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INTERNATIONAL CONFERENCE IN ENGINNERING APPLICATIONS 19

ICEA19

- Home
- Conference Topics
- Deadlines
- Invited Speakers
- Committees
- Submission
- Program
- Special Issues
- Conference Location
- Local Information
- Registration
- Camera ready paper submission
- Previous Conferences

EVENT LOCATIONS

No locations

ICEA19 AZORES

SHARE

3rd International Conference in Engineering Applications 2019

INVITATION

It is our great pleasure to invite you to participate in the International Conference in Engineering Applications – ICEA19, to be held in Azores Island, July 8th to 11th, 2019. This conference is organized by UMa – University of Madeira, Madeira Interactive Technologies Institute (M-ITI) and University of the Azores.

Contributions are welcome in both theoretical developments and practical implementations in all areas involving Biomedical, Energy, IoT, Electronics and Education. Between all contributions presented, two will be selected to receive a best paper award. More information in the call for papers. ICEA19 will provide an excellent opportunity for presenting new results and to discuss the latest research and developments in the field.

This conference will join engineering related application areas and is organised in multiple tracks:

Track1:
Biomedical Engineering Applications

Track2:
Energy and Sustainability for Small Developing Economies

Track3:

Internet of Things for Global Community

Track4:
Electronics Applications and System Integration for Future Technologies

Track5:

12:36
27.11.2019

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ICEA19 AZORES

Reinhard Haas, PhD

(University professor)

Energy Economics Group, Institute of Energy Systems and Electric Drives, Vienna University of Technology

SHARE

Keynote Talk: Heading towards sustainable and democratic electricity systems

ABSTRACT:

In the history of the electricity systems in several countries different boundary conditions existed and exist with respect to price formation in the market. After the periods of state regulation and the first phase of liberalisation of the wholesale markets currently the electricity system faces the third huge challenge: the change towards a bidirectional system, which should be more democratic and sustainable allowing also prosum(ag)ers – consumers with own generation units and storage – to play a specific role. This process is currently under way in many countries world-wide and in these countries also a change in the principle how prices come about is already under way. A major reason for this development is that in recent years the electricity generation from variable renewable energy sources especially from wind and photovoltaic power plants increased considerably. The major objective of this contribution is to analyze and provide insights on how to bring about a sustainable and competitive electricity system with even higher shares of renewable energy sources (RES) and an energy economically balanced system but without escalating political interventions. It is triggered by the current discussion on how to integrate large shares of variable RES but the fundamental intention goes beyond that. The major conclusion is that the electricity system of the future will be built on a very broad portfolio of technologies and demand-side options, allowing a higher number of players to participate in the system and, hence, heading towards a much more democratic approach.

Biography:

Reinhard Haas is university professor of Energy Economics at Vienna University of Technology in Austria. He teaches Energy Economics, Regulation and Competition in Energy markets, and Energy Modelling.

His current research focus is on (i) evaluation and modelling of dissemination strategies for renewables; (ii) modelling paths towards sustainable energy systems; (iii) liberalisation vs regulation of energy markets; (iv) energy policy strategies.

He works in these fields since more than 20 years and has published more than 60 papers in reviewed international journals. Moreover, he has coordinated and coordinates projects for Austrian institutions as well as the European Commission and the International Energy Agency.

MARKET DESIGN FOR A SUSTAINABLE AND DEMOCRATIC ELECTRICITY SYSTEM

Reinhard HAAS,
Energy Economics Group,
TU Wien

Azores, July 2019

CONTENT:

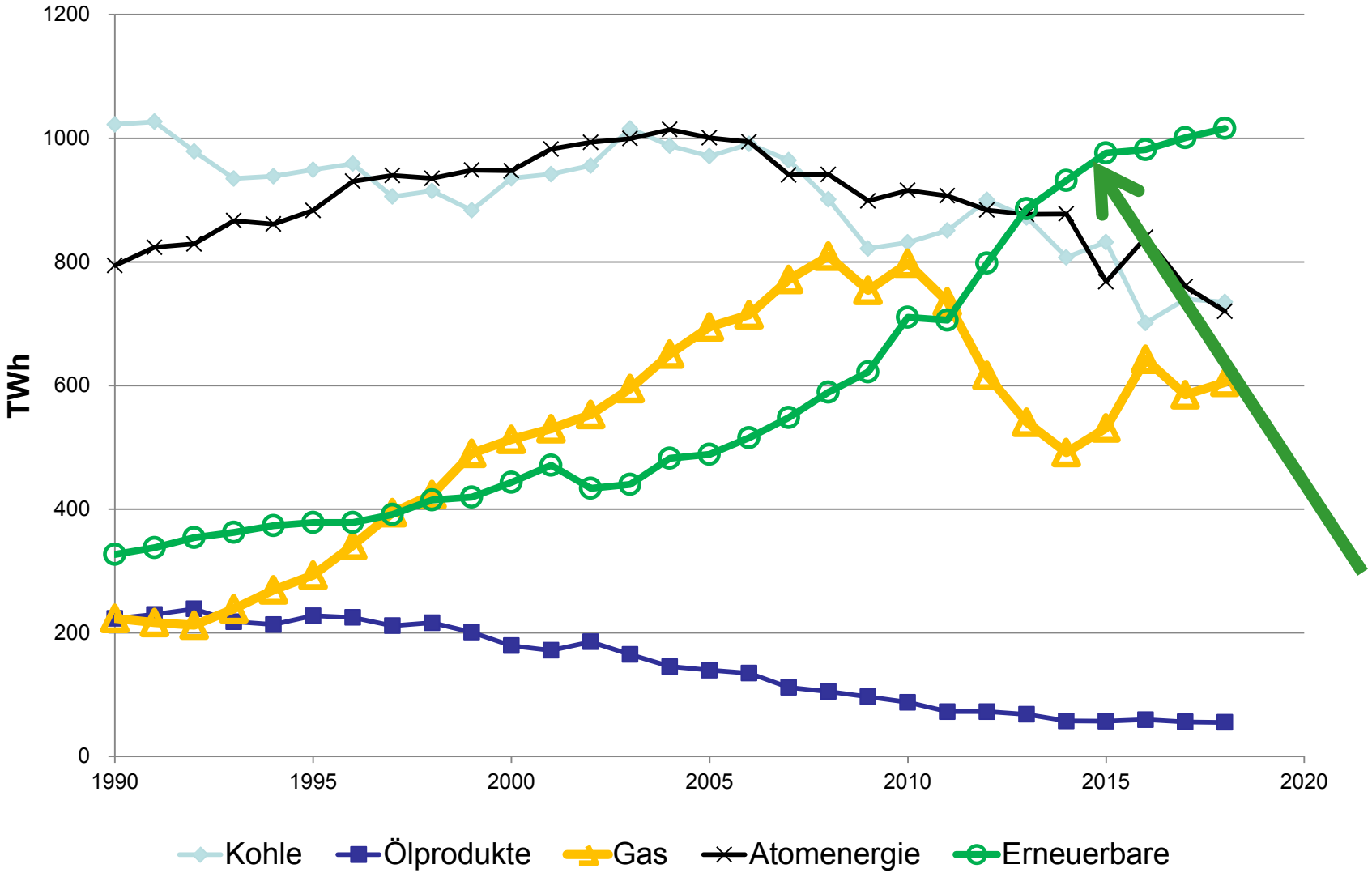
1. Introduction: Motivation
2. Method of approach
3. How variable renewables impact prices in electricity markets
4. The core problem of capacity payments
5. The role of flexibility
6. Storing every peak?
7. Subsidizing renewables?
8. Conclusions

1. INTRODUCTION

Motivation:

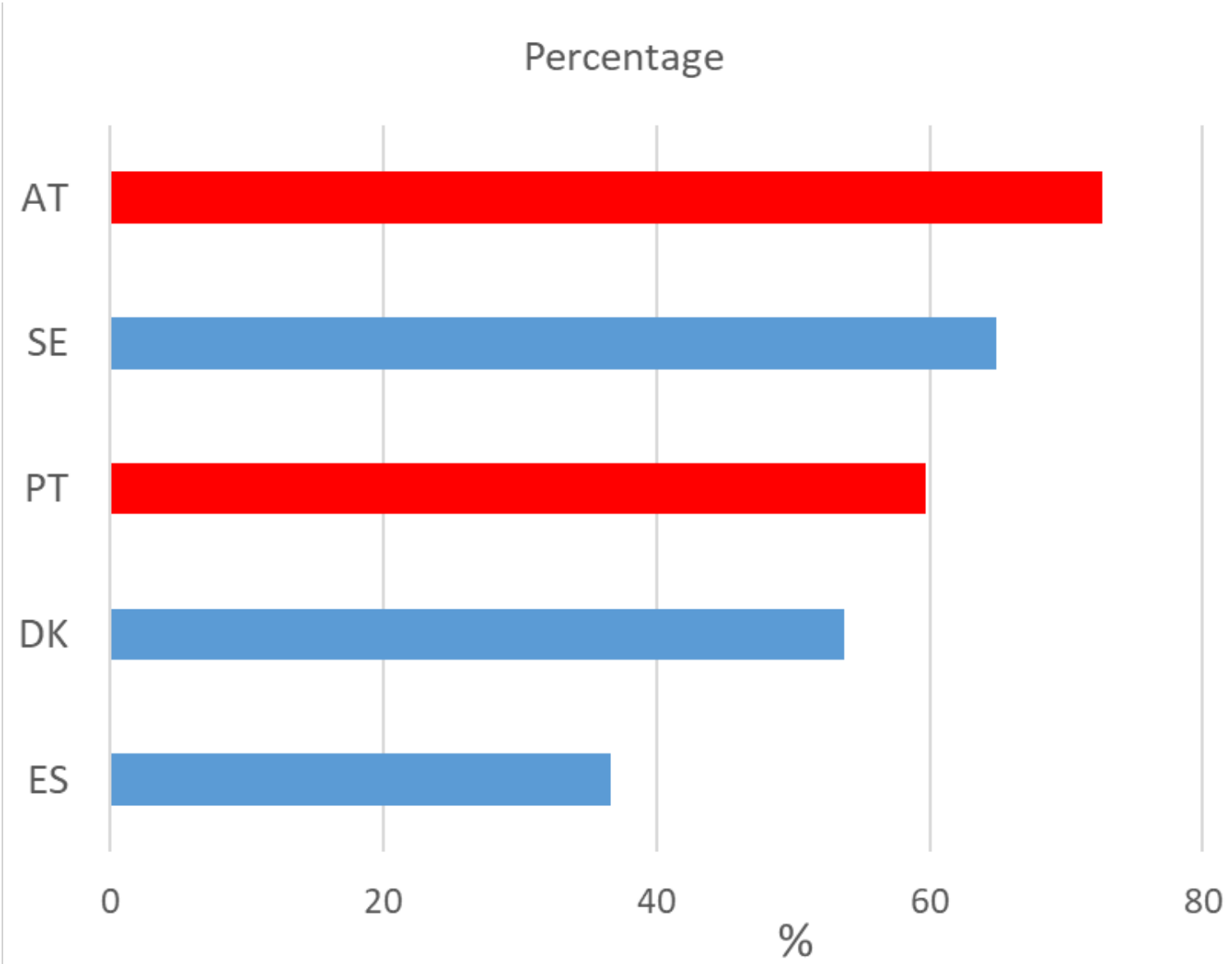
* Climate change → Paris agreements
* Targets for renewables
* Europe: The clean energy package → energy communities
* It is not possible to force variable renewables into the system
* A strong desire of some customers to participate in electricity supply

