

# Renewables 2015

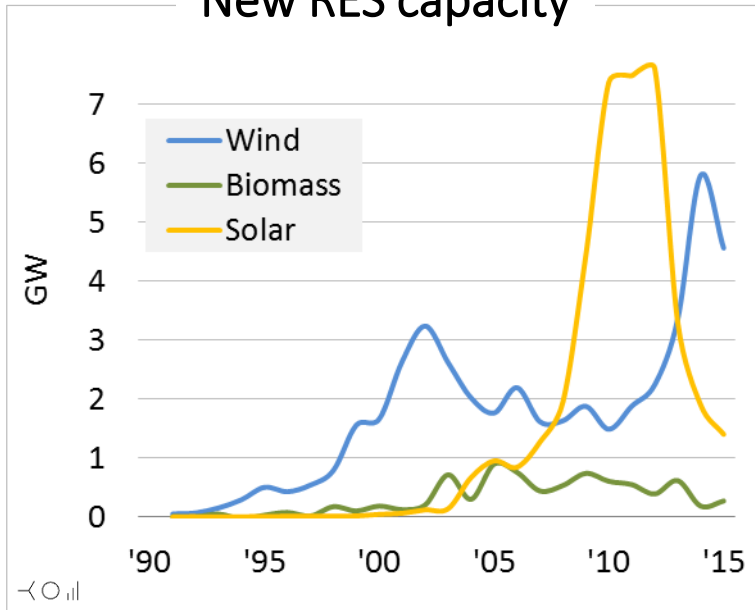
*Germany's renewable power generation in figures*

[www.neon-energie.de](http://www.neon-energie.de)

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# Added renewables generation capacity

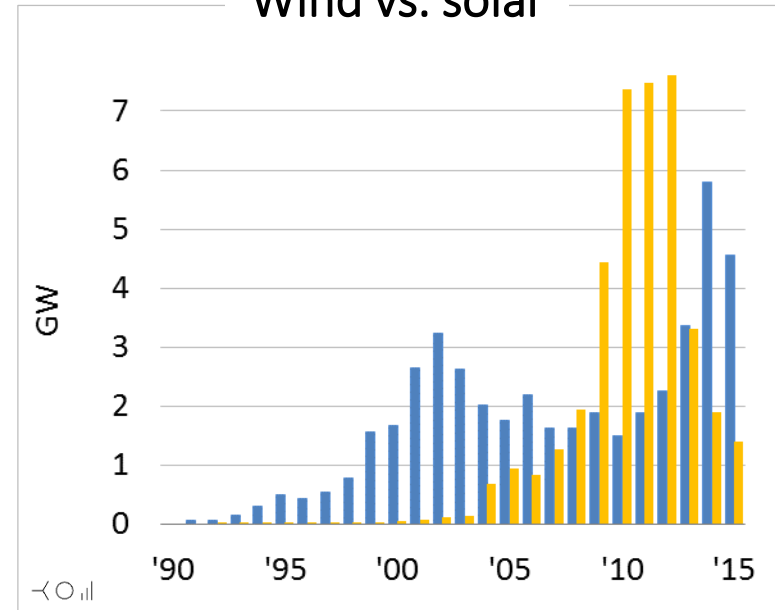
## New RES capacity



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

In historical perspective, wind power additions are very high, but solar additions well below 2009-12.

