Lehrstuhl Steuerung, Regelung und Systemdynamik

Master Thesis

Literature research, Programming and Simulation

Theoretical and technological advances of energy management systems in cities: Literature review

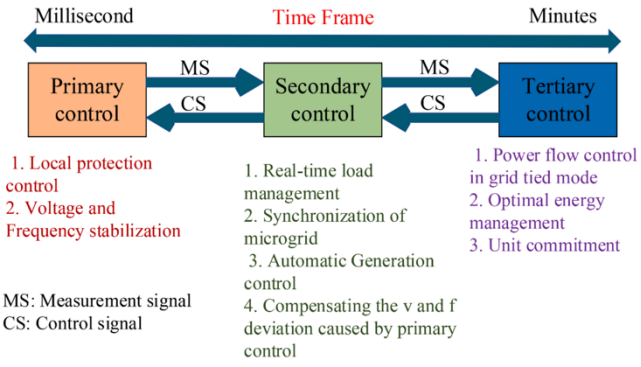
Keywords: energy management, building, district, community, residential sector, industrial sector, transport sector

Conditions:

Duration:	6 months
Requirements:	Strong MATLAB knowledge
Language:	English
Target group:	Master students

Contents:

The increase of renewable energy systems usage in cities raised numerous problems due to their continious fluctuation as a energy source, which leads to the necesssity of controll systems usage in order to avoide energy waste. Energy controle in microgrids generally differ to three control levels: Primary control for current or voltage regulation, secondary control for voltage or current error correction, and tertiary control for power flow and energy management.



[Jane et al., 2023]

Energy management systems (EMS) are systems that control energy flow in different applications and schems. In city microgrid perspective, multiple levels can be distinguished: Community, district, and building. Energy controlers as EMSs can provide different services to both energy providers and energy consumers such as peak shaving, demand scheduling, power profile smooting, and others. In this context, the goal of this work is to focus on the tertiary control, investigate the current EMS methods and applications in the three different city levels, and refine from the literature the requirements and measures necessary to increase the efficiency of EMS in cities. The work includes a scientific review of the current state of the art and provides a thorough analysis of these aspects. The aim of the work is to review, summarize, and analyze existing research on the topic of “Efficient energy management systems in cities”, focusing on the most important technological developments and challenges. These include system topologies, controllers’ levels, objectives and muti-objective EMS, and the efficient usage of the different algorithms. The result will be a scientific discussion on this topic

The goals/steps of this work are:

- Investigation of the current state of the art: Systematic review of existing studies in the field of EMS in microgrids and smartgrids, with a focus on city application.
- Evaluation of the sources: Definition of criteria for the inclusion or exclusion of studies by evaluating the quality and relevance of the sources (e.g. impact factors, publication data).

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- Literature analysis: Review of the development of the research topic. Synthesize existing knowledge and evaluate current methods and theories. Analyze and compare methods, results and assumptions.
- Identify unanswered or contradictory questions.
- Critical evaluation: Examine the strengths and weaknesses of the literature. Identify methodological or theoretical problems, biases and relevance of results to the field.
- Research gaps and future directions: Propose relevant research questions for future studies. Summarize key findings.
- Complete and detailed documentation/presentation of the research results

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