

The Power Market Pentagon

*A Pragmatic Power Market Design for
Europe's Energy Transition*

Christian Redl

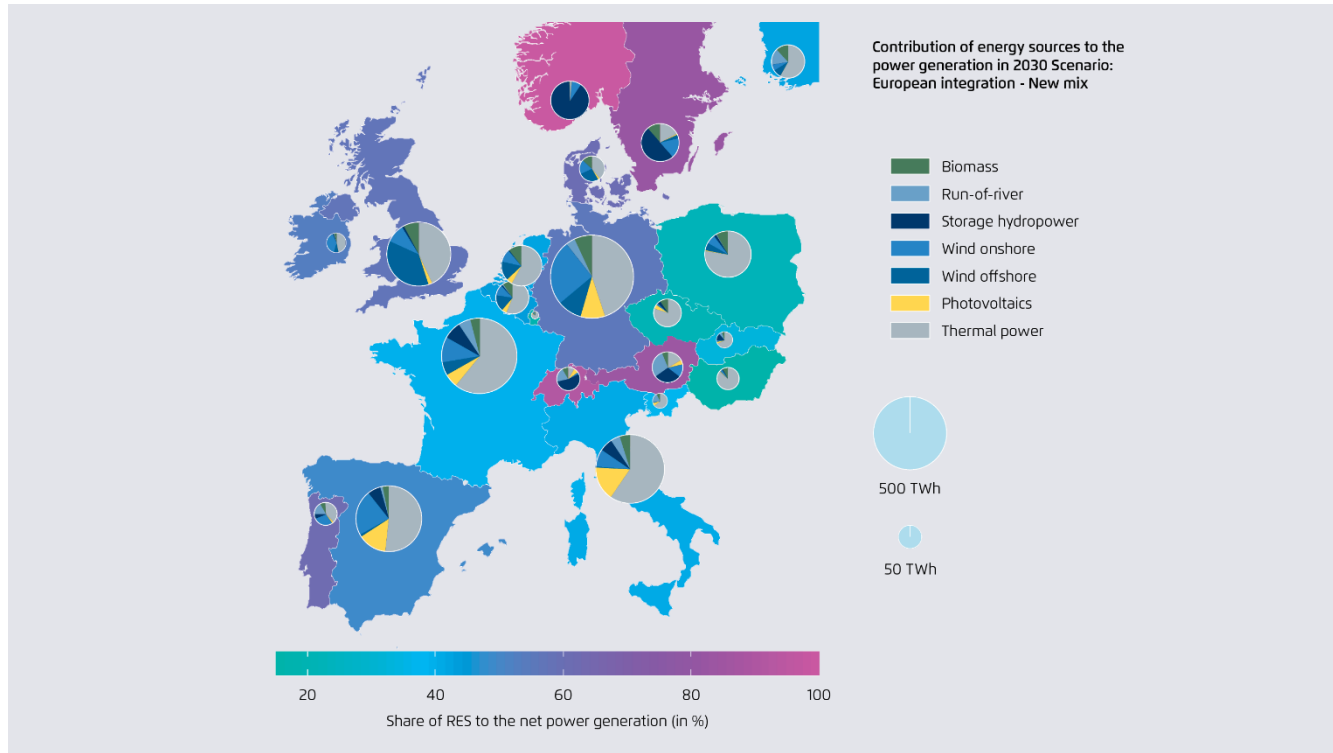
BERLIN, 20 APRIL 2016



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

Renewables in the Power sector are key for Europe's 2030 strategy:

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

Thus, EU 2030 climate and energy targets imply

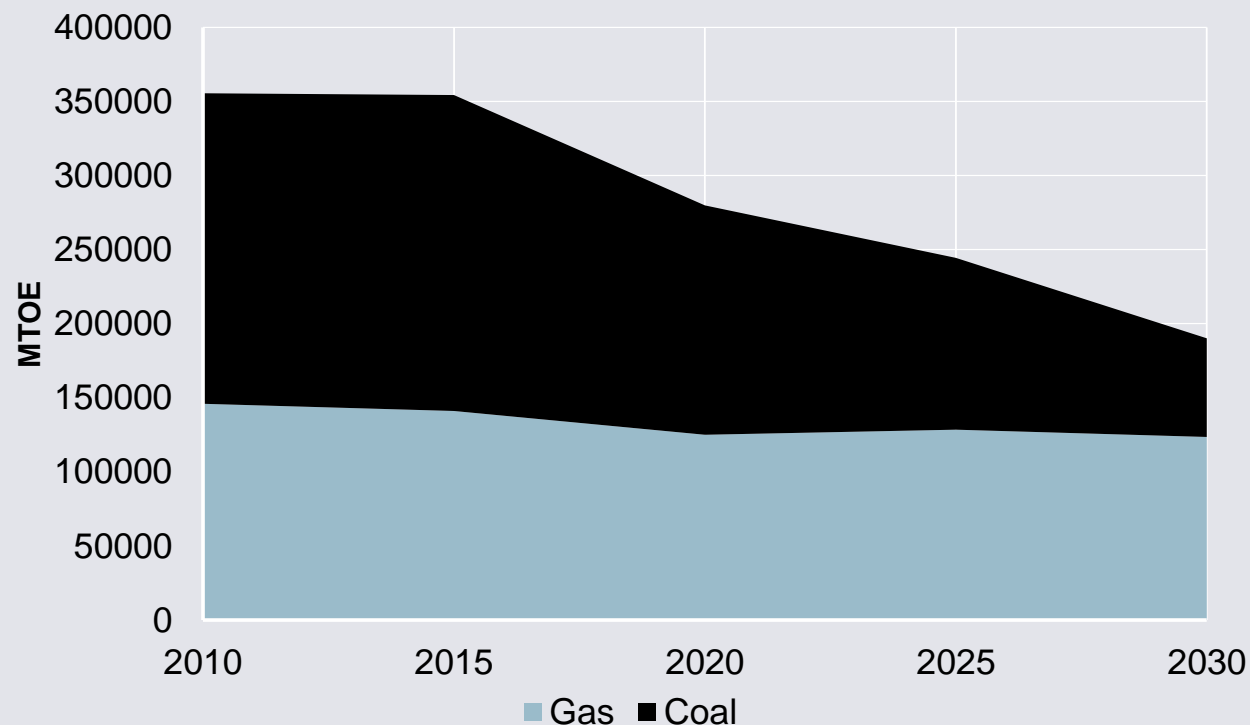
- 50% Renewables in the power mix
- 30% Wind and Solar in the power mix

(* 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



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

- Europe's 2030 climate target of -40% below 1990 puts the power sector in the centre: emissions are to reduce by 65% by 2030 compared to 1990
- In 2015, about three quarters of total CO₂ emissions stem from coal- and lignite-fired power plants, although these make up only a quarter of total European electricity generation.

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

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

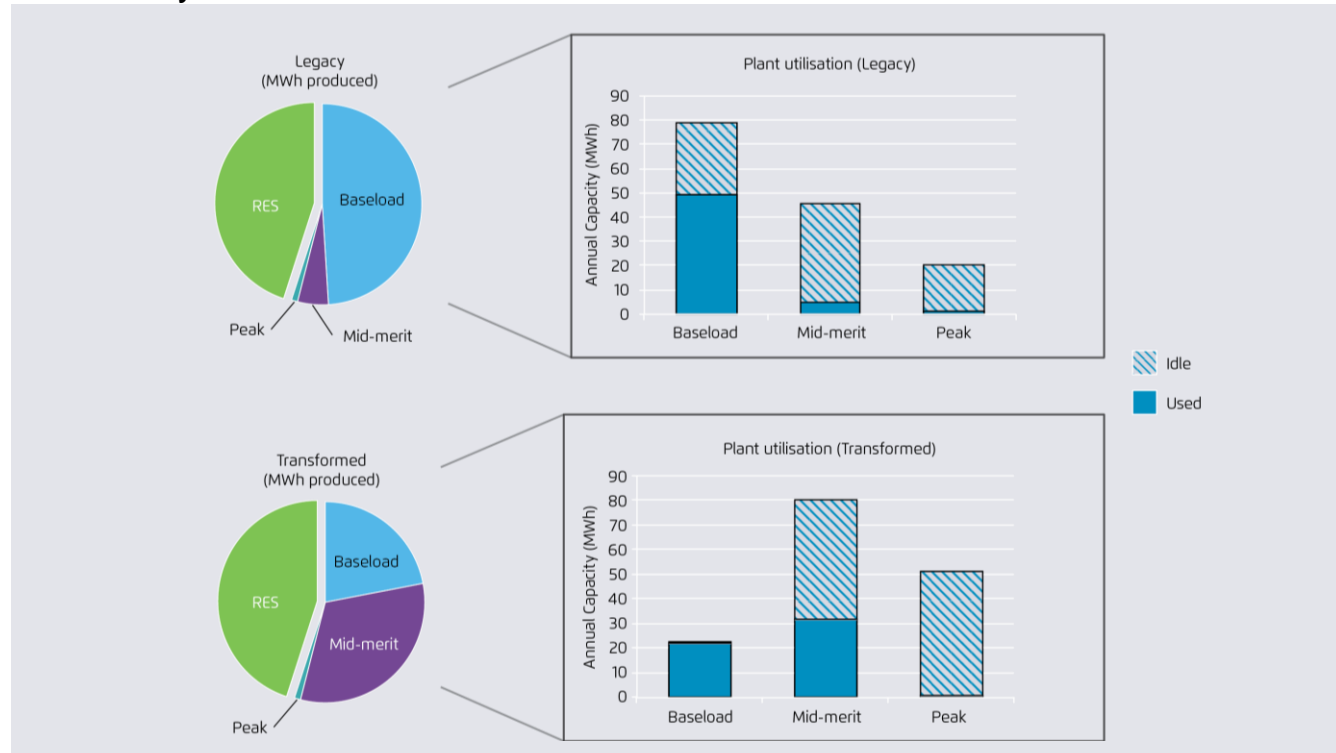
(* EU Commission (2011): Impact Assessment on EU 2050 Energy Roadmap, „Diversified supply technologies scenario“)

