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16th IAEE

European Conference

Ljubljana

25–28 August 2019



IAEEINTERNATIONAL ASSOCIATION of ENERGY ECONOMISTS
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SAEESLOVENSKO ZVEZANJE ZA ENERGETIKO EKONOMIKO

Energy Challenges for the Next Decade

#IAEE19LJ

School of Economics and Business, University of Ljubljana, Slovenia

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Energy markets are becoming increasingly complex. Over the past decades, we have witnessed tremendous changes in the industry's fundamentals induced by policy and technological advancement, which required redesigning of markets. Climate policies aimed at decarbonisation extensively contributed to the changed energy mix. Recent shifts in geopolitical relations with the EU partners additionally add to the industry's complexity and uncertainty. The EU energy policy in the next decade continues to be directed towards achieving competitive, secure and sustainable energy system, which calls for huge investments in infrastructure and low-carbon technology with increased involvement of private capital.

The central topic of this conference will be to assess the impacts and identify the main challenges of these events for all energy segments: oil, natural gas and power markets through the entire value chain in order to design a sustainable policy for the following decade. The main question to be addressed is: Have we learned from the experience how to design effective policies for the next decade together with all stakeholders – consumers, companies and governments? We invite you to be a part of this debate by attending this conference and exploring the vibrant city of [Ljubljana](#), the capital of [Slovenia](#) and the seat of the EU Agency for the Cooperation of Energy Regulators (ACER).

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HEADING TOWARDS SUSTAINABLE AND DEMOCRATIC ELECTRICITY MARKETS

Reinhard HAAS,
Energy Economics Group,
TU Wien

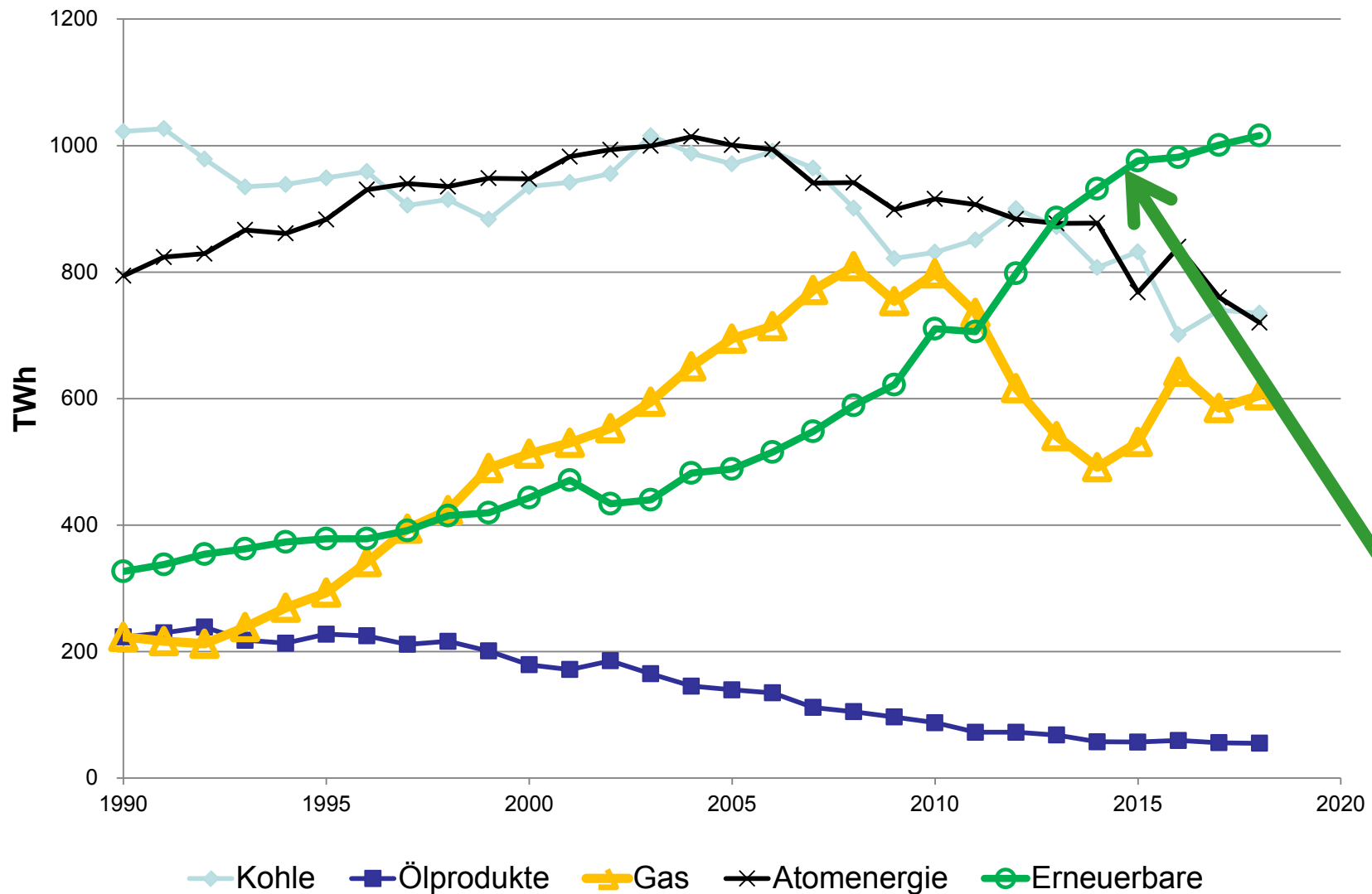
Ljubljana, August 2019

- 1. Introduction: Motivation**
- 2. Method of approach**
- 3. How variable renewables impact prices in electricity markets**
- 4. The core problem of capacity payments**
- 5. The role of flexibility**
- 6. Storing every peak?**
- 7. Subsidizing renewables?**
- 8. Conclusions**

Motivation:

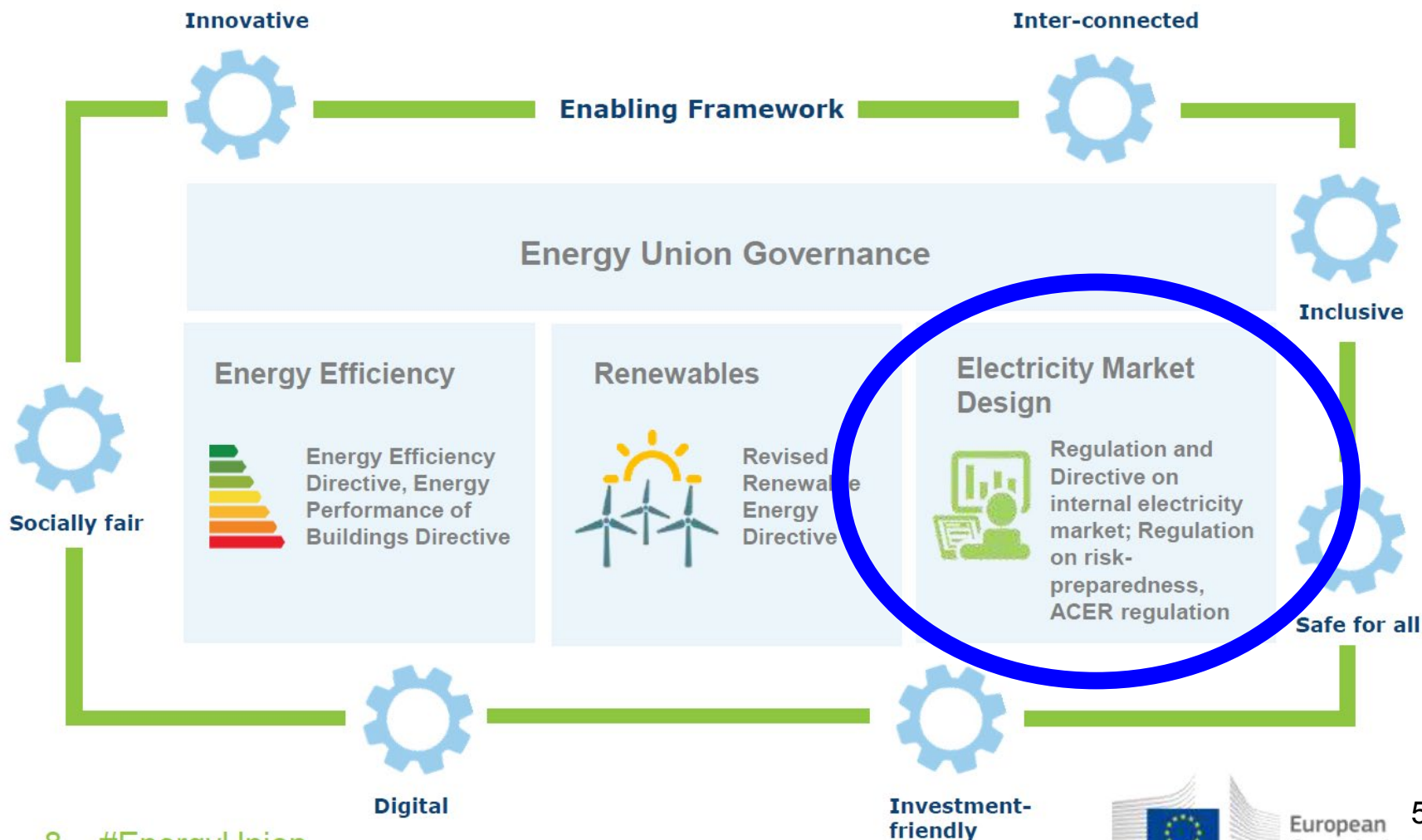
- * **Europe: The clean energy package → energy communities**
- * **It is not possible to force variable renewables into the system**
- * **A strong desire of some customers to participate in electricity supply**

