

CAUSE EVALUATION OF LOAD LOSS HOURS IN MONTE-CARLO DISPATCH SIMULATIONS

Finding trends

MAX MULLER, STRATEGIC GRID PLANNING

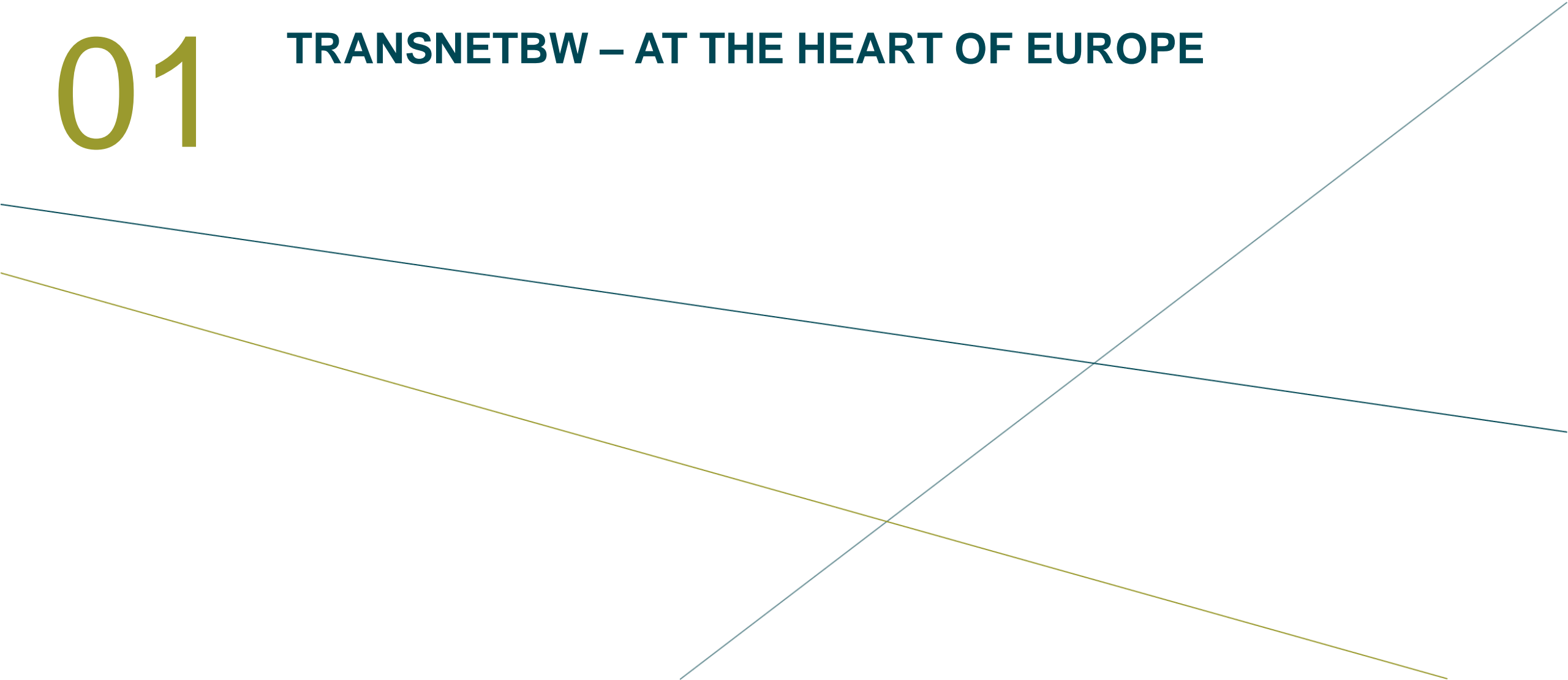
AGENDA

- 01 TransnetBW – TSO at the heart of Europe
- 02 Introduction to our calculations
- 03 Introduction to major causes of scarcity events

