EU FP6 ECO-BUILDINGS PROJECTS

INNOVATIONS IN BUILDING MANAGEMENT SYSTEMS

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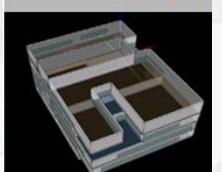
# Energy consumption control in Building Management Systems

1. BMS → Building and energy supply system control
Only in some cases:
→ Monitoring of energy consumption
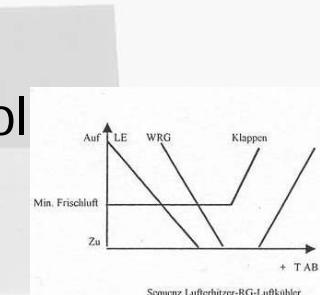
2. Problem of simple energy consumption monitoring:
→ Consumption depends on ambient temperature, solar irradiation, user behaviour
→ Only obvious system faults are detectable
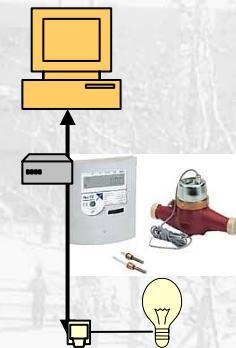
3. Energy management methods: passive monitoring, active "manual" decision making

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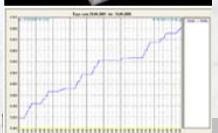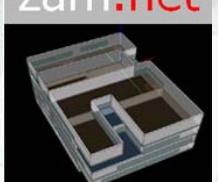
Model based monitoring and control

Active Energy management with improved fault detection and improving control strategies

Bring simulation from the planning phase into the operation phase

"Hardware – in – the loop" testing of controllers

Applications buildings

Optimisation of control strategy
→Room comfort control: Simulate switch on/off times of heaters/coolers
→Simulate passive night cooling times using predictive control
→Optimise heating/cooling strategies using weather forecast

Application energy supply plants

→Detection of "hidden" system faults like slow degradation or mismatching control parameters

Question: Static/dynamic models, detail of modelling

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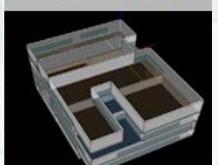
Energy management systems
Model based control