Electricity generation EU-28



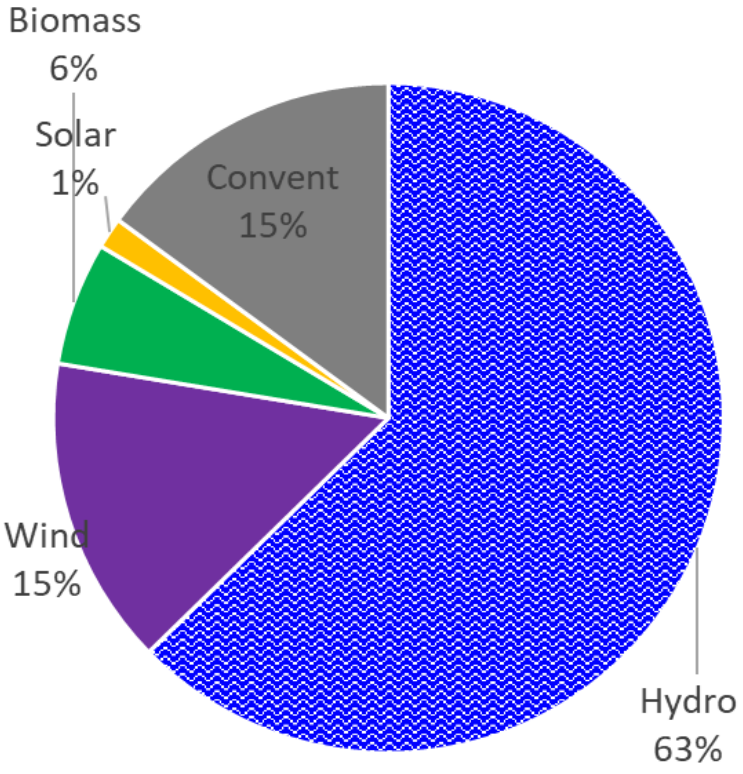
Werte für 2017 und 2018 vorläufig

Ranking: Electricity generation from RES in EU-28

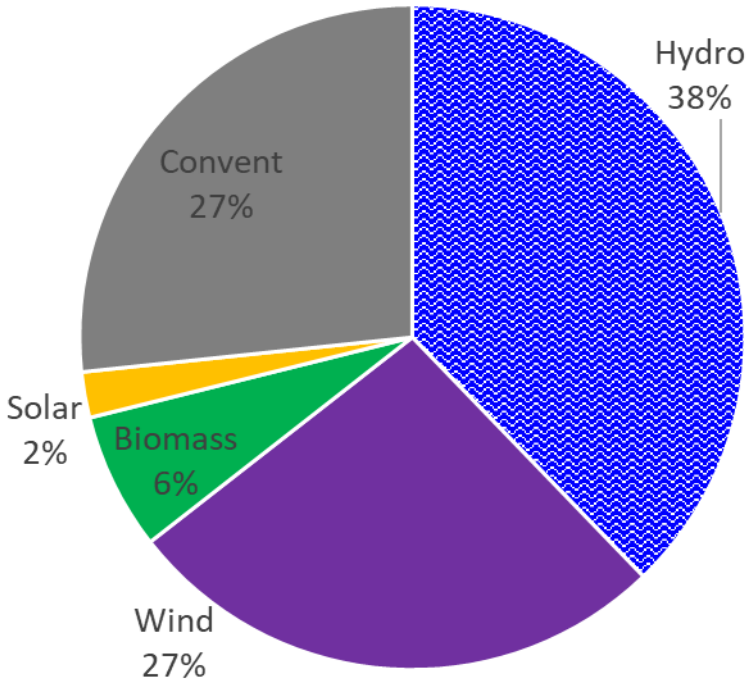


Electricity generation: Austria vs Portugal

Austria

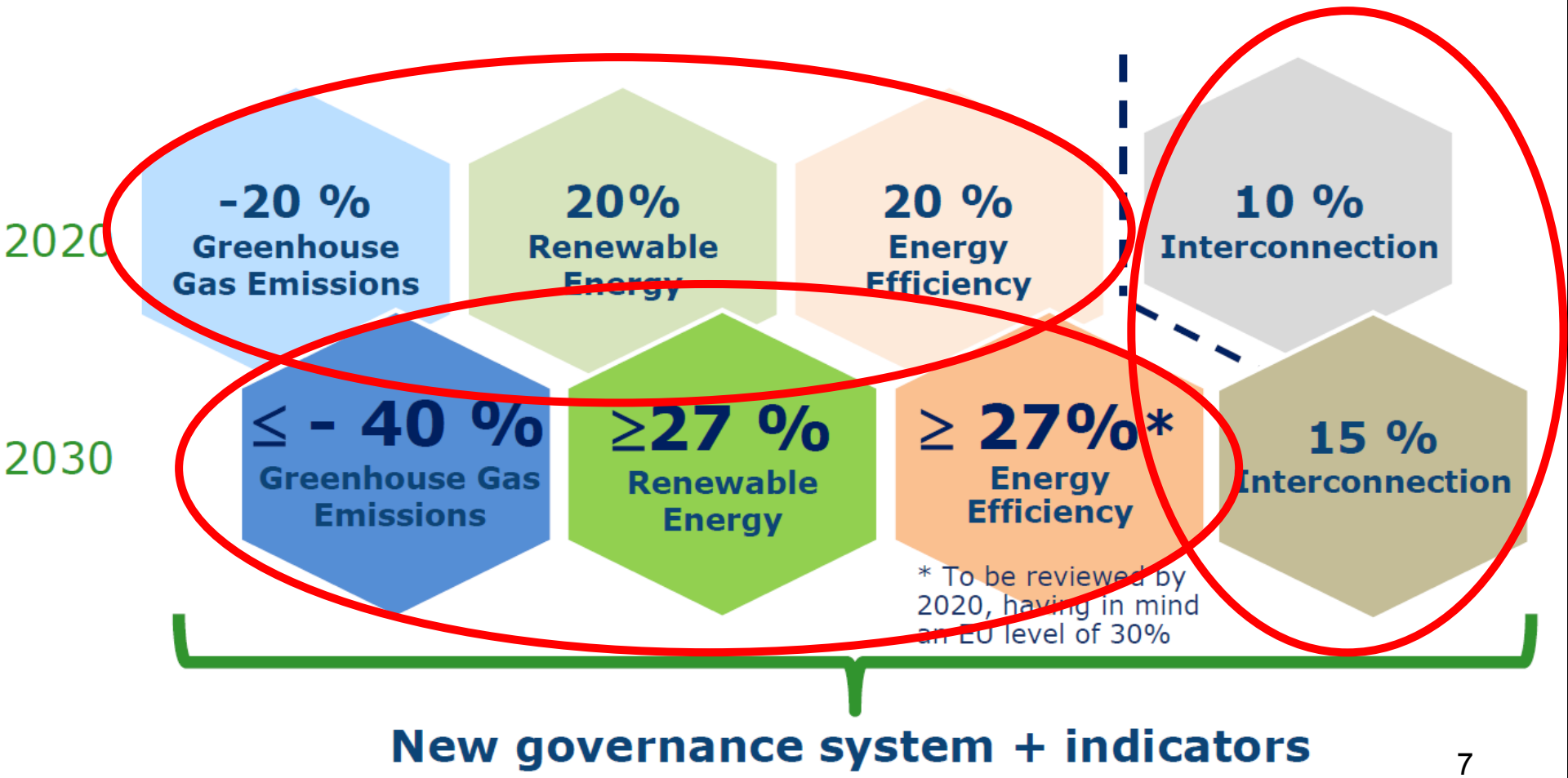


Portugal

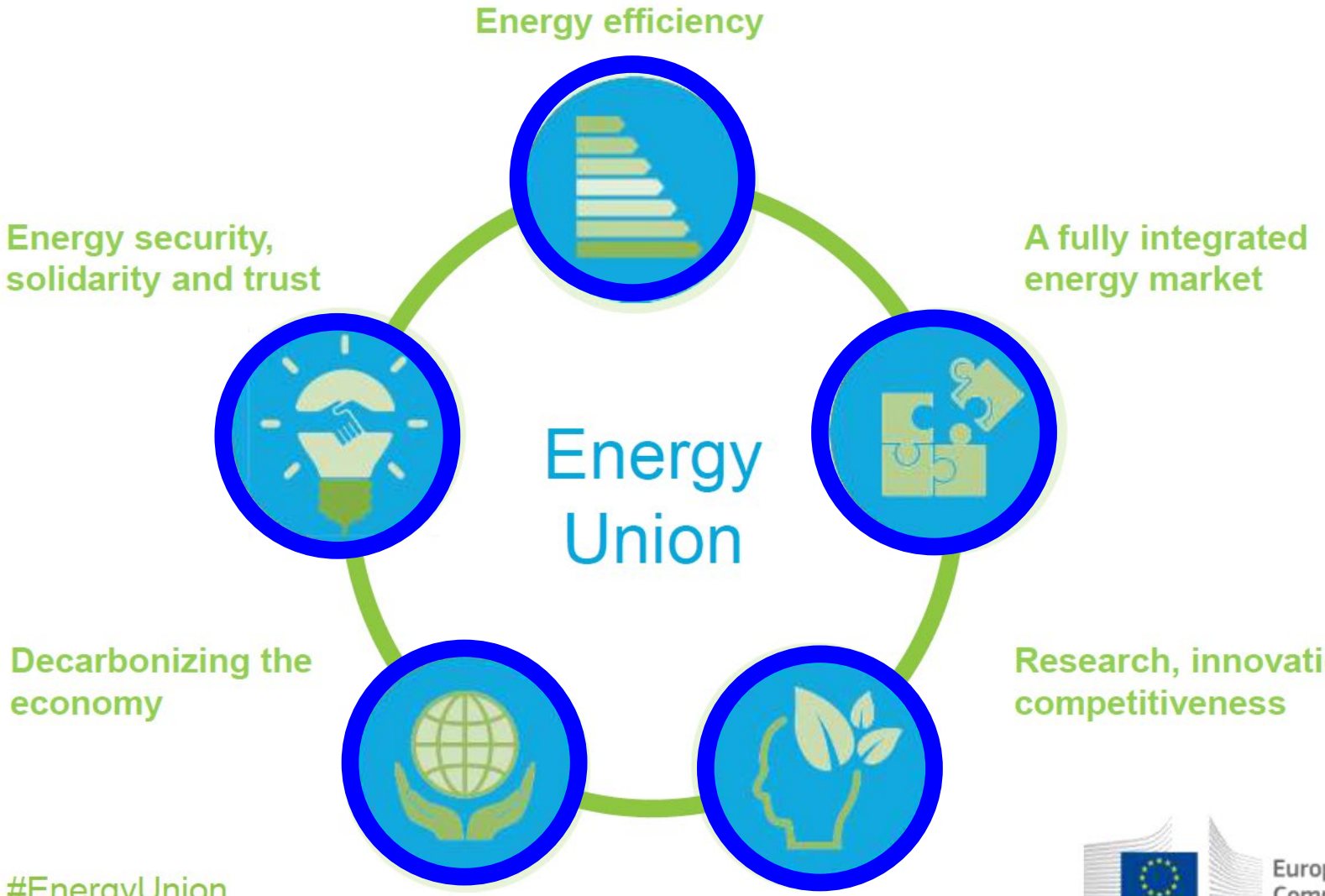


1. INTRODUCTION

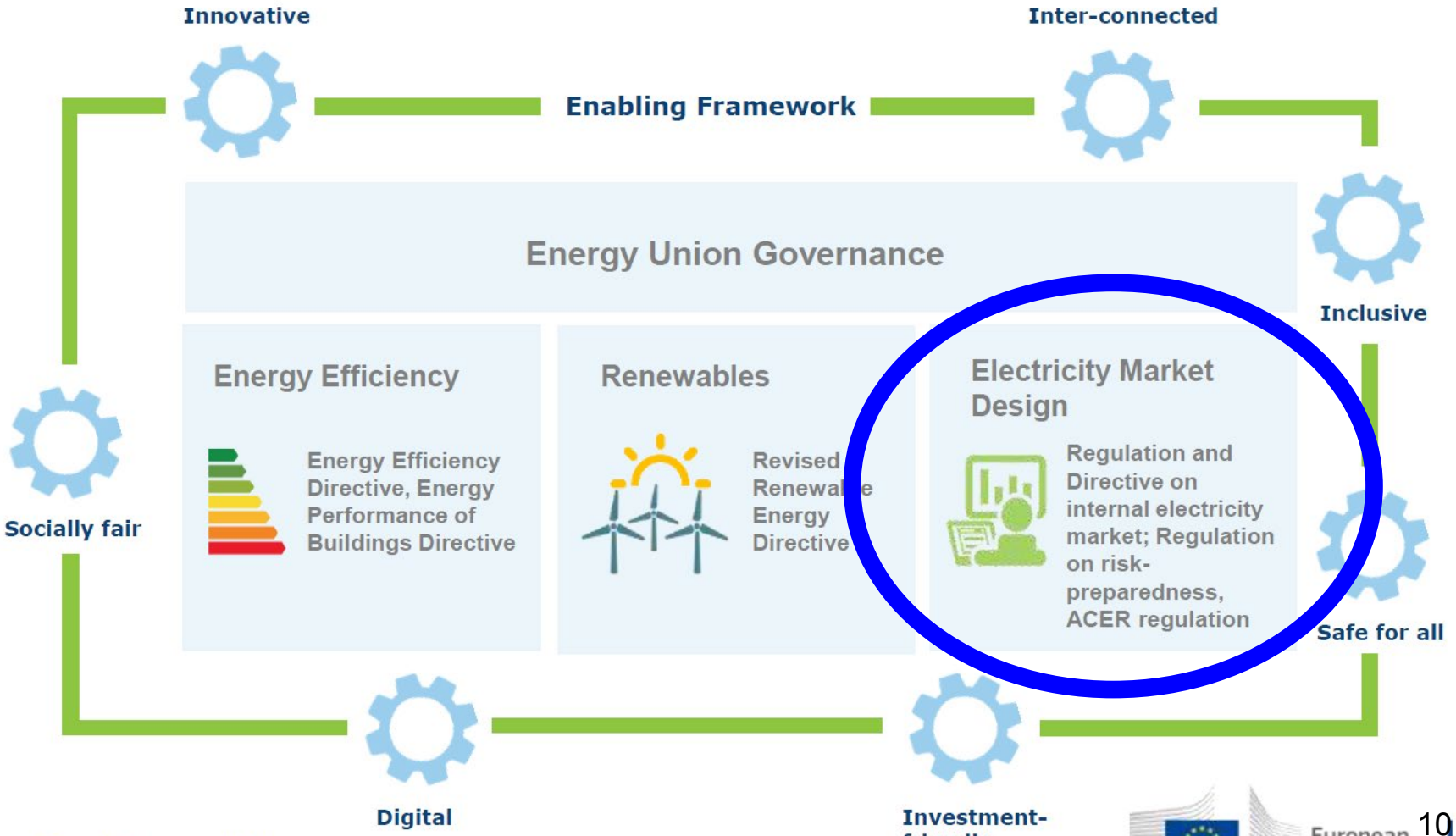
Strategic decision by European Council in 2014



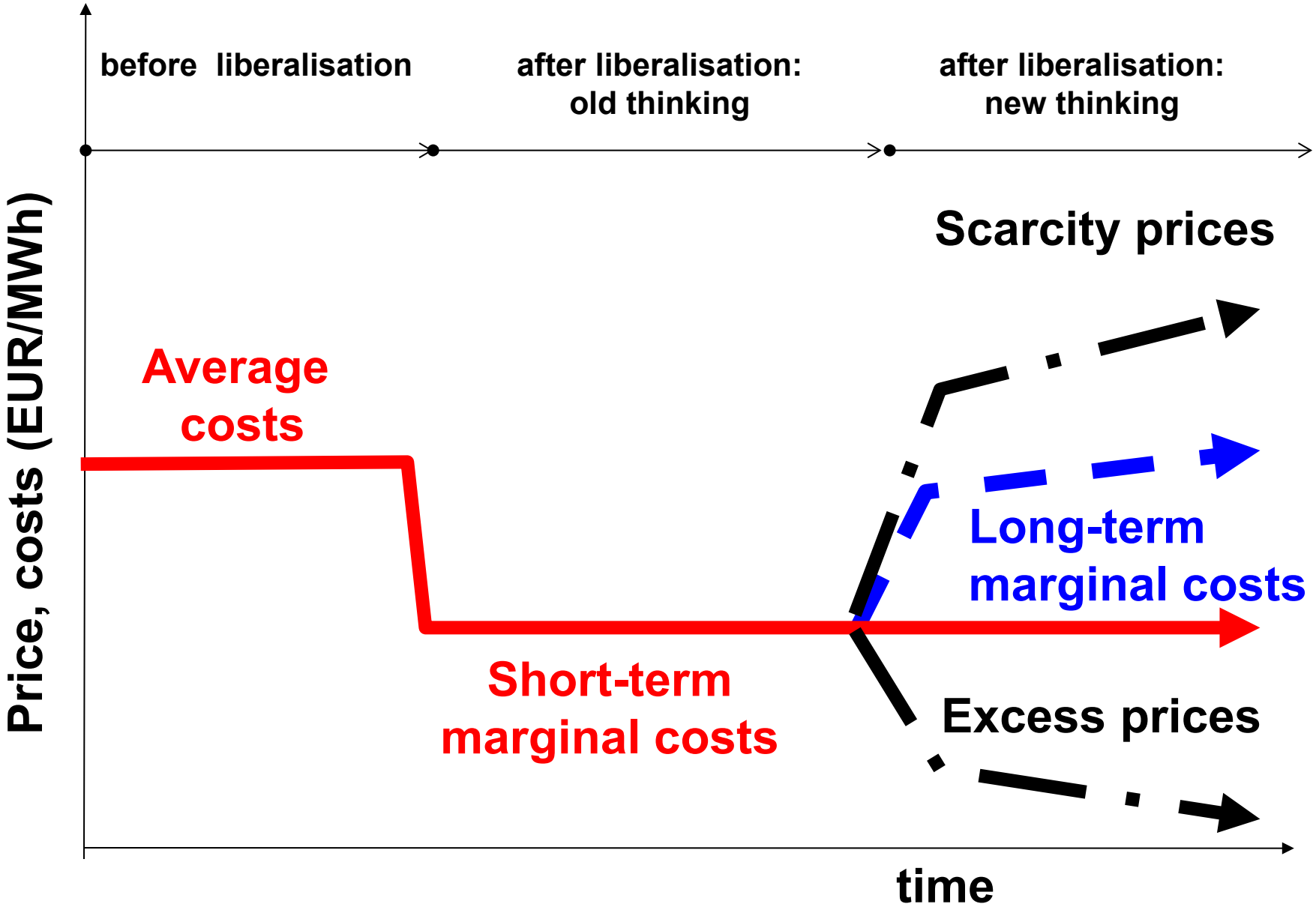
Energy Union Strategy



Structure of the Package



How prices come about: Three periods of market design



Core objective

… 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;

