Navigating energy system options across the Global North-South

Verena van Zyl-Bulitta[1], William Stafford[2], James Gien Wong[3]

[1] University of Leipzig [2] Council for Scientific and Industrial Research (CSIR), Stellenbosch [3] co-founder of Stop Reset Go

Objective

Design a compass with structural, operational and social dimensions to assist navigation of energy system transformation in both the Global North and South in an integral way.

Introduction

In the transformation of energy systems towards diversified and renewable sources, there is an increasing need for inter-sectoral coordination amongst a larger number of disparate players and across political, economic, technical, and social domains. Although technological solutions are often the focus of research in sustainable energy transitions, there may be other non-technical factors that cannot be ignored. As large centralised corporate and institutional energy players, who have traditionally dominated the energy sector begin to migrate enmasse to large scale renewable energy systems, there is a parallel movement from the bottom up, of decentralised energy producers. Ignoring their supply side impact and their mode of operation based on a different business and ethical logic than the dominant economic narrative, can undermine the reliability of projections made by centralised system producers. The migration to a mixed energy system architecture will require significant system changes, a multidisciplinary approach that includes non-traditional players, and the reshaping of structures across scales. While formerly integrated systems become liberalised, privatised, new modes of operation can be envisioned and implemented. An example of desolidarisation from a utility system is an off-grid unit. If this happens in a country, where a connection would be no problem, motivating factors can include the perception of independence or mitigating rate increases. We take an integrated perspective to assist whole system energy transitions by developing dimensions for a map of future energy landscapes; identifying dynamic and integrated solutions between consumers and producers on areas in the map where de-centralised solutions make sense; thus enabling planning and development of more globally equitable energy systems.

Important Result

Given the scale and mode of operation, the location of determination and control in energy systems, and their (different types of) ownership we highlight how externalities can be preempted if the dimensions of the compass are considered. For participatory processes similar results were provided by the MCT. For bottom-up initiatives to be better governed, a shift from the MEconomy to the WEconomy could assist.

Keywords: coordination and navigation system, cross-domain assessment, sustainable energy systems

Compass dimensions

1. Degree of centralisation of infrastructure & power
2. Modes of operation
3. Technology scales
4. Social and technical / virtual (inter)connectedness
5. Inter- and intra-level communication (within and between layers)
6. Social aggregation, self(sufficiency)
7. Self-determination / extension from the individual to the collective
8. Positive counterparts of (negative) 4E

The 4E (enclosure - economic, exclusion - political, encroachment - ecological, entrenchment - social) typology was developed to explain the political economy of climate change adaptation in practice. Changes in existing systems across the different dimensions can be traced over time.

Coordination across Scales

While an individual subunit of a society could gain a sense of independence, autonomy, or autarchy in a system with increased self-sufficiency, this benefit is not necessarily ideal for other system levels. Even though autarchy and self-reliance completely enable to self-determine and to be independent of future policy and regulatory changes, the control and transparency over one's own energy sources and uses comes at high monetary costs for a small individual subsystem. This changes with scale and the number of users, where some systems only make sense at a certain scale and a nested hierarchy of changes needs to be considered.

Case Studies

We illustrate the use of the compass dimensions to guide complex energy transitions, using the transnational solar power Desertec project, the German renewable energy supply cooperative Elektrizitätswerke Schönau (EWS), and examples where solar power has been implemented as a service. Another current example would be the TuNur CSP project - 2250 MWatts to Italy (http://www.nurenergie.com/index.php/english/projects/tunisia, http://www.nurenergie.com/tunur/)

Case	Decentr. level	4E+	4E-
Desertec	L	L	H
EWS coop	M	H	L
Solar as a service	H	H	L

Table 1: Three case studies from Germany and Africa (LMH: low-medium-high.

Levels of (De-)Centralisation

To achieve transformative changes in utility sectors, we compare large scale, centralised systems, characterised by:

- economy of scale
- delays
- wealth concentration and ownership

with distributed de-centralised systems, characterised by:

- greater material requirements (with higher potential for circularity)
- agility and coordination requirements
- wealth redistribution and ownership

Mapping Power Structures and Externalities

To enable discussion, communication and planning between top-down, centralised approaches and bottom-up distributed approaches requires a common space for planning. In an ideal multi-scale holonic system that is composed of decentrally steered subsystems, all the different solutions and stakeholders have mutual awareness and planning, in order to prevent under- or over-utilisation of resources and capacities. Prevailing uncertainties introduce risk for planning and require adaptive solutions, the opposite of technology lock-in.

Due to its different assessment and valuation system, the matrix of convivial technologies (MCT) can significantly reshape which technologies are considered as desirable for a given purpose and context, enabling qualitatively finely differentiated investigations. Combining the dimensions adapted from the 4E method on a broader system level than the technology-specific MCT for the energy transition with the MCT assessment logic, we add appropriate dimensions for option spaces to explore and enhance coordination and cooperation in energy transition processes.

Additional Information

- Sovacool, B. K., Linner, B.-O., Goodsite, M. E. (2015). The political economy of climate adaptation. Nature Climate Change.
- Vetter, A. (2017). The Matrix of Convivial Technology - Assessing technologies for degrowth. Journal of Cleaner Production.

Contact Information

- Email: verena@bulitta.com
  wstafford@csir.co.za
  gien@stopresetgo.org
- Phone: +4917643339437
  +491773911443