HEADING TOWARDS SUSTAINABLE AND DEMOCRATIC ELECTRICITY SYSTEMS

Reinhard HAAS,
Energy Economics Group,
TU Wien

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1. INTRODUCTION

Motivation:

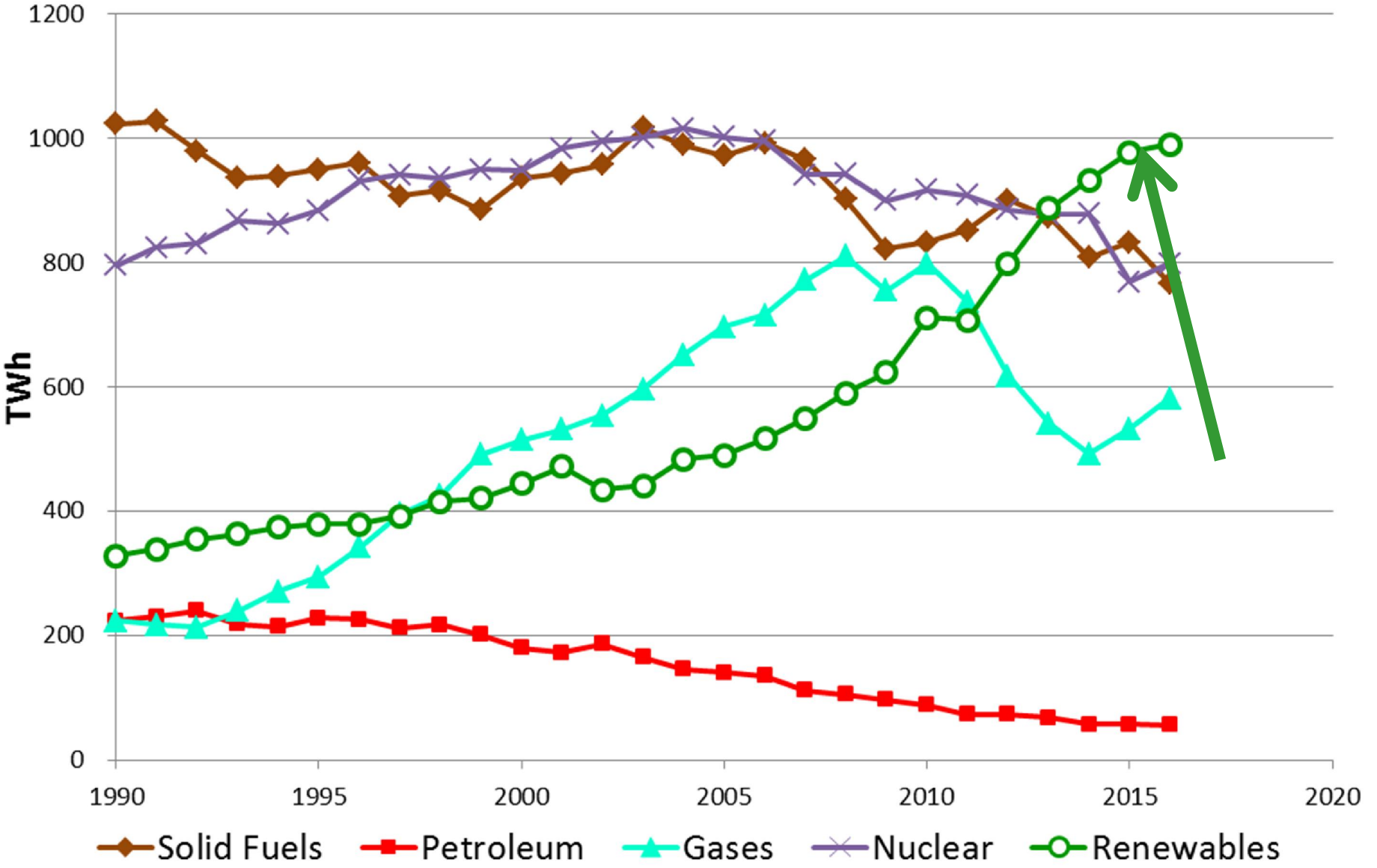
* Climate change → Paris agreements

* Targets for renewables

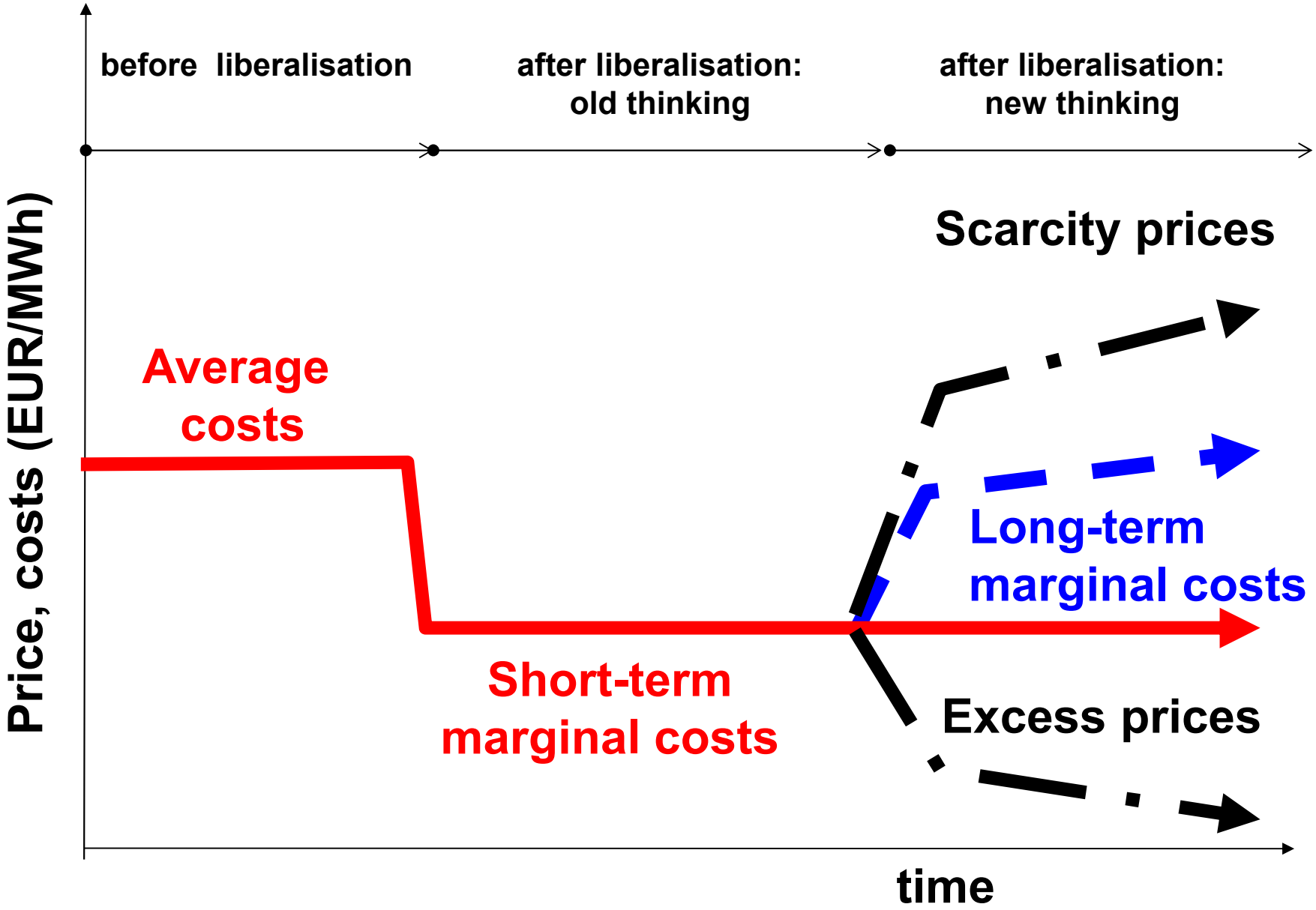
