SUCCESS STORY

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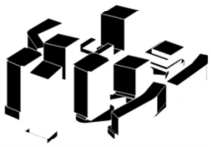
ÖKO-OPT-QUART
Economically optimized control and operating mode of complex energy networks of future city districts

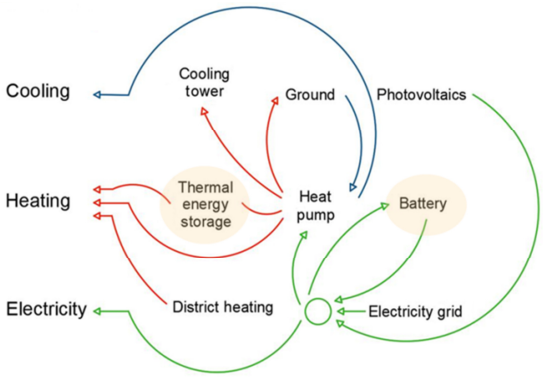
Programme: Stadt der Zukunft

Programme line: Industrielle Forschung

Type of project: ÖKO-OPT-QUART, 02/2017 - 01/2019, multi-firm

bioenergy2020+





ÖKO-OPT-QUART

ECONOMICALLY OPTIMIZED CONTROL AND OPERATING MODE OF COMPLEX ENERGY NETWORKS OF FUTURE CITY DISTRICTS

The focus on a reasonable combination of different and if possible renewable energy sources in future city district is increasing. However, the resulting energy networks are getting more and more complex. This increase of complexity has its origin mainly due to the dependency of renewable energy production on non-controllable, varying environmental conditions (e.g. wind or sunlight), the increasing decentralization and the growing demand for efficiency. However, currently applied control methods are not yet capable of operating such complex systems reliably and efficiently. In order to develop suitable control strategies which would ensure a robust and efficient operating behaviour, detailed simulation models are required. Such models are currently only available to a limited extent due to the high level of complexity of the system.

In the project ÖKO-OPT-QUART a model predictive controller (MPC) was developed based on an energy-based and economic simulation model. The developed MPC was simulated for the planned city districts Q1 and Q4 of the future urban area Graz-Reininghaus in Graz, Austria. This approach allowed for clearly identifying and reliably evaluating the investment, installation and operating mode strategy with the greatest economic benefit. In addition to the methodical findings, a secondary benefit was generated. The evaluation of the developments based on real boundary conditions, made it possible to directly integrate the acquired knowledge into the real development of the city districts.

In the project different models (energy-based, economic and control-oriented) for complex energy networks in city districts were developed. The energy-based modelling describes both the thermal

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as well as the electrical behaviour of the urban energy network in a detailed way. The economic modelling allows a continuous economical evaluation of the operating mode, by providing the possibility to track and analyse the emerging costs. The control-oriented model either consist of a conventional control strategy or the developed MPC (see Fig. 1) for operating complex energy networks in city districts. This makes it possible to compare the efficiency of both control strategies by comprehensive simulation studies.

Afterwards, the energy-based, economic and control-oriented models were combined to an interdisciplinary overall model (co-simulation), which allowed the simulation of various control strategies for the given city districts und various boundary conditions.

Due to this overall model, it was possible for the first time to realistically quantify the economic benefits of an MPC for the operating mode of energy networks. Furthermore, a modular methodology for the systematic design of an MPC for complex energy networks was developed.

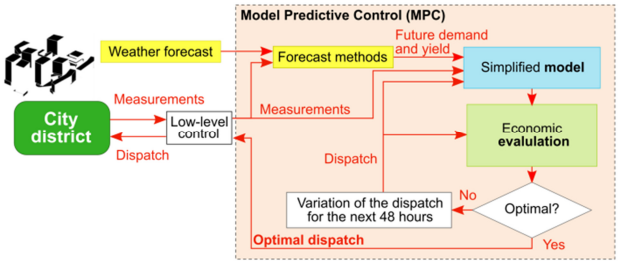

Fig. 1: Developed model predictive control (MPC) for city districts
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Impact and effects

With the aid of the developed modular MPC a total annual cost savings potential of up to 6% (75 k€) was achieved for the considered city districts.

The modular implementation of the MPC ensures an easy adaption to other city districts and energy configurations.

Project coordination (Story)
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- AEE INTEC, Austria
- TB-STARCHEL GmbH, Austria
- PMC GmbH, Austria
- ISWAT GmbH, Austria

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