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Modelling, Simulation, and Validation of Urban Energy Systems

Chair

Arjen van der Meer – TUD

Presentation 4

Optimization modeling of regional energy systems considering coordination mechanisms

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Abstract:

Dutch regional municipalities increasingly take an active role in the transition to more sustainable and autonomous energy supply systems, using local energy sources like wind, solar and biomass. The ambition, on the one hand, concerns how an optimal local energy supply system can be designed such that local energy targets can be realized with minimum dependence on the national energy grids. On the other hand, it is of importance to consider the coordination mechanisms between actors such as municipalities, local communities and grid operators, since they will influence the technical configuration of the system.

In the literature about renewables-based regional energy systems, the technical optimizations are done mostly from a central planner point of view. Therefore, there lacks a study on the optimization models for regional renewable energy planning that has a comprehensive view on coordination mechanisms and their influence on the system performance.

The objective of this work is to enhance the formulation of mathematical optimization models for self-sufficient regional energy systems by taking coordination mechanisms into account, in order to understand their influences on the system performance.

In this paper, a toy model for making optimal long-term investment decisions in electricity generation and transmission will be presented. Two coordination mechanisms, namely one with a central planner, and the other one with a regional market, are considered. In addition, the different modeling approaches for rural and urban energy systems will be discussed.

Initial results show that the coordination with a central planner has the least system cost. In the market-based coordination, it is recognized that the degree of shared information and of market participation influences the problem formulation. This results in the cost differences for different coordination mechanisms and for different actors, and thus gives policy implications in the choice of coordination mechanisms and in cost allocation.