



How Method Choice Shapes the Value of Lost Load: A Systematic Review of VoLL Methodologies

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ENERDAY 2026 - 20th International Conference on Energy Economics and Technology
27th March 2026



Supply security is back on the agenda

But how much reliability is economically justified?



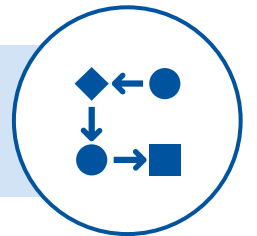
Cost-benefit analysis is commonly used to assess policies aimed at improving supply security.

The costs of additional capacity are relatively easy to estimate, but the benefits of marginal reliability improvements are much harder to quantify.



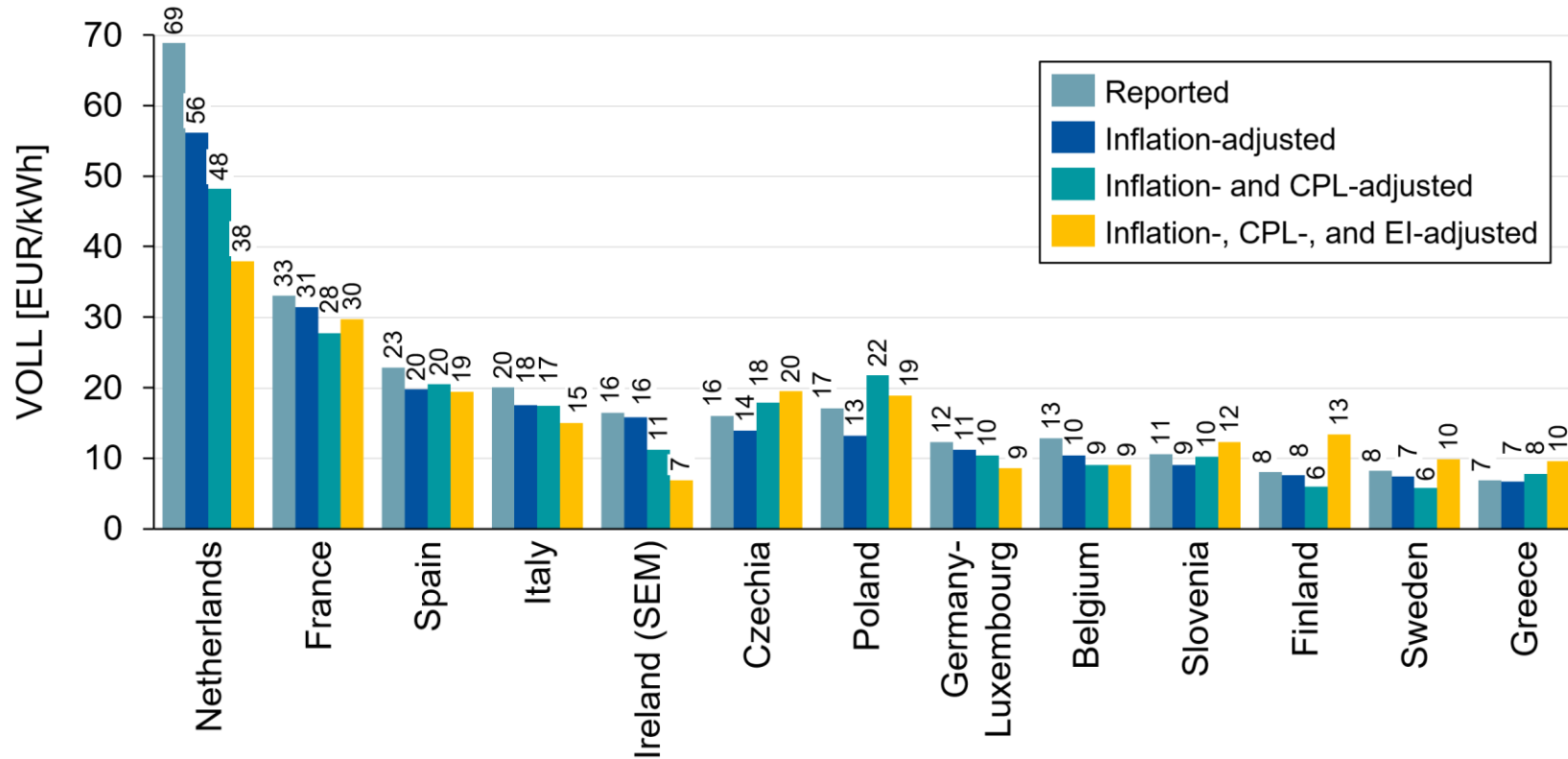
Value of Lost Load (VoLL) is the established metric used to value unserved electricity. Usually measured in EUR/kWh.

