eeEmbedded

Newsletter Nr. 7
October 2016 – March 2017

WELCOME

Welcome to the seventh newsletter of our project: *"Collaborative Holistic Design Laboratory and Methodology for Energy-Efficient Embedded Buildings" (eeEmbedded),* funded by the 7th Framework Programme (FP7). Its duration is 4 years. It started on the 1st of October 2013 and has a budget of nearly 11 M€.

Our project *eeEmbedded* has been running for three years and a half now and we are already in validation phase.

In this issue, you will find information about Simulation Manager, Multi Key Points Analysis Tool and the eeEmbedded Validation. As usual, we also provide news and upcoming events.

We hope you enjoy this newsletter.

IN THIS ISSUE

MULTI KEY POINTS ANALYSIS TOOL

The Multi Key Points Analysis (KPA) is a tool that works along with the Key Points Methodology to support the decision making process by providing cross-domain interactive visualization and analysis of computed Key Performance Indicators (KPIs), Key Risk Indicators (KRIs) and Decision Values (DVs).

The KPA tool integrates results from the analysis and simulations of multiple software tools used in the eeEmbedded project. Such results can be investment costs, return on investment (ROI), risk assessment, lifecycle costs, maintenance costs, lifecycle assessment, energy consumption, CO_2 emissions, etc. All these parameters are commonly used for domain decisions that result in the selection of an end solution according to the initial project set up.

For the selection of an optimal solution the tool supports the decision makers by grouping KPIs into different domains and prioritizing the preferences using a weighting factor to the domains and/or the KPIs.

Afterwards, the KPA calculates a decision value (DV) which forms an integrated representation of the user preferences in the project as it is shown in Figure 1.

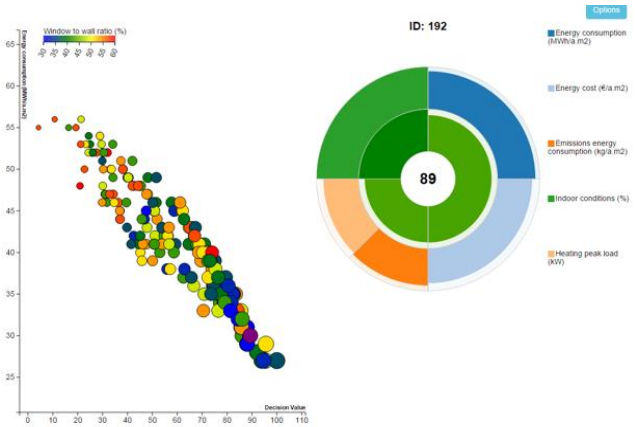


Figure 1: Decision Value representation

In addition, the KPA uses advanced plotting tools that enable multi-dimensional data visualization such as paretto graphics, hyper radial visualization, parallel coordinate plot and radar charts. All the plots are developed and used for analysis purposes allowing the user to assess the relationship between the different variables. By using these plots the user has the option to investigate in detail various alternatives and the data that represent those alternatives.

Additionally, the tool conducts sensitivity analysis to firstly analyze the most critical design parameters that impact the KPIs. Uncertainty analysis is used to control the fluctuation of uncertain parameters such as the weather data or user profiles (see Figure 2).

The main purpose of the tool is to integrate and categorize a wide number of variants and to translate the stakeholder preferences into a Decision Value (DV) established in the initial project setup. The highest DV does not necessarily mean that its corresponding Design alternative is to be chosen, but it enables stakeholders to choose a reduced set of alternatives that are then analyzed in further detail using an iterative process.

Figure 2: Uncertainty Analysis

SIMULATION MANAGER AND EVALUATOR

The simulation manager service fully utilizes the cloud abstraction layer in order to support various cloud architectures. It organizes the transformation of the input data produced within the design steps into an appropriate analysis model according to the specific design related requirements.

The software of the Simulation Manager is integrated within and connected to the eeEmbedded workflow via the Scenario Manager of the eeEmbedded platform.

When the analysis covers more than one simulation job e.g. when processing stochastic analysis, multiple simulations jobs will be created.

Figure 3 explains the Simulation Manager and Evaluator workflow showing the services and tools as well as the separate steps that comprise the overall process.

