



***Integrated applications for energy
performance optimisation –
Georg Ferdinand Schneider (THN)***

Modelling Optimization of Energy Efficiency in Buildings for Urban Sustainability

Project duration: November 2015 – April 2019



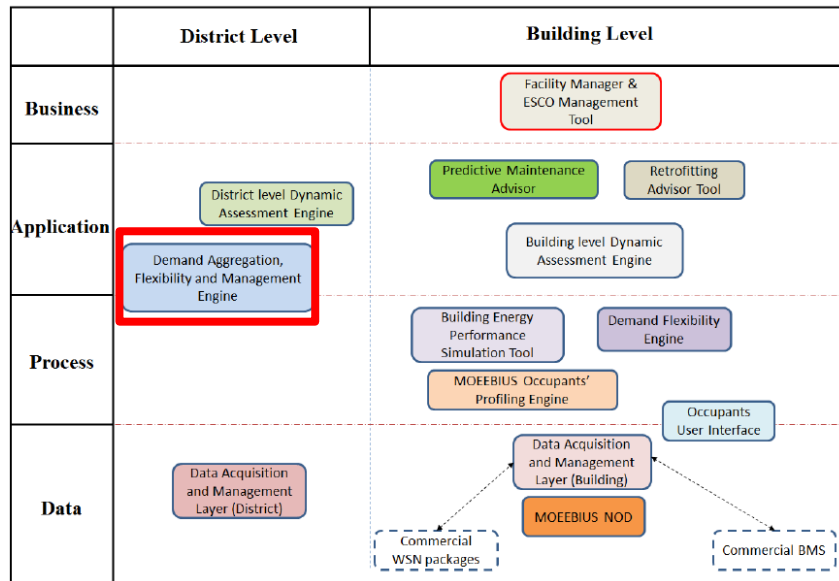
Agenda

- Introduction and Motivation
- Integrated Applications for Energy Performance Optimization
 - DER Flexibility Analysis, Aggregation and Forecasting Module
 - Predictive and Sanitary Maintenance Advisor Module
 - Retrofitting Advisor and Investment Evaluation Module advisor
 - Integrated Decision Support System
- Conclusion and Outlook

Integrated Applications for Energy Performance Optimization

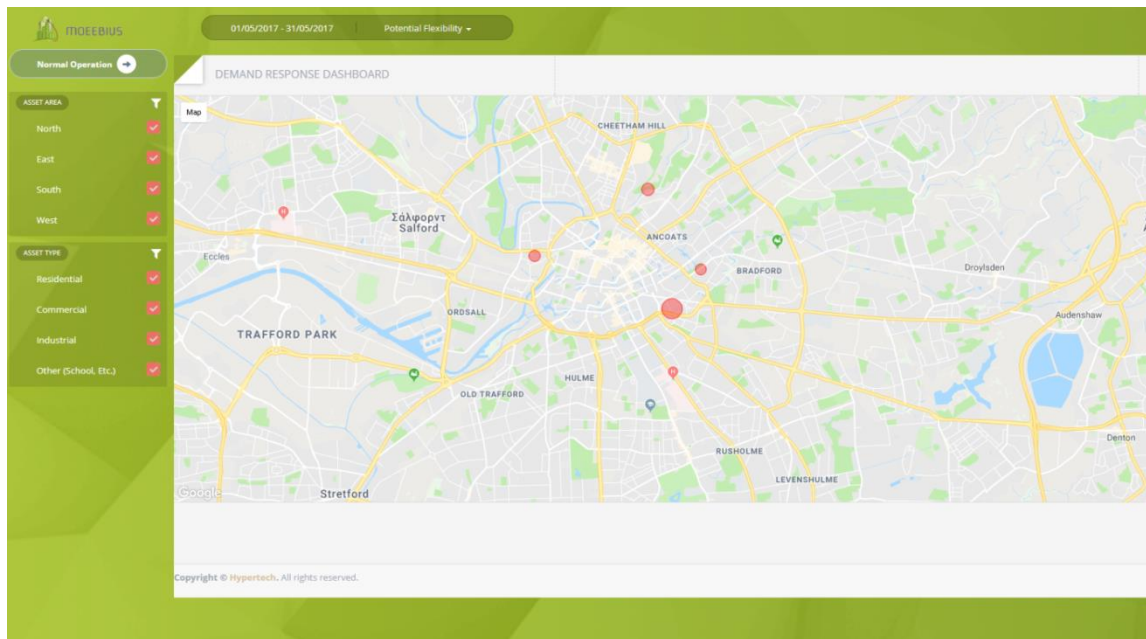
DER Flexibility Analysis, Aggregation and Forecasting Module

