



# CONDITIONS FOR COMPETITIVE, SUSTAINABLE AND DEMOCRATIC ELECTRICITY SYSTEMS

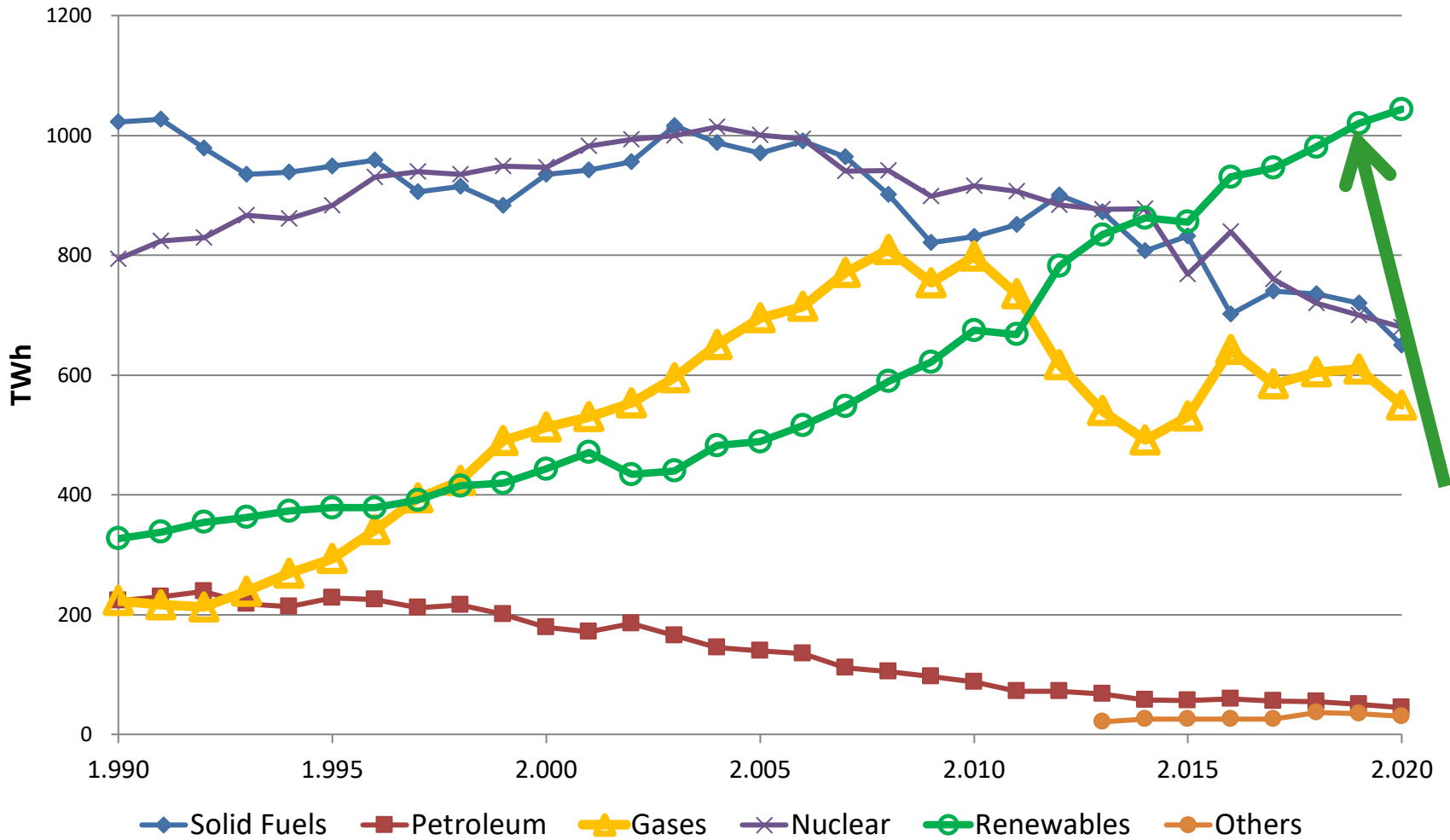
Reinhard HAAS,  
Energy Economics Group,  
TU Wien

**SALZBURG 2022**

- 1. Introduction: Motivation**
- 2. The merit order curve**
- 3. How variable renewables impact prices in electricity markets**
- 4. The role of flexibility**
- 5. Towards prosumagers and energy communities**
- 6. Conclusions**

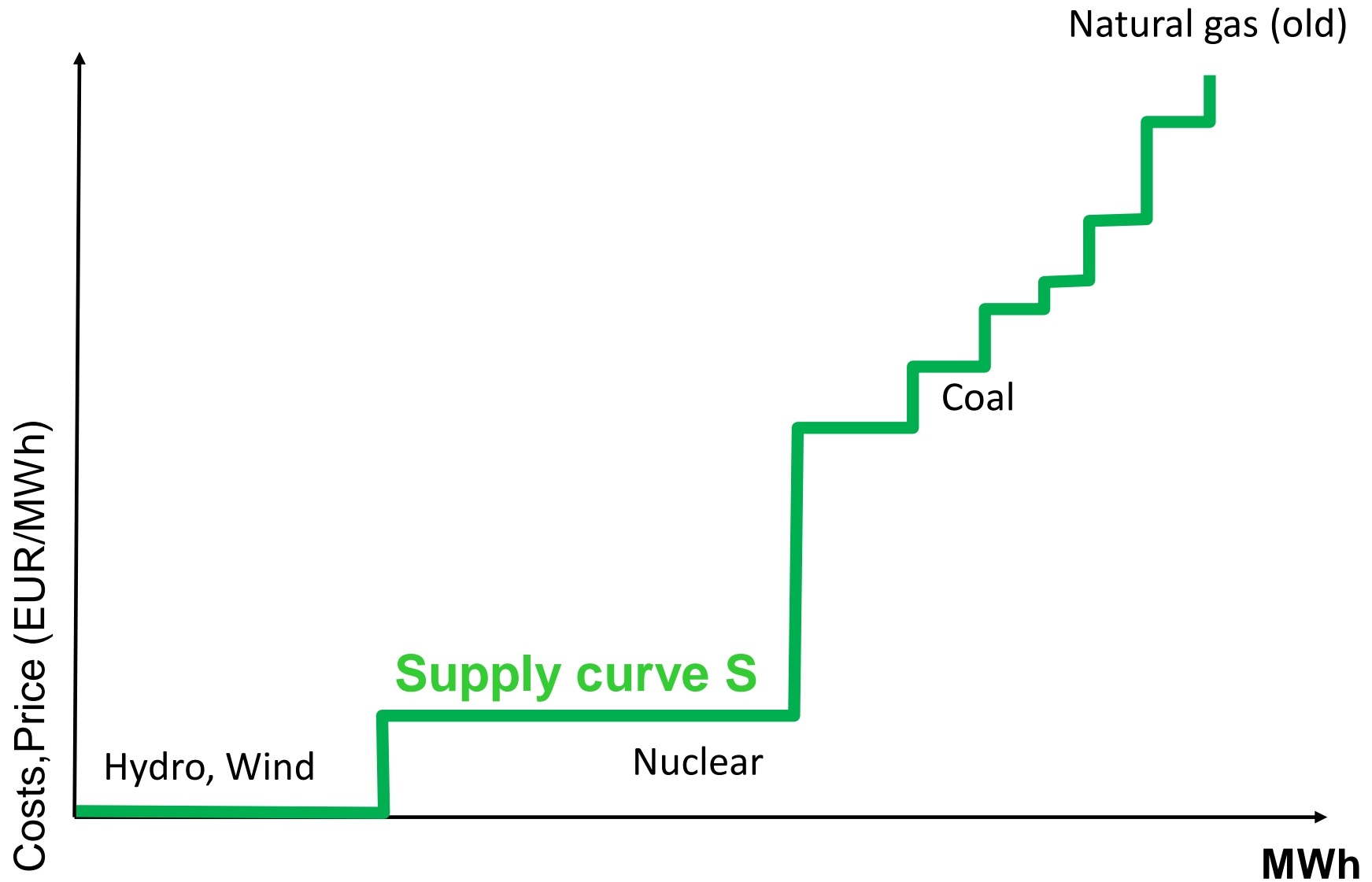
## Motivation:

- \* Europe: The clean energy package → energy communities
- \* It is not possible to force variable renewables into the system
- \* Strong desire of more and more customers to participate in electricity supply
- \* Uncertain electricity prices



