

Extrapolating household load data

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Agenda

1

Motivation

2

Methodic

3

Findings

4

Conclusion

C/sells: Demonstrate! Cell! Sells! Harmonize!

Show case in the Solar Arc: Professionally **demonstrate sample solutions** suitable for the mass in Smart Grids dominated by photovoltaics under the solar Arc Bavaria, Hesse, and Baden-Württemberg

Cells: Connect
diverse, cellular
organized energy
infrastructures safely
and efficiently



sells: market
flexibilities through
different roles in
operational spaces of
action

C/sells: Harmonize markets, grid and safety through Infrastructure
Information System (IIS)

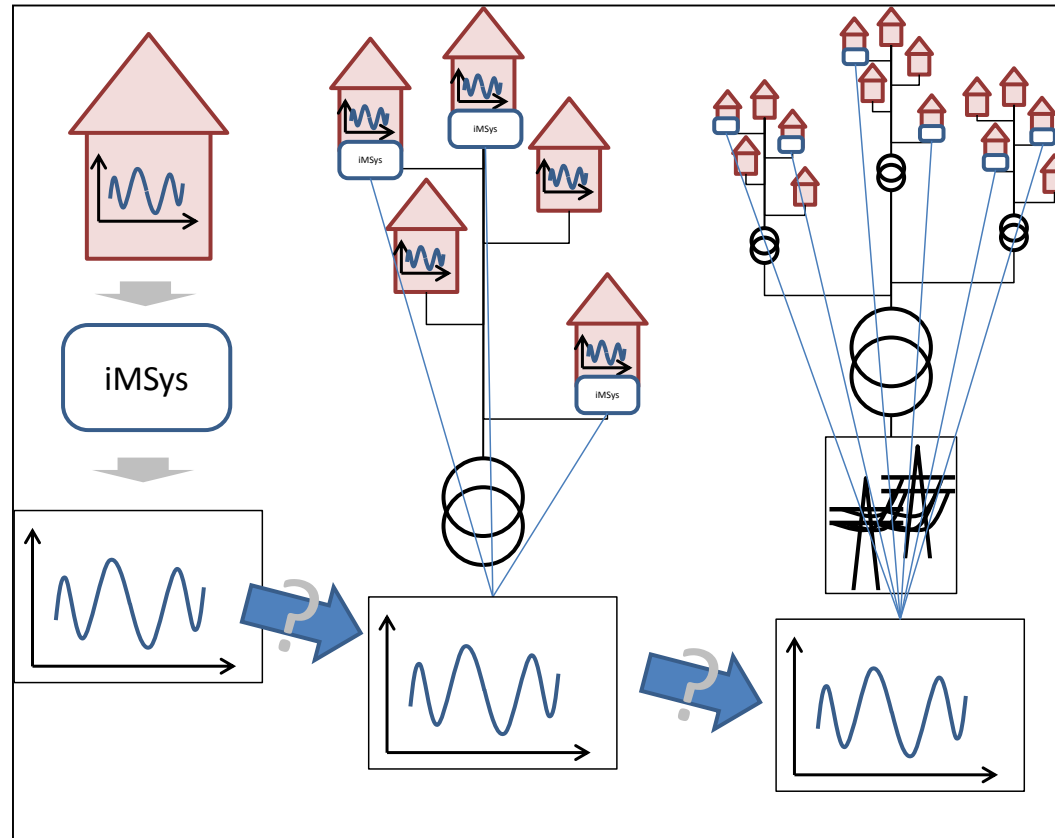
Supported by:



on the basis of a decision
by the German Bundestag

Motivation

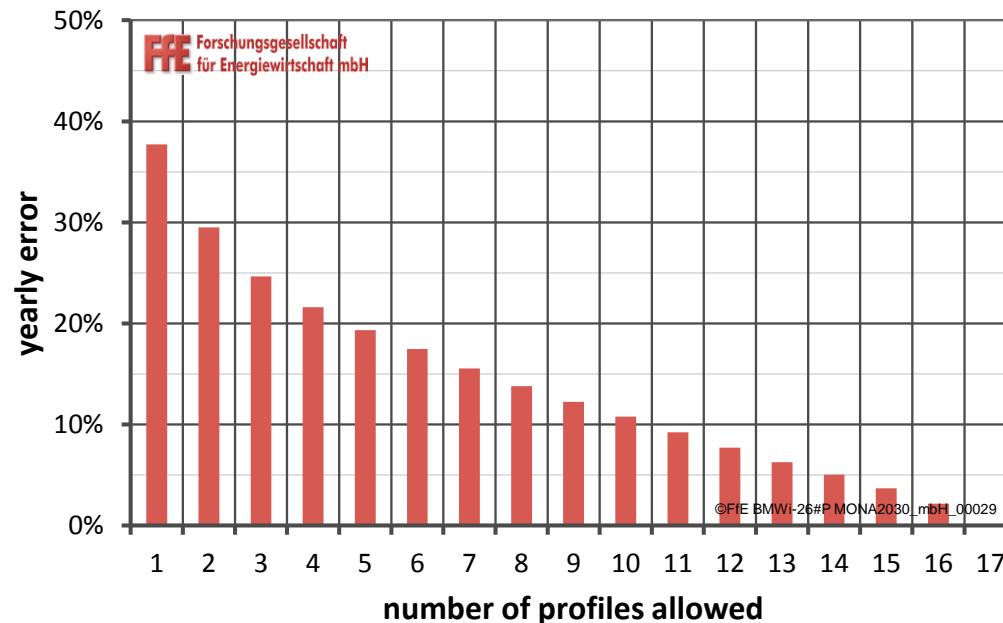
Load monitoring in lower grid levels exists only in scattered resolution



→ How can representative households be selected to synthetically generate network load data?

Using optimization to find the best linear combination

For a given number of N household load data that can be used, mixed integer linear optimization can be used.

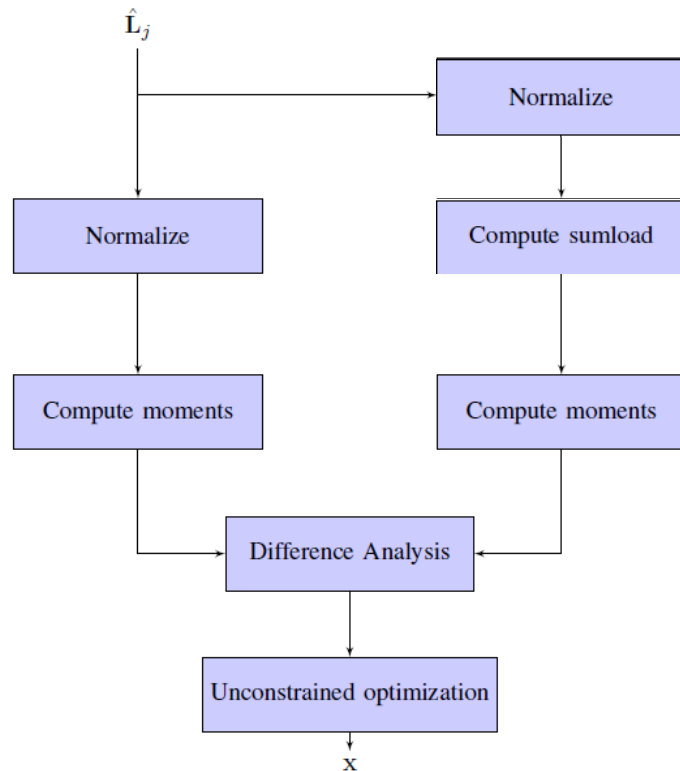


- Mixed integer linear optimization yields the best combination possible
 - Mixed integer linear optimization is time-consuming for bigger problems
 - Solving time for 10 profiles of 17 households and a yearly resolution of 35040 time-steps is more than 5 hours.
- Methods helping to reduce the problem are indispensable for analyzing more data

