AKE 2: AKE 2

Time: Tuesday 13:30–14:45 Location: AKE-H16

Invited Talk AKE 2.1 Tue 13:30 AKE-H16

Systemstudien von Fusionskraftwerken — •Jorrit Lion — Max-Planck-Institut für Plasmaphysik, Greifswald

AKE 2.2 Tue 14:00 AKE-H16

Techno-socio-economic energy system optimization: A pareto-based approach — •Patrik Schönfeldt — DLR-Institut für Vernetzte Energiesysteme, Oldenburg, Deutschland

To meet the 1.5 °C goal of the Paris agreement, a rapid transition of energy supply is needed. Not only fossil based thermal power plants have to be replaced, but also 89 % of the global heat supply. While this parallel transition might be challenging, it also offers the chance to lift the potential of mutual benefits, i.e., the electricity sector can benefit from the integration as the sector coupling can provide flexibility. In this context, automatic optimisation routines can aid finding solutions that are not just feasible but also meet other demands, such as affordability. However, different stakeholders often have deviating, sometimes even contradicting demands for qualities of energy systems. Even affordability might be read in different ways. Also, we find ourselves in a situation where physics and regulations might not overlap.

This contribution presents an approach designed to explore the space of optimal solutions, facilitating informed decisions, including the weighting of various design goals, late in the planning process. The contribution also gives examples, where the energy system model has to deviate from the actual physical system. The Energetisches Nachbarschaftsquartier (ENaQ) serves as a case study for this approach. Its boundary conditions are shortly outlined and example results are assessed.

AKE 2.3 Tue 14:15 AKE-H16

Space-charge-mediated phenomena at oxide interfaces for electrochemical water splitting — •Felix Gunkel[1], Moritz Weber[1], Lisa Heymann[1], Anton Kaus[1], and Christoph Baeumer[2] — [1]PGI-7, FZ Jülich — [2]Twente University

Complex oxides have evolved as a major class of functional energy materials applied in a wide range of energy conversion and storage appraoches which harvest the ability to precisely tailor and combine oxides on the nanoscale. Heterogeneous interfaces of oxides enable the exchange of ionic and electronic defect species between the neighboring materials, giving rise to electronic-ionic charge transfer and space charge formation. Such space charge regions typically possess distinctly different material properties as compared to the bulk and allow tailoring and tuning of ionic-electronic properties by intentional design of interfaces. Here, we will discuss how dedicated design and understanding of interfacial space charge phenomena can be used to tailor electronic and ionic charge transport along and across electrochemically active oxide interfaces and surfaces, with particular focus on the role of space charge at solid-liquid interfaces operating in alkaline water splitting. As will be shown the dedicated control of the surface band structure of oxide catalysts via space charge can be used to mediate activity for oxygen evolution reaction, while the mass transport across the interface is responsible for the degradation and limited lifetime of the catalysts. In this way, the control of space charge and electronic structure can be used to realize hybrid catalysts that attempt to break classical scaling relations of electrochemical activity and stability.

AKE 2.4 Tue 14:30 AKE-H16

Investigating potential climatic side-effects of a large-scale deployment of photoelectrochemical devices for carbon dioxide removal — •Moritz Adam[1], Thomas Kleinen[2], and Kira Rehfeld[1,3] — [1]Institut für Umweltphysik, Heidelberg, Germany — [2]Max-Planck-Institut für Meteorologie, Hamburg, Germany — [3]Geo- und Umweltforschungszentrum, Tübingen, Germany

Integrated assessments of economy and climate favour CO_2 removal from the atmosphere to reach ambitious temperature-stabilization targets by 2100. However, most of the proposed approaches are in conflict with planetary boundaries and they may come with unintended climatic side-effects. Draw-down of CO_2 by photoelectrochemical (PEC) reduction is a recent and promising approach (May & Rehfeld, ESD 10, 1-7 (2019)). If adjusted for high solar-to-carbon efficiencies, PEC devices would require comparably little land for achieving annual CO_2 abstraction rates compatible with limiting global warming to 2°C or below. Yet, their climatic side-effects are unknown. Here, we discuss our work towards investigating potential impacts of PEC CO_2 removal on climate and carbon cycle in simulations with a comprehensive Earth System Model. We plan to compare potential side-effects for localized and delocalized PEC deployment. We expect delocalized setups to have only little impact on climate and to minimize carbon emissions due to land use change, while localized setups might alter circulation patterns and could impact carbon stocks significantly. Still, PEC devices remain costly and in development, leaving emission reductions as the only appropriate measure for stabilizing anthropogenic warming.