



NEW CHALLENGES IN ELECTRICITY MARKETS

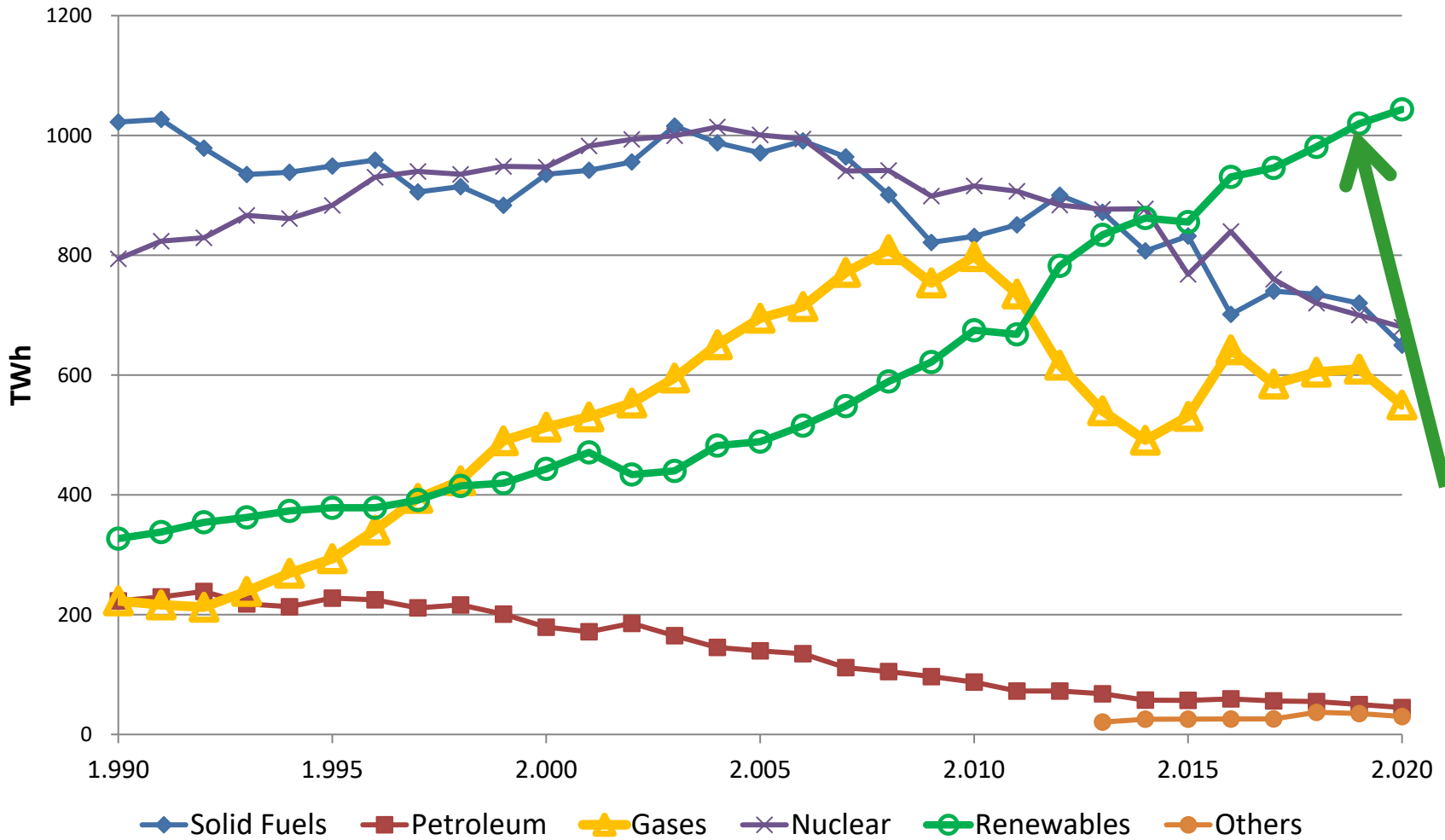
Reinhard HAAS,
Energy Economics Group,
TU Wien

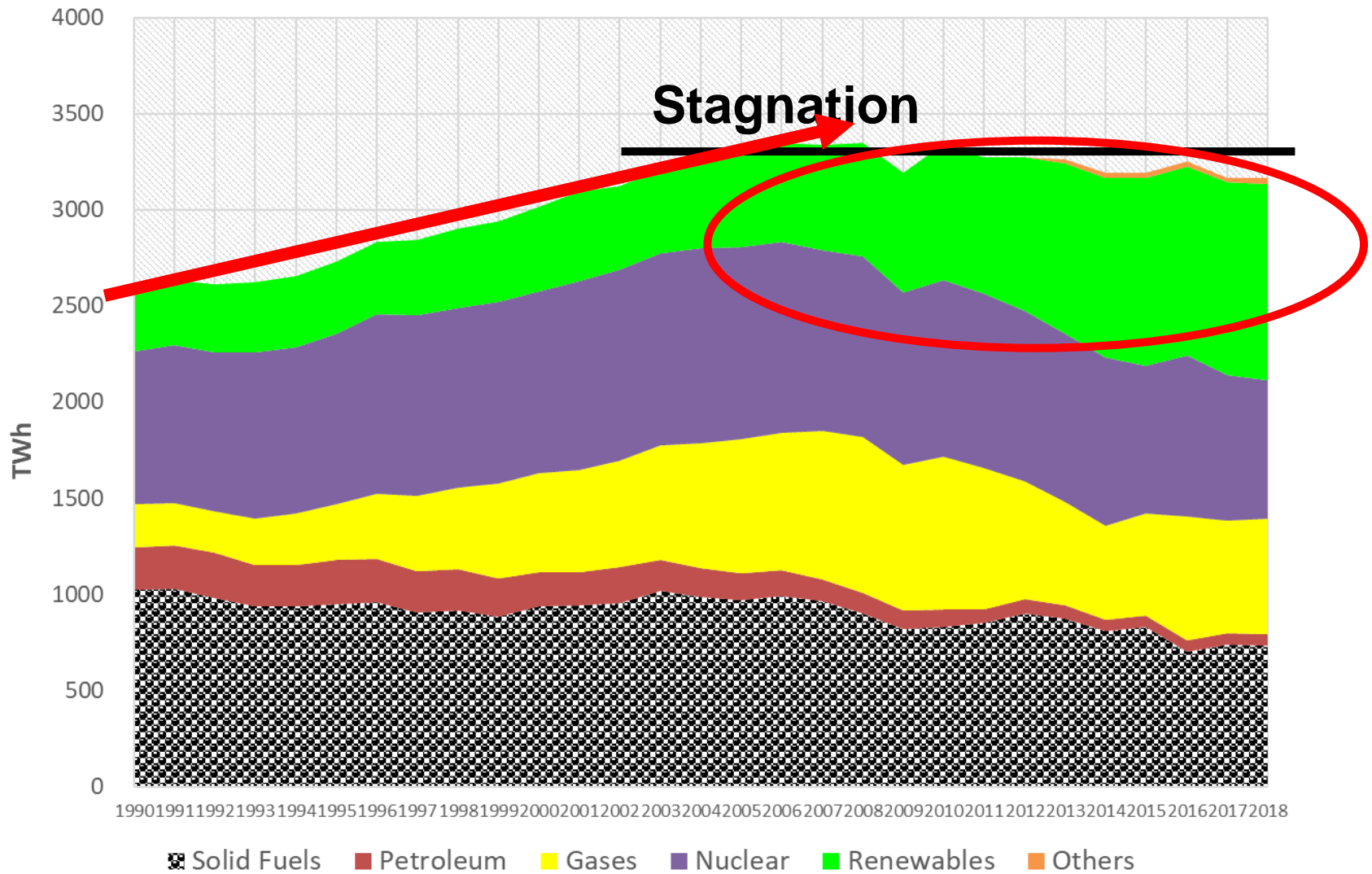
CZ-AT summer school, June 2023

Motivation:

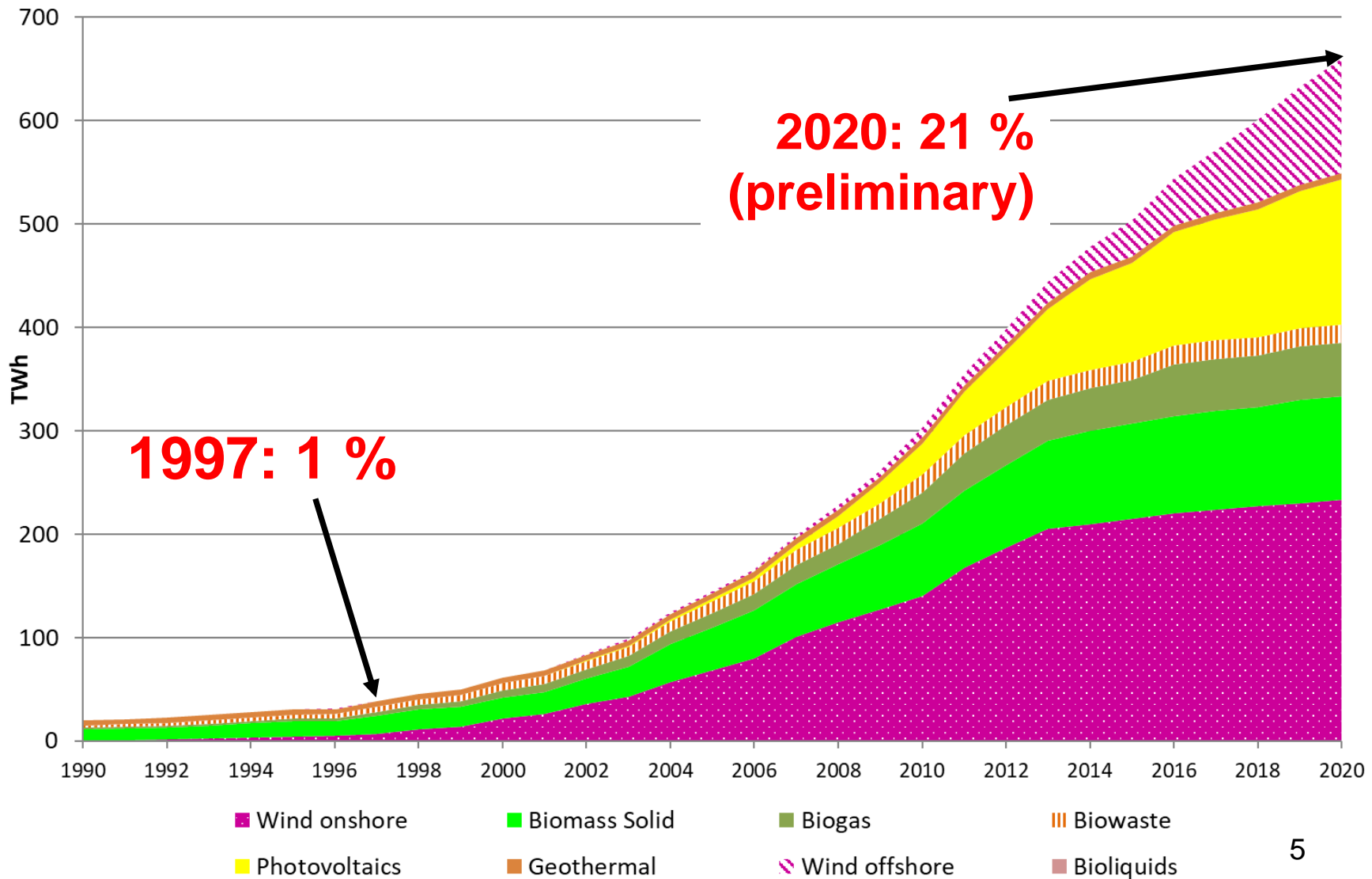
- * Climate change → Paris agreements
- * Targets for renewables
- * Europe: The clean energy package → energy communities
- * It is not possible to force variable renewables into the system
- * A strong desire of some customers to participate in electricity supply

