



Power System Challenges toward a 100 percent Renewables

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 **DANISH
ENERGY ASSOCIATION**

Content

- The ongoing green transformation of the energy system
- Challenges in the green transformation
- Important questions
- The really hard questions: Allocation of risk between society and investors

EU and National 2020 Renewables Targets

EU27: 20 percent

United Kingdom: 15 percent

France: 23 percent

Denmark: 30 percent

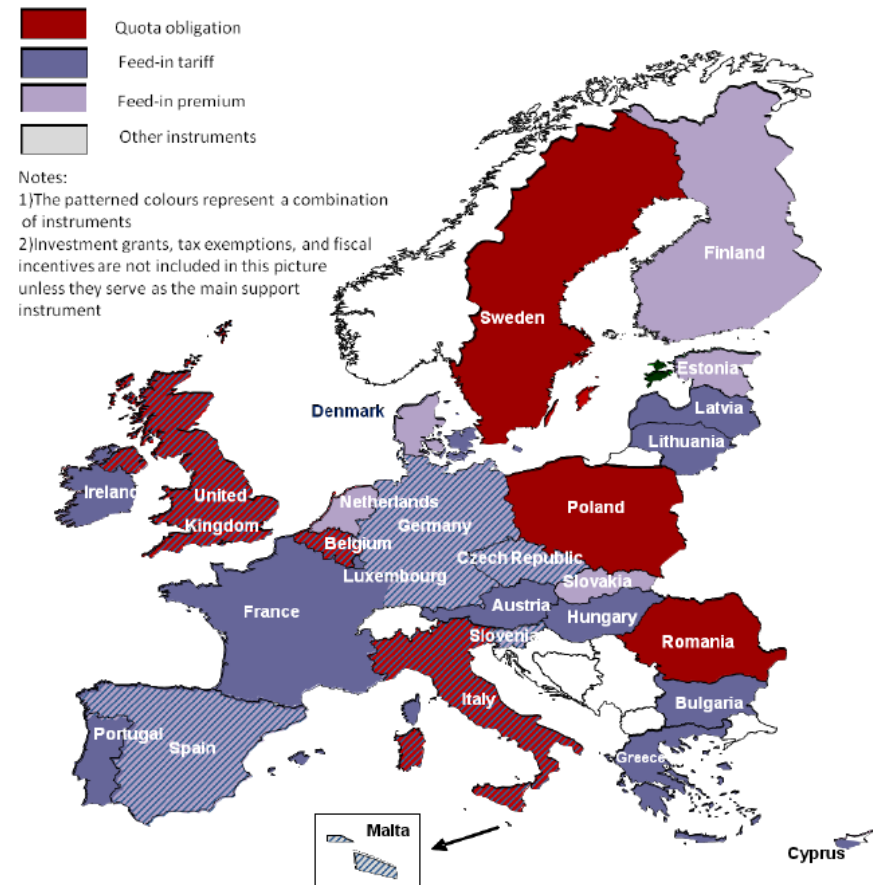
Spain: 20 percent

Germany: 18 percent

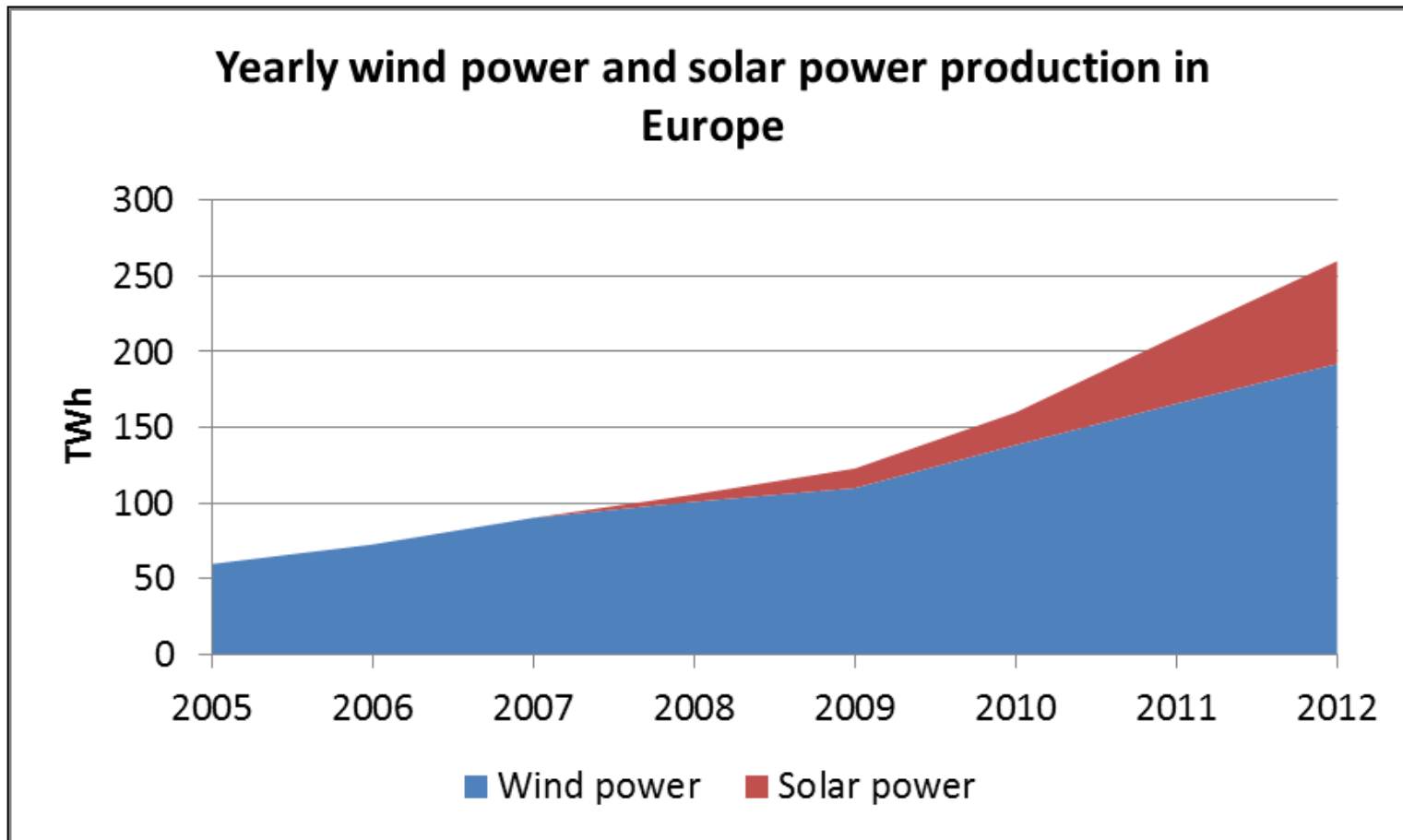
Portugal: 31 percent

Sweden: 49 percent

Renewables Scheme "Quilt"



