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On the Future(s) of Energy Communities in the German Energy Transition

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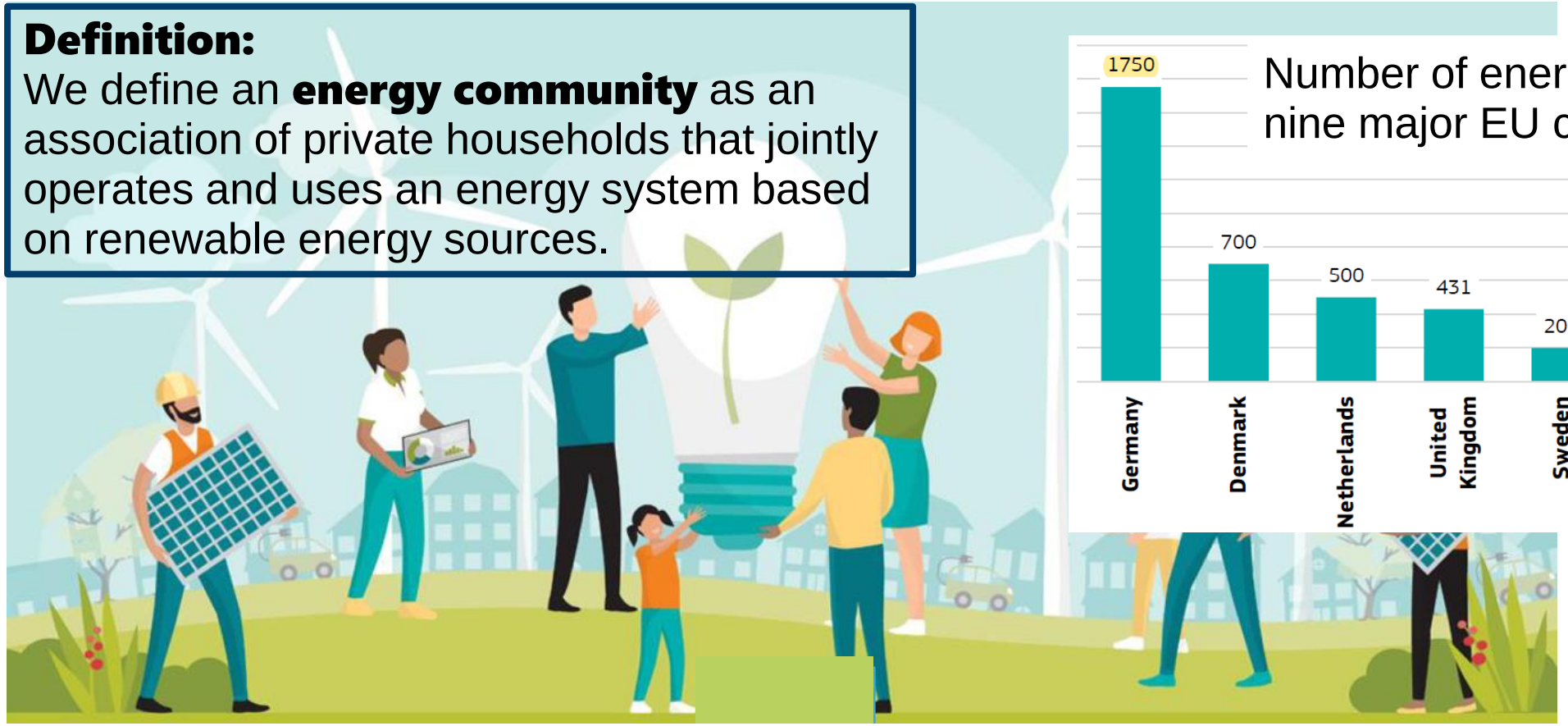
On the Future(s) of Energy Communities in the German Energy Transition

Overview

1 Introduction – Energy Communities in the EU and Germany

Energy Communities in the European Union – Current Numbers

Definition:
We define an **energy community** as an association of private households that jointly operates and uses an energy system based on renewable energy sources.



(Caramizaru & Uihlein, 2020)

1 Introduction – Energy Communities in the EU and Germany

EU Support for Citizen Participation and Energy Communities

in the 2019 Clean Energy for all Europeans Package

The *Renewable Energy Directive*

Includes aims to:

- strengthen the role of renewables' self-consumers and energy communities
- place energy communities on equal footing with large participants when contending for available support schemes

The *Internal Electricity Market Directive*

Includes aims to:

- enable active citizen participation, individually or as members of energy communities
- increase the uptake of energy communities

(European Commission, 2020)