However, there is no unified framework for determining VoLL, and multiple methodologies coexist.



VoLL in EU regulation

Large heterogeneity in reported values across member states



- The reported VoLL values for individual member states reveal significant variation within the EU.
- Adjusting for inflation and accounting for differences in purchasing power and electricity intensity reduce these variations.
- Substantial differences remain, which cannot be explained intuitively.

[1] Inflation adjusted (2015 = 100)

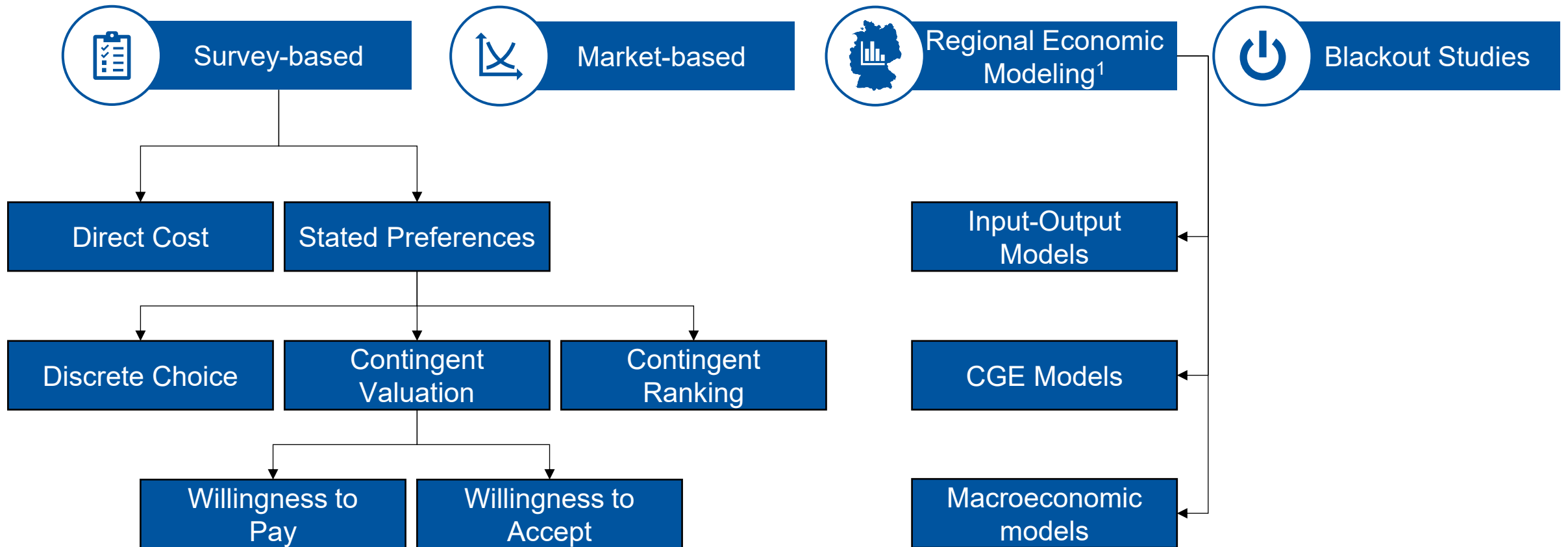
[2] Comparative Price Levels (CPL) (EU27-average = 100)

[3] Electricity Intensity (EI) as the ratio of GDP to total electricity consumption (EU27-average = 100)

Kapeller, R., Kulawik, J., Rusch, K., Knöbl, M., Kockel, C., Priesmann, J., Reichl, J., & Praktijnjo, A. (2026). A review of determining reliability standards for electricity supply via value of lost load and cost of new entry in the EU. *Energy Policy*, 208, 114875. <https://doi.org/10.1016/j.enpol.2025.114875>

How to measure the VoLL?

Systematization of methodologies



¹often termed macro(economic)-approaches

Sullivan, M., Collins, M. T., Schellenberg, J., & Larsen, P. H. (2018). Estimating Power System Interruption Costs: A Guidebook for Electric Utilities (No. 1462980).

Surveys and regional economic modeling predominantly used in the literature

Holistic approach vs. comparability



Survey-based

- Most established and commonly applied methodology for measuring VoLL
- Required method in European regulation
- Broad range of outage cost dimensions can be captured
- Results are strongly affected by specific study design and outage scenario
- Results inherit psychological biases, risk preferences and budget constraints

Cost dimensions

Food spoilage	Data loss	Heating/cooling loss	Equipment damage
Comfort loss	Productivity loss	Health and safety	...



