Under the patronage of **H.E. Dr. Abdullah Belhaif Al Nuaimi -** Minister of Infrastructure Development

CONFERENCE
OMAINTEC
2019
EXHIBITION

17th Edition

International Operations & Maintenance Conference in the Arab Countries

19, 20, 21 NOV 2019
Le Meridien Dubai Hotel
& Conference Centre
United Arab Emirates

Under the Theme:
Enhancing Maintenance
Through Big Data Management

Performance Data Analysis for Intelligent Maintenance in Warm Countries

A case study in UAE

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- How to collect and analyze data
- Case study in UAE
- How to evaluate and implement data in a model for a predictive maintenance
- Conclusion

MOTIVATION

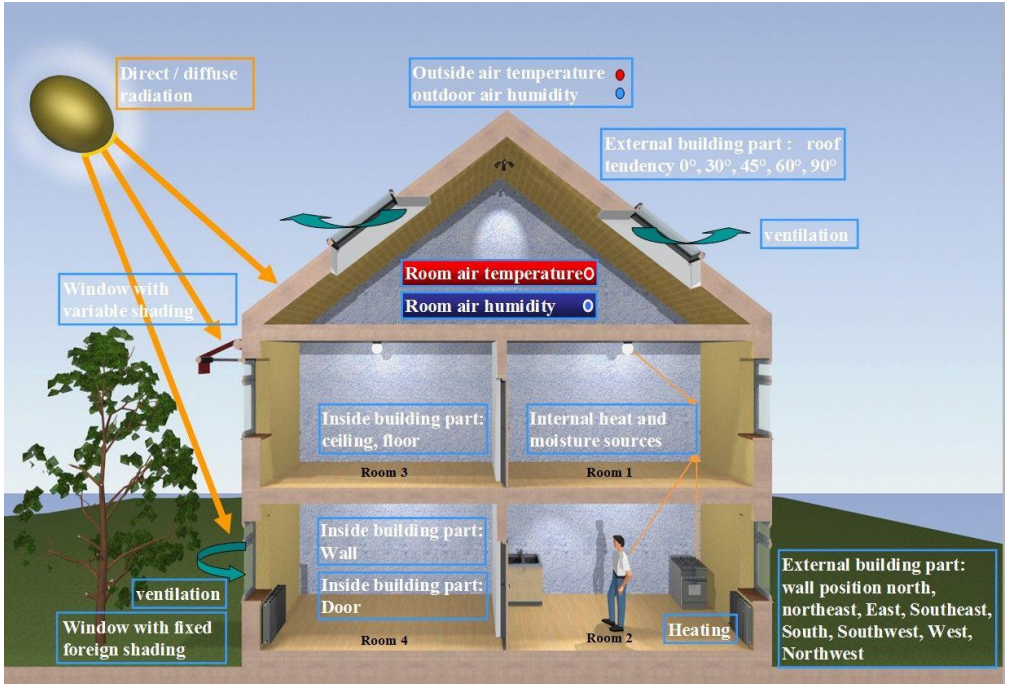
Based on real time measured data, the building maintenance is enhanced by using external insulation composite system (ETICS) in warm countries

ETICS for intelligent maintenance:

- Energy consumption
- Visual appearance of the building

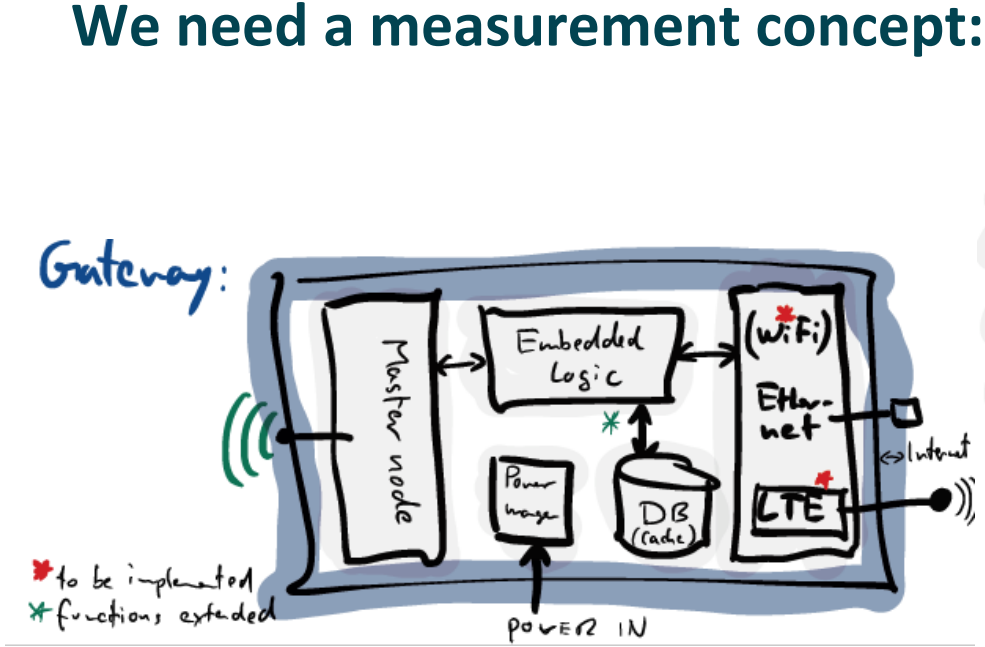
Long-term and real time data:

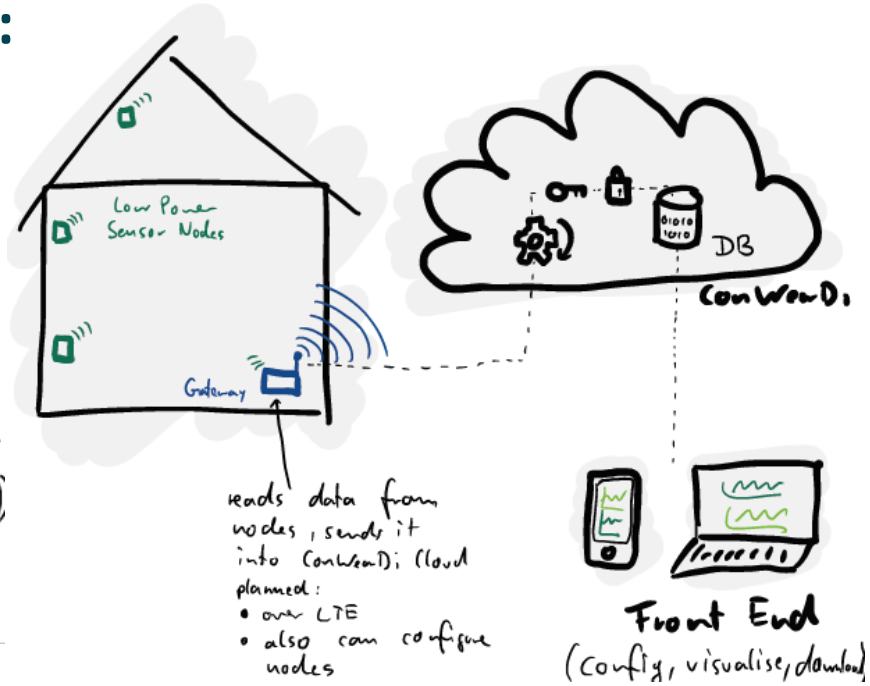
- Looking into the construction
- Predictive maintenance
- Long-term usage
- Quality assurance
- Smart planning



How to collect real time data of a building

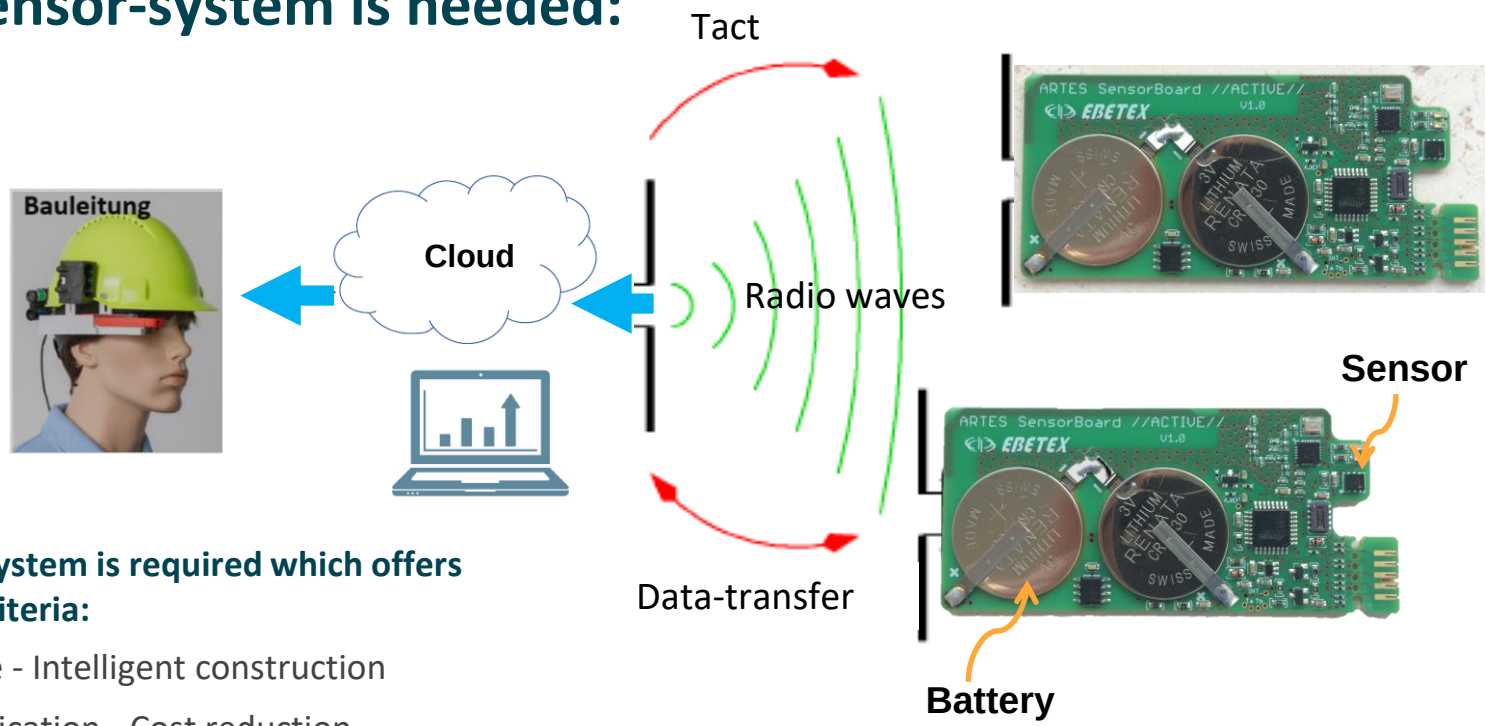
We need a measurement concept:





How to collect real time data of a building

A smart sensor-system is needed:

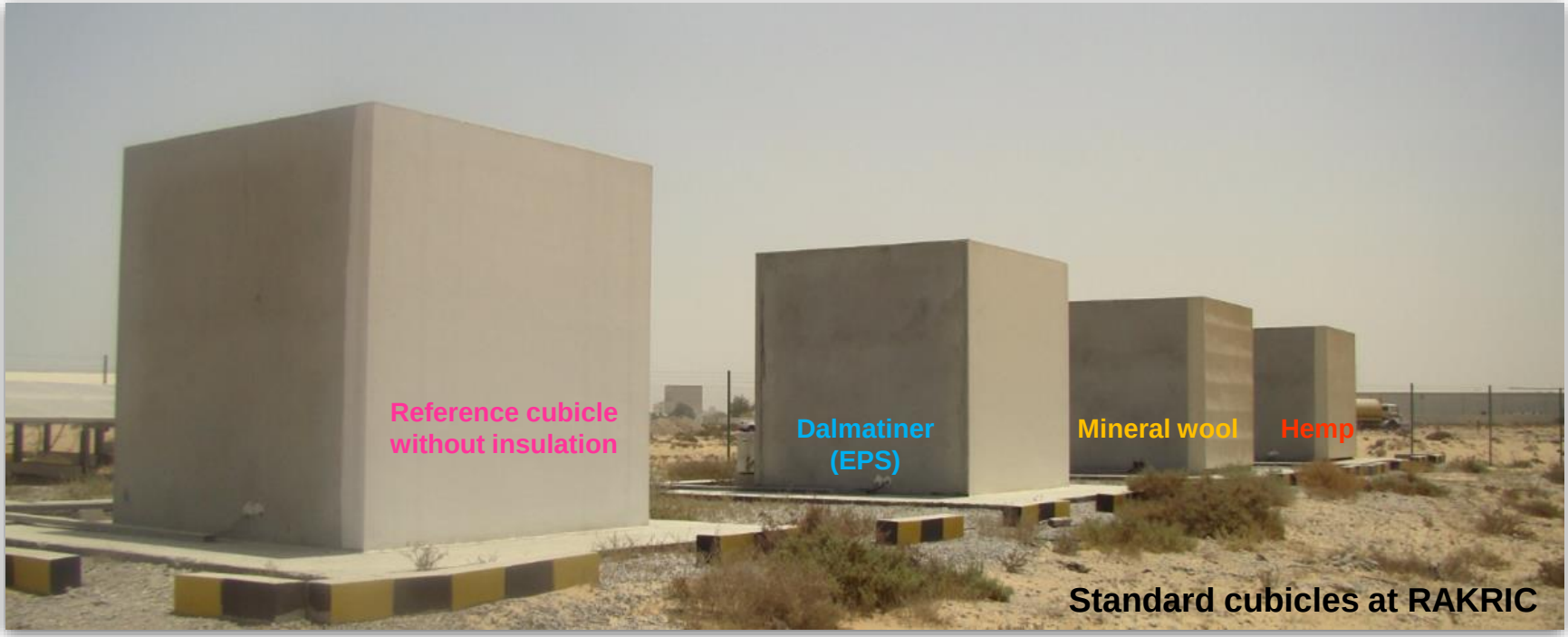


An innovative system is required which offers the following criteria:

- Non destructive - Intelligent construction
- Material identification - Cost reduction
- Quality intensification - Culture enhancement

Thermal insulation system testing

Case study at Ras al Khaimah (UAE)
RAK Research and Innovation Center (RAKRIC)

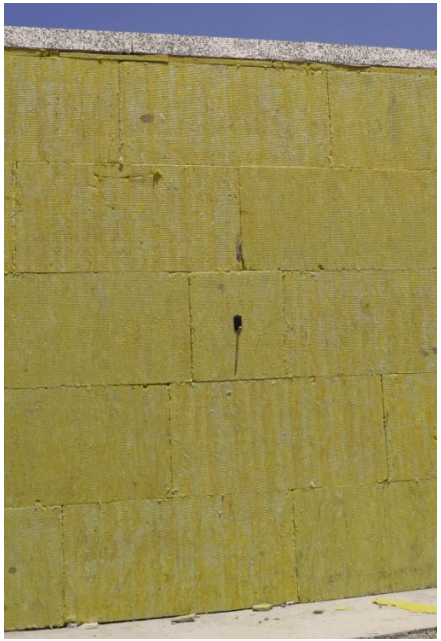


Standard cubicles at RAKRIC

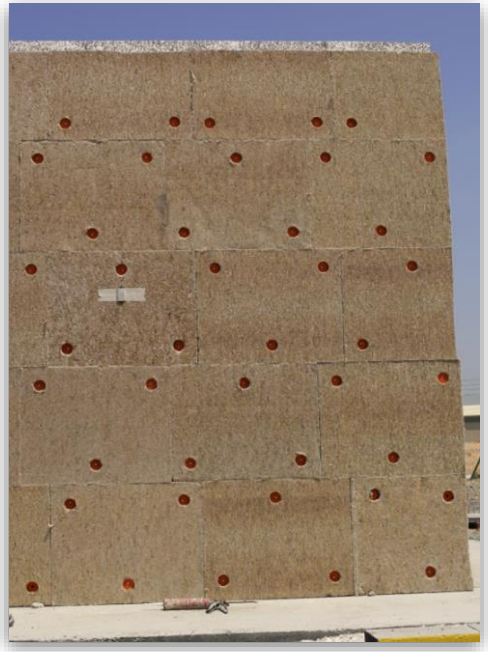
Insulation systems on 3 cubicles

Modification on the existing cubicles with 3 different types of insulation systems on the south walls and on the roof

