SEMANCO

SEMANTIC TOOLS FOR CARBON REDUCTION IN URBAN PLANNING

Workshop Discussion Document

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Introduction

The SEMANCO Workshop, 'Analysing and Visualising Energy Related Data in our Buildings, Towns and Cities' was held in Barcelona on 11th-12th, April 2013. The purpose of the Workshop was to bring together the community of researchers working on the application of ICT to energy efficiency to discuss three closely related Thematic Lines:

- Theme 1. Energy Data for Urban Planning: Multiple Representations of Energy Information
- Theme 2. Interactive Interfaces of Energy Data Visualization and The Pan-European Context
- Theme 3. Developing Business Models Based On New Energy Services

These transversal themes, outlined in detail below, are of concern to researchers in a number of projects.

Thirty eight participants attended the Workshop. Representatives of sixteen projects participated actively by delivering presentations outlining their work and the relevant aspect of the projects within one or more of the Thematic Lines, and/or by participating in the discussions. Details of the participants and the project presentations' abstracts are given in Appendix 1 and 2, respectively. The Programme is given in Appendix 3 and presentation content, along with other related information, can be found at the Workshop Blog: http://semanco-visualization-workshop.blogspot.com.es/

Theme 1: Energy Data for Urban Planning: Multiple Representations of Energy Information

Urban planners and others who hold a stake in city-planning decision making, such as architects, consultants, politicians and citizens, among others, need comprehensive information from different realms in order to take informed decisions. Typically, they base their decisions on public (open data) and proprietary information obtained from disparate sources (regulations, data portals, etc.) and provided by different stakeholders (consumers, institutions, energy providers…). Integrated data environments which combine these different data would be helpful to understand the multidimensionality of the problems they are tackling, including energy efficient planning.

The data collected from different sources need to be modelled in a way that can be later analysed and visualized according to the needs of different stakeholders.

Related topics:

- Combining different information sources.
- Sourcing energy data from consumers.
- Sourcing energy data in real time.
- Modelling energy demand side/smart grids.
- Energy performance indicators.
- Energy simulation.

Theme 2: Interactive Interfaces of Energy Data Visualization and the Pan-European Context

The end user requires that energy related data be presented in such a way that they can understand it and, furthermore, can make decisions based upon it. Additionally, the data will often need to be exported to other tools and be capable of undergoing further processing and review. The data needs to suit the requirements of the different simulation and analysis tools used in each country. Also, the data needs to be presented to suit the local/national regulations being applied in different EU countries. In addition, the data needs to be presented in environments such as online geographic systems (Google Maps, GIS, Bing maps, OpenStreetMap, etc.), as well as in other visual representations which facilitate the understanding of the complexity of the relationships between

datasets. This raises issues of appropriateness of data visualization, complementary visualizations (diagrams, tables, 3d models, etc.) and different data platforms (e.g. portable devices).

Related topics:

- Visualizing energy data.
- Cross-national energy data descriptions.
- Energy assessment.
- Developing tools and platforms.

Theme 3: Developing Business Models Based On New Energy Services

From the analysis of the energy related data, strategies for intervention can be derived and applied in different realms with the common purpose of reducing CO_2 emissions. These functionalities can give rise to new services and their associated business models. The platforms which provide access to these services need to be effective in achieving real CO_2 reductions they must be implementable in a competitive market environment. This requires an assessment to be undertaken to understand the potential value of tools to end users and their willingness to pay, as well as questions of the political value of tools for CO_2 emissions reduction from the built environment.

Related topics:

- Strategies for CO_2 reduction.
- Business models.

Discussion

Following the presentations in each Thematic Session, as per the Programme (see Appendix 3), a list of issues was identified in a plenary discussion. These findings were used as the basis for a small group, round-table thematic discussion session. In each of the following sections describing the three sessions a list of these issues and points is presented, together with the summary of the round-table discussions in relation to them. **Points which were raised in the plenary discussion but which did not receive attention in the round-table discussions are included here in order to fully reflect the proceedings of the workshop discussions.**

Thematic Session 1

Key Performance Indicators (KPIs):

KPIs emerged as important because:

- KPI selection affects data source selection
- KPI selection affects selection of computation methods
- Good selection of KPIs helps to make correct decisions and vice versa

How to calculate, to integrate different realms

The calculation of KPIs depends on the point of view from which the information is being evaluated. This is different between projects, as the focus may be on city plans, utilities, ESCOs, etc., and the particular KPIs chosen for the project, and hence the data requirements, are strongly influenced by this. In the identification of the best, most suitable KPIs – and, indeed, the most suitable simulation models – the scale of the project and the nature of the end user are also important issues: KPI's need to map onto the problems that users need to solve. In contrast to this, there is, arguably, a tendency in academic-led projects for the investigation to be driven by the data. Consequently, the KPI can be altered in order to reflect the availability of data.

An awareness of what has been done in other contexts is critical, to avoid reinvention and to make real progress. Reviews of existing achievements and of the relevant targets and user/stakeholder requirements (and proper identification of who stakeholders are) properly develops the KPIs and hence the data requirements.

This uncovers real and difficult issues around data availability. Not only is it required that data be accessed in secure modes, but also there may be data protection impediments to data access, due to either the nature of the data or the local laws in the particular EU country involved

Measuring human behaviour and setting benchmarks for indicators remain challenges identified by the participants. Workshop participants recognised:

- There exists no common benchmarks for such indicators (governmental policies is one of the factors)
- There are challenges of capturing the activities of humans with respect to energy consumption rate
    - Privacy and security issues
    - User profiling of users at different scales: humans(individuals and families)-buildings-city using socio-economic indicators

Furthermore, it is necessary to standardise the naming and classification of KPIs used in projects, tools and schema around ICT for energy efficiency.

Sharing KPIs across projects

It is critical to share knowledge about definition of KPIs as well as calculations. The projects participating in the workshop agreed to work together towards harmonising the KPIs across the different projects (same terms, same methodologies, etc.) in order to be comparable across the projects/case studies. A KPI repository (wiki, ontologies...) is needed and could be handled by a research project or the European Commission.

Quantify KPIs as final output in projects

Data

Available, generated (simulated), captured (statistical projections).

There are difficulties in sourcing data and it is becoming more expensive to generate data. Concomitantly, it is recognised that the output analysis is only as good as the input data. Even though not all the data is standardised, projects are providing real intelligence as to how energy is consumed in historical buildings, the impact of seasonality and human behaviour. Therefore, it is recognised increasingly that it is important to share data. Furthermore, if we desire common uptake of tools/products, projects need to use same data where possible.

Data generated in one project to be used in another one

A repository such as CKAN.org might be useful for population by the research projects sharing its data schemas. This way, everybody would know which data are available and who owns which kind of data. A general purpose example is: http://datahub.io

To this end, the matrix originally circulated to generate pre-workshop discussion has been updated to highlight the connections and commonalities between projects – see Appendix 4.