- Visualization of energy relevant metrics (Energy consumption, CO2 emissions, ...)
- Demand flexibility (potential and request)
- DR performance
- Compare individual asset performance to portfolio
- Hypothesis analysis for evaluation of different DR scenarios



Integrated Applications for Energy Performance Optimization

DER Flexibility Analysis, Aggregation and Forecasting Module



DR capabilities of
building portfolio

Integrated Applications for Energy Performance Optimization

DER Flexibility Analysis, Aggregation and Forecasting Module

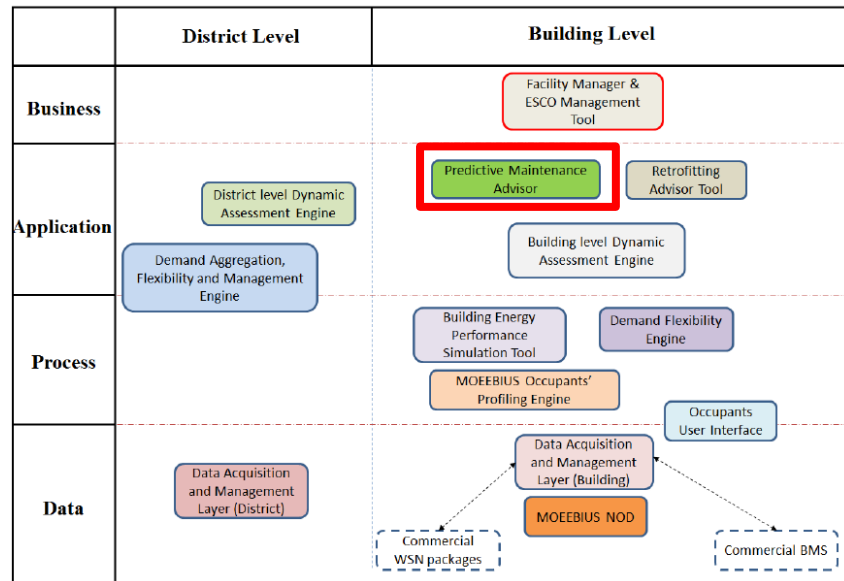


Comparative view
of an selected
asset (emissions,
consumption,
cost)

Integrated Applications for Energy Performance Optimization

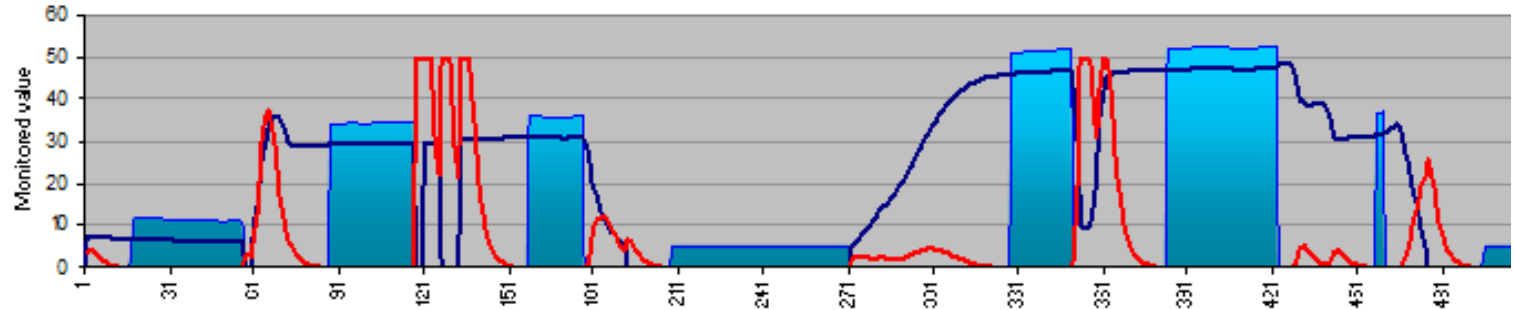
Predictive and Sanitary Maintenance Advisor Module