Electricity generation EU-28

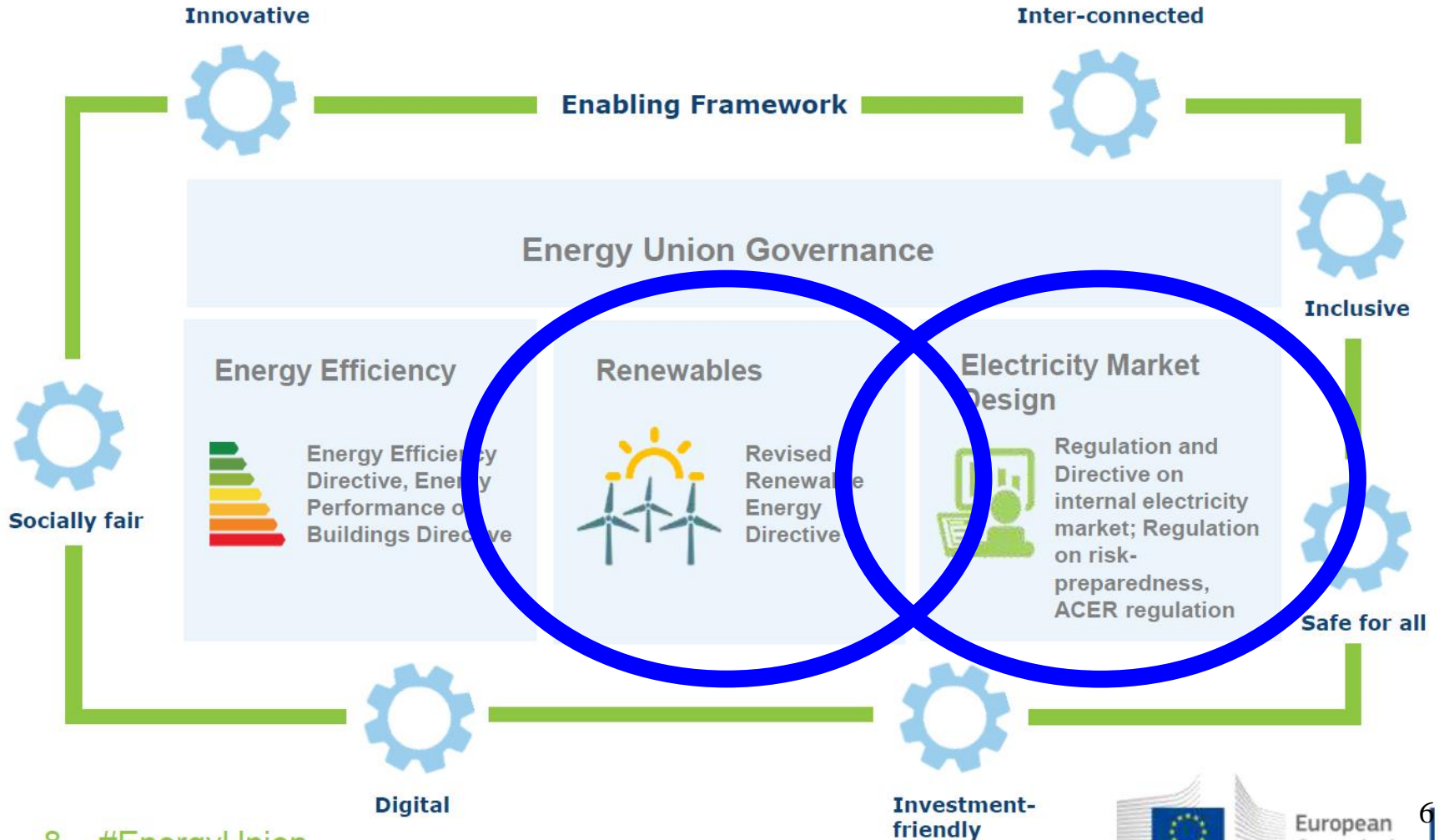




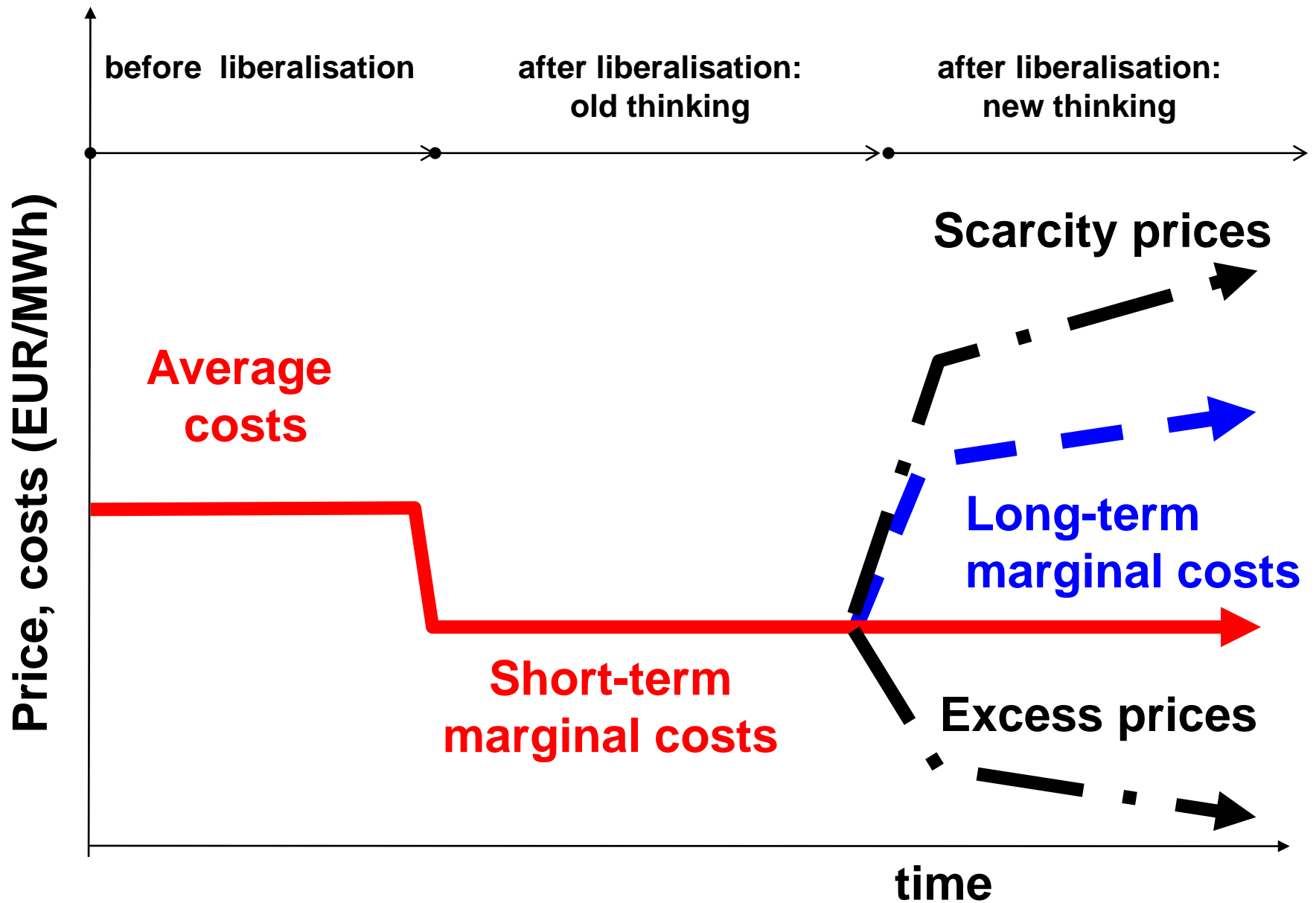
EU-28: Electricity generation from „new“ RES



Structure of the Package

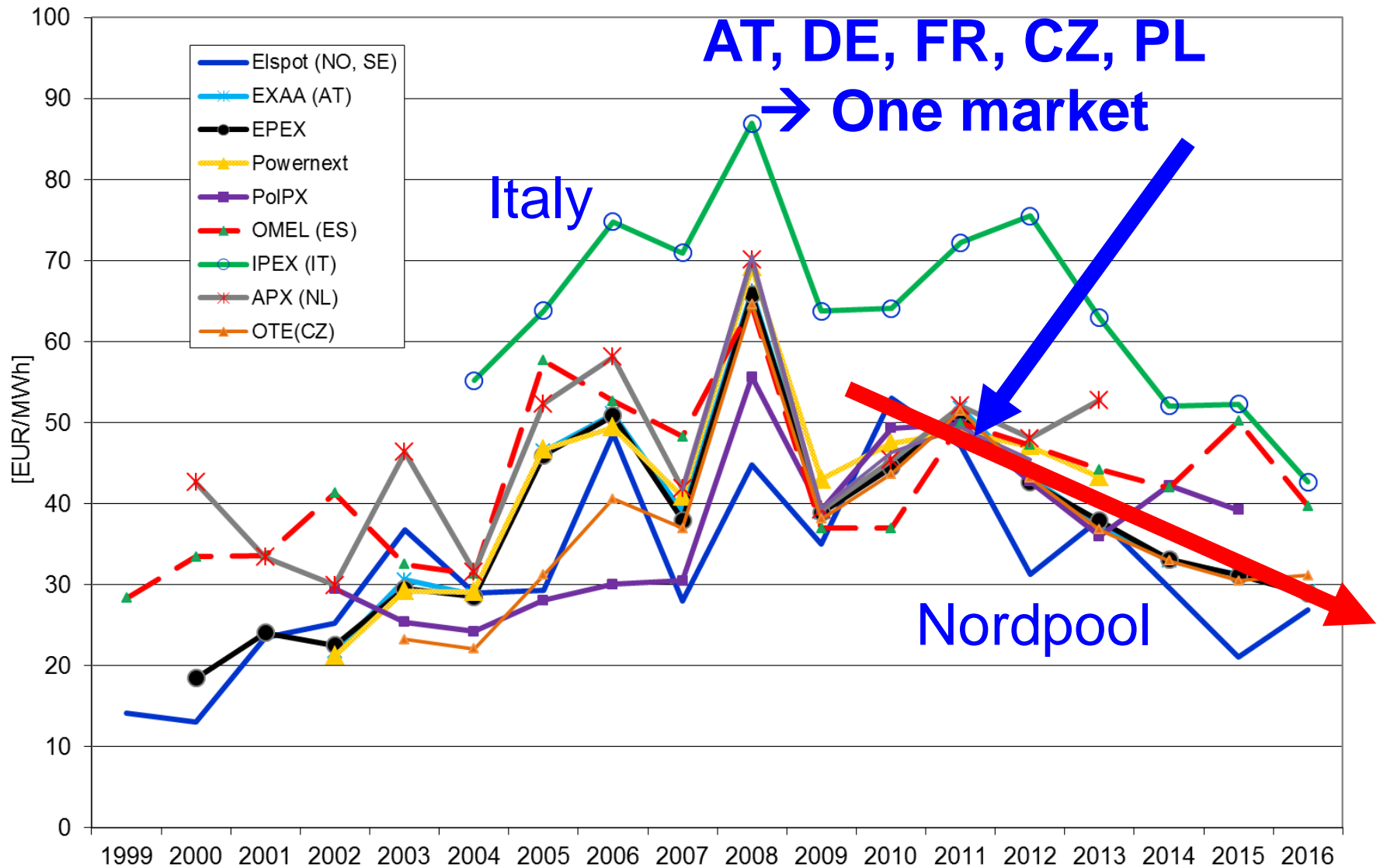


2. How prices come about: Three periods of market design



3 HOW VARIABLE RENEWABLES IMPACT PRICES IN ELECTRICITY MARKETS

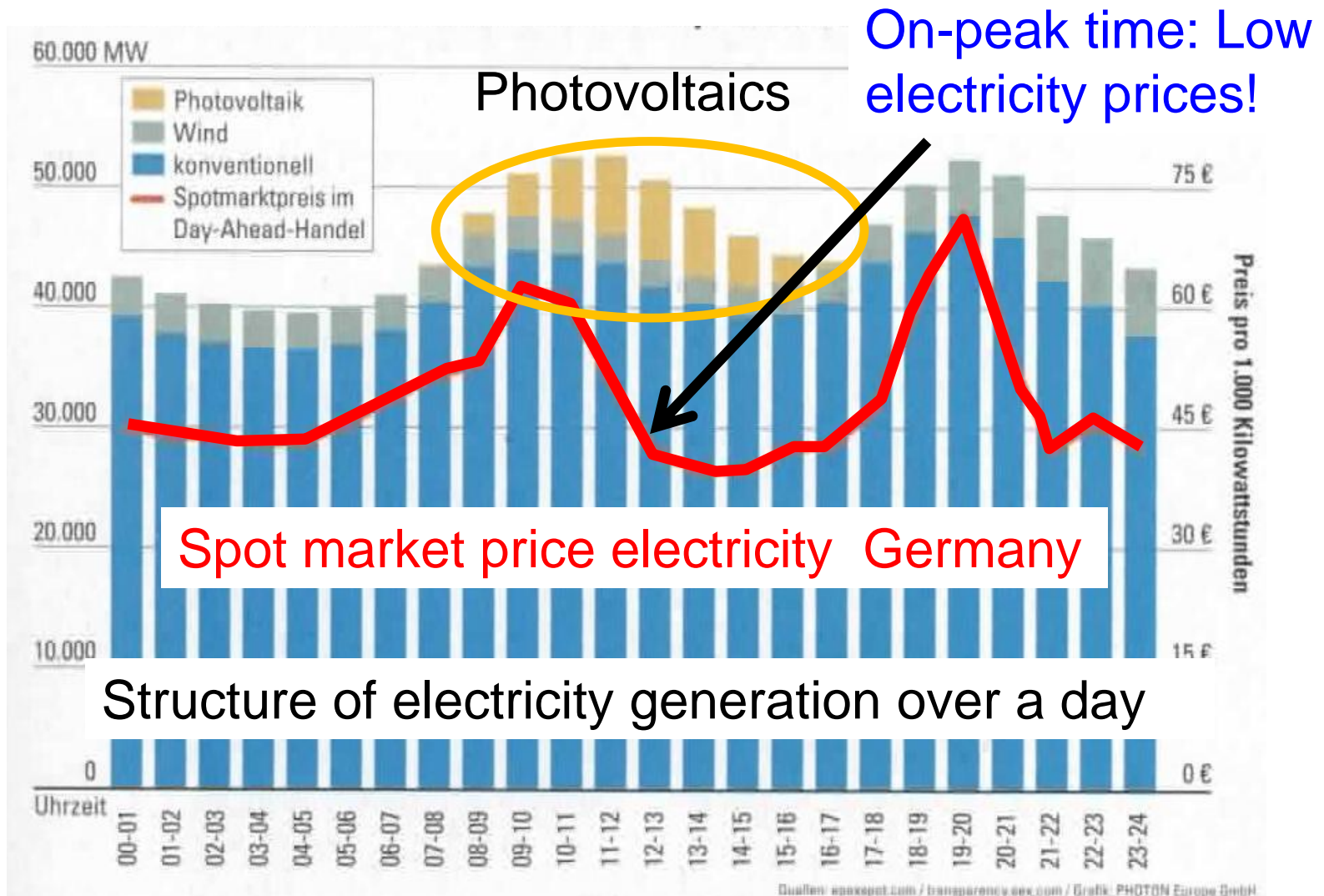
Development of electricity prices in Europe up to 2016 (1)



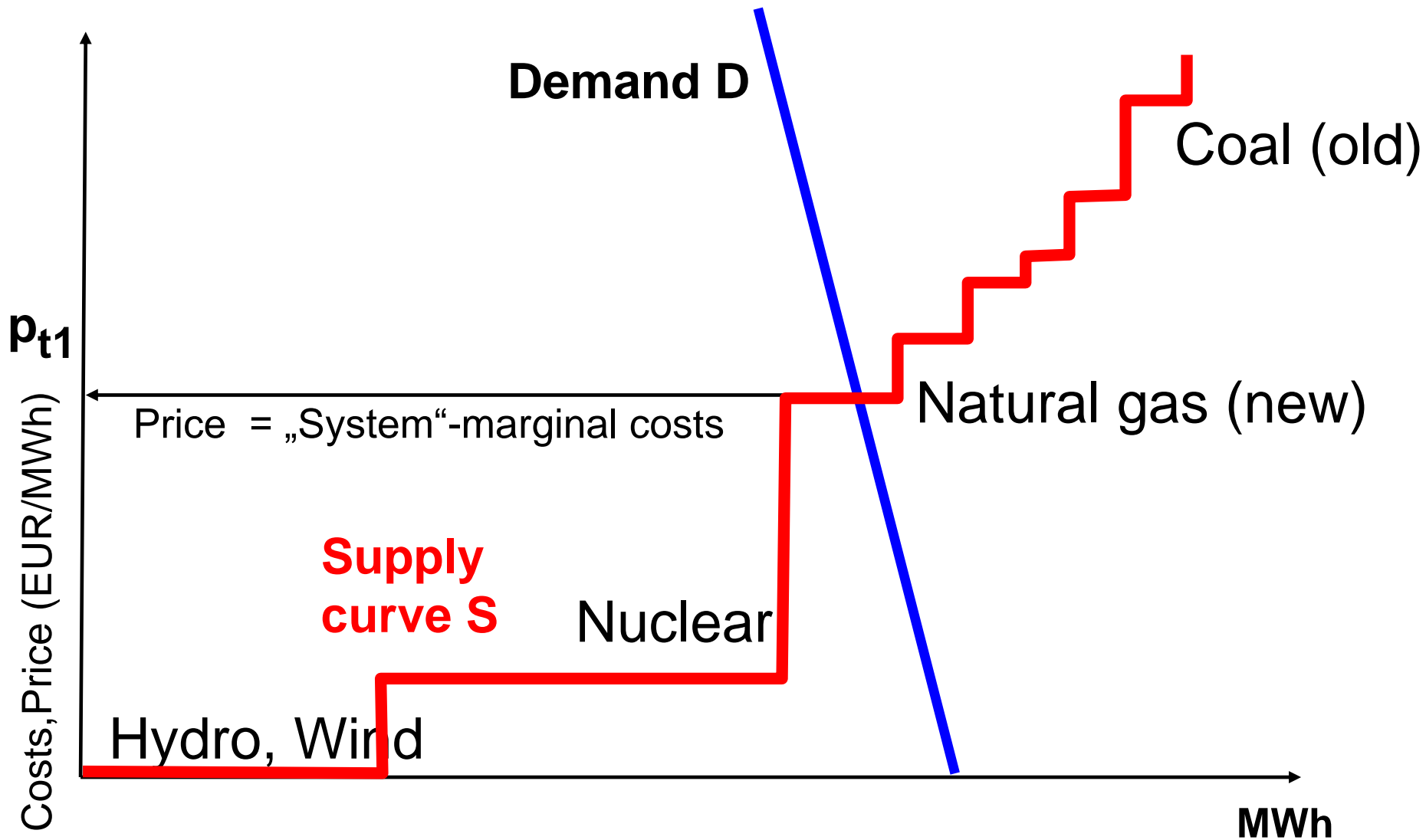
WHY?

STMC = 0!