Diversity of data

Computer/human generated data

Real data / reliability of data

Data protection rules at EU countries (difficult to get consumption private homes)

- Need for *anonymous* data about consumption of resources in private homes (support from state and utilities is needed)

Management systems

Centralized

Development of a cockpit for management of energy in building, districts etc. is a laudable, though ambitious, vision.

Distributed

Everything related to data collection becomes very much more complicated when systems are distributed. As systems are more efficient when centralised (as a generalisation), it is logical that technology be created for this type of system. Despite that, a lot of distributed systems are already implemented in many countries, and cheap technology to gets data from these systems should be available until such time that the systems are updated/centralised.

Reinvented in every project

It is important to find ways to avoid reinvention: use what already exists. In the proposal phase we make SoA to set differences with other project. An alternative approach, a top-down process led by the Commission, would provide a list of existing projects to refer to them. Those who need to be convinced are users, not peers. But companies are reluctant to change. It would work with research institutes, not with companies.

Ontologies

Different meanings of the term

The term “ontology” might have different usages and meanings. In some cases, it is used as a simply as a synonym of “taxonomy” while in the context of Semantic Web technologies, an ontology implies a formal representation of a domain knowledge created with standard languages (e.g. RDF, OWL).

Different domains already in place (home…)

Upper ontologies (e.g. SUMO,…)

Sharing ontologies

It was perceived by the discussion groups that there is a problem with ontology development in that, once developed by individual projects or groups for particular purposes, there is a tendency for ontologies not to be shared. Furthermore, ontologies steer data and knowledge: it would be good to have these standardised across Europe. The eeSemantics forum is a good example of this trend towards sharing ontologies in specific domains.

Scales

Policies and rules to limit the energy consumptions in public spaces include:

- Monetary penalties
- Consumption restriction
- Incentives targeted both at individual users and facility owners

Home/building/district/city

As we move from building scale to urban scale (city, neighbourhood), KPIs should be developed to encompass environmental, social and economic vectors.

Thematic Session 2

Visualizing for understanding

To simplify complexity

Visualised data must suit users' needs; the role of visualization is to convert data into meaning. Data is visualized to facilitate users to understand the complexity of issues behind. Visualizing and understanding are inseparable.

To do this effectively and efficiently there must be a clear understanding of what is meaningful to users. The process of defining value must therefore occur early in the process and must involve the users/stakeholders. Furthermore, users should be involved throughout, so as to ensure value is maintained: in a similar sense to that encountered in consideration of KPIs above, it is important not to let the technical challenges and technical objectives lead the implementation of data visualization. As well as understanding the nature of the information that the visualisation tools should be bringing to particular users, consideration should also be given to the most effective interface design: for example, an interface should display only as many KPIs as are required by a given user and therefore should be capable of personalisation/adaptation. In addition, consideration should be given to whether mobile technology is likely to be required. Ideally, visualisation software should be multipurpose.

Ultimately, data is monitored so that change may be brought about; to achieve effective change, users need to be presented not simply with numbers or even visualisation of numerical output. Rather, visualisations should offer incentives for change and motivation for users to change. In this connection, gamification – applying game techniques to non-game experiences – can be used in visualisation of energy data in order to drive user behavioural change. However, the ways in which consideration may be given to different types of user, with different levels of understanding and buy-in, involves an analysis and understanding of behavioural aspects of the end user. This remains a key challenge in the technological development of visualisation of energy information.

Visualization strategies are different for different domains, but the tools for visualizing buildings or transport networks, for example, must be common. There is a market in this regard for visualization tools.

Reaching out to citizens requires making energy information interesting. Using graphically interesting interfaces will increase support and engagement and will attract new groups e.g. young generation.

To enable/empower stakeholder's actions

Empowerment is a crucial concept in regard to energy efficiency, as it leads stakeholders to develop the interest to become contributors and positive actors.

User manual

How to use buildings properly (which information concerning energy efficiency)

Rooms, buildings and neighbourhoods typically do not have user manuals. Those first generation manuals that have been tried and tested in the intelligent building arena do not work well: much information is compiled and seldom referred to. Second generation manuals should be more interactive and informative, giving appropriate guidance and advice on the proper (correct) use of the building/neighbourhood (in terms of heating, lighting, ventilation, waste management). This may require something of a culture change. In the context of energy data visualization, users should be informed of the benefits of using the manual (and hence the building/neighbourhood) correctly: the cost and carbon implications of real or proposed changes and of particular patterns of use. Visualisation tools need, therefore, to take into account the users' business case for change and/or the users' economic motivation to know/simulate the impact of applying certain strategies.

The utility of printed reports compared to interactive maps is worth consideration. This has been tested in four projects and it is understood that the format is good for those users (such as architects) who require rapid, colour information that is portable and easily shared. This format is also important in instances where audit trails may be required. It is noted, however, that exporting various layers of data can be difficult due to interoperability problems.

Knowing what tools users have before creating new ones: providing the tools they really need, can assimilate easily or integrate in their workplace

Requirements capture as a first step before developing software prototypes

It is important to know what users are already employing before trying to create more value with new tools. This ensures that users will interact with the tool and exploit it.

Are maps the best way to display information?

Printed reports allow reflection while the screen demands a quick reaction

The utility of a given visualisation strategy depends on use case and purpose of tool.

There is no scientific explanation between consumption and demand, the link must be explained through statistics

Thematic Session 3

Who is going to buy?

This is a broad question at heart of the issue of this Thematic session. It is initially necessary to ask and answer fundamental questions about the nature of business (e.g., 'what is a business?') and to work to establish clearly who customers are likely to be and what are their actual requirements. This analysis is likely to be quite difficult: new markets are emerging in response to energy policy and, due to the newness of these marketplaces, it is still unclear who the client is, what their needs are, etc.

In answering these questions it is necessary to identify the customer segments of the market and to establish effective strategies for communication with these segments. It is also necessary to gain an understanding of the distribution/logistics of delivering to these markets.

How to substantiate the value of a tool?

At the building level there are lots of tools. At the planning level there is more opportunity as there is a lack of tools addressing the needs of planners. Energy managers are well catered for in terms of the tools available to them, though it is possible they have a need for additional visualisation. In principle, end-users of energy services are likely to be un-interested in tools or visualisation, but they are directly affected by decisions made by planners and managers.

What are feasible business models?

Business models could be developed around the principles of sustainability, capitalising on social, economic and environmental drivers.

Business model 1 "Mandatory deployment": Compulsory publication of data from the rest of stakeholders (DSOs, ESCOs, facility management, etc.) in exchange for their access to Open Energy Service Platform (OESP) information.

Business model 2 "Incentives from the municipality": Stakeholders incentivized (discount in municipal taxes) to publish their data in exchange for their access to OESP.