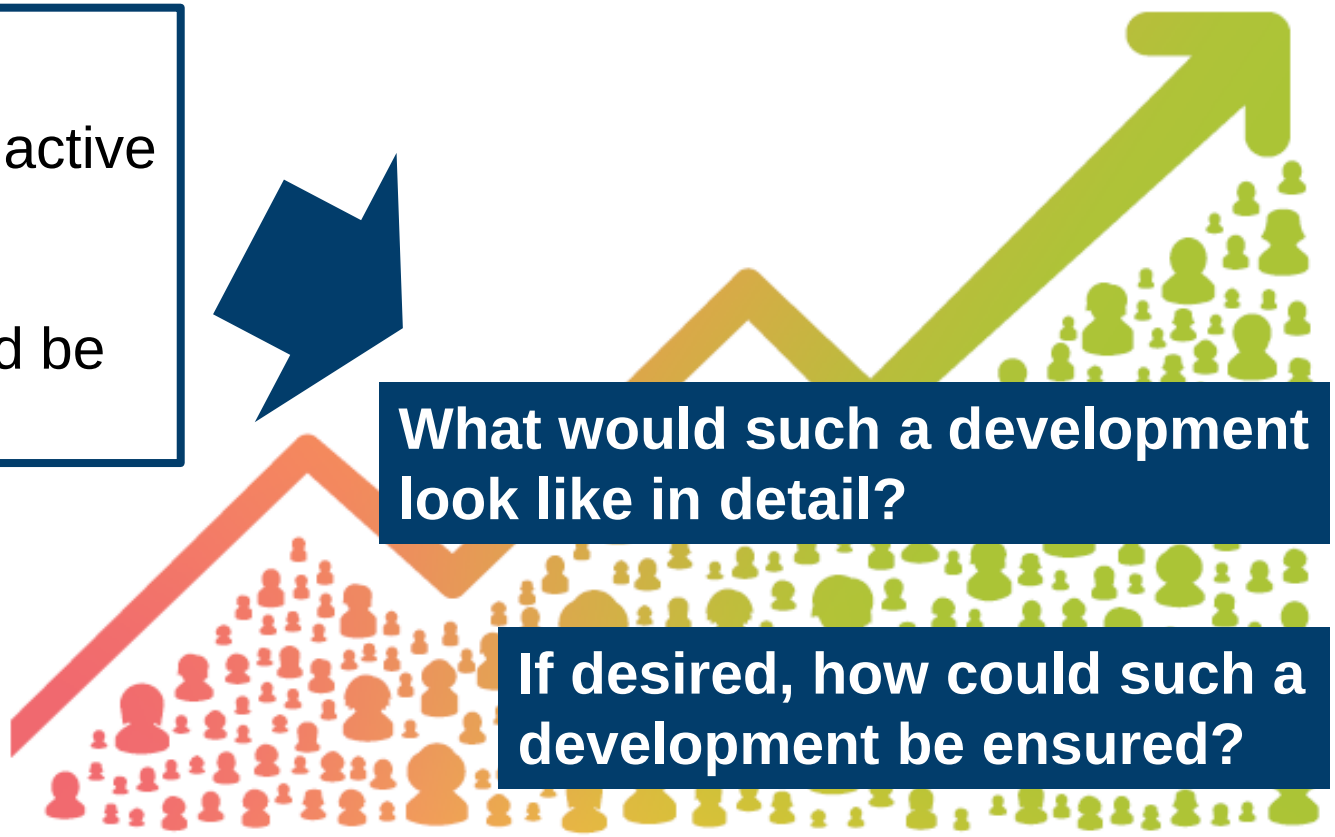
1 Introduction – Energy Communities in the EU and Germany

Predictions of energy community growth

Predictions until 2050:

- > **80 %** of EU households could become active in the generation of energy
- **37 %** of the EU's electricity demand could be produced in **energy communities**

(REScoop et al., 2016; Kampman et al., 2016)

