

PROJECT FINAL REPORT

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Project acronym: UMBRELLA

Project title: Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation

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² The home page of the website should contain the generic European flag and the FP7 logo which are available in electronic format at the Europa website (logo of the European flag: http://europa.eu/abc/symbols/emblem/index_en.htm logo of the 7th FP: http://ec.europa.eu/research/fp7/index_en.cfm?pg=logos). The area of activity of the project should also be mentioned.

4.1 Final publishable summary report

4.1.1 Executive Summary

Due to barriers that exist when considering the sustainability of the built environment, optimising energy efficiency in buildings is often a management issue and not one of design. In many cases, it is the organisation responsible for the building that makes the decision with respect to where best to invest their limited resources. For this reason, decision support tools, providing information with respect to a building's energy consumption and methods for implementation and incentivisation of the solutions, benefiting all stakeholders involved are required.

UMBRELLA addressed this issue through the development of an innovative, web-based decision-support application, which provides common independent evaluation tools built around new and adaptable business models. The interface uses guided navigation to ascertain key information from users such as: key stakeholders; building location; building type; new or retrofit build; owner objectives and preferences e.g. energy efficiency, carbon and budget requirements etc. Business models, specific to the project and stakeholders are then provided through the online dynamic web portal, which will allow users to explore and optimise different business models and the relating implications and recommendations for interventions to their specified building. This can be applied to any building at any stage of design or use. Once the initial assessment has been carried out by the end user, they have the option to perform a more comprehensive analysis, which creates a full Dynamic Simulation Model of their building, calibrated against energy monitoring data (where appropriate) in order to facilitate decisions with respect to design options, retrofit options and in-use system changes through an understanding of the impact of these decisions to the buildings, its occupants and comfort and the required investment and payback that would result.

The project has resulted in 2 software tools available as prototypes at the end of the 36 month R&D project, these are: a Free online web tool which allows end users understand the energy use of their building and the potential design/retrofit solutions which would be suitable to their building type and location; a Commercial tool which is a desktop solution offering the user a comprehensive analysis of their building from design, retrofit or in-use perspective allowing them to design to a better energy efficiency, understand the impact of a variety of retrofit options or optimise their existing building while in-use at minimum cost. Both the Free and Commercial tools advise the user with respect to the appropriate business model that would allow them to implement the solution depending on their situation and the stakeholders involved in their project.

Subsequently, the project has also identified the potential for a third Hybrid tool, which will maximise the tools developed for both the Free and Commercial tools, and offer the end user a simple tool, which provides a higher level of accuracy of the Free tool, yet does not require all of the information required for the Commercial tool. This is additional development which will take place during the commercialisation of the project, beyond the R&D 36 month phase.

The project has been demonstrated in 4 regional flagship projects located in the UK, Italy, Spain and Poland. The demonstration exercise has identified a number of changes required to bring the products from prototypes to products and an exploitation plan has been created to carry out these changes and identify the route to market for the products.

4.1.2 Description of Project Context and Objectives (4 pages max)

The project was split into 8 Work Packages with 28 deliverables. All deliverables have been submitted and all milestones have been met.

WP1 focussed on the Technical and Administrative Management of the Project. Good communication between the coordinator and the WP leaders and project partners was maintained through the project. The project had a dedicated document management and storage site, called Zoho and its own GoToMeeting conference facility for use for project meetings between partners. There were no significant disputes throughout the project. Two partners left during the project, the first TST (Think Smart Technologies) left before the project started and hence they were replaced with TCD (Trinity College Dublin) in Month 4 of the project; the second UNEXE (Exeter University) were replaced with UNBAT (Bath University) at M18 due to the Principle Investigator for the Project changing between UNEXE and UNBAT. As such, an amendment was submitted and accepted for each change of partner.

WP2 characterised the value chain and best practices to be used with the UMBRELLA tools. This includes a mapping of the building energy retrofit chains, analysis of stakeholder needs, motivations and drivers, examination of new and emerging technologies and the creation of a generic dataset of design/retrofit solutions to be used by the UMBRELLA tools. This WP helped define the interface for the Free and Commercial tools, identify the target end users and what they want to see from such a tool and identify which design/retrofit solutions should be integrated.

WP3 carried out a more thorough stakeholder analysis through a number of workshops, online questionnaires and face to face interviews. These activities were carried out with stakeholders from each of the demonstration sites as well as with the general public. The data from the stakeholder engagement was analysed and this was also used to define the tools, how they will encourage end user engagement and have maximum impact.

WP4 generated the New Business Models which will maximise uptake of Design/Retrofit/In-Use solutions for the next generation of high performance buildings. This involved a comprehensive Market Research exercise examining the Energy Efficient Buildings market, the tools that exist and how UMBRELLA can fit within this market. Following this a number of business models were generated to be used with both the Free and Commercial UMBRELLA tools. A detailed matrix of solutions, incorporating over 100 new business models was generated to automatically identify the appropriate business model based on the user situation using the Free Tool. The Commercial tool can then adapt and modify the potential business models based on more detailed discussions with the building owner.

WP5 developed the software components of the Free and Commercial UMBRELLA tools. For the Free tool this included:

- The creation of master templates and design options to automatically generate a simple block model based on the inputs entered by the user

- A simulation scheduler which takes this block model and simulates it using a Dynamic Simulation Modelling engine via a cloud Kernel
- A Multi-Decision-Diagram (MDD) algorithm to sort and filter the solutions. (Note it was decided that this would not be used with the final Free tool and will instead be integrated with the Hybrid tool during the commercialisation stage.)

For the Commercial tool, this included:

- Also the creation of the master templates and design options to create a first iteration of the building model
- A Genetic Optimise algorithm which can be used to optimise 1000's of different design/retrofit combinations to identify the best solution for the building
- Climate weather files to allow for an assessment of future climate based on a number of different potential scenarios
- An End of Life solution set to determine the best way to dispose of components at the end of their life
- A value choice weighting tool which allows the user identify easily which solution they would like to choose based on their own individual objectives and constraints.
- An in-use control algorithm to be used for identifying system changes for a building in-use that do not require any significant investment

WP6 developed the user interface for the Free tool and the database architecture behind it. This allows for the user to enter inputs into the online web tool, these inputs are automatically matched to a library of master templates and design options which then generates a box model, the box model is simulated via a cloud based simulation scheduler and the results are returned to the online web interface. The results include both the technical interventions and the appropriate business models to implement the solution.

WP7 demonstrated the use of both the Free and Commercial tools on 4 sites in the EU: UK, Poland, Italy and Spain. The UK site demonstrated the aspects of the in-use part of the tool, the Italian site demonstrated the aspects of the retrofit part of the tool and the Polish and Spanish sites demonstrated the aspects of the design part of the tool. The results highlighted a number of improvements that could be made before the software is released to the market and in particular highlighted the need for a Hybrid tool which goes beyond the simple analysis that the Free tool provides without the comprehensive data that the Commercial tool requires.

Finally WP8 conducted the dissemination of the project at 16 conferences and events, as well as the submission of 8 academic publications, the delivery of bi-annual newsletters, the generation of leaflets for general dissemination as well as a standardised project presentation and 2 minute demo video. WP8 also produced standardization strategy paving the way to the standardization of the results of UMBRELLA and an exploitation plan which identified the route to market, the ownership of the various components of the tools and the ownership of IP and joint IP.

The following table outlines the objectives for the project and how they were achieved:

Objective as per p11 of the DoW	How it was Achieved
<i>UMBRELLA will comprehensively and effectively engage with relevant stakeholders with an interest in the development and/or implementation of energy conservation and/or energy generation within buildings. This will ensure the business models and associated tools and techniques are fit-for-purpose. This will include addressing the perspectives of different stakeholders in the building energy efficiency value chain.</i>	WP2 and WP3 carried out a number of tasks with respect to stakeholder engagement and understanding of the end user needs. The results from these tasks were presented in Deliverables 2.1, 2.2, 3.1, 3.2 and 3.3. In addition, WP4 conducted an in-depth market review, the results of which are presented in D4.1. All of these contributed towards the development of the Free and Commercial UMBRELLA tools.
<i>UMBRELLA will show how processes and business models naturally integrate, for example where new innovative software is available, the business model should be enhanced providing better value proposition, more accurate information and new knowledge on what can best be achieved etc</i>	WP4 carried out in-depth analysis with respect to the business models to be developed and how these integrated with a technical software. This was a complex and challenging task. The results can be observed in Deliverables 4.2, 4.3, 4.4 and 4.5.
<i>UMBRELLA will integrate lessons learnt from the past by providing suggestions to the user which relate to design solutions which have already been successfully implemented</i>	WP2 carried out an analysis of existing and emerging technologies which are best suited for the next generation of high performance buildings from both a design and retrofit situation. The results can be seen in D2.3
<i>UMBRELLA will contribute towards a comprehensive review of current and emergent practices, initiatives and tools. The project will aim to target 2% of European buildings within 5 years, which will increase the market share of energy-efficient solutions by 10% per year measured on the basis of each technology (see Impact section for further details)</i>	WP2, WP3 and WP4 created the roadmap for the tools to be delivered. WP5 and WP6 created the necessary tools to allow the project meet the objectives provided in the DoW. The exploitation plan will aim to meet these objectives, however whether this was achieved will only be known after commercialisation of the project.
<i>UMBRELLA will generate business models which are based on a unifying framework across different performance measures e.g. life cycle, energy, carbon, cost, etc. This allows for an interactive approach for problem solving, avoiding risks</i>	WP4 delivered a comprehensive dataset of business models which can be used with both the Free and Commercial tools. Over 100 new business were created, all of which are available as a dataset which the UMBRELLA agent can exploit.
<i>UMBRELLA will generate a framework for a whole-life performance-based business model for the demonstration and marketing of energy saving measures and energy generation within buildings</i>	The UMBRELLA solution has tools which allow a user to start at the Design, Retrofit or In-Use stage of a project and also examine the End of Life Solutions of each proposed intervention. As such, the project has delivered a whole-life solution which can be used no matter what stage

	a project is at.
<i>UMBRELLA will provide a new energy toolset which incorporates all inter-related building performance indicators and goes beyond existing linear, 'trial and error' approaches to encourage new business models</i>	The UMBRELLA tools incorporate models which are created based on user information (whether simple for the Free tool or detailed for the Commercial tool) to create a model that is representative of the end users building. A library of master templates and design options and interventions has then been created to allow for multiple solutions and combinations of solutions to be explored, ensuring that all solutions are taken into account and no solution is missed because of a 'trial and error' approach. The business models are linked directly with the user inputs and hence the solutions provided and again, this ensures that no potential solution is left out.
<i>The energy toolset will integrate a common methodology for simulation and analysis at the EU level to support the business models</i>	Both the Free tool and Commercial tool have a well-defined workflow that can be used by any end user or Agent of the tool
<i>UMBRELLA will provide better decision making tool as a result of closer modelling of the users natural decision making process in designing and monitoring an energy efficient building</i>	UMBRELLA incorporates a number of tools which put the user at the centre of the results, this includes: the ability for the user to discard any interventions they know will not work, the ability for the user to place a priority or constraint on different objectives appropriate to them, the ability of the user to weight the options based on their preferences and analyse the results in this manner. Both the Free and Commercial tools ensure that the user is in control of the process and can examine the solutions that are most appropriate to their needs.
<i>UMBRELLA will validate the business models in a number of flagship projects located in different climatic regions and reflecting different socio-economic structures</i>	Both the Free and Commercial tools have been validated in 4 flagship projects in the UK, Poland, Italy and Spain.
<i>UMBRELLA will ensure the adaptability of the business models, in terms of potential changes in aspects such as: climate; economics; technologies; market requirements; etc.</i>	The business model database is a complex database which takes into account multiple changing factors relating to climate, economics, technologies, market requirements etc. The business model to be used is chosen based on the inputs of the user and hence is adaptable to the end user needs.

Table 1 – Objectives of the Project and how they were Achieved

4.1.3 Main S/T Results and Foreground

The UMBRELLA project incorporates technical components of the generation of a set of software tools incorporating socio-economic aspects of business models which are generate to aid in the implementation of the solutions which the technical tools provide. An initial workflow of the tool was generated early in the project as illustrated in Figure 1. This early analysis identified the need for two software tools, a Free tool and a Commercial tool. The purpose of the Free tool is to provide an easy to use and understand tool for non-technical users and encourage them to identify potential changes they could make to their building. It is also a ‘teaser’ for the Commercial tool with the aim that a % of those engaging with the Free tool will then be tempted to contribute with the Commercial tool.

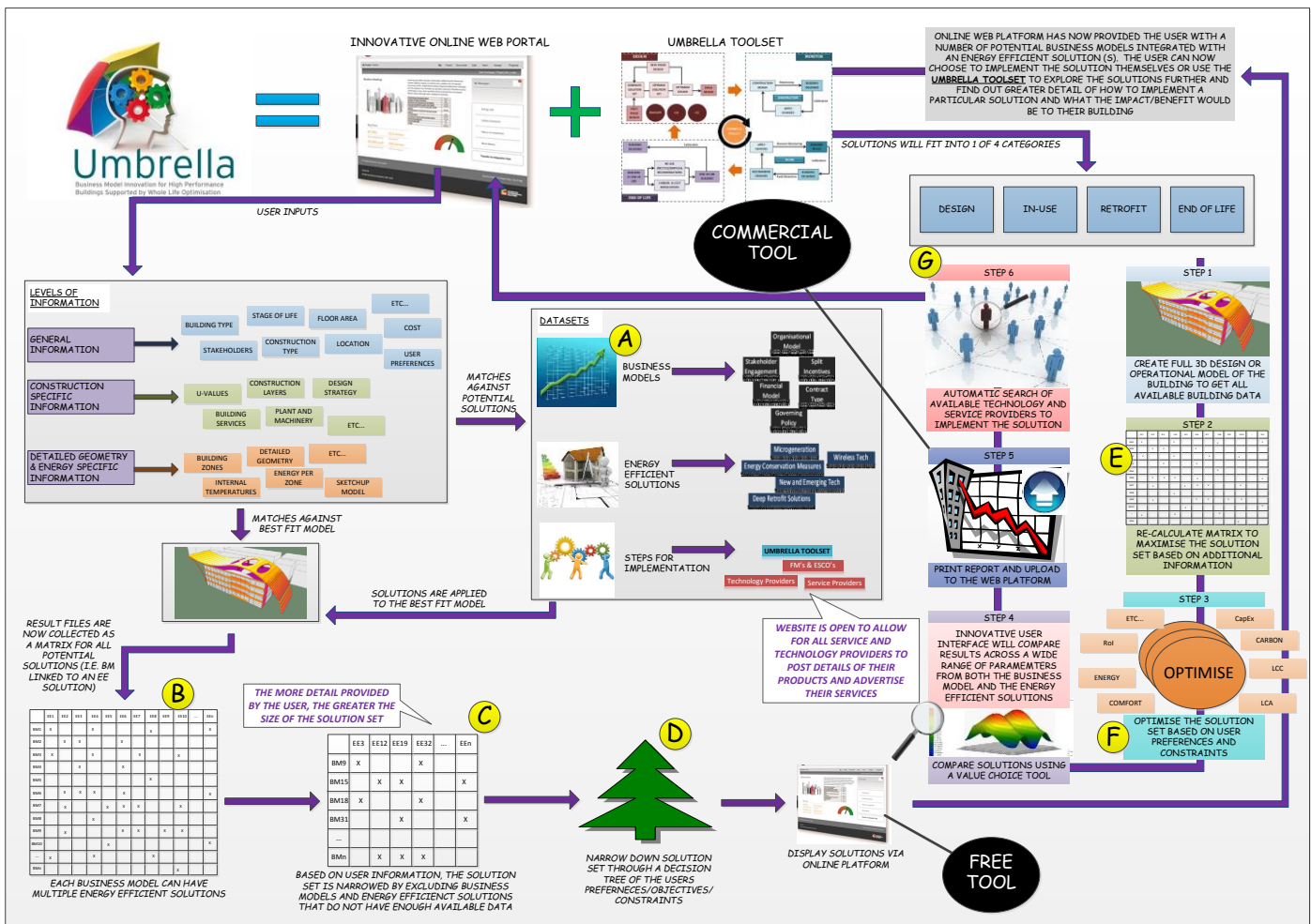


Figure 1 – Early identification of the UMBRELLA components

Following this early analysis and demonstration and testing of the tools which were ultimately developed, a third tool has also been identified which exploits results from both the Free and Commercial tools. This is called a Hybrid tool, which is also a commercial offering, but offers a more accurate version of the Free tool, without going into the complexities and detail required for the Commercial tool. This tool will be created beyond the end of the R&D project duration as it requires some work to create the interface and integrate the different components together. Figure 2 now illustrates these 3 tools, which types of buildings each target, who the customer is and what

the client offering is. This is the result of final detailed analysis and demonstration activities to fully understand how the tool can be exploited in the existing conservative Engineering, Architectural and Construction market.





	UMBRELLA TOOLS	BUILDING TYPE	EXAMPLE BUILDINGS	TARGET MARKET	CLIENT OFFERING	
Level 1 Residential 	FREE TOOL	HYBRID TOOL	Residential Semi-detached or detached dwellings, apartment building, terraced houses etc	SME Energy Management Market (i.e. EPC, Green Deal etc)	Free online simple web tool to allow end users understand the potential within their building for energy reduction and retrofit and potential business models for implementation	App based tool which allows the end user to draw a simple building, implement various design options and discuss with the client various results (i.e. both technical and Business Model). Used where no real data is available.
Level 2 Simple Commercial 		Small and Medium Commercial Buildings Buildings < 10,000m ² , < 5 stories, < 10 tenants; no BMS; no dedicated staff to energy management	Building owners, tenants, managers etc, i.e. no limit as to who can use the Free tool			
Level 3 Large Commercial 		COMMERCIAL TOOL		Large Commercial Buildings Buildings > 10,000m ² , > 5 stories, > 5 tenants; complex control infrastructure; on-site energy manager	Existing Clients, VE users, prospective new clients, i.e. large engineering firms	Sophisticated Dynamic Simulation Modelling based tool, which creates detailed model of the building, implements various design options and provides the end user with detailed analysis (energy, carbon, Rol etc) and Business Models for implementation
Level 4 Complex Commercial 		High complex commercial buildings Large supermarket, hospitals, large warehouses etc				

Figure 2 – Description of the Tools Developed

Each of the individual components of the tools which have been developed for each of the Free, Hybrid and Commercial tools is then illustrated in Figure 3 as follows:

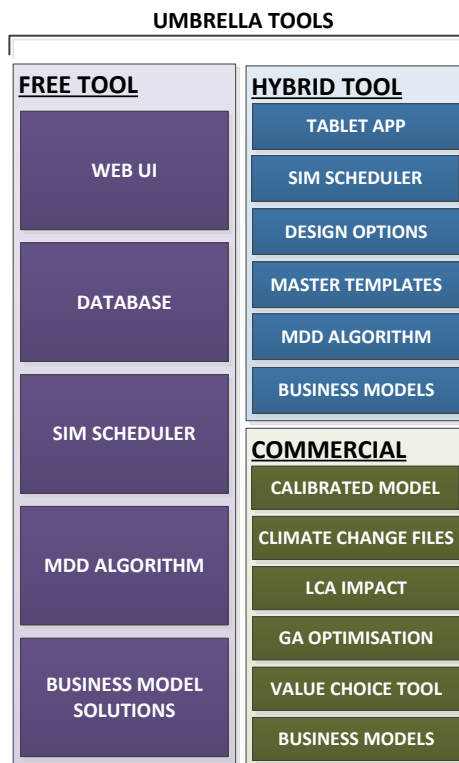


Figure 3 – Individual Components Developed for Each Tool

It is noted that there is some crossover between the components that are used for the tools, many of the development can be used for multiple purposes however in different capacity based on the tool.

The individual work that has been carried out for each work package is now provided in the subsequent sections.

WP2 - Characterisation of the Value Chain and Best Practices

WP2 involved 4 tasks and 3 deliverables.

Task 2.1 Mapping of building energy retrofit value chains is intrinsically linked with task 2.2, with the two interdependent tasks being performed simultaneously and jointly resulting in deliverable 2.1 ‘Analysis of Stakeholder Interaction within the Building Energy Efficiency Market’. The stakeholder identification and mapping of value chains, which form the focus of T2.1 were achieved in a step-wise and iterative manner. A model of the construction industry was developed with specific emphasis of its applicability to energy efficient building projects. This model synthesised insights from a broad ranging review of the literature, and forwarded a coherent approach through which the analysis of value generation activities across the building energy efficiency supply chain could be structured. This mapping exercise was validated and refined through the information gathered from the stakeholder engagement.

Stages or *Hubs of Activity* were identified across the construction life cycle, within which activities could be assembled into logically related groups, as shown in Table 2 below.

<i>Hub</i>	<i>Example of activity</i>
(1) Upstream activities	Extraction of raw materials, manufacture, transport, <i>etc.</i>
(2) Initiation & viability check	Original proposal, making business case, <i>etc.</i>
(3) Design & planning	Designs, building plans, project plans, <i>etc.</i>
(4) Construction and/or installation	All site activities
(5) Operation and maintenance	Use and upkeep
(6) End of life and downstream activities	Deconstruction, reuse, recycling, disposal, <i>etc.</i>

Table 2 - Hubs of Activity of an energy retrofit or conventional construction project (after Dunphy et al., 2013³).

These identified stages are discrete in their own right, but they are also inter-linked and co-dependent. While distinctions can be made to the level of identified *Hubs of Activity*, the boundaries between the hubs are not absolute. Furthermore, as the lifecycle of a building is not a linear process

³ Dunphy, N.P., Morrissey, J.E. & MacSweeney, R.D., 2013. Building energy efficiency: a value approach for modelling retrofit materials supply chains. In A. Méndez-Vilas, ed. *Materials and processes for energy: communicating current research and technological developments*. Badajoz, Spain: Formatex Research Center, pp. 649–657.

(a building can be bought and sold, renovated, upgraded, extended, and refurbished many times in its lifespan), there is a large amount of movement back and forth between the different hubs. This is because within the lifecycle of a generic building there will be multiple cycles of design and construction; occupation and use; renovation and upgrade; deconstruction and recovery/disposal; before the building finally reaches its ultimate end of life.

Task 2.2 Analysis of stakeholder interests, drivers and motives, was based around the six Hubs of Activity identified in T2.1 (upstream activities; initiation and viability; design and planning; construction and implementation; operation and maintenance and end of life and downstream activities). The ‘Hubs of Activity model and the identified categories of stakeholders were used to analyse the interests, drivers and motivations of those key stakeholders within energy efficient building projects.