Business model 3 "Incentives from the rest of end-users": Stakeholders incentivized from the rest of the stakeholders (reduction electricity bill, electric vehicles information, etc.) to publish their data in exchange for their access to OESP.

What is the preparedness to pay?

How can volume be built?

Provision of software/service

It is difficult to make a business model with open data. Perhaps the business model lies in the tools, the data manipulation and in how data is displayed to the final user. The availability of data, therefore, leads to tools which lead to sales: this is one model. A variant of this is to obtain data from different parties, do something with it and then sell it. This is difficult, though, as data is power; it is difficult to understand how data owners would participate in such an exchange. However, some agencies, e.g. local authorities and housing groups, are data rich but may be unable to clearly see the value of the data and its manipulation. This may be due to poor internal communications and/or lack of awareness of the external opportunities, as well as to lack of resources within the organisation for the exploitation of the data. The owner of the data may require, or may be led to see the value of, their data being treated in some way: this is potentially a provision of service.

Where the data belongs to the utilities it is likely that they will not be motivated to participate in its provision (as this is potentially contra to their interests) without policy/legislation leading them. There is a need for policy development monitoring and control at a government level in order to drive the market. There are consideration of end-user buy-in here and the need to raise trust among the user/stakeholder communities as end-users of energy services typically have low levels of trust in utility companies. A suggestion to build trust is to utilise community groups and to interact directly with them to demonstrate the potential positive impact on end users.

There is an underlying conflict between using public finding to create value and in the commercial exploitation of this.

Localisation requirements

Data input

User/stakeholder/client

Who needs what and who is willing to buy what? For example, planners need tools: see the matrix below, in which the strength of the offering is noted also (that is, the added value of information for the User is that it is made appropriate, both in terms of when they receive it and also its fit with their requirements). The uniting principle, the true added value, in the matrix, is the enhanced, effective communication that the offering brings.

	Policy/urban/building		
	Planning	**Management**	**Users**
Tools	✓ Visualisation	✓ Integrate ✓ Exchange (data protection)	
Reports		✓	
Information			✓ Appropriate
	Communication		

Summary: Overarching Issues

The Workshop discussions converged on several points, open questions and overarching issues; these are summarised in the following bullet points.

- There is a need to share intelligence and encourage collaboration and development in in this field. The sharing not just of ontologies, but also of project data in repositories was discussed, and it was felt that this should be achievable, although difficult.
- Is it possible/valuable to compare the activities within projects, at the level of their overview diagrams, in order to generate interaction, commonality and standardisation?
- There is the question of research not going over the same point several times: the "research sector" has a tendency to go over the same ground, develop the same (or similar) prototypes, rather than looking at the real problem (that is, the underlying business, social or environmental problem) and bringing about effective solutions. To address this, the Commission is increasingly bringing Industry into the project space in order to create more acute focus on real problems and the generation of real impact.
- Fundamentally, the community of developers of ICT for energy needs to consider the interface between technology and people: technology provides what people need so there is a strong requirement for technology to be integrated with behaviour.
- There is a strong requirement for the community to stay connected to the realities in the field: why are problems important? This is not a technology question, but is an important question in the development of useful technology.
- It is not energy itself, but energy information that is important thing in the ICT field. However, we don't, as a community, have all the data we need. This problem persists. Also, it is difficult to bring ICT into energy because energy is 'boring' in the minds of many end-users.
- The identification of data requirements and the creation of repositories is a theme that cuts across all the projects in this area.

Conclusions

The participants in the Workshop have identified that they represent a Community of Interest. This community has identified the need to work towards a set of guidelines for the development of tools for ICT for Energy Efficiency that will be suitable for cross-project utilisation. These guidelines should involve the articulation of a minimum-requirements set for prototype tools in this area, and the Community if Interest will work towards the development of the necessary repositories.

There are five key areas with which the Community of Interest is primarily concerned, as identified over the course of the workshop and as reflected in the Matrix 1. These are:

1. Energy (and energy-related) Key Performance Indicators
2. Energy Assessment
3. Development of tools and platforms
4. Strategies for CO_2 reduction
5. Business models.

The Community of Interest has identified that it is unable, in the time available for the Workshop, to codify any guidelines at this stage yet has identified a clear scope for collaboration. To this end, the recommendation of this Workshop is that such collaborative interaction takes place, initially by virtual conference technology in order to more clearly outline the scope of the guidance to be prepared, and then as a Workshop from one of the Community of Interest member projects to develop further these guidelines. This development is envisaged to take the form, initially, of a matrix of common methodologies and techniques, perhaps with some training for users. This will require the participation of Project Coordinators and the solution to IP issues surrounding access to relevant documentation.

Appendix 1: List of Participants

Forename	Surname	Job Title	Organisation	Associated project
Lola	Alacreu García	SMARTKYE Coordinator and Researcher	ETRA I+D, Valencia, Spain	BEAMS and SMARTKYE
Marta	Arrufi Franch	RDI Technician, Directorate for Quality of l'Building	Agència de l'Habitatge de Catalunya, Barcelona, Spain	
Mike	Barker	International Project Developer, Building Energy and Environment	CIMNE BEEGroup, Barcelona, Spain	
Cristina	Cardenete Suriol	Environmental Technician, Research, Development and Innovation	Agència de l'Habitatge de Catalunya, Barcelona, Spain	
Nashwan	Dawood	Professor and Director of Technology Futures Institute, University of Teesside	University of Teesside, Middlesbrough, United Kingdom	SEMANCO
María	Eguaras Martínez	Town Planning Architect, Building Services and Energy Section, School of Architecture	Universidad de Navarra, Madrid, Spain	Adapt4EE
Håkan	Engman	CEO, Agency9	Agency9, Stockholm, Sweden	SEMANCO
Chris	Ennis	Senior Research Fellow	Teesside University , Middlesbrough, United Kingdom	SEMANCO
Regina	Enrich	Researcher, mobility and energy group	Barcelona Digital Technology Centre, Barcelona, Spain	
David	Erba	Temporary Researcher	Politecnico di Torino, Turin, Italy	SEEMPubS
Izaskun	Fernández González	Researcher	IK4-Tekniker, Gipuzkoa, Spain	AMBASSADOR
Anna	Florea	Researcher, MSc, Faculty of Business and Built Environment	Tampere University of Technology, Tampere, Finland	URB-Grade
Mathias	Fraaβ	Professor	Beuth Hochschule für Technik Berlin, Germany	HeatMap
Mali	Gondesen	Research Assistant	LIMA Association - Low Impact Mediterranean Architecture, Barcelona, Spain	MARIE
Claire	Henderson	Communications Officer	National Energy Action, Newcastle Upon Tyne, United	SEMANCO