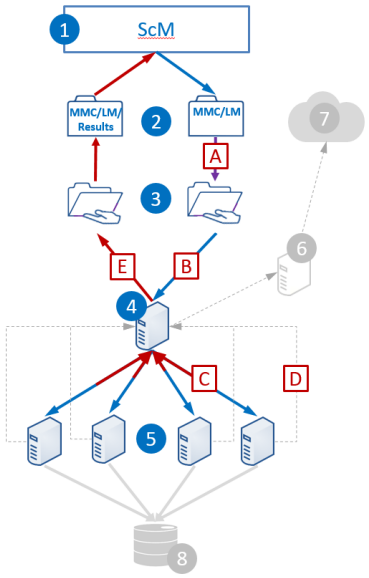


Figure 3: Simulation Manager and Evaluator Workflow

The involved tools are:

1 Scenario Manager (ScM)

2 Multi model container (MMC) and link model (LM)

3 Handover gate

4 Simulation Manager application

5 Computing clients (physical or virtual hosts)

6 Web server providing status data

7 Access to monitoring data

8 Archive for analysis results.

The workflow steps comprise:

A generation of analysis jobs

B Job registration and job transfer

C Job distribution and result collection

D Collecting status data

E Aggregation and linking of analysis results

At first in Step (A) the input data from the Multi Model Container are analyzed, transformed and pre-processed into simulation jobs containing the analysis model. Step (B) covers the transfer of the pre-processed simulation jobs to the central component of the Simulation Manager. These components deliver the simulation jobs to the computing clients. After finishing a simulation, the results are delivered from the clients back to the manager component (C). Before this data transfer is initiated, the raw results of a single simulation are aggregated and post-processed into KPI's if needed. This post-processing step is handled on the client side.

Following is an example illustrating the generation of analysis jobs:

- **5** wind directions (W, SW, S, E, N)
- At least **3** reference wind velocities (2.7 m/s, 4 m/s, 8 m/s)
- **15** simulations per variant leading to **45** simulations for each alternative (for 3 alternatives and 3 variants per alternative)
- The simulations are assigned for execution on clients in the cloud.

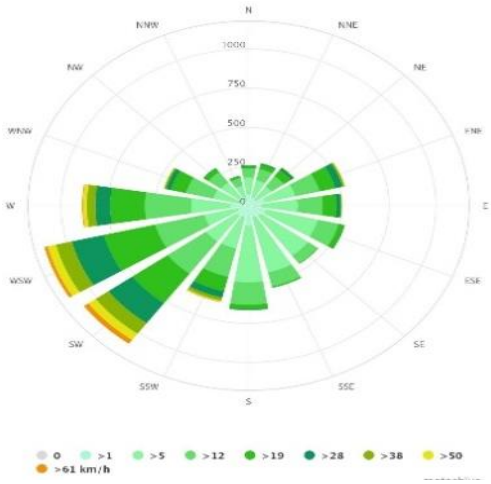


Figure 4: Generation of analysis jobs example

eeEmbedded VALIDATION

The validation aims at evaluating if eeEmbedded tools and methods are the right products that fulfill end-users needs and satisfy the specified requirements. For that purpose, two validation methodologies have been selected and two real pilot buildings are being designed using the eeEmbedded Virtual Lab.

After analyzing several validation methodologies SWOT Analysis (Strength, Weaknesses, Opportunities and Threats) and Cost Benefit Analysis have been selected as most suitable validation methodologies for eeEmbedded. While SWOT Analysis will be used to identify internal factors (strength and weaknesses) and external factors (opportunities and threats) resulting from the use of the eeEmbedded platform in our pilot projects, Cost Benefit Analysis aims at quantifying impacts of the project to help assessing whether the advantages (benefits) are greater than its disadvantages (costs).

PILOT 1: Well Office A2, Leidsche Rijn

This pilot, provided by BAM Group, is an on-going project which gives the opportunity to identify the benefits of the

eeEmbedded platform compared to the current way of working and the capability to optimise the sustainable performance of our designs.

