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Understanding alternatives for the Swiss electricity sector transition under deep uncertainty

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Abstract:

Widely used energy system models have been shown to underestimate the deep uncertainty inherent in the real-world energy transition. The models generate a small set of scenarios, too sparse to cover the broad range of alternatives for the future energy transitions. This presentation introduces the EXPANSE model (EXploration of PATterns in Near-optimal energy ScEnarios) and reveals how it can be used to facilitate a systematic selection and learning about alternative future energy system transitions under deep uncertainty. The model will be demonstrated by applying it to the Swiss electricity sector in 2035 and 2050. EXPANSE is a deterministic bottom-up, technology-rich energy system optimization model. After defining the supply-demand, technology and resource - constraints for the future energy system, like in any conventional optimization models, a Modeling to Generate Alternatives (MGA) approach is used to sample a large number of energy scenarios. A maximally diverse subset is then selected to better understand the spread of future energy scenarios. EXPANSE distinguishes itself from conventional bottom-up energy system optimization models that only display fragmented segments of the multidimensional space where important uncertainties may remain unacknowledged. Future research shall focus on developing an interactive user-driven interface where stakeholder preferences are added to the model as further constraints, supporting decision makers in identifying energy scenarios that are acknowledged across a wide range of different stakeholder views.