SEMANCO Semantic Tools for Carbon Reduction in Urban Planning

SEMANCO

Deliverable 8.4
Implementation effectiveness

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DoW	Task 8.4 *Final report on implementation*. The outcomes of this task provide feedback on the work of WP2 to perform the verification of the impact of the platform. This task involves various stages: 1. Individual – analysis of each case study implementation; 2. Comparison between case studies – comparison of results and identification of common factors, differentiation and scope for learning in each of the case studies; 3. Comparison with other benchmarks and projects to verify wider applicability. Deliverable 8.4. *Implementation effectiveness*. Results of the third and last round of implementation and demonstrations. Providing the conclusions of the performance of the platform.					
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EXECUTIVE SUMMARY

Deliverable 8.1 *Implementation Plan* provided a detailed three phase implementation plan for the demonstrations undertaken as part of the SEMANCO project. These demonstrations are now completed in each of the three case study areas in Newcastle, Copenhagen and Manresa. The findings from phase one and two of the demonstrations are presented in Deliverable 8.2 *Implementation Success Indicators* and Deliverable 8.3 *Intermediate implementation report.* This report describes the third and final stage of the implementation plan for the demonstrations undertaken as part of Task 8.4 *Analysis and conclusions of the implementation.* This work involves the demonstration of the functionality added to the SEMANCO integrated platform undertaken as part of Task 5.6 *Integrated platform* and described in Deliverable 5.6 *Operative integrated platform.* The iterative approach applied to the implementation and demonstration of the SEMANCO integrated platform has enabled user feedback to inform the technical development undertaken during the project undertaken as part of work package 5.

The third and final phase of the demonstrations involved 12 participants using the platform to conduct a sequence of activities defined as meeting objectives relevant to energy efficient urban design in each of the case study areas. This sequence of tasks is similar to those followed in the first two phases of the demonstrations: creating an urban energy model, defining a baseline, analysing a baseline, creating new plans and projects, and evaluating and comparing projects. In addition, as part of Task 8.4, usability tests have been conducted by participants from each case study area. These tests were designed in Task 5.6 *Integrated platform* and described in Deliverable 5.6 *Operative integrated platform.*

The work presented in this report:

- Illustrates how user feedback from the previous phases of the demonstration have informed the technical development of the SEMANCO platform;

- Identifies when user feedback from the previous phases of demonstrations has been overlooked in the functionality of the latest version of the SEMANCO platform and why this is the case.

- Presents the findings from the usability tests conducted to assess the latest version of the SEMANCO platform in terms of navigation, predictability and intelligibility of the interfaces.

- Provides user feedback to inform a further refinement of the SEMANCO platform being undertaken to enhance its exploitation potential after the lifetime of the project.

In the final stage of the demonstrations users in all case studies were, in general, satisfied with the performance of the platform. However some users had problems performing some tasks. These problems largely arose from the following issues:

- Difficulties in distinguishing between an urban energy model, a plan and a project;

- Administrative IT security protocols related to Java which caused problems with the functioning of the platform;

- Some elements of the usability tests could not be completed due to issues with the functioning of the platform;

- Difficulties in understanding how to carry out specific tasks indicating that a 'user guide' is desirable to clarify how to conduct specific tasks.

The feedback from all three rounds of the demonstrations suggests that some additional functionalities are required to enhance the user's experiences when using the SEMANCO platform. These include tutorials and reference values as well as minor improvements to be refined in the final months of the project. These issues are currently being addressed in the final

review and enhancement of the platform prior to its public release via the EECITIES energy services web-portal. This customer-oriented product web-portal is being developed in Task 5.8 *Energy service platform web portal* and Task 7.6 *Contents of the energy service platform web portal*.

1 INTRODUCTION

1.1 Purpose and target group

The review and evaluation of the SEMANCO integrated platform followed an iterative process consisting of three phases of implementation and demonstration of the tools produced during the projects lifetime. This approach has enabled user feedback to inform the technical development undertaken during the project undertaken as part of work package 5. The demonstrations were conducted in Newcastle, Copenhagen and Manresa. Each phase of the demonstrations had a different purpose in accordance with the progress of the development of the SEMANCO integrated platform project at the time it was conducted.

Following each of the first two phases of demonstration, the platform was improved and updated according to the requirements expressed by domain experts and users during those demonstrations. Deliverable D8.2 *Implementation success,* describes the findings of the first phase of the implementation, these pointed to the need for the integration of calculation tools and the need to support calculating electricity consumption, CO_2 emissions, energy costs and solar energy production. Deliverable D8.3 *Intermediate report on implementation* describes the second phase of the implementation and identified the need for the refinement of urban energy indicators supported by the platform and user guides.

Finally, the third round of demonstrations was carried out in Task 8.4 *Analysis and conclusions of the implementations* with the following objectives:

- To check that the functionalities proposed by users in the previous rounds of demonstrations (Task 8.2 and Task 8.3) are successfully implemented in the current version of the platform.

- To perform usability tests to evaluate the platform in terms of navigation, predictability, layout and graphics.

- To provide user feedback to inform further fine-tuning of the SEMANCO platform.

1.2 Contribution of partners

FORUM, RAMBOLL, UoT, NEA and CIMNE contributed to the work presented in this report. FORUM RAMBOLL and the NEA were in charge of the implementation of the demonstration scenarios at each case study area and conducted the usability tests with end users. Special acknowledgement to UoT's contribution is highlighted for writing the executive summary and supporting the NEA in the work related to the UK case study. As leader of the task, CIMNE coordinated the production of this deliverable and the work presented in it. The internal reviews were conducted by POLITO and HAS. A proof-reading of an early version of the document has been performed by UoT and the final one by NEA..

1.3 Relations to other activities of the project

The findings presented in this deliverable will inform the development of D2.5 *Final verification*, in the sense that D8.4 provides the information to evaluate the platform in terms of its ability to support decision-making in the energy efficient urban planning domain.

The results of this final demonstration also contribute to making a final evaluation of the platform before it is made public through the energy service platform EECITIES. This will be developed in Tasks 5.8 *Energy service platform web portal* and Task 7.6 *Contents of the energy service platform web portal*. In particular, the activities performed during the demonstration will form the basis of many of the contents (videos, presentations and tutorials) which will be included in the energy service platform. Other supporting materials such as presentations and

tutorials will be developed based on the outcomes of this final round of demonstrations. They will include, among other items, user manuals describing how to use the calculation tools integrated in the platform.

1.4 Structure of the report

This report is structured as follows. Chapter 2 introduces the methodology adopted to evaluate the demonstration scenarios. Chapters 3, 4 and 5 describe the work carried out in the demonstration scenarios of Newcastle, Copenhagen and Manresa, respectively. Chapter 6 presents an evaluation of the performance of the platform from the point of view of users and domain experts according to the results obtained from the usability tests. It also includes the verification of the implementation of the recommendations to improve the platform derived from the previous demonstration rounds. Finally, the conclusions of the report are presented in chapter 7.

2 METHODOLOGY

Deliverable 8.1 *Implementation plan* (Cipriano et al, 2012) provided a detailed three phase implementation plan for the demonstrations undertaken as part of the SEMANCO project. These demonstrations are now completed in each of the three case study areas in Newcastle, Copenhagen and Manresa. The findings from phase one and two of the demonstrations are presented in Deliverable 8.2 *Implementation Success Indicators* (Gamboa et al., 2013) and Deliverable 8.3 *Intermediate implementation report* (Gamboa et al., 2014). This report describes the third and final stage of the implementation plan for the demonstrations undertaken as part of Task 8.4 *Analysis and conclusions of the implementation.* This work involves the demonstration and evaluation of the functionality added to the SEMANCO integrated platform as part of Task 5.6, which has been described in Deliverable 5.6 *Operative integrated platform* (Madrazo et al., 2014).

The iterative approach applied to the implementation and demonstration of the SEMANCO integrated platform throughout the project lifetime has enabled user feedback to inform every stage of the technical development undertaken as part of work package 5.

Following a similar strategy to that used in the previous two demonstration rounds, each partner in charge of the demonstrations has defined a sequence of activities required to fulfil some objectives which are relevant for energy efficient urban planning in each of the case study areas. The identification of problems is done by means of the use case methodology developed for the SEMANCO project (Madrazo, 2012).

While the details of the activities undertaken in the demonstrations in each case study differed, the same process –based on a methodology that is embedded in the integrated platform has been followed in all cases:

1. Creating an Urban Energy Model: Defining an urban energy model by naming and describing it, selecting the tools to be used and importing the data required to conduct the energy assessment of the urban area.

2. Defining a baseline: The baseline of the energy performance of buildings and target urban areas is calculated with the data and tools defined in the Urban Energy Model.

3. Analysing the baseline: Navigating through the 3D-map, applying filters to identify the buildings and urban areas with poor energy performance. This information allows the user to analyse the current situation.

4. Creating a new plan: To select the target urban area, i.e. a set of buildings, in which the user would create and evaluate urban energy efficient interventions.

5. Creating a new project: To define a set of improvements to the whole urban area or to a sub-set of buildings. Several projects can be created by changing the parameters of individual buildings or of groups of buildings.

6. Comparing projects: Projects are compared by using a multi-criteria data analysis tool (MCDA tool) using the set of multidimensional indicators defined in the project.

The demonstrations have been performed by domain experts. While these demonstrations were ongoing, detailed usability information was captured. The domain experts also checked whether the functionalities required from previous demonstration rounds have been implemented in the current version of the platform.

2.1 Usability tests

The purpose of the usability test is to evaluate the interactions of the end-users with the platform. The performance of the platform has been checked in terms of responsiveness and stability when the user performs different tasks. In concrete terms, the usability test evaluates the platform against the indicators of navigation, predictability, and the intelligibility of the interfaces.

Before performing the tests, a facilitator introduced the SEMANCO platform to the users by explaining the structure of the platform, the functionalities and the interaction with the interfaces by means of an example. The facilitator has also been present during the execution of the tests to measure the time spent in the realization of the tasks. Moreover, the facilitator decided, according to their prior knowledge of each user, how many scenarios a particular user could complete.

The usability test considers six possible scenarios based on the same sequence of activities presented in the introduction to this chapter. The tasks performed by the users are described in chapter 5.

After each usability test an evaluation form has been completed, which includes the information regarding:

- Time spent: an amount of minutes or seconds.

- Task completion: yes or no answer.

- Scores for each usability indicator: between 0 (worst) and 4 (best).

The usability indicator scores can be affected by issues such as slow loading, erratic behaviour of windows, incorrectly calculated values and unexpected log-offs. They are relevant in terms of visualisation and understanding any displayed information. Essentially, the platform should enable a non-technical user to take advantage of the system.

2.2 Functionalities required from previous demonstrations

As a result of the second round of demonstrations reported in D8.3 *Intermediate implementation report* the following improvements to the platform were requested by the users:

- A quick guide explaining the tools integrated in the platform. Regarding the MCDA tool, users had difficulties to understand the parameters of the tool (i.e. weights and thresholds). Also, concepts and elements of the platform such as the "max" check box and the ranking coefficient should be explained. An explanation of the parameters involved in the SAP Rating and Improvement tools is also needed. In the case of the UEP tool, the idea would be to make available the corresponding Excel spread sheet.
- A set of benchmarks and/or reference values are necessary to allow users to compare the results of the evaluations. (i.e. indicator scores)
- Demonstrations have been based on the simulation of some energy efficient improvements, such as insulation improvements, window replacement or changes in heating/cooling systems to improve the energy performance of buildings. This requires users to know how much they have to change the value of the corresponding parameters in order to simulate the energy efficient improvements. This applies to the Urban Energy Planning and the Urban Energy simulation tools (the SAP improvement tool has some predefined improvements already incorporated). Therefore, a guide with reference values regarding energy efficient improvements is required.

- Layers of urban space categories should be integrated into the platform: e.g. neighbourhood, district, city.
- Indicators should remain visible when the user moves up and down through different scale levels, e.g. from building to neighbourhood level.
- Differentiate between energy carriers and final energy uses when calculating indicators of energy use.

After completing the usability tests and with the information acquired during the demonstration, domain experts checked whether the above issues are already addressed in the platform. The results of this evaluation are presented in chapter 6.

3 DEMONSTRATION SCENARIO: NEWCASTLE UPON TYNE

3.1 Objectives

The main goal of the final and third round of demonstration in the Newcastle case study is to investigate the potential use of SEMANCO in order to evaluate several different proposals for refitting housing within Newcastle and to evaluate how effectively it does so.

The Domestic Housing work stream aims to address emissions from approximately 122.000 domestic properties in Newcastle, which contribute 34% of the CO_2 generated in the city. Following these requirements, the Local Authority NCC (Newcastle City Council) wants to know how to target current initiatives and resources to reduce fuel poverty and CO_2 emissions from existing privately rented and owner-occupied housing stock.

As part of the aims to deliver the Energy Master Plan for the city, NCC wants to prioritise resources against the worst performing areas of the city in relation to energy efficiency. An Energy Consultant has been contracted by NCC to provide three scenarios to improve low energy efficient dwellings in the Kenilworth Road area which is currently amongst the worst performing streets in Newcastle upon Tyne.

Against the policy context outlined above, the objective of NEA's demonstrations is to enable a focused group of users to engage with the visualisation of the SEMANCO platform. Each user was taken through the same scenario conducting simulated tasks and activities to gain insight into the functionalities and abilities of the platform. Feedback from users was recorded in written form and used to inform the content of this report.

