Cornerstones of a Successful European Energy Transition

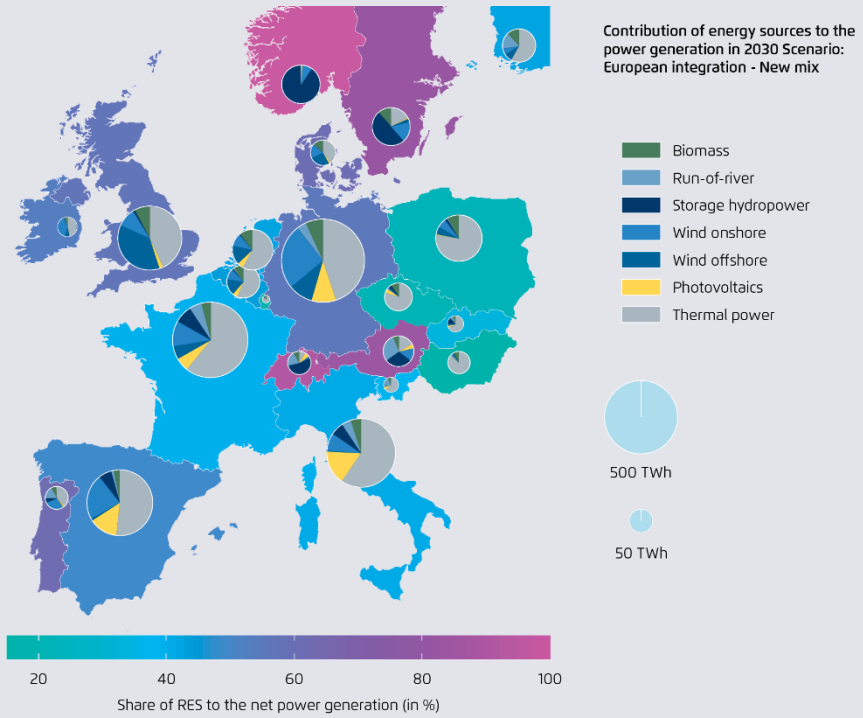
Key reform elements in the power sector

Matthias Buck

COPENHAGEN, 7 OCTOBER 2016

What do Europe's 2030 climate and energy targets imply for the power sector?
(1) A share of 50% RES in its power mix

RES-E share in the EU generation mix 2030



Fraunhofer IWES (2015): Assumptions based on national energy strategies and ENTSO-E scenarios in line with EU 2030 targets

RES-E are key for EU's 2030 strategy:

- EU's 2030 climate target of -40% THG below 1990 puts power sector in centre: Emissions are to reduce by 65% by 2030 compared to 1990*
- EU's RES target of 27% by 2030 will largely be delivered by power sector, as biofuels and RES heating sources are limited

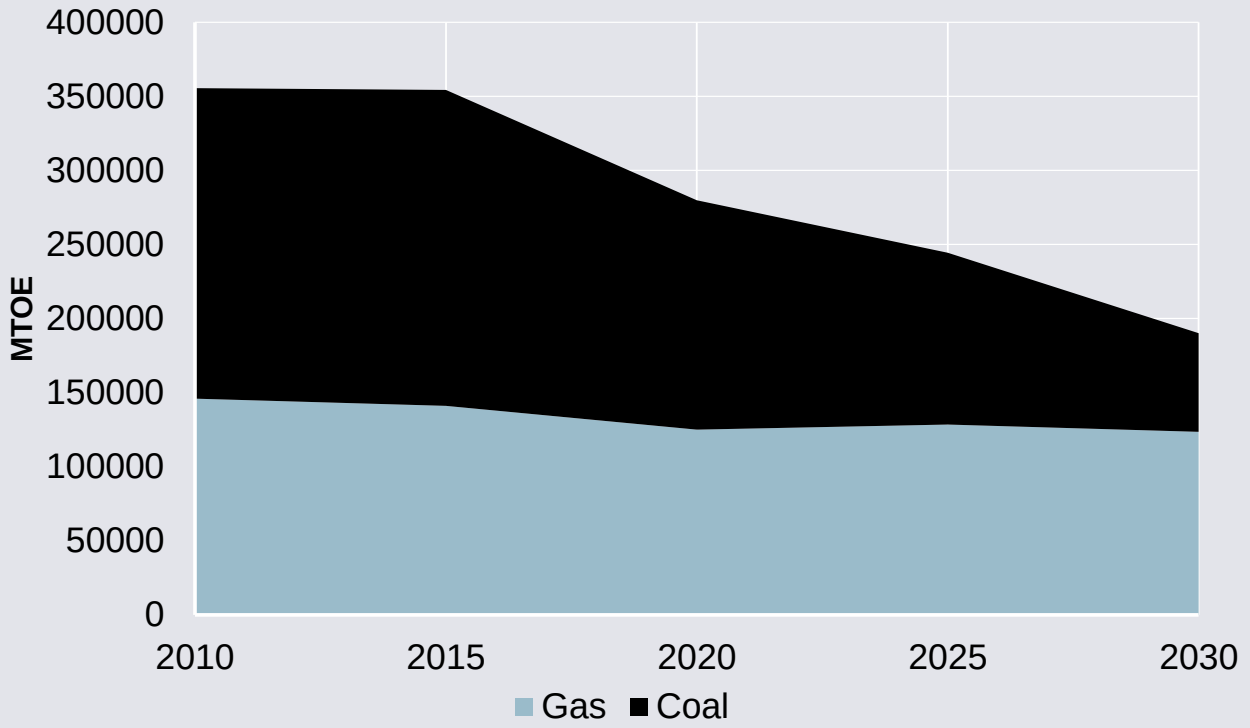
Thus, EU 2030 climate and energy targets imply