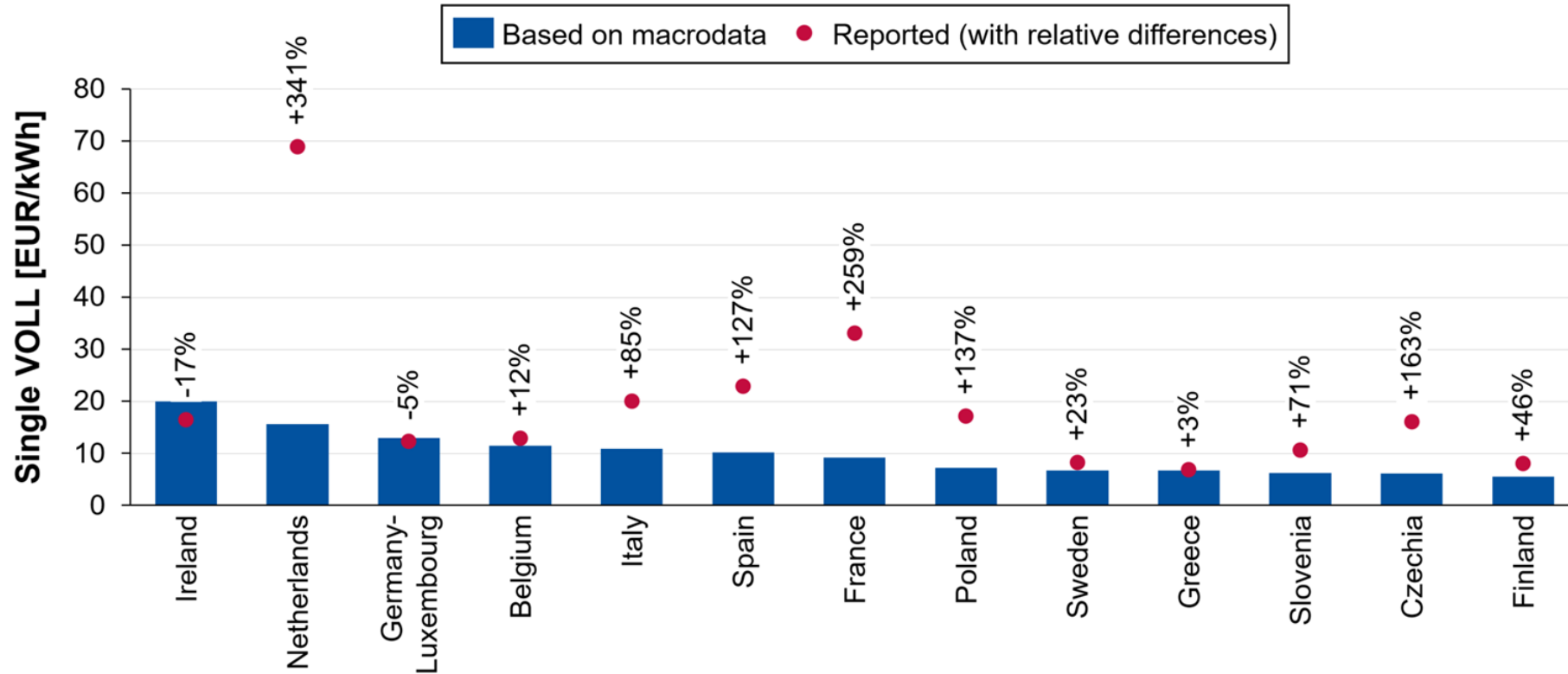
Regional Economic Modeling¹

- Models based on economy-wide input data
 - Input-output data
 - Energy balances
 - Value added
 - Labor market data
 - ...
- VoLL results are easily comparable and reproducible
- Household sector often captured via hypothetical leisure value (following Gary Becker)
- Limited ability to examine regional, temporal, and sectoral differences

Output loss	Restart delays	Supply chain effects	Idle resources
Macro effects	...		