Before each demonstration was conducted, each participant was provided with some preliminary context. The idea here was to focus the minds of the participants as to why the platform is put to use. Using this contextualisation ensured consistency across the three demonstrations. Each participant was provided with the following context:

*"A consultant conducted some research about the SEMANCO visualisation tool following a recent conference organised by National Energy Action (NEA) and decided to trial the tool to assist in the development of strategic energy plans. As part of the trial the consultant also attended a 1 day training course in order to learn about the various functionalities of the SEMANCO visualisation tool. With access to the tool and training in place, the consultant (user) working for NCC has been asked to consider three options for the Kenilworth Road area. The consultant has been using the SEMANCO visualisation tool for a period of time and has preloaded an **urban energy model** using secondary data obtained with the support of NCC. With the necessary tools and data in place, the consultant develops a **plan of** three **projects** aimed at dealing with the most energy inefficient dwellings in this low income area. The model, plan and projects will now be demonstrated to the client NCC step by step."* For the purposes of this demonstration the consultant will be referred to as 'the user'.

After introducing the context, the next steps would be to describe the demonstration scenario applied by the users or participants in the demonstration.

3.2 Users

The following users took part in the usability tests of the platform in the Newcastle case study.

Table 1. Users taking part of the Newcastle demonstration

User name	User profile	Institution/Organization
Giulia Privatera	Innovation Engineer	UK Power Networks
Craig Anderson	Engineer	Warm Wales
Michael Hamer	Technical Projects Manager	National Energy Action (NEA)

NEA used the following three representatives in its usability test of the SEMANCO platform:

Giulia Privatera is employed by UK Power Networks as an Innovation Engineer; Giulia's role includes projects focused on electricity demand reduction in the domestic setting. Giulia is currently working in partnership with NEA on a research programme to measure the potential for electricity demand reduction in the homes of the fuel poor.

Craig Anderson is the Chief Executive of an organisation called Warm Wales which has been set up using funding from the devolved administration to find and improve energy efficient dwellings in Wales. Craig has conducted a range of data modelling exercises aimed at locating and dealing with low levels of energy efficiency in the domestic setting.

Michael Hamer is NEA's Technical Projects Manager. Michael is responsible for a range of technical programmes designed to assess the applicability of new technologies to deal with fuel poverty in the domestic setting.

3.3 Demonstration

3.3.1 Step 1. Login

The user loads the SEMANCO visualisation platform (Figure 1). The user is aware that no functionalities are enabled at this point until the user logs into the account. No urban indicators or performance indicators are enabled at this point.
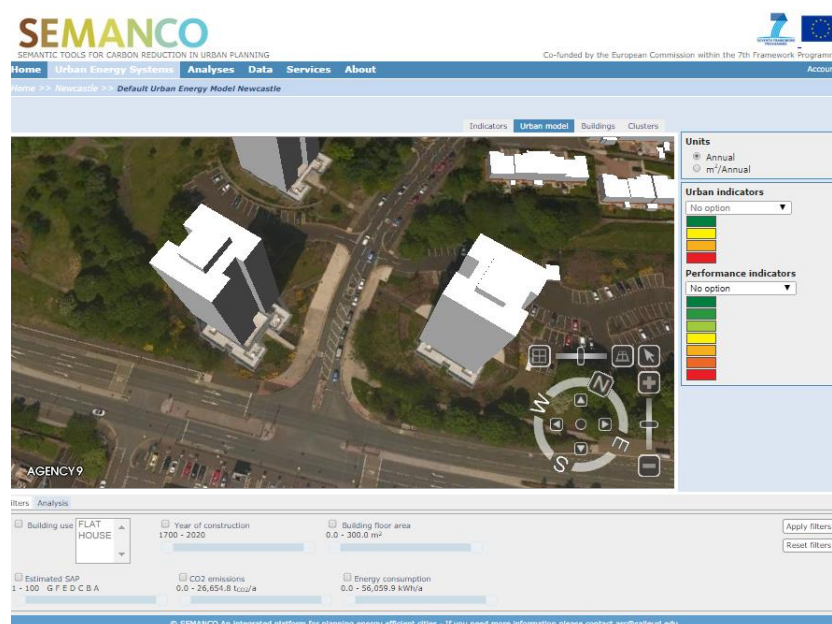

Figure 1. Public user is enabled to navigate in the platform without the functionalities activated

To activate functionalities within the platform, the consultant logs into the platform using a secure subscription password (Figure 2). The password is unique to the user offering secure access to the platform.
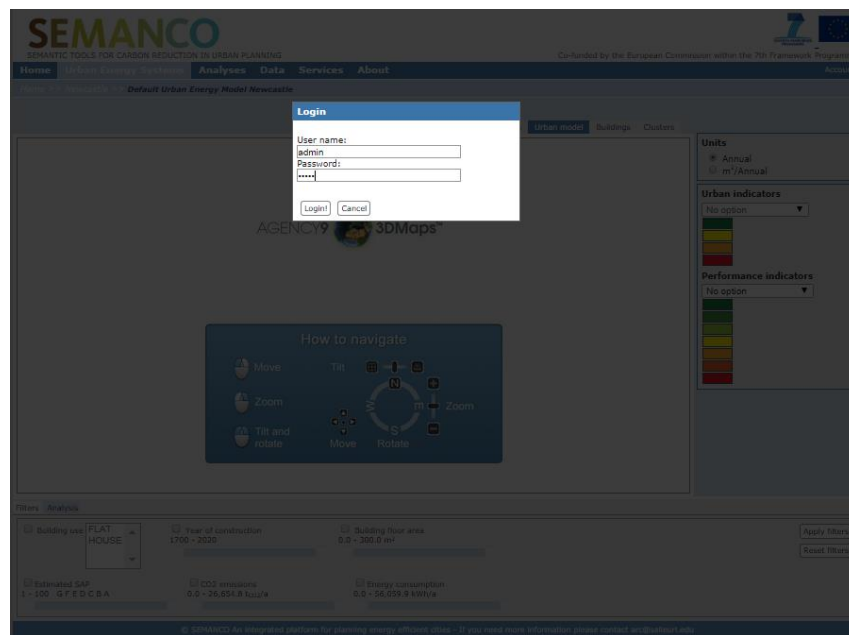
Figure 2. Introducing user's account data to log into the platform

The user is now logged into the platform and uses the navigational functions to pan out of the map. The user selects income score from the drop-down box, 'Urban Indicators' (Figure 3). The map turns various shades illustrating areas with the lowest levels of income. Using the colours illustrated on the map the user begins to visualise the areas illustrating high, medium and low levels of income.
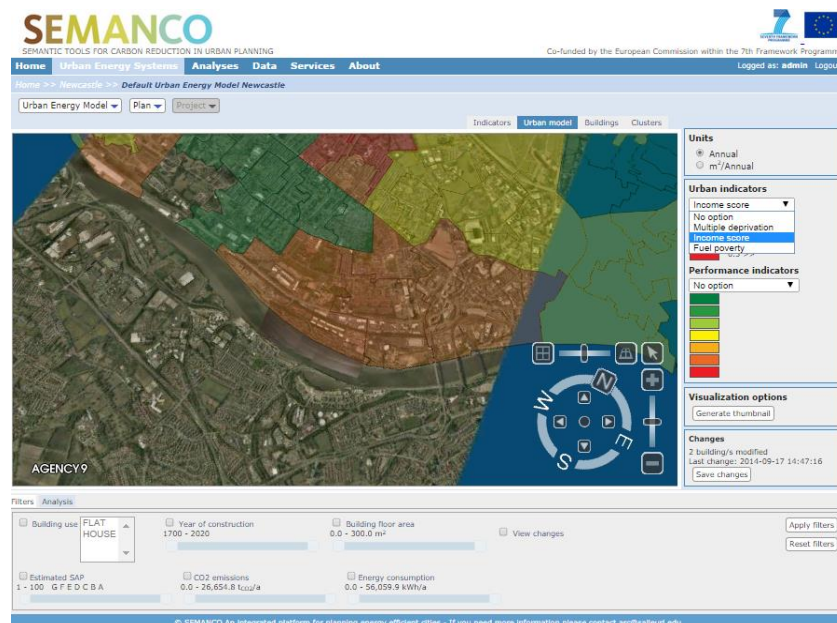

Figure 3. Once the user is logged, can select 'urban indicators' from the drop-down box.

The user zooms further into the model to focus on a particular neighbourhood illustrating low levels of income. With the neighbourhood identified the consultant selects 'Energy Consumption' from the performance indicator drop-down icon (Figure 4).

Figure 4. The user selects 'Energy consumption' indicator after identifying the target neighbourhood in the 3D model

3.3.2   Step 2. Selection of the target urban area

The user uses the drop-down Urban Energy Model menu to load an energy model developed prior to this demonstration (Figure 5).

Figure 5. Loading an existing Urban Energy Model

The user selects load from the drop-down menu and a series of urban energy models appears. A summary of each model and a supporting statistical summary is displayed (Figure 6). In this case the user selects 'Demonstration Urban Energy Model Newcastle'. Again the user has previously worked on this model and is re-accessing it to illustrate the results to his client.
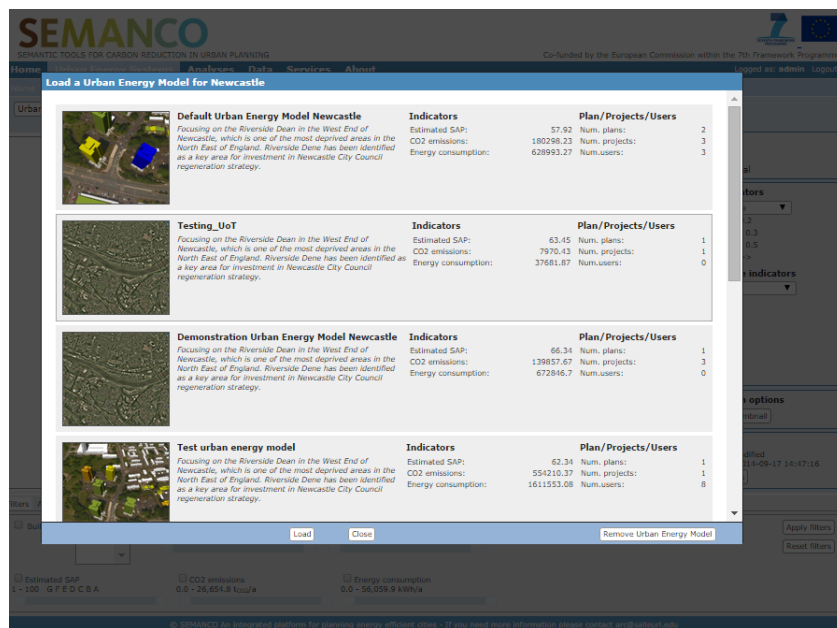
Figure 6. Selection of the 'Demostration Urban Model Newcastle' previously saved

The user moves along to the next tag in the SAP tool and can review the heating data aligned to the property (Figure 7). The shading illustrates pre-loaded SAP calculations for households in the neighbourhood. The user is interested in dwellings located on Kenilworth Road and can visualise the current energy performance of these dwellings using the map.

Figure 7. Visualisation of the baseline with the estimated SAP calculations

3.3.3 Step 3. Creation of a new plan and projects

To address some of the properties on Kenilworth Road, the user loads a plan by selecting the plan icon and load from the pop-up drop-down list (Figure 8).

Figure 8. Loading an existing plan

Once the plan has been selected from the drop-down menu a summary page pops up to show a pre-loaded plan previously developed by the user (Figure 9). The view shows a visualisation of the area in question, its name and key attributes aligned to it, including KPIs and Indicators (CO_2 and SAP rate). The view also illustrates the number of projects within the plan, in this case three and the number of users contributing to the plan.

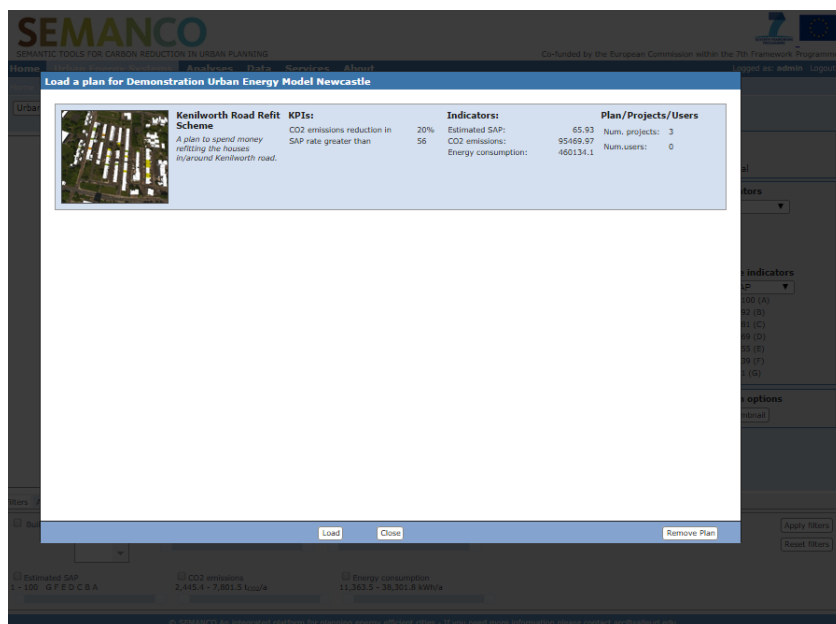
Figure 9. Selection of the Plan 'Kenilworth Road Refit Scheme' previously saved

The user is able to select the three projects within the plan by selecting the project then clicking on "Load" from the drop-down menu as illustrated in Figure 10.

Figure 10. Loading an existing Project.