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

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

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

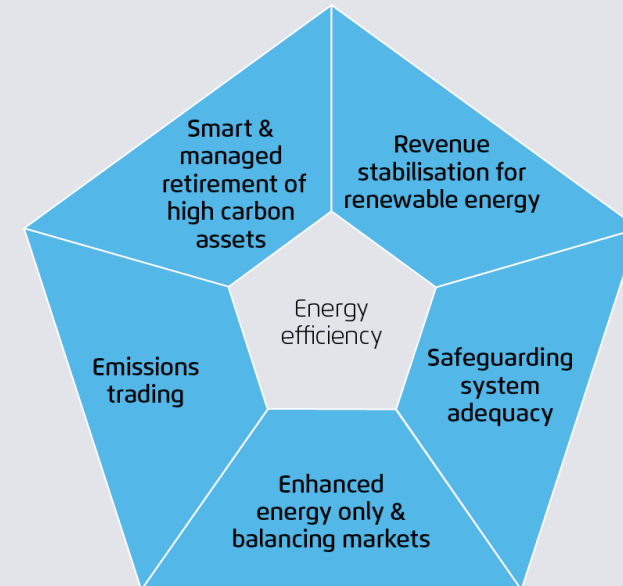
Which market design will get us cost-effectively to a 2030 power system with 50% RES-E, -68% coal and a flexible mix?

Simple textbook economics market design

Energy-Only Market

Emissions Trading

Solution-orientated power market framework for the transition



Agora Energiewende (2016): The Power Market Pentagon

Why a simple textbook market design is not enough: Energy-only markets increasingly complemented by out-of-market mechanisms as politicians do not fully trust the EOM

Simple textbook economics market design

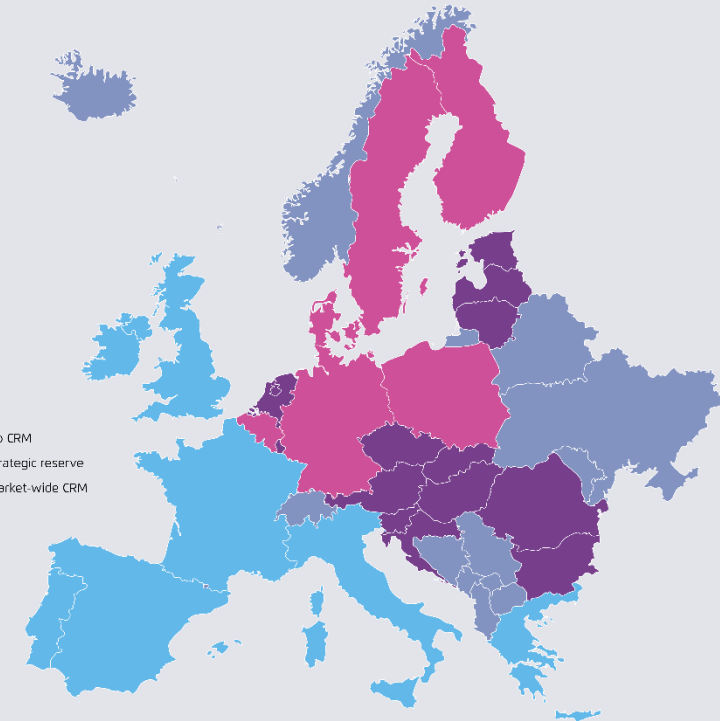
Energy-Only Market,
generating system adequacy
through peak pricing