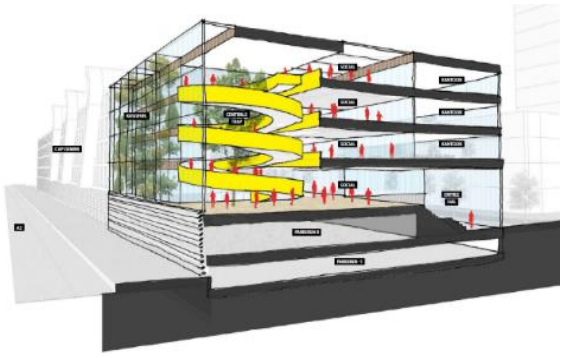


Figure 5: Leidsche Rijn Pilot

It is a neighbourhood development including retail, restaurants, leisure, hotels and conference, service, offices and flats. The focus for validation is the Well Office Building A2 which should comply with the Well Building Standard. In the Urban Design Phase we are able to check the design regarding the masterplan and client requirements and to analyse various design alternatives as e.g. different shapes and variants for the window-wall-ratio (WWR), the energy systems etc. regarding our Key Performance Indicators (KPI). The simulation, Life Cycle Costing and Assessment results are processed and visualised for transparent decision making.

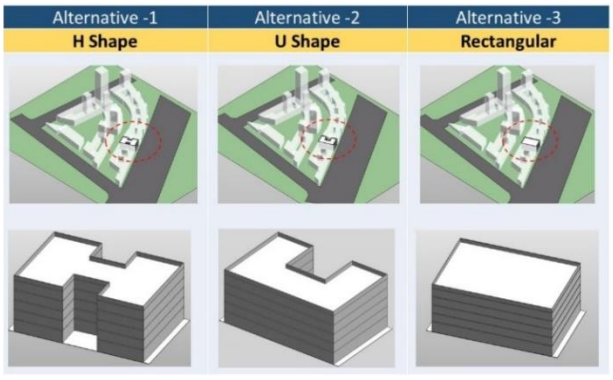


Figure 6: Alternatives in Leidsche Rijn Pilot

PILOT 2: Z3 building, Stuttgart

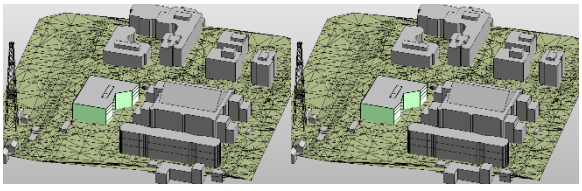
The Z3 building is the second pilot used for the eeEmbedded platform validation. The existing building is a result of Strabag's aim to increase the amount of working spaces for the staff at the Stuttgart HQ and at the same time create an innovative testing site for sustainable construction research (Source:EnOB).

Z3 produces largely its own energy by using various renewable energy solutions. It has 5 storeys enclosed by a unique façade created of vertically structured timber strips. Moreover, the high-quality glazing used in Z3 supports the building to meet passive house quality.

Z3 was built and opened in 2012. The gross floor area of 10,145 m² creates 250 new work places for company's staff. The building is also equipped with an underground garage. By using this existing pilot model we can compare real life KPI's and KDP's with the results from the eeEmbedded analysis to clearly see what could be improved if the eeEmbedded platform would have been used during the design of the existing Z3. For validation purposes, two additional alternatives of the building were created as shown below.

Existing Z3

Z3 IFC Model



Alter. 2 – Larger size

Alter. 3 – Amended position

eeE PRESENTED AT…

… Spanish Construction Technology Platform (PTEC)

Spain, March 1, 2017

eeEmbedded project was presented in the Spanish Construction Technology Platform (PTEC) within the group "City of the Future" on the 1st of March 2017. Dr. Gloria Calleja-Rodríguez from CEMOSA provided an overview of eeEmbedded methods and tools focused on the Urban Design.

…BIM World Munich 2016

Munich (Germany), May 30 – June 3, 2016

On the BIM World 2016 in Munich, the eeEmbedded project had the opportunity to present its current status on a share booth. Other shown projects were Streamer, Proficient and SWIMing. Each project had its poster. The eeEmbedded poster showed the workflow of the early design use case. Within this use case, the building automation was emphasized as one of the design domains. In addition review videos were shown on a notebook. The visitors were interested in the new holistic approach of energy efficient building design.

