## SUSTAINABLE PLACES 2015 September 16-18, 2015 Savona, Italy

## EVENT REPORT —



#### Sustainable Places 2015

A CONFERENCE CO-ORGANISED BY THE RESILIENT AND THE PERFORMER PROJECTS UNDER THE AEGIS OF THE EUROPEAN COMMISSION



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## INTERNATIONAL CONFERENCE SUSTAINABLE 2015 SEPTEMBER 16-18, SAVONA, ITALY sustainable-places.eu



#### ABSTRACT

The third edition of the Sustainable Places conference took place on September 16-18, 2015 at the University Campus of Savona, Italy. Sustainable Places 2015 is an original initiative from the RESILIENT and PERFORMER FP7 European project consortiums, which received support from the European Commission, BUILDUP, ECTP–E2BA, EIP-SCC (Eu-smartcities), EUbusiness, and Ideal-ist.

Sustainable Places 2015 gathered institutional, researchers, and engineers, around one of the greatest challenges that our societies have ever faced: ensuring long-term environmental sustainability of ever growing, densifying urban areas, in a resource-constrained world. To tackle these issues, the conference offered to question energy efficiency at building, district and city levels. Information and Communications Technology (ICT) along with other key research domains (energy, materials, methods and practices, etc.) were at the core of the conference. Once again, the Sustainable Places conference proved to be a fantastic opportunity for networking and clustering among projects funded in the framework of the FP7 and H2020 EeB PPP. Participants had the chance to assess innovative initiatives, access up-to-date information, discuss market trends and envision possible synergies.

## 2. Sessions highlight



#### **Opening session**

Beginning with the presentation leaded by Rajvant Rijjhar Director of iVEES, in PERFORMER. partner focused on the importance of standardization as the main tool for overcoming the technical barriers for introducing new products into the market. The session continues with a very interesting speech driven by Tomas Messervey of R2M versed on how launching sustainable startups and giving us some remarks on the main risks to the exploitation of the results of an RD project and bootstrapping via SME Owner Rule closing his presentation with the a closing challenge:

"If Venture Capital is willing to invest based on a 2 minute elevator pitch, why does the research community not pursue post-project investment when:

- The ideas have been validated by the proposal selection process
- The project has conducted development, validation and branding

For closing the opening session Germain Adell presented how Nobatek. non-profit а private technology centre, faces the sustainability market the and European projects in which they are involved.

#### FP1: Innovative Decentralised energy production

Within the session, four interesting works were presented related to the innovative decentralized energy production. As start point, an investigation work of the University of Genoa related to off-design analysis of a micro gas turbine under stochastic conditions has been presented. Alessio Abrassi, emphasized the importance of taking into account the uncertainty for energy system plants and their behavior in order to characterize properly their outputs. Comparing two methods: Monte Carlo Simulation (MCS) and Response Sensitivity Analysis (RSA), as tools for treat uncertainties and applicated to a mGT model. The work done on the mGT model permits to figure out advantages and disadvantages of RSA in respect to MCS.

Herman Ejidems, presented the mine water initiative in Heerlen (Mijnwater) which is a geothermal project originating from the European Interreg IIIB NWE programme and the 6th FP project EC-REMINING-lowex, the abandoned coal mines are now giving the perspective to become an innovative green tech region, due to the sustainable geothermal energy that is contained in the groundwater reservoir.

Mijnwater BV – a private company owned by the municipality of Heerlen – is building a successful business based on this concept and is rapidly expanding connections to the grid.

This grid will be evolved in the future, according to the formulated principles, towards a full 4-th generation DHC-grid, where the remaining needed auxiliary energy is provided from a multisource of local renewable energy technologies.

The presentation concluded with the remark that financing these new kinds of regional-based energy provisions is a complex process. Many financial institutions are yet not capable of adequately estimating the risks of these developments. Nevertheless, financing is one of the main barriers in the energy transition process. Due to step-by-step expansion and proof by result, Mijnwater BV is able to build up financial trust.

Emmanuell Malliotakis of NTUA presented a study done about the evaluation of energy saving potentials for commercial districts served by distributed mCHP units. According to this innovative energy management concept, the buildings in a district are interconnected by thermal and electric micro-grids. Heat and power are produced within district limits by a "swarm" of centrally controlled micro-CHP units. The energy conversion devices are considered for "Reference" two settings: а (centralized system and gas boiler) and a "micro-CHP" (decentralized micro-CHP units) and for two primary energy factor settings (one constant electrical PEF of 2.5 and one setting with variable PEF). A commercial district type, located in Munich is examined., containing more buildings of the tertiary sector. By using an inhouse developed, Matlab based, software. named DEPOSIT the importance of heat-led control and of a variable PEF for electricity is shown. A clear PEC reduction potential has been identified for all cases examined, Moreover with variable PEF, savings from the mCHP operation can be increased.

The forth presentation was carried by Patricio Aguirre of Tecnalia who presented the work done within three projects which aim the on management and conservation of urban districts. The three projects are based on a 3D city model and a decision support system. The decision support system is fed by the 3D city model and provides assistance to select the most suitable interventions for urban districts focusing on the sustainability of a district. The 3D city model is based on CityGML and enables the storage and presentation of data at city and building scales. It contains both geometric and semantic data as part of a single data

model. The described projects are and National European research EFFESUS, FASUDIR projects: and **REACT.** The EFFESUS project develops a Decision Support System (DSS), which aims to select suitable energy efficiency interventions for historic districts. The FASUDIR tool is an integrated decision support tool which assists decision makers to select the best energy retrofitting strategy at building scale, taking into account the surrounding area (the whole district). The REACT project develops an integrated management platform for the identification of interventions facing the conservation and improvement of habitability, energy efficiency and accessibility of historic districts.