* Europe: The clean energy package

* It is not possible to force variable renewables into the system

Introduction:
Electricity generation EU-28



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

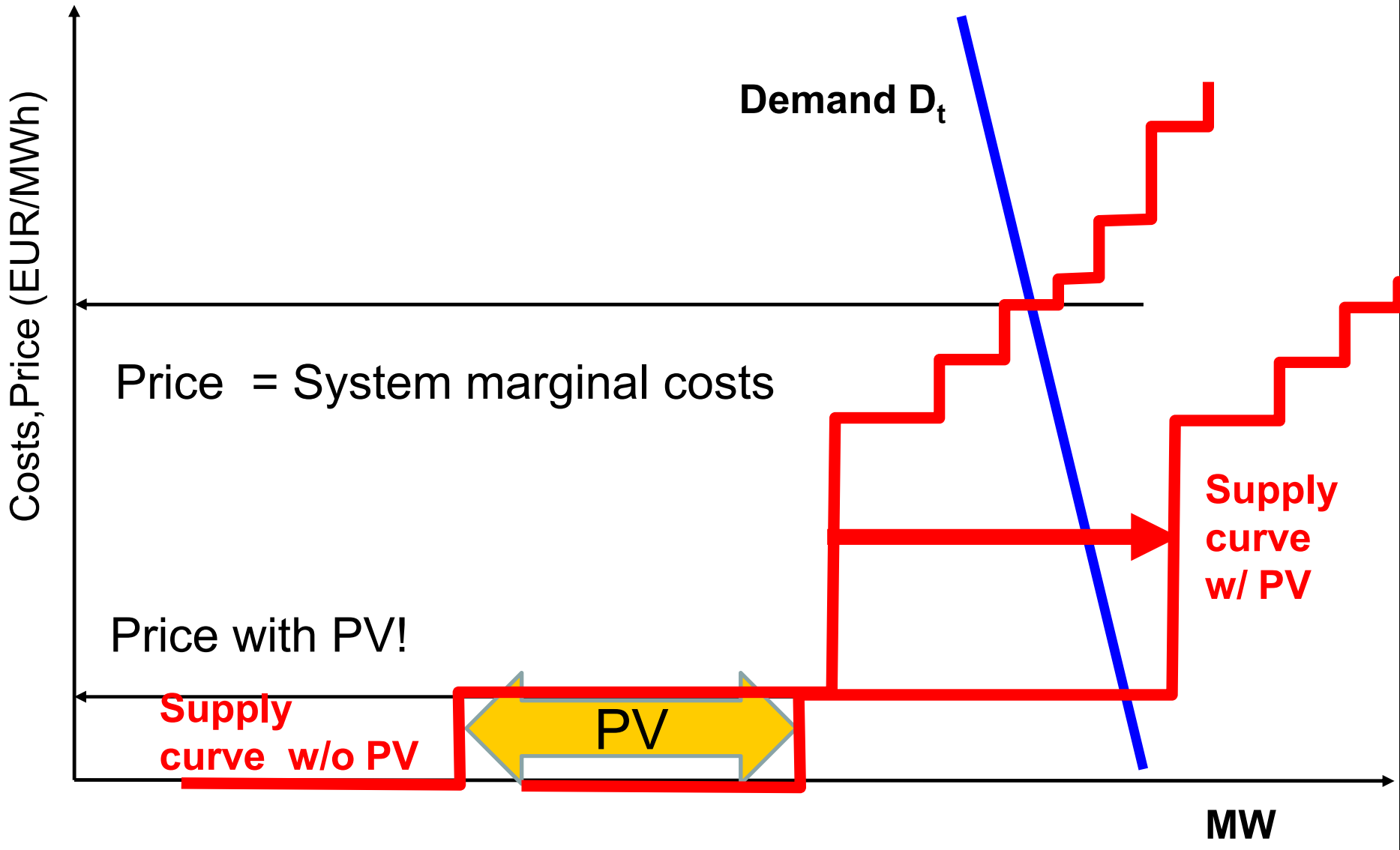
prices = Short-term marginal costs

(Short-term marginal costs = fuel costs)