- Monitoring of time series and important process parameters
- Systematic comparison of actual and predicted values
- Detection of symptoms and deviations
- Compiles list of issues and faults
- Compiles list of recommend actions based on rules



Integrated Applications for Energy Performance Optimization

Predictive and Sanitary Maintenance Advisor Module

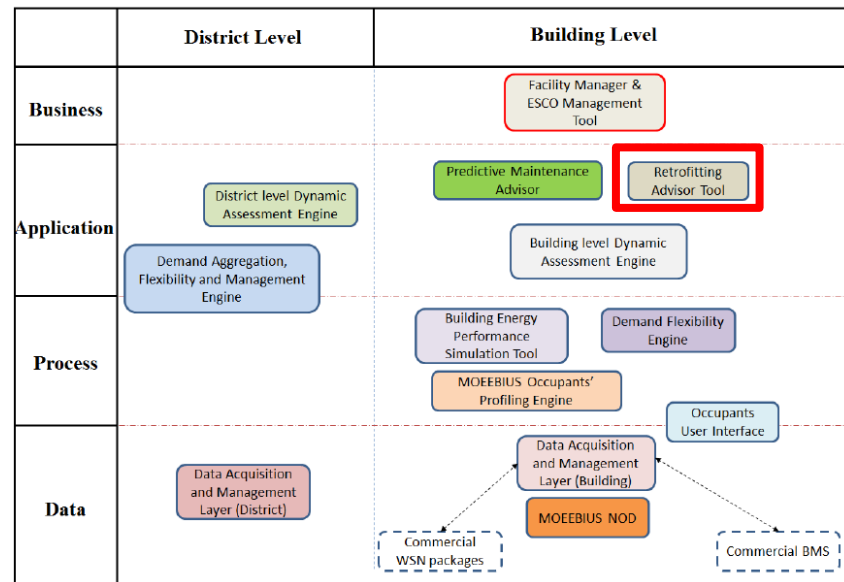


- Generic modules for sensor analysis
- Dynamically configured from project knowledge base

Integrated Applications for Energy Performance Optimization

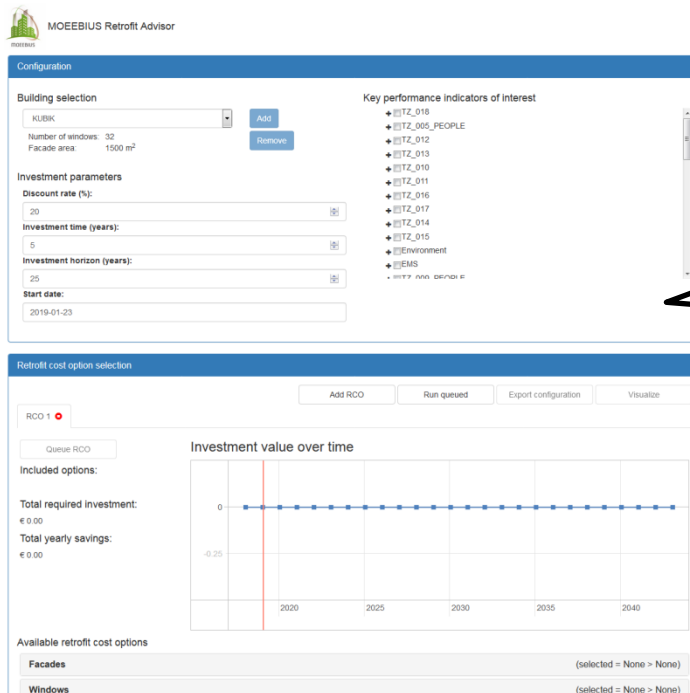
Retrofitting Advisor and Investment Evaluation Module advisor

