

Third periodic report (1.9.13-30.11.14)

Publishable summary

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The major achievements of the third period are:

- The completion of the SEMANCO integrated platform;
- The implementation of the second and third cycles of the demonstrations;
- The engagement of stakeholders in the technical development, exploitation planning and dissemination;
- The refinement and initial implementation of plans to exploit the assets arising from the project.

In parallel to the technical development activities to disseminate the projects findings continued to make the results of the project known to the research community, professional bodies and local community stakeholders. As a result, the methods and tools developed in the project are being applied to new areas beyond the three cases of study considered in the project.

1. SEMANCO integrated platform

The development of the integrated platform was completed during the third period of the SEMANCO project with the integration of the tools that utilise the semantic data provided by the Semantic Energy Information Framework (SEIF). The SEIF facilitates the interoperability between data from different domains, sources and applications, and between these combined data and the assessment, simulation and analysis tools that interoperate with it¹. A key component of the SEIF is the ontology developed in the project based on the existing standards and conventions of energy related data². The final version of the integrated platform enables users to:

- Develop urban energy models of cities and districts;
- Assess the current energy performance of buildings in those models;
- Develop new plans and protects to reduce urban energy demand
- Set a baseline against which to measure the potential of different plans and projects to reduce urban energy demand;
- Conduct a multi-criteria analysis of the proposed solutions to identify the one that fits their policy or organisational aims most closely.

The following energy assessment and analysis tools have been integrated in the platform:

- The SAP estimator and decision support tool (SAPMAP) based on a simplified standard assessment procedure for domestic energy usage. It provides assessments of the current state of domestic buildings and evaluates the costs and benefits of the possible interventions to improve their energy performance;
- The USiT improvement tool to simulate the energy performance of urban areas based on the URSOS simulation engine. It enables the calculations of the current energy performance of urban areas and the assessment of different measures to improve the energy performance of those areas.

¹ Keirstead and Shah have described an urban energy system as “The combined process of acquiring and using energy to satisfy the demands of a given urban area”. Keirstead, J., Shah, N. (editors) (2013). *Urban Energy Systems: An Integrated Approach*. Urban energy systems: an integrated approach. London: Routledge.

² Corrado, V., Ballarini, I., Madrazo, L., Nemirovski, G. Data structuring for the ontological modelling of urban energy systems: the experience of the SEMANCO project. *Sustainable Cities and Society* (in press).

- The Urban Energy Planning tool (UEP) and the Urban Energy Optimization tool (UEO) used for energy supply planning in urban areas. The UEP tool provides an assessment of energy demand and the UEO tool identifies the optimal combination of measures to achieve sustainable energy supply and energy savings.
- The Mine-On data mining and analysis tool which estimates missing energy data using data mining processes carried out using RapidMiner and RapidAnalytics technologies.
- A Multi Criteria Decision Tool that enables comparisons of different plans and projects to improve existing conditions of buildings and energy infrastructures in urban areas.

2. Demonstration scenarios

Three demonstration scenarios were carried out during the lifetime of the project. Their design and implementation has been closely intertwined to the technological development of the project. The objective of the first demonstration scenario –finalized in June 2013– was to deploy the use case methodology in the three case studies (Newcastle, Manresa and Copenhagen) pursuing a common objective in all cases: to calculate the energy consumption, CO₂ emissions, costs and /or socio-economic benefits of an urban plan for a new or existing development. The feedback provided by this first implementation helped to define the specifications of the integrated platform.

The second and third implementations of the demonstration scenarios were carried out during the third period. In the second iteration –completed in April 2014–, the purpose was to verify the functionalities of the prototype of the platform with regard to accessing data, effectiveness of the energy assessment tools and relevance of the energy performance indicators in each case study. A group of potential users were contacted and asked to carry out the activities defined within each demonstration scenario: to access information, to create urban projects and to evaluate their energy performance. Following the demonstrations, users and domain experts evaluated the platform in terms of its ability to provide useful and relevant information to tackle the targeted problems. Finally, based on the answers of the users and the evaluations of the experts, feedback to technological development was provided to indicate where the tools and the functionalities of the platform needed to be improved

The third and final implementation of the demonstration scenarios was carried out between May and November 2014. A total of 12 end users applied the final version of the integrated platform to perform a sequence of tasks similar to the previous implementation: creating an urban energy model, defining a baseline, analysing a baseline, creating new plans and projects, and evaluating and comparing projects. In addition usability tests were performed by end-users. The results of the usability test led to a final refinement of the user interface conducted in the final two months of the project activity.