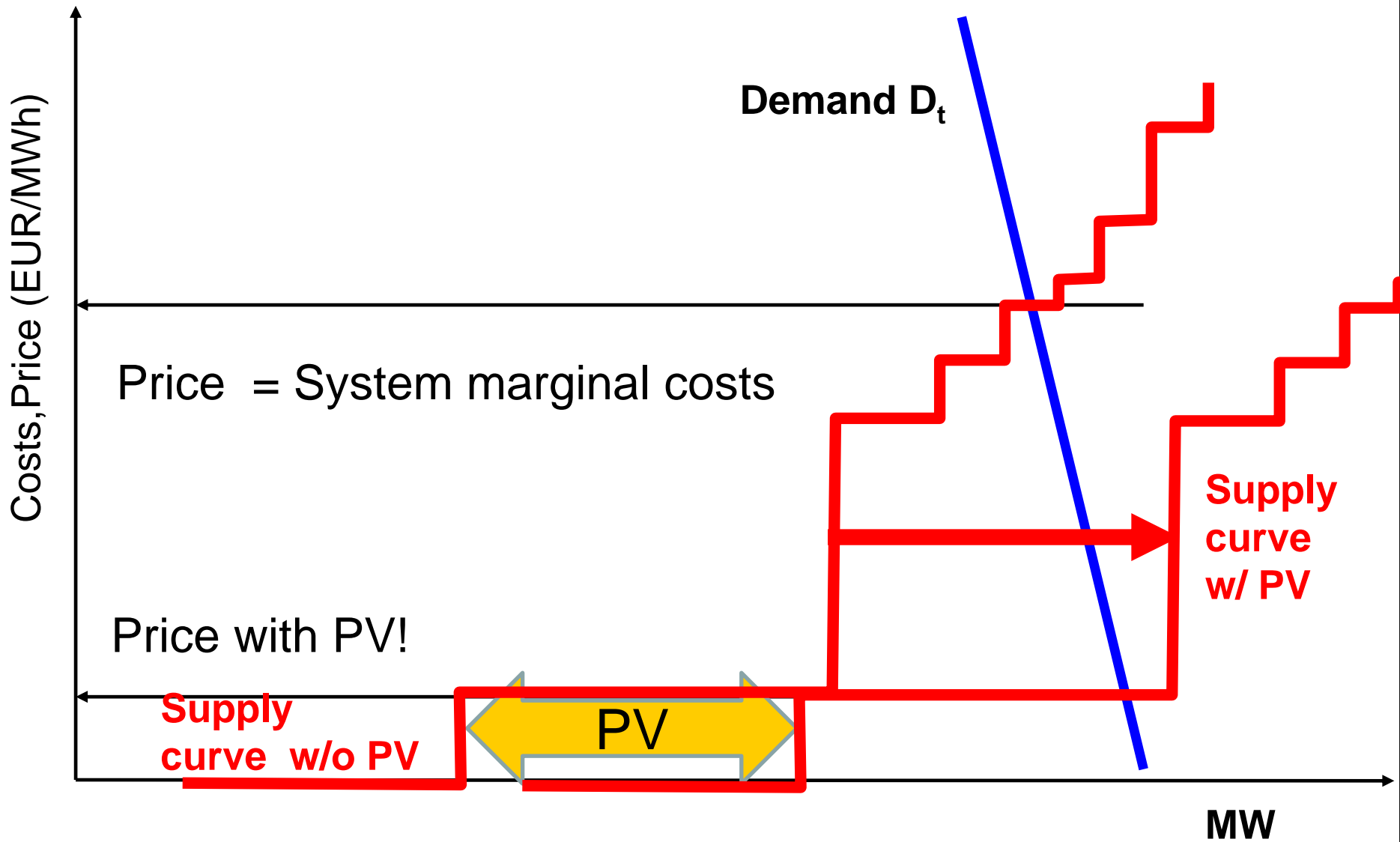
PV AFFECTS THE ELECTRICITY MARKET PRICE IN GERMANY



BASIC PRINCIPLE OF COMPETITION: PRICE = MARGINAL COSTS

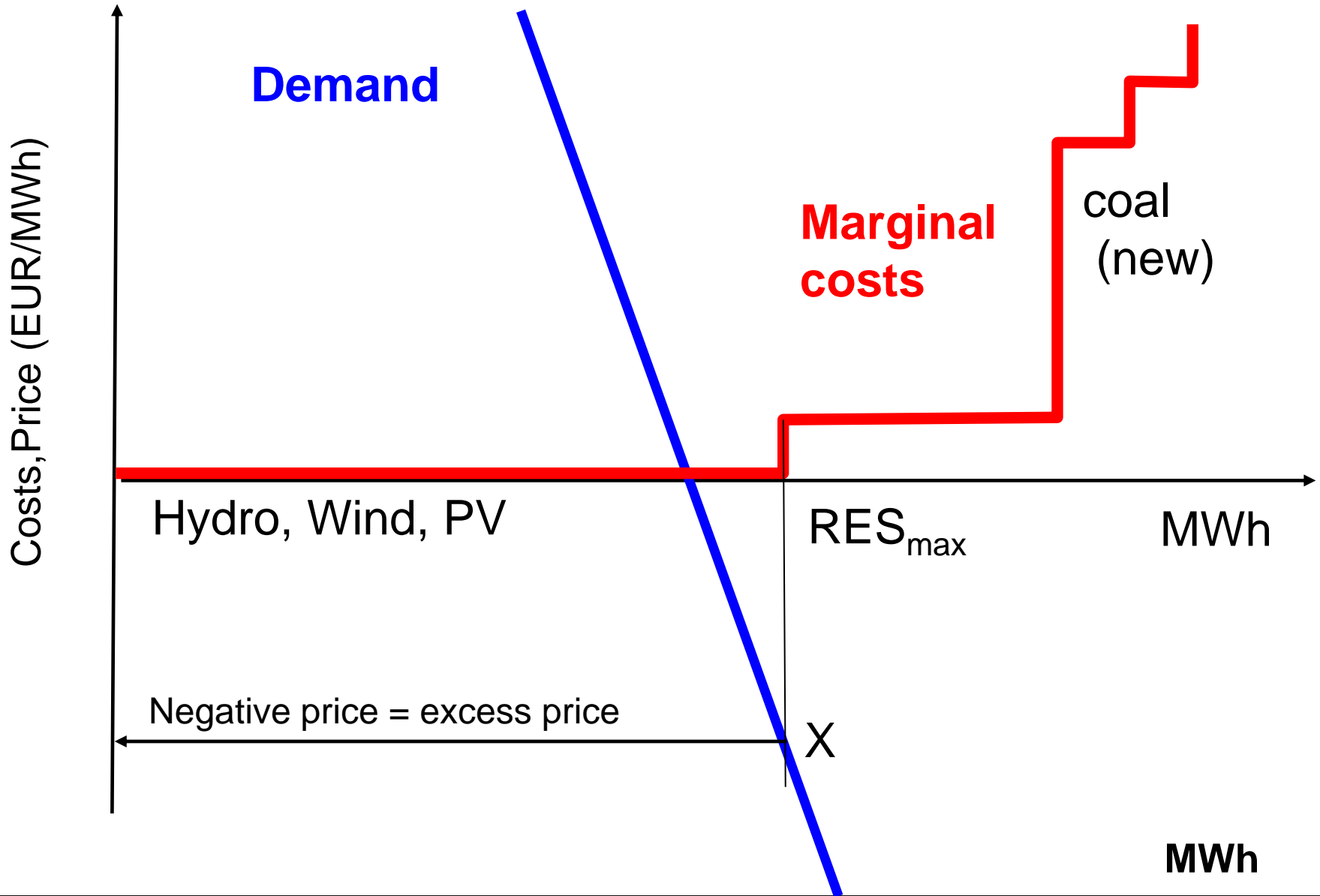


PRICES WITHOUT AND WITH PV

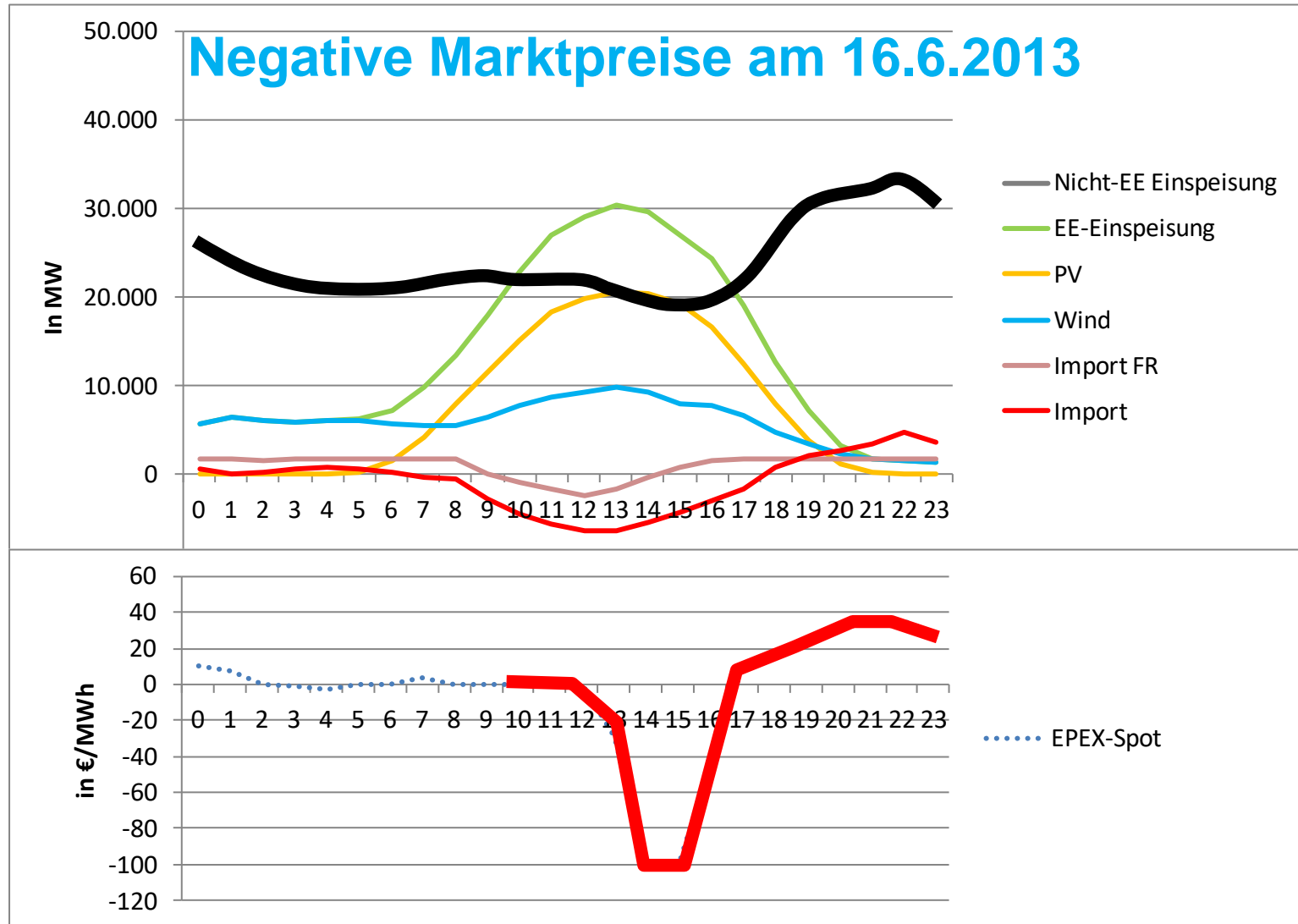


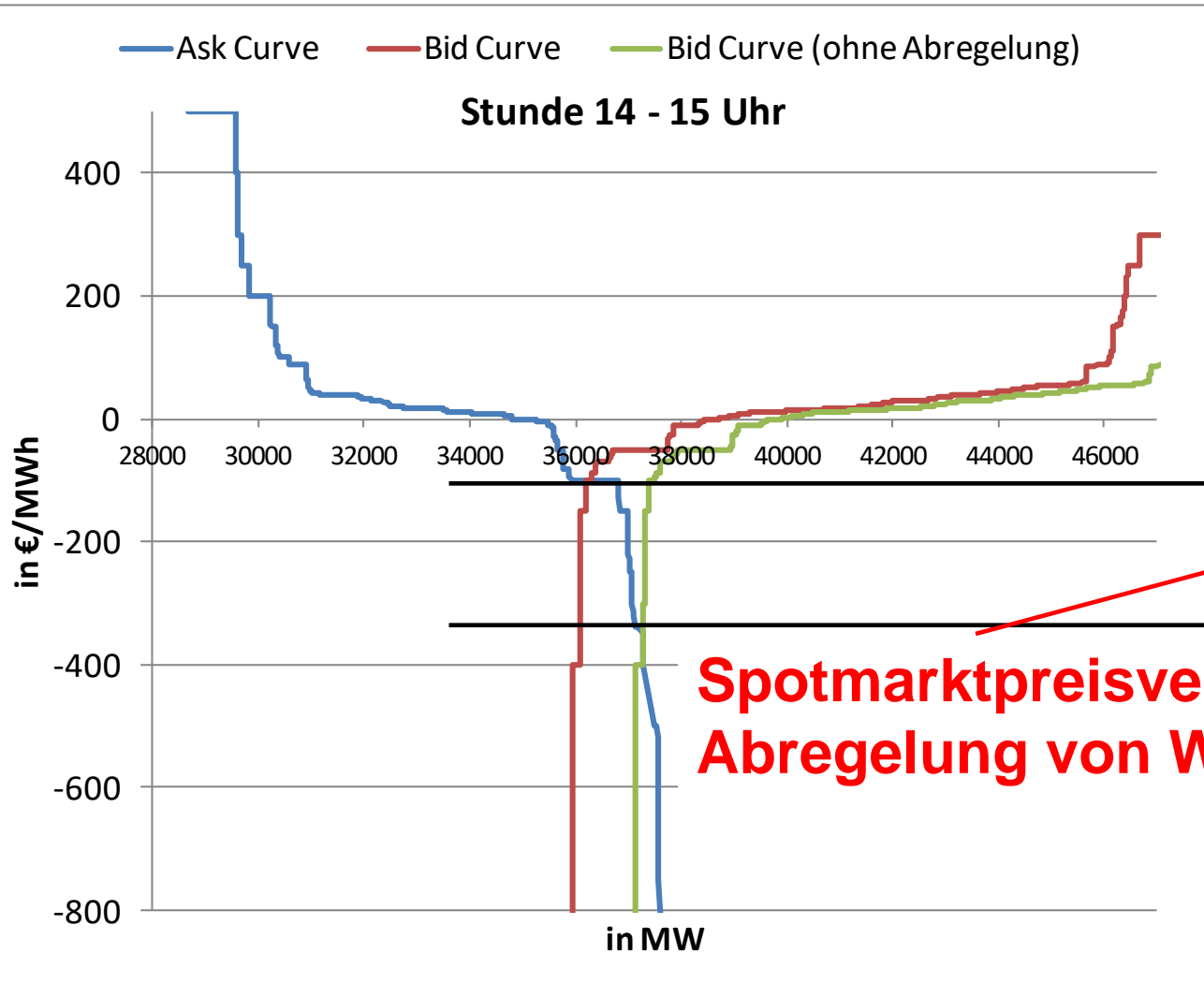
- 1. Prices decrease to Zero (or below) at a number of days;**
- 2. Lacking contribution margin to fixed costs**
- 3. On how many days will we face high and on how many days low prices?**

