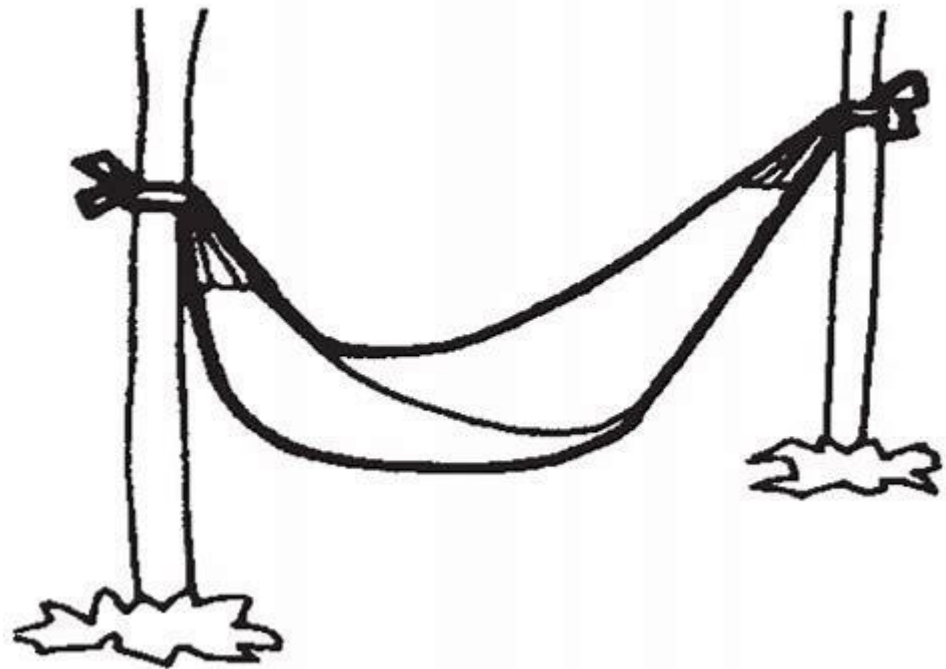


Sufficiency:

the “key” nobody wants to try?



Agenda

- Role of strategies for climate neutrality (GER)
- Sufficiency in the EU
- Sufficiency strategies
 - Types
 - Uses
 - Potential

Strategies, **Dimensions** and Side-effects

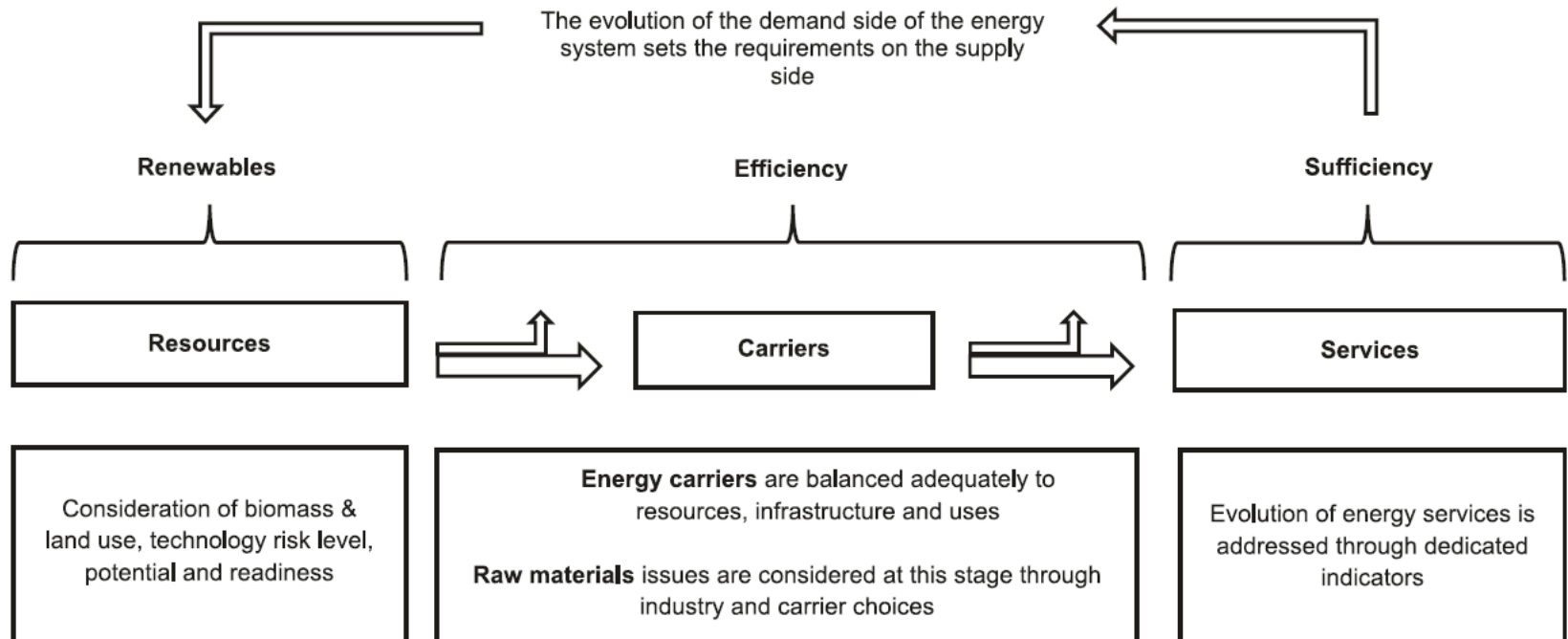
Sustainability - matrix					
Dimensions	Environment	Social	Economy		
	Nature, resources	Needs, Ethics	Growth, competitiveness		
Strategies	Efficiency	Consistency	Sufficiency		
	Resource use, input per output	Circular thinking, regeneration time	Reduction, substitution revision of habits		
Criteria	Conservation	Acceptance	Solidarity	Participation	Justice ...
Indicators	Resource use	Fatalities	Access	Costs	...

Sufficiency in the EU

Scenario-based analysis:

CLEVER (Collaborative Low Energy Vision for the European Region)

- **Bottom up** national scenarios: 30 countries, national and regional levels



Sufficiency in the EU

Scenario-based analysis:

CLEVER (Collaborative Low Energy Vision for the European Region)

- **Bottom up** national scenarios: 30 countries, national and regional levels
- **Sufficiency indicators:**
 - Dimensional: size of vehicles
 - Service-related: intensity and duration use
 - Organisational: public transport

Sufficiency in the EU – Indicators and sectors

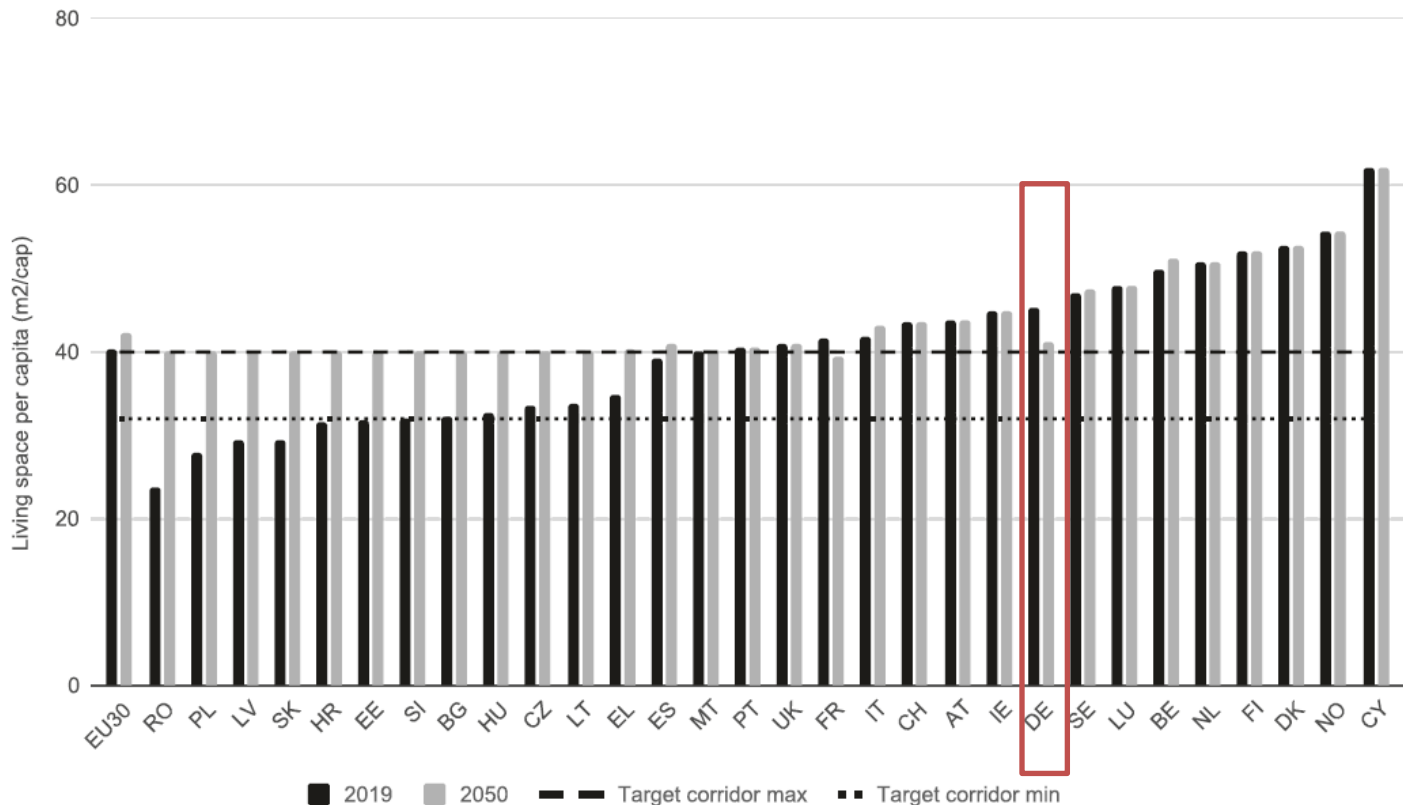
Table 1 | Overview of main energy sufficiency indicators applied in the CLEVER scenario