He emphasized that integrated approaches with intuitive userfriendly software represent an innovative alternative for decisionmaking to prioritize the action to be taken and to improve the sustainability of urban districts and their subsequent management. The management strategic of the information generated by a city should be a key part of this process.

The development of data models based on the international CityGML standard allows GIS and BIM concepts to be integrated within the same model. The information contained in the model is unique and can be used to develop various applications that the different agents (city managers, technicians and members of the public) employ. At the end of the session some questions were launched to the speakers related to the Impact of the auxiliary elements in the final system performance and capital costs, replicability of the system by distributed mCHP for example which depends on the PEF and PEC factors. And finally, a remark was done by Herman Elidems regarding that financing these new kinds of regional-based energy provisions is a complex process. Many financial institutions are yet not capable of adequately estimating the risks of these developments. Nevertheless, financing is one of the main barriers in the energy transition process. Due to step-by-step expansion and proof by result.

#### FP2: Digital Tools for Optimized Building Design

The session is dedicated to the description of the benefits of using semantic-based technologies to support design and management of buildings.

Semantic-based technologies can help to overcome some of the complexities that are intrinsic to the development of decision-support systems, which rely on large amount of heterogeneous data. As demonstrated by Álvaro Sicilia from the University Ramon Llull of Barcelona, these technologies can be applied to a variety of scenarios (e.g.

management of smart cities) and not only to the building sector. However, focusing on the building sector and considering the whole life cycle of a building, the most effective use of semantic-based technologies occurs during design (including retrofitting) and operational stages.

At design stage ontology-controlled technologies can used be in combination with BIM (Building Information Model) to support earlydesign and energy-related decisions. As showed by Mark Koster, the EU STREAMER project aims at demonstrating the benefits of using semantic-driven design methodologies applied to BIM to optimise building spatial layout and energy-efficient envelope in healthcare districts. The STREAMER concept is applied in particular to the Rijnstate Academic Hospital in Nederland to enhance the use of BIM and support the large-scale retrofitting of some areas and services of the existing building together with the design of a 10,000m2 extension.

Ontology-controlled methodologies can be also applied to energysimulation workflow to include enhanced energy-analysis capabilities to BIM and support early-design stage. As stated by Ken Baumgärte from the Technische Universität of Dresden, BIM is currently not enough to perform energy simulation and show the effectiveness of various design variants from an energy point of view. Step-by-step extensions with ontology individuals and inference rules and provision of additional data (materials, weather, etc.) are required to pass from the actual BIM to an intelligent "eeBIM". The resulting ontology-controlled energy simulation workflow could be then used to identify best design variants based on energy resources (e.g. construction).

At operational stage semantic basedtechnologies can be used to deal with great amount of data and generate short-term actions to support building management. This is the objective of the EU project OPTIMUS, which aims at helping local authorities to optimise the energy performance of public buildings by short-term applying the actions suggested by a Decision Support System (DSS) using semantic web technologies. As showed by Álvaro Sicilia, semantic modelling is used to integrate data captured from the and buildings their contexts; inference rules are then used to compare sets of integrated data and prediction based on historical data to generate short-term action to improve energy efficiency and reduce energy consumption.

The three reported examples show the potentialities of semantic-based technologies and methodologies in the building sector and especially during design and operational stages. However the exploitation of such technologies still presents significant challenges. If it true that these technologies represent the future for design engineers and architects, their application to existing building (and in particular historical ones) is still limited. Effectiveness is also limited at the very beginning of the design stage, when no information about the building and its context is available. Finally, one of the main challenges is represented by the possible paths to exploitation. So far, main exploitable results of projects working in the field of semantic-based models of buildings oriented towards are Standardization and rarely to real applications; the challenge is now to find alternative paths to exploitation...and only good ontologies will reach the goal.

#### FP3: Large Scale Demo of Smart Built Environment Technologies

Boosting the performance and the sustainability of existing buildings, to match those of recent buildings has proven to be a complex and challenging task. The session focused on software-based tools to help decision makers and/or engineers to undertake refurbishment of existing buildings and districts.

Such tools have become necessary because:

- multiple domains are involved, often with diverging goals (e.g. energy savings, water usage, ecological impact...);
- different phases of a renovation project have different requirements;

- building renovation needs to be contextualised in their urban, social and natural environments;
- some existing buildings have a historical value that must be preserved.

The session has highlighted a number of common trends regarding the design of these new Intelligent Decision Support Software (IDSS). The presented tools intend to demonstrate two or more of the following qualities:

- interdisciplinary, design and development require various skills and knowledge (architects, civil engineers, software engineers, urban planning experts);
- multi-scale, from building scale to regional scale;
- user-friendly, facilitating the use by various stakeholders (graphical user interfaces, webbased, 3D visualisation);
- developer-friendly, e.g. based on reputable open source software;
- interactive/semi-automated, able to speed up the process of acquiring the data and knowledge required for decision making
- able to provide recommendations with even incomplete data, combining existing databases and documents (e.g. GIS maps, design plans), traditional building surveys, high-tech building surveys (e.g. laser scans,

photogrammetry) with generic typologies or well accepted substitutes;

 supported by semantic models (BIM, GIS, ontologies).

Barriers to the diffusion of such tools still exist:

- they not only require a large quantity of data, but most of the time the required data suffer from a disparity in data models/schemas;
- they have to compromise between bespoke and generic approaches;
- the full automation of the reconstruction of BIM models and/or urban scale models (e.g. CityGML) is still difficult;
- the accuracy of the decisions recommended by those tools greatly depends on the accuracy of the input data and the modelling framework.