Emissions Trading

Agora Energiewende (2016)

Capacity mechanisms in the EU 2015

Legend:
No CRM
Strategic reserve
Market-wide CRM



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

Why a simple textbook market design is not enough: The huge CO₂ allowance surplus in the EU ETS will keep CO₂ prices well below 30 EUR/t for another 10-15 years

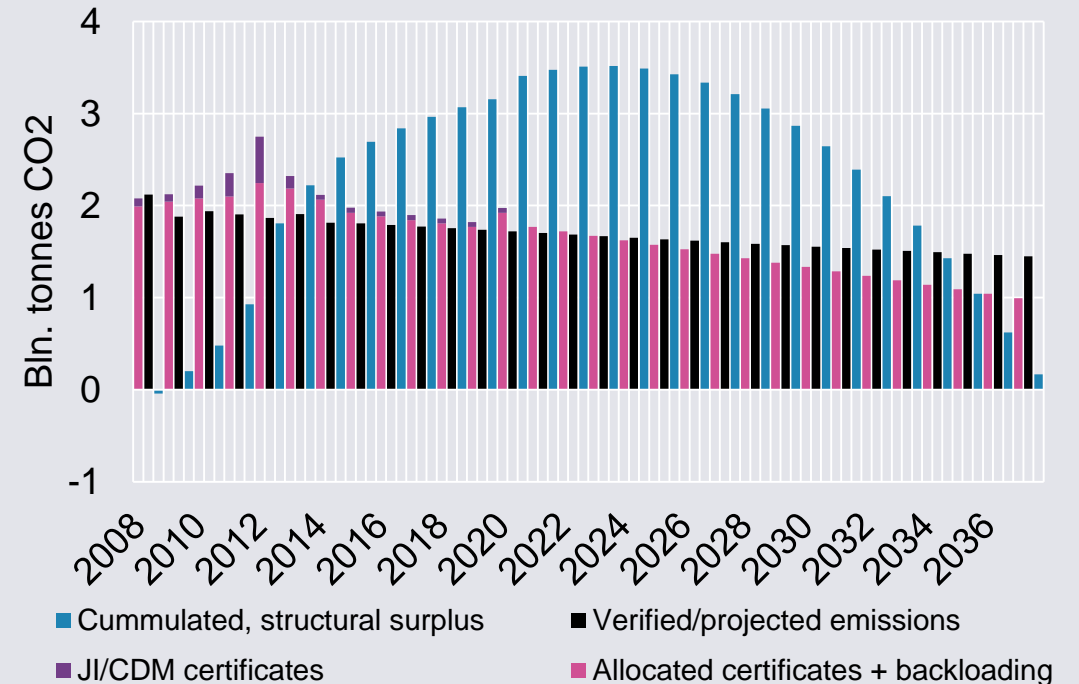
Simple textbook economics market design

Energy-only Market

Emissions Trading
(with CO₂ price reflecting social cost of carbon, i.e. > 60 EUR/t)

Agora Energiewende (2016)

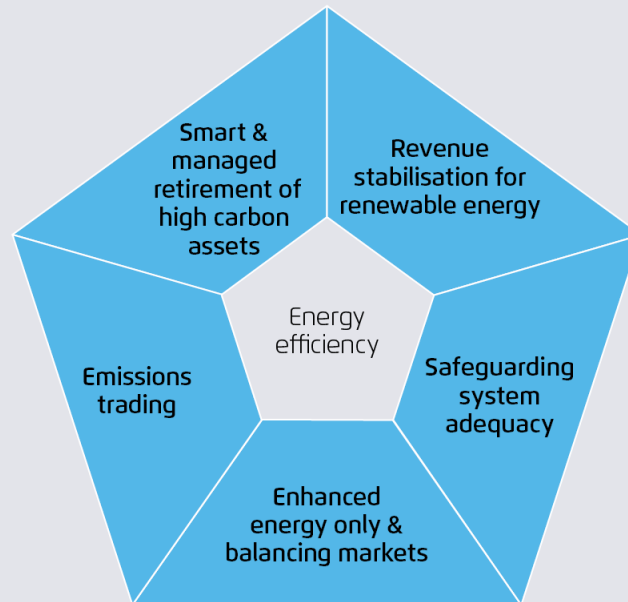
Cumulated allowance surplus in the EU Emissions Trading System



Agora Energiewende (2016)

***A market design that fits:* Elements of a pragmatic market design approach consistent with the objectives of energy policy: The Power Market Pentagon**

The Power Market Pentagon

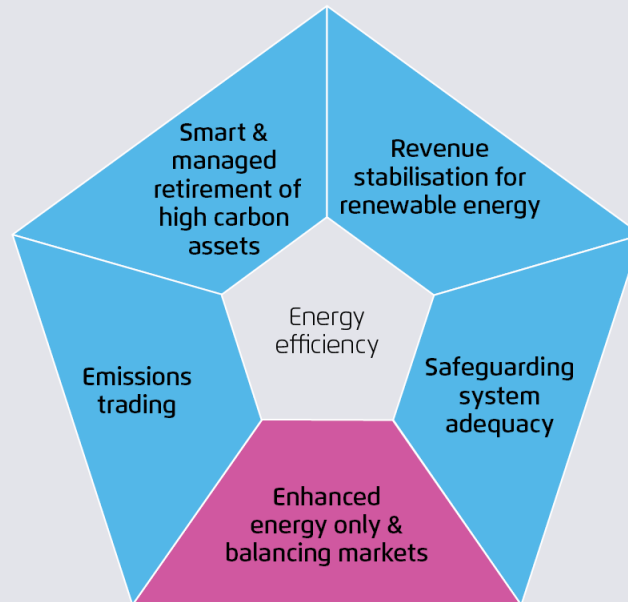


- All five elements required for functioning market design
- Their interplay ensures that despite legacy investments, market uncertainties and CO₂ prices well below social cost of carbon, transition to reliable, decarbonised power system occurs cost-efficiently
- Policy makers need to consider repercussions with other dimensions of the power system
- The Power Market Pentagon takes these repercussions into account → holistic approach, mutually supportive elements

Agora Energiewende (2016)

Element 1 of the Power Market Pentagon: Enhanced energy-only and balancing markets to manage the flexibility challenge

The Power Market Pentagon: Enhanced energy-only & balancing markets

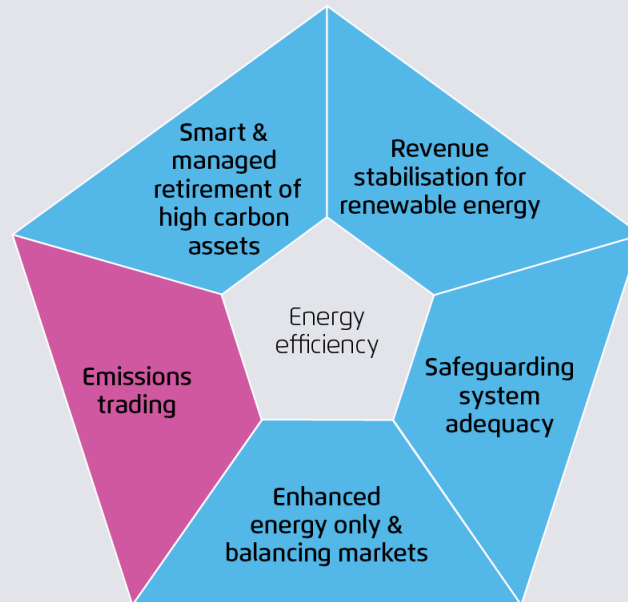


Agora Energiewende (2016)