VoLL in EU regulation

Comparison of reported survey-based values with macro-based benchmark

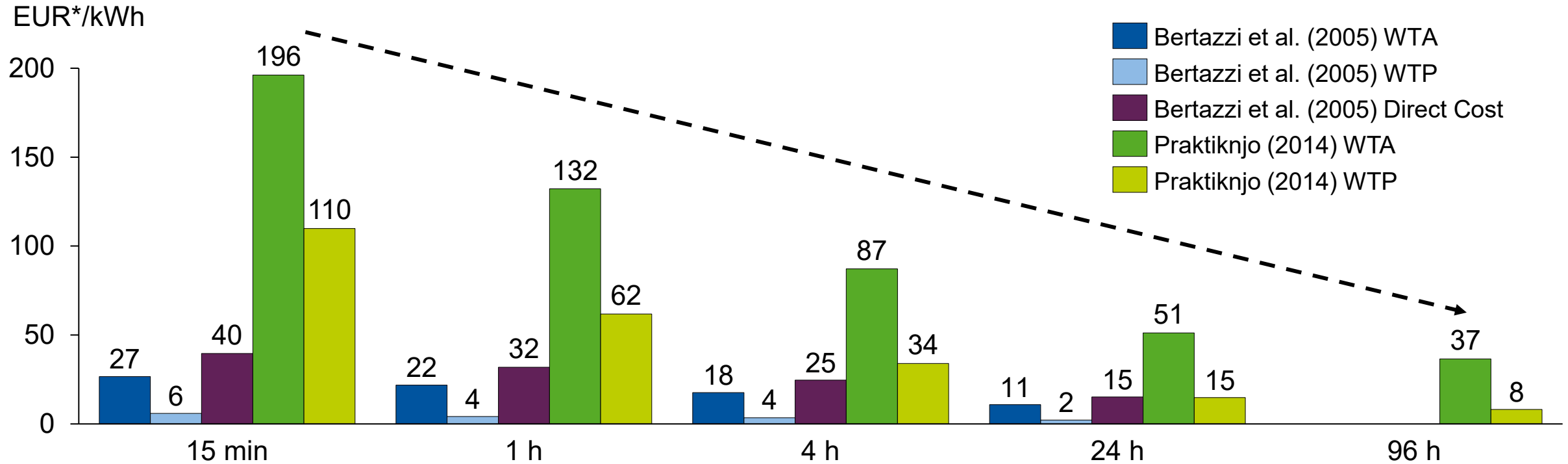


- Comparison of reported VoLL values calculated using a uniform method based on macroeconomic data does not explain differences across member states
- Reported VoLL for most countries significantly higher than VoLL based on macro data
- Difference is not consistent across states

Macroeconomic VoLL calculation based on data from Eurostat and the OECD; own calculation

Survey results show large differences in results – two selected papers

VoLL decreases with longer outage duration



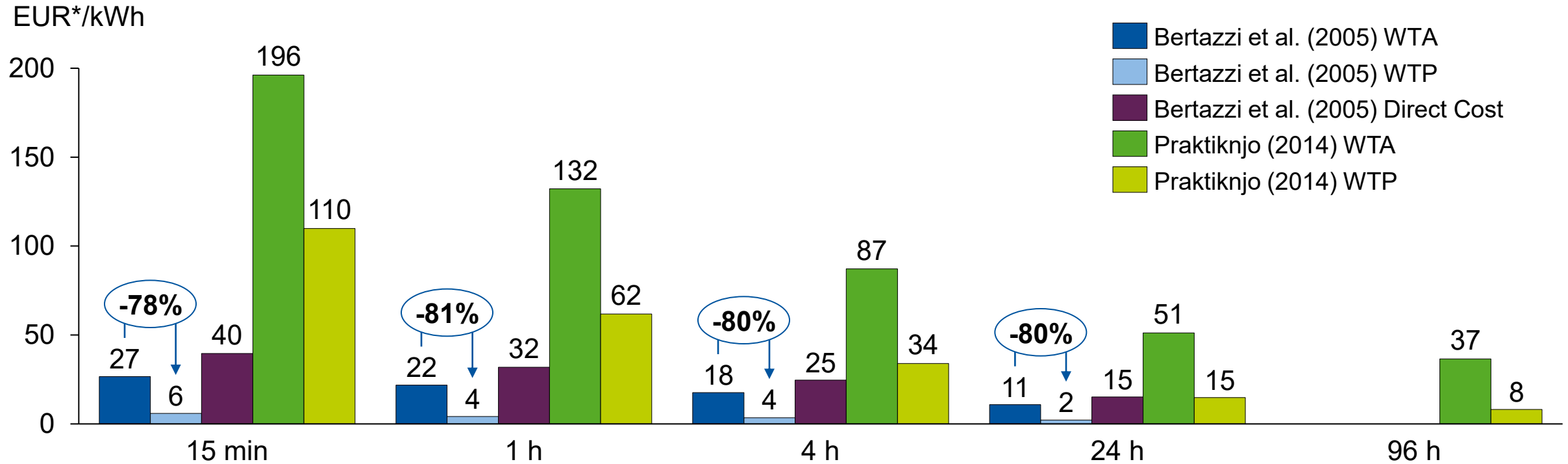
- Large difference between studies as a result of differences in study design and cultural background
- Absolute outage cost increases with duration
- Marginal decreasing outage cost for longer interruptions