PRICE SETTING UNDER EXCESS CAPACITY



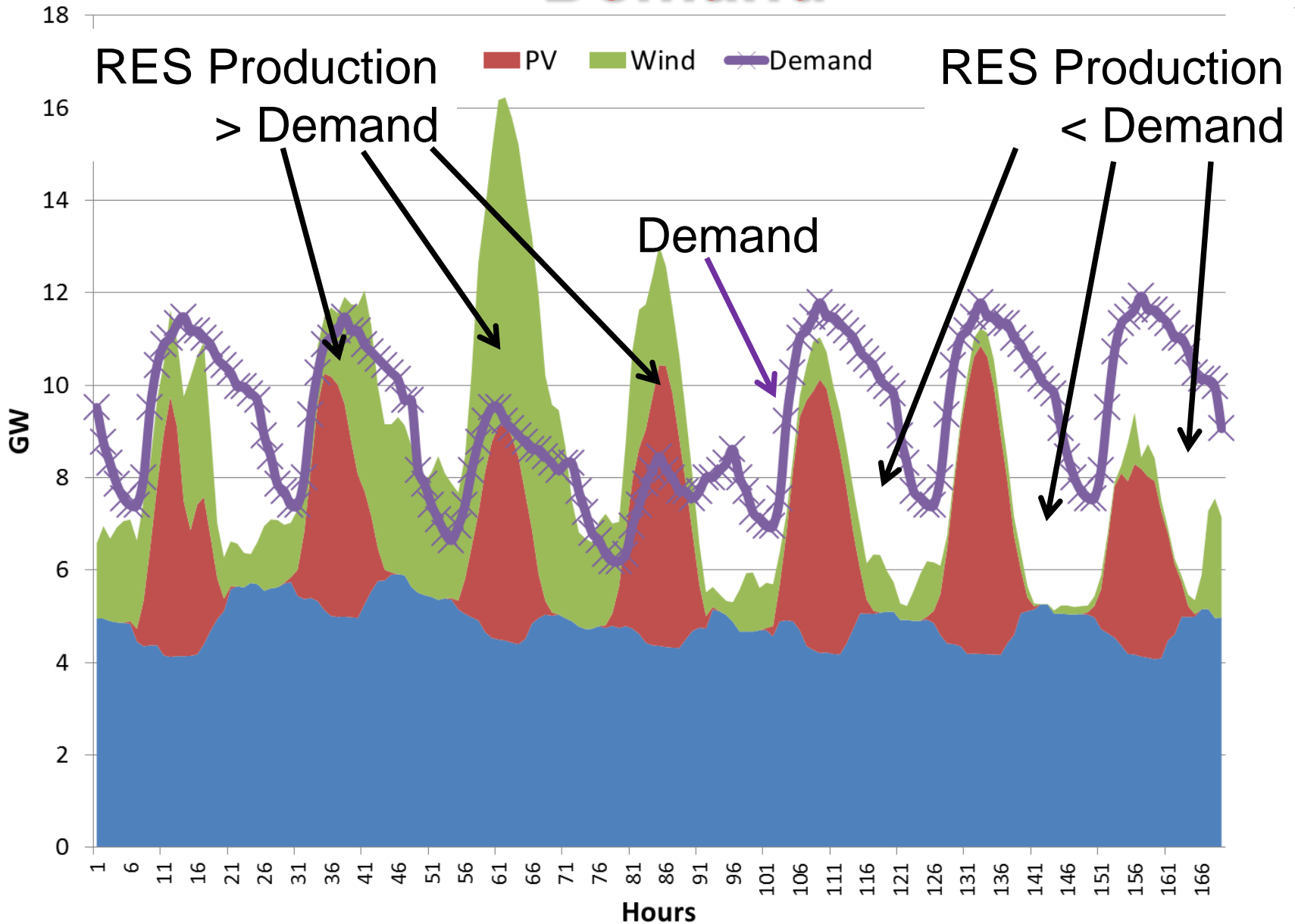
PROBLEM: EINFLUSS TEMPORÄR GROSSER MENGEN EET (?) AUF SPOTMARKTPREISE



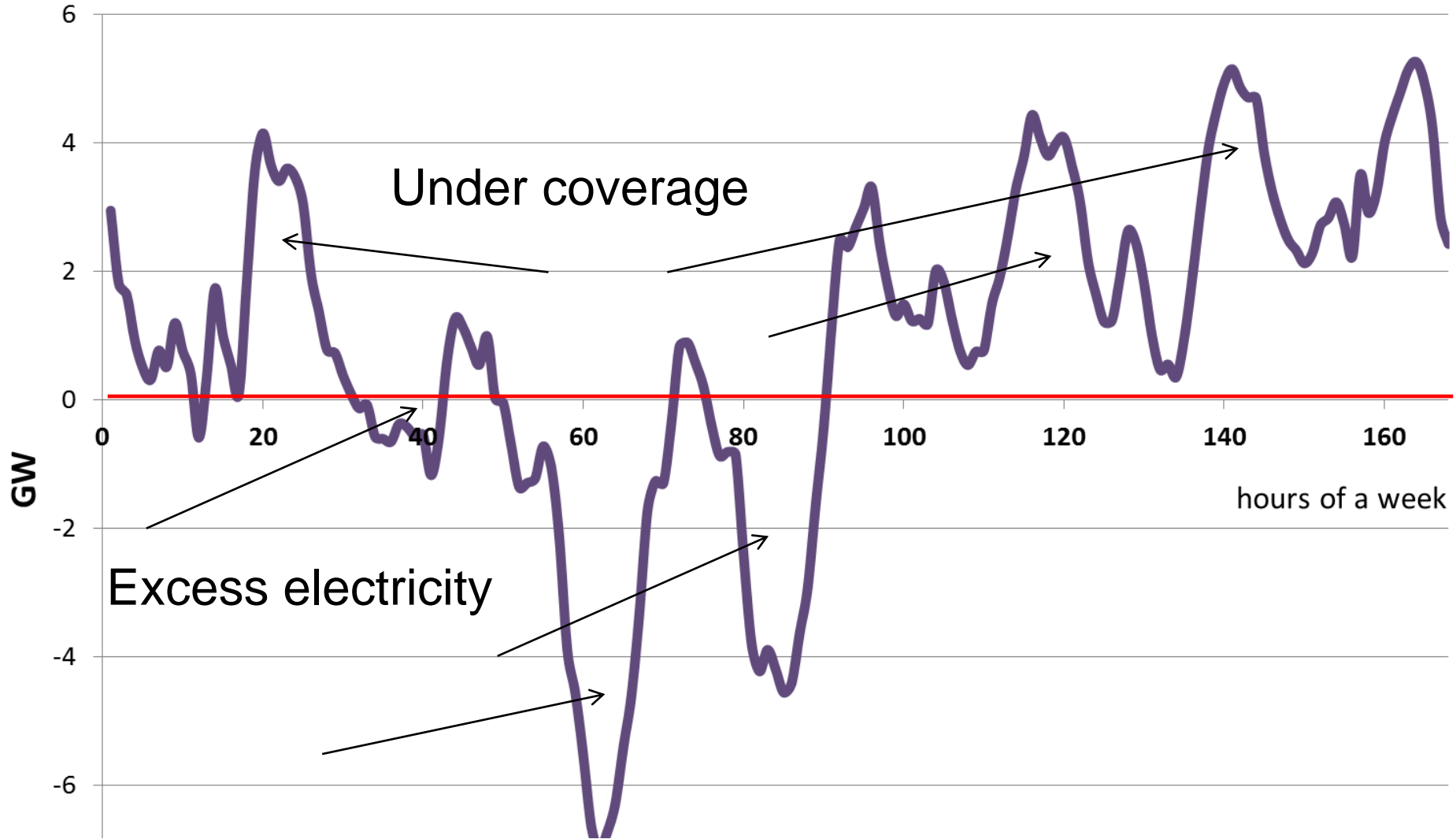


**Spotmarktpreisveränderung durch
Abregelung von Windkraftanlagen**

Example: Supply and Demand

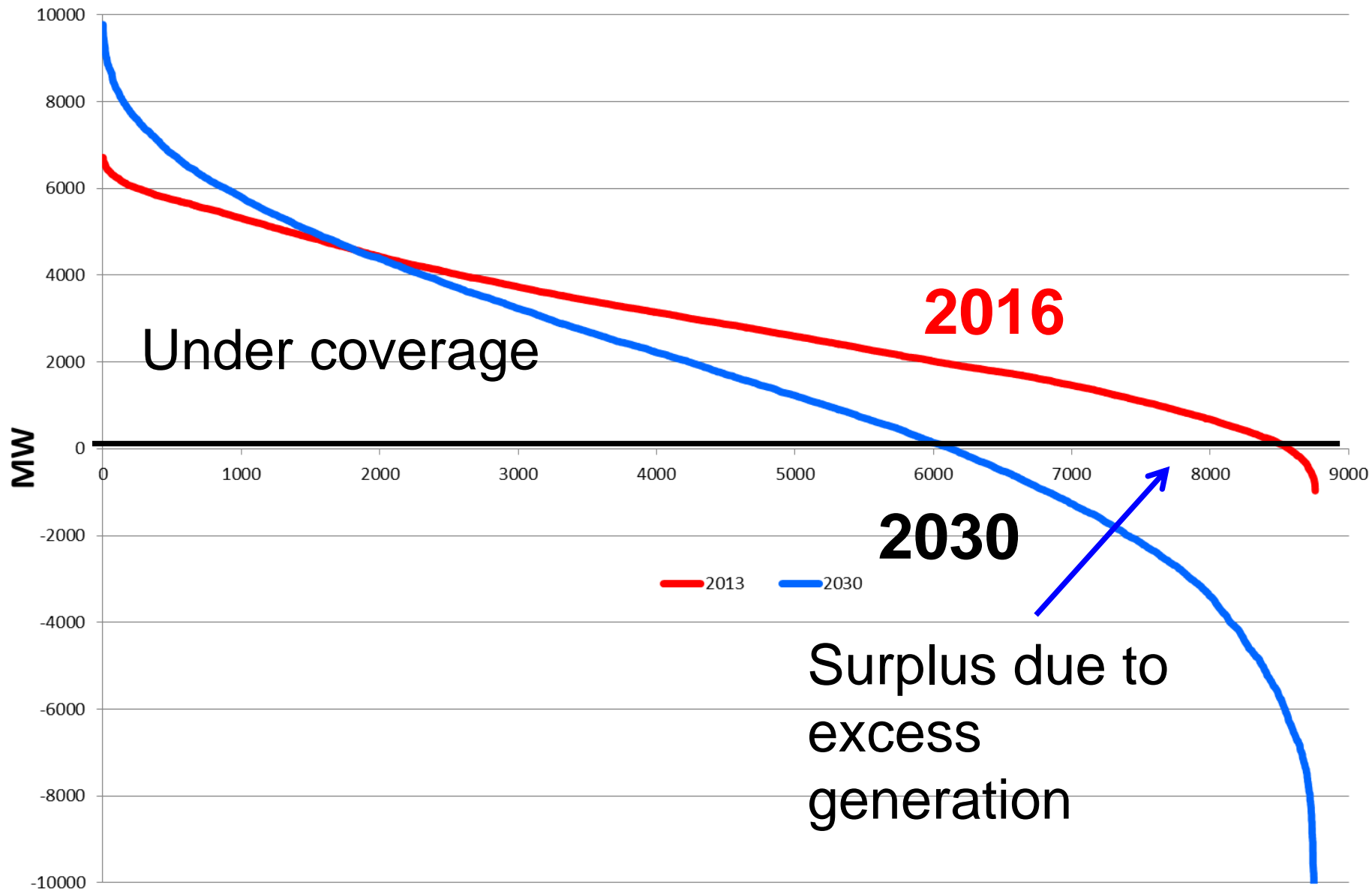


4. Key term of the future: Residual load

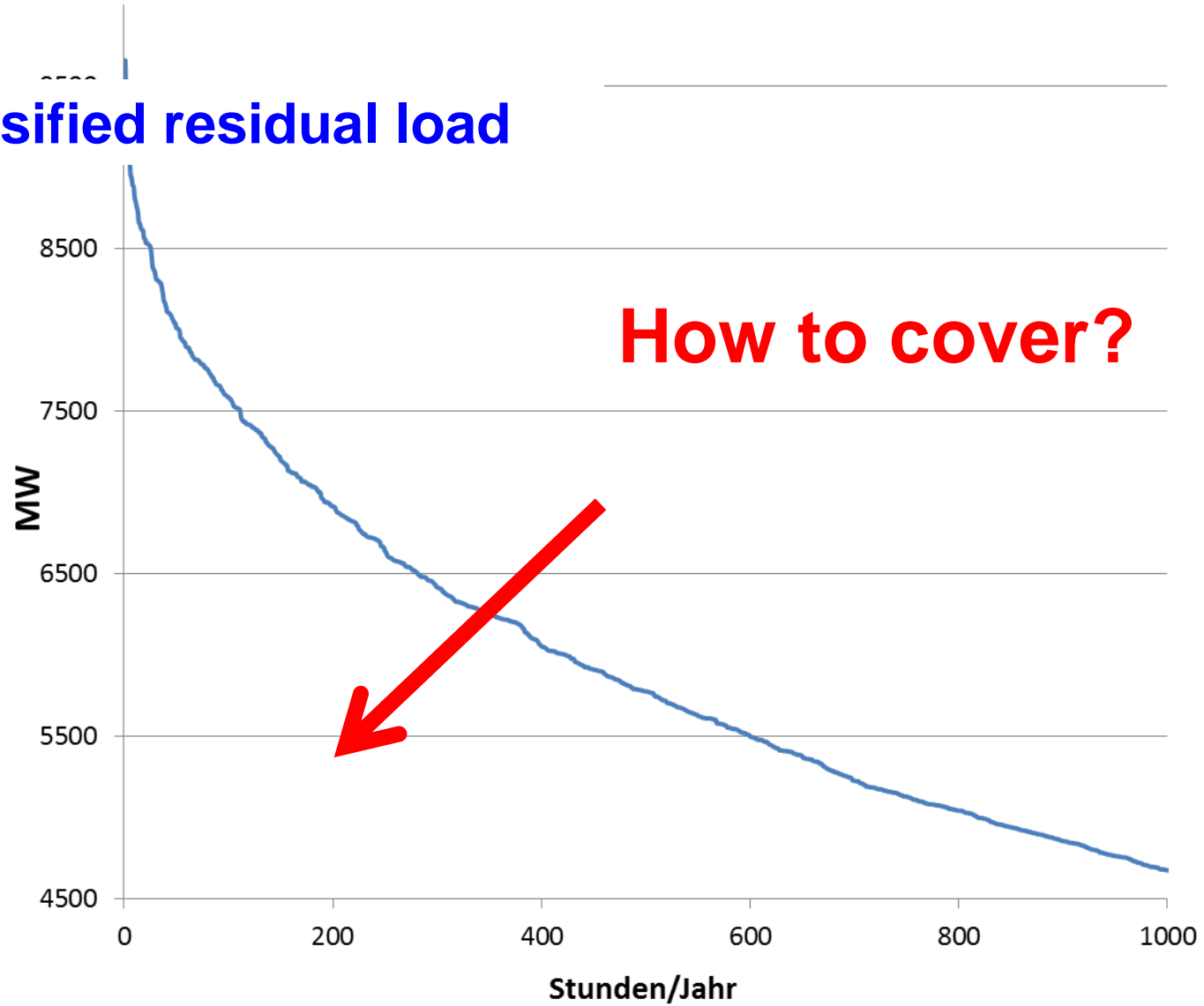
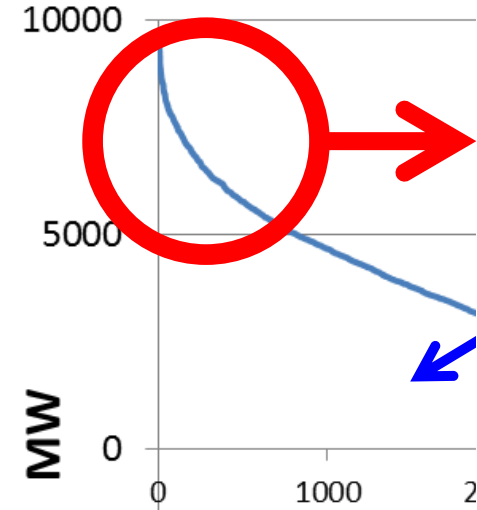


Residual load = Load – non-flexible generation

Classified residual load



Classified residual load



How to cover?

