International Institute for
Applied Systems Analysis
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Participatory Governance and Social Factors in the Energy Transition

Oxford Energy
Trinity Term Seminars

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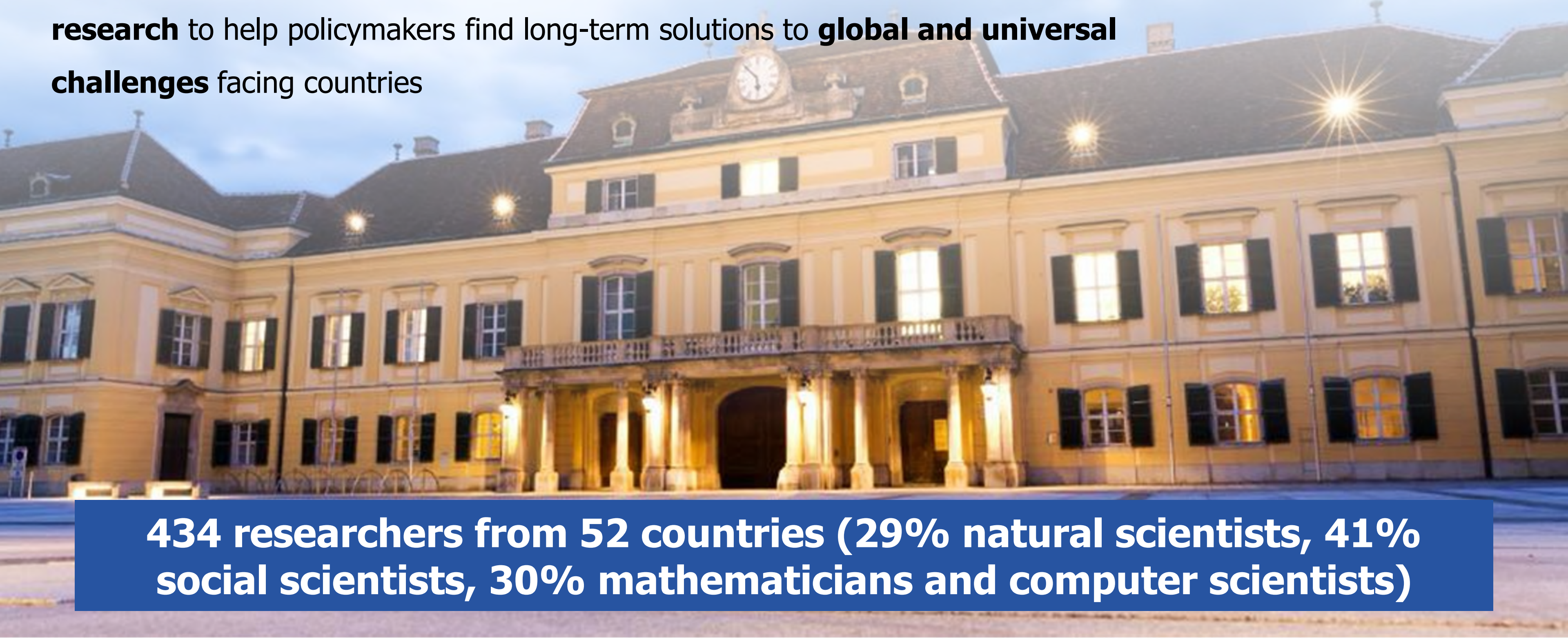
Nadejda Komendantova

International Institute for Applied Systems Analysis (IIASA) is…

An international research institute that conducts **multidisciplinary/ transdisciplinary research** to help policymakers find long-term solutions to **global and universal challenges** facing countries



434 researchers from 52 countries (29% natural scientists, 41% social scientists, 30% mathematicians and computer scientists)

Cooperation and Transformative Governance (CAT) group

CAT Group: Interdisciplinary approach on governance and decision-making processes under uncertainty, complexity, ambiguity and volatility while incorporating systems thinking into strategic policy planning, addressing social dilemmas and wicked policy issues

1/ Cooperation models

2/ Decisions support systems

3/ Participatory modelling

Methods in CAT group

Cooperation models

- Game-theoretical models for public good and common pool management with real-world complexities
- Including bounded rationality, social heterogeneity, cultural dispositions, and institutional incentives

Decision support systems

- Problem structuring methods
- Including prioritization of criteria, connection of drivers and criteria elicitation, selection of background influences, formulation of strategic goals, selection of most important drivers

Participatory modelling

- Multi-criteria optimization and prioritization
- Systems mapping and morphological analysis
- Participatory scenario planning

Research strategic alignment

CAT Research Group aims to contribute with development of methodologies on cooperation models, decision support systems and participatory modelling to research on **existing and emerging governance challenges**, and **their complex structures and dynamic evolutions** on the following topics:

- -Health-related issues (cf., e.g., COVID-19)
- -Climate change, natural hazards, biodiversity and ecosystems
- -Societal transitions caused by technological innovations, industrial transformations or environmental changes
- Cyber/Internet effects, including issues of digitalization

Participatory governance of energy transition and human factors

Individual reasoning: Behavioral economics methods for evaluation of cognitive and behavioral patterns of individual decision-making

Contested policy issues require understanding of behavioral factors of various stakeholders who are participating in decision-making processes and are affected by policy interventions. Behavioral goals govern or 'frame' what people attend to, what knowledge and attitudes become cognitively most accessible, how people evaluate various aspects of the situation, and what alternatives are being considered.

Individual decision making is influenced by the perceptions of gain, normative, and hedonic goals.

- Theory of planned behavior corresponds with Gain motivator with the assumption that people make decisions while relying on perceptions of costs and benefits. Other theory in this category are health beliefs model, social cognitive model, theory of interpersonal behavior, protection motivation theory
- Norm activation theory is associate with normative motivator. It is based on moral evaluations, depending on the extent to which the behavior has a more positive or negative effect on the environment or society
- Theories on affect focus on the role of feelings and on hedonic goals. It is depending on positive or negative feelings related to the behavior, such as feelings of satisfaction, joy, fear or anger.