## Wind vs. solar

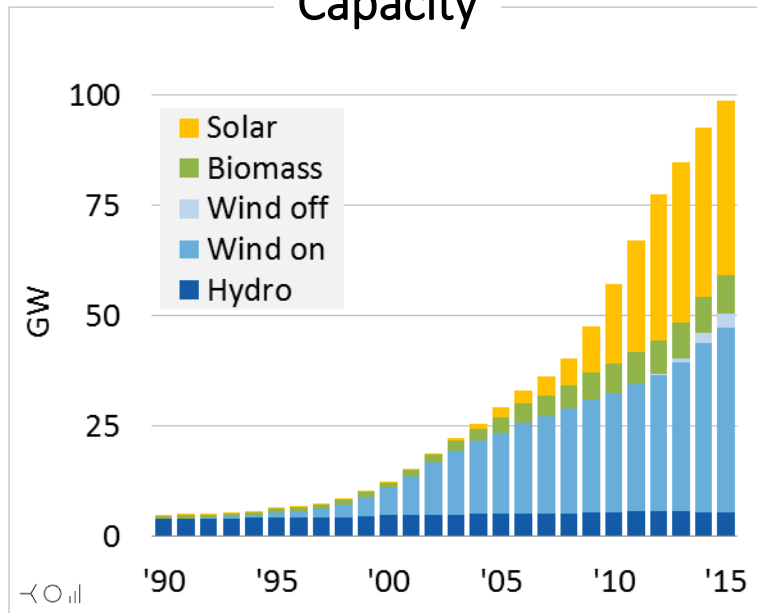


Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

For the third year in a row, more wind power capacity is added than solar PV.

# Renewable capacity and electricity generation

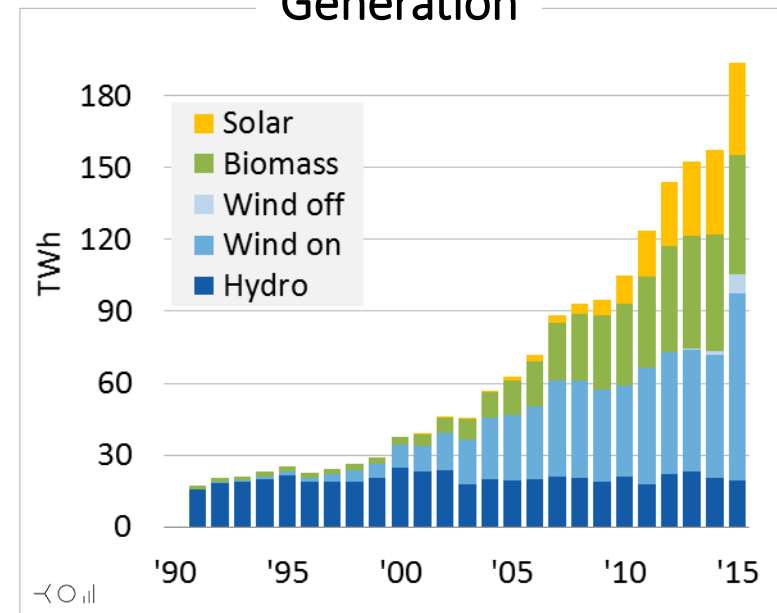
## Capacity



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

Renewable capacity reached nearly 100 GW by the end of 2015.