- Power market has to become highly flexible for continuous interplay between generation, consumption and storage
- Efficient dispatch requires power prices reflecting real-time value of electricity. Key features of market design:
 - Coupling energy markets and making them faster (e.g. 15 minute products with 30 minute gate closure)
 - Improving predictability of scarcity prices to reduce risks and support efficient flexibility investments
 - 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 of the Power Market Pentagon: **The EU Emissions Trading Scheme should provide a stable mid-level carbon price (~ 30 EUR/t CO₂)**

The Power Market Pentagon: Emissions Trading

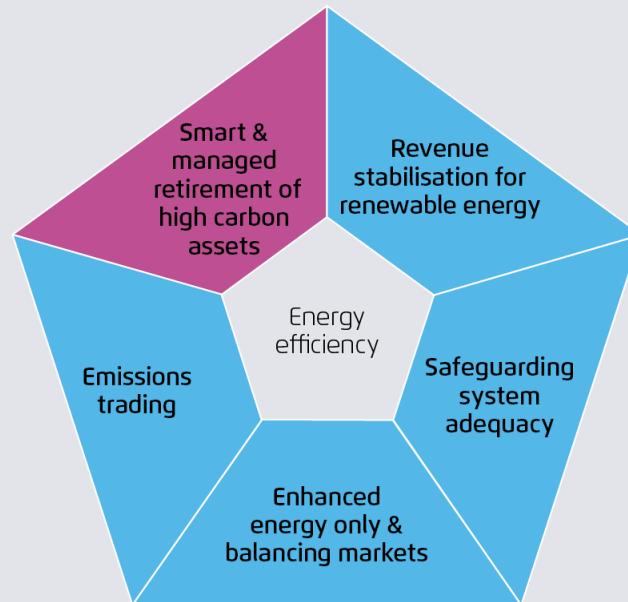


- Main role of ETS in power sector: shift fossil generation mix from high- to lower-carbon
- ETS not right instrument to drive investments in zero-carbon assets like renewables
- ETS cap must interact smartly with CO₂ reductions from other climate instruments (RES, EE and smart retirement policies) and should enable national climate policies
- Key measures:
 - Cancellation mechanism for additional domestic or EU climate policy measures
 - Stabilisation of ETS price through carbon floor price (e.g. 30 EUR/t CO₂)
 - Cancellation of EU ETS surplus as part of EU's contribution to Post-Paris-ratcheting-up mechanism

Agora Energiewende (2016)

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

The Power Market Pentagon: Smart retirement of high carbon assets

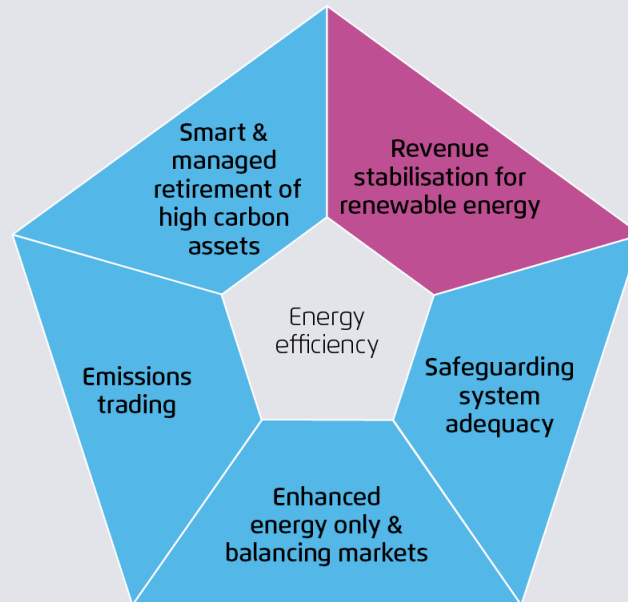


Agora Energiewende (2016)

- Most urgent challenge of EU power markets are implications of legacy investments in high-carbon, inflexible generation; Energy market design alone reaches limits in transition phase
- Smart retirement of old, high-carbon, inflexible capacity is a prerequisite for successful market design; Required EU level action:
 - Efforts to close gaps in Industrial Emissions Directive
 - Appropriate emission performance standards (EEAGs)
 - Spotlight on system adequacy, flexibility challenge and required reduction of carbon intensity in *national energy and climate plans*
 - Transparent flexibility check of national power systems (IEM and RE Directive revisions)
 - EU budget to offer opportunities to assist lower-than-average GDP member states

Element 4 of the Power Market Pentagon: Providing for stable revenues for new RES-E investments to achieve EU target at least cost