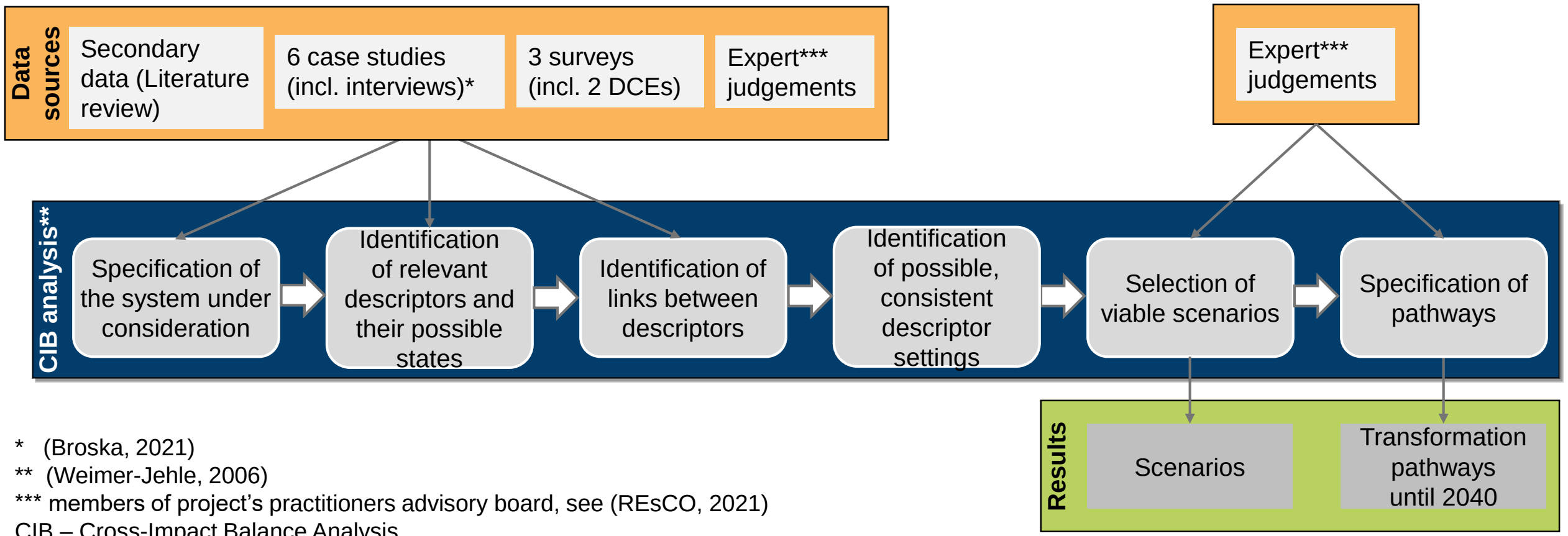


What would such a development look like in detail?

If desired, how could such a development be ensured?

2 Study Design, Data Sources, and Methods

Study Design and Central Methodology



* (Broska, 2021)
** (Weimer-Jehle, 2006)
*** members of project's practitioners advisory board, see (REsCO, 2021)
CIB – Cross-Impact Balance Analysis
DCE – Discrete Choice Experiment

(Broska et al., forthcoming)

