PEAR
ENERGY EFFICIENT AUTOMATION AND CONTROL OF BUILDINGS
Energy Flexible Buildings, 26.9.2017

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CONTENT

• Basics Project PEAR

• The „Post am Rochus“ Building

• Building Systems modelling and potential for flexibility

• Accelerated testing of building controls
THE PROJECT PEAR

- **Titel:** Test bench for energy-efficient automation and control of buildings

- **Primary Goal:** Significant reduction of the commissioning phase by developing a new “Controller-in-the-loop” method

- **Project frame:**
  - Funded by the Austrian Research Promotion Agency and the BMVIT within the „City of tomorrow“ funding frame
  - Project start November 2015
  - 3 Year duration
  - Project team

- **Demonstration Building:** “Post am Rochus”
„POST AM ROCHUS“
HEADQUARTER OFFICE BUILDING

BUILDING INFORMATION

- Headquarter Office building + Shopping Centre
- Located in Vienna
- Gross Floor area: 48,000 m² approx.
- New building and refurbishment
- Opening on the 21th September 2017
POST AM ROCHUS
HEADQUARTER OFFICE BUILDING

HVAC SYSTEM
- District heating
- Compression chillers and dry cooler heat rejection
- FreeCooling Options: Heat Rejection + firewater basin used as storage
- Eight ventilation systems

INDOOR CLIMATE
- Concrete Core Activation
- Trench heater
- Mech. ventilation
PROJECT CONTENT OVERVIEW

1. **Thermal Simulation** --- Scientific planning support, test different control strategies, setpoints for free cooling etc.
2. **Hardware-in-the-Loop (HIL)** --- Review of the implemented control strategies for shortening commissioning phase
3. **Validation** --- Validation of the simulation models and the Hardware-in-the-Loop method with monitoring data
THERMAL SYSTEM SIMULATION
SCIENTIFIC SUPPORT AN OPTIMIZATION OF BUILDING AUTOMATION STRATEGIES
THERMAL SYSTEM MODEL VISUALIZATION

COOLING SYSTEM

HEAT REJECTION

COMPRESSION CHILLER

BUILDING

VENTILATION SYSTEMS

SPRINKLER TANK

COLD DISTRIBUTION
ACCESS POINTS BUILDING AUTOMATION
ACCESS POINTS BUILDING AUTOMATION
EXAMPLE: FREE COOLING OPTIONS

1. Heat Recovery
2. FreeCooling operation mode
3. 4. 6. 8. HT/LT cold distribution / use
5. 7. 9. Heat Rejection options (1/3 // 2/3)
ACCESS POINTS BUILDING AUTOMATION

EXAMPLE: FREE COOLING OPTIONS

1. Heat Recovery
2. FreeCooling operation mode
3. HT/LT cold distribution / use
4. Heat Rejection options (1/3 // 2/3)
ACCESS POINTS BUILDING AUTOMATION
EXAMPLE: FREE COOLING OPTIONS

- Outside temperature
- Temperature setpoint firewater basin
- Cooling need – temperature / demand
- Temperature setpoints storages
- Operation mode of compression chillers
ACCESS POINTS BUILDING AUTOMATION

1. Heat Recovery
2. FreeCooling operation mode
3. HT/LT cold distribution / use
4. Heat Rejection options (1/3 // 2/3)
THERMAL SYSTEM SIMULATION RESULTS: CONTROL STRATEGIES

Annual difference in terms of energy costs (related to V01)
(based on following costs: el. energy: 0.1055€/kWh, district heating: 0.06436€/kWh)

Approximately 25%
CONTROLLER IN THE LOOP (CIL)
REVIEWS IMPLEMENTED CONTROL STRATEGIES
FOR SHORTENING COMMISSIONING PHASE
PEAR – CIL: GOAL

1. Real time coupling

2. Accelerated Coupling

→ Shortening the commissioning phase significantly
PEAR - CIL – SIMULATION ENVIRONMENT

controller

BACnet

Verification or improvement

interface

TRNSYS Cooling

TRNSYS TABS

TRNSYS Ventilation

Ptolemy II

Evaluation

Real building

Virtual building

BTA

RLT

Kälte

Messsignal

Stellsignal
CIL – SIMULATION VIA BCVTB IN PTOLEMY II
CIL – SIMULATION - ACCELERATION

Ptolemy II

"accelerated" real time
CIL – SIMULATION COUPLING
• the controller runs all the time with 100 ms sampling time
• TRNSYS needs to be started
• Each simulation time step can take any duration below 900ms
• The simulation model is running accelerated
THANK YOU!

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