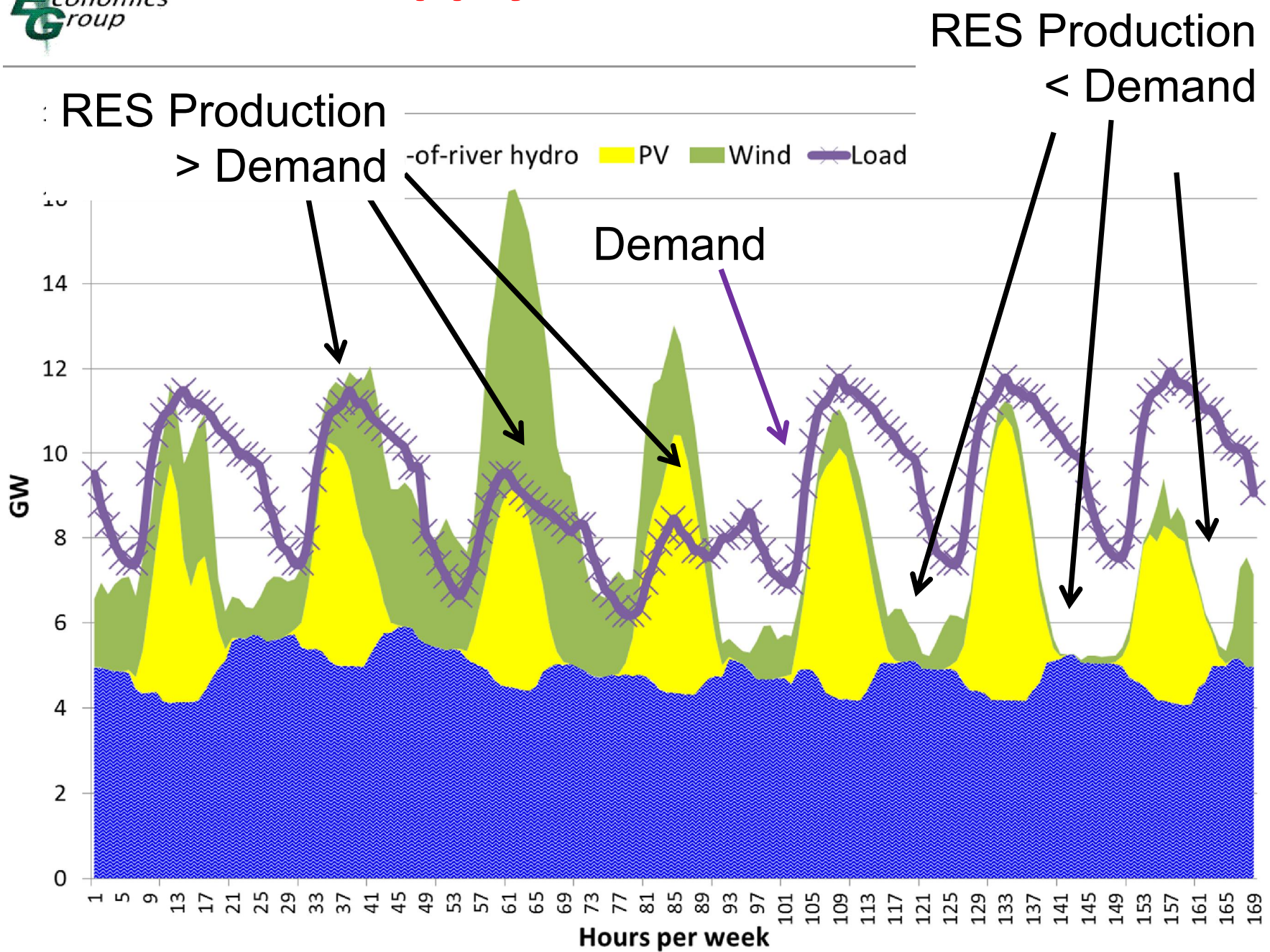
due to huge depreciated excess capacities at the beginning of liberalisation!

