On integrating large shares of variable renewables into the electricity system

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2. How variable renewables impact prices in electricity markets
3. A „MARKET“ design
4. Economic incentives for flexibility measures
5. Conclusions

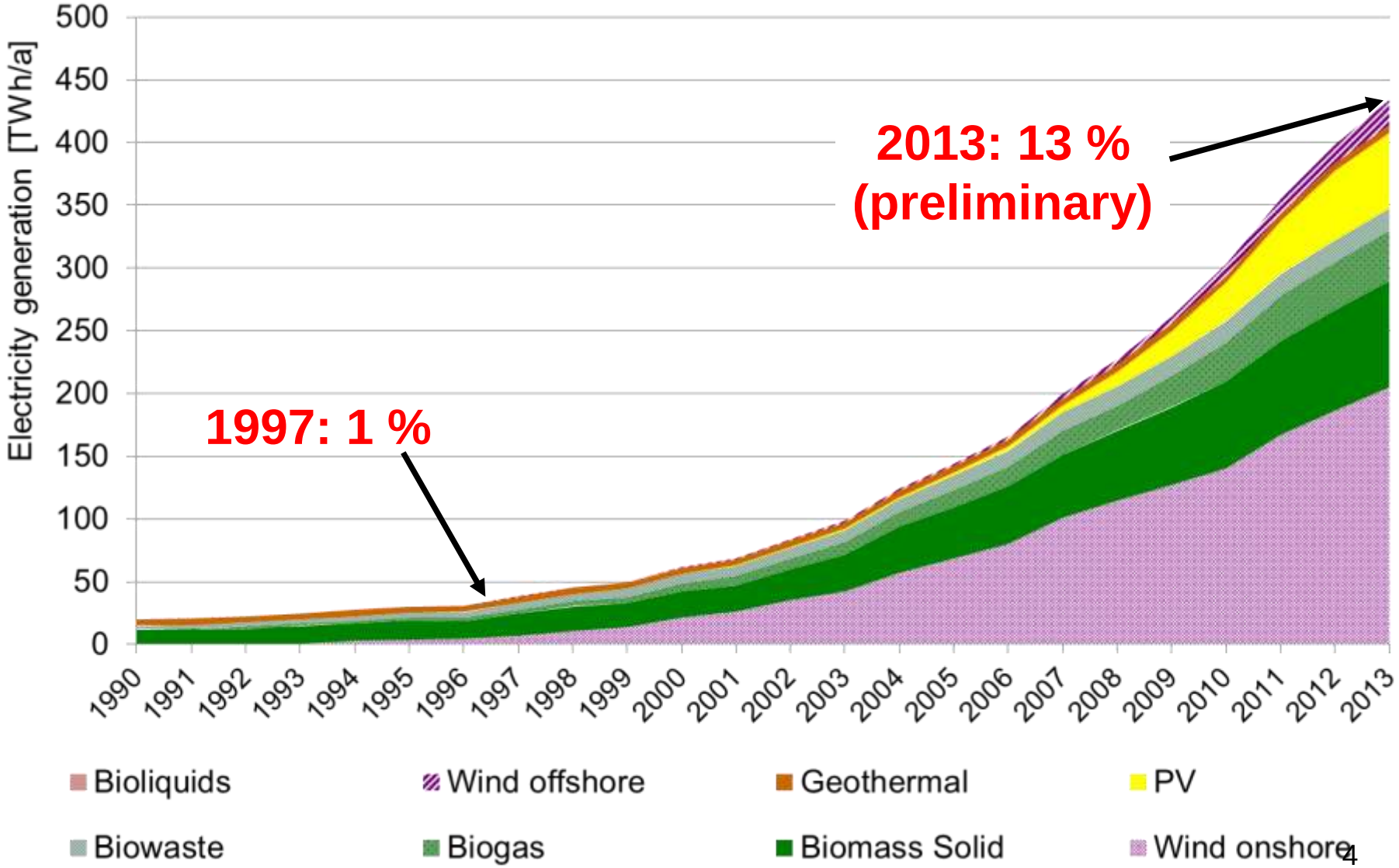
In day-ahead electricity markets:

Expectation of:

prices = Short-term marginal costs:

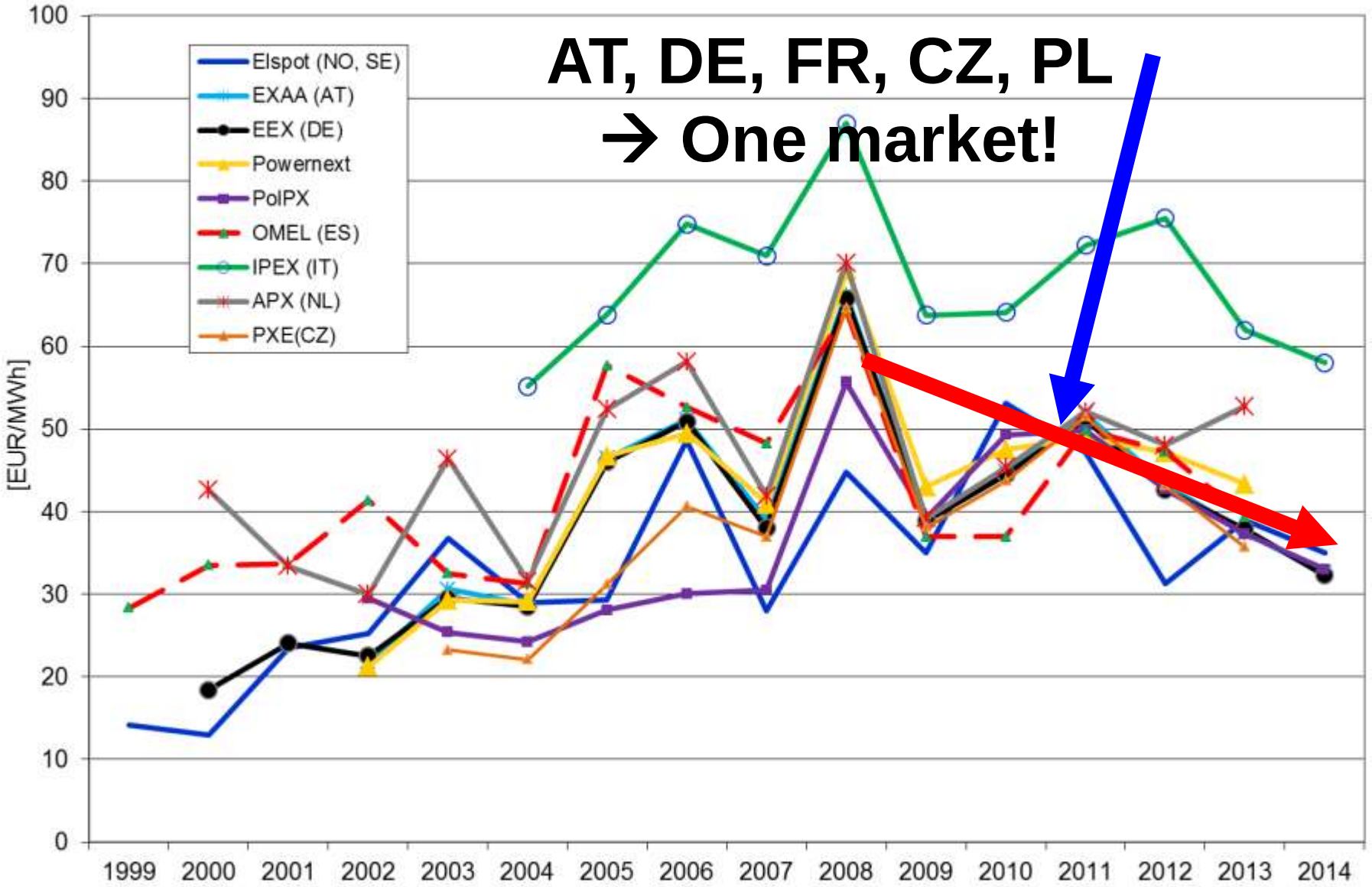
(Short-term marginal costs = fuel costs)
due to huge depreciated excess capacities at the beginning of liberalisation!