#### FP4: Large Scale Demo of Smart Built Environment Technologies

During the first presentation, the introduction to the Savona Campus SPM was very useful for following day visits and in order to stimulate attendees' curiosity to the local energy facilities.

In the session different destination test cases were presented showing the specificity of each aim and the importance of energy efficient actions in different scenarios (university, research centre, district, hospitals...).

It has been important to present different European Research Project experiences too (INTREPID, RESILIENT....) with different level of involvement of the users and of smart control (electrical appliances, users' habits, generators operating management, storage...).

In all the presentations it was underlined the importance of customers' involvement and the aim of smart appliances in changing their habits towards energy sustainability.

Another important issue was the analysis of extra-European an scenario, thanks to the presentation by Terese Peffer from the California Institute of Energy Environment, who presented a test case located in one of the most energy demanding area in the World where energy demands are really different from European ones (particularly in terms of heating and cooling request) and renewables are increasing vear by vear the importance of their role in the local energy production market.

## FP5: Energy planning at district and urban scale

The presentation, first entitled "Interoperable energy systems research and innovation strategy for ICT" by Mari Sepponen, and was focused results from the on Ready4SmartCities project. One of the goals of this project was to build an innovation and research up roadmap for smart cities.

The presentation introduced the definition of "smart grid" as:

- a large connected system
- composed by several subsystems
- these subsystem are operated in close communication and coordination
- the system is characterized by a large number of stakeholders

Furthermore, the smart grid concept involves the entire energy chain, from generation to consumption.

So, it a highly complex structure, with many stakeholders and a variety of sources.

How ICT can support such a system in a holistic way? To answer this auestion, in the context of Ready4SmartCities project, а methodology was proposed. First, a conceptual framework was built, taking into account all the actors, adopting a common vision and exploiting the experience from previous projects. Then, a roadmap was proposed, including a set of recommendations and assessment criteria.

The proposed road map is structured according to four main stakeholders categories: citizens, buildings, energy sector, municipality.

Their expectations and behaviours are taken into account and the subsystems they belong is identified.

The roadmap also considers the issues concerning the big amount of energy-related data a smart city collects: how to use it, how to assure data interoperability to obtain system interoperability, how create harmonization.

The roadmap identifies the needs for future research, technical development and innovations, and proposes subjects for future funding for the EU. It collects ideas for potential developments to propose to cities.

The results are available on the Ready4SmartCities site.

In the discussion, the topic of the best way to promote smart city "actions", either with feeding policy or with regulation requirement, was addressed. The difficulties related to the high variety of sources of legislation and regulations (EU directives, States legislations, local regulations) were also underlined.

Given the fact that most of the smart grids are polygenerative, the decision whether to focus the attention primarily on the electrical part or on the thermal one has no general answer: it has to be decided case by case.

The second presentation, entitled "Thermo-economic analysis of the storage role in a real polygenerative district", was given by Stefano Barberis.

The presentation was focused on the economic analysis and optimization of storage ("hot" thermal, "cold" thermal, and electrical) in a smart grid, with special reference to the Smart Polygeneration Microgrid and the E-Hub laboratory of the University of Genoa. The simulations where carried out by using the WECoMP software, with in input real curves of the electrical and thermal demands of the Campus.

The SPM and the E-Hub were described, highlighting the main characteristics of the equipment installed in them (CHPs, electrical storage systems, thermal storages, etc...).

The presented analysis takes into account the Campus demands, the scenarios economic and the operation in grid connected mode and islanding mode, and provides two outputs: the optimal sizing of the equipment and the best operational strategy. The software takes into account the variation of the CHPs performances with the ambient temperature. A typical day for each month is considered.

Furthermore, as it is not possible to associate to storage operative costs (like the fuel costs of conventional generators), in order to properly take into account them in the economic fictitious analysis, costs were introduced, related to their charge/discharge efficiency and to the production cost of the energy they store.

The results of the simulation were presented in detail, considering various scenarios:

- with no storage
- with thermal storage only

- with electrical storage only
- with both

The summer also case was considered (taking into account the presence of a cold thermal storage). In summary, the simulation results the demonstrated how thermal the storage improves economic performance of the system, lowering the operating costs by decoupling the thermal and electrical demands, while the electrical storage increases the period of time in which the CHPs operate at their point of maximum efficiency, thus helping to meet the requirements to obtain feed-in tariffs.

In the final discussion, it was stressed how, in order for smart grids/smart cities initiatives to be effective, it is essential to involve all the stakeholders of an energy system and, in particular, the costumers. In this negotiation respect, plays an important role, and must be preferred over setting up obligations.

#### FP6: Open Architectures & Interoperability for Built Environment

The session started with the presentation of Prof Alberto Traverso. The presenter explained conventional and distributed generation capacities and mentioned that we are moving towards distributed capacity. After explained this the presenter distributed general modelling and how we can use an open-source tool to model them, and also open Modelica and its features i.e. to model dynamic systems. The difference between Modelica and Simulink approaches were also explained. The author explained the focus of the work in Polygeneration microgird lab of the University of Genoa, Savona, Italy. The work was focussed on two photovoltaic qas boilers. array, electrical storage and vehicle charging station. At the end of the presentation, current and future work presented. The was second presentation was presented under the title "Open Software-Architecture for Building Monitoring and Control" by Carl Blumstein. The presenter started his presentation by introducing coauthors. The presenter explained vertical and horizontal software architectures that can be used in building services industry. The presenter emphasized on developing a system, which is open to every manufacturer's instruments. The presentation was concluded by mentioning that the components should be interconnect by using logical layers so that one can easily talk to different devices. The final presentation of the session was presented by Davide Mazza and explained objective of HOLISTEEC project, main assets of the project's platform. The presenter mentioned that HOLISTEEC's methodology is a new design methodology and explained its main features. Davide Mazza also explained BIM (Building Modellina) Information based collaboration platform along with platform services, BCF for integration and extensibility. The presenter also presented a workflow example.