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

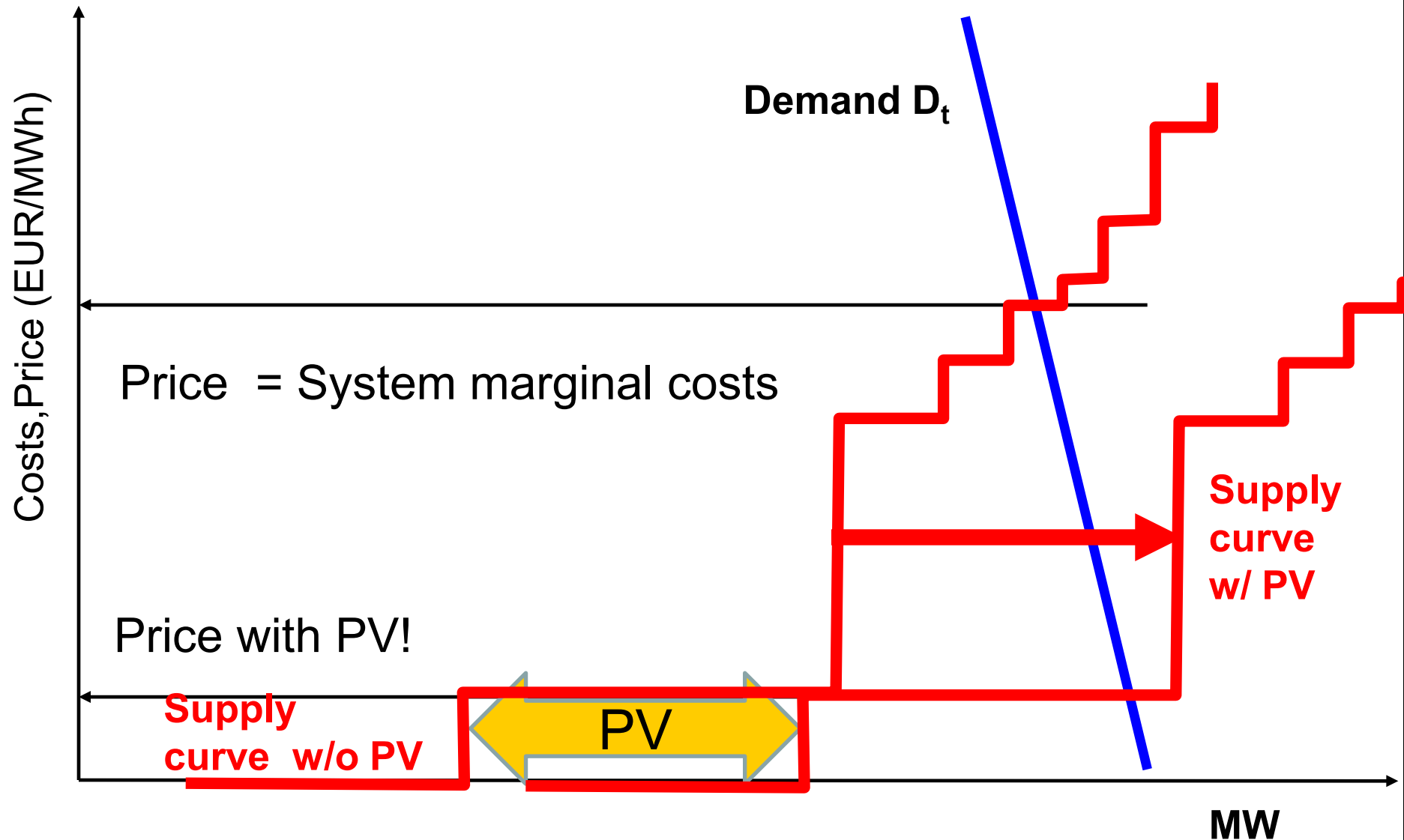
.... are based on **electricity economic** point-of-view