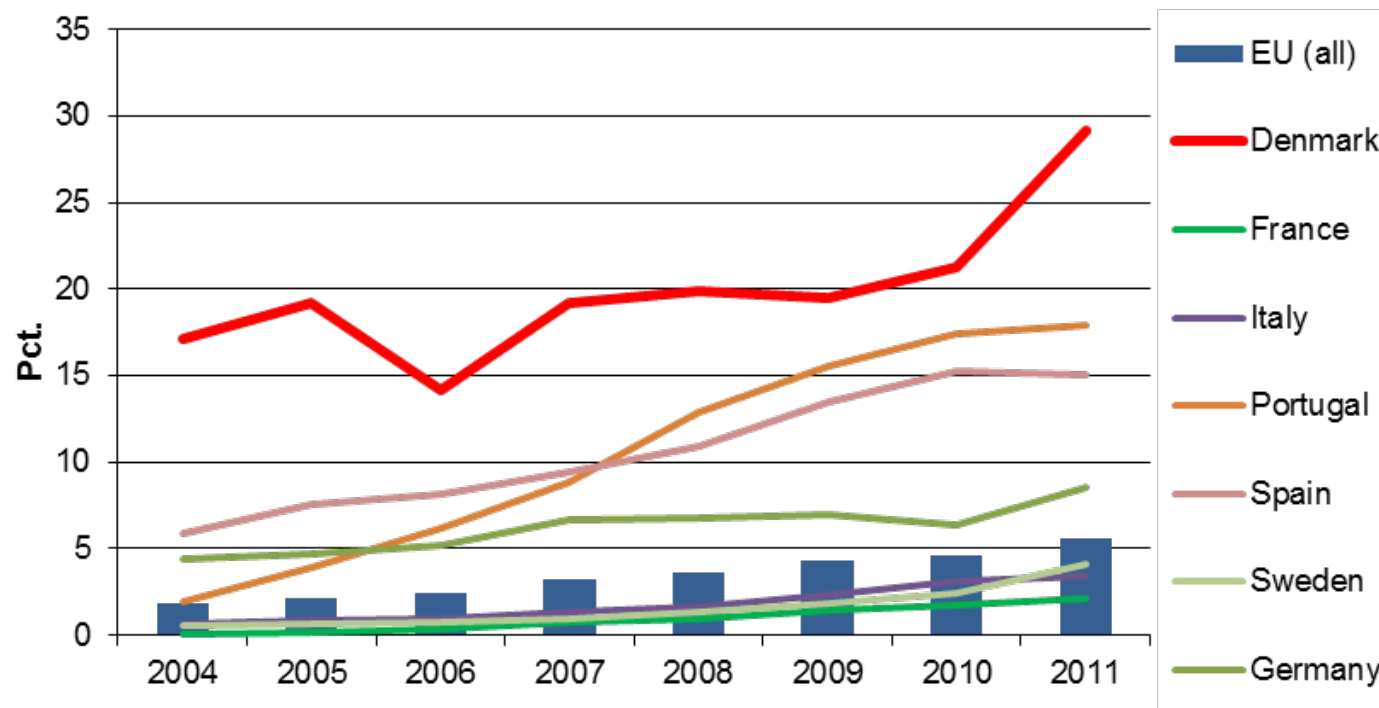
Green transformation of the European energy systems



Source: ENTSO-E data portal

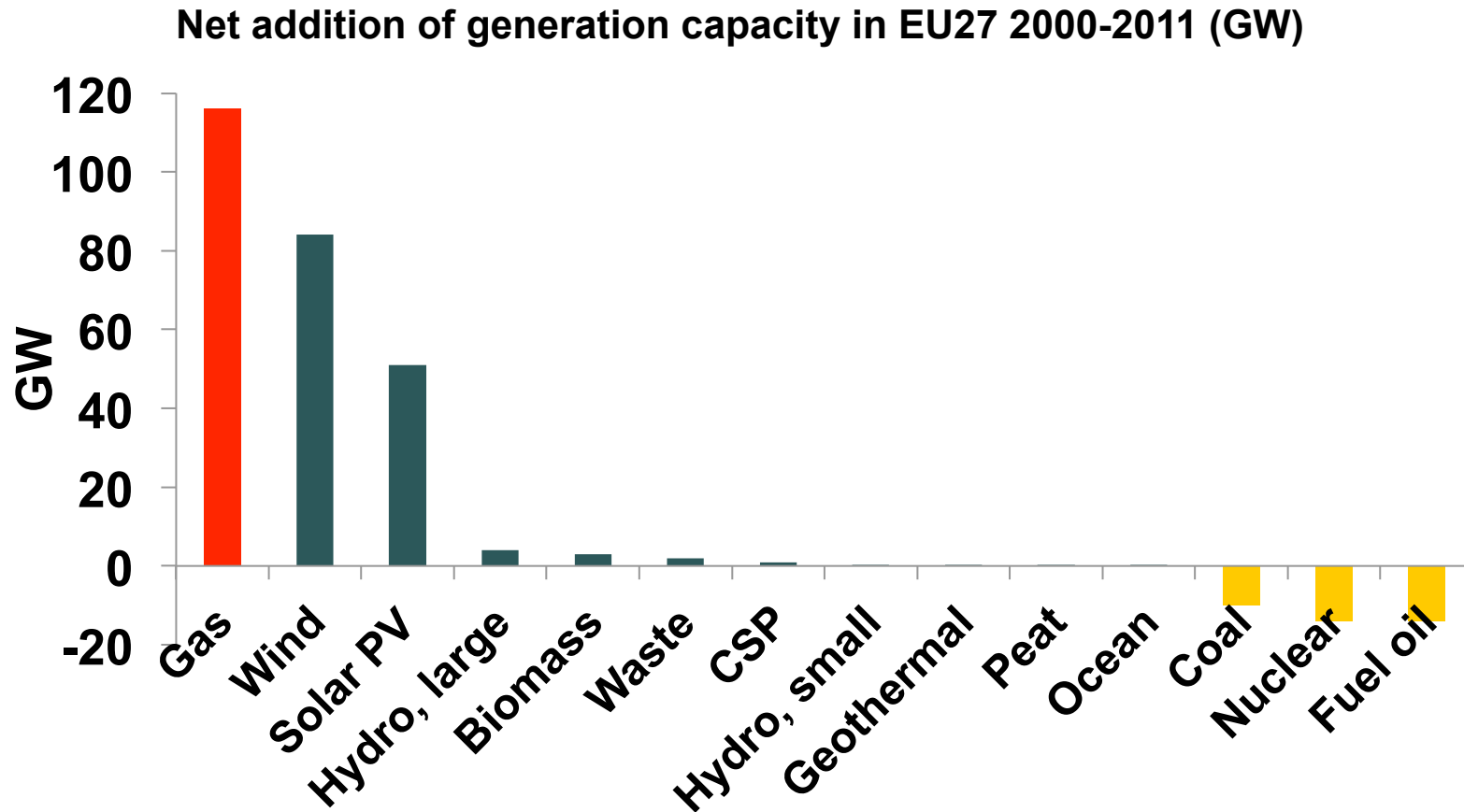
Green transformation of the European energy systems

Share of wind power (percentage) in the electricity consumption



Source: Eurostat: tabel nrg_100, nrg_1071a, nrg_1072a and own calculations

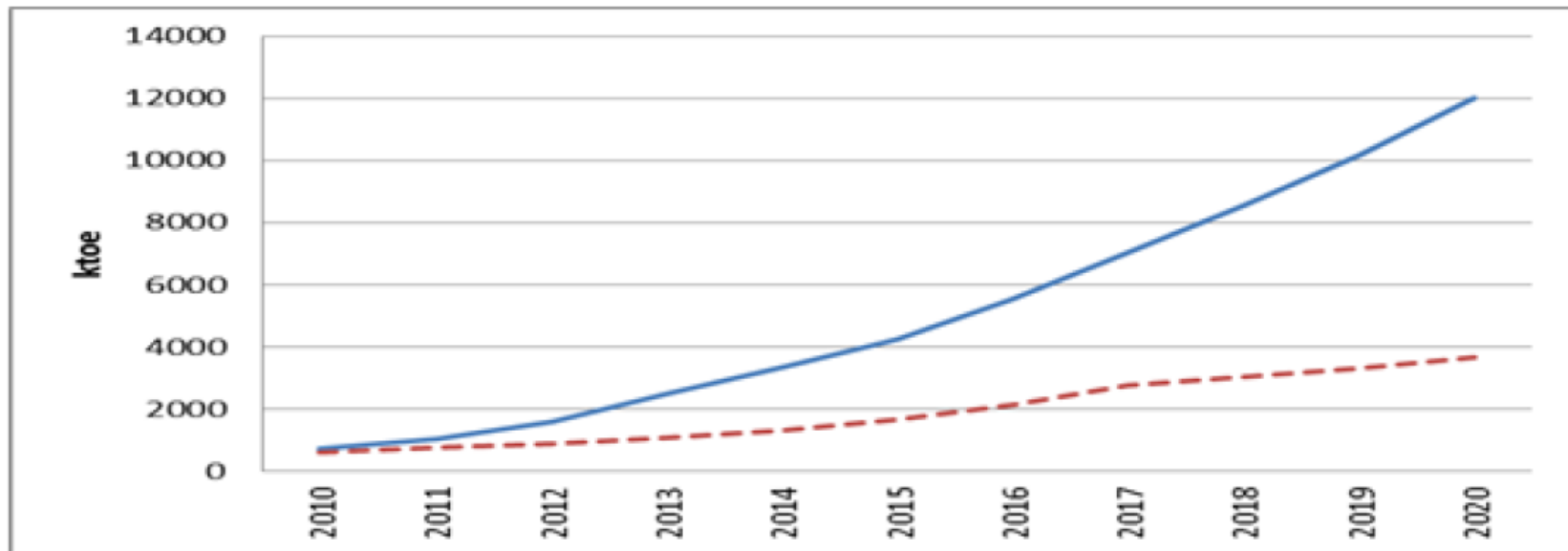
”The Healthy Investment Profile”