The presentations were followed by question and answer session. The chair of the session asked Carl Blumstein that to what extent it is important to implement horizontal architecture? The presenter mentioning that responded the system will evolve with advancements in renewable energy technologies, change in climate (which we can't change). We have to change the way we control our systems, the pathway to control will look like horizontal way architecture. The presenter also emphasized that we have to make our buildings like the Internet. The second question was asked by Dr. Ahmad of Cardiff University, UK. He asked: "Do you think it is better to make devices that are interoperable with each other or developing the architecture that was just presented and then have to develop drivers for each device?" The presenter replied that we don't know which one is the better solution to tackle interoperability issues but we interoperability can't have with vertical architecture layout. The third question was "Does someone will need to learn API to work with the author's API?" The presenter replied that it may be their API but it can a standardised API. The last question of the session was to Davide Mazza. One of the attendees asked whether there are any use cases for renovation or not? The presenter replied that there are no use cases in the project for renovation but he can't see any problem in defining use cases.

#### SP1: Business and Organisational Enablers to Energy Efficiency

This session highlighted the need for defining new empirical objectives metrics to measure wasted energy in the EU Countries.

The core role of innovative Business Models in the building sector was underlined and the experience of the UMBRELLA project presented, which has the objective of creating new adaptable business models for various different stakeholders.

The need for innovative financing mechanism is also recognised by the European Commission. Projects like CROWDFUNDRES propose the utilisation of crowdfunding methods, which bring together the crowd, the citizens, to finance this type of projects.

Numerous crowdfunding platforms exist. In addition, the overall cost of financing, which varies a lot from project to project and from country to country, proved to be lower and faster compared to the traditional methods. Crowdfunding is very used in the UK, and is also growing in Germany, Scandinavia and it is suitable especially for smaller projects.

Different crowdfunding schemes have been also introduced.

Auctions are also potentially suitable for RES, even though there is a limited experience with this support scheme so far in Europe.

There are several frameworks and market conditions that need to be considered to design the optimal auction format.

The importance of facilitating the interactions of the different stakeholders in district renovation projects has been also discussed. The integrated Decision Support System developed in the project ECODISTR-ICT with this aim and the lessons learned were presented.

## SP2: District energy and smartgrids solutions

Speaker: Alberto Traverso

"Performance curves of prime movers for smart polygeneration grids" Goal of this work is to provide complete maps for simulation of CHP plants components based on real data

obtained from tests performed both with a composition of real machines and simulated ones.

After a brief introduction of facility layouts and emulator situated in research laboratory of Savona he have shown a set of results representing performances the of main components of a hybrid system plant. In particular efficiencies, fuel mass flow consumption, thermal power have been represented on nodimensionalized maps the at changing in ambient temperature condition. This was done for different components such as micro gas turbine mGT, internal combustion engine ICE and so on. It was underlined how efficiency of fuel cells can be a key point for the comparison with other system because its unusual increasing during off design working condition (part load).

#### Speaker: Kalevi Piira

"Demonstration of management and decision support systems for energy positive neighbourhoods"

In the first part of his presentation speaker has shown a set of features of tool he was presenting such as: nas management, data logger, PV production forecast, neighbourhood presumption prediction, adaptation requester and so on. After he has switched to the presentation of demo site modelled by game engine a brief intro description on of neighbourhood was performed, followed by: a description of tool for energy brokering; a presentation of forecasting heating energy consumption and validating results with some words on fault detection. The speech ended with a BimZone demo of monitoring applications.

Speakers: John Gravelin and Kelly Mcgill

"EcoDistrict in the US: Implementing District-wide opportunities"

Presentation of the Smart Sewer (a sort of bio digester) in protection of Charles river (Boston). The main benefits presented obtainable from this proposal are: recharge groundwater, produce energy, reduction in pollutants, reduce emission, production of fertilizer for farms, reduce overflow recycling water in buildings (not for drinking purpose).

#### Speaker: Thomas Masservery

"Business perspective of smart grid services developed"

Presentation of the rule of R2M company in optimization of smart grid behaviour in real time working. Introduction of different cases study for this type of applications.

The discussion took place after the highlighted presentations several issues such as: the need to quantify the benefits that smart grids and their optimization can bring in terms of energy saving and cost reduction (if this is feasible). It was highlighted the difficulty of quantifying benefits and secondary issues not directly visible but that the application of these solutions inevitably bring to districts and populations, in reference to any introduced case study during different presentations.

Other considerations were made about what are the basic parameters for the correct diagnosis and fault analysis during the monitoring of these systems, and also have been touched issues such as identification of the correct use of data collected from previous studies and tests in order to optimize simulations for the design of hybrid systems and smart grid.

#### SP3: Building and Urban-level Energy Optimization

Optimization at Building and Urban level is a task involving energetic, architectural, social and economic aspects. Tools for simulation and decision support, as well as the identification of KPIs are a powerful instrument for an effective building, districts and cities planning and managing.

Starting from Energy Optimization both at building and district/urban level, the Session was also characterized by an all-encompassing approach, including social and comfort aspects at urban scale, among others.

The common goal of efficient decision support procedures was presented in different contexts.

