Estimating electricity interruption costs for households across the EU

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Why measure electricity interruption costs?

- Required to know the value society places on supply security
- Dependent on time, duration, service
- Initial estimate may be less arbitrary than, e.g., Loss of Load Probability (LOLP)
- Consumers have no choice to choose tariff depending on reliability
- Utilities/TSOs lack balanced incentives to engage in investments

Composition of costs

Direct: Infrastructure

Indirect: Production outage

Macro-economic long-term: Change in investments, e.g., choice of business location

Households

Only partly material -> costs such as fear, inconvenience, loss of leisure time

Industry/Commerce

1. Output
2. Loss of productivity
3. Damage
4. Labour
5. (Loss in reputation)

Characterising interruptions

Type of end-users: hospital vs. industrial plant vs. household

Time of occurrence: weekday vs. weekend, winter vs. summer

Duration: instant losses (PC files) vs. time-dependent losses (food)

Advance notification: e.g., elevator; regular outages: notifications not as important any longer -> lower immediate cost, but less confidence in system

Perceived reliability level: 'vulnerability conflict' -> higher perceived reliability leads to higher vulnerability in case of outage

Source of the outage: failure in network vs. failure in power plant

Quantifying interruptions

Surveys/Interviews

- Willingness to Pay (WTP)
- Willingness to Accept (WTA)
- Choice experiment
- e.g., winter, WTP is 30% higher in Austria

Production-function

- Estimates welfare costs accross different sectors, durations, times
- e.g., lost production, reduced convenience
- Uses statistical information

Market behaviour

- Revealed preferences/expenditures
- e.g., backup facilities, insurances, interruptible contracts
- US: 170 GW of backup generators

Case studies

- List and monetise effects of outage
- Surveys after interruption

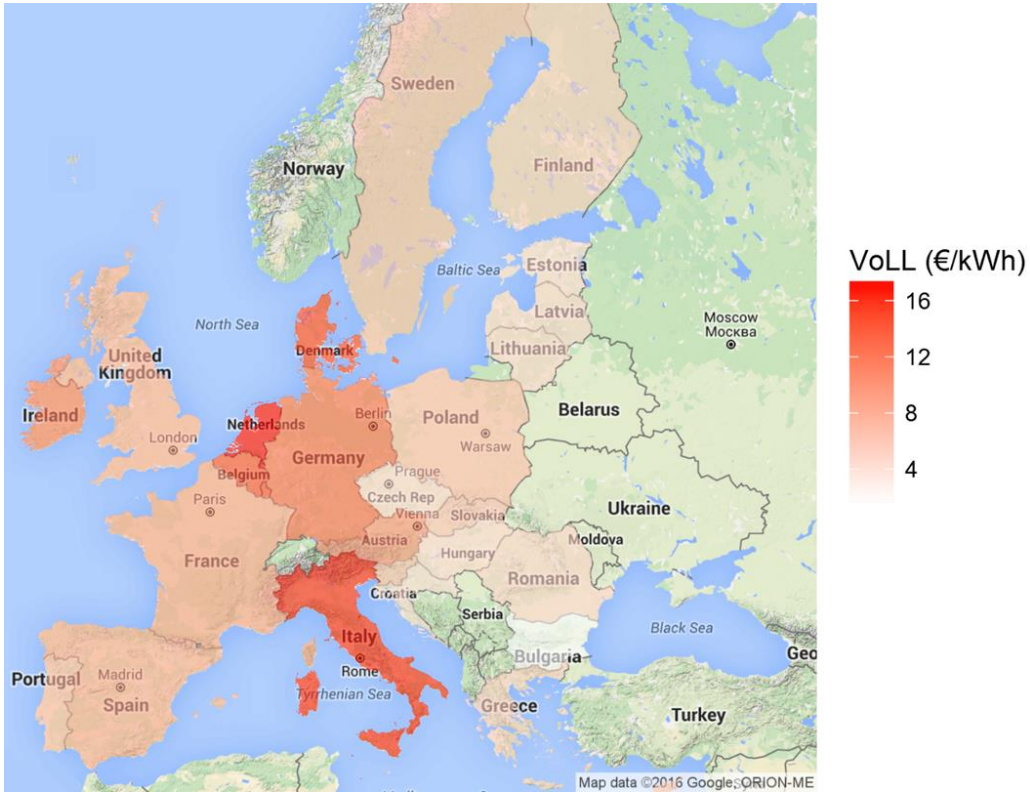
Comparison across EU-28

EU-28 average: **8.10 €/kWh**
Lowest in EU-28: **1.58 €/kWh (Bulgaria)**
Highest in EU-28: **17.21 €/kWh (Netherlands)**