Kilde: EPIA og EWEA

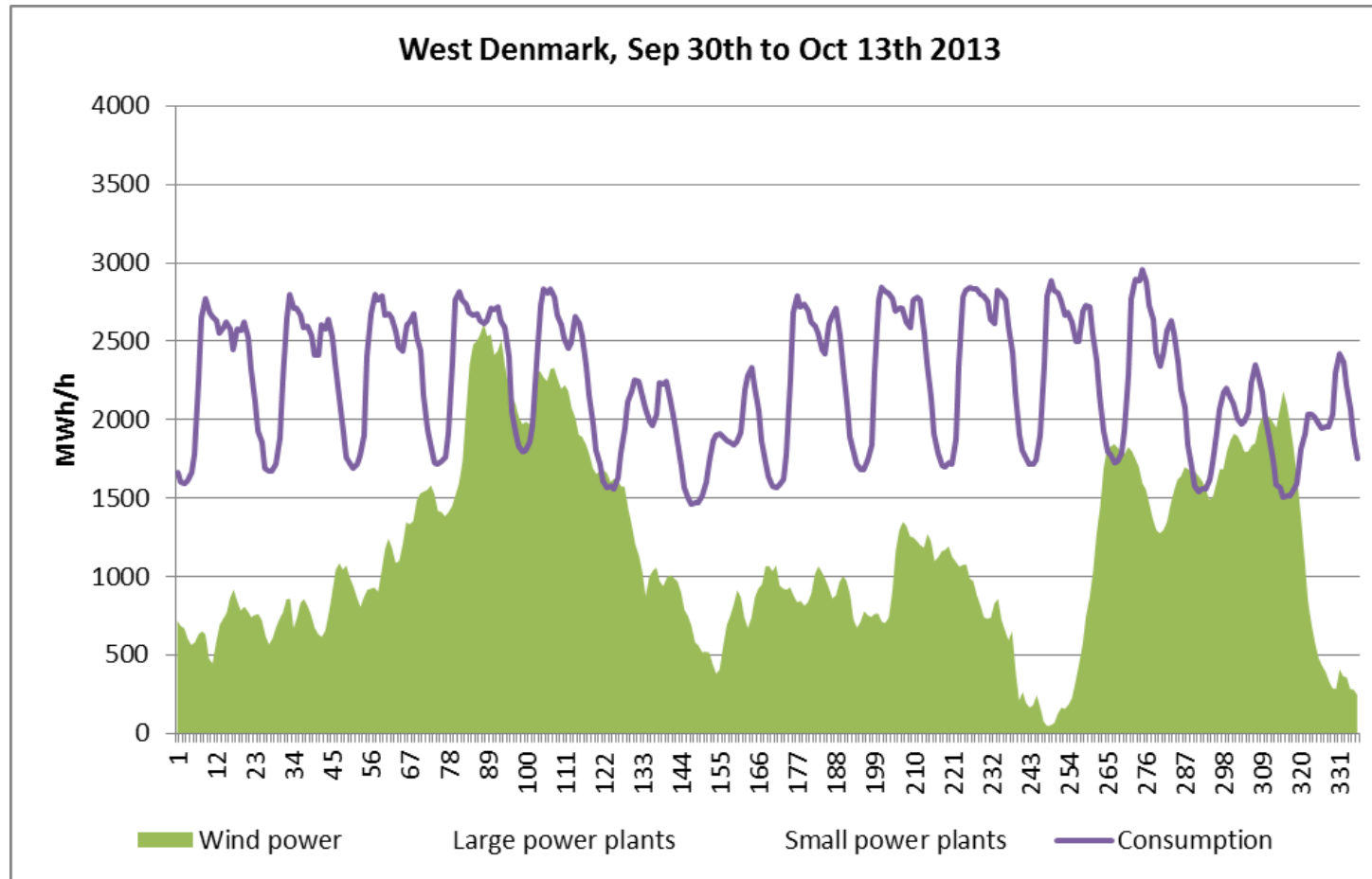
Are we on track in the EU?

Planned (blue) versus estimated (red/dotted) trend in EU offshore wind energy



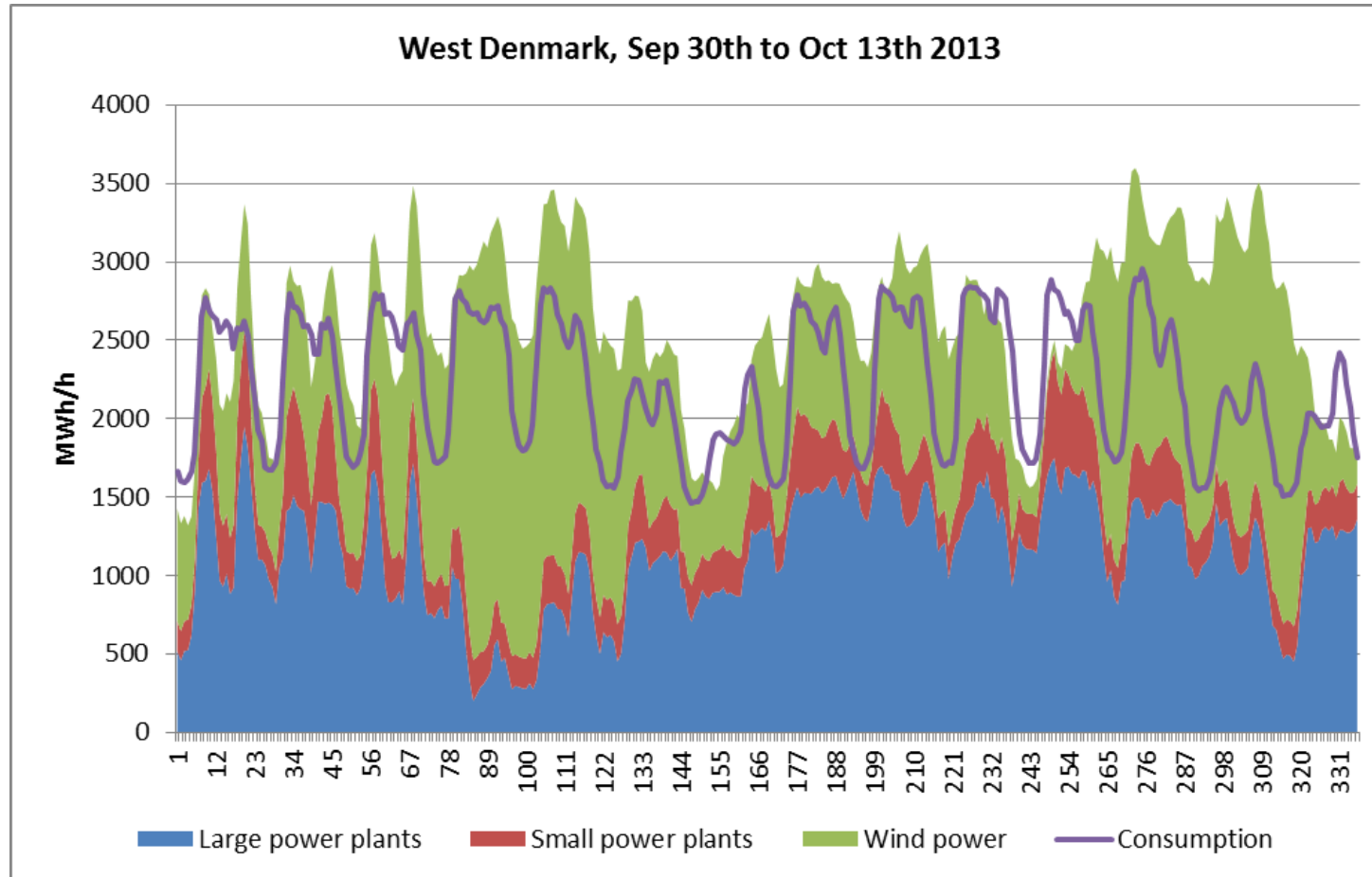
Source: European Commission, 2013 - Planned NREAPs