From а design and energy management point of view, different tools were presented focused on the energy optimization for complex energy district; energy generation and storage devices optimal sizing and building design support. The presented tools also feature a wide applicability through the implementation of modular approaches and a user friendly and state of the art interface.

At a higher level referring also to comfort and social aspects, different

approaches to KPIs identification for Smart Cities and the quantification of public spaces wellbeing through objective/subjective factors were presented. Techniques for information gathering and retrieving were shown and underlined the importance of indicators rarely used in urban management, besides the energy-related ones.



#### WS04: Innovative Retrofitting Activities

The "INNOVATIVE RETROFITTING ACTIVITIES" workshop took place Sustainable under the Places conference on Thursday, September 17. 2015. The workshop was organsised by three EU funded projects; A2PBEER, BRICKER and RESSEEPE.

The main objective of the workshop was to present the work carried out in the projects mentioned above towards reducing the building energy consumption in public and identifying affordable and sustainable retrofit solutions as well.

A2BRICKER project was presented by Fabrizio Alberti from Fondazione Bruno Kessler- FBK BRICKER project was presented by Jose Luis from TECNALIA RESSEEPE presented by Redondo Pierre from Polylogis

When the speakers ended with their project presentation the "Open discussion" section has started. Below

we present the most significant issues raised on this interactive procedure.

Francisco Javier asked Jose Luis about the payback period for PV panels and if it is worthy to install them in public buildings. Matthias Schuss from TUW answered that the payback period cannot be defined as a standard value.

Considerable is the fact that that PV panel efficiency depends basically on the 2 parameters:

- the solar irradiation that the place where the panels are installed, receives
- and the quality of the panel which is in other words the panel efficiency.

Thus, is difficult to set a standard value for the payback period. For the second part of your question I can answer to you that PV panels combined with BMS can be at a reasonable price. Regarding the second part of Francisco Javier's question Matthias Schuss answered that PV panels combined with BMS can be at a reasonable price.

A significant issue was raised by Giulia Barbano, asking Fabrizio Alberti how their project team handle the risks (e.g performance guarantees) that the technology providers face participating such in research projects. Fabrizio highlighted that the risks cannot be eliminated, however this procedure is very fruitful for the technology providers as they put their technologies in real conditions and can have valuable feedback. He also finished by adding that Risks also are covered bv the background/ foreground agreements made within project partners. Fabrizio was also asked whether in their project monitor the electrical consumption and Fabrizio answered affirmatively.

Maciej Czaika from Trend Controls asked Jose Luis about the reversible windows that Jose showed in his presentation. In more details Maciej asked whether this type of windows are a EU project result and who holds the patent. Jose Luis answered that BERGAMO hold the patent and brought this technology in the project Tom Basset for BRE asked RESSEPE Redondo presenter Pierre how RESSEPE handle the different mix of technologies in different use profile patterns buildings. Redondo came back highlighting that this complicated issue was defined from the very beginning of the project. He continued presenting the variability of **RESSEPE** pilot sites; a school building in Sweden, a university building in UK and a hospital in ES and how retrofit technologies where selected to address the different demands for every building and building users. However he also noticed that some basic technologies will be applied and tested in all buildings, hence a clear insight of how technologies behave in various ambient and internal parameters will be available.

Finally, Giulia Barbano highlighted the fact that EU projects contribute significantly in development of EU entrepreneurship by bringing SME's closely to R&D organisations, SME's encouraging to test new technologies and lastly by bringing the building users closely to new and innovative technologies and making them more approachable.

#### WS05: RESILIENT Project: Workshop on Standardization

Standards reflect a consensus-based process, involving different stakeholders: industries, RTOs, representing universities the excellence in the field. Their application to the Energy Efficiency in Built environments are discussed showcasing the overall approach from the point of view of CEN -CENELEC, the idea from a large industrial player and the results of R&D performed within a FP7 project.

Standards set a competitive advantage for industries following them, but do not represent a limit: in their products the industries can do also better than existing standards, and on the basis of such achievements propose solutions for more restrictive standards.

Standards can foster the market uptake of project results. Standardization represents at the same time an opportunity and a challenge for the future in energy efficiency in buildings.

Standardization process is supposed to involve more and more not just components but also a wider energy landscape emerging through smart grid and district energy management. The standardization process indeed is long: from proposition to publication it can take as long as 36 months, implying the acceptance and consensus from a differentiated range of stakeholders. Every 5 years standards are meant to be revised, therefore making the standards landscape a very dynamic one. Standards applied to research project can have a dual approach: they can cover emerging results and newer fields to ensure the safety (e.g. in nanotechnologies, where such thematic is a turnkey to permit the research itself to be performed) and results of research that have already become a marketable products.

#### WS06: Decision support tools to optimize energy use in buildings

Optimizing energy efficiency in buildings is often an operational and management issue and not one of design. In today's economic context, individuals and organizations need to deliver on multiple and sometimes conflicting priorities; increasing profits and reducing costs; whilst complying with ever tighter regulations, and contributing to a more sustainable environment. There are many existing web-based tools offering energy efficient solutions but it is difficult to understand which solutions are the most suitable for our buildings and priorities. The results of the existing services fail to match services and solutions with consumer needs and has resulting in a market that is confusing to navigate and ineffective in delivery terms. The current state of the market of Energy Efficient Buildings was presented, including identified market barriers. In order to overcome these barriers and disseminate a smart energy vision in building sector, the several companies, research groups and associations have developed free and commercial tools that can help professionals and building owners in taking strategic decision. Α comparative analysis of the most innovative tool on the market was discussed. However. these tools cannot suggest the best cost-efficient solutions: they can compute the impact of different configurations or interventions, but not guiding the user to the optimum solution, according to their budget and expectation.