Methods for negotiations, contested policy issues and development of compromise solutions

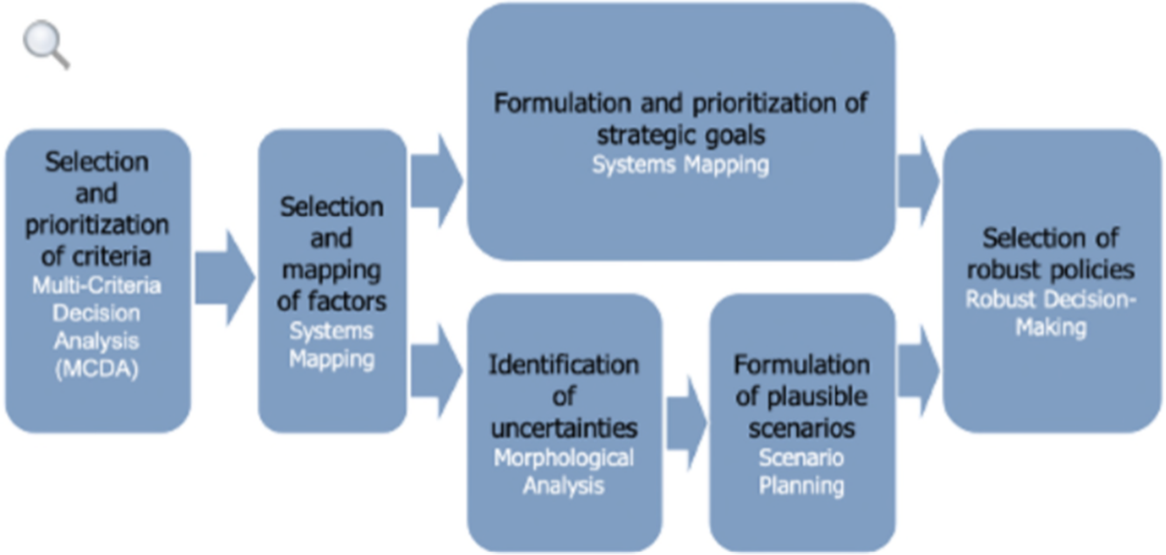
We are developing and applying a range of methods for integrated multi-attribute evaluation under risk, subject to incomplete or imperfect information, and evaluations of decision situations using imprecise utilities, probabilities, and weights, as well as qualitative estimates between these components derived from sets of weight, utility and probability measures. To avoid some mathematical aggregation problems when handling set membership functions and similar, we use higher-order distributions for better discrimination between the possible outcomes.

(i) a co-creative preference elicitation component,
(ii) a multi-criteria component,
(iii) a risk analytical component, and
(iv) an aggregation and analysis component.

These methods have been applied in a variety of decision situations, such as Covid-19 mitigation, large-scale energy planning, allocation planning, de-mining, portfolio risks, gold mining, and many others, and is suitable, for instance, in interactive multi-criteria decision analysis approaches to synthesize outcome predictions and stakeholder preferences from multiple perspectives into decision recommendations.

Compromise oriented policy solutions to inform strategic planning

To address these challenges, IIASA tailored a suite of systems analysis methods each tackling a specific planning step (or, sometimes, multiple steps simultaneously).



These methods belong to qualitative (or sometimes called 'soft') systems analysis methods which are mainly based on work with stakeholders and experts. These methods provide the following benefits:

Structure the problem
Identify priorities
Identify compromise solutions
Social learning
Negotiations
Legitimacy

These methods were applied in the following projects:

Strategy of sustainable industrial development of Kyrgyzstan

Growing globalization increases the interconnectedness of countries embedded in complex supply and value chains. Countries also become increasingly interdependent through transnational transport corridors, the exchange of information and knowledge investments and migrant flows, etc. The future of the Kyrgyz Republic - a small, landlocked and open developing economy - is heavily influenced by global and regional geopolitical and geoeconomic processes. More

Water Nexus Policy Strategic Planning

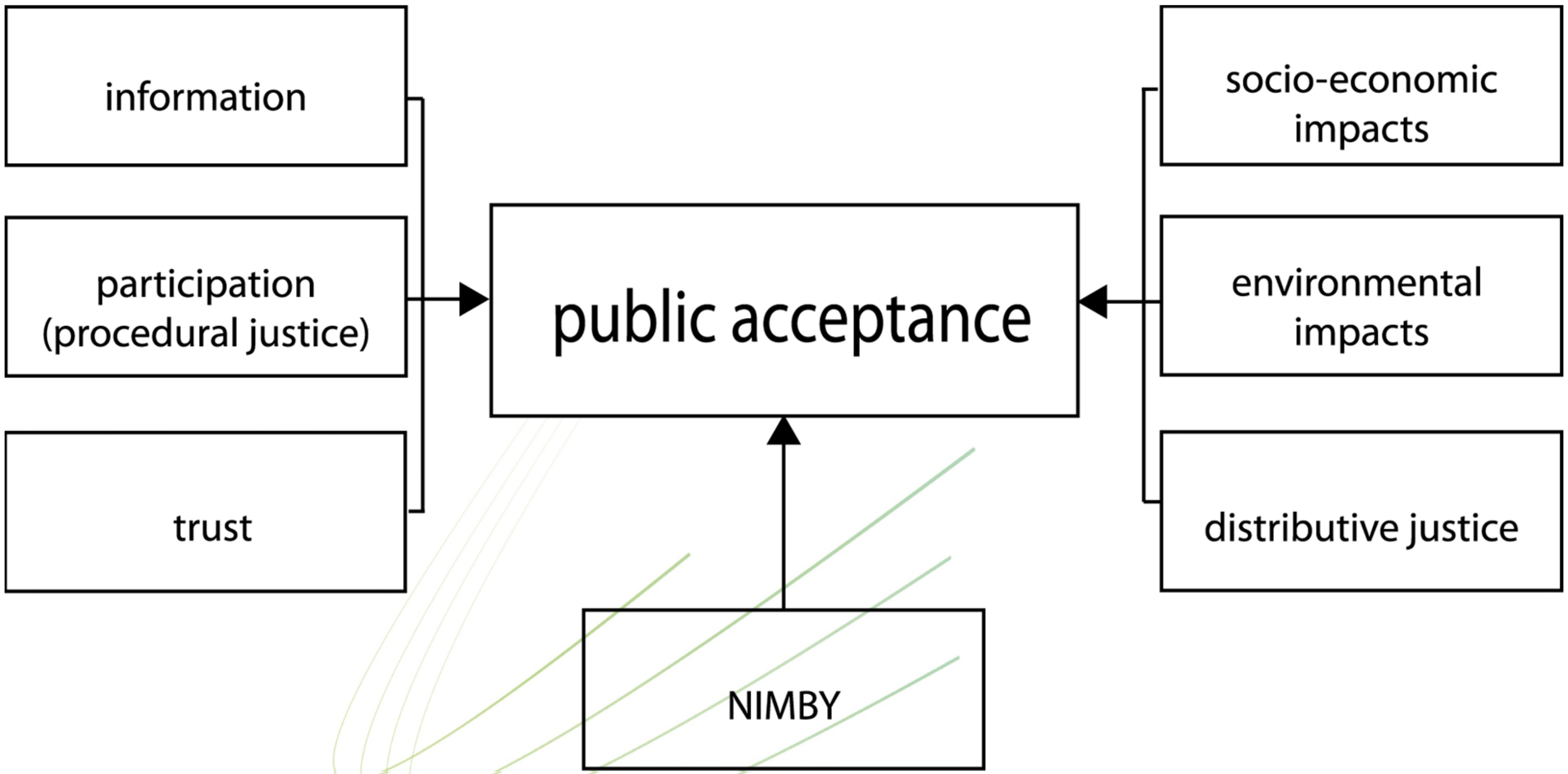
Water is a truly cross-sectorial resource that has an impact on population well-being, economic growth, and the environment. Developing resilient ("no-regret") water strategies given conflicting interests and great uncertainty is of the highest importance for the sustainable development of any country. Feasible policies should reconcile conflicting interests of different sectors and different stakeholders and should take a proper account of immense uncertainty about the future availability of water resources and key factors, which impact it. More