By a regulated capacity „market“ ?
or

**By competition between supply-side
and demand-side technologies (incl.
storages and grid)?**

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

DIMENSIONS OF ELECTRICITY MARKETS

SUPPLY

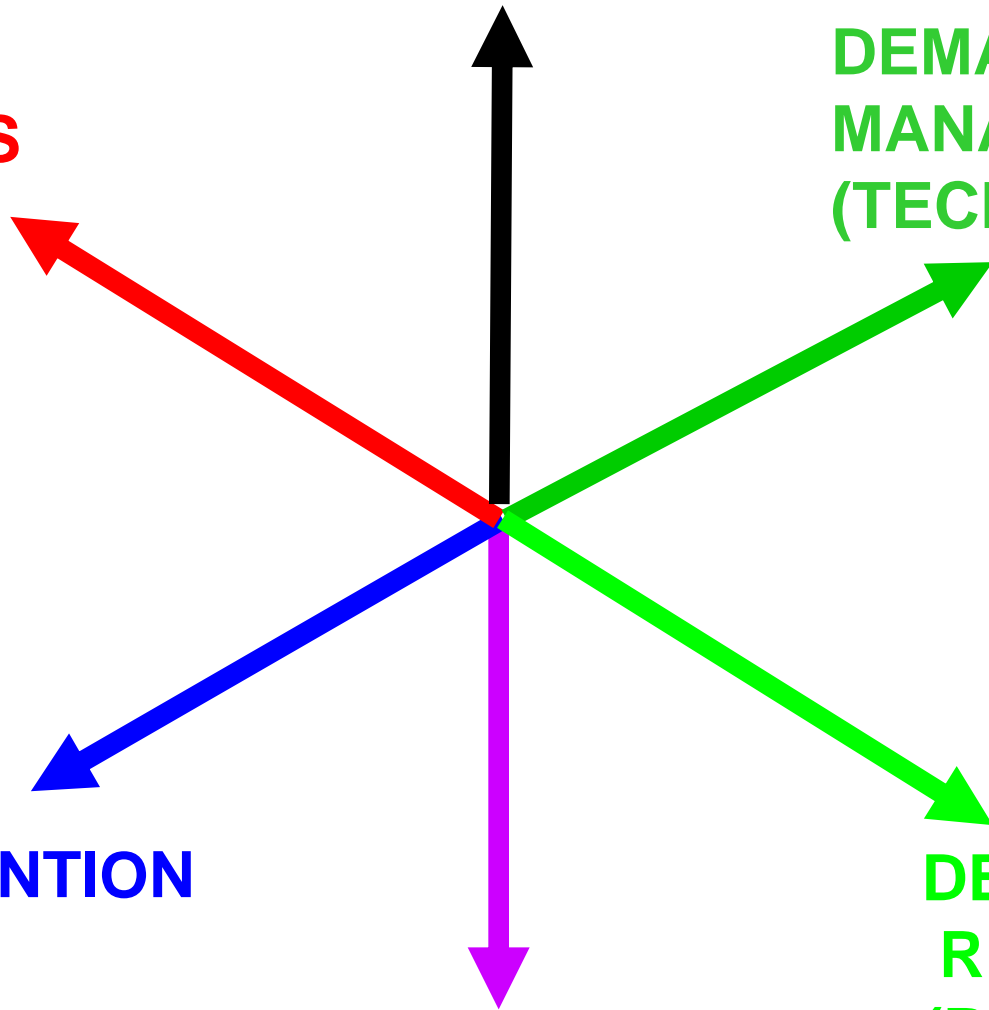
STORAGES

**DEMAND-SIDE
MANAGEMENT
(TECHNICAL)**

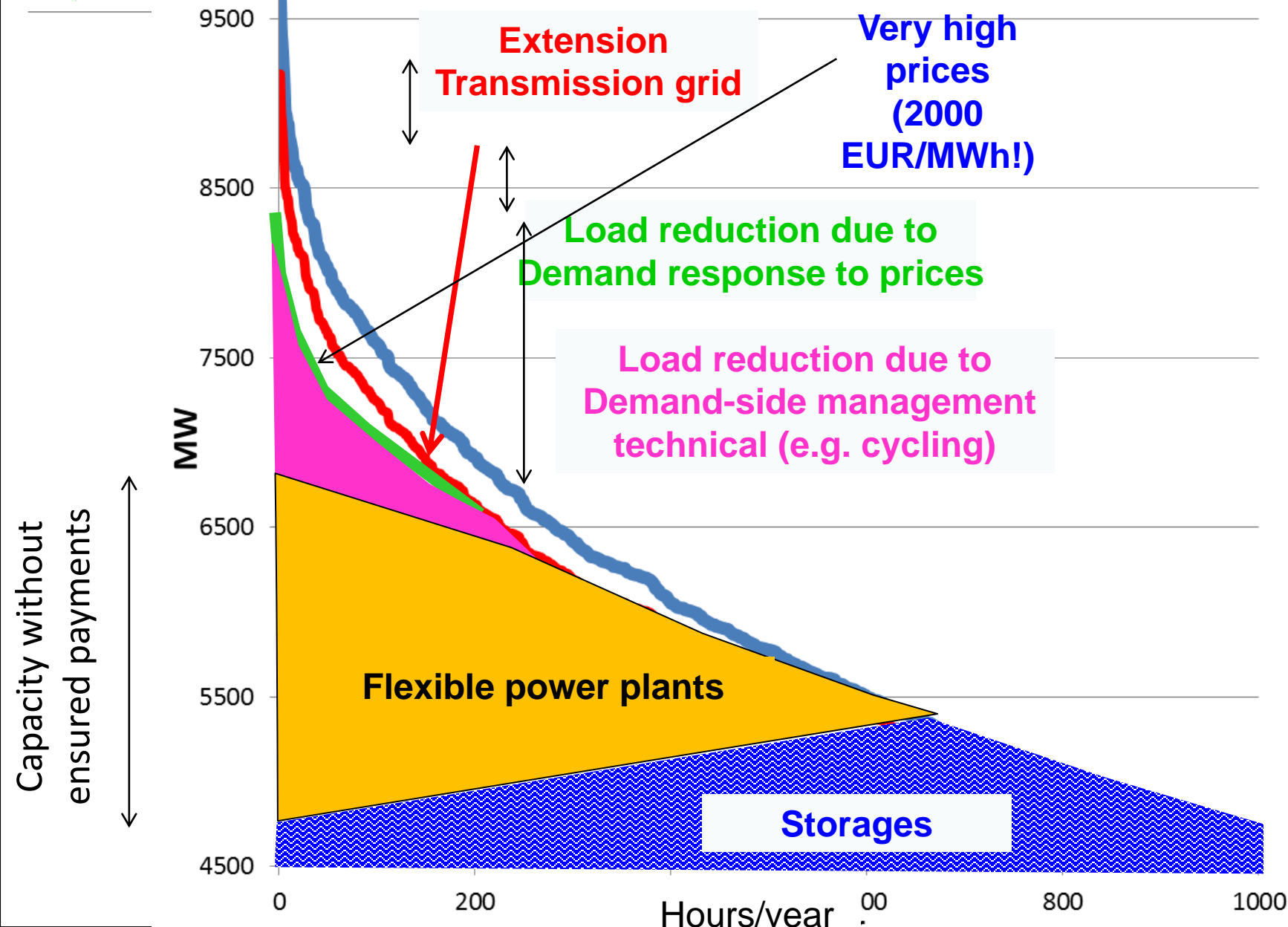
GRID EXTENTION

**DEMAND
RESPONSE
(PRICE SIGNALS)**

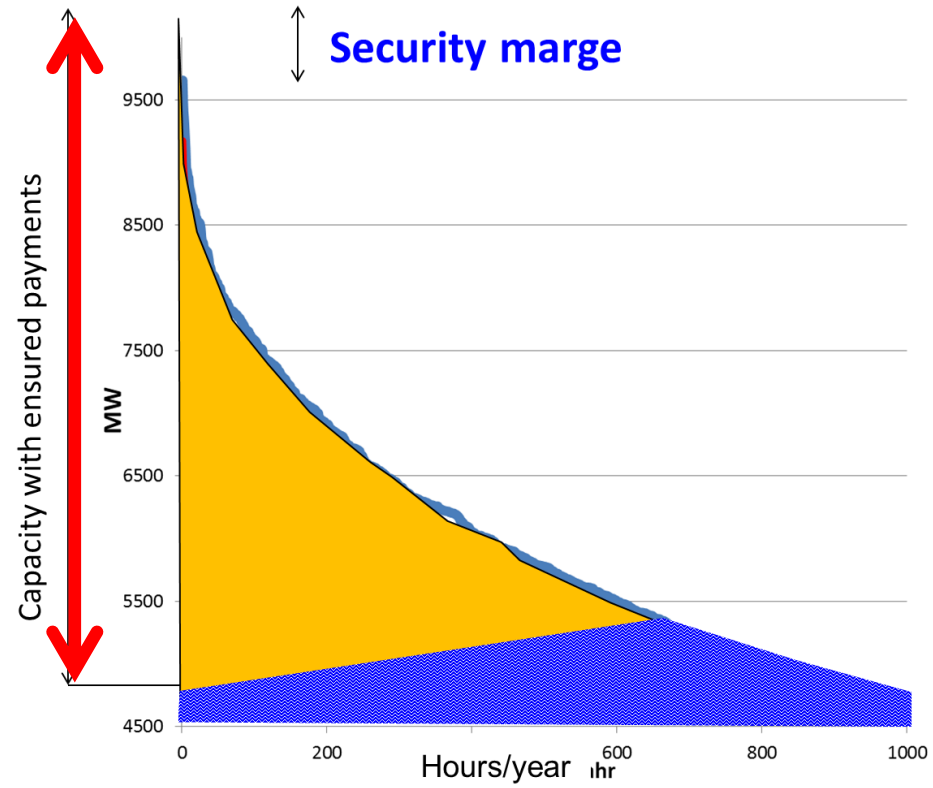
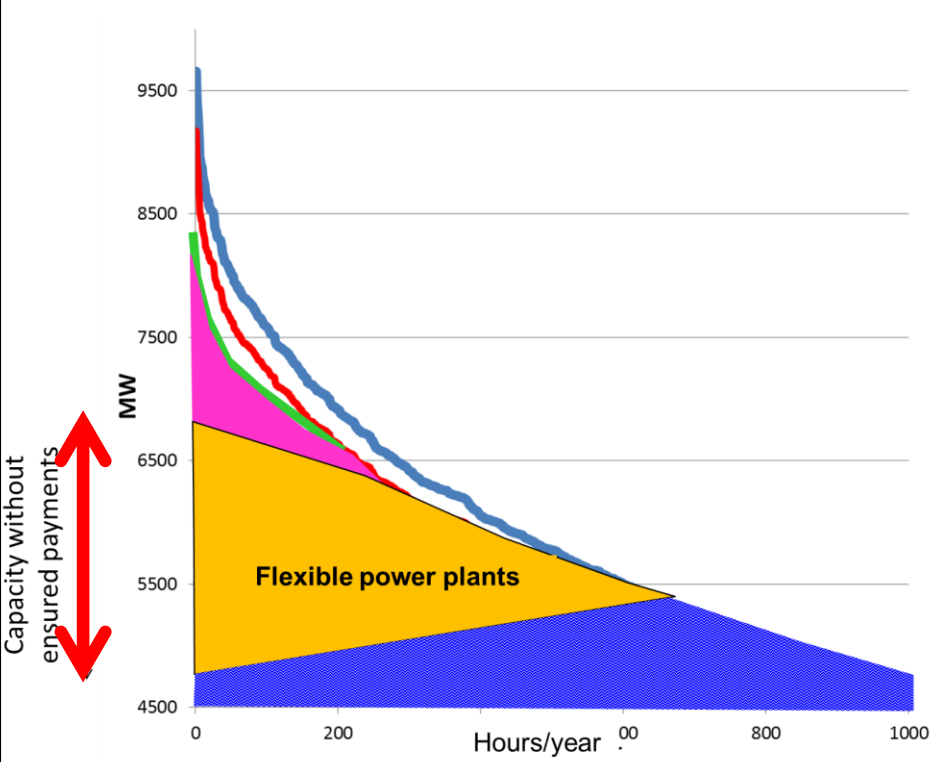
SMART GRIDS