Day-ahead electricity markets

Expectation of

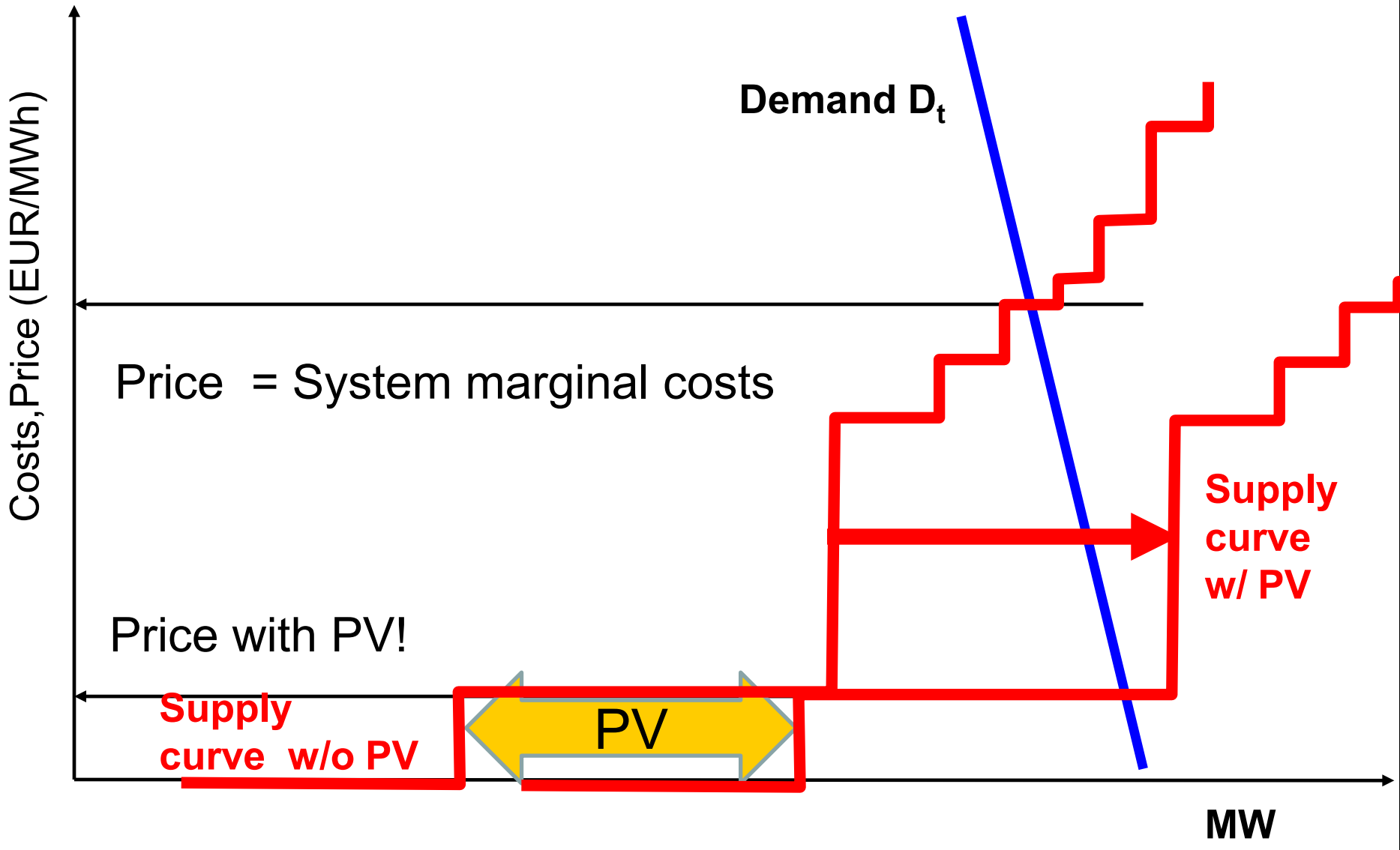
prices = Short-term marginal costs

(Short-term marginal costs = fuel costs)

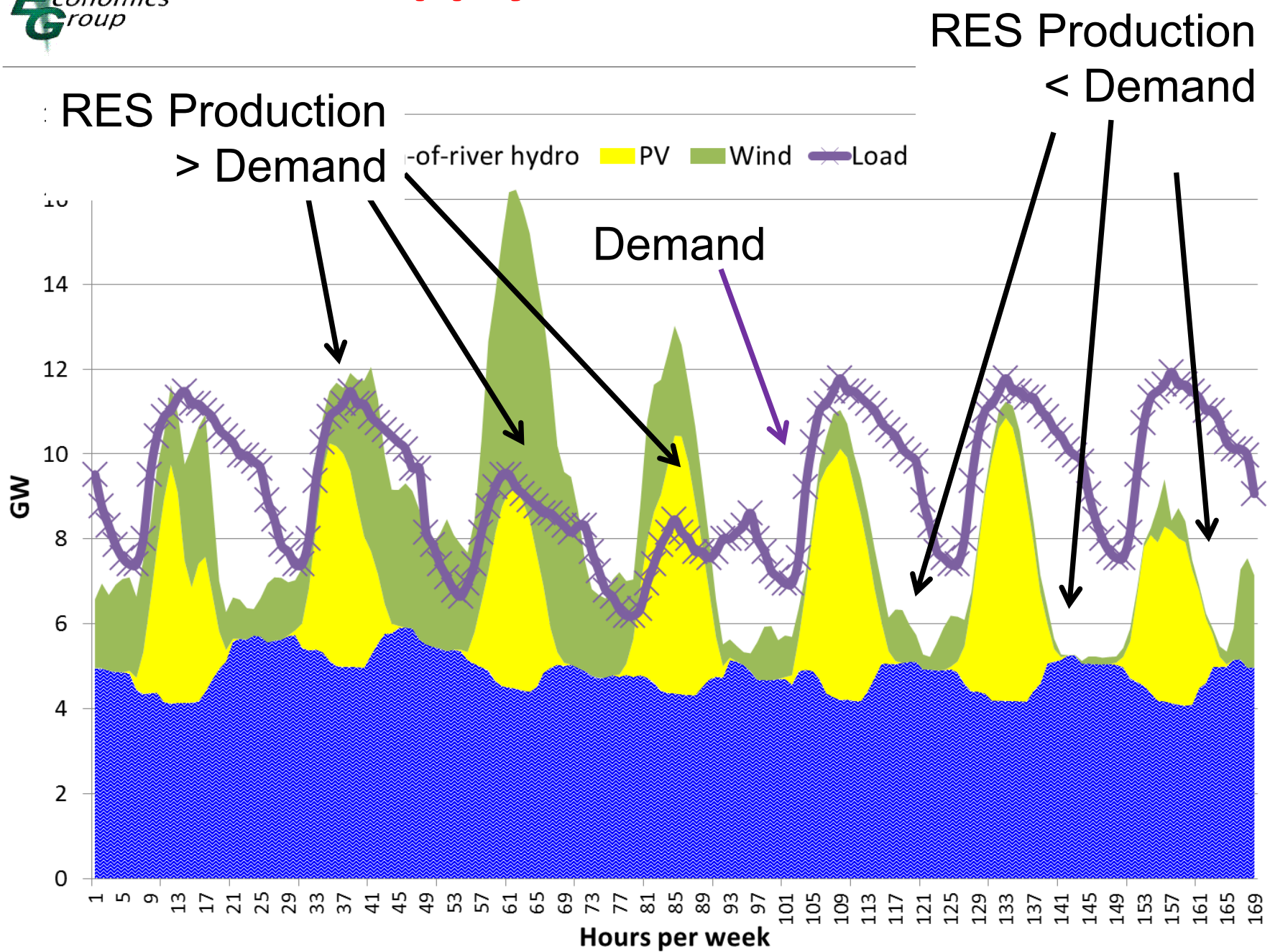
due to huge depreciated excess capacities at the beginning of liberalisation!

