

Project Results

ENERFICIENCY Towards optimum energy management

Energy demand, its economic consequences and the implications for climate change are probably the most significant challenges facing any government at the start of the 21st century. The huge investments that are being made on the supply side have to be matched by improvements on the demand side in the efficiency of energy consumption. By increasing the level of intelligence on the consumer side. The ITEA 2 ENERFICIENCY project set about developing a comprehensive, flexible and configurable open software platform able to analyse and respond to user needs in managing energy demands and consumption.

By identifying the end user needs of the different actors in the sector, a list of user scenarios was generated, whose solutions cover a broad field of applications beyond the current state of the art in the domain. Implementing the use cases on a distributed platform required the design of innovative software modules and algorithms, the implementation of HMI modules and the development of an interoperability framework based on computational intelligence, sensor networks and communication technology. These solutions are expected to significantly improve energy efficiency performance for buildings and enable reliable modelling and prediction, even where only partial information is available, as in the case of existing buildings for which no detailed BIM models may be available.

END-USER FOCUS

Since ENERFICIENCY focuses on the needs of the end user, the visualisation module became a key success factor; it has to allow the modelling and intelligence to be exploited and the innovative methodologies in the multi-functional building management system or building design software to be seamlessly integrated. Furthermore, with short and medium-term business potential having been identified in the extension or creation of new energy-efficiency products, the project provided a framework for validation and testing in the context of the user scenarios. In the medium term, the interfaces developed in the context of the distributed architecture could generate service-based commercialisation models and platforms, and may even contribute to the definition of a new standard of energy-efficiency interoperability.

INNOVATION ... THE BOX SET

The main innovations include the real-time optimisation and integration of externally forecasted variable data (e.g. weather predictions) that impact upon the building's energy consumption patterns and, in turn, the 'energy gap'. This reduction of this energy gap has been facilitated by improved modelling of passive buildings, enhanced sensors (heat flux measurement prototype), improved predictions (grey-box self-learning models) and real-life case assessments and assessments under controlled conditions (such as the such as the INCAS platform, a full scale test facility developed since 2008 including 4 PASSYS test cells, 4 experimental houses and 10 PV-integration benches). The project also developed automatic control with grey-box (semi-physical) models incorporating a methodology and tool box for model identification and the implementation of real-time automated

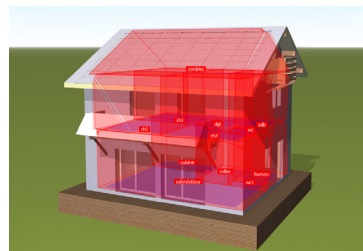


Fig 1: BIM Extraction (White Box model)

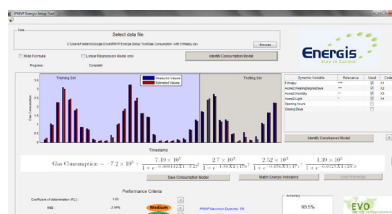


Fig 2: Correlation (Black Box model)

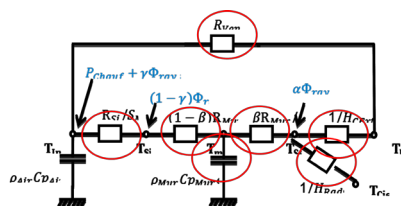


Fig 3: Analogy with electric network (Gray Box model)

ENERFICIENCY (ITEA 2 ~ 10009)

Partners

3E
Aeltari International
Airbus Defence and Space
CEA
FreeMind
HPC-SA
University of Girona

Countries involved

Belgium
France
Spain

Project start

December 2011

Project end

October 2014

Contact

Project Leader :

Max Grau Stenzel, Airbus Defence and Space

Email :

max.graustenzel@cassidian.com

Project Results

control in an operative building control system (including predictions based on current state and forecasted inputs, optimisation and monitoring). Black box data-driven modelling focused on measuring energy savings in compliance with the International Performance Measurement and Verification Protocol (IPMVP) standard while simulation and modelling functions for architects were developed (energy BIM platform: ArchiWizard). Through the full spectrum of white, grey and black boxes along with whole loop sensors, predictors and evaluators, the energy gap can be reduced.