## **2 THE MERIT ORDER CURVE: BASICS OF ALL EVILS IN DAY-AHEAD ELECTRICITY MARKETS (?)**

# THE MERIT ORDER CURVE

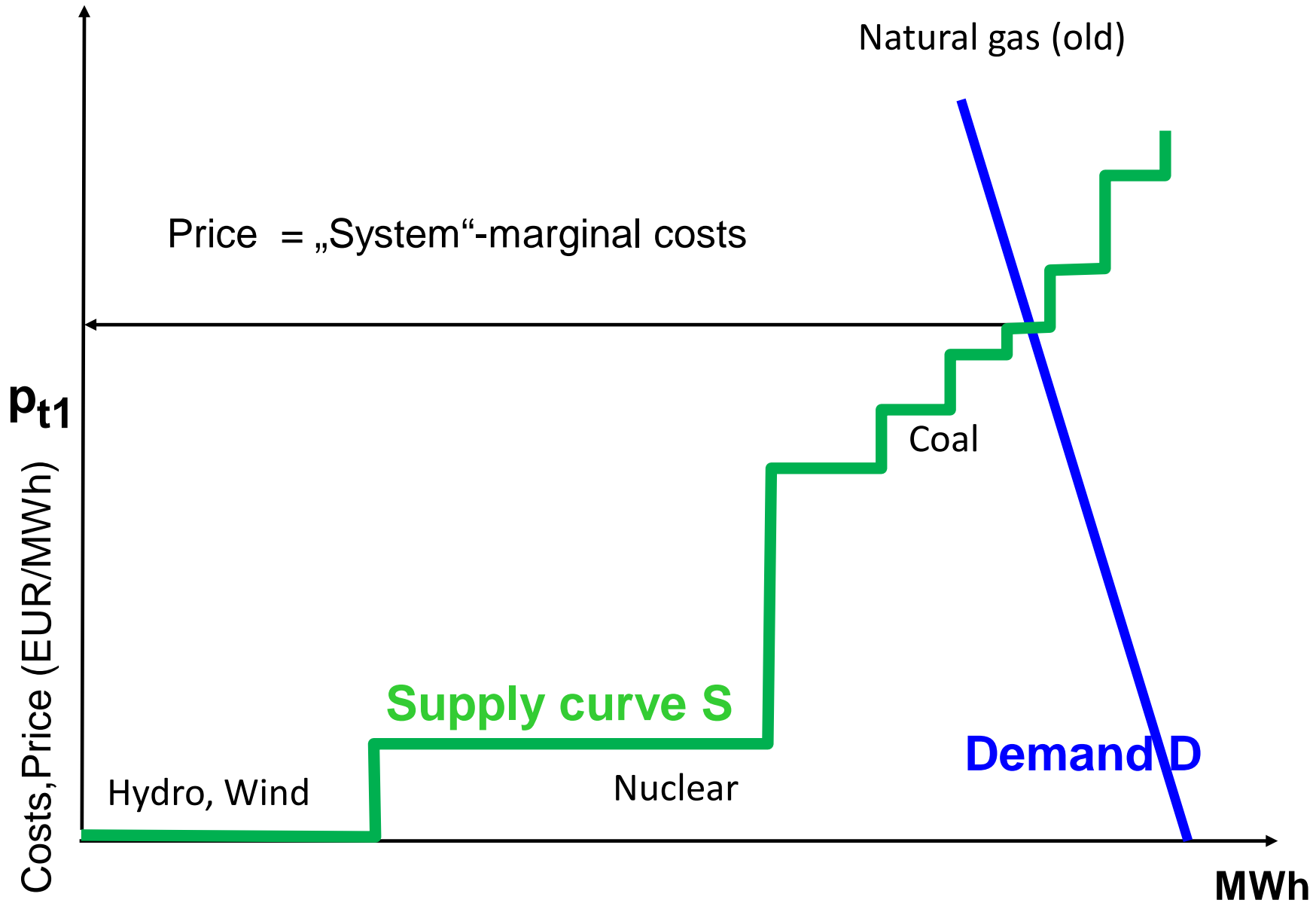


But: already in communist Czechoslovakia →  
Principle of merit order was used

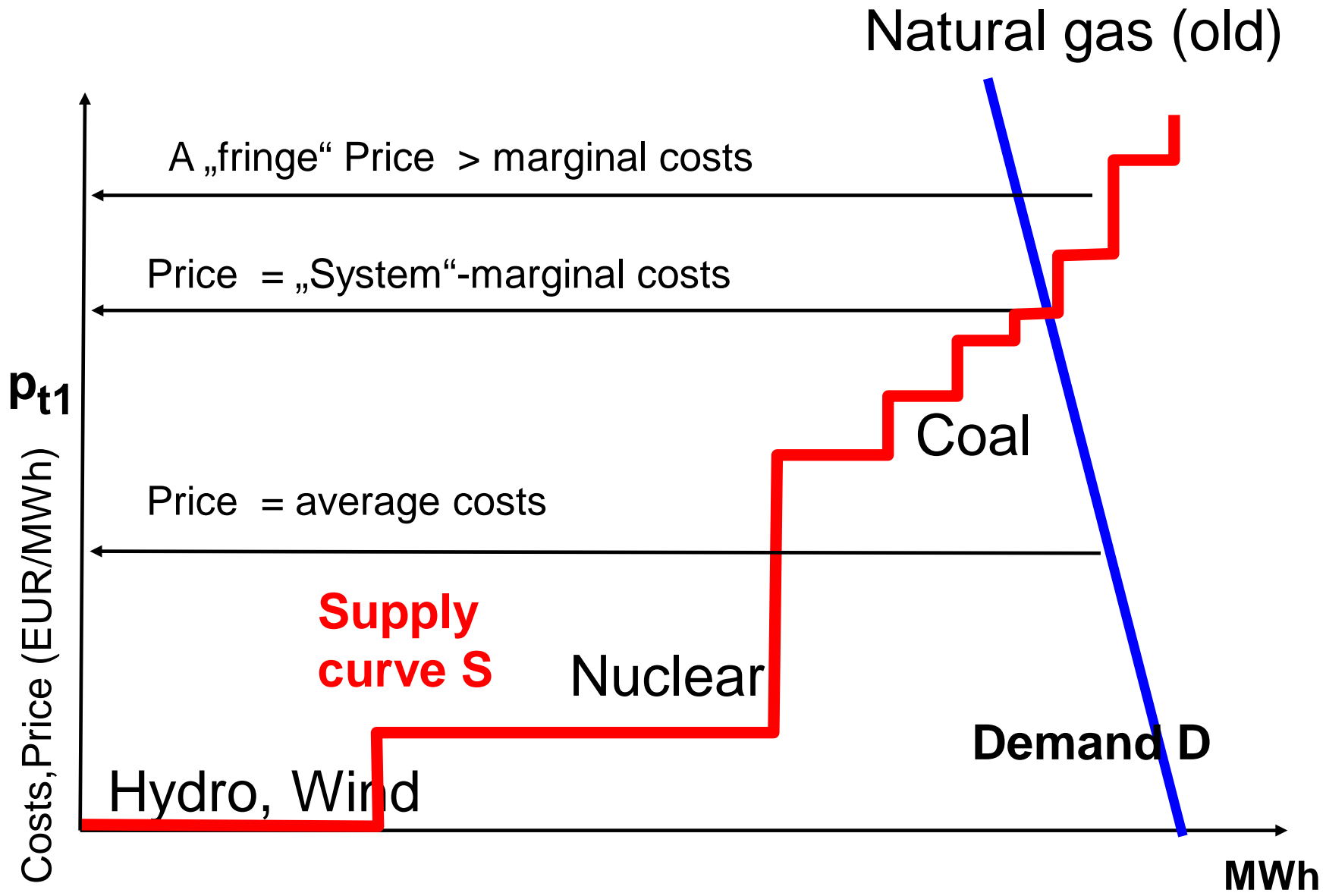
**OR IS THE „EVIL” THE MC - PRICING-  
PRINCIPLE?**