2 Study Design, Data Sources, and Methods

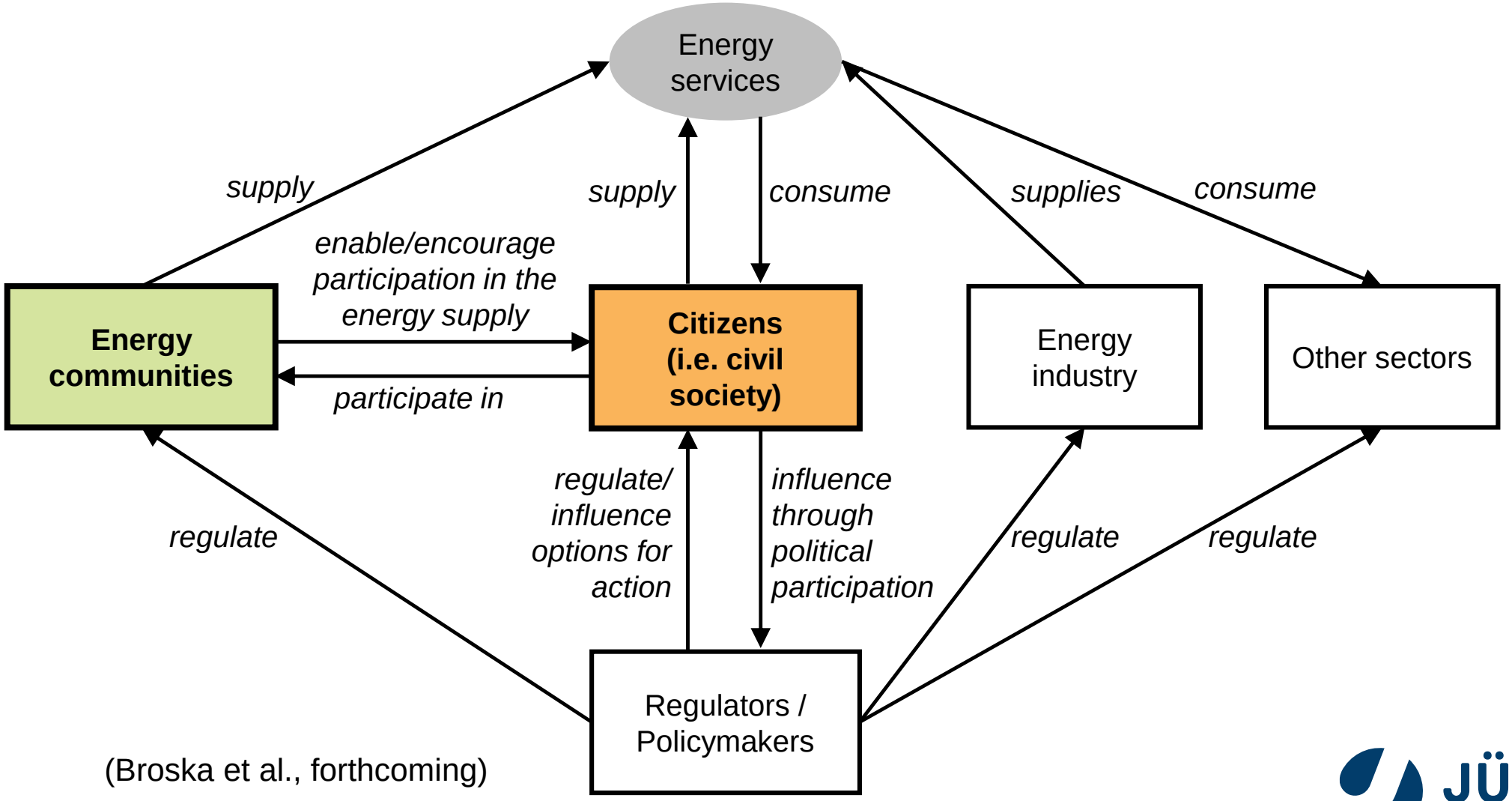
Data Sources

6 case studies incl. interviews (n=31)*		Sustainable community projects in Germany: What motivates people to participate? Why and how does a broad sustainability transformation come about?
3 surveys	Representative sample German population (n=3.043)	Willingness to participate in a local energy community: what predictors are relevant?
	Representative sample German population, incl. DCE (n=1.500)	Characteristics of local energy communities: Which characteristics are particularly relevant for the choice between different energy communities?
	Quota sample German homeowners, incl. DCE (n=1.600)	Individual prosumers vs. energy communities: what type of participation is preferred? What factors are particularly relevant?
Expert judgements		Evaluation of factors' importance for the CIB model by members of practitioners advisory board**
Complementary secondary data (important external studies)		Systematization of heterogeneity in society: social milieus framework by Sociodimensions (Schipperges, 2019; BMU & BfN, 2019) Value change in German society (Hornik, 2020)

* (Broska, 2021), ** (REsCO, 2021), DCE – Discrete Choice Experiment

3 CIB – Our Approach

Citizens in the Energy System



(Broska et al., forthcoming)

3 CIB – Our Approach

Two Groups of Descriptors / The Actors

Descriptor groups:

Group 1:
People's actions and effects on different societal levels

Group 2:
Context factors

Possible actions by individuals:

1. Jointly active (e.g. in an energy community)
2. Active alone (e.g. installing a renewable energy system in their home)
3. Not active

3 CIB – Our Approach

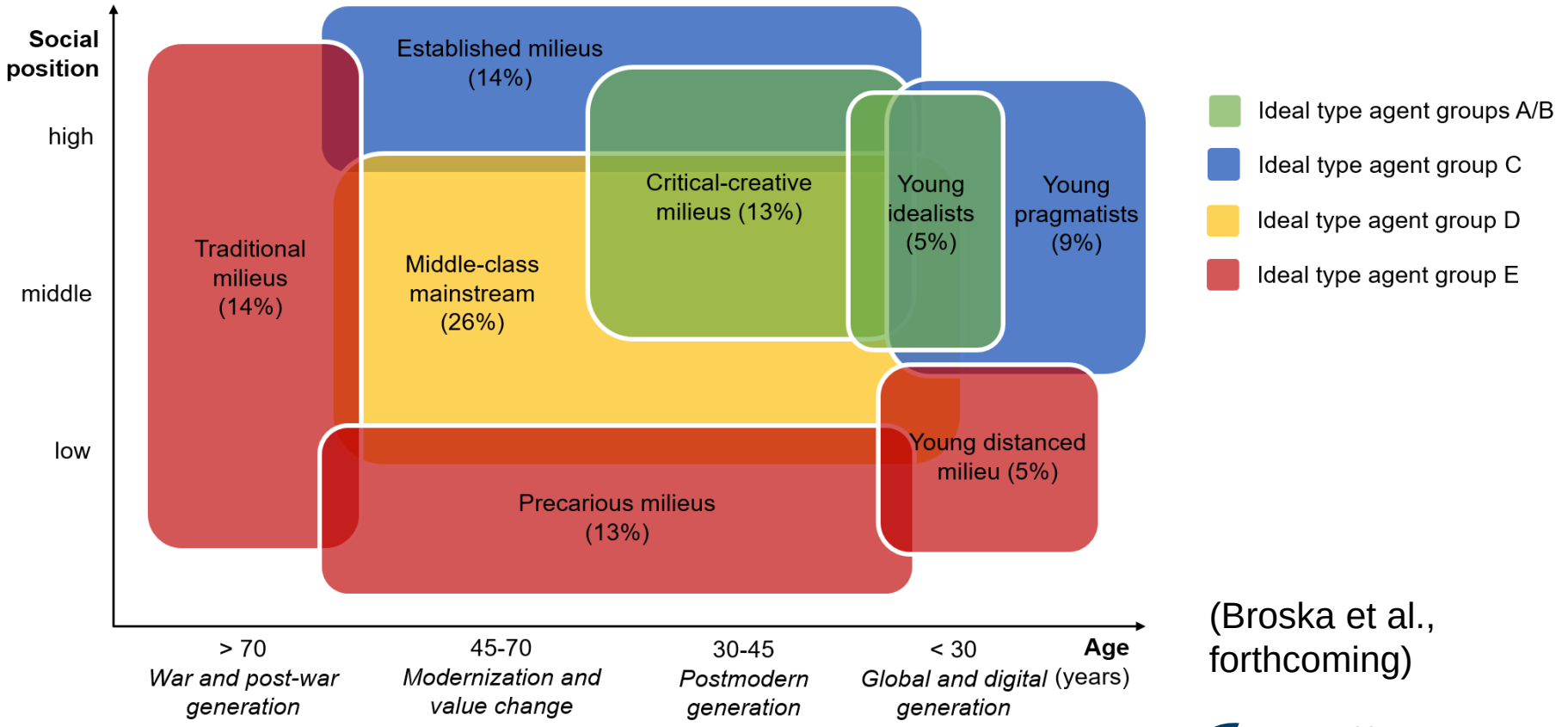
Who is currently active in the energy transition?