The UMBRELLA project addressed these issues through the development of a web-based decision-support application, Re:form, enabling users to identify, understand and visualize

energy efficiency and conservation measures applicable to their building and align these with optimized business models to enable greater operational efficiencies and savings for the best return on investment. The new decision support tools developed by the UMBRELLA project, which help optimize the energy efficiency of buildings across their whole life, were presented: the Re:form free web tool and the Re:form commercial products - End of life solutions, business models, climate change analysis, environmental/LCA analysis, LCC analysis, genetic optimisation and value choice tool. It is arguable that nowhere else in the market can such a complete, comprehensive one-stop shop be found.

The definition of business models concerning the energy efficient building market and their role in the energy transition was presented, according to several authors. introducing the multi-level perspective theory, co-evolution theory and the performative role of business model. Using these theories it was demonstrated that business model innovation is key to reframe the building market value chain to transition from the current, nonefficient building market to the new energy efficient building market. Business model innovation gives the opportunity to break down barriers to the EEB market. However, it was specified that the business models cannot overcome all barriers, therefore there is a specialization of business models according to the barriers and segment specificities. Following an argument that business model shape the value chain and are shaped by their environment, it was proved that in order to overcome the energy and environmental crises, innovative business models must be sustainable in themselves.

Then examples were provided of innovative and sustainable business models for the EEB market, like MEETS: Metered Energy Efficiency Transaction Structure developed in the US. Explanations were given on how business models are integrated within the Re:form tool, what information the users get, and how the information is tailored according to the user profile, needs and expectation. Finally some considerations on how to maximize the impact of business model innovation were presented.

This was followed by a discussion about increasing the impact of energy efficient building projects by external stakeholder incorporating perspectives in business model development, focusing firstly on the identification of the stakeholders of energy efficiency building projects. By definition no two energy efficient building projects are the same and consequently the relevant significance of different stakeholders for each project will differ. As a result, a scoping exercise is important to characterize the project, assess its objectives and thereby identify the key stakeholders. This may often be an iterative process, with stakeholder

engagement resulting in the determination of previously unacknowledged objectives, which in turn leads to the recognition of new 'key' stakeholders. The discussion then moved to the success metrics. which are based multiple on perspectives depending on the view of the different actors (e.g., financial return, reduced energy consumption, greenhouse gas emission avoidance, increased comfort and utility, regulatory compliance) and how to increase the impact, by recognizing and acknowledging the different stakeholders' objectives, aligning the business models within the project delivery configurations and sharing the information and collaborative innovation. This reauires а participatory design processes to reflect needs of not only end users, but also external stakeholders.

The last session of the workshop was dedicated to a preview of the Re:form tool, which is the major result of the UMBRELLA project. The initial presentation was focused on the free tool. The full process flow was presented, using as a reference one of the regional flagship projects used to demonstrate the project results: the Findhorn Eco Village in the UK. The interface was presented, that uses guided navigation to ascertain key information from users: building location and type; building stage of life; user objectives and preferences, energy bills. Once the information is complete, the full package is sent to IES' server for simulation and the user receives an e-mail when the

simulation is finalized. The user can then access the web-tool and retrieve the results for his/her project, which are graphically reported. The following step is focused on the business models, which are specific to the project and stakeholders and allow the user to explore and optimize different business models and the relating implications and recommendations for interventions. Then the focused moved to the commercial tool, when the user engages with the UMBRELLA agent, in order to receive more detailed information and support for his/her project. A detailed model of the building is created, tuned according to the real metering, and used as a reference for the baseline model and the improvement simulations. The commercial tool is going to offer several additional tools and is planned to be launched on the market in about 6 months.

The following key questions were raised at the end of the workshop:

 What is the target market for Re:form? Are you targeting also the US market?

#### At the moment the target is EU.

2. How can the tool manage the huge existing differences in the characteristics of the interventions?

In the free tool we used mean values in terms of characteristics and performances. The commercial tool is going to be much more detailed and customized on the specific project.

- 3. How did you deal with the differences in price for the same intervention, depending on country, manufacturers, etc.? In the free tool we used mean prices among several producers for each intervention. The commercial tool will deal with this issue by providing dedicated and tailored service to the user.
- 4. We developed a similar project in the Netherlands, which failed because of strong difficulties in entering the market. Are you confident there is a market and are you going to invest your own money in developing the commercial tool?

IES is already in the market with a solid customer base. Besides there is increasing demand for such products. We will learn from your project failure to avoid the same errors and accurately plan the launch in the market.

5. How are going to manage the IP issues among the project partners?

The IP is agreed in the Consortium Agreement at the start of the project.

6. Why is your tool better than competitor ones?

It is the only one stop shop tool with business models included available in the market. Nowhere else in the market can such a complete, comprehensive one stop shop be found, that includes: free web tool, End of life solutions, business models, climate change analysis, environmental/LCA analysis, LCC analysis, Genetic Optimise and Value choice tool.

- 7. Have you proved the energy saving resulting from the tool? We have calibrated enerav savings in the simulations against real metered data from Findhorn buildings. To prove the savings in real life, we would need to implement that recommended solutions into the buildings and then monitor for a period of time – which we have been unable to do in the timescale of the project.
- 8. Are there free deliverables dealing with available the business models and the tool? Some are going to be released and made available online soon. For commercial reasons however most of the deliverables are going to remain confidential. There exist several papers, developed during the project, on business models and business model innovation. which will be released on the website too.