# BASIC PRINCIPLE OF COMPETITION: PRICE = MARGINAL COSTS

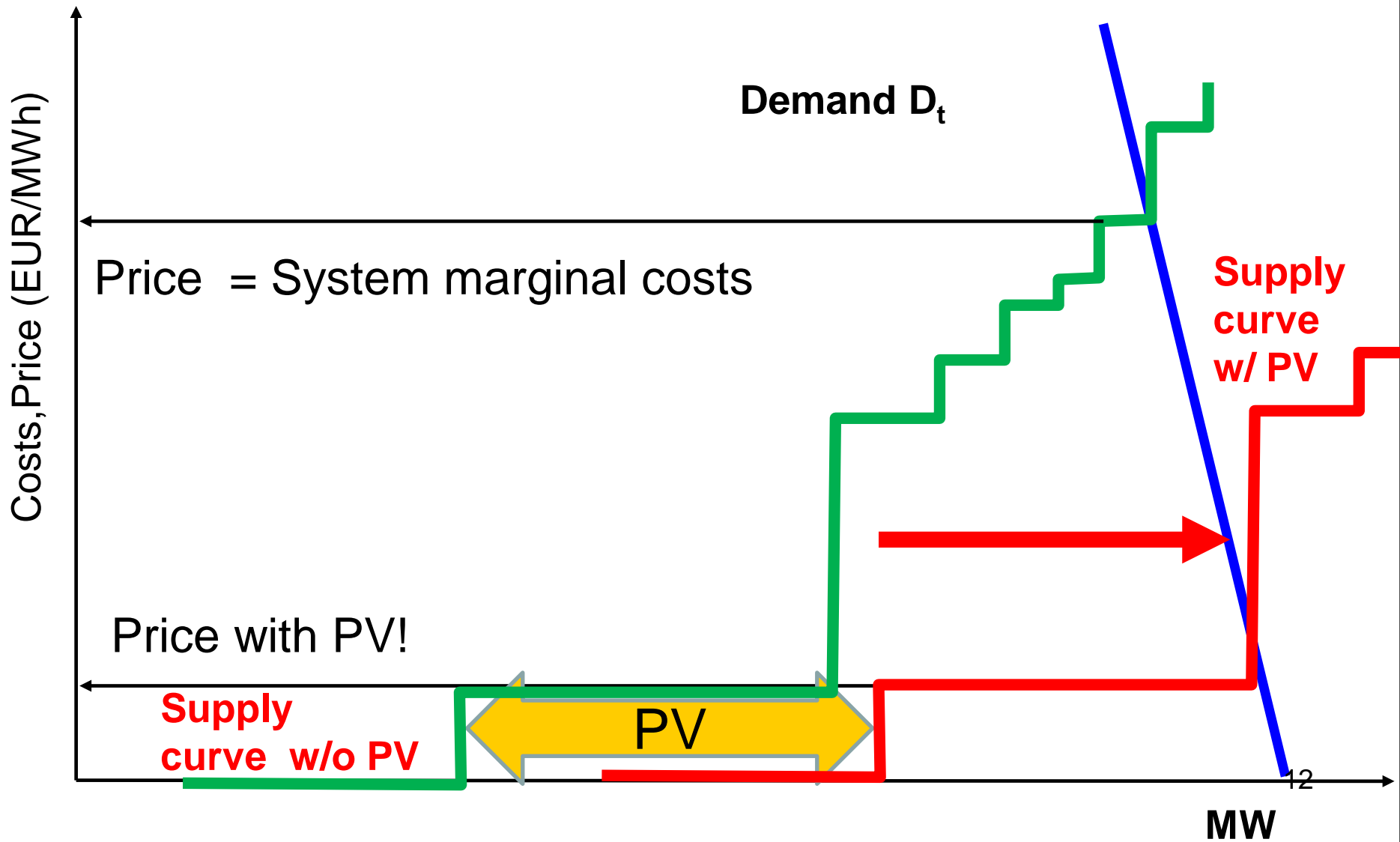


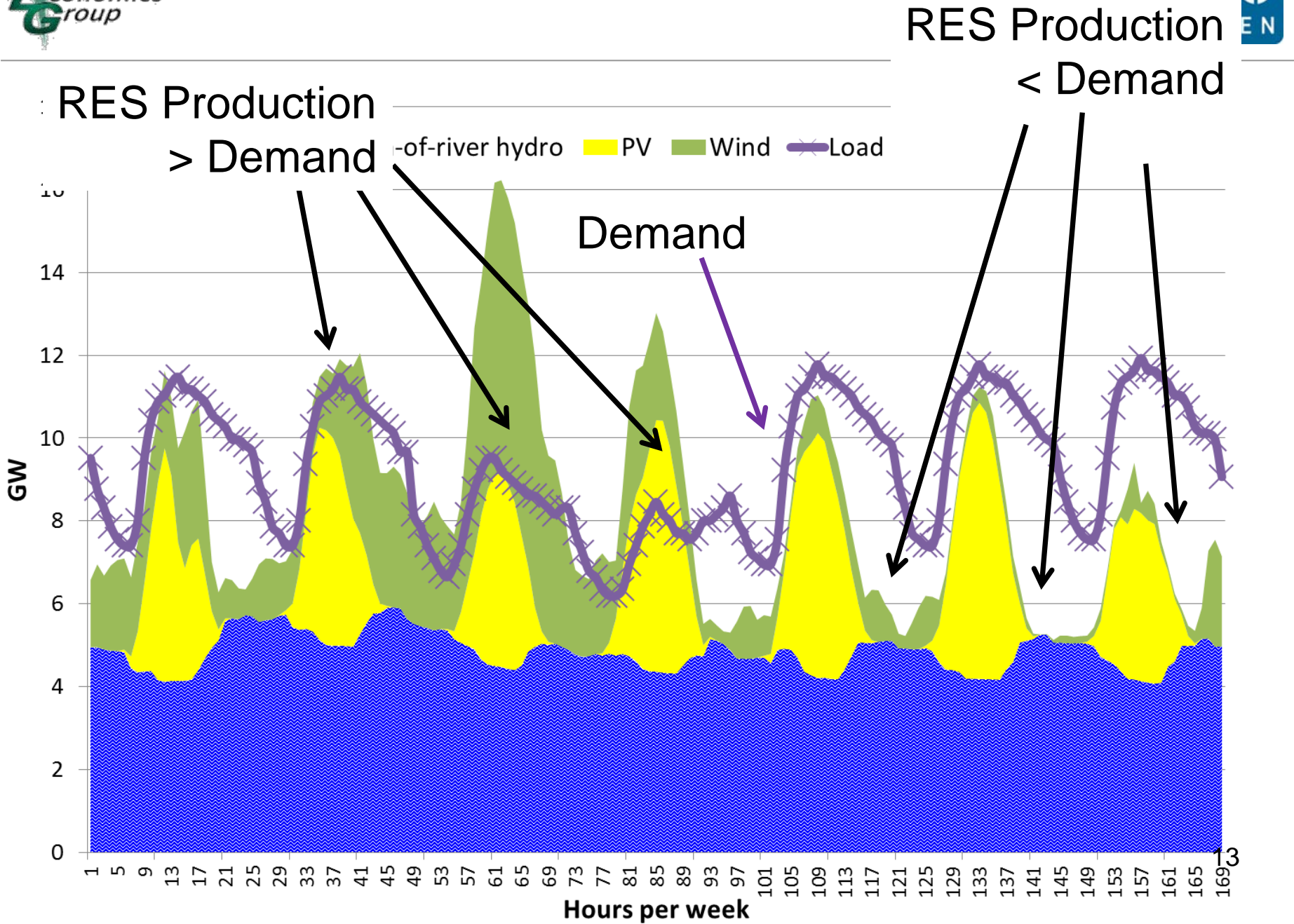
# BASIC PRINCIPLE OF COMPETITION: PRICE = MARGINAL COSTS



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

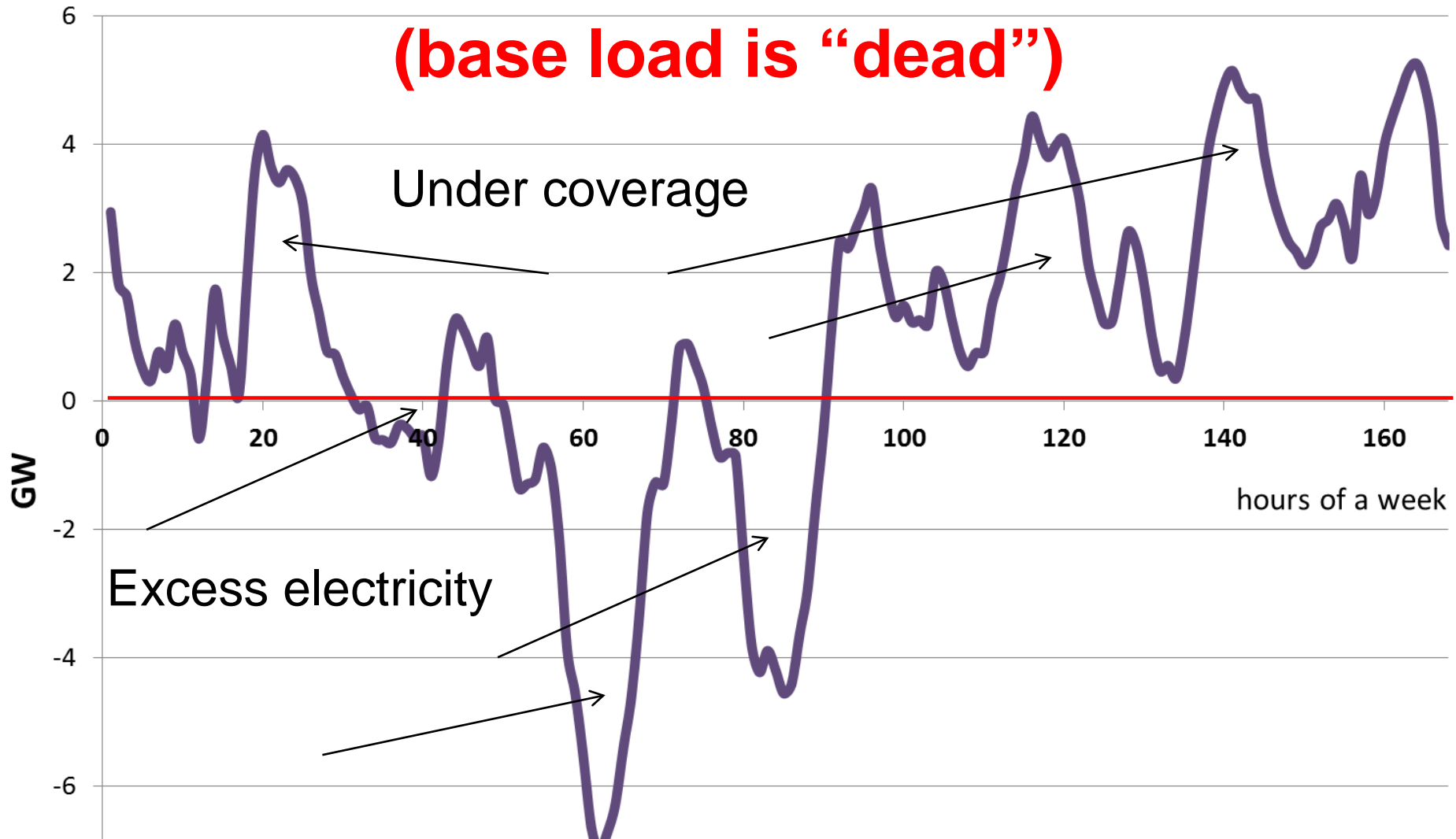
# Example: prices without and with PV





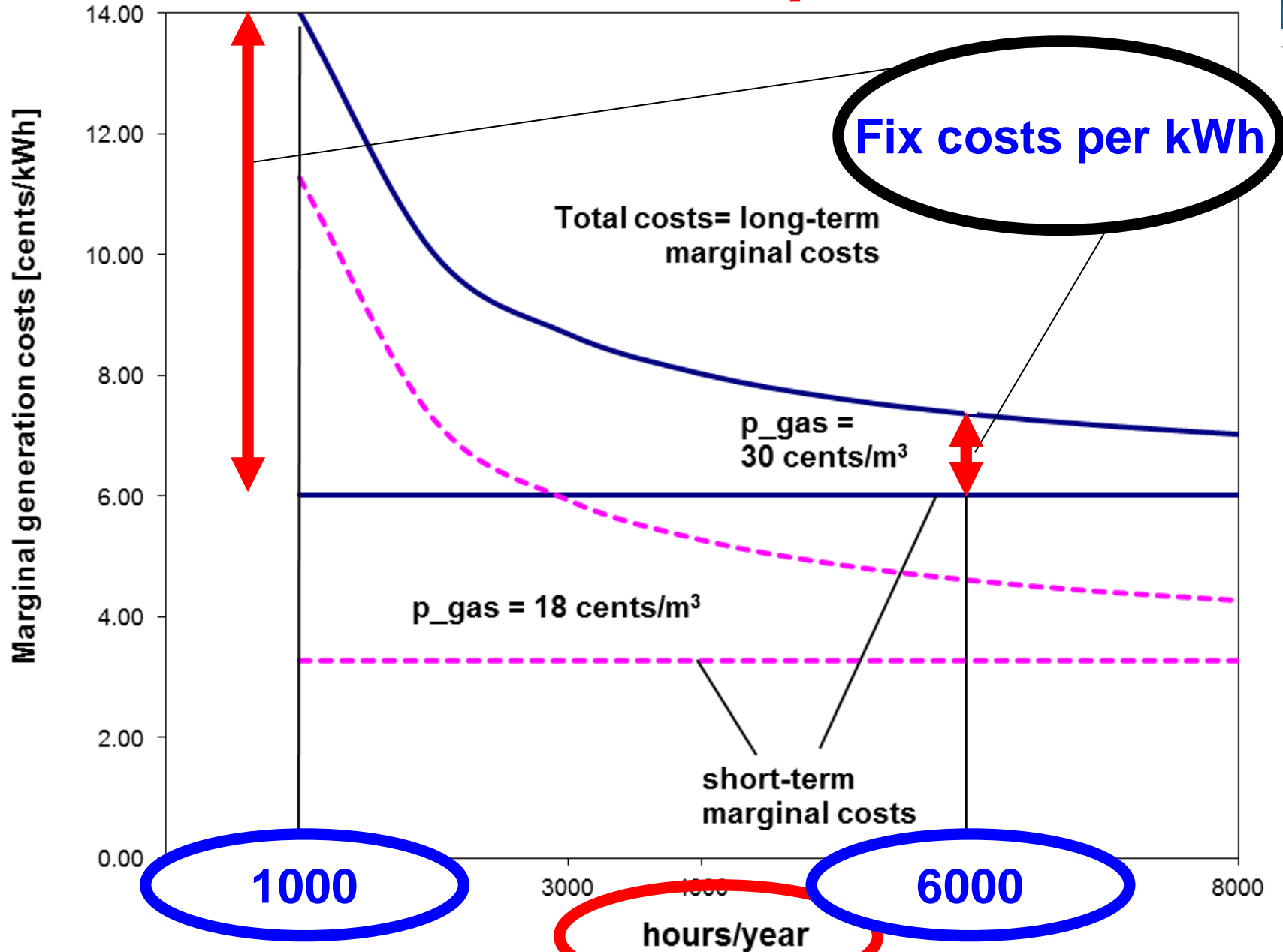