- Evaluate what if decisions on energy related investments
- Uses BEPS service to evaluate retrofit options
- Parallel evaluation of multiple retrofit alternatives



Integrated Applications for Energy Performance Optimization

Retrofitting Advisor and Investment Evaluation Module advisor



MOEBIUS Retrofit Advisor

Configuration

Building selection

KUBIK: Add

Number of windows: 32
Facade area: 1500 m²

Investment parameters

Discount rate (%): 20

Investment time (years): 5

Investment horizon (years): 25

Start date: 2019-01-23

Key performance indicators of Interest

- ITZ_018
- ITZ_005_PEOPLE
- ITZ_012
- ITZ_013
- ITZ_010
- ITZ_011
- ITZ_016
- ITZ_017
- ITZ_014
- ITZ_015
- Environment
- EMS
- ITZ_005_DEVELOP

Retrofit cost option selection

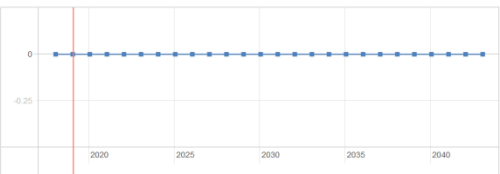
RCO 1

Included options:

Total required investment:
€ 0.00

Total yearly savings:
€ 0.00

Investment value over time



Available retrofit cost options

Facades (selected = None > None)

Windows (selected = None > None)

Simulation
configuration, KPI
selection

Integrated Applications for Energy Performance Optimization

Retrofitting Advisor and Investment Evaluation Module advisor



Investment
assessment

Façade
alternatives

Retrofitting Advisor

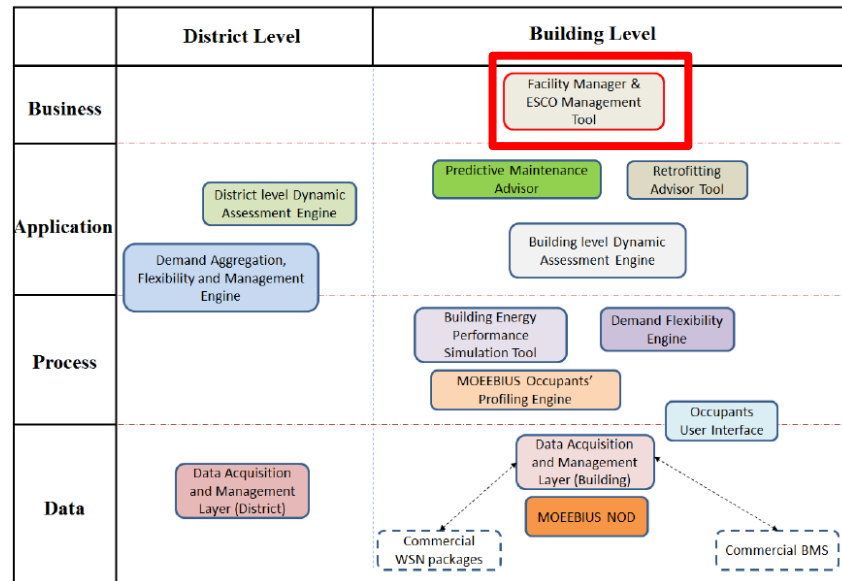
1. Retrofit Calculation Option Manager
2. Retrofit Project Management Service
3. Energy Conservation Measures Library
4. Retrofit Option Calculator Service
5. Retrofit Portfolio Viewer