- 04 The effect of weather years on major causes
- 05 Outlook

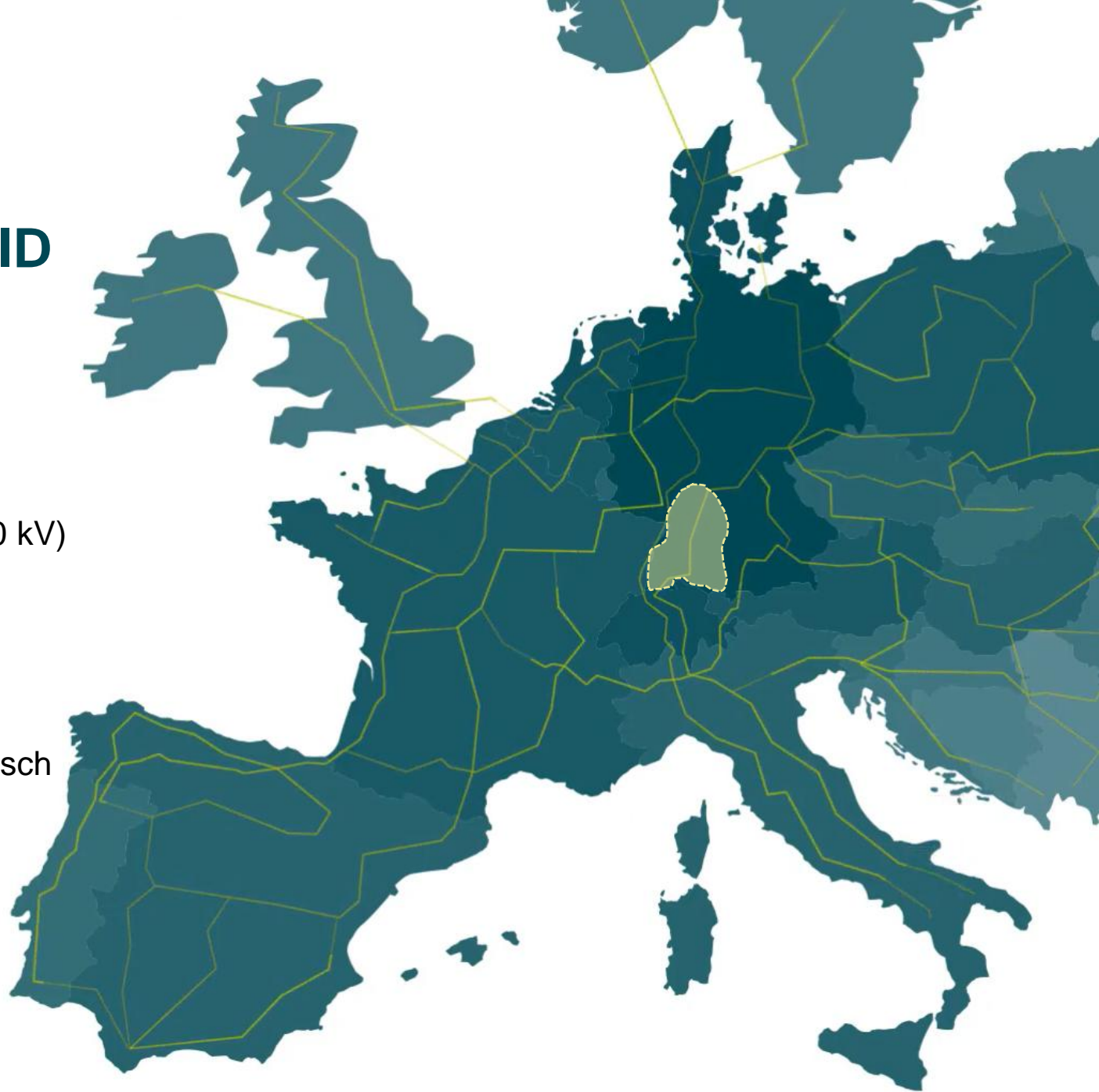
01

TRANSNETBW – AT THE HEART OF EUROPE



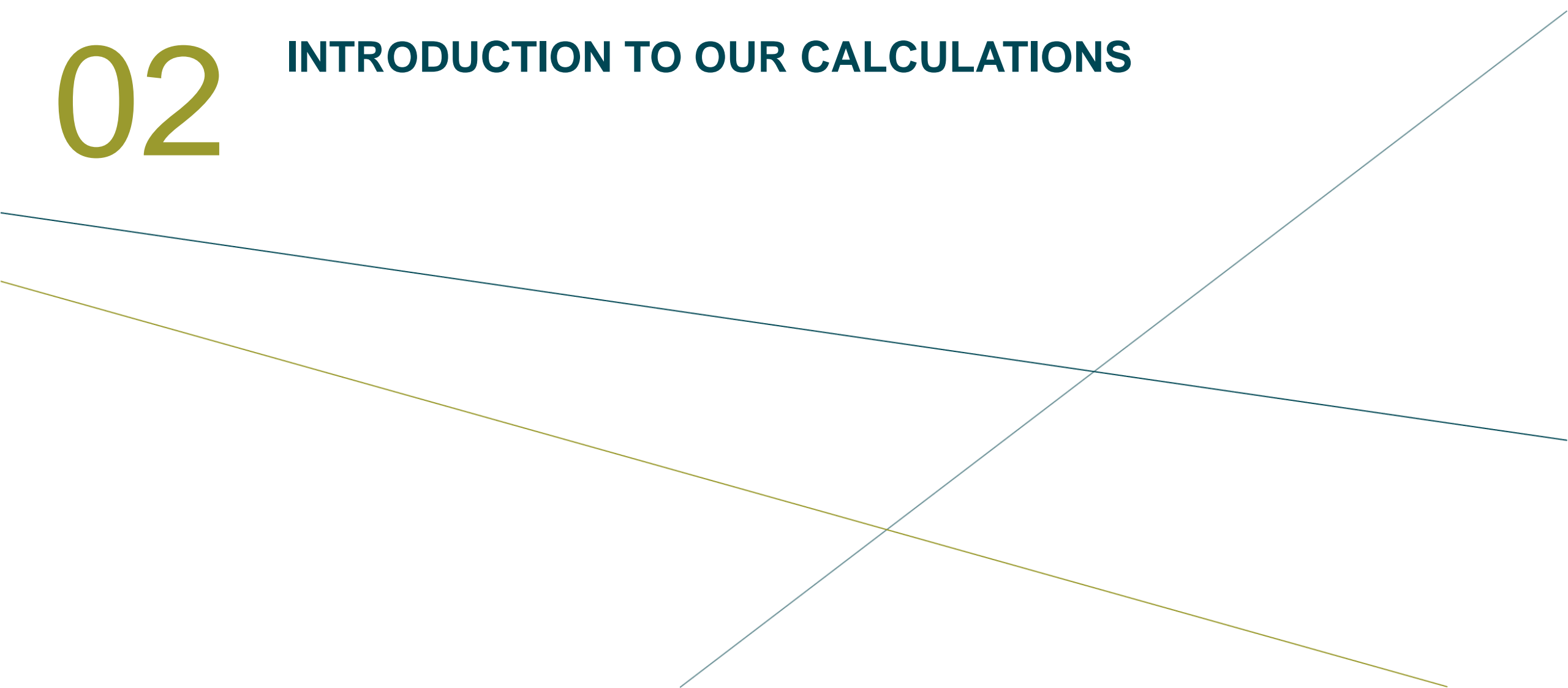
AT THE HEART OF THE EUROPEAN TRANSMISSION GRID

- / Certified Independent Transmission Operator
- / Founded in 1998, rebranded as TransnetBW in 2012
- / Approx. 1,800 employees (as of 2024)
- / 50 substations, 3,057 km total line length (220 kV, 380 kV)
- / 11 million people in our area served
- / Fully integrated into the German and European transmission system
- / Highly industrialized area, e.g. Porsche, Daimler & Bosch



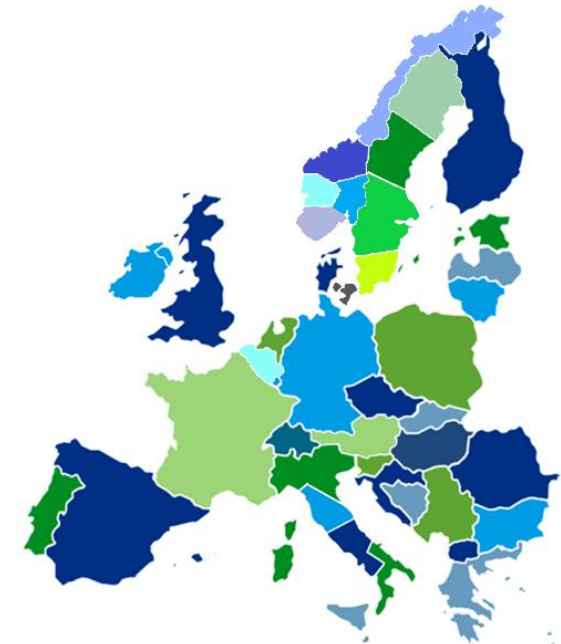
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INTRODUCTION TO OUR CALCULATIONS