Possible communication solutions depend on BMS

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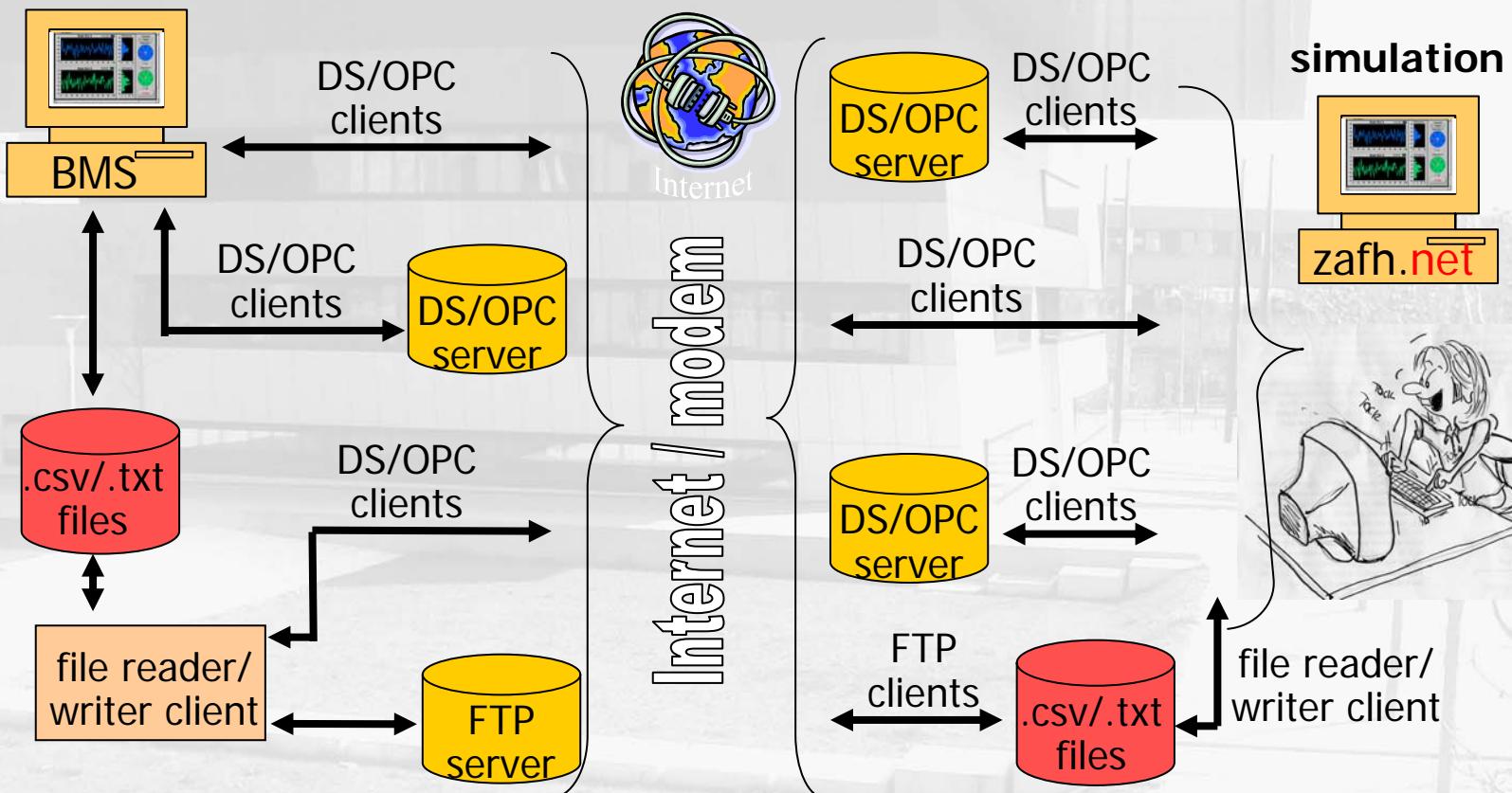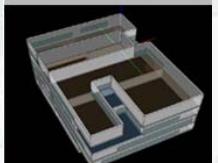
Energy management systems
Model based control
Online building simulation model in INSEL

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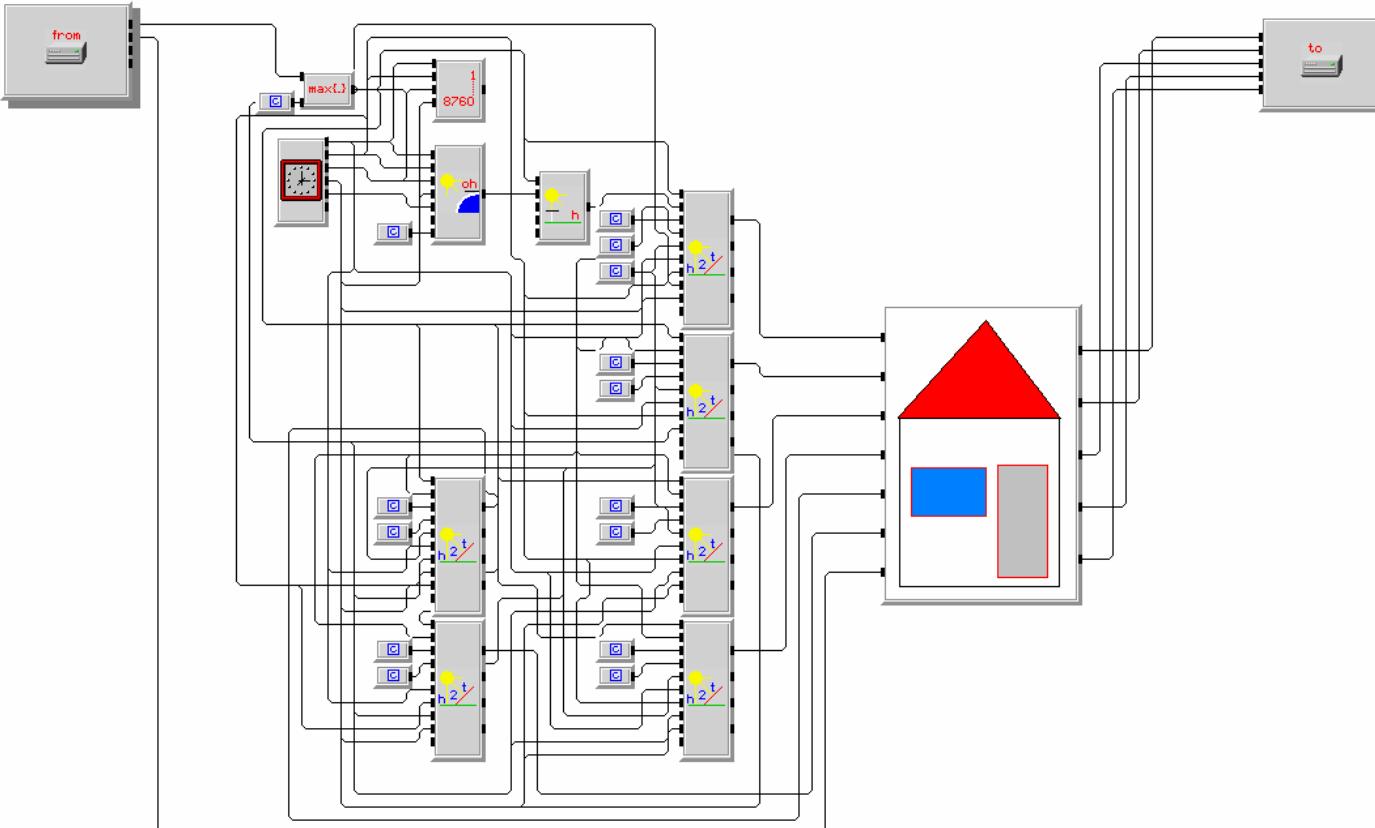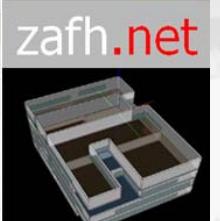
Example Project SARA
Seven ECO-buildings with innovative BMS and control strategies