- 50% Renewables in the power mix
- 30% Wind and Solar in the power mix

(* EU Commission (2011): Impact Assessment on EU 2050 Energy Roadmap, „Diversified supply technologies scenario")

What do Europe's 2030 climate and energy targets imply for the power sector?
(2) A decline of 68% of coal use in power generation

Actual and projected coal use in EU power generation



EU Commission (2011): Impact Assessment on the 2050 Energy Roadmap

A decline of coal use in power generation is key for the EU's 2030 strategy:

- → Power sector emissions are to reduce by 65% by 2030 compared to 1990
- → In 2015, ~ 3/4 of total CO_2 emissions stem from coal- and lignite-fired power plants, although these make up only 1/4 of total EU power generation

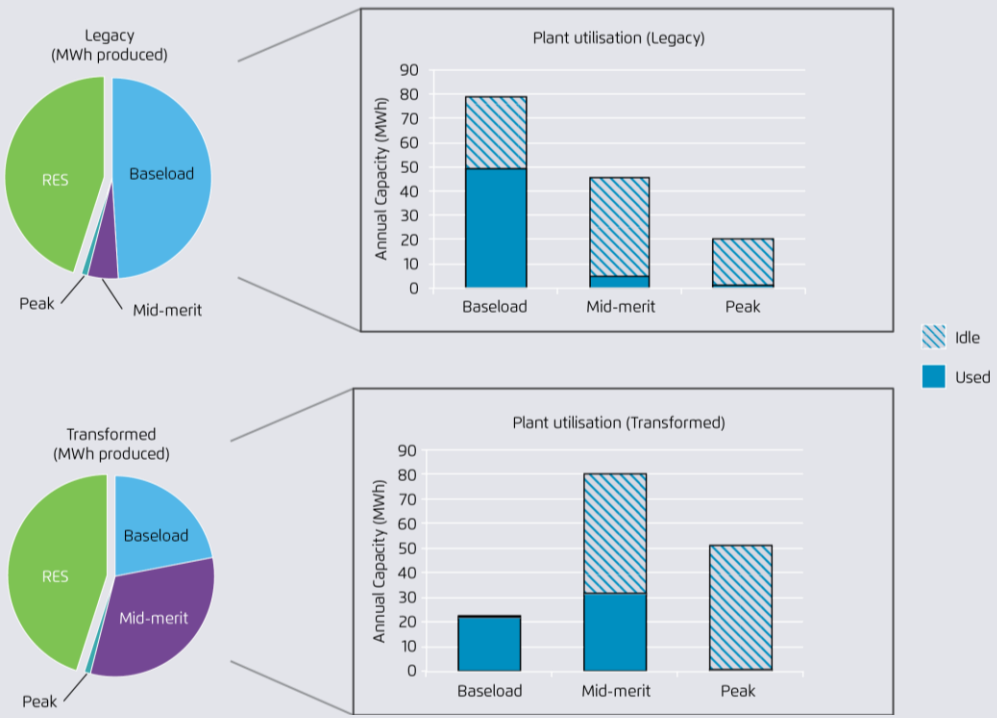
Thus, EU 2030 climate and energy targets imply for coal power production

- → Minus 68% of coal use in power generation*
- → Decomissioning of roughly half of the coal fleet

(* EU Commission (2011): Impact Assessment on EU 2050 Energy Roadmap, „Diversified supply technologies scenario")

What do Europe's 2030 climate and energy targets imply for the power sector?
(3) Transition to more flexible mix

Impact of thermal plant mix on plant utilisation rates and investments in a 45% RES-E system



RAP (2014) based on IEA (2014)

***Increasing* share of *flexible* resources and *decreasing* share of *inflexible* resources should go hand in hand with a growing share of variable renewables**

- → If mix remains essentially unchanged during transition all power plants have lower utilisation rates compared with shift to more flexible capacity mix
- → 40% less investment required if capacity mix is transformed towards greater flexibility
- → In transformed scenario all market participants are economically better off
- → System adequacy ensured at lower cost in a "transformed mix"

Which market design will get us cost-effectively to a 2030 power system with 50% RES-E, -68% coal and a flexible mix?