… University of Malaga

Malaga (Spain), October 13-14, 2016

The European Project ACCEPT (An Assistant for Quality Check during Construction Execution Processes for Energy-Efficient Buildings) organized a Workshop on the topic "Construction. New Digital Sector" at the University of Malaga and invited the eeEmbedded project. Dr. Gloria Calleja-Rodríguez explained the eeEmbedded design methodology and the developed Virtual Lab within the session Energy Efficiency a European Challenge.

…buildingSMART International Summit

Barcelona (Spain), April 3 – 6, 2017

eeEmbedded participated in the buildingSMART International Summit that took place in Barcelona (Spain). Prof. Raimar Scherer from TU Dresden presented an overview of the project as well as its research challenges and Mr. Wilfred van Woudenberg from BAM explained eeEmbedded from the point of view of the end-users within the Construction Room on the 4th April. In addition, Mr. Ken Baumgaertel presented the Scenario Manager during the BCF (BIM Collaboration Format) session of the Building Room. The feedback of the audience, about 30 BIM experts, was very positive. They showed their interest in eeEmbedded results and asked about tools availability for industry and their maintenance after the project.

MEETINGS IN THE CURRENT PERIOD

Intensive Workshop and General Assembly Meeting

Munich (Germany), March 13 – 15, 2017

The eeEmbedded team had an intensive internal workshop and general assembly meeting held in Munich on 13 - 15 March, hosted by Obermayer Planen + Beraten GmbH. The main goals of the meeting were 1) the check of AS-IS validation status of "Urban Design", 2) the kick-off of the validation of early design, and 3) upcoming dissemination and exploitation activities.
The highlighted results were a plan for the last implementation tasks and updated validation plan.

Intensive Workshop and General Assembly Meeting

Vienna (Austria), December 7 – 12, 2016

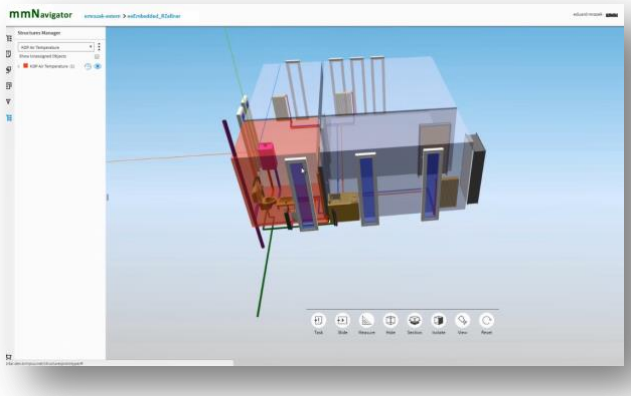
A coordination workshop was held at the premises of STRABAG in Vienna (Austria). As in previous workshops, it was organized into general assembly sessions and parallel working groups sessions where specific topics were addressed by partners whose expertise and project role are related.
The specific focus was on checking the implementation status, detailing modeling requirements for the pilots and defining exploitation and dissemination strategies for the 3rd working period.

2nd Review Meeting

Brussels (Belgium), October 28-29, 2016

The second review meeting of the project took place in Brussels (Belgium).

The team took the opportunity to present the results of the project to the European Commission by means of a walk-through video where a Test Case building was designed with the tools and methods of eeEmbedded.



UPCOMING EVENTS...

…eeEmbedded Workshop and Roadshow

Mainz (Germany), May 8 – 9, 2017

eeEmbedded project will organize an expert Workshop in Mainz (Germany) on May 8th . Due to topics alignment, it will take place in parallel to others workshops organized by buildingSMART Working Groups and one day before the "15th buildingSMART User Day". We will discuss on the impact of energy sustainability, on how to utilize BIM-based integrated simulation and analysis for multi-criteria decision making in early design phases, and on how to ensure interoperability of data models across domains and phases. **We kindly invite you to join us** on May 8th from 12-17h in Mainz, Kurfürstliches Schloss and Hochschule. You can find more information **here.**

Additionally, eeEmbedded project will be presented during the buildingSMART User Day on May 9th. We will address the following topics: 1) Influence of planning phases on sustainability, 2) Urban design simulation utilizing BIM, and 3) Use of buildingSMART standards in energy optimization.

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