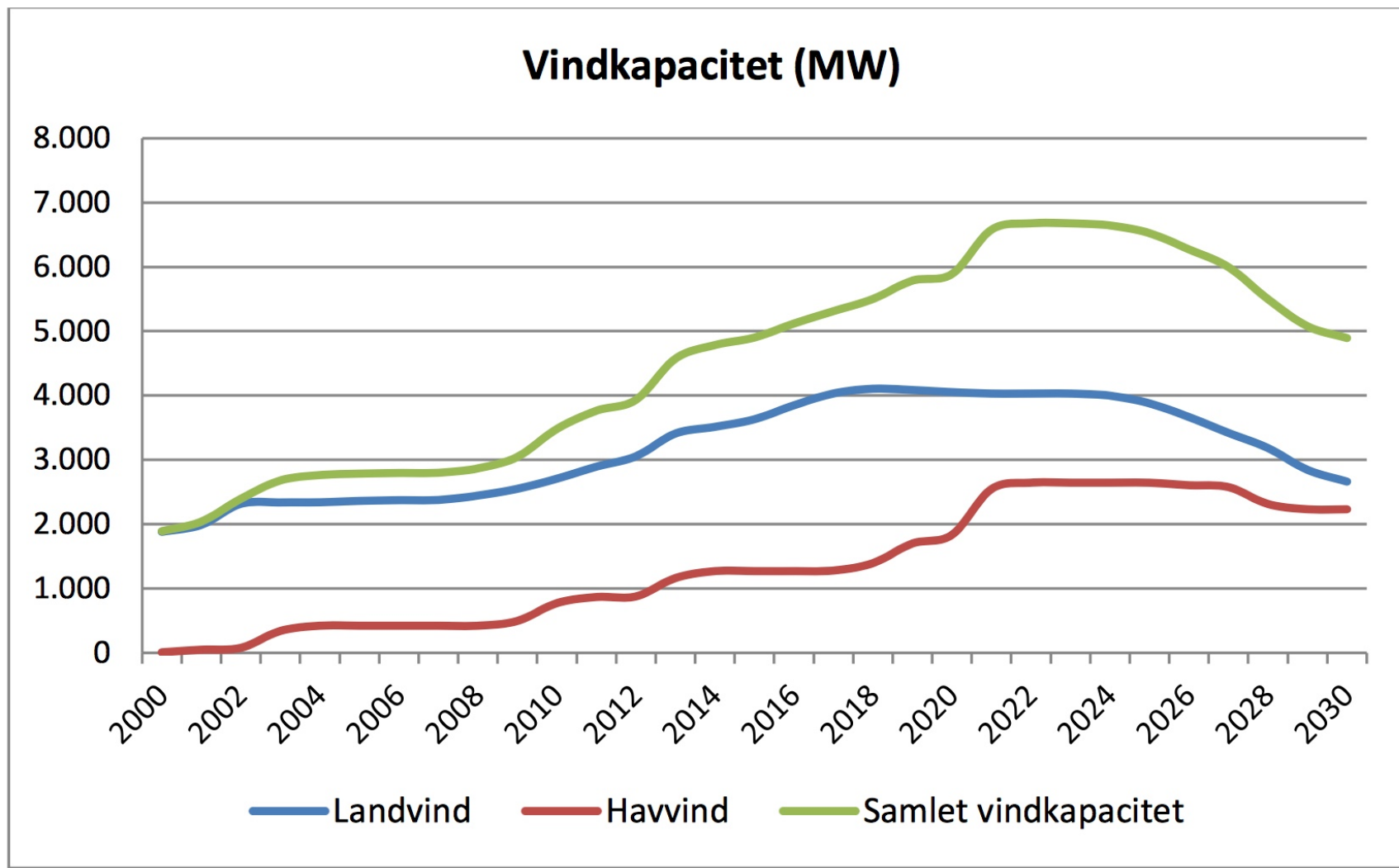
Low Danish power prices – wind at a 10-15% discount