Initial work comprised literature review and desk based studies. Subsequently stakeholders interviewed within the context of T3.2 were mapped onto the hub of activity model (see Figure 12 below) and the information obtained from these respondents were used with the developed power / interest matrices associated with each Hub of Activity to further characterise stakeholder and their interactions.

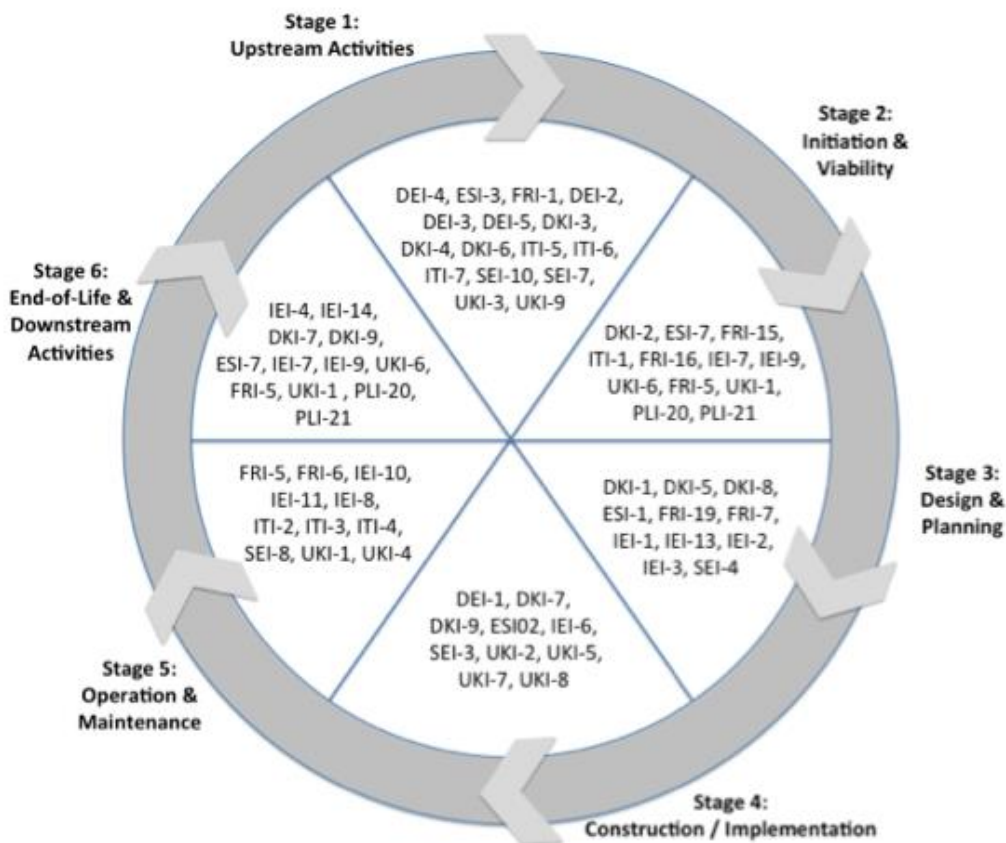


Figure 4 - Interview stakeholders mapped onto Hubs of Activity Model

Task 2.3 Examination of New and Emerging Technologies and Processes aimed to identify, through a technological review, new and emerging energy conservation measures (ECMs), retrofit solutions and microgeneration technologies, augmenting information captured through the stakeholder

engagement. These technologies and processes were reviewed, assessed and a SWOT analysis from the perspectives of the key stakeholders was conducted to ascertain their potential value.

A SWOT analysis is a subjective assessment of data which is organized by the SWOT format into a logical order that helps understanding, presentation, discussion and decision-making. The four dimensions are a useful extension of a basic two heading list of pro's and con's. Moreover, a scan of the internal and external environment is an important part of the strategic planning process. Environmental factors internal to the investigated product/system usually can be classified as strengths (S) or weaknesses (W), and those external can be classified as opportunities (O) or threats (T).

STAM supported Solintel in reviewing the deliverable D2.2 “SWOT analysis of new and emerging energy conservation measures (ECMs), retrofit solutions and microgeneration technologies”.

Finally, Task 2.4 created the UMBRELLA Generic Dataset an energy efficient solutions database, starting from those listed in D2.2; these solutions are required to be modelled by the IES software, the <Virtual Environment>, and as such each of the variables required to model the solutions has been included as a result of detailed discussions between STAM and IES. This database will now be used as part of Task 5.1 and Task 5.3 in order to model the energy efficient solutions and link these to various building typologies and suitable business models through the online web portal.

WP3 - Stakeholder Engagement and Assessment of Requirements

Work Package 3 “Stakeholders Engagement and Assessment of Requirements” main objective was to ascertain the knowledge, requirements and preferences of the various stakeholders involved in the energy efficient building market. WP3 is conceived around the stakeholder. T3.1 creates the first contact with the stakeholders of the EEB market; workshops and on-line contacts were established to engage them and determine their needs and preferences. T3.2 deepened the analysis with face-to-face interviews. These in-depth interviews allowed for more detailed information to be gathered by creating a confident relationship with the stakeholder. Finally, T3.3 analysed the results of the interviews to allow a complete understanding of their role and market expectations.

Task 3.1 Stakeholders’ Network: workshops & online component was based on information drawn from interviews and questionnaires filled in within the UMBRELLA project, supplemented by the authors’ professional experience. The whole involved two different phases.

In the first phase a draft questionnaire was sent to stakeholders identified within the four Umbrella flagship projects. Stakeholders were selected by the partners responsible of each one of the flagship project, according to their contact network and experience. After that, stakeholders were interviewed in a small workshop setting, in order to understand their needs and requirements and to refine the questionnaire for the second phase.

In order to understand the actual stakeholders needs in terms of energy efficient buildings business plan, DAPP in collaboration with the flagship project responsible person, conducted several interviews through a questionnaire which was circulated among the four flagship project stakeholders.

In the second phase the new version of the questionnaire modified according to the input received both from questionnaire analysis and the small workshop, was spread around Europe, in order to reach the maximum audience possible. European contacts were retrieved from the network of the Umbrella partners and from the contacts that DAPP currently has in the E2B Association.

The questionnaire was implemented in the Umbrella website platform, publicly accessible from all the internet users. The questionnaire has been created with Google Form, the on-line application allowing the free creation of survey. The application created automatically a spreadsheet (like MS Excel) in which all responses are saved.

Task 3.2 In-depth interviews obtained detailed information from the different types of stakeholders of the Energy Efficiency Buildings (EEB) market. This added to the analysis already performed within task 3.1 with face-to-face interviews. The Information from their business model, market views and expectations, involvement in EEB projects and stakeholder's interaction was obtained through the interviews. The result of this work is not a market analysis (to be performed in task 4.1), neither an analysis of the results from the interviews (to be performed in task 3.3). It presents the information obtained though the interview process objectively, as a means of capturing the initial impressions from the stakeholder interviews.

As considering the whole of the EU would have been too ambitious, ten countries were involved in the process: Italy, Poland, Spain, UK, France, Germany, Ireland, Denmark, Czech Republic and Sweden. The possibility of interviewing different stakeholders in different construction contexts, climatic zones and energy consumption profiles have enriched the data gathering and allowed having a complete understanding of the different characteristics of the European markets.

Task 3.3 Data analysis relates specifically to the analysis of the information, (primarily stakeholders in-depth interview transcripts) obtained in other tasks of the work package. The interviews were conducted face-to-face in a free form, open-ended manner in keeping with a grounded theory approach. Grounded Theory, developed by Glaser and Strauss (1967) is an inductive type of research, which aims to generate ideas or theory based or "grounded" in the observations or data from which it was developed.

Wherever possible, and where interviewees permitted, the interviews were recorded to facilitate transcription and subsequent qualitative analysis through 'coding' of interview transcriptions; coding means to capture a datum's primary content and essence.

In addition where applicable, notes were taken to note non-verbal communication or other relevant observations. Interview guides were developed with the objective of collecting a large list of potential questions of interest for the project, with informants allowed to speak as much as they wished on any particular area. The questions were kept short and easy to answer to avoid participants losing interest in completing the questionnaire. Furthermore the questions were straightforward and neutral, so as not to influence the users in their answer.

Considering the previous facts, the analysis approach was qualitative in nature; qualitative analysis of the interviews provides for a comprehensive characterisation of the marketplace, a deeper understanding of the roles (albeit dynamic) played by the various stakeholders in energy efficient

building projects and knowledge of business models currently adopted in this sector. Consequently, this analysis will allow for the development of novel business models and supportive innovation governance policies that will encourage greater uptake of building energy efficiency retrofit and new builds (input for WP4).

The number of steps required to complete the coding process varies between research methods and the amount of raw data, but qualitative coding commonly utilizes three or four steps. The portion of data to be coded during the first iteration of coding can range in magnitude from a single word to a full sentence to an entire page of text. At the second stage of coding, codes should be analysed to find similarities between them, and to enable grouping into categories based on their common properties. If necessary, sub-categories can be developed first from the codes before then linking to categories.

NVivo software was selected to facilitate the analysis of interview transcripts for Task 3.3. NVivo supports qualitative and mixed methods research and provides a platform to collect, organize and analyze content from a range of data sources, including from interviews, focus group discussions, surveys, and web content. NVivo provides a means to analyse data qualitatively by using powerful search, query and visualization tools.

The software allowed a common analysis approach, and enabled the development of a series of comprehensive databases to store and save all collated data. Database files were developed for each individual study jurisdiction, with the ability and option to merge individual country files where appropriate for analysis. Developed databases provide the added advantage of serving as a data repository for Umbrella, providing the possibility to be queried at further stages of the research process.

The possibility of interviewing different stakeholders in different construction contexts, climatic zones and energy consumption profiles enriched the data gathering process and facilitated a complete understanding of the different characteristics of the European markets.

The information collected within the single interviews, classified under a specific node, provided useful information to inform work on Task 4.2, taking into consideration the nine building blocks of the business model canvas, namely: Customer segments, Value proposition, Channels, Customer relationship, Revenue streams, Key resources, Key activities, Key partnerships and Cost structure.

WP4 - Novel Business Models for Integration of Energy Technologies with Design Stakeholders

The Work Package 4 “Novel Business Models for Integration of Energy Technologies with Design Stakeholders” has an essential role in the project programme to support a complete understanding of the European market of energy efficient buildings and their related innovative services and products and to provide the framework for the subsequent WPs for the final creation of the software.

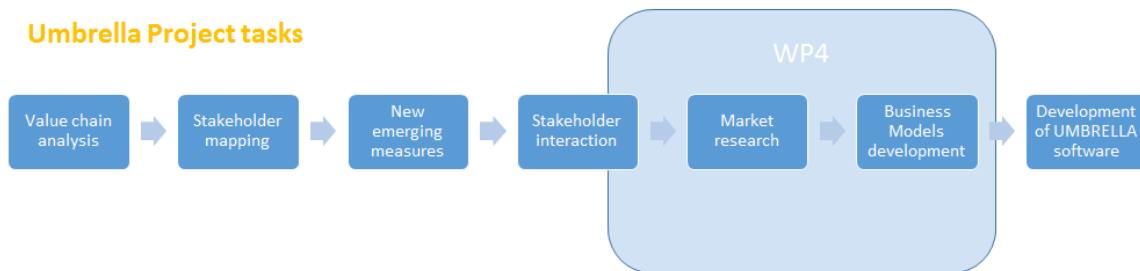


Figure 5 – Workflow of WP4

Task 4.1 - Market research, analysed the current state of the market which the UMBRELLA project will target. A large list of stakeholders have been consulted in order to obtain a complete understanding of the market: building owners, European and national associations, construction companies, electricity grid operators, utilities, energy service companies, building tenants, manufacturers of products for energy efficiency, architects, municipalities, public energy agencies, construction economists, etc. The stakeholders were classified into primary and secondary as follows:

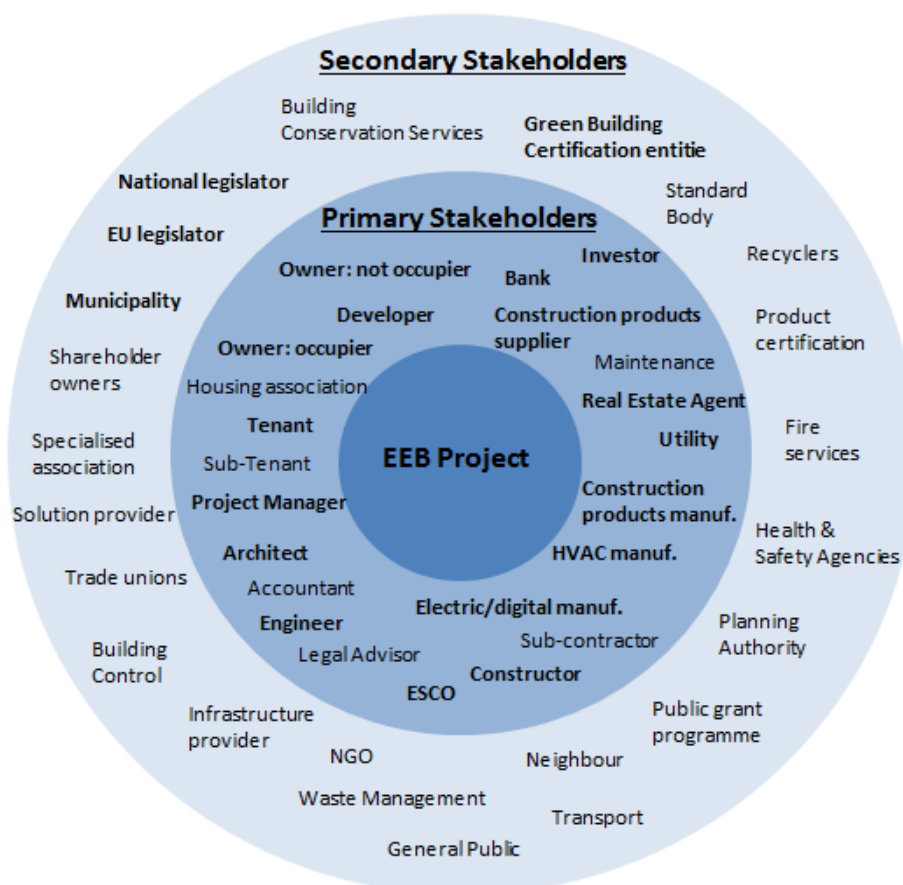


Figure 6 – Classified Stakeholder groups

The outcome of the task 4.1 was the deliverable 4.1 describing the current status of the EEB market in the EU. Besides having a EU perspective, the report focuses on the particular situation of the

national markets of the 10 countries under study. The report also covered an analysis of the different types of the stakeholders involved all over the life of a building and a general description of the current strategies followed in the market.

Task 4.2 – Business model options and financial analysis for every stakeholder identified the potential business models and financial structures for the EEB project and the implications in the different stakeholders involved in the Flagship Projects. The work undertaken for this task has been structured in four steps as follows:

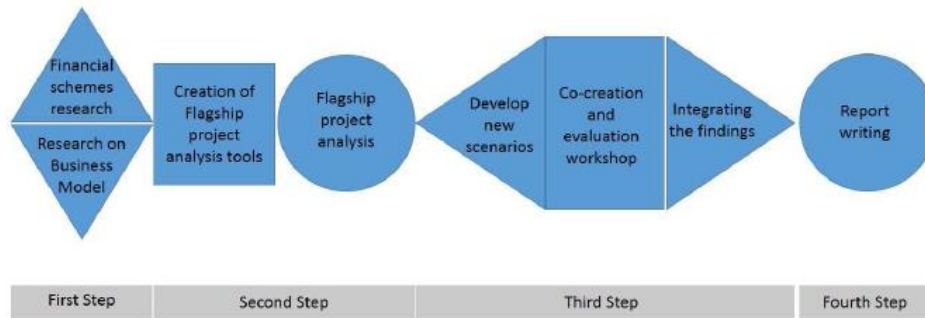


Figure 7 – Work undertaken for T4.2

The work in Task 4.2 has been carried out with the hypothesis that the best innovative business models are supported by a coherent project configuration where the energy efficient solutions are supported by the right actors, at the right time and at a cost-effective level according to the project budget. Being dedicated to finding new business model options for stakeholders, the work in Task 4.2 was focused on project ecosystems and specifically on the analysis of financial aspects. New project configurations have been proposed relying for the most part on new project ecosystems, involving the existing stakeholders in a different manner or introducing new ones leading to a different investment, costs and income profile. These new project configurations rely on a thorough review of the financial mechanisms that seemed the most appropriate for each project and of the promising business models for energy efficiency in the built environment.

The task ensured that that new business models can be successfully articulated together in order to activate the energy efficient buildings value chain that supports the new project configurations of the flagship projects. It is a key preparatory task towards the development of incentive-driven contracts to be tested afterwards in the flagship projects and the creation of generic business models applicable for EEB stakeholders in Europe.

Task 4.3 – Recommendation for a strong innovation governance and supporting policies involves assessing the policy frameworks supporting innovation and energy efficient buildings in the regions of the flagship projects. The assessment builds upon the in-depth understanding of the value chain for innovative EEBs integrating new services gained through stakeholder interaction. Following the assessment, recommendations will be made to local authorities for establishing or improving multi-level (local, regional, national and/or EU) innovation governance so that it acts as it a powerful support to innovative EEB projects.

Theory-based policy analysis is being used to evaluate the policy context relating to energy efficient building and innovation in the locations of the flagship projects, viz. Spain, UK, Italy and Poland. This is being conducted on a multi-level perspective covering national, regional and local governments.

The final outcome of the task 4.3 was a list of recommendations, which is presented below:

- Recommendation 1: Policies should aim to develop new market opportunities not attempt to stimulate demand for particular technologies.
- Recommendation 2: Alterations to innovation systems conditions (rules) should be done on a case-by-case basis with specific objectives in mind.
- Recommendation 3: A multi-perspective view should be taken to attempts at improving innovation governance.
- Recommendation 4: The concept of innovation needs to be reframed in recognition that not all innovation is technological,
- Recommendation 5: Industry led partnerships should complement but not replace stakeholder engagement in the policy making process.
- Recommendation 6: Greater efforts need to be made to include the views of smaller companies and non-governmental organisations in policy development.
- Recommendation 7: Support project-based knowledge capture initiatives and develop inter-firm knowledge exchanges for energy efficiency building activity
- Recommendation 8: Review education and training of building professional for applicability to an enhanced focus on energy efficiency retrofits and
- Recommendation 9: Facilitate and promote the development of financial approaches than decouple project funding from owners ability to get credit
- Recommendation 10: Optimise policy mix to encourage building energy front-runners as well as laggards
- Recommendation 11: Review of existing policies for coherence
- Recommendation 12: Review of existing policies for applicability to current objectives

Task 4.4 – Adaptability of the Business Models main objective was to ensure that business models were adaptable all over the life of the building to ensure that business models are not abandoned once the initial phase has been carried out. Workshops from task 4.2 were used to ask stakeholders from flagship projects to assess the impact that different business models will have had in the project if they had been chosen initially. This information was assessed in this task to check the main project characteristics that make business models applicable.

The different typology of projects was analysed: new/retrofit; public/private building; typology of buildings: school, office, museum, prison, hospital; type of services included; building status; country; etc. business models were then assessed to verify under which conditions they could be applied.

Task 4.5 - Business Model Development enabled a deep understanding of the role of business models for overcoming barriers to energy efficient buildings. This understanding was built upon the

multi-level perspective theory and a clear definition of the performative role of business models. The multi-level perspective theory aided in the explanation of why there are barriers to energy efficient buildings. These barriers are due to a lock-in of the socio-technical system and regime, which greatly influence the energy efficient building market. Due to their performativeness, business models, and especially innovative business models, are able to reshape the socio-technical system, which, coupled with pressures from the environmental and energy crisis, participate into reshaping the socio-technical regime. Through reshaping these system and regime, barriers can be overcome.