analysis and improvement of the implemented BMS control strategies

• development and integration of online simulation tools

→ Building simulation (static/dynamic)

→ Part of energy supply systems:
  - PV-System all buildings
 - Ventilation and cooling system some buildings

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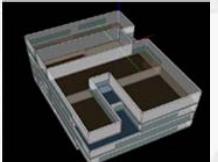
Example Project SARA
Online Simulation and monitoring
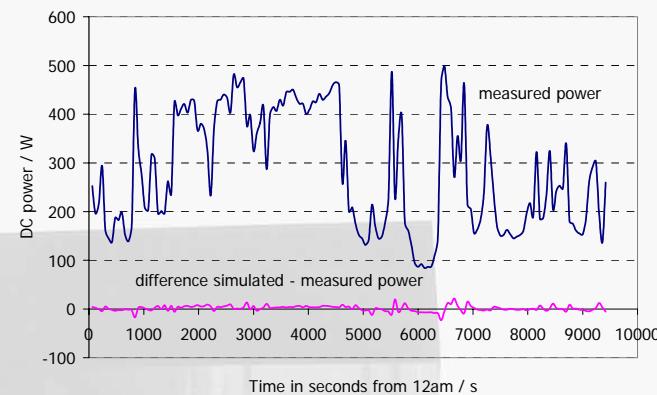
- PV-Systems educational office building in Southampton, UK and training centre in La Tour des Salvagny, France

- Heating energy demand of the educational office building in Southampton with special focus on the Atrium

- Cooling and ventilation system including the liquid desiccant air drying unit and a building model, primary heath care centre in Barcelona, Spain

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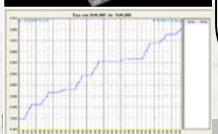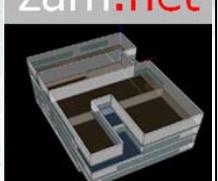
Example Project SARA
Communication and dissemination structure

Data collection online simulation

Data transformation

Internet site

OPC / DSS*

Weather **BMS** PV

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UB

HESPUL

DSS*

FTP /Labv.