Dalmatiner EPS

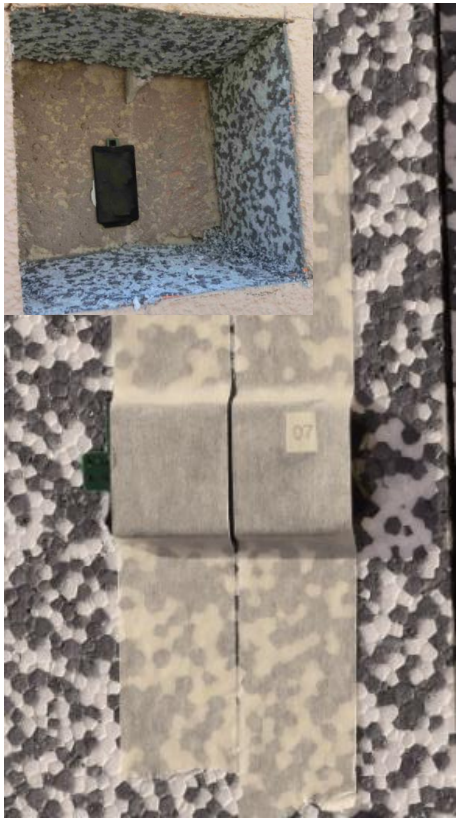


Mineral wool



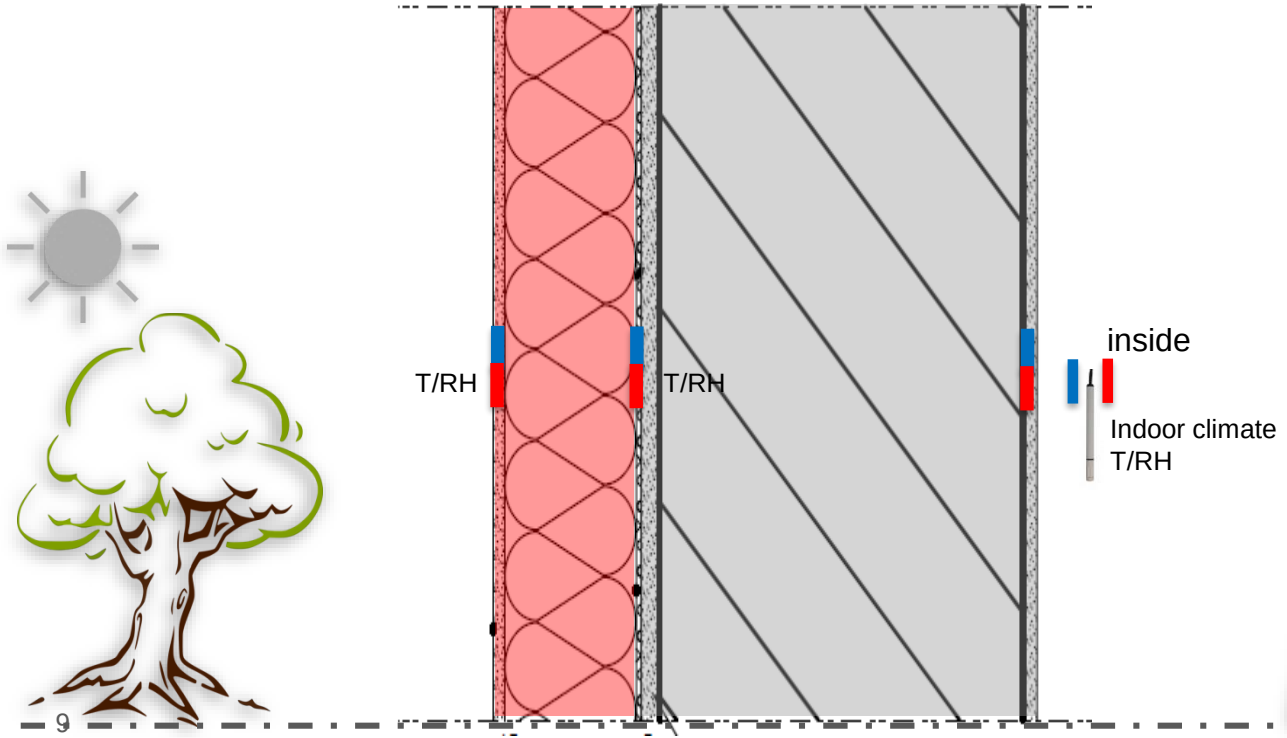
Hemp

Application of the measuring system



Measurement concept

Case study at Ras al Khaimah (UAE)- Position of the sensors



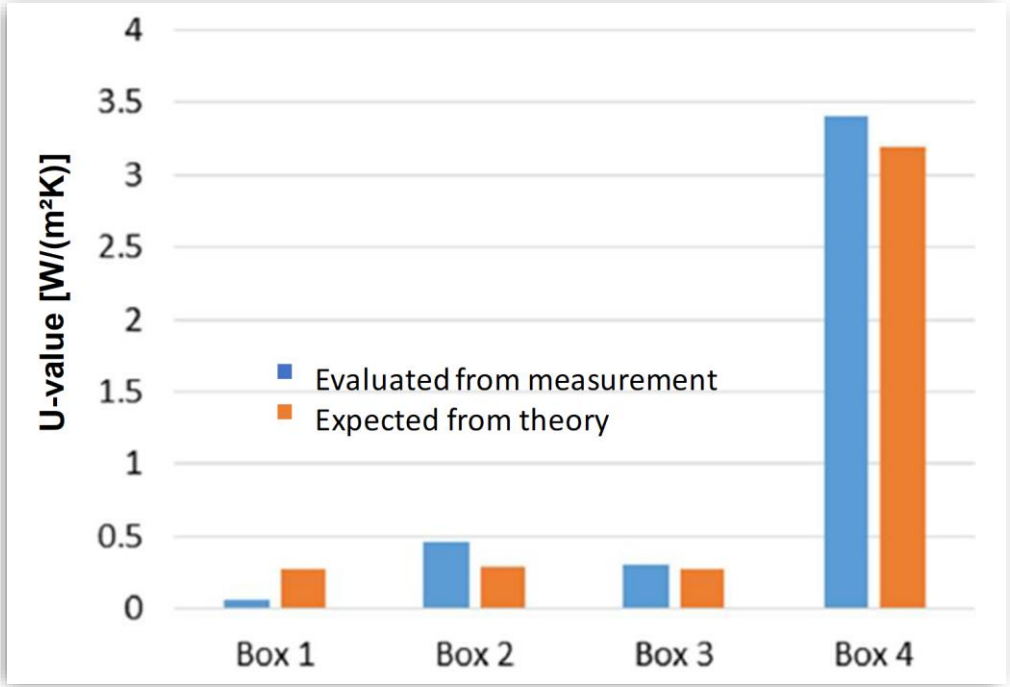
160 mm ETICS

10 mm exterior plaster
385 mm concrete
10 mm interior plaster