Market design based on simple textbook economics

Energy-only market, System adequacy through peak pricing

Emissions Trading (with CO_2 price reflecting social cost of carbon, i.e. > 60 EUR/t)

Agora Energiewende (2016): The Power Market Pentagon

Energy-only markets increasingly complemented by out-of-market mechanisms

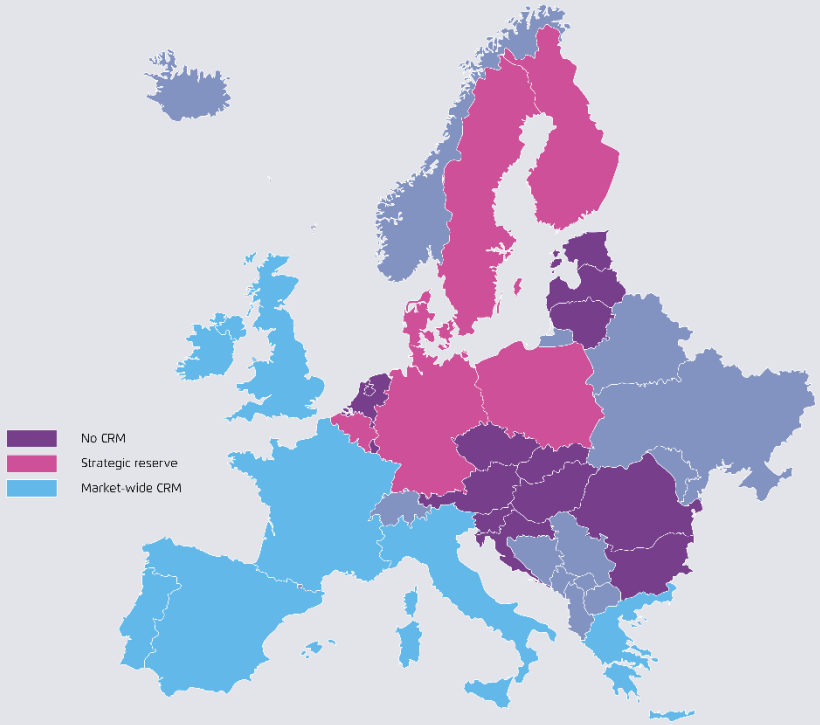
Market design based on simple textbook economics

Energy-only market, System adequacy through peak pricing

Emissions Trading (with CO_2 price reflecting social cost of carbon, i.e. > 60 EUR/t)

Agora Energiewende (2016)

Capacity mechanisms in the EU 2015



Agora Energiewende (2016) based on ACER/CEER (2015)

Huge CO_2 allowance surplus in EU ETS will keep CO_2 prices well below 30 EUR/t for another 15 years

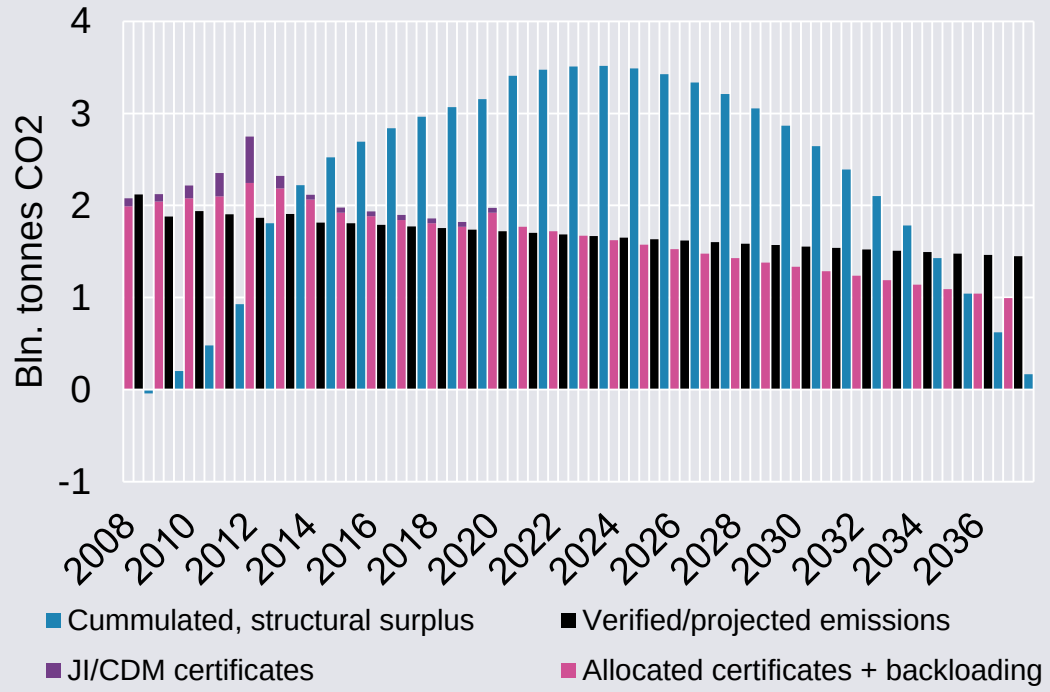
Market design based on simple textbook economics

