ENERGY IN TIME WORKSHOP

European Research Conference: Buildings
Europäische Forschungskonferenz: Gebäude

Implementing and analysing EiT solutions in four demo sites

(Helsinki, Levi, Faro and Bucharest)

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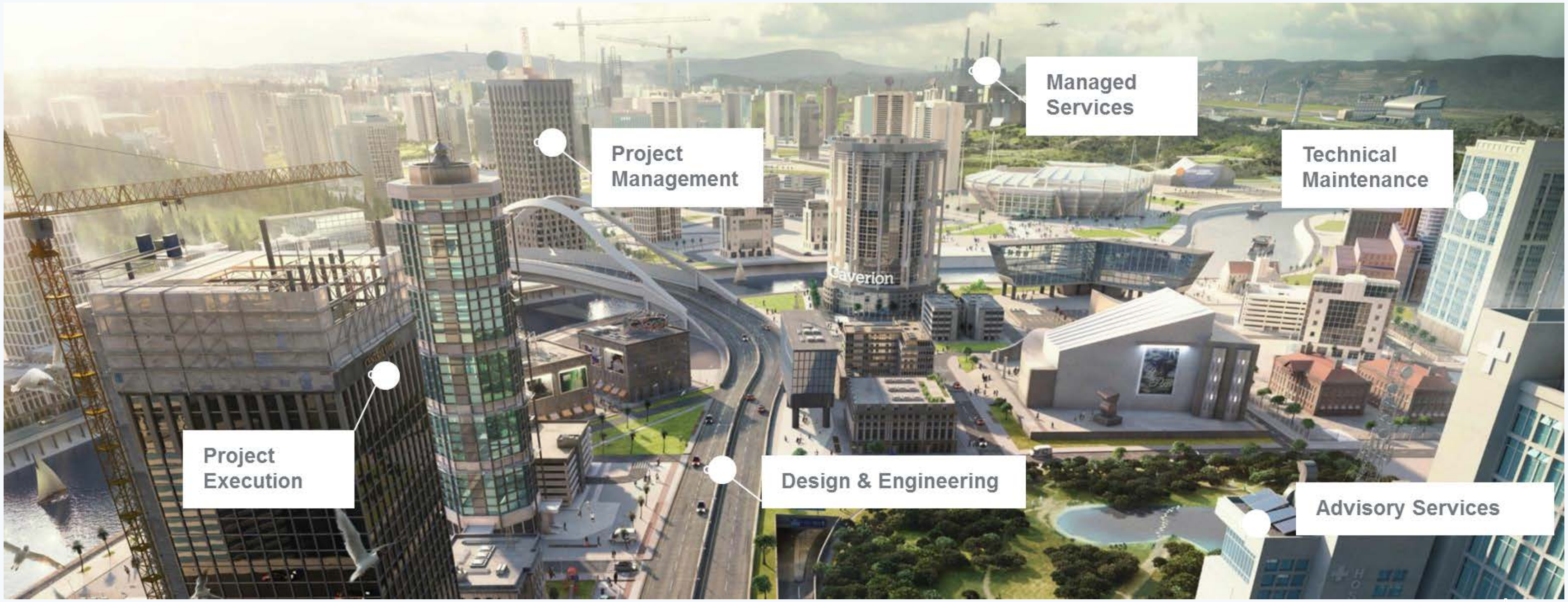
World Sustainable Energy Days
1 - 3 March 2017, Wels/Austria

Topics of presentation

- Caverion company presentation
- EiT demo sites
- EiT Work package 7: demonstration
- Goals for the demonstration
- Modules to demonstrate
- Expected results

Caverion offers advanced and energy-efficient solutions for the entire life cycle of buildings, industries and infrastructures



17,400 employees

EUR 2.4 billion revenue

Headquartered in Helsinki, Finland

12 countries

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Demo sites

EIT DEMO SITES ANA / ICPE

Faro Airport, Portugal	ICPE offices Bucharest, Romania
Built 1965/1989/2000/->	Built 1982
c. 6 million passengers / a	17.384 m²
42.690 m²	

