



Technische
Universität
Braunschweig

Institut für Werkzeugmaschinen
und Fertigungstechnik **IWF**

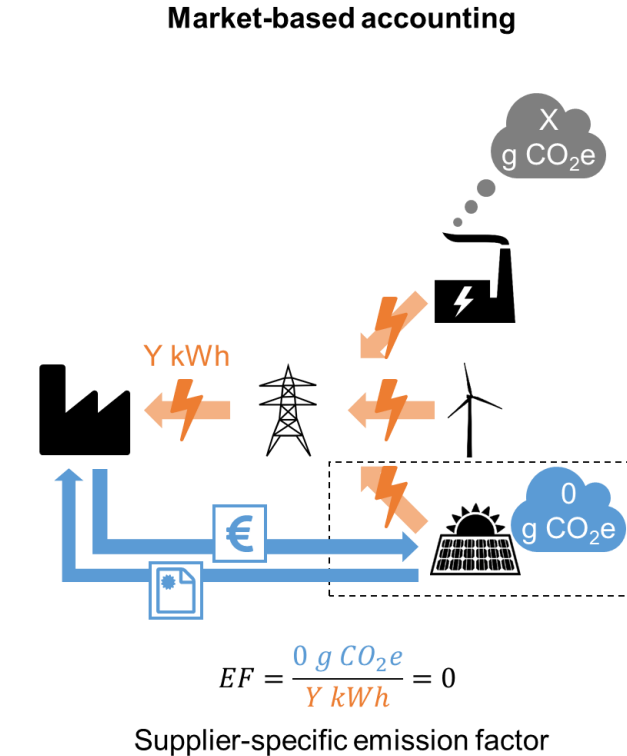
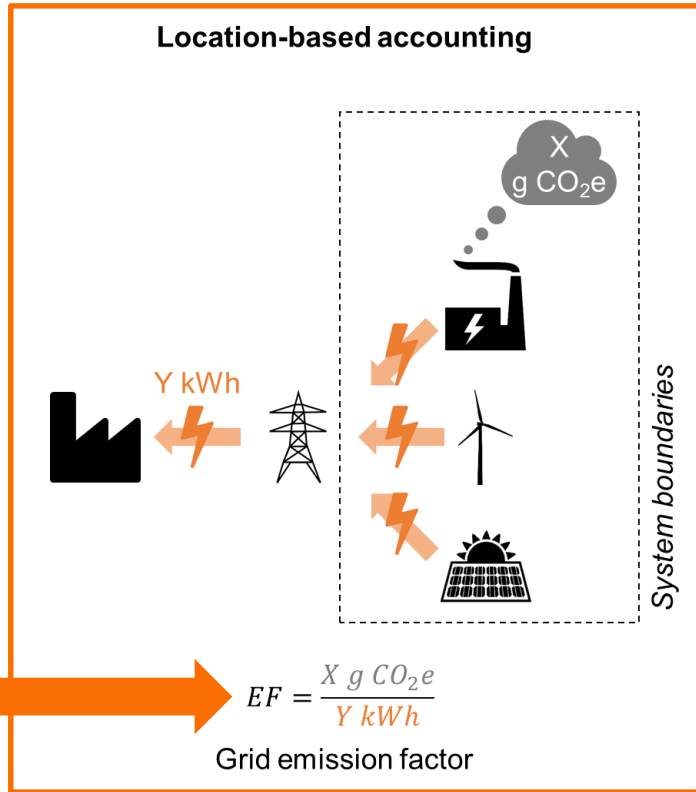


Methodological aspects of calculating a national grid emission factor 85th LCA Discussion Forum