Three projects for Kenilworth road have been developed by the user and are proposed for the area. The pop-up image illustrates the nature of each refit proposed and a summary of the indicators including estimated SAP if applied, CO_2 emissions and Energy Consumption (kWh). The user selects insulation-based refit simply by clicking on it and pressing load at the bottom of the screen (Figure 11).
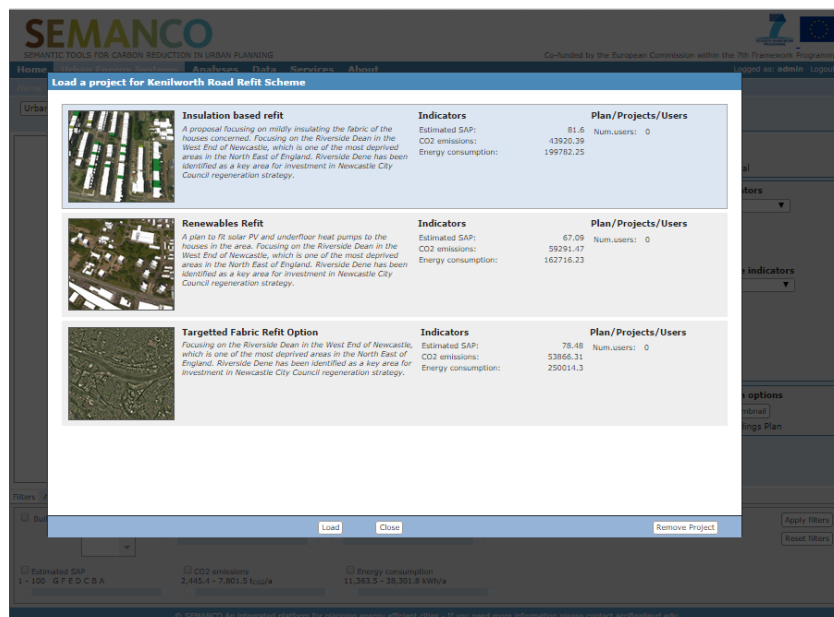
Figure 11. Selection of the Project 'Insulation-based refit' previously saved

The user has now selected an urban energy model, a plan within the model and a project. The view illustrates the results of the insulation-based retrofit project to the client. The user can see where they are within the visualisation platform and has the opportunity to switch between the plan (pre-intervention) and project (post-intervention) illustrating how the dwellings' SAP rate can be improved on Kenilworth Road (Figures 12, 13).

Figure 12. View of the Kenilworth Road - Pre intervention (plan)

Figure 13. View of the Kenilworth Road – Post intervention, insulation refit (project)

3.3.4   Step 4. Multi-criteria analysis

The user performs a multi-criteria analysis of the three projects proposed for Newcastle upon Tyne. Firstly the user goes to the drop-down menu under plan and selects 'Compare'; doing so launches the Multi-Criteria Data Analysis (MCDA) tool (Figure 14).

Figure 14. Launching the MCDA tool

The user is able to see the three retrofit programmes set out, an insulation-based refit, a renewable energy refit and a targeted fabric refit (Figure 15). The user can also see the baseline for the Kenilworth Road Refit Scheme, however this can be removed from the refits comparison by clicking on the scheme and removing it by clicking on the bin icon on the right hand side of the window.
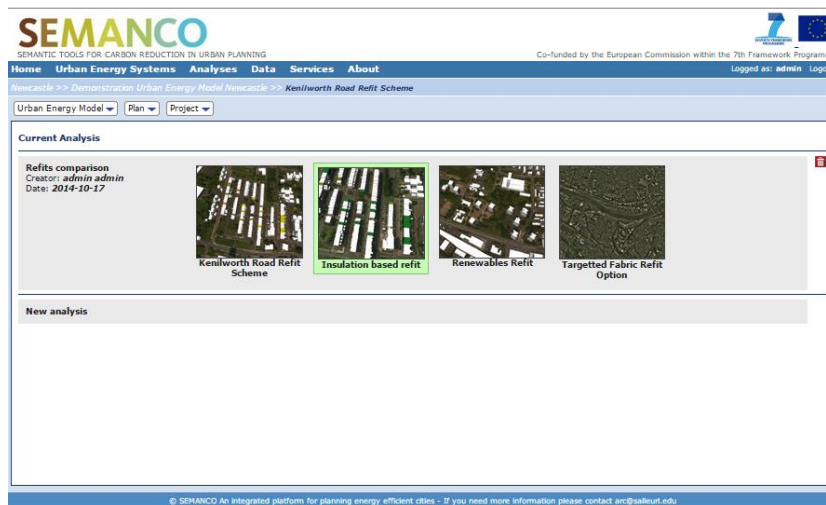

Figure 15. Selection of the Project 'Insulation based retrofit' previously saved

The user has removed the baseline Kenilworth Road Retrofit Scheme from the calculation and is now able to see the three refit comparisons set out in the MCDA tool. There is functionality to add another project to the calculation if the user wishes to do so.

The user is now able to see the three refit comparisons set out in the MCDA tool. The user can see a summary of each performance indicator, estimated SAP, CO_2 emissions and energy consumption (kWh). Using the unit measurements, the user can set weights and threshold measurements. Once the weights have been successfully entered the user can select the 'Perform multi-criteria analysis' menu (Figure 16).

Figure 16. MCDA tool and definition of parameters

Once the user 'Performs multi-criteria analysis' another sub screen pops up to summarise the results of the analysis (Figure 17). These are presented in ranked order one to three as illustrated below. The results are presented as a coefficient.

Figure 17. Results of the multi-criteria comparison by selecting one indicator option.

Using the multi-criteria analysis tool, the user can use the mouse to float over any of the options listed. In doing so a pop-up menu provides a summary of three performance indicators. The results presented on this screen enable the user to see that an 'Insulation-based retrofit' has been scored above targeted fabric upgrade and renewable energy refit. Using this screen the user can select each proposed option and see the score aligned to that option (Figure 18). Here the user is able to see how the options are ranked and scored against each other.
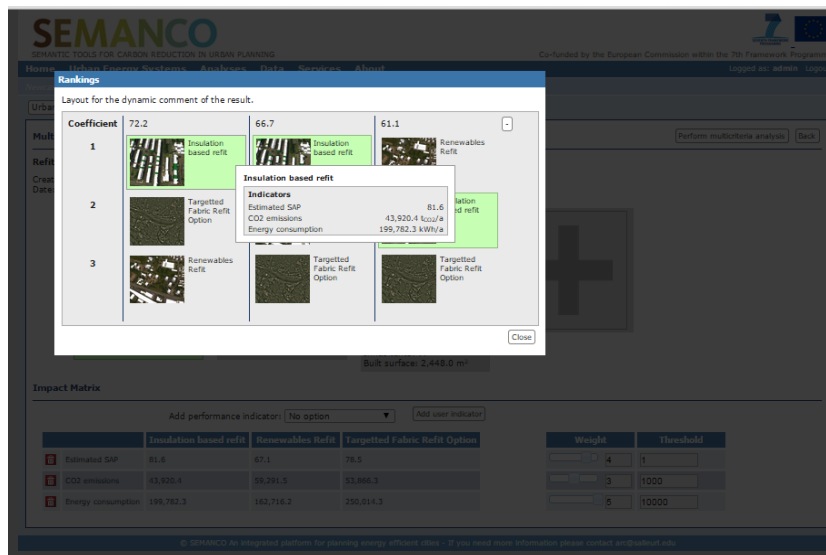
Figure 18. Results of the multi-criteria comparison by selecting three indicator options

3.4 Conclusions

The user has gone through the process of logging into the platform, using performance indicators to select target energy efficiency initiatives within a selected urban area. The user has created a project plan and finally performed a multi criteria analysis using three performance indicators.

Using the platform tools, the user has been able to meet the energy efficient urban planning objectives defined for this case, namely, to prioritise resources against the worst performing areas of the city in relation to energy efficiency. The improvement options were defined as an 'Insulation-based refit', a 'Targeted fabric refit option' and a 'Renewable energy refit'. The analysis was performed according to different indicator options:

- One Indicator: 'Estimated SAP'
- Three indicators: 'Estimated SAP', 'CO_2 Emissions' and 'Energy Consumption'.

The improvement of 'Insulation-based refit' was the best option under both comparisons.

The calculations with the SAP rating tool have been validated against evaluations carried out manually by sites visits. Those manual calculations were conducted by visits to properties by the social housing provider in the Newcastle case study area- Your Homes Newcastle (Mhalas et al, 2012).

The results of the multi-criteria assessment can be used in strategic planning reports to initiate investment in local housing stock. These results can be presented to representatives who have not had previous interaction with the SEMANCO tool such as local planning officers, strategic regeneration officers, councillors and consultants working in partnership with Newcastle City Council or Your Homes Newcastle. Senior representatives are likely to question the validity of the results emerging from the SEMANCO platform and are likely to test the validity using other urban energy models, tools or local intelligence which may include housing stock databases or secondary evaluations of retrofit programmes.

4 DEMONSTRATION SCENARIO: COPENHAGEN

4.1 Objectives

The objective for the third demonstration in the Copenhagen case study is to evaluate the capacity of the SEMANCO platform to support decision-making regarding energy supply in a greenfield planning situation. In the demonstration the user is encouraged to develop new scenarios in order to assess different strategies regarding supply of energy, based both on central and distributed solutions.

In order to assess the different supply strategies for the area, a combined use of the energy supply tool followed by scenarios evaluated in the multi-criteria tool are carried out. With the use of the energy supply tool the possibility to assess different strategies and strategic options are available with regard to selecting different solutions for all buildings already proposed in the new area.

The analysis is undertaken in order to assess which energy supply strategy would best suit different policy scenarios. An example of this would be a situation where local vs. centralised solutions for an area would be considered in terms of cost and/or climate mitigation effects. Also the energy supply would have very different economic aspects based on the energy consumption of the building and the buildings as a whole.

This demonstration scenario considers a user as being an urban planner from the Environmental Department of the Municipality. This user has been assigned the task of evaluating several potential new strategies currently being debated between representatives at the city hall. The user has been asked to evaluate them in order to quantify and inform the discussions among the politicians. The politicians are eager to find out how different supply strategies will affect their ambitions within climate policies and whether they should go for local supply or a central solution if they want to act in accordance with their previously established climate goals. Currently they are debating about the possibility to change their energy supply plan into one with heat pumps for one of the larger buildings in the new area.

It is the hope of the urban planner that the user will be able to use the SEMANCO tools in order to visualise the complexity and different scenarios, as well as provide a solid base of knowledge for the decision-making process among the politicians.

4.2 Users

The following users took part in the usability tests of the platform in the Copenhagen case study.

Table 2. Users taking part of the Copenhagen demonstration

User name	User profile	Institution/Organization
Jane Moustgaard	Engineer	Rambøll
Thomas Rønn	Energy Planner	Rambøll
Louise Rosenberg	Engineer	Rambøll
Martin Fogsgaard Nilsson	Energy Planner	Rambøll

Thomas Rønn is an energy planning specialist, and is working with energy master plans and strategies. Thomas has a good insight into the different aspects that exist in the field of energy planning in Denmark as well as in the UK. Key competences lie within data handling, production of heat maps and mapping of opportunities for district heating projects. With an

analytic approach, Thomas possesses fine skills in scenario and data modelling, business- and socio-economic assessments of energy projects and is also an experienced GIS user.

Jane Moustgaard is Master of Science from the Technical University of Denmark and also NLP Master and Project Manager at Ramboll Department for Energy and District Heating. This user works with strategic energy and heat planning for the district heating utilities and the public sector, and is project manager for renovation and extension work in the district heating areas. This user also works with other development plans for the district heating companies, and planning and analysis in the district heating sector and the public sector.

Louise Rosenberg is Master of Science from the Technical University of Denmark with good knowledge in the field of optimisation of energy and water-systems. Louise has a solid base of knowledge within sustainable production, urban planning, environmental economics and climate change. Furthermore Louise has experience with GIS using MapInfo.

Martin Fogsgaard Nilsson is an energy planning specialist, working with energy and climate mapping and strategies. Martin has a good insight into the different aspects of strategic energy planning, especially regarding holistic approaches to energy planning. Martin has developed good skills within spatial analysis, economic appraisal/assessment and socio-economic assessments. He is also an experienced GIS user.