Human / social factors of energy transition
Arnstein Ladder (1969)

Source: Komendantova et al., (2018) Energy Research and Social Science

Public acceptance

Drivers of acceptance:
Nonparticipation and tokenism



Drivers of public acceptance

Guiding principle	**Elia (underground cable)**	**TenneT**	**50 Hertz**
Need	Unclear need as it is not clear if energy consumption in the region will be growing	Unclear need because of decentralized generation options	Unclear need of the project
Engagement	Optimum time for engagement, perception that the voices will not be heard	Place of public information events, where everybody could pass by and not only already informed stakeholders	Information about who will be involved into discussions about the project
Transparency	Planned corridor, sources of electricity	Criteria of selecting priority corridor, sources of electricity	Planning procedures, source of electricity, EMFs
Environment	Impacts of construction works, visibility effects	Visibility impacts, security of transmission system, impacts from EMFs	Impacts on environment, visibility impacts, impacts from EMFs
Benefit	Modernization of routs during construction period, jobs and impulses for socio-economic development		Compensation to land-owners, compensation to environment

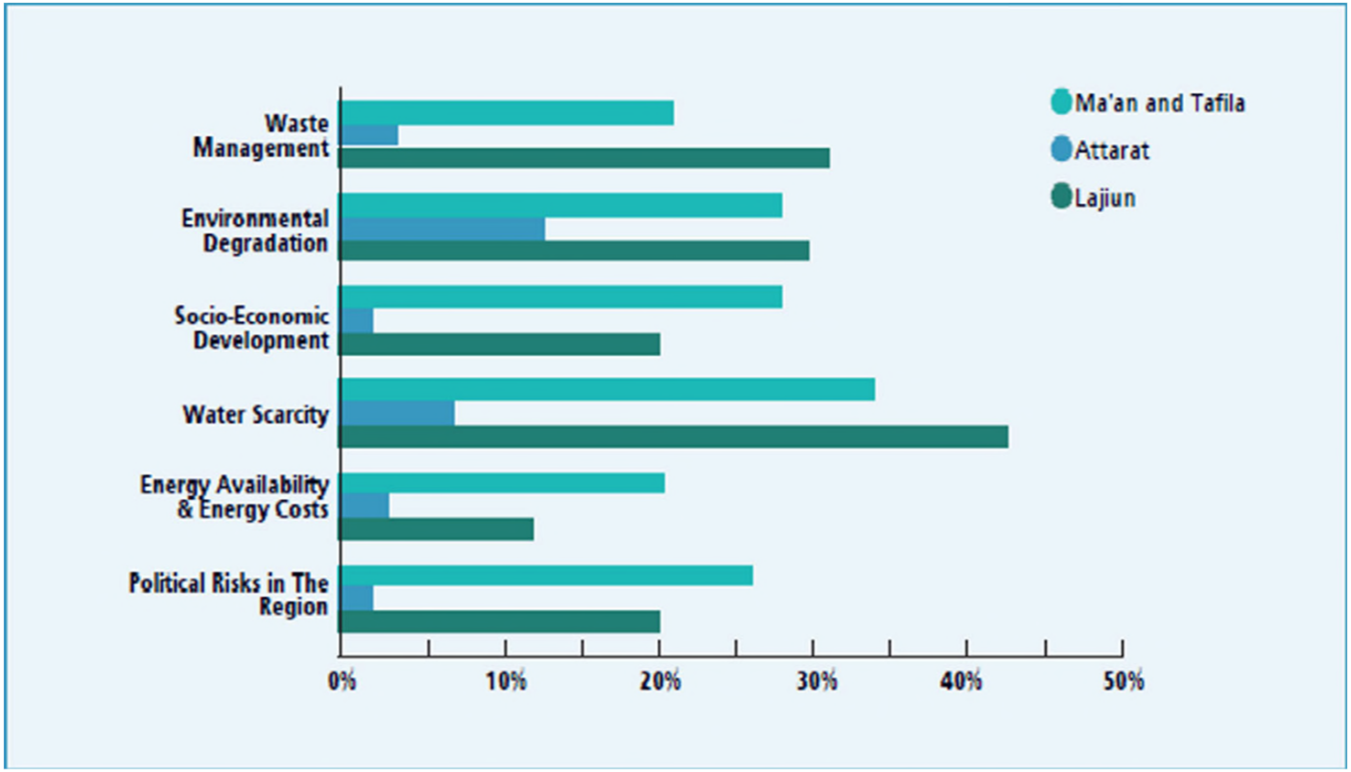
Source: Komendantova et al., (2015) Energies

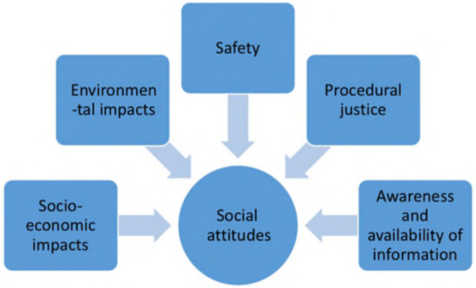
Social acceptance of new technologies in Germany, Norway and Finland: carbon capture and storage

	"The Good, the Bad and the Ugly": German's views on CCS	"Pride and Prejudice": progressive development of CCS in Norway	"To be or not to be": story of CCS in Finland
Setting	Strong opposition against CCS projects exists among politicians, NGOs and general public.	Norwegian government aims to make the country as a leader in CCS technology.	Though there is no active CCS project in Finland, there are some R&D projects
Villains	Distrust to politicians and the concern that energy policy is driven by interests of coal industry	Risk perceptions are also connected with the absence of storage sites, risk of leakage and the lack of technology learning.	Another barrier is the absence of storage sites and not developed mechanisms for monitoring of storage sites.
Heroes	To apply CCS only for offshore storage or to limit its application to steel and other energy intensive industries.	To provide financing incentives and certainty to investors and to limit application of CCS to steel and cement industries.	To increase financial support for CCS demonstration projects from EU and reductions of costs of project implementation.