Insel.lnk

SARA Austria

SARA France

SARA Italy

SARA Slovenia

Some buildings

SARA Spain

Online Simulation

Monitoring/ Visualisation

SARA UK

SARA Uzbekistan

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Public access interface (www)

www.sara-project.net

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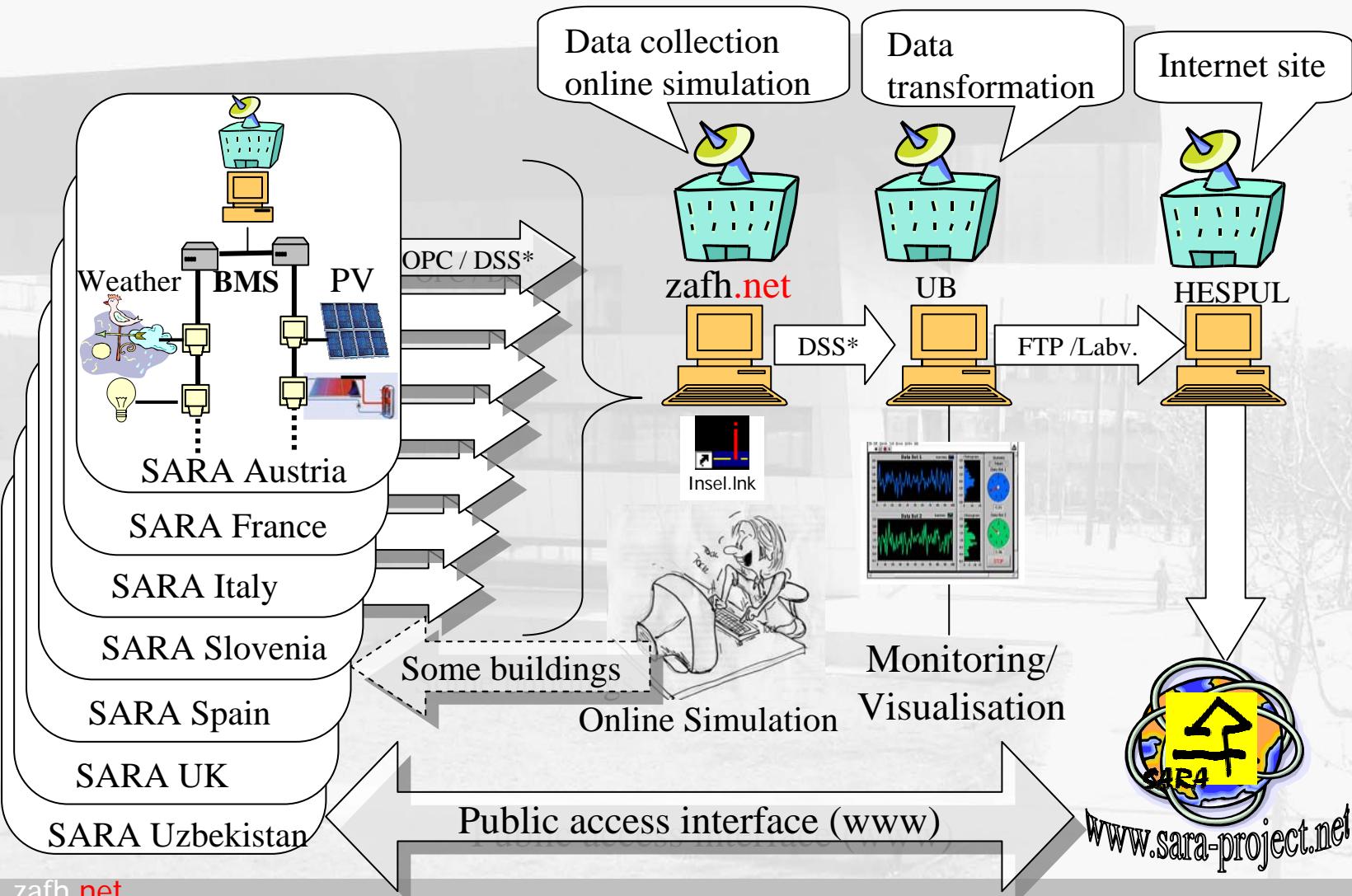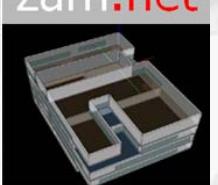
Example Project
1st EM implementation: Cityhall Scharnhauser Park

