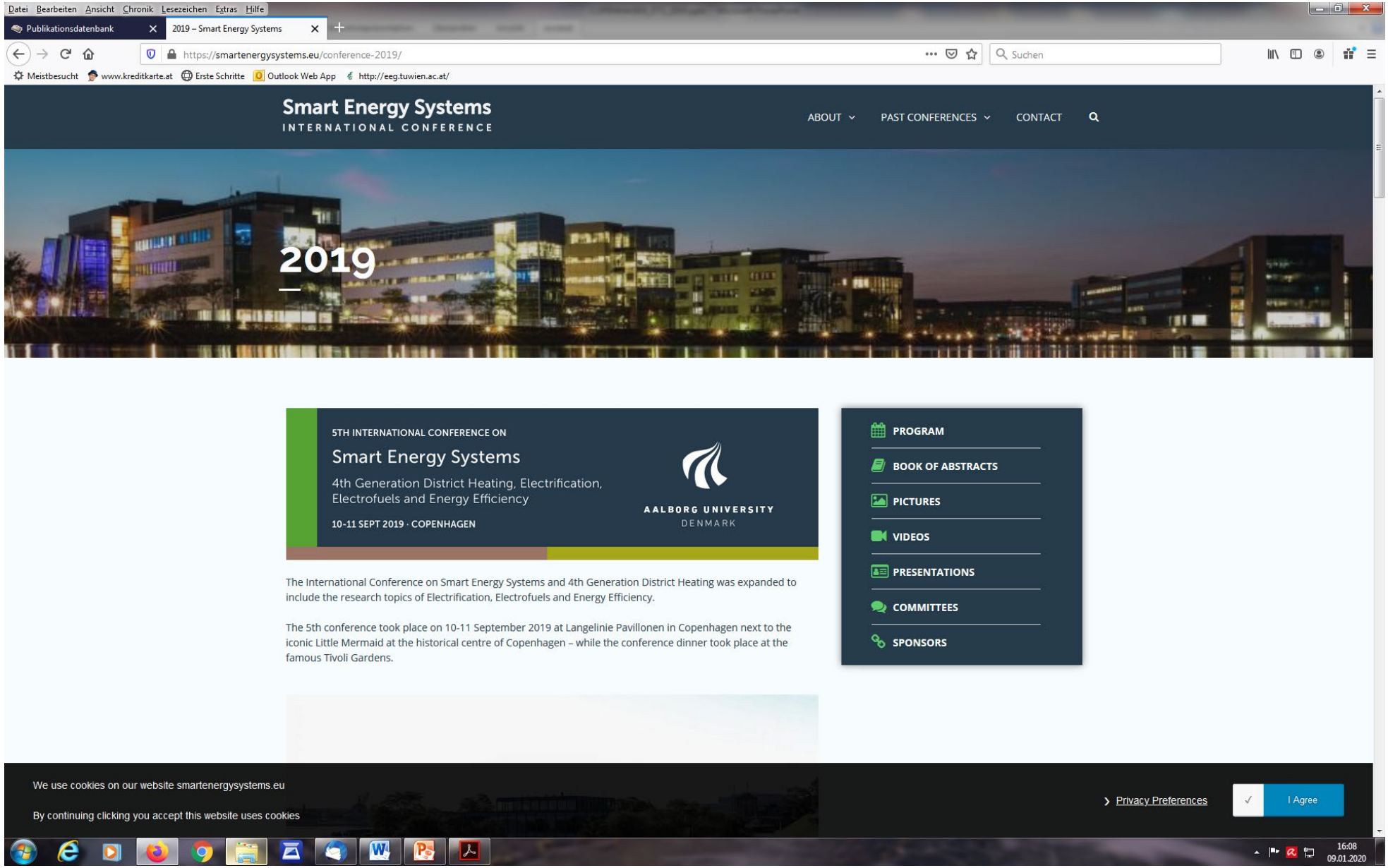
Datei Bearbeiten Ansicht Chronik Lesezeichen Extras Hilfe
Publikationsdatenbank
2019 – Smart Energy Systems
https://smartenergysystems.eu/conference-2019/
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www.kreditkarte.at
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2019
5TH INTERNATIONAL CONFERENCE ON
Smart Energy Systems
4th Generation District Heating, Electrification, Electrofuels and Energy Efficiency
10-11 SEPT 2019 · COPENHAGEN
AALBORG UNIVERSITY
DENMARK
PROGRAM
BOOK OF ABSTRACTS
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The International Conference on Smart Energy Systems and 4th Generation District Heating was expanded to include the research topics of Electrification, Electrofuels and Energy Efficiency.
The 5th conference took place on 10-11 September 2019 at Langelinie Pavillonen in Copenhagen next to the iconic Little Mermaid at the historical centre of Copenhagen – while the conference dinner took place at the famous Tivoli Gardens.
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ON THE ROLE OF ELECTRICITY STORAGE IN SMART ENERGY SYSTEMS

Reinhard HAAS,

Energy Economics Group,

TU Wien

Copenhagen, September 2019

CONTENT:

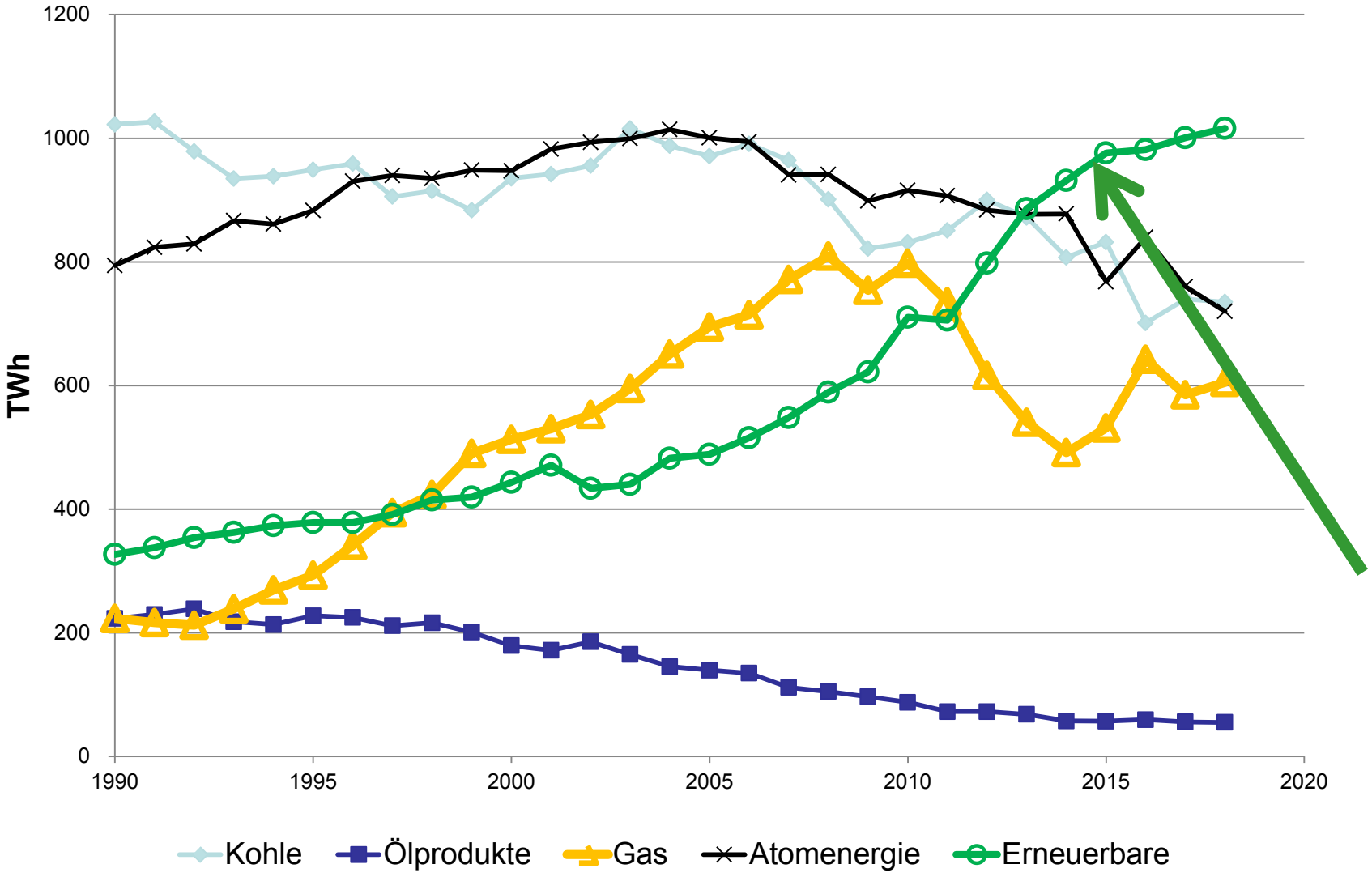
1. Introduction: Motivation
2. How variable renewables impact the electricity system
4. Storing every peak?
3. The costs of storage
5. The role of flexibility
6. Conclusions