1 INTRODUCTION



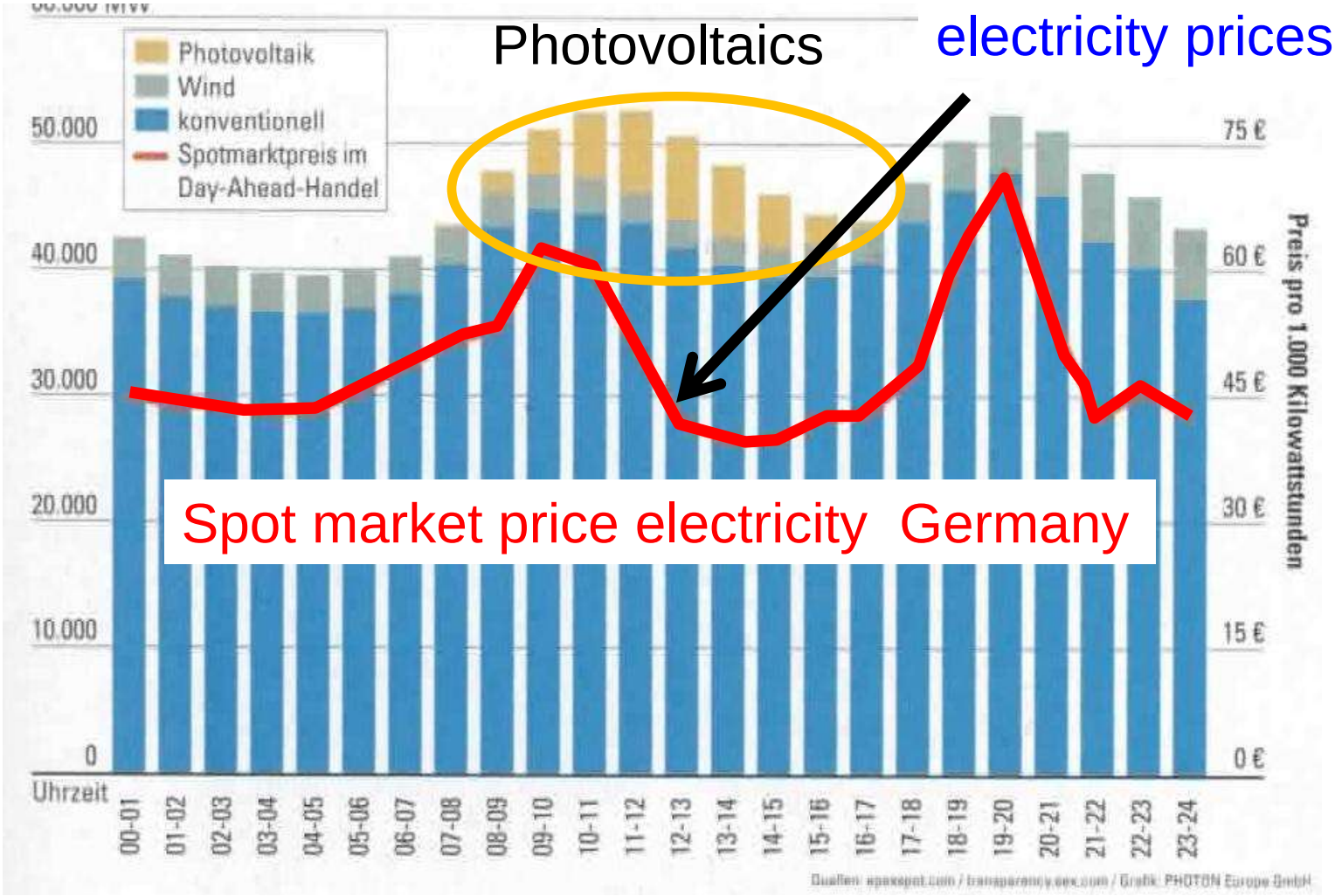
2 HOW VARIABLE RENEWABLES IMPACT PRICES IN ELECTRICITY MARKETS

Development of day-ahead electricity prices in Europe per year



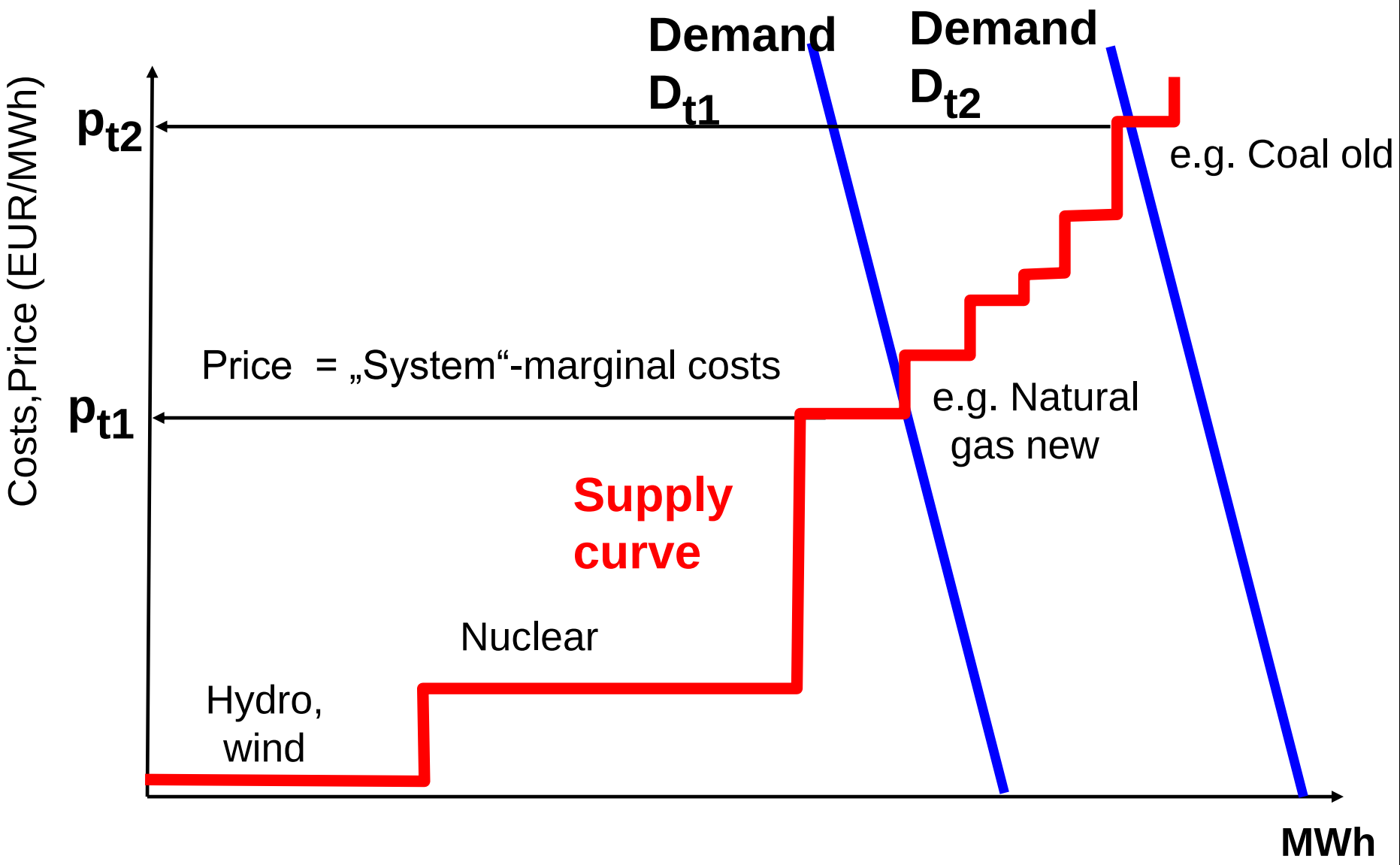
Impact of PV on the electricity market price in Germany