Wind Power in Denmark 2017

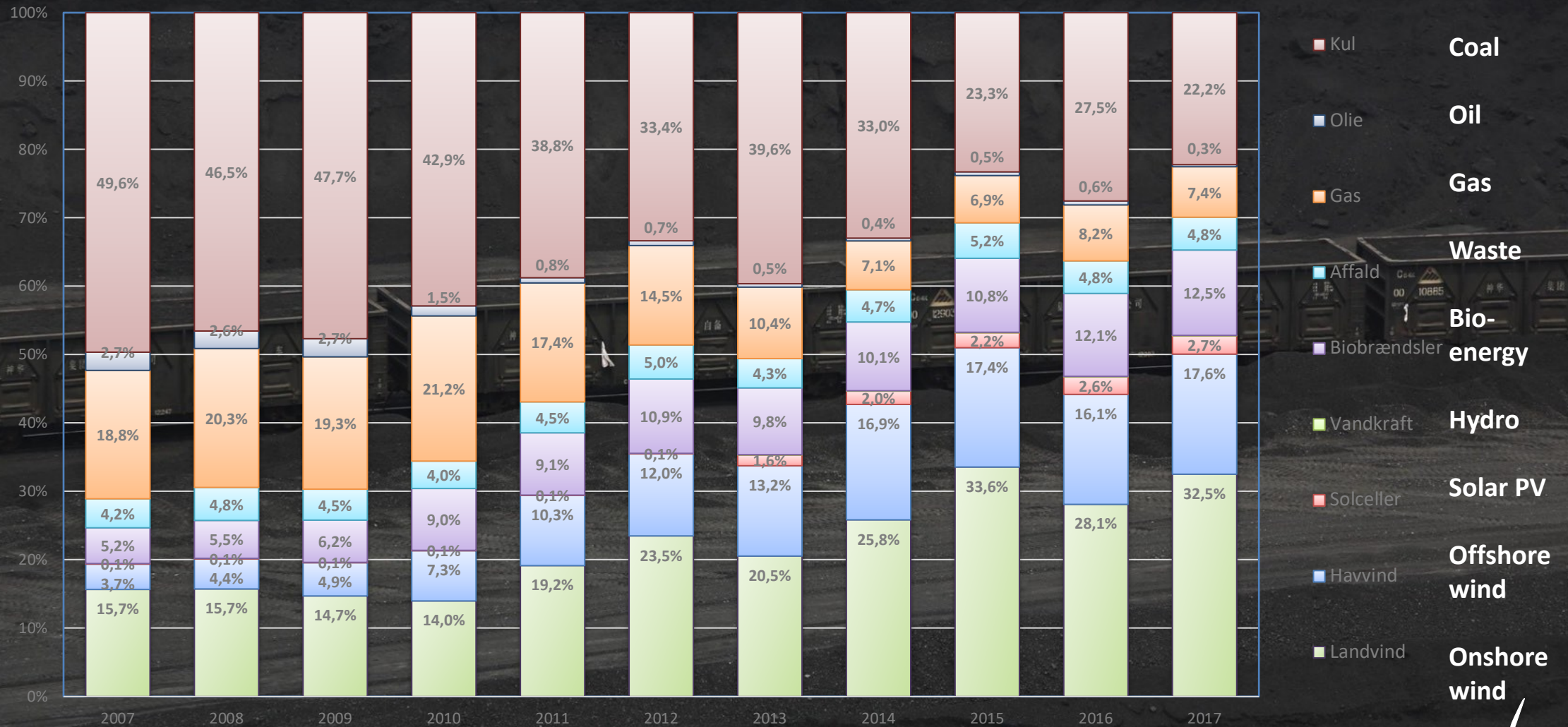
	TWh	% of DK's wind energy	% of DKs electricity consumption
Onshore	9.6 TWh	65%	28.3%
Offshore	5.2 TWh	35%	15,3%
Wind energy	14.7 TWh	100%	43,4%
Total demand	33.9 TWh		100%