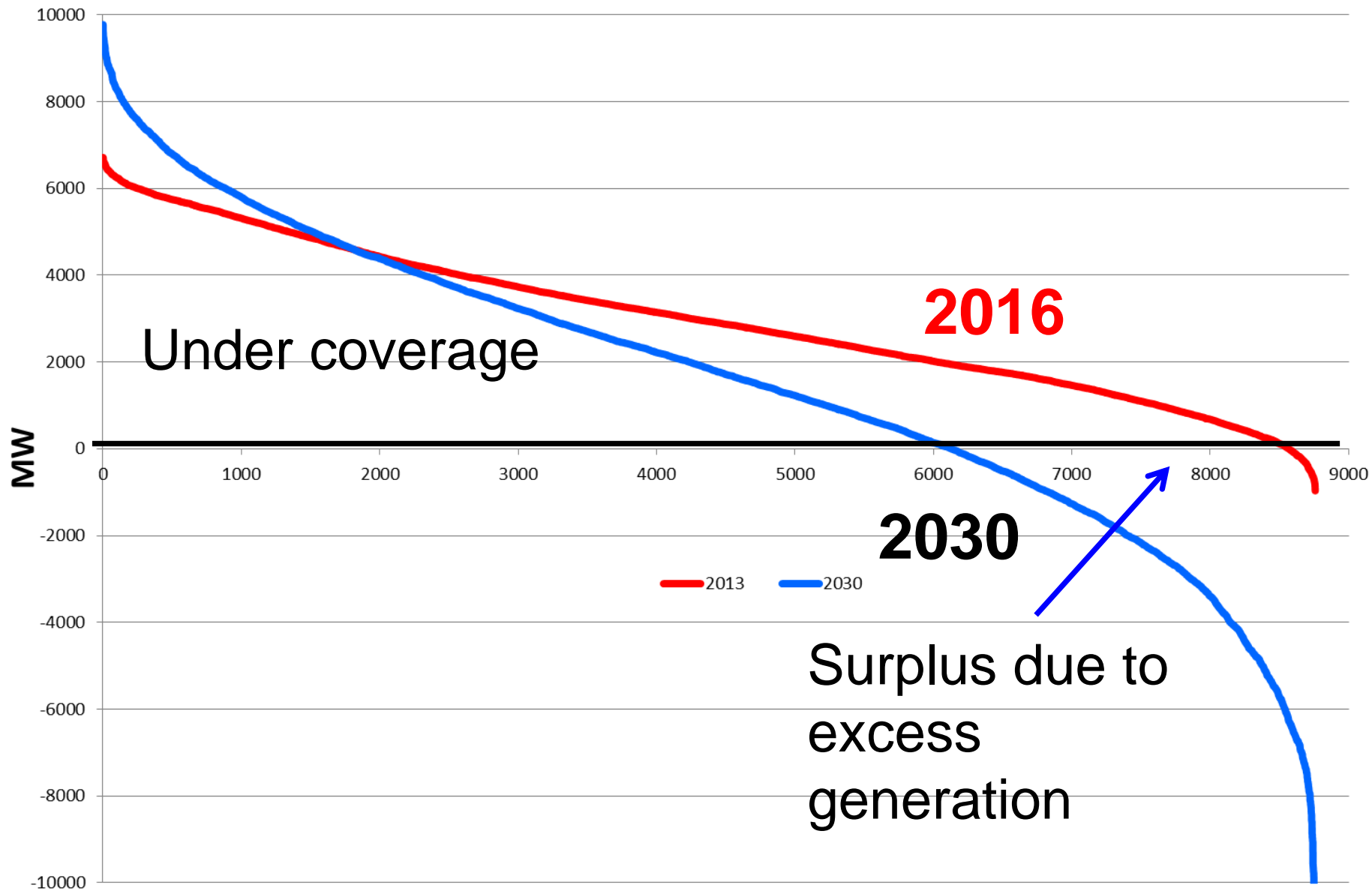
5 Flexible coverage of residual load



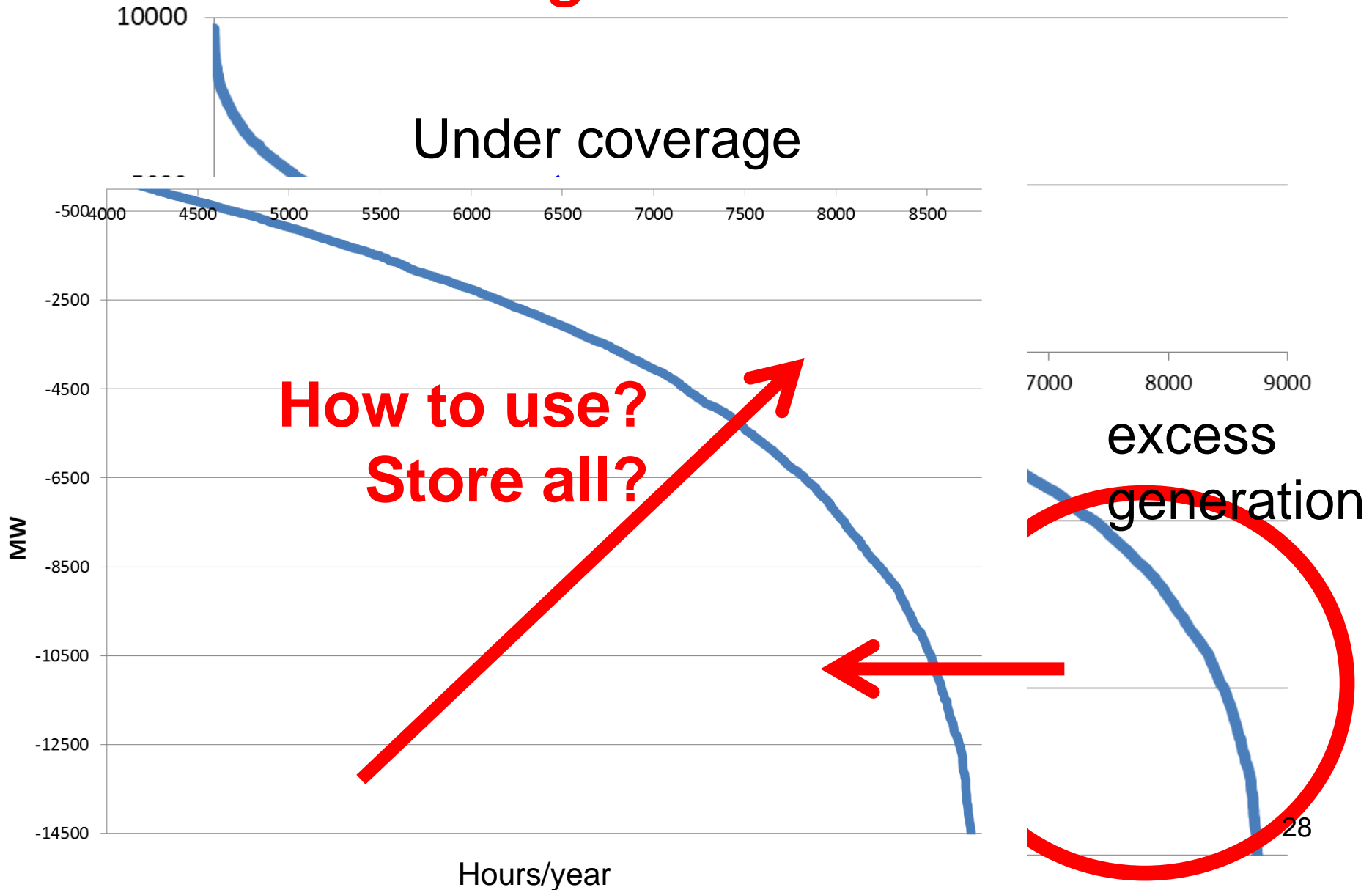
Comparison



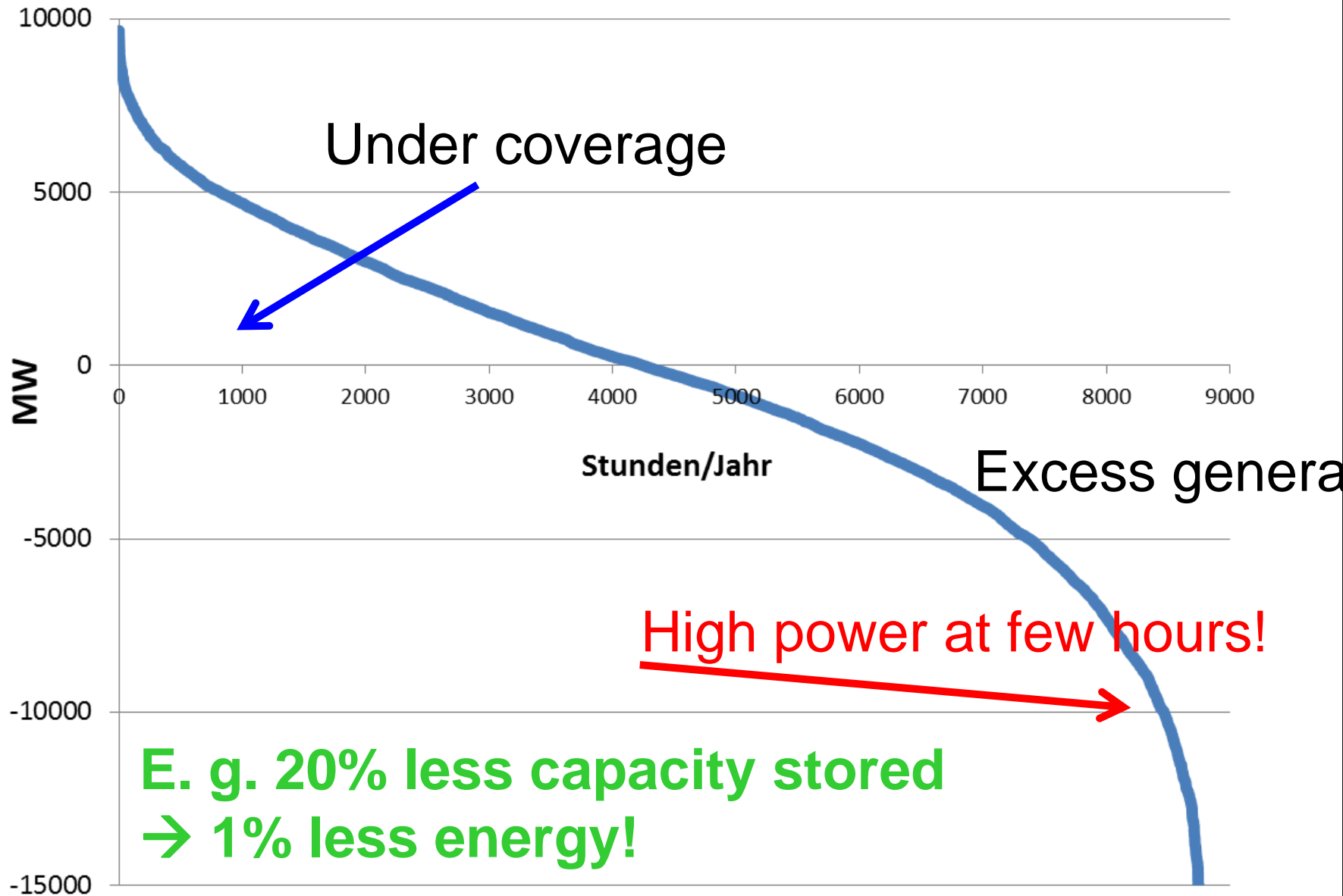
Classified residual load over a year



Specific question: How much storage do we need?



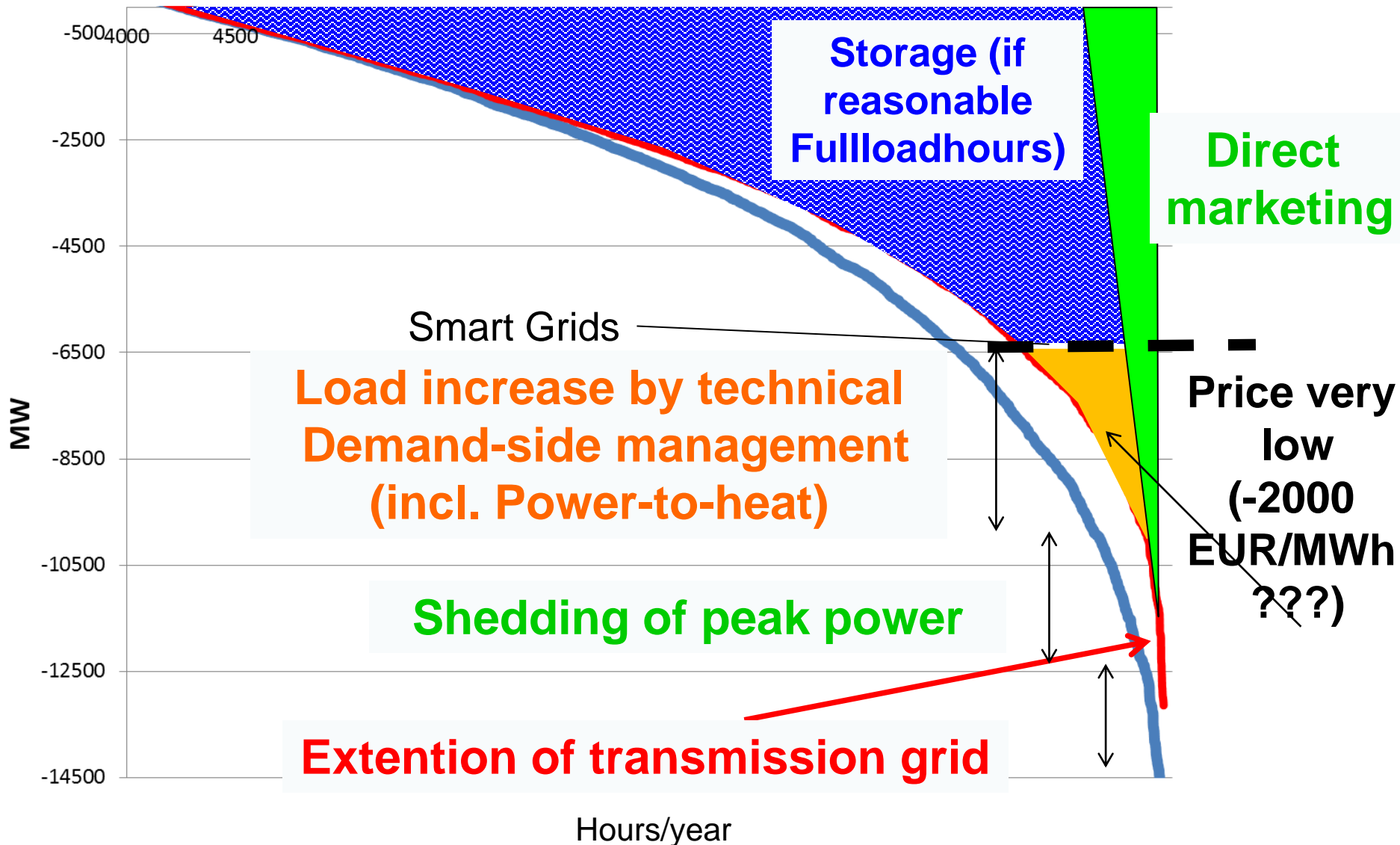
Storing every peak?



E. g. 20% less capacity stored
→ 1% less energy!

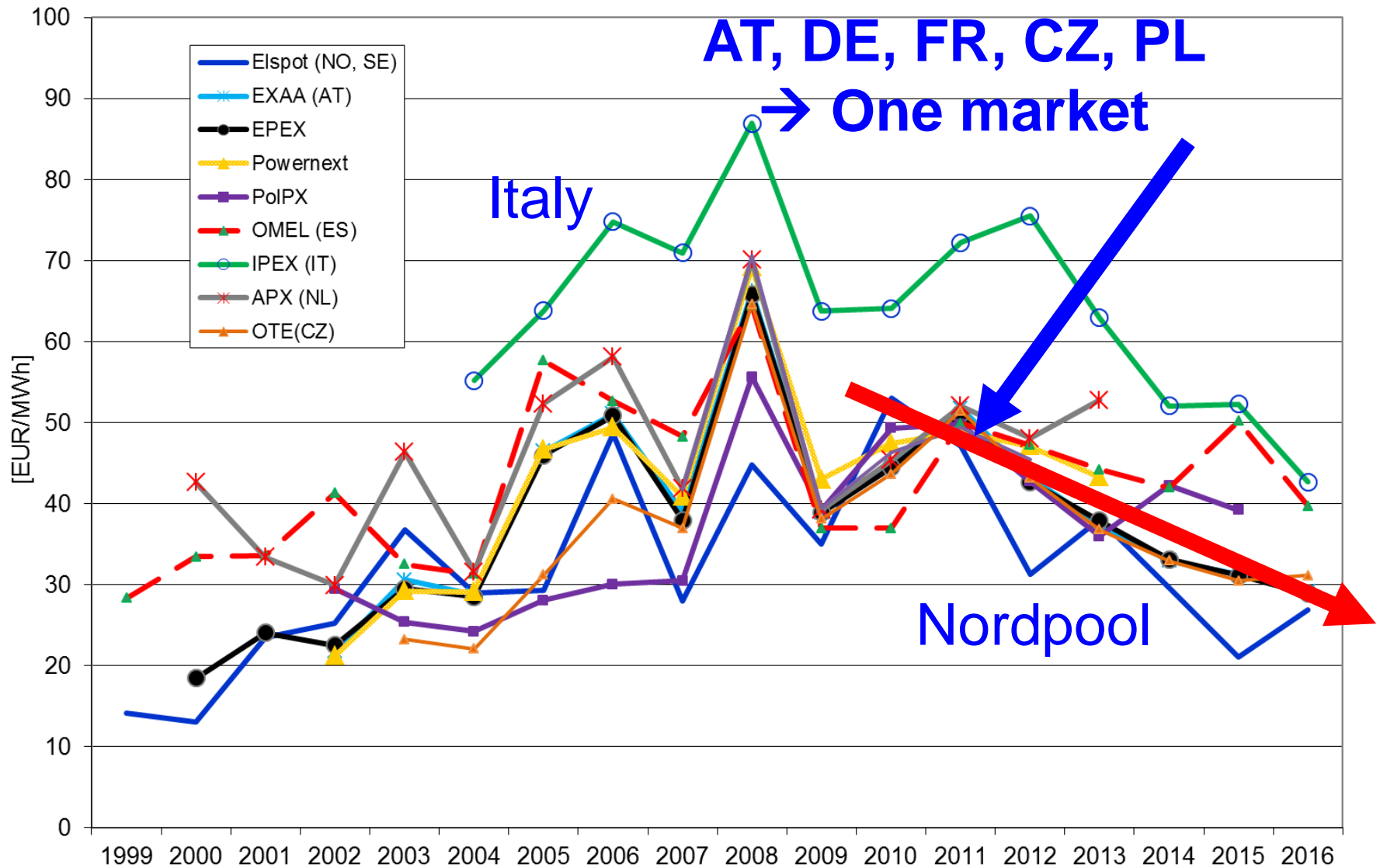
High power at few hours!