			Kingdom	
Giammario	Incao	Senior Engineer, Innovation Consulting Division	D'Appolonia SpA, Genova, Italy	EPIC-HUB
José Javier	García	Researcher mobility and energy group	Barcelona Digital Technology Centre, Barcelona, Spain	
Esther	Llorens Nadal	Leader of the MARIE project	Government of Catalonia, Barcelona, Spain	MARIE
David	Lynch	Senior Research Officer	National Energy Action, Newcastle Upon Tyne, United Kingdom	SEMANCO
Leandro	Madrazo	Professor, Coordinator of SEMANCO project	ARC Engineering and Architecture, La Salle (FUNITEC), Barcelona, Spain	SEMANCO
Xavier	Martí	Leader of the MARIE project	Government of Catalonia, Barcelona, Spain	MARIE
Javier	Martín Sanz	Energy Efficiency Engineer	DALKIA EyS, Valladolid, Spain	BaaS
Marc	Miguel Baños	Masters student	School of Engineering and Architecture, La Salle, Barcelona, Spain	
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Jane	Moustgaard	Project Manager, Energy Supply and Planning	Ramboll, Copenhagen, Denmark	SEMANCO
Sergio	Muñoz Gómez	Innovation Director	AIDICO, Valencia, Spain	E4R Project
Martin	Olascoaga	Architect	RDS SA, Buenos Aires, Argentina	
Joan	Oliveras	Architect	Forum SA, Manresa, Barcelona, Spain	SEMANCO
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Edoardo	Patti		University of Polio, Turin, Italy	SEEMPubS
Christoph	Peters	Architect	LIMA Association - Low Impact Mediterranean Architecture, Barcelona, Spain	MARIE
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Nicolas	Salmon	Head of the Technology unit	NOBATEK, Aquitania, France	IDEAS and NEST
Ganesh	Sauba	Consultant	Software Solutions, United Kingdom	
Álvaro	Sicilia	Researcher	ARC Engineering and Architecture, La Salle (FUNITEC), Barcelona, Spain	SEMANCO

Appendix 2: Presenters' Abstracts

SEMANCO Semantic Tools for Carbon Reduction in Urban Planning

Leandro Madrazo

SEMANCO is a research project being carried out with the support of the European Union's FP7 Programme "ICT for Energy Systems" 2011-2014. The goal of SEMANCO is to provide semantic-based tools to different stakeholders involved in urban planning (architects, engineers, building managers, local administrators, citizens and policy makers) to help them make informed decisions about how to reduce carbon emissions in urban settings. The technological approach of SEMANCO is based on the integration of energy related open data structured according to standards, semantically modelled and interoperable with a set of tools for visualizing, simulating and analysing the multiple relationships between the factors determining CO2 production. A Semantic Energy Information Framework (SEIF) is being developed to model the energy-related knowledge that planners and decision makers need. The tools interoperating with the framework will support systems innovation and include available technologies, enhancements to existing open source platforms, and new technological solutions. The tools are being developed and implemented in three cases of study, in Manresa (Spain), Copenhagen (Denmark) and Newcastle (United Kingdom).

BaaS: Buildings as a Service (Ecosystem)

Javier Martin Sanz

The BaaS system aims to optimise energy performance in the application domain of "non-residential buildings, in operational stage". In the building operational life-cycle three significant tasks have to be continuously performed:

- Collection of information and assessment of the building's current state
- Predicting the effect of various decisions on Key Performance Indicators (KPIs)
- Performance optimisation.

A generic ICT-enabled system will be developed to provide integrated assess, predict, optimise (APO) services that guarantee harmonious and parsimonious use of available resources.

The BaaS system comprises four components:

1. A data management component to collect, organise, store and aggregate data from various in- and out-of-building sources. An (IFC-based) BIM will act as a central repository for all static building data, and a data warehouse will be used for dynamic data.

2. A service middleware platform to abstract the building physical devices, support high level services on the cloud and facilitate secure two-way communication between the physical and ICT layers (building) with high level services (cloud).

3. Energy models for performance estimation and for control services, looking for a trade-off between prediction accuracy (performance estimation) and computational complexity (fast-model for control design).

4. APO services

- for assessment and prediction services: simulation models, acting as surrogates of the real building, incorporating sensor dynamic data, will be used to assess performance and comprehensively estimate the values of relevant KPIs as well as help perform sensitivity analyses;
- optimisation services will automatically generate holistic nearly-optimal control strategies with the goal of achieving operational efficiencies as measured through relevant KPIs and

will be imbued with adaptive and re-configurability properties to respond to faults and atypical scenarios.

The BaaS system will be demonstrated in two buildings and will be validated as an Energy Conservation Measure with Energy-Services Companies as the end-user. End-user acceptance will be accomplished by analysing the replication potential in tandem with the results of a sensibility study.

URB-Grade

Anna Florea

URB-Grade defines the district as the basic unit into which cities are divided for the management and local control of services, the built environment, and the local infrastructure. In this context, common decision support platforms intended for design of sustainable retrofitting actions must provide a quantification and analysis infrastructure able to grasp the diversity of the district characteristics and information sources. The discussed approach builds on requirements arriving from the three usage phases of the platform and sees rule engines as core means to handle the required degree of customisation.

HeatMap

Mathias Fraaβ

A heatmap is a web based interactive graphic visualizing room temperatures in order to involve users in energy saving efforts. Heatmaps particularly aimed at poorly insulated buildings in which user-behaviour can lead to large amounts of wasted energy. This has been shown both by investigation and by practical experience of performance contractors. Fully developed heatmaps will be able to contribute to avoidance of energy waste in a way which can be easily adopted over a wide range and scale of buildings and may serve as a business model for commercialisation. Moreover heatmaps could deliver consolidated data for further evaluation such as new KPIs for waste profiles and waste potentials.

EPIC-HUB

Giammario Incao

EPIC-HUB aims to develop a new methodology, an extended architecture and services able to provide improved energy performance to neighbourhoods. By combining powerful Energy-Hub-based optimization capabilities with seamless integration of pre-existing and new ICT systems, EPIC-HUB will contribute to achieve the global objective of the energy-positive neighbourhood.

EPIC-HUB covers all the aspects directly or indirectly connected to efficient energy-based management, control and decision-support at neighbourhood-level. The project defines a fully-interoperable middleware solution able to provide integration and a structured vision of the overall infrastructure in a user-friendly way that is accessible to all stakeholders.

By exploiting the concept of Energy Hub, EPIC-HUB middleware will focus on energy usage optimization at neighbourhood level: EPIC-HUB will define a “neighbourhood-aware” e-trading platform that will improve energy efficiency and reduce energy cost, taking into account RES as well as the Electricity Distribution Grid.

The involvement of the neighbourhoods, operators, energy utilities and the local Public Authorities will allow EPIC-HUB to effectively tackle the development of innovative Business Models.