Energy-only market, System adequacy through peak pricing

Emissions Trading (with CO_2 price reflecting social cost of carbon, i.e. > 60 EUR/t)

Agora Energiewende (2016)

Cumulated allowance surplus in the EU Emissions Trading System



Agora Energiewende (2016)

Which market design will get us cost-effectively to a 2030 power system with 50% RES-E, -68% coal and a flexible mix?

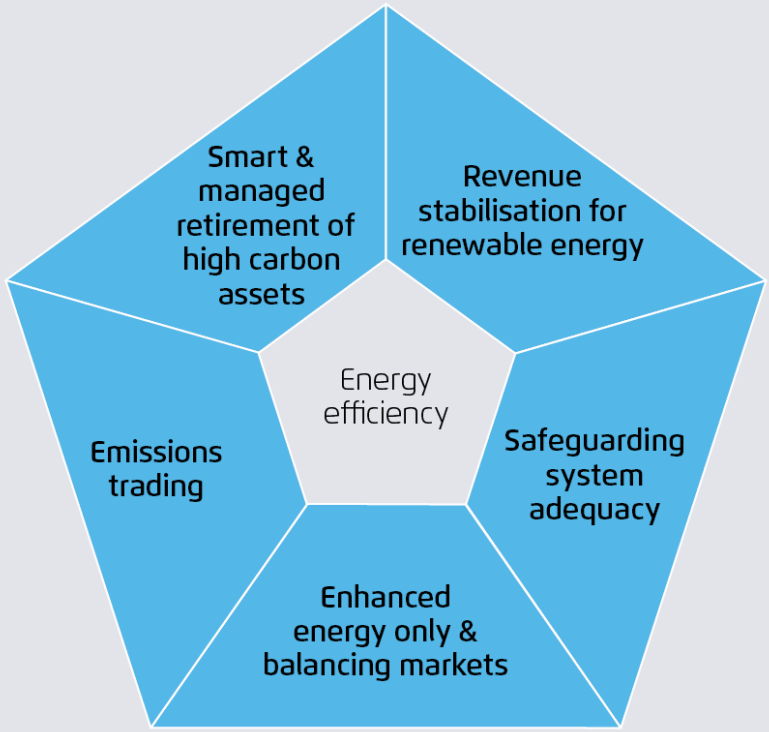
Market design based on simple textbook economics

Energy-only market, System adequacy through peak pricing

Emissions Trading (with CO_2 price reflecting social cost of carbon, i.e. > 60 EUR/t)

Agora Energiewende (2016): The Power Market Pentagon

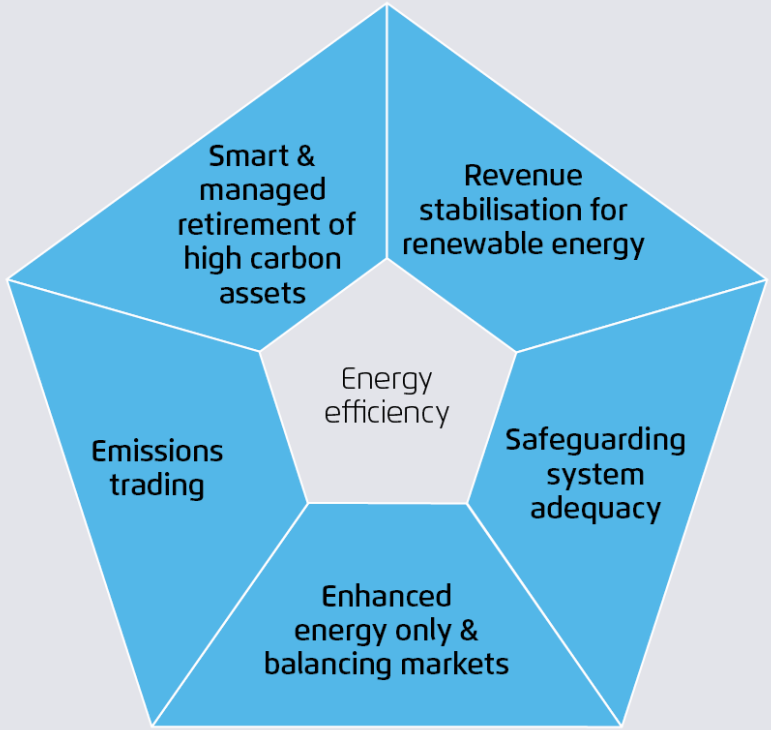
The Power Market Pentagon



Agora Energiewende (2016)