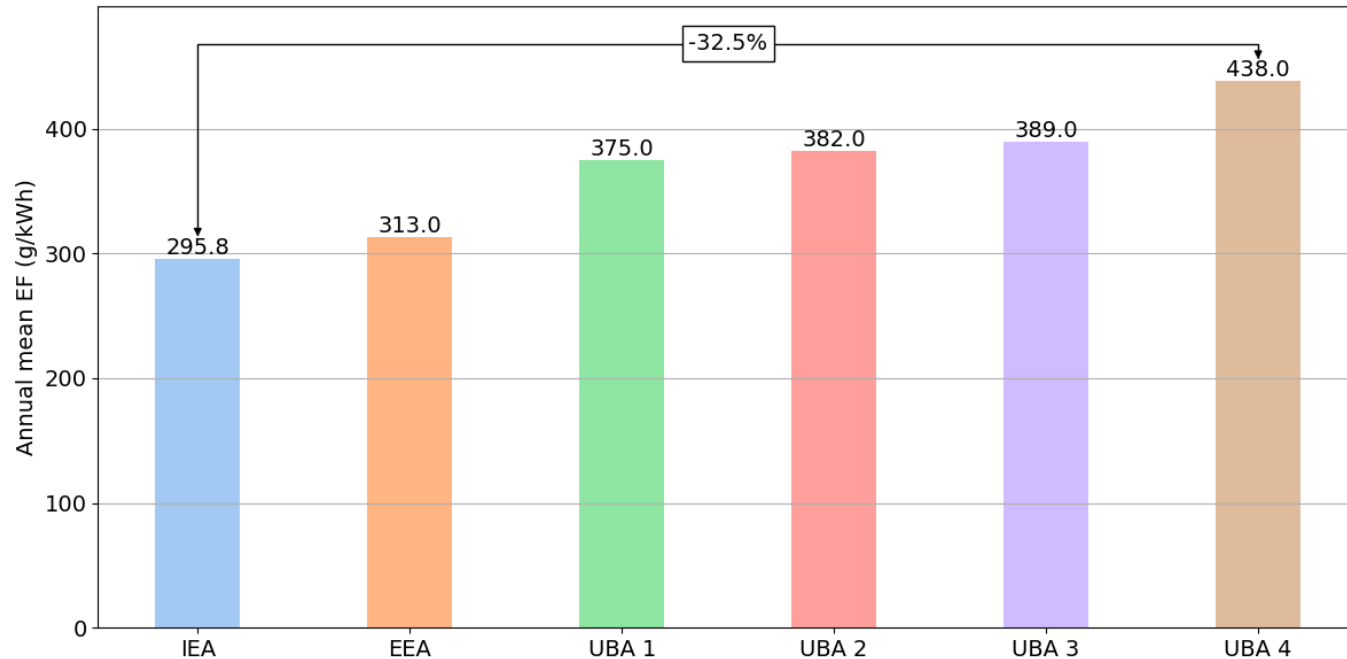
Malte Schäfer, 9.11.2023

National grid emission factor (NGEF) f. consumption emissions

Q Focus



NGEF varies depending on the data source



NGEF can vary by up to **one third**,
depending on the data source. *Why?*

Germany, 2020

IEA: International Energy Agency
EEA: European Environmental Agency
UBA: Umweltbundesamt (German Federal Environmental Agency)
NGEF: National grid emission factor

Three research questions (RQs) on NGEF calculatory aspects

- RQ1:** Which methodological aspects impact the final grid-average electricity EF?
- RQ2:** How significant is the effect of various choices within these aspects on the outcome?
- RQ3:** Which methodological choices best represent the emissions from an organization's electricity consumption?