Flexible use of excess electricity and Sector coupling

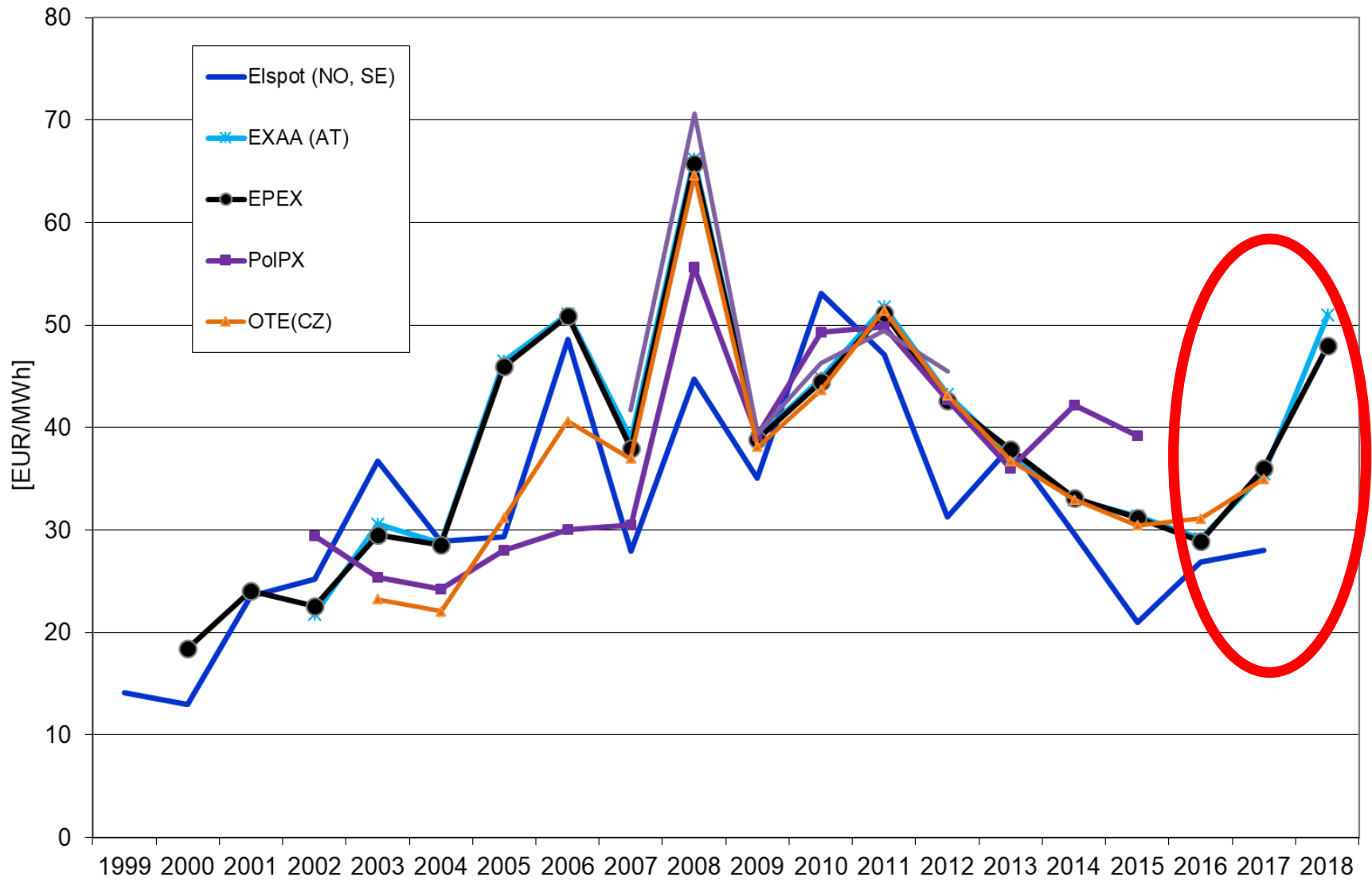


6 IMPACT PARAMETERS ON ELECTRICITY PRICES

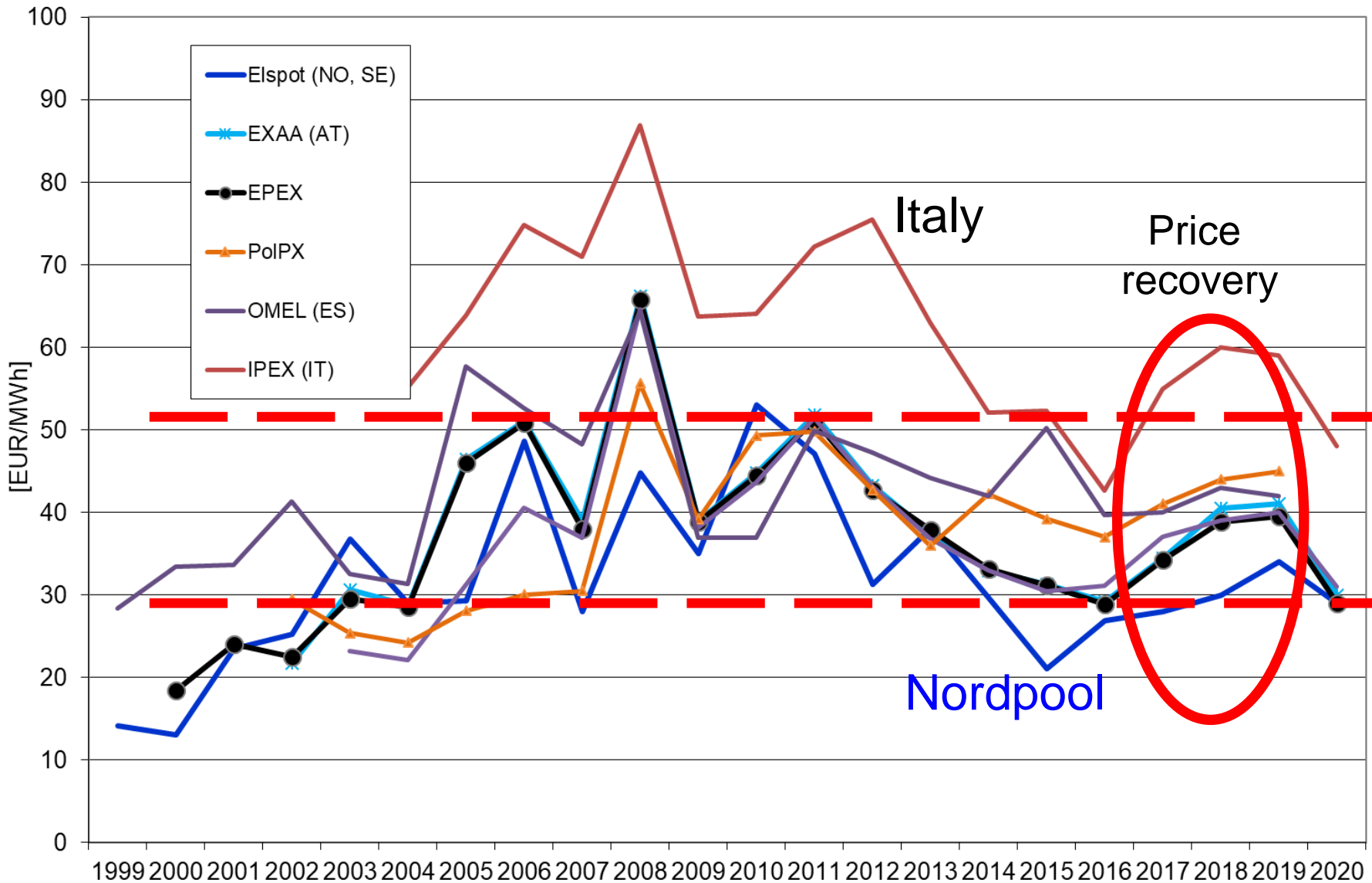
Development of electricity prices in Europe up to 2016 (1)

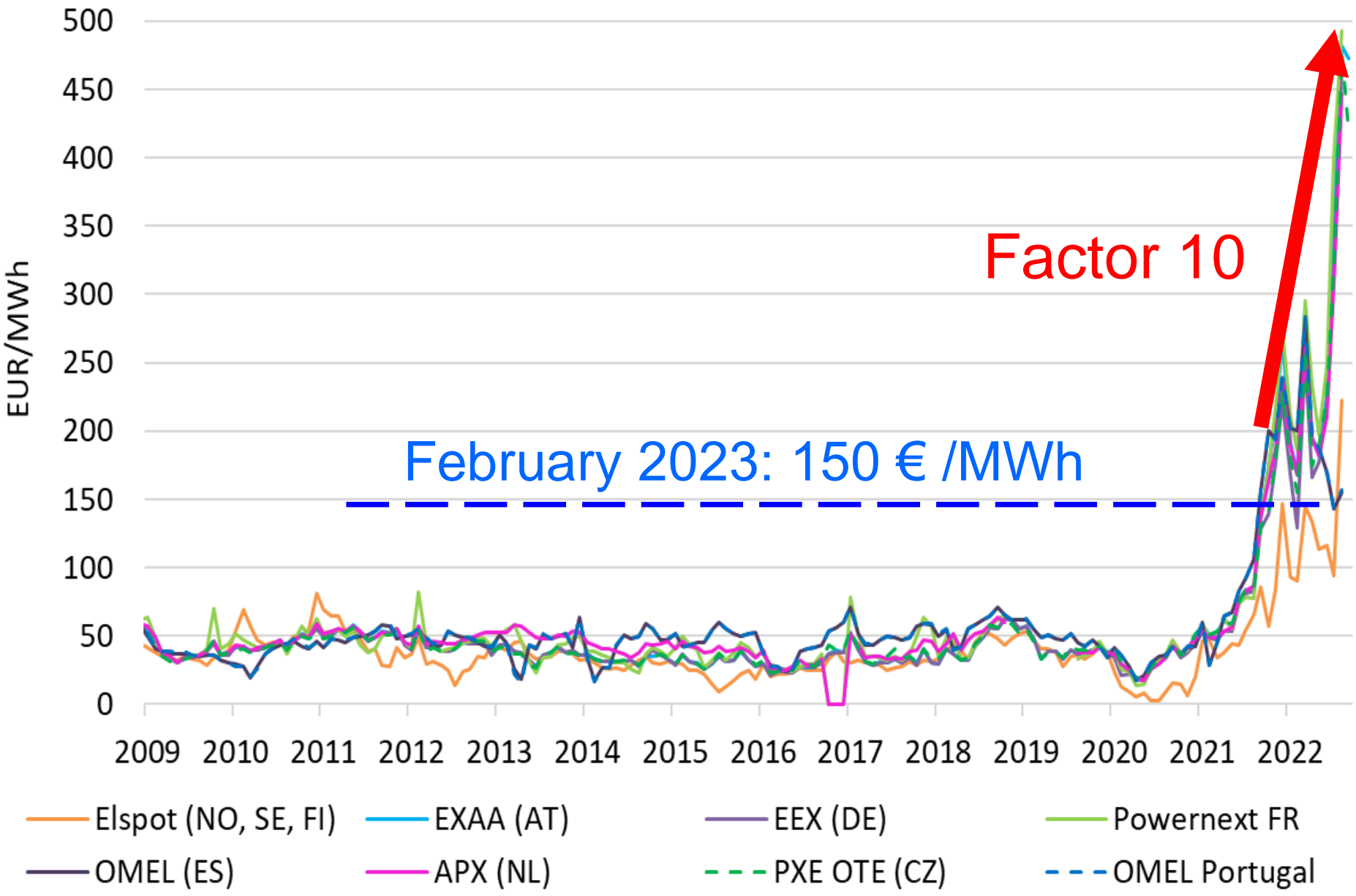


Development of electricity prices in Europe up to 2018 (2)

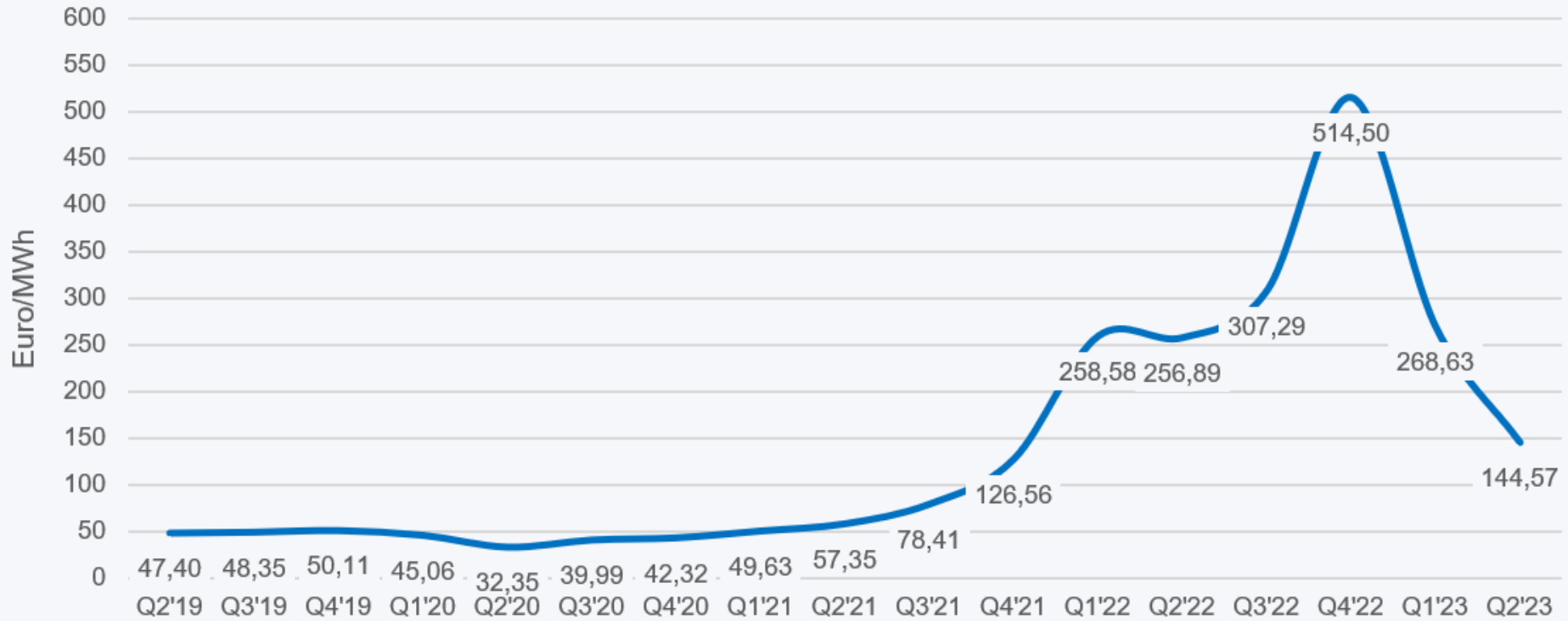


Development of day-ahead electricity prices in Europe per year (2)

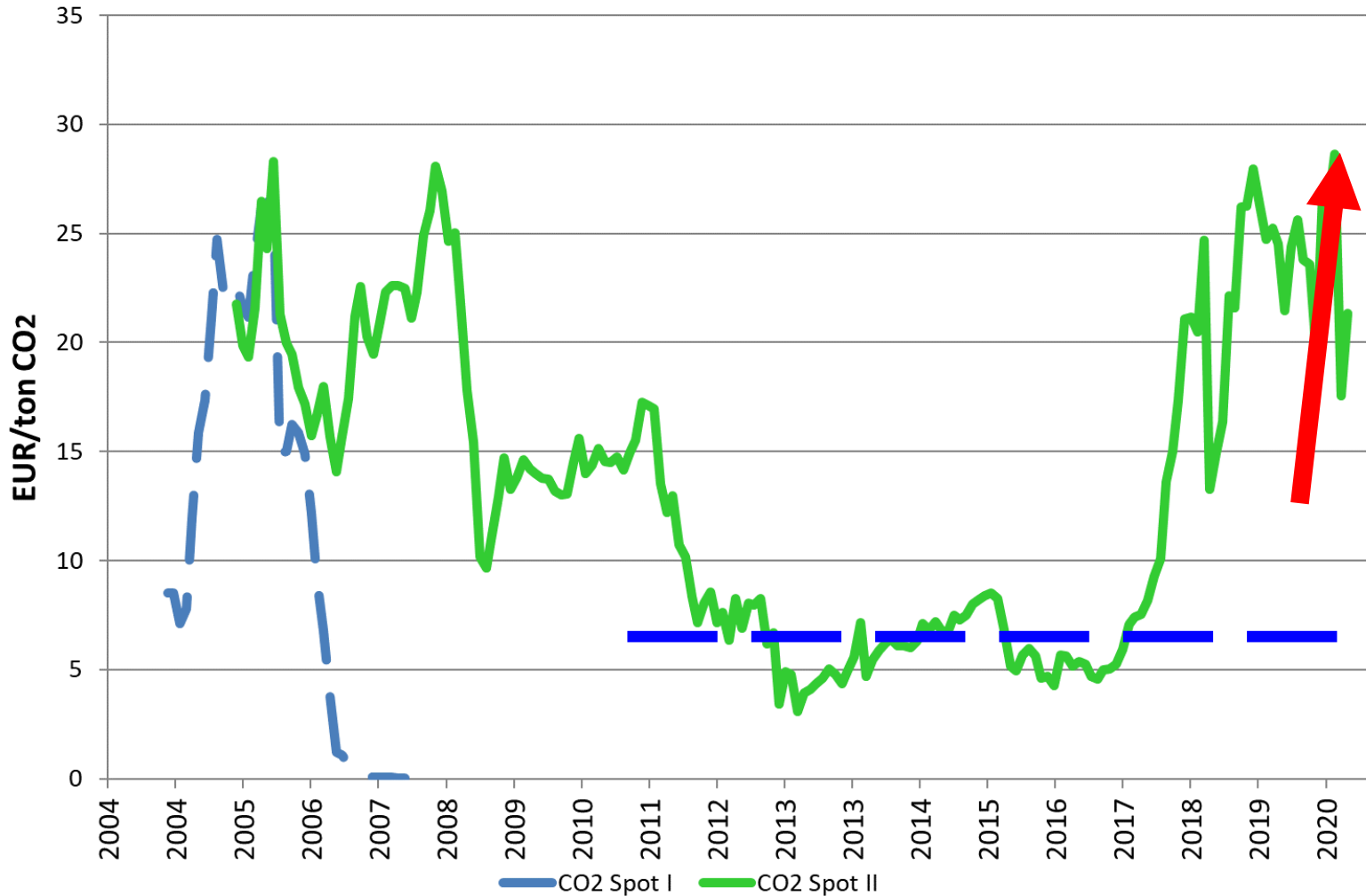




MARKTPREISENTWICKLUNG ab dem 2. Quartal 2019 auf Basis Phelix-AT
 Marktpreis gemäß § 41 Ökostromgesetz 2012



Development of CO2 prices in Europe 80 (!)