On-peak time: Low electricity prices!



WHY?

COMPETITION: PRICES = MARGINAL COSTS



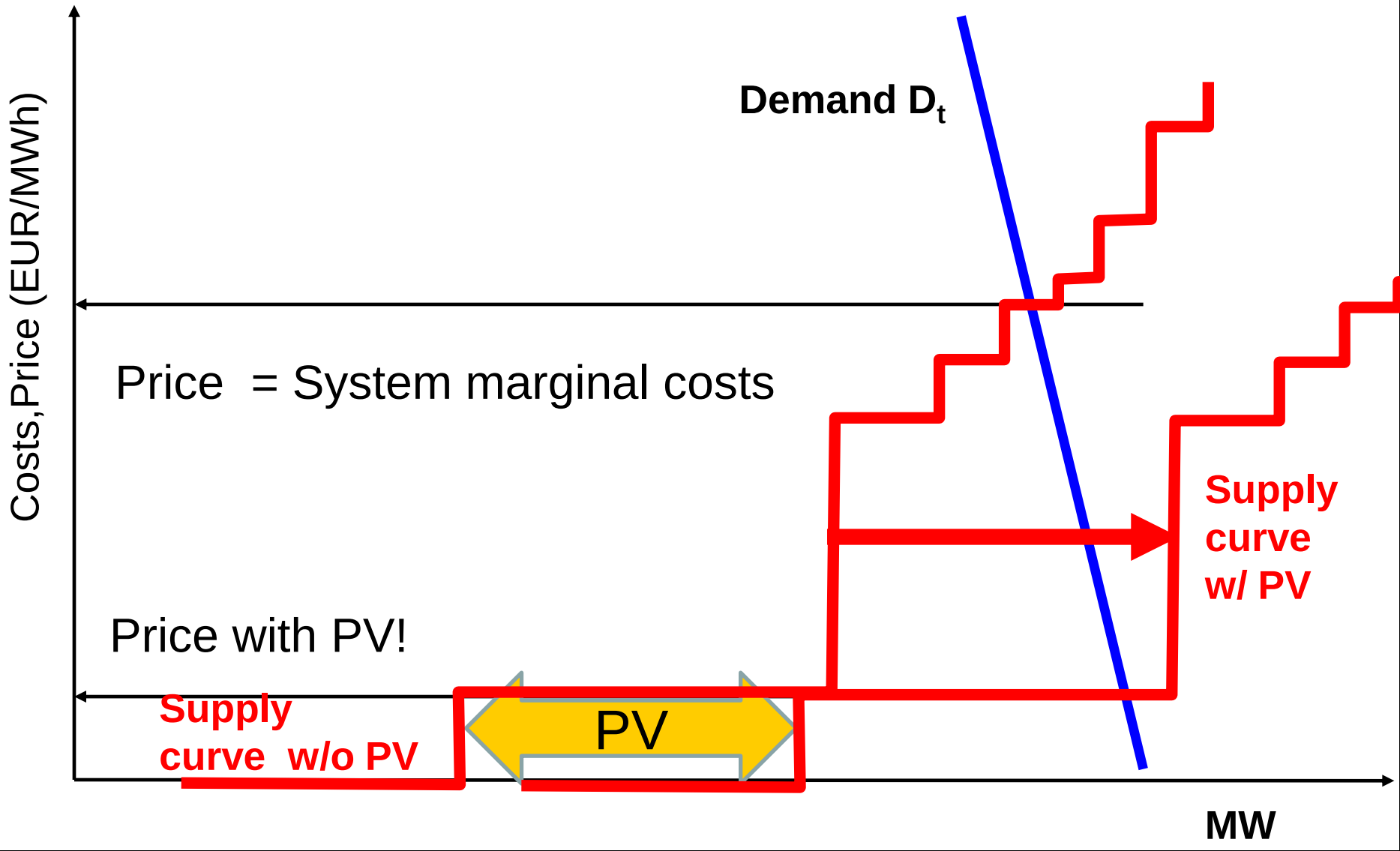
In day-ahead electricity markets:

Expectation of:

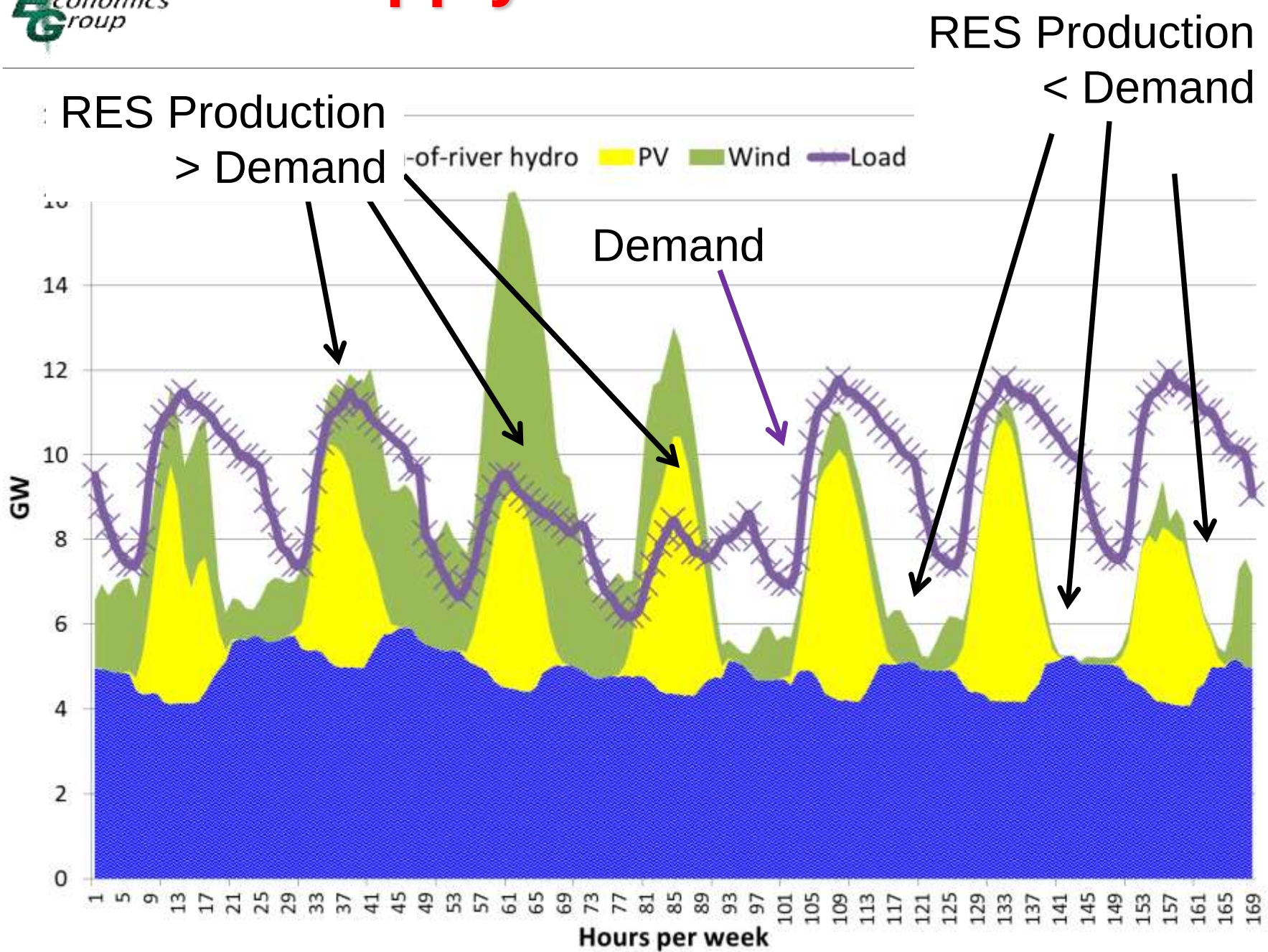
prices = Short-term marginal costs:

(Short-term marginal costs = fuel costs)
due to huge depreciated excess capacities at the beginning of liberalisation!

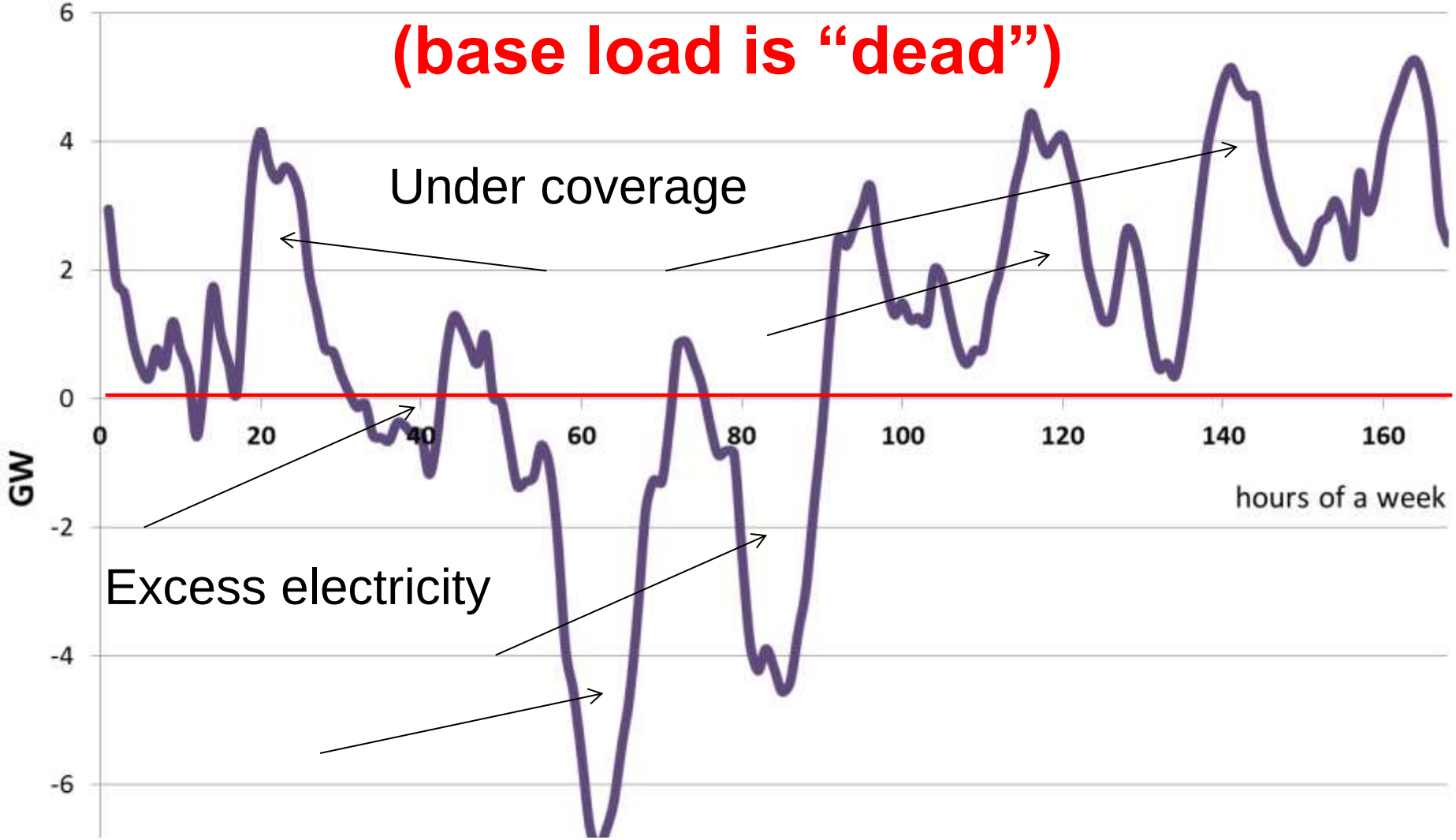
2. PRICES WITHOUT AND WITH PV



Supply and Demand

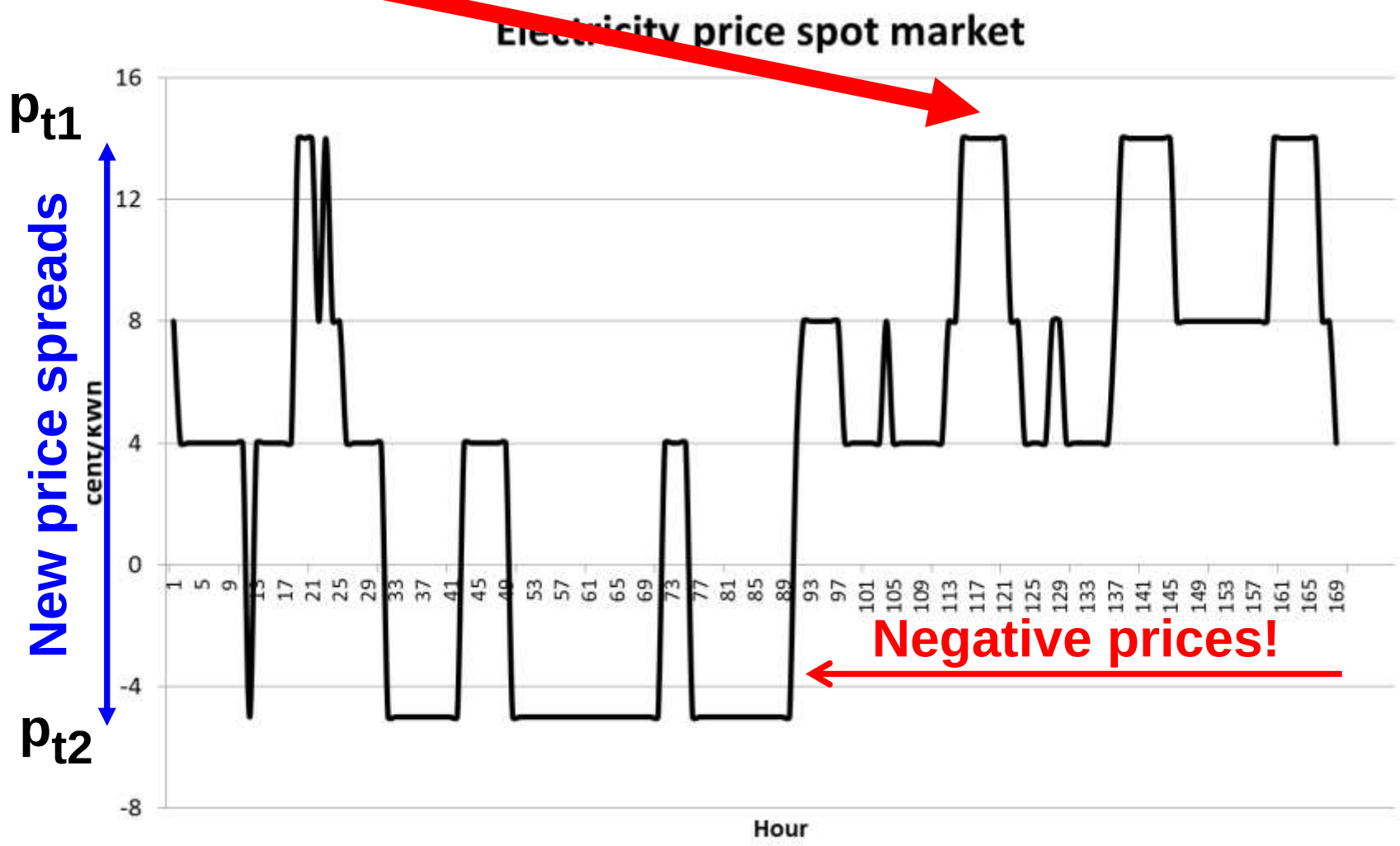


Key term of the future: Residual load (base load is “dead”)