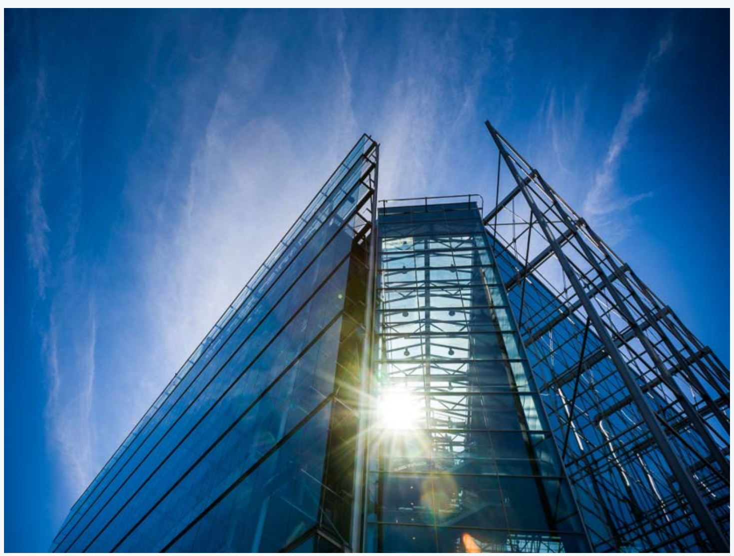
EIT DEMO SITES CAV

Sanomatalo; Helsinki, Finland

Built 1999

42.734 m²

1400 people working daily



Levi Panorama Hotel, Finland

Built 2010

42.500 m²

170 guest rooms

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Demonstration

EiT WP 7: Demonstration

- Energy audits to demo sites
- Upgrades for the metering and communications elements

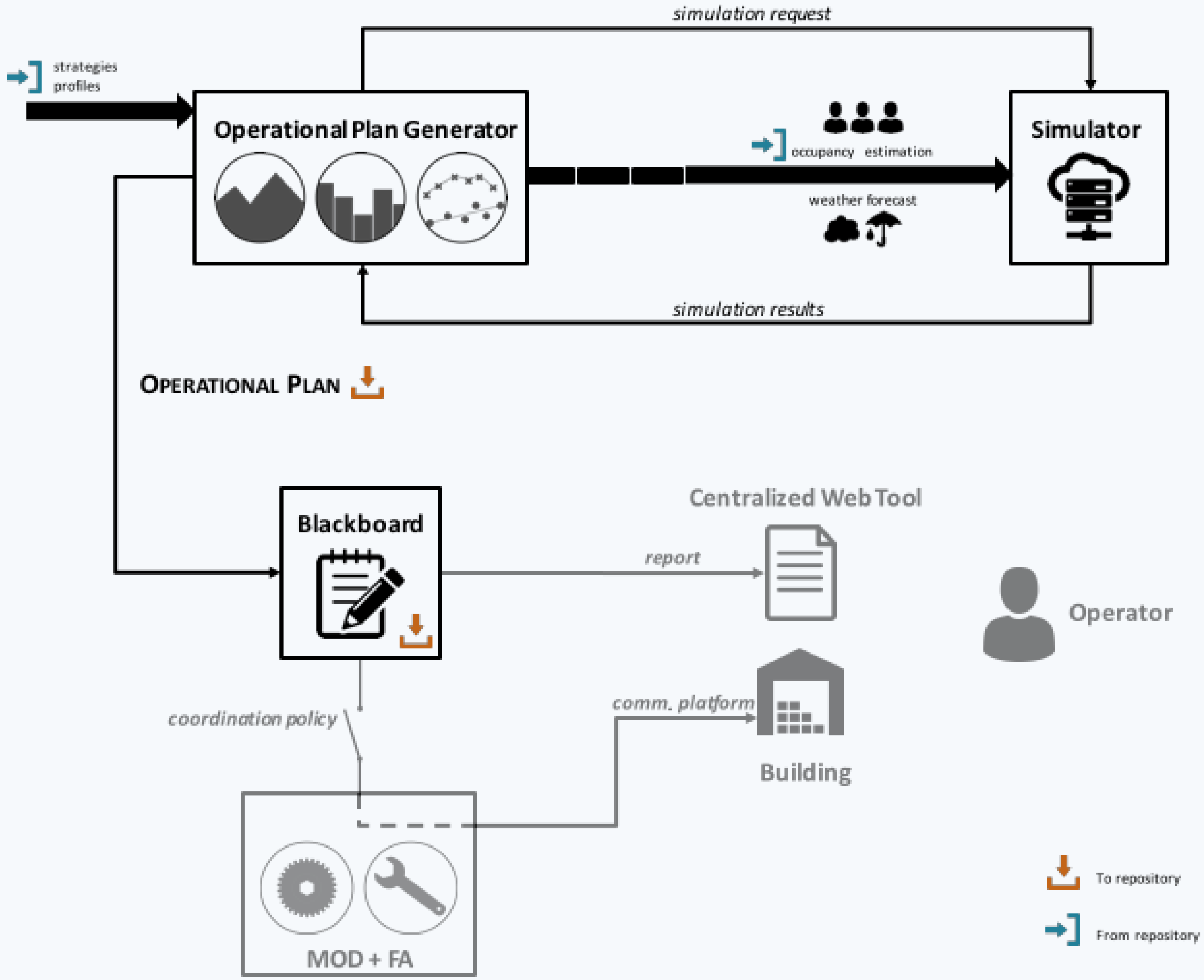
  → Key actions for the EiT solution implementation
- Demonstration phase tests function and feasibility of the developed systems

