Chameleon Research Group
Adapting Energy & Transport to Climate Change

Chameleon – Adapting Utilities to Climate Change
Analysing and Developing Private and Public Action

Selected Findings

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Institute for Ecological Economy Research (IÖW)
Potsdam Institute for Climate Impact Research (PIK)
Indiana University Bloomington, Ostrom Workshop in Political Theory and Policy Analysis

Partners from Industry and Politics
Association of German Transport Companies (VDV), Deutsche Bahn AG, Federal Association of the Energy and Water Industry (BDEW), Federal Environmental Agency / KomPass – Competence Centre on Climate Impacts and Adaptation, Fraport AG, HEAG Südhessische Energie AG (HSE), RWE AG

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Research group on adaptation to climate change in the public utility sector – analysis and development of options for business and political action

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Climate change affects the operation and maintenance of key infrastructures in the utility sector. The energy supply system and the transport sector are two areas whose functioning is greatly influenced by climatic conditions and is thus vulnerable to more frequent extreme weather events and rising temperatures. The aim of the project was to develop a well-founded, differentiated picture of the effects of climate change on the energy and transport sectors as well as adaptation options for key actors in the sectors, with a specific focus on the German situation.

There are already isolated private and public efforts in the energy and rail transport sectors that are, or could be, conducive to climate change adaptation, whether explicitly or implicitly. Examples include internal reviews of technical standards within a company, adaptation in the areas of overhead line monitoring and vegetation management, logging of operational failures caused by weather events, considering the integration of climate change impacts and adaptation into environmental impact assessments, and approaches to adapting cooling water management and to reducing the number of large-scale thermo-electric power plants in the course of the energy transition.

Germany's utility sector is basically able to adapt to climate change, with the help of technical expertise and methods from the field of risk management. While the course of climate change is uncertain, it is also slow, so in the case of short-term or medium-term decisions it is sufficient if action is taken only when further findings on climate impacts become available. Most actors in the utility sector can then make decisions on technical and organizational adaptation autonomously, following their own interests. **However, there are important, general exceptions to this statement:**

- **The longevity of many infrastructures in the utility sector requires anticipatory adaptation right now.** The way in which new power plants are constructed now, as well as current reinvestment e.g. in electricity grids, railway lines, tunnels, and bridges, will be a deciding factor in how sensitive they are to climatic conditions in the coming decades. Therefore, in order to avoid very high costs, the future climate must already be taken into account now. A complicating factor here is the uncertainty surrounding climatic developments, which is not likely to be fully resolved in the future. It is probably inevitable that some investments in long-lived infrastructure will be maladapted, which will then require costly retro-fitting.
- **Climate change requires organizational restructuring.** Climate impacts represent a new problem area that cannot always be dealt with by existing organizational structures. In some cases, new kinds of information and uncertainties must be processed and taken into account when decisions are made. This can lead to barriers, institutional voids and unclear or a lack of responsibilities for adaptation. Therefore, climate change adaptation requires organizational restructuring both in public authorities and in utility companies; this must be dealt with at an early stage.
- Traditionally, the utility sector is strongly regulated. **De facto, this regulation determines whether there are incentives to invest in adaptation or not.** Cost-based regulation mechanisms reduce the uncertainty of climate change for grid operators and transfer the risk

of maladaptation to electricity customers. Incentive-based mechanisms, on the other hand, bring with them uncertainty about the vulnerability and the behavior of the other grid operators and make adaptation decisions more difficult.