Sector	Indicator	Unit	Explanation
Mobility	Passenger transport demand	pkm/cap per year	Distance travelled per capita: Number of kilometres travelled per person and per year
	Passenger transport demand: Plane	pkm/cap per year	Number of kilometres travelled by air per person and per year (domestic and international)
	Share of active mobility	pkm/cap per year or%	Distance travelled per person and per year via active modes (mainly cycling and walking) expressed in passenger-kilometres or as a share of total distance travelled per capita
	Share of collective transports	%	Share of domestic distance travelled per capita (pkm), except air and active mobility, travelled by bus, coach, metro/tram, train or boat
	Car occupancy	person/car	Average number of passengers per car travelling (weighted average over all segments of cars)
Freight	Domestic freight transport demand	tkm/cap per year	Domestic freight amount and distances: Tons times kilometres transported per year divided by the population
	Share of rail transport	tkm/cap per year or%	Part of domestic freight transport by rail
	International maritime freight transport	tkm/cap per year	International maritime freight amounts and distances: Tons times kilometres transported on international waterways to the country per year divided by the population
Residential	Living space	m ² /person	Useful floor space of dwellings permanently occupied, divided by the population
	Domestic hot water FEC	kWh/person per year	Final energy consumption per person for hot water per person per year; mix of sufficiency (hot water needs per person) and efficiency of the water heating system
	FEC for specific electricity	kWh/person per year	Final energy consumption per person for specific electricity; mix of sufficiency (size and number of equipments; frequency/duration of use) and efficiency (energy performance of the equipment)
Industry	Production / demand of a material	Index (2015)	Evolution by comparison to 2015 of the production of several materials (cement, steel, pulp/paper, glass, ammonia and high value chemicals); no relocalisation/delocalisation assumptions have been made. The ratio between national demand and national production is supposed to remain stable. Then an evolution of demand (in%) is equal to the evolution of production
	FEC of an industrial sector	Index (2015)	Evolution by comparison to 2015 of the final energy consumption of an industrial sector (food, chemicals, non-ferrous metals and "Others"); mix of sufficiency (evolution of the demand, circularity) and efficiency of the process
Agriculture and Food	Meat consumption	g/day	Average daily meat consumption per person
	Consumption of dairy products	g/day	Average daily consumption of dairy products per person

Sufficiency in the EU – Indicators and sectors

Assumptions

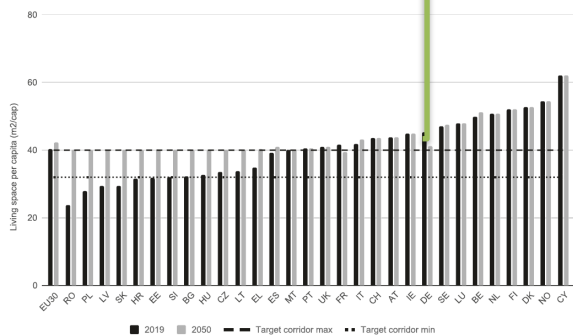
Living space per capita



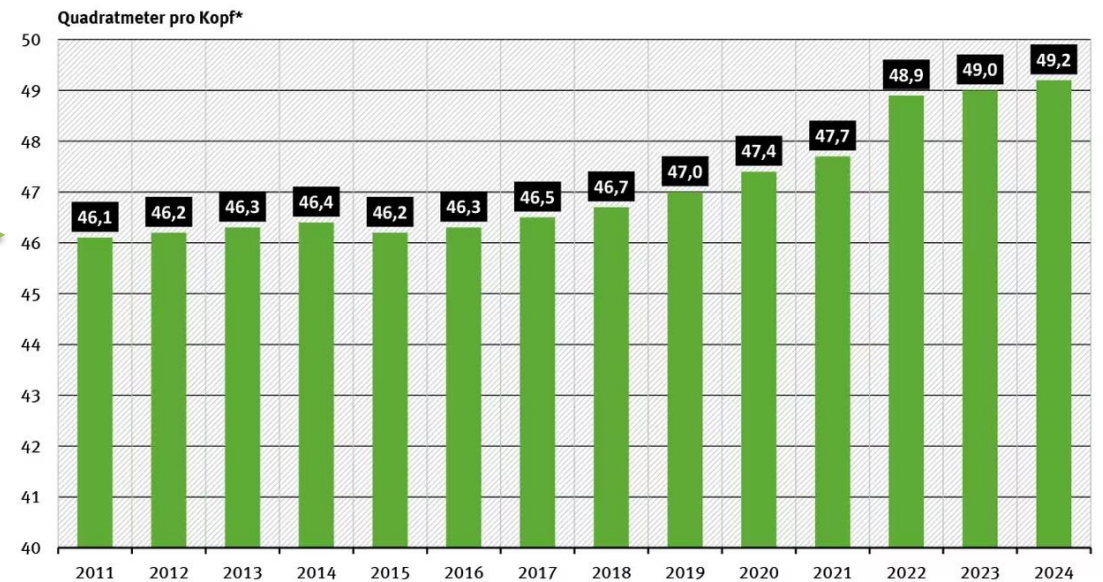
Sufficiency in the EU – Indicators and sectors

Assumptions

Living space per capita – current trends!



Wohnfläche pro Kopf



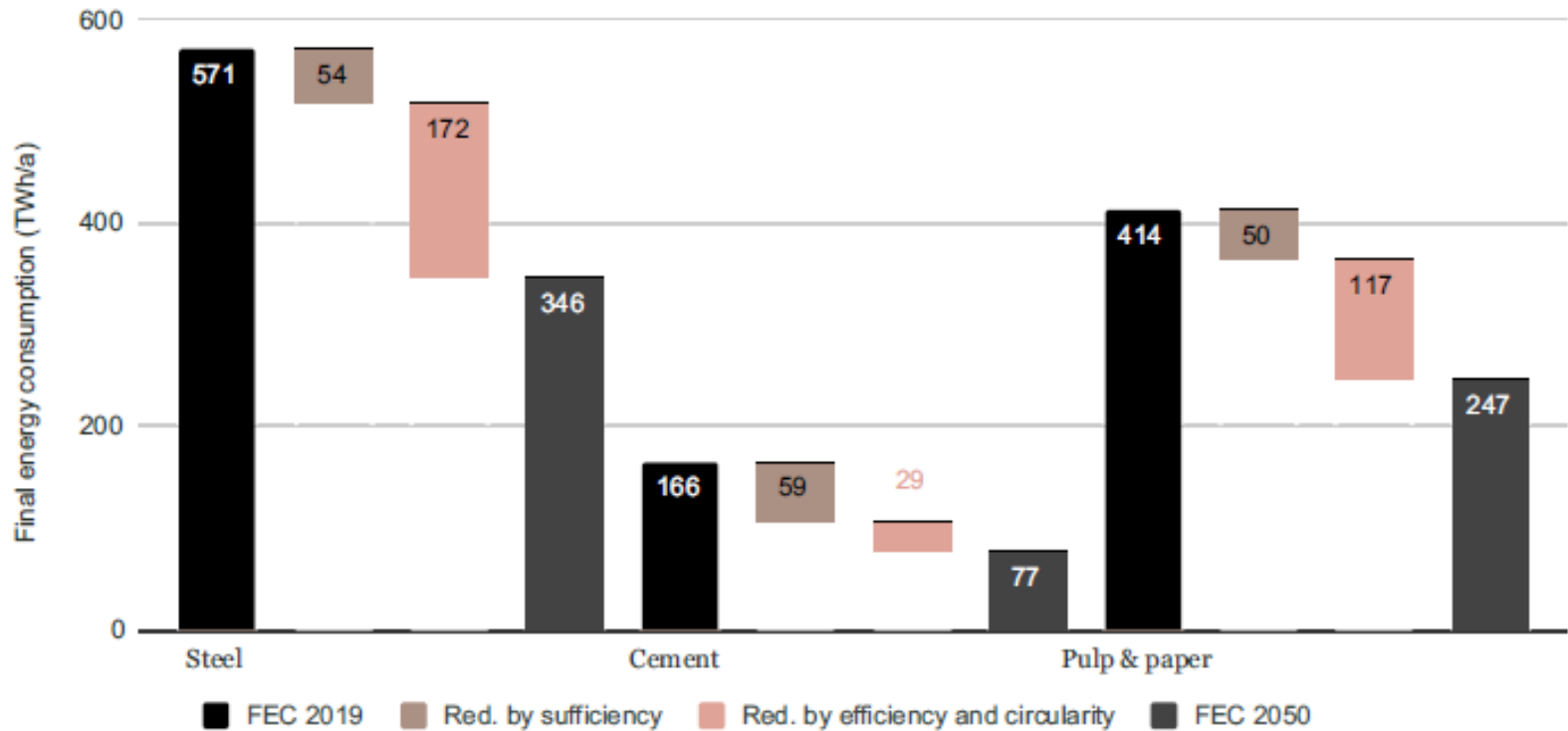
* auf Basis der Bevölkerungsfortschreibung des Zensus 2011 (2011-2021) und Zensus 2022 (2022-2024)