Source: Karimi and Komendantova, GeoJournal 2015

Social attitudes towards renewable energies and shale oil in Jordan





Source: Komendantova et al., OPEC Energy Review 2021

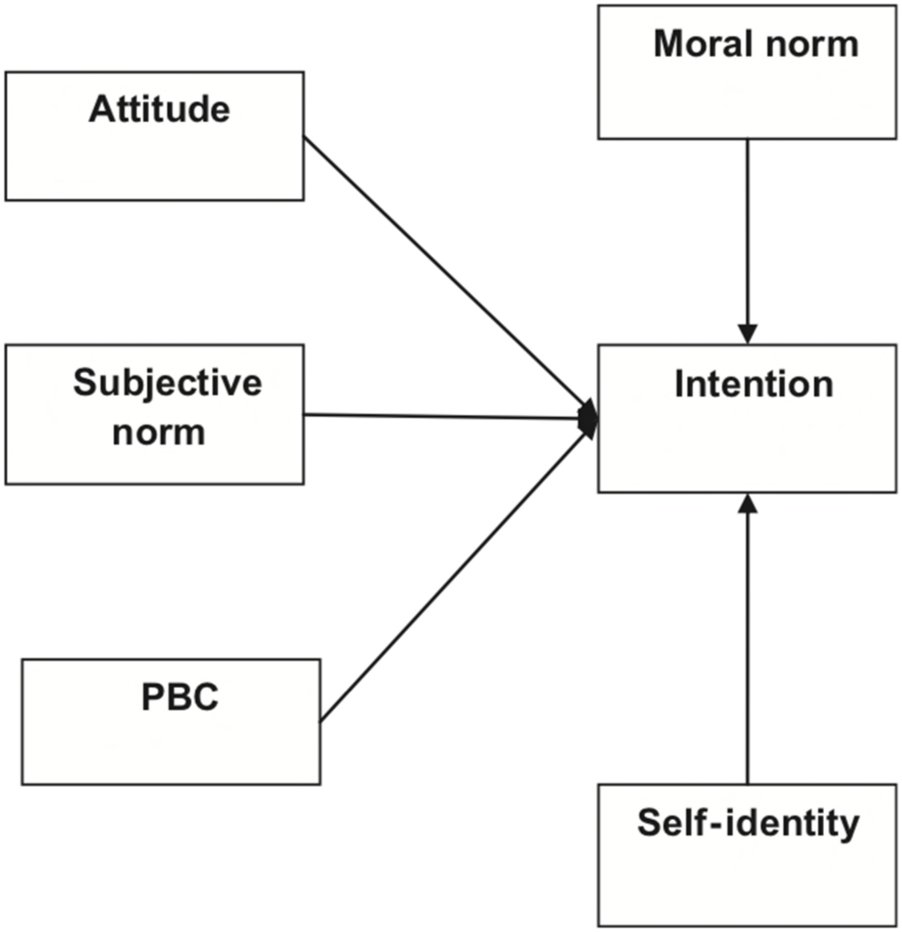
Participation and engagement

Engagement and ownership of the process

- Willingness to use various technologies, willingness to pay for various technological options
- Co-funding and crowdfunding of energy transition
- Engagement and participation on decision-making processes: participatory governance, polycentric governance and co-creation

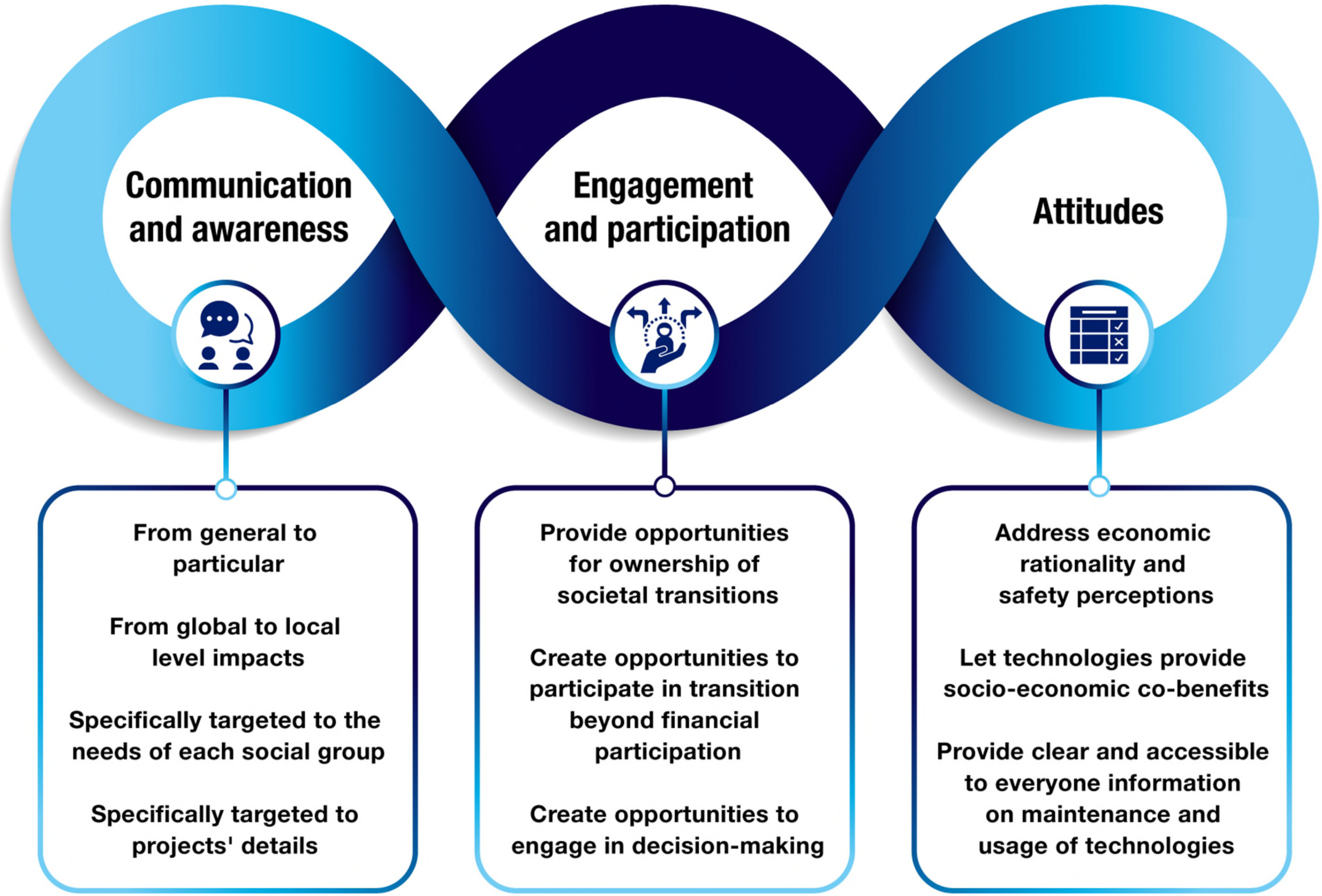
Source: Komendantova et al., (2021) Energy Policy