1. INTRODUCTION

Motivation:

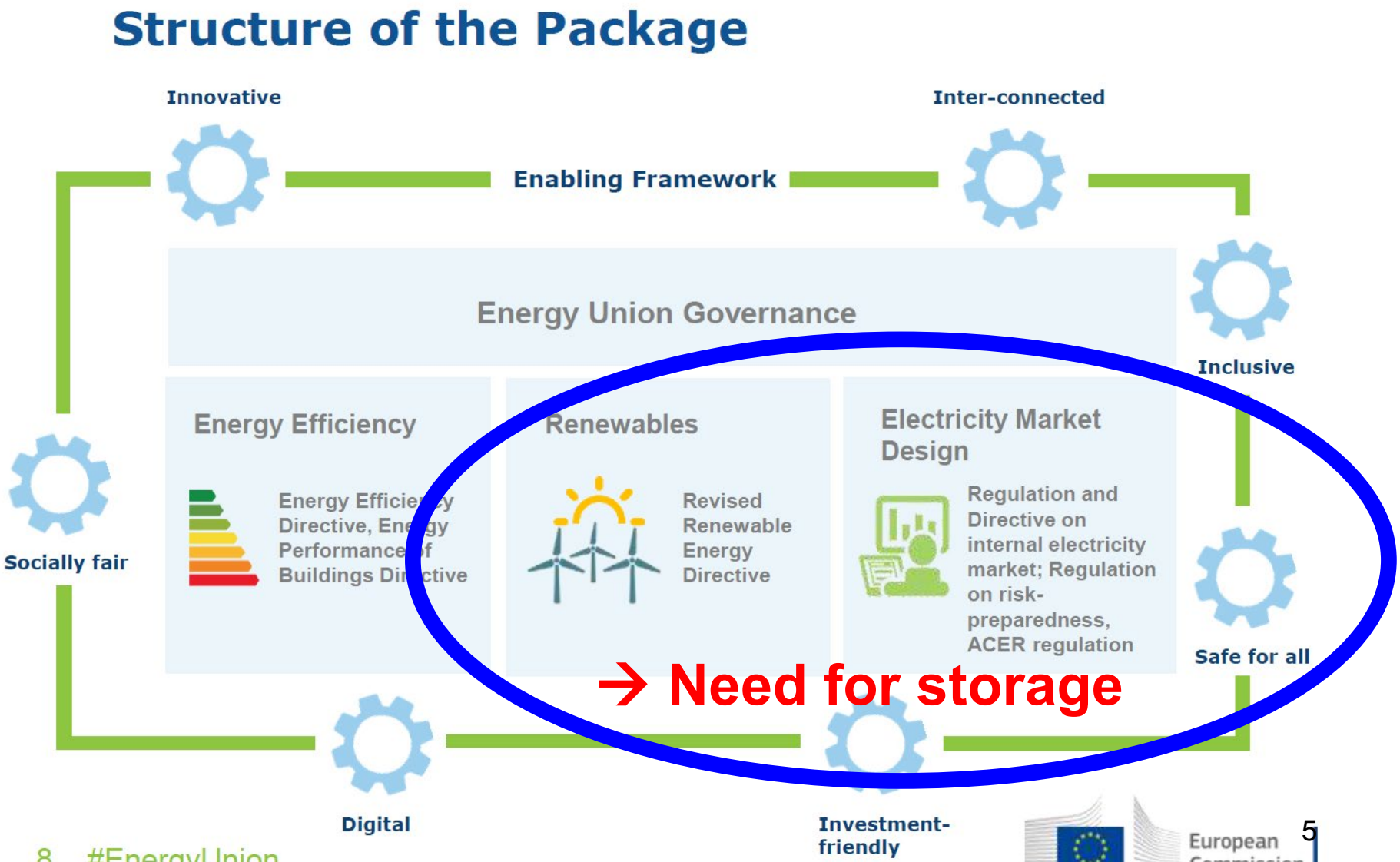
* Climate change → Paris agreements
* Targets for renewables → Need for storage
* Europe: The clean energy package → energy communities → Need for storage
* Not possible to force variable renewables into the system → Need for storage
* Strong desire of some customers to participate in electricity supply