Quelle: Statistisches Bundesamt 2025, Gesellschaft und Umwelt, Wohnen, <https://www.destatis.de/DE/Themen/Gesellschaft-Umwelt/Wohnen/Tabellen/wohnungsbestand-deutschland.html>, abgerufen am 20.11.2025

Sufficiency in the EU – Indicators and sectors

Assumptions

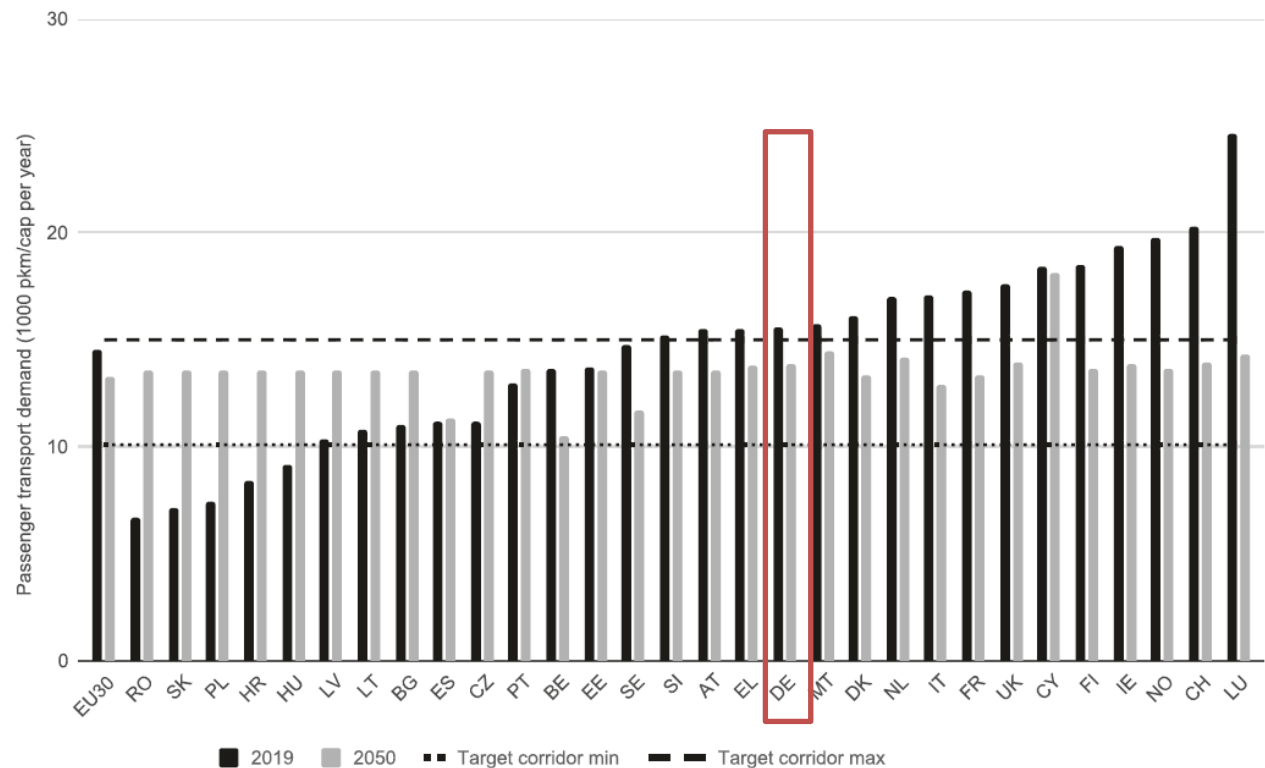
Changes in final energy consumption (FEC) in three energy-intensive industrial subsectors in EU30



Sufficiency in the EU – Indicators and sectors

Assumptions

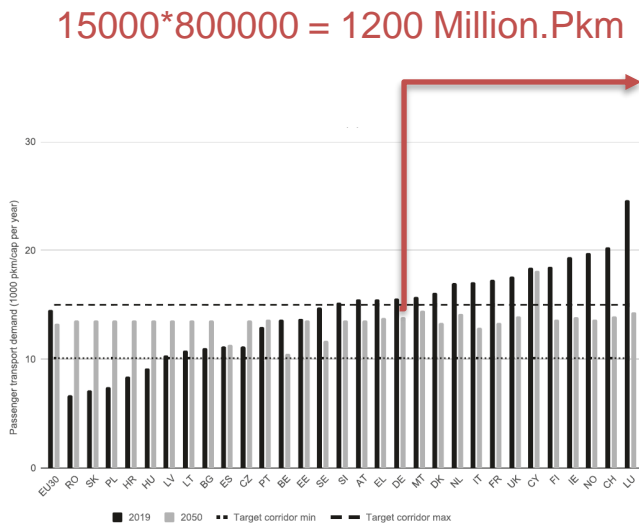
Passenger transport demands



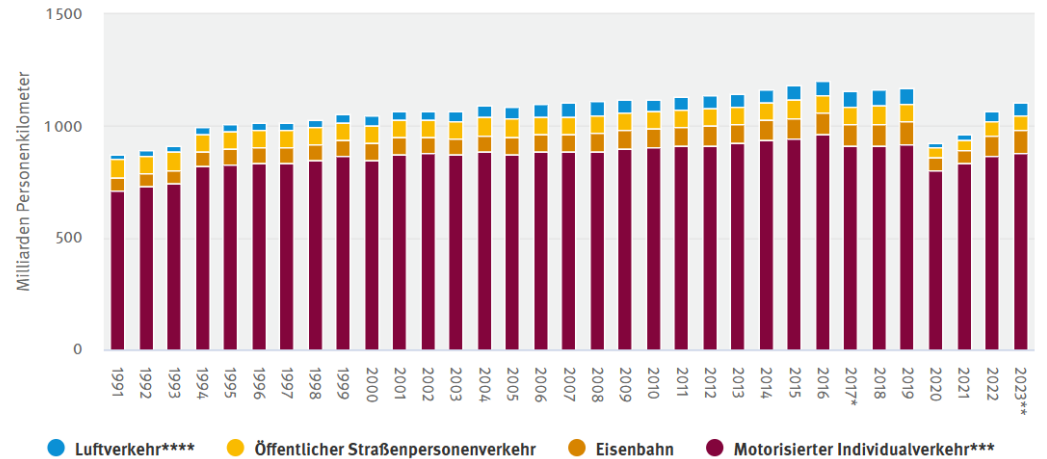
Sufficiency in the EU – Indicators and sectors

Assumptions

Passenger transport demands – current trends!