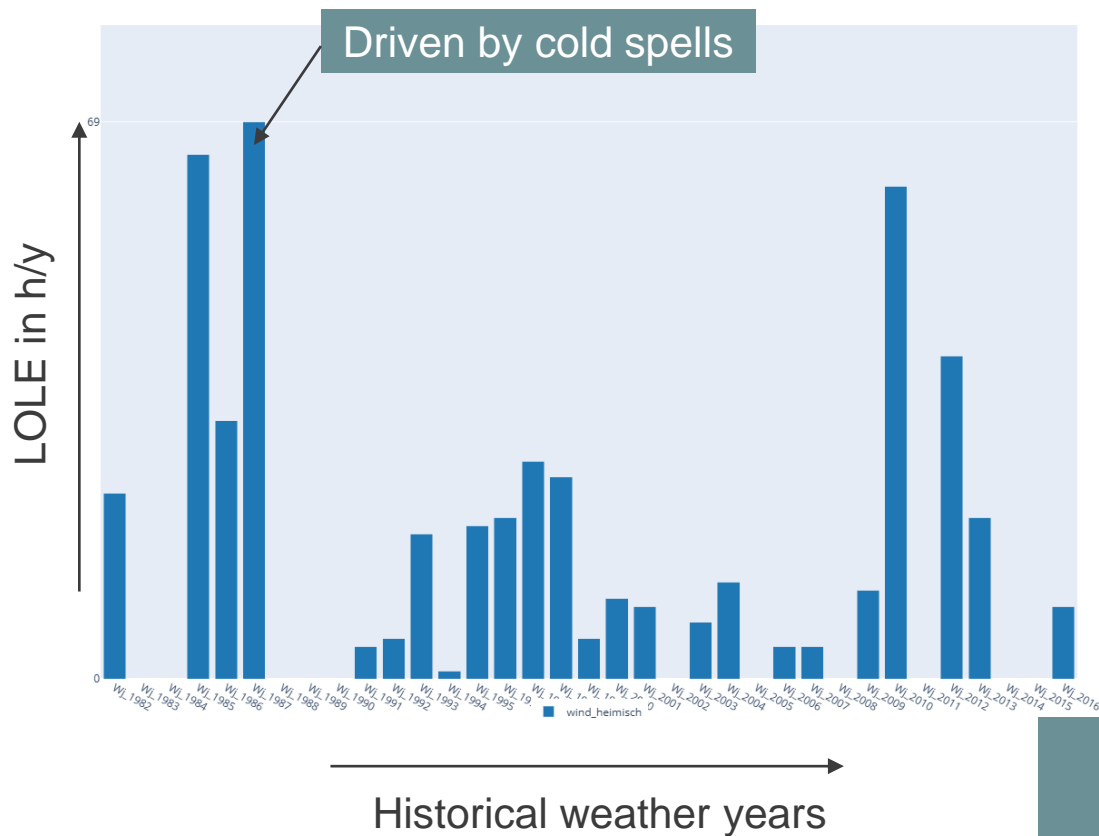
KEY FACTS ABOUT OUR SIMULATIONS

- **Regional Scope:** Europe with most of its bidding zones
- **Temporal Scope:** 8760h per year
- Results focused on Germany
- 20 outage time-series of conventional power plants
- Two sets of 35 weather years we like to compare:
 - historical weather years (1982 – 2016)
 - projected synthetic weather years that include climate change effects
- → 2 x 700 Monte-Carlo simulations (dispatch runs)