Building description:

- Completed end of 2003

- 4186 m² heated floor area

- Low energy standard 41 kWh/m²a

- Electricity consumption 43 kWh/m²a

- No active cooling device

- Mostly naturally ventilated

- Kieback & Peter BMS

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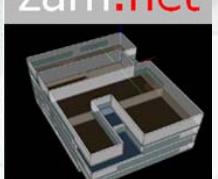
Comparing energy indicators

- German engineering association VDI 3807-2 (1994)
- Ages GmbH 1999
- City of Stuttgart, energy report 2003

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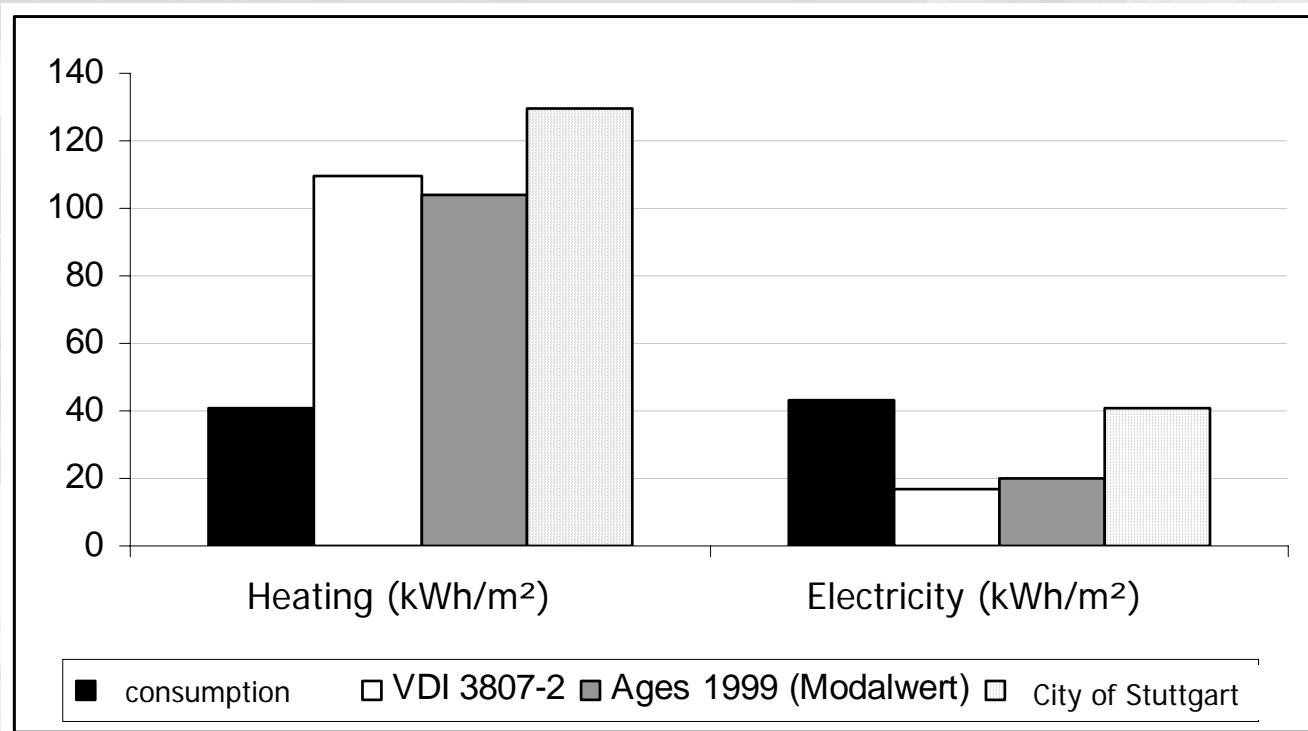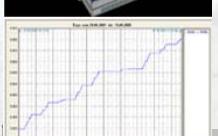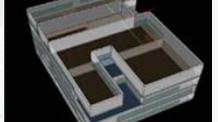
Example Project
Cityhall Scharnhauser Park