From awareness to action: Theory of Planned Behavior



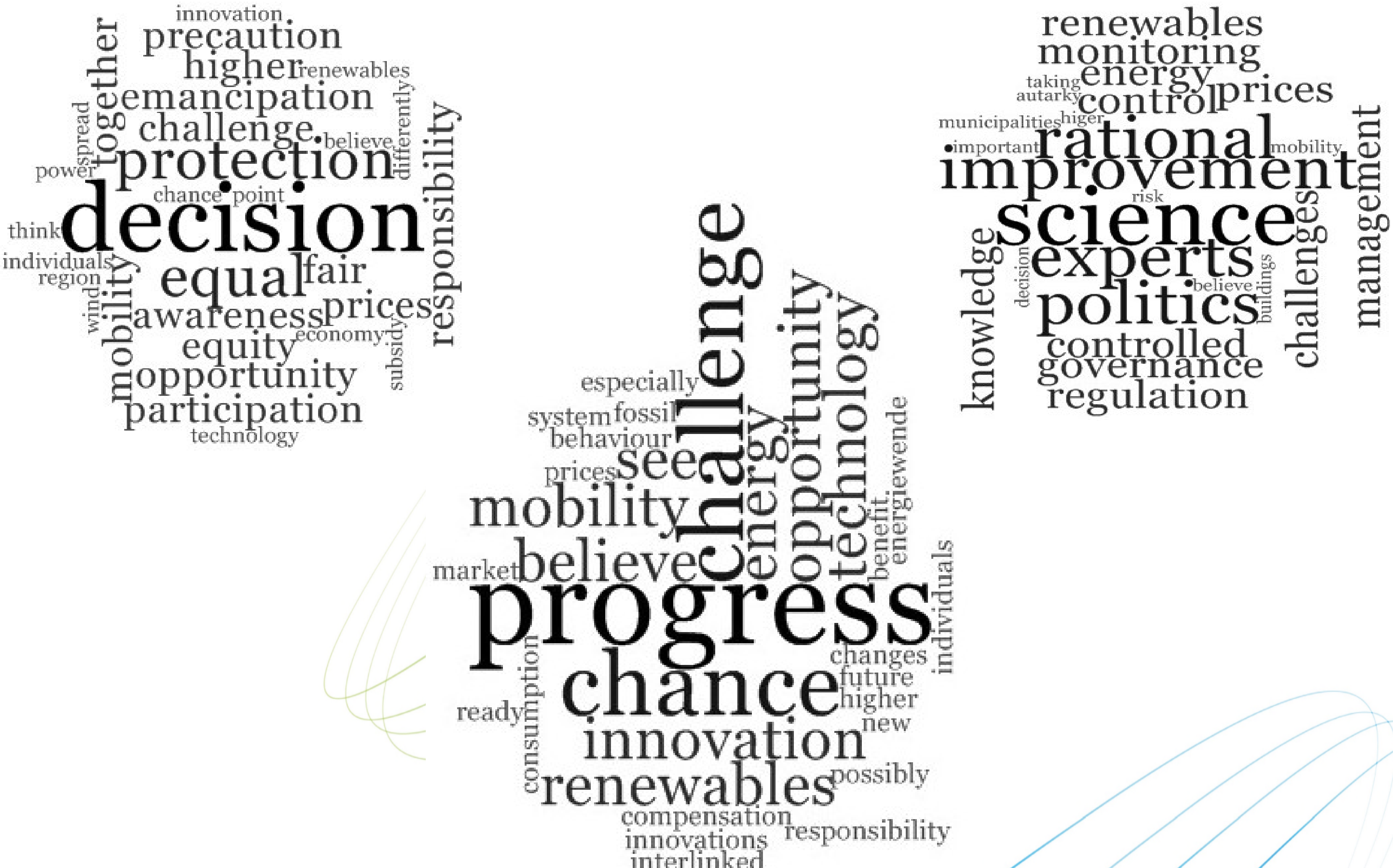
Source: Yazdanpanah et al., (2015) Renewable and Sustainable Energy Reviews