Residual load = Load – non-flexible generation

Are these prices TOO HIGH?



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

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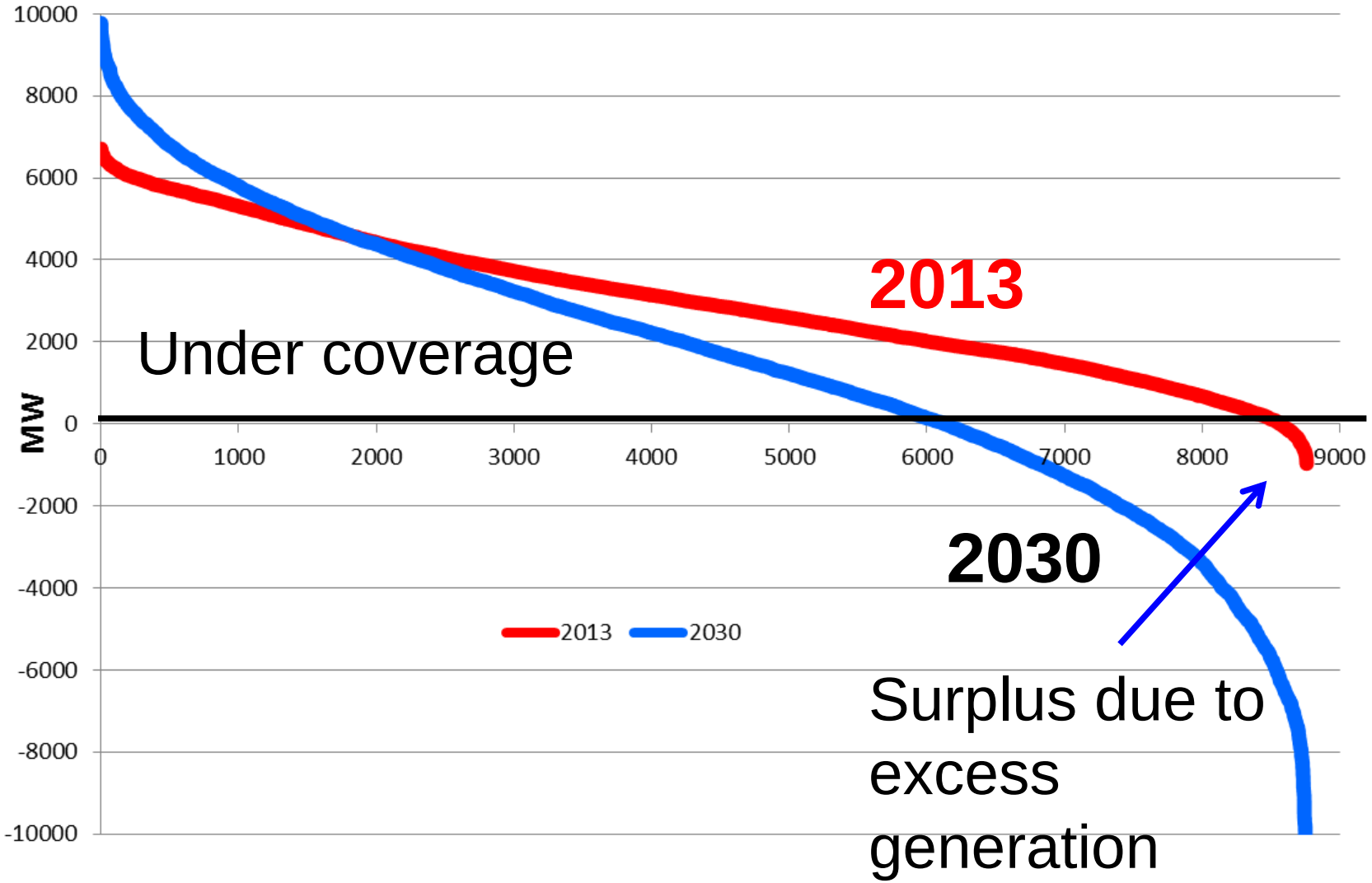
Given this price pattern, showing excess and scarcity it would be attractive for (some) power plant operators to stay in the market