Application of the reinforcing layer

ETICS for summer heat protection (Motivation)

Comparison of thermal transmittance (U-value) of the 4 boxes



- Box 1: EPS
- Box2: Hemp
- Box3: Mineral wool
- Box4: Reference, no Insulation

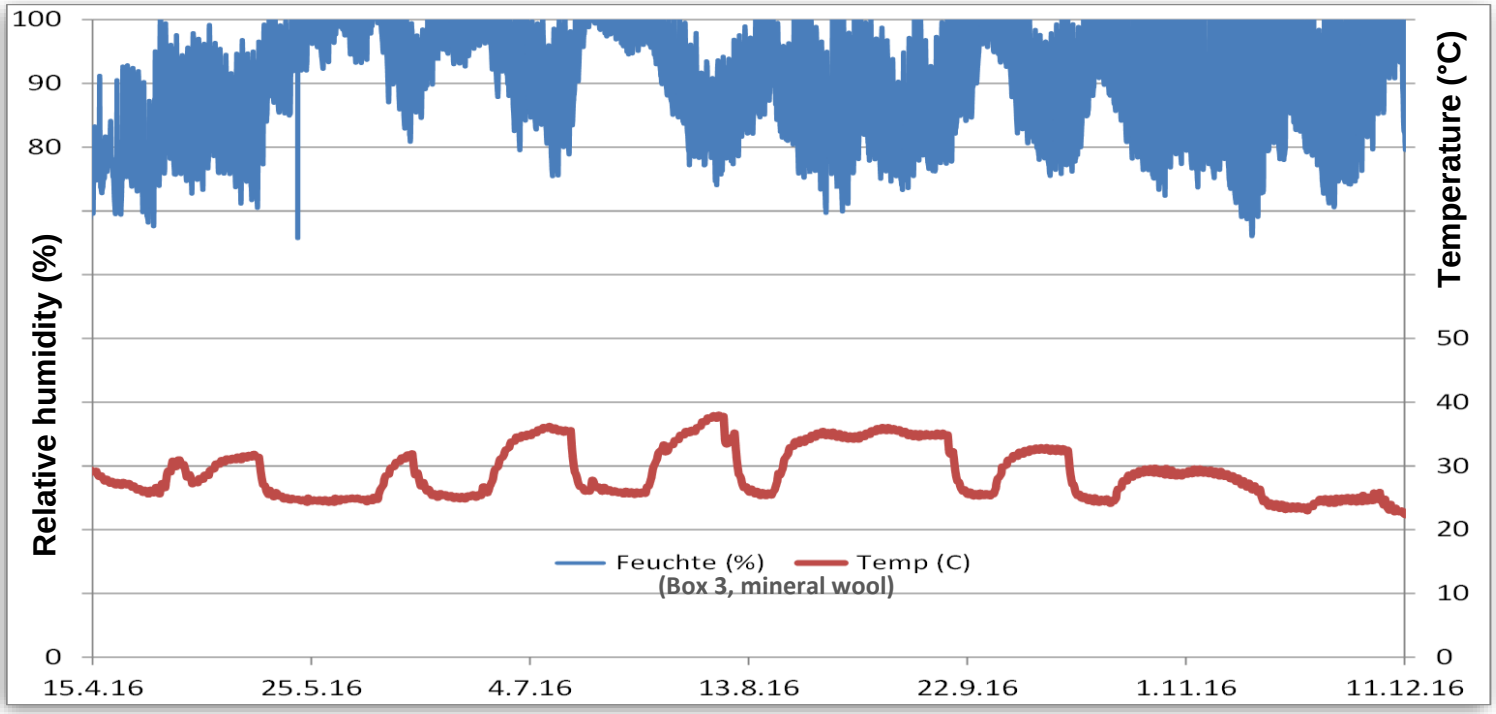
Thermal insulation system testing

Insulation reduces not only operating costs of energy:

- Reduce the consumption of energy
- Protect the environment
- Increase the comfort in the apartments
- Minimize the risk of mold
- Protect the exterior wall from moisture influences
- Upgrade the visual appearance
- Increase the value of the property

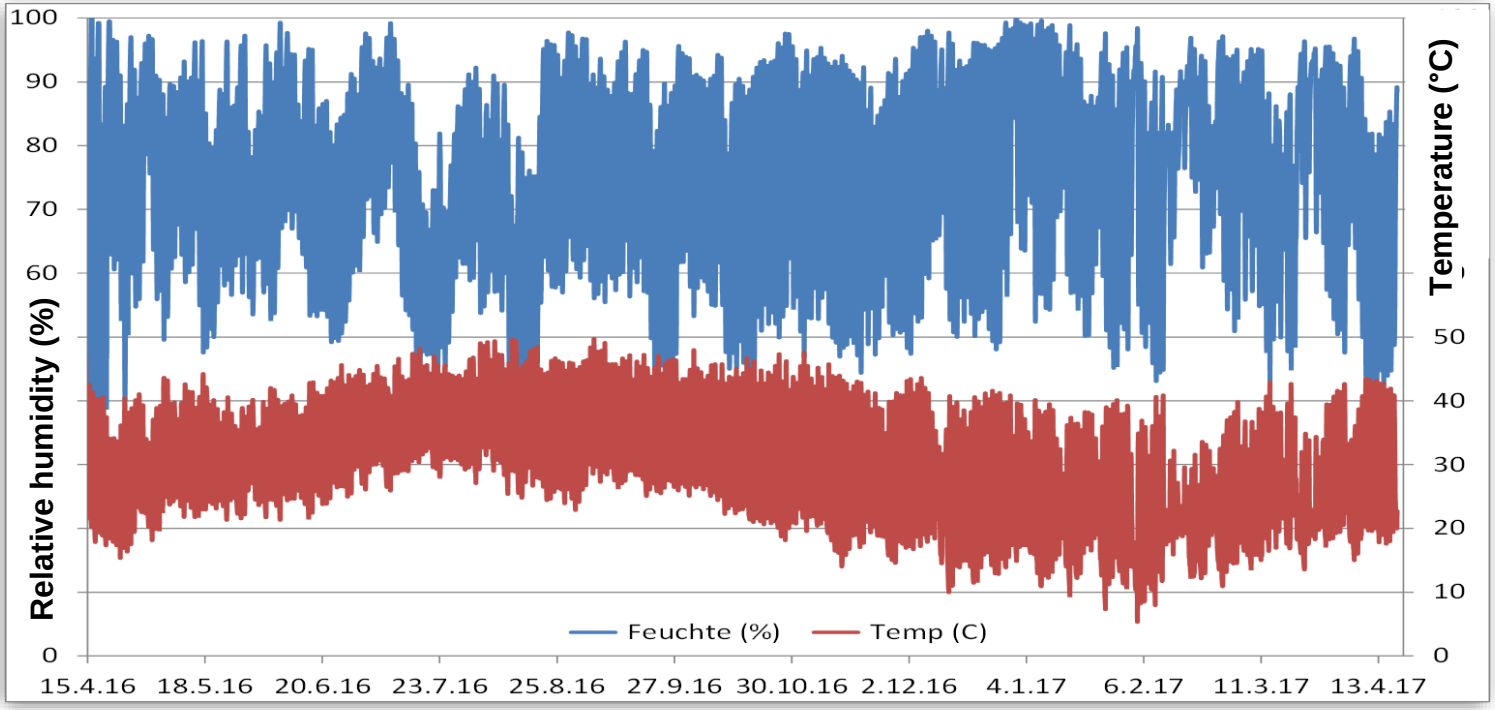
Data analysis

Temperature and relative humidity between wall and insulation



Data analysis

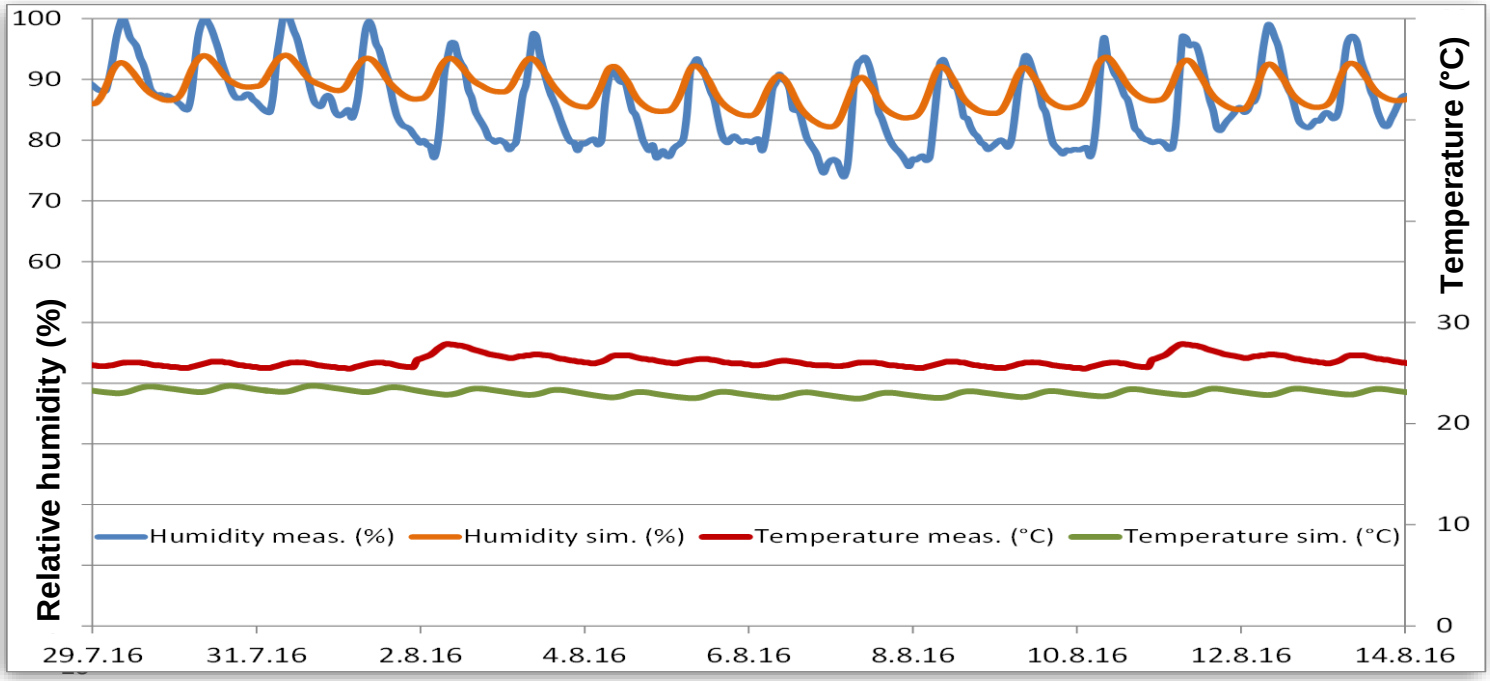
Temperature and relative humidity between insulation & plaster