Electricity generation EU-28



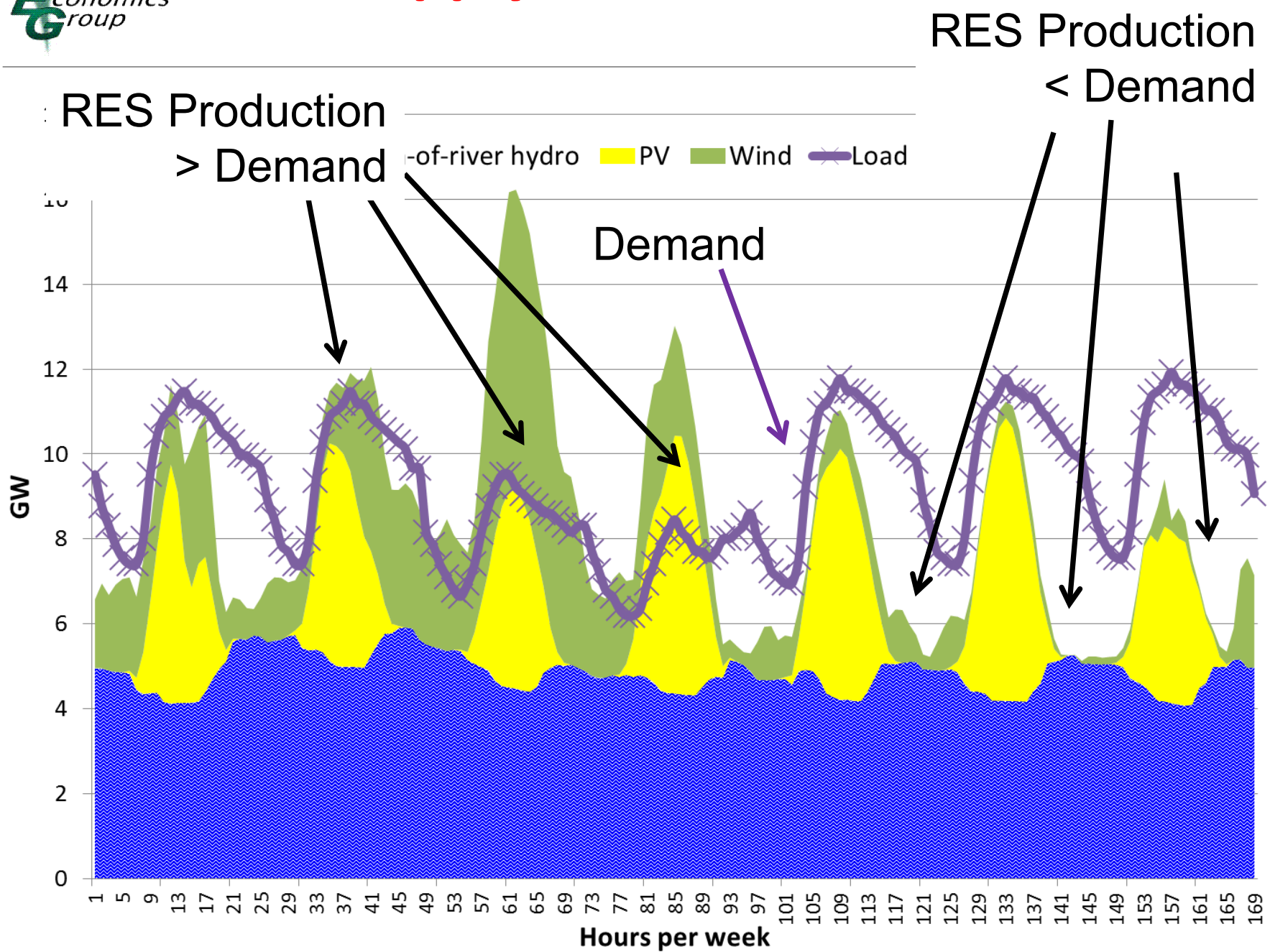
Werte für 2017 und 2018 vorläufig

The clean energy package of the EU

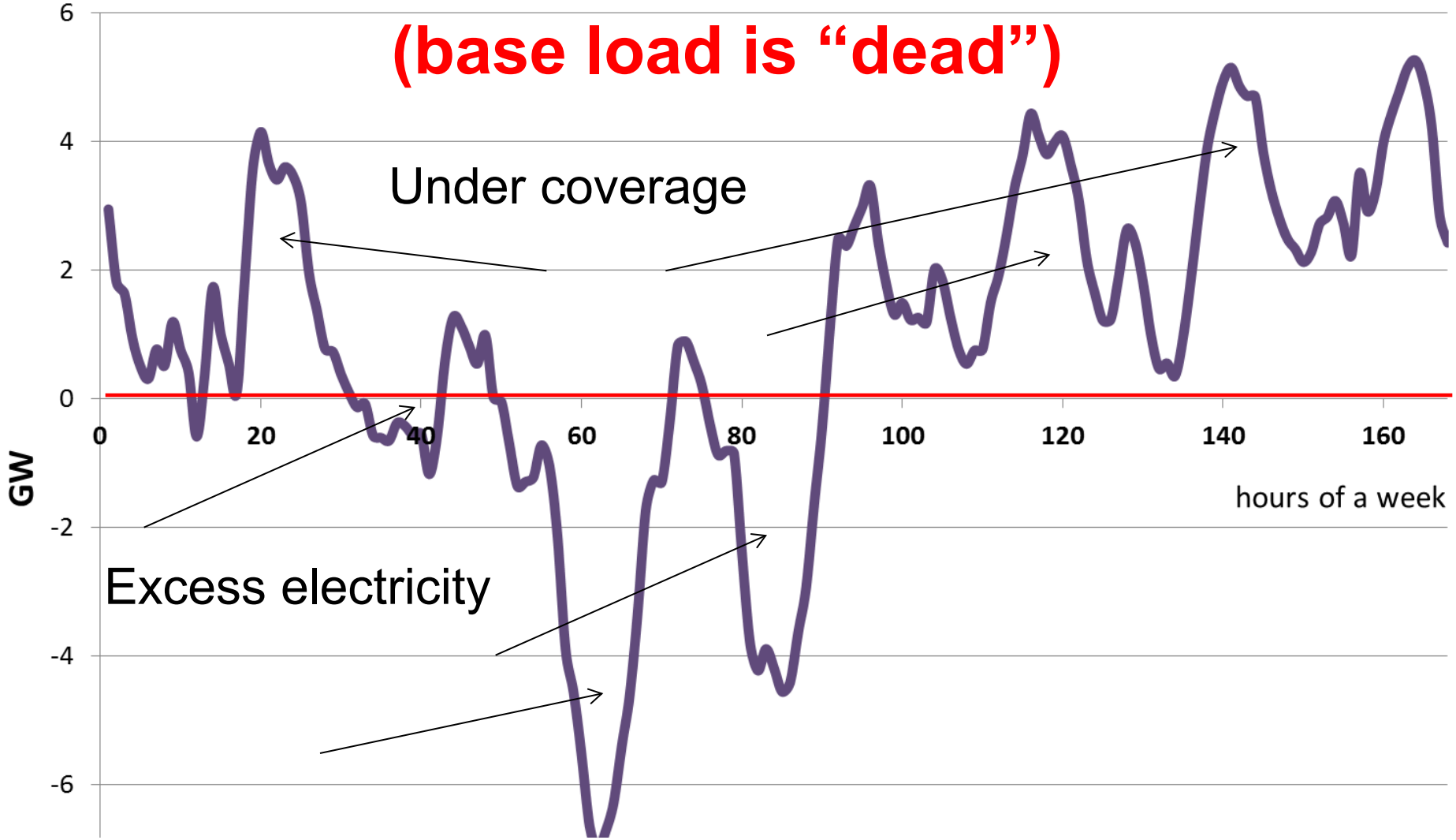