4.3   Demonstration

4.3.1   Step 1. Login

First, the user selects the city in the home screen of the platform and logs in (Figure 19). Afterwards, the user selects an urban energy model for Copenhagen, and the baseline plan for the area in Copenhagen the user is working on.
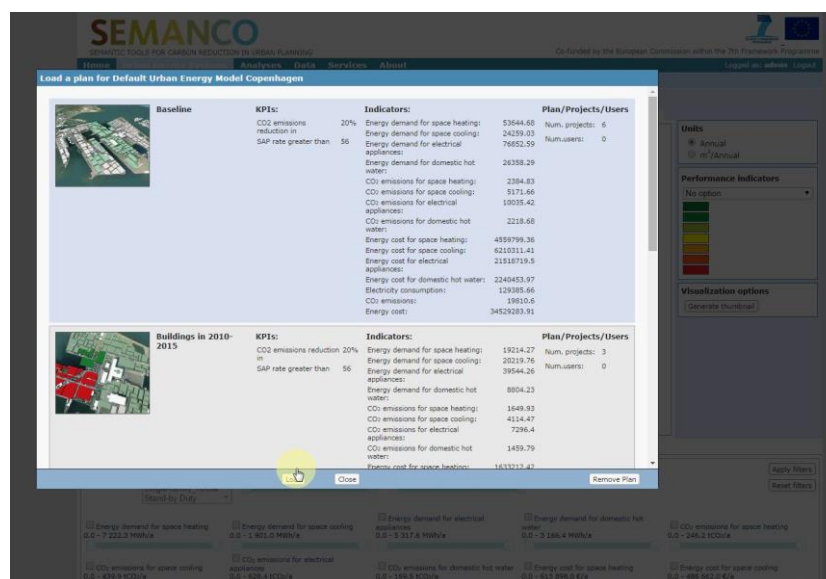
Figure 19. Loading and selection for the Model 'Baseline' previously saved

4.3.2   Step 2. Selection of the target urban area and creation of a new project

Once loaded, the 3D model provides an overview of the areas currently being debated by the city administrators. The user navigates around in the model and creates a new project within the plan. In order to simulate the effects on the energy system if the energy supply would be changed to a ground source heat pump for the building, the user creates a new plan. Then, the user evaluates the energy data for the technologies, and makes sure these are the same as the comparison in the other projects the user has already established with district heating as in the original plan. Finally, the user creates a project (Figure 20).
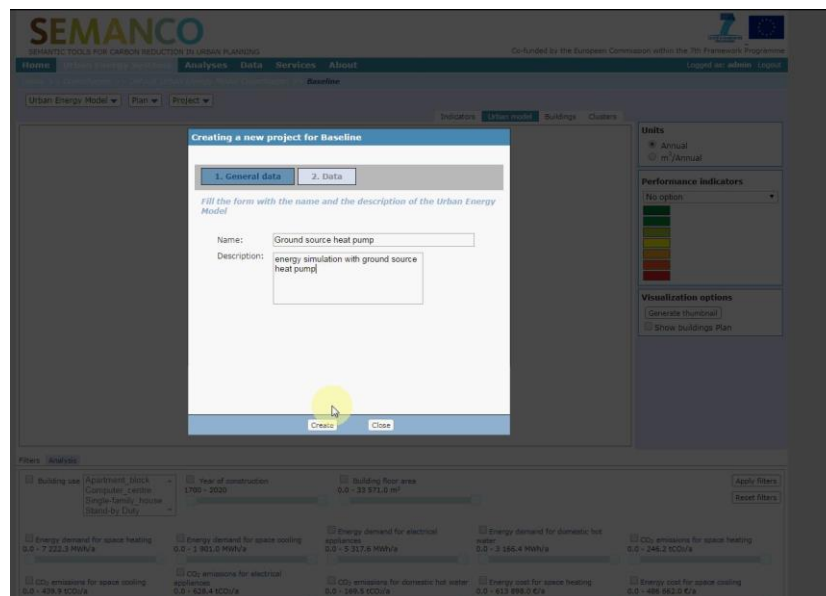
Figure 20. Defining a new Project for the baseline: 'Ground source heat pump'

Through the performance indicators for the energy consumption the user quickly singles out the building in question (Figure 21). The user is able to locate the building based on its higher energy consumption, illustrated by the red colour.
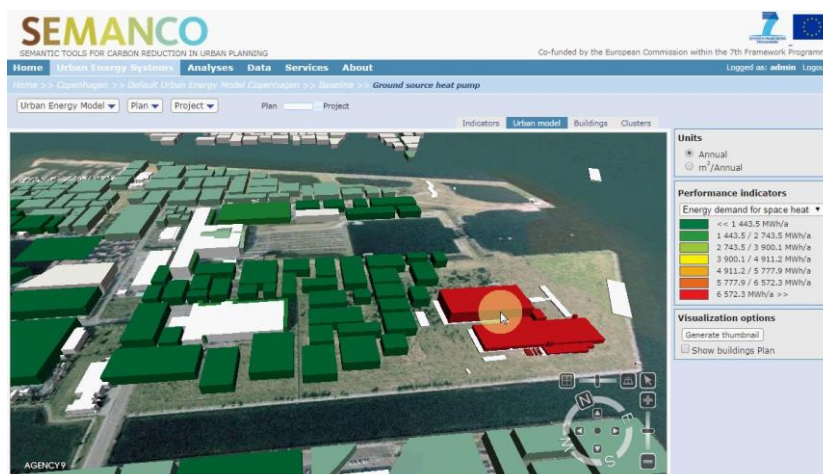
Figure 21. The user selects 'Energy demand for space heating' indicator and then identifies the highest energy consumer

In order to assess the proper impact of changing the energy supply, the user runs the Urban Energy Planning tool for a specific building in its new project (Figure 22). Hereby the user gets to manipulate a big amount of variables related to the specific energy production and consumption of the building. The user is only interested in what will happen if the supply is changed. Therefore, the user leaves the current data in the panes related to the consumption as is and moves to the panel related to the building's energy supply.

Since the municipal authorities can only have influence in the planning of the supply for heat, only the supply side of the heat source is chosen. The user finds the panel and changes the energy supply to match the heat pump option. Then, the user chooses the ground source heat pump as prefixed technology.
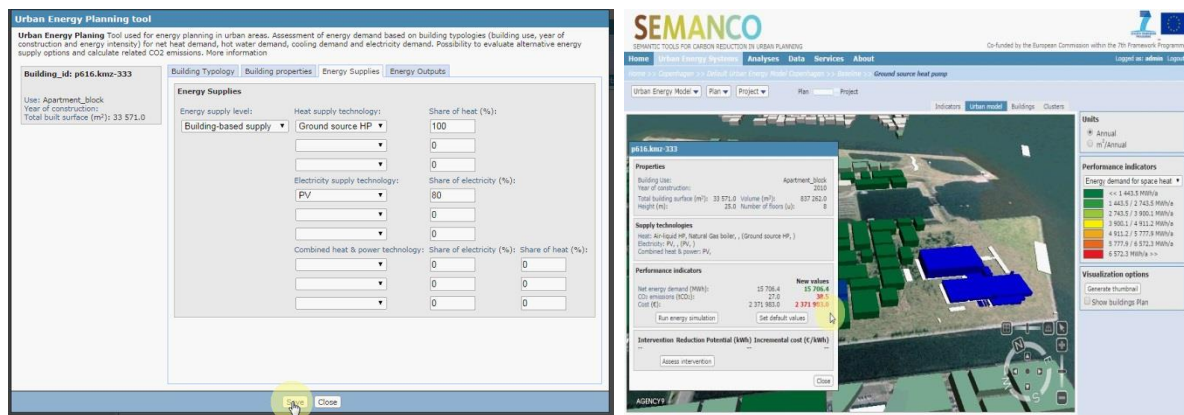
Figure 22. Changing technology and updating the previous calculations through the Urban Energy Planning tool

After changing the technology in the previous screen, the user saves the changes to the model to see the result. The user can now see that even though the energy cost and production has not increased, the level of annual CO_2 emissions related to the specific building has risen, due to the potential change in technology.

4.3.3   Step 3. Multi-criteria analysis

In order to assess the different projects, the user decides to make a multi-criteria analysis (Figure 23) selecting 'Compare'.
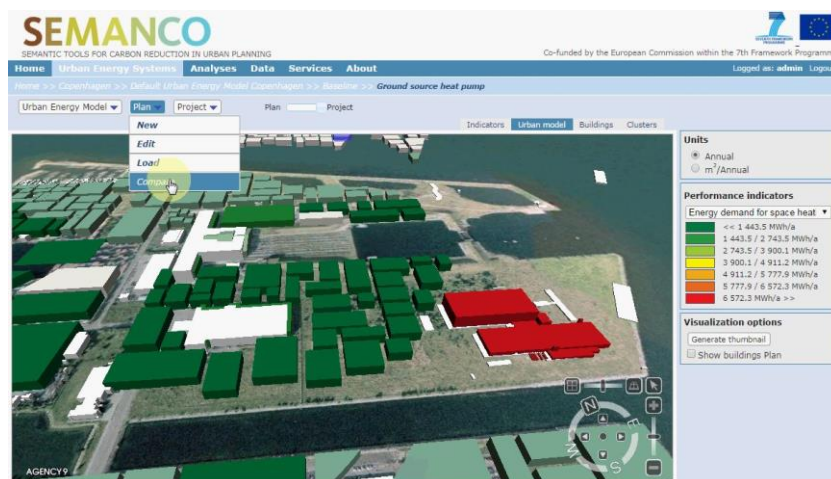
Figure 23. Launching the MCDA tool

The user selects and deselects the projects and plans that need to be compared in order to give the politicians the best base for comparison (Figure 24). Then the user sets the weights and thresholds to the values the user knows have been debated the most in order to address the concerns of the politicians. Once the user is satisfied with the set up for the comparison, the user runs de multi-criteria analysis by clicking on the right top button and the results come up almost instantaneously.
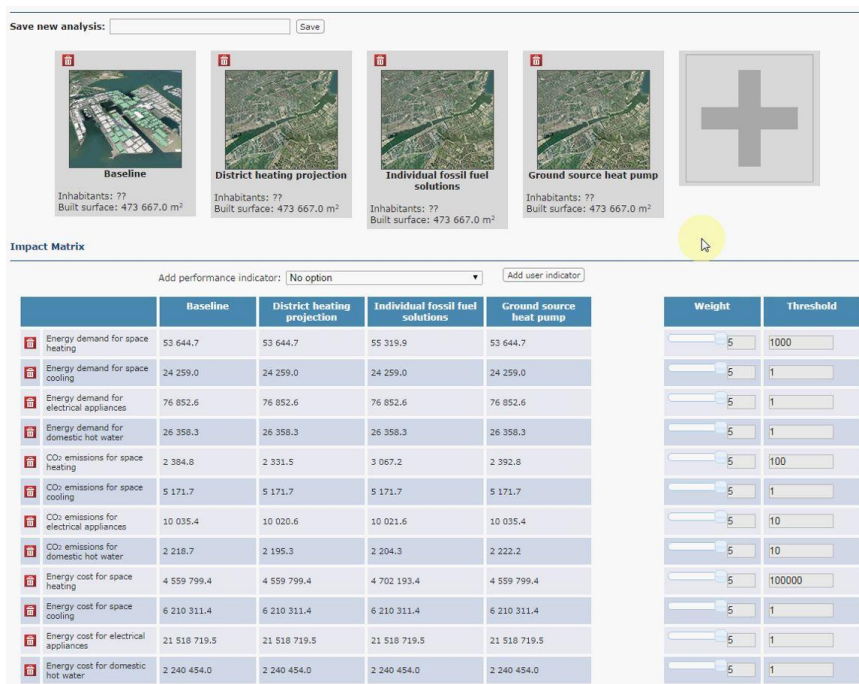
Figure 24. MCDA tool and definition of parameters

Interestingly enough the comparison shows the ground source heat pump to be a better solution than the baseline scenario, but not nearly as good as one of the previously established scenarios involving district heating (Figure 25).
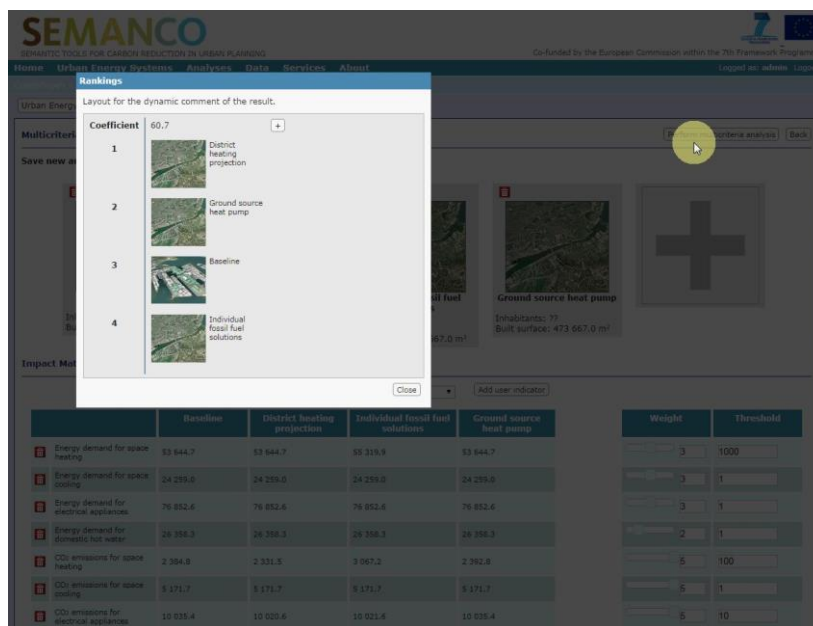
Figure 25. Results of the multi-criteria comparison by selecting one indicator option

The user knows that the comparison between district heating and individual solutions within energy supply is being debated. The user is pleased to find that most of the information for each scenario is available just by moving the cursor across the different scenarios (Figure 26).
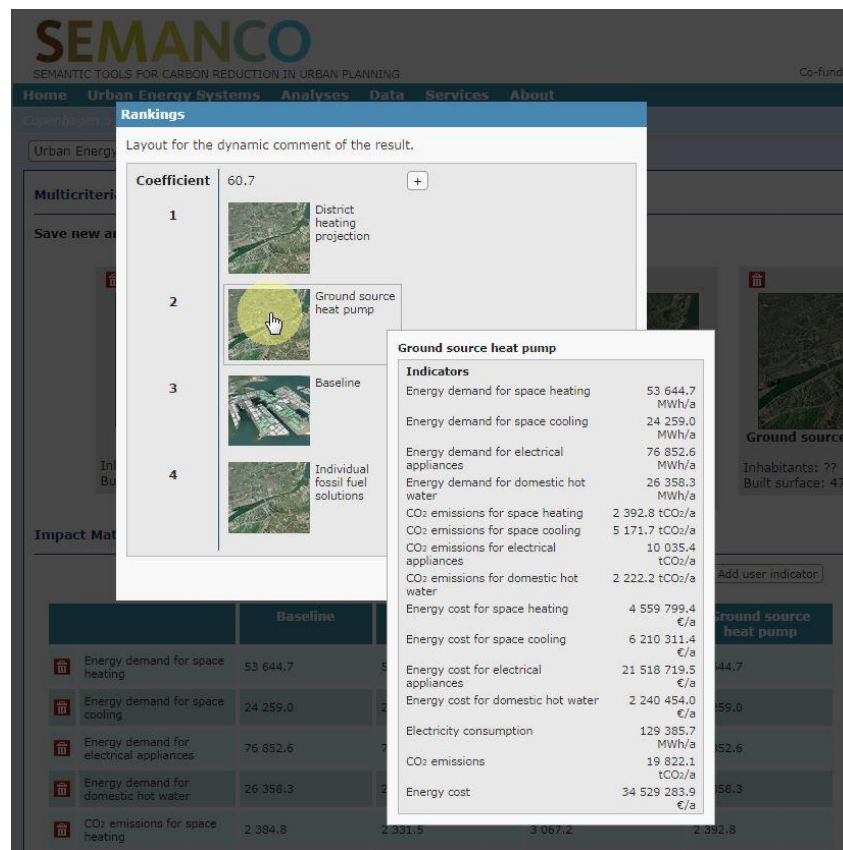
Figure 26. Detailed information provided from each scenario result

4.4   Conclusions

In this demonstration, the user has been able to deal with the following issues:

- Identifying a building with the highest energy consumption.
- Developing projects by changing the heating supply system in order to evaluate the effect on its heating demand.
- Comparing the improvement options (i.e. projects) with the MCDA tool, based on a set of predefined indicators.
- Analysing the results obtained from the multi-criteria comparison.