Challenges – intermittency of wind power



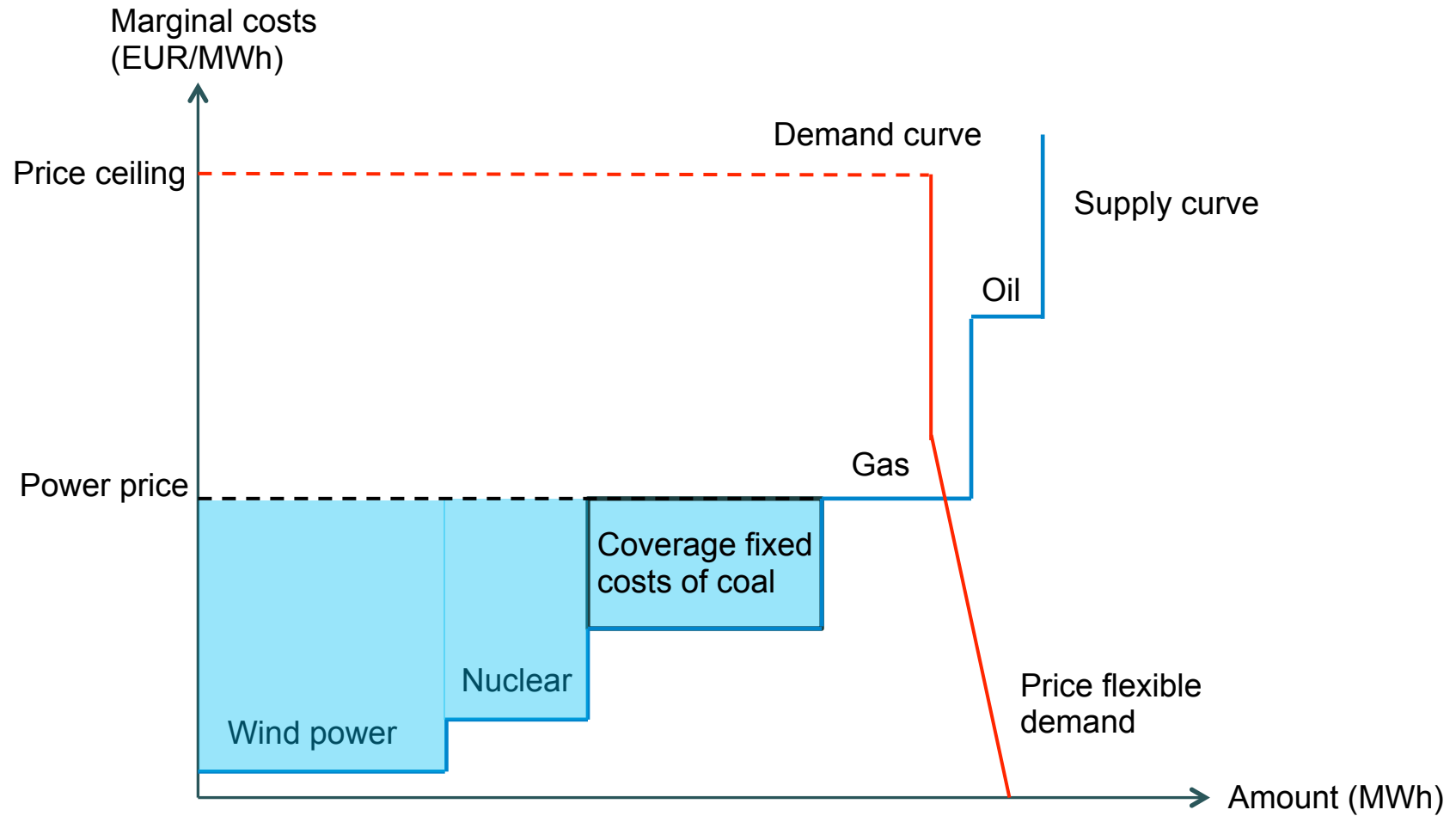
Source: Energinet.dk market data

Challenges – intermittency of wind power

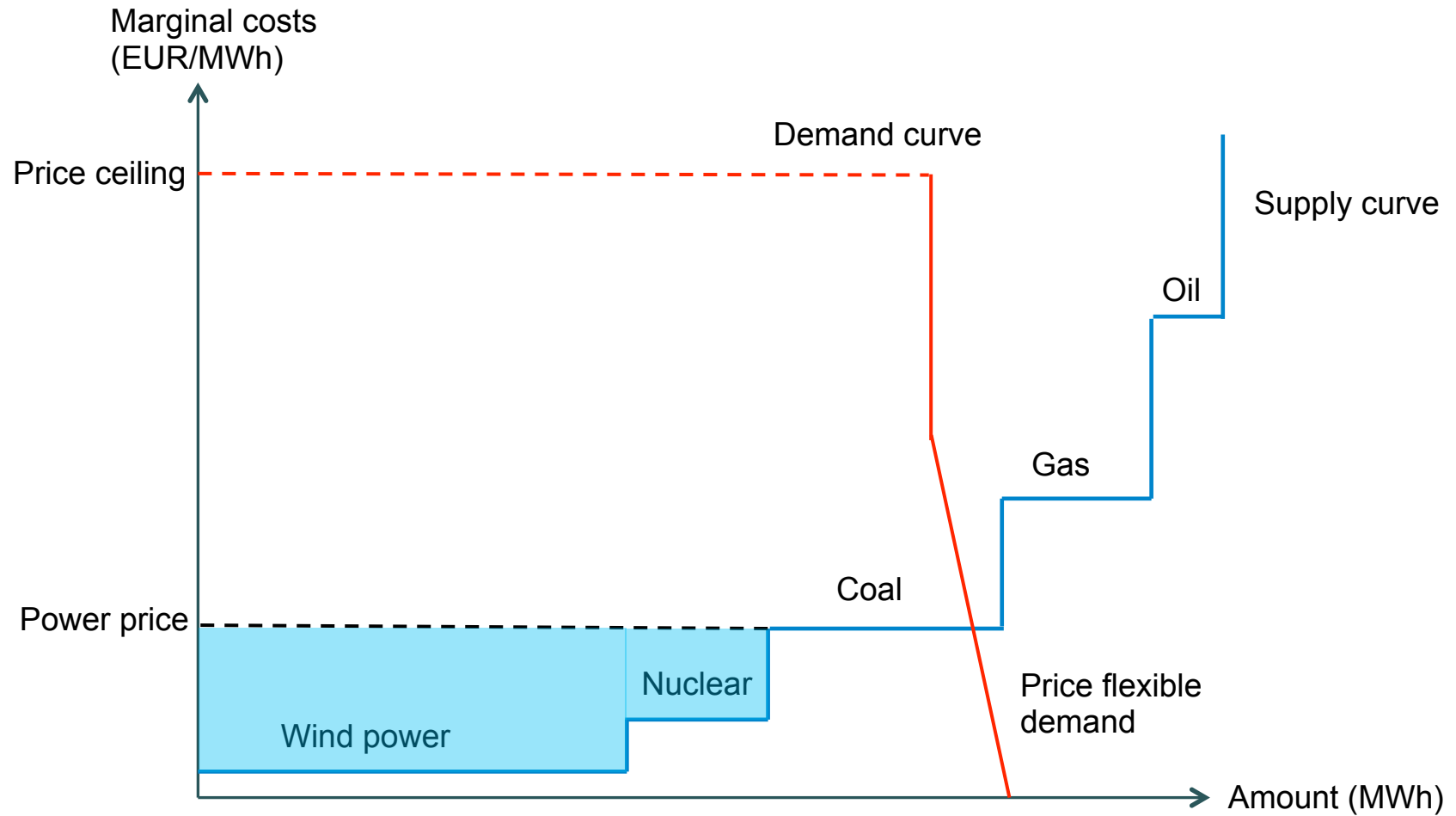


Source: Energinet.dk market data

Price formation in a day-ahead power market

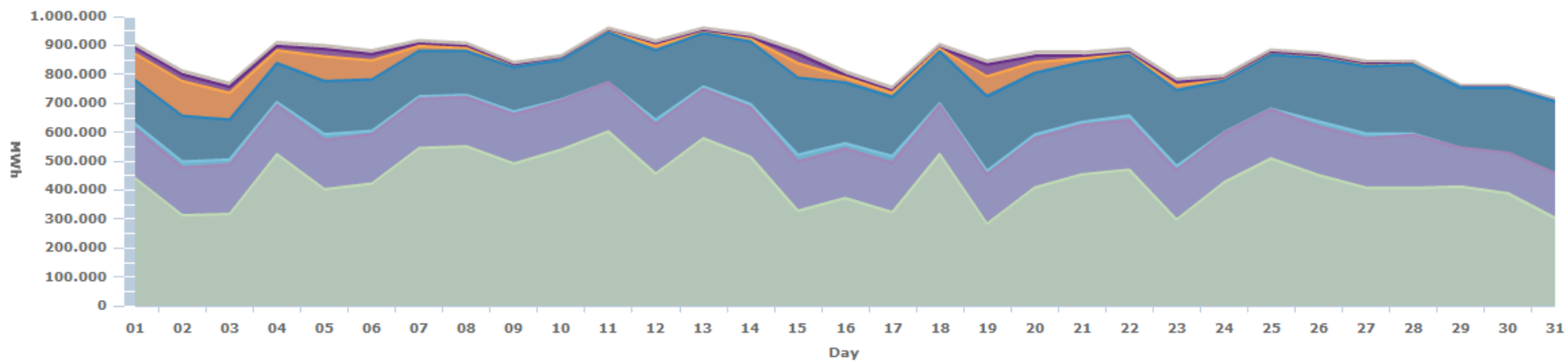