The research undertaken on the business models in the EEB market ended up with more than 100 different business models, each of them with different characteristics. A classification and structuration was needed to identify the applicability of the business models and how they could be automatically identified using the software tools in WP5. The Ontology was developed to assess and characterise the different types of services provided:

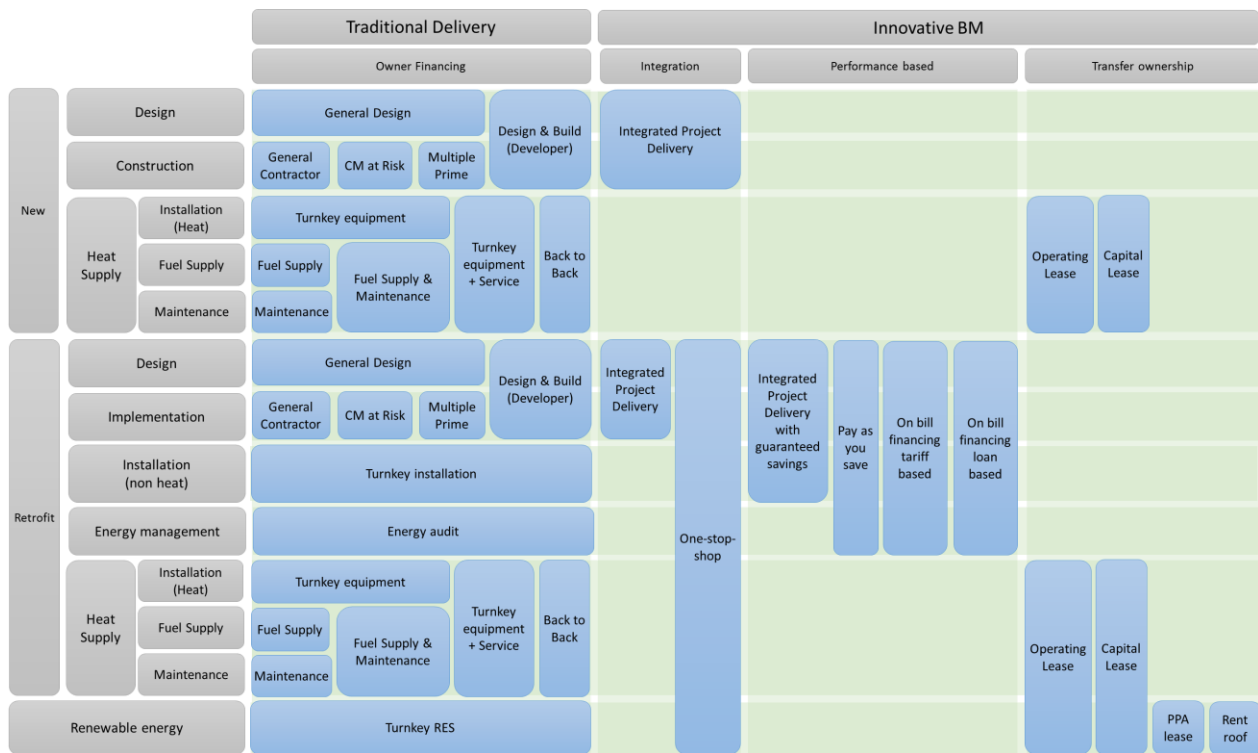


Figure 8: BM Ontology for small residential projects

Finally the navigation flow and database for the tool were created as shown in Figure 9:

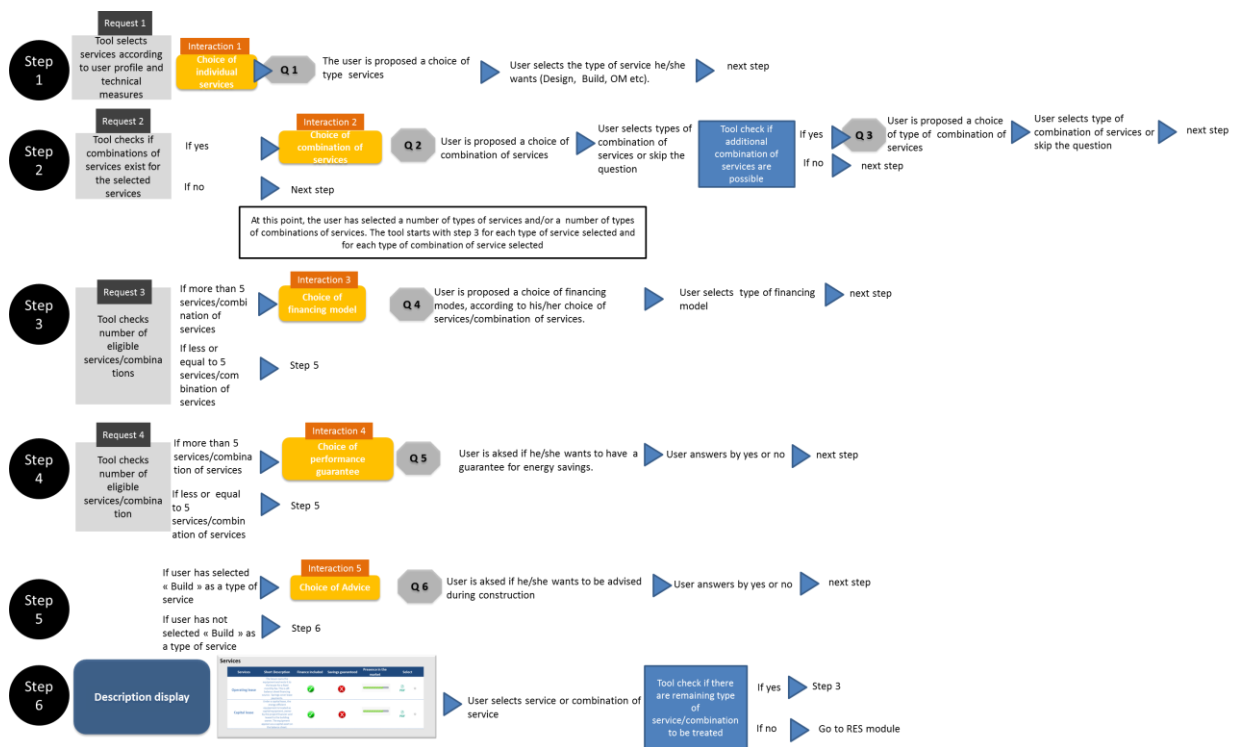


Figure 9: BM Module navigation flow

WP5 - Innovative UMBRELLA Toolset with Combined Economic and Environmental Aspects

WP5 is the creation of the technical tools required to deliver both the Free and Commercial tools. This work began in Period 1 with the development of the functionality for scenario generation which included the creation of the Master Templates and what we then called Search and Replace tools. The Search and Replace was updated and improved in P2 and is now called Design Option. Period 1 also saw the creation of a Parametric Batch tool for optimisation, this has also been updated and improved to include a Genetic Algorithm which allows for the creation of a more in-depth solution space to be examined. P1 developed the first version of the MDD algorithm to reduce the solution space. P2 has seen the completion of the Future Weather files to allow for climate change analysis, the End of Life Solutions set now incorporating the ICLD protocols, the value choice tool to allow for optimisation of the final solutions and the in-use algorithm to allow for system changes in an existing building. In addition, there was an additional task introduced with respect to integration of the business models so that the software can automatically decide which business model(s) are the most appropriate for the situation presented by the end user.

Task 5.1 Metadata Engineering and Scenario Generation involved the creation of tools to generate multiple single and combination scenarios and enable the efficient use of the best case solution sets for the UMBRELLA tools. As such, two tools were created: (1) Master Templates which allows for the auto-generation of a building model based on user input such as building typology and floor area and room details such as system set up and profiles of use and (2) Design Options which allow the analysis of multiple different design situations or retrofit interventions that could be applied to a building (Commercial tool) or for the auto-generation of the building model selecting the Design Option most appropriate to the user inputs. As such Design Options were used for both the Free tool and Commercial tool, in different capacities. Overall for the project, there was 18 room specific and

16 whole building MT's along with 575 DO's created which included 179 interventions and 396 construction design options. This provides a vast library for the UMBRELLA tool to start with and this can be expanded over time as more MT's and DO's are needed.

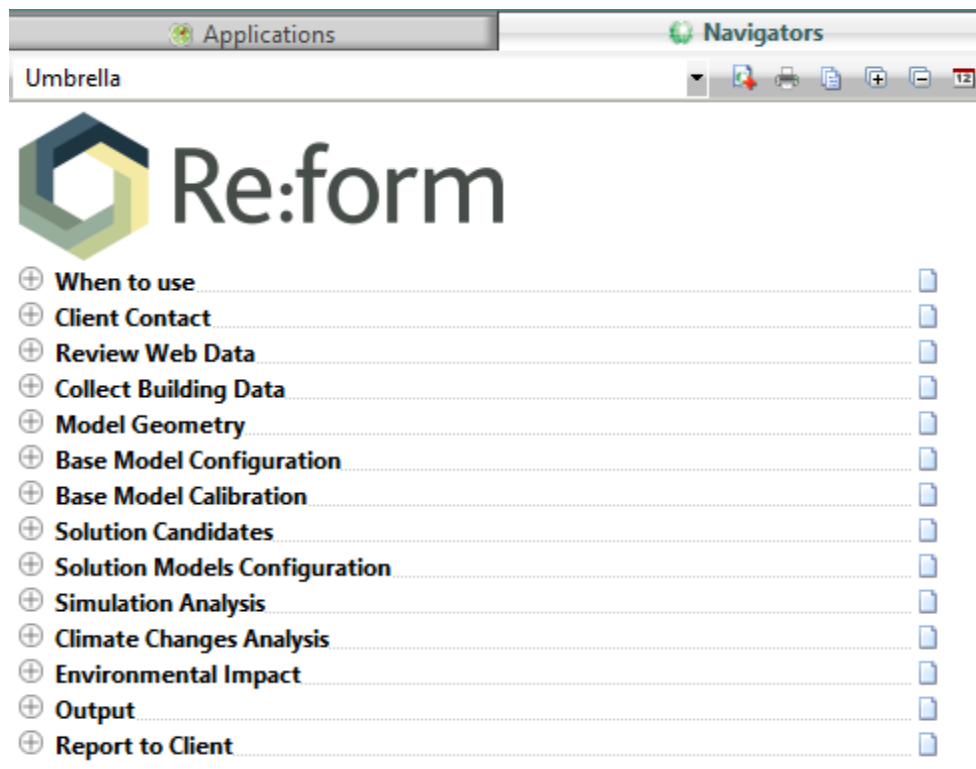


Figure 10 – Re:Form Navigator for the UMBRELLA tools developed

Task 5.2 Decision-making / Optimisation Multi Decision Diagrams for Design Solution Set involved the creation of the MDD algorithm to reduce the solution set. as a result of testing, it was noticed that the solution space of the Free tool is not vast enough to make the MDD valuable within the Free tool and hence the coding to integrate it with the Free tool would have been redundant work. Instead it has been decided to integrate the MDD with the proposed Hybrid tool which will take advantage of the software developed for the Free and Commercial tools to create a bigger solution space and better results accuracy without going to the full complexity of the Commercial tool. This Hybrid tool will be developed jointly by IES and TCD during the commercialisation phase after the project. As part of this task, a navigator to guide the user through the use of the tool was also created as shown in Figure 10.

Task 5.3 Decision-making / Optimisation GA for Design Stage involved the creation of a Genetic Algorithm which will further advance the optimisation of the solution beyond that which the MDD can provide. This work was starting in P1 through the creation of the Parametric Batch tool and completed in P2 with the full development and integration of the GA and associated interface with the UMBRELLA Commercial tool. The result is an advanced software tool and interface to allow a user identify their objectives, parameters and constraints for multiple combinations of design/retrofit scenarios and find the optimum solution set which can then be taken for further analysis by the Value Choice tool developed in Task 5.6. An illustration of the interface is shown in Figure 11.

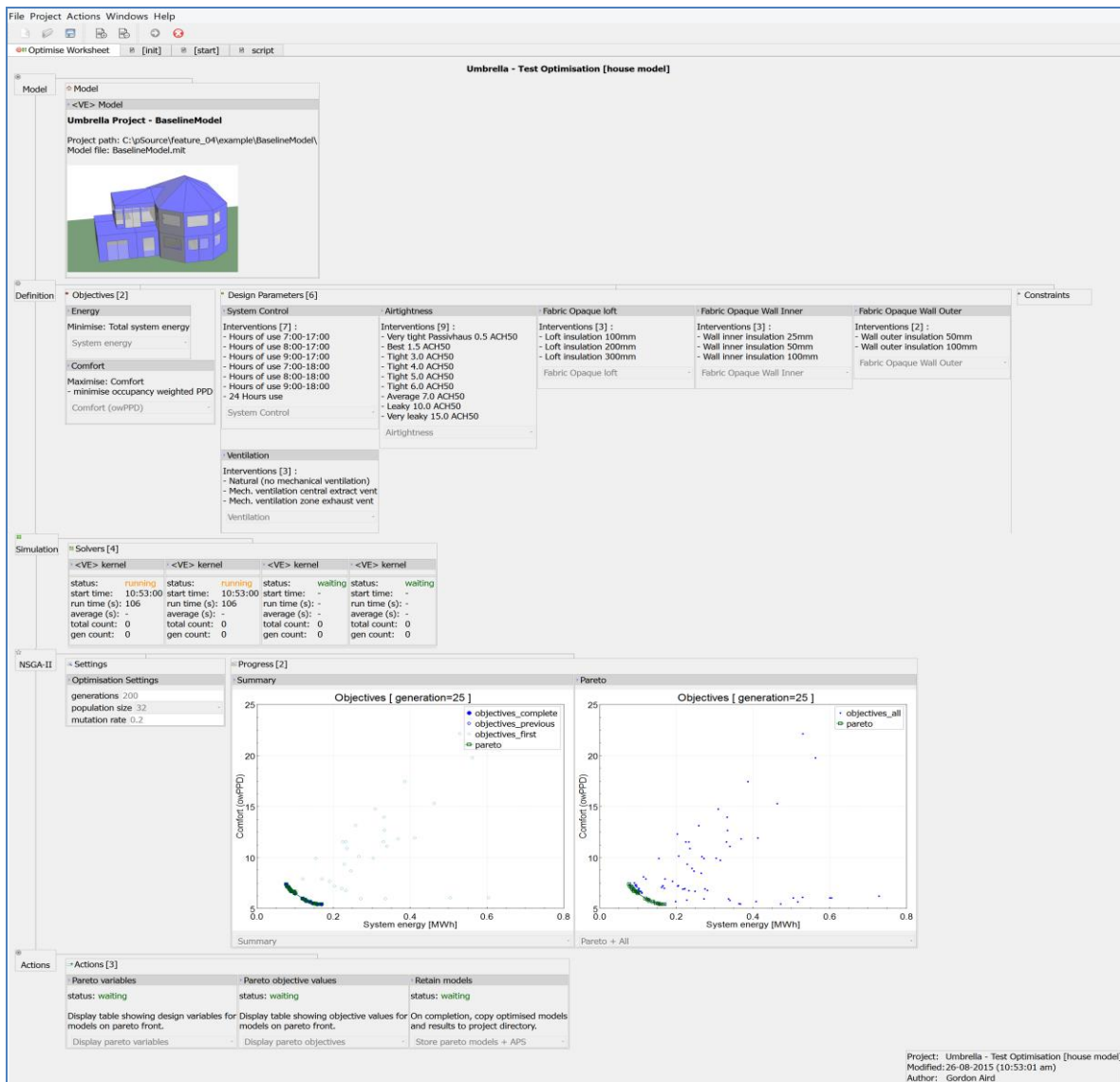


Figure 11 – Interface for the Optimisation Tool

Task 5.4 Adaptability for Building Use and Climate Change involved the creation of future weather files for multiple locations to assess climate impacts. Different elements of a building with different life expectancies and replacement cycles was investigated and a timetable of replacement generated. This included for example upgrade to facilities to cope with the impacts of climate change providing provision for increased size of HVAC systems or allowance for night time ventilation. This allowed for the exploitation of intervention and adaptation to modify buildings at least cost. The main development has been the generation of the Future Climate Weather Files. This has also been linked with the Value Choice Tool (DEFT) in T5.6 to allow the user to assess a range/combination of options and look at them using different future weather scenarios. As such the impacts of climate change can be analysed and the end user can decide which solution offers a result which will be most likely to address all future weather situations, e.g. the sizing of a particular HVAC system or allowance to ensure that the size can be increased over time if necessary. As such, the user can keep in mind potential future changes to the system that might have to be made and hence ensure that they install the system with adaptability in mind.

Task 5.5 Optimisation of the End of Life Solution Set created an initial End of Life Solution set. A number of PDF's which look at the End of Life Solution for each of the interventions included in the UMBRELLA tool have been created. A structure has been developed to ensure that if future interventions/technologies are added to the software, an End of Life Solution can be generated and added to the dataset for these technologies.

Task 5.6 Creation of the optimisation algorithm for the final solution set involved the creation of a Value Choice Tool which allowed for the analysis of the final solution set generated by the UMBRELLA commercial tool. The Value Choice Tool links the results from the MDD and GA algorithms that have been created in T5.2 and T5.3 along with the solution set that has been generated in T5.1 through the Design Options and Master Templates. The Value Choice Tool (DEFT) provides solutions with respect to Cost, Return-on-Investment (RoI), Life Cycle Costing (LCC), energy, carbon and Life Cycle Assessment (LCA) etc. A weighting function has been included to allow the end user to weight the solutions based on their individual priorities or constraints, this ensures that the solutions presented are those which are important to the end user. An example of the interface of the DEFT tool is shown in Figure 12.

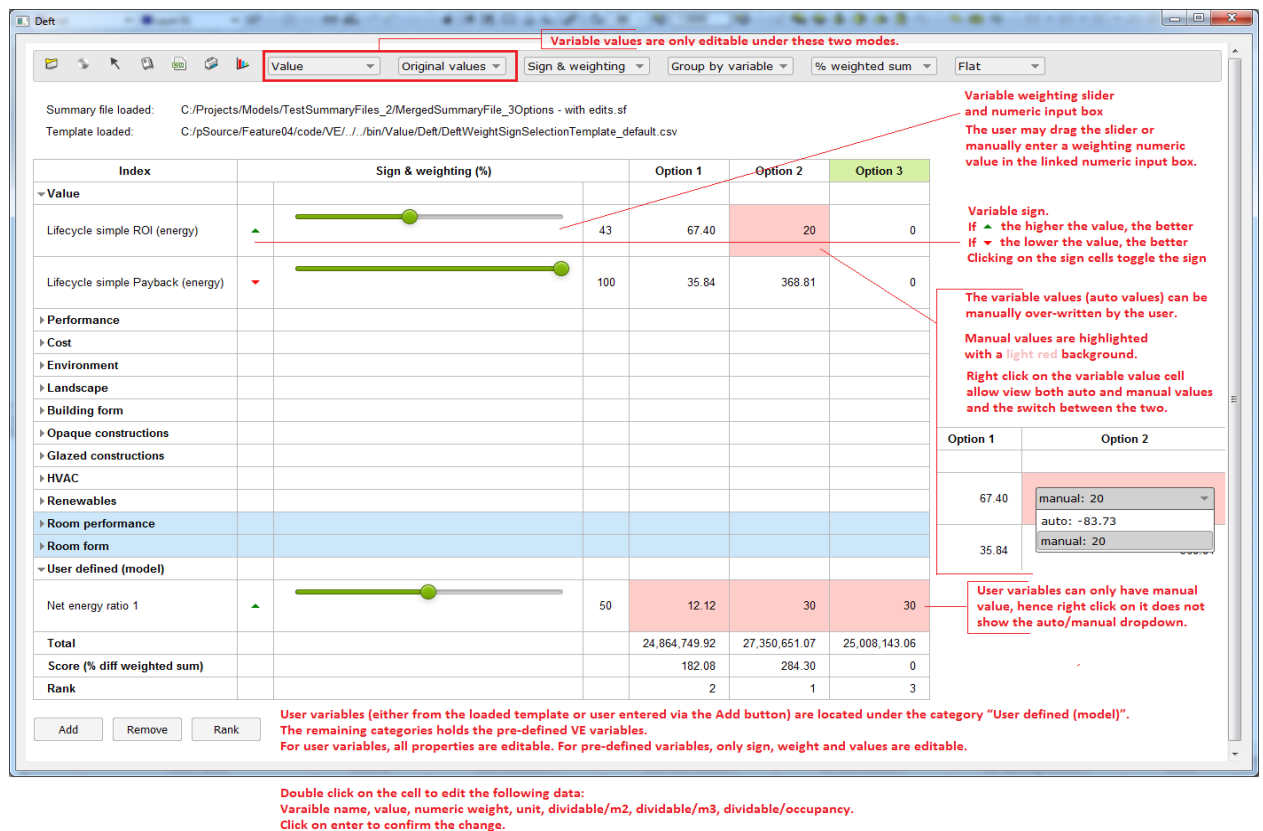


Figure 12 – The DEFT Interface

Task 5.7 Development of in-use control algorithm created an optimal control algorithm to optimise the in-use energy performance of a building. The purpose of the algorithm is to allow for energy efficient solutions to be applied to buildings which are not in a position to make significant investment into the building or buildings which cannot make changes due to reasons such as protection of listed buildings. The in-use control algorithm has been designed using Model Predictive Control (MPC) and Economic Model Predictive Control (eMPC) to ensure that both user

behaviour and cost of energy supply are taken in account with respect to optimising the building in-use. This algorithm is used only with the Commercial software as a result of the requirement of a detailed calibrated model for the building.

An additional task: Business Model integration was not in the Description of Work, however needed to be included in this deliverable in order to complete the UMBRELLA toolset integration. Following the creation of innovative business models or 'The Energy Efficient Building Project Model (EEBPM)' from deliverable 4.5, there was the requirement to integrate this within the toolset to allow users to be given access to basic business model information that was optimised to suit their needs and the suggested energy efficiency solutions from the tool. Two solutions are offered, the first provides a short description of the Business Models which are integrated with the Free Tool and the second is a full dataset of Business Models (in pdf format) which are sold with the Commercial Tool. For the full dataset, these are a starting point for the Agent to use to engage with the building owner and understand how the solution can be implemented, however these Business Models can also be modified and adapted to suit the individual building owners needs and priorities and hence they are seen as a starting point for the Agent to engage with the building owner. A vast amount of work has been carried out to produce these Generic Business Models and this has formed one of the main outcomes and unique selling points of the UMBRELLA project as this is not something that is included in any other commercial tool in this area (refer to D8.5 for more information on competing products).

WP6 - Communication Infrastructure and Knowledge Platform for the Support of Increased Technology Uptake

WP6 developed the functionality for the Free tool, this included the user interface of the online web portal, the simulation scheduler which takes the information from the end user via the web portal, creates the box model and simulates the result and the architecture and database for the import/export function between the online web portal and the simulation scheduler. In addition, WP6 focussed on the branding and identity of the overall tool and renamed UMBRELLA to Re:Form, to be used as the final product name.