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

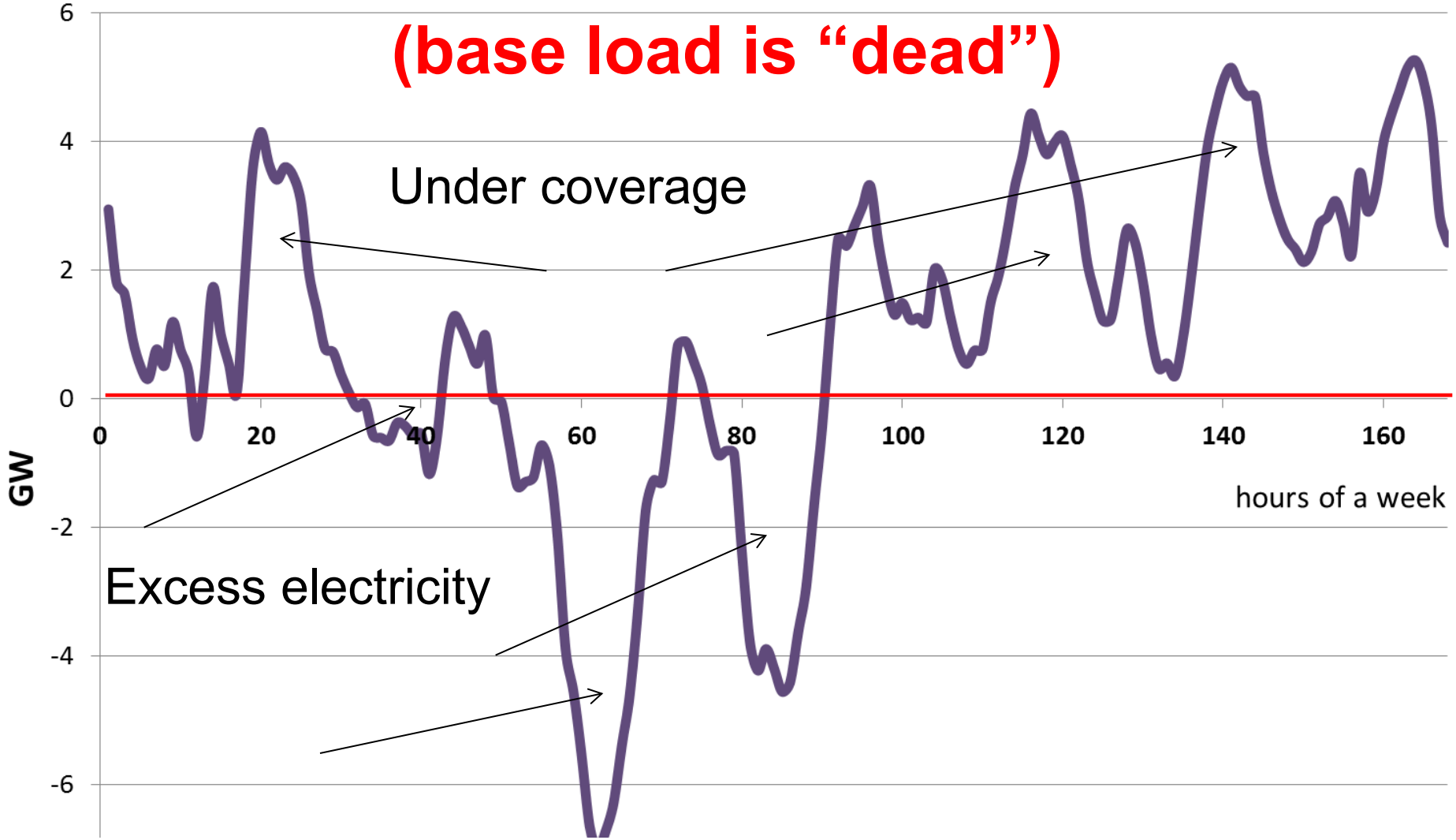
Example: prices without and with PV



Supply and Demand



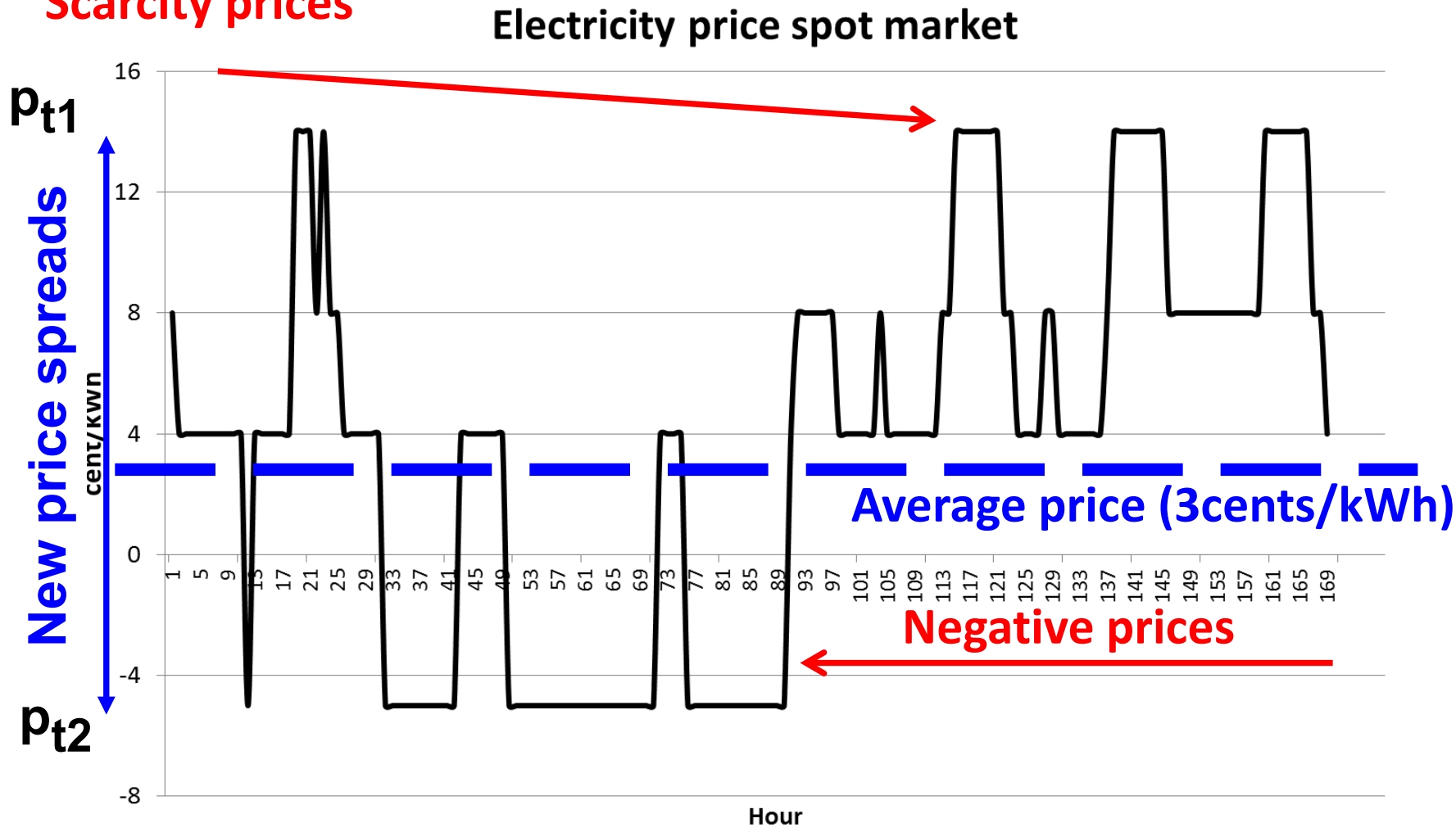
Key term of the future: Residual load (base load is “dead”)



Residual load = Load – non-flexible generation

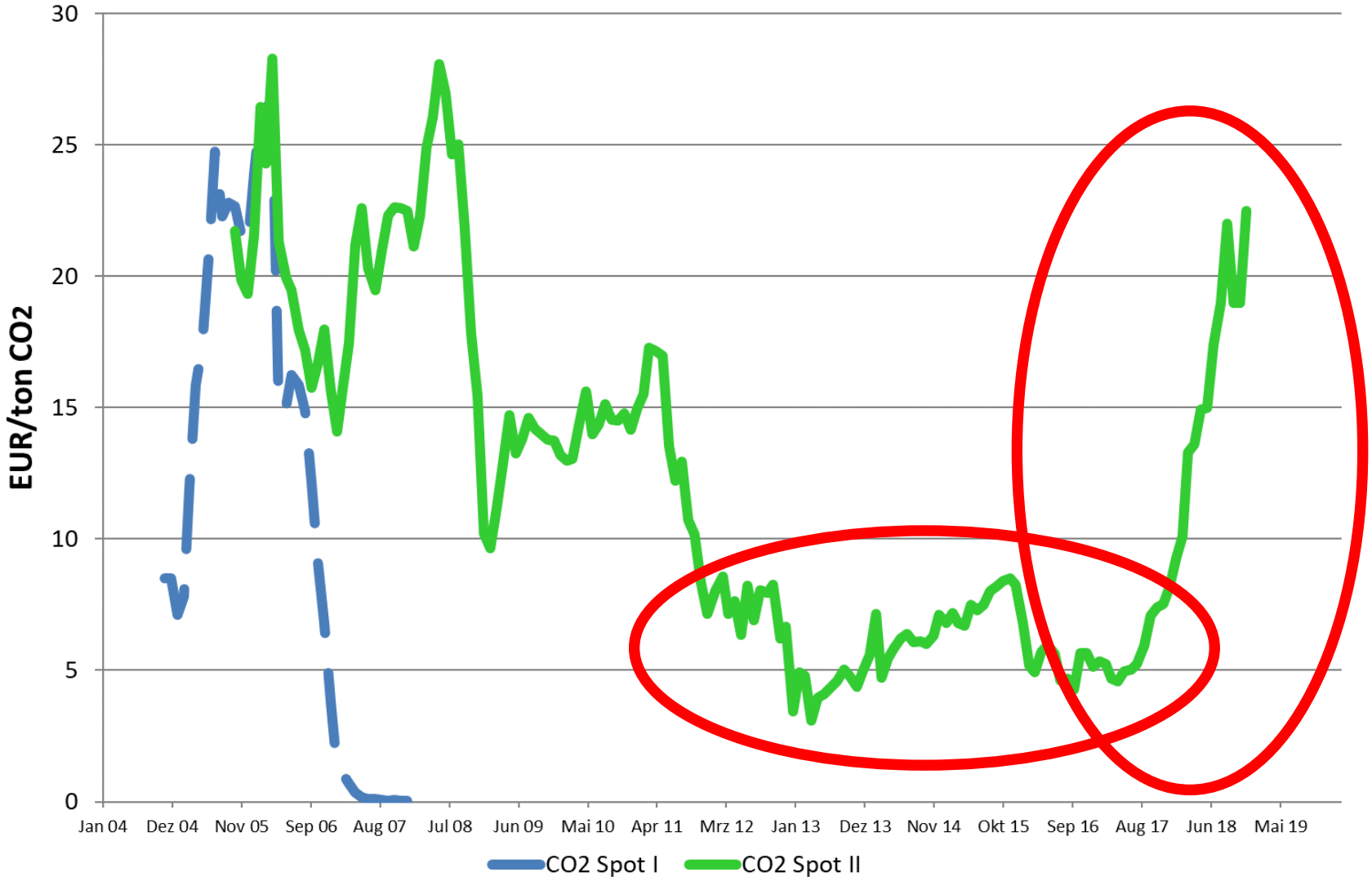
Deviation from STMC-pricing in spot markets

Scarcity prices

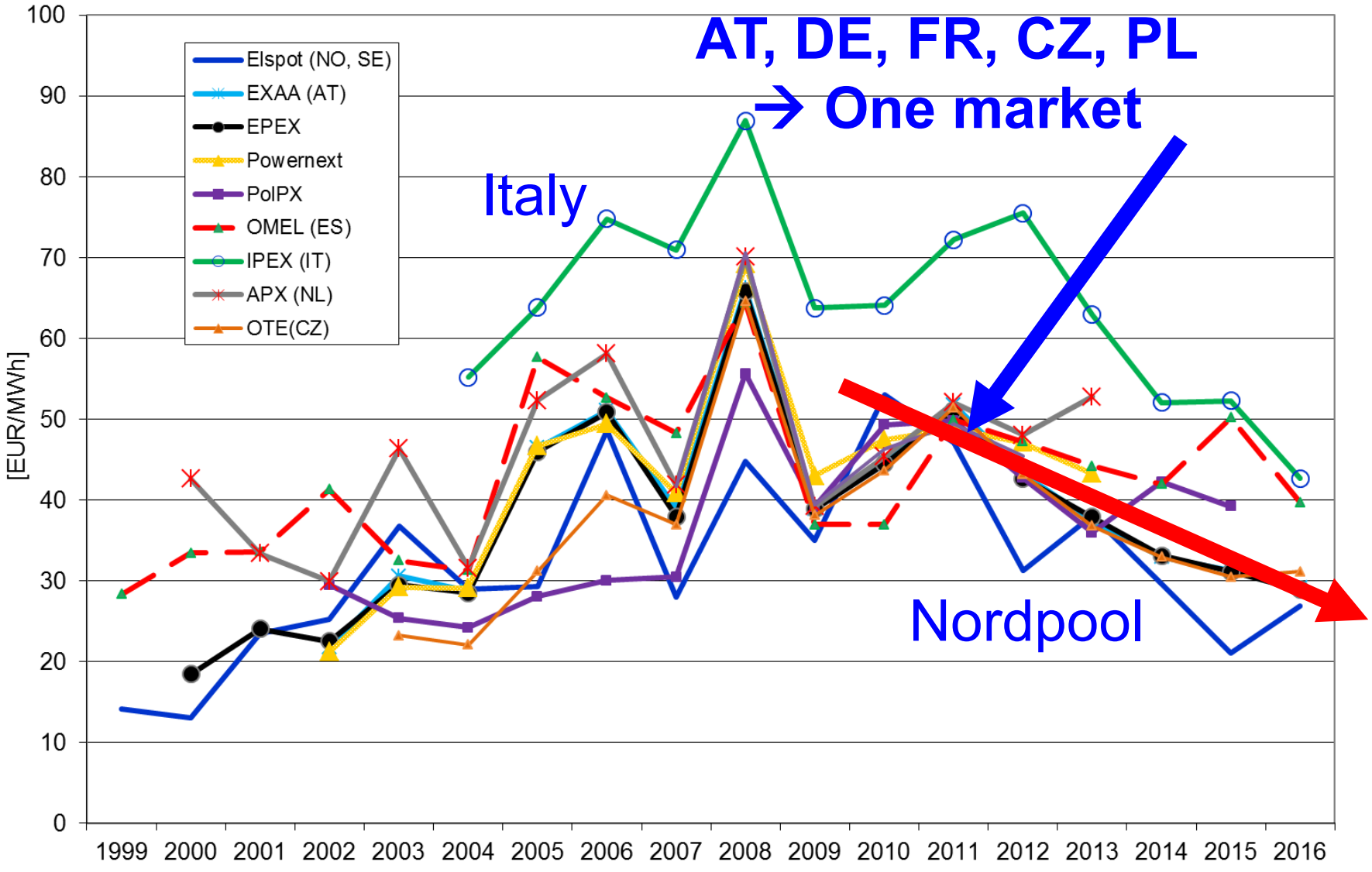


→ These price spreads provide incentives for new flexible solutions!!!!