Integrated Applications for Energy Performance Optimization

Integrated Decision Support System and FM Tool

- Robust and Explainable Building Control Framework
- Day-ahead design of rule-based and/or linear controller functions
- Comprehensive GUI to applications and collected data
- Integrated knowledge-base for automated configuration and deployment

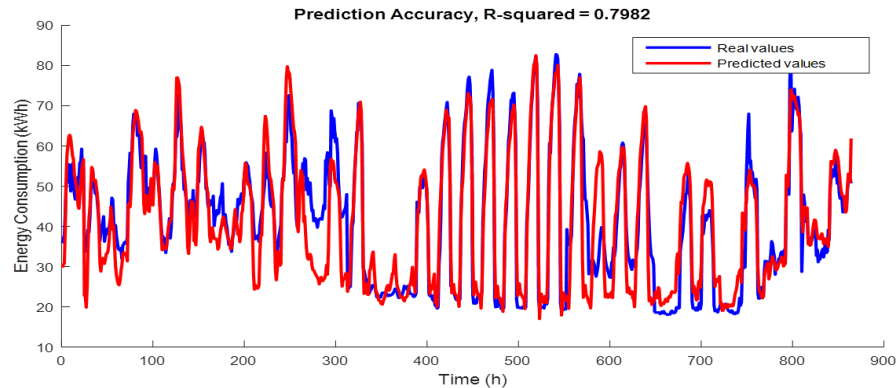


Integrated Applications for Energy Performance Optimization

Integrated Decision Support System and FM Tool

Definition of Baseline Energy Consumption of the Whole Building and for Individual Building Systems/Components

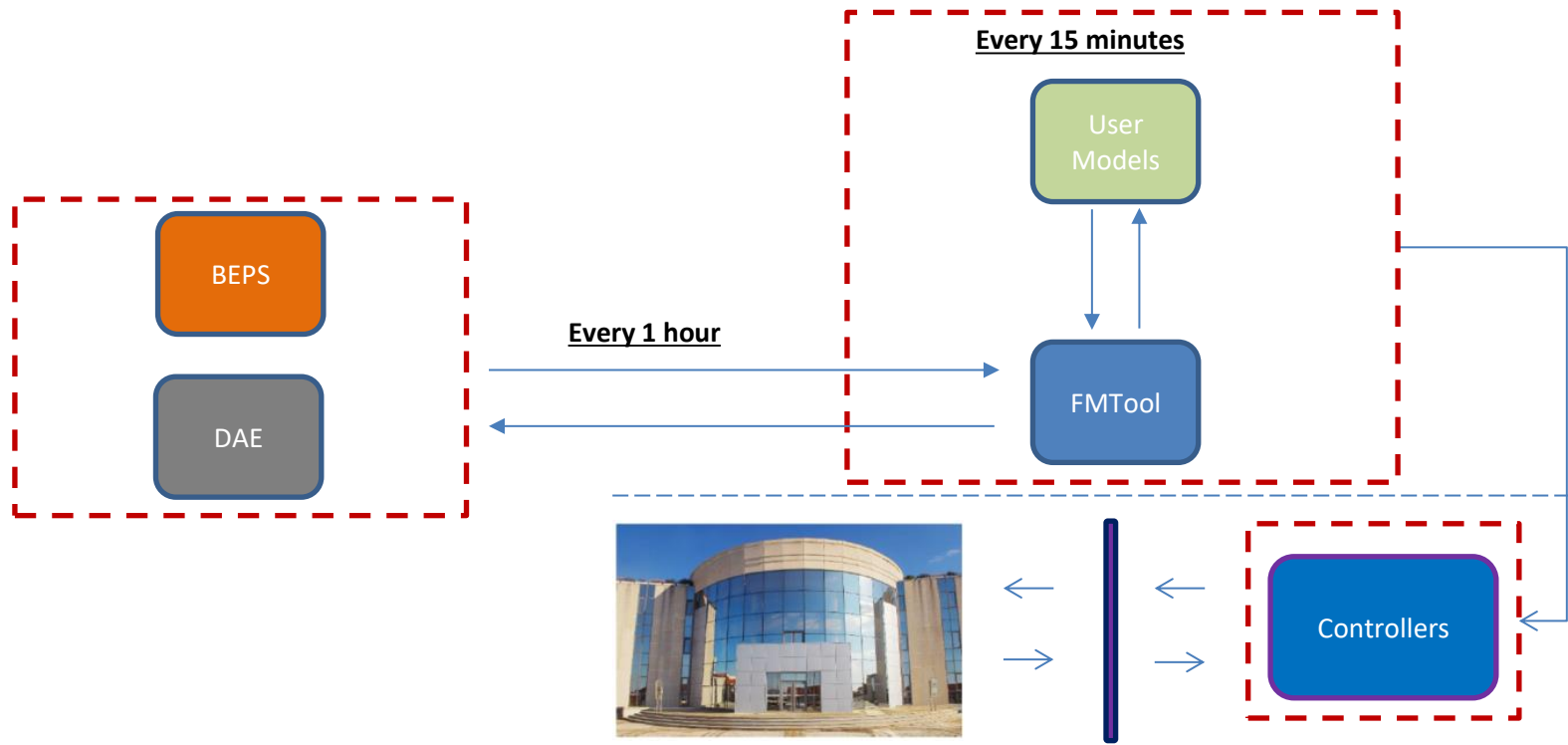
- Data-driven (regression) models for energy consumption prediction
- IPMVP-like information to the building managers to assist in the decision-making process