Task 6.1- Architecture Design created the basic architecture for the online web tool including the formats to be used for both the front end UI and the back end database structure. The front-end has been developed in HTML5, CSS3, Javascript, jQuery and Ajax. For the back-end Django 1.4.3 has been used. Django is a high-level Python Web framework that encourages rapid development, clean and pragmatic design. The language used is the SQL: Structured Query Language is a special-purpose programming language designed for managing data stored in a relational database management system (RDBMS) such as the UMBRELLA tool. The global architecture identified for the development of the tool is illustrated in Figure 13 as follows:

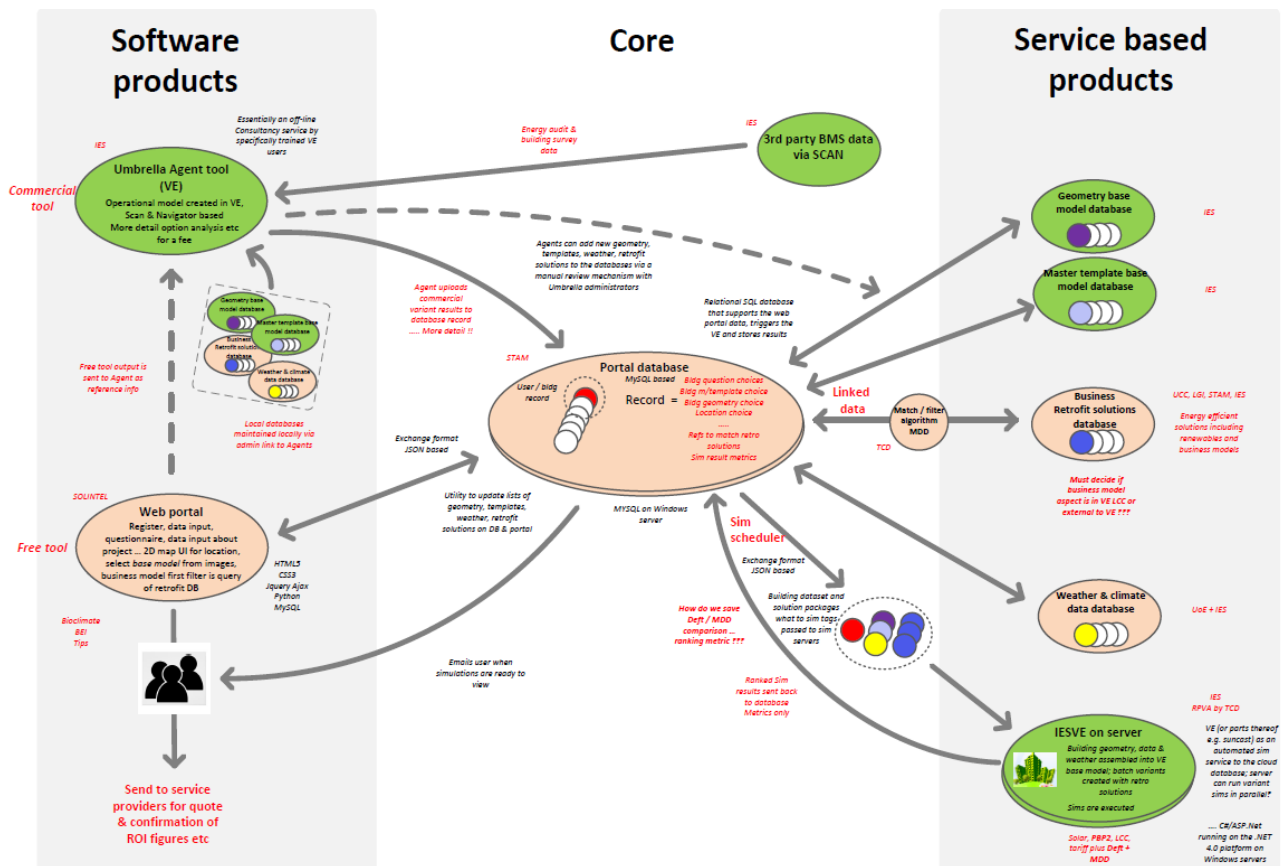


Figure 13 – Global Architecture Defined for the Tool

Task 6.2 – User Interface (UI) Design created the User Interface for the Free tool. The UI has been designed to be intuitive and user friendly; making it easy and efficient to operate the UMBRELLA tool. This means that the operator needs to provide minimal input to achieve the desired output (optimised energy efficiency solutions, and appropriate low carbon micro generation technologies).

During the development of the project, several prototypes of user interfaces have been developed. As shown in deliverable 6.1, there had been four different alliterations of the interface (the last of which was Version 4.0), with each one building on the research conducted and feedback received from the user community. A mixture of features and aesthetics of the different versions are the baseline of the actual version. The key advances and developments include the graphical design, the usability, the dynamism and the parameters adapted to the technological requirement of the platform.

It was still felt that that site required significant upgrades to improve its look and functionality, as well as back end upgrades to ensure integration with the toolset. It was decided to change completely the appearance of the user interface to be more professional, with more minimalistic structure. As such, three more iterations (7 in total) were carried out before the final UI was delivered.

In addition to this, although the project is branded as ' UMBRELLA ', as we prepare for the market launch and exploitation of the toolset, it was felt that the UMBRELLA name did not necessarily the best fit the market for the tools that were going to be produced. The toolset will need to appeal to different types of users in the different sectors of in use, retrofit and new build, so a more

professional brand was required that would reposition the toolset to open up to this broad marketplace.

The brand and logo finally settled on was Re:form (see below). The idea behind the brand name and concept is that everything the application does helps to ‘reform’ the building. The marque is made up from a series of arrows going in a circular direction, which represent the things the application does i.e. improve performance, Increase energy efficiency, reduce energy bills and improves the buildings lifecycle and are also used to show the different sectors that the tool will be used in.

The word reform can be used as verb (i.e. to make changes to something in order to improve it) or as a noun (i.e. the action or process of reforming an institution or process). As shown below the brand is flexible and can be extended to use the ‘Re:’ part of the brand to demonstrate all the things the application does, for example: Re:form - Re:invest, Re:evaluate, Re:structure, Re:generate, Re:duce, Re:adapt, Re:analyse, Re:calculate, Re:configure, Re:design, Re:develop. An example of the brand is shown in Figure 14.



Figure 14 – Example of the Re:form branding

An illustration of the final interface is shown in Figure 15.

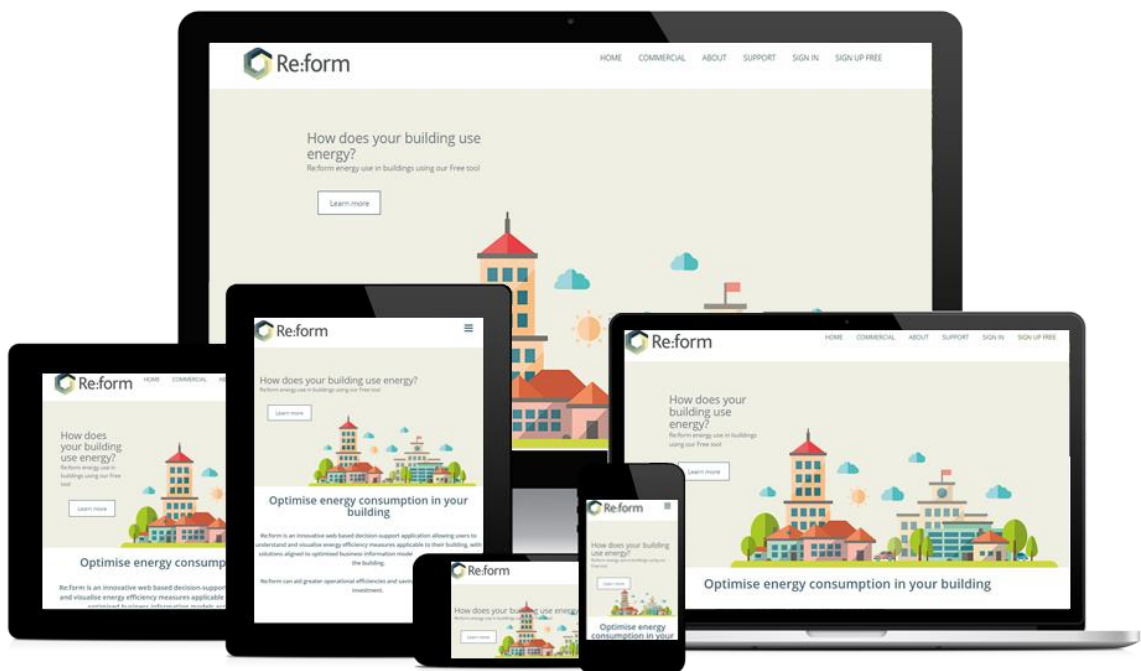


Figure 15 – Interface including the Re:form Branding

WP7 - Implementation and Validation of the UMBRELLA Online Web Portal, Business Model Generator and Implementation Tool

WP7 was responsible for the implementation and validation of the UMBRELLA tools on four test sites in the EU. There were a number of changes to the test sites as a result of projects being stopped due to funding and issues with respect to interactions with some of the building owners. However, all issues were resolved during the course of the project, with 2 of the demonstration sites being replaced and changes to the scheduled 'testing' of each site. In addition, a transfer of budget for consumables for one site to another was made due to the change in the 'testing' nature of the site. Both the Free tool and Commercial tool were successfully tested on all four sites and have highlighted a number of important points which must be taken into account for the commercialisation stage of the project (beyond this R&D project).

Task 7.1 Evaluation Methodology and Benchmark established the evaluation methodology as well as the benchmarking framework to guide the holistic evaluation of the UMBRELLA system based on an integrative framework. This evaluation methodology had to include methods for evaluation of the testability framework metrics, user engagement and usability evaluation.

Each of the test sites was then modelled and tested using both the Free and Commercial tools. Deliverable 7.2 - UMBRELLA Functional Testing & Usability presented the usability survey that evaluated seven different categories of the User Interface: structure, use, information for the user, intuition, appearance, contents and general opinion. The results of the survey were also included in the deliverable. It can be said that currently, regarding usability, the UI has obtained an acceptable average mark. However, it was detected that the information provided to the user was a weak point of the UI that had to be further improved, while the highest marks were the ones related to the User Interface fast response. This document was the cornerstone to improve the User Interface to a higher level of users' acceptance. This deliverable also presented the good results of the UI regarding accessibility and speed, by showing related test results that complement the Usability Survey carried out.

Deliverable 7.3 - UMBRELLA Solution Implementation Evaluation presented the results of the application of the free and commercial tool to each of the demonstration sites as described above. The Findhorn village in the UK has been examined with respect to In-Use, the Demonte school in Italy has been examined with respect to Retrofit, the Jurata apartments in Poland and Valencia apartments in Spain have both been examined with respect to Design. A comparison is made between the results of the Free and Commercial tools and it is shown that the Free tool is a good indicative tool to examine the ranking of potential Design Scenarios and Retrofit Interventions and provide a good % comparison with the given baseline, in comparison to the Commercial tool. The application of the Commercial tool shows that it is valuable with respect to better design, understanding retrofit options and optimising a building while in-use.

After performing the evaluation within each of the four demo sites, the results demonstrated that UMBRELLA rankings of energy saving potential compare very closely to that of a detailed model; both the ranking order and the % comparison to the respective baselines are very close. These detailed models take significantly more time and cost significantly more to prepare than the

UMBRELLA tool. As such, the Free tool is a good initial analysis of the intervention the user should examine in more detail.

Regarding the KPI results, these were very different. This highlights the need for a detailed commercial model, as the Free tool would not be reliable enough to give a definitive value of Return on Investment, payback or energy to be saved and this is the reason the results are presented as rankings and a % comparison to a baseline only. If the end user wants to know with a high level of accuracy the savings that can be achieved and hence how much money is required to finance the intervention based on an x number of years return, a commercial model would be required.

As such, the Free tool is used as a first exploration to allow the end user understand their options and what they should explore further and the Commercial tool is then used to calculate the actual savings and the business model to implement such a solution.

4.1.4 Potential Impact (10 pages)

Overall Impact

The consortium, agreed at an early stage that the UMBRELLA tool will be made up of two offerings; a Free tool and a Commercial tool. The Free tool offers a range of energy efficient solutions using a selection of template building typologies (e.g. office building, dwelling, hospital and so on) through an online, user friendly and intuitive website, as well as the appropriate business model to implement the solution. The Commercial tool takes the user beyond the basic analysis delving into more complex analyses recommending solutions based on a very detailed and accurate representation of the user's building. In the last few months of the project, the demonstration activities also identified a 3rd potential offering, that of a Hybrid tool which combines aspects of the Free and Commercial tools to offer a more detailed analysis but without the complexity of the data required for a full Commercial analysis.

For a greater socio-economic the consortium agreed to target specific countries based on floor distribution per country; these chosen countries are: Germany, France, UK, Italy, Spain and Poland.

With the exception of Germany and France, the other countries are home to the UMBRELLA pilot test sites therefore we have already performed relevant stakeholder analyses and interviews to understand each of the different environments and have gauged the initial feedback on the proposed tool which has ultimately informed the design of the tool itself. It is expected that during the commercialisation period (i.e. prototype to product) there will be further stakeholder workshops in these relevant countries which will enable us to not only increase the exposure of the tool but gauge further the target market to enable a greater impact to the market and environment. In addition, the next countries to be added will also be examined.

The commercialisation phase will target 2% of the EU building stock within 5 years of commercialisation of project deliverables. This will result in an increase in the market share of energy efficient solutions of 15% within 5 years, resulting in reductions of 3.096Mtoe per year. This is a significant impact to the EU. The partners are confident that this impact will be met as a result of

- The quality of tools which have been developed
- The USP that exists with respect to the integration of a technical and business solution
- The route to market and exploitation plan which has been identified
- The exploitation lead already being a lead in software development and sales and having a strong track record in bringing R&D prototypes to commercial products
- The commitment of the exploitation lead and project partners to ensure that the UMBRELLA project is a commercial success

Overview of Dissemination

The project carried out a vast number of dissemination activities to reach as wide an audience as possible and have the maximum impact as possible. This included

- Participation in and presentation at conferences, workshops, seminars and trade-fairs within Europe and internationally, to make the project visible to the widest audience possible. The following events were attended by the project partners from March 2014:
 - EcoBuild, 5 March 2014, London, UK (EXE)
 - EERA Annual Congress, 9 April 2014, Brussels, Belgium (SOL)
 - Industrial Technologies 2014, 9-11 April 2014, Athens, Greece (IES)
 - ECTP-E2B Conference, 17-19 June 2014, Brussels, Belgium (STAM)
 - Forum of public facility managers, 9 June 2014, Warsaw, Poland (NAPE)
 - SMARTGREENS 2014, 15-17 July 2014, Bangkok, Thailand (TCD)
 - Sustainable Places, 1-3 October 2014, Nice, France (STAM)
 - Smart Energy Expo, 8-10 October 2014, Verona, Italy (STAM, DAPP)
 - 40th IAHS World Congress, 16-19 December 2014, Funchal, Portugal (LGI)
 - Bahrain International e-Government Forum, 15-19 March 2015, Sakhir, Bahrain (STAM)
 - Facility & Property Management - safe and economical property conference, 27 August 2015, Warsaw (NAPE)
 - Med Green Forum, 27 August 2015, Florence, Italy (STAM)
 - UPEC 2015, 1-4 September 2015, Staffordshire, UK (TCD)
 - Construction Scotland Innovation, 15 September 2015, Stirling, UK (IES)
 - Sustainable Places, 16-18 September 2015, Savona (STAM, IES, LGI, UCC)
 - SET Plan Conference, 21-22 September 2015, Luxembourg, Luxembourg (LGI)
- Release of technical papers and publication by the project partners describing the work and results of the project in targeted journals and conferences:
 - Dunphy et al., “Energy Efficiency in Commercial Buildings: Capturing Added-Value of Retrofit”, (in press) Journal of Property Investment and Finance, Emerald Group Publishing Limited, July 2014.
 - STAM, “UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation”, Smart Energy Expo 2014, October 2014.

- Boo et al., “How innovative business models can boost the energy efficient buildings market”, 40th IAHS World Congress on Housing, IAHS, Funchal, Portugal, December 2014.
- Dunphy et al., “Developing a Sustainable Housing Marketplace: New business Models to Optimise Value Generation from Retrofit”, 40th IAHS World Congress on Housing, IAHS, Funchal, Portugal, December 2014.
- Dunphy, Morrissey, “Optimization of Construction Supply Chains for Greenhouse Gas Reduction”, Optimization of Supply Chain Management in Contemporary Organizations, IGI Global, Hershey, PA, March 2015.
- Dinh, Basu Kennedy, “Development of a Procedure to Analyze Customers’ Choice of Renewable Energy Heating Technologies: Application in Ireland”, Journal of Clean Energy Technologies, Vol. 3(4), pp. 312-316, 2015.
- Staino, Aird, Kerrigan, Basu, “An MPC Based Control Strategy for the Findhorn Ecovillage”, Paper n. 360, UPEC2015, Staffordshire, UK, September 2015,
- Staino, Basu, “Comparison of Conventional and Economic MPC in Smart Grid Applications”, Papers n. 262, 360, UPEC2015, Staffordshire, UK, September 2015.
- Constant update of the UMBRELLA project website for active and timely presentation of the project results, announcement of forthcoming events, and dissemination. The following dissemination material was prepared and made available for download on the project web-site:
 - Periodic newsletters
 - Poster and roll-up banners
 - Leaflets
 - Project presentations
 - Project video
- Besides the public project deliverables were uploaded and made available for download:
 - D2.1 “Analysis of Stakeholder Interaction Within Building Energy Efficiency Market”
 - D3.1 “Identification of key stakeholders needs and requirements with respect to Umbrella”
 - D3.3 “Report on Data Analysis”
 - D4.1 “Market report”

- D4.3 “Recommendation for innovation governance models supporting energy efficient buildings”
- D5.2 “UMBRELLA toolset second prototype integrated”
- D6.2 “UMBRELLA online dynamic web portal integrated”

The periodic project newsletter was released every 6 months, containing news, technical updates, report of past events, forthcoming events, contacts through social networks. It was sent to more than 1,000 contacts, which are stakeholders in the energy efficient buildings market, and then published for download on the project web-site.

Workshops in relevant European events, where the project is presented by taking advantage of several activities. UMBRELLA participated to a joint workshop session at the Industrial Technologies 2014 in Athens, with the following title “Energy Efficiency Today: understanding the market & overcoming green-wash through new technologies”, in the calls for “Workshop” and “Best Posters”. Besides UMBRELLA participated to Smart Energy Expo 2014 in Verona (Italy), with its own stand, for the whole duration of the event, where STAM presented a workshop/seminar dedicated to the project. At the end of the project, a final successful workshop was organised by the Consortium during the Sustainable Places 2015 event in Savona, with the following session title: “Decision support tools to optimize energy use in buildings”. Four different partners contributed to the workshop, each of them speaking about a different topic.

New project leaflets: two different versions of the leaflets were prepared to be distributed in all the events where the UMBRELLA project was presented or attended by project partners.

New project posters: two different 200x80cm roll-up banners were created. These were shown at several events: the ECTP-E2B Conference 2014 in Brussels, the Smart Energy Expo 2014 in Verona, the Facility & Property Management conference 2014 in Warsaw, the Sustainable Places 2015 in Savona, the SET Plan conference in 2015 in Luxembourg.

Dissemination through the social networks. In order to make the best diffusion of the results and mission of the project, a Twitter account (twitter.com/UMBRELLA_FP7), which has now more than 600 followers, and a LinkedIn group (www.linkedin.com/groups/Umbrella-Project-4995437) have been constantly updated, with discussions and news on the project development.

Presentation video: a two minutes video has been created and published on Youtube and on the project website, in order to clearly shows the capabilities of Umbrella tool to potential users.

Project presentation: a 31 slides animated presentation was prepared to show the latest advancements of the project and present the Re:form tool to the audience of different events. This was uploaded and made available for download on the project website.

4.1.5 Project Website

The website was launched by STAM at month 2 and has been constantly updated, improved and enhanced with news, links, public deliverables, etc. and information on project development. The address of the official project webpage is: www.umbrella-project.eu.

4.2 Use and dissemination of foreground

4.2.1 Dissemination Measures and Scientific Publications

Several dissemination tools and measures were used and made available to create awareness on the project and disseminate its results.

4.2.1.1 Images and branding

Achieving an image for the project allows an easier identification for the public as well as a better visibility to obtain a branding for the project during the dissemination activities. At every dissemination activity, tool, event, etc. there has been an UMBRELLA reference.

Project logo

A project logo was created at the beginning of the project in order to define a project identity, thus clearly identifying any kind of internal or public document such as deliverables, reports, internal communications, publications, and any other kind of document within the framework of the project.



Figure 16: UMBRELLA logo.

The logo was created as an official icon for the project necessary to give the public an immediate recognition about the project. The project logo has been used in the following cases:

- in all documents developed under the framework of the project, and in particular in documents to be submitted to the EC, such as deliverables, etc.;
- in PowerPoint presentations to be used for communication and dissemination activities carried out by each Participant under the framework of the project;
- on the project website, and in websites of the Participants with a link to the project website.

Re:form brand and logo

The idea behind the brand name and concept is that everything the application does helps to reform the building. The marque is made up from a series of arrows going in a circular direction. The arrows represent the things the application does: improve performance, increase energy efficiency, reduce energy bills and improve the buildings lifecycle. As shown below the brand can be extended to use the 'Re:' part of the brand to demonstrate all the things the application does. A comprehensive visual style guide has also been created to further enhance the brand including font, colours, illustrative style and graphic elements.



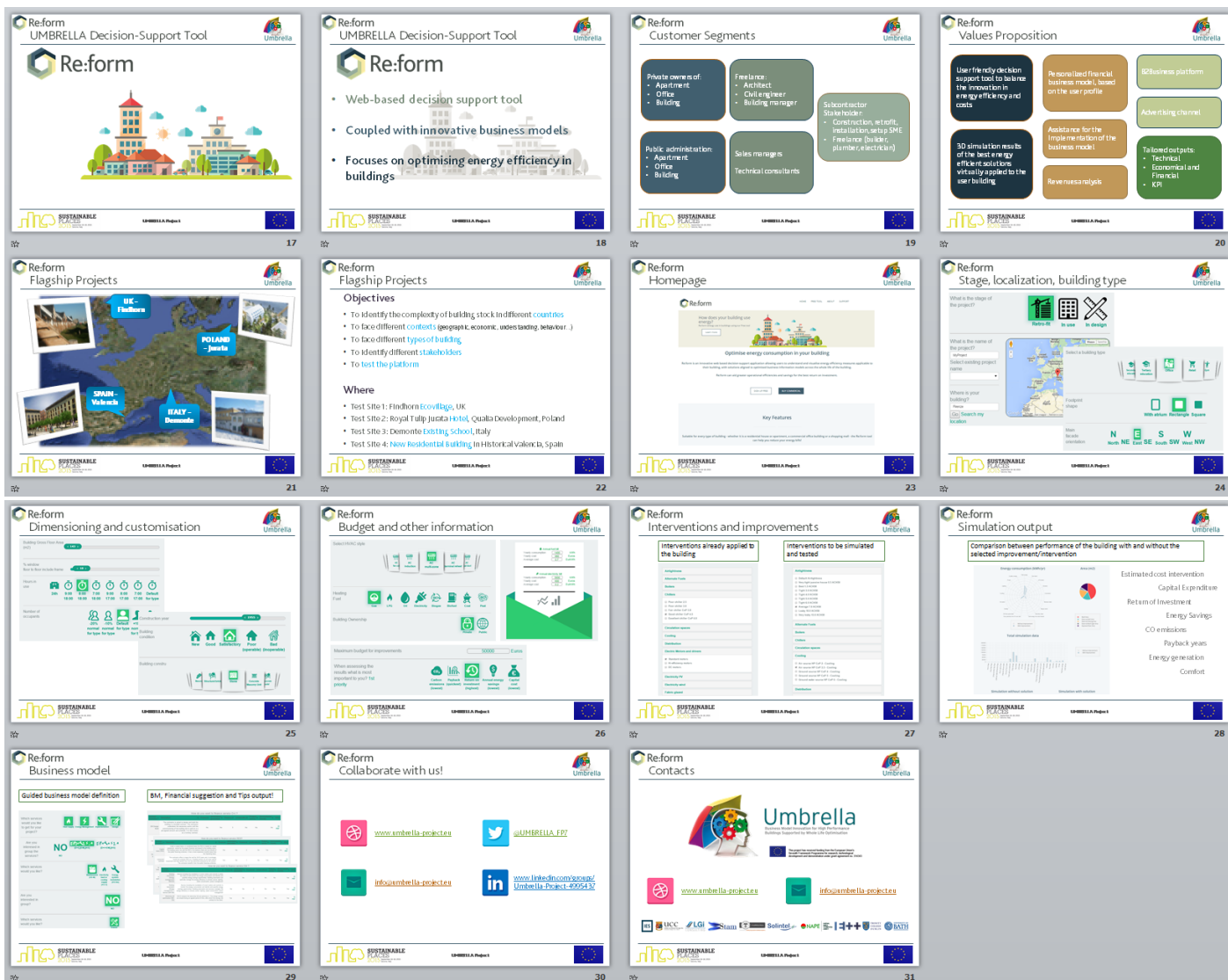
Figure 17: Re:form logo.