Implemented communication infrastructure

Internet / modem

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Cityhall

OPC interface

Kieback & Peter BMS

OPC server

ennovatis smartbox

Heating energy counters

Electricity counters

Smartbox clients

ACCESS database

DataSocket server

DataSocket reader/writer client

OPC reader/ writer client

Online simulation

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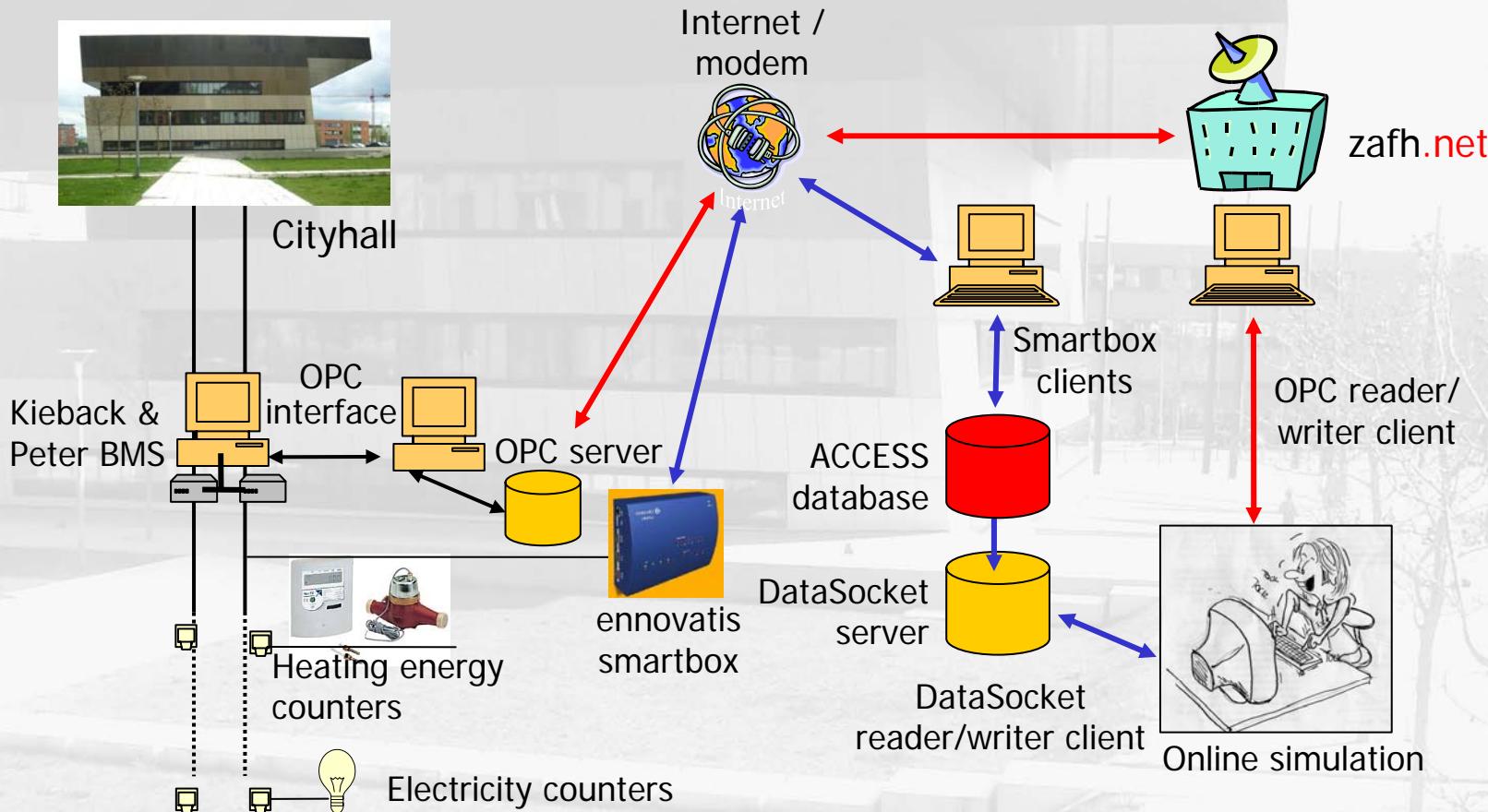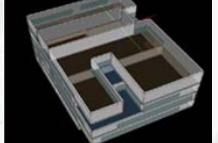
Example Project
Cityhall Scharnhauser Park: Energy balances


Monthly comparison
measured consumption - calculated energy demand DIN EN 832

Chart: Heating energy consumtion/demand (kWh), y-axis from 0 to 50000, x-axis months Jan 04 through Apr 05.