2. METHOD OF APPROACH

- 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



RES Production

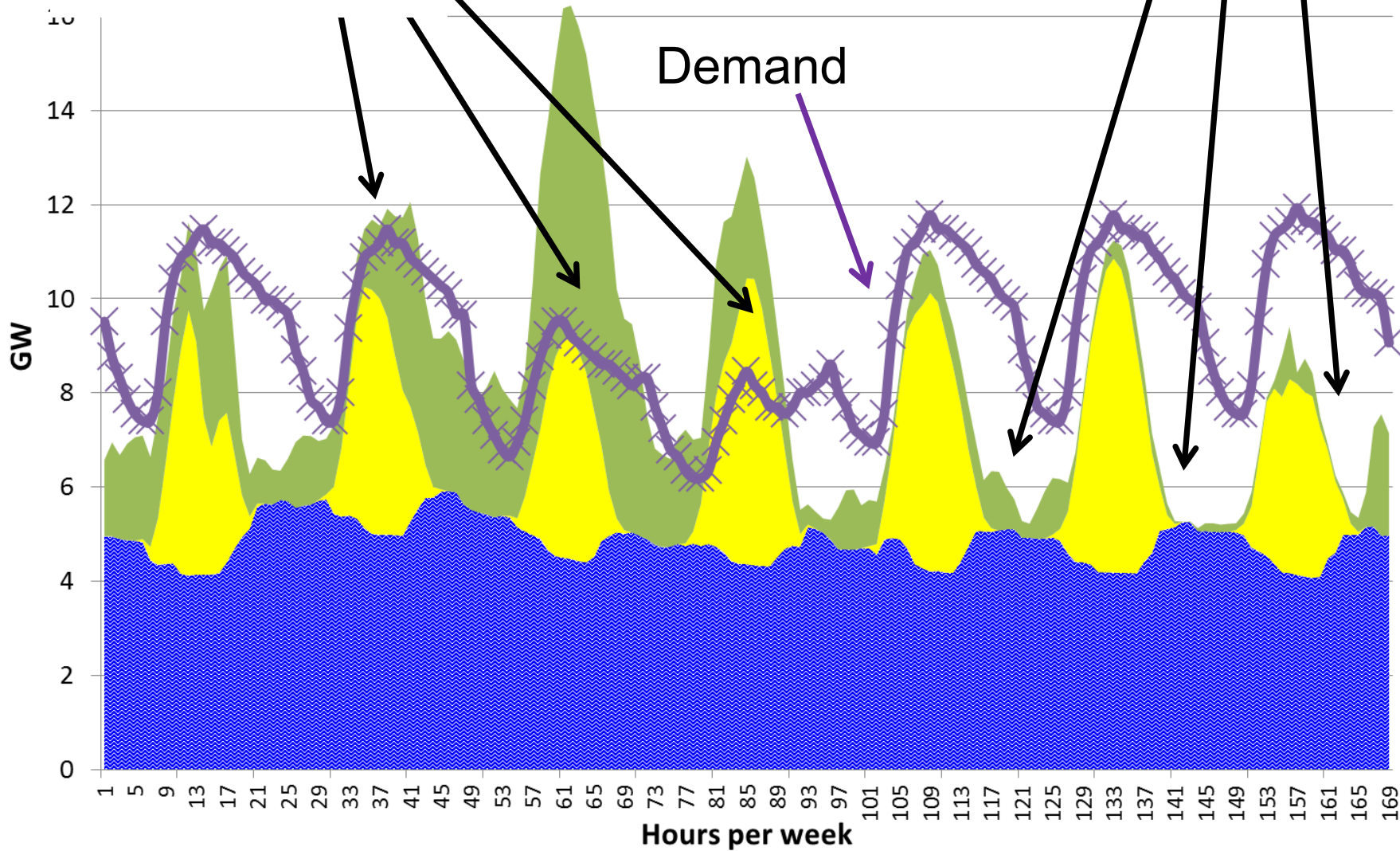
> Demand

on-river hydro PV Wind Load

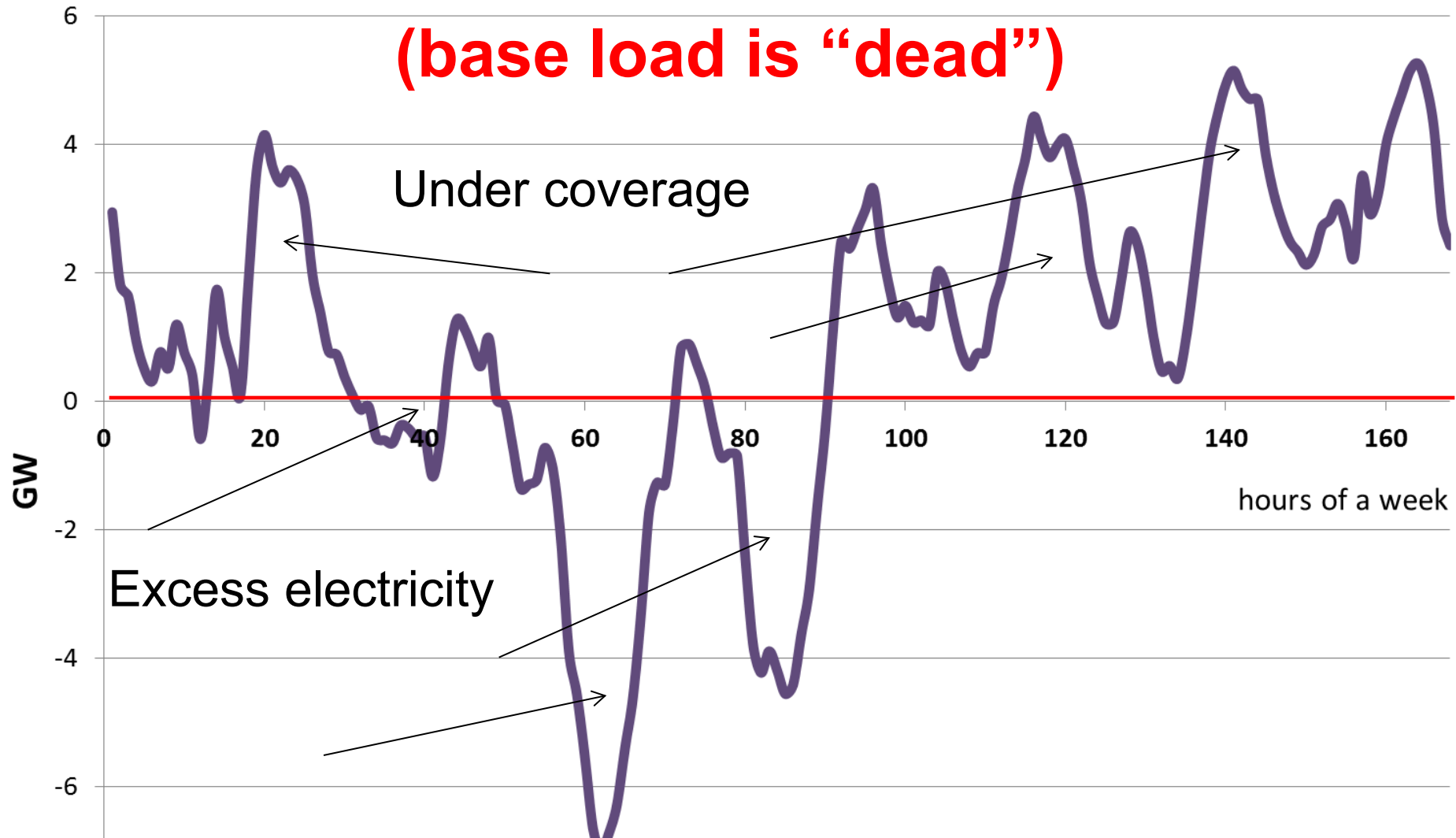
Demand

RES Production

< Demand



Key term of the future: Residual load (base load is “dead”)