3. Engaging stakeholders

During the third period of the project members of the SEMANCO consortium were involved in over forty events to engage stakeholders in the technical development exploitation planning and dissemination. These include events organised by the SEMANCO consortium and active participation in specialized conferences organised by the wider academic and business community. The latter included: *ICT Exhibition*, *SmartCityExpo*, *World Sustainable Building Conference*, *European Construction Technology Platform*, *Sustainable Places Conference* and *European Conference on Product and Process Modelling*.

A significant event organised by the SEMANCO consortium was a VoCamp entitled “Energy Data Models for Urban Planning” held at the School of Architecture and Engineering La Salle, Barcelona, on 13-14 February 2014. Thirty-three researchers participated in the workshop, representing five on-going European research projects: SEMANCO, Ready4SmartCities, NRG4Cast, COOPERaTE and Odysseus. Discussions at the meeting focused on the application of ontologies to integrate data from various domains and scales to improve energy efficiency in urban areas³. Participants in the VoCamp exchanged their experiences of ontology modelling. The topics discussed include the ontology modelling methods and tools used by participants, the relation of ontologies to existing standards such as IFC and CityGML, the creation of models to describe an urban environment and the integration of multiple scales in these models. The conclusions referred to the need to strengthen the use of standards, not only for the data but also for the ontologies; the lack of resources to support the exchange of knowledge and resources among ontology developers; and the use of ontologies to

³ Madrazo, L., Sicilia, Á. (eds.) (2014) SEMANCO Deliverable 4.6 *VoCamp “Energy Data Models for Urban Planning”*. Retrieved 29.1.15 at http://www.semanco-project.eu/index_htm_files/SEMANCO_D4.6_20140603.pdf

support the creation of urban models that take into consideration both, the physical infrastructures and the activities that take place within the urban areas.

Other significant events organised by the SEMANCO team include three stakeholder workshops held in the three cases study areas (Newcastle Copenhagen and Manresa) with professionals and policy makers involved in urban planning. In total one hundred and thirty people attended the three events from companies, local authorities, universities and charities. The workshops featured presentations in the area of energy efficiency from keynote speakers in addition to presentations of the results of the SEMANCO project and facilitated discussion groups. The events were highly valuable in terms of disseminating the results of the SEMANCO project and gaining feedback from participants regarding the utility of the project final outputs.⁴ Feedback from participants was gathered during the discussion groups and through the use of a questionnaire. A total of 61 questionnaires were collected (18 in Newcastle, 19 in Copenhagen, and 24 in Manresa).

In addition to the taking part in more than forty dissemination events in the third period of the project partners in the SEMANCO consortium published a total of eighteen articles in academic journals conference proceedings and the trade magazines This includes an article summarising the work on ontology modelling and standard energy data accepted for publication in the *Sustainable Cities and Society* Journal.

Stakeholders were also intimately involved in the development of the business approach and exploitation planning with over fifty professionals taking part in the interviews conducted as part of the business modelling development. The findings from this work suggested that the consortium should develop an Energy Services portal to promote the SEMANCO platform and provide potential customers access to the tools on the platform.

4. Exploitation strategies

A first version of the plans to exploit the project outputs was produced in the second year. In the final period of the project these plans were refined with considerable efforts being focused on the business planning and initial steps were taken to implement the exploitation plan. This work included

- Identifying customers that might be interested in using the SEMANCO platform which include Municipalities, Energy companies, Property management companies, Technology companies, Sustainability consultancies, Professional institutions, Research organisations and Charity/community groups.
- Defining the final set of individual assets produced during the SEMANCO project. The combination of all of these assets is the SEMANCO integrated platform.
- Defining the IPR for each of the SEMANCO projects assets together with how they will be exploited beyond the lifetime of the SEMANCO project.