CASSANDRA

Vasiliki Moumtzi

CASSANDRA, pilot cases as a simulation of demand response programs in a large commercial centre and a multi-residential building for senior people

Project CASSANDRA develops an expandable software platform for modelling the demand side of a power system. Two out of the three pilots analyse and visualize energy data in the context of a large commercial centre and a multi-residential building for senior people.

Pilot case 1: Evaluation of CASSANDRA performance in consumption optimisation and feedback programs, as well as simulation of demand response programs in a large commercial centre in northern Italy.

Pilot case 2: Evaluation of CASSANDRA performance in feedback and demand response programs, identification and analysis of consumer social networks, as well as simulation of a multi-residential building for senior people at Luleå, Sweden.

AMBASSADOR

Izaskun Fernández

The purpose of the AMBASSADOR project is to study, develop and experiment with systems and tools that will aim at optimising the energy usage in the perimeter of a district by managing the energy flows, predicting and mastering energy consumption and energy production. The overall goal is to define and experiment with a system that optimises the cost of energy in a district, the cost being expressed in Primary Energy, CO_2 or €. The project will investigate energy efficiency both at a building level and at a district level. A number of mechanisms and technical systems will be studied both at buildings and district level for the creation of such a system.

MARIE Pilot Action 1.2 - Urban planning model for buildings energy renovation

Xavier Martí

The MARIE project aims to: design a methodology for the characterization of the energy performance of buildings within urban areas; structure and store the information, together with spatial data; and assign energy improvement measures through multi-criteria analysis. The methodology will be tested in four different pilot sites in Montenegro, Italy and Spain. Guidelines for its application will be elaborated at MED Space scale with the final goal being to conceive promotion opportunities and to define priorities for building energy renovation in the urban context. Currently, the URSOS and Generation tools are being used for building characterization and simulation of improvement measures in the four pilot sites.

BEAMS

José Javier García

BEAMS project's goals include the development of an open interoperability gateway based on OGEMA, an open software platform for energy management, and a facility management tool where advanced monitoring and control algorithms with learning capabilities will interact with the interoperable gateways.

The solution proposed will not only support the human operator of the facility to achieve higher efficiency in the use of energy, but it will also open new opportunities to third parties -such as Energy Service Companies (ESCO), utilities and grid operators– needing and willing to interact with BEAMS management system through the interoperability gateway in order to improve the quality and efficiency of the services provided, such as participation in the electric market or variable price tariffs, demand request response or active demand management.

The BEAMS approach could enable the development of new business models. It is for this reason that within SEMANCO workshop we will present the basic concepts and elements of BEAMS

architecture and the expected contributions to the definition of a holistic reference architecture and a set of data models and interfaces that could be applied to any facility.

Adapt4EE

Maria Eguaras Martínez

Adapt4EE: Occupant Aware, Intelligent and Adaptive Enterprises aims at augmenting the contemporary architectural envelope by incorporating business and occupancy related information to the early construction products, providing a holistic approach to the design and evaluation of the energy performance at an early stage and prior to their realisation.

During the first year of the project, the Pilot Sites have been modelled with the free software OpenStudio, firstly using the templates (schedules, occupation and loads) provided by the software and secondly using the data from the business processes as well as the information gathered in situ. The differences regarding the energy performance that have been found will be presented during the workshop.

SMARTKYE: Business decision support tool for Public authorities

Lola Alacreu García

SMARTKYE aims to develop a system for the future smart grid neighbourhood that will enable better business decisions to be made based on real-time fine-grained data. Target end-users are those public authorities that can monitor and manage key indicators in neighbourhoods with the goal of better energy efficiency and CO2 reduction.

To maximize the value and the impact of the project results, special attention will be paid to the business models and management strategies during the realization of the project, focusing on public authorities, but taking into account also in the requirements of other stakeholders (facility managers, DSOs, ESCOs, etc.).

EMPOWERING energy services

Mike Baker

April 2013 sees the kick-off of the EMPOWERING project, co-funded by the Intelligent Energy Europe Programme and led by CIMNE BEEGroup. The context of the project is the roll out of Smart Meters in the EU electricity market and the challenges this presents. The project will develop advance billing services for use by electricity companies so that they can provide their clients with more meaningful information about how they are using electricity and then test the response to these services. The ultimate aim of the project is to improve the company-client relationship and develop win-win situations for the provision of new energy services. The presentation will provide insight into the innovative aspects of the project.

E4R Presentation title - Energy Assessment tools for homeowners

Sergio Muñoz

The goal of the European project E4R is to encourage and promote the retrofitting of existing buildings in SUDOE Space through the design and development of an Energy Assessment Web Tool specifically for homeowners. This tool must be capable of quantifying the energy consumption of existing buildings and prioritizing different energy saving strategies. To achieve this, information from several sources (National Cadastre, Google Maps, Bing Maps) is used to create a 3D building model.

CIMNE's Vision of Energy Management

Mike Barker

CIMNE Building Energy and Environment group (BEEGroup) is currently participating in 9 EU co-funded, Research and Technical Development projects as well as 3 nationally funded research projects. In addition BEEGroup is involved in private consultancy contracts and development of the energy service company Inergy. This work includes a wide range of topics including social housing based energy improvements, urban scale energy modelling, advanced energy billing services and the promotion of near zero energy buildings. The purpose of the presentation is to explain the unifying vision driving this work. This vision is to contribute to making energy use in buildings more sustainable (socially, economically and environmentally), by making better energy management more affordable, more effective, more attractive and therefore more appealing.

Appendix 3: Workshop Programme

Throughout the proceedings, discussions will be supported dynamically by an online Lino post-it space and a live mind map to capture the proceedings and provide the basis for developing the Discussion Document. Further details of the application are at:

http://linoit.com/users/cennis108/canvases/SEMANCO%20Workshop

THURSDAY 11TH APRIL

8:00-8:30 Registration

8:30-9:00 Welcome and introduction to the workshop

- Introduction to the workshop objectives and programme

9:00-10:00 PROJECT PRESENTATIONS

Each project will give a five minute overview of their project aims, objectives and achievements to date.

SEMANCO (Leandro Madrazo), **BaaS** (Javier Martin), **URB-Grade** (Anna Florea), **HeatMap** (Prof. Dr. Mathias Fraa), **Epic Hub** (Giammario Incao), **Cassandra** (Vasiliki Moumtzi), **AMBASSADOR** (Dra. Izaskun Fernández), **MARIE** (Xavier Martí), **BEAMS** (José Javier García), **Adapt4EE** (María Eguaras), **SMARTKYE** (Lola Alacreu García), **CIMNE** (Mike Barker), **E4R project** (Sergio Muñoz).