Price formation in a day-ahead power market

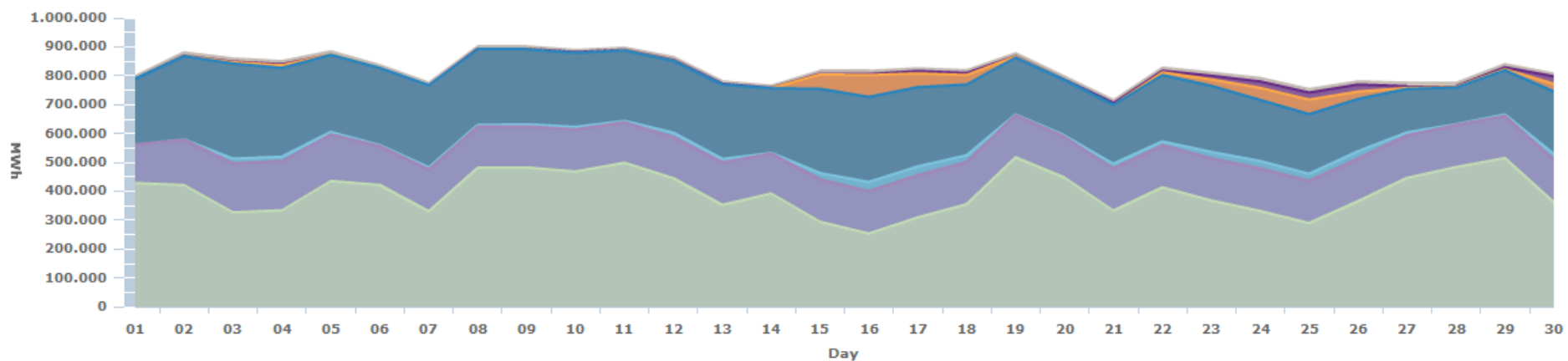


Coal and gas fired power plants are displaced

03/2013 - Daily power by technologies - System: MIBEL



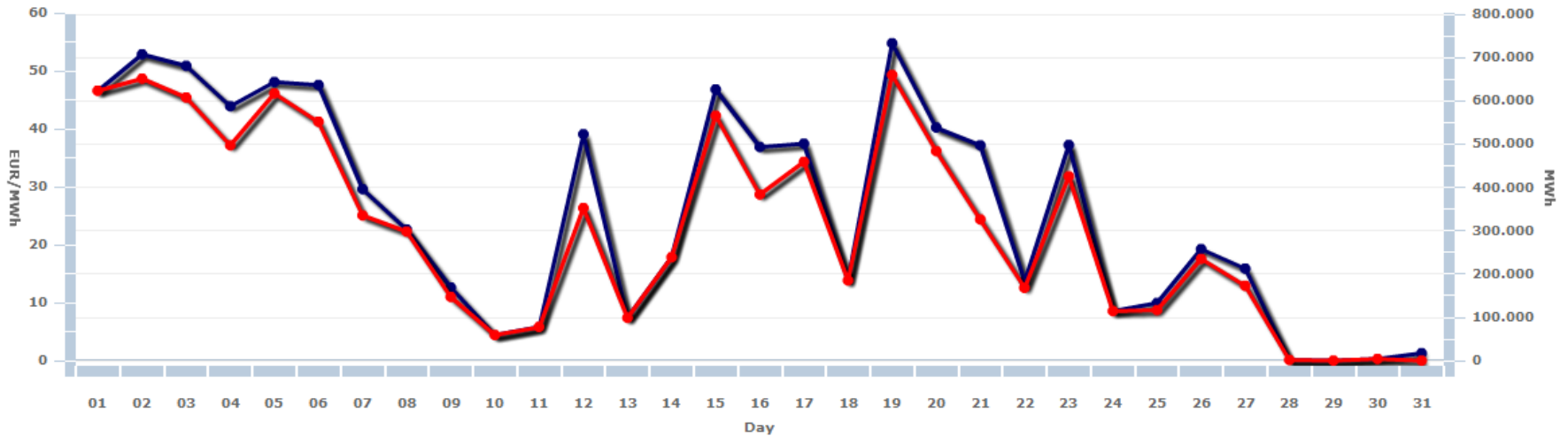
04/2013 - Daily power by technologies - System: MIBEL