The workshop presented the current energy efficiency environment and the major outcomes the of UMBRELLA FP7 project. In particular it focused on the Re:form tool, an web-based innovative decisionsupport application, that allows users to identify, understand and visualize energy efficiency and reduction measures applicable to their building and these with tailored align optimized business models to enable greater operational efficiencies and savings for the best return on investment. To date the Re:form tool is the most complete, comprehensive one stop shop that can be found on the market.

#### WS09: Social & Business dimensions in Energy Efficient Districts

#### Introduction (Valeria Ferrando, IES)

The workshop is chaired by Valeria Ferrando. She opens the floor by reminding the audience the major topic of the session which is "how to go beyond the projects and turn project results into products?".

She presents a series of 11 EU projects fromFP7 that all are addressing the energy efficiency (EE) challenge at the scale of District or City. Each (almost) of them has issued in the frame of its activity a corresponding business model.

All projects (except the CSA nReady4Smartcities) are focusing on providing a decision support system (DSS) dedicated to various types of actors (from Citizens to Municipality actors or Stakeholders, Escos, Grid operators, Facility Managers, etc.). This variety is leading to different business profiles of course, but in each of the requirements, the need for integration (holistic approach, holistic systems) is clearly stated. Beside the exchange of energy, all platforms are these relying on exchange of information (production consumption / of data/

measures/indicators/etc.) and the reference to "Open Data" is made as possible enabler towards these holistic solutions.

Among the points discussed, it is mentioned that the actors from the regulation domain are missing in the picture depicted above. Nevertheless they may have an important federative role when interoperability issues and thus the need to adopt common solutions across sectorial silos arise.

#### New for new business models (Silvia Capato, D'Appolonia)

Silvia Capato focuses her presentation on the various proposals made by the projects in terms of business models, reminding that there is a radical change in the energy market and it leads to a need for a radical change in business models also.

In order to do so, the projects have applied different approaches (SWOT, PORTER'S 5 FORCES, workshops...) to analyse the market against the project results through given Use-Cases or Business Scenarios. Then, in order to issue an implementation plan, other instruments have been used here (Bowman's strategy clock for instance). At the current stage, the situation is a bit heterogeneous among the projects as they are not at the same maturity level. Again, the link between energy and information appears, Information being one of the most important means to attract the users.

Some difficulties were also listed like:

- The vocabulary for communication across domains and between heterogeneous actors is difficult does not exist. It requires time to come to a shared understanding.
- The motivation (especially for the citizens) is low and difficult to maintain over the time. In a similar way, there are low incentives for business actors.
- The regulatory constraints are strong and very heterogeneous among the EU countries.
- The market environment is not competitive at the moment as well as the maturity / acceptance level for these new DSS solutions.
- Technological issues hamper the good perception of such tools (the services are partially developed; there are interoperability issues, etc.).

According to the projects learning, it seems that the citizen's profiles are heterogeneous across countries. In most of the situations, the benefits are too small to convince people to adopt new behaviour and to spent time with new tools. The continuous engagement of the citizens is something difficult to obtain. Some training seems needed to make the population aware of what an energy efficient behaviour is and to make a smart home as common as a smart phone (also in terms of data privacy).

Some of the business models have been already developed but not yet

tested. The first results / feedback will be available year.

#### WS11: ICT & Open Data for Building Life Cycle Energy Management

#### Introduction

This report summarizes the main the SWIMing aspects of 3rd workshop, held on Thursday 17th September, 2015, at the University Campus of Savona, Italy and aligned with Sustainable Places. The workshop focused on clustering experts for discussion on research questions related with an open BIM approach for building lifecycle (BLC) energy management processes in buildings and more in general around standards and interoperability. It was co-organized by the EC funded projects SWIMing (Semantic Web for Information Management in Energy Efficient Buildings) and EEBERS (ICT for EeB clusters). The EC funded project Ready4SmartCities also participated at the workshop.

The main focus of the workshop was to explore how ICT and open data solutions can benefit BLC energy management. Due to the time constraints of 120 minutes, the structure of the workshop was that of presentations with open questions towards the end. The first set of presentations introduced the workshop and also gave background information on the three represented

projects, Ready4SmartCitites, EEBERs and SWIMing. There were then three technical presentations around specific use cases which may benefit from the application of open, decentralized publication of data models. The workshop also set out to explore current barriers related to open BIM.

The main outcomes of this workshop were 1) dissemination of information regarding the clustering efforts of the three CSAs, 2) identification and categorization of use cases which can benefit from the application of ICT technologies and LD, 3) identification of challenges and barriers facing the use of BIM standards and in particular, open BIM.

#### Main Content

The workshop consisted of one session with several talks relevant to open BIM. The session was chaired by Kris McGlinn (ADAPT), coordinator of the SWIMing project. Here we present a short description of each presentation.

Javier (Solintel) presented several slides related to the EEBERS project and expected outcomes. This included the methodology that is being followed to map all the technologies related to ICT that are currently being developed in the EeB domain at European level. It was emphasized the importance that this project has for researchers, industries, and other main stakeholders since they can see where the latest ICT technologies are being developed and who is doing it; having the chance to establish alliances for their future research or exploitation. It was also explained that the project was one out of the four CSAs approved under the H2020-EeB4-2014 call.

(D'Appalonia) Andrea Cavallaro presentation the R4SC project objectives and main outcomes. He presented how R4SC set out to increase awareness and interoperability for the adoption of ICT and semantic technologies in energy systems and to obtain a reduction of energy consumption and CO2 emission at smart cities level communities' through innovative relying on RTD and innovation outcomes and ICT-based solutions. This included the development of a portal for sharing and accessing ontologies and other data structures relevant to smart cities.