Descriptor groups:

Group 1:
People's actions and effects on different societal levels

Group 2:
Context factors

Ideal type agent groups in the social milieu framework by Sociodimensions



(Broska et al., forthcoming)

3 CIB – Our Approach

Two Groups of Descriptors – The Context

Descriptor groups:

Group 1:
People's actions and effects on different societal levels

Group 2:
Context factors

Social context factors	G. Neighborhood cohesion
	J. Recommendations from people in social network
Individual context factors	T. Future outlook
Societal context factor	O. Trends in value orientation
Societal / economic context factor	X. Degree of innovation
Economic context factors	F. Saving potential
	Q. Incentives
	R. Administrative / legal barriers for energy communities
	Y. Regulatory requirements
External context factor	Z. Perceived extreme event

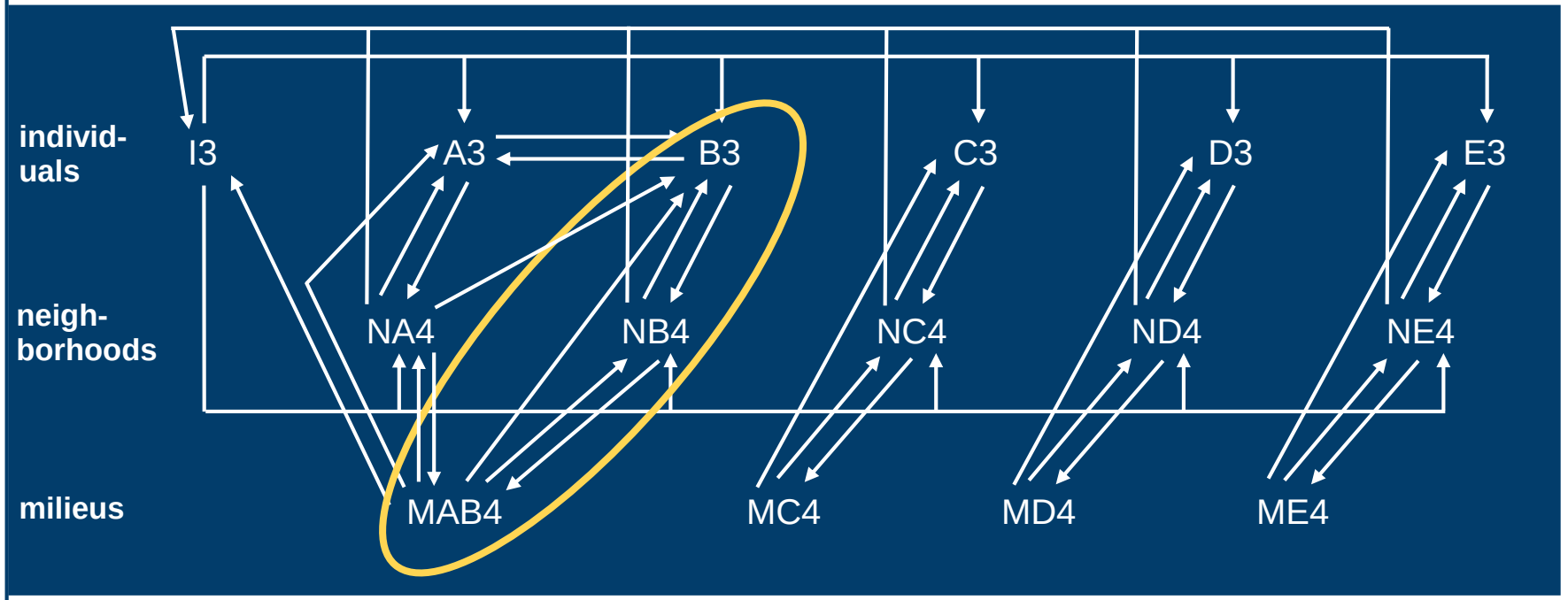
(Broska et al., forthcoming)

3 CIB – Our Approach

Interdependencies between Descriptors

Example:
The present under COVID-19

Individuals' actions and their effects in society



I3: Initiator – not active / A3-E3: ideal type agents – not active /
NA4-NE4: A-E's neighborhood: CRE-low & RES-low / MAB4-ME4: A-E's milieu: CRE-low & RES-low