10:00-10:15 Coffee break

THEMATIC LINE 1
ENERGY DATA FOR URBAN PLANNING: MULTIPLE REPRESENTATIONS OF ENERGY INFORMATION
Facilitator: Leandro Madrazo, ARC La Salle

Urban planners need comprehensive information from different realms in order to take informed decisions. Typically, they base their decisions on public (open data) and proprietary information from disparate sources (regulations, data portals, etc.), provided by different stakeholders (consumers, institutions, energy providers…). Integrated data environments which combine these different data would be helpful to understand the multidimensionality of the problems they are tackling, including energy efficient planning.

The data collected from different sources needs to be modelled in a way that can be later analysed and visualized according to the needs of different stakeholders.

Related topics:

- Combining different information sources.
- Sourcing energy data from consumers.
- Sourcing energy data in real time.
- Modelling energy demand side/smart grids.
- Energy performance indicators.
- Energy simulation.

10:15-11:45 Project presentations

11:45-13:00 Facilitated round-table discussions and conclusions

13:00- 14:00 Lunch break

THEMATIC LINE 2

INTERACTIVE INTERFACES OF ENERGY DATA VISUALIZATION AND THE PAN-EUROPEAN CONTEXT

Facilitator: Leandro Madrazo, ARC La Salle

14:00-15:30 Project presentations

The end user requires that data be presented in such a way that they can understand it and, furthermore, can make decisions based upon it. Additionally, the data will often need to be exported to other tools and be capable of undergoing further processing and review. The data needs to be presented to suit the local/national regulations being applied in different EU countries. Also, the data needs to suit the requirements of the different simulation and analysis tools used in each country.

In addition, the data needs to be presented in environments such as online geographic systems (Google Maps, GIS, Bing maps, OpenStreetMap, etc.), as well as in other visual representations which facilitate the understanding of the complexity of the relationships between datasets. This raises issues of appropriateness of data visualization, complementary visualizations (diagrams, tables, 3D models, etc.) and different data platforms (e.g. portable devices).

Related topics:

- Visualizing energy data.
- Cross-national energy data descriptions.
- Energy assessment.
- Developing tools and platforms.

15:30-15:45 Coffee break

15:45-17:00 Facilitated round-table discussions and conclusions

17:00 Wrap-up conclusions Theme 1 and 2

FRIDAY 12TH APRIL

9:00-10:00 Review of Day 1 incorporating online content and mind map.

10:00-10:15 Coffee break

THEMATIC LINE 3

DEVELOPING BUSINESS MODELS BASED ON NEW ENERGY SERVICES

Facilitators and speakers: Håkan Engman, Agency9 and Nashwan Dawood, University of Teesside

From the analysis of the energy related data, strategies for intervention can be derived and applied in different realms with the common purpose of reducing CO2 emissions. These functionalities can give rise to new services and their associated business models. The platforms which provide access to these services need to be effective in achieving real CO2 reductions they must be implementable in a competitive market environment. This requires an assessment to be undertaken to understand the potential value of tools to end users and their willingness to pay, as well as questions of the political value of tools for CO2 emissions reduction from the built environment.

Related topics:

- Strategies for CO2 reduction.
- Business models.

10:15-11:45 Project presentations

11:45-13:00 Facilitated round-table discussions and conclusions

13:00-15:00 Lunch at CosmoCaixa restaurant

15:00-17:00 Concluding remarks: towards a Discussion Document

In this final session, the summary mind map and discussion notes will used to facilitate a consensus view that will be the basis for compiling the Discussion Document from the workshop. By sharing experience we intend to produce a document that will be a valuable tool to address the current key issues for the analysis and visualisation of energy related data in the urban environment throughout Europe.

Appendix 4: Matrices of potential interaction between workshop participants.

Please follow the links below to the output matrices from the Workshop. The matrices are also available on the Workshop blog: http://semanco-visualization-workshop.blogspot.com.es/

1. Matrix of participants links to general Workshop issues
2. Matrix of participants links to specific Workshop issues

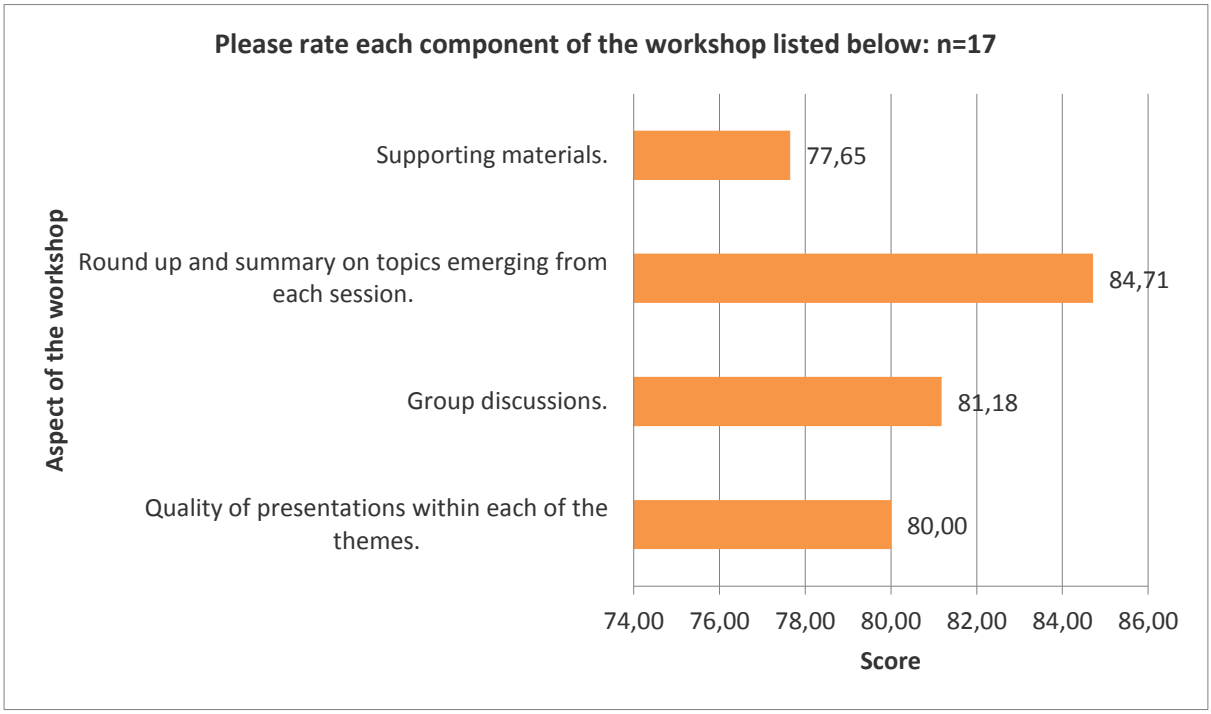
Appendix 5: Evaluation Report

Following the workshop, delegates were invited to provide feedback, the results of which are summarised below.

Overall components of the Workshop

When evaluating the charts, each response is assigned a score between 0 (minimum rating) and 100 (maximum rating). An average score is then presented to gauge the average rating amongst the sample.