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

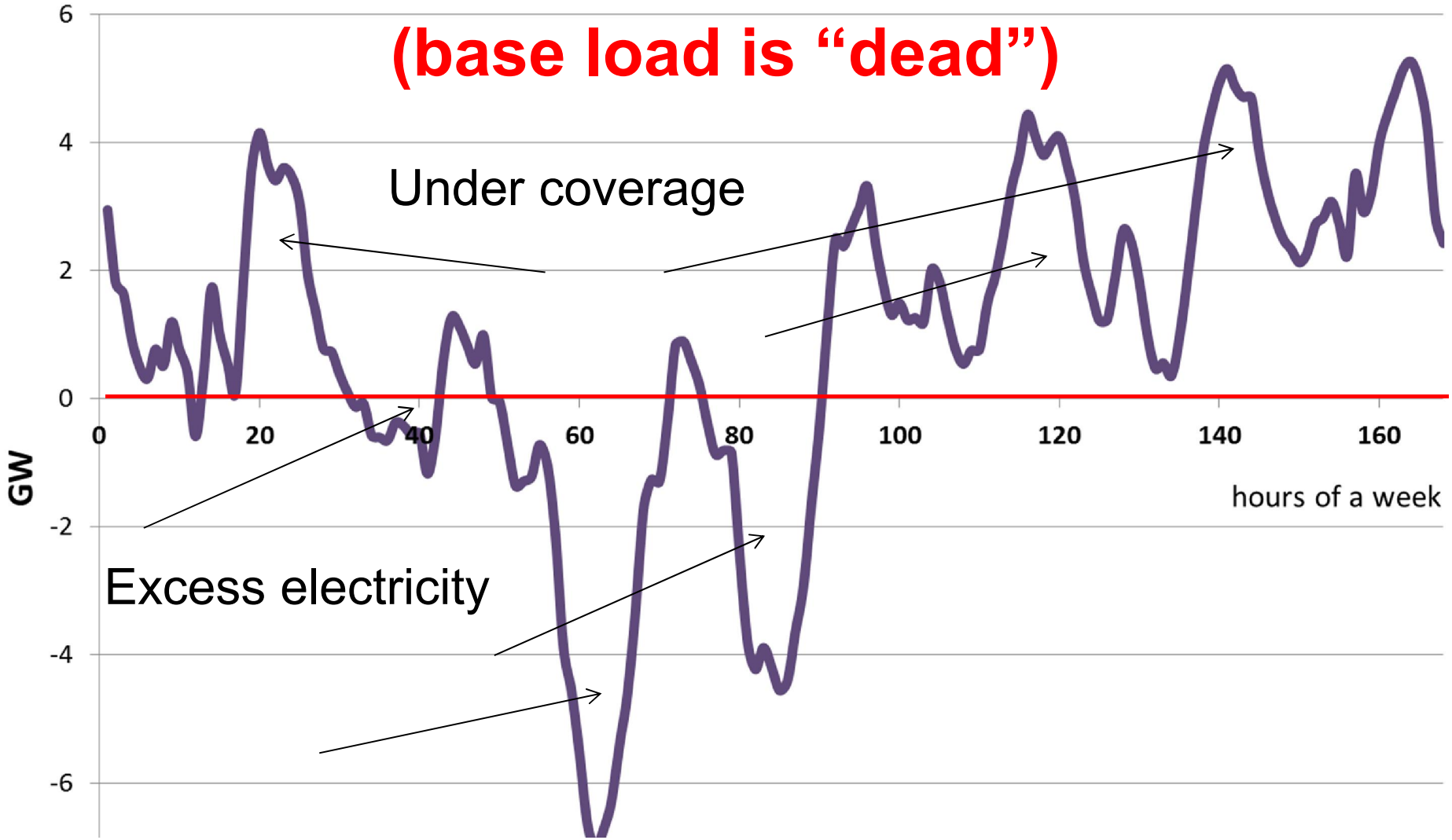
Example: prices without and with PV



Supply and Demand



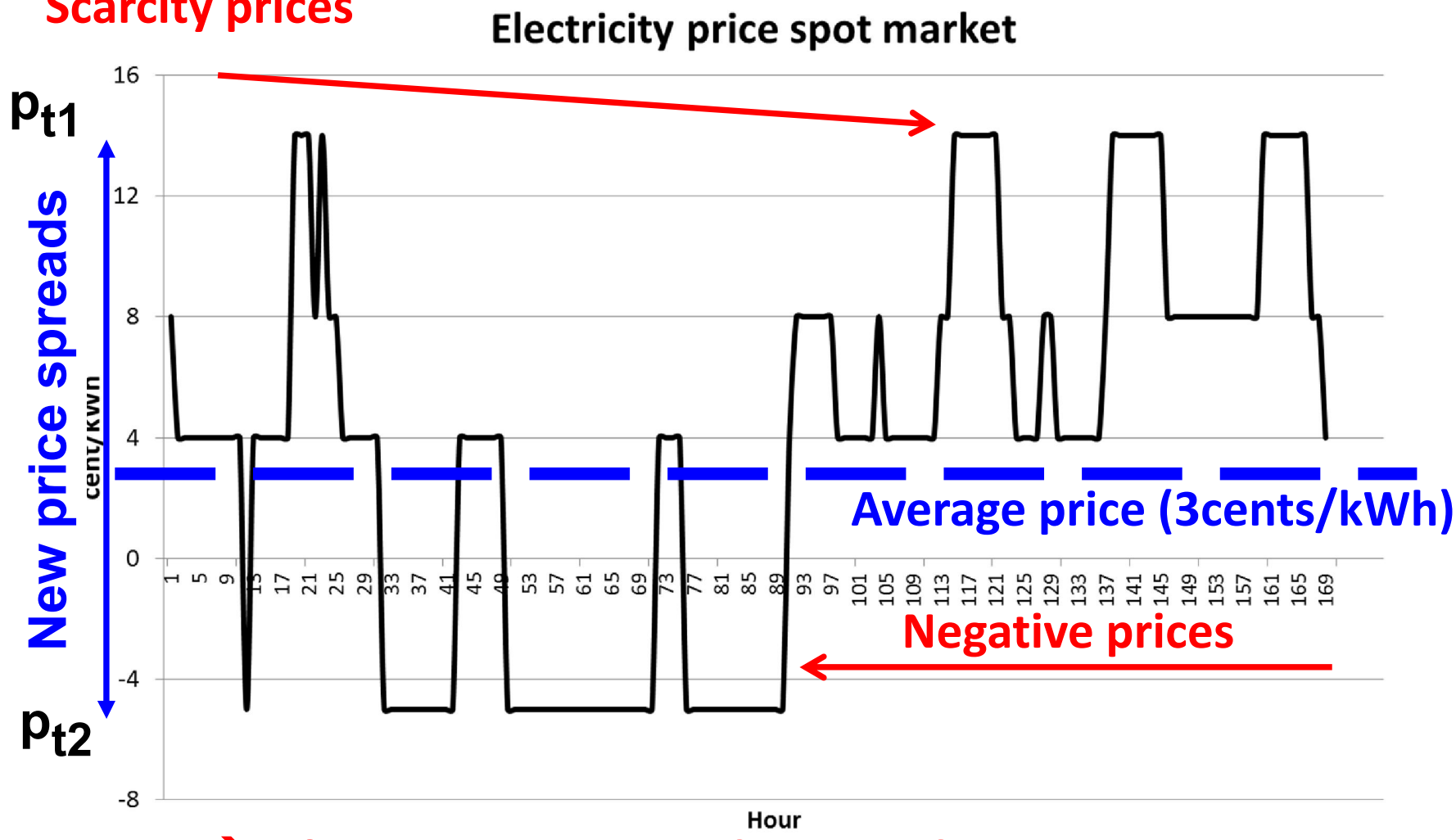
Key term of the future: Residual load (base load is “dead”)