→

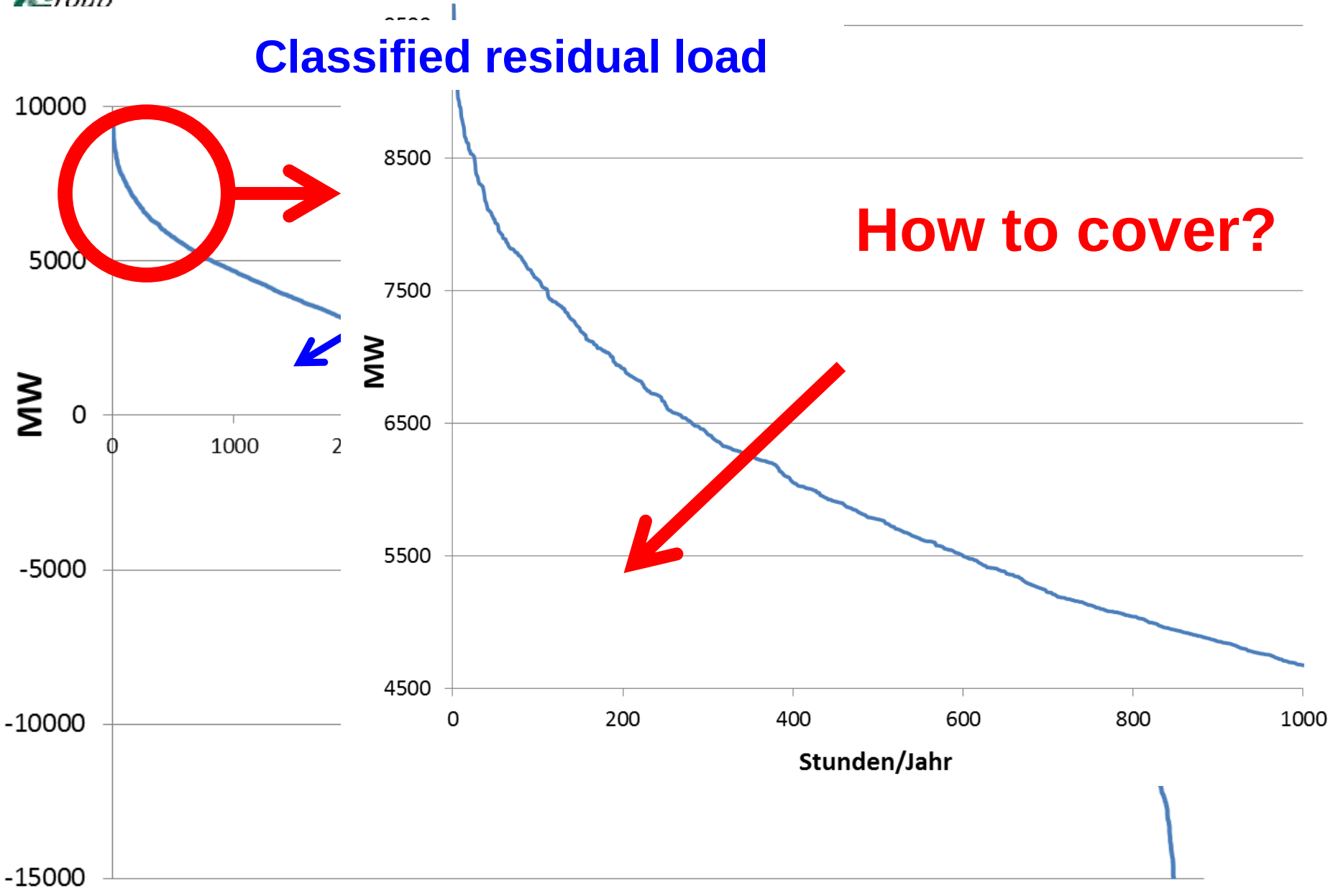
REVISED ENERGY-ONLY MARKET

Classified residual load



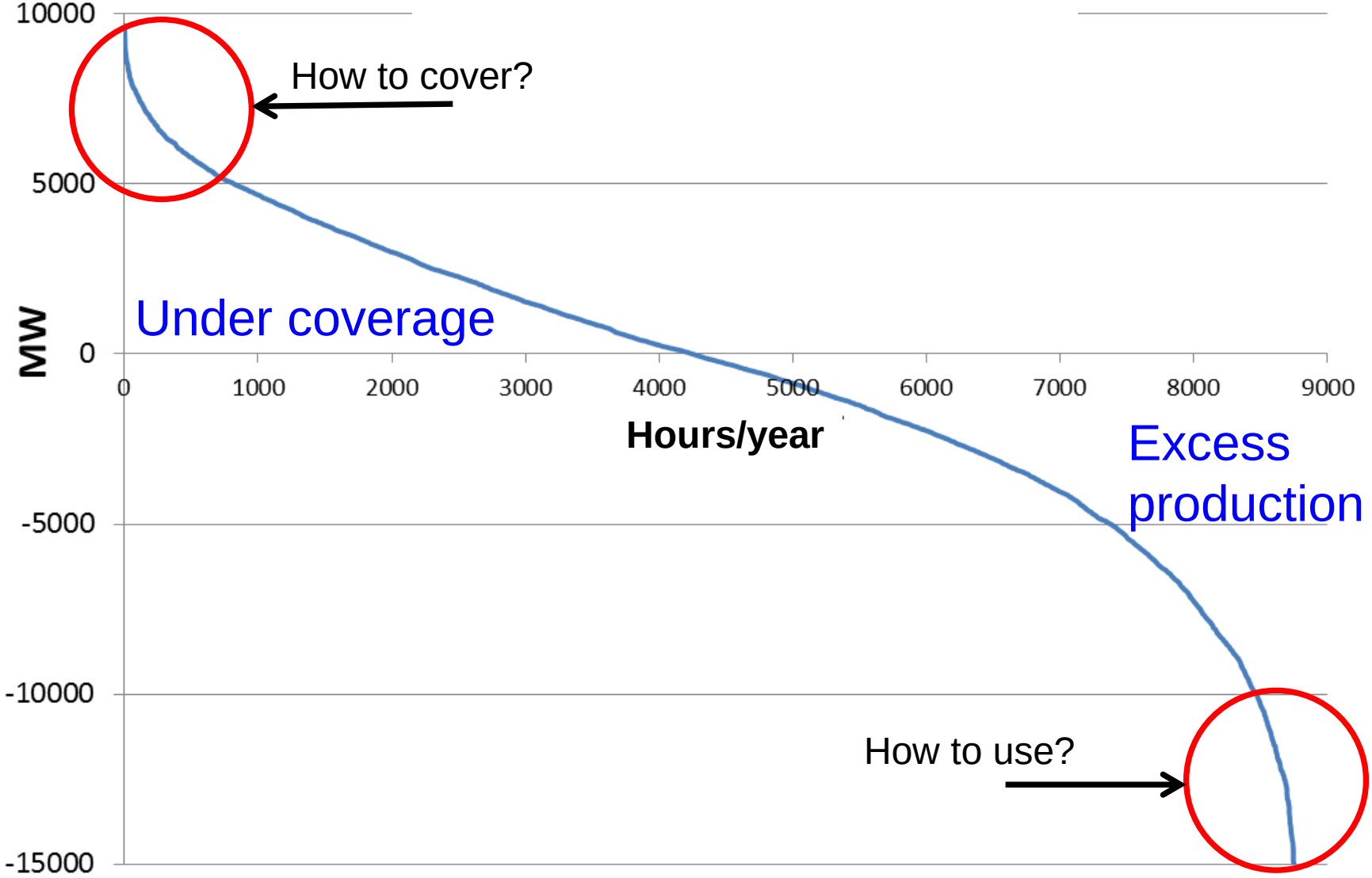
3. A MARKET DESIGN

Classified residual load



How to cover?