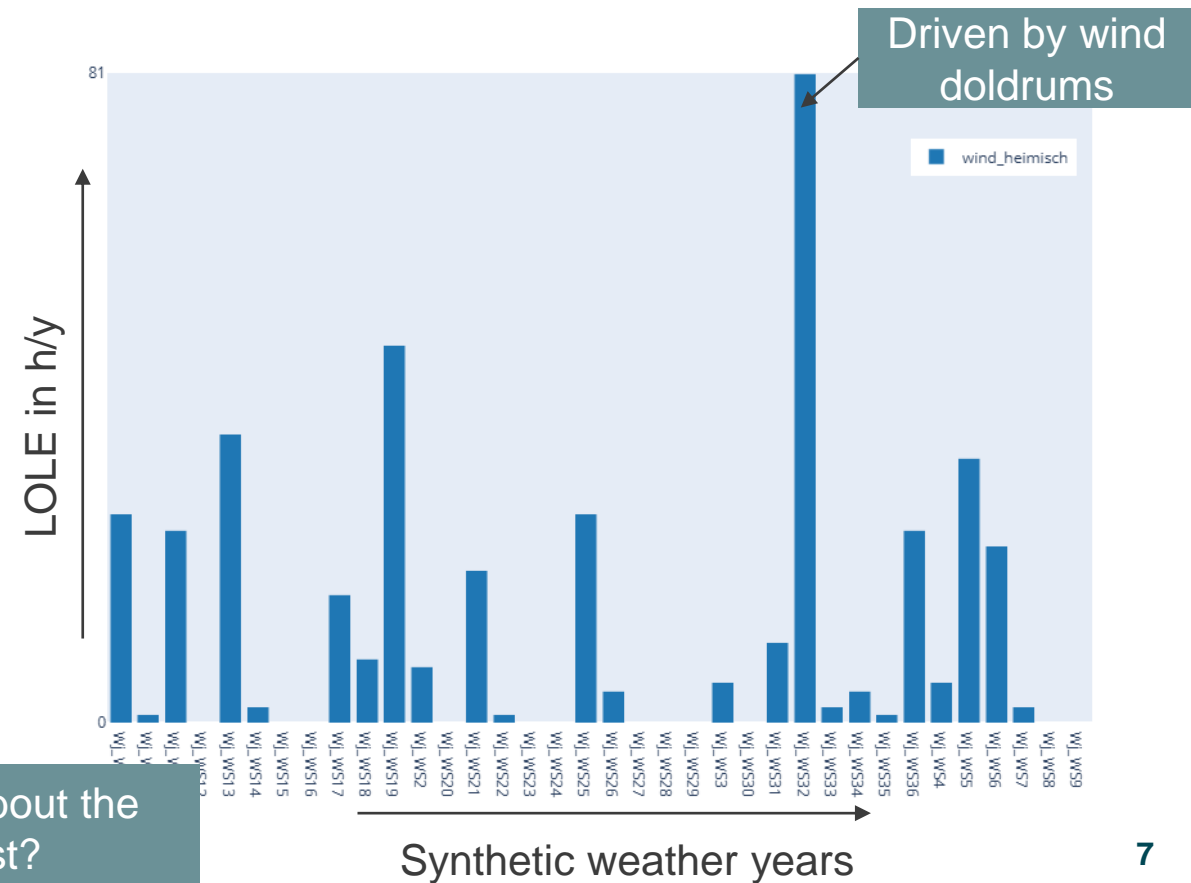


RESULTS: LOLE FOR THE TWO SETS OF WEATHER YEARS

Historical Weather Years 1982 - 2016



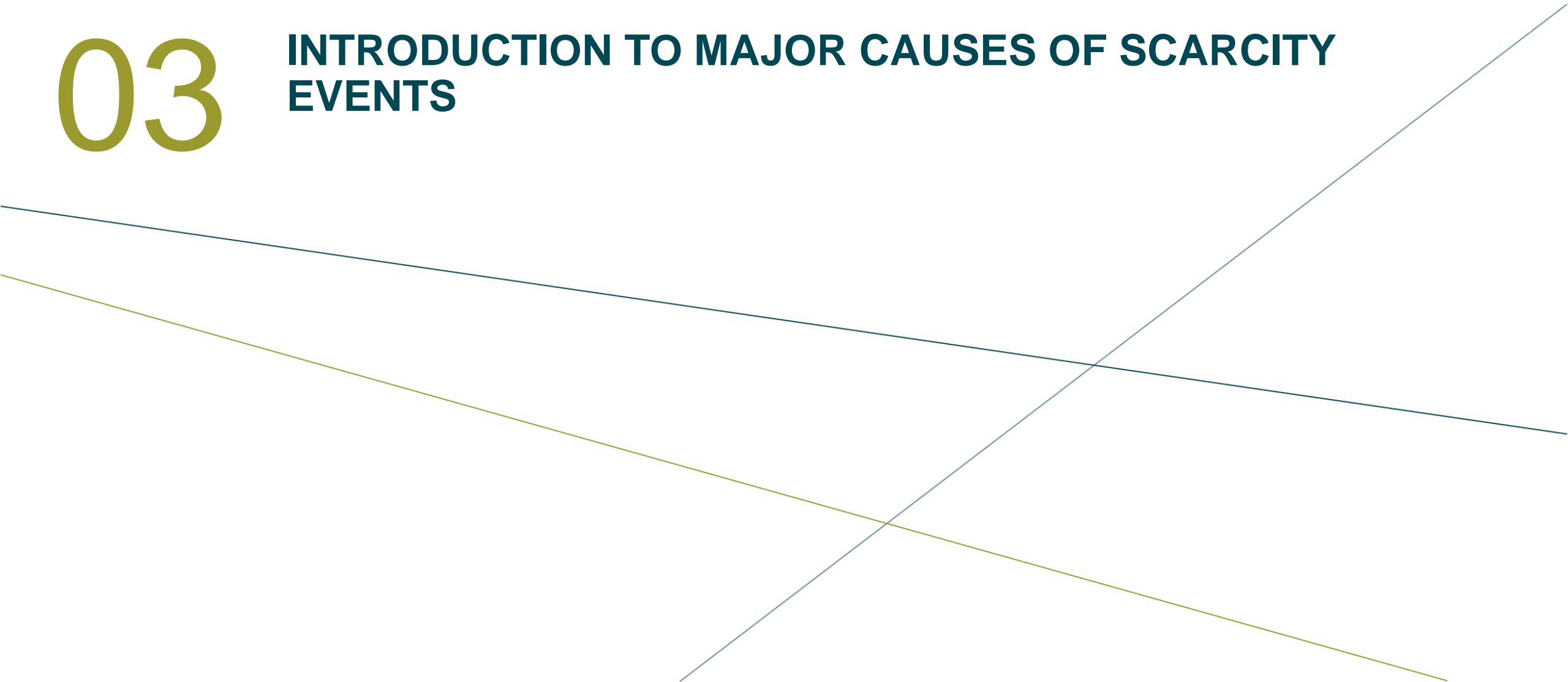
Synthetic Projected Weather Years



What about the rest?

03

INTRODUCTION TO MAJOR CAUSES OF SCARCITY EVENTS



MAIN CAUSES FOR RESOURCE ADEQUACY CONCERNS

Wind doldrums

Low capacity factors for wind onshore and offshore

- for Germany,
- for neighbouring countries



Cold spells

Very low temperatures leading to very high electricity demand

- for Germany
- for neighbouring countries



Major power plant outages

Conventional power plant availability



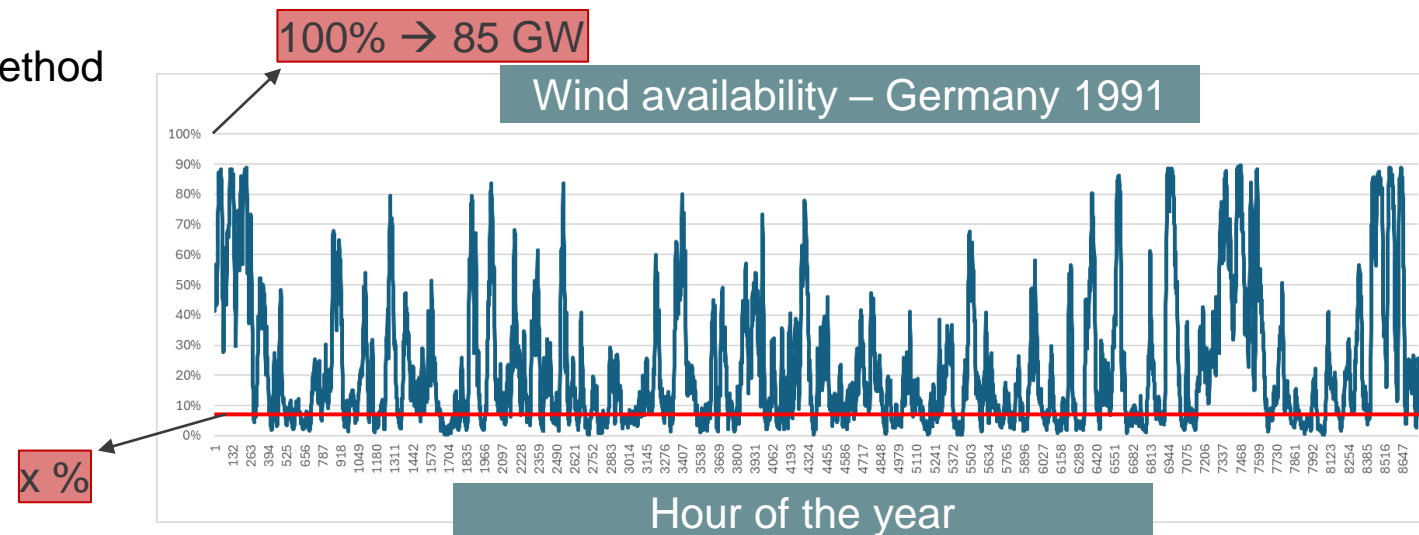
Lack of imports

Major lack of imports from neighbouring countries



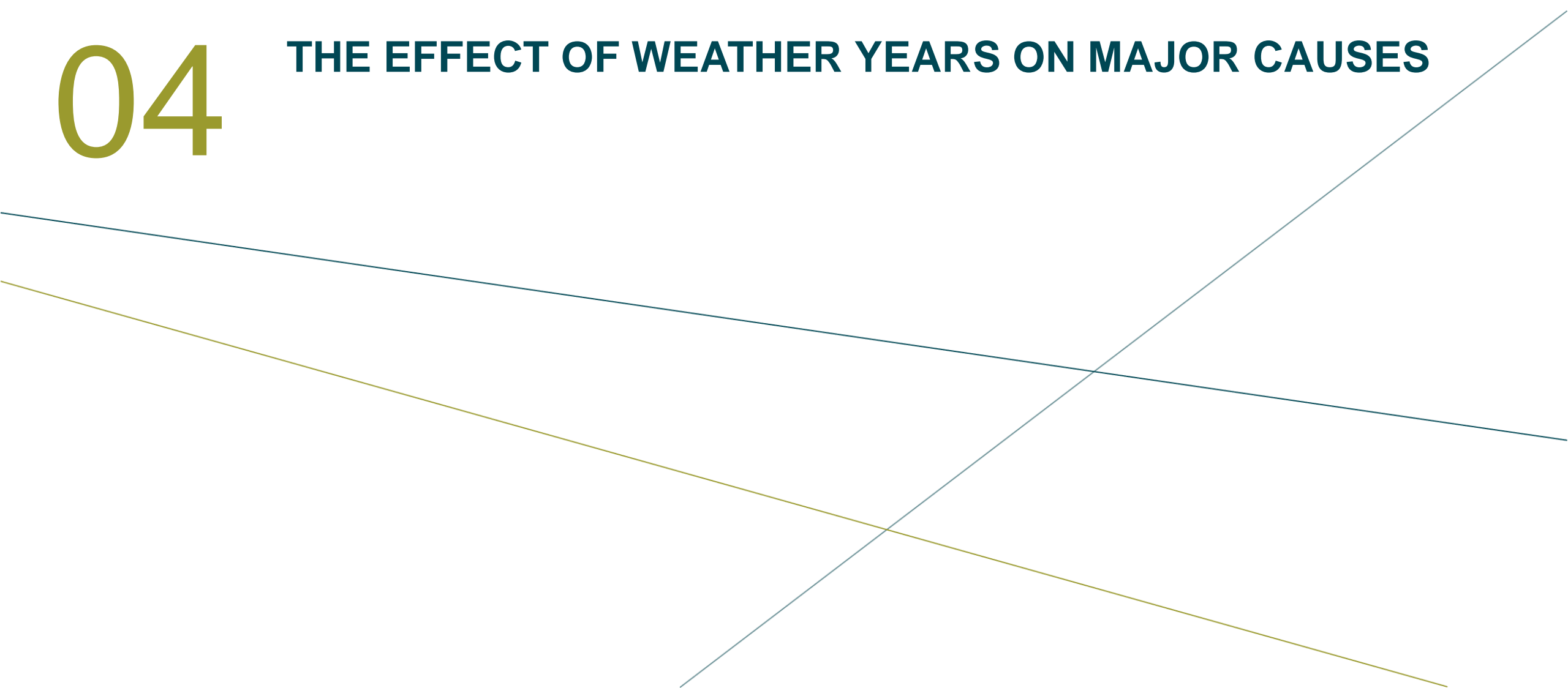
INTRODUCING FLAGS FOR EACH CAUSE

- For each LOLE hour, we analysed the causes of scarcity e.g. lack of wind
- By introducing flags (values 0 or 1)
- Defining thresholds, what make a cause “**major**”.
 - This is a critical point, since multiple methods can be applied.
- Easiest starting point:
 - Setting a hard value e.g. wind capacity factor < x%
- Comparing two scenarios allows to use a simple method
 - Median of LoLE hours of the first scenario