EF: Emission factor
RQ: Research question

Nine aspects found to influence NGEF

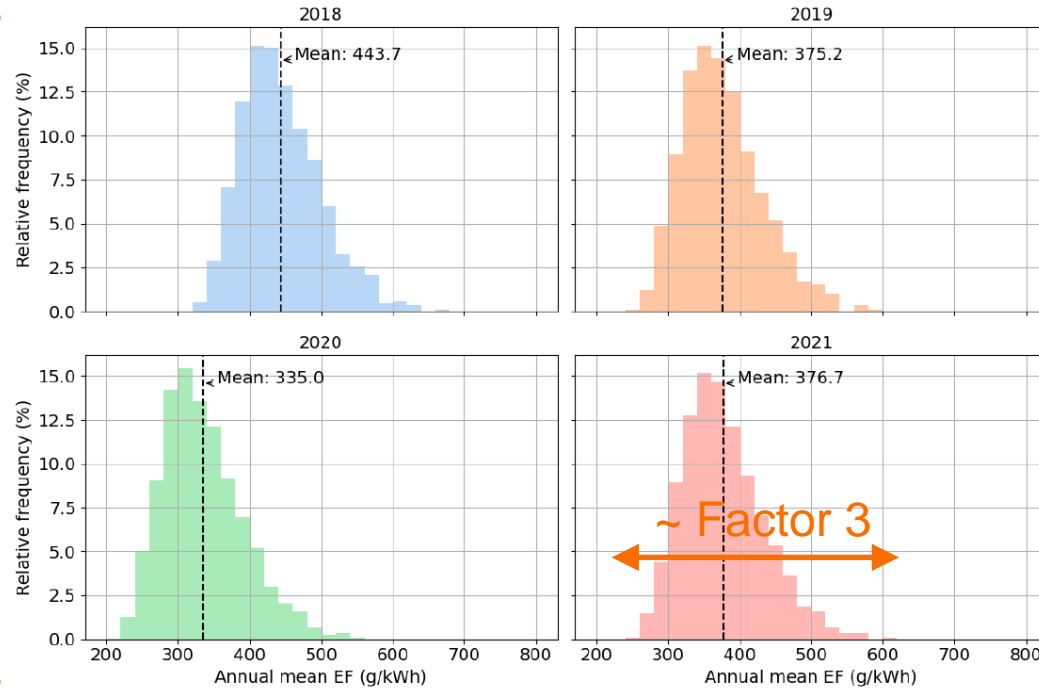
Previous studies

Aspect	Absolute effect (g/kWh)	Relative effect (%)
Impact metric	+9...+33	+1.9...+5.9
System boundaries	+14...+69	+2.2...+13.2
Co-generation of heat	+1	+0.2
Auto-producers	–	–
Auxiliary consumption	+20	+5.1
Electricity Trade	-22...+12	-4.0...+2.9
Storage Cycling	+5...+6	+1.2...+1.3
Transformation & Distribution	–	+3.9...+4.2
Temporal resolution	-398...+275	-60.9...+40.7