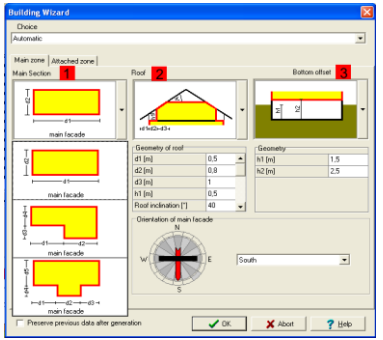


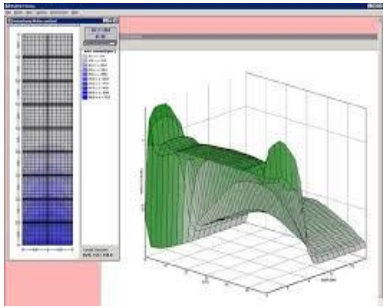
Big data implementation in sim. model

Calibration of the simulation model

Comparison of measured and calculated T/RH (Box 3 insulated with mineral-wool)

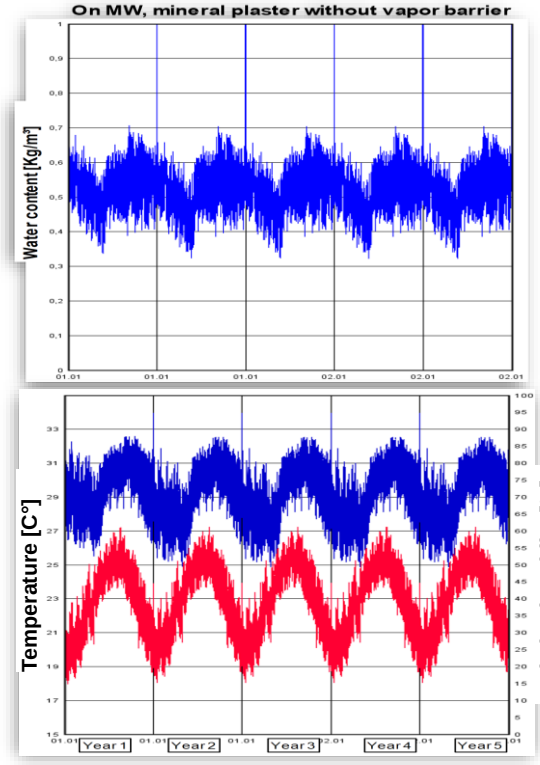


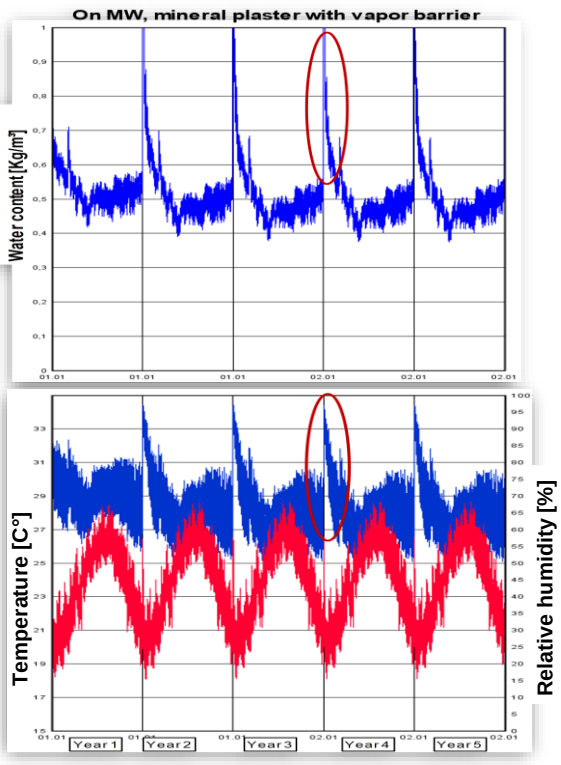


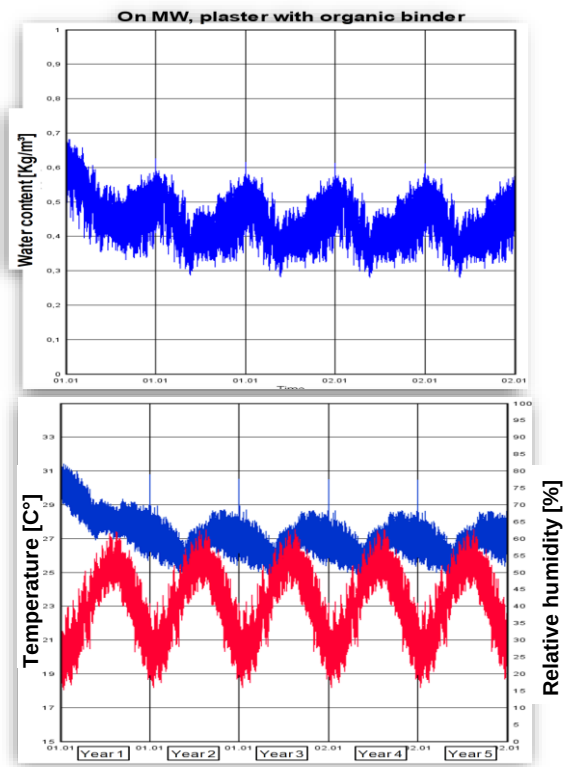


Results

Numerical simulation results for Box 3 (water content/ Temperature of mineral-wool (MW))







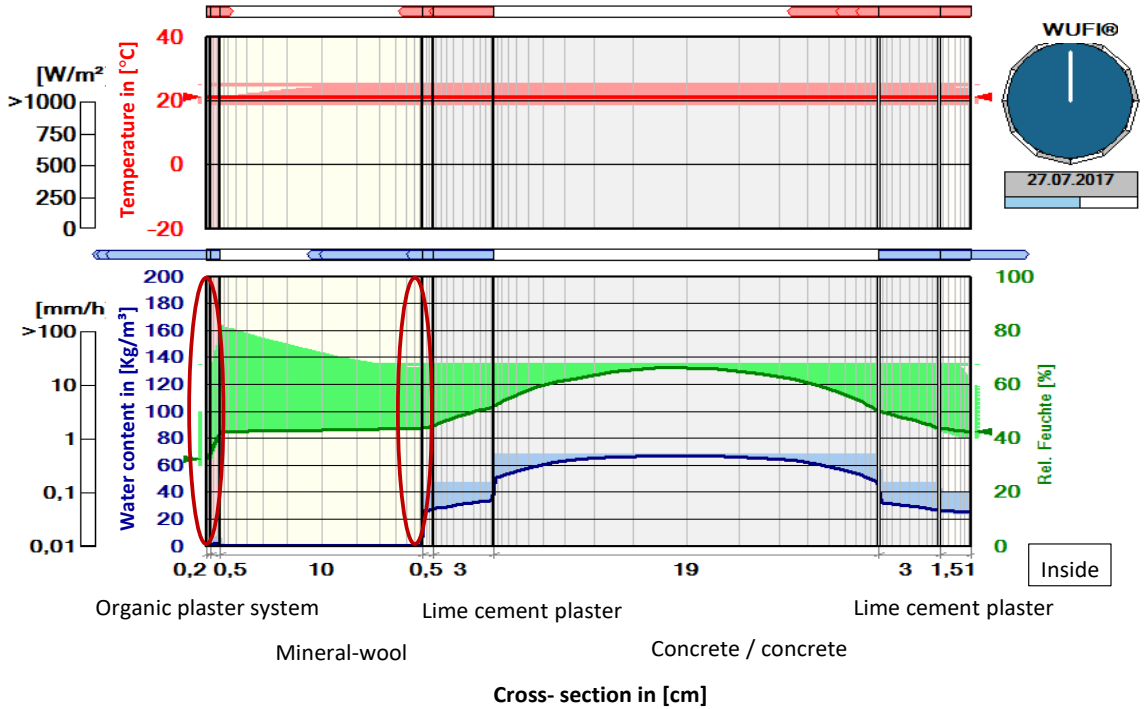
$$14\frac{kg}{m^3}\cdot 0.01m = 0.14\frac{kg}{m^2} = 140\frac{g}{m^2} < 200\frac{g}{m^2}$$

Does not exceed the standard value (European Standard EN ISO 13788)

Results

Numerical simulation results for Box 3 (water content/ Temperature of mineral-wool (MW))

Film display showing the history of water content, relative humidity and temperature in the construction



Conclusion

- The collection and analysis of **real time data in a building** could be achieved.
- Through measuring for few years the results of the data analysis show:
  - ETICS has a positive effect on summer heat protection.
  - ETICS has a big effect of significantly reducing heat flow under hot climatic conditions.
  - Avoidance of construction damage by “looking into” the construction.

- The functionality of ETICS could be shown under hot climate conditions → the system can be monitored permanently which contributes significantly to the **prevention of structural damage**.

- The optimization of the hygrothermal conditions using ETICS under hot climate conditions could be achieved.

- Based on the big data collected, a **simulation model** for predictive building maintenance could be calibrated and implemented.

- **This study proves that, big data collected with an integrated wireless- sensor system, an intelligent building maintenance enhanced by means of a fluent workflow on the construction site and by “looking into” the construction for a long-term damage-free operation during the building use.**

Thank you for your attention

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