By performing these tasks, the user has been able to meet the energy efficient urban planning objectives defined for this case, namely, to assess which energy supply strategy would best suit different policy scenarios. That is, for example, compare solutions based on local vs. centralised heating systems considering costs and/or climate mitigation effects. The improvement options were defined as a 'District heating projection', 'Ground source heat pump', 'Baseline' and 'Individual fossil fuel solutions'. The comparison suggests that the 'District heating projection' is the best option in this case.

5 DEMONSTRATION SCENARIO: MANRESA

5.1 Objectives

The main goal of the final and third round of demonstration in the Manresa case study is to assess the energy performance of groups of buildings within an urban area. For this purpose, the users need to create an urban energy model that comprises the buildings within a neighbourhood.

In this demonstration scenario, the user profile corresponds to that of a professional without specialization, either in planning or urban energy performance of buildings. The users should verify whether the platform and its integrated tools provide the information they need. In addition, the users should be able to make a decision on how to obtain the best results when planning a budget to fund building refurbishments. Therefore, the user should propose different measures to improve a significant amount of buildings. The proposed refurbishment options will need to be compared under predefined indicators and the outcomes will be forwarded to the Environment Department to decide which is the best option to allocate the available funds.

In the demonstration, the user plans to evaluate the impact of the energy efficiency on the building by using the USiT simulating software tool integrated within the platform. Then, the user selects the target area by analysing the energy performance at the urban scale. Firstly, the user chooses the buildings with poorer performance and secondly, the user detects which is the poorest performance area at neighbourhood level.

5.2 Users

The following users took part by following the steps described in the demonstration and filling the usability tests of the platform in the Manresa case study.

Table 3. Users taking part of the Manresa demonstration

User name	User profile	Institution/Organization
Enric Massana	Architect	PIREEB
Gemma Cucurella	Industrial Engineer	e3ener
Jose Santos	Engineer	CIMNE
Joan Oliveras	Architect / Urban Planner	FORUM
Gonzalo Gamboa	Engineer	CIMNE

Enric Massana is an architect and Representative of the Catalan Association of Architects for the Bages-Berguedà region. Chief of the Building and Urban department of the SUMMA Engineering company (http://www.summa-eng.com). Founder of the Platform for the Promotion of Energy Efficient Building Refurbishment in the Bàges Region (PIREEB - Plataforma per l'Impuls de la Rehabilitacio Energètica d'Edificis al Bages)

Gemma Cucurella is an industrial engineer and Founder of e3ener, an Energy Services company (http://www.e3ener.com). This company is a member of the Group of Energy Managers (Grup de Gestors Energètics http://www.gge.es), Cluster of Energy Efficiency of Catalonia (Clúster de l'Eficiència Energètica de Catalunya http://www.clustereficiencia.cat), Efficiency Evaluation Certification (http://www.evo-world.org). She is a specialist in the field of industrial energy efficiency, recognized by the quality label CMVP (Certified Measurement & Verification Professional).

Jose Santos is an experienced engineer working as a researcher in urban planning at CIMNE. He has been involved in several European projects in the field of energy efficient urban planning and the implementation of the Covenant of Mayors.

Joan Oliveras is an architect that has worked in several refurbishment projects developed by the public housing company of Manresa. He represents FORUM in the SEMANCO consortium.

Gonzalo Gamboa is a mechanical engineer with experience in energy and urban metabolism related issues. He represents CIMNE in the SEMANCO consortium.

5.3 Demonstration

5.3.1 Step 1. Login

Firstly, the user selects the city of Manresa from the main screen and secondly, logs in the platform. Afterwards, the user selects a specific Urban Energy Model which will set the rules to perform the evaluation. In this case, the user selects an already existing UEM based on the USiT tool with a pre-calculated baseline of the current city performance (Figure 27).

Figure 27. Login to the platform and load an existing Urban Energy Model

5.3.2 Step 2. Selection of the target urban area

The user is able to zoom out in the 3D model view to activate the urban scale indicators (Figure 28). The user wants to see which of two neighbourhoods have more energy demand and then more consumption. To do this, the user can choose the corresponding indicator from the drop-down list until reaching a good view of the city and coloured according to the proper indicator. Afterwards, the user notices that the poorest energy performance areas are "Barri Antic" and "Vic Remei" which are corresponding to the neighbourhoods with the oldest buildings in the city.

Figure 28. Selecting the target area: Neighbourhood approach level

The values are appearing within panes by clicking over each of them, and the user zooms in the "Barri Antic" until achieving a building level view and then, the user again chooses the "Energy demand" indicator from the list on the right (Figure 29). To help the user in grouping the buildings with poor performance, the user makes use of the filtering options to remove the good ones from the selection. It creates a better view to detect where the worst buildings are concentrated. Then, the user detects a highly coloured spot, and so, the user can decide which group of buildings is the best and are to be targeted for potential refits.

Figure 29. Selecting the target area: Building approach level

5.3.3 Step 3. Creation of a new plan and projects

When the user creates a new plan, a name, a description is required first (Figure 30). The following step is to select the group of buildings which were previously detected as suitable for potential refits in the area, and add these into the plan one by one. Once this is done, the user ticks the box 'Show buildings in the plan', zooms out and observes that the chosen area contains around ninety buildings. The user knows that the platform can evaluate a large amount of buildings at the same time and could add more, but the user refrains to do so after considering the amount of time necessary to perform the calculations of a large set of buildings.
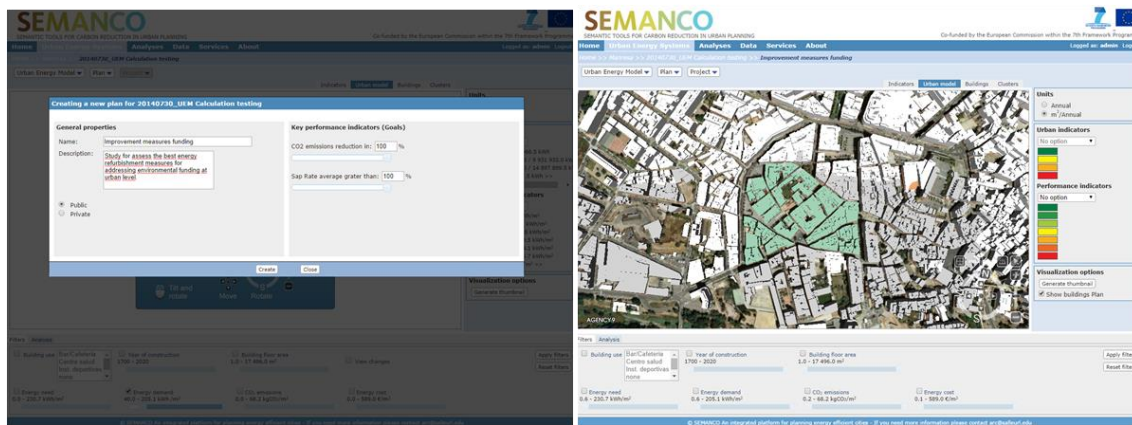
Figure 30. Creating a new plan from a previously selected target area

Historically, the funding action lines have been those dedicated to replace windows and boilers. Therefore, the user creates projects oriented to those action lines. In this sense, the user creates one project to simulate a potential change of glazing and frames for all the windows in the area, and another project to simulate replacing the existing boilers with more efficient models (Figure 31). As the user does not have a specialized background in energy performance evaluation, the 'Improvement' tool enables the user to select options from a drop-down list with just three simple steps. After seeing the results of these changes, the user tries something new. Then, the user has noticed that energy demand is very high, so the user considers that funding the installation of solar panels could be a good investment. Thus, the user creates a new project with this purpose.
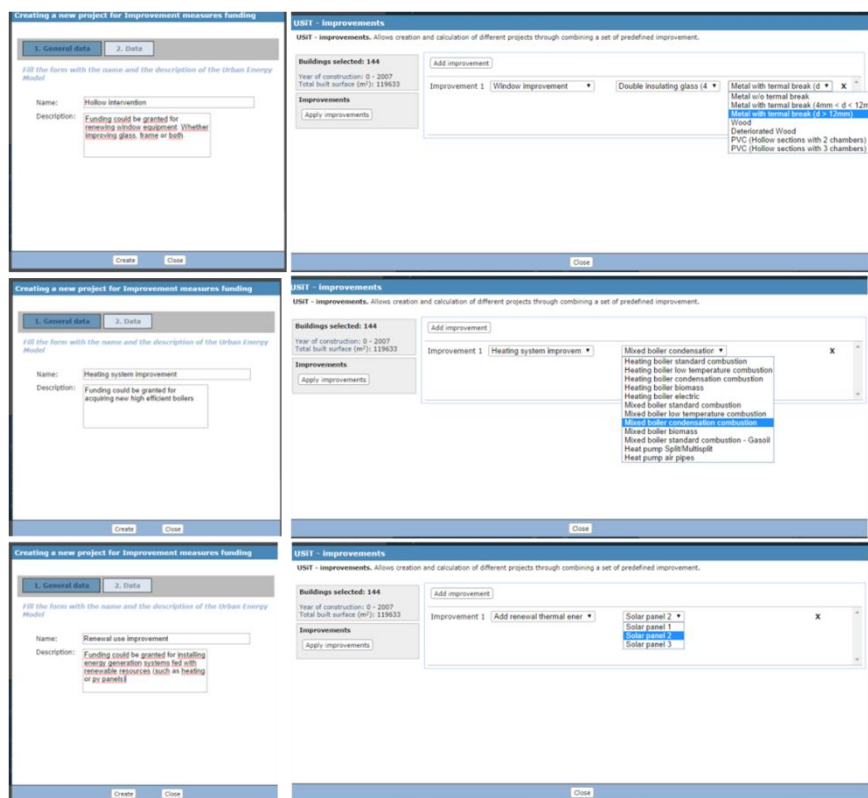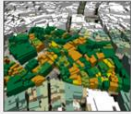
Figure 31. Creating a new project by using the improvement tool

After creating and calculating the different alternative projects, the user observes that it is difficult to make a decision based only on the figures. The user cannot easily decide which project has a better behaviour under a specific set of indicators (Figure 32). To solve this, the user chooses to compare different projects by using the MCDA tool.

Figure 32. Loading the project 'Hollow Intervention' previously saved

5.3.4   Step 4. Multi-criteria analysis

The user moves to the comparison tool. Before creating and saving the multi-criteria analysis, the user discards the baseline which the platform initially includes in every comparison by default. Then the user enters the name 'Analysis 1' and fills the parameters for each of the energy performance indicators which are significant for the analysis. The user sets both the weight and threshold of each indicator by considering the CO_2 emissions as the most important one. The user has done this due to the relevance that the Covenant of Mayors gives to this indicator.

Moreover, the user has also added a 'User defined indicator' with the name 'Foreseen funding amount' (Figure 33). The user sets the values of this indicator based on the experience gained in previous years seeking funds to foster building refurbishments. Thanks to this experience, the user knows which options would be more attractive to investors among the projects being compared.

Figure 33. MCDA tool and definition of parameters

When the user is satisfied with the input data for comparison, the user runs the MCDA tool by clicking on the right top button, and the results come up almost instantaneously (Figure 34). These results show the refitting of boilers as the most effective option to fight against the CO_2 emissions.
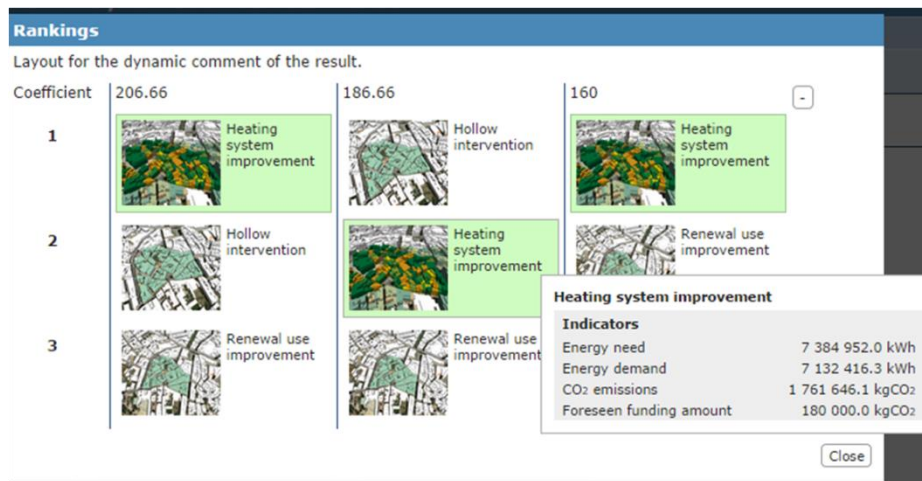
Figure 34. Results of the multi-criteria comparison by selecting three indicator options

At this point, the user wishes to see how the rankings of the various options changes instead of focusing on reducing CO_2 emissions (Figure 35). This is done by reducing energy demand. To simulate this new option, the user removes all other indicators except the energy demand. Since there is only one indicator to be compared there is no need to adjust weights or thresholds.

