Characterization of Building Energy Performance involving Building Automation and Smart Grid Technologies

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IEA Workshop “Thinking the Smart Grid from the Consumer End”

A. Susanne Metzger

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Overview

- Background: IEA Annex 58
- Current Work in Process
  - BAS and Field Experimentation
  - Smart Meters and Data Acquisition
  - Smart Grid Optimization with Energy Models
- Outlook
IEA Annex 58: Overview

Measured Energy Performance vs. Design Computations of Buildings

**Objective:** Characterize Real Performance
- Issues with Craftsmanship
- Complexity of Variables Involved
- Uncertainties and Inaccuracies of Planning Tools

**Activities**
- From Test Boxes to Individual Homes (Scale)
- International Cooperation on Field Measurements, Simulation and Advanced Modeling Methods (System Identification)

**Challenges**
- Simplifications with Installed Information Systems (BAS, meters)
- Smart Grid Use of the Models


FhG Test Buildings (Holzkirchen) and High-Rise Test Site (Hongkong).
Information in Building Automation Systems

Information potential in buildings

Information potential in homes
Layer model: System Architecture

Management Level

Office Network

BMS

Access control, Intrusion detection

Fire alarm, Emergency lighting

Field Level

DDC Zone 1

DDC Zone 2

DDC Cooling

Automatic control

Control loops

Interaction with the environment

Supervisory Control

Monitoring

Trending

Logging

Scheduling

Forwarding
Individual Solutions for Buildings

- **Management Level**
- **Automation Level**
- **Field Level**
2-tier Architecture for Homes

Fig. 3  Home Automation: Two Layer Model and Communication Protocols
Smart Meters and Data Acquisition

Kammerstetter et al. (2014): Smart Grid Device and Network Model
Smart Meters and Data Acquisition

- Wireless M-Bus
- PC-based software and USB-stick: configuration & design monitoring
- Information from service provider for channel selection (permission)
- Time consuming
- Requires some communication background

Recommendation: Integrate into BAS management systems
Background: Building-to-Grid Research

- Smart Grids Model Region Salzburg (Austria)
- Building-to-Grid Project (2010 – 2013)
- Load forecasts for demand side management based on limited thermodynamic building model (building design, energy pass)

Raudaschl et al. (2013)
Building-based Load Forecasts for DSM (FFG)

- New B2G project: Load forecasts with improved thermodynamic modeling
- Which parameters for SG?
- Austria, Belgium, Denmark
- Smart grid study: Generic High Level Use Case „Short Term Load and Generation Forecasting (WGSP-0301)
- Low voltage area
- Storage modeling (building)
- Monitoring information for DSM
Co-Validation Experiment for Load Forecasts

Information Systems Study

Smart Meters

Physical Modeling

New Configurations?

Use Cases?

Field Protocol

Heating Cooling

Load Forecasts

City Electricity Simulation

Pools

Samples

Wireless field network

Field networks

Sensors, actuators, and controllers (SACs)

Twisted pair Powerline

IP Backbone

Management devices (MDs)

Backbone level

Field level

WAN (e.g., Internet)

Interconnection devices (ICDs) (e.g., router, gateway)

New Configurations?

Heating

Cooling

Smart Meters

Physical Modeling

Load Forecasts

City Electricity Simulation

Information Systems Study

Use Cases?
Outlook

- Results available by end of June 2016

A.Susanne Metzger  
Vienna University of Technology  
Automation Systems Group  
www.auto.tuwien.ac.at  
ametzger@auto.tuwien.ac.at

References


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