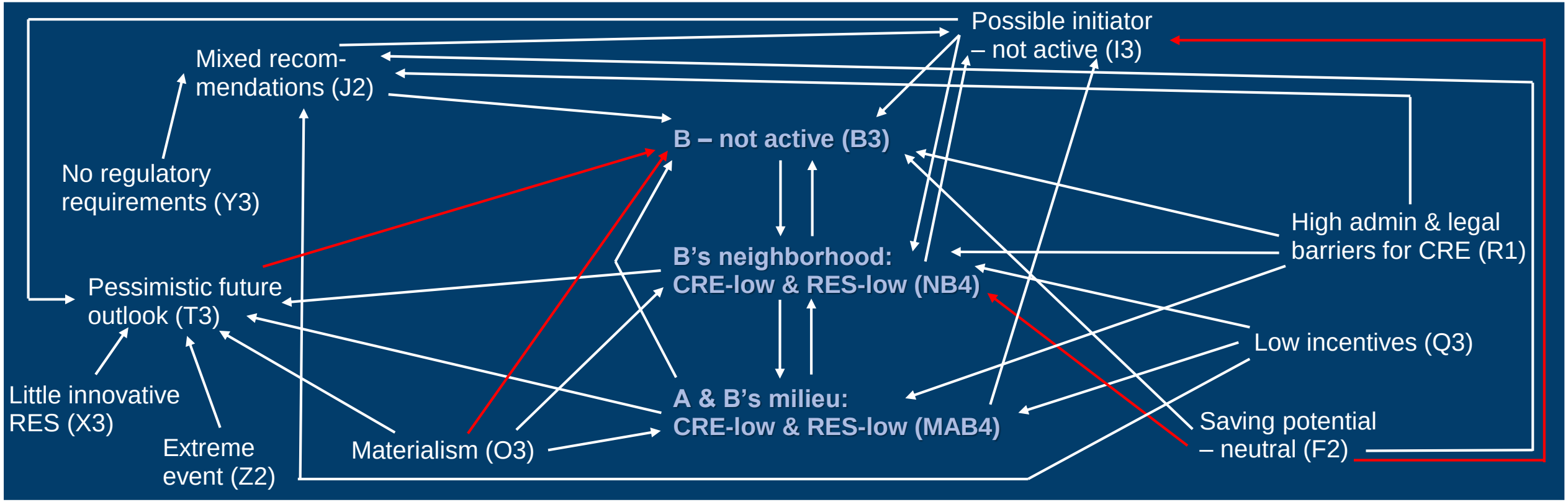
* Strength of the influences not indicated in arrows:
White arrow – positive influence
Red arrow – negative influence
CRE – community renewable energy
RES – renewable energy system

3 CIB – Our Approach

Interdependencies between Descriptors

Example:
The present under COVID-19

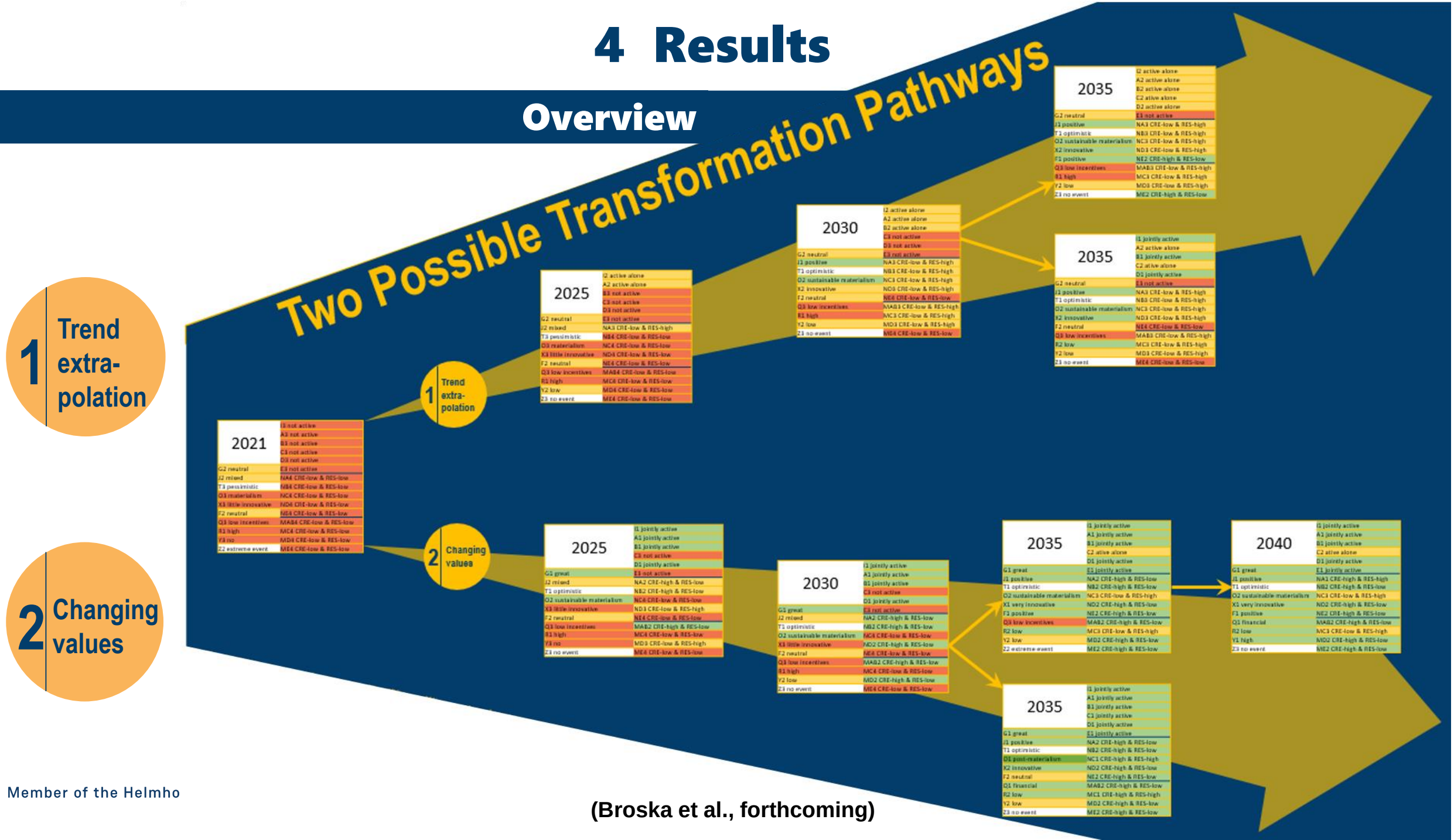
Section focusing on B, the “social-ecological renter”