To retain both potential commercial exploitation and support future research work, the consortium decided to follow a twin pronged strategy. This involves considering the commercial exploitation of the SEMANCO integrated platform as a whole, while releasing many of the individual components of the platform as open source. It was agreed that the exploitation root for the SEMANCO integrated platform as a whole is via the EECITIES energy services provider. Hence EECITIES web portal (www.eecities.com) was created to attract customers and enable SEMANCO partners to collaborate to provide answers to future customers' requests.

⁴ Carpenter, M. (ed.) (2014) SEMANCO Deliverable 7.5 *Project stakeholder dissemination events*. Retrieved 29.1.15 at http://www.semanco-project.eu/index_htm_files/SEMANCO_D7.5_20140630.pdf

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Energy efficient cities

SERVICE PLATFORM TO SUPPORT PLANNING OF ENERGY EFFICIENT CITIES

Eecities is an energy service platform that supports planners, energy consultants, policy makers and other stakeholders in the process of taking decisions aimed at improving the energy efficiency of urban areas. The services provided are based on the integration of available energy related data from multiple sources such as geographic information, cadastre, economic indicators, and consumption, among others. The integrated data is analysed using assessment and simulation tools that are specifically adapted to the needs of each case.

Technologies

EECITIES brings you technologies for make your city better in terms of energy performance. Build urban energy models of your urban area visualizing a navigable 3D model of your buildings and infrastructures. Assess the energy performance of your buildings with a diverse set of tools. Bring your data and compare with the EECITIES technologies for making informed decisions with regard the energy performance of your city.

- 3d model of a city
- Urban energy planning
- Energy assessment of buildings
- Cluster analysis
- Multi-criteria decision making
- Data mining analysis

Applications

Refurbishing the old city

Large property owners, like public authorities managing a wide stock of buildings use to have a limited yearly budget to spend in refurbishment actions.

Allocate budget for refurbishment actions within a grant line

Successfully design and plan a budget line that subsidize activities affecting the energy performance of buildings is not an easy task.

Evaluation of central vs. decentralised energy supply for a new urban area

Policy makers and urban developers are eager to find out how different energy supply strategies for an urban area will affect their climate goals.

Evaluation of different energy standards of buildings for a new urban area

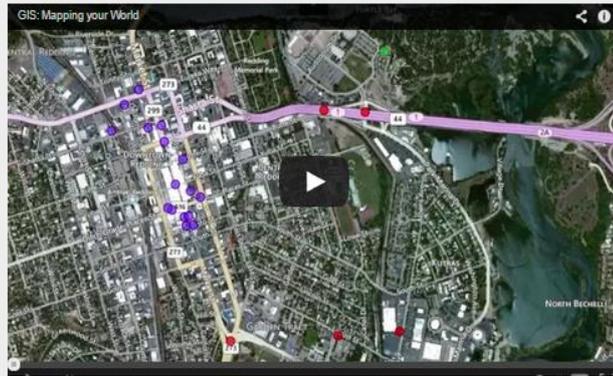
Policy makers, urban developers, architects and energy planners in new urban develop projects often discuss how energy efficient new buildings should be.

Evaluation of the energy performance of domestic dwellings in a specified neighbourhood

The social Housing Provier (Your Homes Newcastle) is required to improve the energy efficiency of their domestic housing stock, particularly those performing poorly.

Evaluation of three proposals to improve the energy efficiency rating of domestic dwellings in a specified area

Enhanced functionality of the eeCities platform enables the social landlord to consider three retrofitting proposals to improve the energy efficiency of the existing housing stock.



The effectiveness of the dissemination efforts and the initial steps taken towards implementing the exploitation plan is evidenced by the interest shown by external researchers and other stakeholders in the methods and tools developed in the project. This interest has led to the application of the SEMANCO integrated platform to new study cases in Barcelona and Torino. This suggests that there is a real potential to continue with the exploitation and further development of the SEMANCO technologies after the end of the project, under the umbrella of the EECITIES energy services provider.