Expected market development to 2030



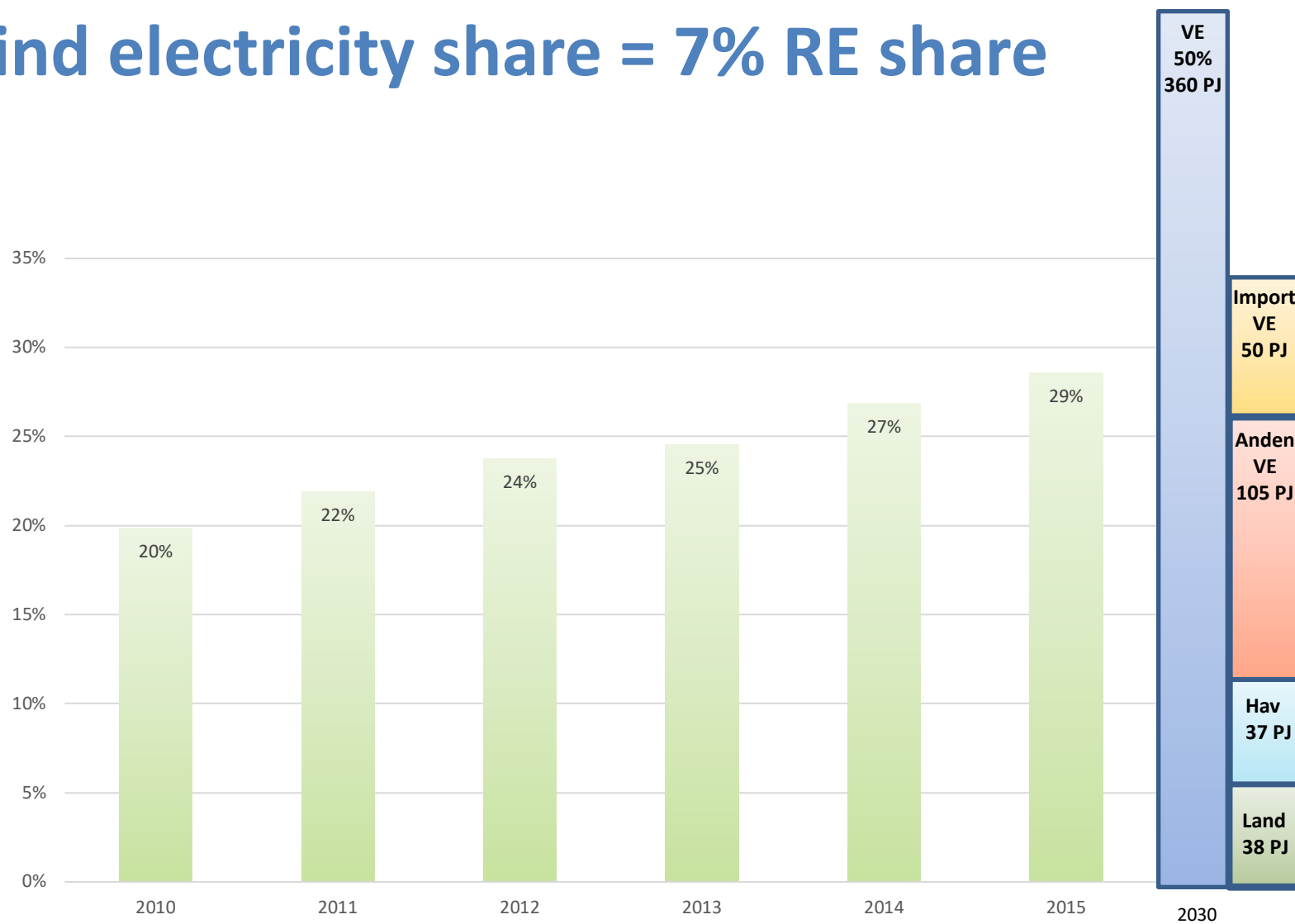
Danish electricity supply

Danish power production mix 2007 - 2017
(% of total net power production of 29,4 TWh)