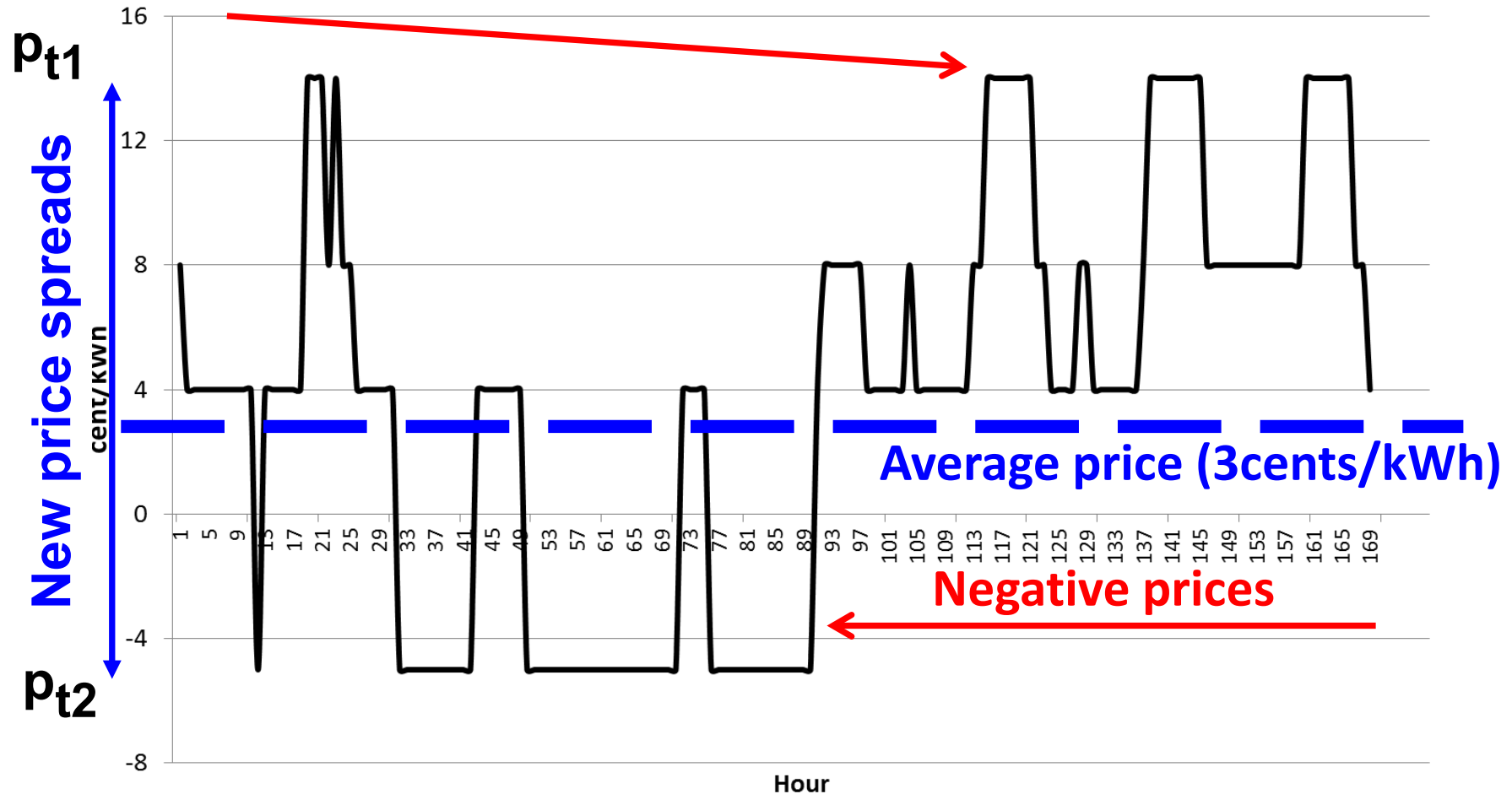


Residual load = Load – non-flexible generation

Deviation from STMC-pricing in spot markets

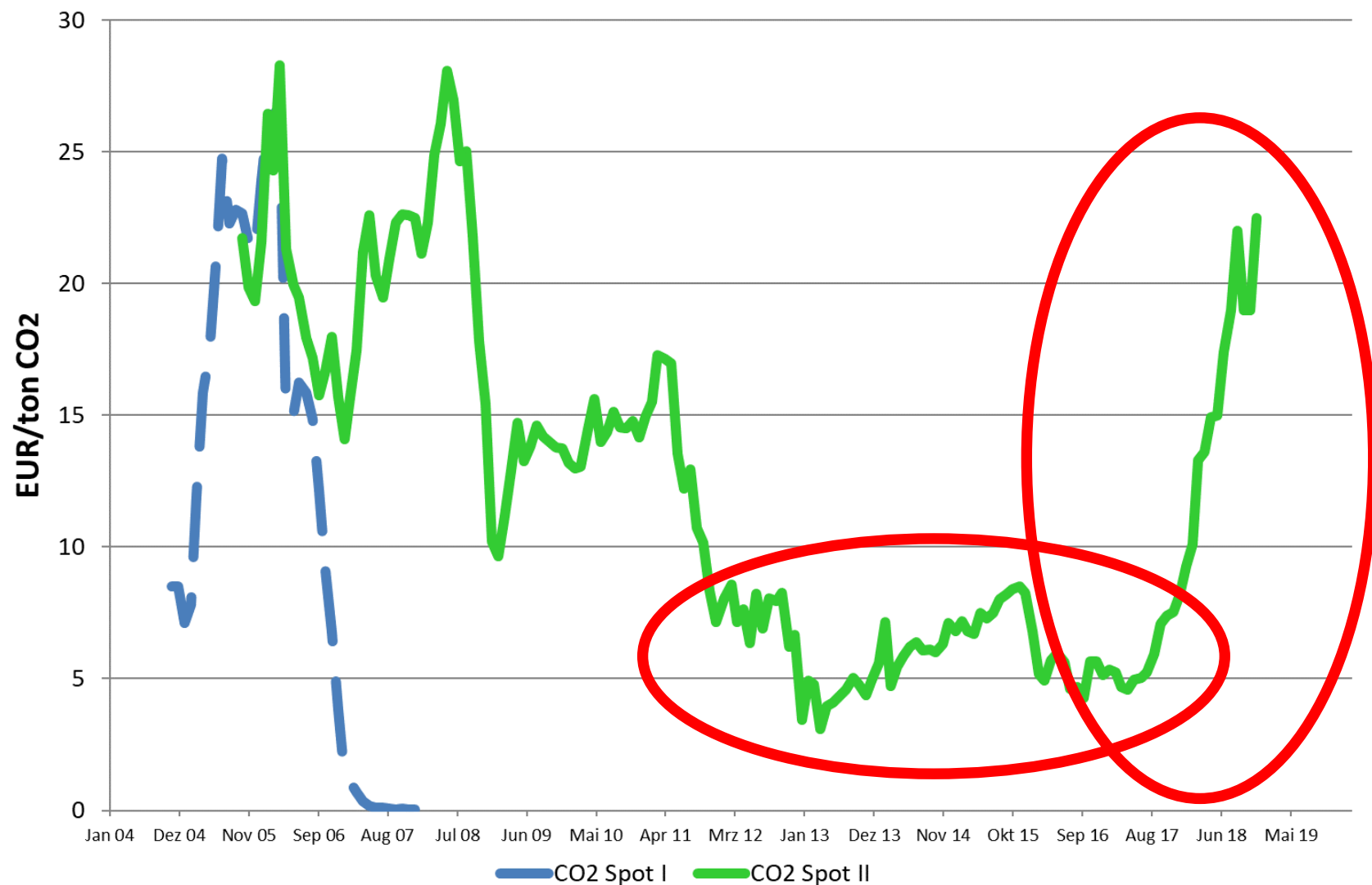
Scarcity prices

Electricity price spot market

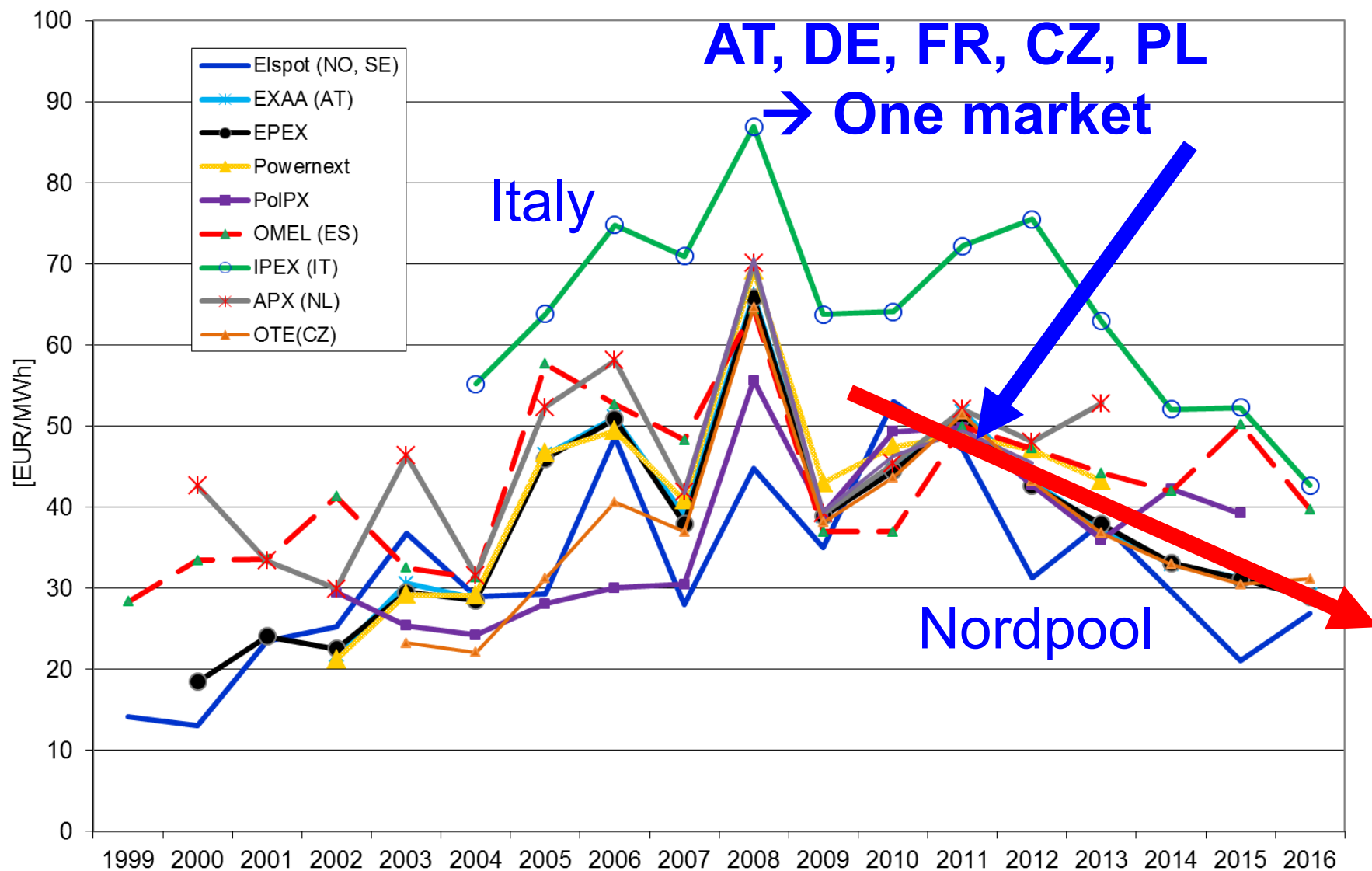


→ These price spreads provide incentives
for new flexible solutions!!!!