A market design that fits:
EU-level provisions on EOM, ETS, Smart retirement, RES-E revenue stabilisation and System adequacy safeguards

The Power Market Pentagon



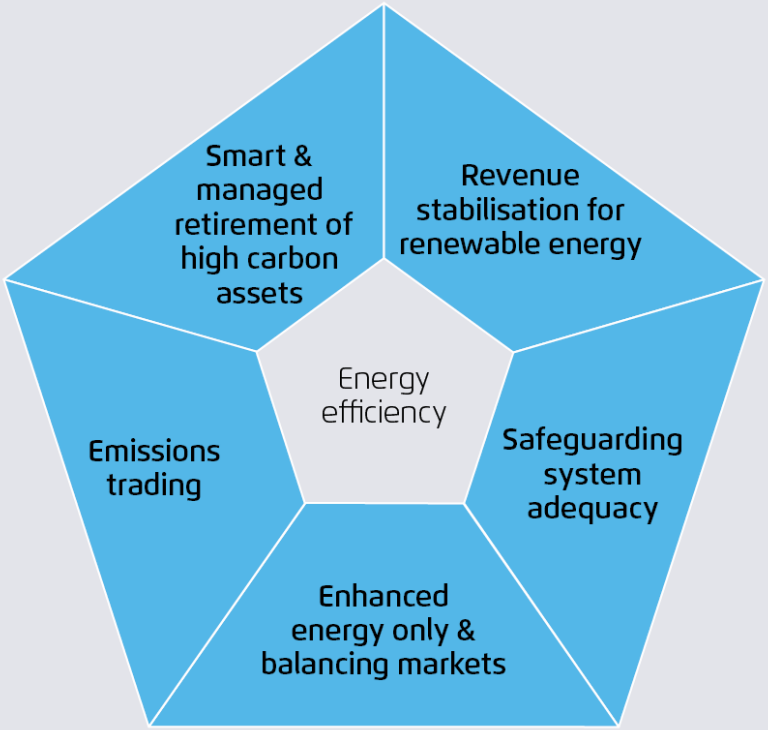
Agora Energiewende (2016)

Real-life constraints of EOM and ETS require broading of perspective and consideration of policy interactions:

- → Refining EOM design is no-regret, but reaches limits due to old, high carbon, inflexible capacity in legacy mix
- → Smart retirement of old, high-carbon, inflexible capacity is prerequisite for market design reform to be fully effective
- → Reformed ETS will not deliver smart retirement, but must complement it
- → Reformed ETS will not close revenue gap for RES-E investments
- → De-risking RES investments could make RES electricity cheaper than coal
- → System adequacy safeguards must be consistent with RES-E integration and retirement of high-carbon assets

The real-life challenge: Designing the elements of the Power Market Pentagon so that they are mutually supportive and do not contradict each other

The Power Market Pentagon



Agora Energiewende (2016)

Things *not to do* include:

- → Introduce a capacity market which grants money to high-carbon & inflexible assets
- → Reform the ETS under the assumption it would enable full refinancing of RES-e
- → Enhance the energy-only market without letting demand side and RES-e fully participate in the balancing markets and implementing smart retirement policies
- → Redesign renewables remuneration mechanisms without taking their effects on the energy-only market into account, **…**

Think of market design in a holistic way, combining all five elements sensibly!

More information and studies available at our website www.agora-energiewende.org

Agora Energiewende
Rosenstraße 2
10178 Berlin

T +49 (0)30 284 49 01-00
F +49 (0)30 284 49 01-29
@ info@agora-energiewende.de

Please subscribe to our newsletter via
www.agora-energiewende.de
www.twitter.com/AgoraEW

Thank you for your attention!

Questions or Comments? Feel free to contact me:

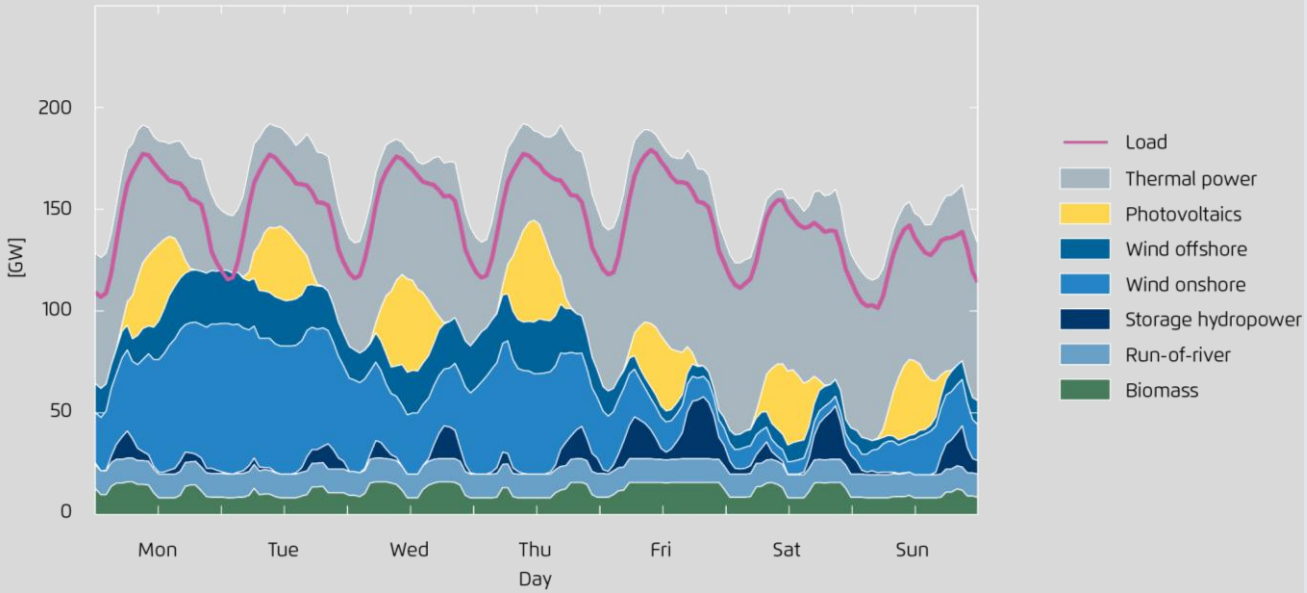
matthias.buck@agora-energiewende.de

Agora Energiewende is a joint initiative of the Mercator Foundation and the European Climate Foundation.

Back-Up Slides

Element 1: Enhanced energy-only and balancing markets to manage the flexibility challenge

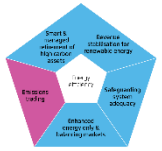
Electricity generation* and consumption* in the CWE region in a week in late summer 2030 (calendar week 32)



Fraunhofer IWES (2015)

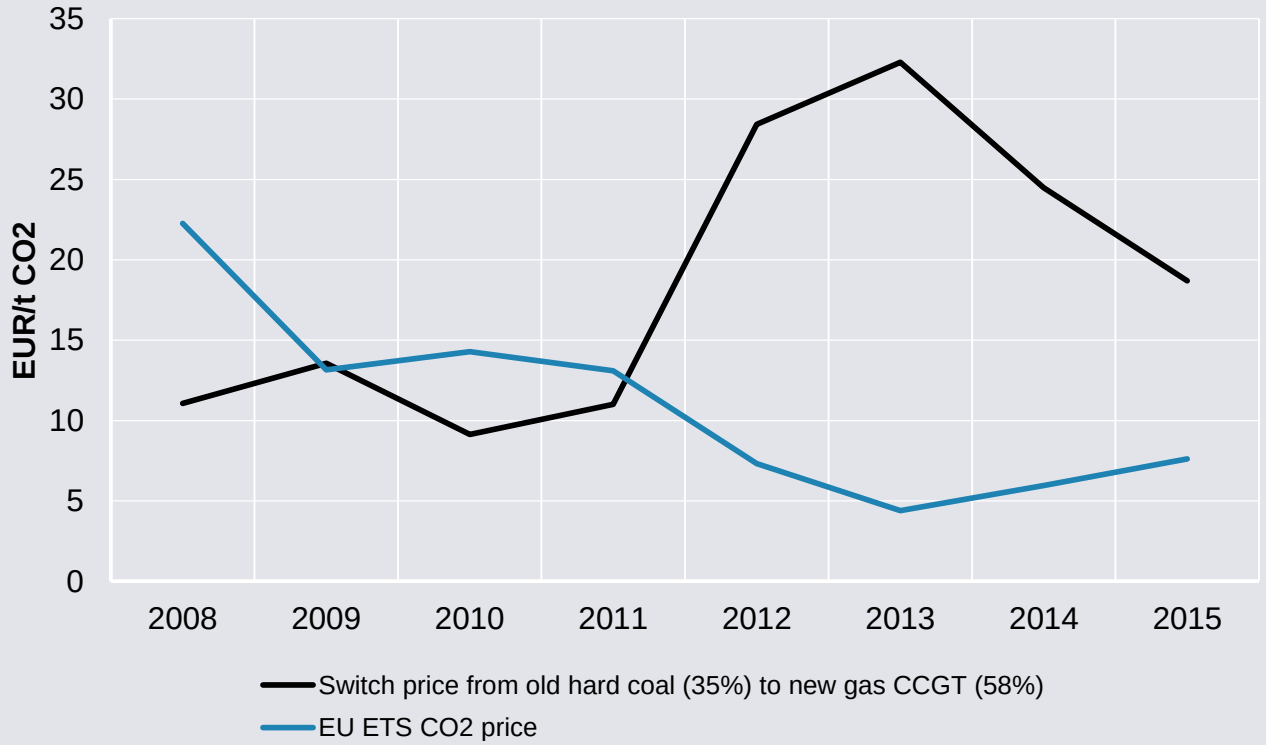
*Modelling based on 2011 weather and load data