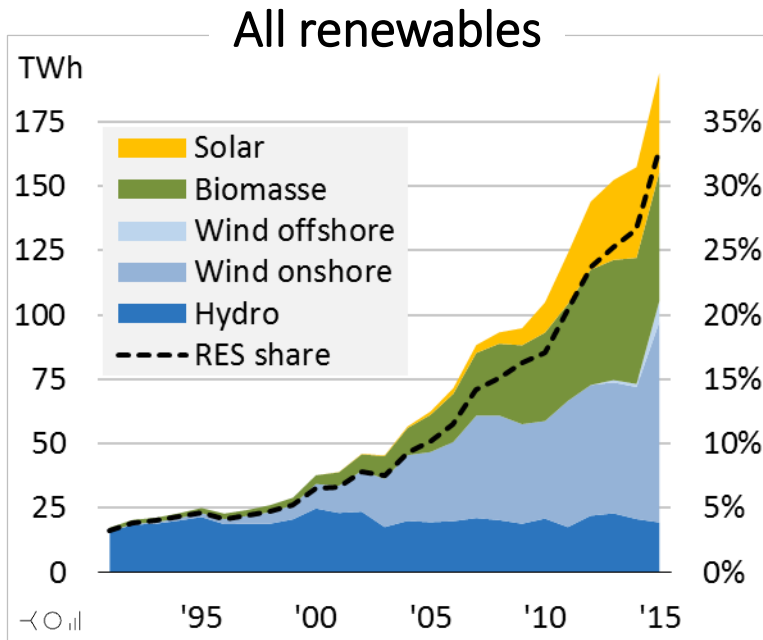
## Generation



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

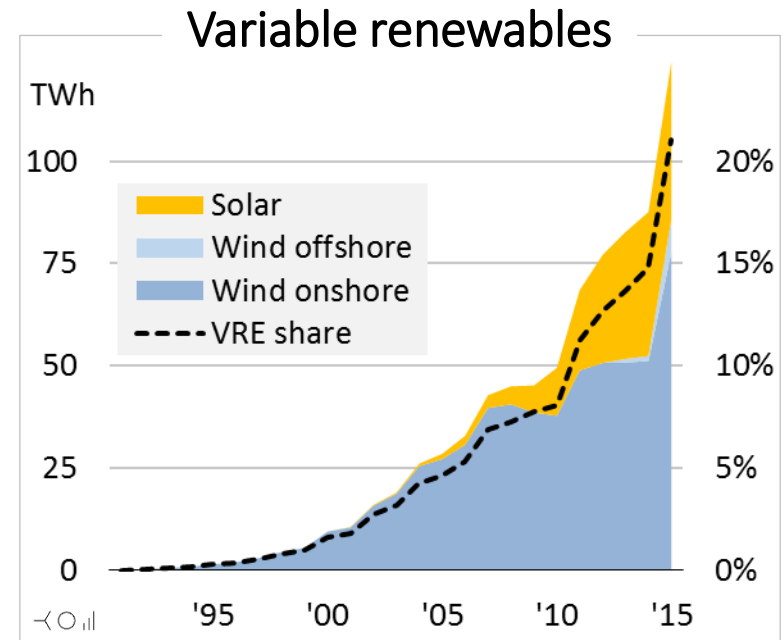
More than 190 TWh of electricity was generated from renewable energy sources.

# Renewables supply 33% of German electricity demand



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

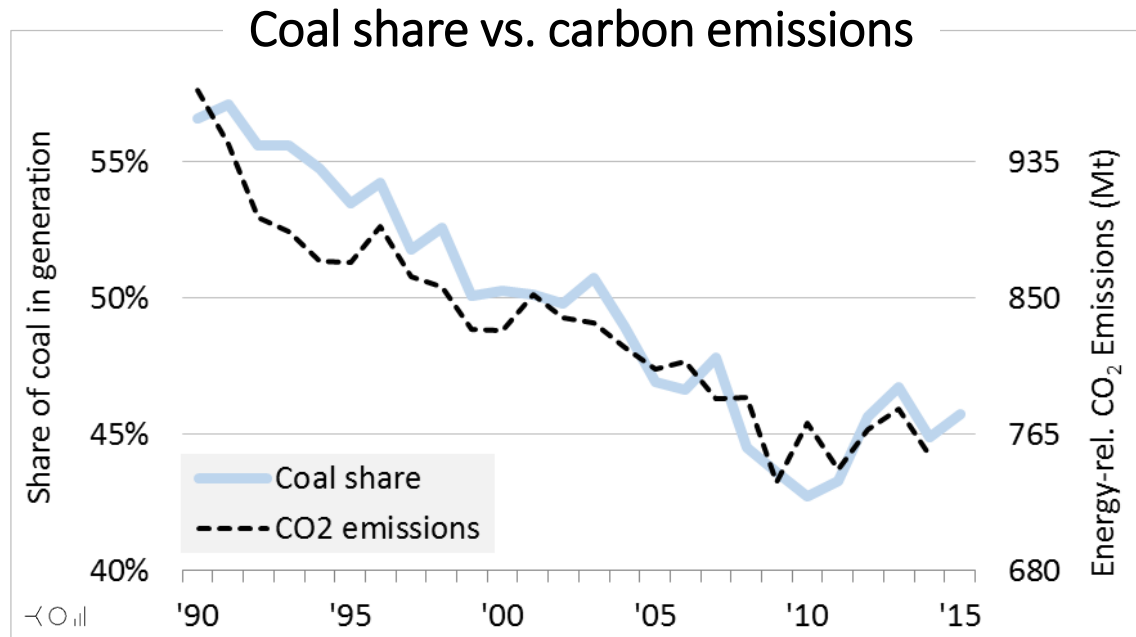
Renewables supply 32% of German electricity consumption (30% of supply).



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

Wind and sun – variable renewables VRE – provide 21% of electricity demand.