- G.D. Kontes & D.V. Rovas: Modelling and prediction of buildings energy consumption using Machine Learning techniques, ISEneC 2016

Integrated Applications for Energy Performance Optimization

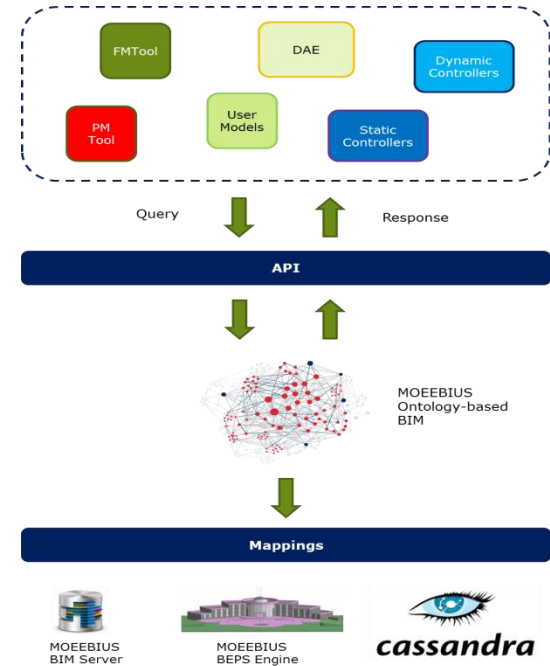
Building Optimization through Simulation-based Automation



Integrated Applications for Energy Performance Optimization

Integrated Decision Support System and FM Tool

- Information requirements by applications for configuration, deployment and, partly, execution
- Established a project knowledge base
- Ontology-based BIM service
- Acquisition of site knowledge from structured collection process