WELL DEMONSTRATED ...

There were several demonstrations of the results of the project, including a grey-model selection system of the Belgian SME 3E whereby the number of non-physical parameters were adjusted to find the appropriate prediction model and a 3E predictive heating control based on the learnt grey-model (to achieve appropriate temperatures during working hours). The Energis demo (dashboard UI) of the Belgian SME Freemind involved a prediction model to measure the actual 17-21% energy

saving achieved by various measures while CEA demonstrated results with INCAS houses test bed.

... AND ON THE WAY TO EXPLOITATION

In terms of integration services in the energy domain, Airbus Defence and Space not only achieved progress in implementing energy and site management functionality but also improved and extended the Airbus Defence and Space communication and interoperability asset with adapters for energy monitoring software such as the Freemind Energis product and software for architects such as HPC-SA ArchiWizard. In the ESCO (Energy Service Company) market, the Freemind Energis IPMVP tool will allow continuous consumption verification and savings quantification as well as complement the range of products and services in the field of Energy Performance Contracts. In the 3E spin-off, LESS (Local Energy Savings Solutions), energy efficiency in tertiary buildings is being targeted using the ESCO business model. As for Energy Management Systems (EMS), the data obtained can be used to perform self-diagnostic and optimisation routines and to produce trend analysis and annual consumption forecasts. Industrial companies are likely to be early adopters of energy management initiatives.

THE BOTTOM LINE

The project's objective of enabling businesses to establish effective business models that are attractive to the market and boost competitiveness is not only expedient in large-scale integration solutions but, with growth in global building energy management systems expected to be strong, will also help to boost the EU's ambition to excel in the energy efficiency domain and create a precursor market and an opportunity for local companies.



INCAS platform from CEA - a full scale test facility including 4 PASSYS test cells, 4 experimental houses and 10 PV-integration benches

Major project outcomes

DISSEMINATION

- Scientific Publications (e.g. IEA EBC, Renewable & Sustainable Energy Reviews, eSIM 2014)
- Presentations and demos at conferences and fairs (e.g. Intelligent Building Operations, Cluster Lumière seminar, Intelligent Building Systems conference, Building Simulation conference, BATIMAT, IBPSA, EADS Energy Network)

EXPLOITATION (SO FAR)

- Forecast based savings calculation software for ESCO companies
- Smart control tools for energy usage optimization
- Improved modelling of buildings based on sensor data and/or BIM information
- Simplification of modelling tools and integration of a marketplace for modelling of commercial building components
- Integration of energy management and site security functionality to effectively operate smart building

STANDARDISATION

- Extension of JModelica open source library
- Implementation of the IPMVP standard in energy savings product

ITEA 2 Office

High Tech Campus 69 - 3
5656 AG Eindhoven
The Netherlands

Tel : +31 88 003 6136
Fax : +31 88 003 6130
Email : info@itea2.org
Web : www.itea2.org

■ ITEA 2 – Information Technology for European Advancement – is Europe's premier co-operative R&D programme driving pre-competitive research on embedded and distributed software-intensive systems and services. As a EUREKA strategic Cluster, we support co-ordinated national funding submissions and provide the link between those who provide finance, technology and software engineering. Our aim is to mobilise a total of 20,000 person-years over the full eight-year period of our programme from 2006 to 2013.

■ ITEA 2-labelled projects are industry-driven initiatives building vital middleware and preparing standards to lay the foundations for the next generation of products, systems, appliances and services. Our programme results in real product innovation that boosts European competitiveness in a wide range of industries. Specifically, we play a key role in crucial application domains where software dominates, such as aerospace, automotive, consumer electronics, healthcare/medical systems and telecommunications.

■ ITEA 2 projects involve complementary R&D from at least two companies in two countries. We issue annual Calls for Projects, evaluate projects and help bring research partners together. Our projects are open to partners from large industrial companies and small and medium-sized enterprises (SMEs) as well as public research institutes and universities.



ENERFICIENCY
(ITEA 2 - 10009)

March 2015