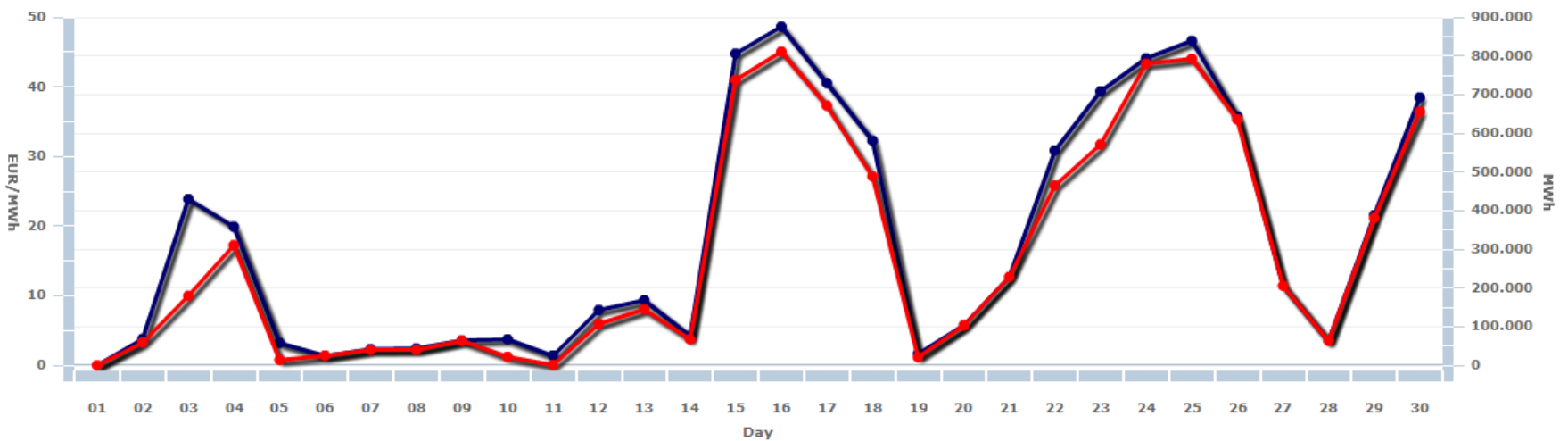
-  Special regime to market
-  Nuclear
-  Int. Exchanges
-  Hydroelectric
-  Coal
-  Combined cycle
-  Fuel oil-gas

Two weeks of power prices close to zero!

03/2013 - Daily market minimum, average and maximum price - System: MIBEL



04/2013 - Daily market minimum, average and maximum price - System: MIBEL

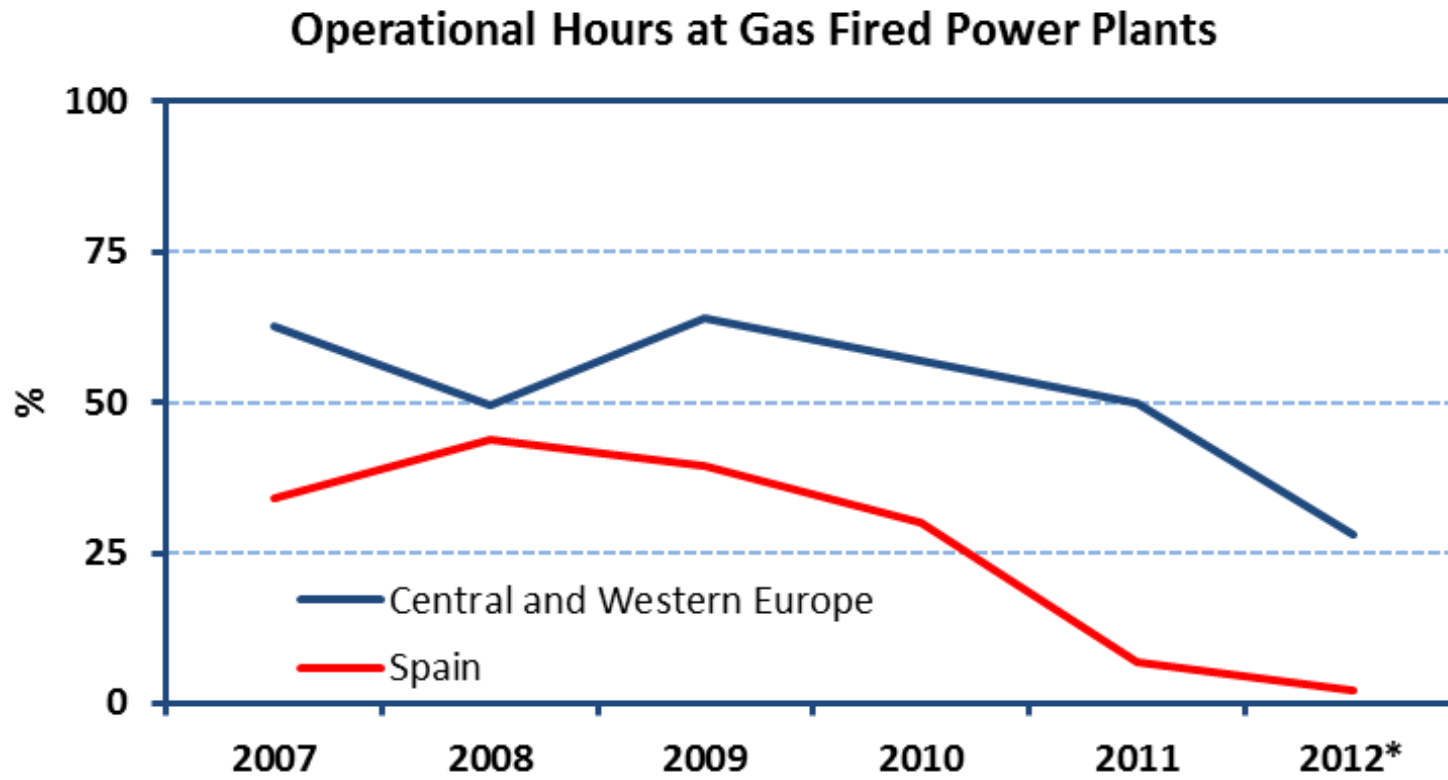


■ Spanish arithmetical average price
 ■ Portuguese arithmetical average price

The Perfect Storm

- Decreasing demand for power across Europe
- The global coal price drops
- The EU ETS Carbon Credit drops
- Introduction of intermittent renewables (wind and solar)

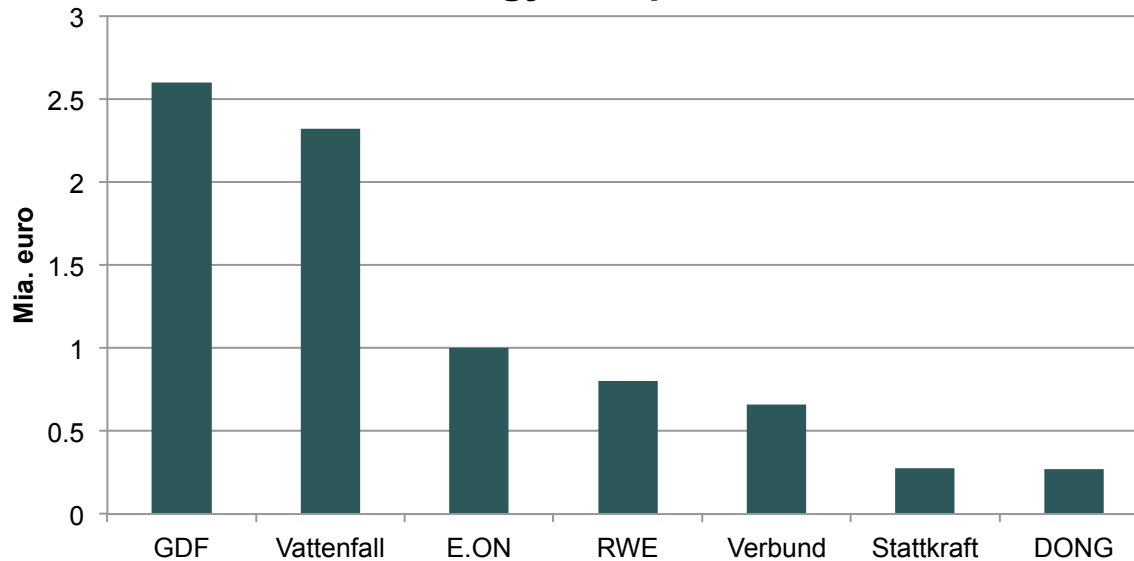
Gas fired power plants have gone bust.