2 HOW VARIABLE RENEWABLES IMPACT THE ELECTRICITY SYSTEM

Supply and Demand

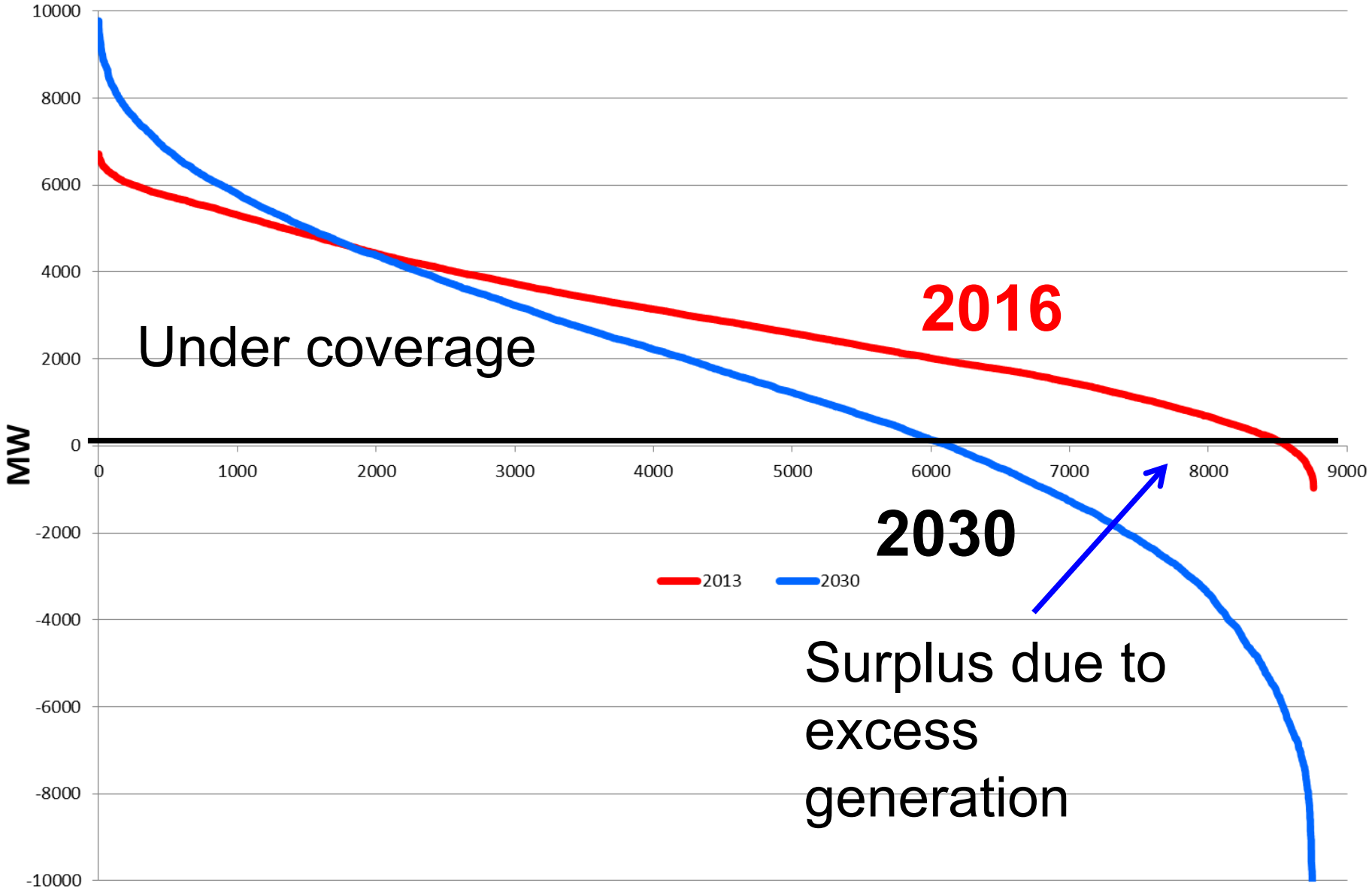


Key term of the future: Residual load (base load is “dead”)