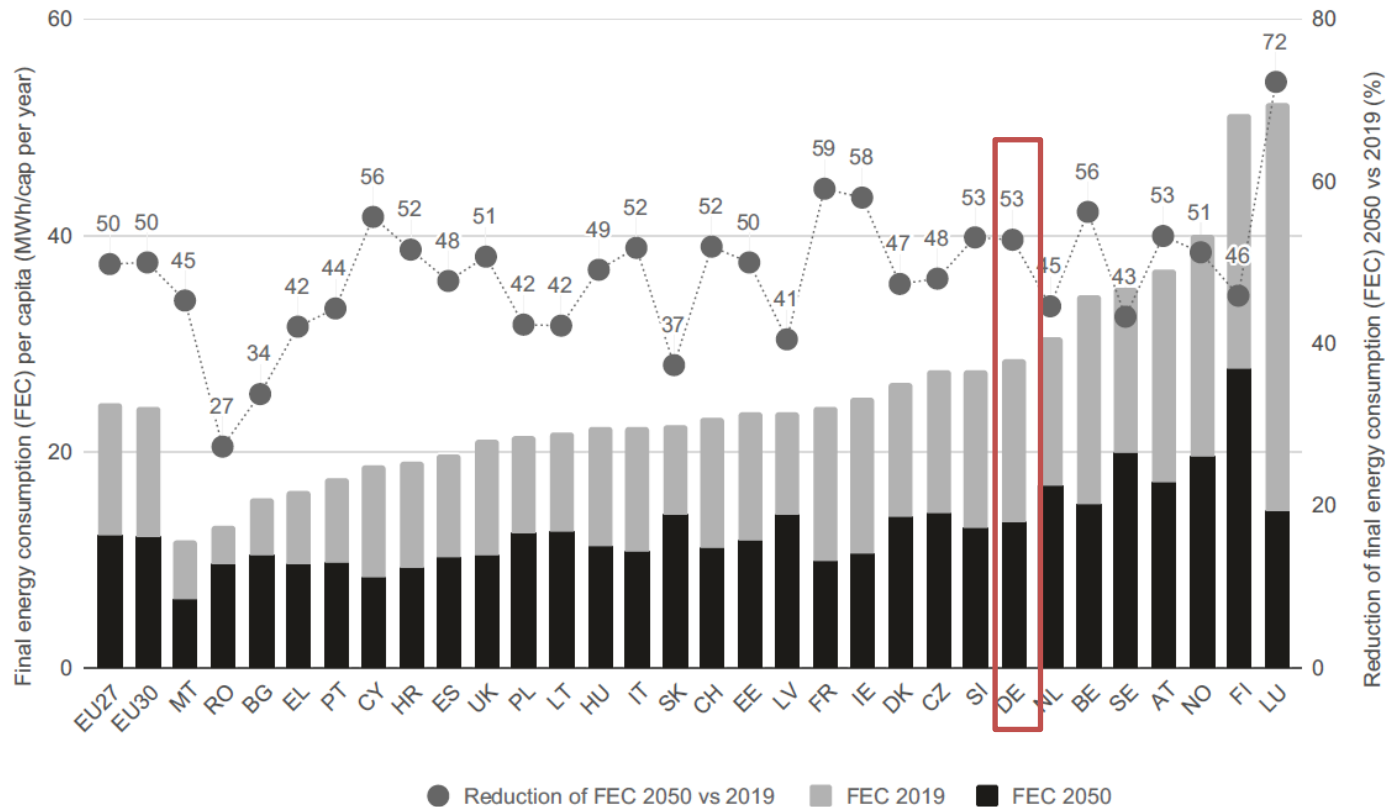
Personenverkehr: motorisierte Verkehrsleistung nach Verkehrsträgern in Deutschland



Sufficiency in the EU

Impacts

Final energy consumption (excl. energy sector)

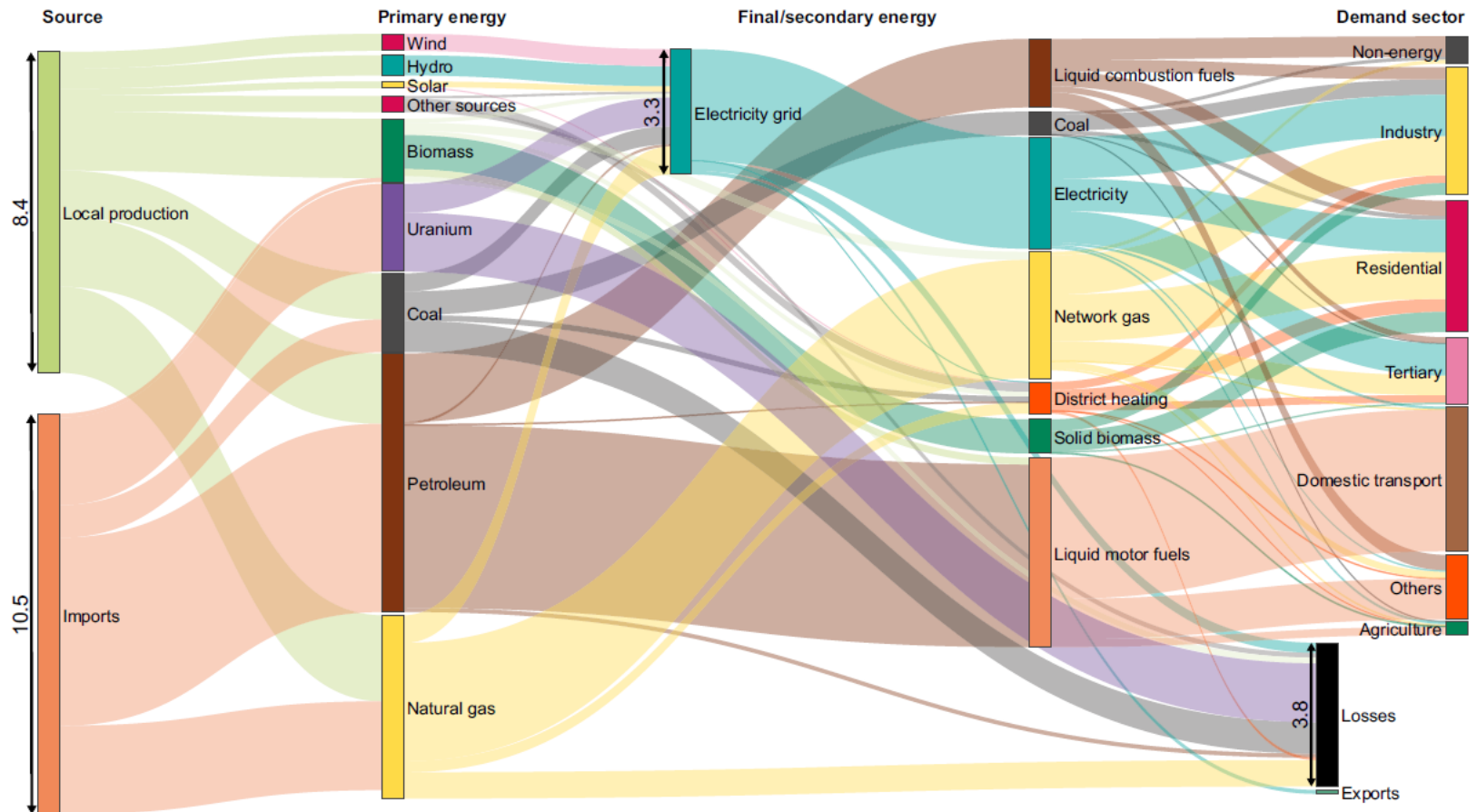


Sufficiency in the EU

Impacts

Final energy consumption (incl. energy sector)

a Energy flows in 2019

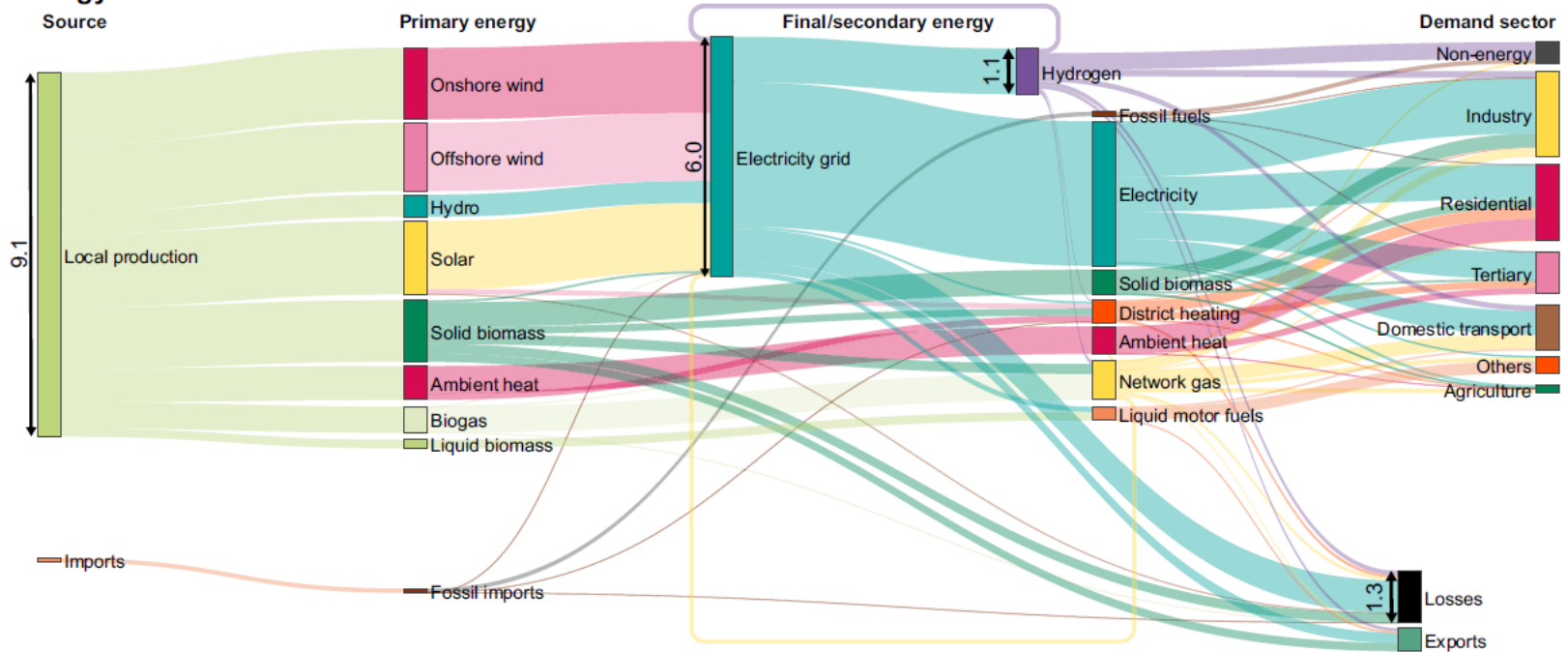


Sufficiency in the EU

Impacts

Final energy consumption (incl. energy sector)

b Energy flows in 2050



Agenda

- Role of strategies for climate neutrality (GER)
- Sufficiency
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Strategies, **Dimensions** and Side-effects

	Sustainability - matrix				
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Criteria	Conservation	Acceptance	Solidarity	Participation	Justice ...
Indicators	Resource use	Fatalities	Access	Costs	...