Classified residual load

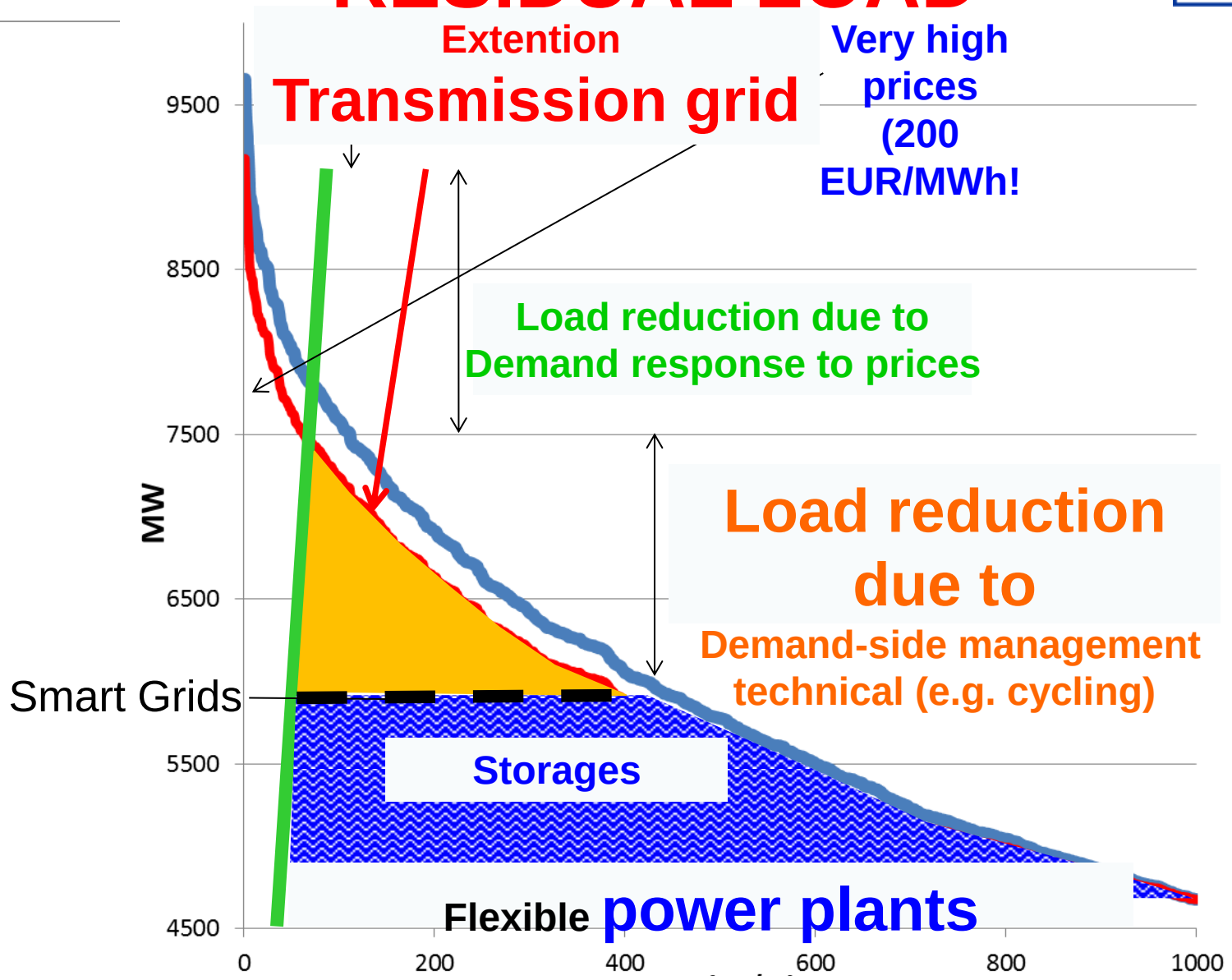


By a regulated capacity „market“ ?