It på tal fra Energinet og ENTSO-E

43% wind electricity share = 7% RE share



Political objective

Independence from coal, oil and gas by 2050

20% reduction in GHG by 2020 compared to 1990

30% RE by 2020; 50 % RE by 2030

Status

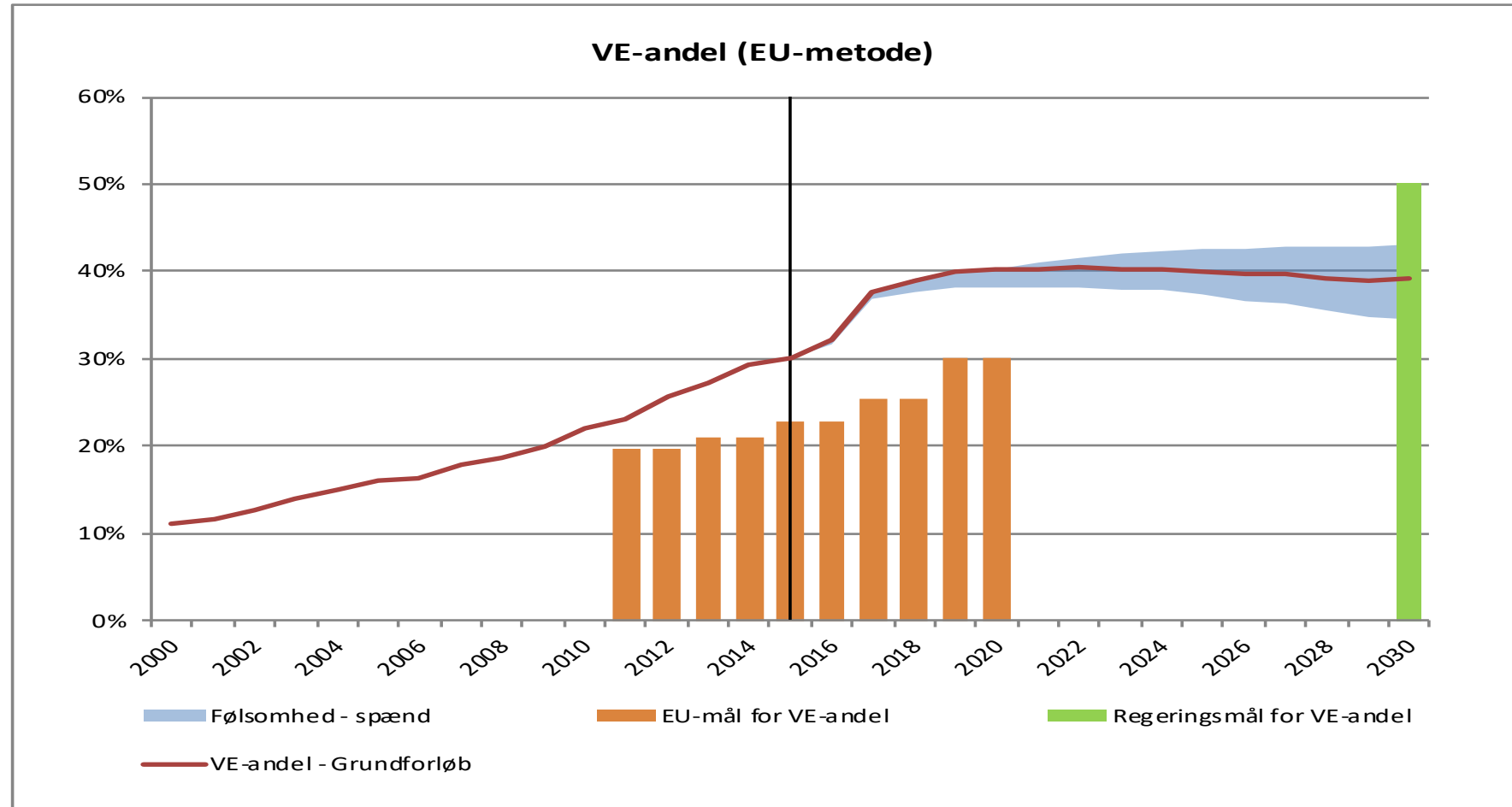
31,3% RE (2016)

