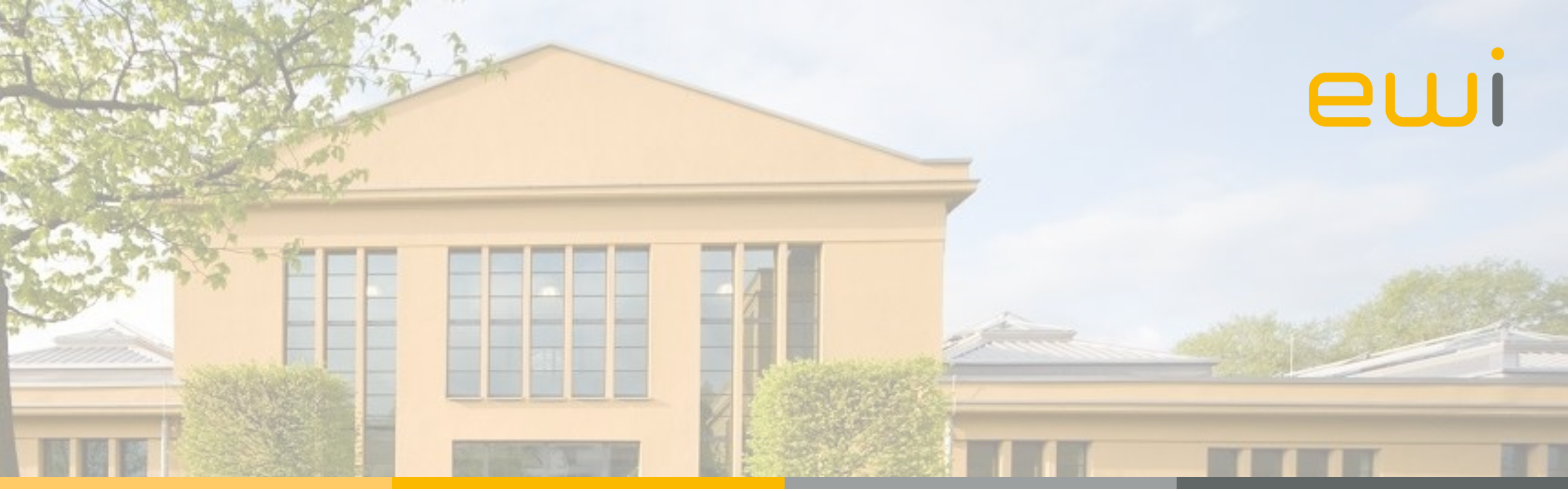


# Security of supply in Germany

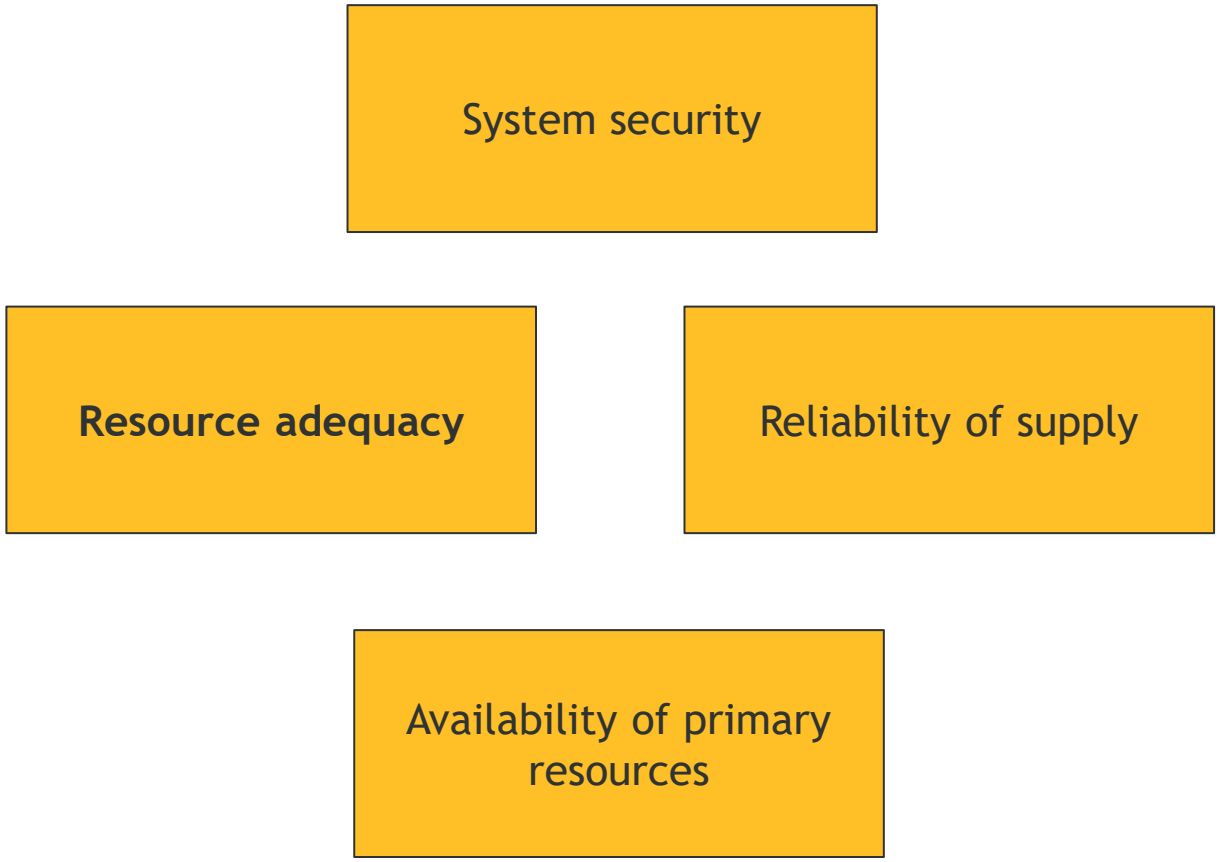
## Seasonal variability and transformation challenges

Philip Schnaars

Energiewirtschaftliches Institut an der Universität zu Köln (EWI) gGmbH | Paris, 07.10.2022