Technology \ Demo Building	Faro Airport	ICPE	Levi	Sanomatalo
Optimal operation Plan Generator	Cooling mode	Heating mode	Heating mode (decision support)	Heating mode
Model On Demand Control				Heating mode
Fault Adaptive Control	Simulation			
Continuous Commissioning methodology				Sanomatalo AHU331
Fault Detection and Diagnostics	WP6 demo site in Montluel France and other buildings			
Predictive Maintenance			Levi AHUs 302, 305 and 308	

Goals for the demonstration

- Verify the function of the developed systems in real buildings
- Detect possible ways to improve developed systems
- Find direct energy and maintenance cost savings
- Improve indoor climate in spaces
- Visualize further research topics

Optimal operation Plan Generator (OPG)



Optimal operation Plan Generator (OPG)

- Implemented in all four demo sites
- Faro, ICPE and Sanomatalo automatic BMS writing
  - In Sanomatalo also Model on demand control
- Levi manual set points
- Energy saving evaluation
  - OP under predicted conditions vs OP under real conditions vs actual operation (ICPE and Levi)
  - Analysis of OP-based operation vs past season operation (Faro and Sanomatalo)

Model on Demand Control (MoDC)

- Implemented in Sanomatalo
- Works together with OPG
- Automatic set point writing in the heating network
- Goals to achvieve better conditions (cut over-heating, more stable temperature conditions) and save energy
- Energy saving evaluation
  - Comparing the difference of the MoDC set points with the actual heating curve in Sanomatalo
  - Energy consumption in the building (pilot area)
  - Temperature conditions in the spaces

Continuous Commissioning (CC)

- Implemented in Sanomatalo AHU 331 VAV-units
- System drives VAV-units fully open and close once a week → Prevents jamming in the VAV-units
- System alarms if the air flow difference from the AHU and the sum of the VAV air flows is over the limit (upper or lower limit) during the test
- Evaluation process
  - Comparing alarms → Capability for fast actions (compared to the faults that are detected only during maintenance and through user complaints) → better indoor climate and user satisfaction
  - Comparing the system function with other VAVs (without the system)

Continuous Commissioning (CC)

- Since operating, the system has alarmed :
  - Supply side
    - Upper limit (too much air): 10 alarms
    - Lower limit (not enough air): No alarms
  - Exhaust side
    - Upper limit (too much air): No alarms
    - Lower limit (not enough air): 1 alarm