19,3% reduction in GHG in 2016

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



Expected RE share to 2030



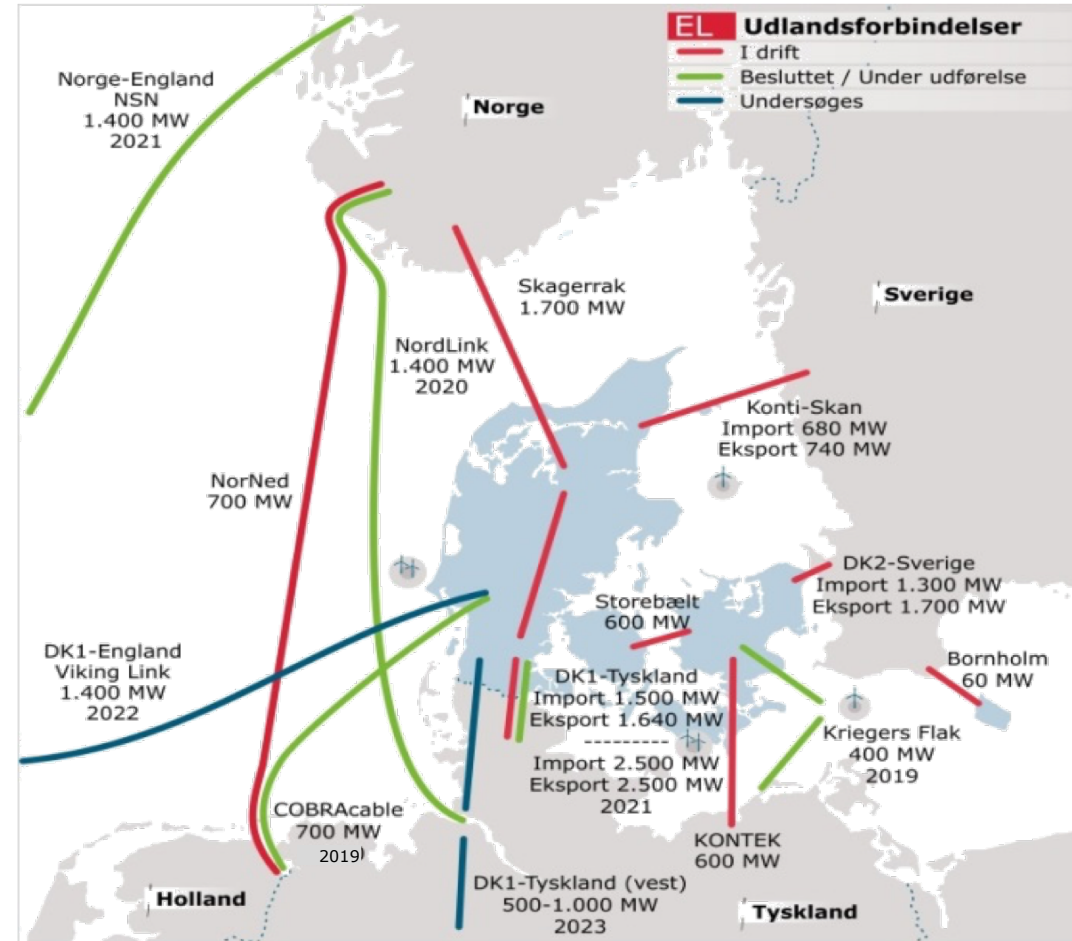
Denmark: Lowest power prices in Europe



Source: European wholesale power exchanges



Strong interconnectors needed to harmonise prices across Europe



CHALLENGES

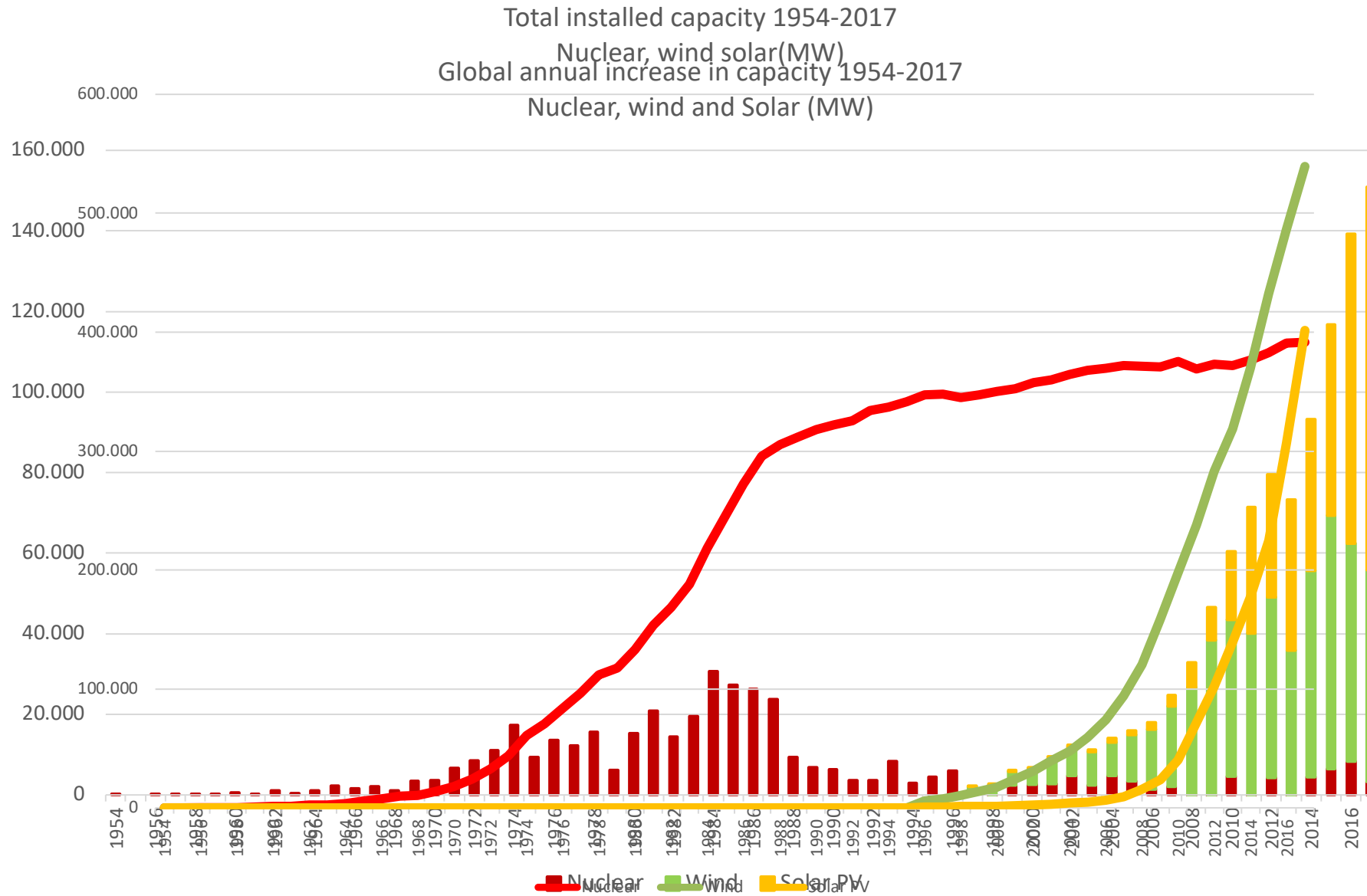
- Heavy tax penalties for using electricity for heating (DK)
- No incentive at local level to plan for new sites (DK)
- Offshore wind is perceived to be as cheap as onshore
- Lack of long-term power contracts – NordPool and PPAs
- Reversal of the polluter pays principle, i.e. subsidies are removed for wind / PV while new subsidies are invented for fossil / biomass