4.2.1.2 Project Presentation

An UMBRELLA project presentation was prepared as part of the several tools identified to support the dissemination efforts. The presentation provides a general project overview, background information, objectives, rationale, partners and results. It was shown at public events and made available on the project website, in the public documents section.

The presentation consists of 16 slides, each with a number in the bottom right corner:

- Slide 1: Umbrella** - Business Model Innovation for High-Performance Buildings Supported by Whole Life Optimisation.
- Slide 2: Reform UMBRELLA General Information** - Includes Timing and Budget (Start: September 2012, Duration: 3 Years, End: August 2015, Budget: €2.8 million) and a list of Partners (IES, USC, LGI, STAM, D'Apollonia, Solintel, NAFPE, E+, Trinity College, University of Bath).
- Slide 3: Reform Background and Barriers** - Discusses barriers in the building construction field like Design, Improve, and Re-to-fit.
- Slide 4: Reform UMBRELLA Concept** - Project Concept: "A web-based decision support tool enabling building's stakeholder(s) to analyse its performances against the user's needs, outputting recommended energy efficient solutions and business models for implementation which are validated through a simulation of the building".
- Slide 5: Reform UMBRELLA Objectives** - Lists 4 objectives: innovative/adaptable business models, whole-life performance-based framework, innovative energy-efficient indicators, and better decision-making tool.
- Slide 6: Reform UMBRELLA Innovations** - Diagram showing 3D building model analysis, offering validated energy efficient solutions, business models for implementation, and a web-based decision support tool.
- Slide 7: Reform Business Models** - Defines a business model as the value a company offers to customers and its network for creating, marketing, and delivering this value.
- Slide 8: Reform Business Models in Building Sector** - Diagram showing the flow from climate change and energy supply to building sector transition, involving various stakeholders and business models.
- Slide 9: Reform Business Models in UMBRELLA** - Explains how users can choose the kind of services (Design, Retrofit, Operation, Energy supply) and the type of financing (Equity/private loan, Leasing, Finance through operation, Concession).
- Slide 10: Reform Business Models in UMBRELLA** - Lists more than 100 services and 100+ public schemes, focusing on improved building owners/users.
- Slide 11: Reform Energy Efficient Solution Database** - Features more than 200 state-of-the-art solutions and customized, filtered options based on user needs.
- Slide 12: Reform Web-Portal Database and Architecture** - Diagram of the web-portal architecture including Cloud, MySQL Database, Algorithms & Logic, Web services, and User/Agent interaction.
- Slide 13: Reform Building Energy Simulation** - Energy model simulation of user's building with and without proposed improvements.
- Slide 14: Reform Output KPIs** - Table of Key Performance Indicators (KPIs) such as Capital Expenditure, Return of Investment, Energy Savings, CO2 emissions, Payback years, Comfort, and Energy generation.
- Slide 15: Reform Project Achievements** - Lists achievements: innovative business models, energy efficient solution database, and enhanced web-portal.
- Slide 16: Reform Project Achievements** - States the tool is integrated in the Re:form on-line tool and is a decision-support tool for designing, improving, and retrofitting buildings.



4.2.1.3 Leaflet

The leaflet is a traditional but useful non-electronic dissemination material to be distributed during conferences, workshops and project events. The main objective of the leaflet is to provide an attractive and essential overview of the project. It includes brief information regarding the objective and outputs of the project, its partners, and provides contact information for the benefit of interested readers, including the contact of the coordinator and the URL of the website, which contains more comprehensive information.

A project leaflet was prepared to be distributed at public events. The design was updated during the project, in order to include the most recent project results, and conveys the fundamental concept of UMBRELLA: information on the project and consortium is provided. The text is clear and there are four paragraphs for easy reading, with the headlines Concept, Objectives, Flagship projects and Products, replaced in the last phase by the Re:form Tool. The leaflet is made to be folded in three parts, as shown below. It was made available on the project website and distributed during several dissemination events.



Figure 18: First version of the project leaflet, front and back side.

The project

UMBRELLA is a three year EU funded research project aimed at engaging a range of stakeholders in the identification of suitable energy efficient business models, and equipping them with the necessary tools to create new high performance buildings and retrofit existing buildings. UMBRELLA will specifically take into consideration the user's needs and demographic data, producing suitable solutions to not only meet but exceed one's expectations.



Key Facts

Project No. 314343
 Total budget: 2.9 million Euro
 Start date: 1st September 2012
 Project Duration: 3 years
 Project Coordinator: Nick Purshouse, Integrated Environmental Solutions Ltd

For further info please contact:
info@umbrella-project.eu

Consortium



Business Model Innovation for High Performance Buildings Supported by Whole Life Optimization

Website: www.umbrella-project.eu
 Twitter: twitter.com/UMBRELLA_FP7
 LinkedIn: www.linkedin.com/groups/Umbrella-Project-4995437

This project has received funding from the European Union's Seventh Framework Programme for research, technological development and demonstration under grant agreement no. 314343



Concept

Optimising energy efficiency in buildings is often a management issue and not one of design.

Decision support tools, providing information with respect to a building's energy consumption and methods for the implementation and incentivisation of solutions benefitting all the stakeholders involved are required.

UMBRELLA addresses this issue by developing a web-based decision support application, which provides independent evaluation tools built around adaptable business models.

This can be applied to any building at any stage of design or use.



Flagship projects

The UMBRELLA products will be demonstrated in the UK, Poland, Italy and Spain.

- Test site 1: Findhorn Eco village, UK
- Test site 2: Royal Tulip Jurata, Qualia Development, Poland
- Test site 3: Existing school in Demonte, Italy
- Test site 4: New residential building in historical Valencia, Spain



The tool

Re:form

Re:form is an innovative web based decision-support application, developed within the UMBRELLA project, allowing the user to understand and visualise energy efficiency measures applicable to the building, with solutions aligned to optimised business information models across its whole life.



All the existing technologies and improvements, available on the smart energy building market, that should be virtually applied to buildings and simulate its performances, can be selected.

Figure 19: Second version of the project leaflet, front and back side.

4.2.1.4 Poster

The main purpose of the poster is to catch the audience attention during conferences. The UMBRELLA poster includes the following main items:

- Short description of the project;
- Scientific and technical objectives;
- List of partners and contacts.

Several posters were developed to be used in workshops, conferences and other events, as a presentation of the project, where the partners participate or hold the event. A poster is complementary to leaflets and short papers, since the latter provide more detailed information about UMBRELLA. The poster has a catchy graphic and explains the concept with the use of diagrams, as shown below.

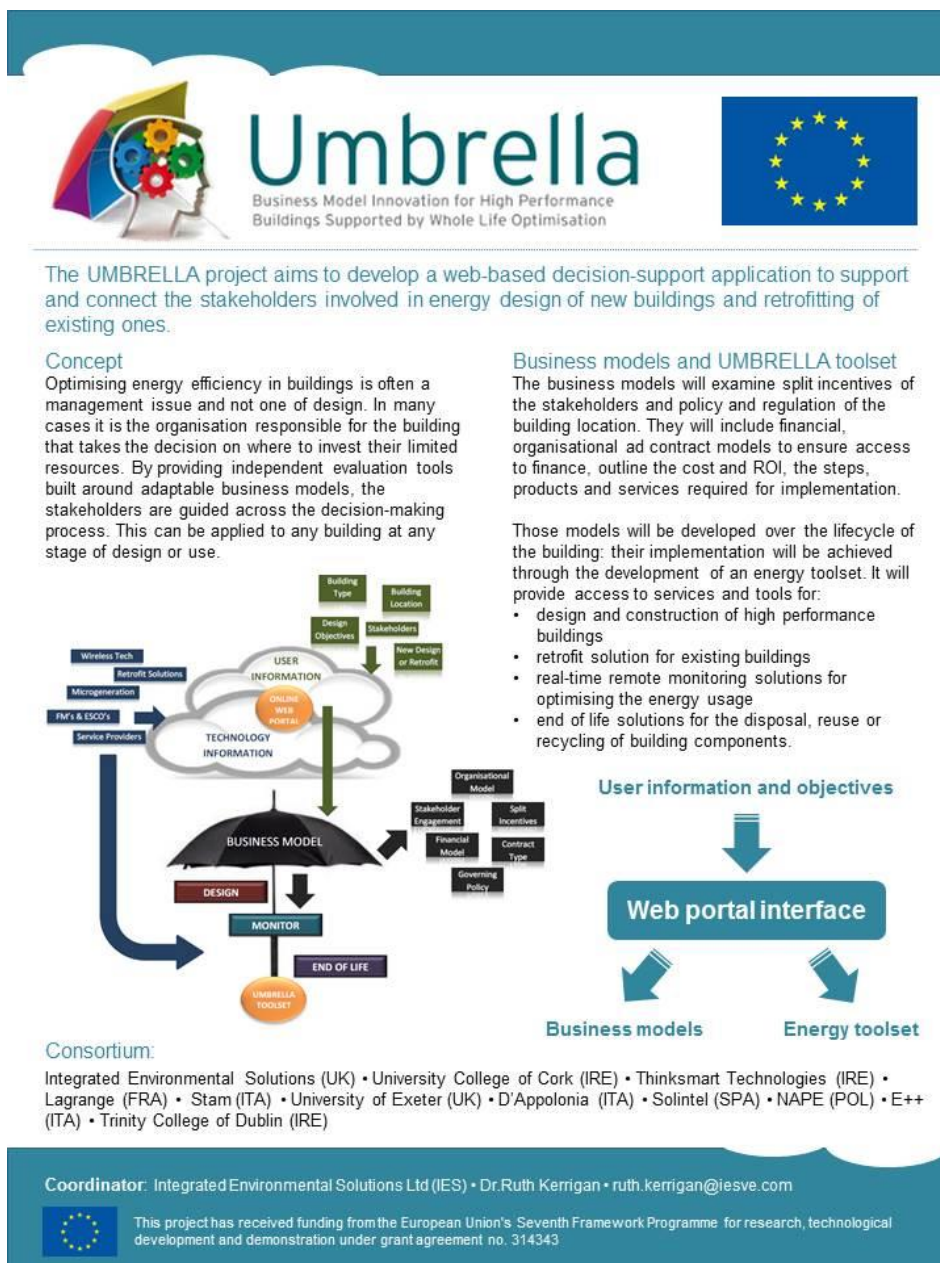


Figure 20: UMBRELLA poster.

Two roll-up posters, with a printed area of 200x80 cm, were prepared, the first one shown at the ETCP-E2BA Conference 2014 in Brussels, Belgium, and at the Smart Energy Expo 2014 in Verona, Italy. It provides the base concept of UMBRELLA, objectives, Flagship projects and contacts.

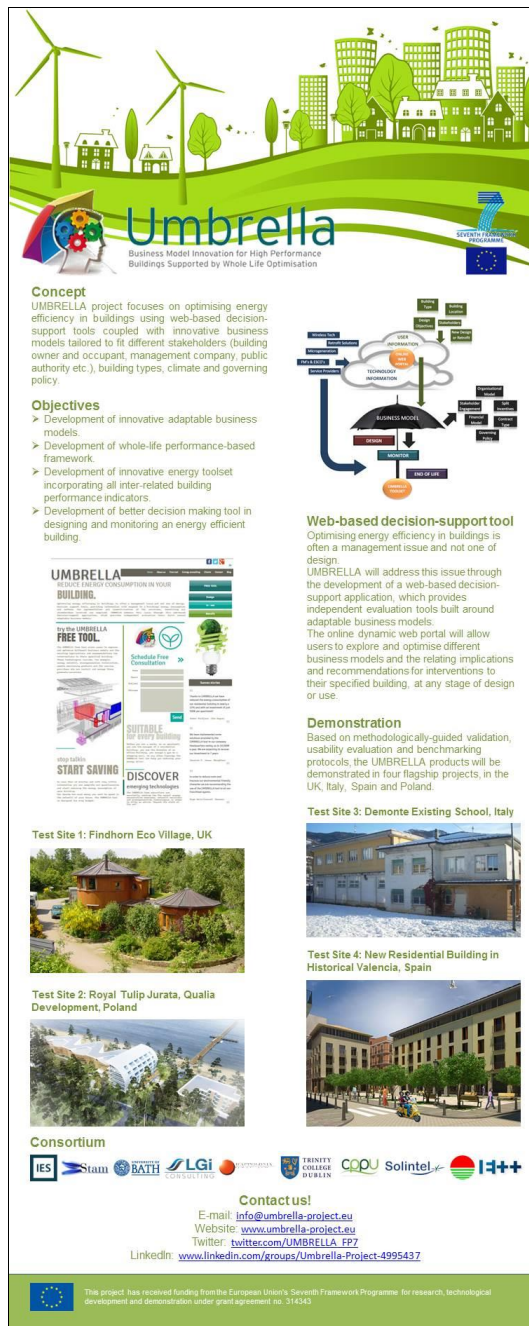


Figure 21: UMBRELLA roll-up poster, presented at ECTP-E2BA and Smart Energy Expo 2014.

The design was then updated to include new project developments and results, as shown below.

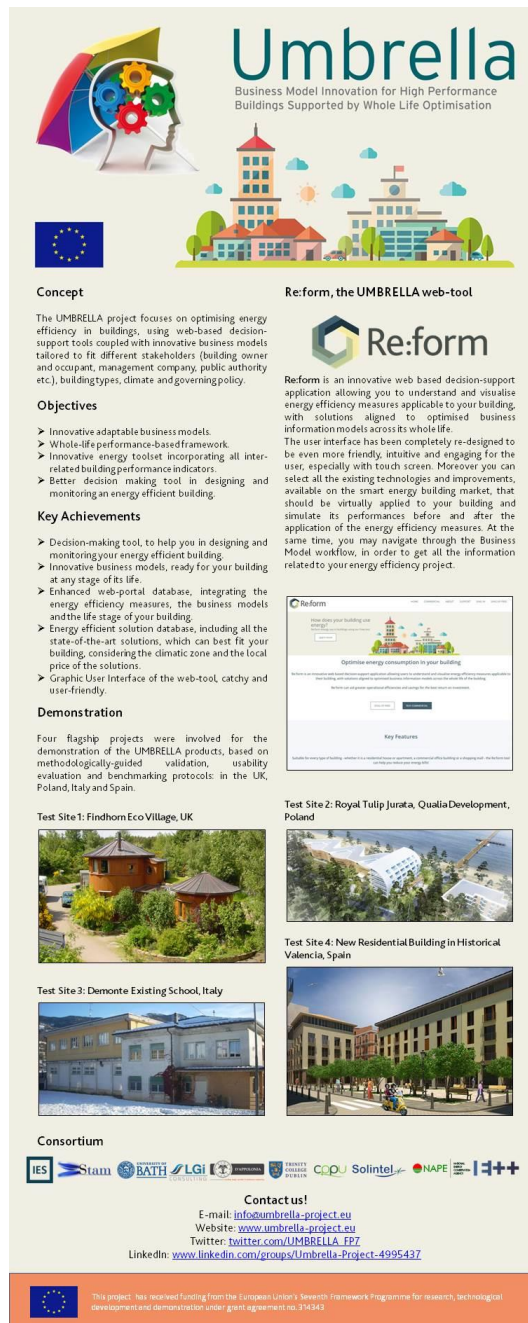


Figure 22: UMBRELLA updated roll-up poster.

Finally a horizontal banner was produced and shown at the Smart Energy Expo 2014.



Figure 23: UMBRELLA horizontal banner.

4.2.1.5 Website

The UMBRELLA website (www.umbrella-project.eu) has been one of the project’s main dissemination tools, because it provides exhaustive information on the project through eye-catching graphics and has been kept up-to-date during the project execution. The .eu domain was selected to underline the European level of this initiative, as well as the support of the European Commission. The website presents a project overview, including: concept, objectives, products, demonstration activities and project structure. Furthermore, it provides the list of project partners, a section where public documents can be uploaded and a “news and events” page, to inform visitors about upcoming actions and happenings. It was launched at Month 2 and has been constantly updated, improved and enhanced with news, links, public deliverables, etc. and information on the project development.

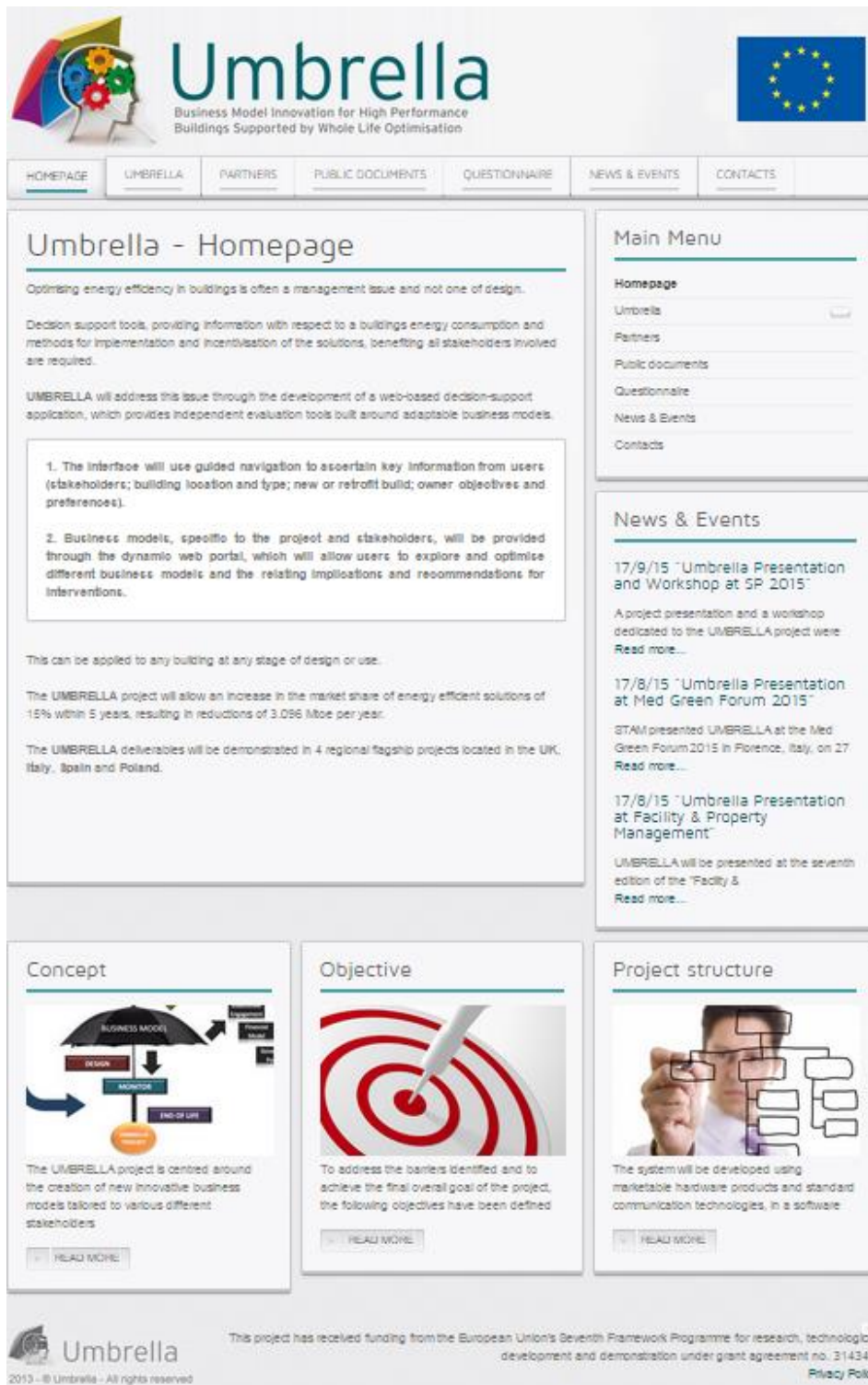


Figure 24: UMBRELLA website homepage.

The website provides overall project information and news, access to publications and the possibility to download all the public deliverables released in the project.

To understand the project in details, the “UMBRELLA” section includes five sub-sections: concept, objectives, products, demonstration and project structure. Each section is completed by the relevant figures, to better explain the project and has been constantly updated during the project.

The list of partners and a link to their websites is included in “Partners” section. This has been modified to keep into account any change in the Consortium.

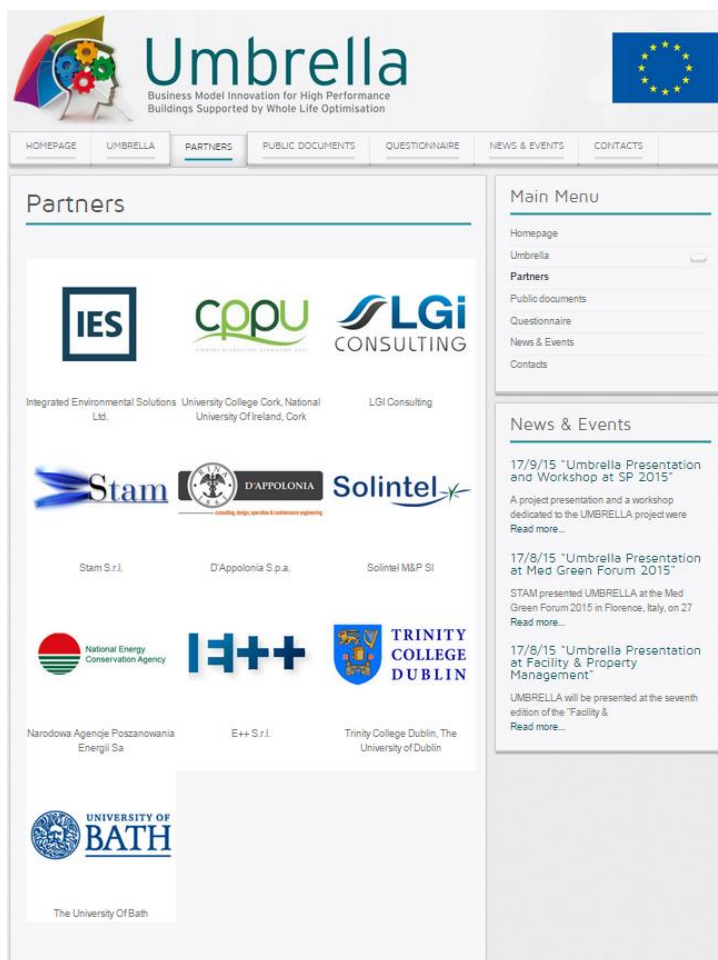


Figure 25: Partners webpage.