Legend:
- ■ consumption (kWh)
- ■ DIN EN 832 air exchange rate 0,7 h-1
- ■ DIN EN 832 air exchange rate 0,4 h-1

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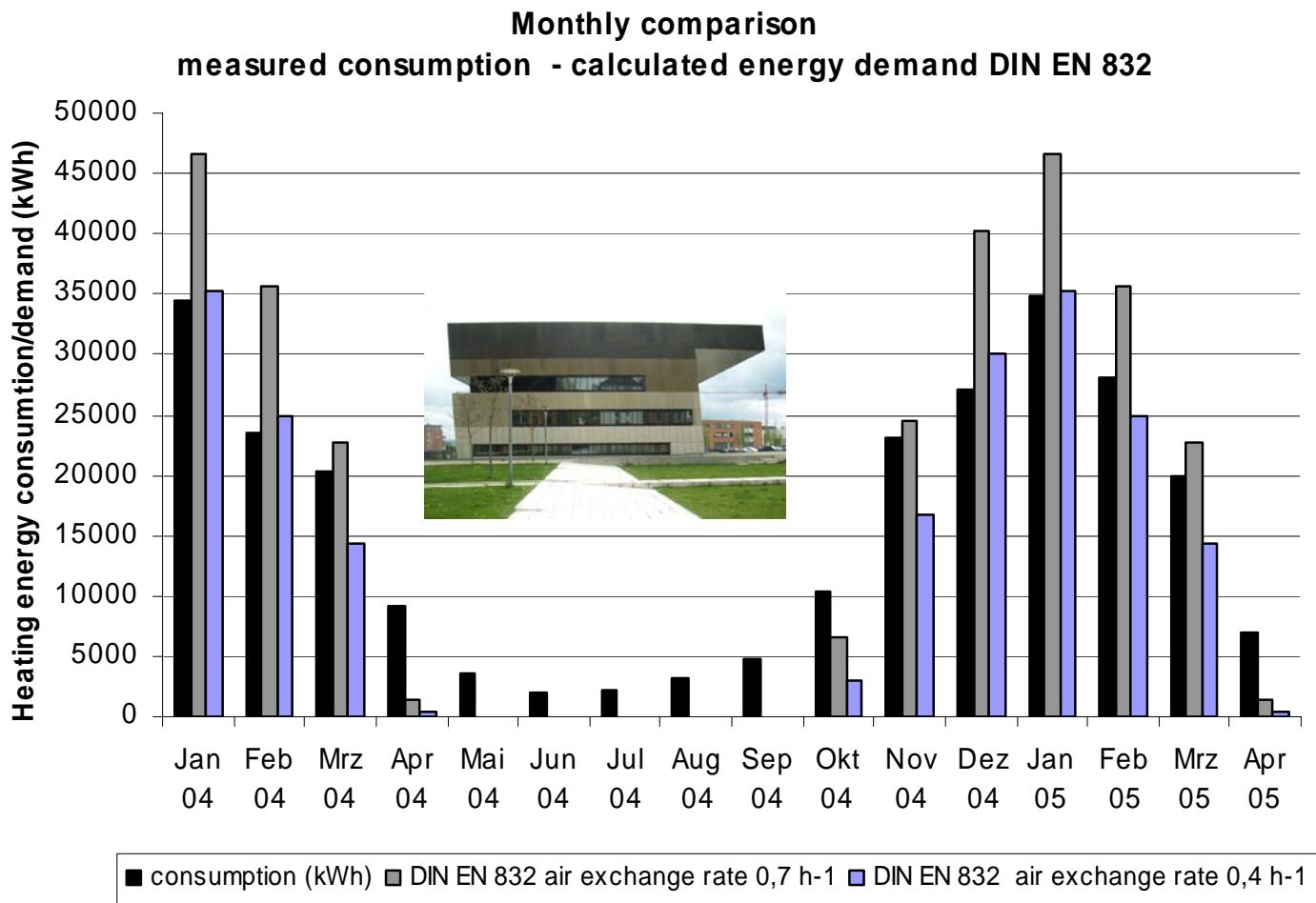
Daily comparison of measured and consumed data