*CPL and inflation adjusted to EUR 2025;

WTA: Willingness to Accept; WTP: Willingness to Pay

Survey results show large differences in results – two selected papers

WTA results up to 5 times higher compared to WTP



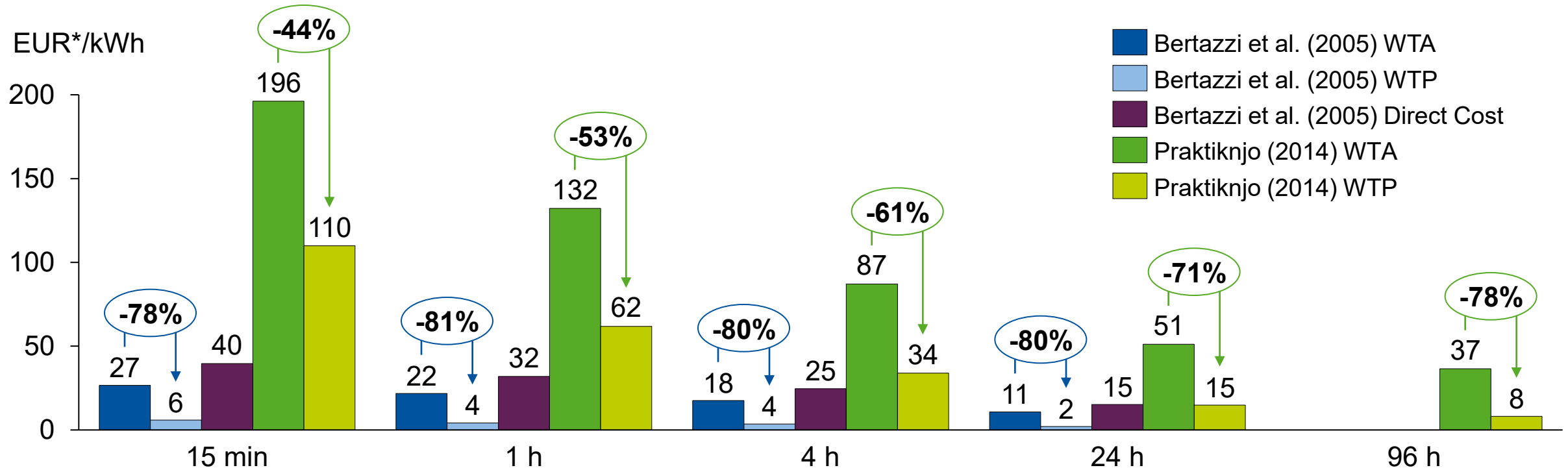
- WTA approach produces consistently higher VoLL results
- Magnitude of this difference varies strongly across studies
- Clear impact is hard to identify due to large heterogeneity in study designs

*CPL and inflation adjusted to EUR 2025;

WTA: Willingness to Accept; WTP: Willingness to Pay

Survey results show large differences in results – two selected papers

Increasing difference between WTA & WTP observed in Praktijnjo (2014)



- WTA approach produces consistently higher VoLL results
- Magnitude of this difference varies strongly across studies
- Clear impact is hard to identify due to large heterogeneity in study designs
- While Bertazzi et al. finds a stable difference between WTP and WTA, Praktijnjo observes the difference to increase for longer durations

*CPL and inflation adjusted to EUR 2025;

WTA: Willingness to Accept; WTP: Willingness to Pay

Main takeaways and next steps



Takeaways

- **Survey-based:** broad outage cost coverage, but highly design-sensitive
- **Regional economic modelling:** comparable and reproducible, but limited in cost coverage

VoLL estimates often differ because they measure different things for different purposes.



Next steps

- Complete the meta review and quantify how design choices, study contexts, and cost dimensions shape VoLL
- Develop a combined VoLL model using regional economic modelling as benchmark and add-ons for omitted costs
- Integrate the differentiated VoLL dataset into adequacy modelling



Website: <https://vaelues.eu/>

Supported by:



Federal Ministry
for Economic Affairs
and Energy

on the basis of a decision
by the German Bundestag



Thank you for your attention!



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