Communication, engagement, and attitudes cycle



Source: Komendantova, Energy Research and Social Science, 2020

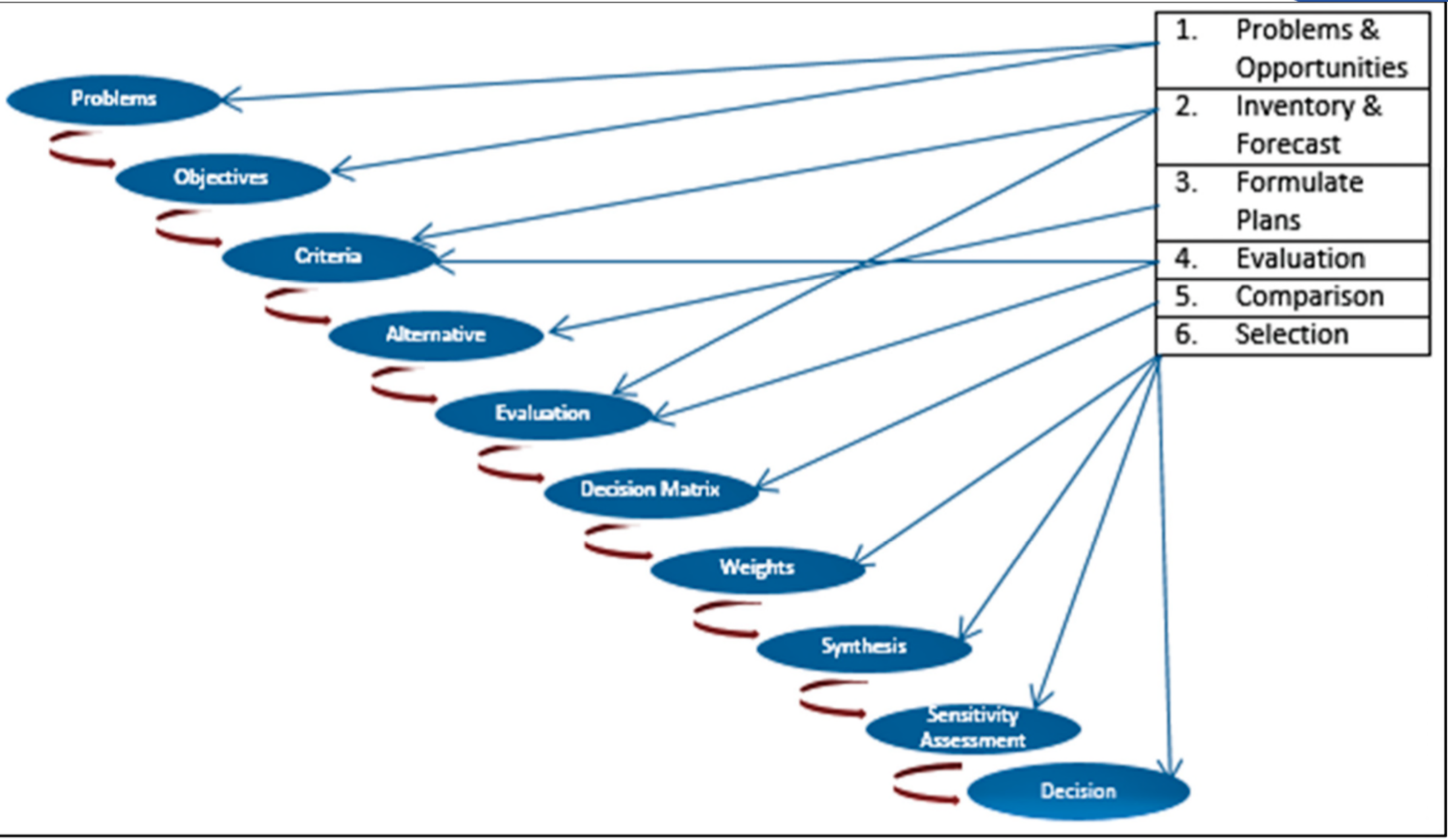
Discourses about energy transition



Source: Komendantova and Neumueller (2020) Energy and Environment

Compromise policy solutions

Multi-criteria decision making

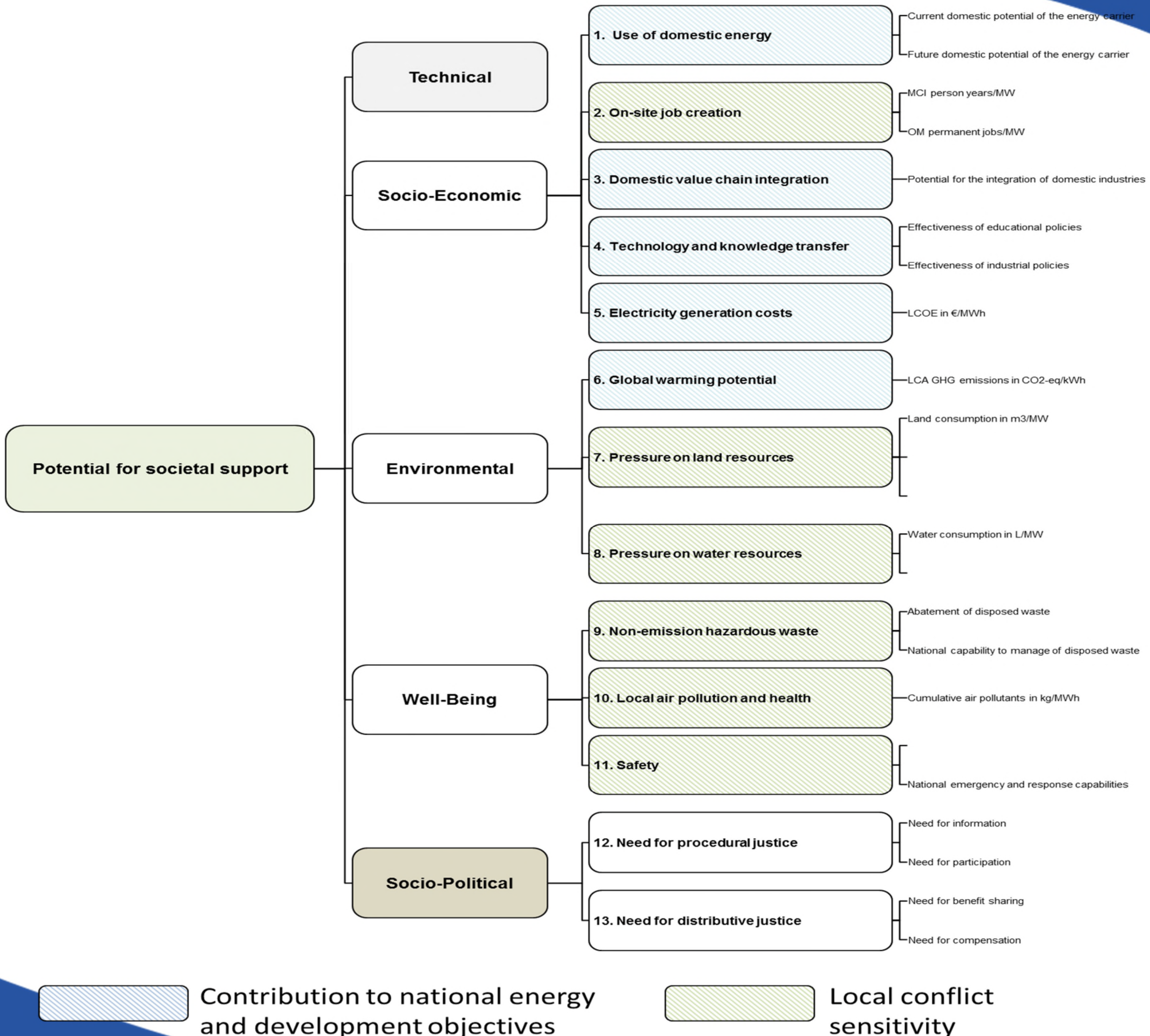


Source: Singh et al., (2020) Sustainability

Middle East North African Sustainable Electricity Trajectories (MENA Select)

Investigates the socio-economic impacts, risks and opportunities, and potential for conflict, of different electricity scenarios and power production technologies in several countries within the MENA region.

- Renewable energies, fossil fuels (oil, coal, gas) and nuclear
- Several stakeholders workshops
- Each technology will be evaluated against a set of criteria