Methodic

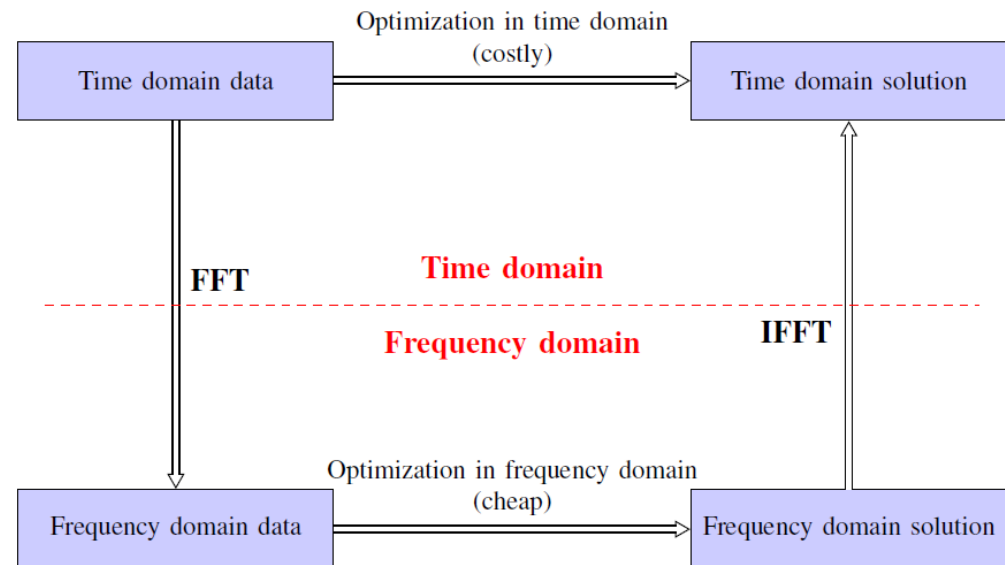
How can single profiles be selected for representative network load generation?

Statistic moments:



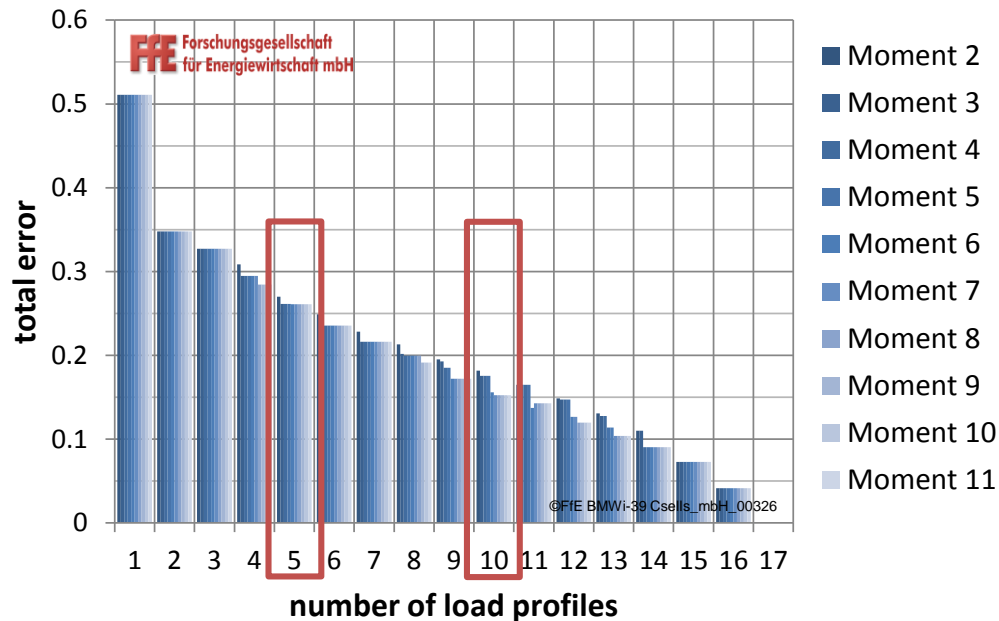
\hat{L}_j Household load data

Frequency transform:

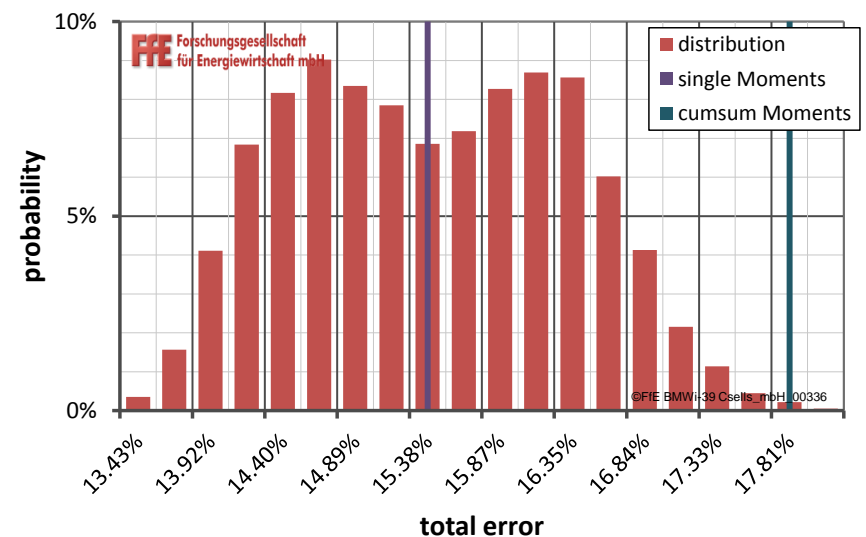
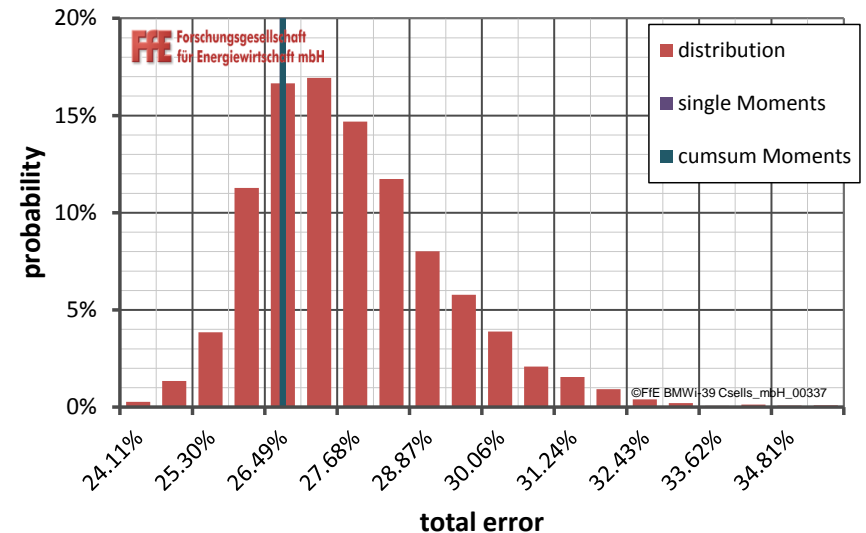


Findings – Statistical moments

Analysis of central moments

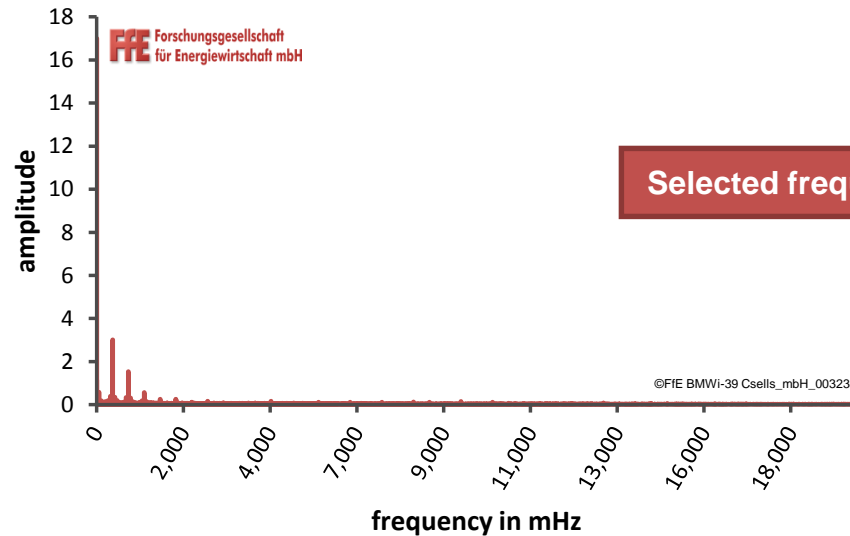


Sorting central moments does not yield any advantages over picking a random combination of profiles.