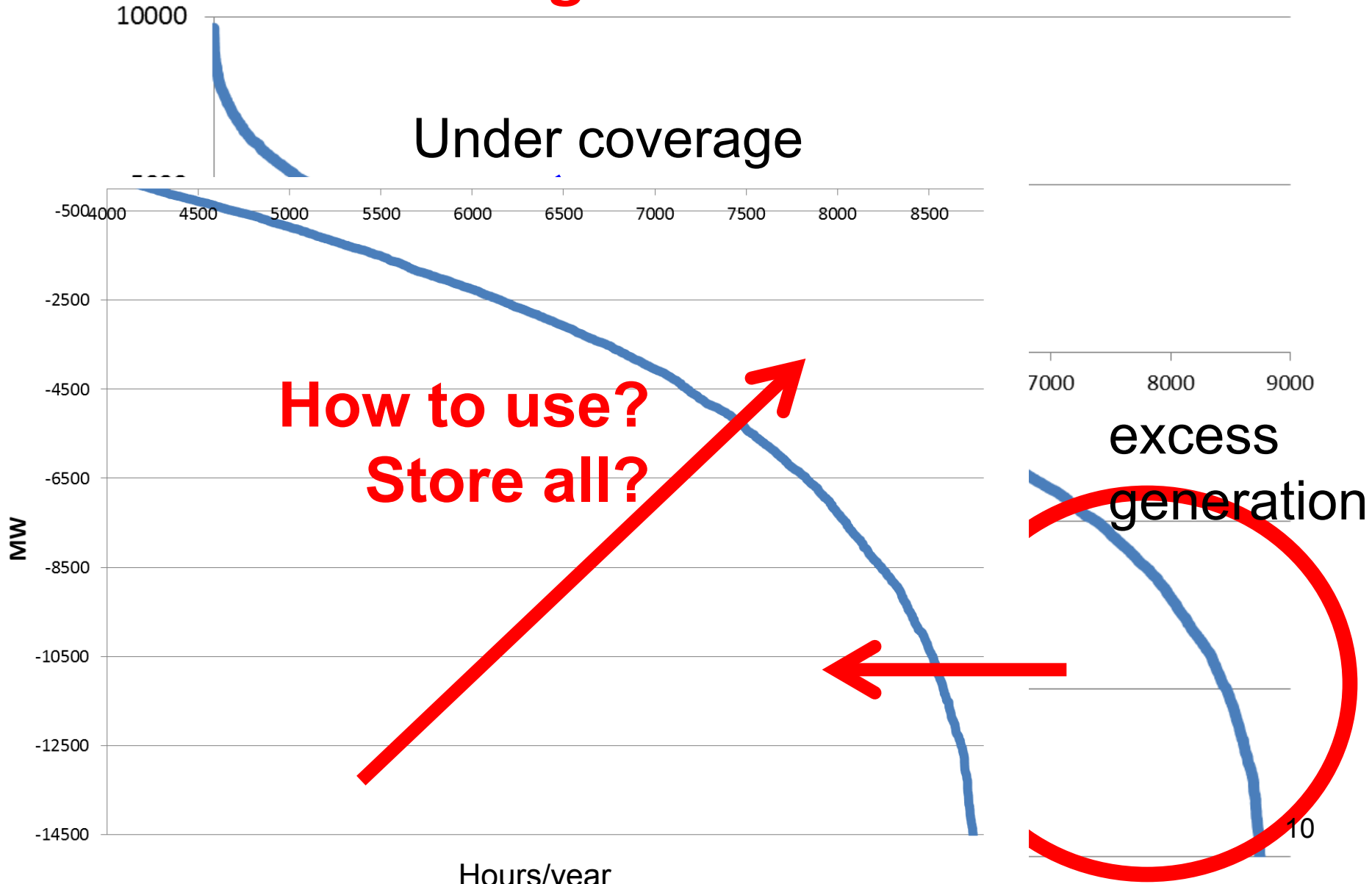


Residual load = Load – non-flexible generation

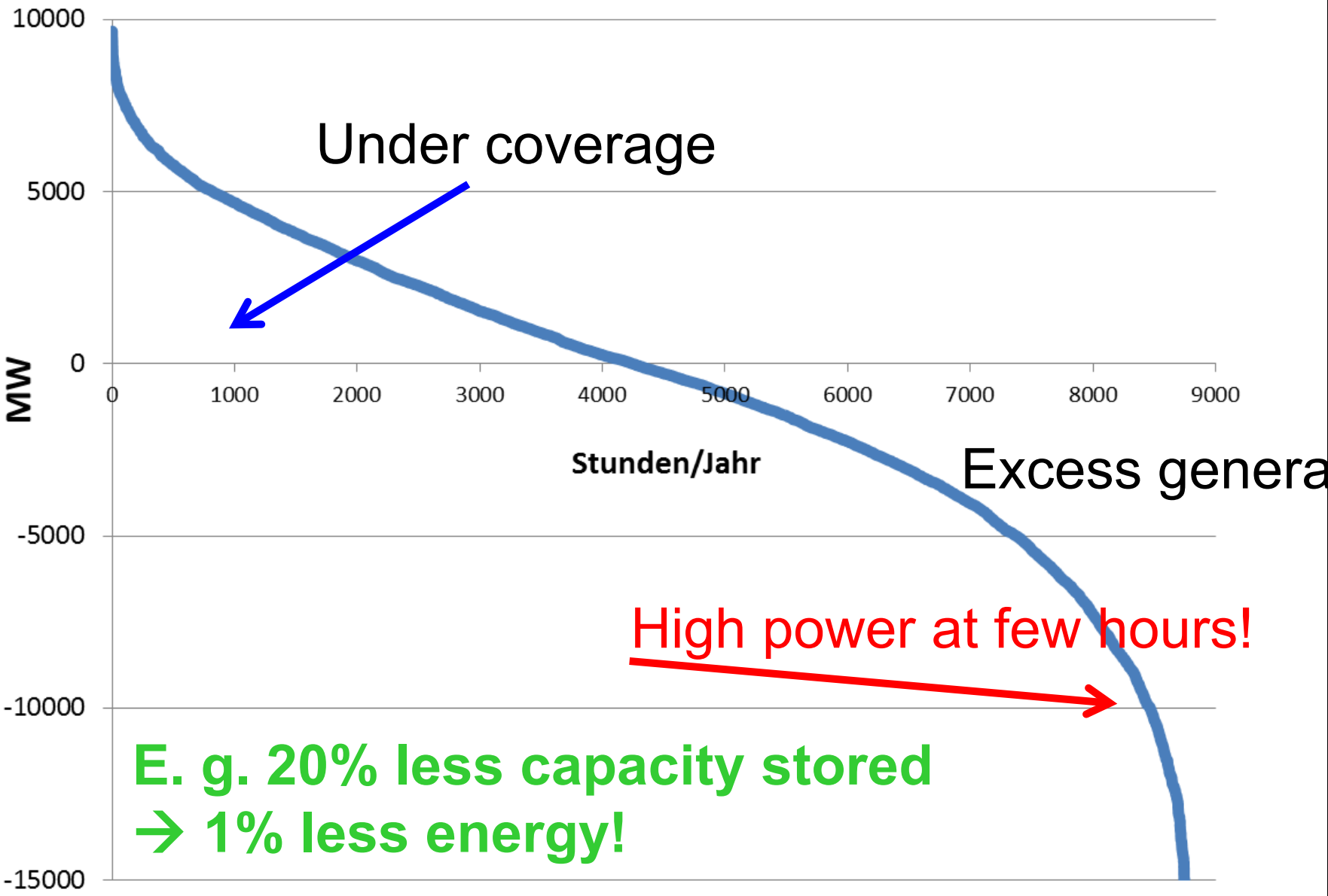
Classified residual load over a year



3. Specific question: How much storage do we need?



Storing every peak?



4. 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

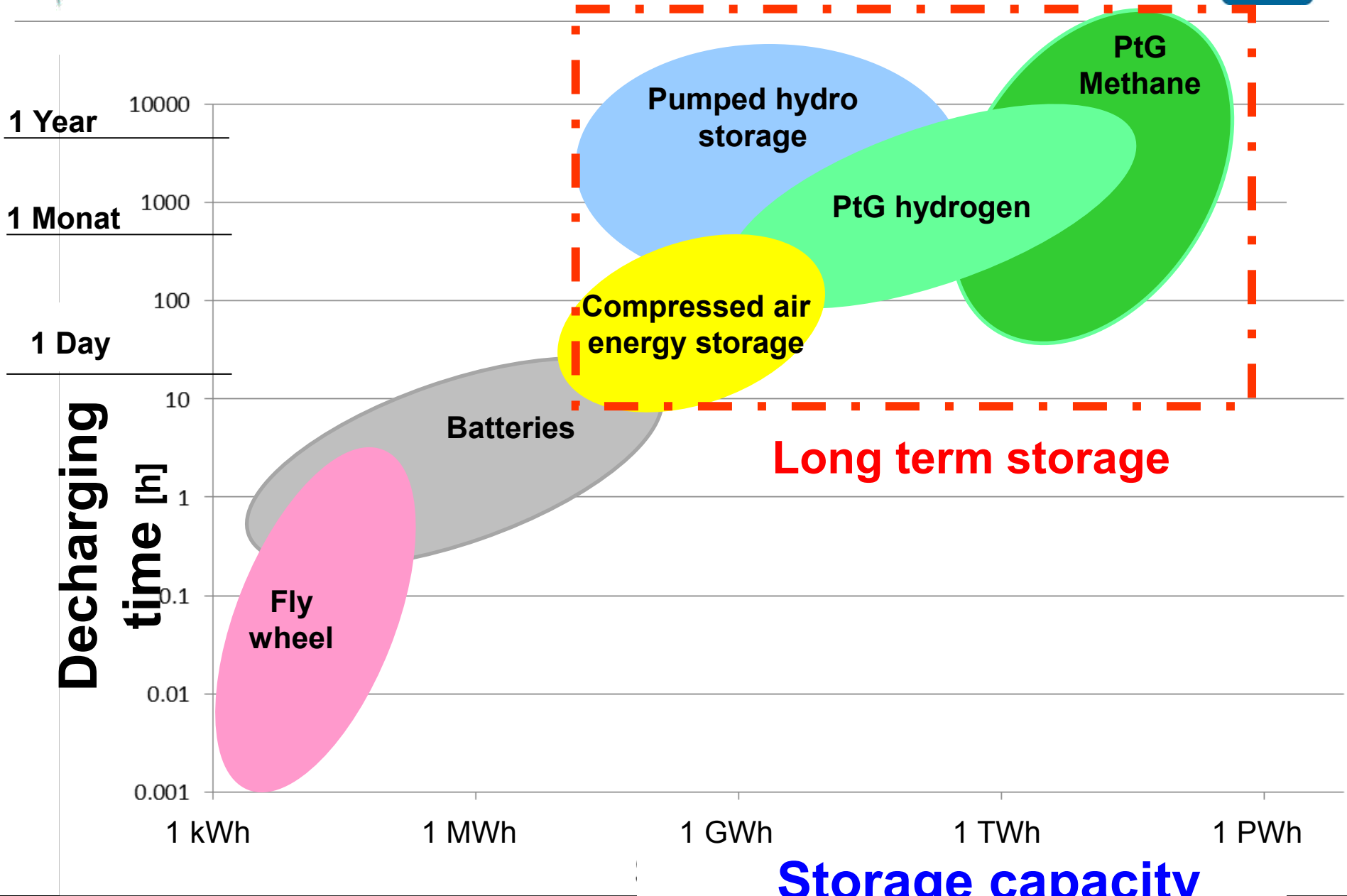
T … Fullloadhours (hours per year)