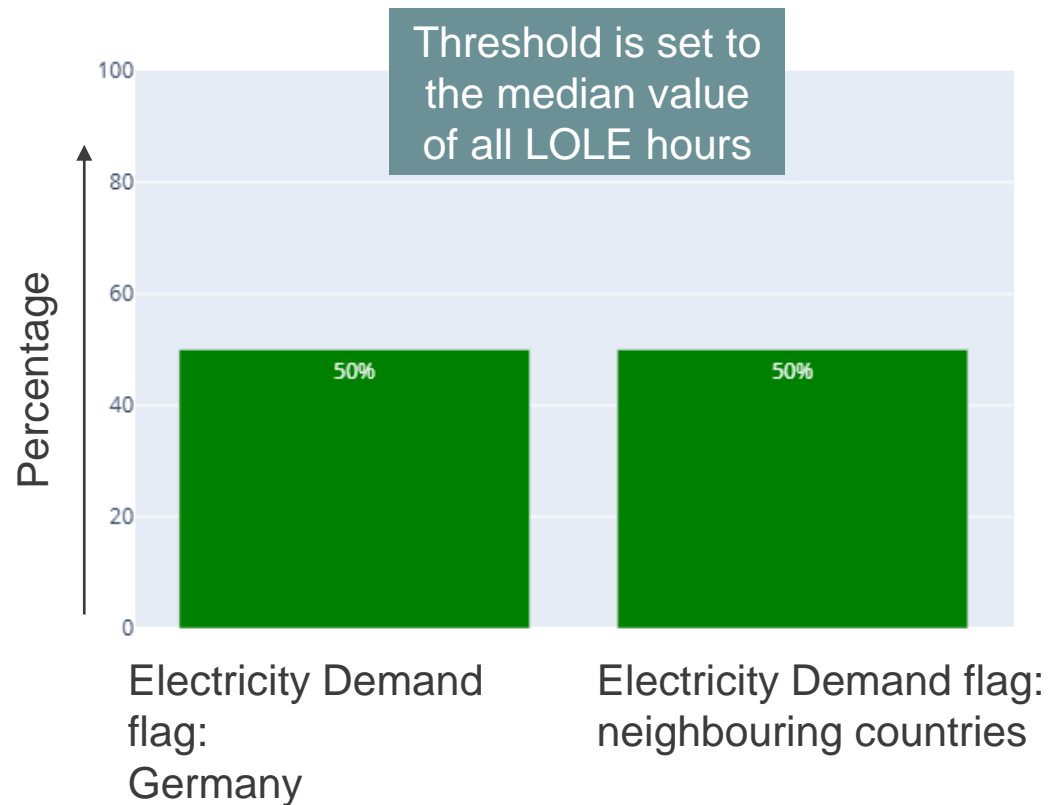
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THE EFFECT OF WEATHER YEARS ON MAJOR CAUSES