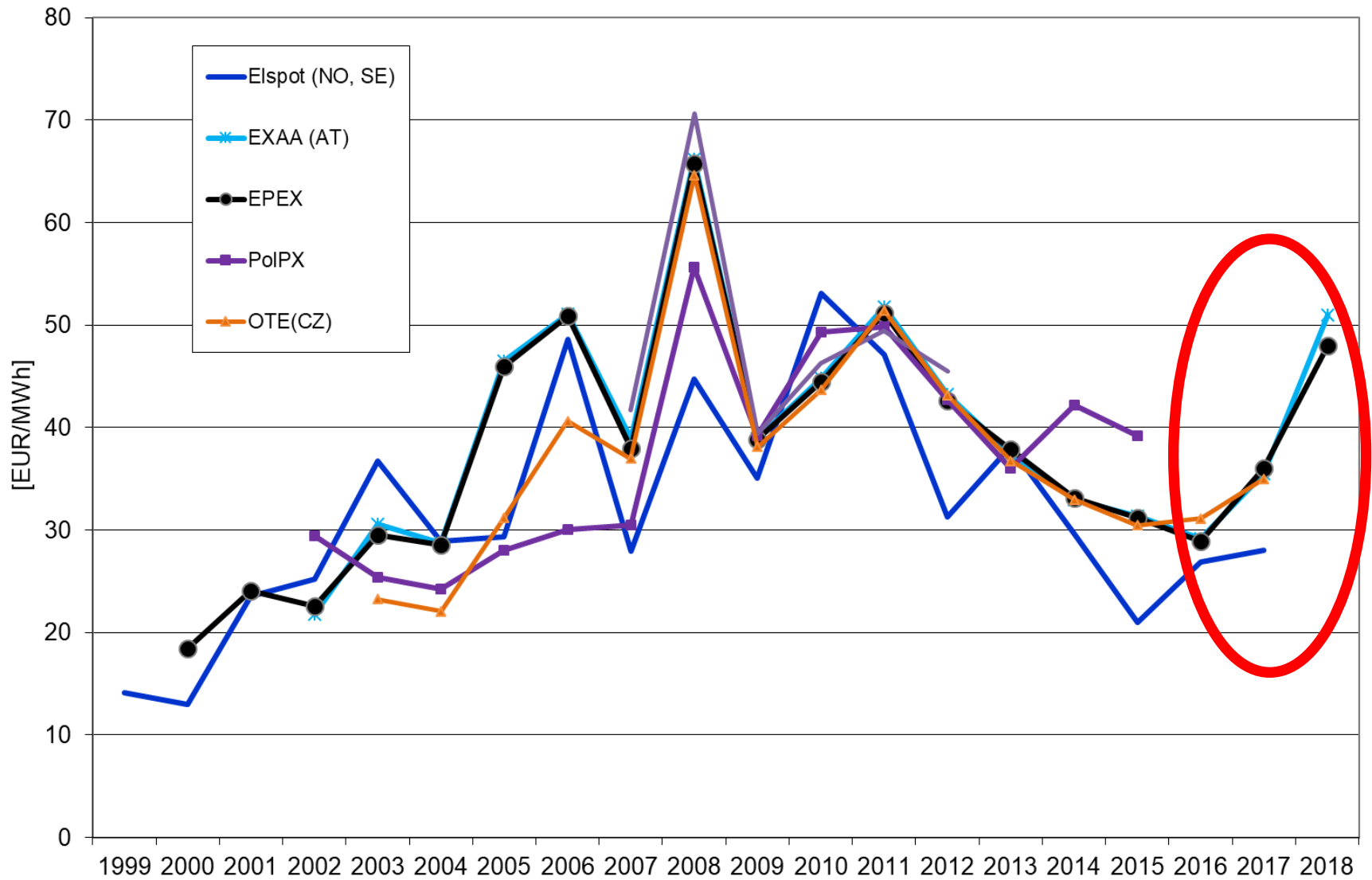
The CO₂-Price



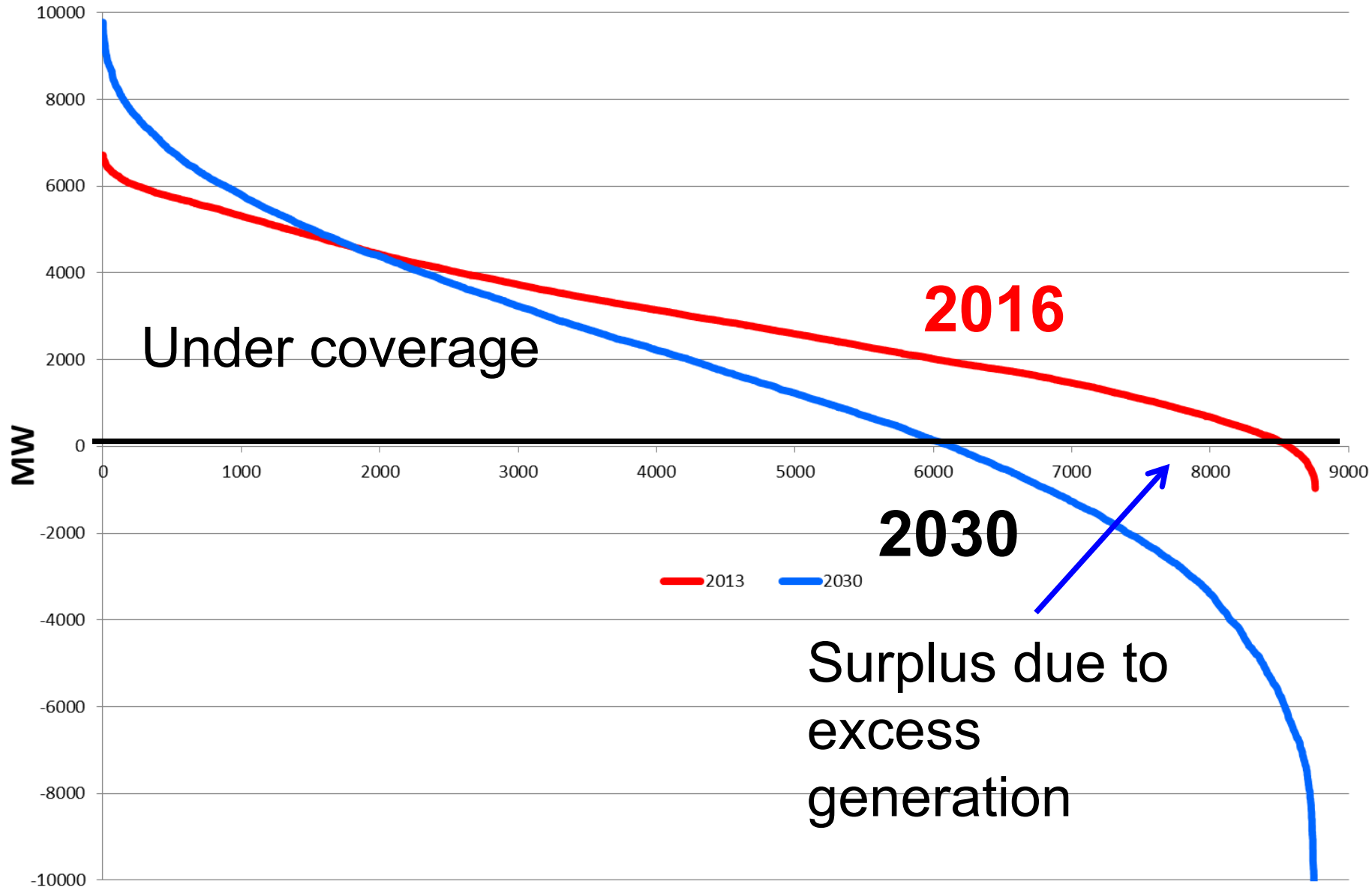
Development of electricity prices in Europe up to 2016 (1)



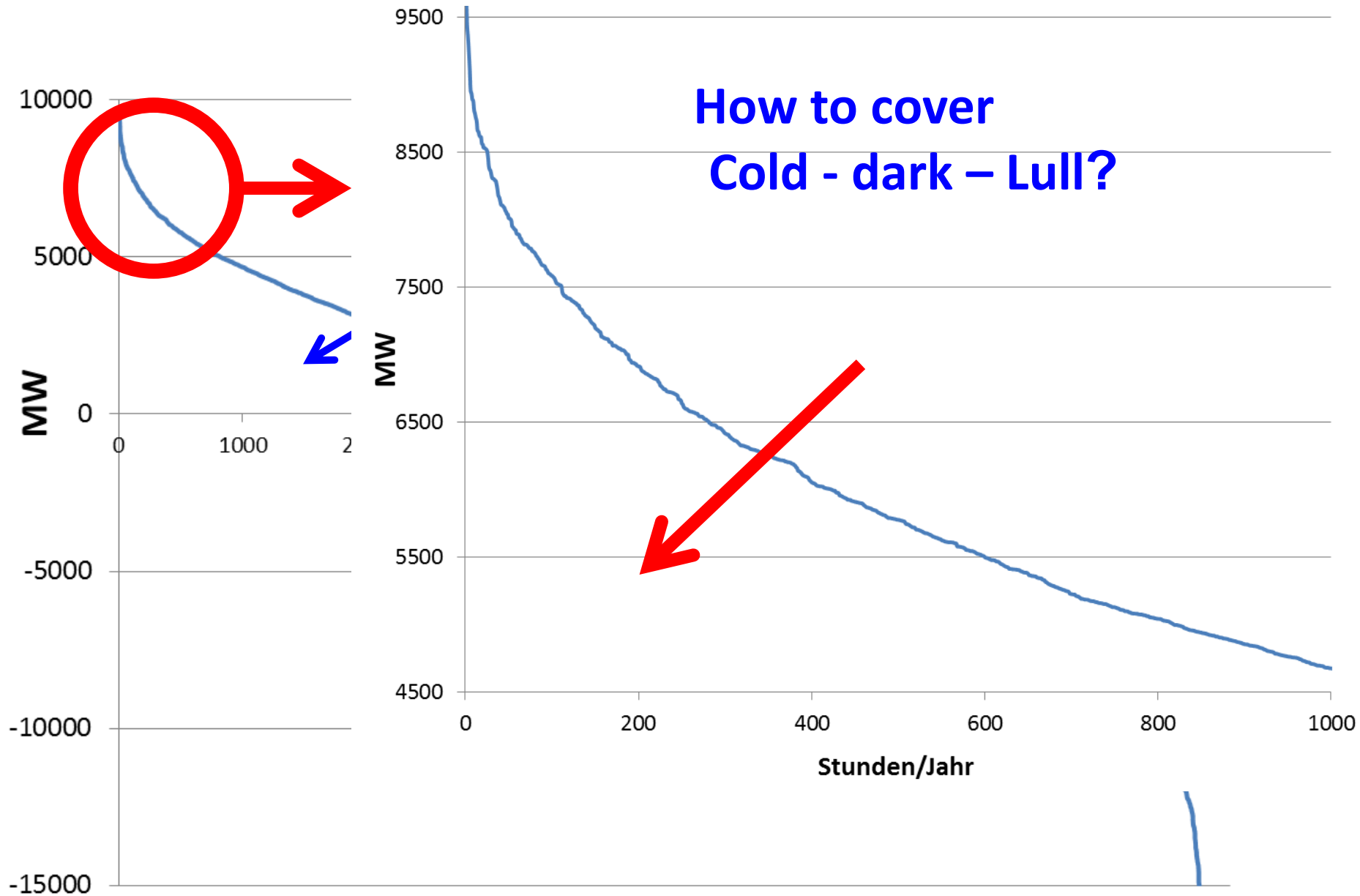
Development of electricity prices in Europe up to 2018 (2)



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

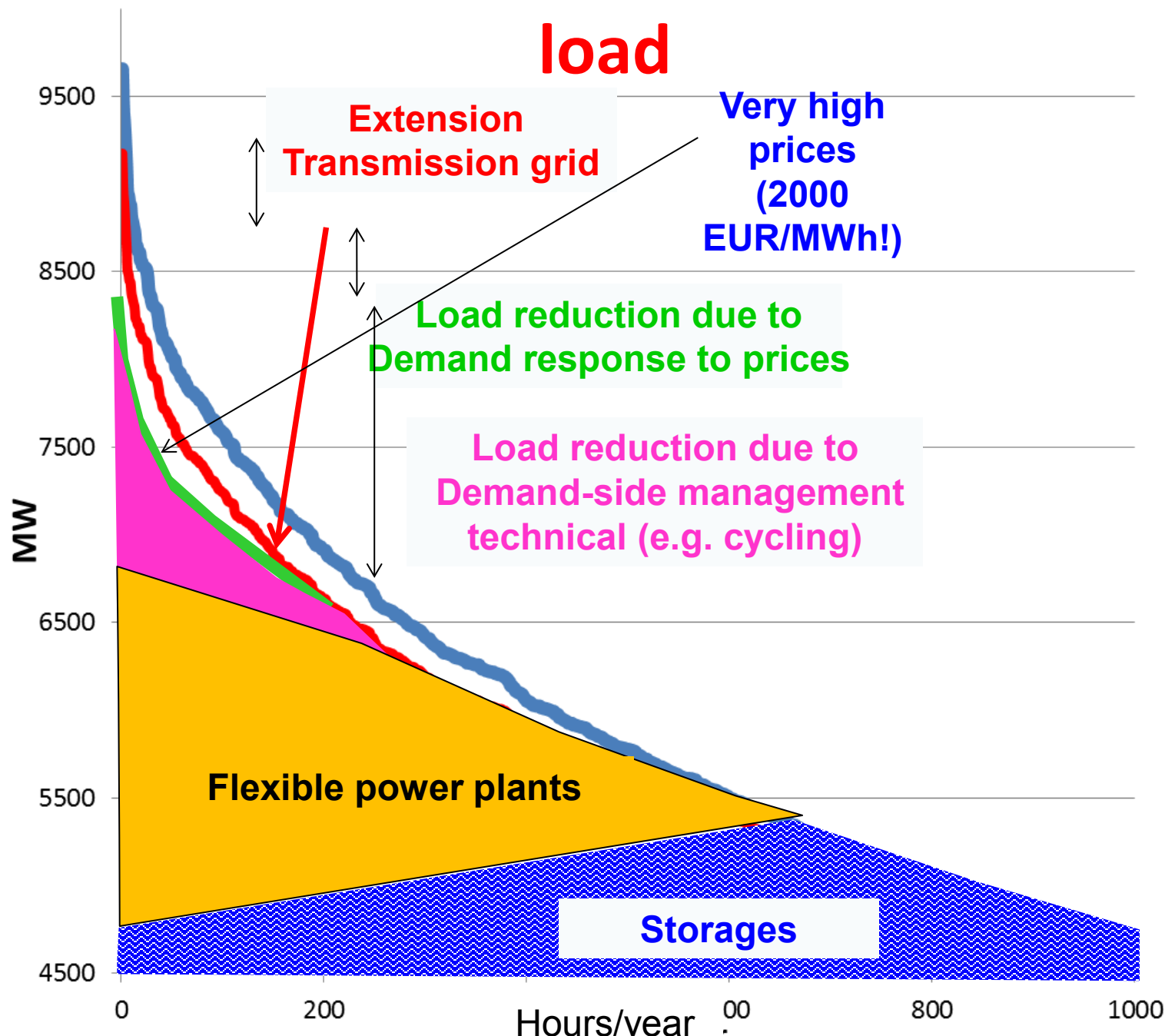
Price peaks at times of scarce resource should revive the markets and lead to effective competition