Classification of Sufficiency strategies

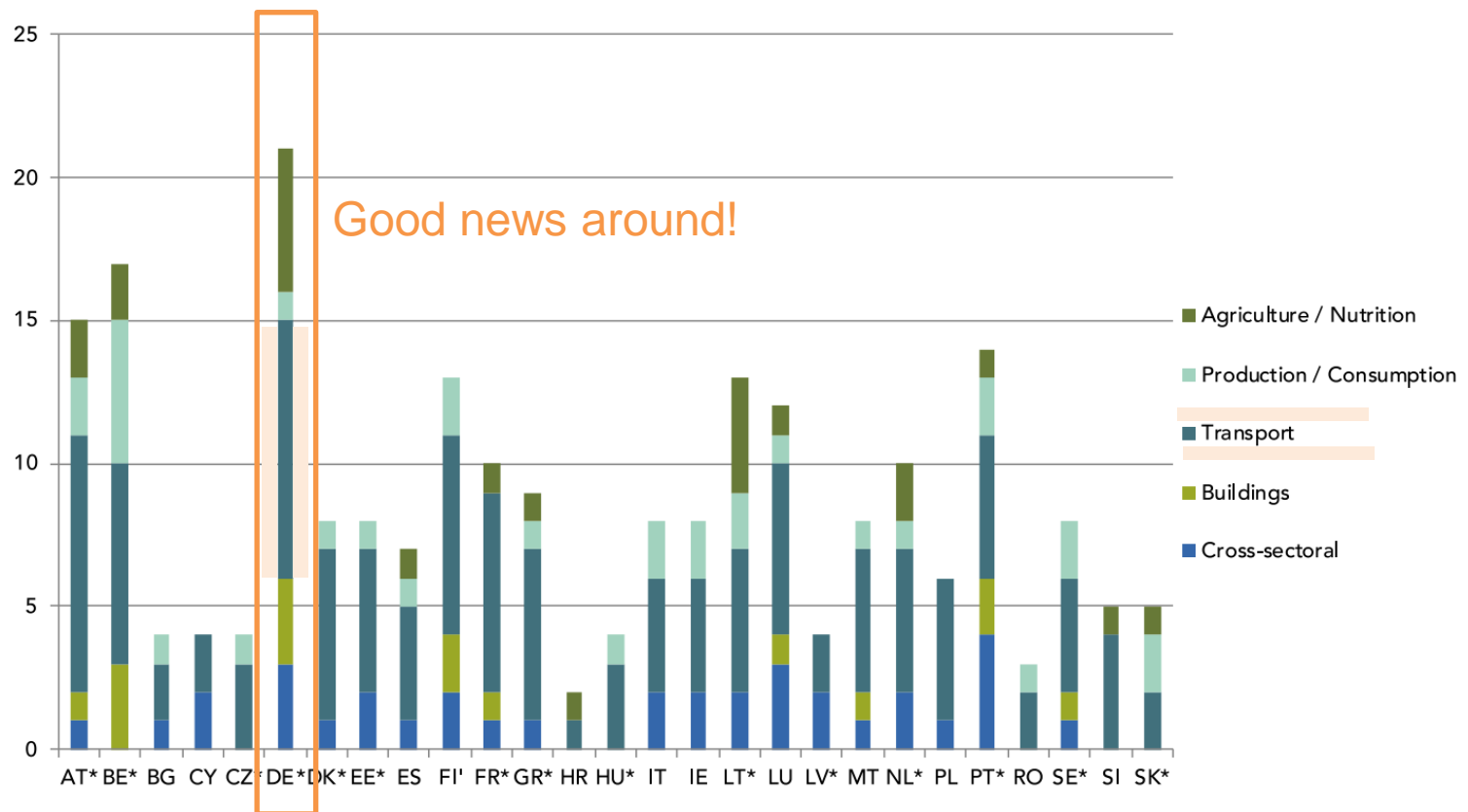
Types

- a) **Reduction:** reducing services provided, e.g. less living area per capita, less Pkm
- b) **Substitution:** replacing one service by another less intensive one, e.g. private mobility by public transport, ICEs by BEVs → close to efficiency!
- c) **General:** strategies addressing reduction of GHG emissions in general (e.g. Carbon taxes) without aiming at one particular strategy/way to achieve them

Classification of Sufficiency strategies

Uses in different sectors (EU)

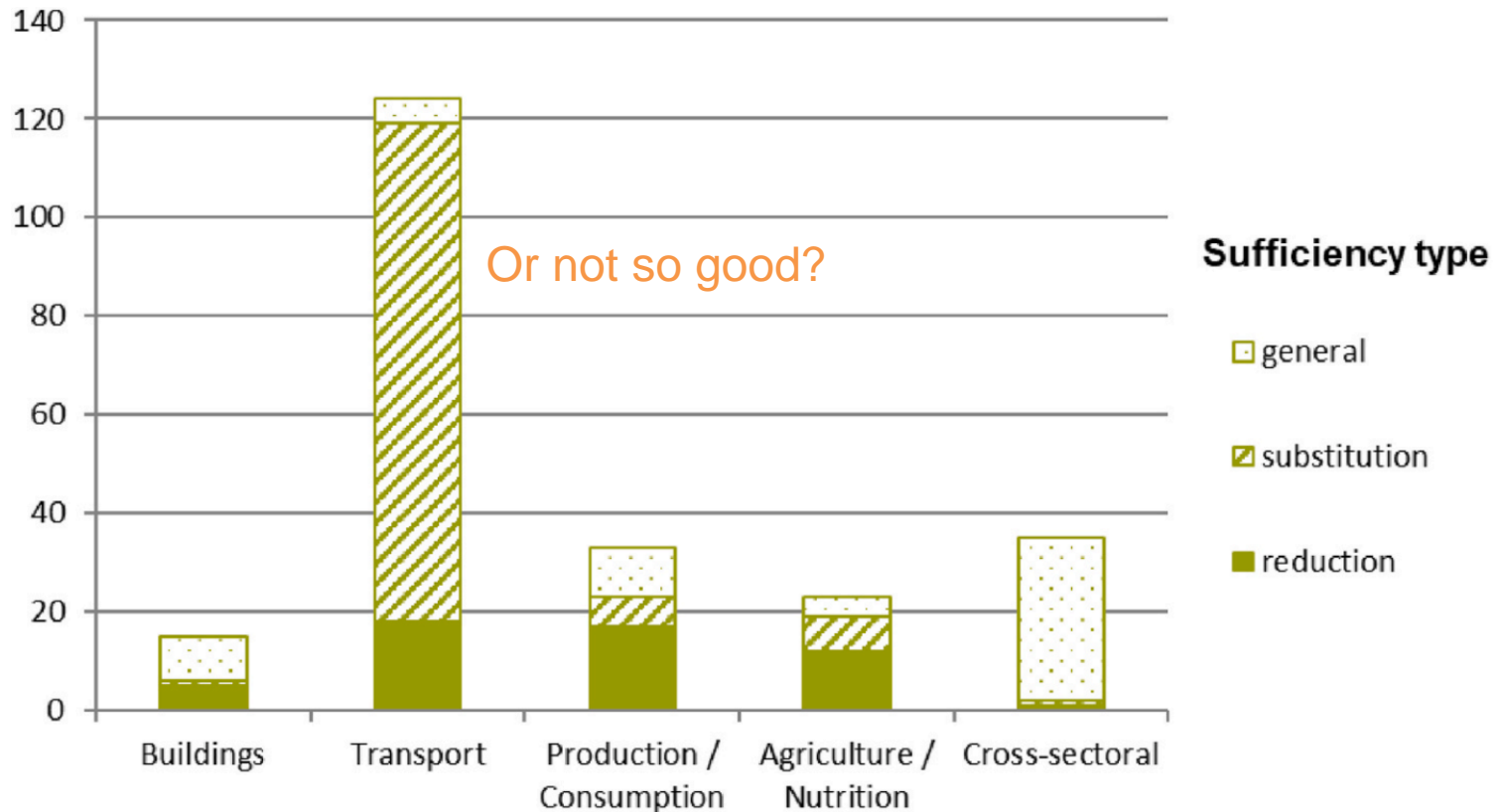
Number of sufficiency measures by country (EU) and sector



Classification of Sufficiency strategies

Uses in different sectors (EU)