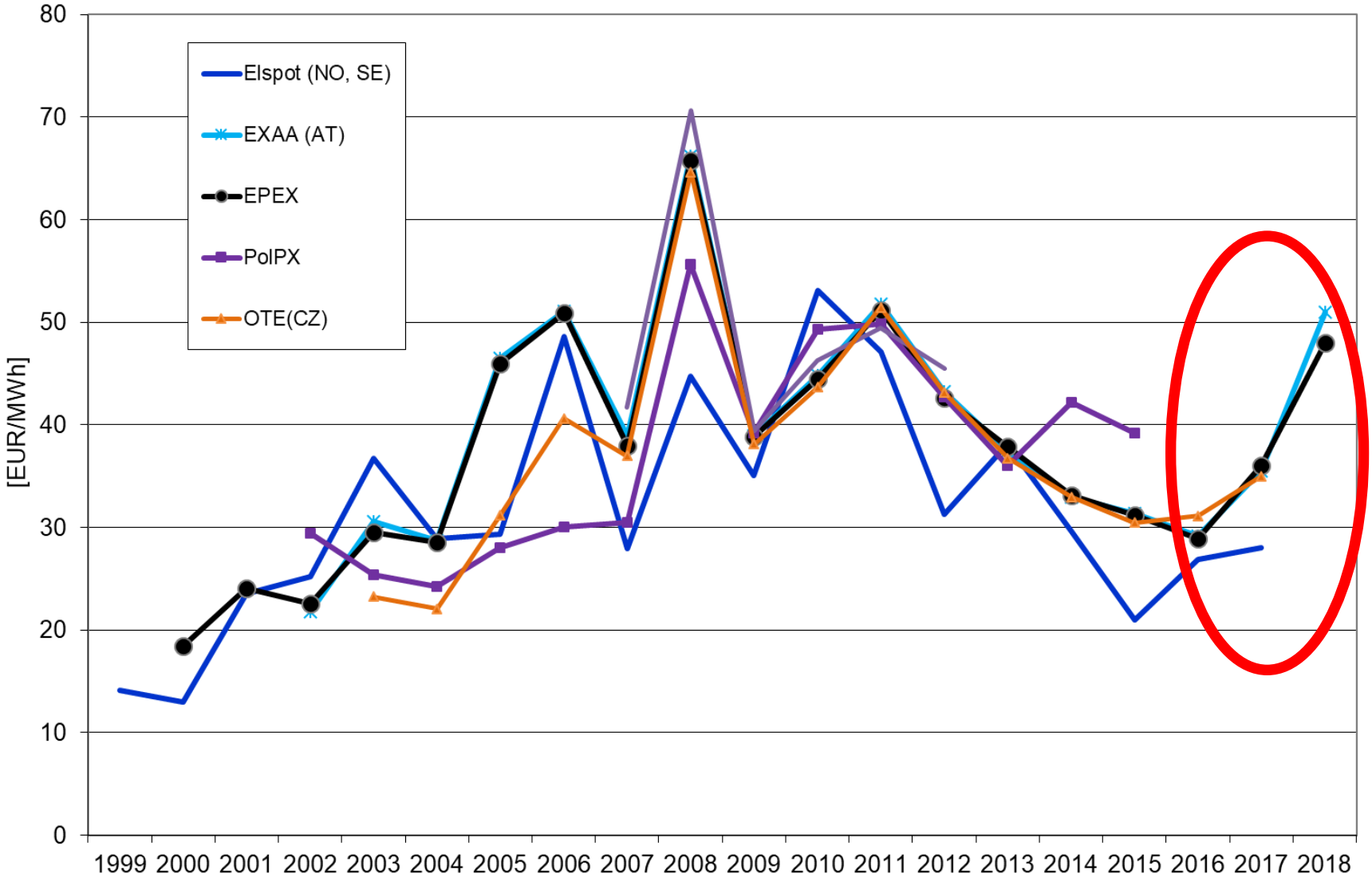
The CO2-Price



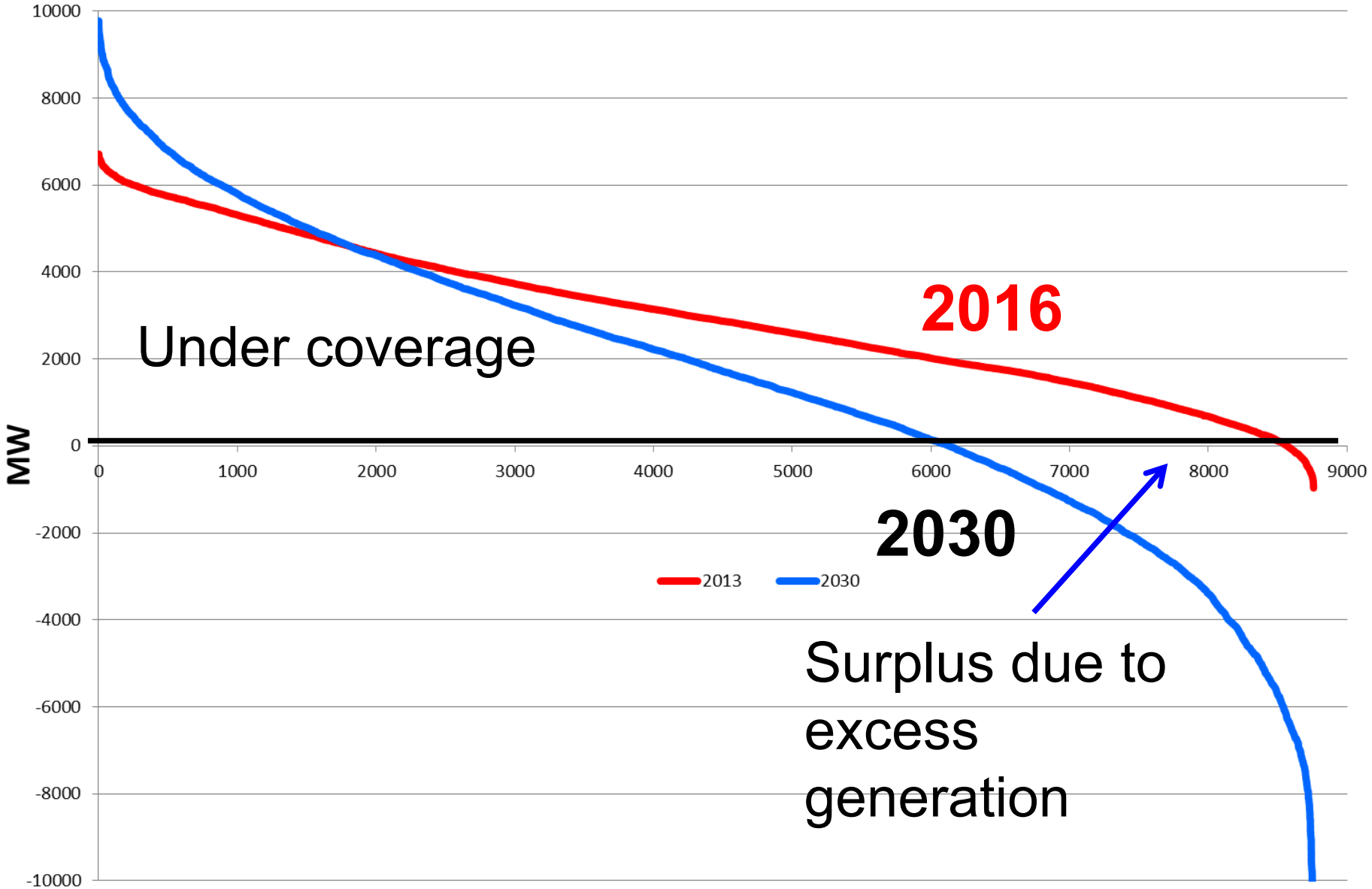
Development of electricity prices in Europe up to 2016 (1)



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



Classified residual load over a year



Classified residual load

There are two extreme positions:

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

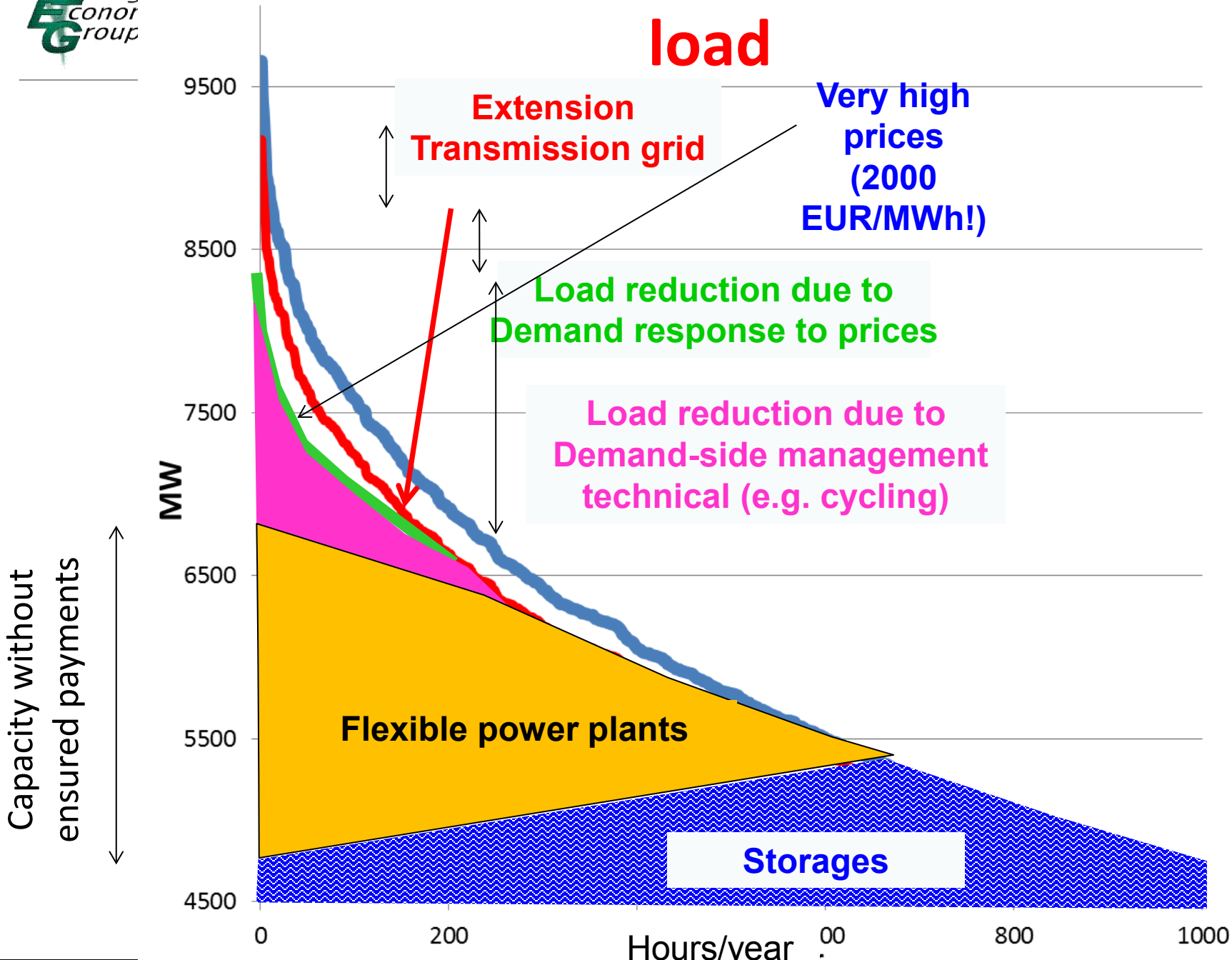
All regulatory capacity payments for power plants destort the EOM and lead to wrong price signals for all other options

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

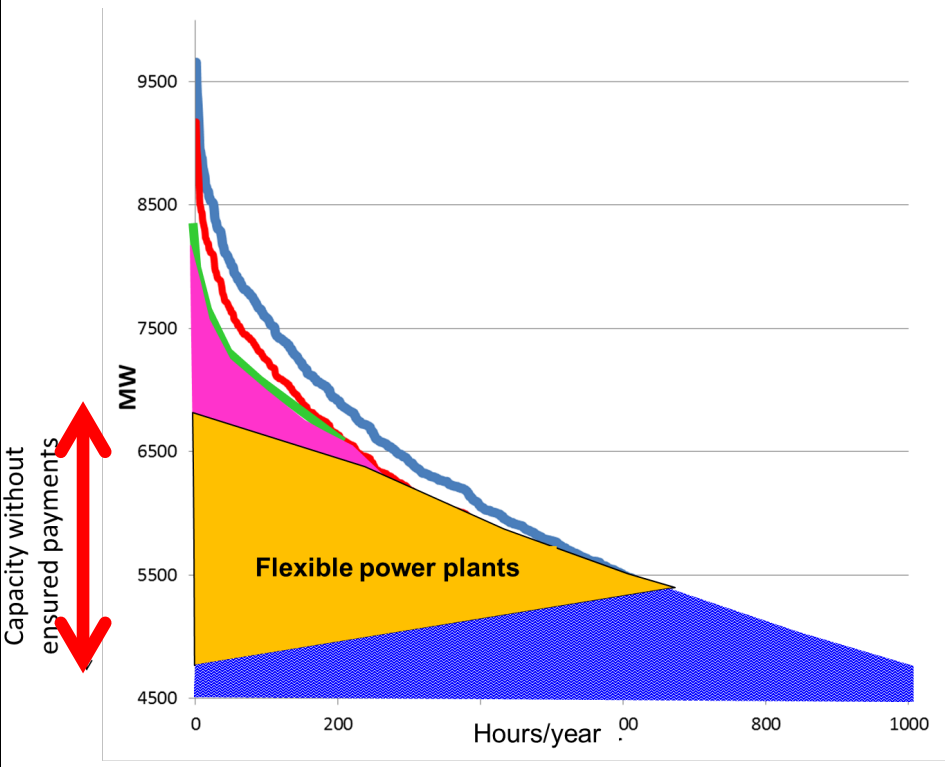
The higher the excess capacities, the lower is the share of RES

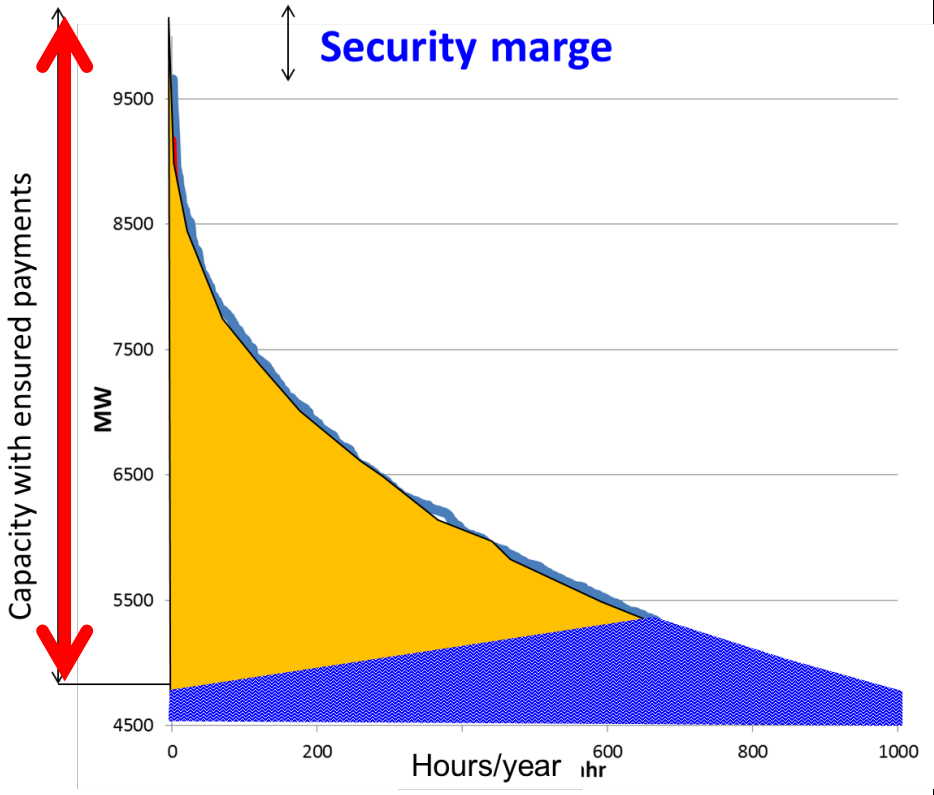
strive to retain system resource adequacy by correct price signals