- → Power market has to become highly flexible for continuous interplay between generation, consumption and storage
- → Efficient dispatch requires <u>power prices reflecting real-time value of electricity</u>. Key features of market design:
  - Coupling energy markets and making them faster;
  - Improving predictability of scarcity prices;
  - Enable level-playing field for demand-side and supply side flexibility;
  - Balancing market design (products, contracting of reserves) must not distort incentives for energy market operations
  - Linking day-ahead, intraday and balancing markets to achieve prices that reflect real-time value of power



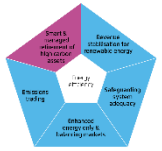
Element 2: The EU Emissions Trading Scheme should provide a stable mid-level carbon price (~30 EUR/t CO2)

Comparison of the hard coal-to-gas CO_2 switching price* and the actual CO_2 price in the EU-ETS



BAFA, DEHSt, EEA, Lazard, Federal Statistical Office Germany, UBA, own calculations. *Assuming an electrical efficiency of 35% for (old) hard coal plants and 58% for (new) gas-fired plants.

- → Main role of ETS in power sector: Shift fossil generation mix from high- to lower-carbon
- → ETS not right instrument to drive investments in zero-carbon assets like renewables
- → ETS cap must interact smartly with CO_2 reductions from other climate instruments (RES, EE and smart retirement policies) and should enable national climate policies
- → Key measures for EU policies:
  - Cancellation mechanism for additional domestic or EU climate policy measures
  - Stabilisation of ETS price through carbon floor price (e.g. 30 EUR/t CO_2)
  - Cancellation of EU ETS surplus as part of EU's contribution to Post-Paris-ratcheting-up mechanism



Element 3: Smart & managed retirement – The active removal of old, high carbon, inflexible capacity

Coal power plant

Fotolia

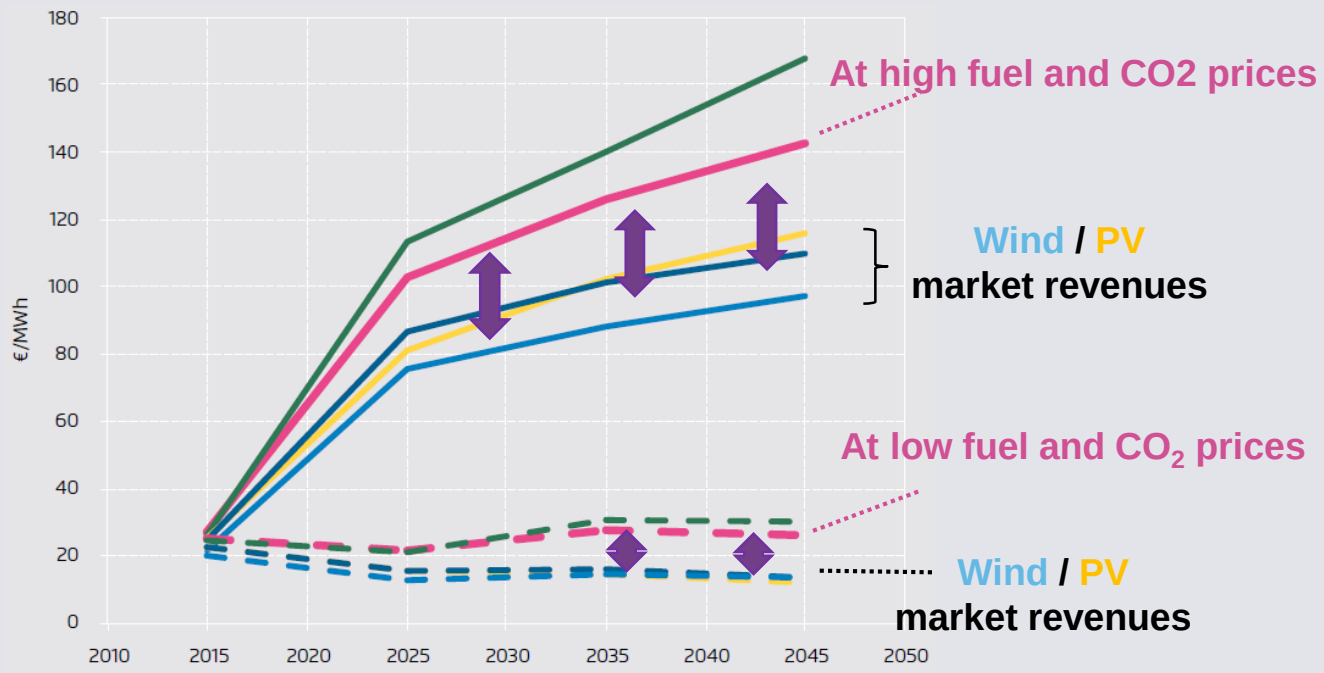
- Most urgent challenge of EU power markets are implications of legacy investments in high-carbon, inflexible generation; Market design alone reaches limits
- Smart retirement of old, high-carbon, inflexible capacity is prerequisite for successful market design.