For example, a score of 50 would be average, 75 fairly good, 100 excellent and 90; between fairly good and excellent.



Answer Options	Very Poor	Poor	Average	Good	Excellent	Rating Average
Quality of presentations within each of the themes.	0	0	2	13	2	80.00
Group discussions.	0	0	2	12	3	81.18
Round up and summary on topics emerging from each session.	0	0	3	7	7	84.71
Supporting materials.	0	0	5	9	3	77.65

Issues discussed during networking opportunities

The Workshop provided formal and informal opportunities to network. Qualitative responses below highlight the issues discussed during networking opportunities.

"Common knowledge by use of similar data representation among the different projects "

"The need to have the sync with other projects facilitated in a top down fashion by the Commission / policies encouraging such collaboration / regulations"

"Cooperation"

"Calculate and integrate the same KPIs, Project managers, Universities, other"

"KPIs"

"MODELING SCALE"

"Ontology engineering/ researchers/ Universities"

"User needs"

"Visualisation software, developer, private company"

"Availability and data representation"

"Ontologies; IT developers and researchers"

"About data availability with many projects that require individual real data consumption. My company collects this kind of data and offers it to the projects."

"Energy consumption"

"Business models / urban planners, project developers / research centre, public authority, business models vs. research results"

"What can be safely shared between projects without IPR or any other legal/privacy issues"

"Create an ontology for interoperability, software programmers, Universities"

"Ontology- different significances of the word"

"End-user requirements/project coordinators and managers/ companies"

"BIM and software Interoperability"

Visualizations; IT developers and researchers, and architect

"About the importance of waste. This was not in the programme, but at some point it was discussed that is important what goes in a building (energy, water, goods), but also important what goes out"

"energy supplier companies"

"Information model and semantics / Engineers, researcher / Universities and Engineering school user participation vs. automation"

"Visualization as a tool to understand complexity of data and its meaning for the user of the data"

"Data common repository, architect, electrical engineers, Universities and IT industries"

"Mapping"

"Opportunities for energy savings/urban planners and architects/ companies"

"Wireless Sensor Networks"

"Manuals: IT developers and researchers and architect"

"In a round table it was discussed the importance of using mobile technologies as the better way to communicate with people in general"

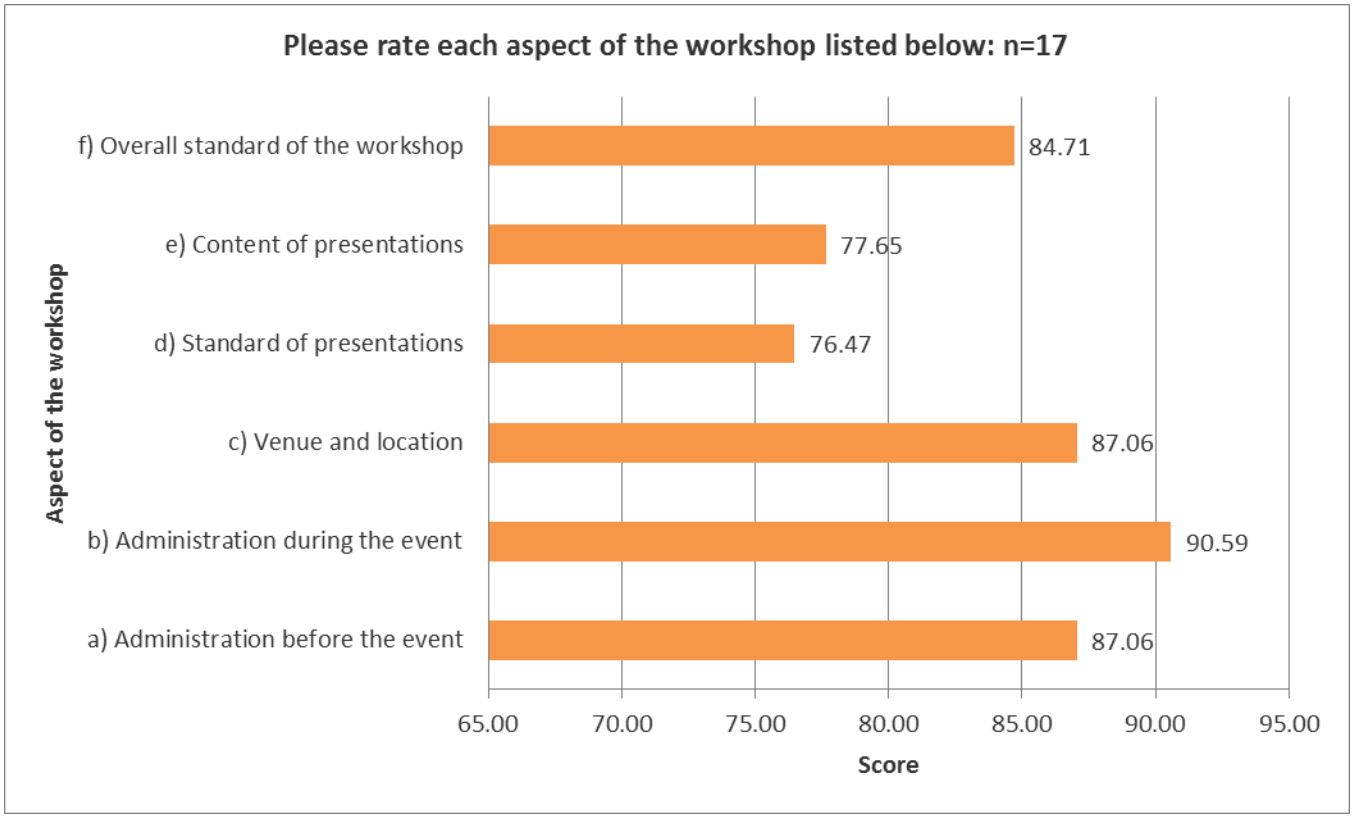
Level of knowledge regarding Framework 7 projects from the category 'ICT Systems for energy efficiency' before and after the workshop

The level of knowledge before the workshop (shown at the bottom of the graph) is lower than the level of knowledge after (shown at the top). The 'movement' between the knowledge before and after shows an increase from average to fairly good.

Answer Options	None	Limited	Average	Fairly Good	Excellent	Rating Average
Knowledge Before	1	8	5	2	1	52.94
Knowledge After	0	0	8	8	1	71.76

Overall Workshop ratings

Attendees were asked to rate various aspects of the workshop including, overall standard of the workshop, content of the presentations, standard of presentations, venue and location, administration during the event and administration before the event. The scores range from 'fairly good' to 'excellent'.