# Key term of the future: Residual load

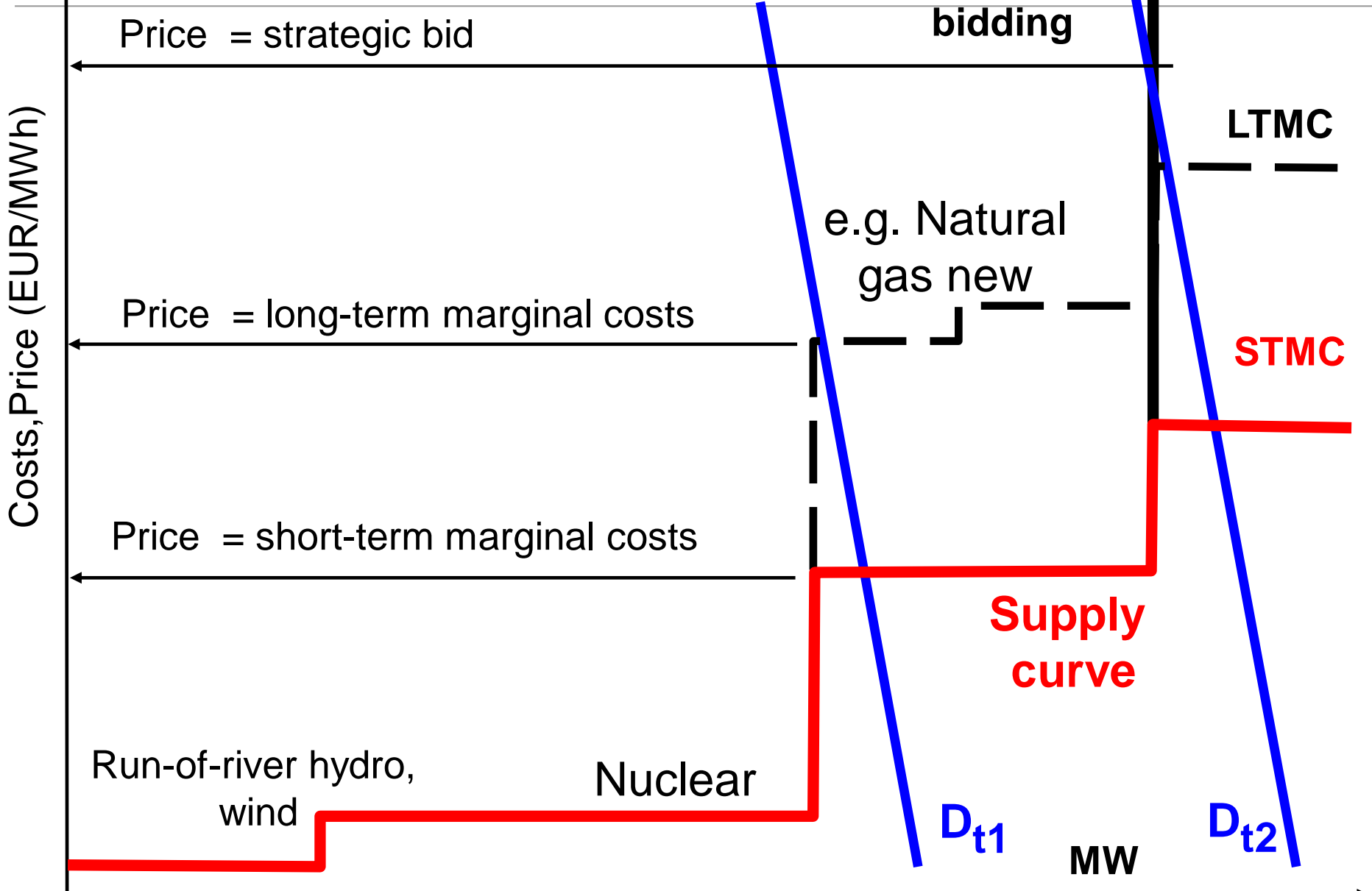
(base load is “dead”)



**Residual load = Load – non-flexible generation**

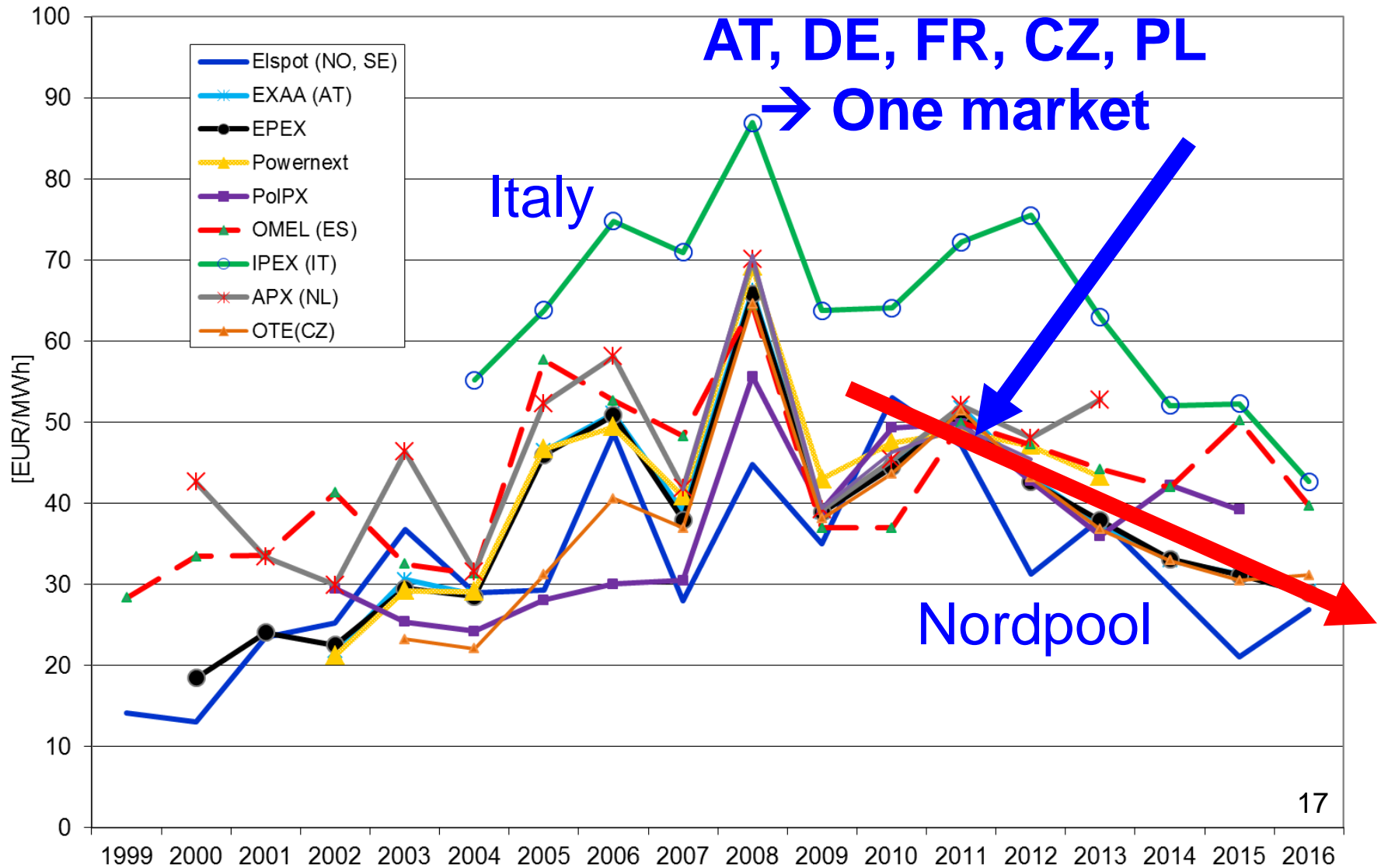
# Effects on CCGT plants







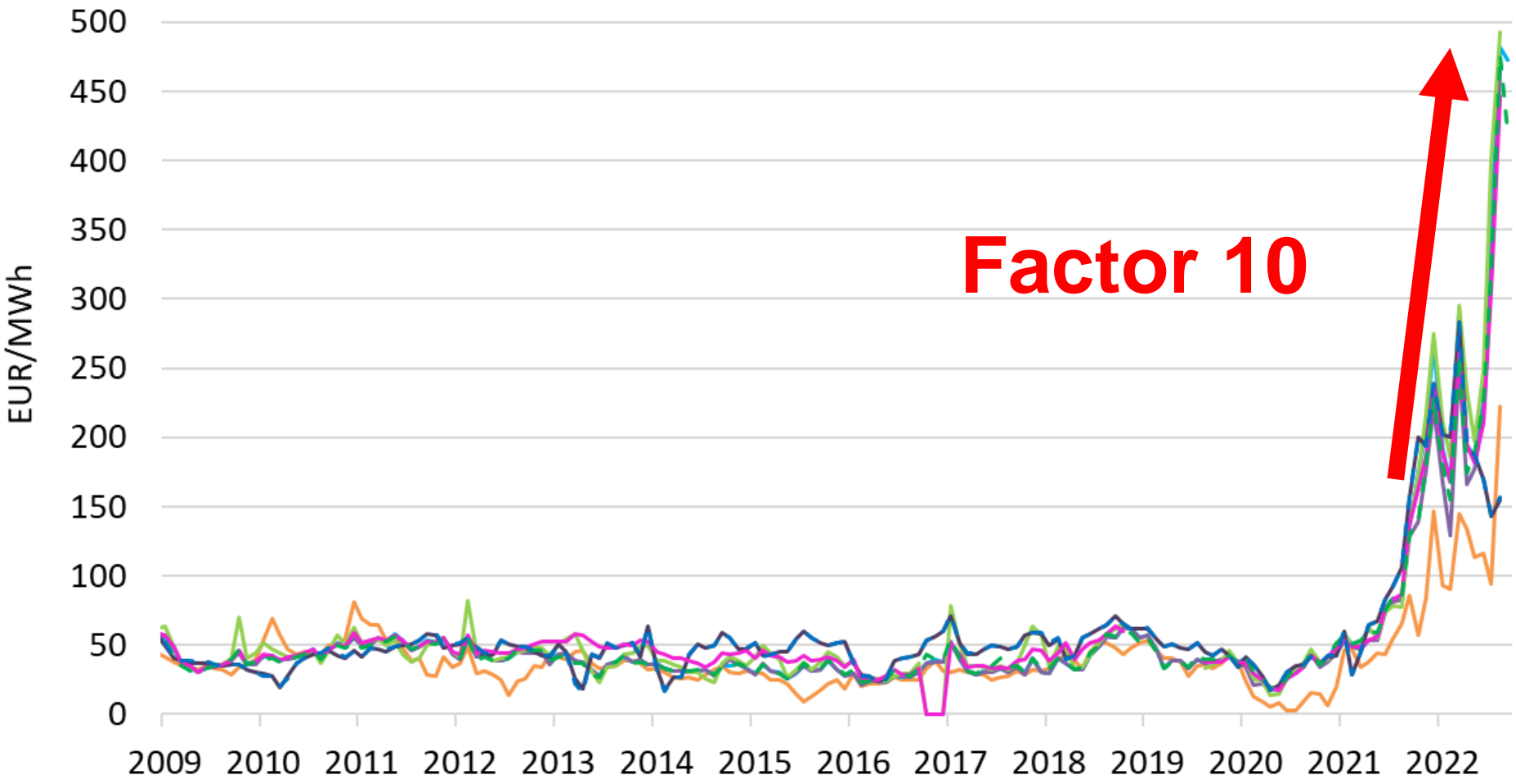
# Development of electricity prices in Europe up to 2016 (1)