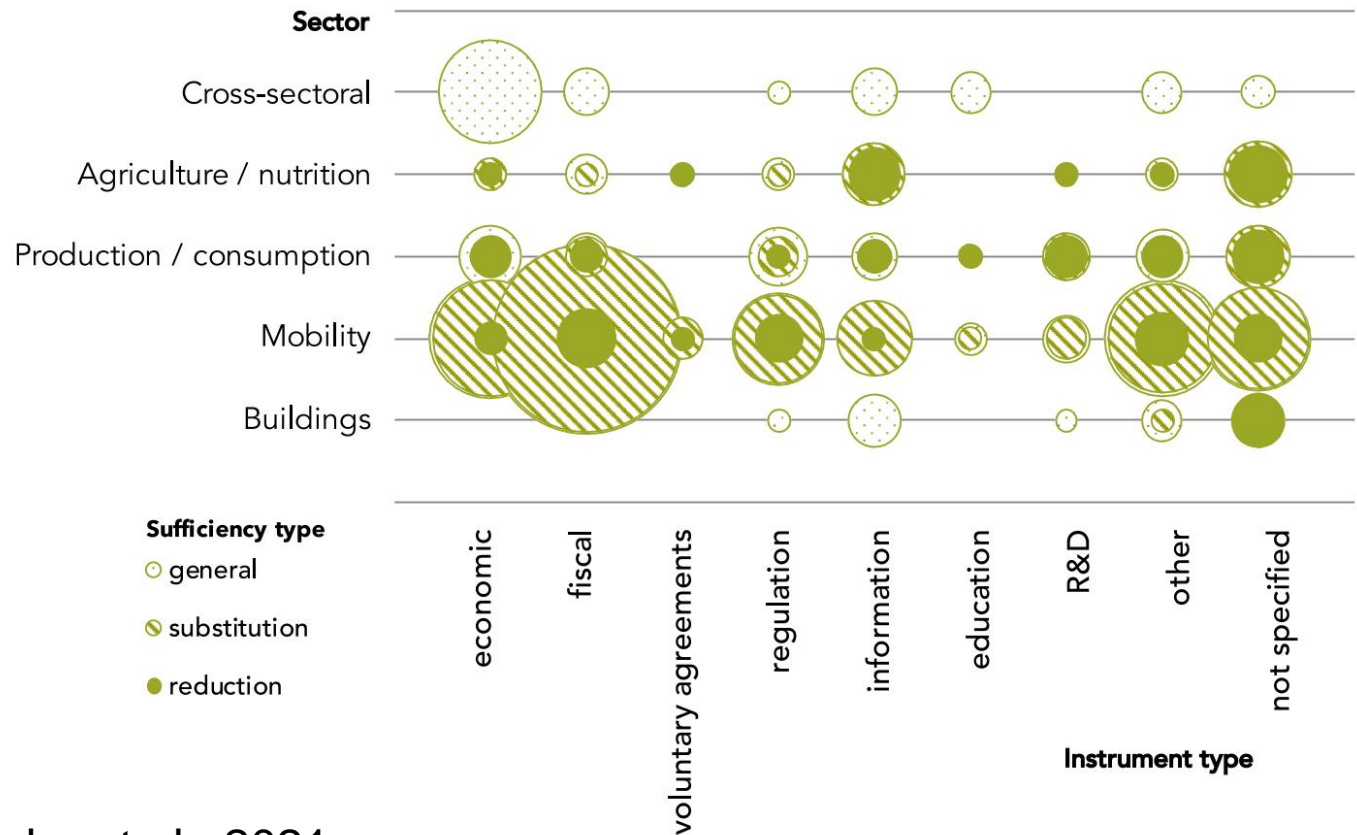
Number of sufficiency measures by sector and type (total 230 measures found)



Classification of Sufficiency strategies

Uses in different sectors (EU)

Number of sufficiency measures by sector, type and policy instrument



Source: Zell-Ziegler et al., 2021

References

Wiese et al., 2022. *Strategies for climate neutrality. Lessons from a meta-analysis of German energy scenarios.* Renewable and Sustainable Energy Transition 2 (2022) 100015 <https://doi.org/10.1016/j.rset.2021.100015>

Zell-Ziegler et al., 2021. *Enough? The role of sufficiency in European energy and climate plans.* Energy Policy, Volume 157, 2021, ISSN 0301-4215, <https://doi.org/10.1016/j.enpol.2021.112483> .

“Renewables don't lose an ecological problem,
only transform them into another physical,
spatial, temporal or systemic dimension”

Niko Paech

2012. Auf dem Weg in die Postwachstumsökonomie. In: Orientierungen zur

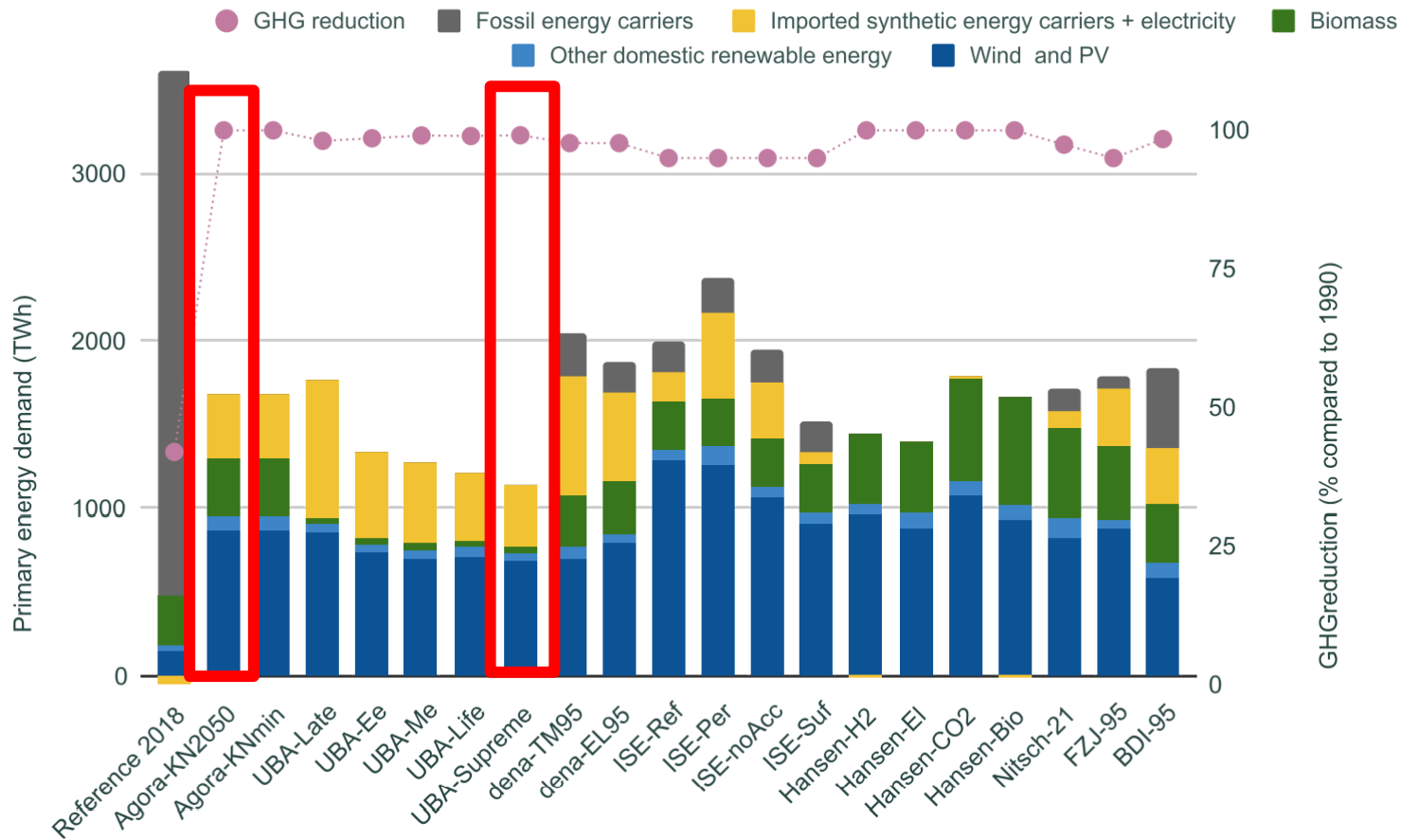
Wirtschafts und Gesellschaftspolitik. Nr. 134, pp. 61-67

<http://www.postwachstumsoekonomie.de/wp-content/uploads/Paech-2012-Orientierungen-134.pdf>

Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

Total primary energy demand and emission reductions



Focus:
AGORA
UBA Supreme

Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

Total primary energy demand and emission reductions



And the winner seems to be.....Consistency

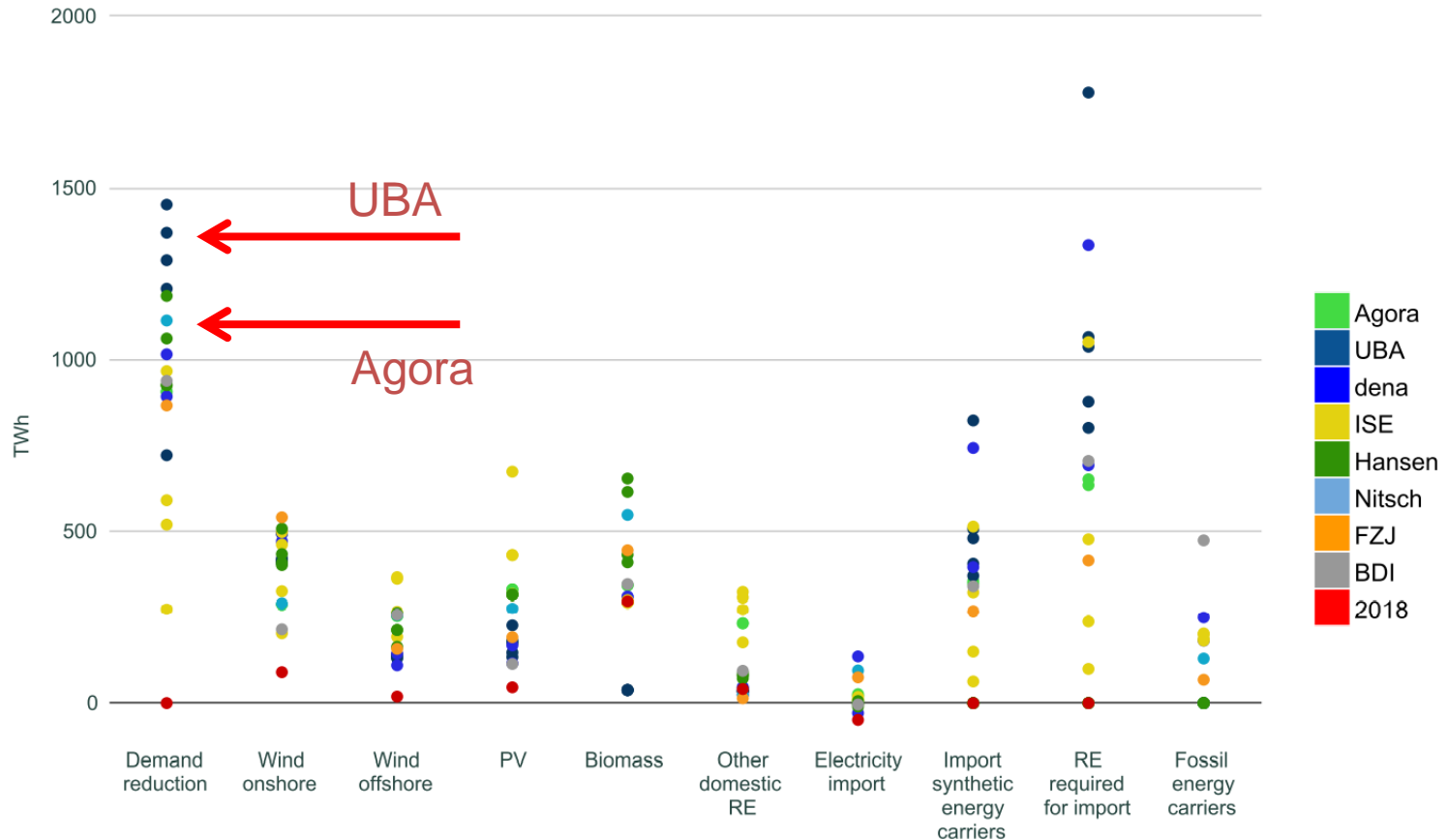
- Wind and PV represent more than 50% of total energy supply in nearly all scenarios
- Synthetic fuels or Biomass would do another 30%



Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

Energy balances



Note:

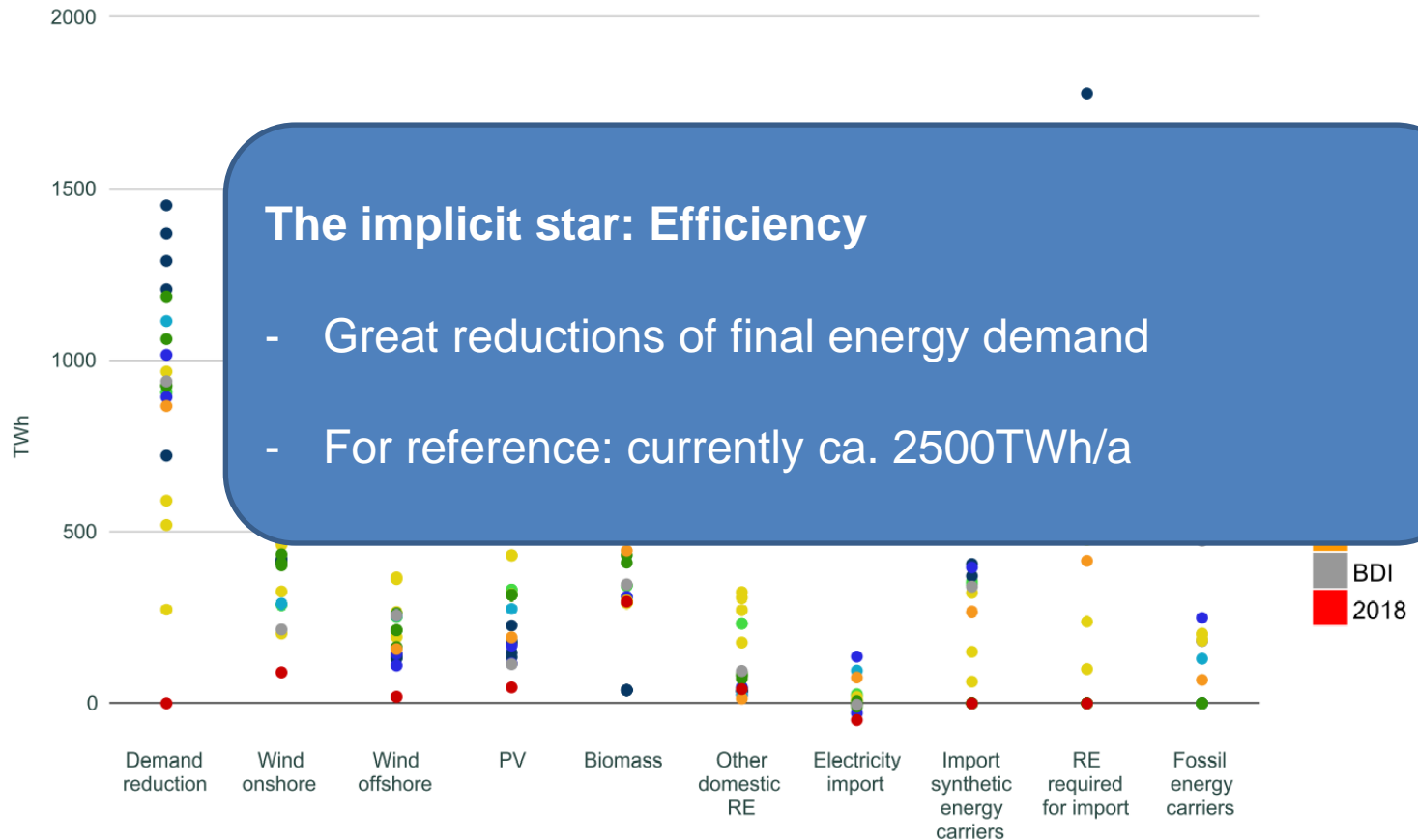
Demand reduction in final energy

All the rest in primary energy

Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

Energy balances



Note:

Demand reduction in final energy

All the rest in primary energy

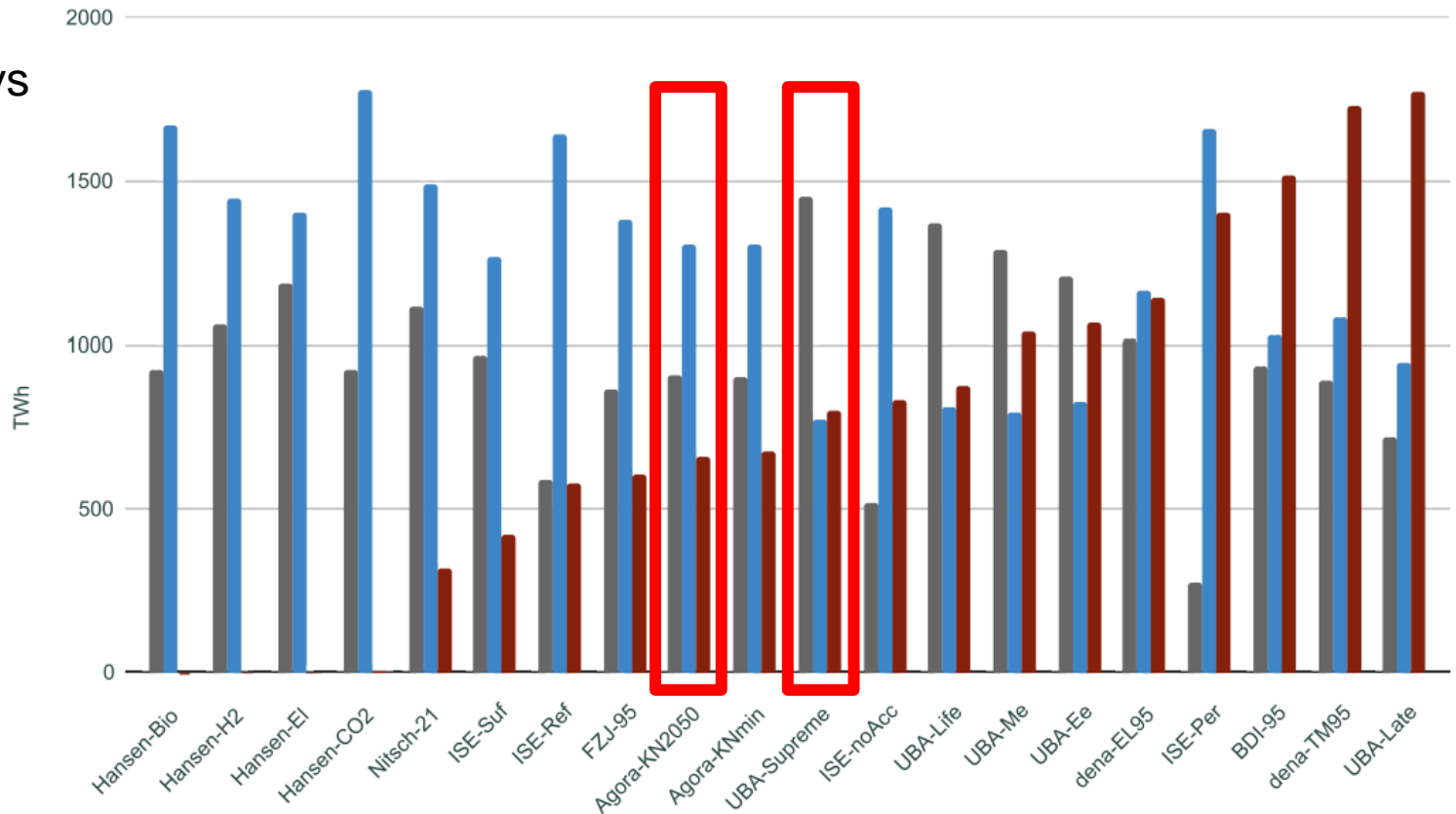
Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