Residual load = Load – non-flexible generation

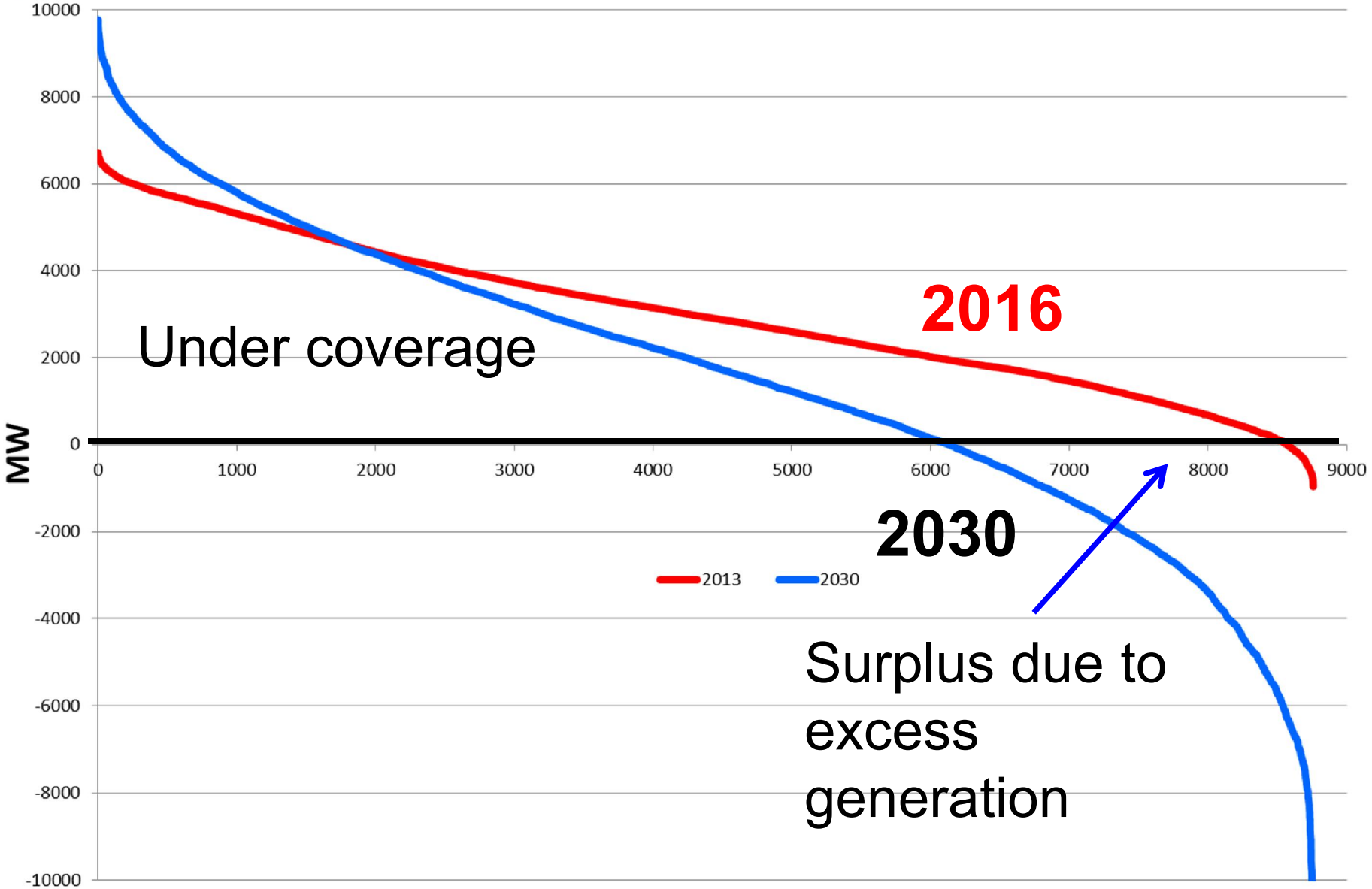
Deviation from STMC-pricing in spot markets