**2011-2016: All that went „wrong“ in the last year worked „well“ between 2011 and 2016:**

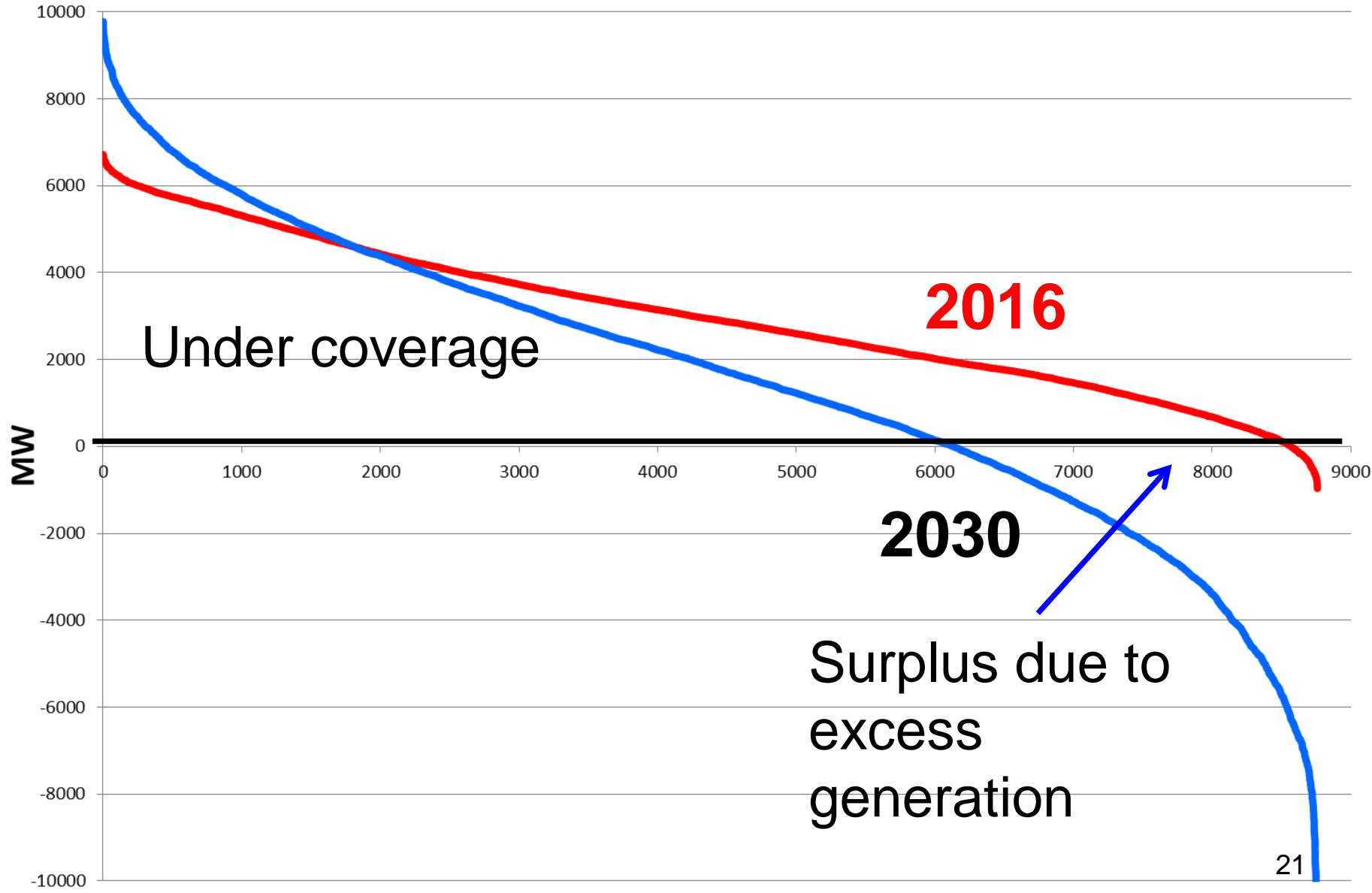
- **Low CO<sub>2</sub>-prices;**
- **Low natural gas prices;**
- **Good hydro conditions;**

**... in favour of LOW ele prices, not in favour of the environment !**



- Elspot (NO, SE, FI)
- EXAA (AT)
- EEX (DE)
- Powernext FR
- OMEL (ES)
- APX (NL)
- PXE OTE (CZ)
- OMEL Portugal

# Classified residual load over a year



# Classified residual load



**By a regulated capacity payment with STMC pricing?**

or

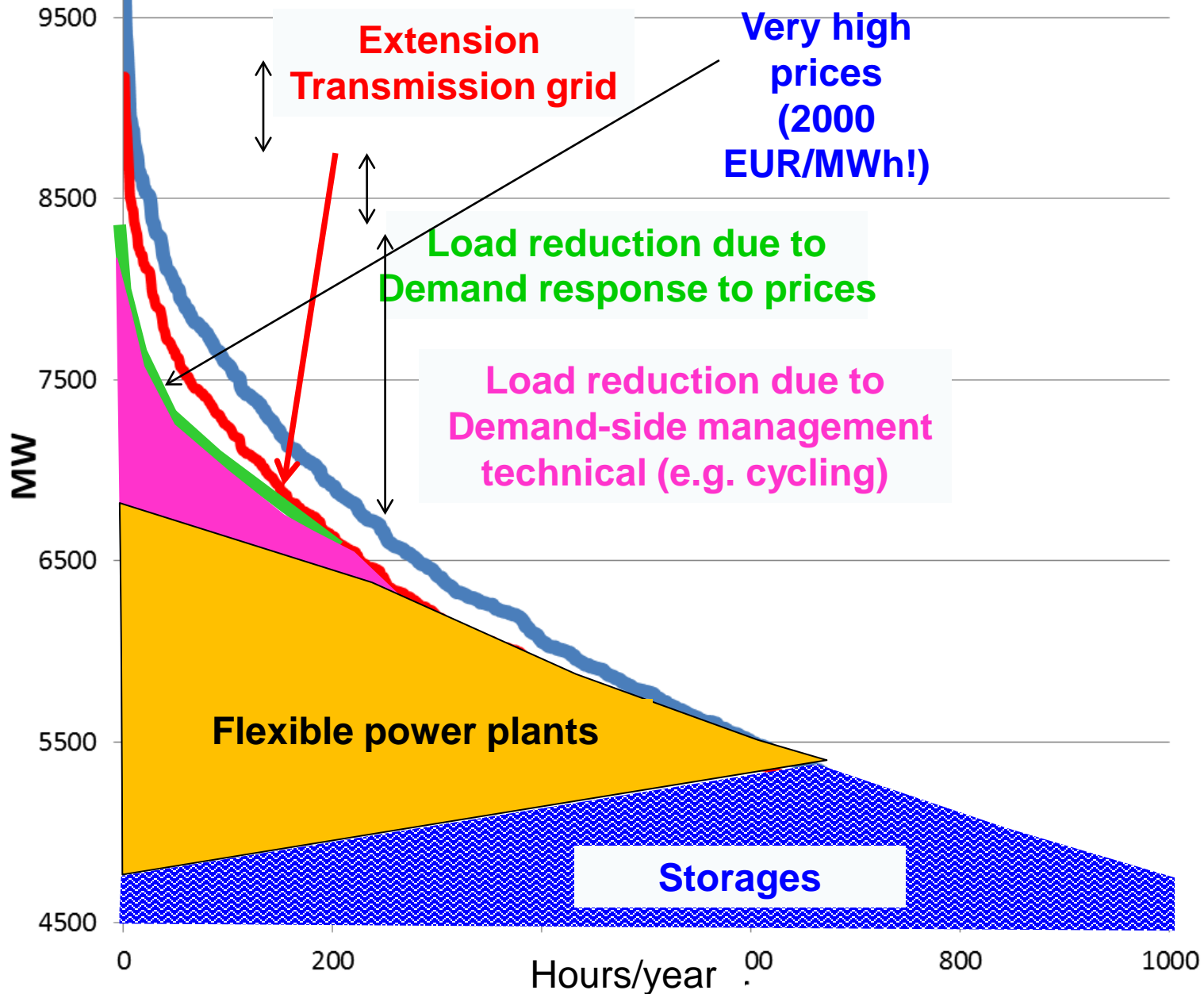
**By competition between supply-side and demand-side technologies and behaviour (incl. Storages, grid and other flexibility options) with correct scarcity pricing signals?**