5 Flexible coverage of residual load

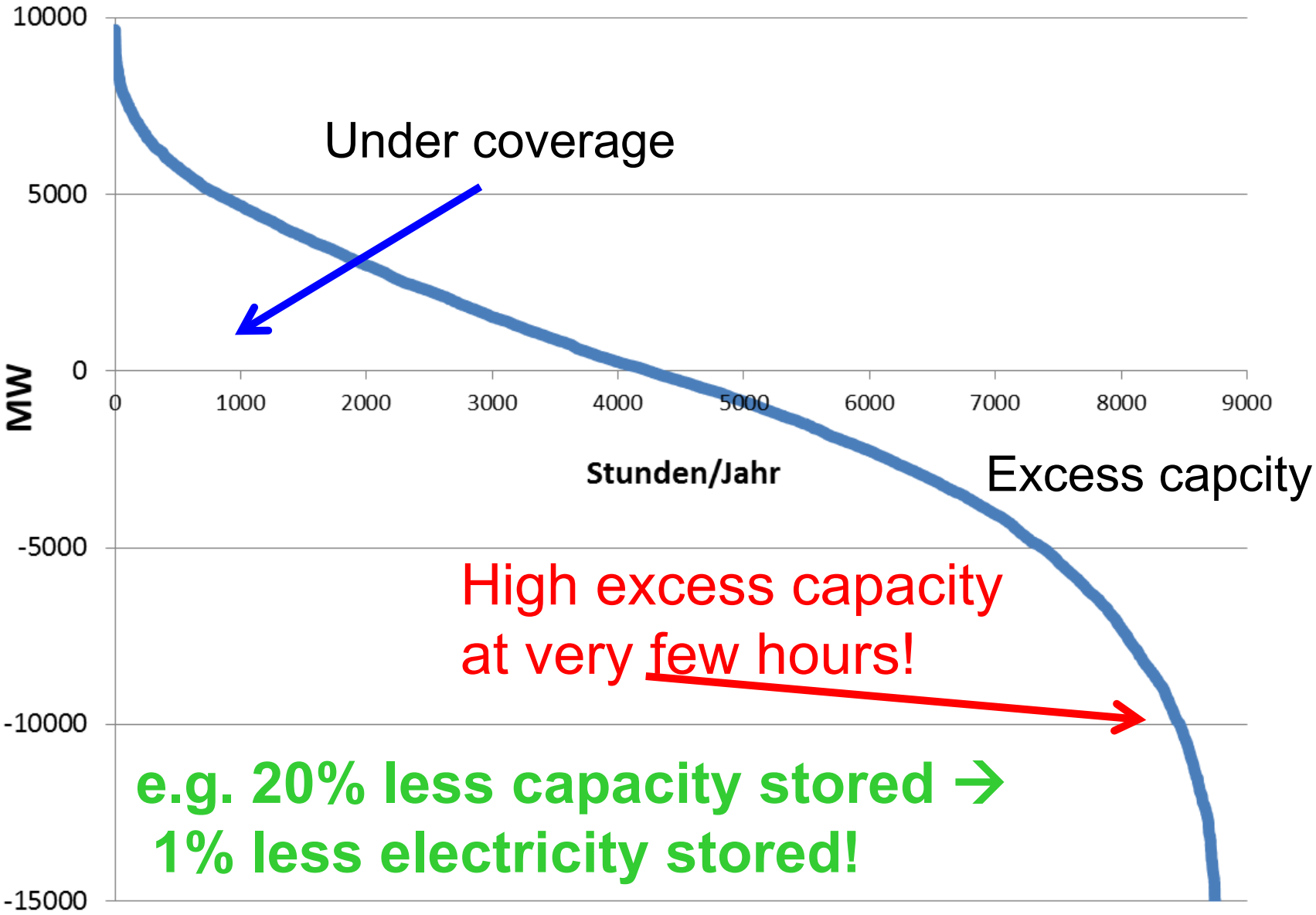


Comparison


Capacity without ensured payments
MW
9500
8500
7500
6500
5500
4500
Flexible power plants
0
200
Hours/year
800
1000


Security marge
Capacity with ensured payments
MW
9500
8500
7500
6500
5500
4500
0
200
600
800
1000
Hours/year

6. Storing every peak?



The costs of storage

$$C = \frac{\frac{IC \cdot \alpha + C_{OM}}{T} + C_E}{\eta_{STO}} \quad [\frac{EUR}{kWh}]$$

C … Storage costs (EUR per kWh)

C_E … Energy costs (EUR per kWh)

C_{OM} … O&M costs (cent per kWh)

IC … Investment costs (EUR/kW)

α … Capital Recovery factor

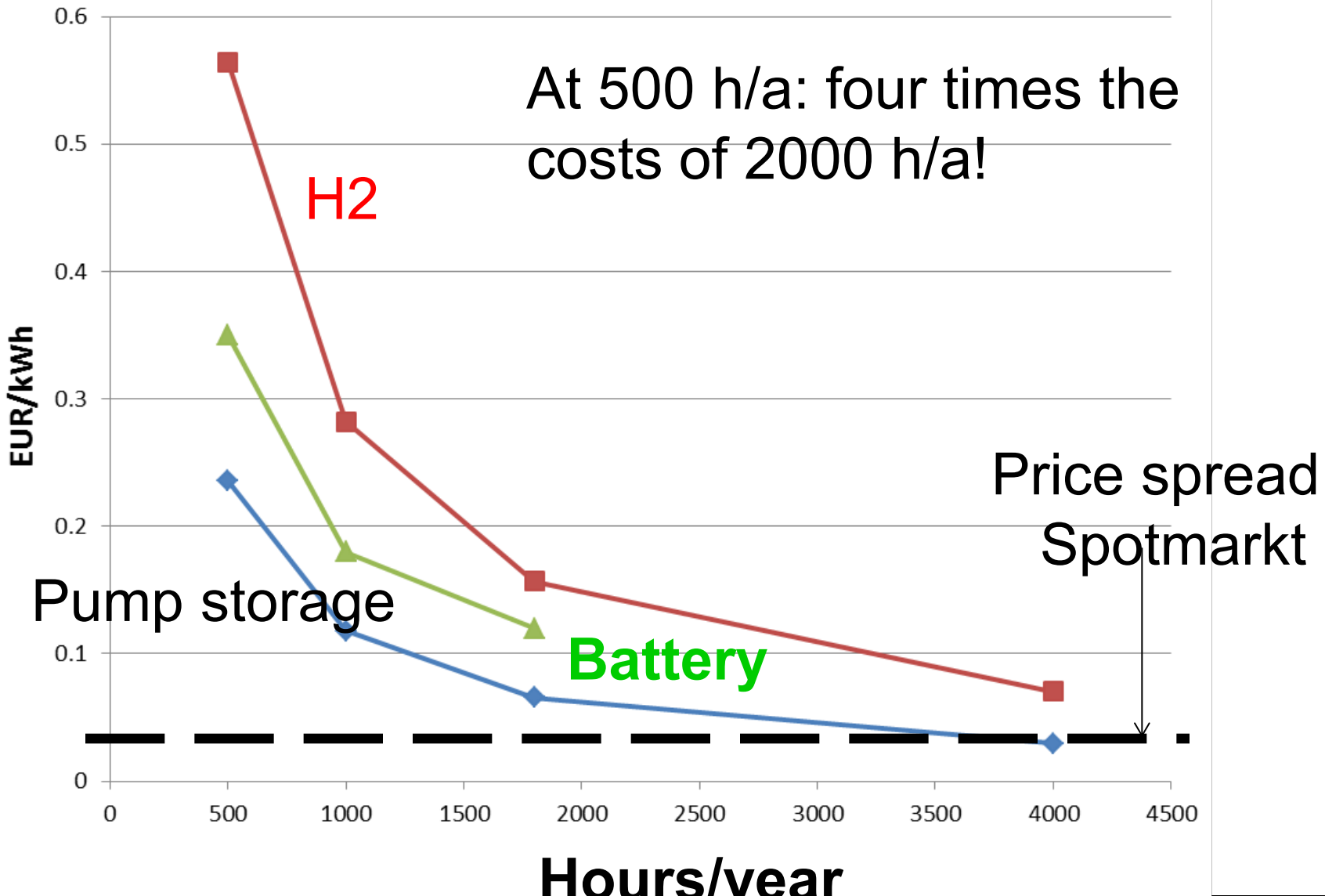
T … Fullloadhours (hours per year)

η_{SP} … Efficiency of storage

Key factors:

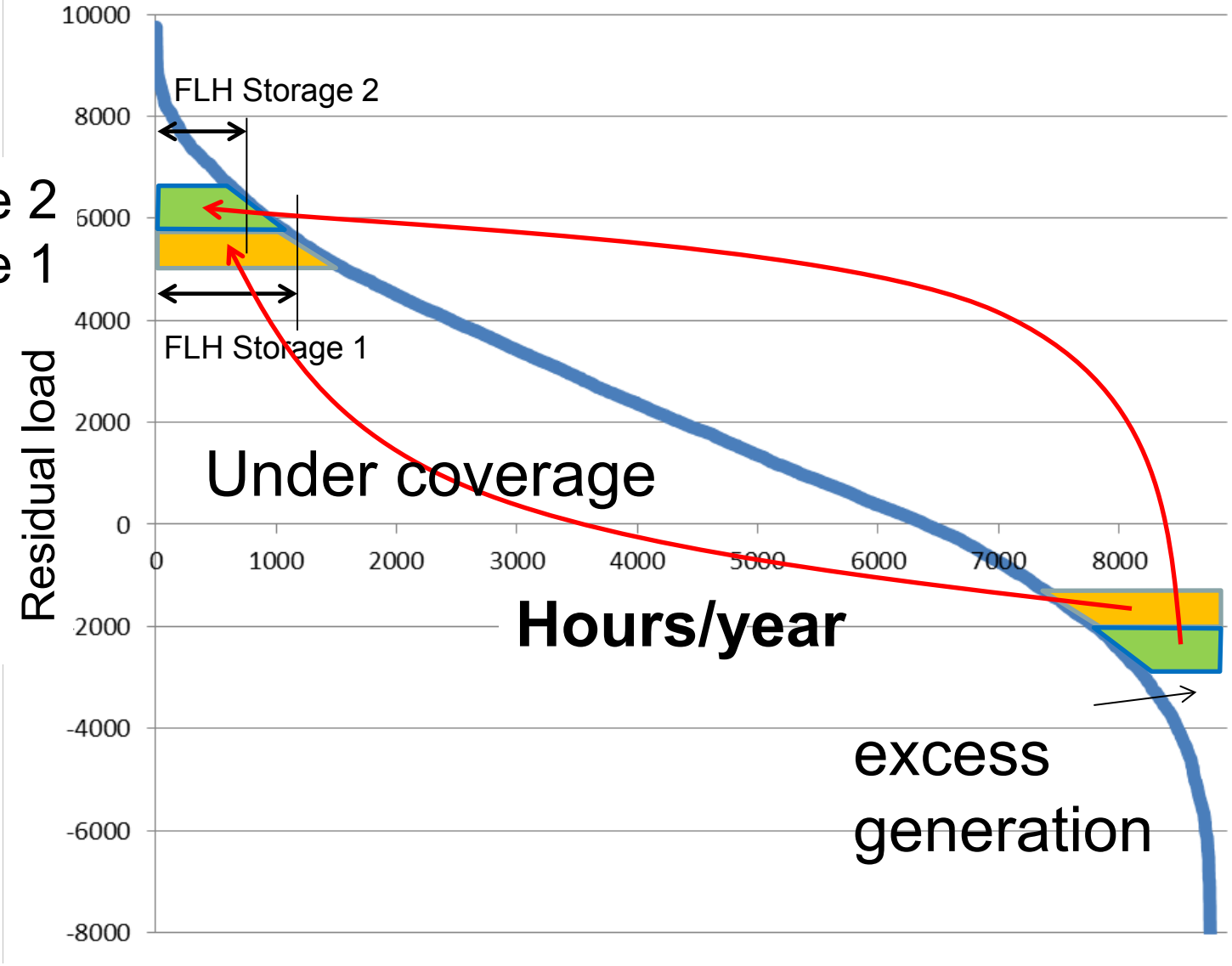
- **T (Fullloadhours)!**
- **C_E (electricity price)**