Scarcity prices

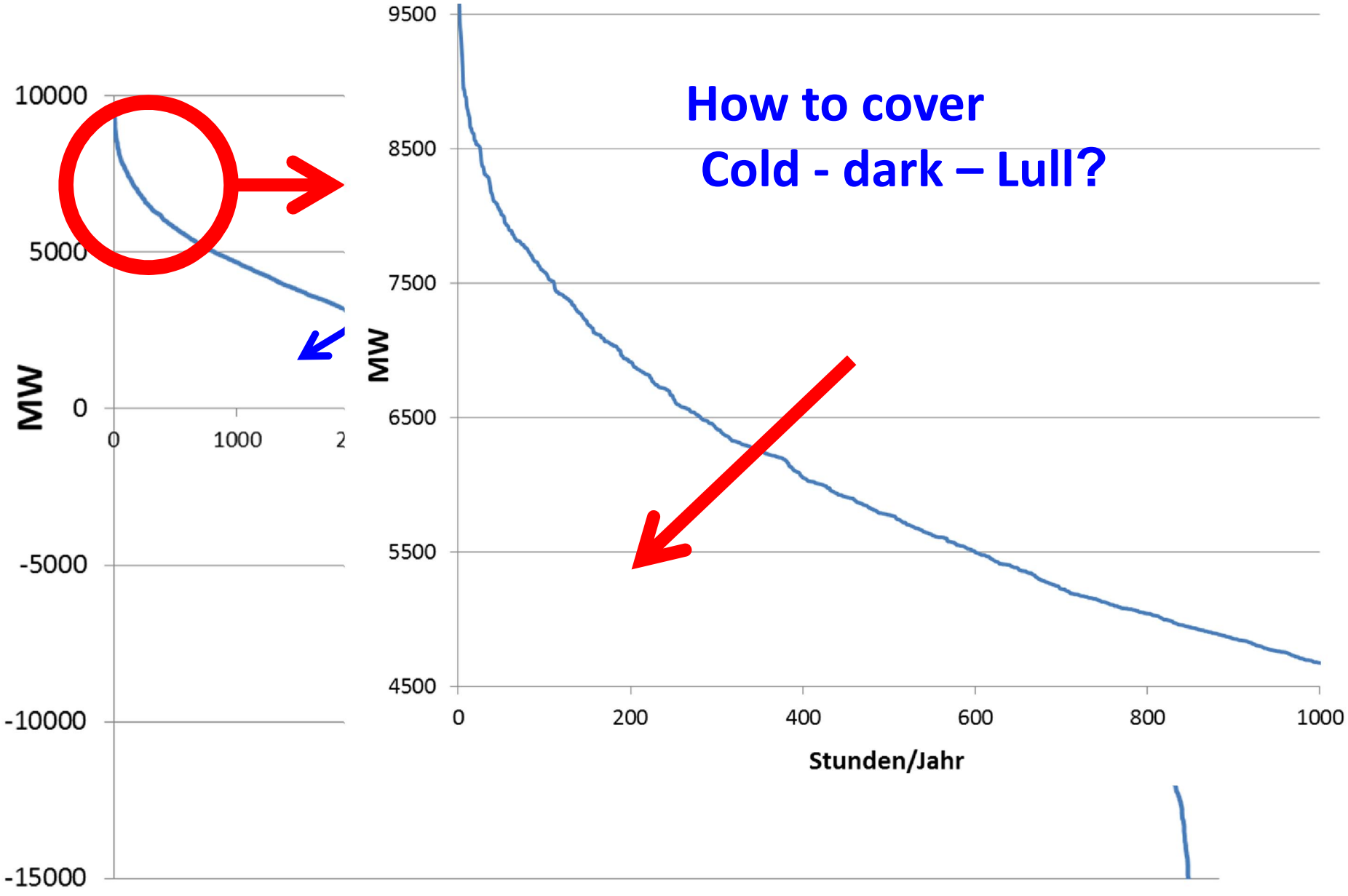


→ These price spreads provide incentives for new flexible solutions!!!!

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

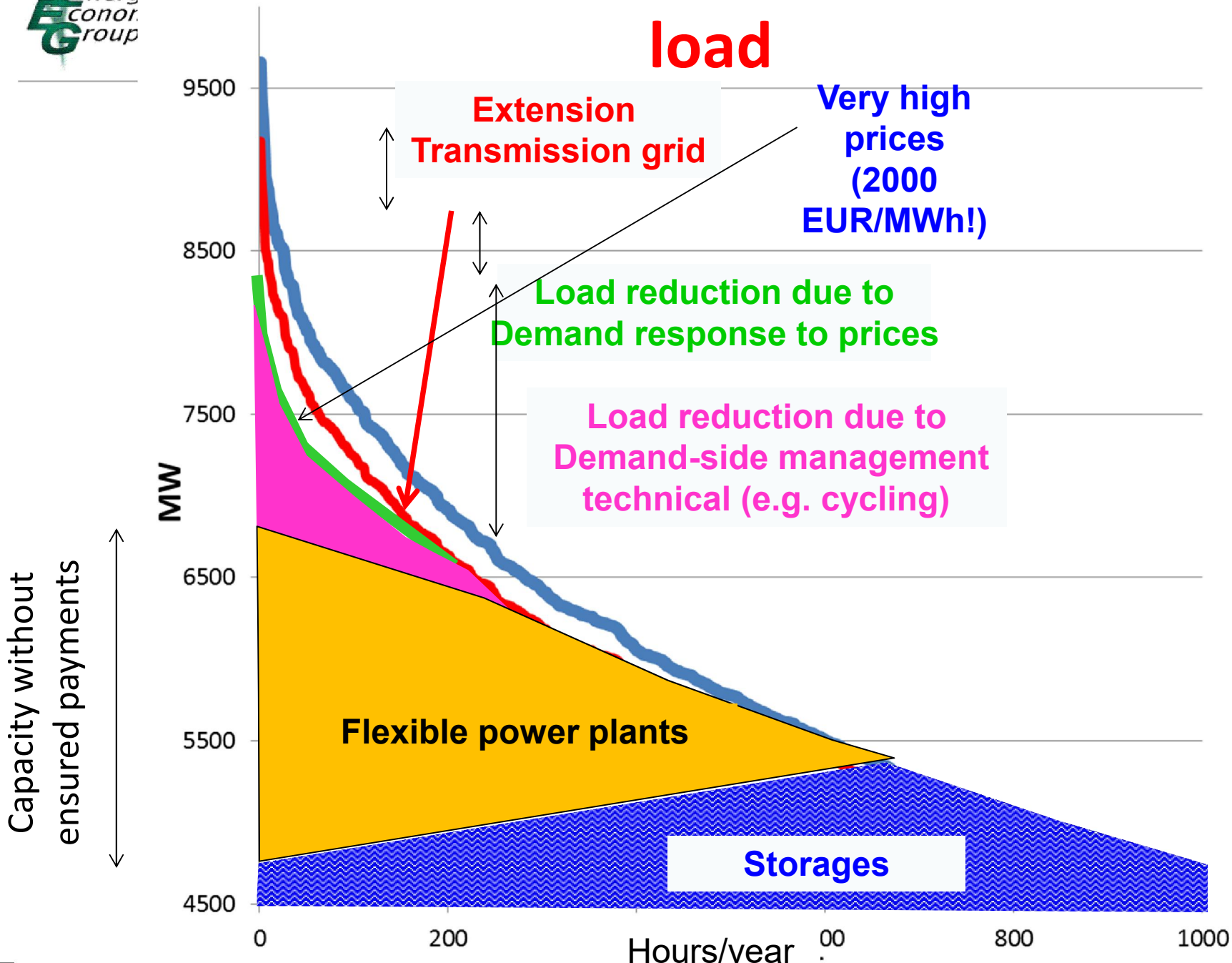
All regulatory capacity payments for power plants destort the EOM and lead to wrong price signals for all other options