# Security of supply in this presentation

**The dimensions of security of supply**



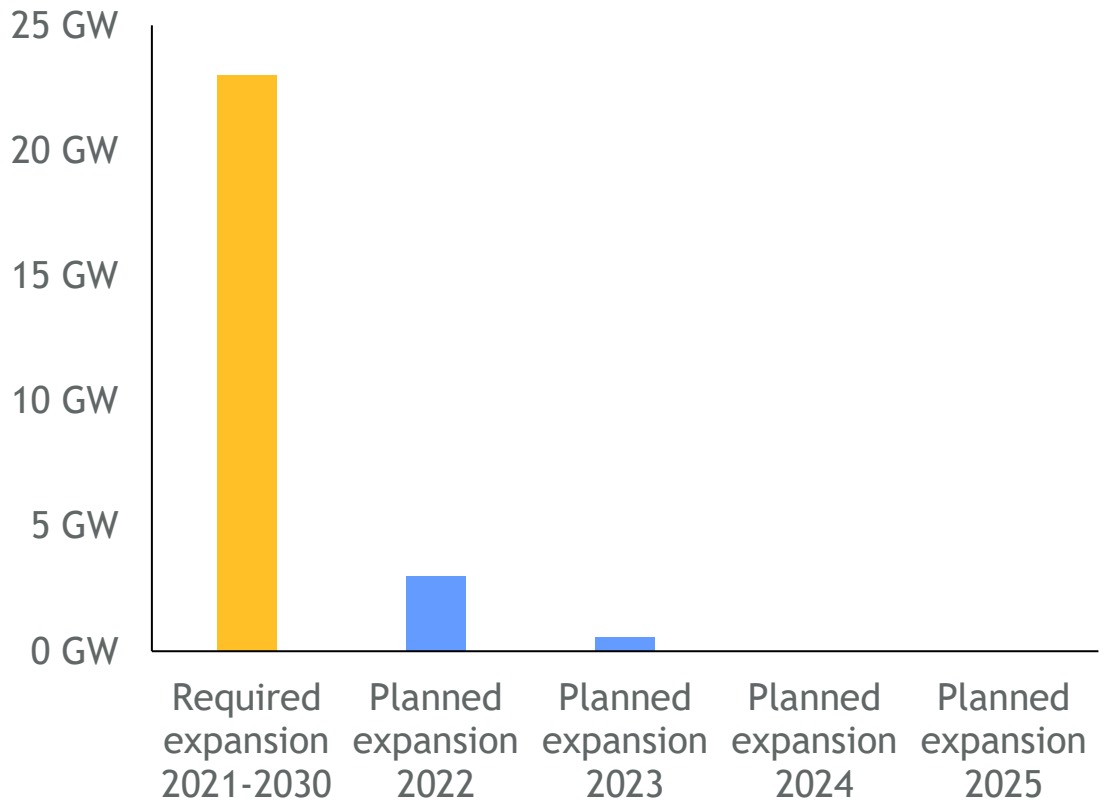

- Security of supply has four different aspects:

- **System security**: Is the system stable?
- **Reliability of supply**: Is the consumer always connected to a grid?
- **Resource adequacy**: Is sufficient generation capacity available to cover demand during all times?
- **Primary resources**: Are enough primary resources for electricity generation available?

- We study the **adequacy of resources** to cover electricity demand in Germany during historical extreme weather situations.