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

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

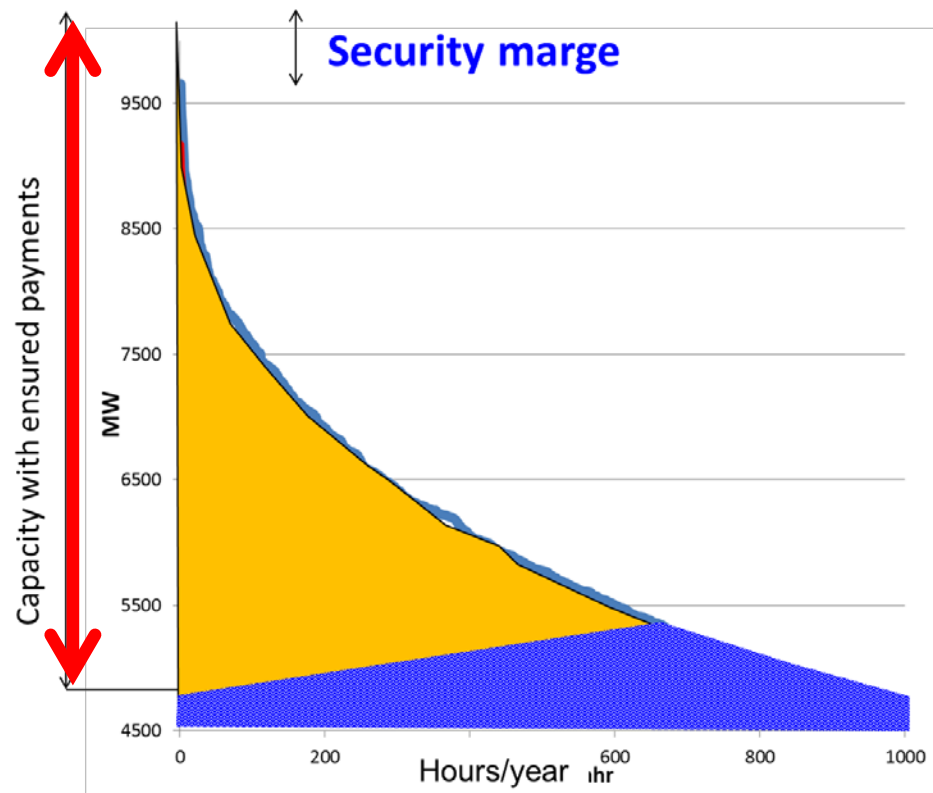
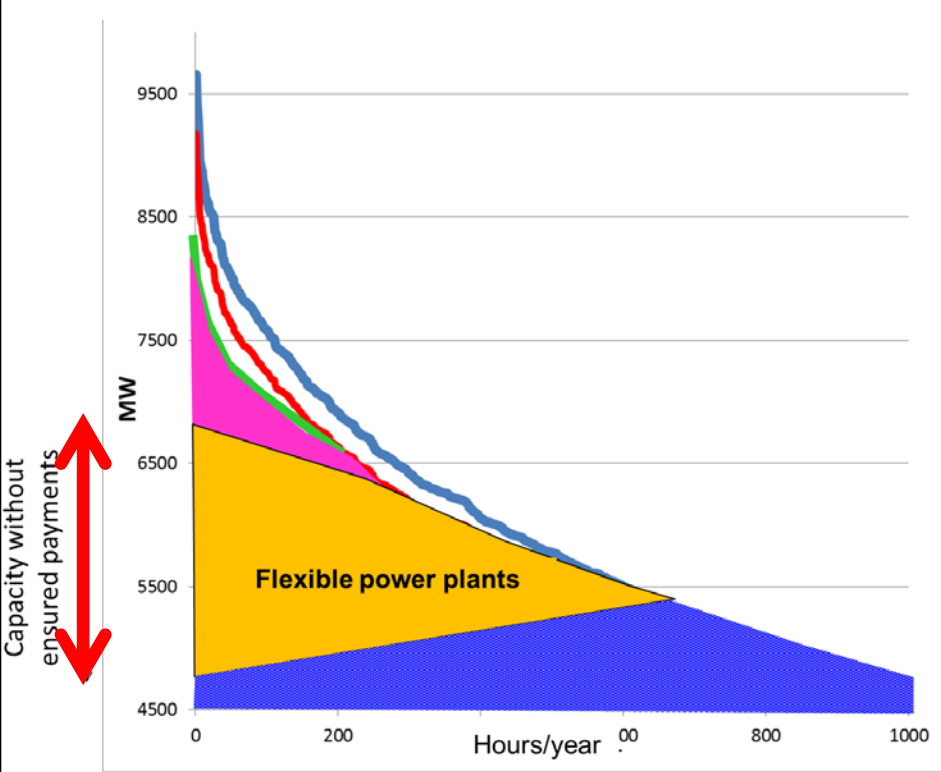
**strive to retain system resource adequacy by correct price signals**

