ACA-Modes: FHNW modelling & design methods

Advanced Control Algorithms for the management of

decentralised energy systems



31st January 2020, Prof. Dominique-Stephan Kunz

Agenda

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- Intro ACA-Modes
- Previous project Energy Chance
 - Parallels
 - Lessons learned
- Laboratory concept
- From WP4 to WP7 from the perspective of modelling & design methods

Trinational project

"Increase in the number of cross-border consortia from the Upper Rhine area developing the Applications and Innovations"

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France:

University of Strasbourg

Germany:

University of Applied Sciences Offenburg (lead)

University of Applied Sciences Karslruhe

University of Applied Sciences Koblenz

University Freiburg

Switzerland:

University of Applied Sciences and Arts Northwestern Switzerland



Project: ACA-Modes

Advanced Control Algorithms for the management of decentralised energy systems Term 2019 - 2022



Project: Energy Chance System



BIG picture project: Energy Chance

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Control-Signal and loadprofile



Price has an energy and power component!

Forecast of loads

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12

Time [h]

14 16 18 20 22

10

Last Schedule

24





Cross-site test setup of the regional energy network



Location of the storage defines the geometrical border for the rules of dimensioning supply line (average or peak load)

The battery can solve the peak load problem of the network.

The placement of the battery defines the problem border.

What applies in the house also applies in the neighborhood or distribution network.

Dimensioning of elements and line:

- Loads (source and sink)
- Time range to shift energy
- Use cases

A question of economy.



Battery

Lessons learned

- Concept worked, custom energy manager followed the target
- Decentralized control has its advantages
- Simulation models are important (validated, reliable..) for forecasts & laboratory test
- Real time (15min) adaption of schedule/planning instead of daily
- To establish acceptance by end-user:
 - Comfort must be assured
 - Behaviour or of the system must be in the interest of the investor (end-user)
 - What can be automised must be automated without need of a intervention by user
 - Visualise behaviour of system is not easy
- Iteration process to find best operation condition as further improvement





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Work packages

WP 1 project preparation

WP 2 State of the Art: literature research on technical, economic and regulatory conditions and state of the art in dimensioning an operation of hybrid energy systems.

WP 3 Analysis of (existing) energy and socio-economic field studies

WP 4 Modelling and computer-aided simulation of hybrid energy systems with experimental validation

WP 5 Improved design methods for hybrid energy systems and control algorithms for grid friendly operation

WP 6 Development of operating strategies for networked, hybrid energy systems

WP 7 Experimental analysis of the supra-regional operation of five coupled, hybrid energy systems

(Connecting 5 laboratories)

WP 7 Every partner has his laboratory which participates in the project

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Laboratory concept

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Hardware in the Loop, example heat pump



University of Applied Sciences and Arts Northwestern Switzerland School of Architecture, Civil Engineering and Geomatics

Challenges

- Different models of same component ٠
- Different technology •
- same Building ٠
- Supervisory control •
- High level control ۲

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- Exchange of models
- Validation of models ۲
- Consolidation on technology ۲

WP4, **WP5**

New algorithms



Approach on existing models (WP4)



 \rightarrow Exchange of models and further development

Approach on modelling a simulation (WP4)



Approach: on design methods and improved control (WP5)



WP6 Supervisory control



Approach on laboratory test (WP7)

Simulation onsite

Simulation in the university network

Real time emulation in the laboratory (as isle)

Real time emulation in the laboratory network



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Maturity process for control concepts

From simulation to product



Cooperation with industrial & energy suppliers

From every country industrial & energy suppliers are involved

- As a source of inspiration and boundary conditions
- As sparring partner
- As a mirror group

Participants will carry the outcome further into the market

Thank you very much for your attention.



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