Mirkka Rekola (VTT) presented an example of applying linked data technology into interoperability in building design, construction, and facility management. The presentation gave an overview of interoperability in building processes, how linked data fits to it, and a case example of a Finnish consortium developing web based interoperability into building design software. Project Drumbeat targets to take building information management into web.

Kris McGlinn (Adapt Centre, Trinity College Dublin), coordinator of the SWIMing project, introduced SWIMing to the audience. Currently there is a vast amount of heterogeneous data generated during the Building's Life Cycle (BLC), which we define as its design, construction, commissioning, operation, redesign (reconfiguration, retrofitting and refurbishment), and finally demolition. This data covers several domains, for example: buildings products and geometry, building devices, building behavior, building communications, building data, building energy and geolocation and weather. The purpose of the SWIMing project is to make this data more accessible to building energy management processes to improve the energy efficiency across the BLC. Towards this goal it has undertaken analysis of over 30 EeB projects and identified use cases for each of those projects along with their respective data modelling requirements.

Kris also introduced the Linked Building Data W3C community group to participants, highlighting the need for participation amongst the wider community in the process of developing use cases and providing information on open data models. The LBD wiki was introduced as a common forum, accessible to anyone and editable by members of the LBD group. The LBD group therefore facilitates access to key players in the BIM and linked data field.

Gianmario Incao (D'Appolonia S.p.A.), presented the EPIC-HUB project (EU FP7) which focus is energy efficiency, self-generation, emissions reduction, and novel solutions to exploit the excess energy generated and the unused / unshared storage potential often available at the neighbourhood community level: through the Energy Hub model, the EPIC-HUB solution enables the development of dedicated services, for the integration of multi-domain and multi-energy carrier resources in a neighbourhood environment to manage the local energy sources.

Mr. Incao described a) the development of the **EPIC-HUB** Information Model describing data structure and functionalities of the application services and b) the definition of the interoperability requirements of the whole system. A particular focus has been given to the mixed approach (by merging Top-Down and Bottom-Up modelling approaches) to deliver the EPIC-HUB Project Ontology and the Canonical Data Model (CDM): the presented EPIC-HUB ontology defines all the semantic aspects of the EPIC-HUB Information model aiming at formalising all the relevant knowledge available in the domains impacted by project, while (from the the perspective of the ICT integration) the CDM represents the enabling element to define and implement the services of the EPIC-HUB solution.

Walter Terkaj presented "Advances in ifcOWL standardisation: technical overview" focused on the potential benefits coming from the integration of Building Information Modeling (BIM) and Semantic Web technologies. In particular, the presentation provided details about the initiative for the development of a recommended ifcOWL ontology, i.e. an ontology version of the Industry Foundation Classes (IFC) standard that represents one of the main references in the BIM domain. Also, guidelines for the development of ontology-based software tools were discussed. Finally, an application scenario exploiting ifcOWL in the context of industrial sustainability was outlined.

#### Discussion, Conclusion and Next Steps

The session concluded by opening up the floor to questions. A number of issues were raised during the presentations and discussion that followed. These related in particular to barriers and challenges facing those who improve wish to interoperability of their solutions and to making data more accessible.

Some of the barriers to the use of IFC and other building data ontologies which were identified were:

- Lack of awareness of existing standards and ontologies
- The amount of effort to develop and maintain IFC models against

the perceived return on investment

 Lack of expertise/knowledge about IFC and how to identify the aspects of IFC to meet a specific set of requirements

Some of the identified challenges for use of building data were:

- How best to represent geometrical data in the Web of Data
- Link generation between models, so that changes to one representation of the building model (e.g. architectural) propagate to other versions of that model (e.g. structural)
- Complex systems with lots of cross-utilisation of models need methods to keep track with origin and authorship of information
- Ensuring that data is secure
- Convincing industry of the advantages of making data open and available.
- Improving awareness and training in the use of BIM and semantic web technologies.

conclusions The main of the workshop were that there needs to be greater awareness of existing standards, for example IFC, and that for research projects which are developing new data structures to meet their needs, there should be greater emphasis first to map these solutions as best they can with existing data structures, and where possible, use existing standards to meet their data requirements.

A questionnaire was also passed amongst attendees of the workshop to identify background information about participants and for them to prioritise data resource requirements. The results of this questionnaire are being collated with previous results and will be published together on the W3C Linked Building Data community group wiki.

Finally, we set out the next steps for the Linked Building Data community, which is to explore a select set of use cases around energy efficiency in buildings in greater detail. This will be a precursor to the development of a set of guidelines to meet those use cases, for example, to help identify existing candidate models to meet the use case data requirements.

3. Conference attendees



participants









# 3. Satisfaction survey



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FP sessions SP sessions WS sessions Demo site visit

#### Sessions attendance



## Quality of the 1<sup>st</sup> conference day programme



## Overall quality of the 2<sup>nd</sup> conference day programme



## Overall quality of the Demo site visit programme



Delegates planning to attend the next edition

## 5. Testimonies

An important event for energy professional and researchers. The innovative business ideas presented there seem to have the potential to shape the market of energy services and solutions of the next coming years.

> Sustainable Places 2015 was enlightening and informative; it also provided a great opportunity to network with other professionals and academics in the industry.

SP2015 gave our project an excellent platform to cluster with similar projects in our topic area that we did not know about. Thank you SP2015.

SP15 was an exciting conference, with plenty of opportunities for networking and knowledge sharing.

After three editions, Sustainable Places, has been consolidated as a meeting point and an important reference of the main stakeholders in the field of sustainability giving visibility and thrust to diferent European projects. We would like to thank you all, who attended Sustainable Places 2015, in Savona, on September 16-18 2015.



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In the framework of:

