



HEADING TOWARDS SUSTAINABLE AND DEMOCRATIC ELECTRICITY MARKETS

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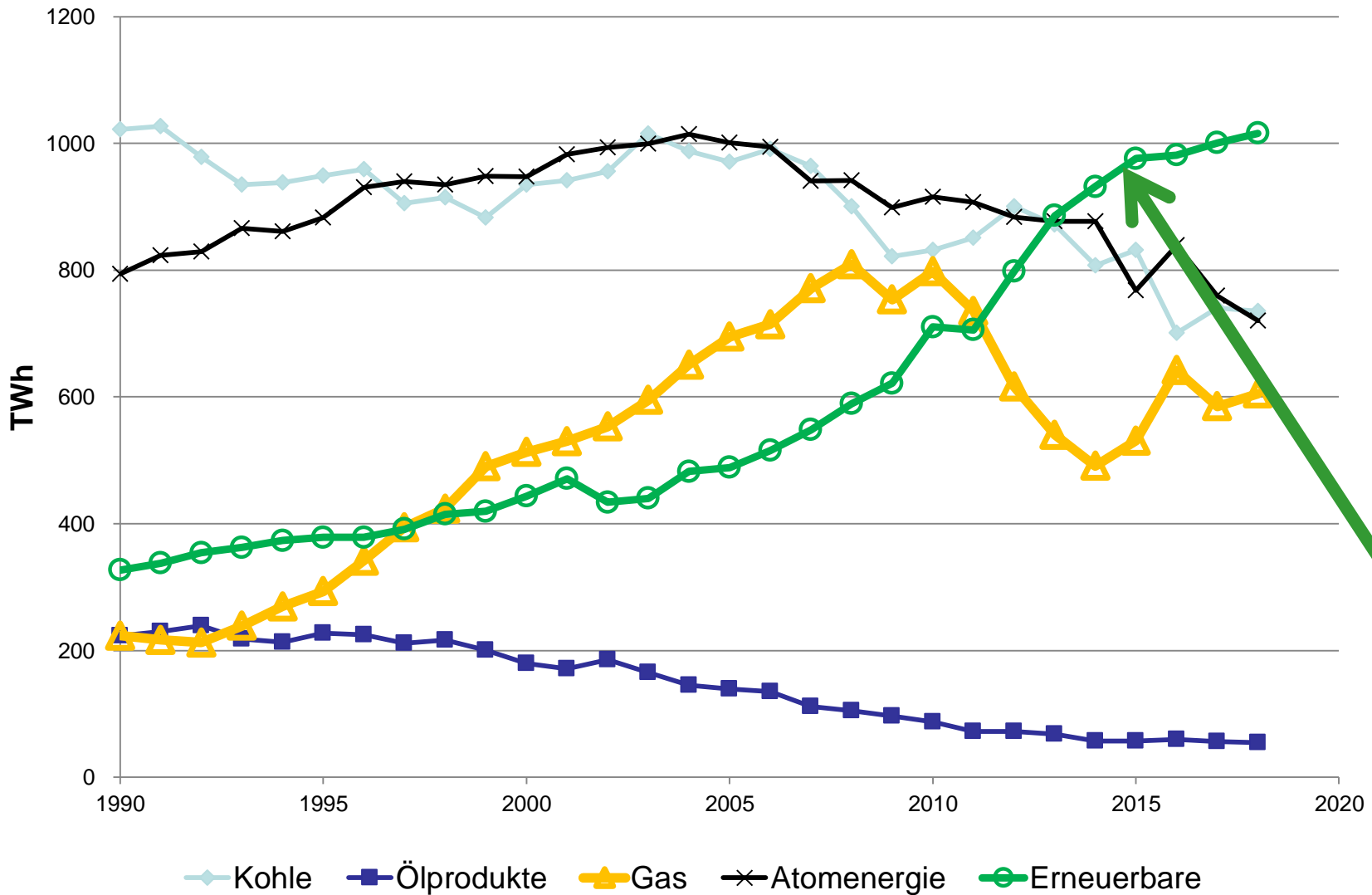
Ljubljana, August 2019

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Motivation:

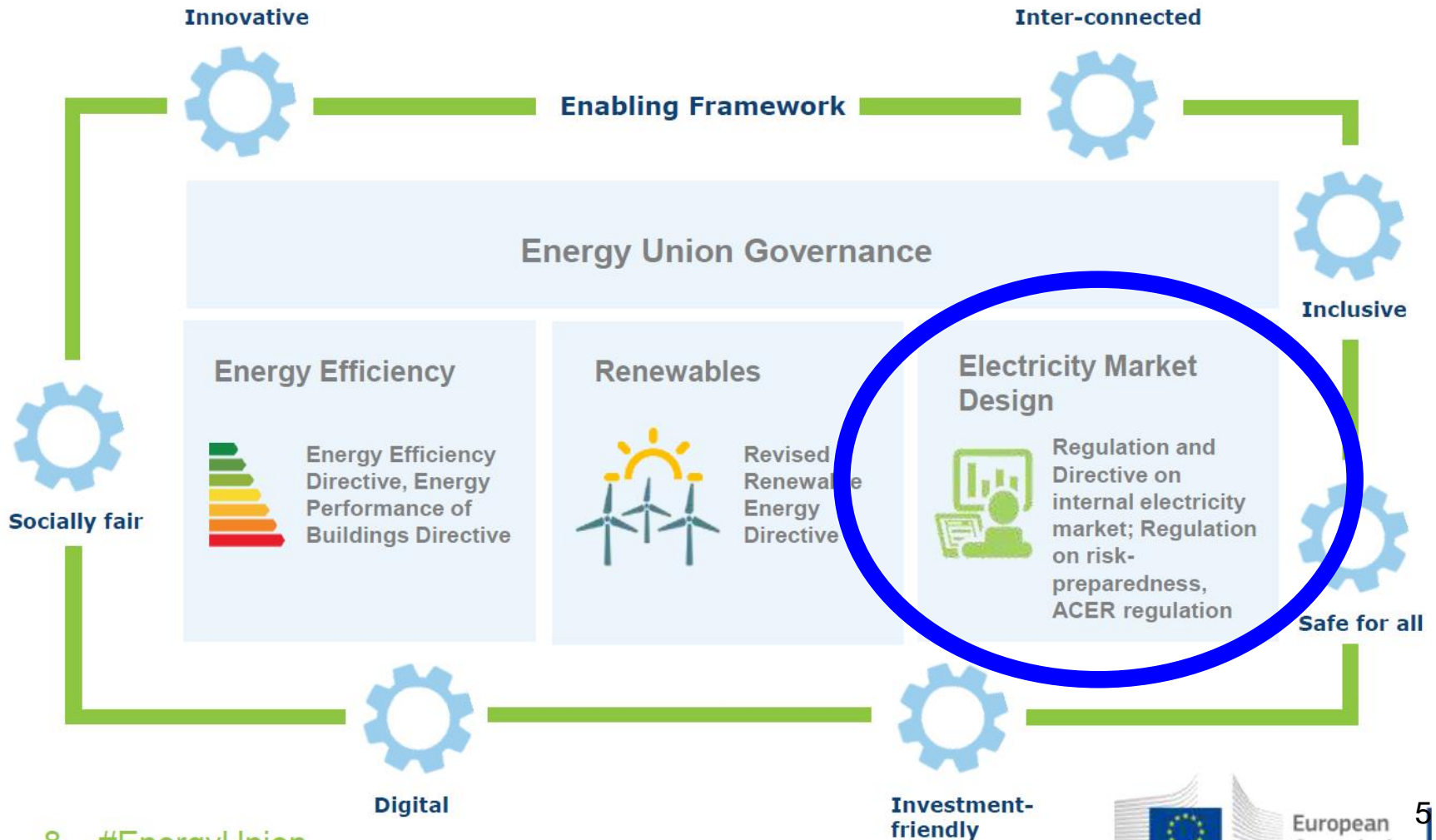
- * **Europe: The clean energy package → energy communities**
- * **It is not possible to force variable renewables into the system**
- * **A strong desire of some customers to participate in electricity supply**

Electricity generation EU-28



2017 und 2018 preliminary

Structure of the Package



... to identify the major boundary conditions to integrate even larger amounts of variable renewables into the electricity system

Very important:

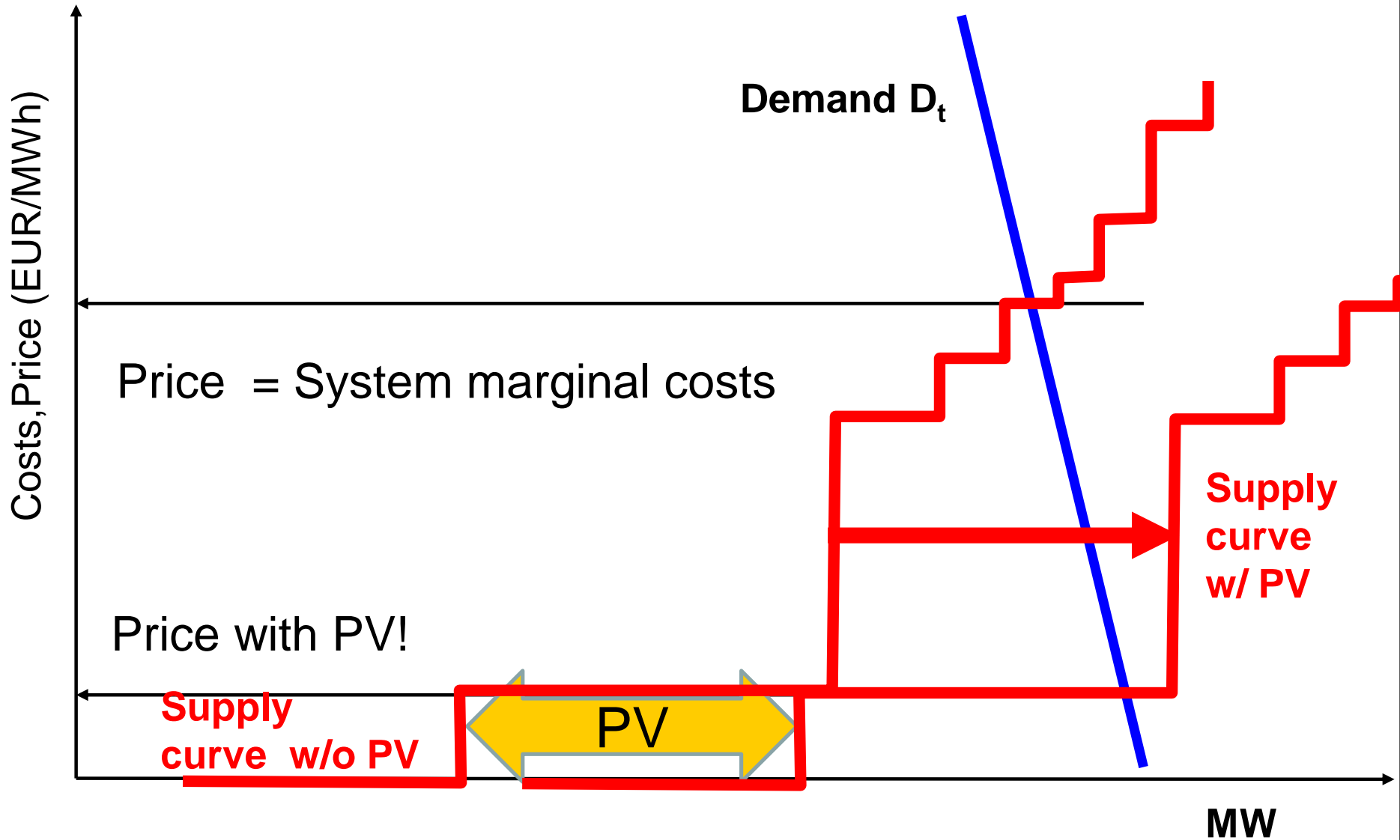
Our reflections apply in principle to every electricity system world-wide

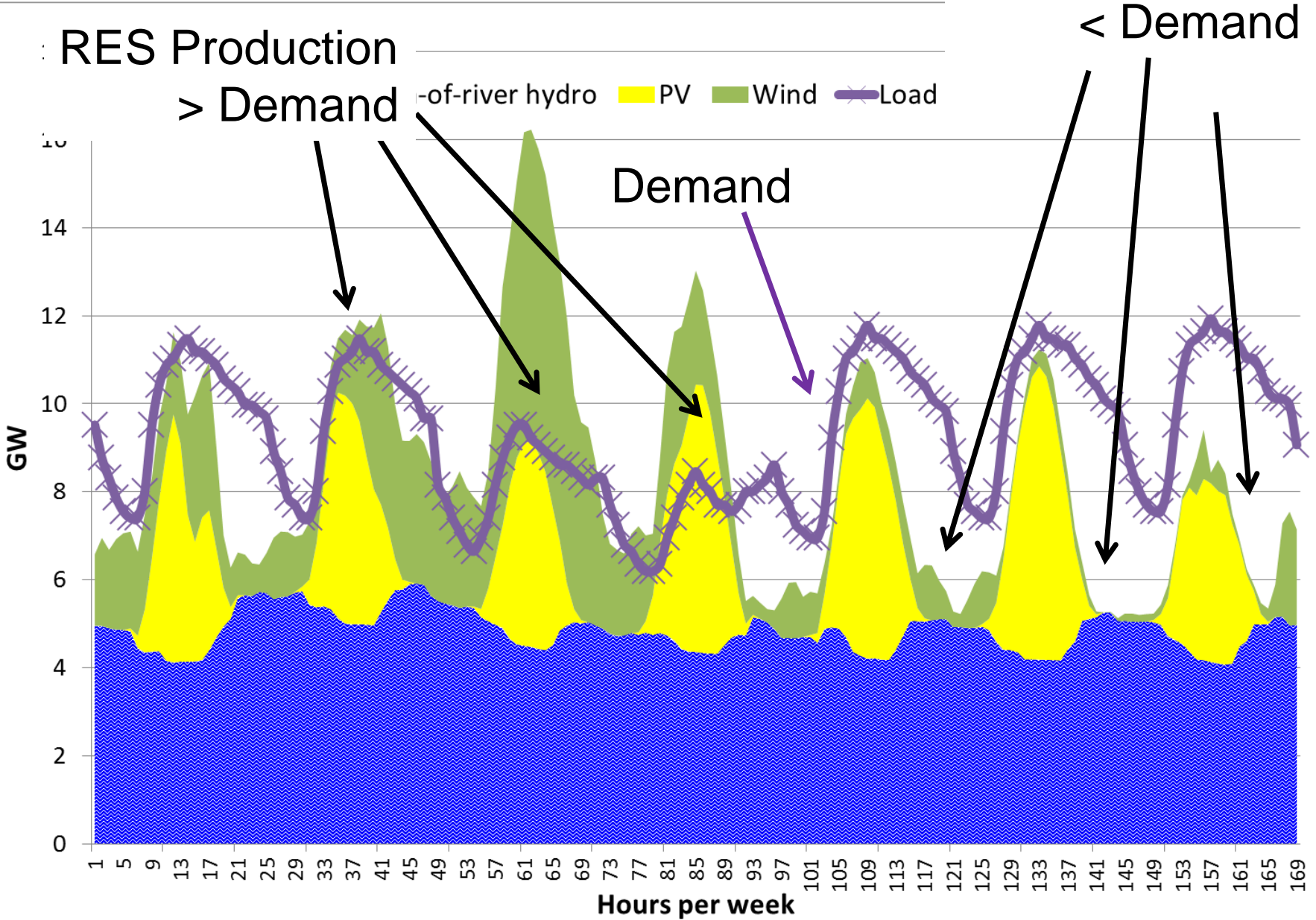
.... are based on **electricity economic** point-of-view

- **hourly resolution of residual load over a year in scenarios with large quantities of variable renewables;**
- **Applying a fundamental model to calculate (static) hourly electricity spot market prices;**
- **Integration of flexibility/elasticity in a dynamic framework for price calculation;**

3 HOW VARIABLE RENEWABLES IMPACT THE ELECTRICITY SYSTEM AND PRICES IN ELECTRICITY MARKETS

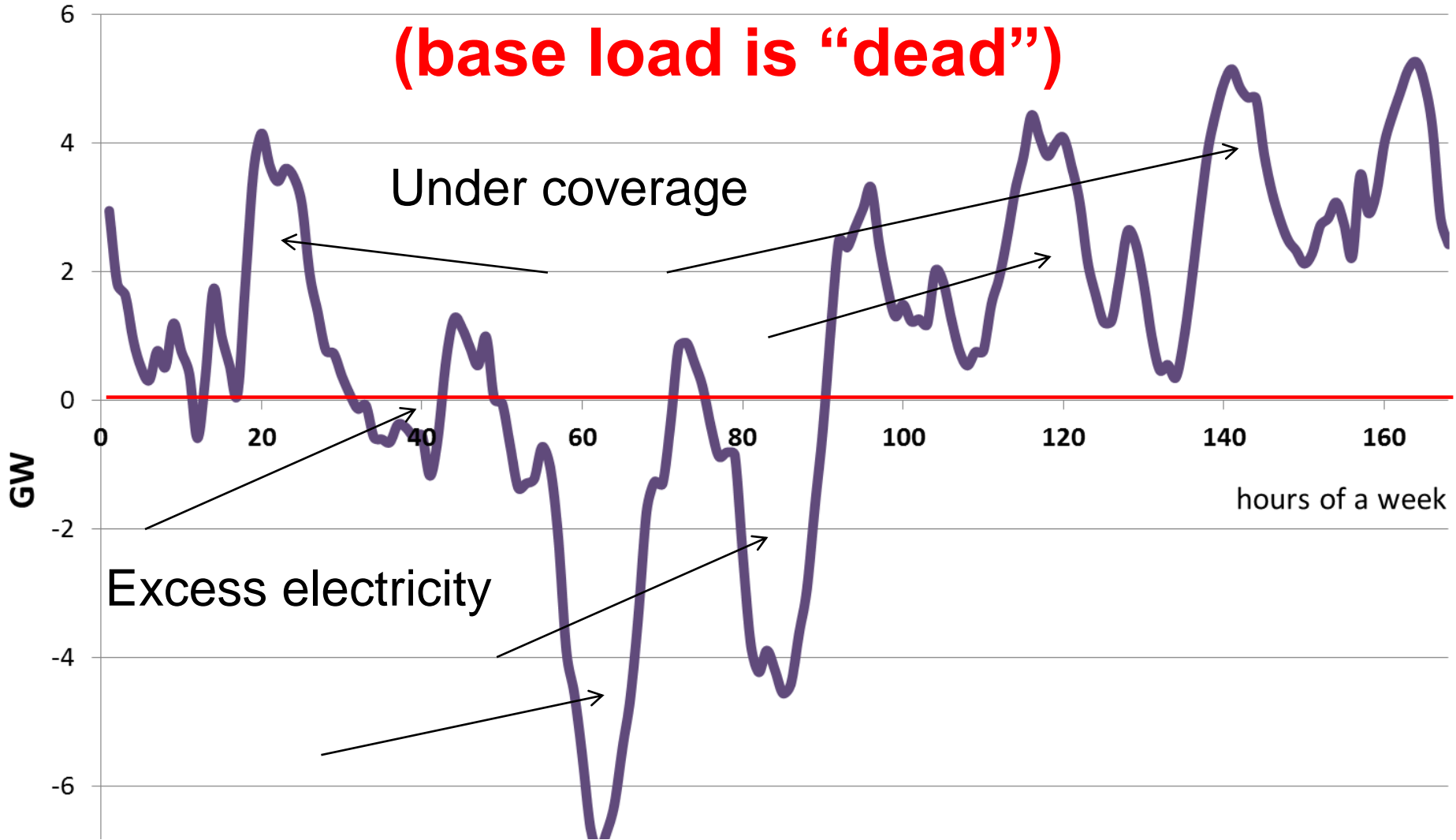
Example: prices without and with PV





Key term of the future: Residual load

(base load is “dead”)

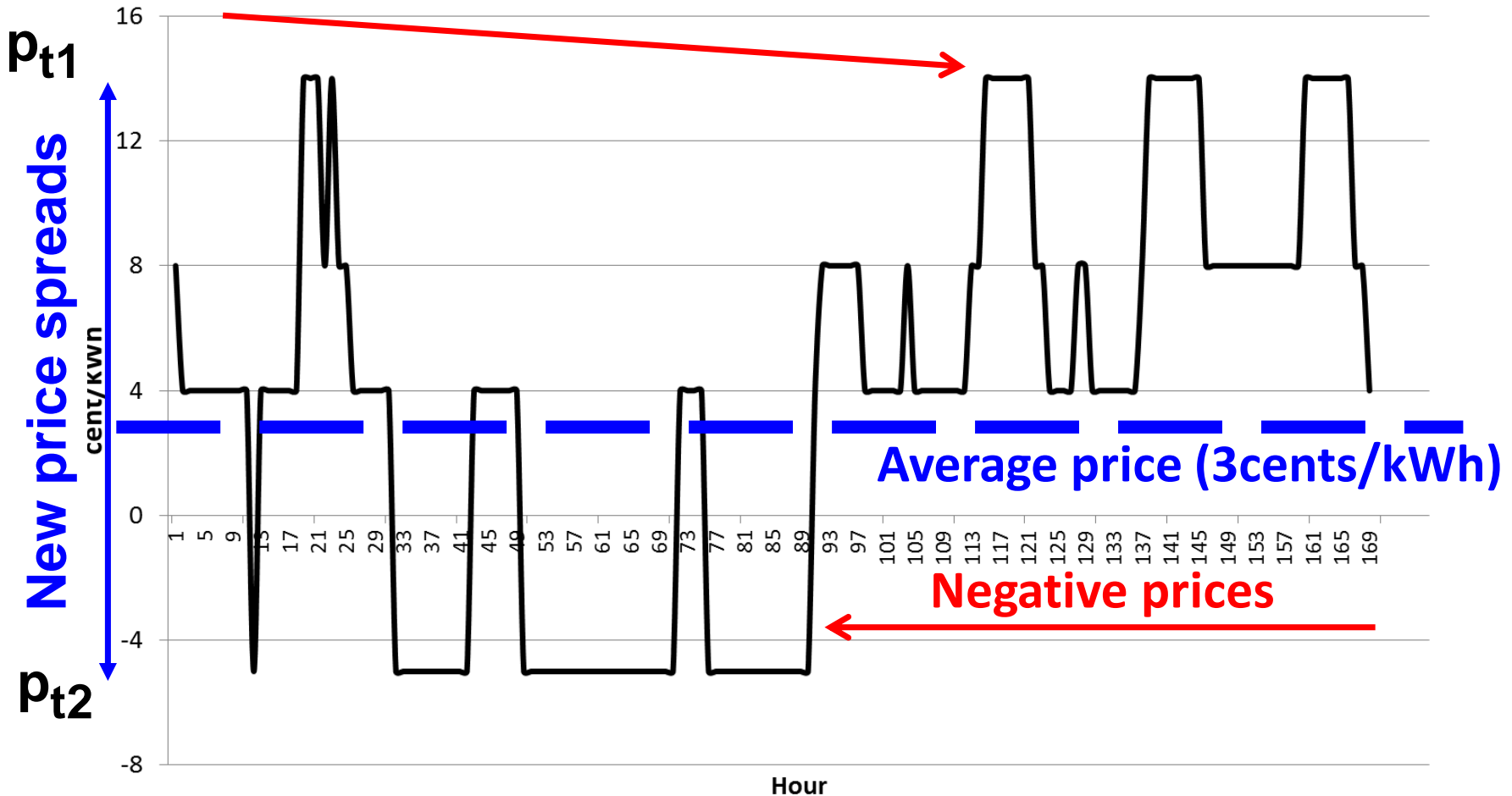


Residual load = Load – non-flexible generation

Deviation from STMC-pricing in spot markets

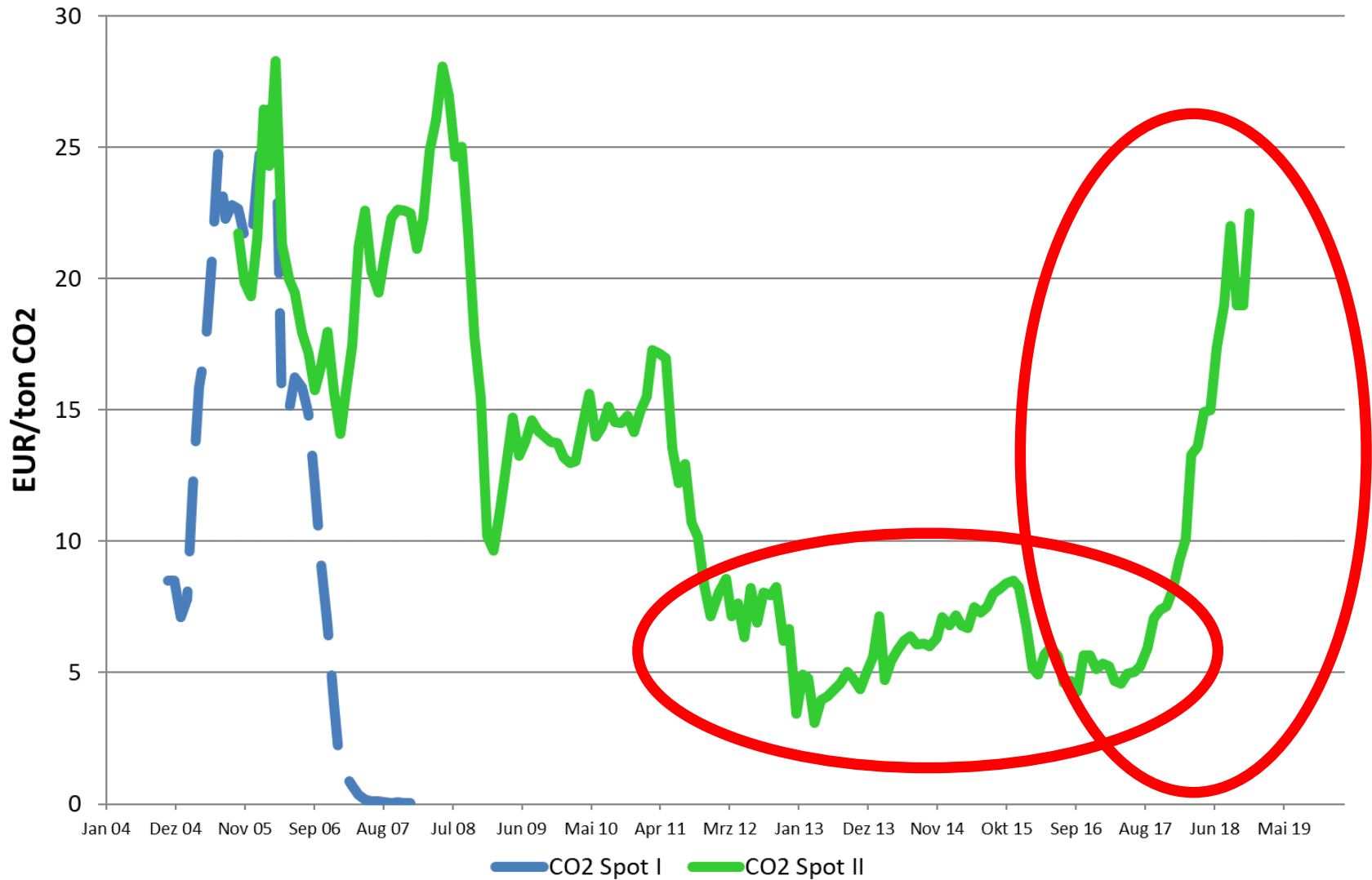
Scarcity prices

Electricity price spot market

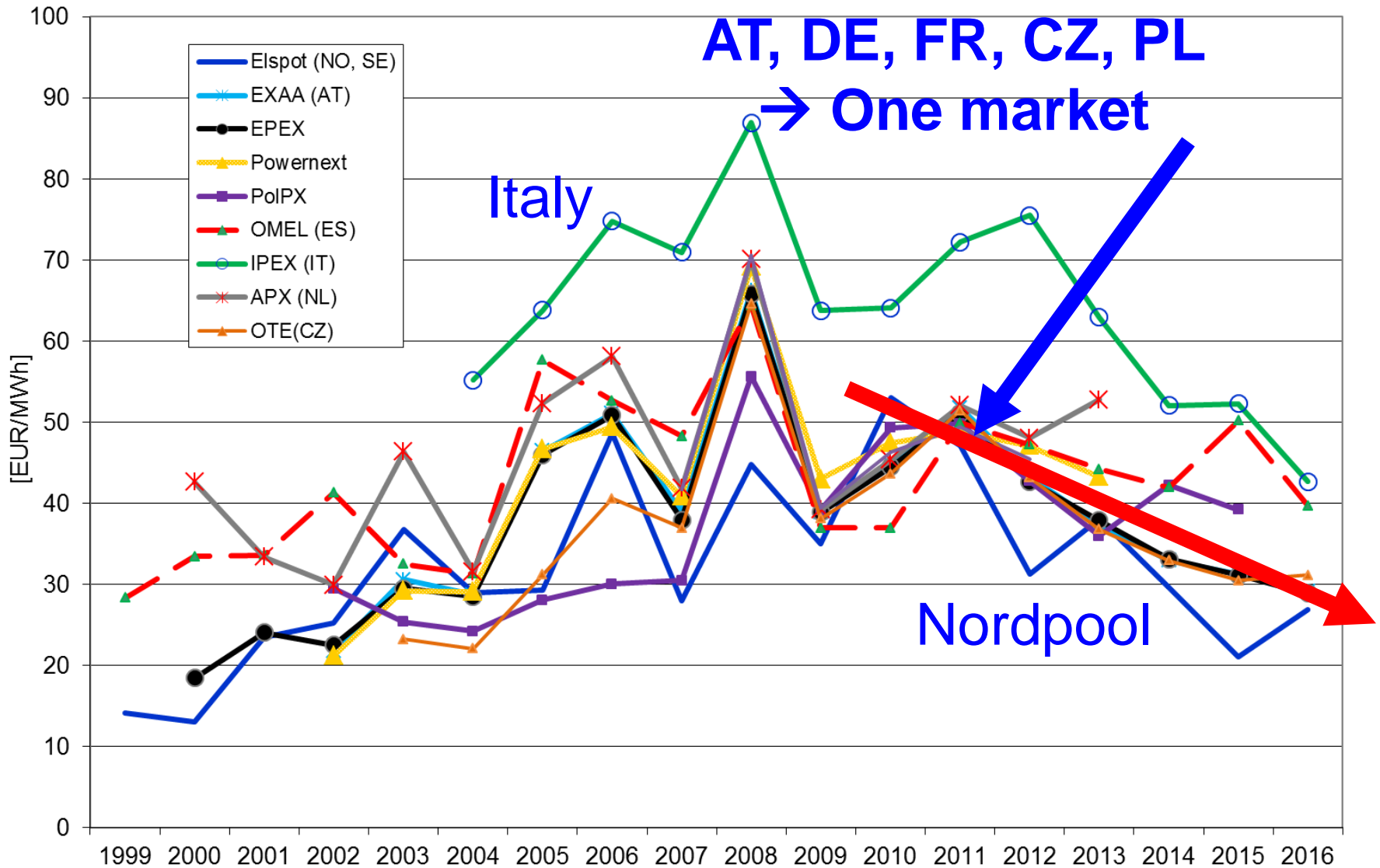


→ These price spreads provide incentives
for new flexible solutions!!!!

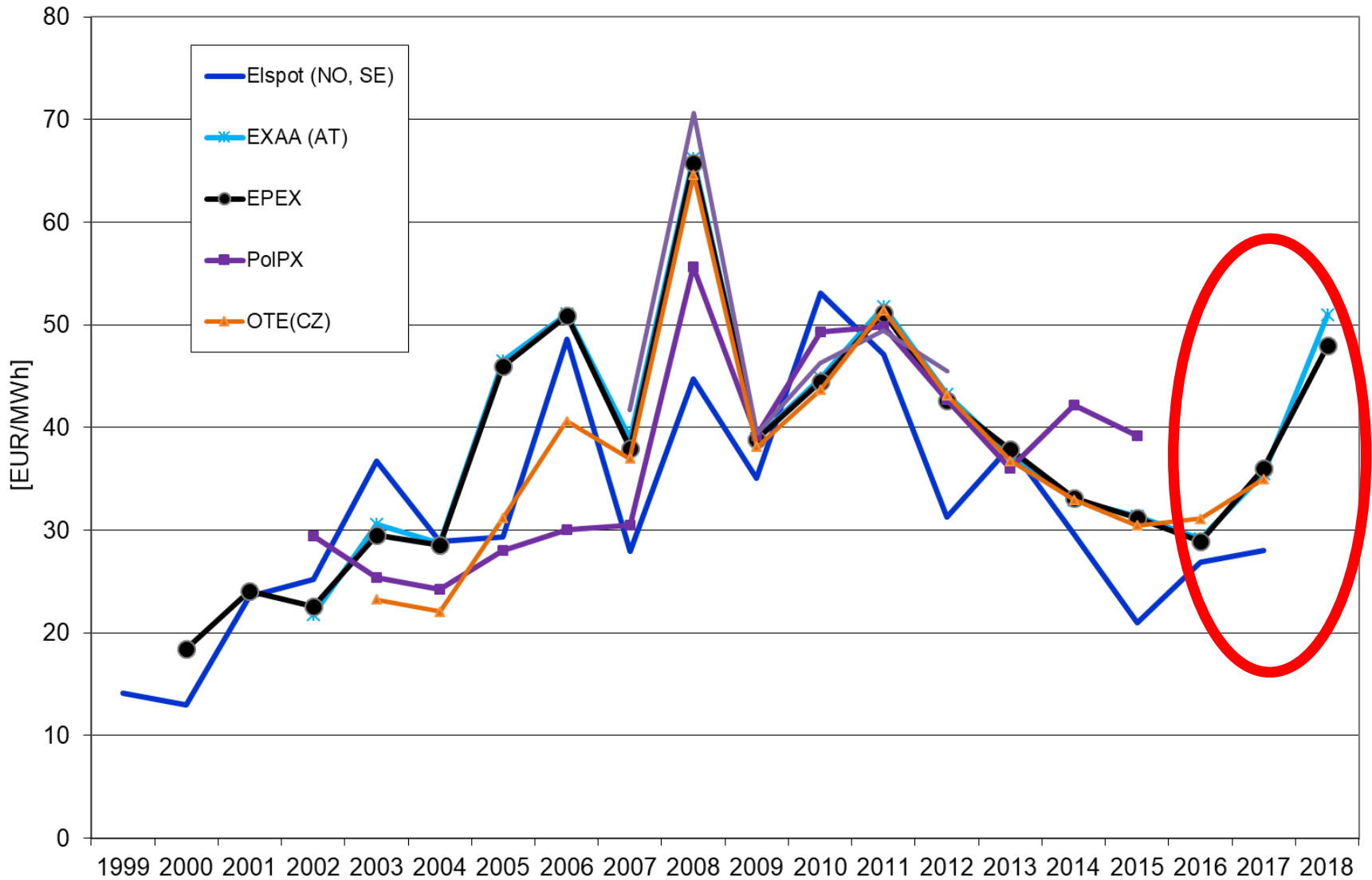
The CO2-Price



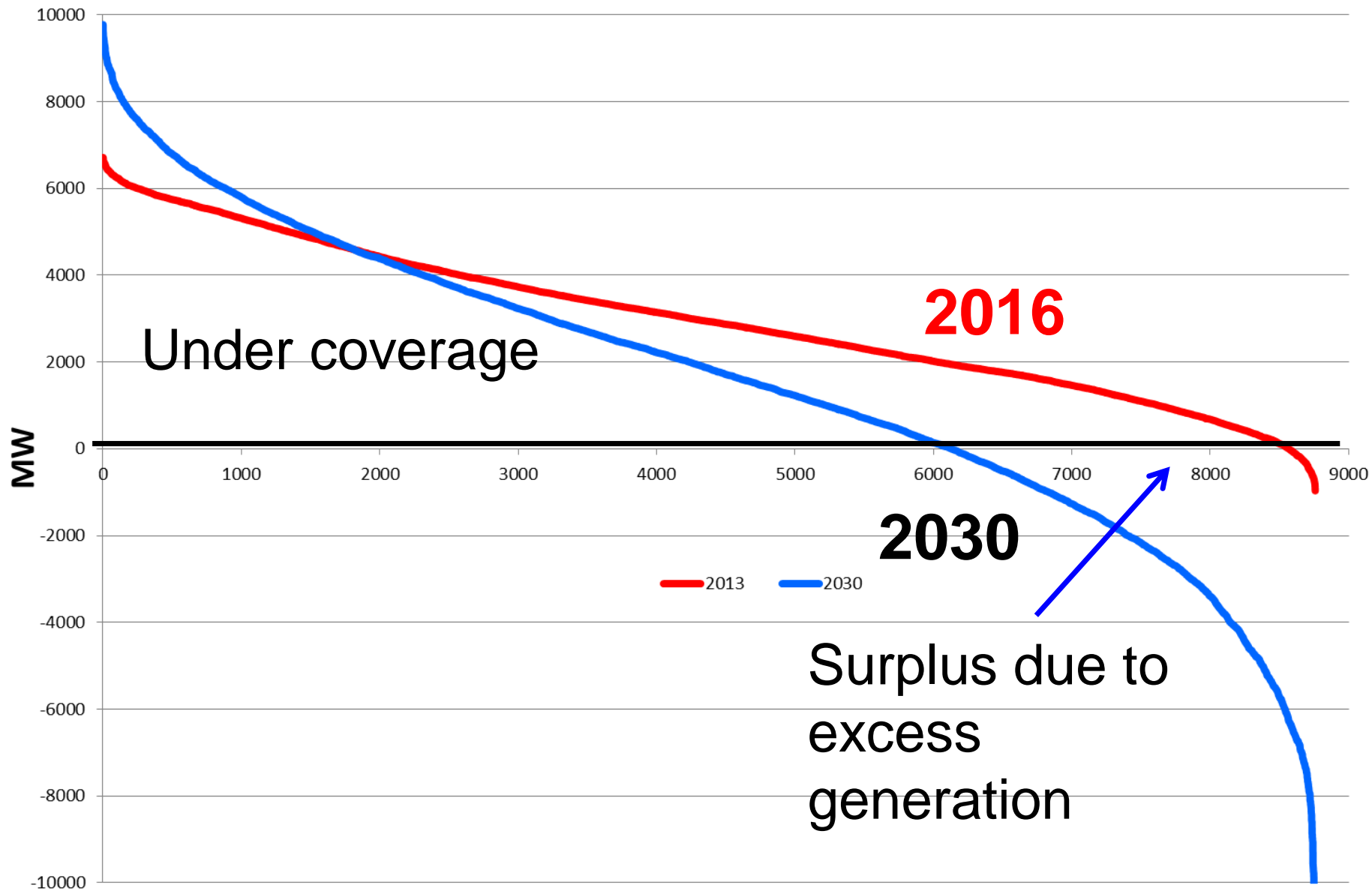
Development of electricity prices in Europe up to 2016 (1)



Development of electricity prices in Europe up to 2018 (2)



Classified residual load over a year



Classified residual load



By a regulated capacity payment with STMC pricing?

or

By competition between supply-side and demand-side technologies and behaviour (incl. Storages, grid and other flexibility options) with correct scarcity pricing signals?

4 THE CORE PROBLEMS OF CAPACITY PAYMENTS

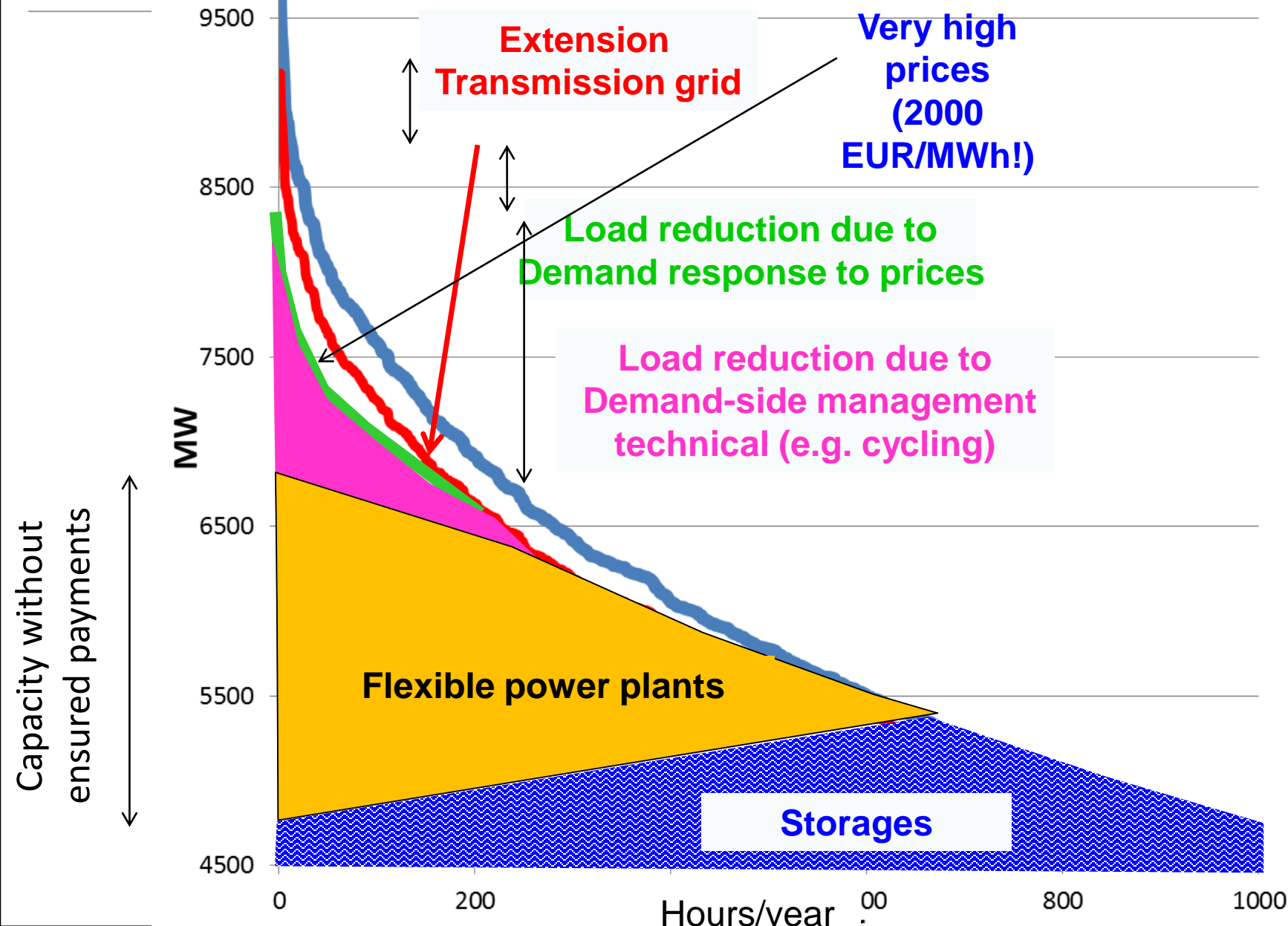
All regulatory capacity payments for power plants distort the EOM and lead to wrong price signals for all other options

Price peaks at times of scarce resource should revive the markets and lead to effective competition

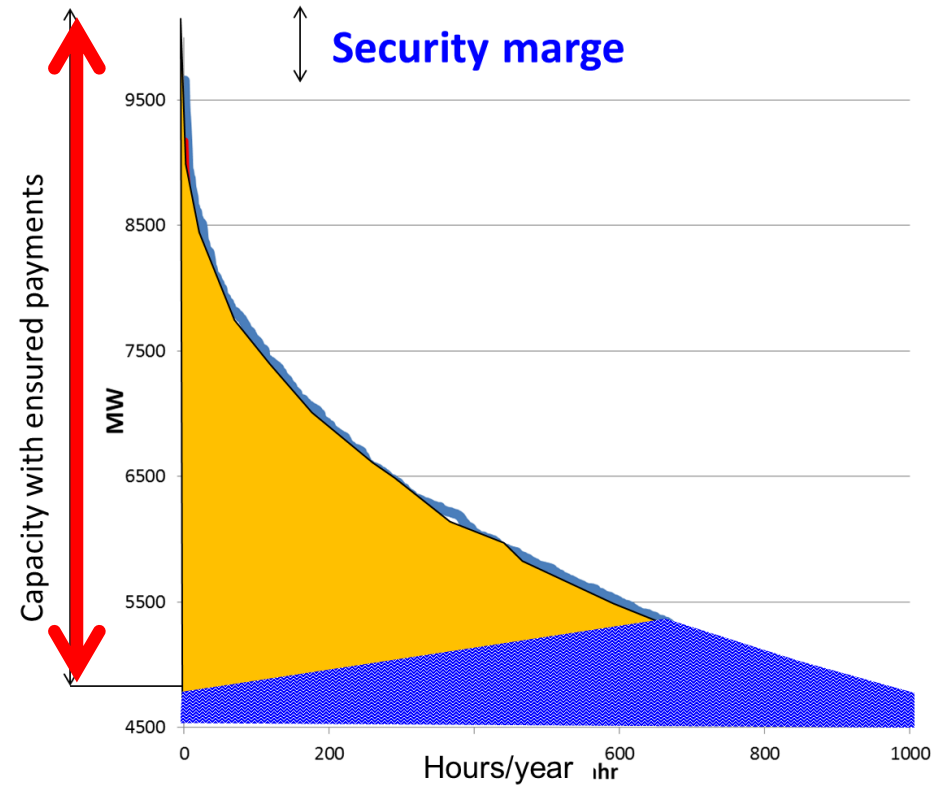
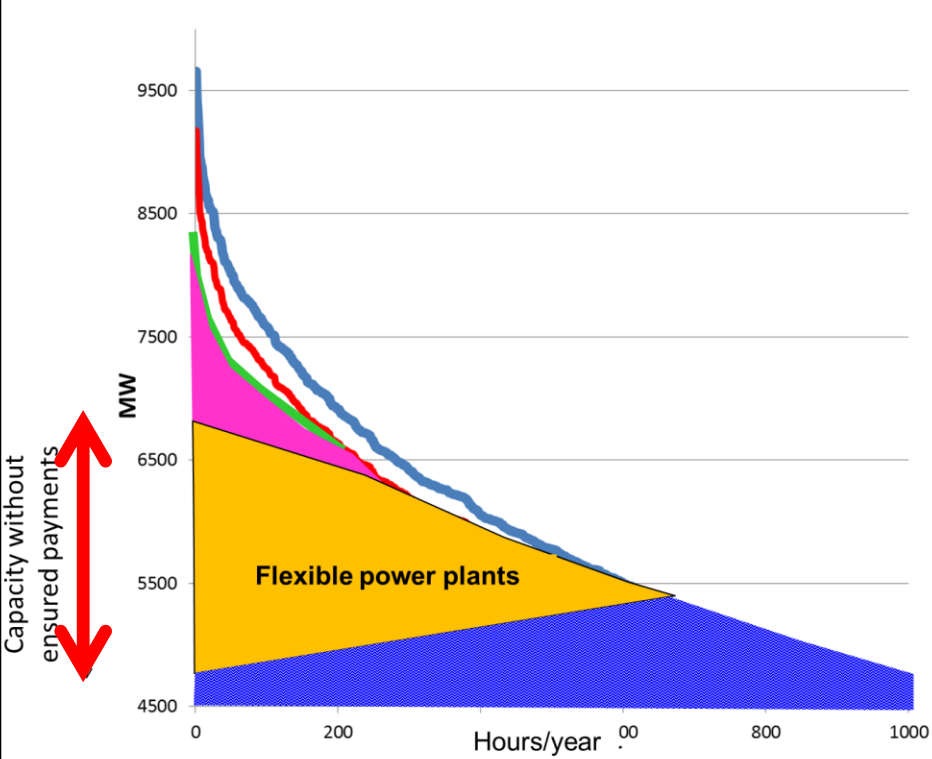
The higher the excess capacities, the lower is the share of RES

strive to retain system resource adequacy by correct price signals

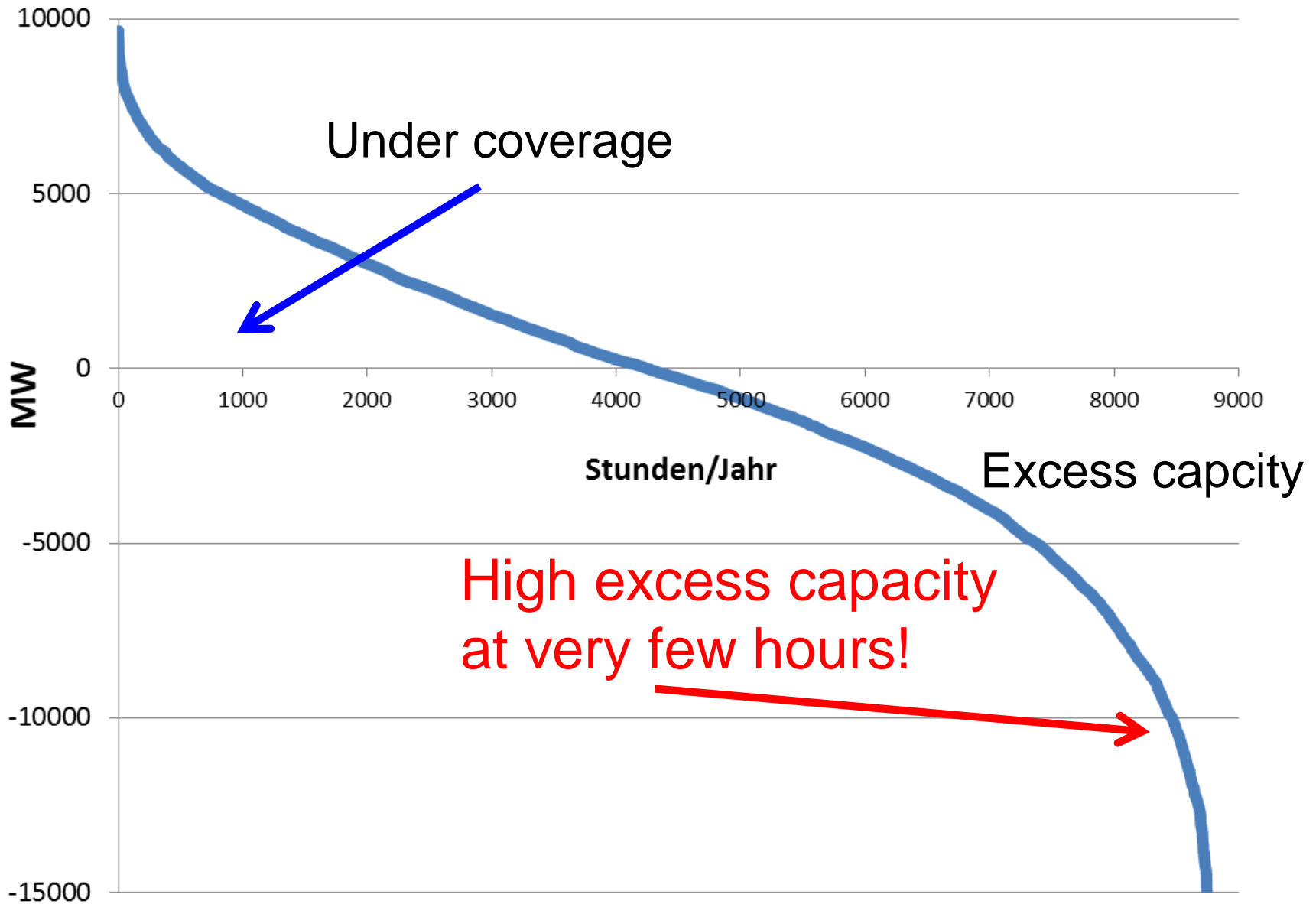
5 Flexible coverage of residual load



Comparison

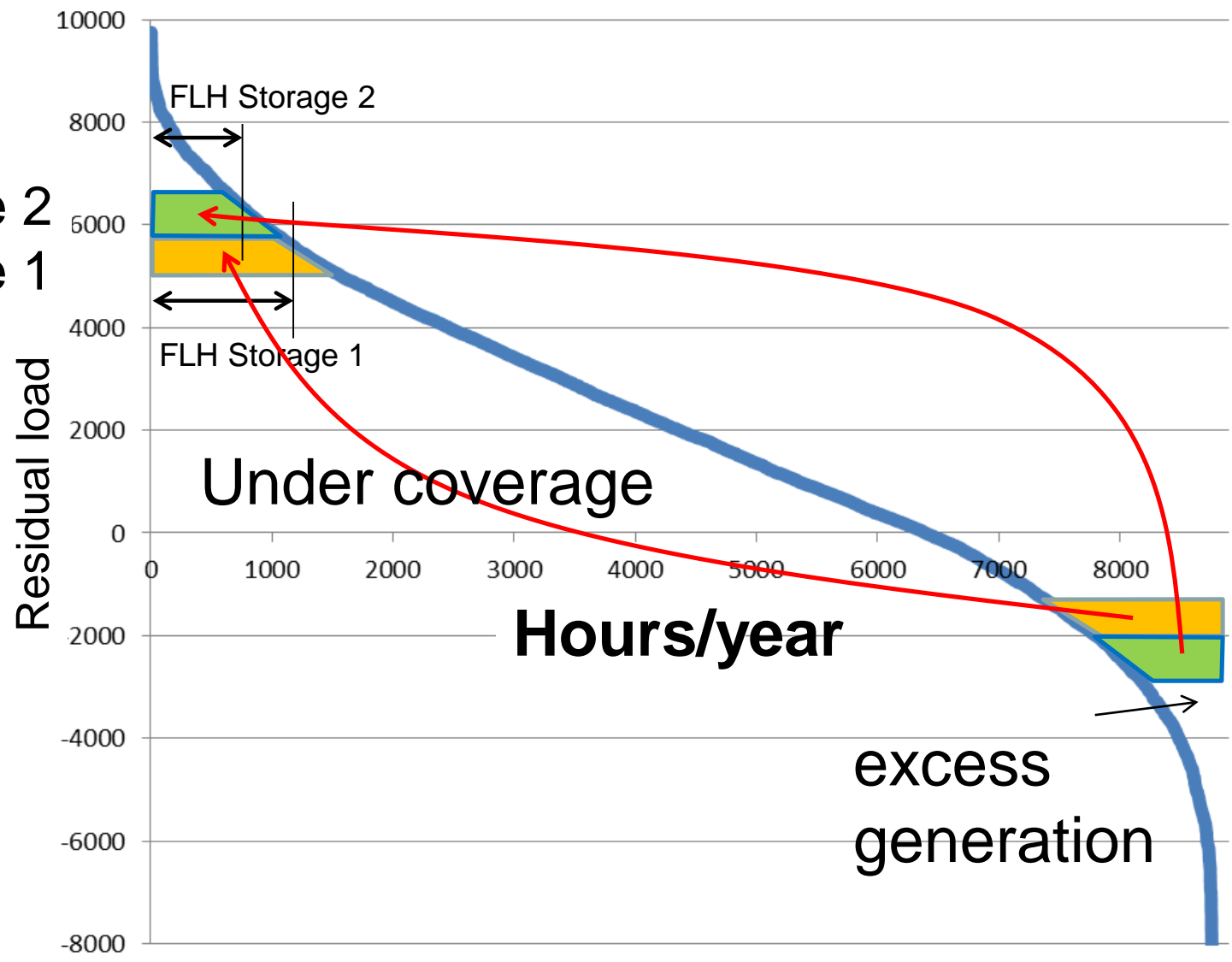


6. STORING EVERY PEAK?

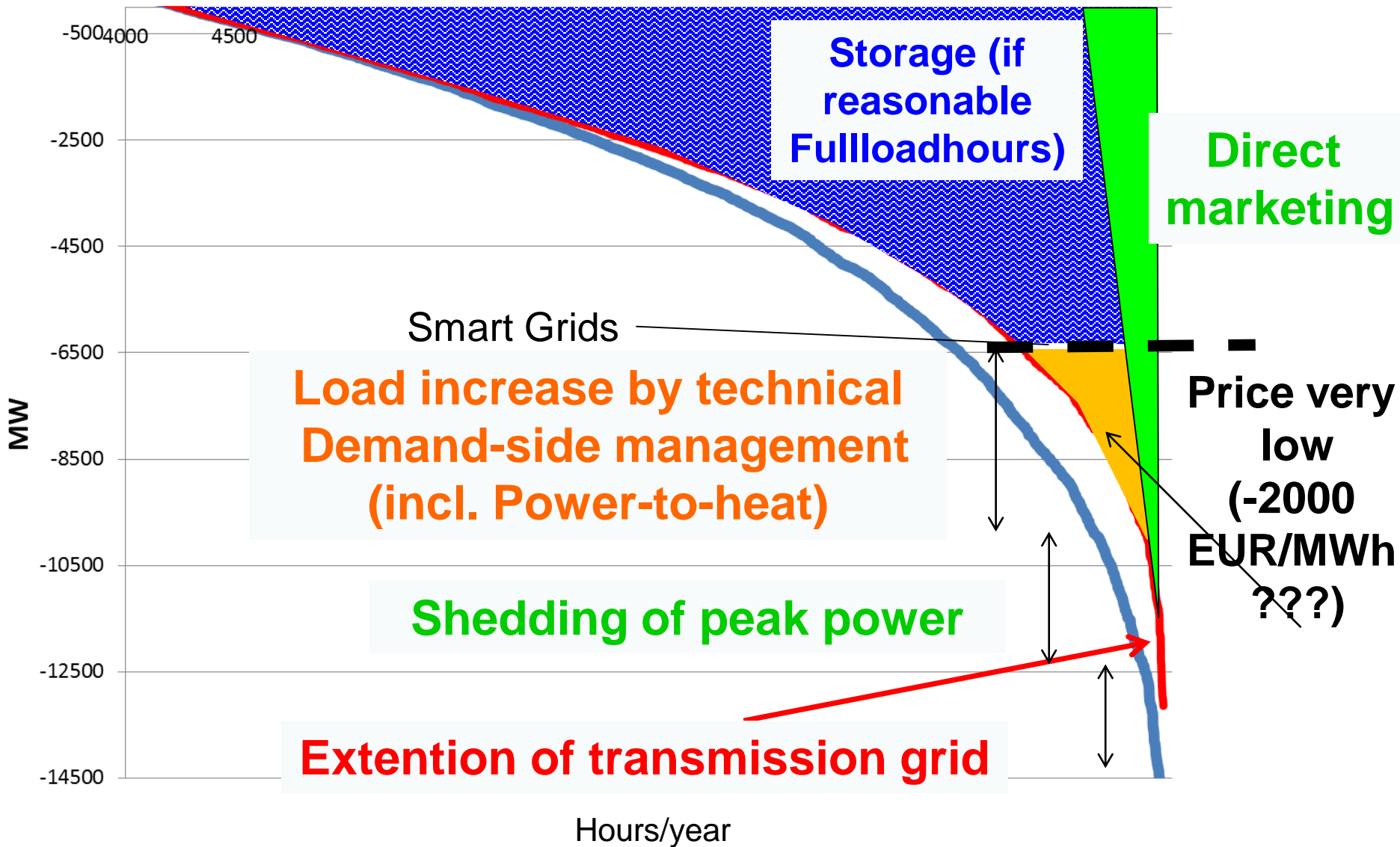


Decreasing full-load hours of storages

Storage 2
Storage 1



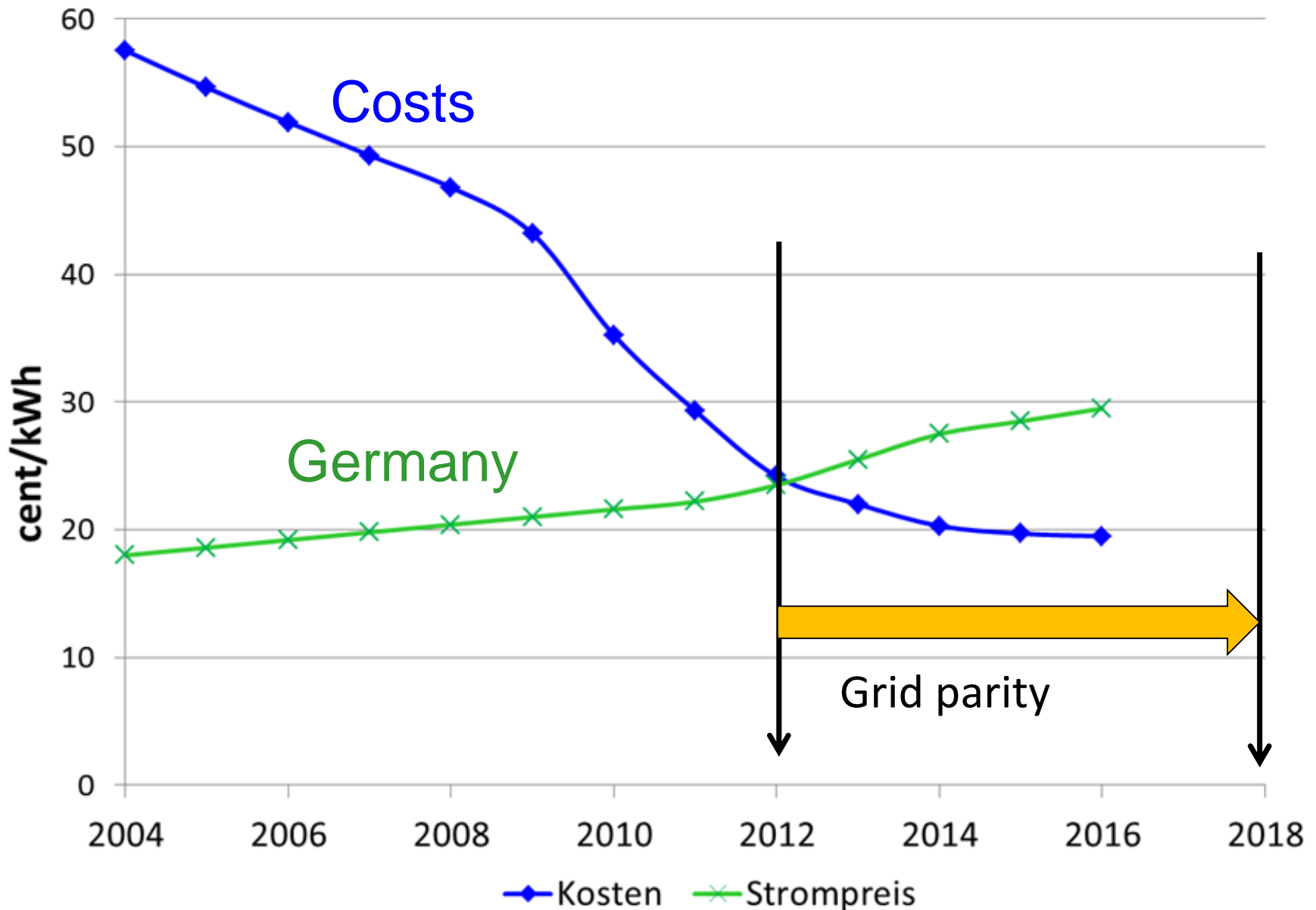
Flexible use of excess electricity



7. IS THE TIME FOR SUBSIDIZING RENEWABLES OVER ?

As long there is no price on CO₂

Grid parity: PV-costs and household electricity prices

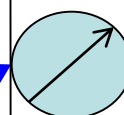


Tenant electricity model and Blockchain

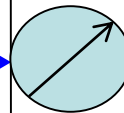
PV-System on the roof

Tenant electricity model:
Contracted PV-electricity

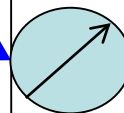
