Amplified sociotechnical problems in integrated infrastructures: The case of coupling energy-related sectors

Session proposal by Christian Büscher, Dirk Scheer, (KIT)

In the face of society´s manifold problems, e.g. rising CO_2 emissions, resource scarcity, dangerous technologies and hazardous waste, researchers call for a holistic transformation of societies vital infrastructures. To achieve significant greenhouse gases (GHGs) emission reductions and the decarbonisation of entire industries it requires not only the transformation of single sectors like energy/electricity, heat, transportation, or industrial production, but intelligent and integrative coupling of those entities. The basic premises for this approach are

- the widespread dissimination of renewable energy sources (RES);
- the integration of knowledge, technical norms and standards, leading to an
- operational coupling of technical systems of production and organization, and
- new forms of social coordination on markets and in regulation between actors and between sectors.

In Germany, the term "sector coupling" (SC) has become a prominent strategy covering these objectives. With several emerging technologies enabling sector coupling, foremost developments in RES and in Information and Communication Technologies (ICT), scholars encourage the combination of different research & development activities and energy related practices. Against this background, the sector coupling approach is crucial for the energy transition and hence a relevant field of investigation for interdisciplinary Technology Assessment due to its potentially fundamental role in the future energy system. We propose to use the concept of "sociotechnical problems"[1] as a heuristic to expose possible issues of such integration processes along commonly shared reference points for analysis:

> *First*, the problem of control despite amplified sociotechnical complexity[2]: More technical systems and social actors are intertwined, which might lead to emergent behaviour of systems, networks of systems and networks of networks.
> *Second*, change has to be enacted in various sectors simultaneously despite the need for reliable operation and secure services: An overall loss of orientation in engineering, operation, planning, investment should not occur whilst de-stabilizing institutions and performances, unlearning proven knowledge and deviating from routines.
> *Third*, uncertainty has to absorbed in order to remain actionable despite non-transparency. Increasing discrepancy between ‘simple’ interfaces and complicated technological realities in the background of integrated, ICT controlled infrastructures needs to be accompanied by social mechanisms to allow for decision making and action.

These problems cannot be reduced to merely technical, or to merely social variables, they cannot be solved permanently and need constant attention. Moreover, the problems mutually influence each other, and changes in one dimension cause permutations in the others. In this session we will provide a comprehensive perspective on integrated infrastructures and therefore propose a way of recognizing consequences and interrelations of interventions.

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[1] Christian Büscher, “Framing Energy as a Sociotechnical Problem of Control, Change, and Action,” in *Energy as a Sociotechnical Problem. An Interdisciplinary Perspective on Control, Change, and Action in Energy Transitions*, ed. Christian Büscher, Jens Schippl, and Patrick Sumpf (London, New York: Routledge, 2018), 14–38.

[2] Todd R. La Porte, “Observing Amplified Sociotechnical Complexity : Challenges for Technology Assessment Regarding Energy Transitions,” in *Energy as a Sociotechnical Problem*, ed. Christian Büscher, Jens Schippl, and Patrick Sumpf (London, New York: Routledge, 2018), 245–61.

Invited speakers and proposed plan

Timeslot	Speaker	Title
10min	Dirk Scheer (KIT, Karlsruhe)	Introduction and moderation
20min	Christian Büscher (KIT, Karlsruhe)	Amplified sociotechnical problems in integrated infrastructures
20min	Michael Ornetzeder (ITA, Vienna)	Sector coupling in an experimental setting: Empirical evidence from an Austrian demo project
20min	Bert Droste-Franke (EA European Academy)	Challenges of system analyses for SC
20min	Chiara Iurato, Dirk Scheer, Lisa Nabitz (KIT, Karlsruhe)	Futuring sector coupling: conceptualizing pathways by scientific disciplines
20min	Discussion	