The results show that upgrading the windows is the most effective intervention to reduce energy demand. The user is now more satisfied with the solution, because passive measures are better for the environment in the long term.

Figure 35 Results of the multi-criteria comparison by selecting one indicator option

At the end, the user saves both analyses, prints some figures and takes some screenshots of the results to provide evidences to support the final decision to be taken by the municipal authorities.

As a final test, the user goes back to the beginning of the demonstration and compares the CO_2 emissions values from the baseline against the project "Heating system improvement". By

doing so, the user confirms that adopting these measures would result in a 10% reduction of CO_2 with regard to the existing baseline (Figure 36).
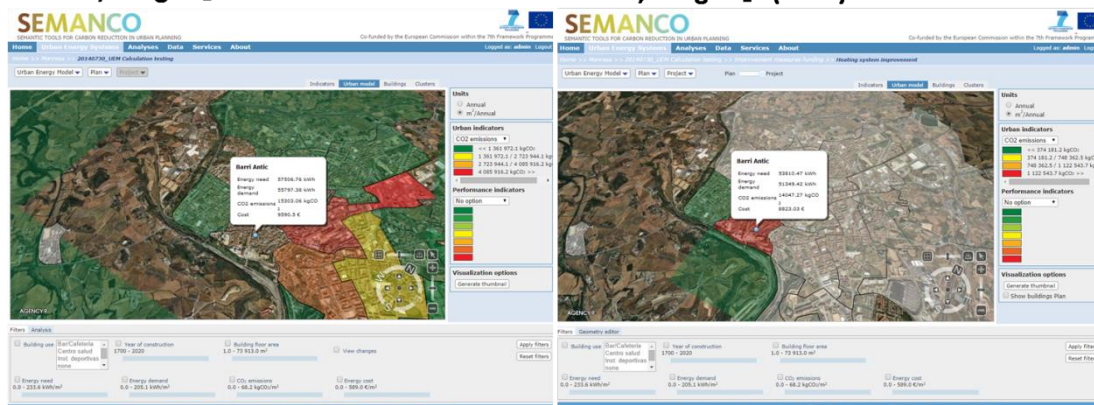
Figure 36. Results of the multi-criteria comparison for a 'Heating system improvement' scenario

5.4   Conclusions

In this demonstration, the user has been able to deal with the following issues:

- Identifying neighbourhoods with high energy demand values from the baseline.
- Identifying a group of buildings with higher energy consumption levels.
- Select the target urban area and create a plan including those buildings.
- Creating several projects, each containing different proposed energy efficient improvements, easily and fast by using the USiT improvement tool.
- Comparing the improvement options (i.e. projects) by using the multi-criteria tool, based on a set of predefined indicators.
- Analysing the outcomes of this comparison.
- Check the results back again at urban scale.

By performing these tasks, the user has been able to meet the energy efficient urban planning objectives defined for this case. That is, to identify urban areas with poor energy performance and to develop, evaluate and compare different urban scale interventions for energy efficient urban improvements. The improvement options (that is, the different projects considered) were defined as a 'Hollow intervention', 'Heating system improvement' and 'Renewal use improvement'. A comparative analysis has been performed using the indicators 'Energy need', 'Energy demand', 'CO_2 emission' and 'Foreseen funding amount'. The refit option 'Heating system improvement' was found to be the best one after the comparisons using the four indicators. The intervention of 'Hollow intervention' was the best refit in terms of reducing energy demand.

6 EVALUATION OF THE PLATFORM

The third round of demonstrations involved to perform a usability test to evaluate the platform in terms of:

- Navigation: browsing, selecting and editing information.

- Predictability: providing the expected results.

- Layout: organisation and structure of the interface.

- Graphics: legibility of visual elements.

The following sections present the main results in each demonstration scenario. The scores presented in the tables are the average values given by the users.

After presenting the results of the usability test, a list of the functionalities required from previous demonstrations are listed. Based on this list, domain experts have checked whether these functionalities are already implemented in the platform.

All this information will feed into D2.5 *Final verification*, which will provide the final evaluation of the platform in terms of its ability to support energy efficient urban planning.

6.1 Results from usability tests

The following sections present a summary of the answers given by the users in each of the three scenarios.

6.1.1 Tests performed in the Newcastle demonstration scenario

The platform is perceived as useful, configurable and clear for the users, but the level of difficulty increases when using the embedded tools.

Unfortunately, in most cases the user comments do not allow the identification of the reasons why a given task was given bad marks. For instance, the users were not able to customise the data required by the calculation tool, neither were they able to visualise outputs after running the calculation tool.

As shown in the Table 4, the platform works and provides results from the calculation tool, but some of the tasks appeared in red colour. These shall be checked to improve the end-user interaction.

- In navigation, the comprehension of the concepts 'Urban Energy Model', 'Plan' and `Project' presents some difficulties.

- The definition of parameter indicators in the MCDA tool looks too difficult and it seems that the users do not know what the tool is comparing and why.

Most of the comments made by users regarding functionalities that do not work have been checked by a domain expert of the consortium and some of them are currently operative. These are the corrections:

- SAP tool does not provide data to be customised and the visualisation of outputs should be fine-tuned.

- Adding more than one building in a project is possible, but only one by one. There is not a Shift option to select more than one building at once.

- The threshold values are set automatically by the MCDA tool, although the user can modify them.

The following table presents the average results of the usability test.

Table 4. Table of test results in Newcastle

Averaged values	Time spent (minutes)	Task completed? (Yes/No)	Navigation (0-4)	Predictability (0-4)	Layout (0-4)	Graphics (0-4)
Scenario 1: Creating an Urban Energy Model						
Task 1: Log in the platform	00:15	Yes	4.00	4.00	3.00	3.00
Task 2: Load a "New Urban Energy Model"	00:19	Yes	3.50	3.50	4.50	3.50
Task 3: Fill in the general data fields	00:38	Yes	3.50	3.50	4.00	4.00
Task 4: Select the most proper tool to carry out the energy performance calculations	00:41	Yes	4.00	3.00	3.00	3.50
Task 5: Customise the data related to the tool	00:44	No	1.00	1.00	1.00	1.00
Task 6: Save the new Urban Energy Model	00:04	Yes	4.00	4.00	4.00	4.00
Positive comments after completing the tasks:	-The interface is clear, neat with neutral colours. The page sits nicely within the frame of the window, quite easy to move about the window. Generally well presented.					
Negative comments after completing the tasks:	-Data and Users tabs do not work. -Some of the measurements are too small and not clearly presented. kWh, income, CO_2 consumption. -Proposal: Improve the data labels.					
Scenario 2: Defining the baseline						
Task 1: Select a building	00:07	Yes	3.50	4.00	3.50	3.50
Task 2: Load the tool	00:09	Yes	4.00	4.00	4.00	4.00
Task 3: Fill in the tool form	04:15	Yes	3.00	3.00	3.00	3.00
Task 4: Run the tool	00:50	Yes	3.00	3.00	3.00	3.00
Task 5: Visualise the tool outputs	03:20	No	2.00	1.00	2.00	2.00
Task 6: Do the same task for 10 buildings (Not applicable in UK case)	05:45	No	4.00	3.50	4.00	4.00
Task 7: Save the changes	00:07	Yes	4.00	4.00	4.50	4.50
Task 8: Visualise the Urban Energy Model indicators	01:35	Yes	1.50	2.00	1.50	2.00
Positive comments after completing the tasks:	- It is easy to move between the screens and find your way back to the right place. -Tool performs well and conducts calculations more or less instantaneously.					

Negative comments after completing the tasks:	- In task 5 there was an issue when trying to visualise the tool outputs. - In Task 6, it is not possible to scale up multiple dwellings for the UK tool. Data has to be inserted for buildings independently, therefore this task could not be completed.					

Scenario 3: Analysing the baseline

Task 1: Select an indicator to colour buildings	00:57	Yes	4.50	2.50	2.50	3.00
Task 2: Filter the buildings by adding some filters	02:30	Yes	4.50	4.50	4.00	4.00
Task 3: In the Buildings tab, search for specific building use	02:12	Yes	4.00	4.00	4.00	4.00
Task 4: In the Clusters tab, select the aggregation by year of construction	01:50	Yes	2.50	2.50	2.50	3.00
Task 5: Modify the horizontal and vertical axis	01:17	Yes	3.50	3.00	3.50	3.00
Task 6: Change the colours of the bubbles	01:07	Yes	3.50	2.00	3.50	3.00
Positive comments after completing the tasks:	-All these functionalities are very useful for analysing: searching and filtering, building features tab and clusters tab.					
Negative comments after completing the tasks:	-In Task 5 Visualising the tool outputs is difficult, user found it hard to interpret the mass of the circles in the 'clusters area', users questioned what do they actually mean? Setting out the x and y parameters also difficult, users not confident which should go where? – Pop up bubble recommended to provide support to the user Generally, users thought colours could be improved simply by using more within this area of the platform.					

Scenario 4: Creating a new plan

Task 1: Select "Creating a new plan for…"	00:11	Yes	4.00	4.00	3.50	3.50
Task 2: Fill in the general data fields	01:32	Yes	4.00	4.00	3.50	3.50
Task 3: Save the new Plan	00:07	Yes	0.00	0.00	0.00	0.00
Task 4: Select some buildings and add them to the plan (not possible in the UK tool)	01:22	No	4.00	4.00	4.00	4.00
Task 5: Visualise all the selected buildings	00:45	Yes	3.50	2.50	1.50	3.50
Positive comments after completing the tasks:	- Users liked the speed of creating a new plan and the ability to customise the name and aspirations of the plan. Generally, they liked the functionality of being able to create a new plan for an area.					
Negative comments after completing the tasks:	In Task 1 when creating a new plan is not clear that the improvements for SAP and CO_2 are presented as percentages. Users are confused trying to distinguish between an urban energy model, plan and project. The staging is not as intuitive as they would like. Users require an explanation of 'urban energy model', 'plan' and 'project'. Although they are three related stages, they require support in understanding why the tool is presented in this way.					

-In Task 4, task could not be completed UK tool only has the ability to select one building at a time. Users believed entering data into a plan in this way would be a very repetitive task.							

Scenario 5: Creating a new project

Task 1: Load "Creating a new project for…"	00:24	Yes	4.00	4.00	3.50	3.50
Task 2: Fill in the general data fields	01:10	Yes	3.00	3.00	3.50	3.50
Task 3: Customise the data related to the tool	00:05	No	0.00	0.00	0.00	0.00
Task 4: Save the new project	00:05	Yes	4.50	4.50	4.50	4.50
Task 5: Visualise all the buildings that belong to the project	00:30	Yes	3.50	4.50	2.50	3.50
Task 6: Select a building	00:12	Yes	4.00	4.00	3.00	4.00
Task 7: Load the tool form	00:09	Yes	4.00	4.50	4.50	4.50
Task 8: Fill in the tool form	04:25	Yes	4.00	3.00	4.00	4.00
Task 9: Run the tool	00:45	Yes	4.00	4.00	4.00	4.00
Task 10: Visualise the tool outputs and compare them to the baseline	00:50	Yes	2.00	1.50	2.00	2.00
Task 11: Do the same task for 10 buildings (not possible for the UK tool)	01:00	No	2.00	2.00	2.00	2.00
Task 12: Save the changes	00:12	Yes	3.00	3.00	3.50	3.50
Task 13: Visualise the project indicators	01:35	Yes	2.50	2.00	1.50	2.00

Positive comments after completing the tasks:	-At this stage, the users find creating a project easier as they have previously developed a plan. The tasks conducted and thought processes now become more intuitive. Users show signs of familiarity with the concepts of model, plan and project.
Negative comments after completing the tasks:	-Task 3 was not applicable to the UK case. - In task 11 it was not possible to do the same task for multiple buildings selected together. However it is possible to run the task building by building.

Scenario 6: Comparing projects

Task 1: Load a plan	00:07	Yes	4.00	4.00	3.50	3.50
Task 2: Select the Compare option in Plan menu	00:25	Yes	3.00	4.00	3.50	3.50
Task 3: Create a new analysis	00:17	Yes	4.00	4.00	4.00	4.00
Task 4: Give a name for the analysis and save it	00:55	Yes	4.00	3.50	3.50	3.50
Task 5: Select projects to be compared	00:50	Yes	4.00	4.00	4.00	4.00
Task 6: Select indicators to be used in the analysis	00:25	Yes	4.00	4.00	4.00	4.00
Task 7: Customize the weight and threshold parameters to be used in the analysis	03:50	Yes	3.00	4.00	4.00	3.00
Task 8: Perform a multi-criteria analysis	02:50	Yes	2.00	2.00	2.00	2.00
Task 9: Select the best project according to the outputs of the analysis.	00:27	Yes	3.50	4.00	4.00	4.00

Task 10: Create a new analysis with an user indicator	02:00	Yes	3.00	3.50	3.50	3.50
Positive comments after completing the tasks:	-Generally the tool is perceived as very useful, configurable and relatively clear. Users like the functionality of being able to extract the results from the platform to be inserted into presentations or reports. -Calculation method fast (instant) and straight forward.					
Negative comments after completing the tasks:	In Task 7, defining the threshold is confusing. Some default values could help to understand the meaning. There is some difficulty in recording the new indicators. Users are unsure as to what figures should go in to define the weights and values. This requires explanation. -In Task 9 although the best project can be selected using the score, users believed it would be beneficial to be able to extract the results in a tabular format or some form of downloadable report.					