Required EU level action:

- Closing gaps in Industrial Emissions Directive;
- Use appropriate emission performance standards where possible;
- Make power system flexibility part of market design reform;
- Reflect long-term decarbonisation pathway and system flexibility needs in national energy and climate plans;
- Assist lower-than-average GDP member states through EU budget.

Element 4: Providing stable revenues for new RES-E investments to achieve EU target at least cost

Average wholesale prices versus market revenues of variable renewables



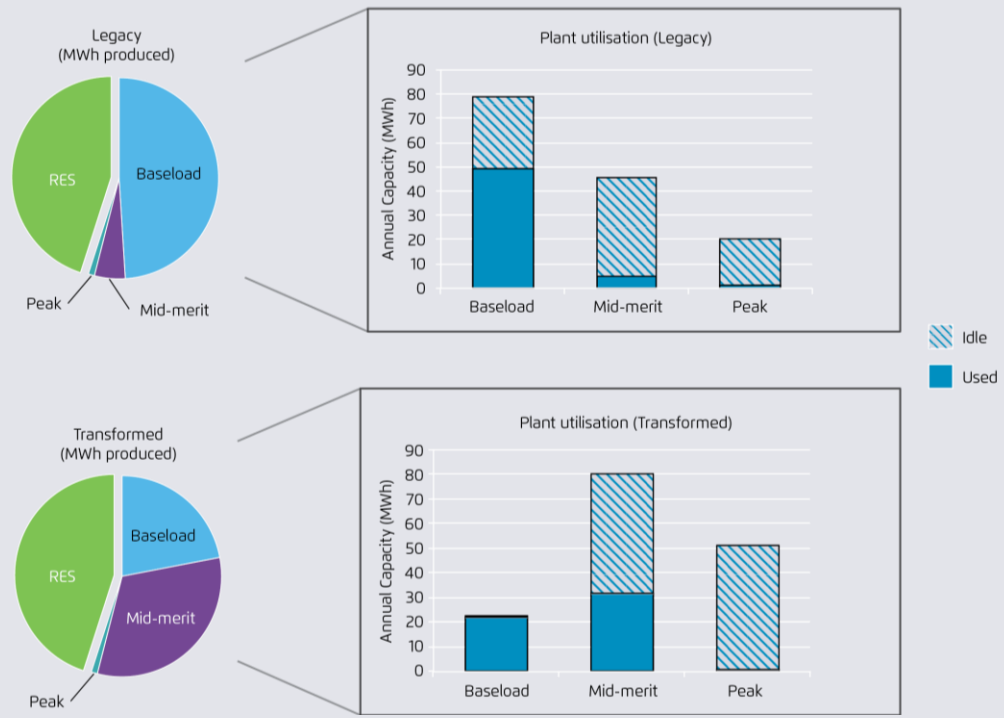
Öko-Institut (2014)

*1% WACC increase yields 8% LCOE increase for wind onshore

- → Wind / PV require revenue stabilisation throughout 2020-2030. High risks for investors lead to high cost of capital and LCOE*
- → Future RES framework should:
  - Acknowledge role of revenue stabilisation to close gaps btw market revenues and returns on investment;
  - Use competitive tendering to identify need for revenue stabilisation;
  - Prohibit retroactive devaluing of investments;
  - Translate elements from state aid guidelines into ordinary EU legislation;
  - Maintain priority grid access and priority dispatch;
  - Make national assessments of RES barriers obligatory;
  - Include robust governance to close possible gaps between national contributions and EU-wide target;
  - Include mechanism for de-risking RES investments.

Element 5: Safeguarding system adequacy consistent with long-term decarbonisation and flexibility needs

Impact of thermal plant mix on plant utilisation rates and investments in a 45% RES-E system



RAP (2014) based on IEA (2014)

- → Increasingly flexible power mix required ➔ Adequacy not only about *"how much"* but *"what kind"* of capacities
- → Interventions must be consistent with long-term decarbonisation and flexibility needs
  - *Strategic* or *capacity reserves* operating fully outside energy and balancing markets
  - *Energy-based payments* by stabilising scarcity prices
  - *Capability remuneration mechanisms*: Resource capability rather than capacity has to be primary focus
- → Cross-border adequacy assessment should be requirement for domestic CRMs
- → MS to develop national/ regional roadmaps to enhance power system flexibility and NECPs used as reference point to ensure SoS interventions consistent with decarbonisation