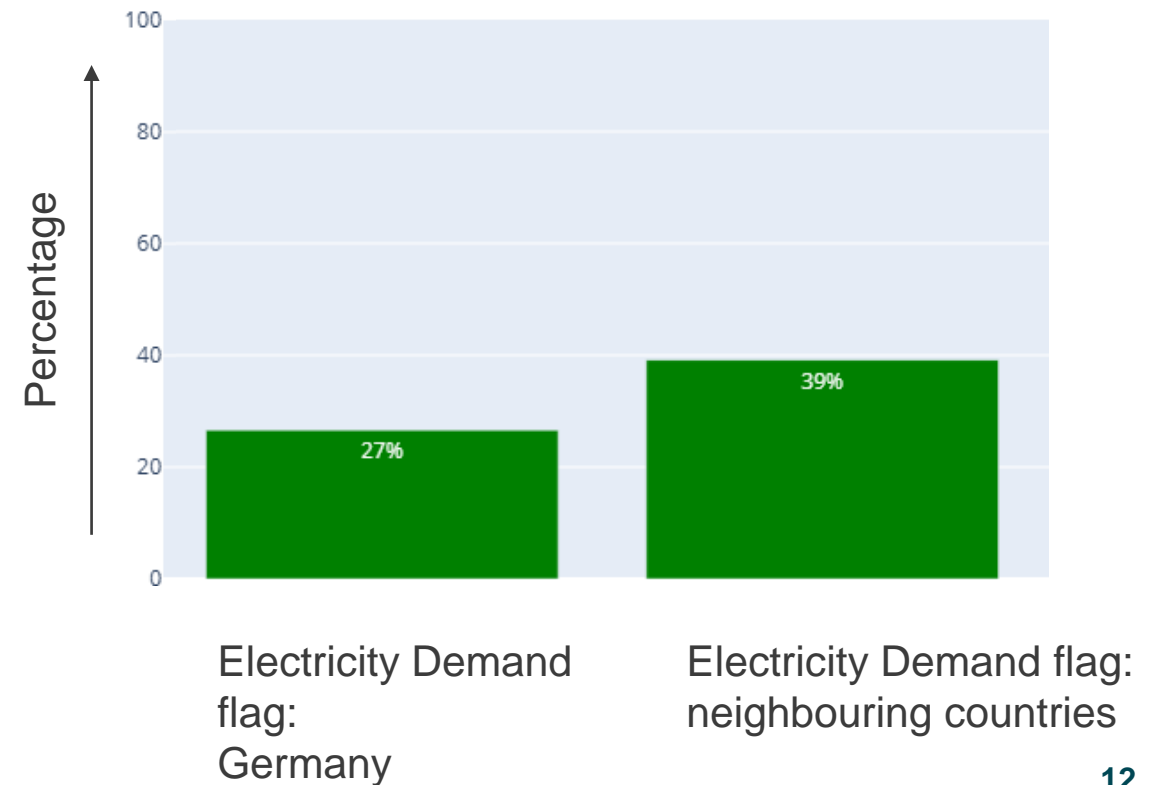


CAUSE: ELECTRICITY DEMAND

Historical Weather Years 1982 - 2016

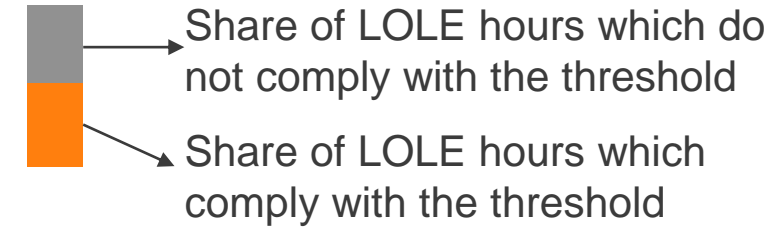


Synthetic Projected Weather Years

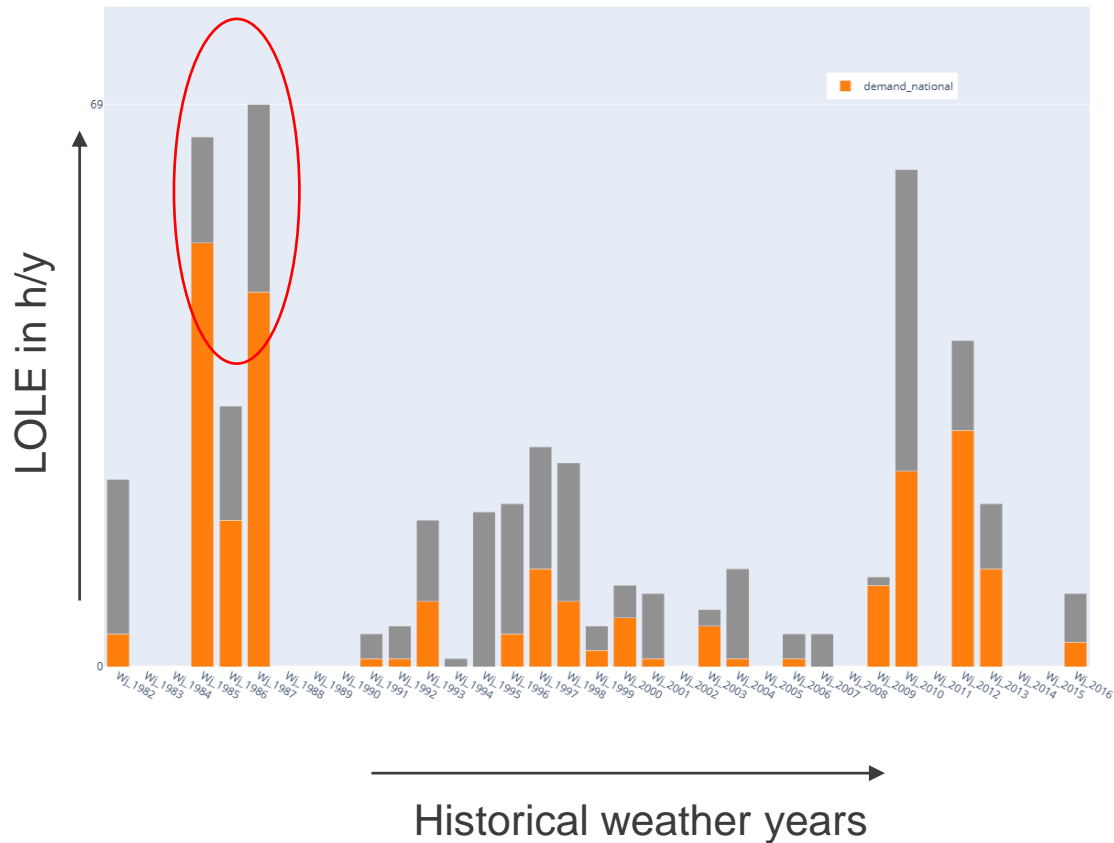


04 The effect of weather years on major causes

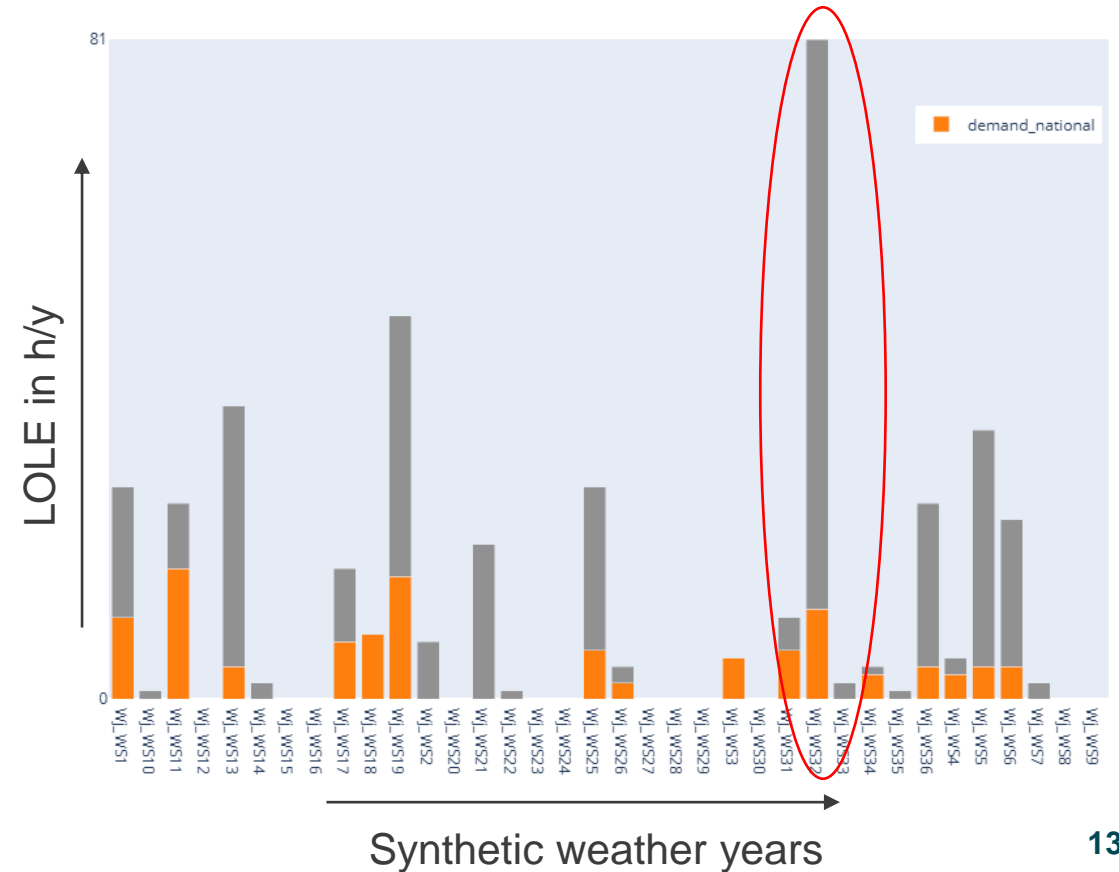
CAUSE: ELECTRICITY DEMAND LOOKING AT EACH WEATHER YEAR



Historical Weather Years 1982 - 2016



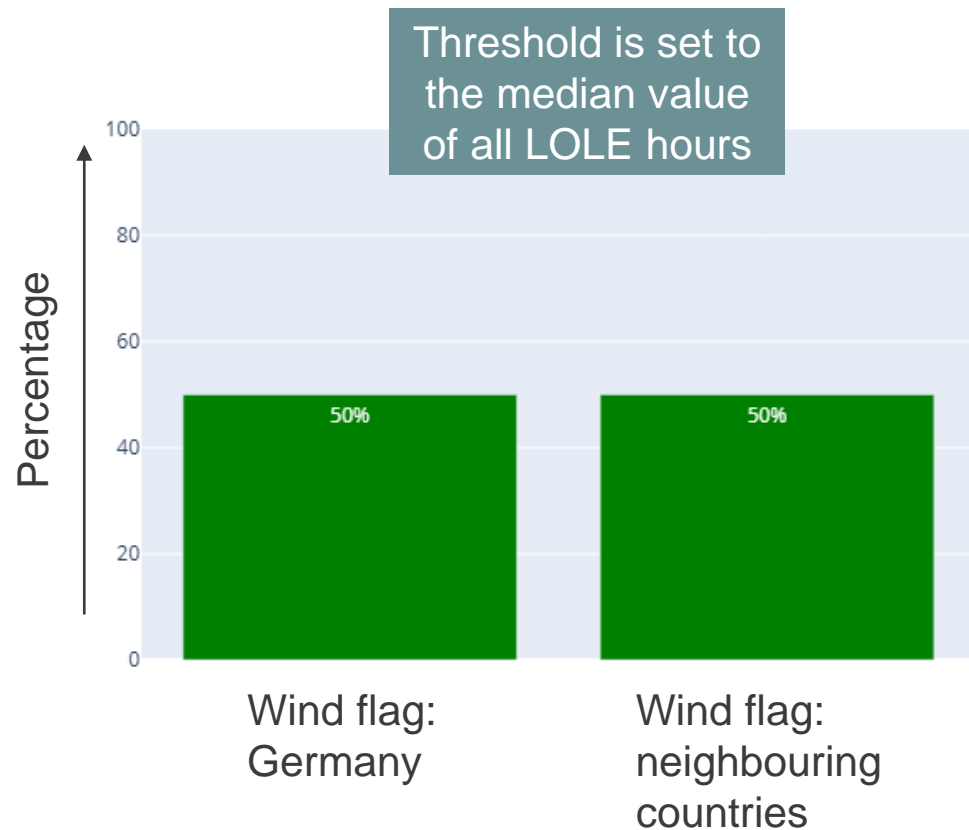
Synthetic Projected Weather Years



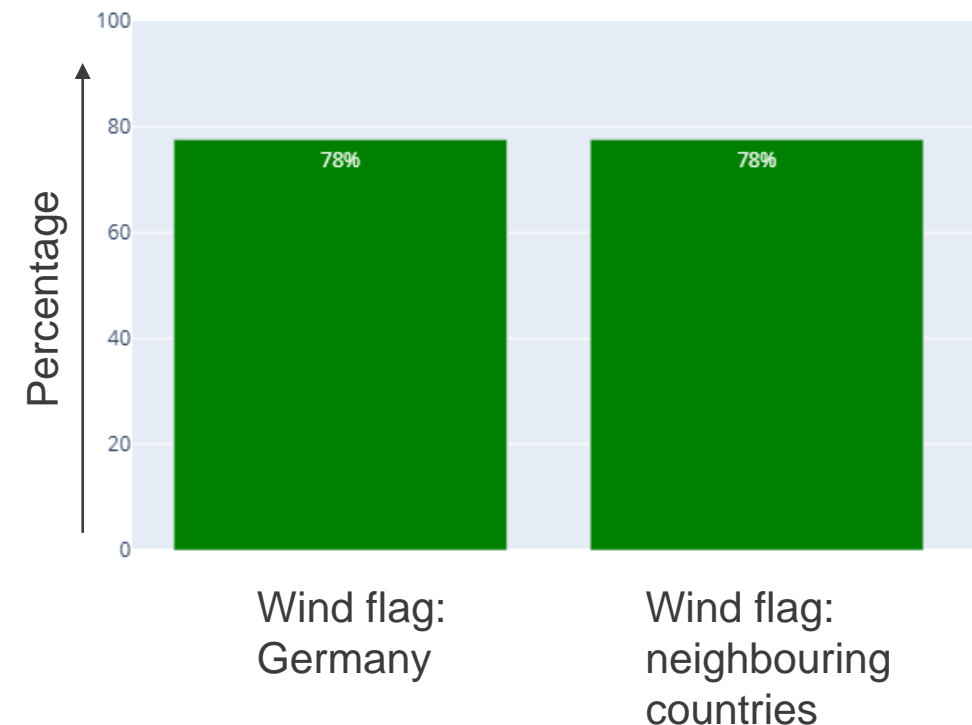
CAUSE: WIND DOLDRUMS

Wind capacity factor:
domestic < +-5%
neighbors < +-15%

Historical Weather Years 1982 - 2016