Interdependencies

■ Reduction of final energy demand ■ Domestic energy ■ Renewable energy required for import

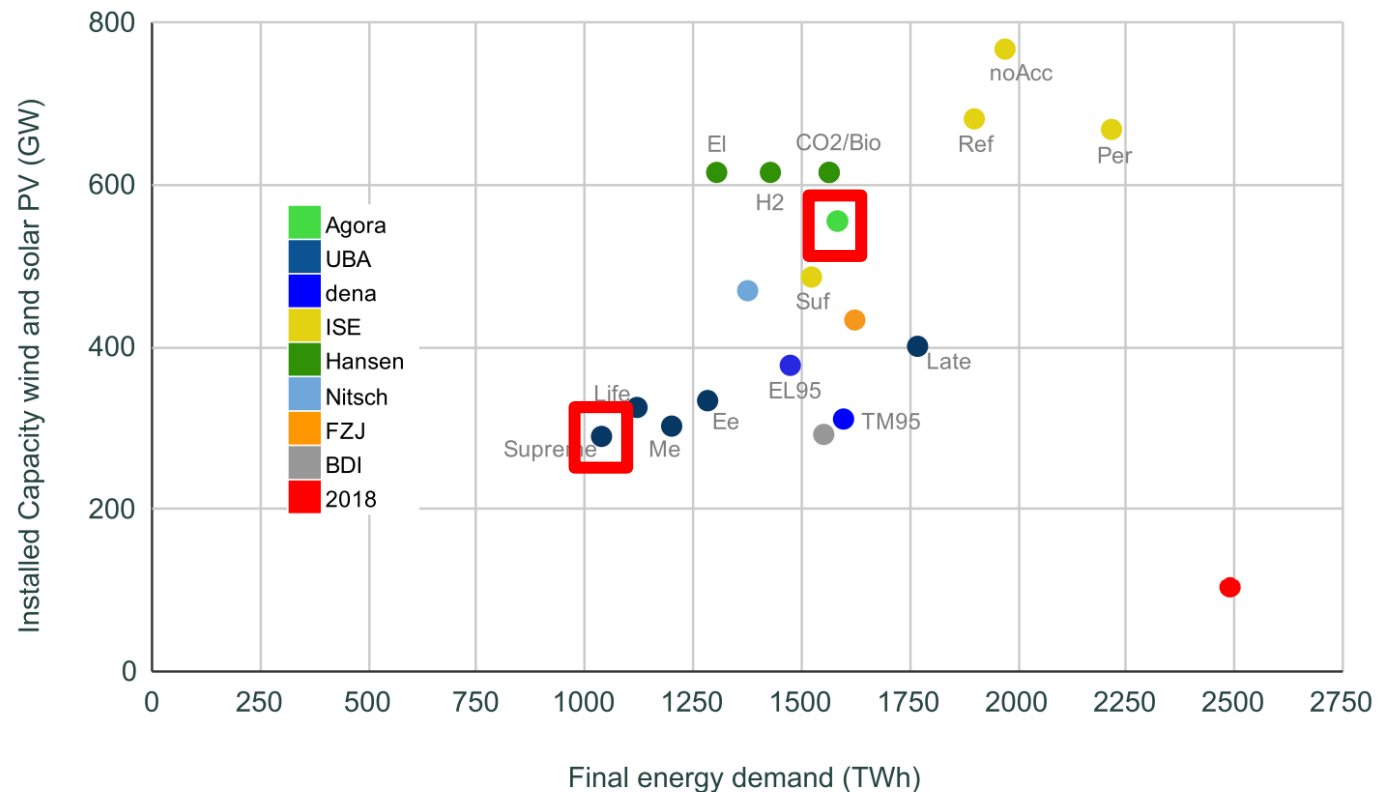
Consistency vs Efficiency?



Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

Interdependencies: Consistency vs Efficiency?



Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

How about sufficiency?

Table 5

Indicators for changes of energy service demand in 2050 .

	UBA-Supreme	Agora-KN2050	reference (year)
billion person-km	958	1200	1200 (2016)
share car use in %	51	54	78 (2016)
billion ton-km	739	900	660 (2016)
avg. living space m ² /person	41	52	45 (2018)
material consumption t/person*a	5.7	not provided	16.8 (2010)

Reduced demands!
in person or goods
mobility, nor in living
area

No reduction!
in person or goods
mobility, nor in living
area

Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

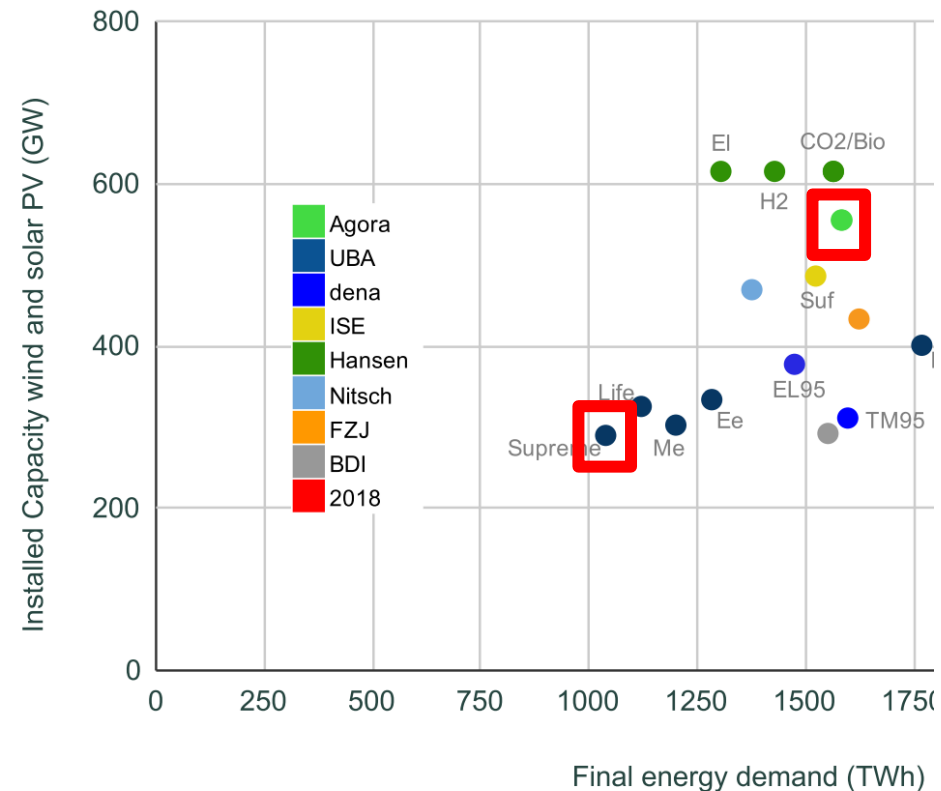
Interdependencies: Consistency vs Efficiency?

Attention, mere rough estimation

Paramount for sufficiency impact:

→ 30% smaller final energy demand

→ 30% required installed capacity (link to critical materials, circular economy)



Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

Interdependencies: Consistency vs Efficiency?

Attention, mere rough estimation

Paramount for sufficiency impact:

- 30% smaller final energy demand
- 30% required installed capacity (link to critical materials, circular economy)



Which are the main sectors?

What kind of sufficiency measures are meaningful?

Role of strategies for climate neutrality

Meta-analysis: energy scenarios in GER (since 2018)

Reductions by sector

Industry → 20 - 40%
 Transport → 60 - 80%
 Buildings → 35 - 50%