6.1.2 Tests performed in the Copenhagen demonstration scenario

The positive comments gathered related to the general visualisation of the platform and the easy and simple definition of the processes to create a plan or a project. In general all of the marks are at three or less. This shows some technical issues were encountered when trying to access the platform.

Unfortunately, in most cases the comments do not allow for identification of the reasons why a task has bad marks. As a conclusion the platform works and provides results from the calculation tool, but some tasks that appeared in red colour shall be checked to improve the end-user interaction:

- In navigation, there is confusion between model, plan and projects.
- The analysis of the results of the MCDA tool was difficult to understand.

Most of the comments made by users regarding functionalities that do not work have been checked by a domain expert of the consortium and some of them are currently operative. These are the corrections:

- The user can customise the values from one building when the project is created/edited (building typologies, supply technologies coefficients…)
- The visualisation of the MCDA tool is enabled

The following table presents the average results of the usability test.

Table 5. Table of test results in Copenhagen

Averaged values	Time spent (minutes)	Task completed? (Yes/No)	Navigation (0-4)	Predictability (0-4)	Layout (0-4)	Graphics (0-4)
Scenario 1: Creating an Urban Energy Model						
Task 1: Log in the platform	00:48	Yes	2.75	3.50	2.25	3.00
Task 2: Load a "New Urban Energy Model"	02:11	Yes	2.75	2.75	2.25	2.00

Task 3: Fill in the general data fields	01:11	Yes	2.25	2.75	2.50	3.00
Task 4: Select the most proper tool to carry out the energy performance calculations	02:07	Yes	2.50	2.50	2.75	3.00
Task 5: Customise the data related to the tool	02:30	Yes	2.50	2.25	2.00	2.25
Task 6: Save the new Urban Energy Model	00:37	Yes	4.00	4.00	3.00	3.50

Positive comments after completing the tasks:	The platform performs well with these tasks. Quick response time and relative intuitive navigation.
Negative comments after completing the tasks:	The login button could be a bit more visible. Could be hard to find, if not knowing where to look. It seems very confusing when the model is loading before you select the model, also without a proper understanding of the data behind the models it's quite hard to select a proper tool for doing an analysis. It doesn't seem very flexible but rather rigid. Also the poor graphics and layout does not help the user to understand what's to be done or give the impression of a solid piece of software.

Scenario 2: Defining the baseline

Task 1: Select a building	00:27	Yes	3.75	3.75	3.50	3.50
Task 2: Load the tool	01:09	Yes	2.25	2.50	2.25	2.00
Task 3: Fill in the tool form	00:52	Yes	2.75	2.75	2.50	2.50
Task 4: Run the tool	00:35	Yes	3.00	2.50	2.75	2.75
Task 5: Visualize the tool outputs	00:35	Yes	2.50	2.50	2.75	2.50
Task 6: Do the same task for 10 buildings	03:40	Yes	2.50	2.50	3.00	3.00
Task 7: Save the changes	00:26	Yes	3.25	3.25	3.00	3.00
Task 8: Visualize the Urban Energy Model indicators	01:03	Yes	2.50	3.00	3.00	3.00

Positive comments after completing the tasks:	Fairly easy to select and edit attributes for buildings The visualisation is easy and nice. It is nice that you can enter the information about the buildings through the building list
Negative comments after completing the tasks:	When you edit the attributes for building in the tool and swap to the next tab it, you are not immediately able to see the changes (before and after) in the energy outputs tab. This could lead the user to believe that the change in attributes does not have the intended effect. It took me some time to understand that by "tool" you meant "run energy simulation".

Scenario 3: Analysing the baseline

Task 1: Select an indicator to colour buildings	00:35	Yes	3.25	3.00	3.25	3.25
Task 2: Filter the buildings by adding some filters	01:10	Yes	3.00	3.00	3.00	3.00
Task 3: In the Buildings tab, search for specific building use	01:15	Yes	3.00	2.00	2.67	2.67
Task 4: In the Clusters tab, select the aggregation by year of construction	00:50	Yes	3.67	3.33	3.33	3.33

Task 5: Modify the horizontal and vertical axis	01:25	Yes	3.67	3.33	3.67	3.33
Task 6: Change the colours of the bubbles	01:00	No	2.00	2.00	3.00	3.00

Positive comments after completing the tasks:	Easy to visualise different indicators and the filter function is intuitive to use and performs well. The bubble diagram is nice and visual.
Negative comments after completing the tasks:	The search function in the Buildings tabs only returns results on exact matches of building uses. E.g. you cannot perform a search on "apartment" and expect that all the building uses that starts with or contains the word "apartment" will show up.

Scenario 4: Creating a new plan

Task 1: Select "Creating a new plan for…"	00:42	Yes	2.33	2.67	3.00	3.00
Task 2: Fill in the general data fields	00:45	Yes	4.00	4.00	4.00	4.00
Task 3: Save the new Plan	01:47	Yes	3.00	3.00	3.33	3.33
Task 4: Select some buildings and add them to the plan	01:20	Yes	3.67	3.33	3.33	3.33
Task 5: Visualise all the selected buildings	00:45	Yes	2.67	2.67	2.67	2.67

Positive comments after completing the tasks:	Easy to create a new plan
Negative comments after completing the tasks:	When you want to select multiple building by holding down the shift key, you cannot deselect a selected building by clicking it.

Scenario 5: Creating a new project

Task 1: Select "Creating a new project for…"	00:27	Yes	3.00	3.67	3.33	3.00
Task 2: Fill in the general data fields	01:55	Yes	3.00	3.33	2.67	2.33
Task 3: Customise the data related to the tool	00:45	Yes	3.50	3.50	3.00	3.00
Task 4: Save the new project	01:47	Yes	2.67	2.67	2.67	2.67
Task 5: Visualise all the buildings that belong to the project	02:02	Yes	2.67	2.33	2.67	3.00
Task 6: Select a building	00:27	Yes	3.67	3.67	3.00	3.00
Task 7: Load the tool form	00:27	Yes	4.00	4.00	3.00	3.00
Task 8: Fill in the tool form	01:30	Yes	3.67	2.67	3.00	3.00
Task 9: Run the tool	00:30	Yes	3.33	3.00	3.33	3.33
Task 10: Visualise the tool outputs and compare them to the baseline	02:10	Yes	2.67	2.67	2.33	2.33
Task 11: Do the same task for 10 buildings	03:00	Yes	3.50	3.50	3.50	3.50
Task 12: Save the changes	00:47	Yes	3.00	3.00	3.00	3.00
Task 13: Visualise the project indicators	00:33	Yes	3.50	3.50	3.50	3.50

Positive comments after completing the tasks:	Easy to create a new project.					
Negative comments after completing the tasks:	When you want to select multiple building by holding down the shift key, you cannot deselect a selected building by clicking it. Customising the data related to the tool??? I'm not quite sure The visualisation doesn't work it only works in the multi criteria analysis. I'm pretty sure the tool is not calculating correctly.					

Scenario 6: Comparing projects

Task 1: Load a plan	00:30	Yes	3.00	3.33	3.67	3.67
Task 2: Select the Compare option in Plan menu	01:07	Yes	3.33	3.67	3.33	3.33
Task 3: Create a new analysis	01:32	Yes	3.33	3.67	3.33	3.33
Task 4: Give a name for the analysis and save it	00:22	Yes	3.50	4.00	3.50	3.50
Task 5: Select projects to be compared	02:05	Yes	2.67	3.00	3.00	3.33
Task 6: Select indicators to be used in the analysis	01:30	Yes	2.00	2.67	2.67	2.67
Task 7: Customise the weight and threshold parameters to be used in the analysis	01:40	Yes	3.33	3.33	3.00	3.00
Task 8: Perform a multi-criteria analysis	00:27	Yes	3.33	3.33	3.33	3.33
Task 9: Select the best project according to the outputs of the analysis.	00:40	Yes	2.00	1.67	1.33	1.33
Task 10: Create a new analysis with an user indicator	02:00	Yes	2.50	3.50	2.50	3.00

Positive comments after completing the tasks:						
Negative comments after completing the tasks:	The results of the multi-criteria analysis are only available when the mouse pointer is above the project/plan in the results/ranking windows. I think one would be better off with a static view of the results. General feedback: Once, the tool did not work because the security on Java was set to very high (it goes from very high to medium). The tool worked when decreasing the level of security to medium, which I find a bit worrying. Wouldn't it be possible to have a very high security when you use this tool?					

6.1.3 Tests performed in the Manresa demonstration scenario

The platform was valued highly in Manresa and received with good comments for the visualisation and general performance. Unfortunately, in most cases the comments do not allow for identification of the reasons why a task has bad marks.

As a conclusion the platform works and provides results from the calculation tool, but some tasks that appear in red colour and shall be checked to improve the end-user interaction:

- In navigation, there is confusion between models, plan and project.

- To customise data related to the tool is not possible.

- The graphic representation needs to be explained in order to help the user to understand it.

Most of the comments made by users regarding functionalities that do not work have been checked by a domain expert of the consortium and some of them are currently operative. These are the corrections:

- Open and load an existing UEM with a large amount of buildings is already possible.

- The outputs are displayed in the 'Outputs tab' when you calculate only one building at once. If you calculate more than one building, then there will be not an output summary

- The colour of the bubbles from the 'Building tab' is dependent on the performance indicator selected. The user cannot change the colour by itself.

- The scroll bar shifting between plans and projects works fine.

- The threshold values are set automatically by the MCDA tool, although the user can modify them.

The following table presents the average results of the usability test.

Table 6. Table of test results in Manresa

Averaged values	Time spent (minutes)	Task completed? (Yes/No)	Navigation (0-4)	Predictability (0-4)	Layout (0-4)	Graphics (0-4)
Scenario 1: Creating an Urban Energy Model						
Task 1: Log in the platform	00:17	Yes	4.00	3.50	3.50	3.50
Task 2: Load a "New Urban Energy Model"	00:14	Yes	4.00	4.00	4.00	3.50
Task 3: Fill in the general data fields	00:27	Yes	4.00	4.00	4.00	4.00
Task 4: Select the most proper tool to carry out the energy performance calculations	00:33	Yes	3.50	3.00	3.50	3.50
Task 5: Customise the data related to the tool	00:31	No	1.50	1.50	0.50	1.50
Task 6: Save the new Urban Energy Model	00:07	Yes	4.00	4.00	4.00	4.00
Positive comments after completing the tasks:	-Quite clear interface and well located windows.					
Negative comments after completing the tasks:	-It has not been possible to load the desired UEM (the one containing several buildings calculated). Demo has been done by choosing another UEM with a smaller number of buildings containing energy related data -Tool window is able to select and not to de-select the boxes. -Data and Users tabs do not work. -Proposal: to include a Next button to allow step-by-step customisation. -The text besides the UEM name is always the same describing something about Riverside Dean and has nothing to do with the text filled in when creating the Urban Energy Model					

Scenario 2: Defining the baseline

Task 1: Select a building	00:12	Yes	4.00	4.00	4.00	4.00
Task 2: Load the tool	00:09	Yes	4.00	4.00	4.00	4.00
Task 3: Fill in the tool form	03:15	Yes	4.00	2.00	4.00	3.00
Task 4: Run the tool	00:25	Yes	4.00	4.00	4.00	4.00
Task 5: Visualize the tool outputs	00:35	Yes	4.00	1.50	4.00	4.00
Task 6: Do the same task for 10 buildings	05:45	Yes	4.00	3.50	4.00	4.00
Task 7: Save the changes	00:12	Yes	3.00	3.00	3.50	3.50
Task 8: Visualize the Urban Energy Model indicators	01:35	Yes	1.50	2.00	1.50	2.00

Positive comments after completing the tasks:	-Indicators values appear when selecting a building is very significant -Process is fast and clear
Negative comments after completing the tasks:	-In Task 3, some errors building properties and occupancy tabs were detected. For this reason, the results obtained in task 5 do not seem true. Neither user knows if changes have been applied. -In Task 5, no output windows appear once the calculation is performed. The visualisation of these outputs in the 3D model can bother the user. -Once user selects the buildings, he cannot de-select any of them. And some tasks, such as creating the baseline, should be automated.