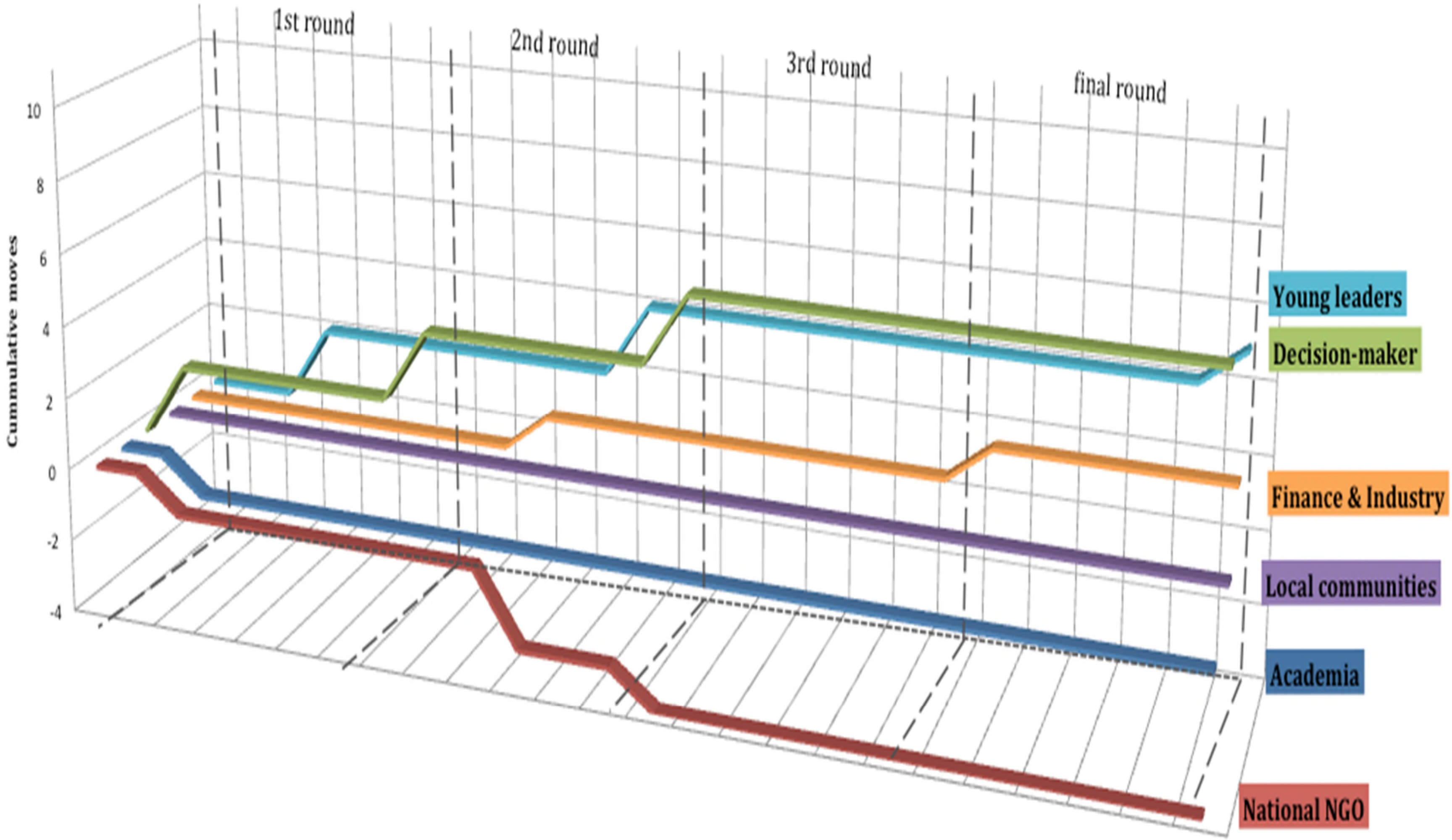
Potential for societal support
Technical
Socio-Economic
Environmental
Well-Being
Socio-Political
1. Use of domestic energy
2. On-site job creation
3. Domestic value chain integration
4. Technology and knowledge transfer
5. Electricity generation costs
6. Global warming potential
7. Pressure on land resources
8. Pressure on water resources
9. Non-emission hazardous waste
10. Local air pollution and health
11. Safety
12. Need for procedural justice
13. Need for distributive justice
Current domestic potential of the energy carrier
Future domestic potential of the energy carrier
MCI person years/MW
OM permanent jobs/MW
Potential for the integration of domestic industries
Effectiveness of educational policies
Effectiveness of industrial policies
LCOE in €/MWh
LCA GHG emissions in CO2-eq/kWh
Land consumption in m3/MW
Water consumption in L/MW
Abatement of disposed waste
National capability to manage of disposed waste
Cumulative air pollutants in kg/MWh
National emergency and response capabilities
Need for information
Need for participation
Need for benefit sharing
Need for compensation
Contribution to national energy and development objectives
Local conflict sensitivity

JORDAN – Qualitative criteria importance

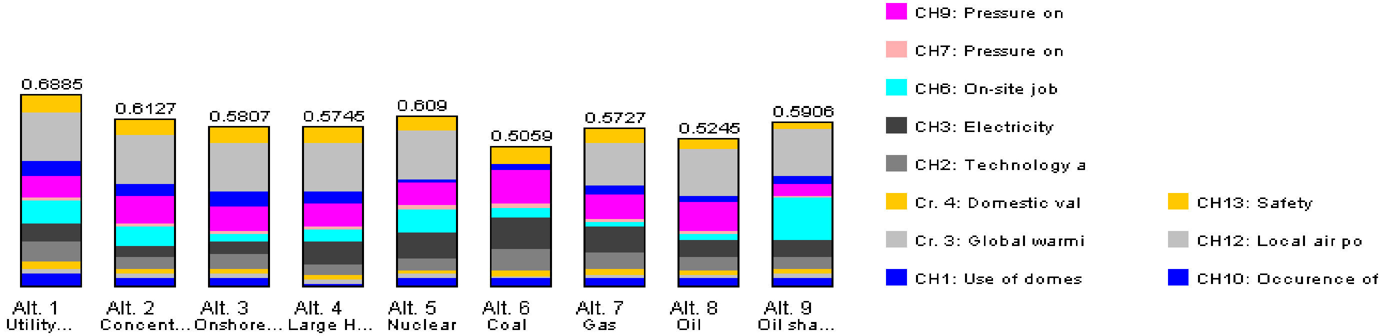
Stakeholders	Use of domestic energy sources	Global warming potential	Domestic value chain integration	Technology and knowledge transfer	Electricity system costs	On-site job creation	Pressure on land resources	Pressure on local water security	Non-emission hazardous waste	Local air pollution and health	Safety
Young leaders	Moderate-low importance	Moderate-low importance	Least importance	Moderate importance	High importance	Moderate importance	Least importance	Moderate importance	Least importance	Moderate-low importance	High importance
National NGOs	Moderate-low importance	Moderate-low importance	Least importance	Moderate-low importance	High importance	Moderate-low importance	Least importance	Moderate-low importance	Least importance	Least importance	Moderate-low importance
Local communities	Least importance	High importance	Least importance	Least importance	High importance	Least importance	Least importance	Moderate-low importance	Least importance	Moderate-low importance	High importance
Academia	Moderate importance	Least importance	Moderate-low importance	Moderate importance	High importance	Moderate importance	Least importance	Moderate importance	Least importance	Moderate importance	Moderate-low importance
Finance/Industry	Least importance	High importance	Least importance	Least importance	High importance	Least importance	Least importance	Moderate-low importance	Least importance	Moderate-low importance	High importance
Policy-makers	Moderate importance	Least importance	Moderate-low importance	Least importance	Moderate importance	Least importance	Moderate-low importance	Least importance	Least importance	Least importance	High importance
Compromise	Moderate-low importance	Least importance	Least importance	Moderate-high importance	Moderate-high importance	High importance	Least importance	Moderate-high importance	Moderate-low importance	High importance	Moderate-low importance

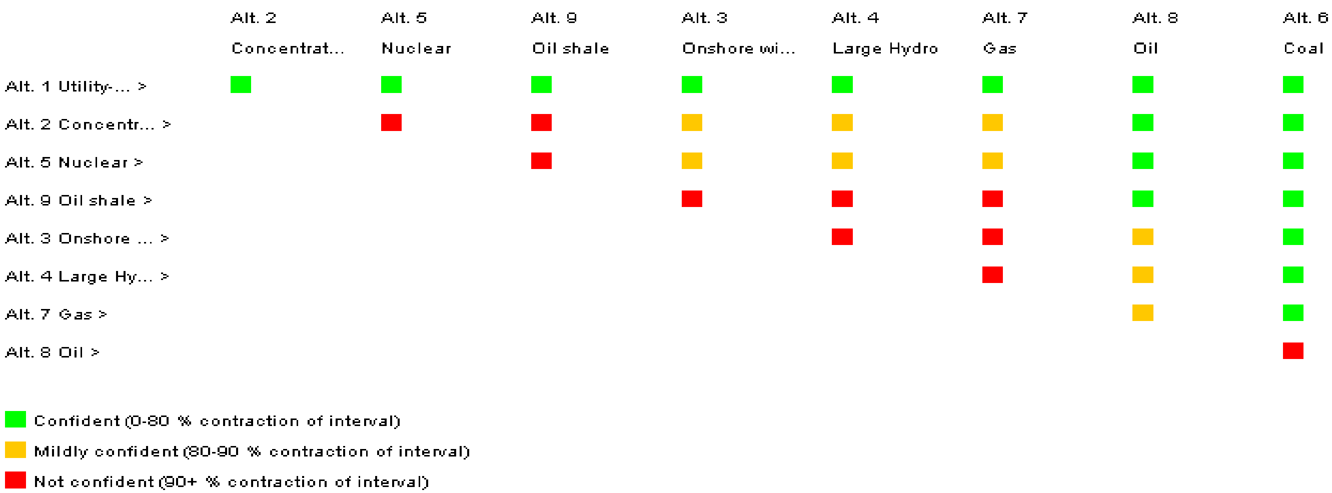
Source: Komendantova et al., Climate 2018