Impact of fullloadhours

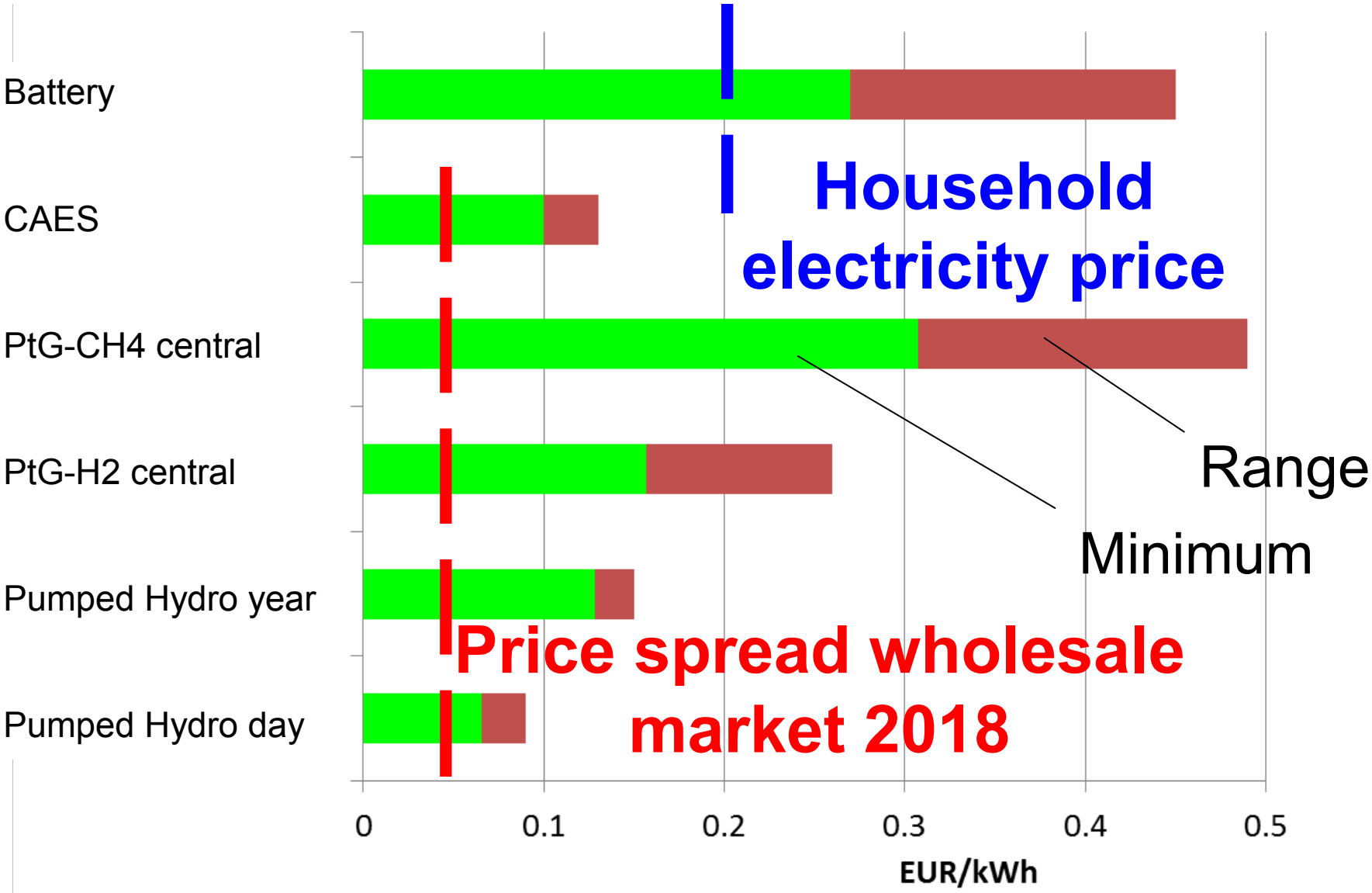


Decreasing full-load hours of storages

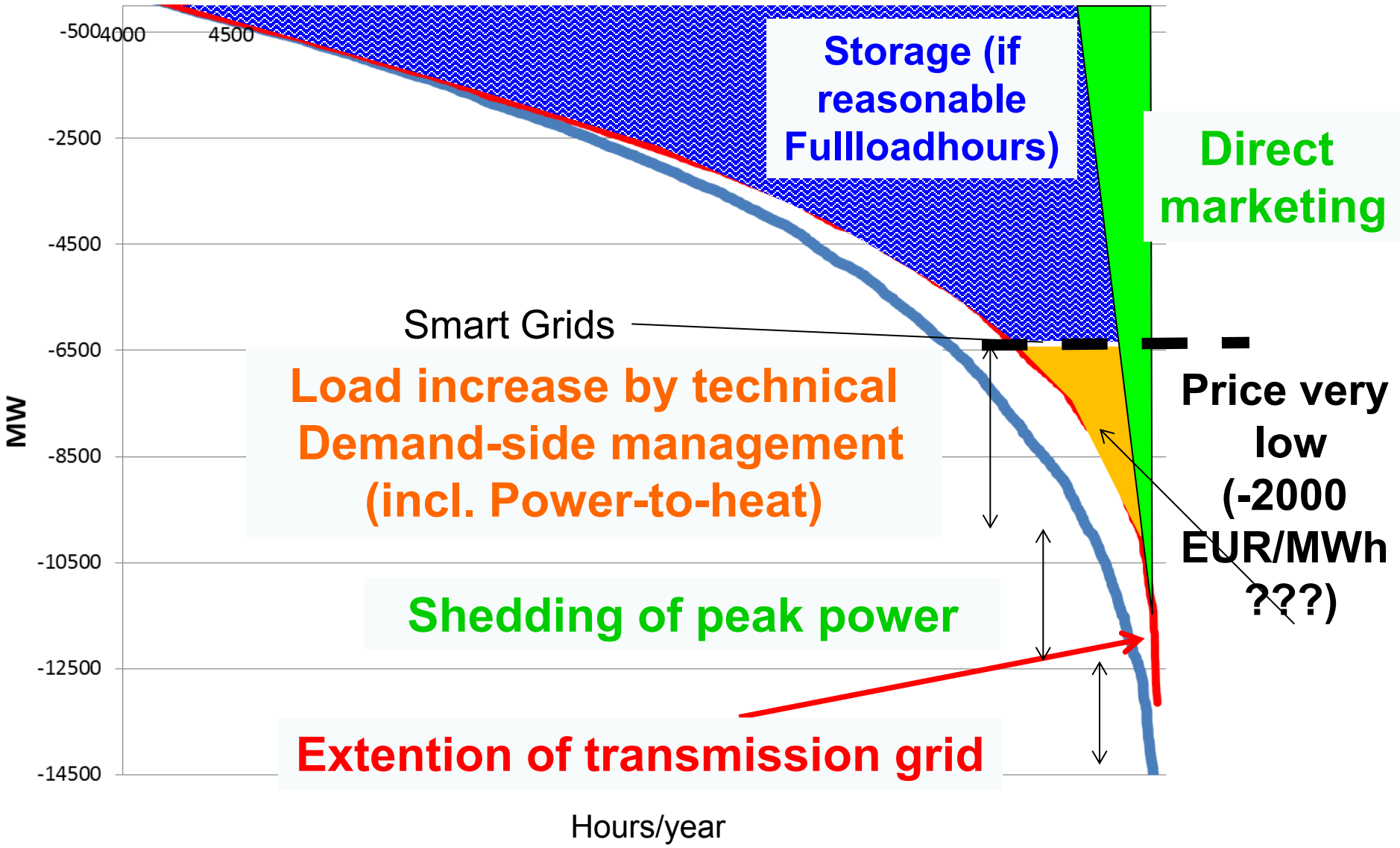
Storage 2
Storage 1



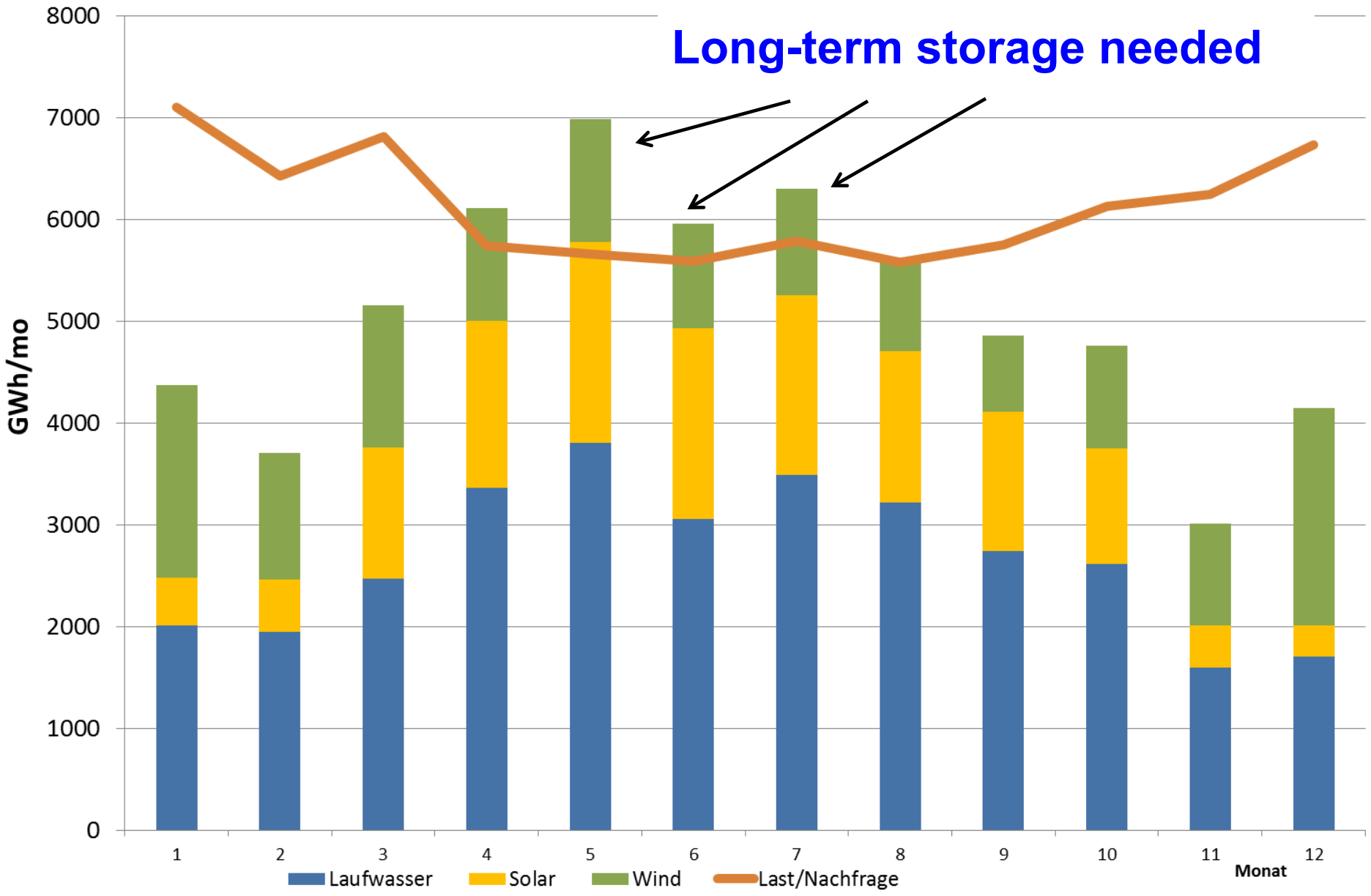
Range of storage costs 2018



Flexible use of excess electricity



Demand for long-term storage



Sector coupling / Sector integration

* In times of surplus generation: How to use excess electricity in meaningful way?

Heating/Cooling

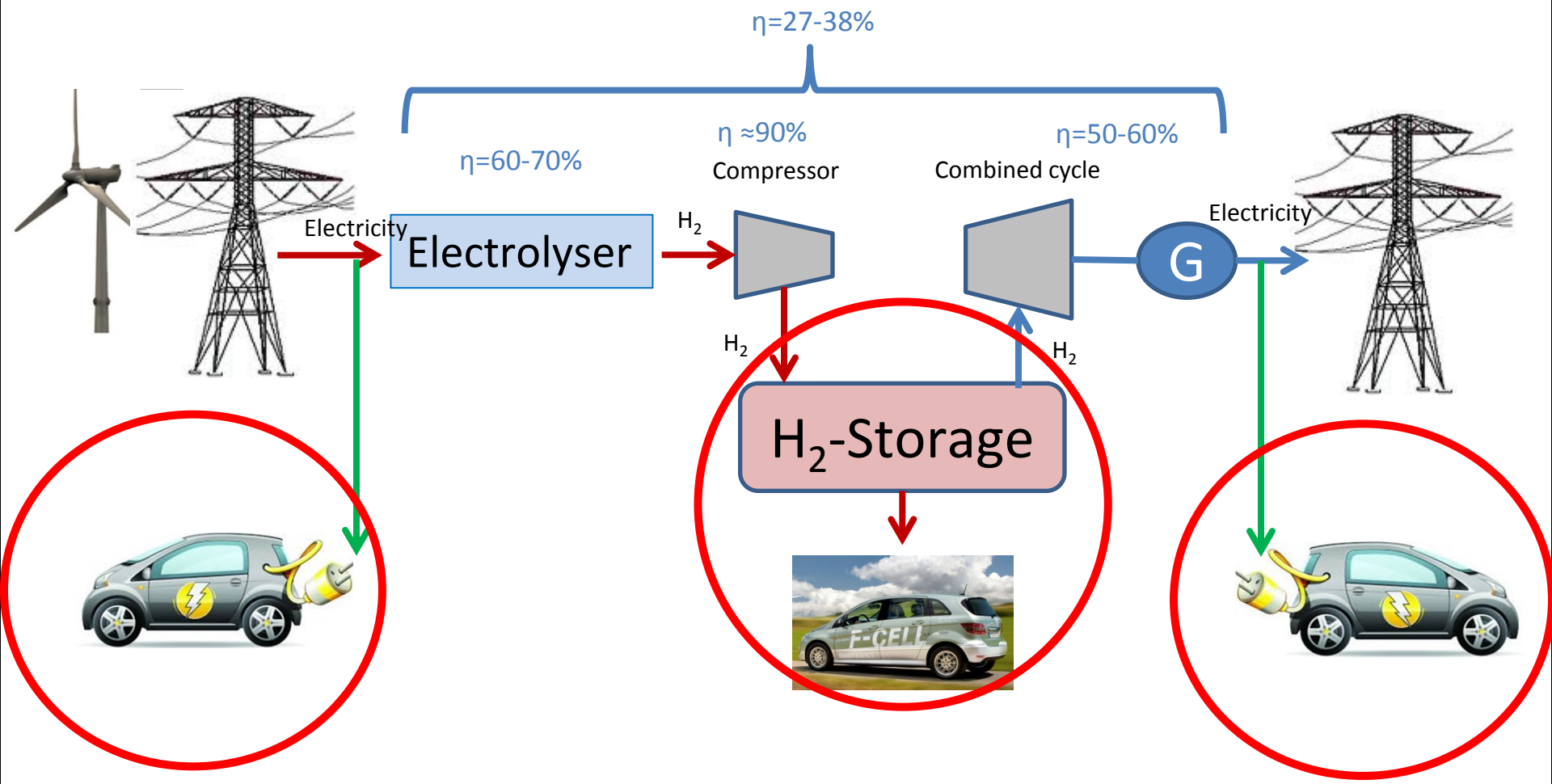
Transport

* Vague simplified suggestions, no convincing long-term solutions

* Central (Ptx approaches, e.g. H2) vs decentral (end user level, E.g. Evs, heat pumps for heating) applications

* How to fit use with time of surplus, e.g of PV for heating ?

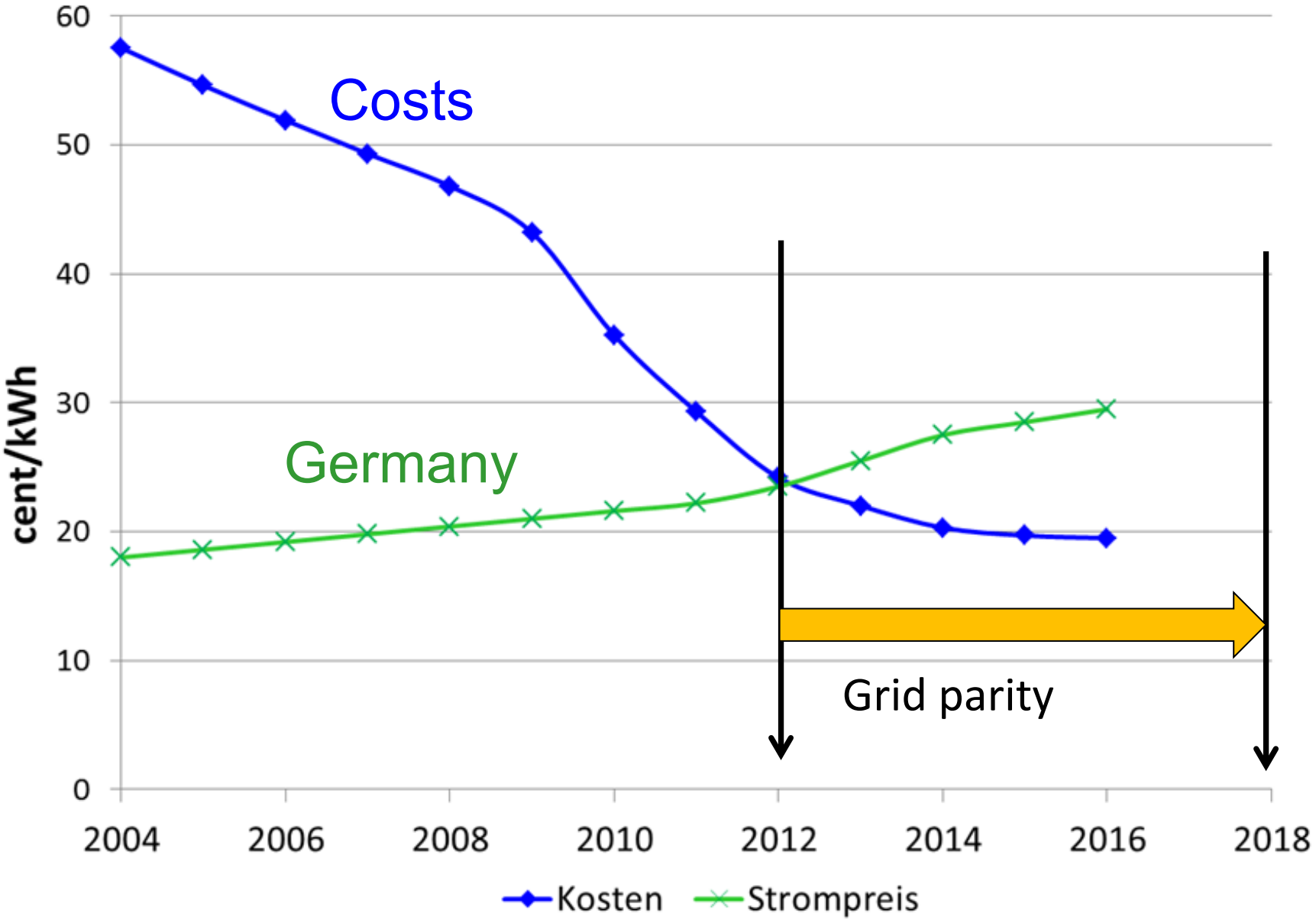
Sector coupling hydrogen: Storage and fuel in transport?