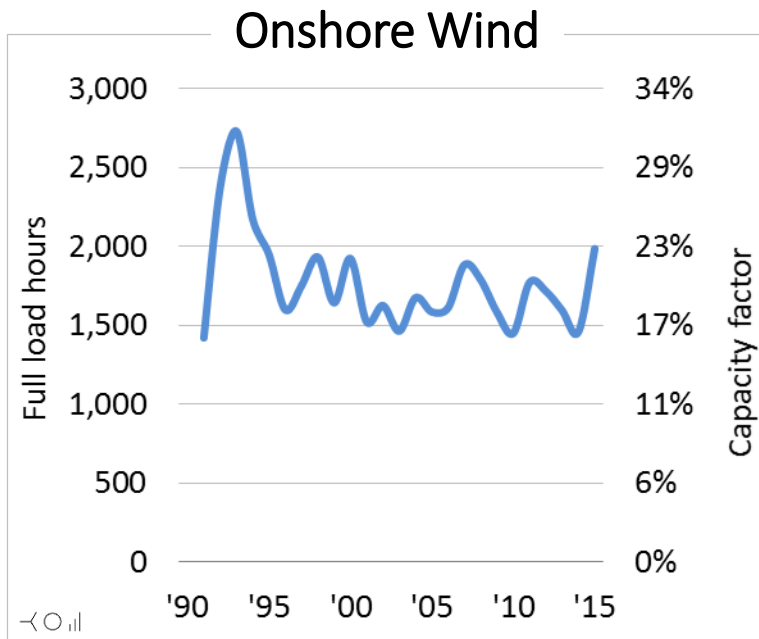
# Share of coal in electricity generation rises to 46%



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

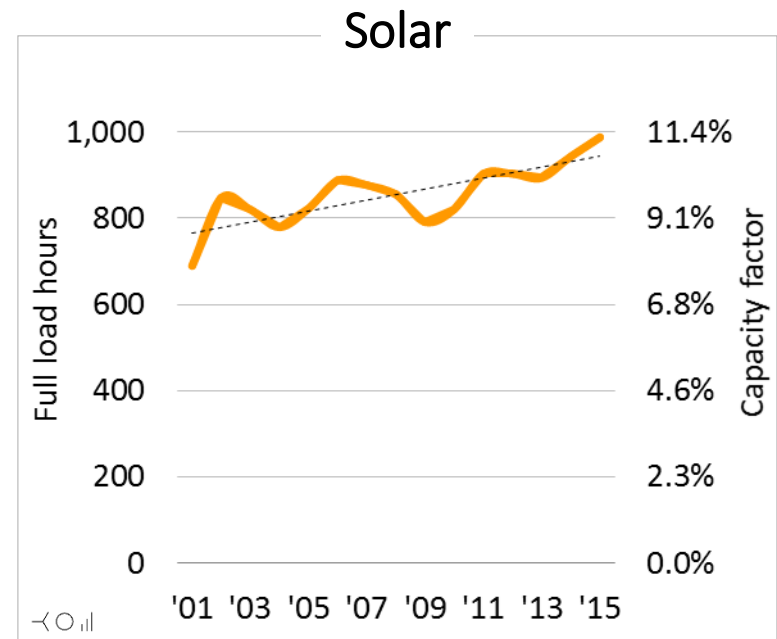
Coal-fired power generators (lignite + hard coal), the main source of energy-related carbon emissions, increased their market share to 46% in 2015.

# Capacity factors: on the rise



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA. Calculated as yearly generation over weighted mean of year-end capacities.

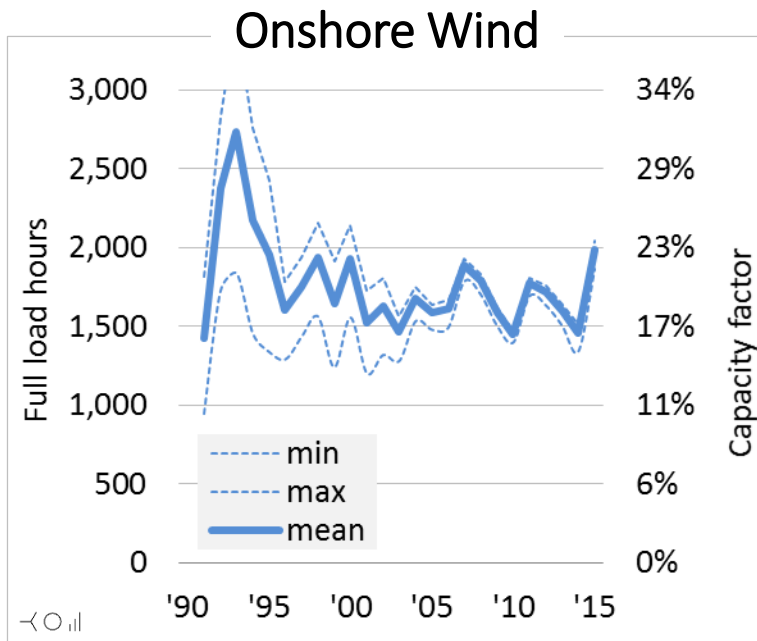
It seems that in terms of capacity factor, 2015 was the best year for onshore wind in two decades: 23% (2000 FLHs).