Public deliverables, newsletters, posters, presentations and other public documents released during project duration have been uploaded on the “Public documents” section. Finally, the “Contacts” section reports the contacts of Project Coordinator and Dissemination Manager, so that visitors can ask and receive further information on the UMBRELLA project.

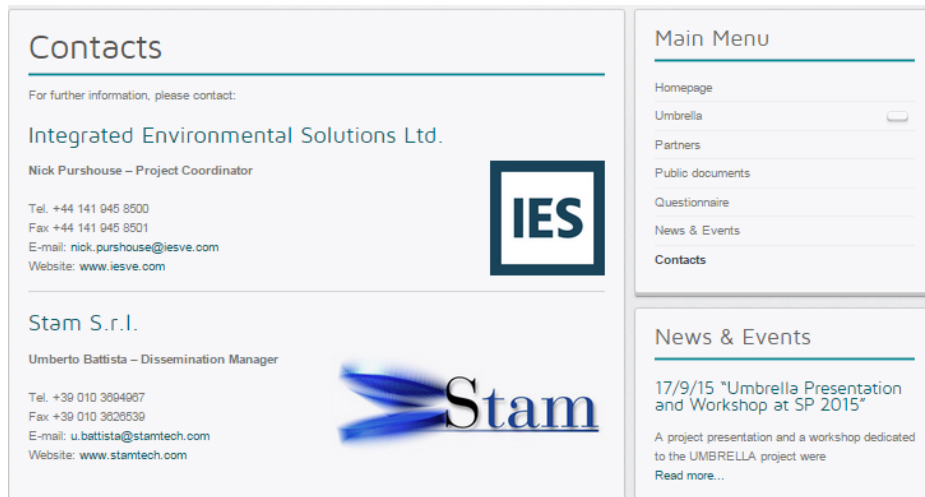


Figure 26: Contacts section.

The website structure has been updated during the project, to keep into account any project's need or change, to provide news and keep visitors updated about the project results. A section was added to provide links to the stakeholder's questionnaires, in order to engage them, to determine their needs and requirements from the tools and business models to be developed within the project.

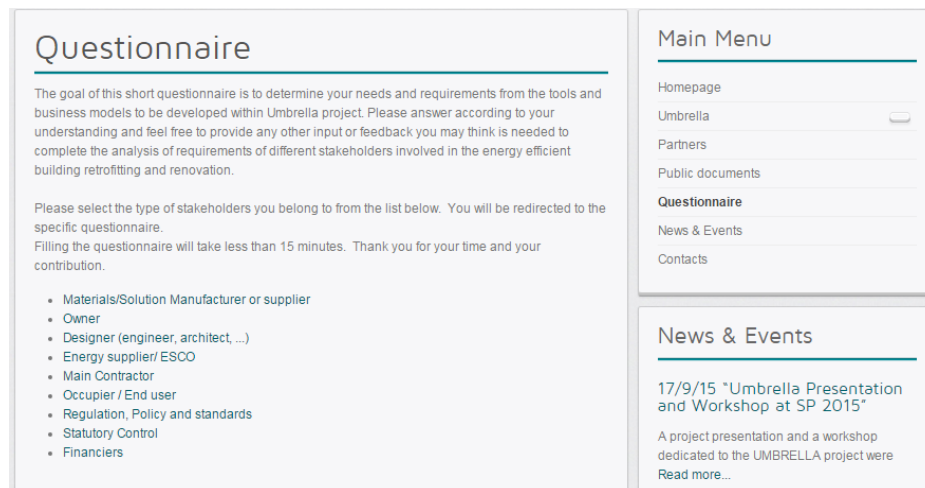


Figure 27: Questionnaire webpage.

The public documents section includes all the public deliverables released, for instance:

- D2.1 “Analysis of Stakeholder Interaction Within Building Energy Efficiency Market”
- D3.1 “Identification of key stakeholders needs and requirements with respect to Umbrella”
- D3.3 “Report on Data Analysis”
- D4.1 “Market report”
- D4.3 “Recommendation for innovation governance models supporting energy efficient buildings”
- D5.2 “UMBRELLA toolset second prototype integrated”
- D6.2 “UMBRELLA online dynamic web portal integrated”

Besides the visitors can download the project flyer, the project leaflet, the project presentation, the posters, the newsletters, which were spread among about 1,000 contacts around Europe, which are stakeholders in the energy efficient buildings market.

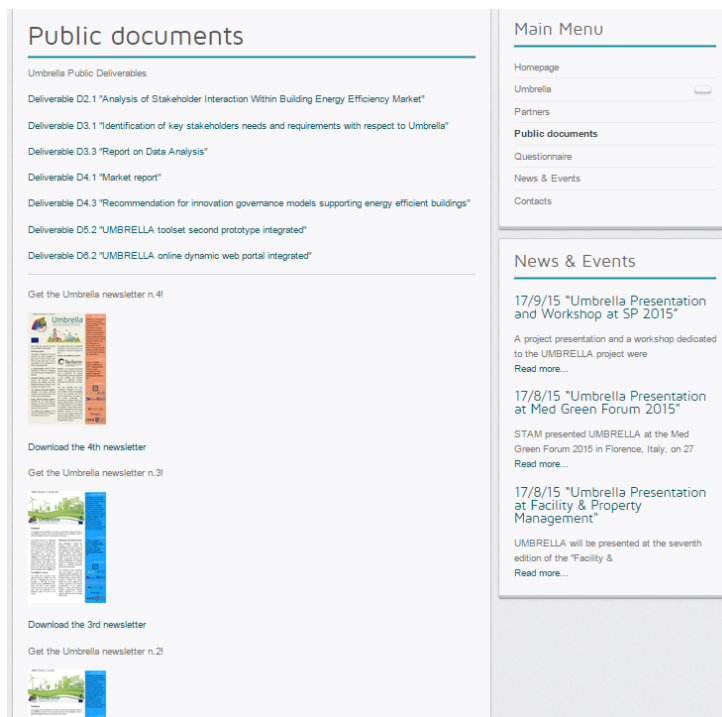


Figure 28: Public documents webpage.

The project website has been continuously updated, including news and information about events relating to UMBRELLA.

UMBRELLA Website Statistics

Statistics for www.umbrella-project.eu are available from October 2012, when the website was firstly published. The following table summarises the statistics of UMBRELLA website.

Table 3: Statistics on the UMBRELLA website.

Parameter	Value
Accesses to the website	6,499
Unique visitors	5,347
Visited pages	13,343
New visits	82%
Country of majority of visitors	Italy (11.5%)

The number of visits per year has been about 2,600, whose average time on site is 2 minutes. Figure 1 below shows the daily visits profile of the website.

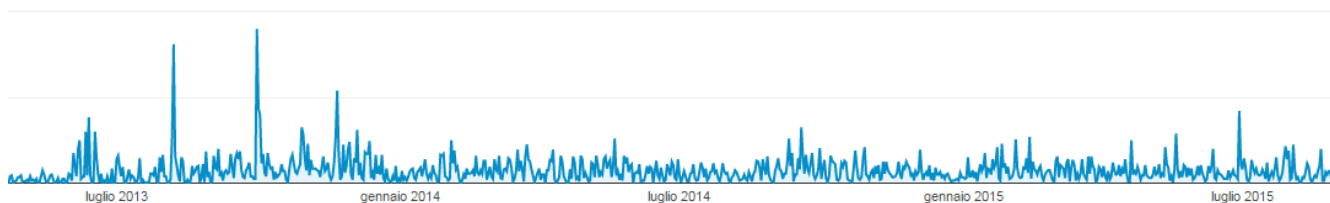


Figure 1: Daily visits of the UMBRELLA website.

Table 4: Visitors per Country.

Country	Visitors
Italy	748 (11.5%)

Ireland	560 (8.6%)
United Kingdom	452 (7.0%)
United States	393 (6.1%)
India	385 (5.9%)
Brazil	345 (5.3%)
France	310 (4.8%)
Poland	297 (4.6%)
Spain	283 (4.4%)
Germany	236 (3.6%)

Table 5: Visitors per Continent.

Continent	Visitors
Europe	3,962 (61.0%)
Asia	1,385 (21.3%)
Americas	984 (15.1%)
Africa	92 (1.4%)
Oceania	50 (0.8%)

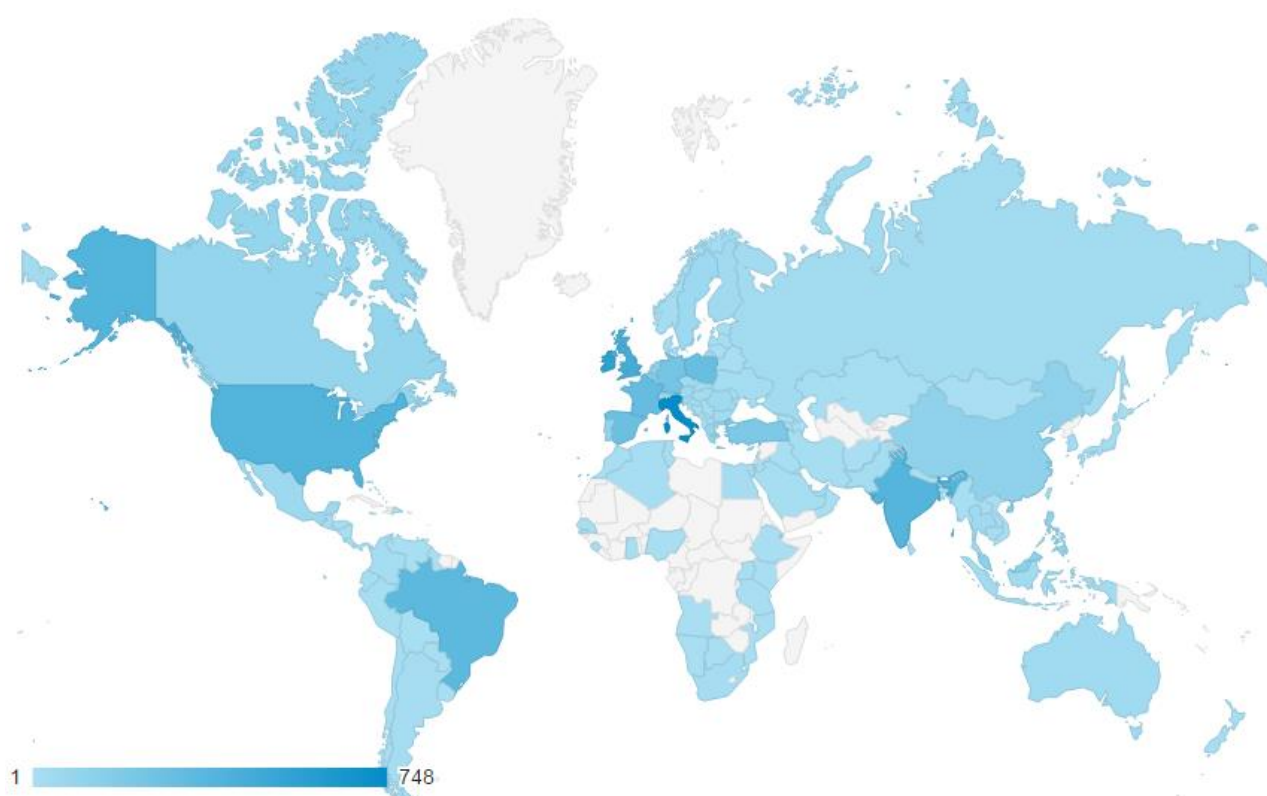


Figure 29: Geographic distribution of website visitors.

1,453 persons (10.9%) visited the Questionnaire webpage, while 955 (7.2%) visitors accessed the public documents section. The most visited page has been the UMBRELLA concept section (10.9%). The 10.6% of total visitors accessed the Umbrella website from mobile devices.

4.2.1.6 Publications

Since publications are one of the most powerful means to disseminate UMBRELLA results, both the partners from academia and from industry have used them. UMBRELLA partners have been publishing and will publish the results in scientific literature, dedicated journals and magazines in the field of ICT,

Construction, Energy, and Business Models. Moreover, results have been also published in the UMBRELLA newsletters and website. The list of all publications performed by the UMBRELLA partners is reported in the following table, as a result of the achievements and outcomes of the R&D activities.

Table 6: Publications released by the UMBRELLA partners.

N.	Author(s)	Title	Journal	Editor	Date	Reference / Link	Free access / Pay per view	Description / Abstract
1	Dunphy, Morrissey, MacSweeney	Building energy efficiency: a value approach for modelling retrofit materials supply chains	Materials and processes for energy: communicating current research and technological developments	A. Méndez-Vilas	January 2013	http://www.formatex.info/energymaterialsbook/book/649-657.pdf	Free	The chapter forwards a value approach to modelling retrofit activities, providing an analysis of typical EER materials in construction project supply chains. The reported research demonstrates a novel application of value analysis in the construction industry.
2	Dunphy, Morrissey, MacSweeney	Identification and characterisation of the actors involved in the energy efficient building market	16 th ERSCP	ERSCP	June 2013	http://www.academia.edu/7564350/Identification_and_characterisation_of_the_actors_involved_in_the_energy_efficient_building_market	Free	This paper presents work carried out under the FP7 supported project 'UMBRELLA' aimed at analysing and understanding the interactions of various actors within the energy efficient building market.
3	Kerrigan, Melvin	UMBRELLA Project	EeB Roadmap - EeB PPP Project Review	Claire Hughes, Arup, London	August 2013	http://ec.europa.eu/research/industrial_technologies/pdf/eeb-ppp-project-review-2010-2011-2012_en.pdf	Free	General overview about the UMBRELLA Project.
4	Kerrigan, Melvin	Retrofitting solutions for future buildings	Advanced Retrofitting Solutions for Buildings		September 2013	-	-	Overview on development of energy efficient solutions.
5	Morrissey, Dunphy, MacSweeney	Energy Efficiency in Commercial Buildings: Capturing Added-Value of Retrofit	Journal of Property Investment and Finance	Emerald Group Publishing Limited	July 2014	http://www.emeraldinsight.com/doi/abs/10.1108/JPIF-01-2014-0008	Pay per view	The purpose of this paper is to investigate, the functioning of value creating configurations and stakeholder interactions in networks of organisations of the retrofit industry for commercial buildings.

6	Battista, Musso, Barbagelata	UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation	Smart Energy Expo 2014	Smart Energy Expo	October 2014	-	-	General overview about the UMBRELLA Project, its objectives and outcomes.
7	Dunphy, Boo, Dallamaggiore, Morrissey	Developing a Sustainable Housing Marketplace: New business Models to Optimise Value Generation from Retrofit	40 th IAHS World Congress on Housing - Sustainable Housing Construction	IAHS	December 2014	http://www.researchgate.net/publication/269103645_Developing_A_Sustainable_Housing_Marketplace_New_Business_Models_To_Optimise_Value_Generation_From_Retrofit	Free	This paper posits that new collaborative approaches to developing business models are required to plan EECR projects such that value generation is maximized while value capture is satisfied.
8	Boo, Dallamaggiore, Dunphy, Morrissey	How innovative business models can boost the energy efficient buildings market	40 th IAHS World Congress on Housing - Sustainable Housing Construction	IAHS	December 2014	http://www.researchgate.net/publication/269103720_How_Innovative_Business_Models_Can_Boost_The_Energy_Efficient_Buildings_Market	Free	It relies on concepts of sustainable and energy efficient transition pathways to address how innovative business models can boost the energy efficient market. It highlights how the co-evolution of business models with both the wider energy system and the natural environment is responsible for the need of both innovative and sustainable business models, which are necessary for ensuring a long-lasting change in the energy efficient building market.
9	Dunphy, Morrissey	Optimization of Construction Supply Chains for Greenhouse Gas Reduction	Optimization of Supply Chain Management in Contemporary Organizations	IGI Global	March 2015	http://www.researchgate.net/publication/274310075_Optimization_of_Construction_Supply_Chains_for_Greenhouse_Gas_Reduction	Pay per view	It provides a rigorous means of assessing the dynamic and complex supply chains of construction to obtain optimal and sustainable levels of GHG reductions in a whole-of-chain approach. Outcomes represent critical new knowledge, enabling deeper understanding as well as enhanced capacity to maximize energy savings from the built environment.

10	Dinh, Basu Kennedy	Development of a Procedure to Analyze Customers' Choice of Renewable Energy Heating Technologies: Application in Ireland	Journal of Clean Energy Technologies	IACSIT Press	July 2015	http://www.jocet.org/papers/214-HK003.pdf	Free	It describes a procedure to analyse customers 'choice of renewable energy technologies (RETs) using artificial neural networks.
11	Staino, Aird, Kerrigan, Basu	An MPC Based Control Strategy for the Findhorn Ecovillage	UPEC 2015	Staffordshire University	September 2015	-	-	-
12	Staino, Basu	Comparison of Conventional and Economic MPC in Smart Grid Applications (Paper n. 262)	UPEC 2015	Staffordshire University	September 2015	-	-	-
13	Staino, Basu	Comparison of Conventional and Economic MPC in Smart Grid Applications (Paper n. 360)	UPEC 2015	Staffordshire University	September 2015	-	-	-

Newsletter

After the first year of the project a newsletter has been released every six months on the website and sent to a mailing list of around 1,000 contacts that collects interested experts, stakeholders and actors in the field, in order to keep the interested parties informed on the latest developments of the project. The newsletter was formatted as a 2 pages PDF file, whose design was updated during the project.

At every new release an e-mail was created and sent to the mailing list, using the MailChimp free service, introducing the latest advancements and forthcoming events, and then reporting the link to the PDF file, downloadable from the Public Documents section of the project website. The newsletter presents:

- The participation in conferences, trade fairs and regulation bodies.
- The current activities of the project dealing with development, evaluation and exploitation.
- External information relevant to the project, e.g. newly published standards or books, events of interest, etc.
- General information regarding the activities of the project.
- Contacts and social media

Such a newsletter is a valuable external communication tool: it provides updated information and raises interest on the project's work and outcomes. The newsletter has been intended to provide the essential information, but in order to remain an attractive communication tool it has to have new interesting contents in each issue: this was difficult in periods when developments were under course, and no new results could be shown publicly. For this reason the periodicity has been low, reduced to a six-monthly letter, adding special issues in the end of the project, when results were available.

UMBRELLA Newsletter n.4 - July 2015

Umbrella

Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation

New brand, new logo and new look for the UMBRELLA Newsletter!

Reaching our goals

The project is coming to its end and activities are being completed. A great deal of work has been done since the last issue and it can be summarized in the achievement of these outstanding results:

A **decision-support tool** has been developed to help you in designing and monitoring your energy efficient building.

Innovative business models, after various and different research processes and refining, have been finalized and they are ready for your building at any stage of its life.

The **enhanced web-portal database** integrates the energy efficiency measures, the business models and the life stage of your building.

Energy efficient solution database, including all the state-of-the-art solutions, can best fit your building, considering the climatic zone and the local price of the solutions.

The **Graphic User Interface** of the web-tool, catchy and user-friendly, is now ready for you to test it.

Our project team work is proceeding smoothly at a fast pace and we are optimistic to reach our final goals on time.

Re:form, the UMBRELLA web-tool

Re:form is an innovative web based decision-support application allowing you to understand and visualise energy efficiency measures applicable to your building, with solutions aligned to optimised business information models across its whole life.

The user interface has been completely re-designed to be even more friendly, intuitive and engaging for the user, especially with touch screen. Moreover you can select all the existing technologies and improvements, available on the smart energy building market, that should be virtually applied to your building and simulate its performances before and after the application of the energy efficiency measures. At the same time, you may navigate through the Business Model workflow, in order to get all the information related to your energy efficiency project.

What is UMBRELLA?

UMBRELLA is a three year EU funded research project aimed at engaging a range of stakeholders in the identification of suitable energy efficient business models, and equipping them with the necessary tools to create new high performance buildings and retrofit existing buildings. UMBRELLA will specifically take into consideration the user's needs and demographic data, producing suitable solutions to not only meet but exceed one's expectations.

The Project

Project No. 314343
Budget: 2.9 Million Euro
Start: 1st September 2012
Duration: 3 years
Coordinator: Dr. Ruth Kerrigan, Integrated Environmental Solutions Ltd

The Consortium

Workshop in Verona

In autumn UMBRELLA consortium held an event Verona, in Italy, from the 8th to the 10th October 2014 within Smart Energy Expo 2014. We participated with our own stand, for the whole duration of the event, and four of our members provided information about the project to the visitors. Moreover there was the opportunity for our researchers to perform a dedicated seminar.

Ready for the future

To be able to consider the performance of your building over its whole lifecycle we need to consider how the climate may change over the next 20-30 years and longer timescales up to the end of the century. This requires the generation of representations of future weather to drive the building models.

Using estimates of future climate from global circulation models, we have mathematically transformed weather files for 185 locations across Europe. This enables the **Re:form** tool to consider how the performance of your building will vary over time and provide information as to the most appropriate business models and interventions for your building.

Discover UMBRELLA!

Come and meet us at SP2015!

The UMBRELLA project will be at **Sustainable Places 2015** in Savona, Italy, from 16 to 18 September 2015.

We will have a dedicated workshop on 17 September 2015 at 11 a.m., showing our project results and a demonstration of the Re:form tool. **Stay tuned** for further details!

Try Re:form!

To know the progress we have made until now, why don't you try our **Re:form** tool? In less than 10 minutes and with very little information you can complete our questionnaire and start reducing the energy consumption of your building. You decide how much money you want to spend either in the retrofit of your house or in a new project. The **Re:form** tool is designed for every budget!