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

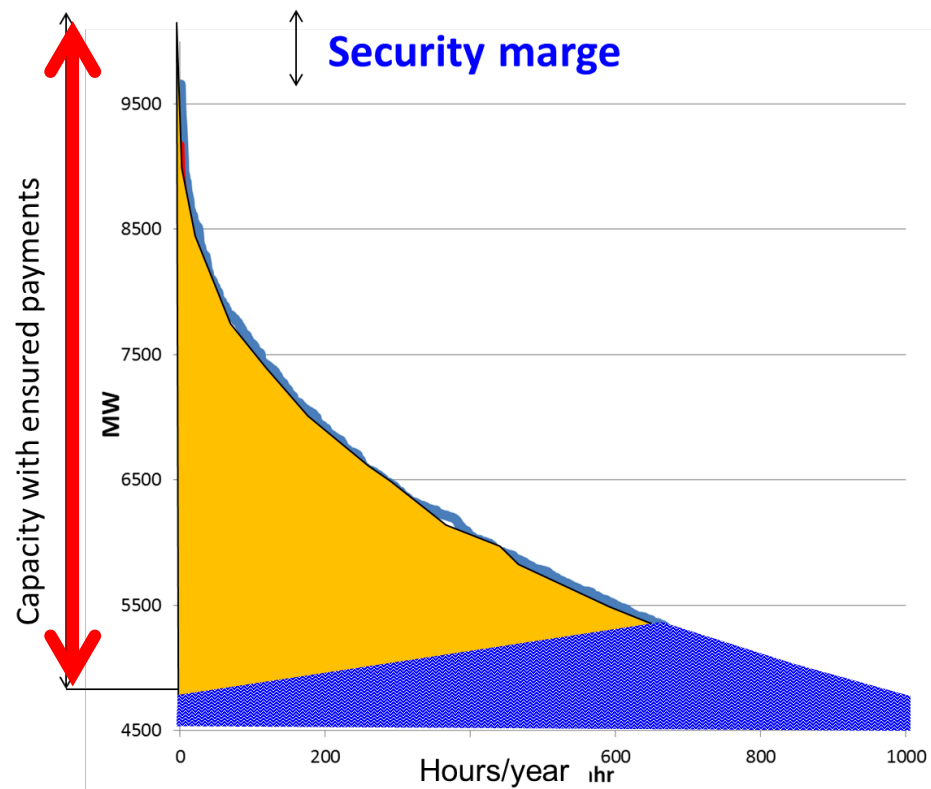
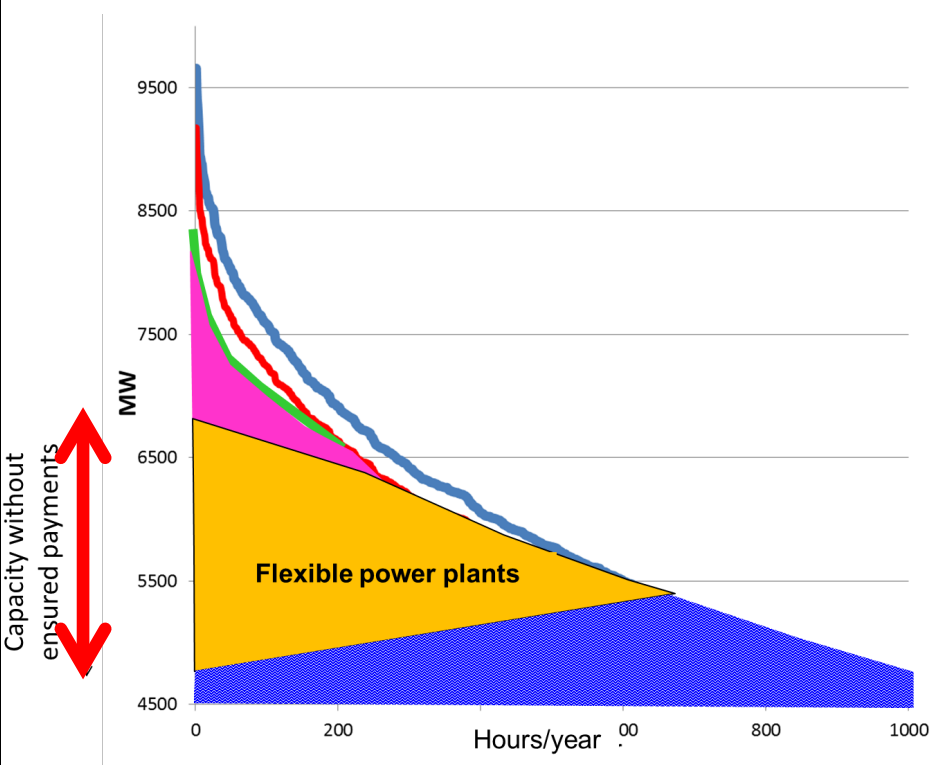
strive to retain system resource adequacy by correct price signals