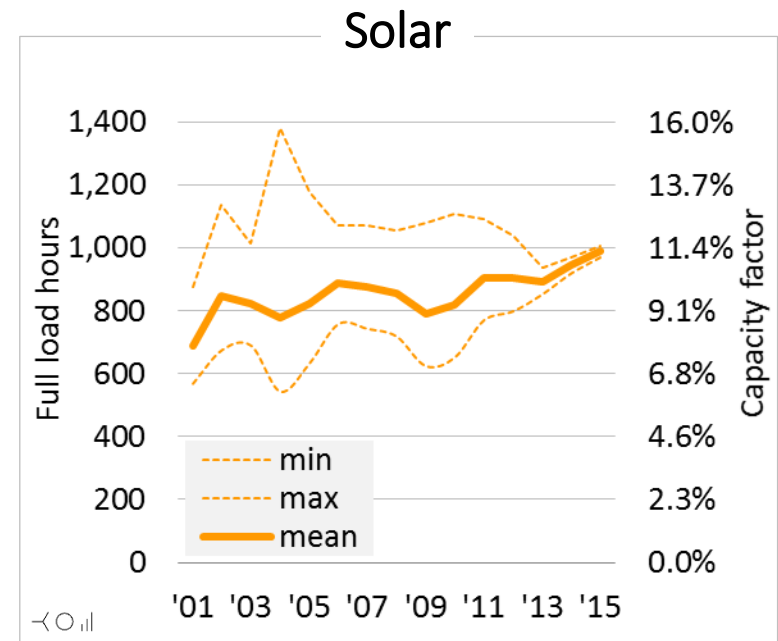
Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA. Calculated as yearly generation over weighted mean of year-end capacities.

Solar PV seems to keep increasing its capacity factor – to 11% in 2015.

# Capacity factor estimates are subject to uncertainty



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA. Calculated as yearly generation over capacities at beginning and end of year.

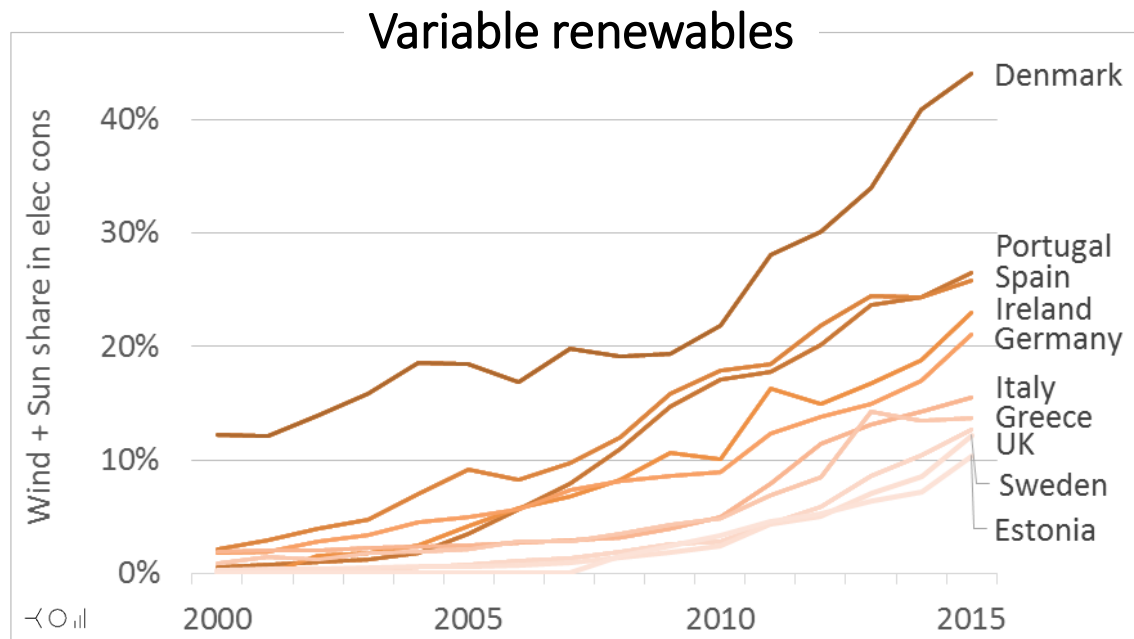


Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA. Calculated as yearly generation over capacities at beginning and end of year.