**Nine methodological aspects influence the NGEF,
some to a considerable extent.**

Own analysis quantifies aspects' influence on NGEF

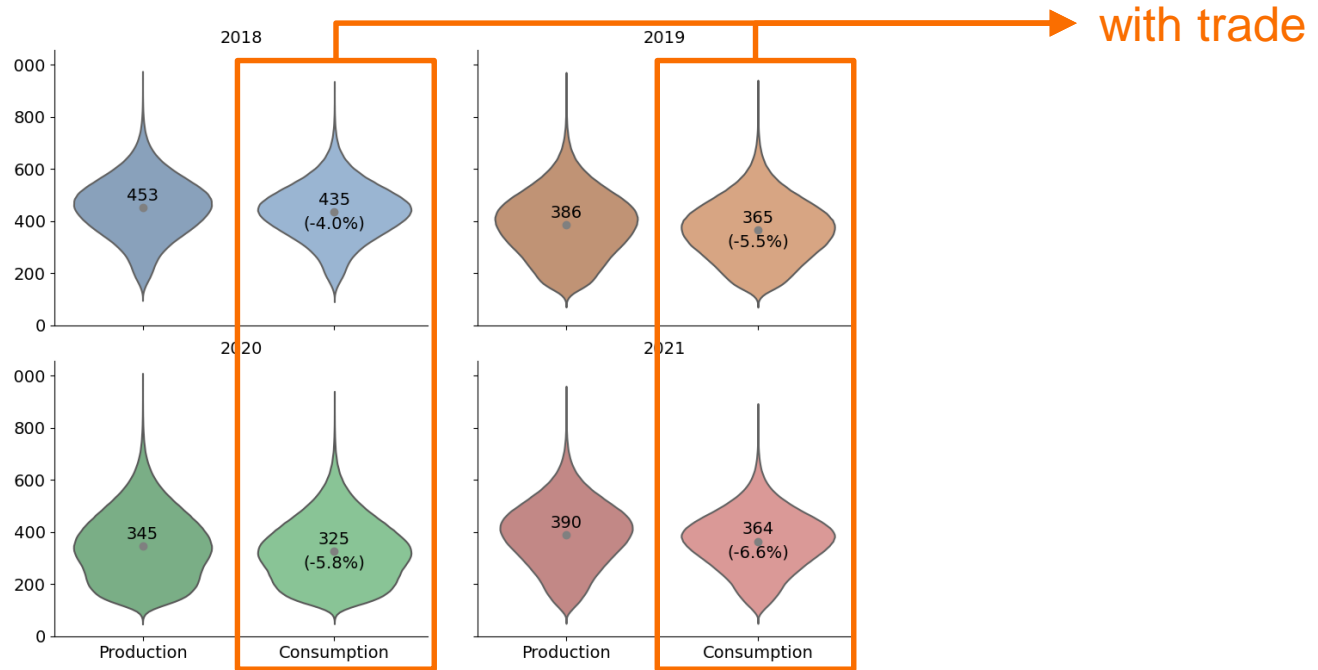
Own calculations



Depending on the methodological configuration, the NGEF can vary by a factor of 3.

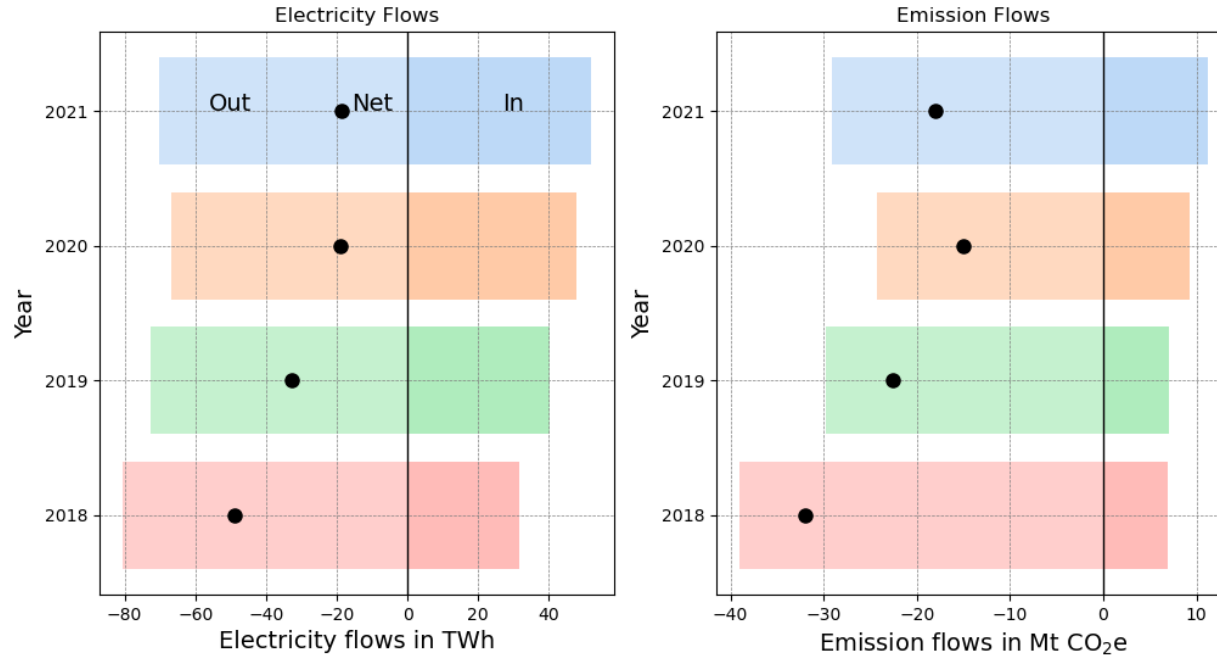
Own analysis, 2304 different NGEF configurations. Bin width = 20.
NGEF: National grid emission factor

Electricity trade reduces Germany's NGEF by 4 to 7 %



Germany exports more emissions than it imports –
due to trade balance, NGEF difference, or both?