# Realized investment keeps lagging the simulated required level

**Required capacity expansion and registered installation**

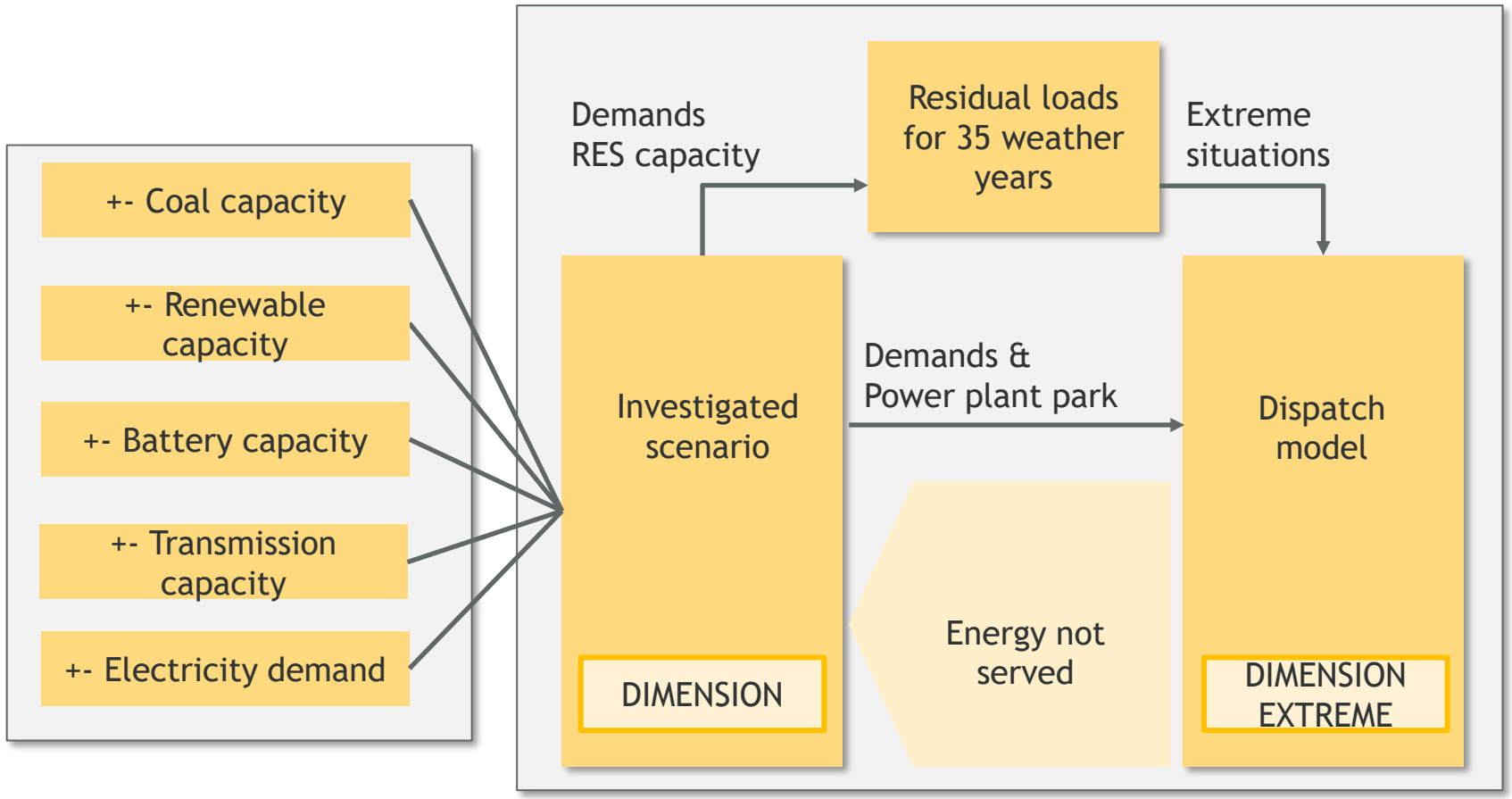



- Around 3.5 GW gas-fired capacity additions are currently expected in the next years.
- Construction times are around 4 – 6 years, using hydrogen often requires additional investment.
- Currently not clear, why **capacity additions keep lagging** the required level.
- New investment in (H2-ready) gas-fired power plants faces **uncertain refinancing possibilities**.
- While it is possible that investment in capacity picks up after 2025, it is currently not clear of **required capacity expansion** can be met.