Go to <http://umbrellatool.eu/> and start discovering the UMBRELLA way of making better buildings!

Contact us!

Get this Newsletter online at <http://www.umbrella-project.eu/public-documents>

Figure 30: UMBRELLA Newsletter.

Project public deliverables

Public deliverables have been made available on the project website, once accepted by the project management board. The list of public deliverables is provided below.

Table 7: Public deliverables.

Del N.	Deliverable Title	WP	Nature	Delivery Date	Published
D2.1	An analysis of the stakeholder interaction, including: relationships, power flows, drivers, conflict	2	Report	Jan 2013	Yes
D3.1	Identification of key stakeholders needs and requirements with respect to UMBRELLA	3	Other	Dec 2012	Yes
D3.3	Report on the data analysis related to the interviews	3	Report	Nov 2013	Yes
D4.1	Market report	4	Report	Aug 2013	Yes
D4.3	Recommendation for innovation governance models supporting energy efficient buildings	4	Report	Apr 2014	Yes
D5.2	UMBRELLA toolset second prototype integrated	5	Demo	Feb 2015	Yes
D6.2	UMBRELLA online dynamic web portal integrated	6	Prototype	Feb 2015	Yes
D8.2	Project website to support dissemination	8	Other	Oct 2012	Yes

4.2.1.7 Conferences and Events

The project partners have participated to relevant conferences in their specific field within the scope of the UMBRELLA project. Scientific partners have preferably participated to scientific conferences and symposiums, while commercial partners focused on trade fairs and exhibitions.

Table 8: Conferences and events attended by UMBRELLA partners.

Number	Partner	Goal(s) of dissemination	Dissemination activity type	Location	Date	Format	Means/media	Title of the contribution	Target Audience	Feedback quality
1	UCC	Disseminate flyers to relevant audience	Other	Dublin, Ireland	April 2013	Flyers	Part of the conference: “Leading Environmental Innovation in Europe”	“UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation”	Civil engineers, architects, industry, scientific communities, etc.	Related R&D projects, National/regional stakeholders, etc.
2	NAPE	Disseminate through networking	Other	Jelenia Gora, Poland	May 2013	Attendance	Spring School of Building Physics	-	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.
3	NAPE	Disseminate through networking	Other	Warsaw, Poland	May 2013	Attendance	Thermomodernization 2013	-	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.
4	LGI	Disseminate through networking	Other	Prague, Czech Republic	June 2013	Attendance	CESB13 conference	-	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.
5	LGI	Disseminate through networking	Other	Brussels, Belgium	June 2013	Attendance	Conference: “Innovation in energy efficient buildings and districts for smart built environment”	-	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.

6	UCC	Present paper	Presentation	Istanbul, Turkey	June 2013	Scientific paper	Present paper at the “European Round Table on Sustainable Consumption and Production” (16th ERSCP)	“Identification and characterisation of the actors involved in the energy efficient building market”	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.
7	LGI	Disseminate through networking.	Other	Marné la Vallée, France	October 2013	Attendance	Greencity	-	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.
8	LGI	Disseminate through networking	Other	Brussels, Belgium	October 2013	Attendance	CONCERTO conference	-	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.
9	NAPE	Disseminate to relevant audience	Presentation	Warsaw, Poland	October 2013	Presentation	Forum of public facility managers	“How to reduce the maintenance cost of the building”	Facility Managers	Related R&D projects, National/regional stakeholders, etc.
10	LGI	Disseminate through networking	Other	Paris, France	November 2013	Attendance	UNEP-SBCI Fall Symposium	-	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.
11	LGI	Disseminate through networking	Other	Paris Villepinte, France	November 2013	Attendance	Batimat	-	Researcher and industries	Related R&D projects, National/regional stakeholders, etc.

12	UCC	Disseminate through short presentation and networking	Poster	Dublin, Ireland	February 2014	Poster	Present Poster during: 24th Irish Environmental Researchers' Colloquium, ENVIRON 2014	"Potential for disconnect between energy efficiency and carbon emissions in building retrofit projects"	Environmental researchers and practitioners	Related R&D projects, National/regional stakeholders, etc.
13	LGI	Disseminate through networking	Other	Paris, France	February 2014	Attendance	AGRION Disrupt 100+	-	Researchers and industries	Related R&D projects, National/regional stakeholders, etc.
14	EXE	Disseminate through networking	Other	London, UK	March 2014	Attendance	EcoBuild	-	Researchers and industries	Related R&D projects, National/regional stakeholders, etc.
15	SOL	Disseminate through networking	Other	Brussels, Belgium	April 2014	Attendance	EERA Annual Congress	-	Researchers and industries	Related R&D projects, National/regional stakeholders, etc.
16	IES	Disseminate through networking and flyers	Workshop	Athens, Greece	April 2014	Presentation	Workshop during "Industrial Technologies 2014"	"UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"	Researchers and industries	Related R&D projects, National/regional stakeholders, etc.

17	STAM	Disseminate to relevant audience	Presentation	Brussels, Belgium	June 2014	Poster	ECTP-E2B Conference	“UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation”	Researchers and industries	Related R&D projects, National/regional stakeholders, etc.
18	NAPE	Disseminate to relevant audience	Presentation	Warsaw, Poland	June 2014	Presentation	Forum of public facility managers	How to reduce the maintenance cost of the building	Facility Managers	Related R&D projects, National/regional stakeholders, etc.
19	TCD	Disseminate to relevant audience	Other	Bangkok, Thailand	July 2014	Attendance	SMARTGREENS 2015	-	Researchers and industries	R&D projects, international/local stakeholders, etc.
20	STAM	Disseminate to relevant audience	Other	Nice, France	October 2014	Leaflets	Part of the conference “Sustainable Places 2014”	“UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation”	Researchers and industries	Related R&D projects, National/regional stakeholders, etc.
21	STAM, DAPP	Disseminate to relevant audience	Other	Verona, Italy	October 2014	Oral presentation, leaflets, poster	Booth at “Smart Energy Expo 2014”	“UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life	Researchers and industries	Related R&D projects, National/regional stakeholders, etc.

								Optimisation”		
22	STAM	Disseminate to relevant audience	Workshop	Verona, Italy	October 2014	Presentation, leaflets, poster	Workshop, poster, leaflets, during “Smart Energy Expo 2014”	“UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation”	Researchers and industries	Related R&D projects, National/regional stakeholders, etc.
23	UCC, LGI	Disseminate to relevant audience	Presentation	Funchal, Portugal	December 2014	Presentation	Presentation during the “40th IAHS World Congress on Housing”	“Developing a Sustainable Housing Marketplace: New business Models to Optimise Value Generation from Retrofit”	Researchers / industry personnel interested in sustainable housing	Related R&D projects, National/regional stakeholders, etc.
24	LGI, UCC	Disseminate to relevant audience	Presentation	Funchal, Portugal	December 2014	Presentation	Presentation during the “40th IAHS World Congress on Housing”	“How innovative business models can boost the energy efficient buildings market”	Researchers / industry personnel interested in sustainable housing	Related R&D projects, National/regional stakeholders, etc.
25	STAM	Disseminate to relevant audience	Other	Sakhir, Bahrain	March 2015	Leaflets	Bahrain International e-Government Forum 2015	“UMBRELLA - Business Model Innovation for High	Researchers and industries	R&D projects, international/local stakeholders, etc.

								Performance Buildings Supported by Whole Life Optimisation”		
26	NAPE	Disseminate to relevant audience	Presentation	Warsaw, Poland	August 2015	Presentation, poster	“Facility & Property Management - safe and economical property” conference	“UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation”	Researchers / industry personnel interested in sustainable housing	R&D projects, international/local stakeholders, etc.
27	STAM	Disseminate to relevant audience	Presentation	Florence, Italy	August 2015	Presentation, leaflets	Med Green Forum 2015	“UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation”	Researchers / industry personnel interested in sustainable housing	R&D projects, international/local stakeholders, etc.
28	TCD	Present paper	Presentation	Staffordshire, UK	September 2015	Presentation	UPEC 2015	“An MPC Based Control Strategy for the Findhorn Ecovillage”	Researchers / industry personnel interested in sustainable housing	R&D projects, international/local stakeholders, etc.
29	TCD	Present paper	Presentation	Staffordshire, UK	September 2015	Presentation	UPEC 2015	“Comparison of Conventional and Economic MPC in Smart Grid Applications”	Researchers / industry personnel interested in sustainable housing	R&D projects, international/local stakeholders, etc.
30	IES	Disseminate to relevant	Presentation	Stirling, UK	September 2015	Presentation	Construction Scotland Innovation	“UMBRELLA - Business	Researchers / industry personnel interested in	R&D projects, international/lo

		audience						Model Innovation for High Performance Buildings Supported by Whole Life Optimisation”	sustainable housing	cal stakeholders, etc.
31	STAM, IES LGI, UCC	Disseminate to relevant audience	Presentation, Workshop	Savona, Italy	September 2015	Presentation, workshop, leaflets, poster	Sustainable Places 2015	Decision support tools to optimize energy use in buildings	Researchers / industry personnel interested in sustainable housing	R&D projects, international/local stakeholders, etc.
32	LGI	Disseminate to relevant audience	Presentation	Luxembourg , Luxembourg	September 2015	Poster	SET Plan	Re:form reduce energy consumption in your building	Researchers / industry/businesses/policy makers interested in energy	R&D projects, international/local stakeholders, etc.

UMBRELLA workshops

Three local workshops were organised and conducted in Italy, Poland and Spain, respectively:

- In Demonte, Italy, the flagship project involves a public school building that needs deep retrofitting. The workshop provided participants with valuable insight on how to finance a renovation project through different sources.
- In Jastarnia, Poland, the flagship project involves a new apartment hotel with a small block that is still in its design phase. The session helped local actors develop new, creative concepts for the potential reconfiguration of the project's design.
- In Valencia, Spain, the flagship project involves a new apartment building under construction in the city centre. The conclusions involved governmental financial support measures in a country severely affected by the real-estate market crisis.

A joint workshop was held during “Industrial Technologies 2014” in Athens, as part of the “Impacts of EeB PPP projects” leading workshop, presenting the project objectives and first outcomes.

Finally a dedicated workshop was held right after the official project end, at the Sustainable Places 2015 in Savona, Italy. The workshop was a great success and received an excellent feedback from the audience.

4.2.1.8 Flagship projects

In order to demonstrate and validate new adaptable business models, regional flagship case studies were identified, each involving a different building at a different stage of life. These are located in the UK, Italy, Poland and Spain and vary from new buildings to existing and include both residential test sites and a school:

- Test Site 1: Findhorn Eco Village, UK
- Test Site 2: Royal Tulip Jurata, Qualia Development, Poland
- Test Site 3: Demonte Existing School, Italy
- Test Site 4: New Residential Building in Historical Valencia, Spain

4.2.1.9 Media and social networks

UMBRELLA partners have disseminated the project result and on-going activities also via public media to enable project outputs to be widely disseminated through general newspapers, and magazines as well as speaking opportunities to the media.

The project has been also exploiting social networks as LinkedIn and Twitter, to diffuse awareness on project advances among a large audience. To promote discussion, a LinkedIn group was created, as seen below, whose aim has been to reach professionals and to create a network that could give more visibility to the project. The group consists of 22 members and can be reached at <http://www.linkedin.com/groups/Umbrella-Project-4995437>.

Umbrella Project 19 members

Discussions Promotions Search Manage

Group Profile

Due to barriers that exist when considering the sustainability of the built environment, optimising energy efficiency in buildings is often a management issue and not one of design. In many cases, it is the organisation responsible for the building that makes the decision with respect to where best to invest their limited resources.

For this reason, decision support tools, providing information with respect to buildings energy consumption and methods for implementation and incentivisation of the solutions, benefiting all stakeholders involved are required.

UMBRELLA will address this issue through the development of an innovative, web-based decision-support application, which provides common independent evaluation tools built around new and adaptable business models.

The interface will use guided navigation to ascertain key information from users such as: key stakeholders; building location; building type; new or retrofit build; owner objectives and preferences (e.g. energy efficiency, carbon and budget requirements etc.)

Based on this information, one or more appropriate business models will be suggested and will include recommendations for:

- contract type;
- organisational model;
- financial model;
- governing policy;
- how to split incentives among the stakeholders;
- how to engage all members of the design team.

Business models will then be provided through the online dynamic web portal, which will allow users to explore and optimise different business models and the relating implications and recommendations for interventions to their specified building. This can be applied to any building at any stage of design or use.

The UMBRELLA project will result in an increase in the market share of energy efficient solutions of 15% within 5 years, resulting in reductions of 3.096 Mtoe per year. The UMBRELLA deliverables will be demonstrated in 4 regional flagship projects located in the UK, Italy, Spain and Poland.

About this Group

Created: May 6, 2013
 Type: Networking Group
 Members: 19
 Owner: [Umberto Battista](#)
 Website: <http://www.umbrella-project.eu/>

Group Members in Your Network

- Federico Meneghello** 1st
Project Manager at D'Appolonia
- Valeria Ferrando** 1st
Project Manager at D'Appolonia S.p.A.
- Carlos González de Ubieta** 1st
Director de Desarrollo de Negocio e Internacionalización en SOLINTEL

Figure 31: LinkedIn group.

To strengthen the presence on the social networks, a Twitter account has also been created at http://twitter.com/UMBRELLA_FP7. It has been aimed at publishing news and updates, timely announcing conferences, workshops and other events: in such a fashion, being Twitter a modern and very widespread social network, it has been possible to reach a lot of stakeholders and keep them updated with the progress of the project. There are 619 followers so far.

Umbrella
 Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation

TWEETS 50 FOLLOWING 2,001 FOLLOWERS 619 FAVORITES 28

UMBRELLA Project
 @UMBRELLA_FP7
 Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation
 umbrella-project.eu
 Joined May 2013

Tweets Tweets & replies Photos & videos

UMBRELLA Project retweeted
ENTRUST Project @EntrustH2020 · Sep 17
 .@umbrella_fp7 workshop on decision support tools for building energy efficiency projects in full flow #sustainplaces15

UMBRELLA Project retweeted
ENTRUST Project @EntrustH2020 · Sep 17
 #sustainplaces15 WS06 up next @npdunphy exploring inclusion of external perspectives in business model @umbrella_fp7

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- #WorldRhinoDay
- Sir Alex Ferguson
- Harry e Cara
- Gucci
- Banca Popolare di Vicenza

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Figure 32: UMBRELLA Twitter profile.

Besides a project video was created and uploaded on the project website. The video has a catchy graphic, based on the most recent design and project results. In about two mins animation the video shows general background information about the UMBRELLA project, its main outcomes and an overview of the Re:form tool, the major result of the project.



Figure 33: UMBRELLA project video.

4.2.1.10 Evaluation criteria

In order to assess whether the UMBRELLA communication and dissemination strategy is efficient, a number of basic quality check parameters has been defined, to evaluate the impact of the dissemination tools and activities deployed and carried out.

Table 9: Evaluation of dissemination activities.

Media/Action/Method	Feedback quality check parameter	Objectives	Today
Website	Number of visits	6,000 visits per year	2,600 visits per year
	Average time on site	40% of user spending more than 5 minutes on the website	Mean time on the website: 2 minutes
Flyers / leaflets	Number of flyer / leaflet / brochure distributed	250	> 500
Publications	Number of publications	2-3 Articles published by specialised press	3 in journals (+1 under evaluation), 1 in a book, 2 in press, 6 in conference proceedings
Conference, workshop and fairs	Number of conference attended	5	29
	Number of attending people	Audience > 30	Mean audience > 30
Demonstration	Number of attending people	30 people visiting pilots	> 30
Media and social media	Number of appearance in media	3	Several appearances on social media
	Number of people	150	> 1,500

contacted through social
media

4.2.2 Plans for Exploitation

Exploitation is something that has been thought about from the beginning of this project. In the initial exploitation brainstorming session at the M6 meeting in Cork, it was decided that in order to exploit the UMBRELLA concept of a technical solution for building design, retrofit and in-use performance as well as the business models to encourage and enable implementation of the solution, the development of both a Free and a Commercial tool would give us the best advantage within the market.

The aim of the Free tool is to allow for wide dissemination across Europe and multiple end-users and encourage investigation of a variety of potential interventions as well as educate these end-users about what they can do to create high performance energy buildings or retrofit their existing building to become more energy efficient. The Free tool would then promote the Commercial tool, highlighting the importance for more detailed analysis and encouraging the end-user to do so; this provides another entry point into the market.

Since this original plan, an additional Commercial tool has been proposed, which will leverage the developments that have been produced for both the Web Tool and the Full Analysis Tool. We are calling this a 'Hybrid' tool and more information can be found in Deliverable 5.2 explaining how it will work. It will leverage existing software from IES to create an App based platform that will improve the block model produced by the Web tool through engagement with the end user to produce a model closer to the reality of the building, without performing full scale Dynamic Simulation Modelling. The reason for introducing this tool is to capture another market, the SME Energy Management market, which targets buildings which don't have full scale Building Management Systems (BMS) or data collection software (which is quite a large part of the buildings market). This tool will simulate the data they need to perform analysis and help the building owner understand potential interventions which they can apply to a higher level of detail than the Free Web tool.

As such, the Free tool will target all buildings, end users and stakeholder types across the EU; the Hybrid tool will target the SME Energy Management market who are looking at buildings which do not have sophisticated monitoring equipment installed; the Commercial tool will target existing users of Dynamic Simulation Modelling software to provide detailed analysis for buildings which have BMS and logged data.

An exploitation strategy has been put in place with respect to the method for selling each of the Free, Hybrid and Commercial tools. The Free tool will only be free up to 5 scenarios per user, after which they will have to pay for further simulations; this is a result of the cost associated with hosting the free tool and running the simulations on a cloud based server. The Hybrid solution will have a Bronze, Silver, Gold and Premium package offering which will provide the end user with increased number of simulations they can run, along with access to different number of country databases for the Design Options. The Commercial tool will also have a similar Bronze, Silver and Gold offering along with additional extras for the components relating to End of Life Solutions, Future Climate Analysis, Life Cycle Costing, In-Use Optimisation etc. As each extra is purchased, the fee associated with this 'Extra' Add-On will go to the owners of that component.

The plan will be to have 2 phases of bug testing and release to our preferred list of beta testers where we will gain feedback and use this to refine the tool with respect to both the technical software and the business models. During this time, we will also re-brand the website and tools to the Re: Form branding which has been identified in WP8 and will put in place a sales plan and sales targets. We will also use this time to identify the cost of each component, put a value on the joint ownership of various components and put in

place the legally binding joint-ownership agreements. The plan is that within 6-12 months of the end date of the UMBRELLA project, the prototype will be transferred to a product for commercialisation.

4.2.2.1 Initial Exploitation Plan (Confidential)

the Initial Exploitation Plan was submitted quite early in the project (in M8) and outlined some of the early thinking for how we could commercially exploit the UMBRELLA project results. A list of target audiences was defined ranging from building professionals to building owners and tenants, government bodies and financial institutions. At this stage of the project, the concept of the Free tool and the Commercial tool were formed. The idea was to offer a Free version of the software to engage the various end users, offer them a simple solution which then leads them into engagement with the Commercial tool. There were two thoughts behind this process, 1) a Free tool ultimately will bring in more potential customers and 2) we are delivering something for free on the back of EU funding which would be good for the dissemination of EU project results. As a result the following diagram was prepared, illustrating the workflow for the two products and the technologies that were to be developed as a result:

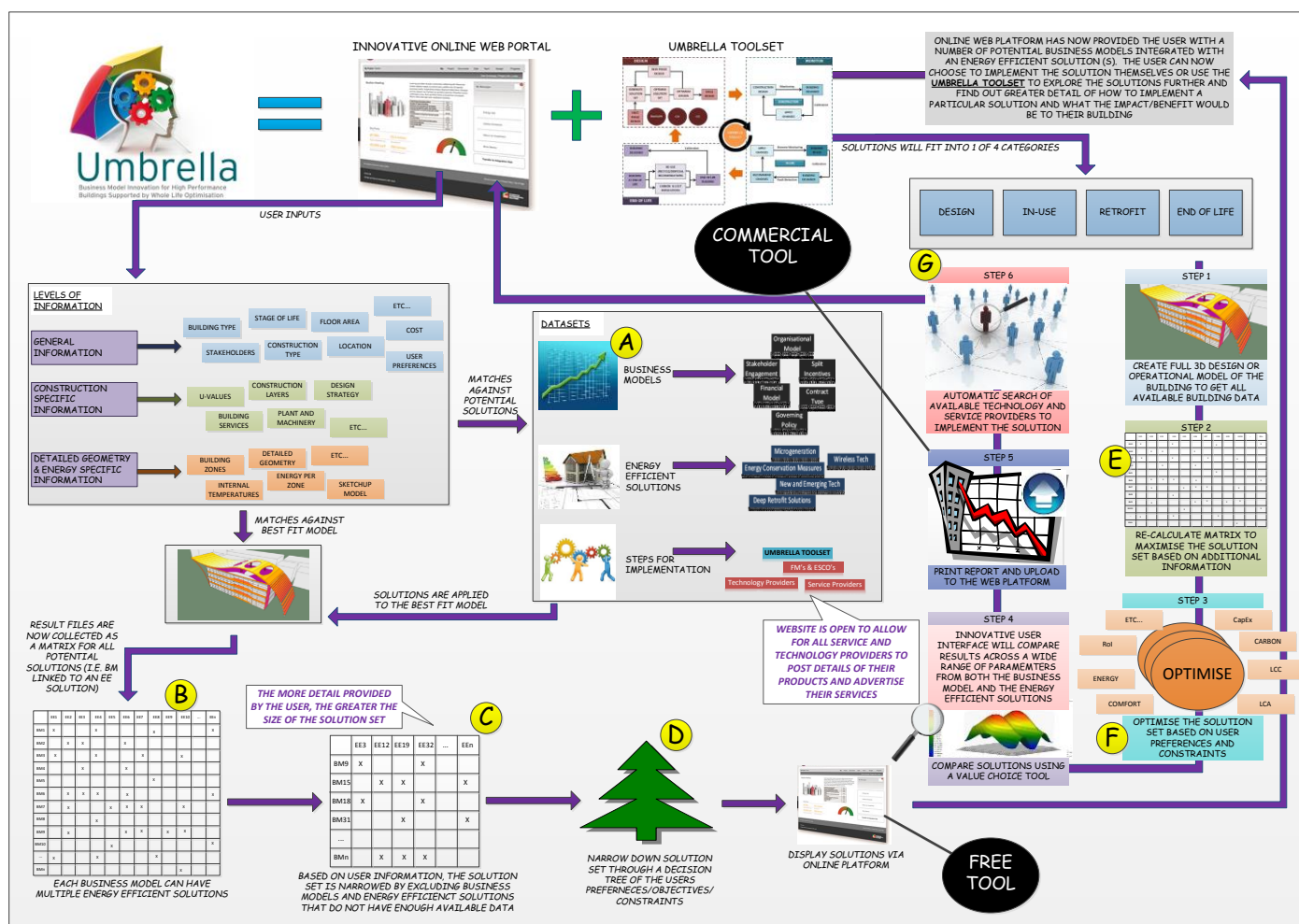


Figure 34– Original Exploitation Diagram

The Free tool and Commercial tool both should follow the same structure with the same expected output, however the Free tool uses simple models for simulation and simple tools for analysis and provides results that are an indication of the types of interventions and business models that the end user could exploit; whereas the Commercial tool now uses the same approach but more sophisticated modelling and analysis tools to provide the end user with accuracy of results and a broader range of business models which are suited to their unique situation.