Source: EURELECTRIC

Challenges - Lower earnings of traditional power producers

Impairments of coal and gas power plants of selected Energy companies in 2012



Source: Announcements from the companies, Reuters and different market analyses
E.ONs relatively small impairments in 2012 might be explained by very high impairments in 2011

Stort fald i DONG-resultat

Berlingske Business, 10. august 2012

Slut på en epoke: Danmark mister 250 decentrale kraftværker

Ingeniøren, 28. januar 2013

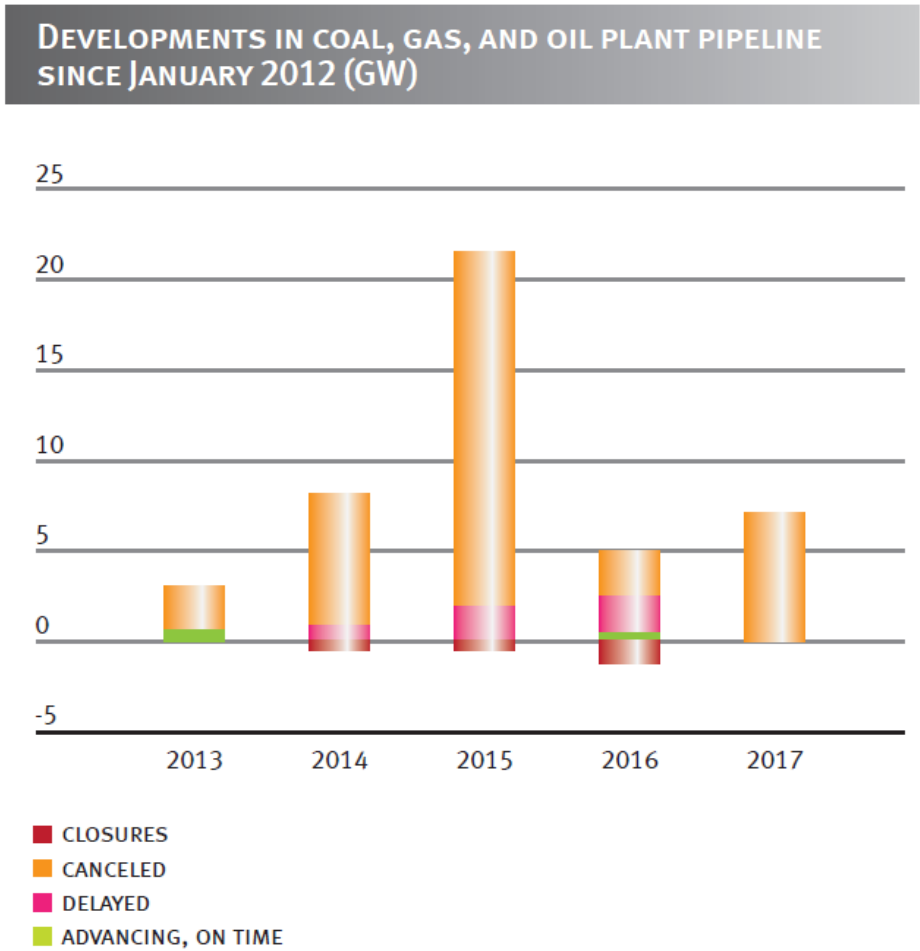
Vattenfall i Danmark skal skrumpes til en fjerdedel

Energiwatch, 23. juli 2013

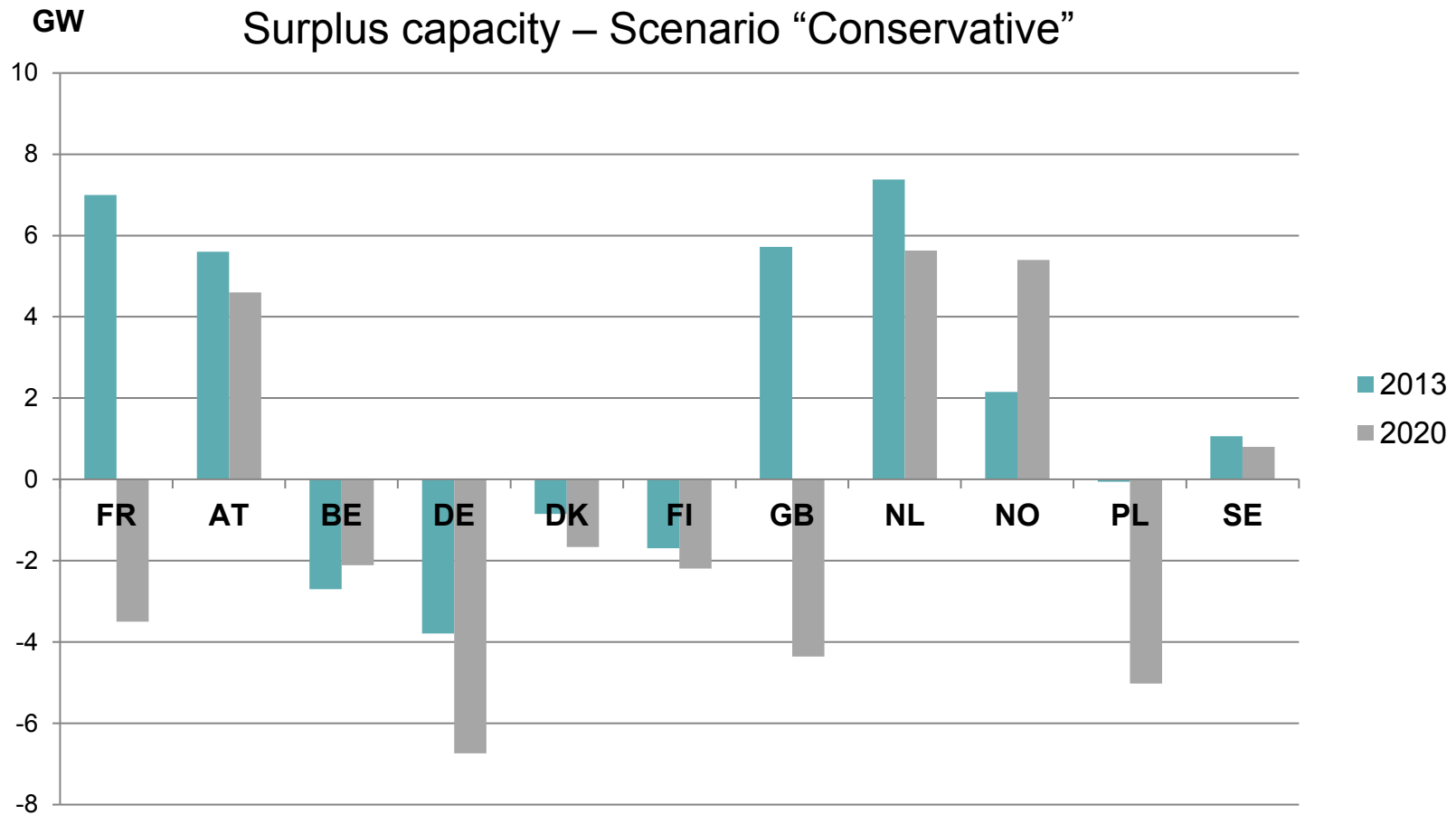
E.ON vil sende kraftværker ud af Europa

Energiwatch, 26. juli 2013

Investments are on hold!