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.



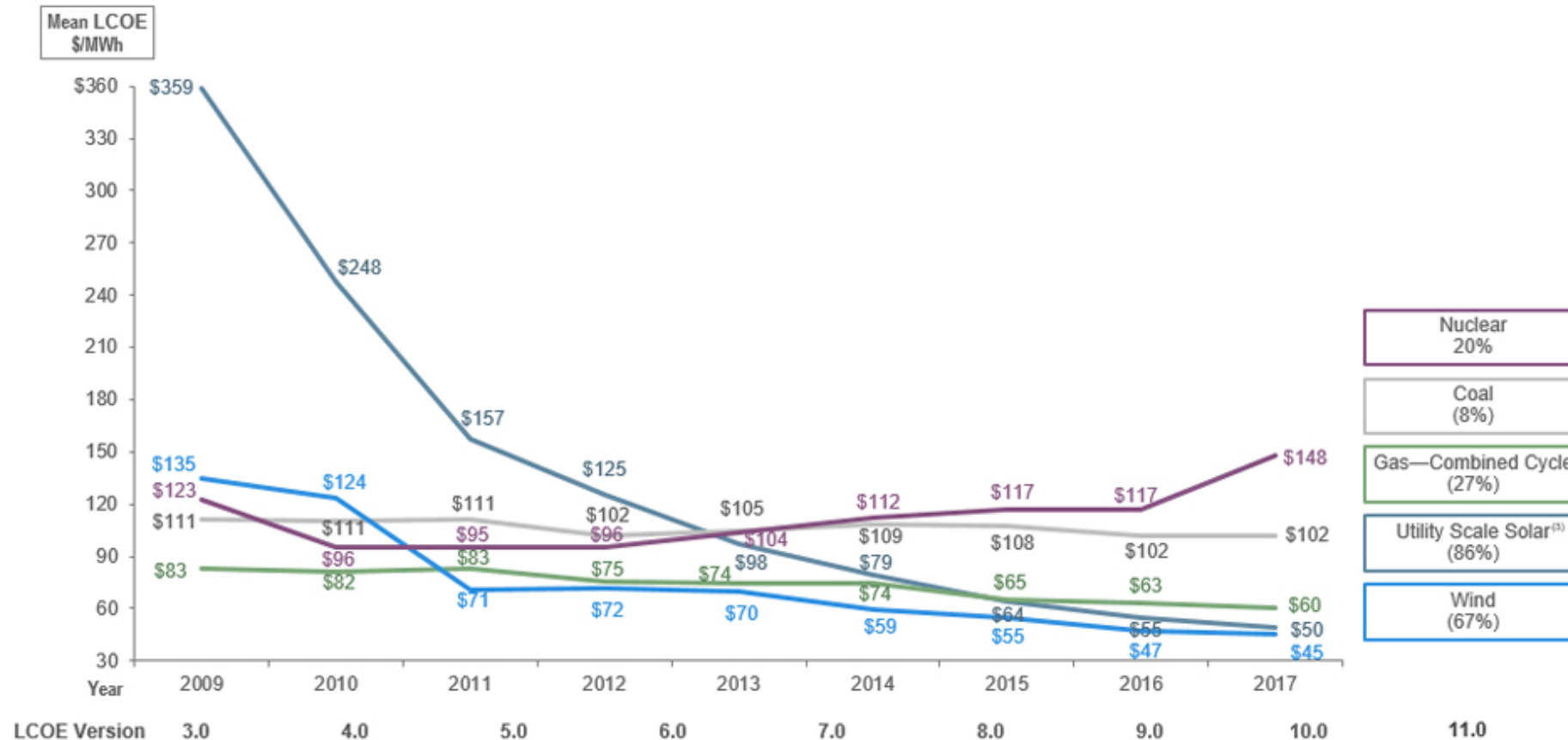
Renewables vs. Nuclear



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.

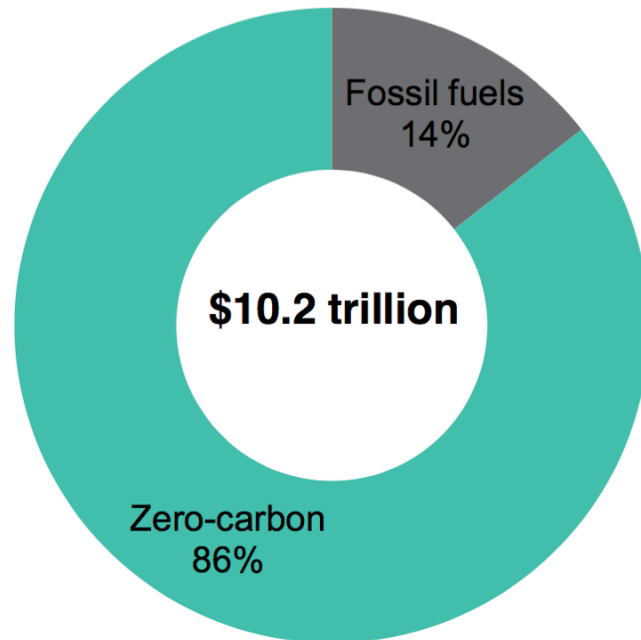
(2) Reflects total decrease in mean LCOE since the later of Lazard's LCOE—Version 3.0 or the first year Lazard has tracked the relevant technology.