- **The German Anreizregulierungsverordnung for electricity grid operators currently provides insufficient incentives to adapt to extreme weather events.** The risks and costs are mainly borne by the customers. **The German Leistungs- und Finanzierungsvereinbarung (LuFV) between the German government and Deutsche Bahn allows for exemption clauses in the case of extreme weather events, which reduces the incentives for ex ante adaptation.** Against the background of a projected increase in the frequency and intensity of extreme weather events, both forms of regulation should be re-examined in order to safeguard incentives for a robust infrastructure design, without risking over-adaptation. Compulsory climate-proofing in the planning process and financing of pilot projects could be a starting point here.
- **The lack of reliable data and the uncertainty on climate change impacts are significant barriers to companies' dealing with adaptation.** Further barriers include that companies often do not consider that climate change impacts impose a new kind of environmental risk. Rather, they consider impacts to be well-known problems that continue or increase in frequency or intensity, and that can be dealt with by existing processes. Compliance with technical norms and standards is seen as a sufficient tool for safeguarding against risks. Politics and the relevant supervisory authorities are assigned a guiding role.
- **Technical norms and standards can be a good entry point for the long-term implementation of adaptation.** The question here is whether it is necessary to make standards more dynamic. In addition, water regulation and legal rules for development approval must be re-examined.
- **Depending on which adaptation measures are selected, different distributional effects of adaptation costs are possible, which point to a long-term political dimension.** The question is to what extent the higher costs and risks generated by climate impacts and adaptation can be passed on to different groups of actors.

Beyond the general statements, individual case studies provided the following in-depth findings:

- **The effects of heatwaves on the electricity market can mainly be attributed to cooling water scarcity for thermal power plants.** This will increase as a result of climate change, as long as large-scale thermoelectric power plant capacities are not reduced. Also consistent climate protections can reduce senstivity to climate impacts at the same time.
- At the electricity market, the **costs of heatwaves are borne disproportionately by the customers** at the electricity exchange, whereas producers as a whole make additional profits.
- **Utility companies in the energy sector and the rail transport sector are beginning to deal actively with the issue of climate change impacts. However, there is currently more debate than concrete action,** or it happens at strategic level. Hardly any tangible measures are being implemented.
- **Obstacles to adapting rail infrastructure include unclear responsibilities concerning adaptation.** Until now, changes in the climate have not been taken into account in the regulation of infrastructure financing and planning. Approaches for improvement consist in developing climate-proofing approaches for the Bundesverkehrswegeplan, integrating climate-change-relevant quality criteria into the Leistungs- und Finanzierungsvereinbarung, and changing rail-transport-relevant norms.
- **Simple statistics for extreme precipitation events systematically underestimate their intensity and overestimate their frequency**. This can be improved by means of a methodically sound, stochastic estimation of precipitation events. This takes into account the scaling behavior of precipitation patterns.
- **Adaptation policies do not primarily require new instruments. Rather, existing instruments should be adequately modified (policy mainstreaming).** A policy field analysis was used to sketch out lines of development for German adaptation policy. The analysis demonstrated that adaptation policy follows a mainstreaming approach, for the most part originating from higher institutional levels and driven by environmental departments.

Selected Publications[1]

Eisenack, K., Moser, S., Hoffmann, E., Klein, R., Oberlack, C., Pechan, A., Rotter, M., Termeer, C. (2014): Overcoming barriers to climate change adaptation, Nature Climate Change, Vol. 4, 867-872.

Pechan, A., Eisenack, K. (2014): The impact of heat waves on electricity spot markets, Energy Economics, Vol. 43, 63-71.

Stecker, R., Mohns, T., Eisenack, K. (2012): Anpassung an den Klimawandel - Agenda Setting und Politikintegration in Deutschland, Zeitschrift für Umweltpolitik und Umweltrecht, Nr. 2, 179-208.

Eisenack, K., Stecker, R., Reckien, D., Hoffmann, E. (2012): Adaptation to Climate Change in the Transport Sector: a Review of Actions and Actors, Mitigation and Adaptation Strategies for Global Change, Vol. 17, No. 5, 451-469.

Eisenack, K., Stecker, R. (2012): A Framework for Analyzing Climate Change Adaptations as Actions, Mitigation and Adaptation Strategies for Global Change, Vol. 17, No. 3, 243-260.

Pechan, A., Rotter, M., Eisenack, K. (2011): Eingestellt auf Klimafolgen? Ergebnisse einer Unternehmensbefragung zur Anpassung in der Energie- und Verkehrswirtschaft. Schriftenreihe des IÖW 200/11 (200/11 in the IÖW's publication series).

[1] A complete, regularly updated list and selected documents can be found at: http://www.climate-chameleon.de/htm/publikationen.html