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

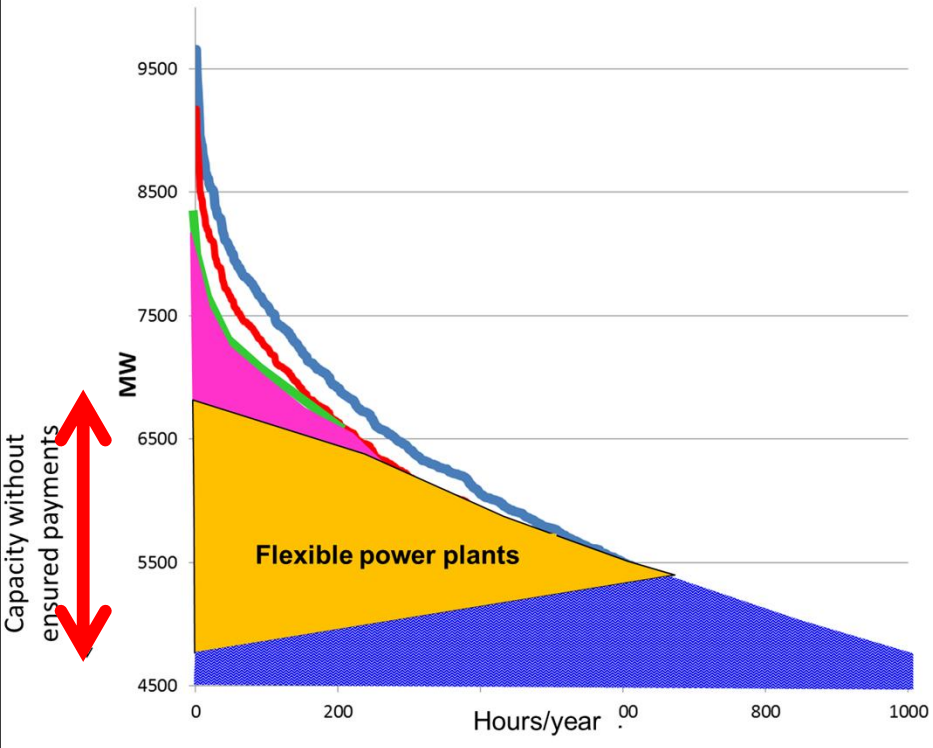
The higher the excess capacities, the lower is the share of RES

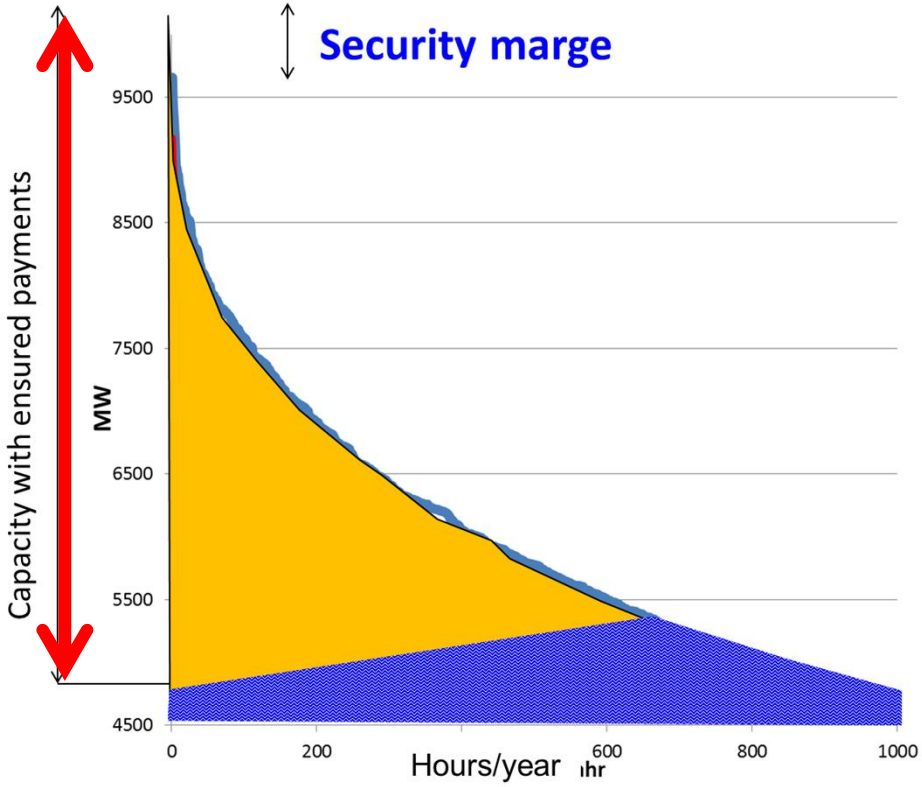
strive to retain system resource adequacy by correct price signals