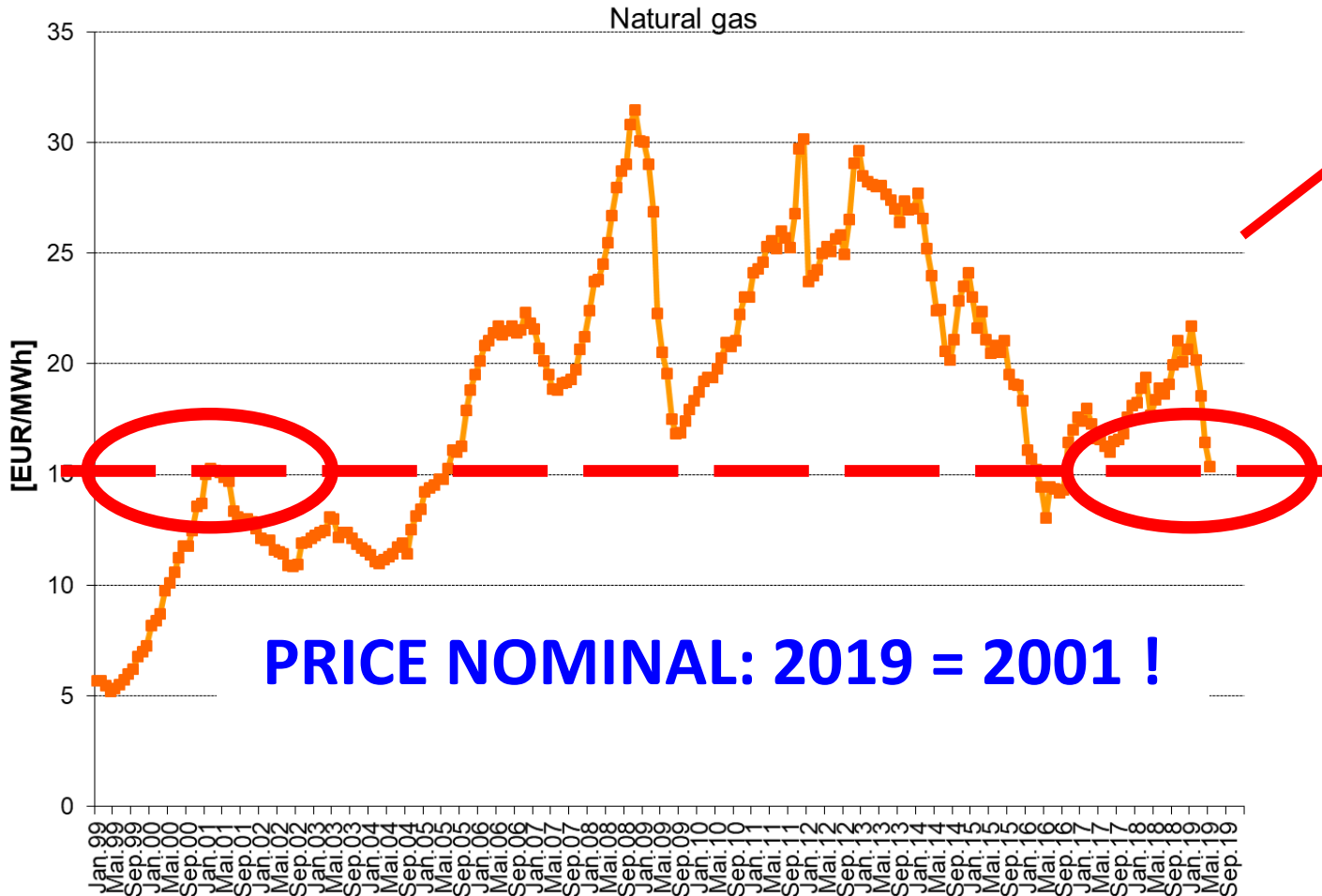




✓ EU Carbon Permits increased 1.72 EUR or 2.13% since the beginning of 2022

Figure 8: EU Carbon Permits price evolution during the last 10 years

THE MARKET PRICE OF NATURAL GAS



— Natural gas

Europe's Economy Today

Natural Gas Prices Fall

Germany's Inflation R...

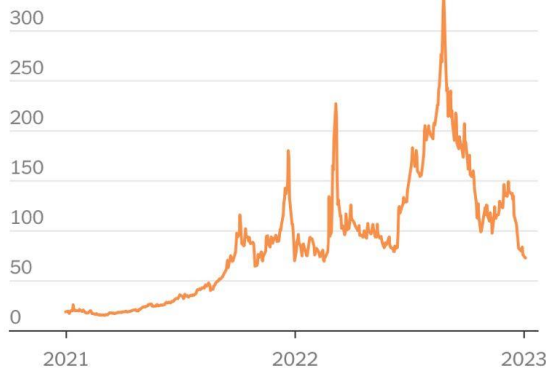
Natural Gas Prices in Europe Fall to Pre-Invasion Levels

Warm weather, alternatives to Russian gas and a buildup of storage all help. But prices remain high for consumers and industry.

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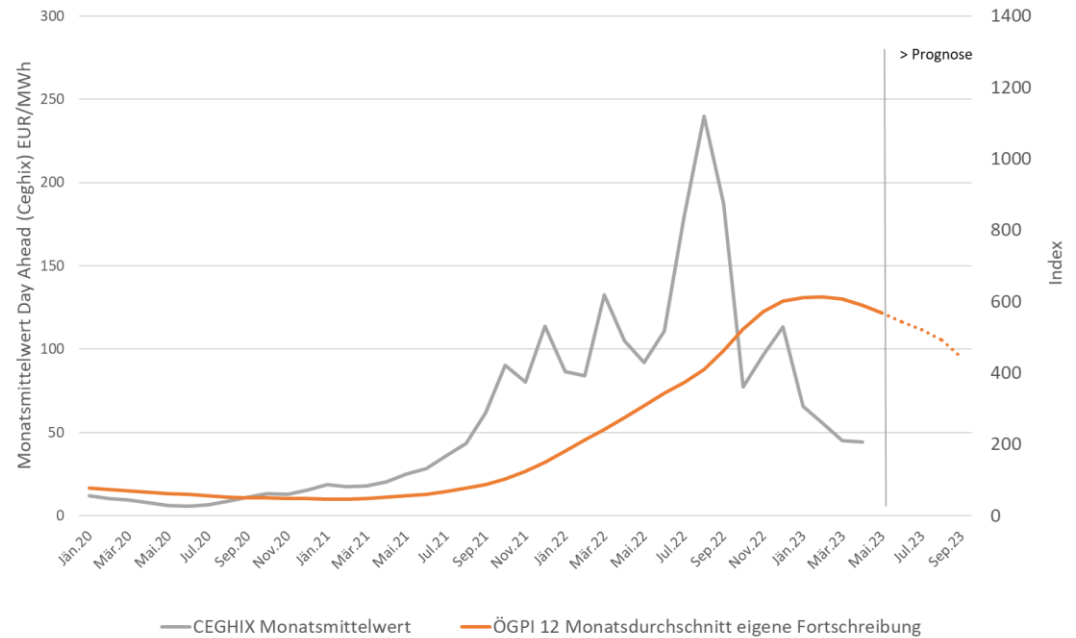
Price of Dutch T.T.F. natural gas, the European benchmark

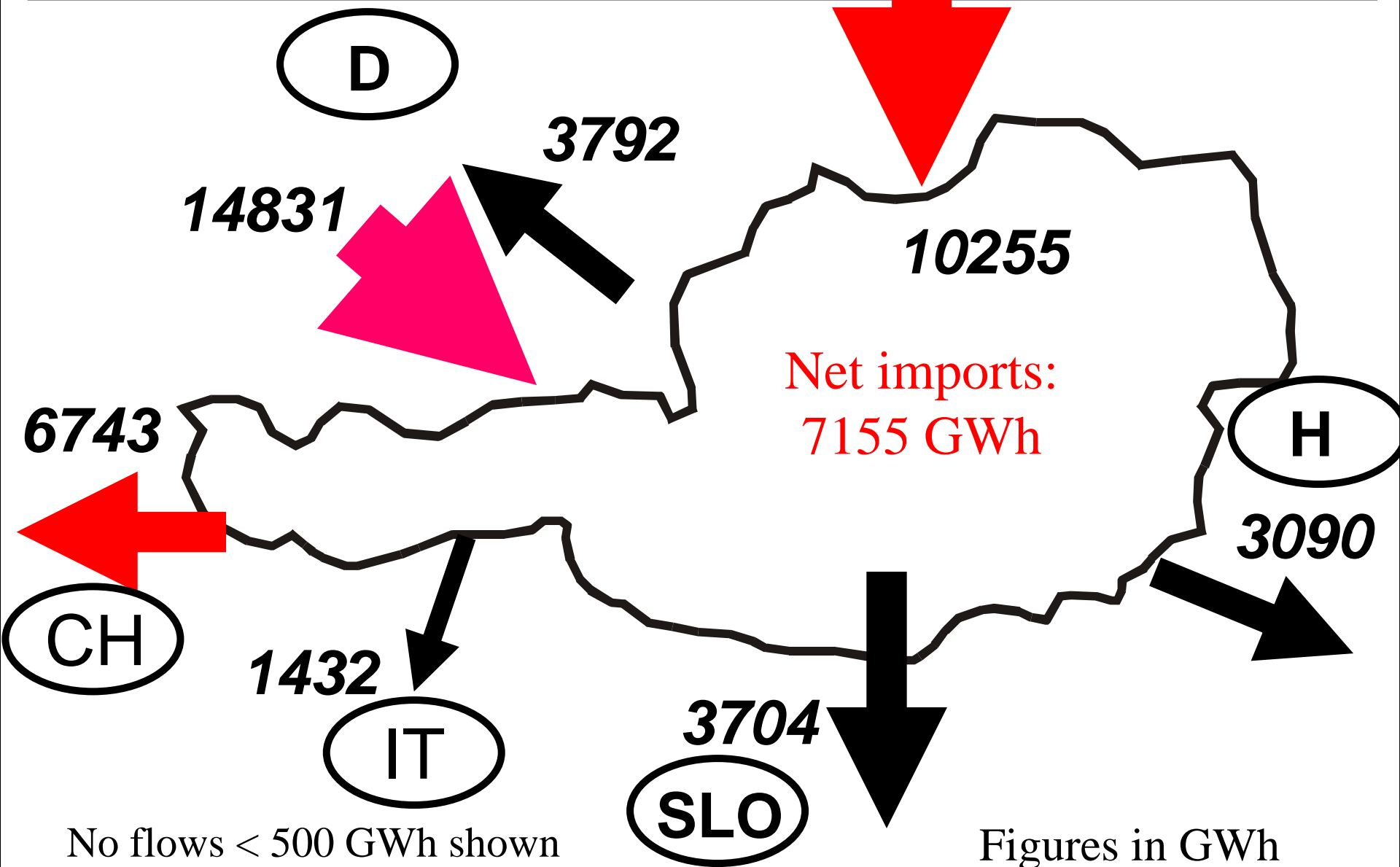
€350 per megawatt hour

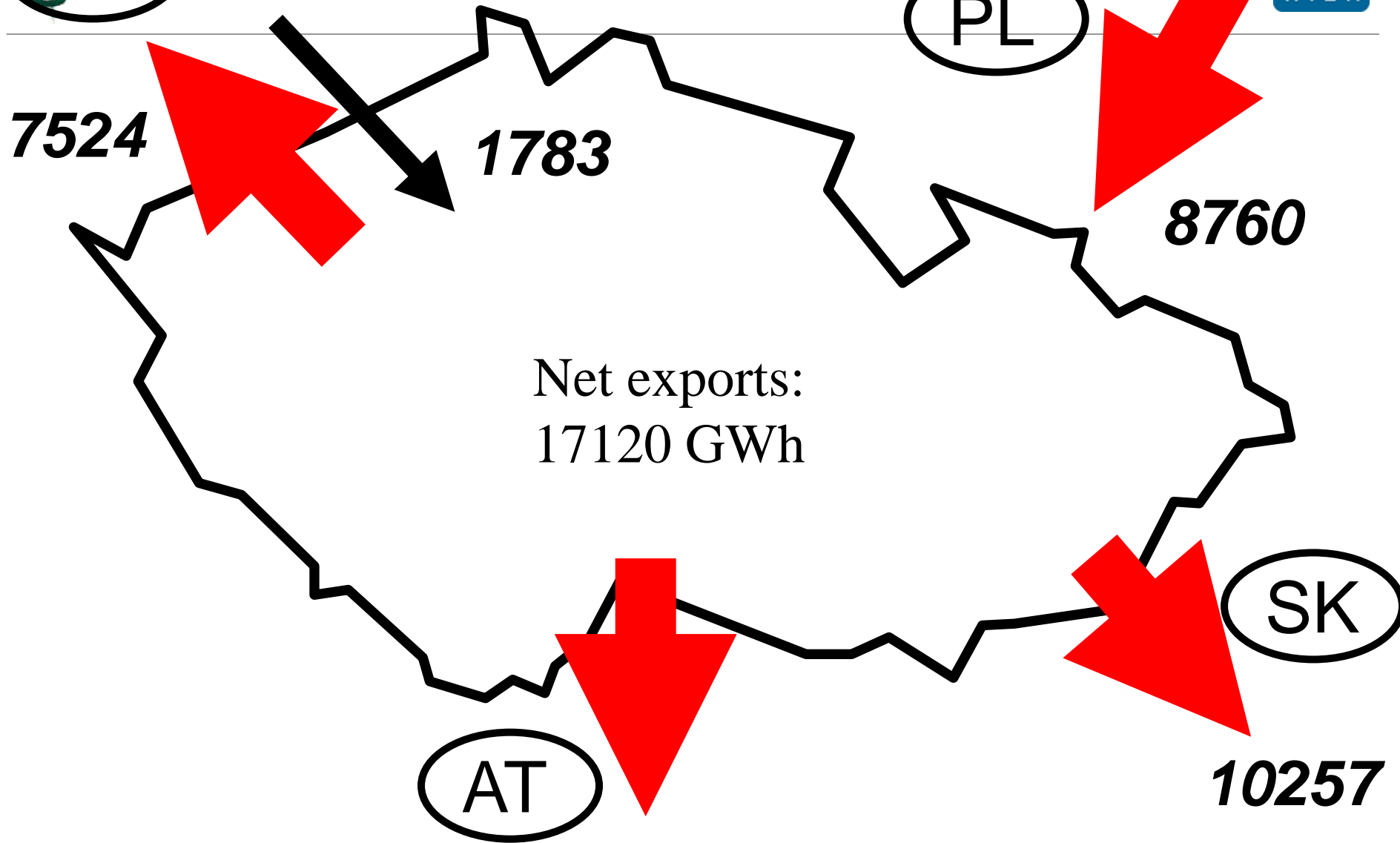


Source: FactSet • By The New York Times

Entwicklung Gaspreise Spotmarkt und langfristiger Gaspreisindex ÖGPI
Jänner 2020 bis März 2023 und Prognose ÖGPI bis August 2023



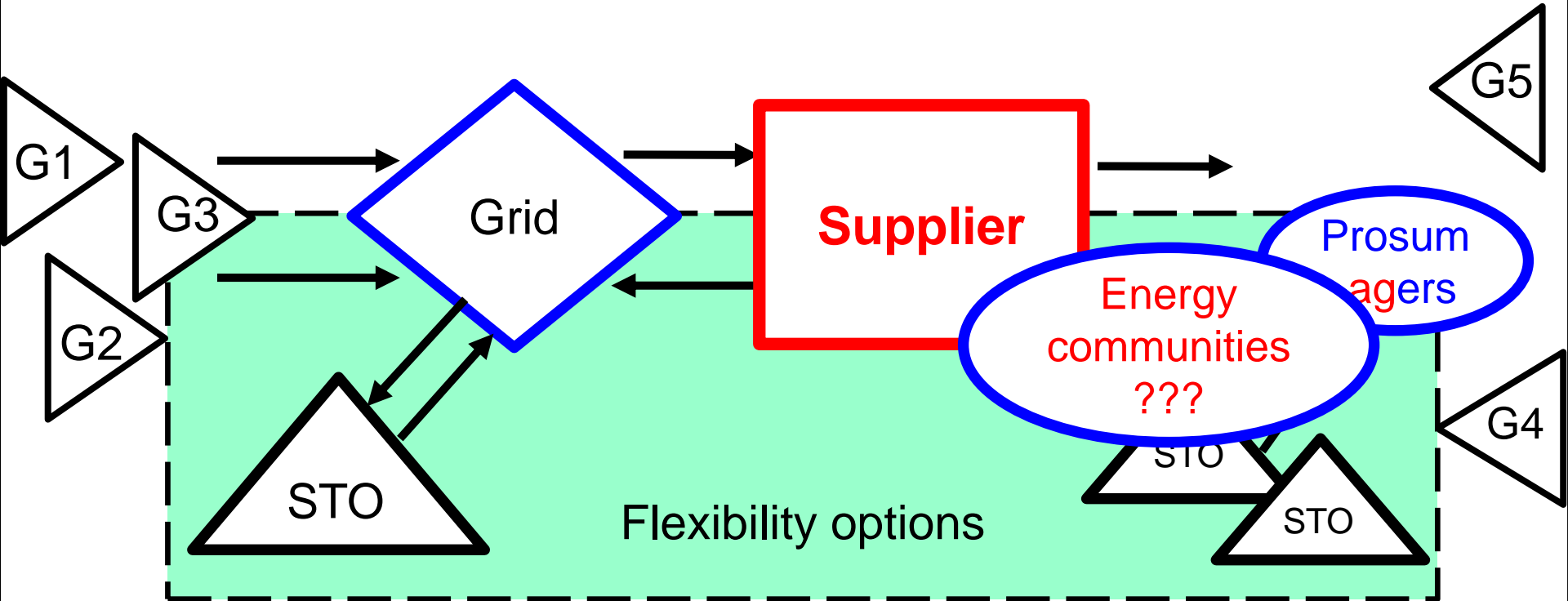




No flows < 500 GWh shown **9882**

Figures in GWh

New Thinking: Making the electricity system more democratic



- 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
- Important: correct price signals (incl. CO₂)
- Urgent: exhaust full creativity for flexibility of all market participants (Erdmann)
- Prospects for storage: less bright than argued
- Core relevance: A contract coordinating entity
- New key players: Suppliers / balancing groups