η_{SP} … Efficiency of storage

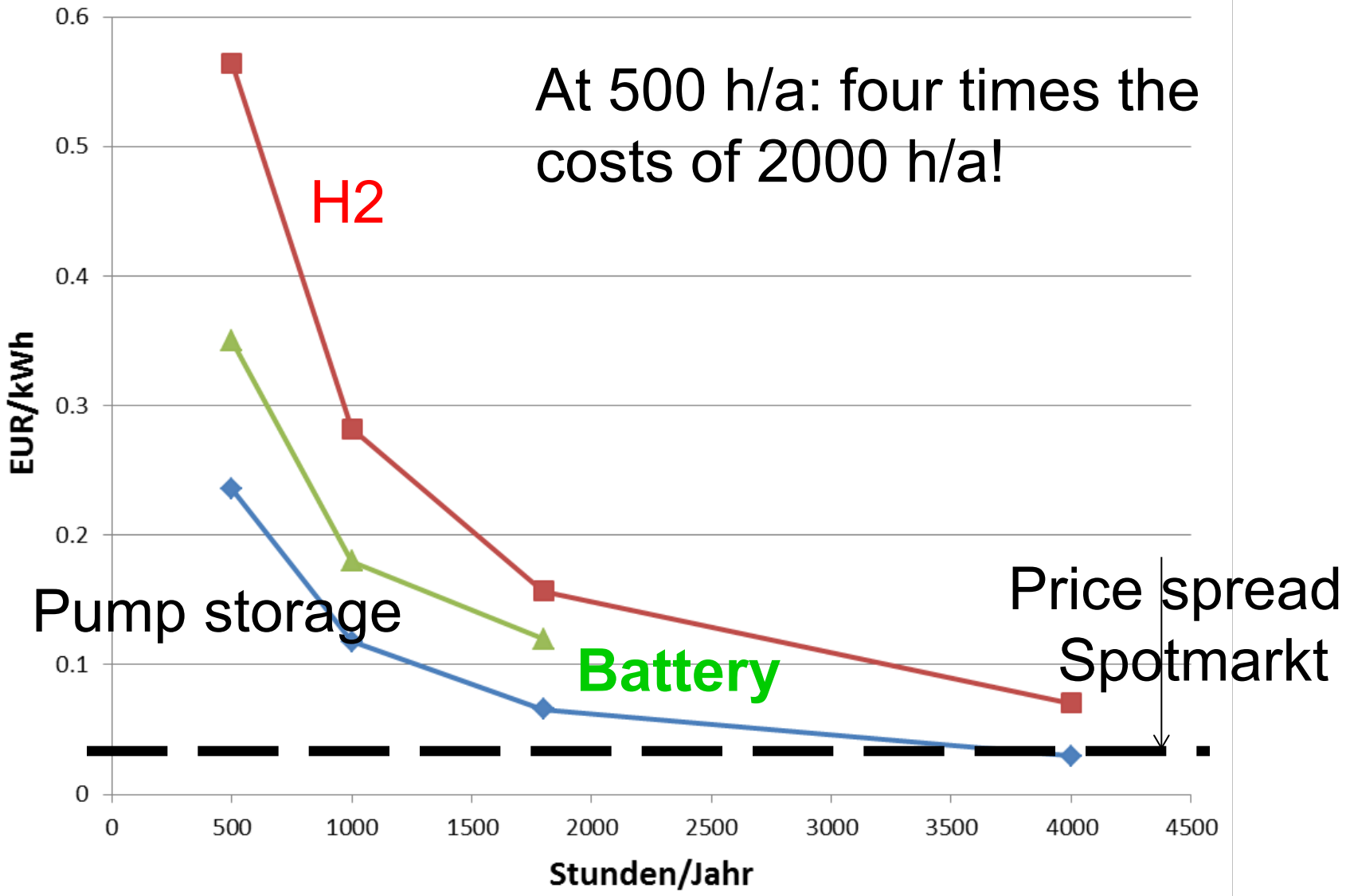
Key factors:

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

Short term vs Long term storage



Impact of fullloadhours

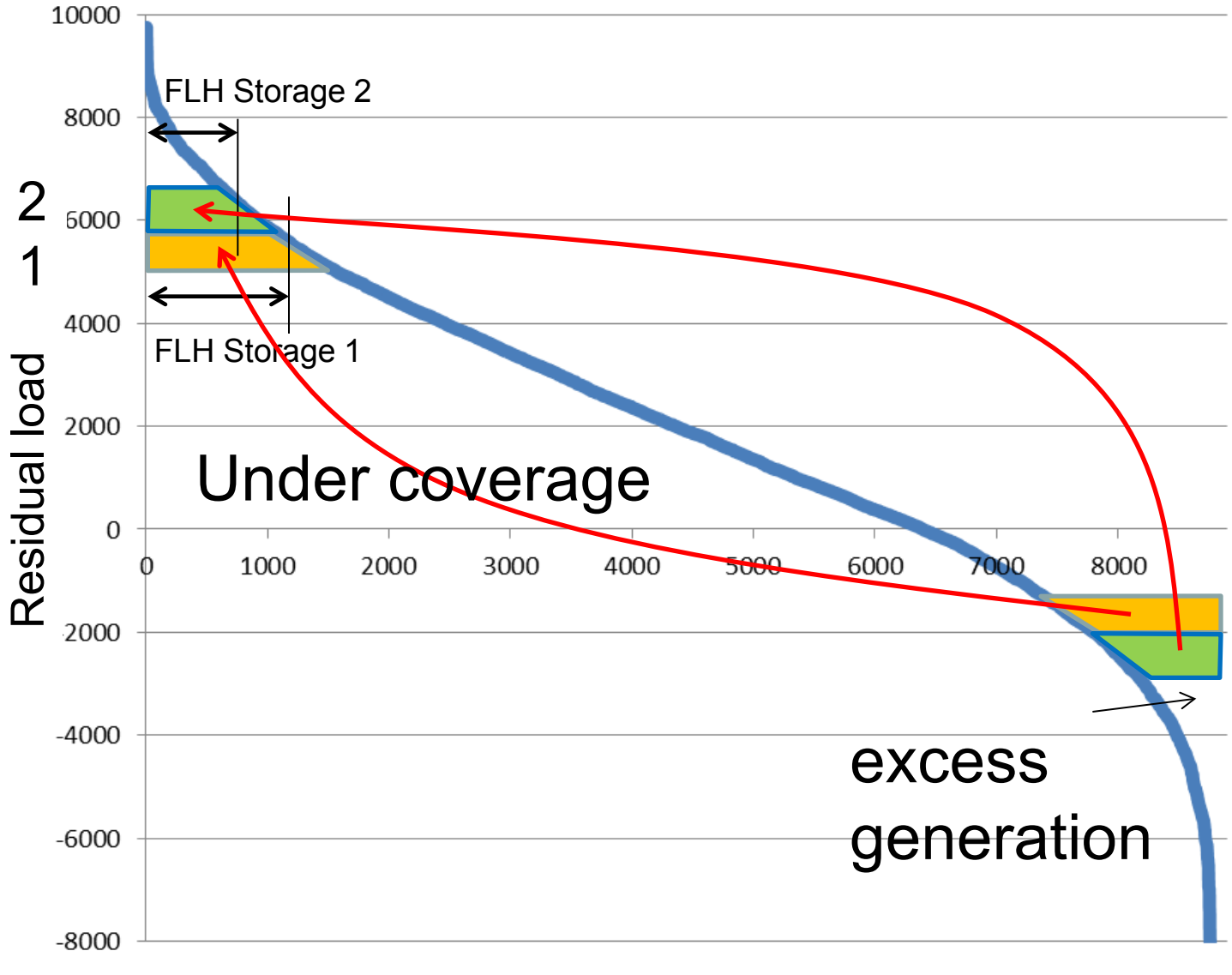


PRINCIPLE OF SELF CANNIBALISM IN ENERGY ECONOMICS:

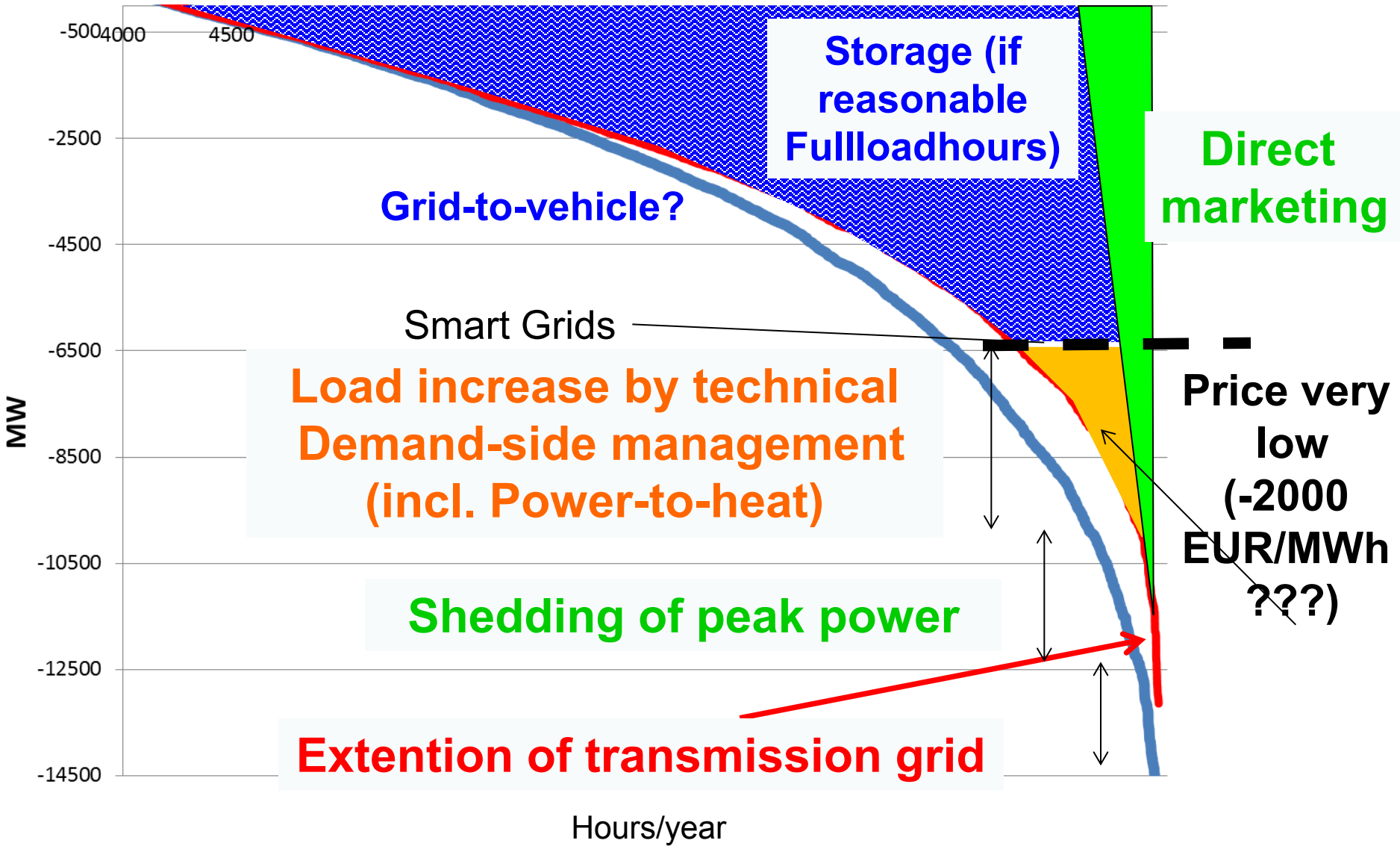
Example storage:
Every additional storage unit makes this one and every other less cost-effective!