Answer Options	Very Poor	Poor	Average	Good	Excellent	Rating Average
a) Administration before the event	0	0	0	11	6	87.06
b) Administration during the event	0	0	1	6	10	90.59
c) Venue and location	0	0	0	11	6	87.06
d) Standard of presentations	0	0	3	14	0	76.47
e) Content of presentations	0	0	2	15	0	77.65
f) Overall standard of the workshop	0	0	1	11	5	84.71

Project of most interest to attendees

Attendees were asked which project was of most relevance and interest to them. The qualitative evidence below indicates a wide range of interest in various projects.

"For me the BEAMS project was of particular interest. They address both hardware and software issues and provide an open platform which could be used in further projects"

"SEMANCO, EPIC-HUB, SMARTKYE could build some bridges with Urb-Grade"

"I was more interested in those projects presented under the 1st thematic session: Energy data for urban planning: multiple representations of energy information"

"All of these projects seemed interesting, especially those which are in progress from a long time ago and presented outcomes. These outcomes in the future can be integrated/extended with the project

that I represented and come to a mature solution. These projects are the Semanco because develops the SEIF Framework that models the energy related knowledge that planners and decision makers need and the Beam project because focuses also to open new opportunities to third parties, such as ESCOs, utilities and Grid operators that are also part of our focus group"

"SMARTKYE, use of KPIs and modelling techniques. Beams - cross over with UK energy policy"

"The different approach of each project"

"SEMANCO - Integration of analytic tools, KPI composition, ontology engineering, SMARTKYE - End-user requirements, objectives, business models, AMBASSADOR - ontology design, BEAMS - energy performance assessment and project validation methodologies, BAAS - energy performance assessment and project validation methodologies"

"EPIC HUB, because of middleware development. URB-GRade, because of the usefulness of the platform"

"Interest all of them: Benefit: deeper knowledge"

"Project E4R. They presented a really good demonstration about how it works their platform, showing an interesting parts of the user interface"

"E4R -Energy Assessment tools for homeowners. I found very interesting, how this project reuses existing tools and data (National Cadaster) to create a powerful tool in different scales"

"Semanco, mainly because of the solution approach with special interest in the development of an ontology representing the energy efficiency domain as well as the tools for such a development and integration, that I hope it will be shared almost with the research community"

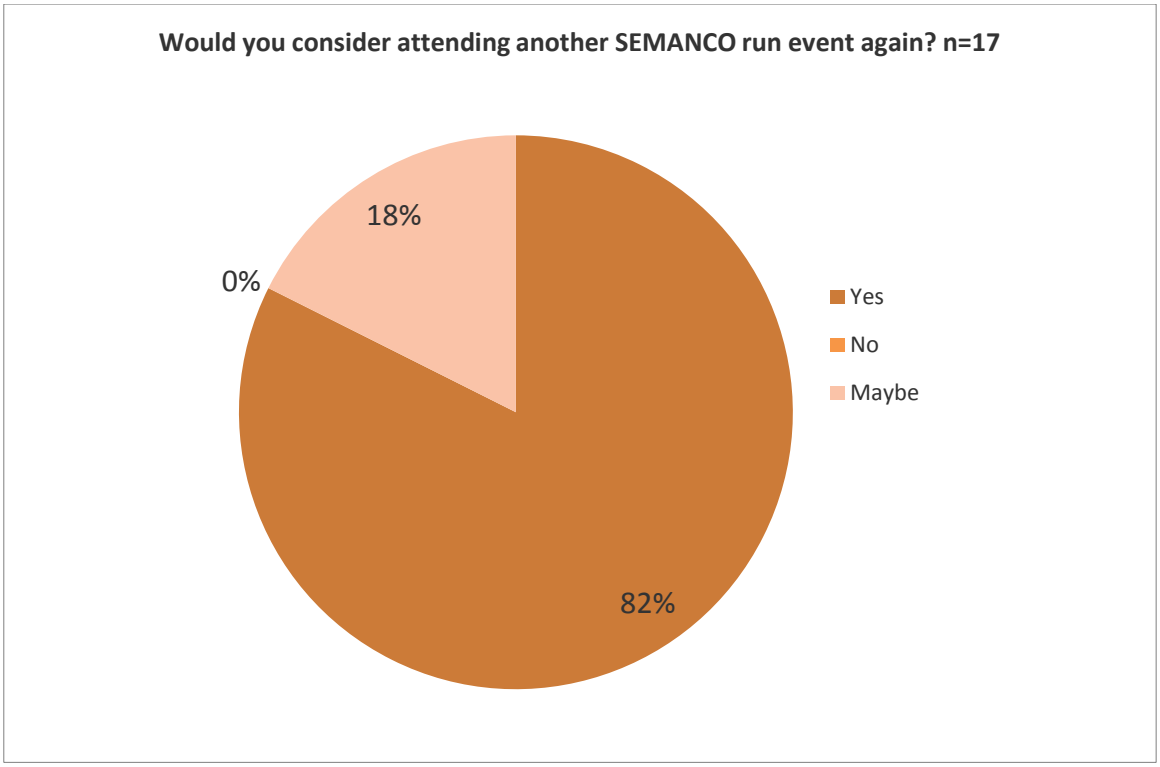
"In general terms, the ones dealing with energy consumption at building level (HeatMAPS, SmartKYE, Empowering ,...) because of personal affinity with the issue, and the ones that at some point run a simulation of Energy Efficiency of Buildings (E4R, Marie, ...) because of the importance of these different simulation with different results in the actual moment in Spain"

"E4R, agency9, Marie because I think they were the most interesting for my profession"

"SEMANCO Project: the semantic information framework is an important aspect for the work I'm performing in the context of EPIC-HUB project. The integration of different data sources and the related semantic integration are important."

Future events

The graph below shows that 82% attendees would consider attending another SEMANCO run event again. 18% answered 'maybe' to this question.



Attendees were asked if there was anything they felt should have been covered at the event that wasn't, most attendees replied 'no' to this question. The following comments were made:

"User's usability"

"Lifecycle buildings"

Attendees were also asked whether there were any topics or issues they wish to be addressed in future workshops. The following comments were made:

"Used respectively developed ontologies"

"Future collaboration options for Horizon 2020"

"More detailed work on visualisation of results"

"Less words, more views and demonstrations"

"Limitation of technologies to create tools"

"More project results"

"Trash and energy"

"Technical aspects on data sources integration and communication interfaces"

General comments relating to the workshop

Participants were provided the opportunity to make general comments on the Workshop and these are presented below.

"Very well prepared"

"Good content, good participation, good flexibility by the organisers to adapt to the flow"

"Group sessions could have benefitted from some more guidance and/or structure"

"I was quite impressed with the capacity to collect as many projects together in a single workshop"

"Clear objectives, perfect organization, dynamic, interdisciplinary"

"I really enjoyed the workshop working dynamics as well as the sharing and discussion of the common aspects of the different projects and initiatives"

"I´ve found it very interesting and informative"

"Valuable information and contact".