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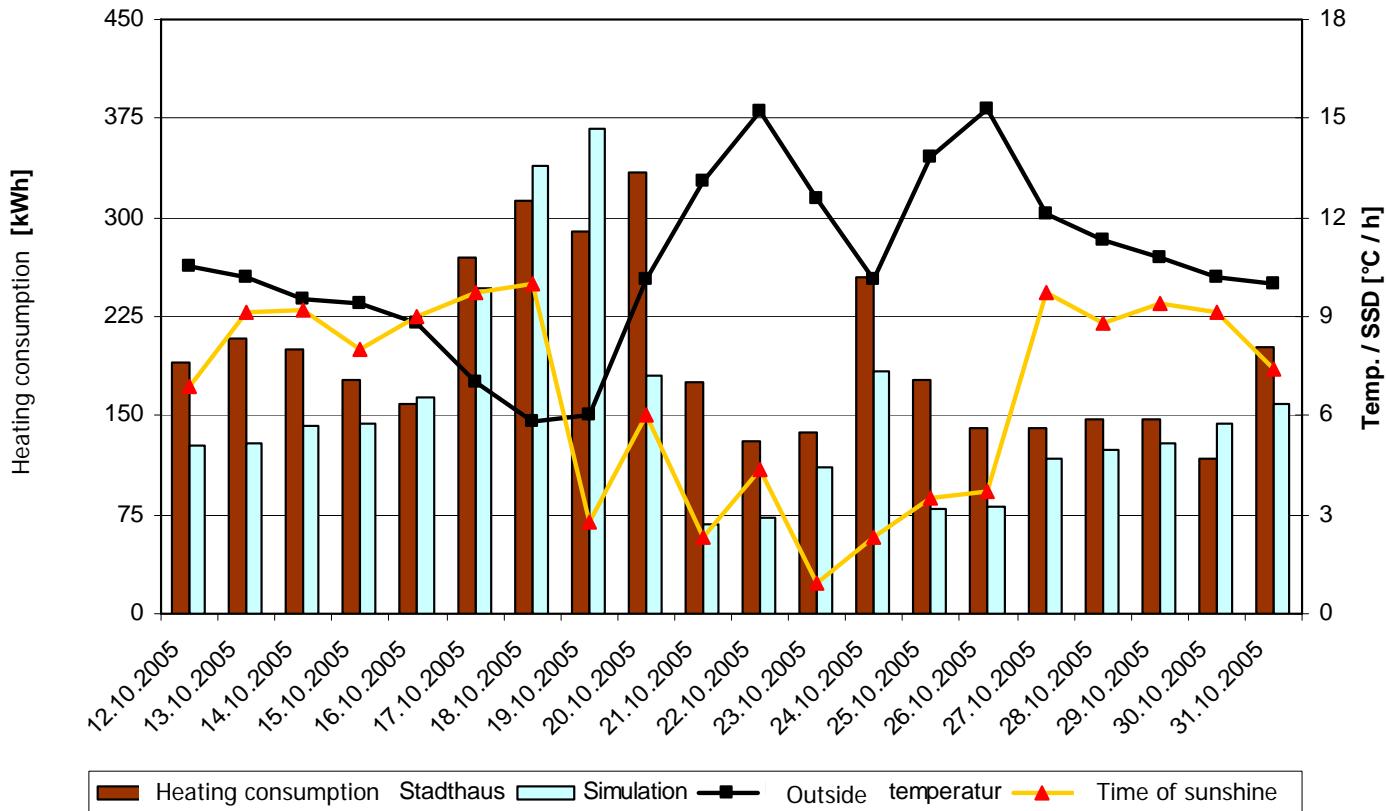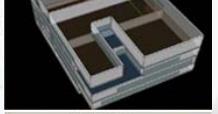
Outlook and conclusions

..to determine modelling depth of different simulation models

..to analyse user behaviour (ventilation, internal loads)

..to use weather forecast data for energy demand prediction and control strategies

IN ORDER TO: reduce energy consumption and cost, as

80% of cost occur during building operation!

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