Germany has a net electricity and emission outflow



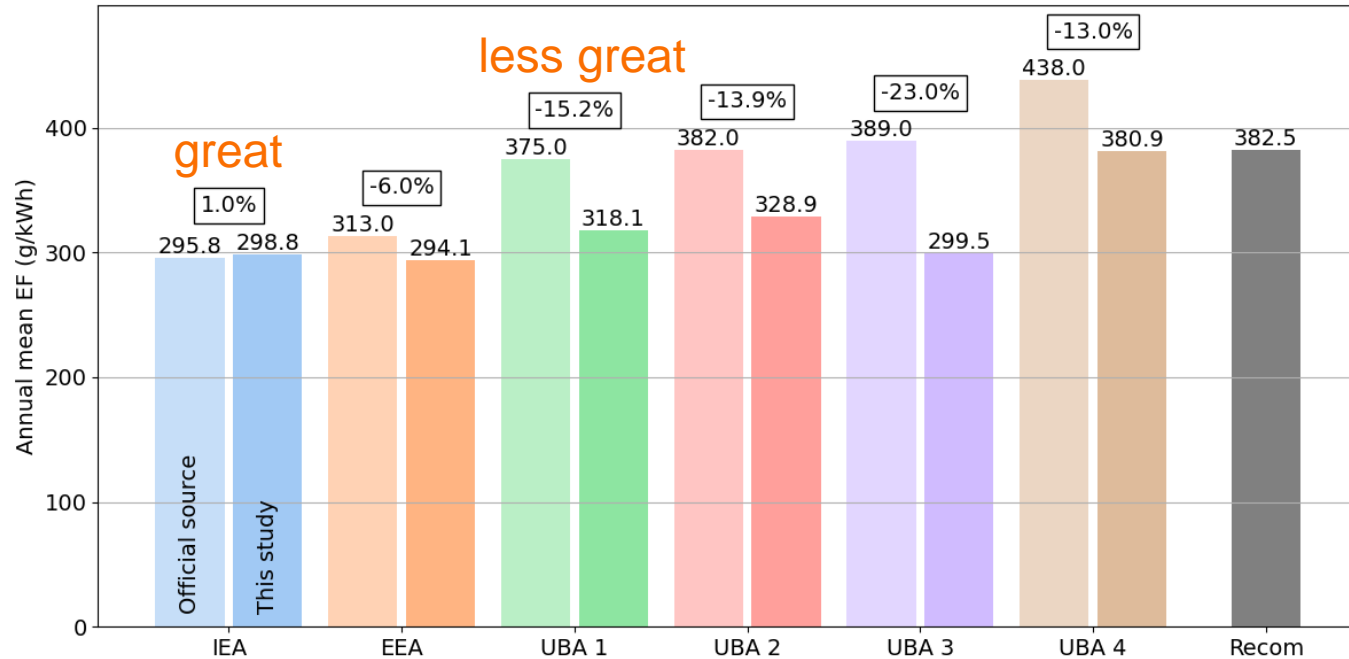
Both the electricity and the emission balance explain the trade's effect on the NGEF.

Recommended NGEF configuration f. consumption emissions

Aspect	Choices
Impact metric	Global warming potential (100a)
System boundaries	Life cycle emissions
Co-generation of heat	Allocation by exergy
Auxiliary consumption	Include
Auto-producers	Include only auto-producers
Temporal resolution	15 min.
Electricity trading	Include
Storage cycling	Include (pumped hydro)
Transformation & distribution	Include (grid losses)

The recommended configuration to be used when accounting for emissions from electricity consumption.

Validating methodology against official sources



Replicating IEA's methodological choices works great,
less so for UBA.

Germany, 2020

Used the same choices for all methodological aspects as documented by the official sources (IEA, EEA, UBA). For an ideal replication, the difference would be 0.0 % between each pair of bars.

Recommendations

eurostat  & entsoe  Harmonize data classification systems.

Document all methodological choices transparently.

Make all data publicly available.

Align/standardize approaches for NGEF calculation.

Disclose source for NGEF in your GHG reporting.

Include recommended NGEF configuration in guidelines.





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Thank you!

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Link to code (& data, study):

<https://t1p.de/ngef4lcaf>