# Methodology: The analysis consists of two steps

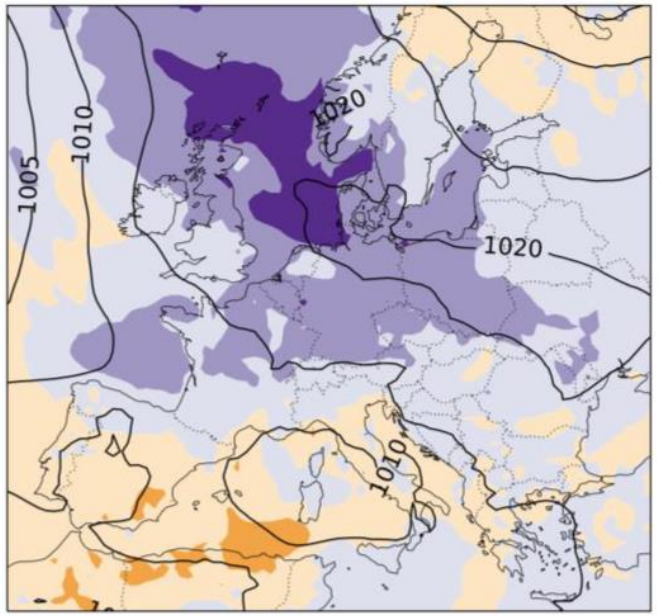
- Investigate **different power systems** with scenario analysis, allowing for systematic variation of key factors.
- Different **residual loads** are calculated using historic weather data over changing durations.
- A **dispatch model** determines **resource adequacy** in these extreme weather situations.

Schematic representation of modeling workflow



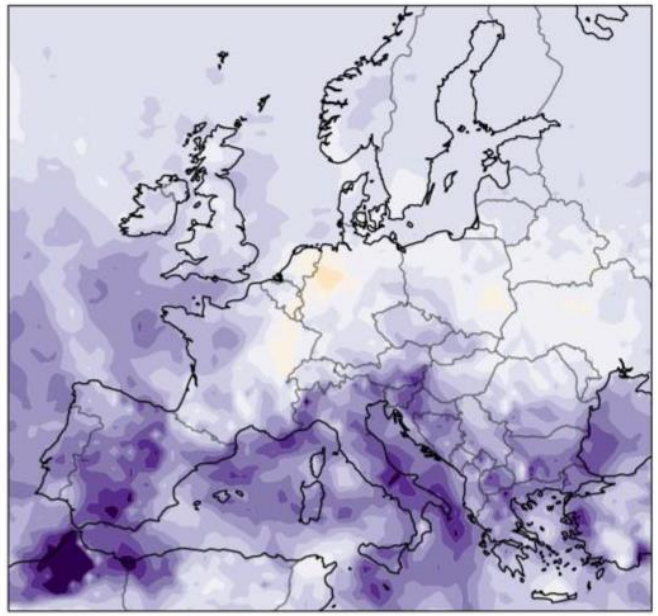
# Step 2: Meteorology of an extreme weather situation