5 Flexible coverage of residual load

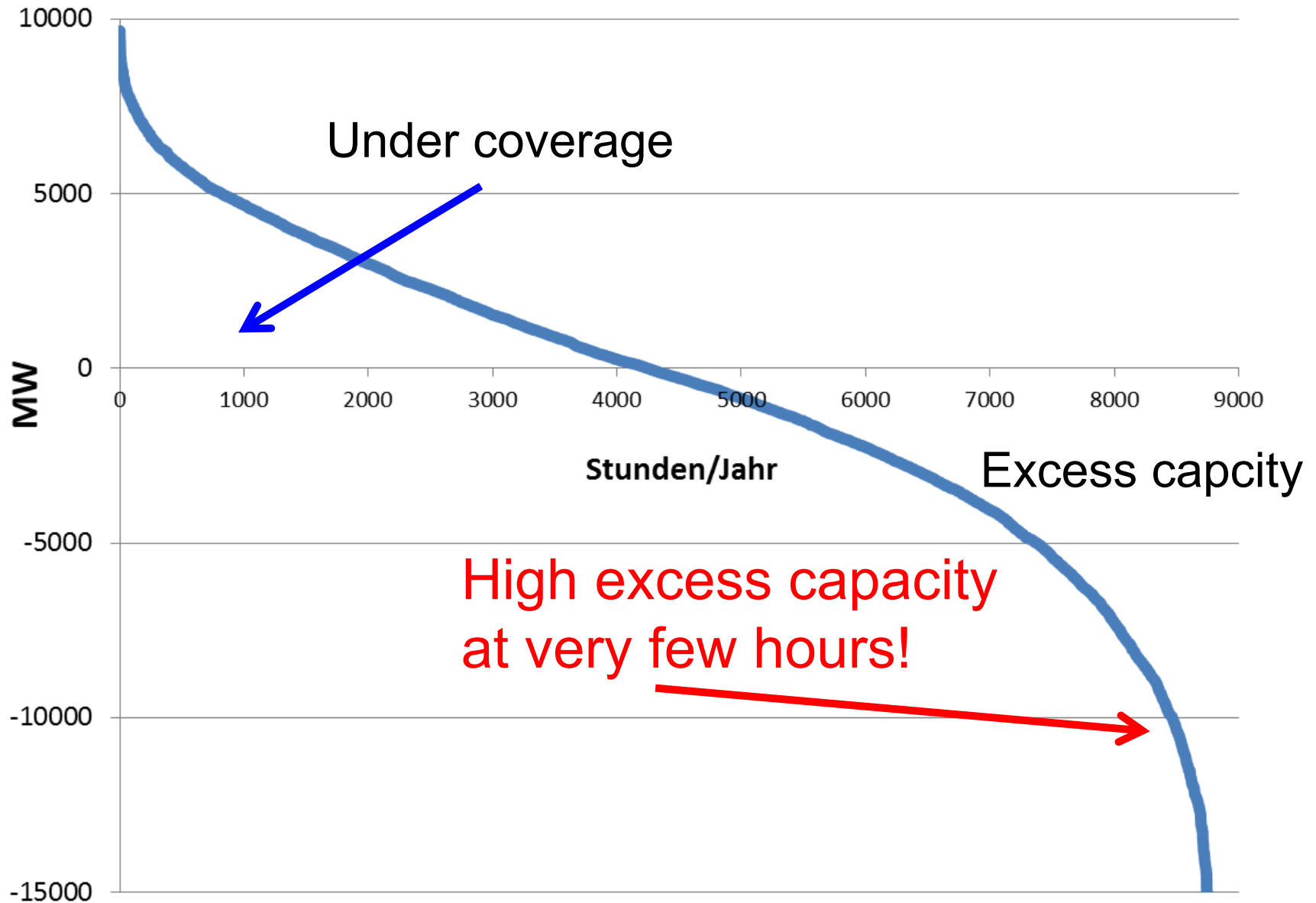
Capacity without
ensured payments



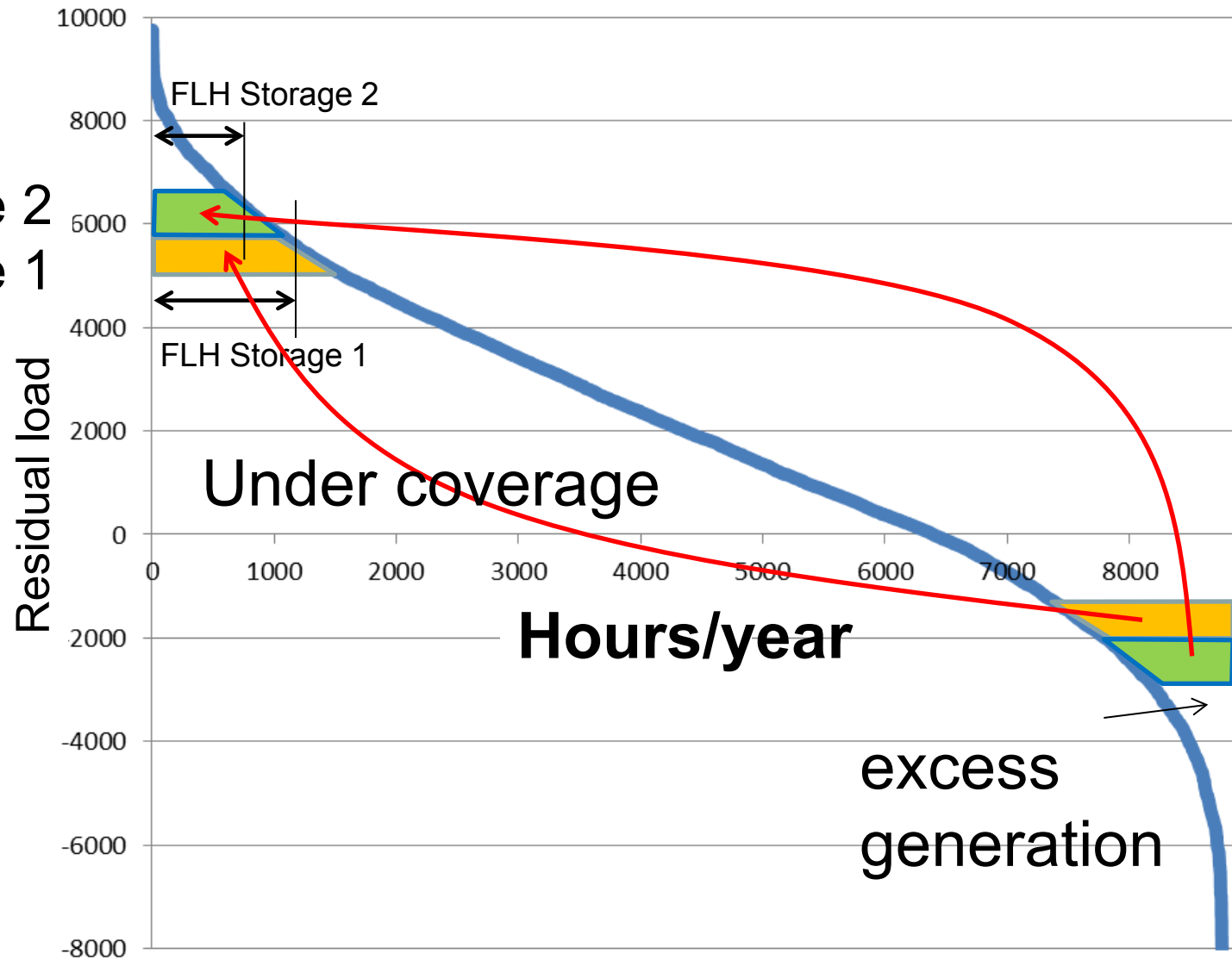
Comparison



6. STORING EVERY PEAK?



Decreasing full-load hours of storages



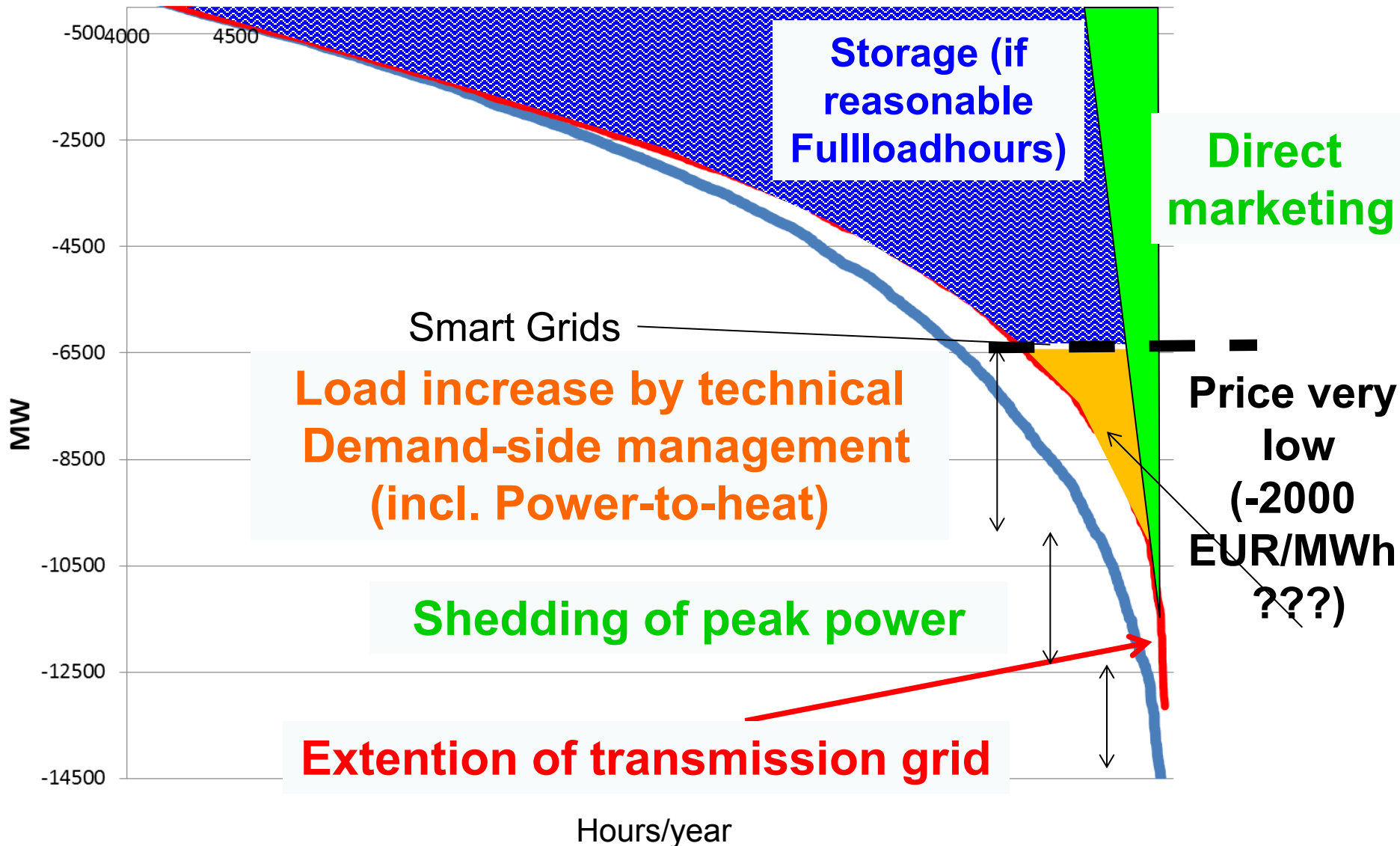
Storage 2
Storage 1

Under coverage

Hours/year

excess
generation

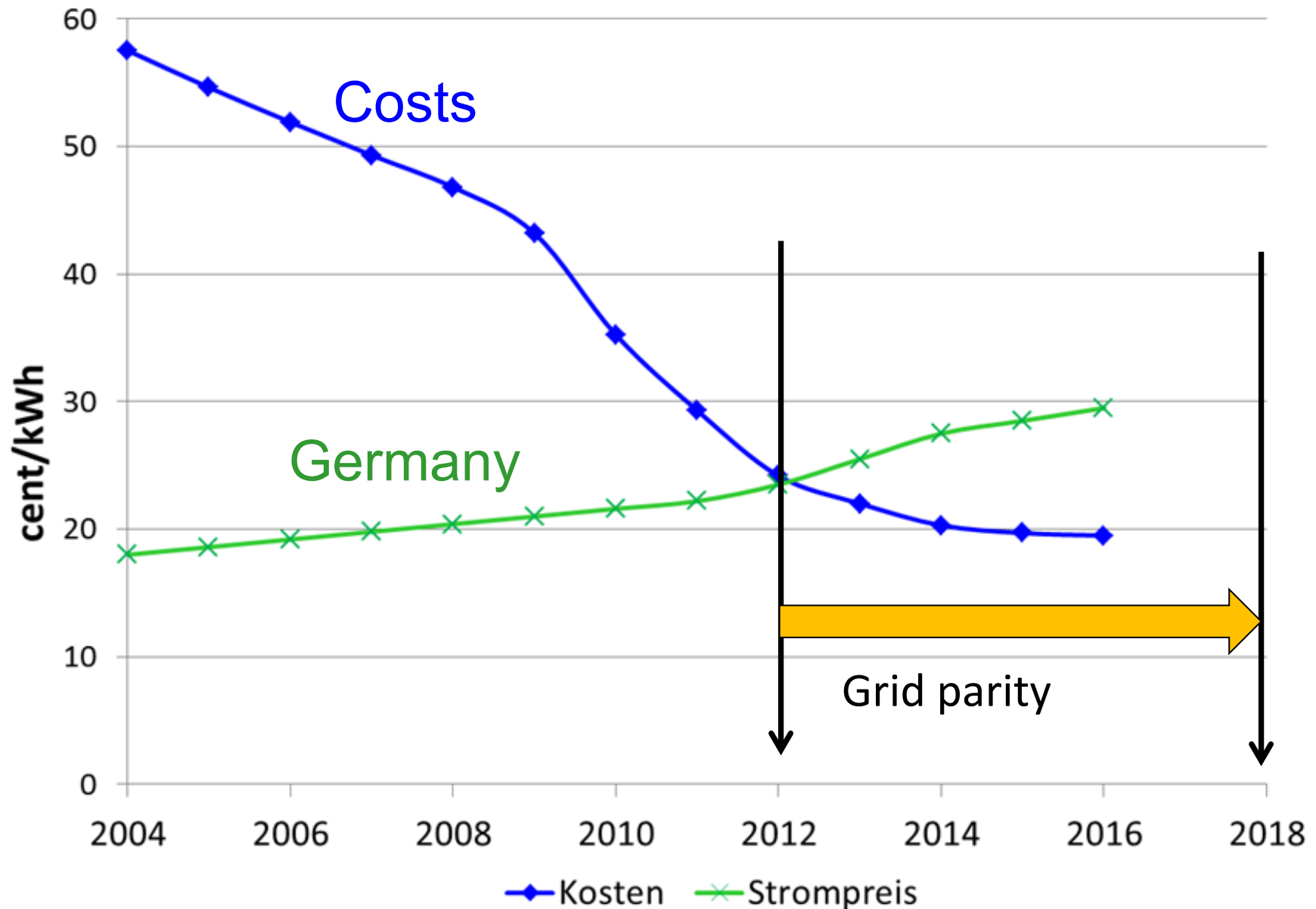
Flexible use of excess electricity



7. IS THE TIME FOR SUBSIDIZING RENEWABLES OVER ?

As long there is no price on CO₂

Grid parity: PV-costs and household electricity prices