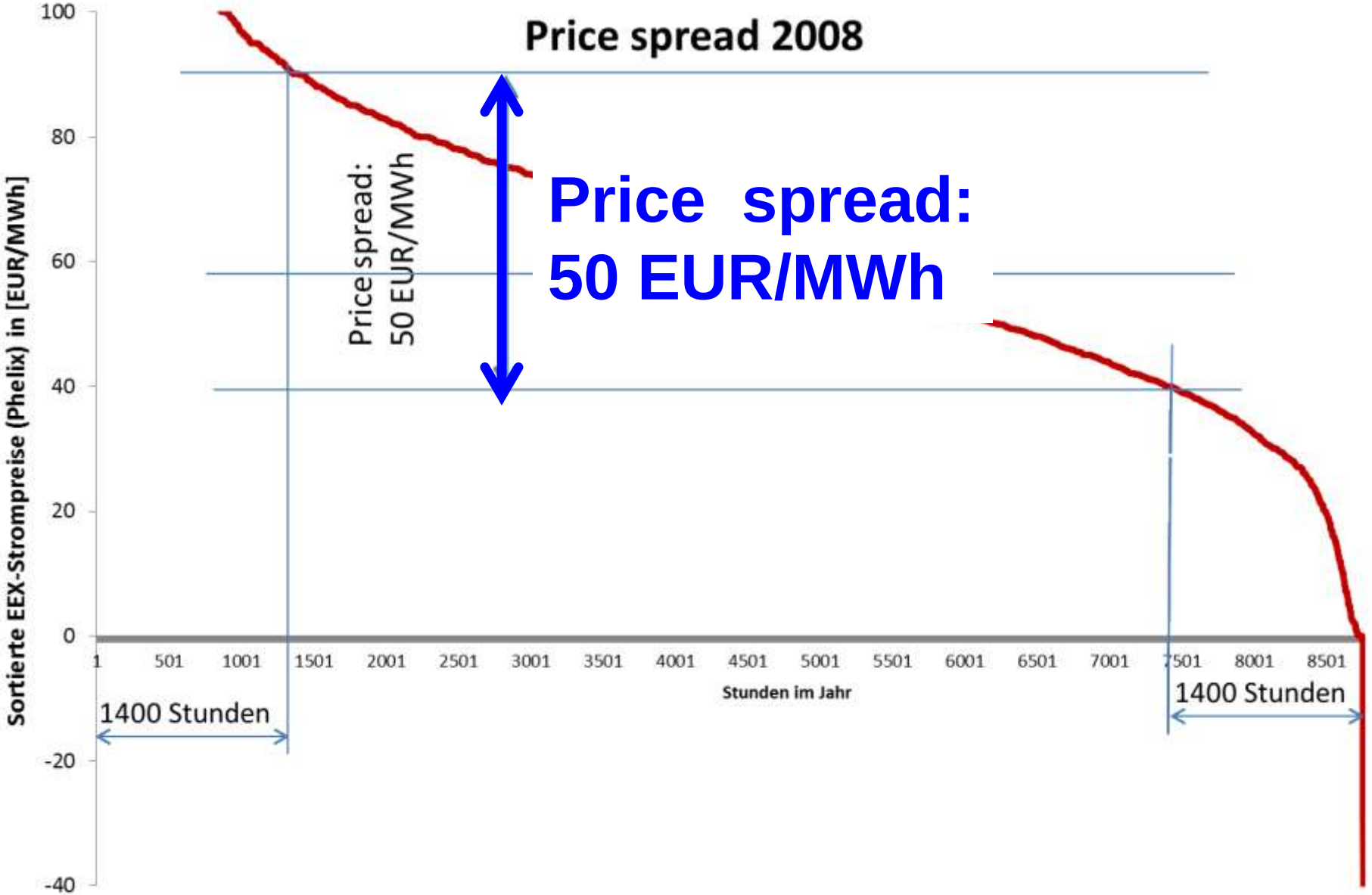
or

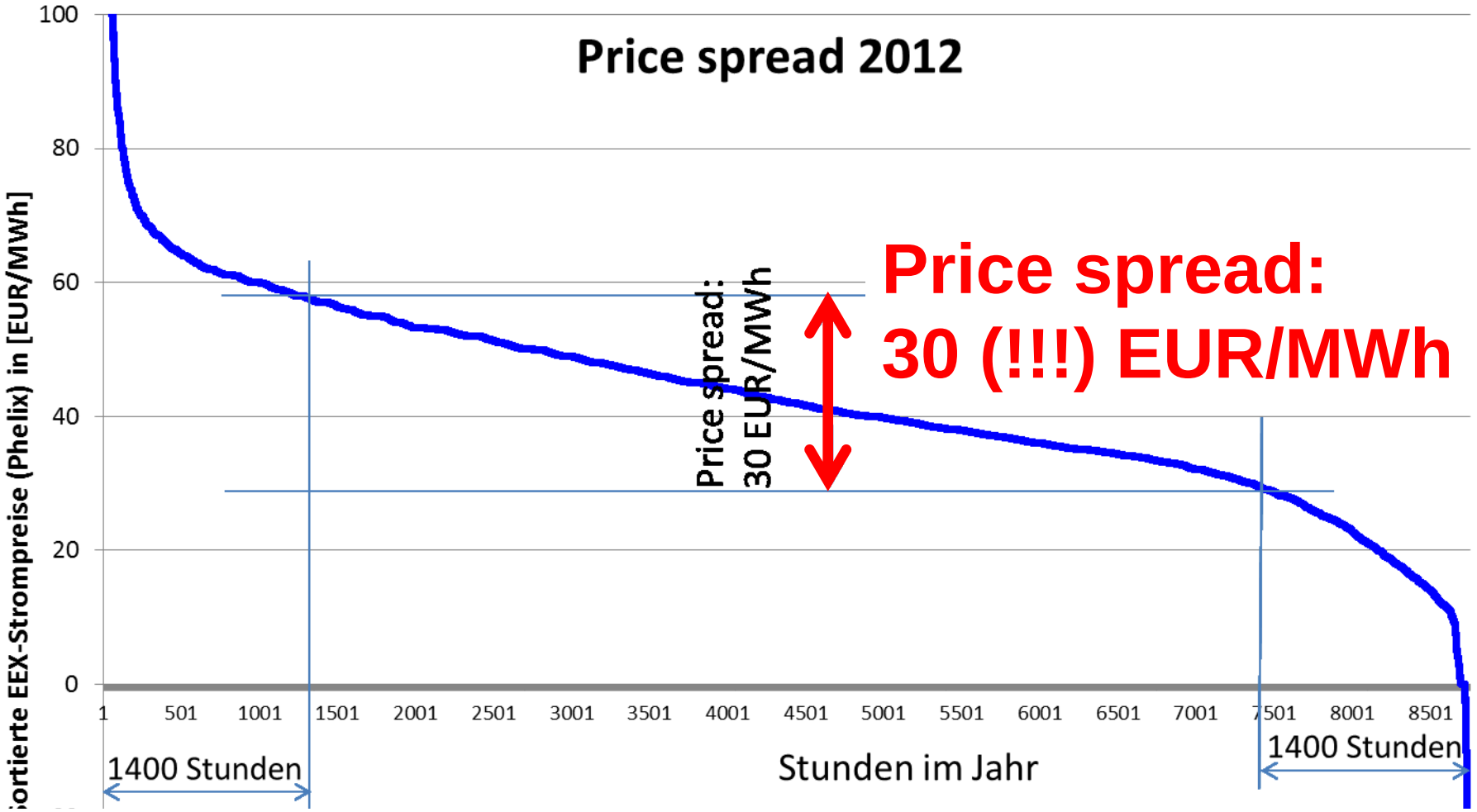
By competition between supply-side and demand-side technologies and behaviour (incl. Storages, grid and other flexibility options)?

FLEXIBLE COVERING OF RESIDUAL LOAD



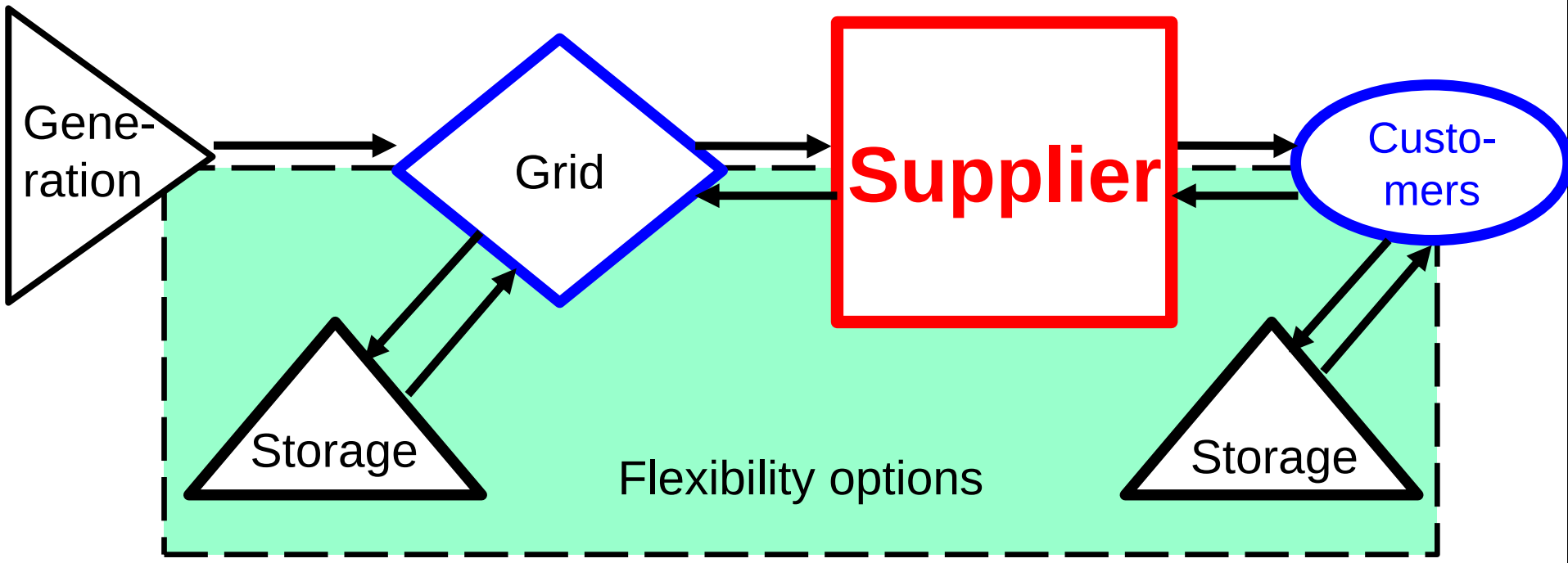
4. ECONOMIC INCENTIVES





→ There is no incentive today to launch flexibility measures (except in the control power market)!

NEW THINKING:



5. CONCLUSIONS

- A sustainable electricity system is not a technological winner-picking problem!
- It is a question of integrating a broad portfolio of technologies and demand response options!
- most important now: exhaust the full potential of the creativity of all market participants!
- The key: Flexibility! Yet, currently no economic incentives but activities started → very promising!
- Very important: correct price signals!!!
- calls for capacity markets: a last try of the old generation-focused system to survive