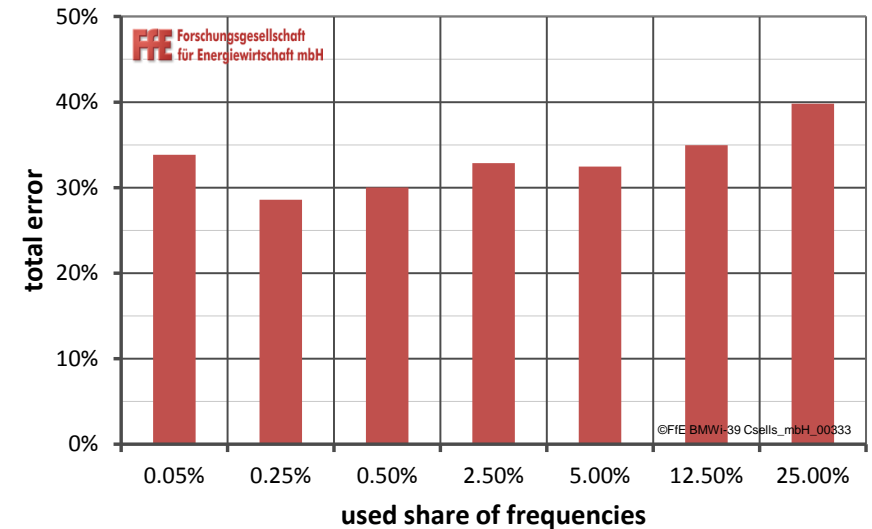


Findings – Frequency transform

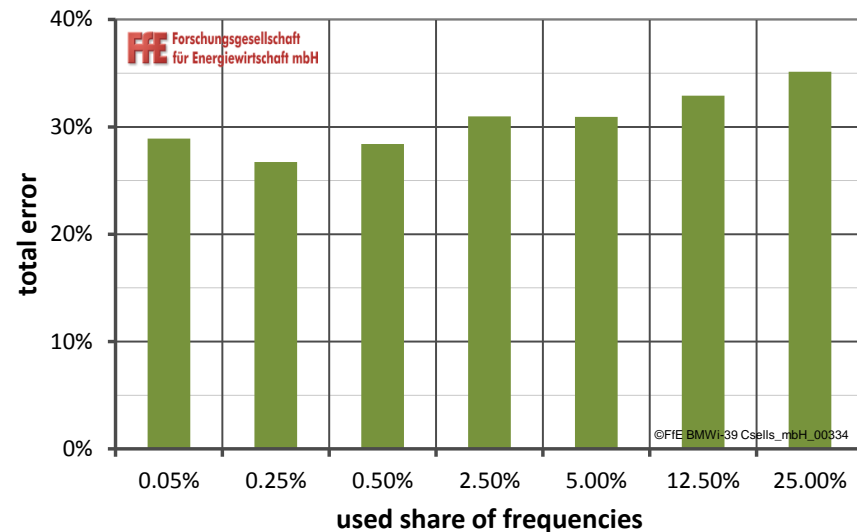
fft of network load



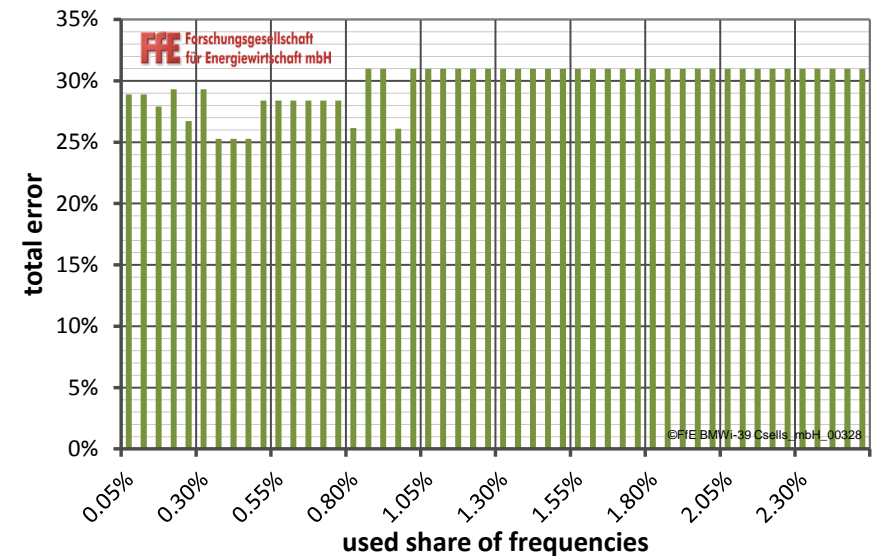
Time based error after optimization in frequencies