**Balancing
Group/
Supplier**



Customer 1



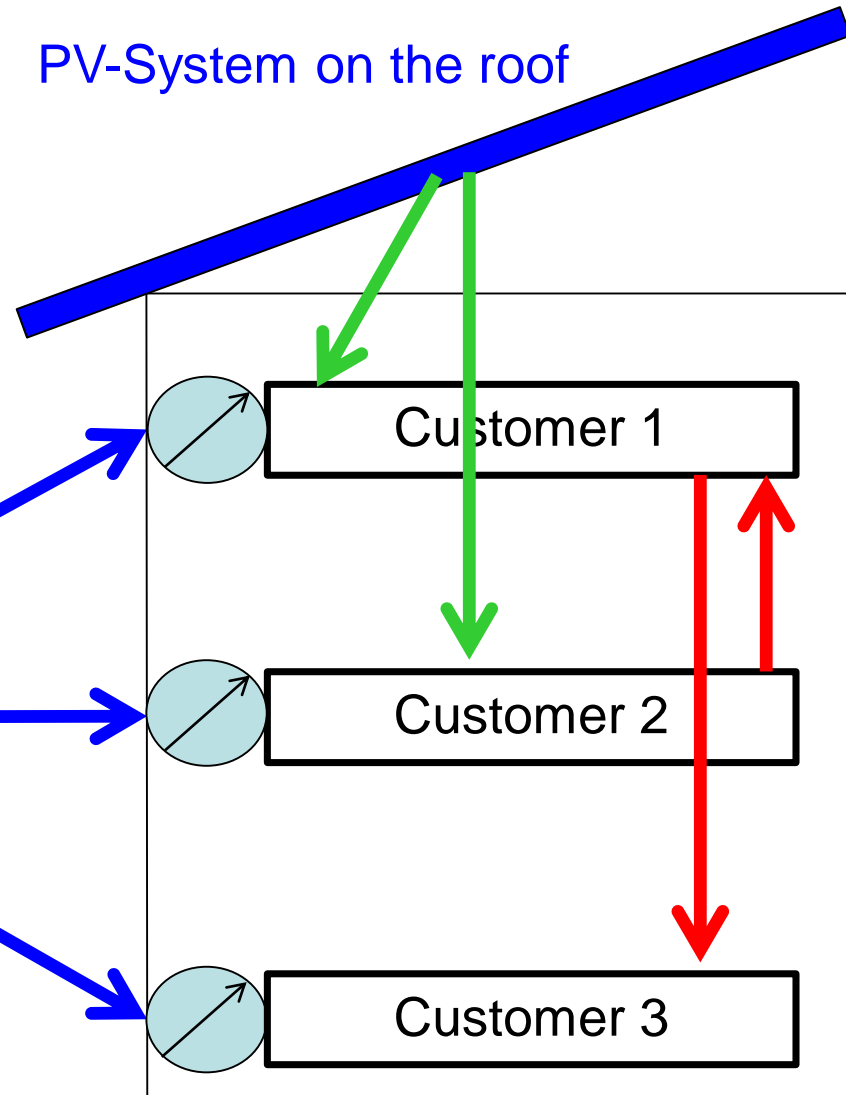
Customer 2



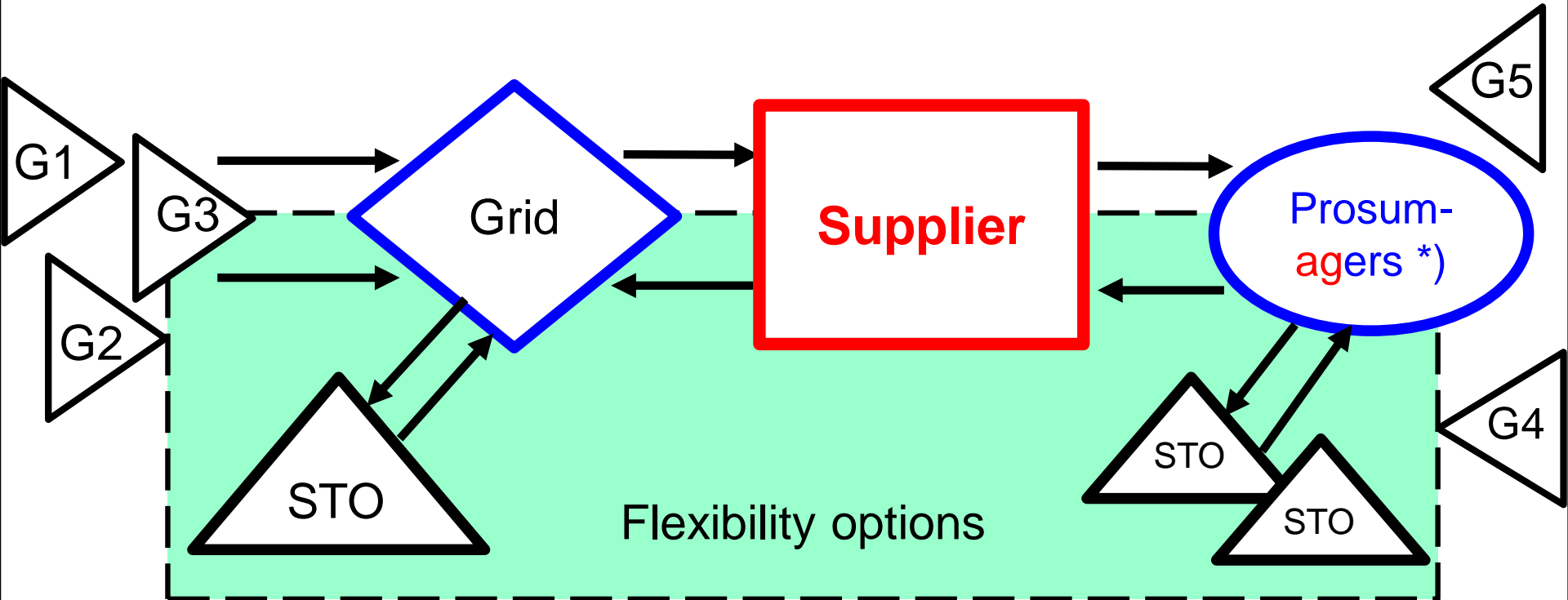
Customer 3

Meter

Blockchain



New Thinking: Making the electricity system more democratic



*) R. Green

- Sustainable electric. system → integration of a broad technology portfolio & demand-side options
- No quick fix, no one size fits all solutions
- Larger market areas favourable
- Very important: correct price signals (incl. CO₂)
- most urgent: exhaust full creativity for flexibility of all market participants (Erdmann)
- Capacity payments: Any CP will distort the system towards more conv. and less RES capacity
- Prospects for storage: less bright than argued
- New key players: Suppliers / balancing groups