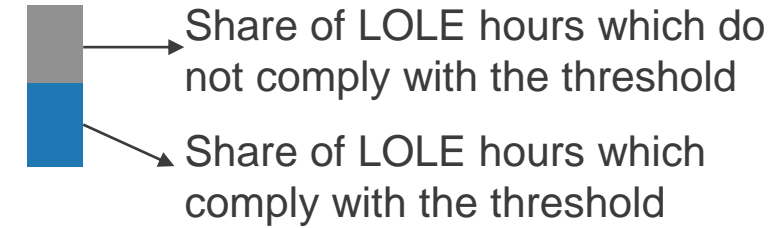


Synthetic Projected Weather Years

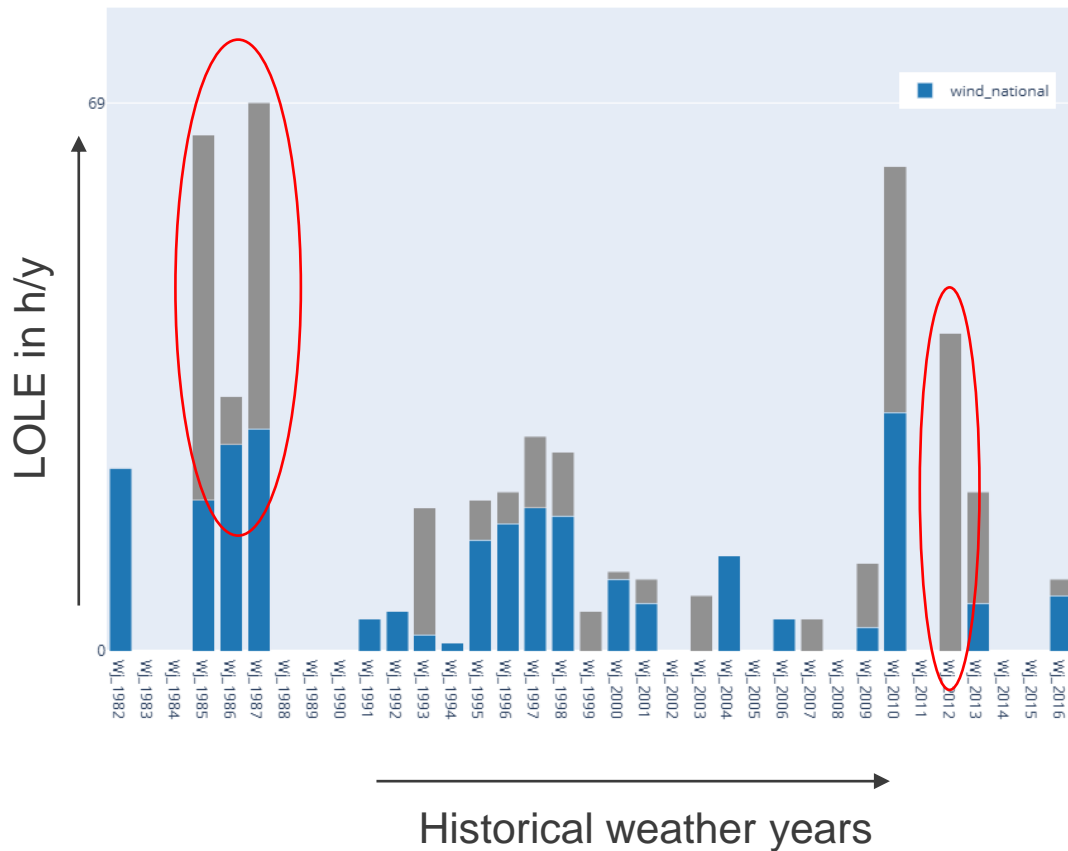


04 The effect of weather years on major causes

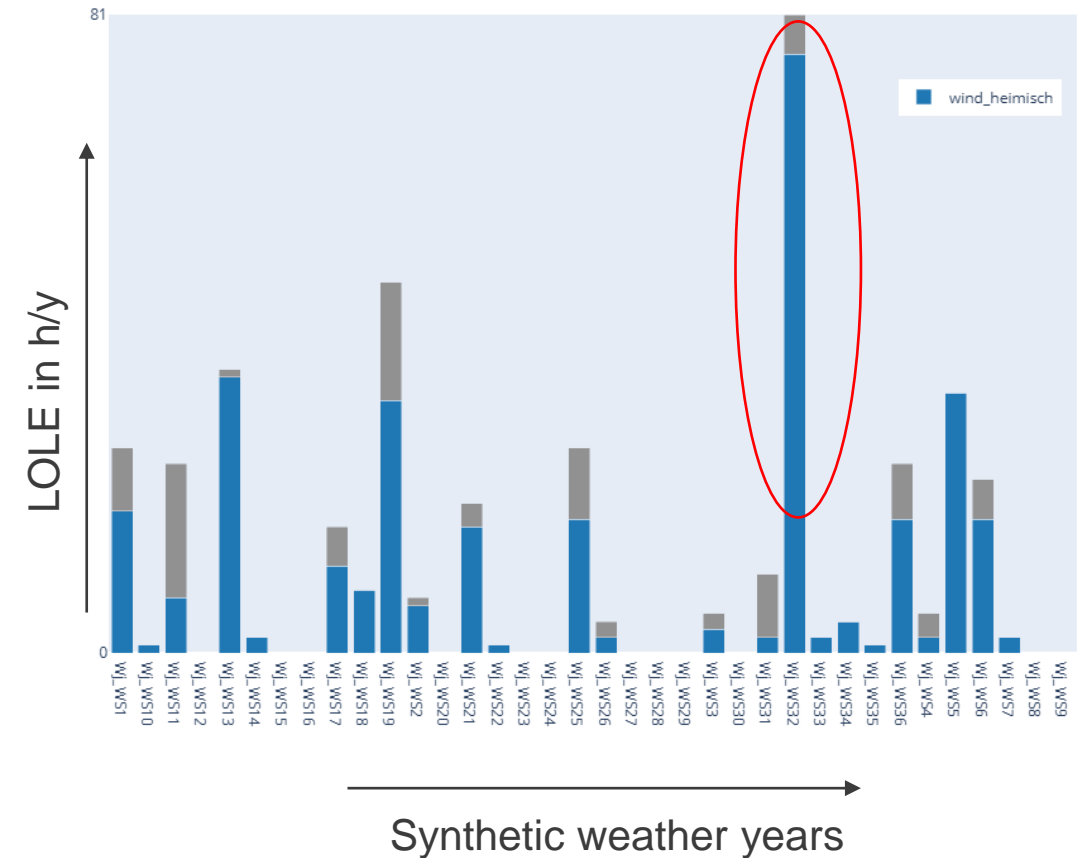
CAUSE: WIND DOLDRUMS LOOKING AT EACH WEATHER YEAR



Historical Weather Years 1982 - 2016



Synthetic Projected Weather Years

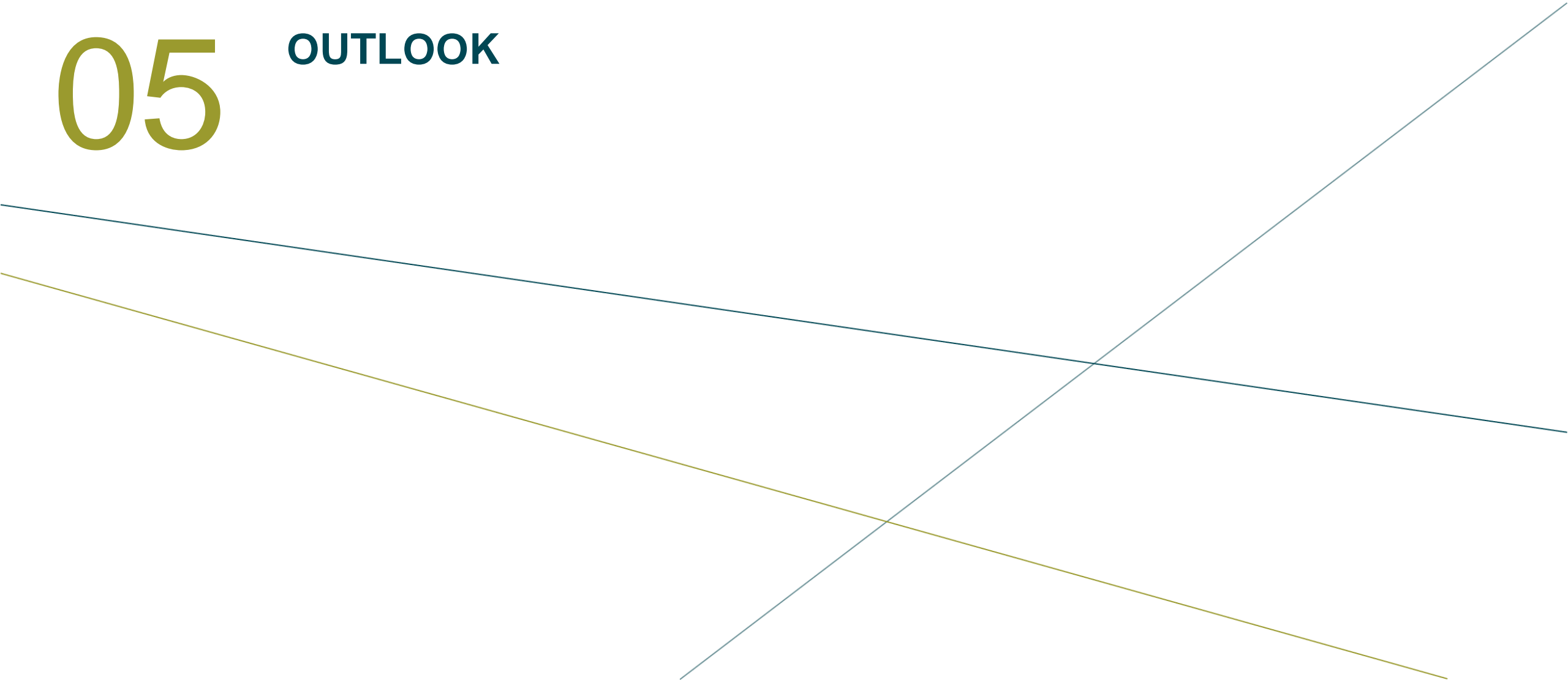


MAIN TAKE AWAYS

- Weather year dependency of Resource Adequacy
- Focus not only on LOLE values, but also why LOLE happens
- Effect of historical vs. projected weather years
 - High demand is **decreasing** as major cause – low wind is **increasing** as major cause
- Method to analyse which cause changes within other scenarios, e.g. with higher electrification, high flexibilities or lower conventional power plants

05

OUTLOOK



OUTLOOK

- Second guess input data
 - Are these weather effects in the synthetic projected weather years what experts expect?
 - What modelling effects can underestimate wind capacity factors? (e.g. spatial resolution change)
- Comparing the shift of causes by changing the system:
 - increasing renewable share
 - increasing electrification
 - increasing flexibilities
- How often do specific major causes occur, without leading to LOLE? And why?

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