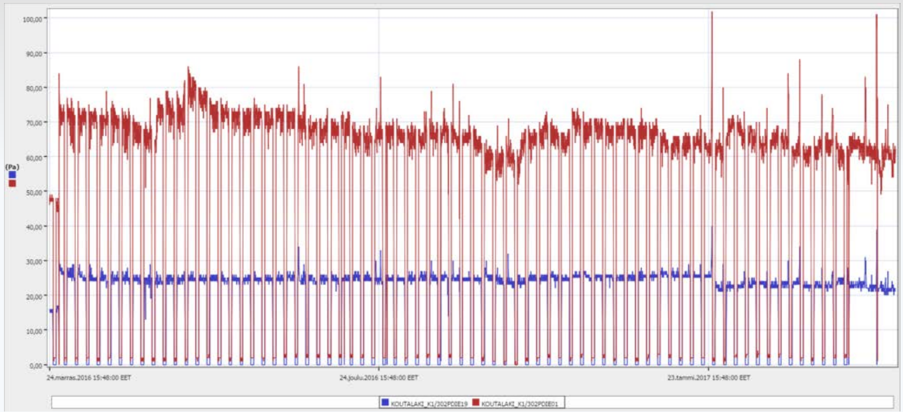
→ System has succesfully ”repaired” the failures by itself (no recurring alarms)

→ Zero complaints from the zones (referring to air quality)

→ No unnecassary maintenance actions done

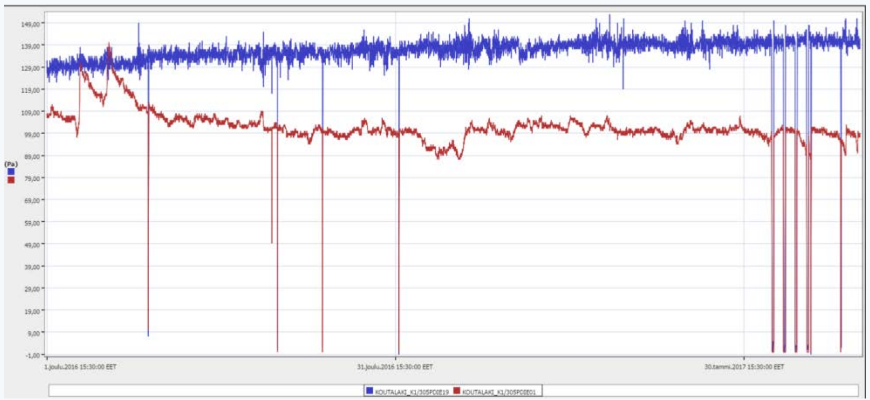
Predictive maintenance (PM)

- Predictive maintenance is demonstrated in Levi in AHUs 302, 305 and 308
- Data from the BMS is collected and analyzed
- For example pressure difference over the filters are monitored and potential changes in patterns are detected
  - Monitoring detects failure of the filter (breach or fouling) and helps schedule the maintenance actions → grown pressure difference increases RPMs in the fan (fixed duct pressure control) → increased energy consumption
  - Goal is to detect right time for maintenance and reduce over-maintenance



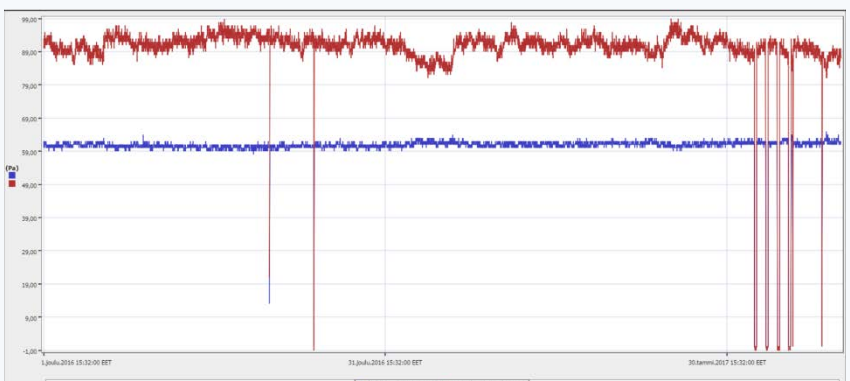
AHU 302

- Supply side filter pressure (red) has decreased
- Exhaust side (blue) stays steady



AHU 305

- Supply side (red) decreased in the monitoring period
- Exhaust side (blue) has a linear growth → possible fouling → if the growth continues, need for maintenance



AHU 308

- Supply side filter pressure (red) varies
- Exhaust side (blue) stays steady

→ No direct conclusions can be made

Remaining actions/Expected results

- OPG tests in demo sites (February-May)
- MoDC test in Sanomatalo (March)
- PM results

- Energy saving evaluation
- Maintenance evaluation

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Thank you / Kiitos!

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