8: Pathways to energy transition

Addressing energy and climate vulnerability: towards an integrated agenda

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Abstract
Reaching the climate targets prescribed by the Paris agreement invariably require significant structural shifts in patterns of energy recovery, transport and demand. Such transformations, *inter alia*, are expected to exacerbate existing and create new social inequalities within and among countries. At the same time, even a 1.5 °C temperature rise is likely to deepen the associated socio-economic risks faced by susceptible communities. These two types of vulnerabilities – in the climate and energy domain – have rarely been considered jointly to date. I therefore aim to create the building blocks for a unified conceptual approach towards energy vulnerability and climate vulnerability. The paper highlights the synergies and interactions that arise at this fulcrum, while emphasizing the potential existence of unintended effects and feedback loops. I use the notion of a 'thermal landscape' to encapsulate the multitude of interventions that can help address the social vulnerabilities arising at the climate-energy interface.

Regional carbon budgets and catalyzing rapid transitions to fossil free futures

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Abstract
The Paris Agreement on climate change delivered an unprecedented covenant amongst world leaders to take action to hold "the increase in … temperature to well below 2°C … and to pursue efforts to limit the temperature increase to 1.5°C." It also acknowledged the need "to undertake rapid reductions [in greenhouse gas emissions] in accordance with the best available science […] and on the basis of equity".
In the spring of 2017, the Centre for Environment and Development Studies (CEMUS)1 and the Zennström professorship in Climate Change Leadership2, were asked to calculate the carbon budget of a Swedish municipality and the associated emission reductions required for them to embark on a pathway to a post-carbon future in line with the climate commitments in the Paris Agreement. This commissioned research led to a

report that was designed to inform the energy- and climate plan that the municipality had been asked to write.
The carbon budgets provided by the Intergovernmental Panel on Climate Change Synthesis Report (AR5) were used as a basis for calculating the emission-space left at the global level to deliver on the temperature commitments enshrined in the Paris Agreement. The global carbon budget was then disaggregated to provide Sweden with a national carbon budget range based on a suite of apportionment regimes. This budget range was subsequently further divided to the regional level and translated into a small family of emission pathways necessary for the municipality to make its equitable contribution to delivering on the commitments enshrined in the Paris Agreement.
This paper first outlines and discusses the methodology used to calculate the regional carbon budget range. This is followed by an analysis of the way in which the report informed and influenced the political process in the municipality, as an illustrative example of the challenges and opportunities underlying the interaction and learning that takes place between climate change research and governance. Hence the paper is envisaged to connect directly to the conference theme of *Innovative methods and processes for research, learning and governance*, but also relate to several of the other themes of the conference.

Designing highly renewable and socially accepted energy systems by integrating the modelling with the "real" world

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Abstract
The mitigation of climate change can be addressed by a large scale integration of renewable energy sources. The UK's power system produces roughly a quarter of the country's CO2 emissions and so its decarbonisation is essential in achieving the long term emission reduction goal enshrined in the Climate Change Act 2008. Furthermore, the sector has some of the most cost effective mitigation options currently available across the energy system. Of these, onshore wind is one of the most developed in the UK, with levelised costs of electricity (LCOE) rapidly approach parity with natural gas fired power stations. However, in the UK rising local opposition towards wind and solar PV projects in combination with unfavourable policy development has led to a drop in renewable projects being permitted.

We use a high spatial and temporal high resolution electricity model to design highly renewable power systems which are robust to the diversity of the weather. In the past we made certain assumptions of relevance to social acceptance of wind energy, such as distance from settlements and exclusions of national parks based on literature. However, as critised by several authors energy models such as highRES which are used for planning and policy making do not integrate the "real world".

We close this gap by conducting two participative modelling workshops with (1) stakeholders (e.g. planning office, nature conservation groups, wind farm developers) and (2) lay people. The aim is to elicit and refine socio-political barriers to wind energy, with a particular focus on quantifying and synthesizing data that are mainly qualitative to begin with. We run the assumptions on social acceptance past a range of stakeholders to test their adequacy and to collect other social barriers previously not included. In this way we aim to empirically calibrate the representation of social acceptance in the model and strengthen the connection between the "model world" and the "real world".

The Transition to Decentralised Solar PV Electrification in Africa: from technical innovations towards adaptability to social practices and socio-technical systems?

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Abstract

Innovations feature prominently in the current 'energy transition' debate in Africa but societal adaptation issues seldom receive thorough airing. In cases adaptation issues come up, local tacit knowledge forms and social practices mediating the quality of societal adaptation to or affinity with the creation, diffusion and utilization of a technology gain limited attention. A study in Ghana shows a recent enthusiasm for Solar Home Systems (SHS) as power back-ups in residential facilities due to high/convoluted tariffs, inefficiencies and corruption in the state-controlled electricity provision. A new class of ''energy-elites'' whose livelihoods and daily lifestyles require regular electricity access to run appliances (cell phones, iPads, internet appliances, TVs and Laptops) seek some autonomy over the production, payment for, and utilization of power by either storing electricity (using power inverters and batteries) for use during power outages or switch to fuel-powered Generator- Sets. These laid foundations for the adaptation to SHS as it resonates with evolving societal practices necessitating self-organized initiatives to reduce dependencies on problematic state-controlled centralized power supply and people's affinity with power components (inverters, charge controllers and batteries) that facilitate back-up power supply from solar photovoltaic (PV) systems. The transition to SHS, we argue, depends not solely on technical innovations but more importantly on the quality of the adaptation to the technology according to how individuals/groups process certain societal practical knowledge about the functionality of alternatives.