Time based error after optimization in time base

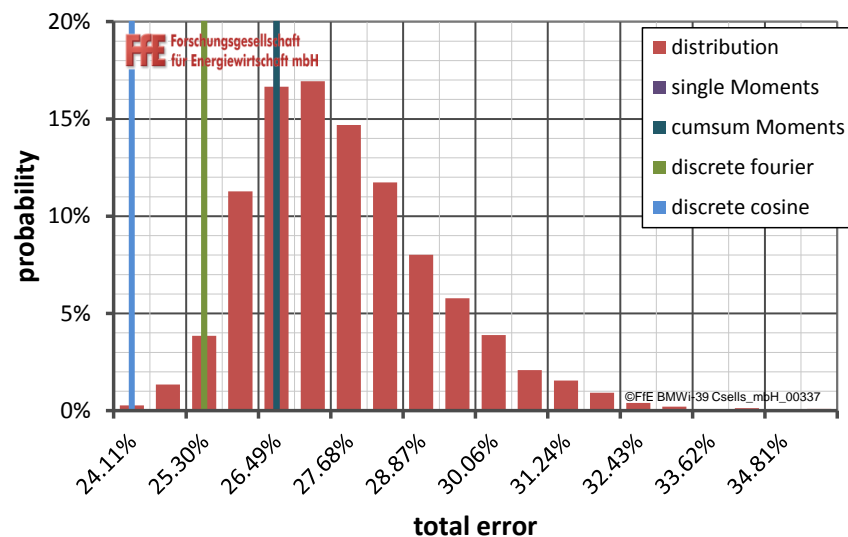


Time based error after optimization in time base

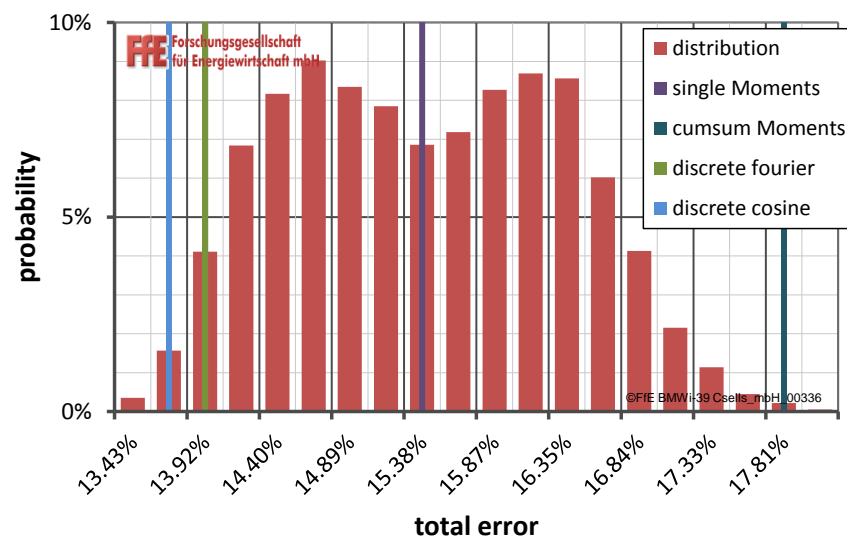


Key-findings & Conclusion

- Choosing profiles by sorting central moments of single profiles does not yield better results than random choosing
- Transform profiles in frequencies and optimizing only selected frequencies produces results near the optimum.
- Computing time of optimization can be reduced to under 0.1% (~about 15 seconds)



Distribution and results for 5 profiles



Distribution and results for 10 profiles

Thank you for your attention. Any questions or remarks?

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