Scenario 3: Analysing the baseline

Task 1: Select an indicator to colour buildings	01:12	Yes	4.00	2.00	1.50	3.50
Task 2: Filter the buildings by adding some filters	01:37	Yes	4.00	4.00	3.50	3.50
Task 3: In the Buildings tab, search for specific building use	01:52	Yes	3.00	1.50	3.50	3.00
Task 4: In the Clusters tab, select the aggregation by year of construction	00:47	Yes	3.50	2.00	3.50	3.00
Task 5: Modify the horizontal and vertical axis	00:57	Yes	3.50	3.00	3.50	3.00
Task 6: Change the colours of the bubbles	01:07	Yes	3.50	2.00	3.50	3.00

Positive comments after completing the tasks:	-All these functionalities are very useful for analysing: searching and filtering, building features tab and clusters tab.
Negative comments after completing the tasks:	-In Task 1, colour ranges are not very different, the boundaries should be adapted to more variety of colours. -In Buildings tab, once you apply the filters is difficult to de-select them. -Clusters tab is difficult to understand and can be a bit confusing to get some results. And it is not possible to change the colour of the bubbles automatically. To have a downloadable option of file could be more useful. -Having two lists of indicators (urban indicators and performance indicators) available is misleading. Both contain the same indicators, and user can only choose an option from one of them. They could easily be just one

Scenario 4: Creating a new plan

Task 1: Select "Creating a new plan for…"	00:14	Yes	4.00	4.00	3.50	3.50
Task 2: Fill in the general data fields	01:22	Yes	4.00	4.00	3.50	3.50
Task 3: Save the new Plan	00:15	Yes	4.00	4.00	4.00	4.00
Task 4: Select some buildings and add them to the plan	03:25	Yes	4.00	4.00	4.00	4.00
Task 5: Visualise all the selected buildings	00:35	Yes	3.50	2.50	1.50	3.50

Positive comments after completing the tasks:	-Once the user can knows what a Plan means, menus makes sense.
Negative comments after completing the tasks:	-There is some confusion to know about the difference between Model and Plan meaning. -In task 2, a question: what it appears the reference 'sap rate' instead of 'energy rate'? - Colours of buildings are somehow misleading. At the beginning they are all white, but once the user has changed something or selected some indicator, they became a sort of grey or green and never return to the original colour white although they should.

Scenario 5: Creating a new project

Task 1: Select "Creating a new project for…"	00:14	Yes	4.00	4.00	3.50	3.50
Task 2: Fill in the general data fields	00:52	Yes	4.00	4.00	3.50	3.50
Task 3: Customise the data related to the tool	00:05	No	0.00	0.00	0.00	0.00
Task 4: Save the new project	00:15	Yes	4.00	4.00	4.00	4.00
Task 5: Visualise all the buildings that belong to the project	00:30	Yes	3.50	2.50	1.50	3.50
Task 6: Select a building	00:12	Yes	4.00	4.00	3.00	4.00
Task 7: Load the tool form	00:10	Yes	4.00	4.00	4.00	4.00
Task 8: Fill in the tool form	03:15	Yes	4.00	2.00	4.00	3.00
Task 9: Run the tool	00:35	Yes	4.00	4.00	4.00	4.00
Task 10: Visualise the tool outputs and compare them to the baseline	00:50	Yes	2.00	1.50	2.00	2.00
Task 11: Do the same task for 10 buildings	06:00	Yes	4.00	3.50	4.00	4.00
Task 12: Save the changes	00:12	Yes	3.00	3.00	3.50	3.50
Task 13: Visualise the project indicators	01:35	Yes	1.50	2.00	1.50	2.00

Positive comments after completing the tasks:	-Once the user can knows what a Project means, menus makes sense.
Negative comments after completing the tasks:	-There is some confusion to know about the difference between Plan and Project meaning. -In Task 3, Data tab cannot be editable and makes no sense.

- Users cannot deselect buildings or deselect completely all buildings pre-selected -Scroll bar shifting between plans and projects does not work. It really does not shift between plans and projects work environment						

Scenario 6: Comparing projects						
Task 1: Load a plan	00:15	Yes	4.00	4.00	3.50	3.50
Task 2: Select the Compare option in Plan menu	00:15	Yes	3.00	4.00	3.50	3.50
Task 3: Create a new analysis	00:17	Yes	4.00	4.00	4.00	4.00
Task 4: Give a name for the analysis and save it	00:25	Yes	4.00	3.50	3.50	3.50
Task 5: Select projects to be compared	00:25	Yes	4.00	4.00	4.00	4.00
Task 6: Select indicators to be used in the analysis	00:25	Yes	4.00	4.00	4.00	4.00
Task 7: Customise the weight and threshold parameters to be used in the analysis	01:22	Yes	4.00	4.00	4.00	3.00
Task 8: Perform a multi-criteria analysis	00:15	Yes	4.00	4.00	4.00	4.00
Task 9: Select the best project according to the outputs of the analysis.	00:27	Yes	4.00	4.00	4.00	4.00
Task 10: Create a new analysis with an user indicator	02:00	Yes	4.00	3.00	3.00	3.00
Positive comments after completing the tasks:	-Tool very useful, configurable and clear. -Calculation method fast and simple compared to the rest of the platform.					
Negative comments after completing the tasks:	-When comparing projects, the description always contains a same text coming from the Riverside Dean description of previous demonstrations in Newcastle. -In Task 7, to define threshold is confusing. Some default values could help to understand the meaning. There is some difficulty in recording the new indicators. -In Task 9, to have a downloadable option of file would be more useful.					

6.1.4 Summary of usability tests

In the following, the most relevant feedback from the users is summarised and presented:

- The users suffered from confusion when distinguishing between urban energy model, plan and project. The staging is not as intuitive as they would like. Users require an explanation of 'Urban energy model', 'Plan' and 'Project'. Although they are three related stages, they require support in understanding why the tool is presented in this way.

- Several security issues related to the use of Java within an internet browser caused difficulties for the user when accessing the platform. For instance, the security level of the browser must be changed to run the platform from High to Medium. This has to be explicitly mentioned in a "System requirements" section of the user manual.

- It seems very confusing when the model is loading before you select the model, also without a proper understanding of the data behind the models it's quite hard to select a proper tool for doing an analysis. It doesn't seem very flexible but rather rigid. Also the

poor graphics and layout does not help the user to understand what's to be done or give the impression of a solid piece of software

- Users were not able to customise the data for the related tools, although the SAP tool is currently the only one which has not enabled the customisation option. The other two tools are already customisable.

- When the users wanted to select multiple buildings by holding down the shift key, they could not deselect a selected building by clicking it.

- The colours of buildings were felt to be somehow misleading. At the beginning they are all white, but once the user has changed something or selected some indicator, they became a sort of grey or green and never return to the original white colour.

- The descriptions of the projects that appear need to be checked by comparing them and be able to particularise them to each study case.

- About data values and ranges, users detected some unrealistic values which ranged much higher or lower than expected. For instance, when filling in the building form in the Manresa case, some errors in the building properties and occupancy tabs were detected. For this reason, the energy efficiency results obtained did not seem to be realistic. Currently, these changes have been applied; therefore these issues should be solved.

- In the MCDA tool, the users found some difficulties in defining indicators, weights and thresholds. Also in some tabs it should be necessary to include a quick tips or a "quick guide" to help the user to perform any task.

Most of the comments made by users regarding functionalities that do not work have been checked by a domain expert of the consortium and are currently operative.

6.2   Verification of the platform functionalities

The inclusion of functionalities requested by participants in the previous demonstration round (see Deliverable 8.3, section 6) in the current version of the SEMANCO integrated platform and supporting material have been checked. Those which are still pending to be solved are summarized in the following sections. Along with the results of the usability tests, the information contained in these tables will be valuable for Deliverable 2.5 *Final verification*, the purpose of which is to check if the platform provides relevant and qualified information to support energy efficient urban planning.

6.2.1   Pending functionalities from the demonstration of the Newcastle case study

Table 7 summarizes the current status of the requested functionalities for this case study.

Table 7. Table of pending functionalities in Newcastle

Required functionalities identified in D8.3	Why is it required?	Current status
A quick guide explaining the tools integrated in the platform	As several users had difficulties to understand some parameters, concepts and elements of the platform	It will be included in the user manual to be delivered by Task 7.6
When performing a multi-criteria analysis it is not clear to the user what the results actually	Users need to be able to interpret the results of the tool	It will be included in the user manual to be delivered by Task 7.6

mean. Coefficients need to be explained		
Guide with reference values regarding energy efficient improvements	Users need to know how much the values can change when an improvement is applied	It will be included in the user manual to be delivered by Task 7.6
Users need to perform analysis on multiple dwellings at a time	To aggregate and disaggregate indicators across scales	Not implemented Just able to show layers with LLSOA data

6.2.2 Pending functionalities from the demonstration of the Copenhagen case study

Table 8 summarizes the current status of the requested functionalities for this case study.

Table 8. Table of pending functionalities in Copenhagen

Required functionalities identified in D8.3	Why is it required?	Current status
A quick guide explaining the tools integrated in the platform	As several users had difficulties in understanding some parameters, concepts and elements of the platform	It will be included in the user manual to be delivered by Task 7.6
Set of benchmarks and/or reference values	To allow the comparison between results from evaluations	It will be included in the user manual to be delivered by Task 7.6
Guide with reference values regarding energy efficient improvements	Users need to know how much the values can change when applies an improvement	It will be included in the user manual to be delivered by Task 7.6
Integrate layers of urban space categories	To aggregate and disaggregate indicators across scales	Not implemented
Define procedures to up-scale indicators	Evaluations at multiple scales are required. What is good at one scale may not be good at a different scale	Not implemented
Check whether relevant indicators are already included in the platform	Each application case requires the use of indicators adapted to their purpose	Not all indicators required by users as the internal rate of return (IRR) and the related to energy saving
Distinguishing between energy carriers and final energy uses when calculating indicator	Different energy carriers can be used to perform different final energy uses. Exchangeability of energy carriers is not always possible	Only final energy uses can be distinguished
Integration of tools developed within T5.2	When data about building and energy use is missing, the definition of building typologies can be very useful to obtain benchmarks or reference values	Not implemented

6.2.3 Pending functionalities from the demonstration of the Manresa case study

Table 9 summarizes the current status of the requested functionalities for this case study.

Table 9. Table of pending functionalities in Manresa

Required functionalities identified in D8.3	Why is it required?	Current status
A quick guide explaining the tools integrated in the platform	As several users had difficulties to understand some parameters, concepts and elements of the platform	It will be included in the user manual to be delivered by Task 7.6
Set of benchmarks and/or reference values	To enable comparisons between results from evaluations	Make available results of Spahousec study (http://www.idae.es/uploads/documentos/documentos_Informe_SPAHOUSEC_ACC_f68291a3.pdf
Guide with reference values regarding energy efficient improvements	Users need to know how much the values can change when they apply an improvement	Ongoing in WP7 – make available tables of data and building parameters
Integrate layers of urban space categories	To aggregate and disaggregate indicators across scales	Only neighbourhood level indicators are integrated
Define procedures to up-scale indicators	Evaluations at multiple scales are required. What is good at one scale may not be good at a different scale	Able to aggregate from building to neighbourhood level. Aggregating from there to the level of blocks or other administrative boundaries represents ongoing work.
Check whether relevant indicators are already included in the platform	Different indicators maybe required a different scales of analysis	Urban indicators (e.g. population density) have not been included
Distinguishing between energy carriers and final energy uses when calculating indicator	Different energy carriers can be used to perform different final energy uses. Exchangeability of energy carriers is not always possible	The platform differentiates between energy carriers and final energy uses
Integration of tools developed within T5.2	When data about building and energy use is missing, the definition of building typologies can be very useful to obtain benchmarks or reference values	Not integrated

7 CONCLUSIONS

7.1 Contribution to overall picture

The third and final round of demonstrations conducted as part of the SEMANCO project validates the efficacy of the functionalities of the SEMANCO integrated platform for different types of potential users. The demonstrations conducted cover the whole scope of the platform functionalities:

1. establishing a baseline of the energy performance of an urban area;

2. proposing actions to improve the existing energy performance;

3. assessing different options for urban development/refurbishment to inform the decision making of the different key actors involved (i.e. policy makers, local authorities and energy consultants).

In each demonstration scenario a problem case was defined from the perspective of a different type of user. Then professionals (with similar roles to the envisaged user) used the SEMANCO integrated platform to conduct the sequence of activities (e.g. calculations related energy performance and CO_2 emissions) required to meet the objective of the relevant problem case. The findings from this process, presented in chapters 3, 4 and 5, illustrate that in all three of the demonstration scenarios users were able to perform the sequence of activities and obtain the information required to address the problem case relevant to them.

1. In Newcastle the envisaged user is an energy consultant in charge of proposing strategic energy plans for local authorities as part of an Energy Master Plan. The aim of this strategic energy plan is to prioritise resources to improve the worst performing areas of the city in relation to energy efficiency.

2. In Copenhagen, the foreseen user is an urban planner from the municipality assigned the task of evaluating several strategies for energy supply in a 'greenfield' project.

3. In Manresa the user is meant to be a professional that is not necessarily an expert in planning or energy building performance that needs to identify the most appropriate measures to refurbish a group of buildings in the city.

The findings of the usability tests presented in chapter 6 illustrate that the platform is perceived by potential users as useful, configurable and clear. However these tests also show that users found that level of difficulty increases when using the embedded tools. This suggests the need to guide users in the process by providing further assistance in the form of user guides and introductory information about the platform structure. A final upgrade of the platform will address the most critical issues identified in the tests.

7.2 Impact on other WPs and Tasks

The results presented verify that SEMANCO platform provides relevant information to support energy efficient urban planning. The outcome of the demonstration scenarios will be reported in Deliverable 2.5 *Final verification*.

Some relevant issues requiring further improvement or fine-tuning of the SEMANCO platform have been identified and these will be addressed in future technological developments.

Finally, the work conducted to underpin this report provide the basic material –e.g. video recordings of the demonstration sessions – for the development of training materials as part of the work of WP7 (e.g. videos, presentations and tutorials).

7.3 Contribution to demonstration

The three rounds of demonstrations carried out in WP8 *Implementation* illustrate that the SEMANCO platform enables users to simulate scenarios that help them develop planning strategies to improve the energy efficiency of buildings in specific urban areas. Based on the work carried out in these scenarios, a palette of energy services will be identified and included

in the EECITIES Platform which is being currently developed in Tasks 5.8 *Energy service platform web portal* and Task 7.6 *Contents of the energy service platform web portal*. The purpose of this platform is to exploit the technologies and experience acquired by the consortium as a whole during the project.

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