* Strength of the influences not indicated in arrows: White arrow – positive influence; Red arrow – negative influence; CRE – community renewable energy; RES – renewable energy system

4 Results

Overview



(Broska et al., forthcoming)

4 Results: Scenarios & Transformation Pathways until 2040

Transformation Pathway 1: Trend Extrapolation

	2021	2025	2030	2035 (possibility 1)	2035 (possibility 2)
Individual level	I3 not active	I2 active alone	I2 active alone	I1 jointly active	I2 active alone
	A3 not active	A2 active alone	A2 active alone	A2 active alone	A2 active alone
	B3 not active	B3 not active	B2 active alone	B1 jointly active	B2 active alone
	C3 not active	C3 not active	C3 not active	C2 ative alone	C2 ative alone
	D3 not active	D3 not active	D3 not active	D1 jointly active	D2 active alone
	E3 not active	E3 not active	E3 not active	E3 not active	E3 not active
G. Perceived neighborhood cohesion	G2 neutral	G2 neutral	G3 bad	G1 great	G1 great
J. Recommendations from people in social network	J2 mixed	J2 mixed	J2 mixed	J1 positive	J1 positive
T. Personal future outlook	T3 pessimistic	T3 pessimistic	T1 optimistic	T1 optimistic	T1 optimistic
Neighborhood level	NA4 CRE-low & RES-low	NA3 CRE-low & RES-high	NA3 CRE-low & RES-high	NA3 CRE-low & RES-high	NA3 CRE-low & RES-high
	NB4 CRE-low & RES-low	NB4 CRE-low & RES-low	NB3 CRE-low & RES-high	NB3 CRE-low & RES-high	NB3 CRE-low & RES-high
	NC4 CRE-low & RES-low	NC4 CRE-low & RES-low	NC3 CRE-low & RES-high	NC3 CRE-low & RES-high	NC3 CRE-low & RES-high
	ND4 CRE-low & RES-low	ND4 CRE-low & RES-low	ND3 CRE-low & RES-high	ND3 CRE-low & RES-high	ND3 CRE-low & RES-high
	NE4 CRE-low & RES-low	NE4 CRE-low & RES-low	NE4 CRE-low & RES-low	NE4 CRE-low & RES-low	NE2 CRE-high & RES-low
Social group level/milieu level	MAB4 CRE-low & RES-low	MAB4 CRE-low & RES-low	MAB3 CRE-low & RES-high	MAB3 CRE-low & RES-high	MAB3 CRE-low & RES-high
	MC4 CRE-low & RES-low	MC4 CRE-low & RES-low	MC3 CRE-low & RES-high	MC3 CRE-low & RES-high	MC3 CRE-low & RES-high
	MD4 CRE-low & RES-low	MD4 CRE-low & RES-low	MD3 CRE-low & RES-high	MD3 CRE-low & RES-high	MD3 CRE-low & RES-high
	ME4 CRE-low & RES-low	ME4 CRE-low & RES-low	ME4 CRE-low & RES-low	ME4 CRE-low & RES-low	ME2 CRE-high & RES-low
G. General neighborhood cohesion	G2 neutral	G2 neutral	G2 neutral	G2 neutral	G1 great
J. Recommendations	J2 mixed	J2 mixed	J1 positive	J1 positive	J1 positive
T. Future outlook	T3 pessimistic	T3 pessimistic	T1 optimistic	T1 optimistic	T1 optimistic
O. Trends in value orientation	O3 materialism	O3 materialism	O2 sustainable materialism	O2 sustainable materialism	O2 sustainable materialism
X. Degree of innovation	X3 little innovative	X3 little innovative	X2 innovative	X2 innovative	X2 innovative
F. Saving potential	F2 neutral	F2 neutral	F2 neutral	F2 neutral	F1 positive
Q. Incentives	Q3 low incentives	Q3 low incentives	Q3 low incentives	Q3 low incentives	Q3 low incentives
R. Administrative / legal barriers for CRE	R1 high	R1 high	R1 high	R2 low	R1 high
Y. Regulatory Requirements	Y3 no	Y2 low	Y2 low	Y2 low	Y2 low
Z. Perceived extreme event	Z2 extreme event	Z3 no event	Z3 no event	Z3 no event	Z3 no event