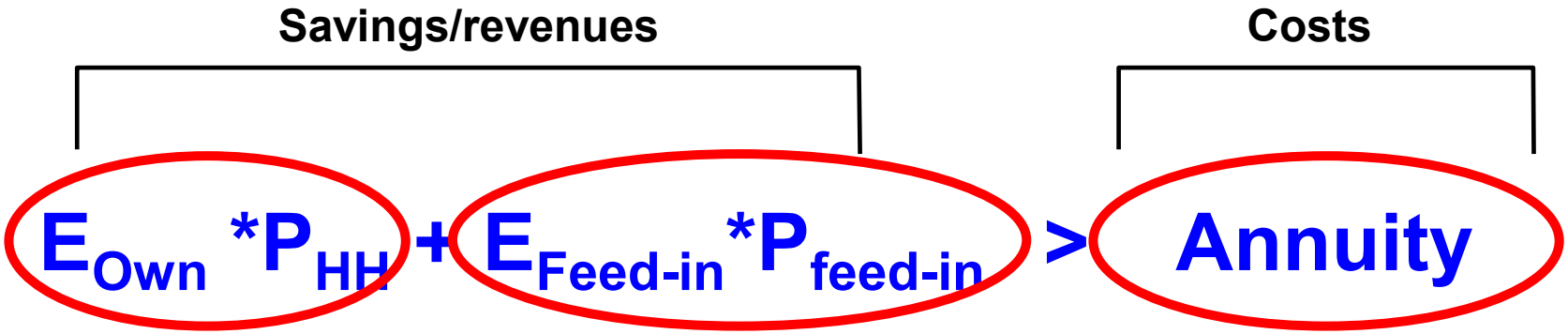
7. IS THE TIME FOR SUBSIDIZING RENEWABLES OVER ?

As long there is no price on CO2 …..

Grid parity: PV-costs and household electricity prices



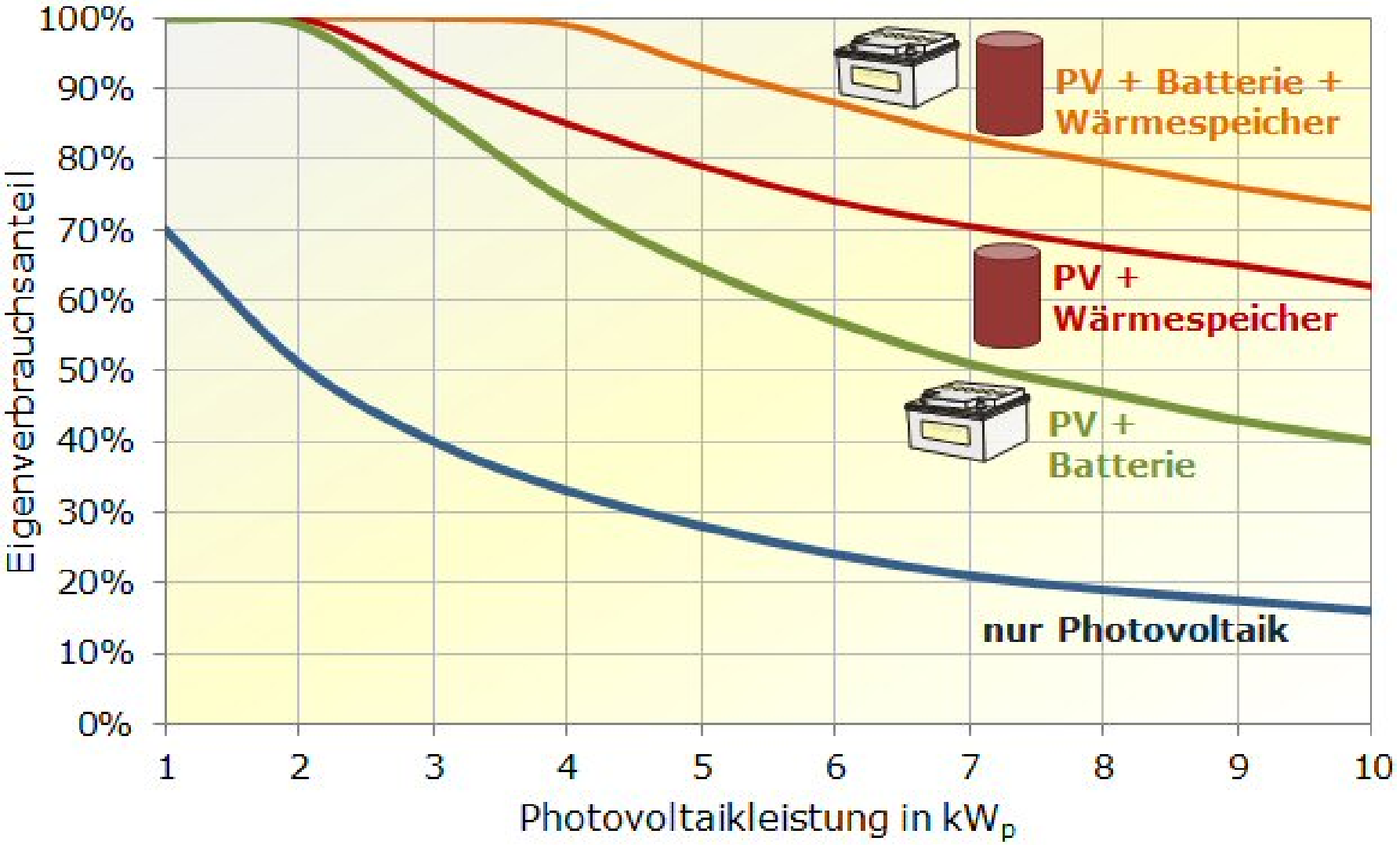
Assessment of Grid Parity



Grid parity term

Subsidy still necessary?

Share of own consumption



Bidding Zero for off-shore wind

Tender for wind farms to be constructed between 2021 and 2025:

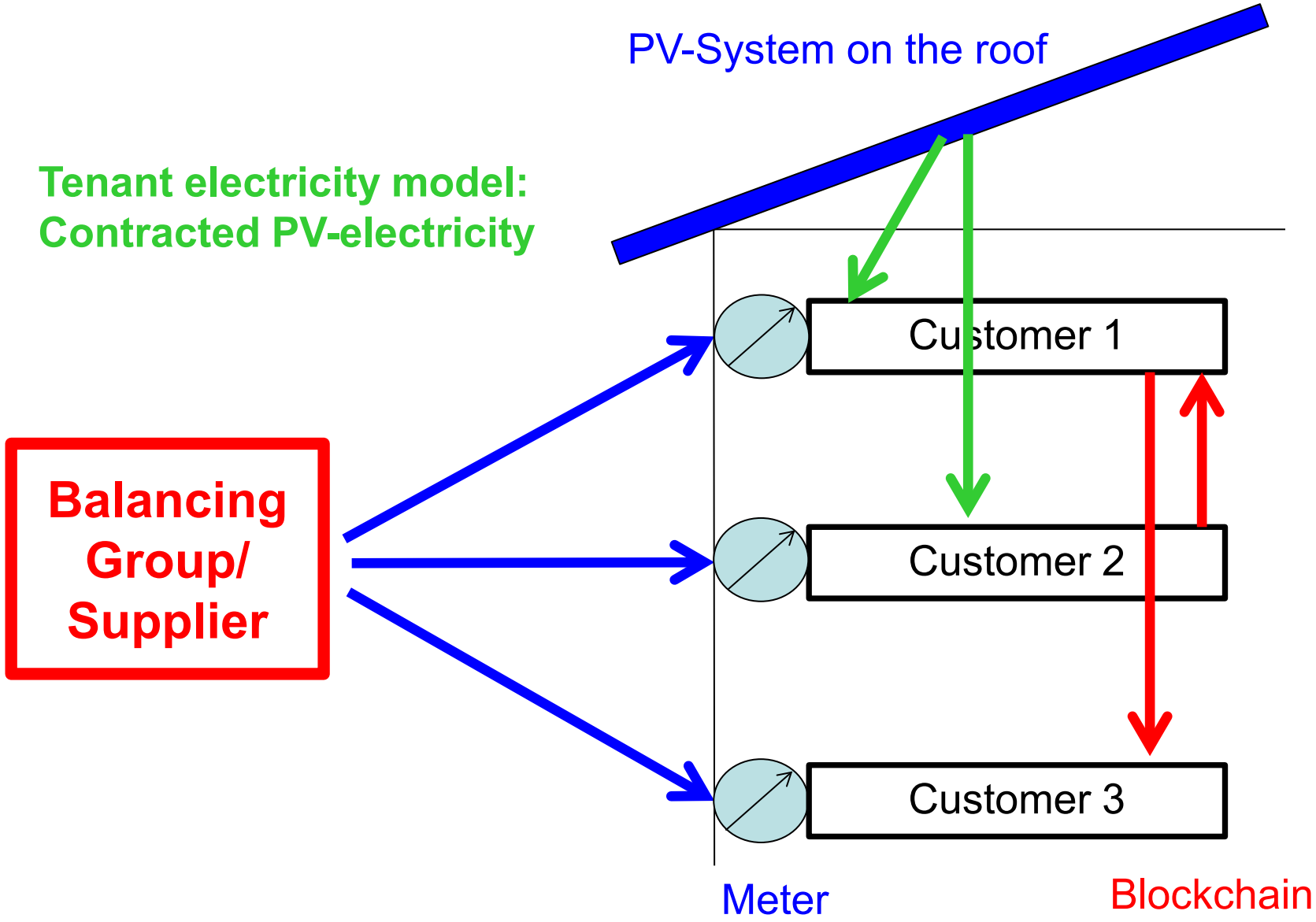
Project	MW	ct/kWh
EnBW He Dreiht GmbH	900	0.0
DONG Energy Borkum Riffgrund West II GmbH	240	0.0
Dong Energy Northern Energy OWP West GmbH	240	0.0
Dong Energy Gode Wind 03 GmbH	110	6.0*
Weighted average	**1,490**	**0.44**

Source: Innogy

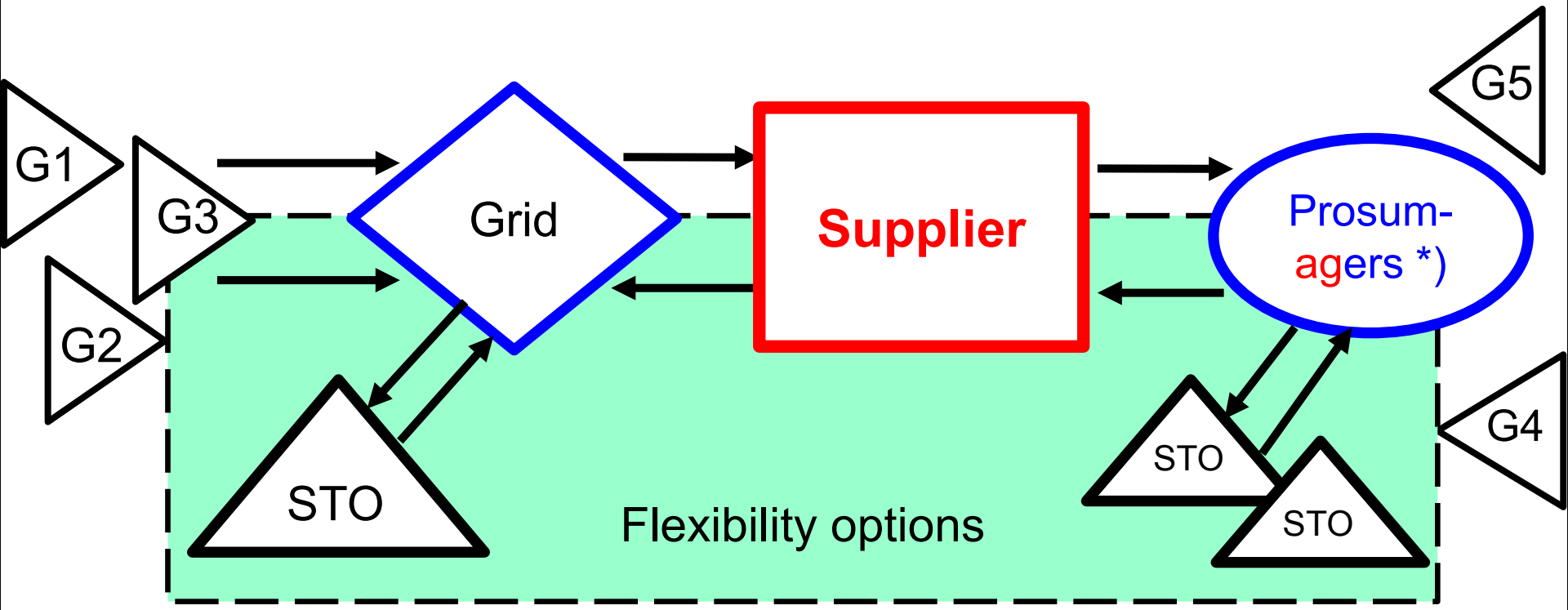
Bets on:

- Increasing electricity prices
- Decreasing technology costs
- Sector coupling works

Tenant electricity model and Blockchain



New Thinking: Making the electricity system more democratic



*) R. Green

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 incl. decentralised systems (PV …)
- Capacity payments: Any CP will distort the system towards more conv. and less RES capacity
- New key players: Suppliers and prosumagers