The Power Market Pentagon: Stable revenues for Renewables



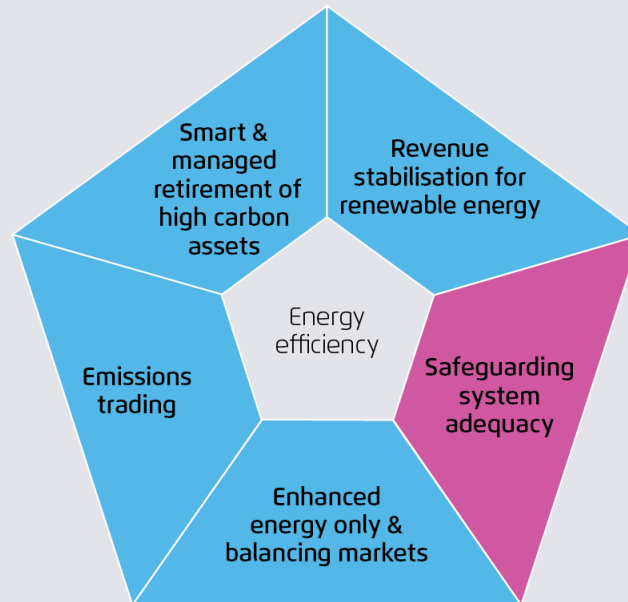
- Wind / PV require revenue stabilisation throughout 2020-2030. High risks for investors lead to high cost of capital and LCOE*
- Future RED framework should:
 - Acknowledge key role of revenue stabilisation to close gaps btw market revenues and returns on investment
 - Competitive tendering will show where and when market conditions are sufficient
 - Prohibit retroactive devaluing of investments
 - Maintain priority grid access and priority dispatch
 - Translate some state aid elements into ordinary EU legislation (e.g. technology-specific support)
 - Make national assessments of RES barriers obligatory and include EU mechanism for de-risking RES investments
 - Framework for closing possible gaps between national contributions and EU-wide 2030 RES target

Agora Energiewende (2016)

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

Element 5 of the Power Market Pentagon: Safeguarding system adequacy consistent with long-term decarbonisation and flexibility needs

Element 5 of the Power Market Pentagon

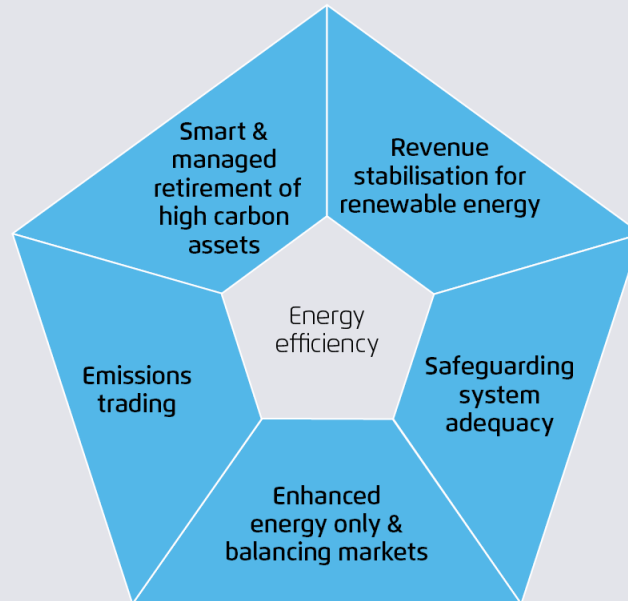


Agora Energiewende (2016)

- 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* through 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

The challenge:
Design the elements of the Power Market Pentagon such 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 be able to fully refinance RES
- Enhance the energy-only market without letting demand side and RES fully participate in the balancing markets and implement smart retirement policies
- Redesign renewables remuneration mechanisms without taking their effects on the energy-only market into account, ...

Rather: 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 – or subscribe to our newsletter!**

The Power Market
Pentagon

A Pragmatic Power Market Design
for Europe's Energy Transition

IMPULSE

Agora
Energiewende



Power Market Operations
and System Reliability

A contribution to the market design debate in the
Pentalateral Energy Forum

IMPULSE

Agora
Energiewende



RAP

Understanding the
Energiewende

FAQ on the ongoing transition of the
German power system

BACKGROUND

Agora
Energiewende



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:
christian.redl@agora-energiewende.de

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