*Coloring indicates whether the descriptor settings are positive (), neutral (), or negative () for energy communities and their emergence

(Broska et al., forthcoming)

4 Results: Scenarios & Transformation Pathways until 2040

Transformation Pathway 2: Changing Values

	2021	2025	2030	2035	2040
Individual level	I3 not active	I1 jointly active	I1 jointly active	I1 jointly active	I1 jointly active
	A3 not active	A1 jointly active	A1 jointly active	A1 jointly active	A1 jointly active
	B3 not active	B1 jointly active	B1 jointly active	B1 jointly active	B1 jointly active
	C3 not active	C3 not active	C3 not active	C2 ative alone	C2 ative alone
	D3 not active	D1 jointly active	D1 jointly active	D1 jointly active	D1 jointly active
	E3 not active	E3 not active	E3 not active	E1 jointly active	E1 jointly active
G. Perceived neighborhood cohesion	G2 neutral	G1 great	G1 great	G1 great	G1 great
J. Recommendations from people in social network	J2 mixed	J2 mixed	J1 positive	J1 positive	J1 positive
T. Personal future outlook	T3 pessimistic	T1 optimistic	T1 optimistic	T1 optimistic	T1 optimistic
Neighborhood level	NA4 CRE-low & RES-low	NA2 CRE-high & RES-low	NA2 CRE-high & RES-low	NA2 CRE-high & RES-low	NA1 CRE-high & RES-high
	NB4 CRE-low & RES-low	NB2 CRE-high & RES-low	NB2 CRE-high & RES-low	NB2 CRE-high & RES-low	NB2 CRE-high & RES-low
	NC4 CRE-low & RES-low	NC4 CRE-low & RES-low	NC4 CRE-low & RES-low	NC3 CRE-low & RES-high	NC3 CRE-low & RES-high
	ND4 CRE-low & RES-low	ND3 CRE-low & RES-high	ND2 CRE-high & RES-low	ND2 CRE-high & RES-low	ND2 CRE-high & RES-low
	NE4 CRE-low & RES-low	NE4 CRE-low & RES-low	NE4 CRE-low & RES-low	NE2 CRE-high & RES-low	NE2 CRE-high & RES-low
Social group level/milieu level	MAB4 CRE-low & RES-low	MAB2 CRE-high & RES-low	MAB2 CRE-high & RES-low	MAB2 CRE-high & RES-low	MAB2 CRE-high & RES-low
	MC4 CRE-low & RES-low	MC4 CRE-low & RES-low	MC4 CRE-low & RES-low	MC3 CRE-low & RES-high	MC3 CRE-low & RES-high
	MD4 CRE-low & RES-low	MD3 CRE-low & RES-high	MD2 CRE-high & RES-low	MD2 CRE-high & RES-low	MD2 CRE-high & RES-low
	ME4 CRE-low & RES-low	ME4 CRE-low & RES-low	ME4 CRE-low & RES-low	ME2 CRE-high & RES-low	ME2 CRE-high & RES-low
G. General neighborhood cohesion	G2 neutral	G1 great	G1 great	G1 great	G1 great
J. Recommendations	J2 mixed	J2 mixed	J2 mixed	J1 positive	J1 positive
T. Future outlook	T3 pessimistic	T1 optimistic	T1 optimistic	T1 optimistic	T1 optimistic
O. Trends in value orientation	O3 materialism	O2 sustainable materialism	O2 sustainable materialism	O2 sustainable materialism	O2 sustainable materialism
X. Degree of innovation	X3 little innovative	X3 little innovative	X3 little innovative	X1 very innovative	X1 very innovative
F. Saving potential	F2 neutral	F2 neutral	F2 neutral	F1 positive	F1 positive
Q. Incentives	Q3 low incentives	Q3 low incentives	Q3 low incentives	Q3 low incentives	Q1 financial
R. Administrative / legal barriers for CRE	R1 high	R1 high	R1 high	R2 low	R2 low
Y. Regulatory Requirements	Y3 no	Y3 no	Y2 low	Y2 low	Y1 high
Z. Perceived extreme event	Z2 extreme event	Z3 no event	Z3 no event	Z2 extreme event	Z3 no event

*Coloring indicates whether the descriptor settings are positive (), neutral (), or negative () for energy communities and their emergence

(Broska et al., forthcoming)

5 Implications and Conclusions

Results and Methodological Advancements

Results Summarized

- Simulation of the development of citizen participation in the energy transition in Germany until 2040 in a quasi-dynamic CIB model

Methodological Advancements

- Development of CIB into a quasi-dynamic scenario modeling approach
- Improvement of the approach to CIB by showing how to base CIB on a wide range of self-collected data
- Advancement of modeling citizens' behavior by taking into account society's heterogeneity

5 Implications and Conclusions

Findings and Implications

Key Findings

- If only current trends continue, likely no successful implementation of a citizen-driven energy transition by 2040
- For a majority of society to become active, changes in several framework conditions necessary (e.g. administrative and legal conditions for energy communities and saving potential from renewable energy technologies)

Implications

- Policymakers in the EU and Germany should reconsider and revise their current support for energy communities

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