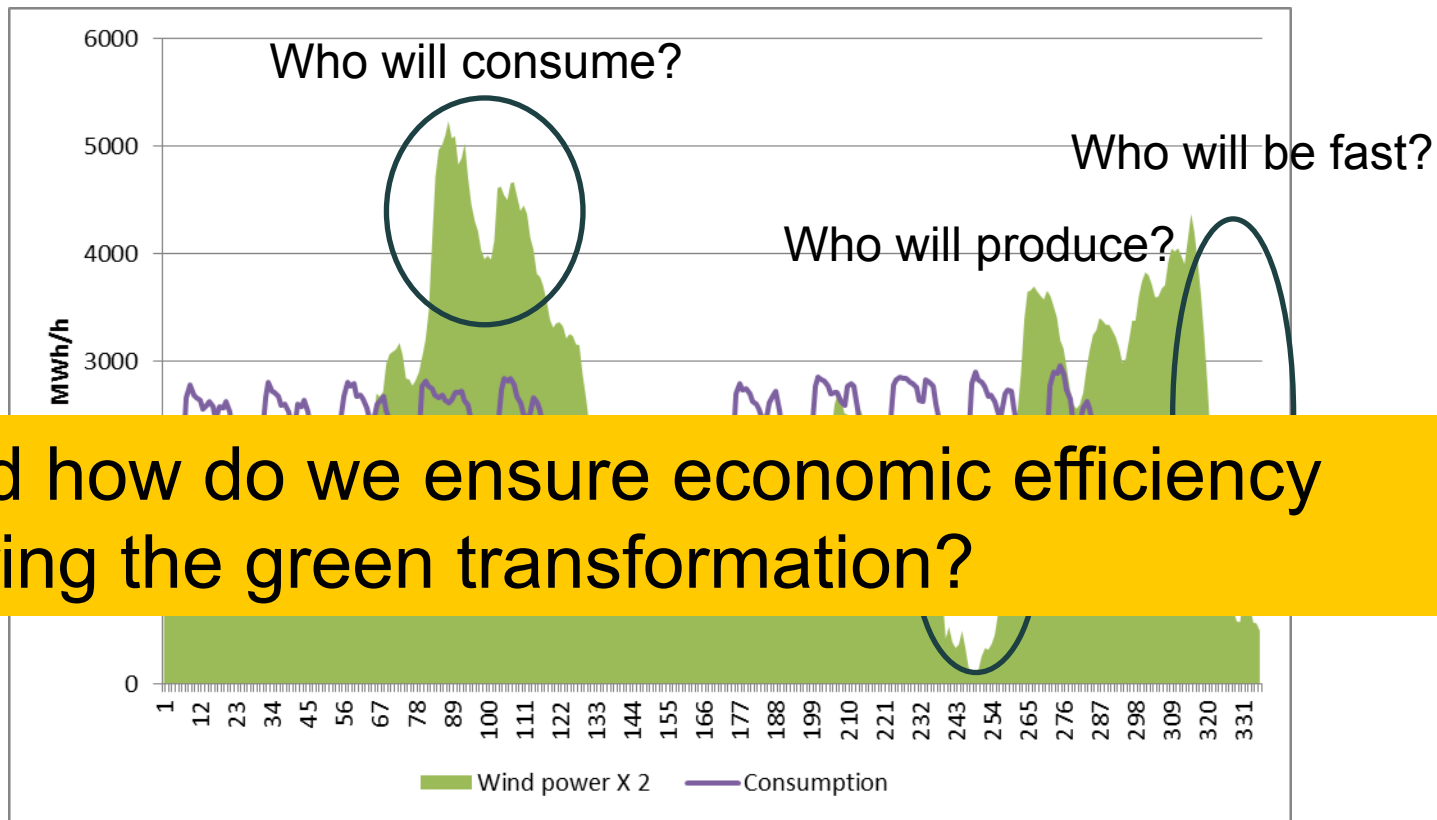


Challenges - Development in power production capacity balances



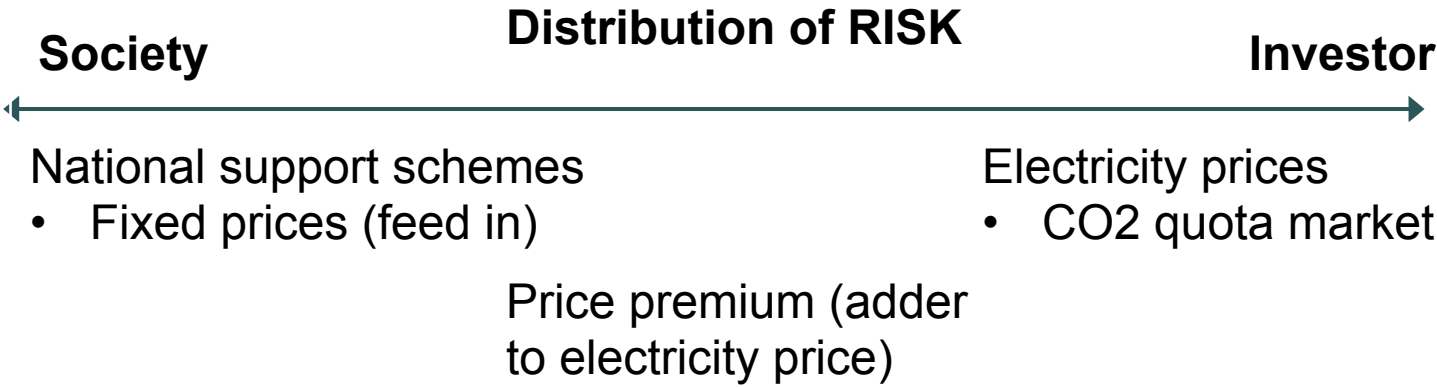
Source: ENTSO-E Scenario Outlook and Adequacy Forecast 2013-2030

Important questions – power systems with large shares of wind and solar power



Policy making: Allocation of risk between society and investor

- Ensuring economic framework conditions allowing for build-out of **renewable power production**



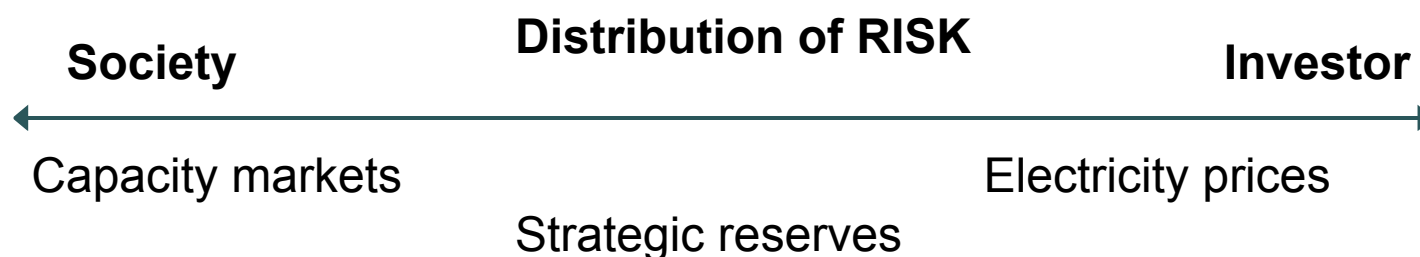
Introduce low carbon technologies and stir innovation:

Increased investor uncertainty → Increased risk premiums

Lack of competition → Too little incentive to reduce costs

Policy making: Allocation of risk between society and investor

- Ensuring economic framework conditions allowing for build-out of future **thermal power production**



Linking national energy only markets together with a variety of different capacity mechanisms.