Decreasing full-load hours of storages

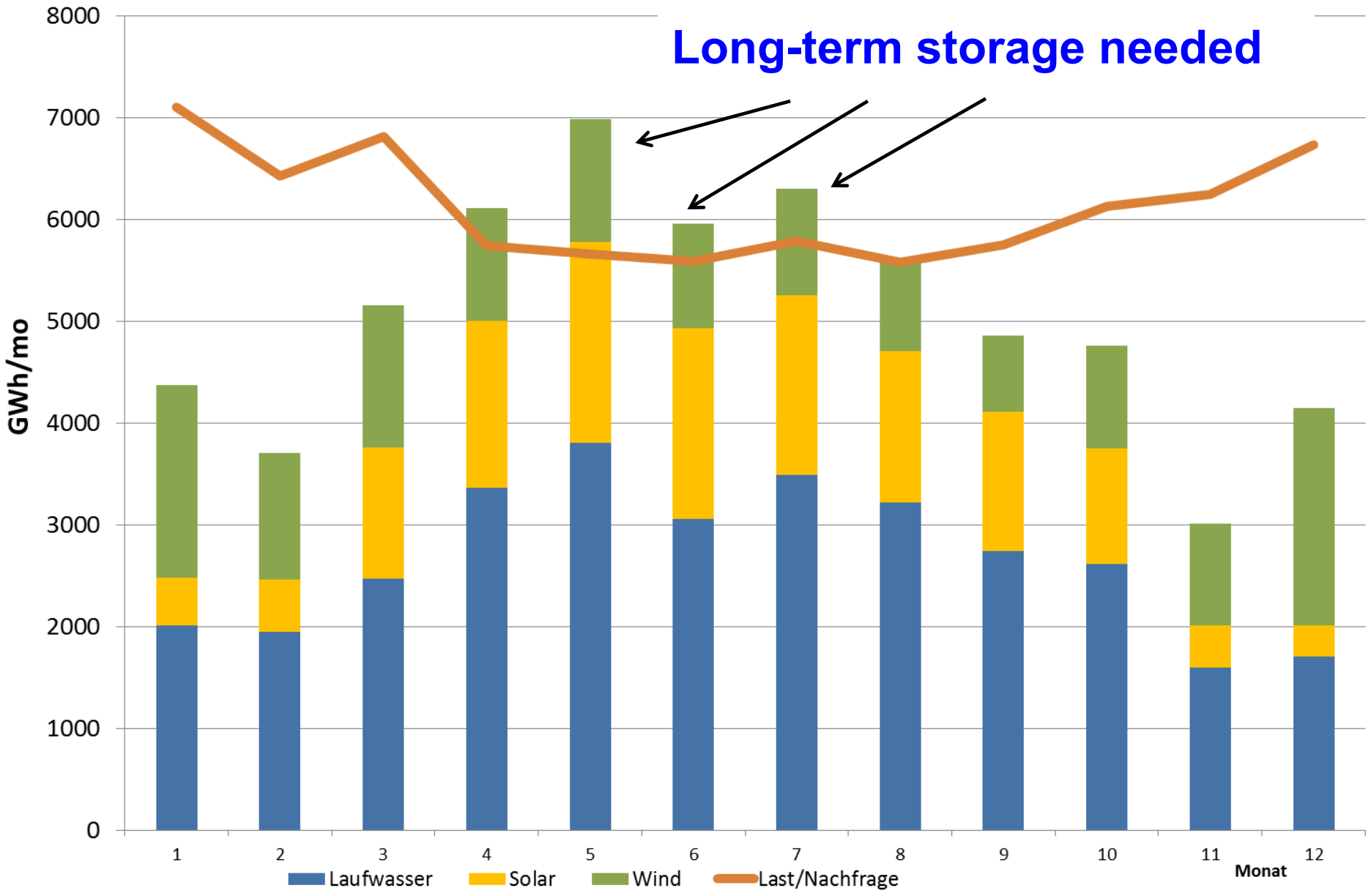
Storage 2
Storage 1



5. Flexibility



Demand for long-term storage



Sector coupling / Sector integration

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

Heating/Cooling

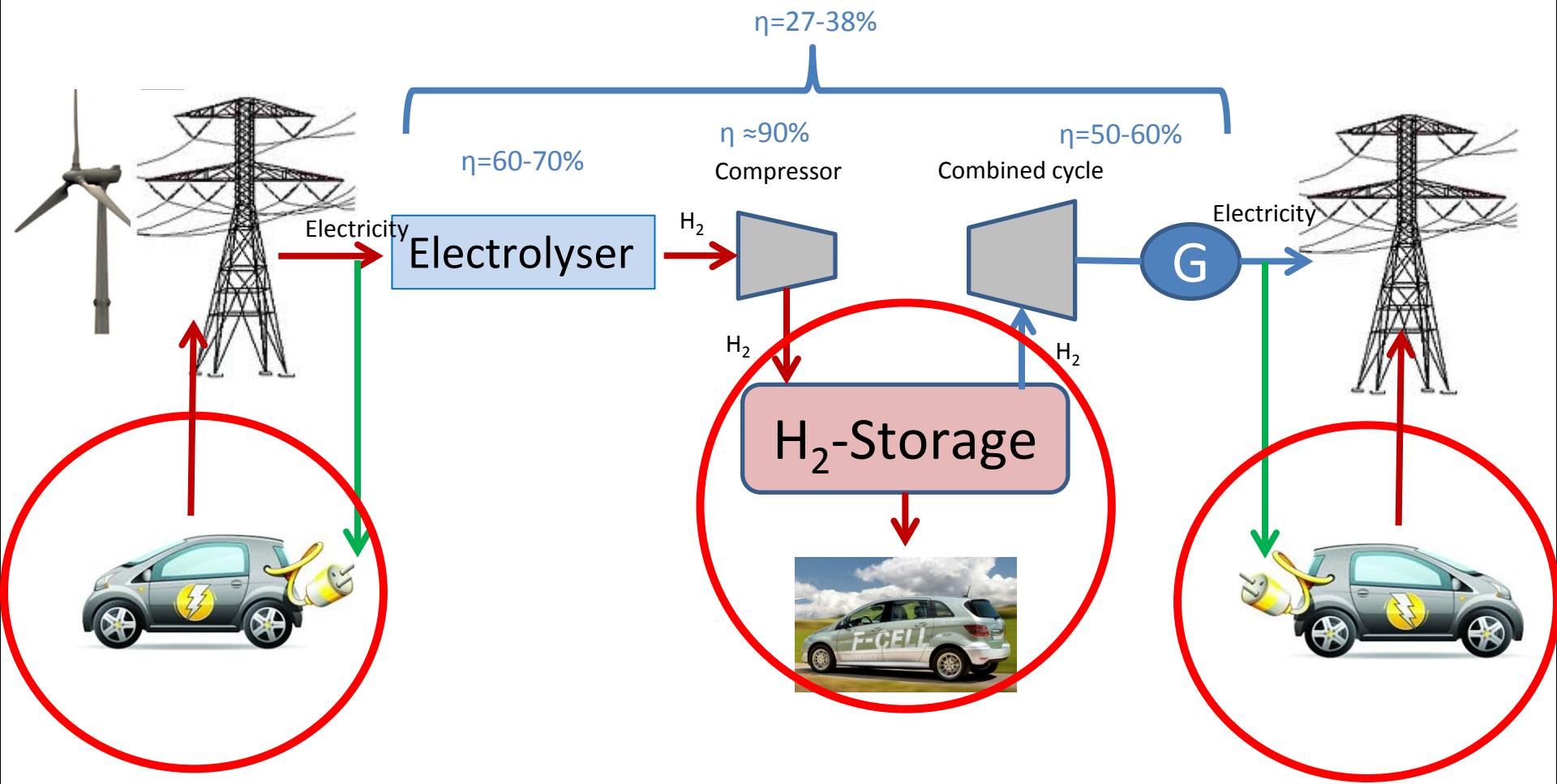
Transport

* Simplified suggestions, no convincing long-term solutions

* Central (Ptx approaches, e.g. H2, use electricity in public transport) 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 EVs ?

Sector coupling electricity vs hydrogen:



Including vehicle-to-grid!

6. CONCLUSIONS

- Increasing electricity generation from variable RES → need for new long-term storage options
- Economic problem of all storage options: low full-load hours
- Decentralized batteries: major benefit relieve of the distrib grid
- PtG as electricity storage: low round trip efficiency
- Stated storage needs do not comply with economics
- In transport: need for environmentally friendly technologies → Zero-emission vehicles