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



Global power sector investment to 2040

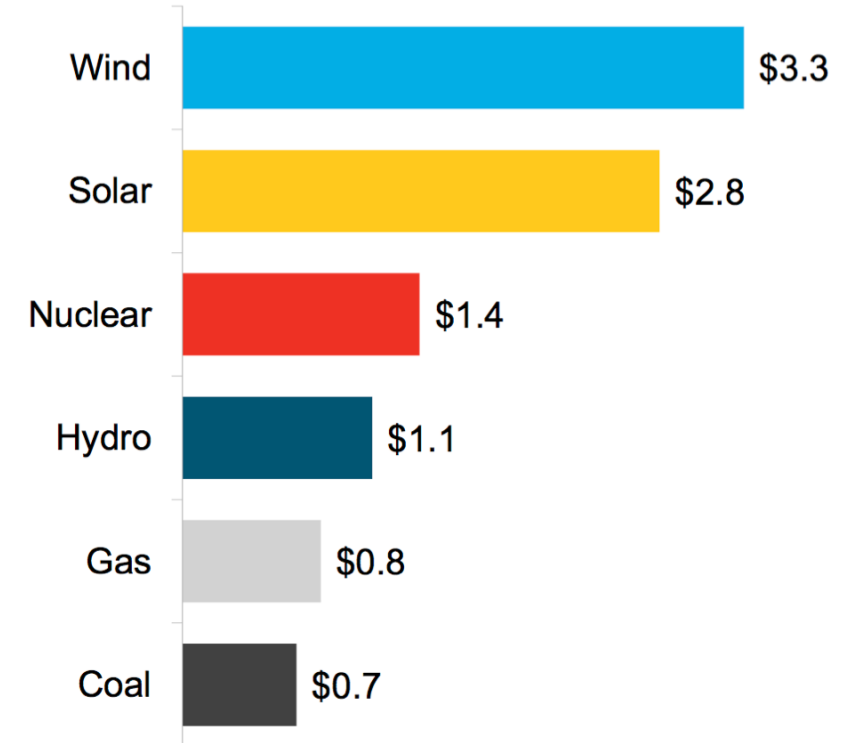
Investment, by technology, 2017-2040



Source: Bloomberg New Energy Finance

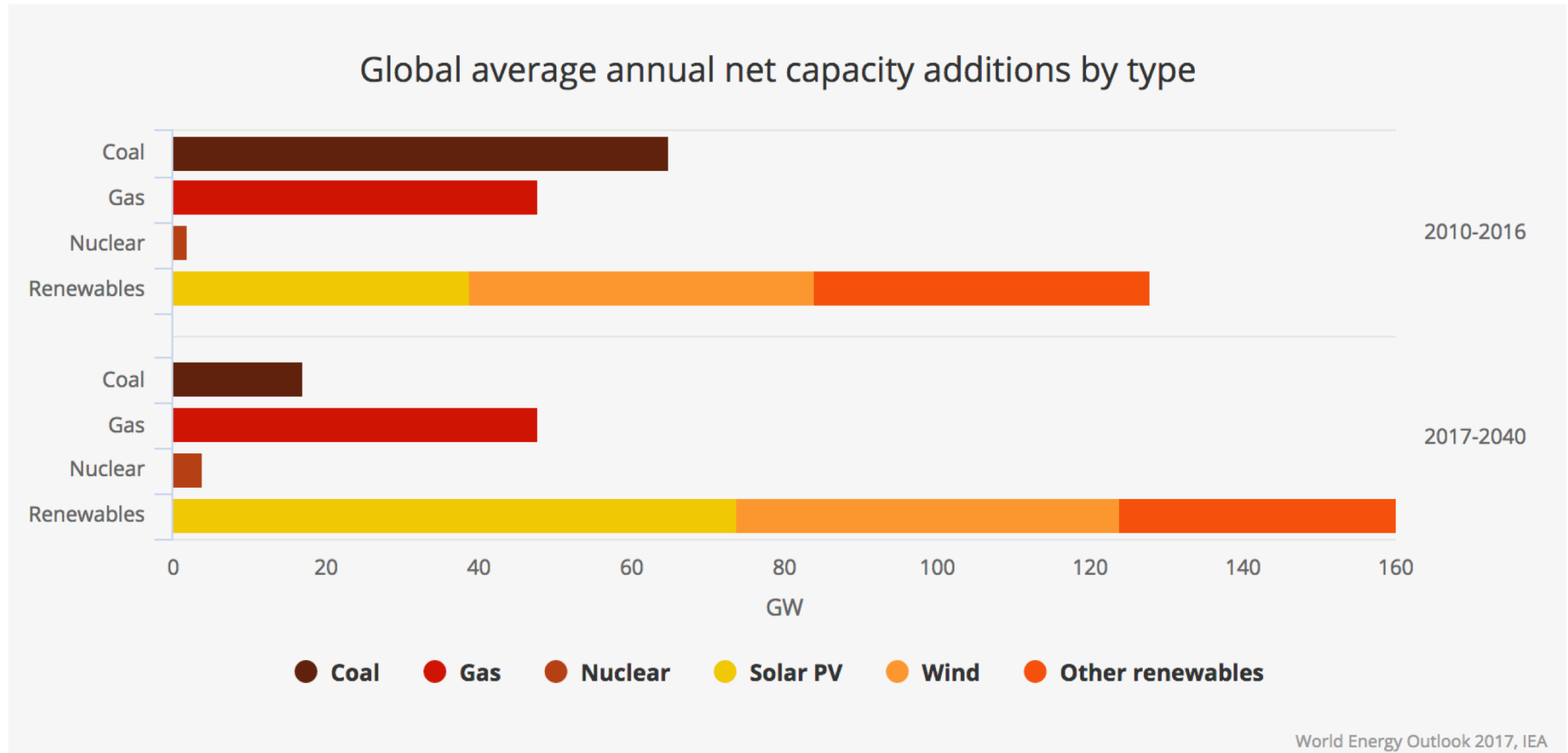
Investment, by technology, 2017-2040

(\$ trillion - 2016 real)



Source: Bloomberg New Energy Finance

Even the IEA acknowledge the change to renewables



www.dkvind.dk

DANMARKS
VINDMØLLEFORENING