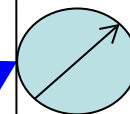


Tenant electricity model and Blockchain

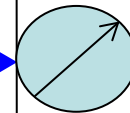
PV-System on the roof

Tenant electricity model:
Contracted PV-electricity

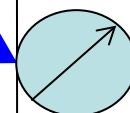
**Balancing
Group/
Supplier**



Customer 1



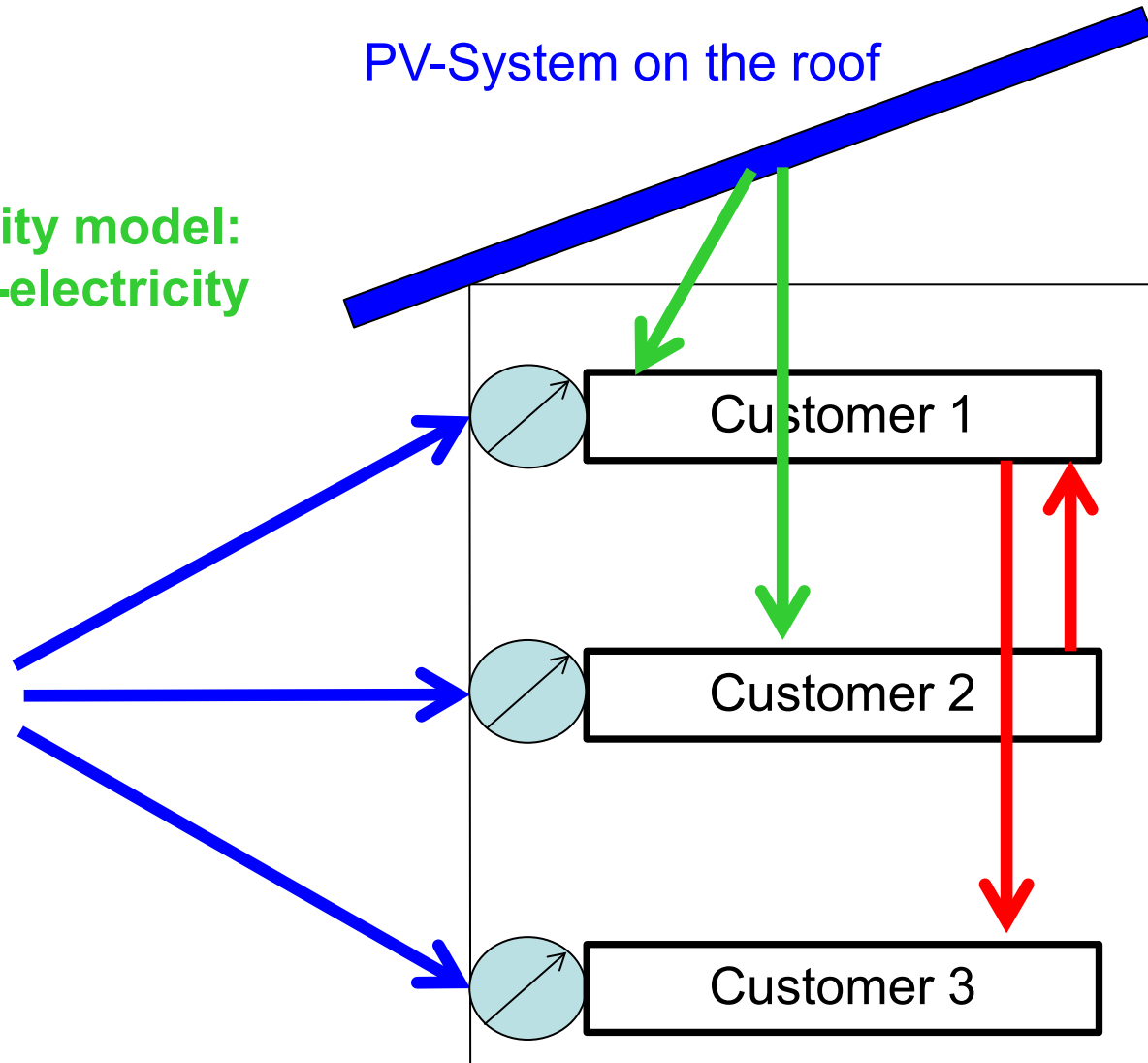
Customer 2



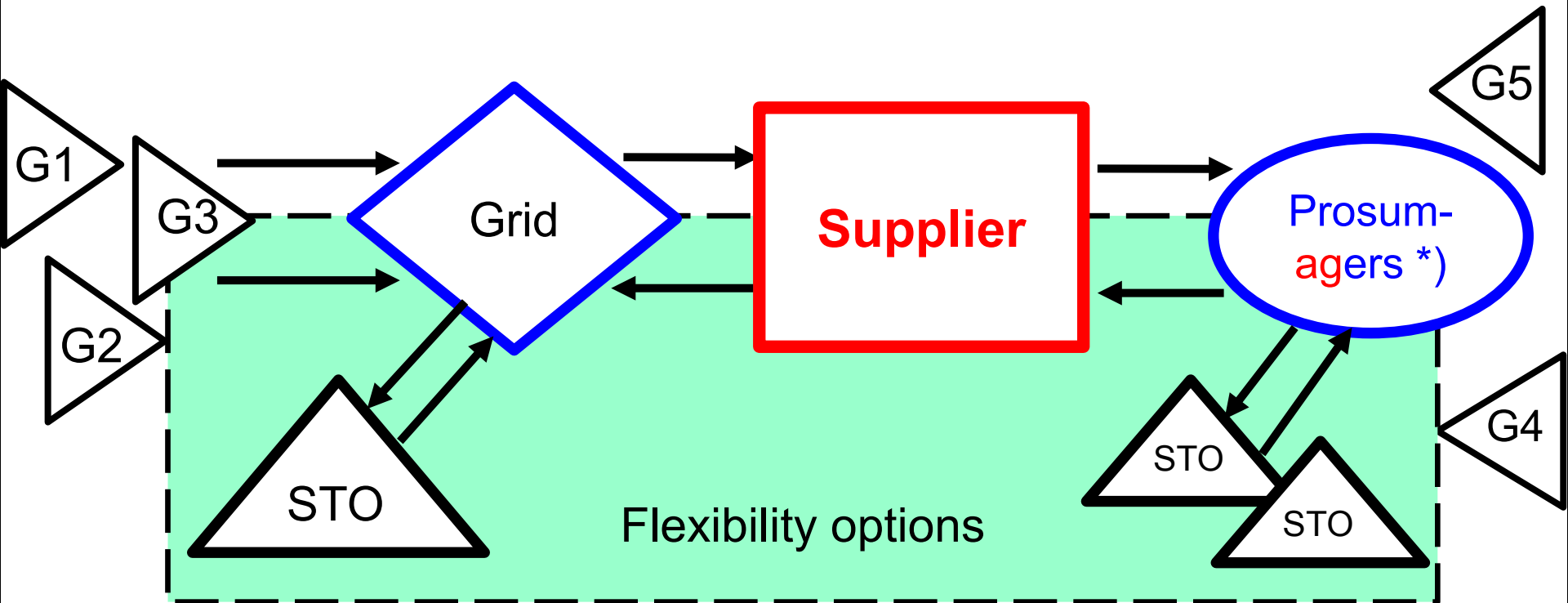
Customer 3

Meter

Blockchain



New Thinking: Making the electricity system more democratic



8. CONCLUSIONS

- 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