JORDAN - Group divergence and convergence on "Safety"



Trade-off on technologies





Conclusion: "Alt. 1 Utility-scale Photovoltaic (PV)" is the best alternative, with "Alt. 2 Concentrated Solar Power" as runner up.
The Alt. 1 > Alt. 2 statement is confident, since the information provided in this decision basis supports a strict ranking with a degree of 22 %, whereas the reverse statement is not supported.

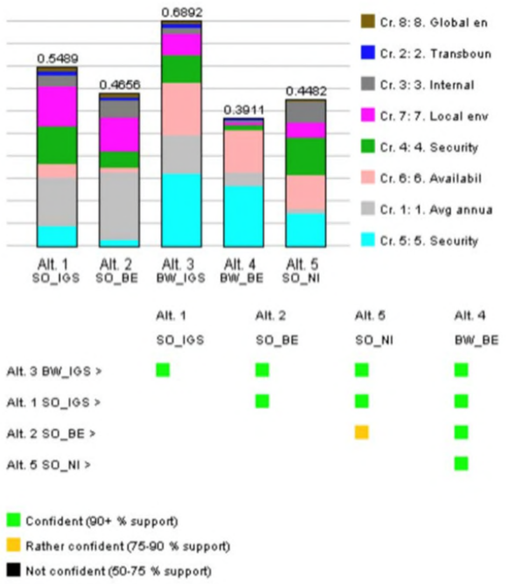
Source: MENA-SELECT project, results generated with DecideIT

Participatory scenario planning of water-energy nexus in Jordan

		Energy Dimension		
		Baseline Energy (BE)	**Low Imports (NI)**	**Interconnected Gulf System (IGS)**
Water dimension	Baseline Water (BW)	BW_BE	BW_NI [1]	BW_IGS
	Smart Operation (SO)	SO_BE	SO_NI	SO_IGS

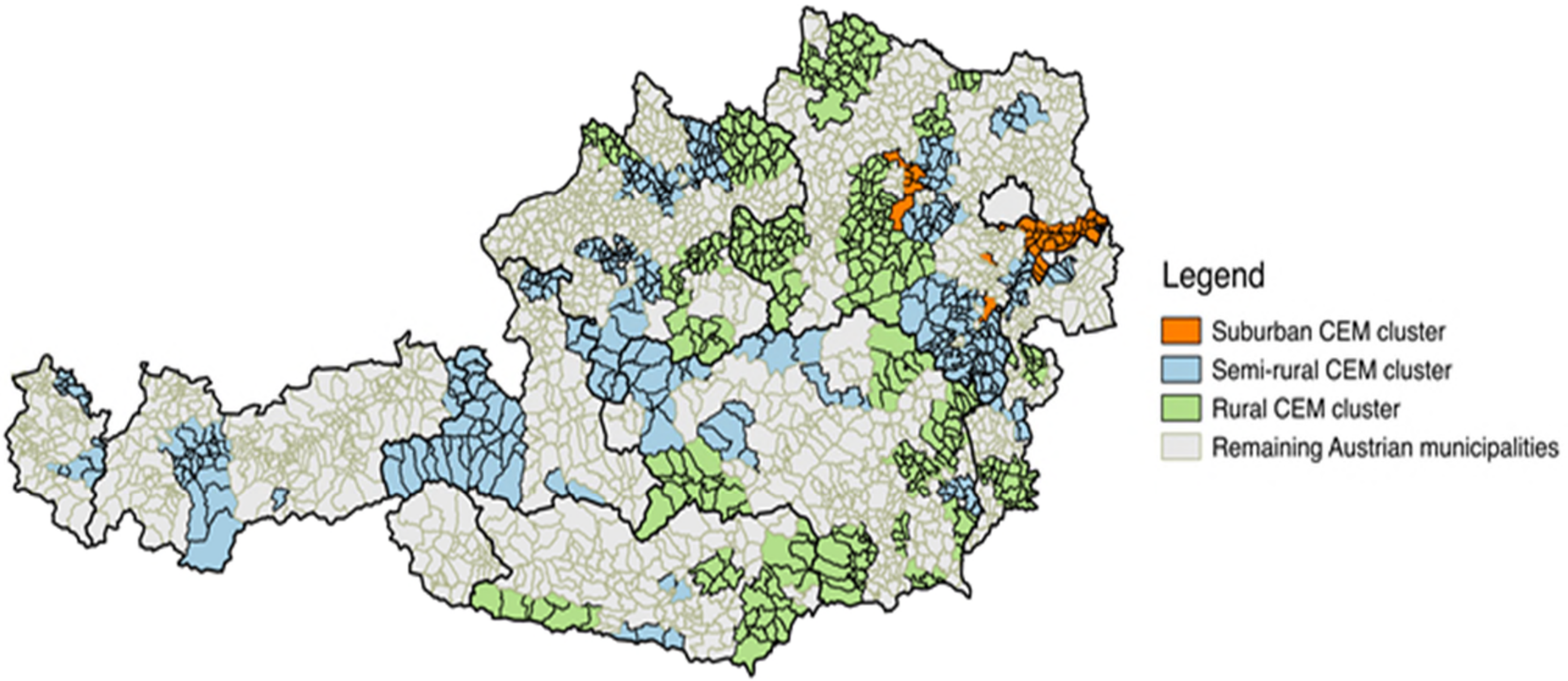
[1] BW_NI was not considered in the rankings due to infeasibility.

Ranking	**1st**	**2nd**	**3rd**	**4th**	**5th**
Energy group	SO_IGS	SO_BE	BW_IGS	BW_BE	SO_NI
Water group 1	SO_IGS	SO_NI	BW_BE	SO_BE	BW_IGS
Water group 2	BW_IGS	SO_IGS	SO_BE	SO_NI	BW_BE



Source: Komendantova et al., Sustainability 2020

Energy transition in Austria



Source: Komendantova et al., Energy Research and Social Science, 2018

Contact Information

Nadejda Komendantova
komendan@iiasa.ac.at