# 4 Flexible coverage of residual load

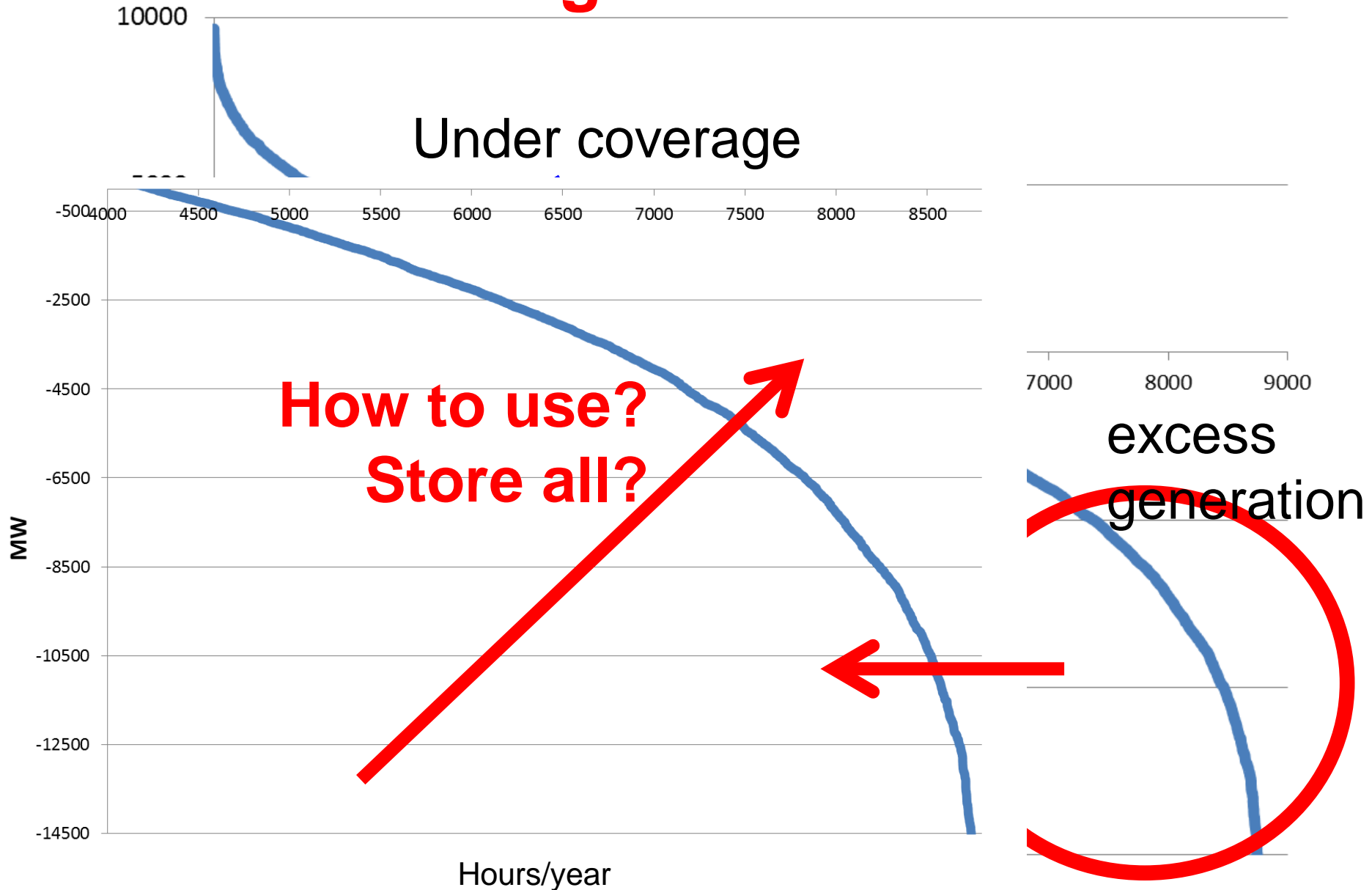




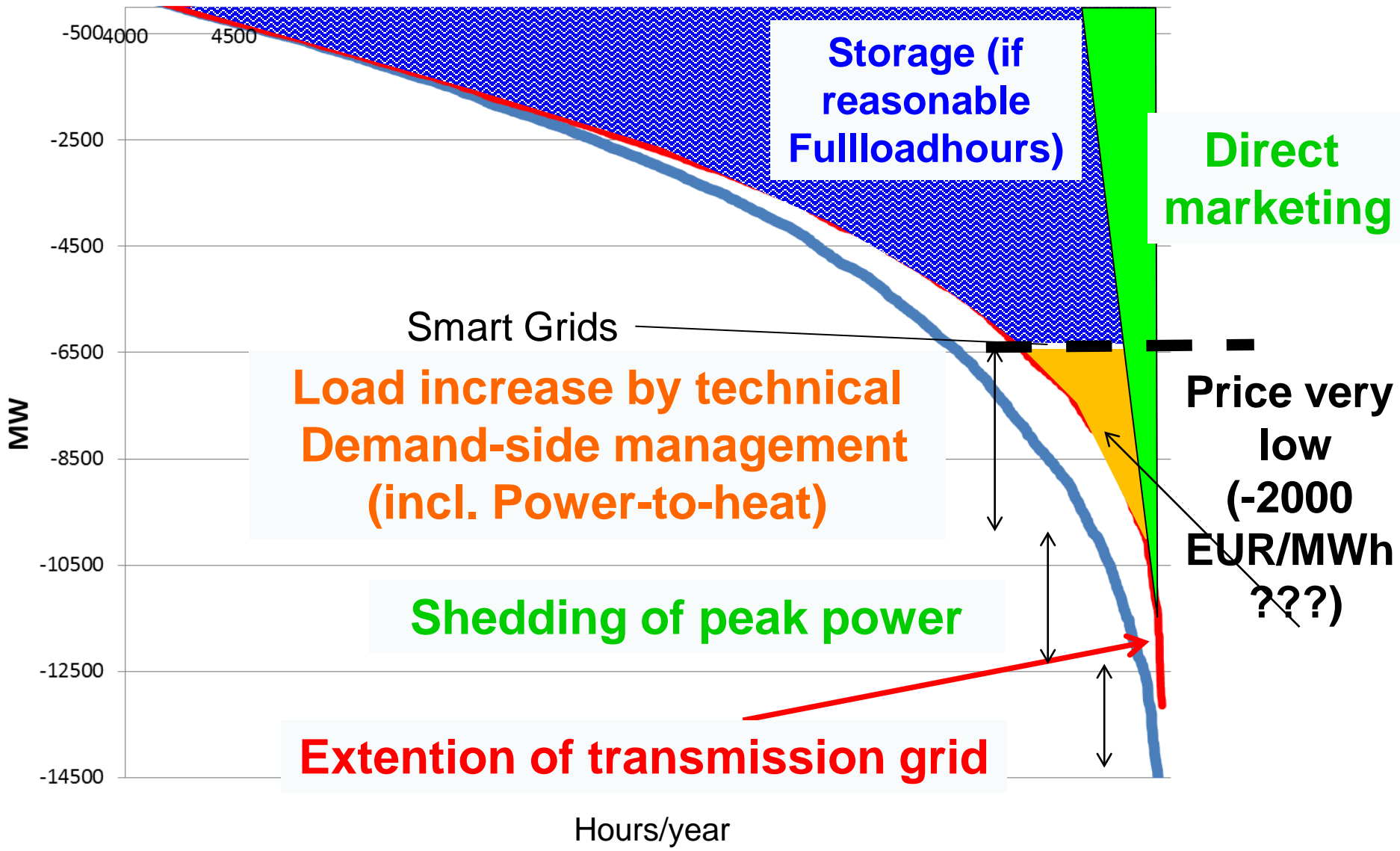
# Comparison



# Specific question: How much storage do we need?

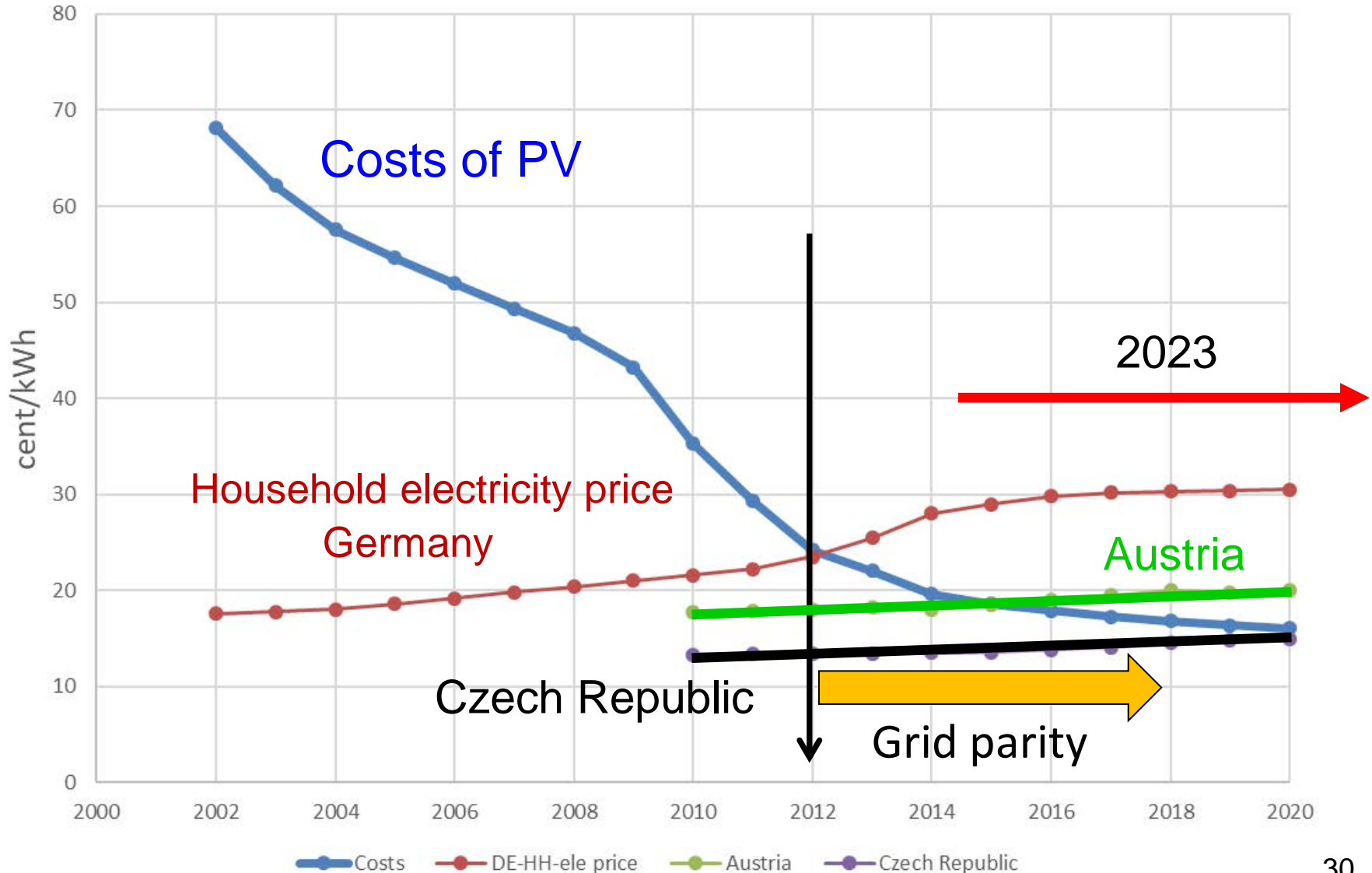


# Flexible use of excess electricity

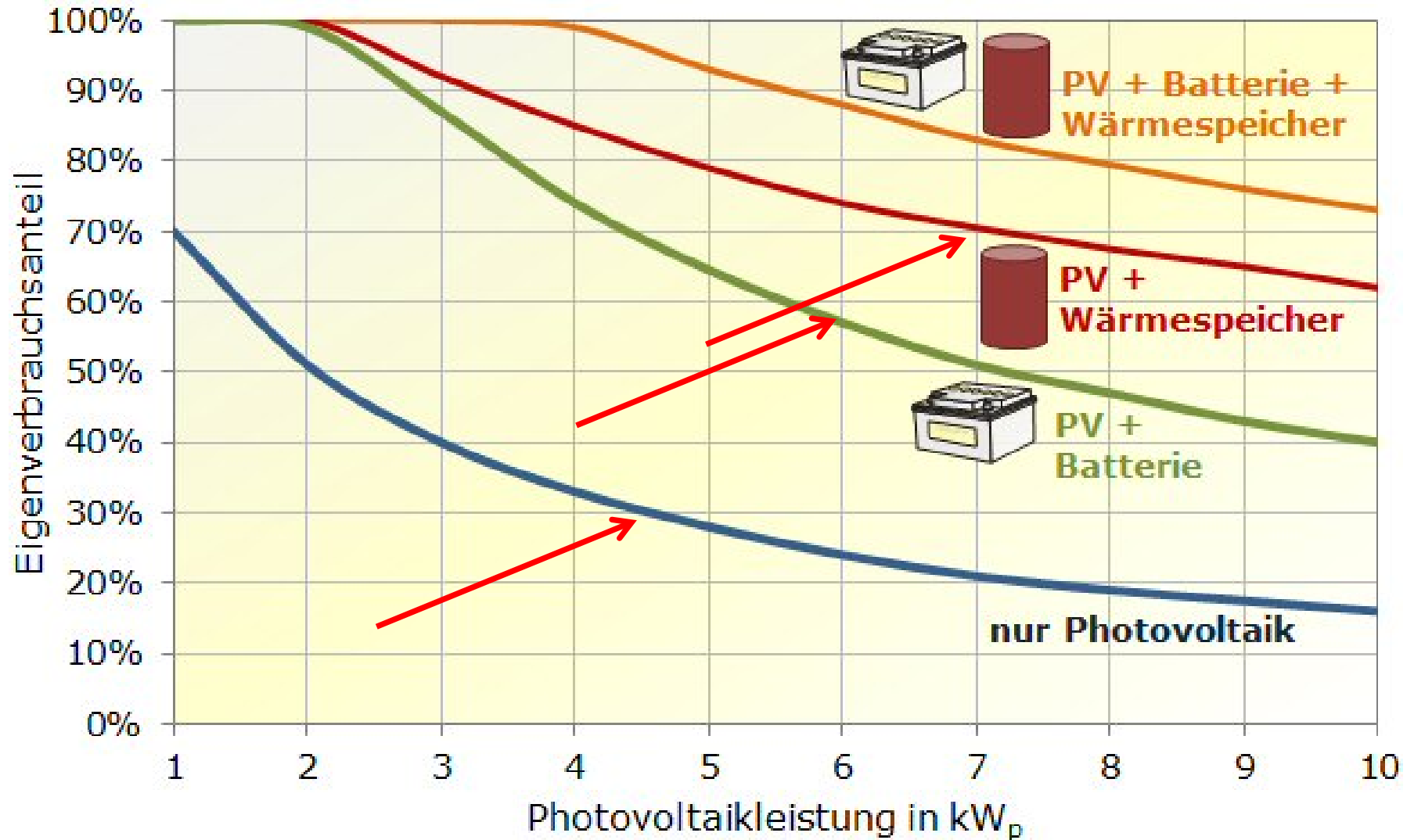


# 5. TOWARDS PROSUMAGERS AND ENERGY COMMUNITIES

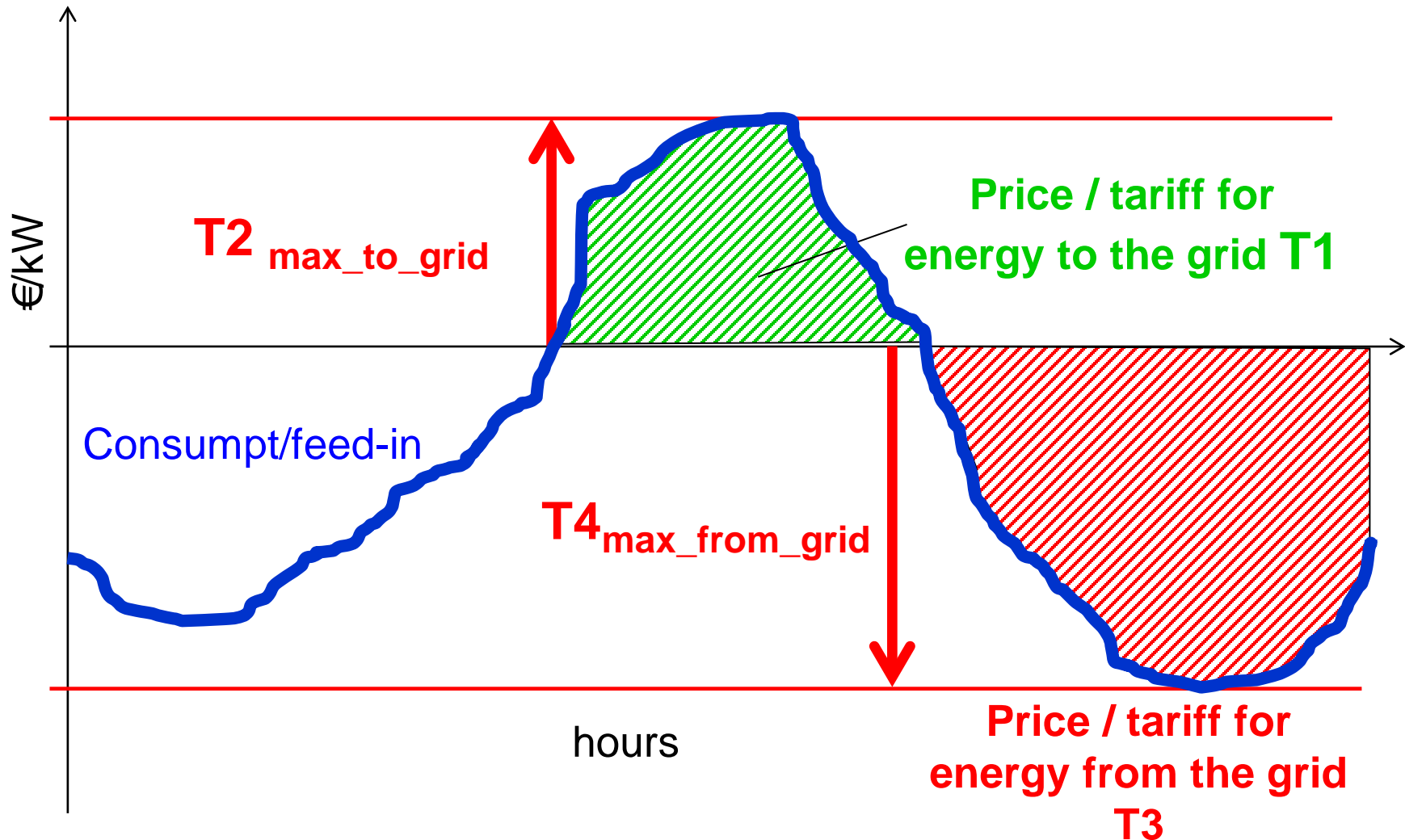
# Grid parity: PV-costs and household electricity prices



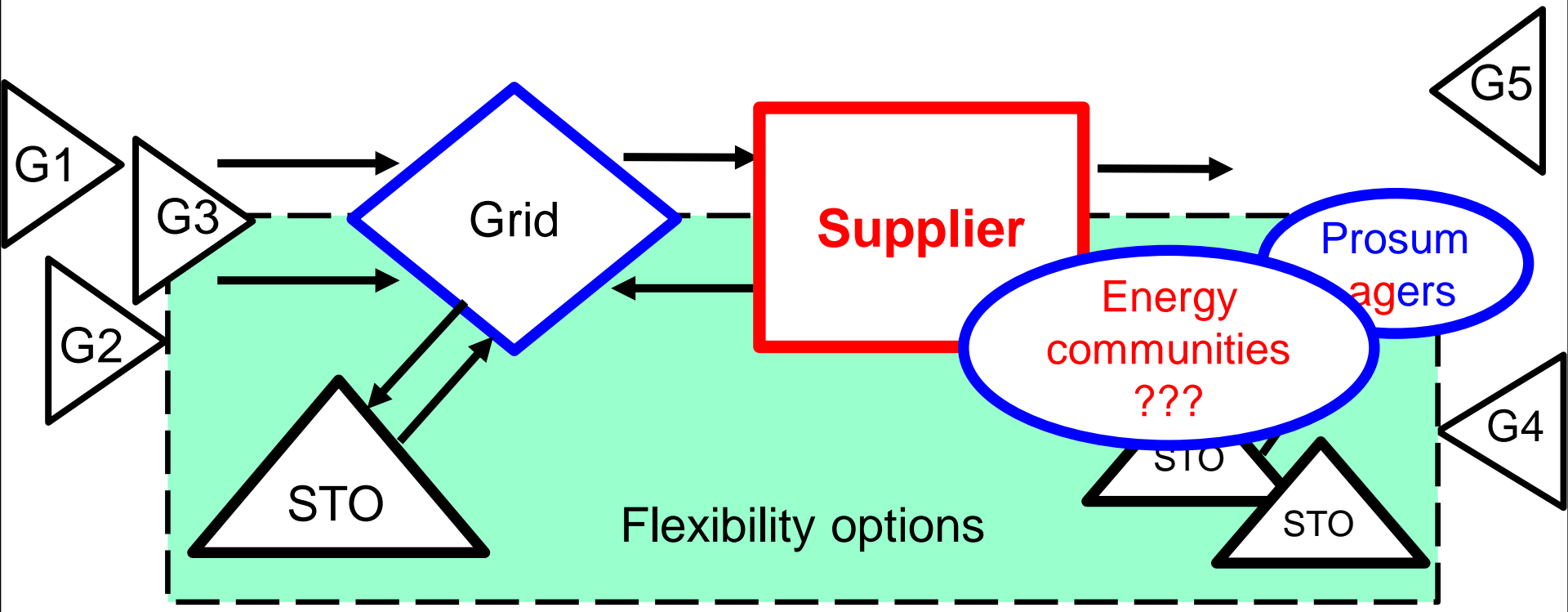
# Own share of use



# Bidirectional tariffs for power and energy



# New Thinking: Making the electricity system more democratic

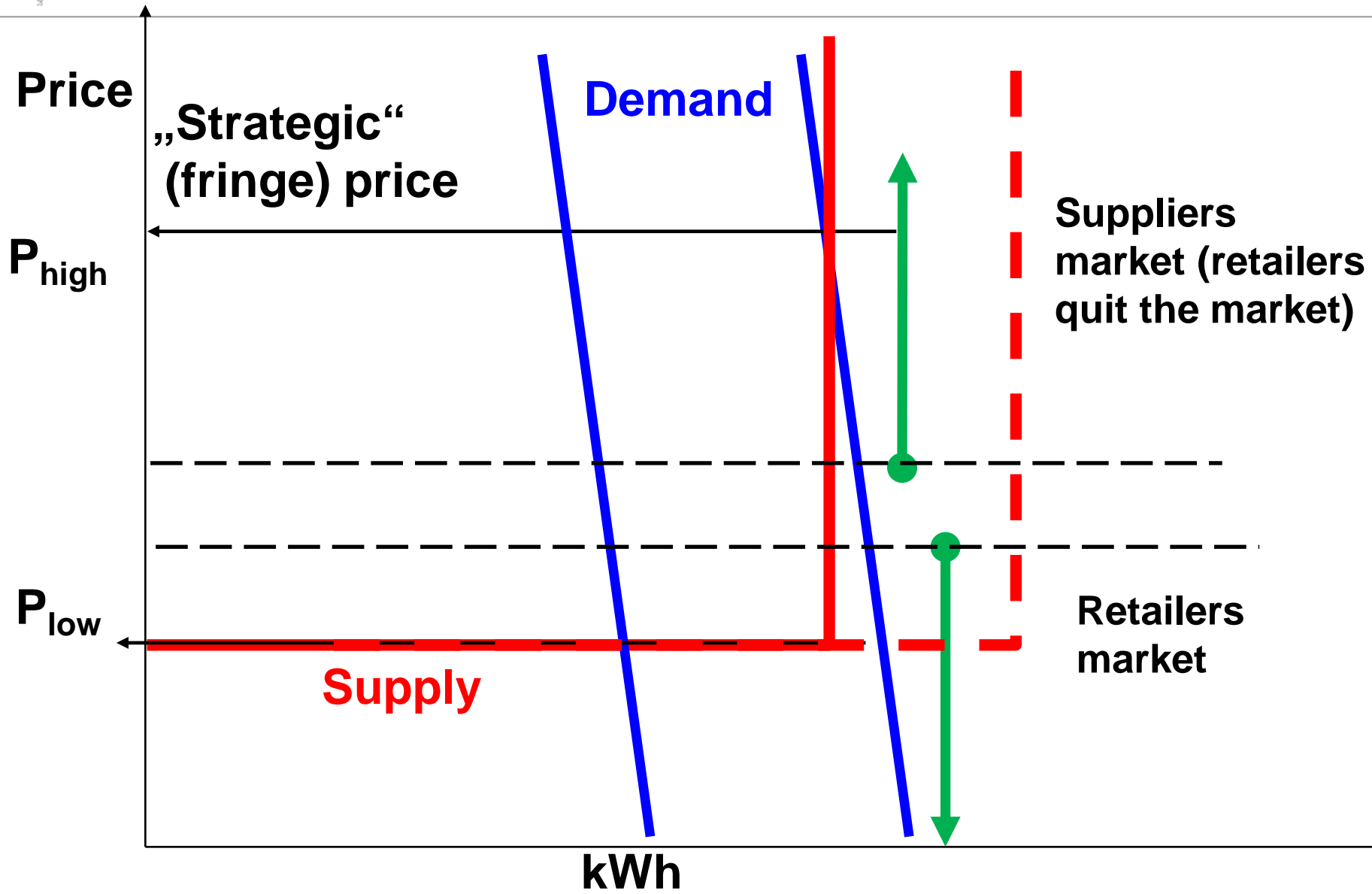




**Remark by Georg Erdmann in Athens:**  
**Today we have all conditions necessary for heading towards sustainability ...**

- **High Fossil prices;**
- **Reasonable high CO2 prices;**
- **Renewables are economically competitive;**

# Suppliers vs retailers market



- Sustainable electric. system → integration of a broad **technology** portfolio & **demand-side** options
- A more **democratic** system allows customers to participate in **supply, storage and DSM**
- most urgent: exhaust **full** creativity for **flexibility** of all market participants (Erdmann)
- **Additional** capacities of (V)RES ensure:
  - \* less need for natural gas plants
- Electricity prices in future: They will **not** drop to former levels soon
- **New** market design (s) ?