## Wind speeds and solar irradiance in January 1997 compared to long term average*




Delta wind speeds [m/s]

−9 −6 −3 0 3 6 9



Delta solar irradiance [W/m²]

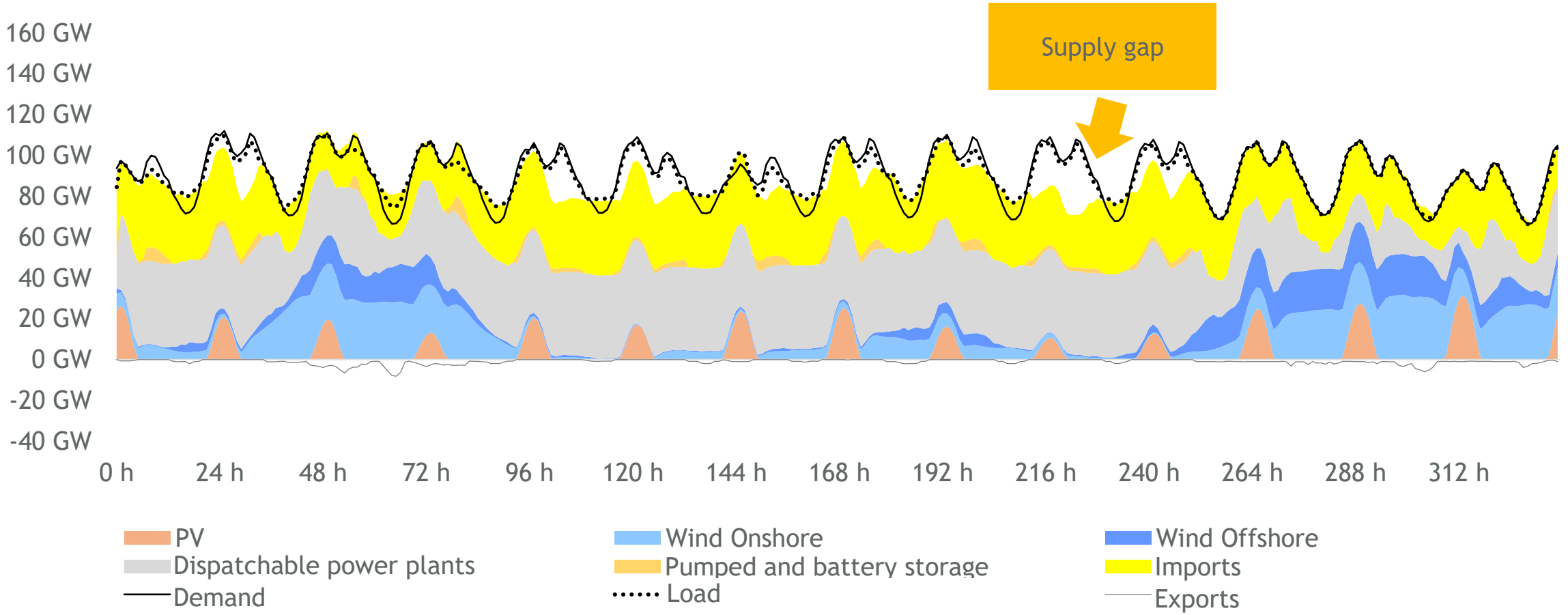
−40 −30 −20 −10 0 10 20 30

- These conditions lasted for **one week** during **January 1997**.
- Potential for electricity generation from **wind below average** in Northern Europe.
- Availability of **solar energy significantly below average** in almost all of Europe.
- Affects **many European countries** simultaneously, decreasing the import potential for Germany.
- Overall, **high residual loads** that need to be covered by dispatchable generation and demand flexibility.

