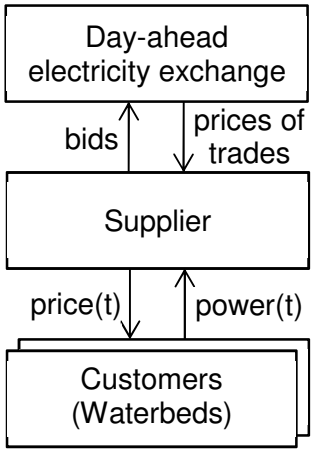
Bachelor thesis or Research Project and Seminar

«Heuristic Day-Ahead Real-Time-Pricing for Demand Response with Waterbeds»

Background

In electricity networks produced and consumed power is the same at any point in time. Therefore, traditionally, power plants are regulated to produce the amount of consumed power. But now, the increasing amounts of renewable energy from wind and solar, produced according to the weather not as needed, demands for new approaches. The approach *demand response* contributes to the issue by changing the consumption of devices in time. Suppliers encourage their customers to change their consumption by providing prices varying during the day. With day-ahead real-time-pricing, suppliers fix these prices once every day for the next day.



In a simplified model, a supplier buys electricity at a day-head exchange only, which offers electricity for a price that may be predicted accurately. Consumers get different prices. The customer's reaction on prices results from non-trivial decisions of control algorithms. Their power consumption can also be predicted accurately for given prices in advance. Thus, the supplier's problem is finding the customer prices changing their consumption in a way that minimizes the price to be paid for electricity at the exchange.

The Institute of Telematics at the TUHH investigates using demand response with waterbeds. Waterbeds are well suited for demand response, as they have a huge amount of water whose electrical heating may be shifted in time. In previous work, waterbeds were modeled, implemented for different temperature control algorithms and simulated to evaluate the performance of the control algorithms [Venzke16].

Goals of thesis or project

The goal of the proposed project is to investigate heuristic approaches for fixing consumer prices assuming waterbeds with known control algorithms as only loads. Therefore, algorithms such as *simulated annealing* or *genetic algorithms* should be applied to find customer prices leading to a solution that is close to the optimal solution. Implementation will use an available simulator (in Java) already containing different control algorithms for waterbeds. Analysis should include effects of the heuristics, its effectiveness for demand response and energy saving, and suitability and effects of the control algorithms. The work shall start with the simplified model described above and continue releasing simplifications.

References

[Venzke16] Marcus Venzke, Volker Turau. "*Simulative Evaluation of Demand Response Approaches for Waterbeds*". In: Proceedings of the 2016 IEEE International Energy Conference (ENERGYCON), Leuven, Belgium, April 2016. http://dx.doi.org/10.1109/ENERGYCON.2016.7514041

Contact: Marcus Venzke
venzke@tuhh.de
Telephone: 040 / 427 78 – 3378
Office: E4.086

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