5 Flexible coverage of residual load

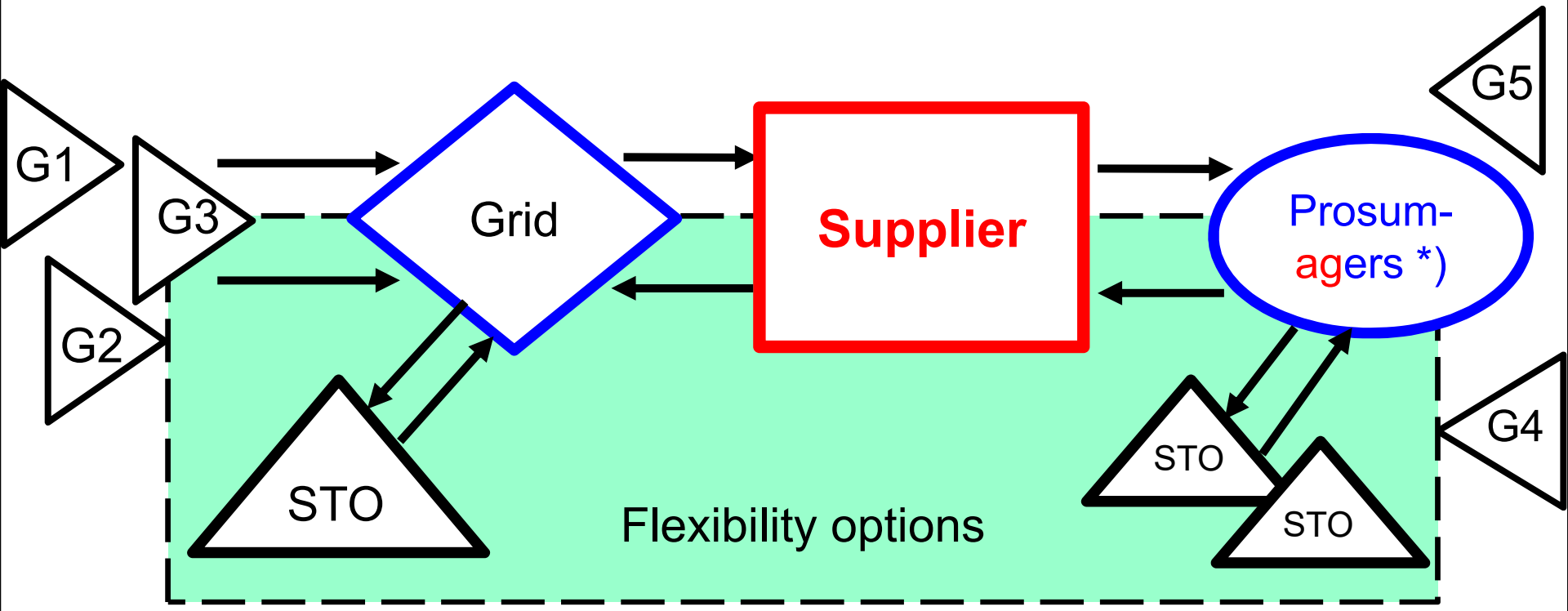


Comparison


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

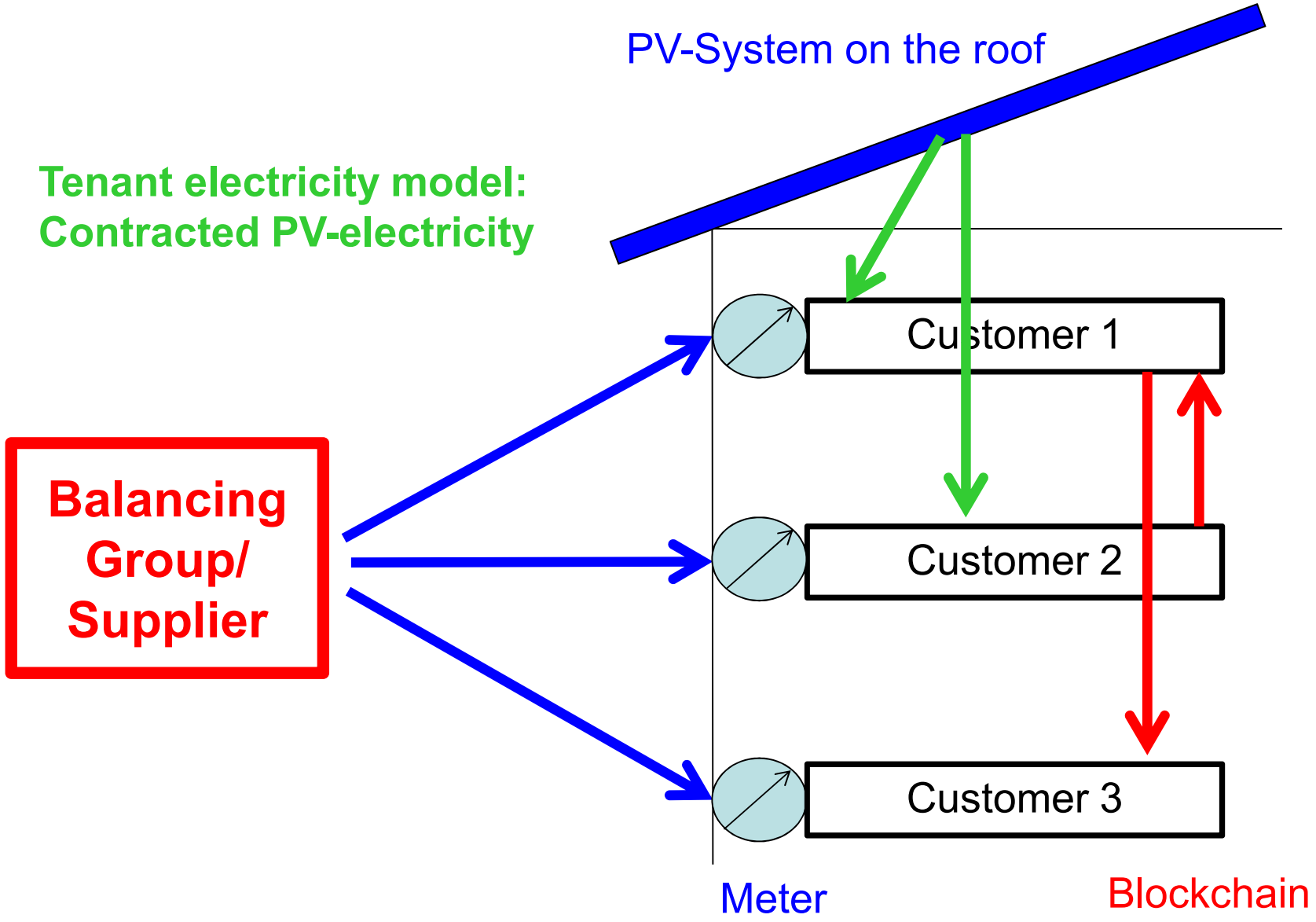

Security marge
Capacity with ensured payments
9500
8500
7500
6500
5500
4500
MW
0
200
600
800
1000
Hours/year

New Thinking: Making the electricity system more democratic



*) R. Green

Tenant electricity model and Blockchain



6. CONCLUSIONS

- Sustainable electric. system → integration of a broad technology portfolio & demand-side options!
- Larger market areas favourable
- Very important: correct price signals (incl. CO2)
- most urgent: exhaust full creativity for flexibility of all market participants incl. decentralised PV systems
- Capacity payments: Any CP will distort the system towards more conv. and less RES capacity
- New key player: Balancing group (Supplier), no more the generator