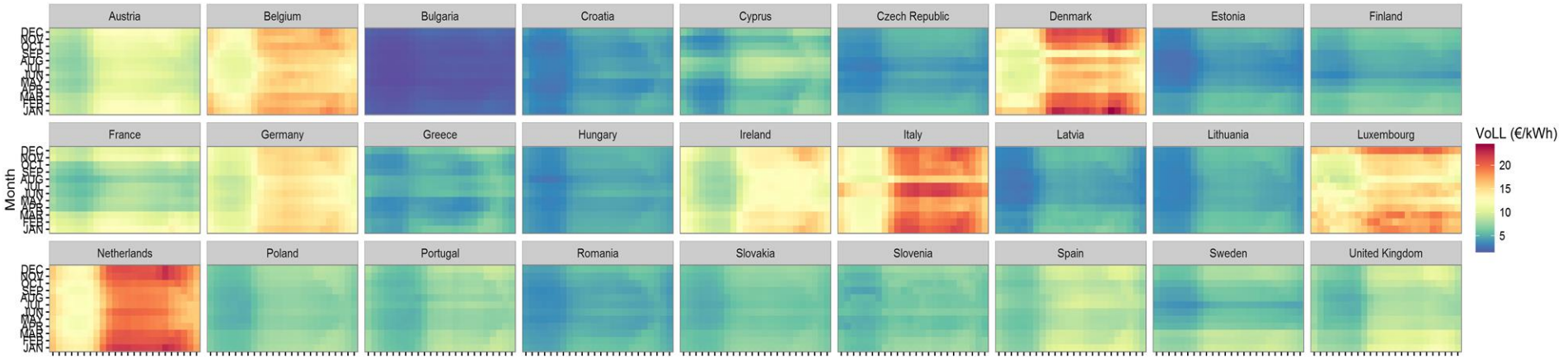
MS with a low VoLL (below 6 €/kWh):
Croatia, Cyprus, Estonia, Finland, Greece, Hungary, Latvia, Lithuania, Malta, and Romania.

MS with a high VoLL (above 14 €/kWh):
Belgium, Denmark, Italy, Luxembourg and the Netherlands.

VoLL obtained in this study closely match previous studies

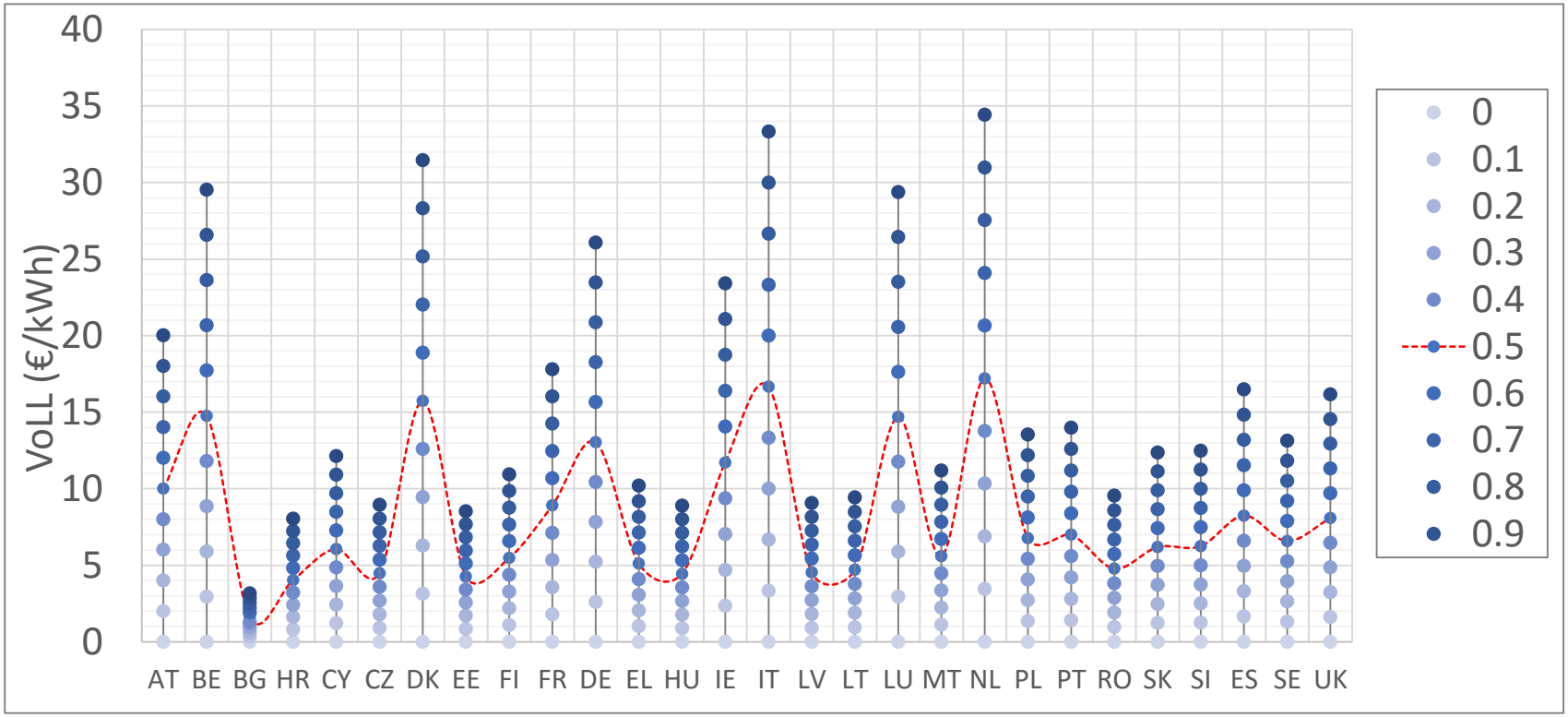


Time-varying nature of electricty interruptions



Highest VoLL between 17:00 – 19:00 in the Winter months (November- February) for Denmark and the Netherlands, and between 10:00 – 16:00 in the Summer months (June-August) for Italy.

Effect of 'substitutability factor'



Discussion

- Socio-economically 'optimal' interruption levels
- Inter-comparison between studies currently difficult
- Current high levels of reliability (relatively) in the EU should not be taken for granted
- Dependence on timing and type of consumer
- Standardised database
- Combine macro-economic approach, WTP surveys, and energy system planning tools (OSeMOSYS, MESSAGE, TIMES etc.)

Further information on the INSIGHT_E Observatory

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