The time within the year when new assets were connected affects the capacity factor estimate. In any case, 2015 was excellent.

The uncertainty is larger for solar power, where growth rates were higher.

# Wind and solar on the rise



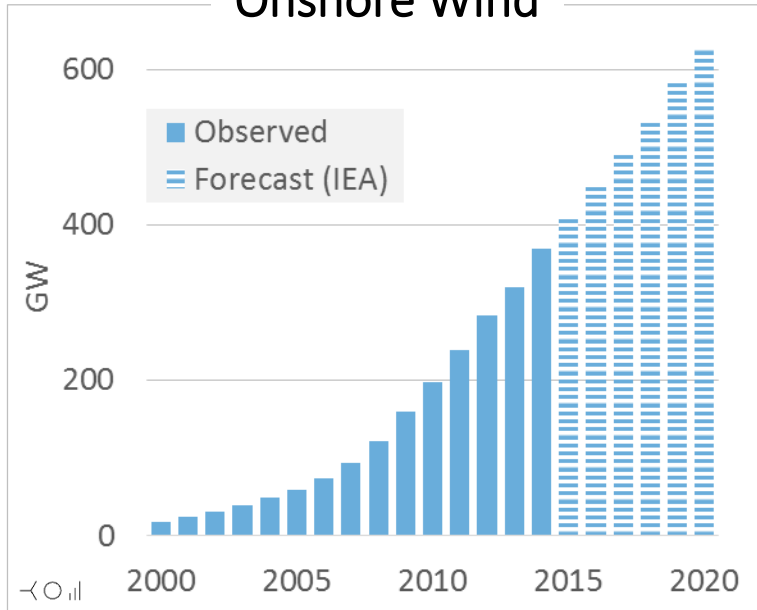
Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA. Data for 2015 runs until 07/2015.

In ten out of 33 IEA member countries, wind and solar power supply more than 10% of electricity demand. On the Iberian Peninsula, they provide more than a quarter of electricity.



# Global wind and solar capacity

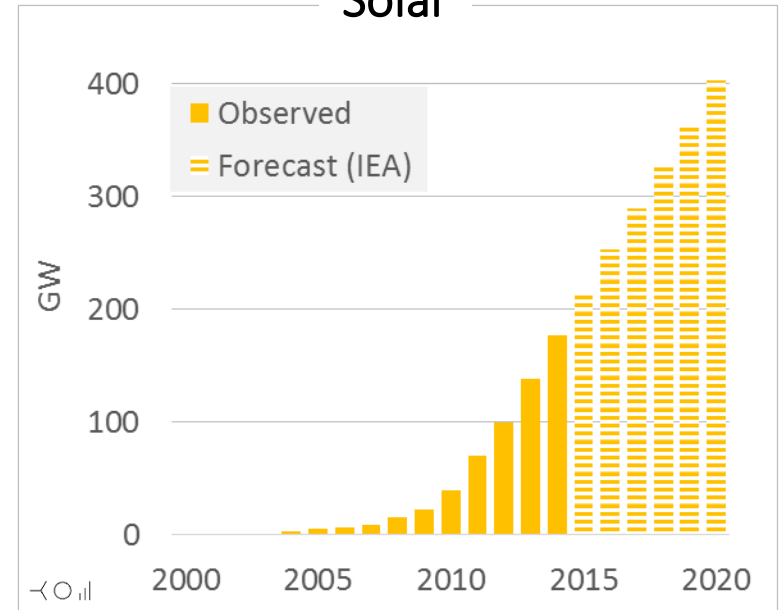
## Onshore Wind



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

Global wind power has likely reached 400 GW.