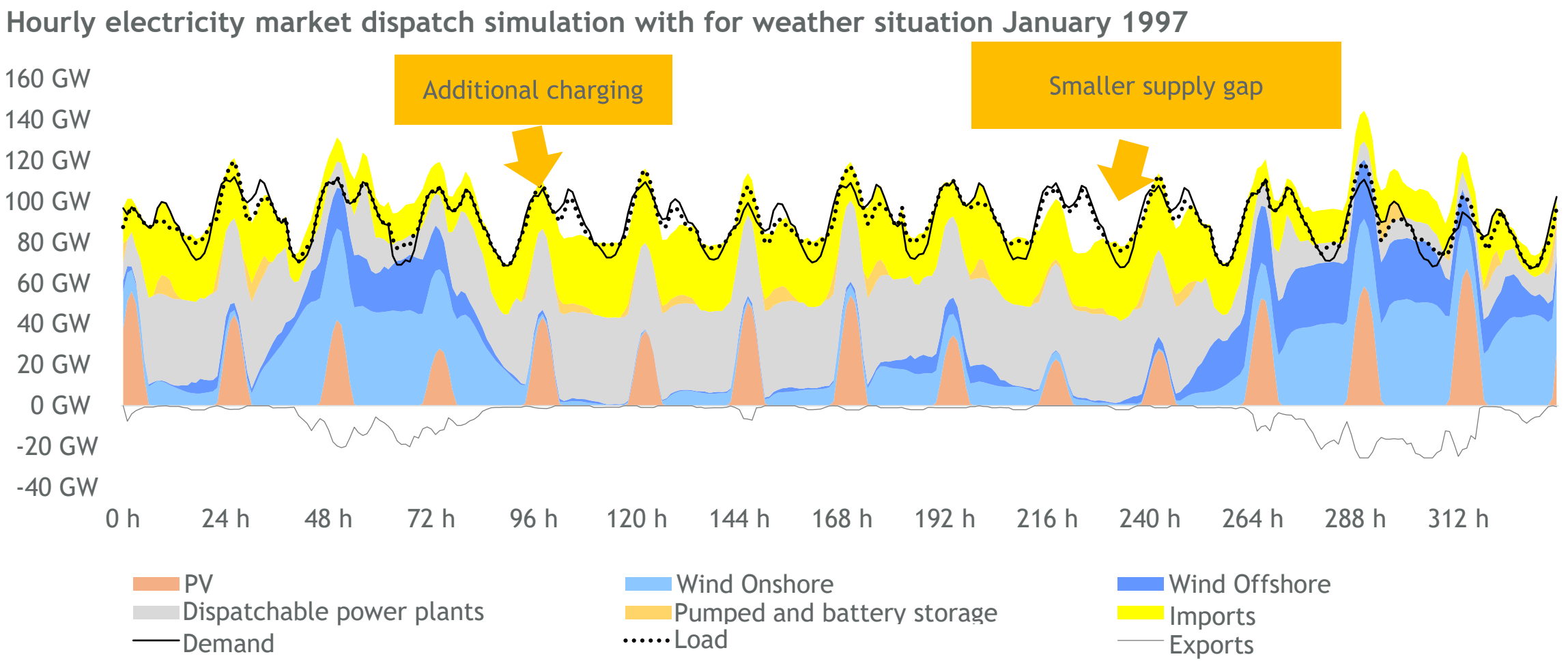
*) Analysis and graphs by Linh Ho and Prof. Dr. Stephanie Fiedler

# Coal phaseout, no additional thermal capacity in 2030 and low renewable capacity

## Hourly electricity market dispatch simulation with for weather situation January 1997



# Coal phaseout, no additional thermal capacity in 2030 and high renewable capacity



# Outlook, Challenges and Research Agenda

- The present study investigates the resource adequacy to cover electricity demand in Germany during extreme weather situations.
- The **security of supply** over the course of this decade is **not guaranteed** over all considered scenarios.
- Multiple options exist to address a potential supply gap, among which:
  - Additional (battery) storage
  - Increase flexibility of demand
  - Extend options to trade electricity
  - Additional H2-ready gas-fired power plants
- Open regulatory question: **How to create proper incentives for new investment?**

- Areas for further research include:
  - Include **availability of water** for hydro and pump storage in calculation of residual loads
  - **Seasonal variability of weather** likely to change from historical patterns under a **climate change scenario**
  - Take a more comprehensive view on security of supply by considering **multiple aspects simultaneously**

# Please reach out!

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