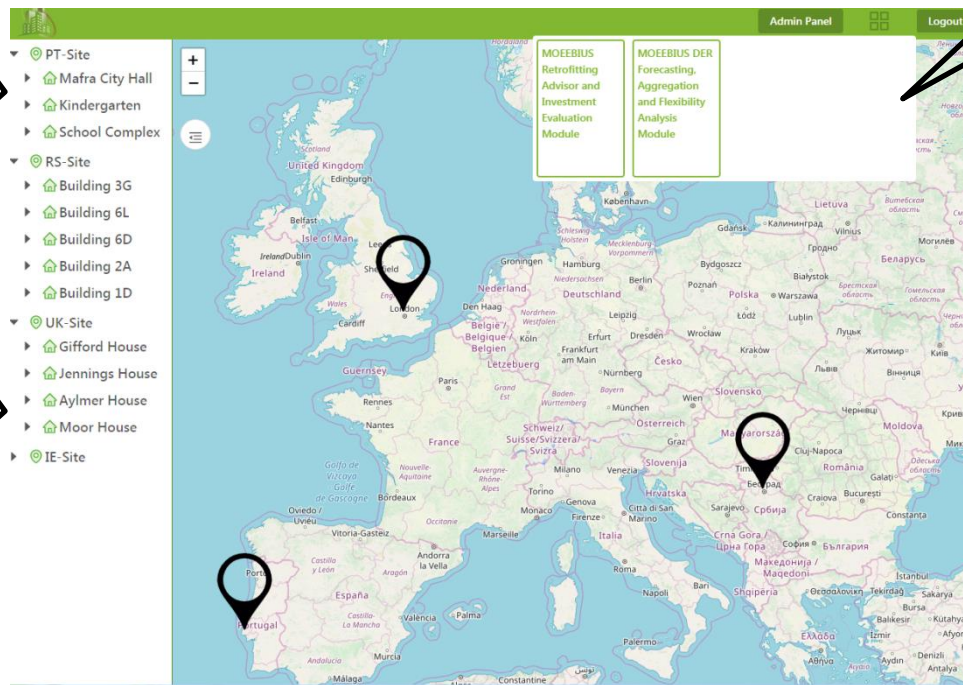


Integrated Applications for Energy Performance Optimization

Integrated Decision Support System and FM Tool

Dynamically
configured
from project
knowledge-
base

Real-time
update with
virtual sensors

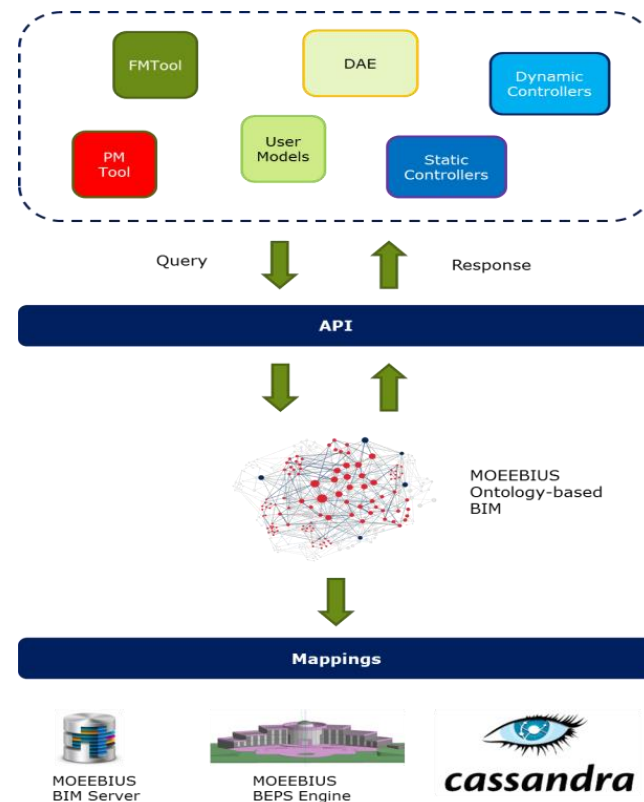


Integrated
Applications

Integrated Applications for Energy Performance Optimization

Ontology-based BIM service

- PM Module
 - Dynamically configure mal-function detection
- Occupancy Profiling Module
 - Query for equipment (NOD) device for configuration
- Integrated DSS
 - Dynamic configuration



Conclusion

- Presentation of the MOEEBIUS Integrated Applications for Energy Performance Optimization
- Investigation of knowledge-based support for application configuration and deployment of energy efficiency applications

MOEEBIUS Partners



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