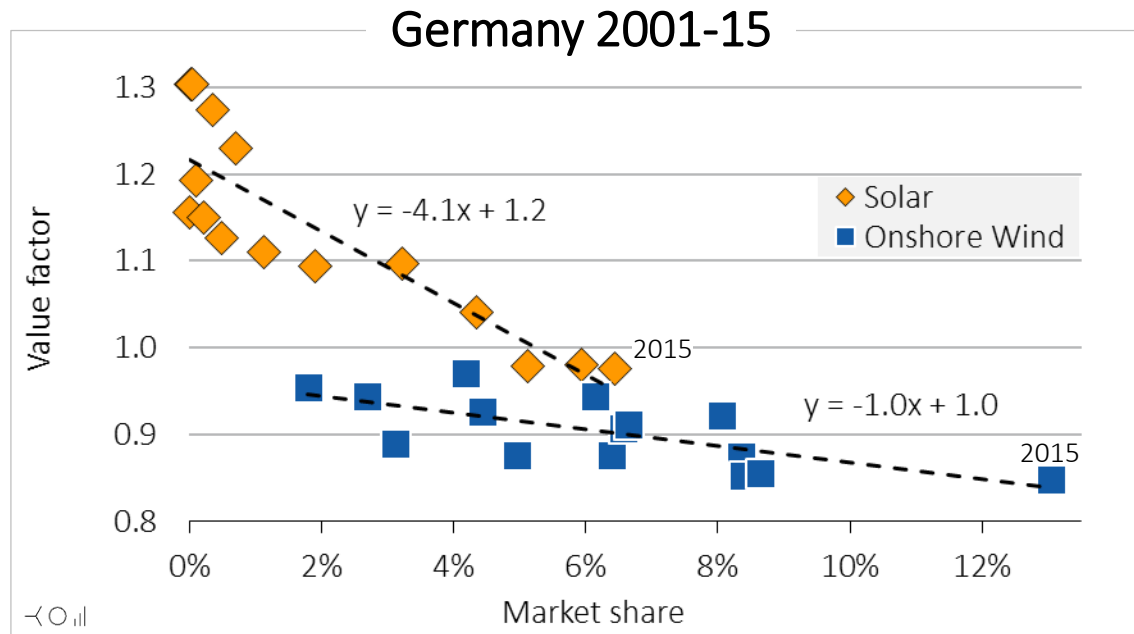
## Solar



Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

About 200 GW solar power is installed worldwide.

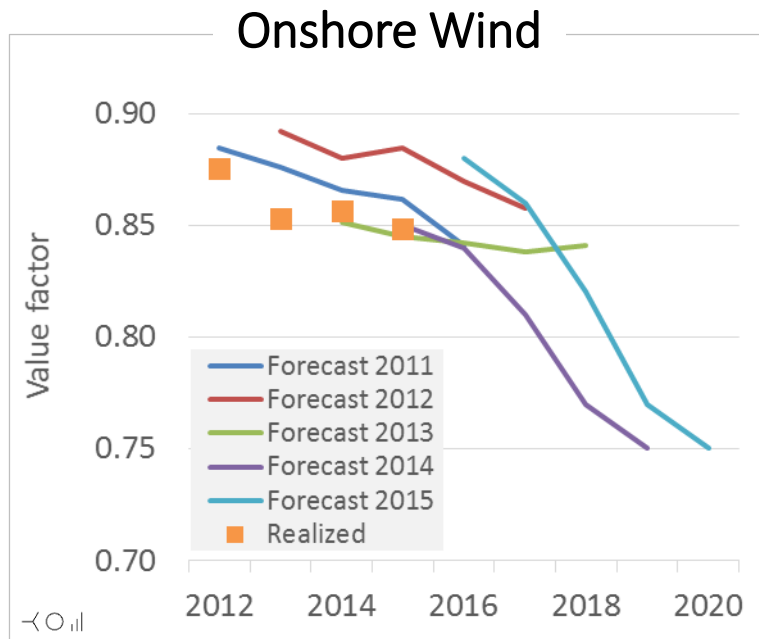
# Market value of wind and solar power



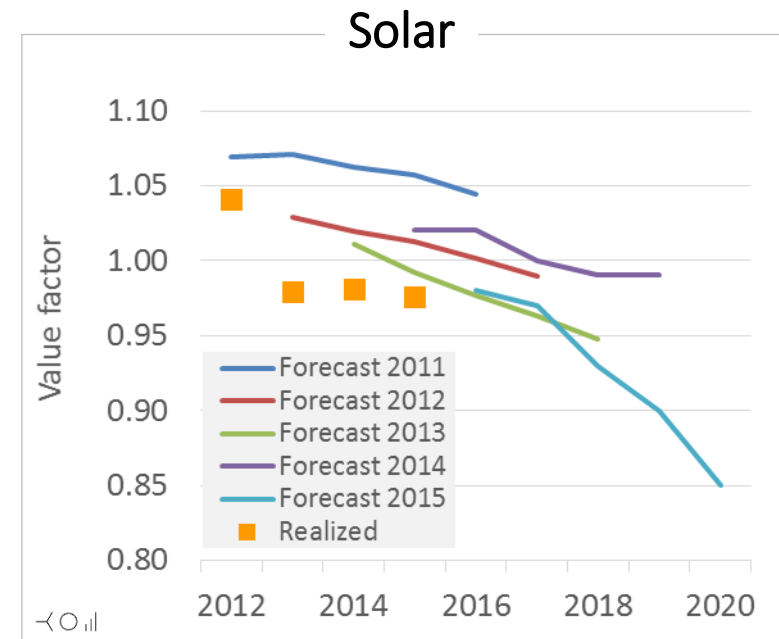
Neon analysis. Based on data from BMWi, AG Energiebilanzen, BDEW, BWE, BSW, IEA.

Both wind and solar power hit record low value factors in 2015: 0.98 for solar and 0.85 for onshore wind. [Read more.](#)

# Market value TSO projections: solar revised downwards



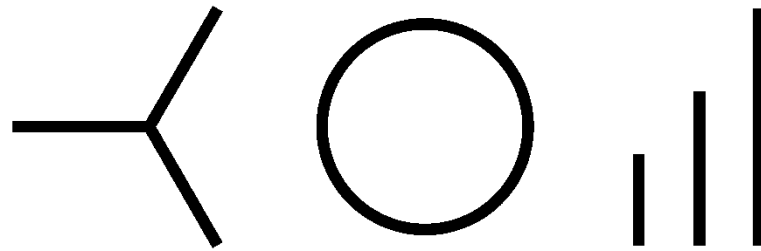
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The German TSOs project the market value of renewables (“EEG Mittelfristprognose”).

The latest updated included a swift downward revision for solar power. [Read more.](#)



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# On the economics of renewable power generation

## Economics of Electricity

Hirth, Lion, Falko Ueckerdt & Ottmar Edenhofer (2016): “Why Wind is not Coal: On the Economics of Electricity”, *The Energy Journal* (forthcoming). [www.feem.it/getpage.aspx?id=6308](http://www.feem.it/getpage.aspx?id=6308)

## Integration Costs

Hirth, Lion, Falko Ueckerdt & Ottmar Edenhofer (2015): “Integration Costs Revisited – An economic framework of wind and solar variability”, *Renewable Energy* 74, 925–939. <http://dx.doi.org/10.1016/j.renene.2014.08.065>

## Market Value

Hirth, Lion (2013): “The Market Value of Variable Renewables”, *Energy Economics* 38, 218-236. <http://dx.doi.org/10.1016/j.eneco.2013.02.004>

## Optimal Share

Hirth, Lion (2015): “The Optimal Share of Variable Renewables”, *The Energy Journal* 36(1), 127-162. <http://dx.doi.org/10.5547/01956574.36.1.5>

## System LCOE

Ueckerdt, Falko, Lion Hirth, Gunnar Luderer & Ottmar Edenhofer (2013): “System LCOE: What are the costs of variable renewables?”, *Energy* 63, 61-75. <http://dx.doi.org/10.1016/j.energy.2013.10.072>

## Market Value of Solar

Hirth, Lion (2015): “The market value of solar photovoltaics: Is solar power cost-competitive?”, *IET Renewable Power Generation* 9(1), 37-45. <http://dx.doi.org/10.1049/iet-rpg.2014.0101>

## Balancing Power

Hirth, Lion & Inka Ziegenhagen (2015): “Balancing power and variable renewables: Three links”, *Renewable & Sustainable Energy Reviews* 50, 1035-1051. <http://dx.doi.org/10.1016/j.rser.2015.04.180>

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