The initial exploitation plan also outlined some potential barriers, benefits to the user and initial thoughts and perceptions for both Free and Commercial exploitable outcomes which has been used to drive the creation of the free Web UI and the commercial product offering. This was invaluable insight to allow us to create tools that will be ultimately exploitable to a wide audience of end users.

As a result of this initial exercise, a number of further steps were outlined. The first step was the engagement with the EU Commission Exploitation Strategy Seminar (ESS), which was held in Cuneo Italy in September 2013. This seminar allowed the consortium to brainstorm the potential exploitation outcomes, identify the risks and potential obstacles for exploitation and analyse how to address them. Following this, further research into understanding the market, potential competitors and our target audiences was carried out. This led to an understanding of the customer proposition which UMBRELLA will offer and ensuring that this is taken into account with respect to the design of the Free and Commercial tools. Finally, the IP ownership of the various exploitable outcomes and strategy for exploiting these while ensuring that all partners benefit was outlined and agreed with all partners. This led to a clear exploitation route and strategy for the final UMBRELLA project outcomes.

Since these meetings and following internal discussions towards the end of the project, we have identified a third commercial offering, which is a Hybrid version of the software, which will leverage developments from both the Free and Commercial tools. We have recently developed within IES an Energy Auditing Application which is targeted for the SME Energy Management market, i.e. those companies who are doing simple analysis and reduction in buildings, performing Energy Performance Certificates, Green Deal Contracting in the UK (and similar in other countries), if aspects of the development could be coupled with this Energy Audit App, this would open up another market for the UMBRELLA product outcomes.

4.2.2.2 Target Countries for First Phase of Exploitation (Confidential)

We are aware that the energy efficiency market in Europe is on the increase. The European Commission (http://ec.europa.eu/energy/publications/doc/2013_pocketbook.pdf) state that:

“The energy sector is one of the pillars of growth, competitiveness and development in modern economies.”

Umbrella supports the energy efficiency cause and gives a platform for users to apply and test energy efficiency solutions (including renewables) on their building(s). The pie-charts below highlight a 100% increase in the use of renewables between 1995 and 2011, however the renovation rate is still less than 2%. A key capability of Umbrella is being able to simulate renewable technologies and from this information forecast performance in monetary and energy saving terms. Through the integration of business models which describe how the solutions can then be financed for implementation, this should allow for a greater uptake of the solutions presented to the end user.

In order to identify which countries should be targeted first for exploitation, research with respect to the countries which have the largest floor area was carried out. The graphs below highlight which countries should be addressed first with respect to exploitation, these are based on floor distribution per country and are:

- Germany
- France
- UK
- Italy
- Spain

These countries will be targeted first and following this, other countries will be added through the exploitation strategy.

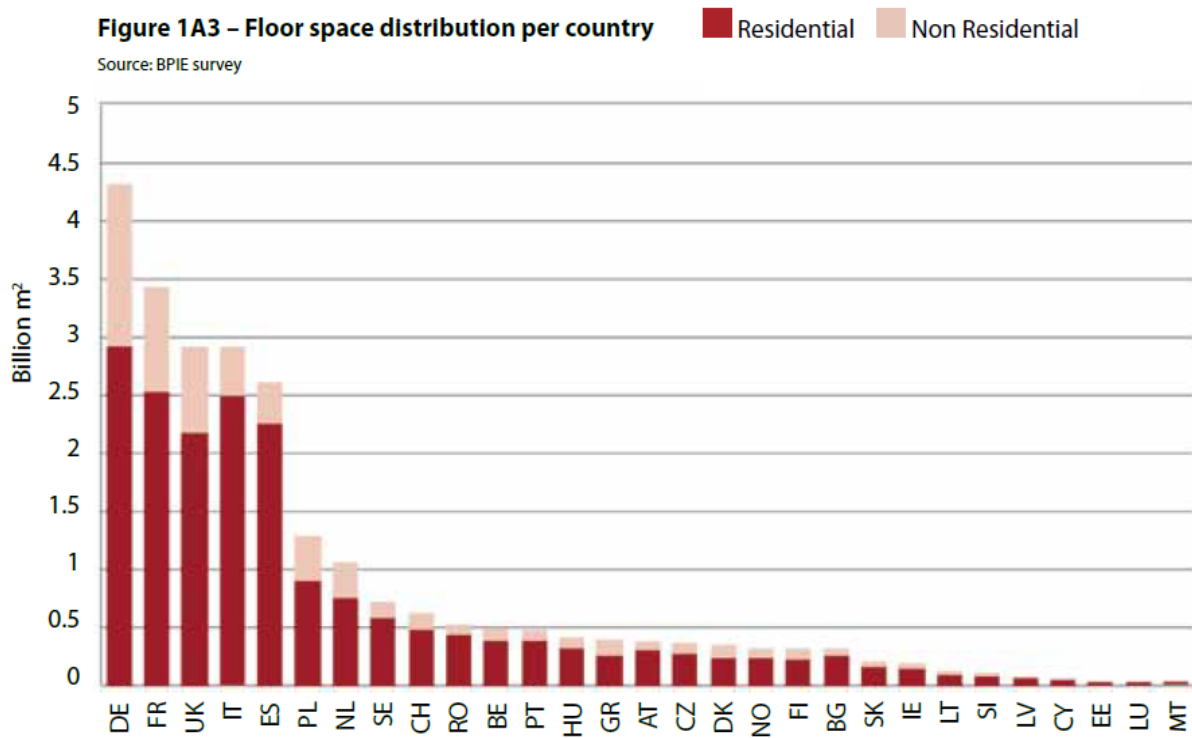


Figure 35 – Floor Space per capita in m2 (BPIE report)

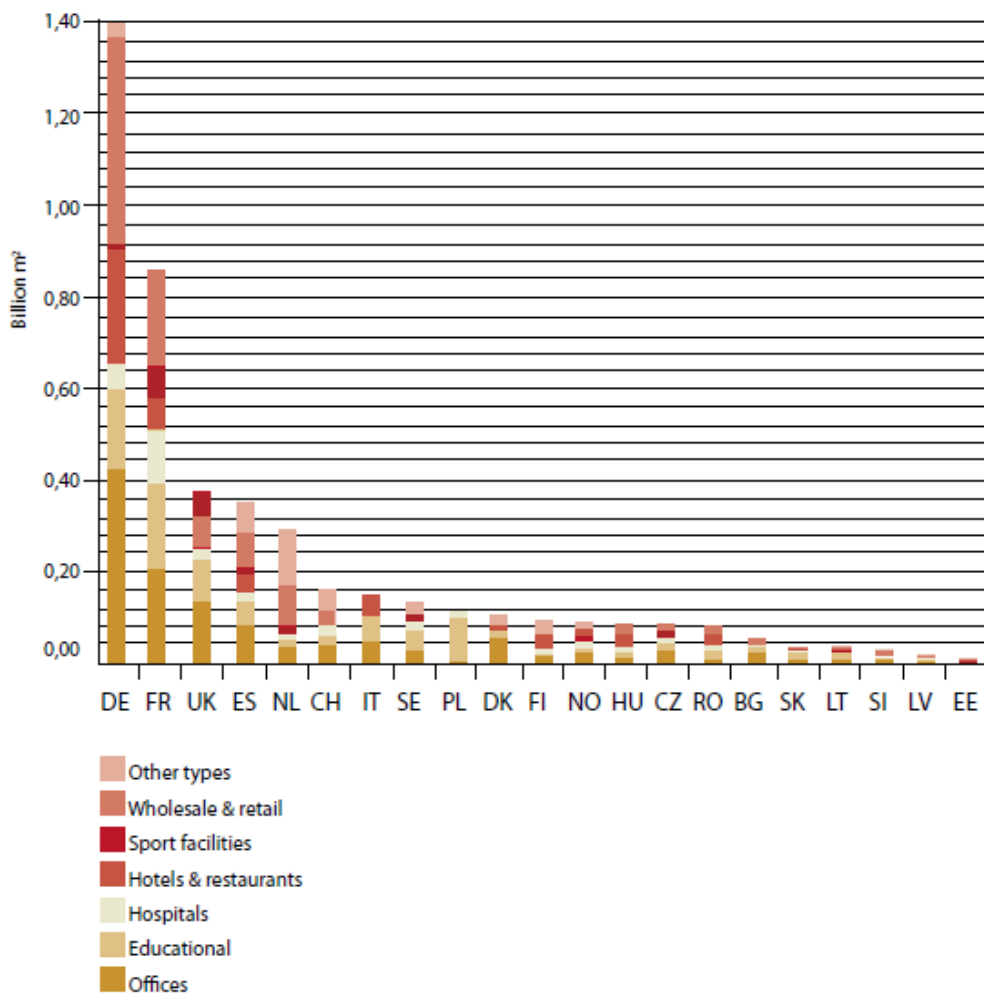


Figure 36 – Breakdown of non-residential floor space (BPIE report)

4.2.2.3 Proposed Customer Proposition (Confidential)

An overview of the UMBRELLA tools, target market, client offering and supply chain is now provided in Figure 10. The 3 UMBRELLA tools (Free, Hybrid and Commercial) will all target different building types as now described in the following Table.

LoD	Description
Level 1	Buildings – Residential: This includes all dwellings, detached, semi-detached or terraced houses. It also includes small apartment buildings without complex controls.
Level 2	Buildings – Small/Medium Commercial: Commercial buildings with an area less than 10,000m ² are considered small/medium. They will be less than 5 stories tall and are leased by tenants. They do not contain a BMS, are cooled with rooftop thermal units, and have older lighting and telecom equipment in place. They do not have staff dedicated to energy management but may employ a building manager or offsite facility manager. Large apartment buildings will also be considered in this LoD.
Level 3	Buildings – Large Commercial: Buildings greater than 10,000m ² are considered large. They will be greater than 5 stories in height and have a greater tendency to be owner-occupied. They will have a more complex control infrastructure including networked lighting, security, fire, and most significantly, HVAC controls. They are likely to have rooftop package units that supply regions or the entire building with heating and cooling. They are likely to have BMS with varying degrees of sophistication, networking, and portfolio management.
Level 4	Buildings – Complex Commercial: These are buildings which are considered to have complex control systems for their energy management. These buildings may already have many existing platforms in place to allow them to control their energy use and are looking for a single platform to enable better optimisation and Demand Response of all systems. Examples include hospitals, large manufacturing facilities, supermarkets, logistics facilities etc.

Table 10 – Levels of Detail for Building Types

As shown in Figure 37, the Free tool targets all building types within these LoD. The Hybrid tool targets simpler buildings that in general do not have any metered or collected data but may have utility bills or Automated Meter Readings (AMR). The Commercial tool targets full scale complex commercial buildings from large office blocks with full BMS to hospitals, large manufacturing facilities etc. Without the Hybrid tool, the LoD 1 & 2 buildings would only be targeted by the Free tool, which would have resulted in quite a large target group that we would have not exploited from a commercial perspective.

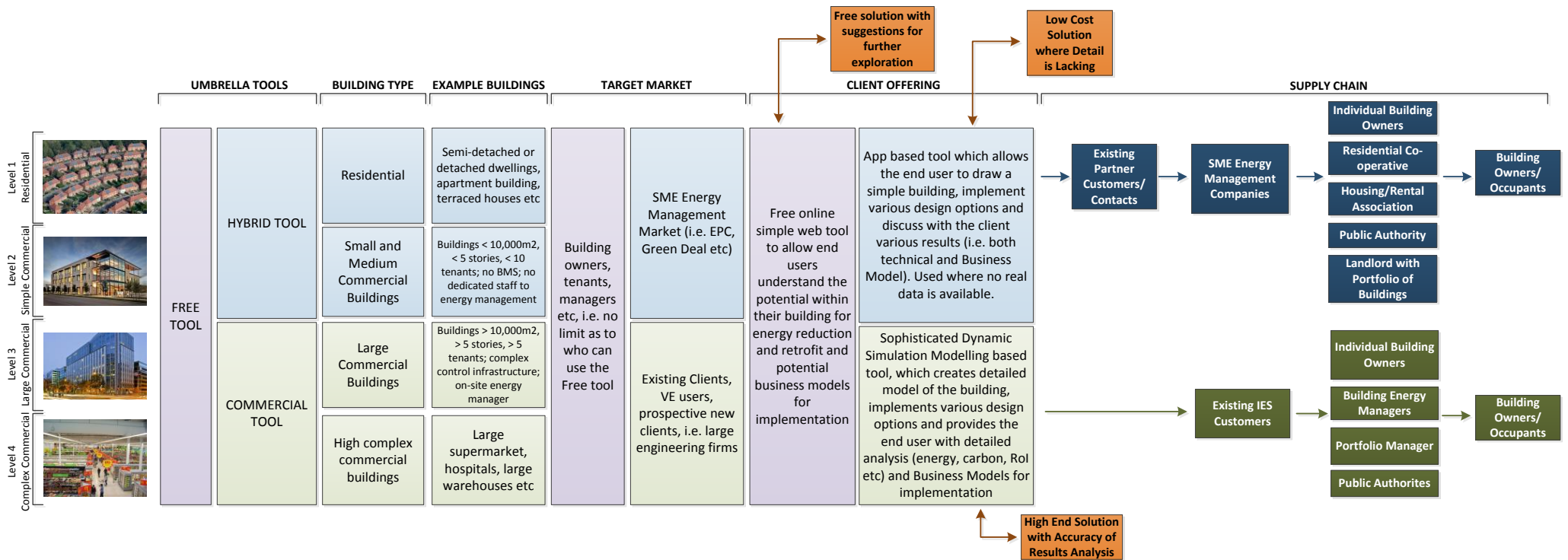


Figure 37 – Description of the UMBRELLA Product Offering and Supply Chain

The Free tool will be available for anyone to use, of any building type or any end user type (e.g. building owner/occupier, building manager, facility manager, SME energy manager etc.), for the Hybrid tool, the target market will be the SME energy manager market, i.e. those companies who are carrying out energy audits, Energy Performance Certificates, the Green Deal in the UK (or similar in other European countries); for the full scale Commercial tool, the target market will be existing users of Dynamic Simulation Modelling tools, i.e. IES existing customers or any potential new customers that wish to convert from some of our competitor products, e.g. Energy+, DesignBuilder, Transys, etc.

A brief description of each tool is now provided:

- The Free tool will offer the end user simple analysis of their building, understanding the potential for retrofit, the ranking of which solution will have the most impact and a short list of business models and descriptions that could be used for implementing the solution.
- The Hybrid tool, will connect with existing Energy Auditing App from IES; it will build in front of the user a simple model of their building, using initially the Design Options and Master Templates. The Agent can then tweak the model while talking with the end user to alter the geometry and orientation of the building or change some of the design assumptions to include better, more realistic profiles of how the building is performing. The tool will then use the cloud based simulation scheduler to simulate the design and provide the client with potential retrofit options for their building with an adequate level of energy/carbon savings and return on investment.
- The Commercial tool will create a full scale 3D calibrated model of the building, using detailed geometry, taking BMS or metered data and ensuring that the model is performing the same as the building in operation. The various different databases and tools from the UMBRELLA tool (e.g. Genetic Optimise to examine multiple scenarios and combinations of scenarios, DEFT to look at value choice and weighting of the solutions, the full and detailed Business Model Dataset for implementation, future weather files for understanding the impact of climate change etc.).

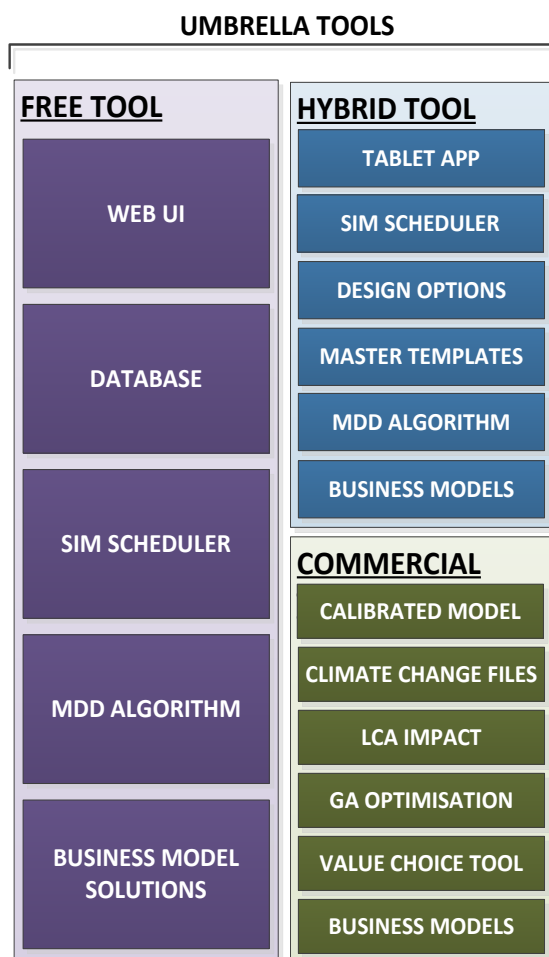


Figure 38 –Components of the

Within the Free, Hybrid and Commercial tools, the various components that have been developed to create these tools have been identified as illustrated in Figure 5. The components are not mutually exclusive, e.g. some of the tools developed for the Free tool can be used by both the Hybrid and Commercial tools and each tool follows the same basic methodology and principles.

It should be noted that there is still development work required to bring all tools from a prototype to a commercial product, and in particular for the Hybrid tool, there will be significant development needed, however this will be put into the commercialisation plan.

4.2.2.4 IP Ownership of the Exploitable Results (Confidential)

As illustrated in Figure38, each of the components of the UMBRELLA tools which have been developed have been identified. In addition to this, the ownership and joint ownership of these tools has also been identified and this is illustrated in Figure 39.

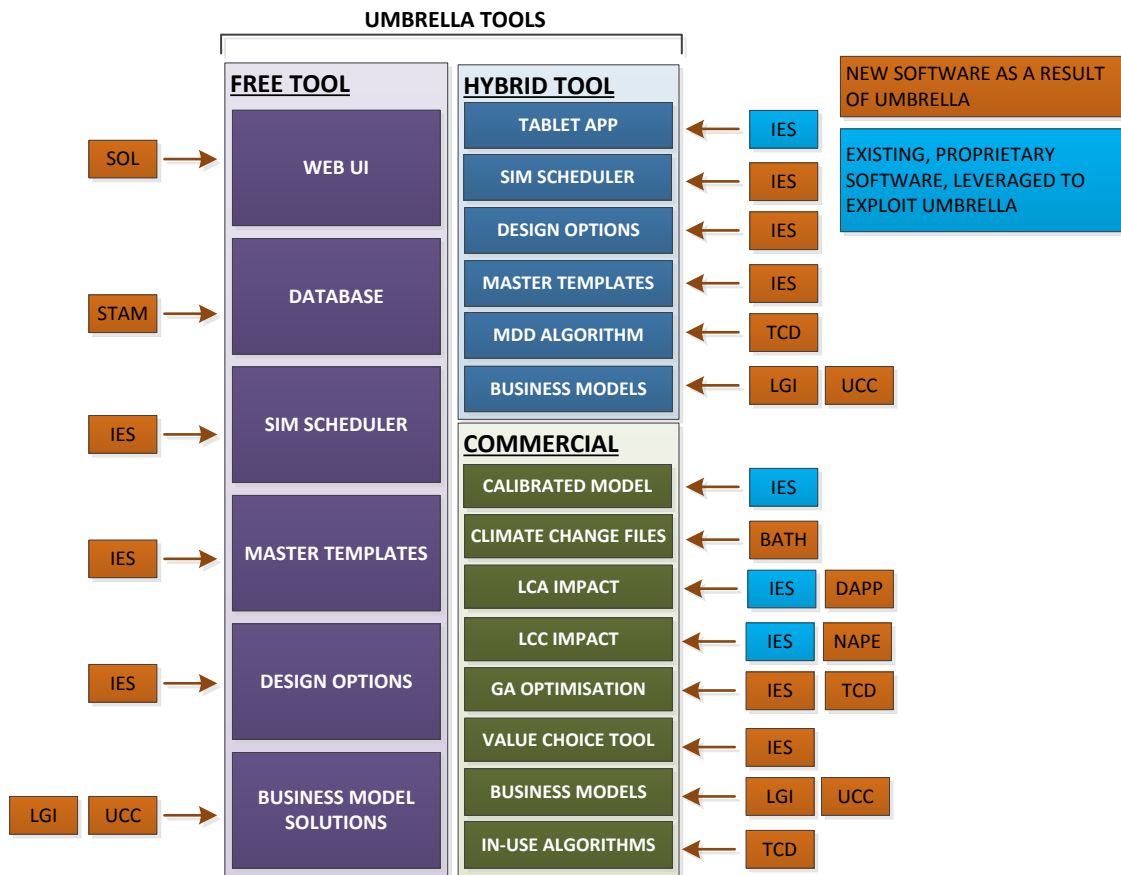


Figure 39 – Ownership of UMBRELLA components

It is shown that in most instances various components are owned by a single consortium partner, however there are a few joint ownership agreement that must be put in place, these are between:

1. LGI and UCC for development of the business models
2. IES and NAPE for integration of the costs database with the IES proprietary LCC tool
3. IES and TCD for development of the Genetic Optimise algorithm and integration of the MDD and in-use algorithms directly with the IES software

Discussions regarding these agreements have already begun and are well underway.

The Technology Readiness Level of each of these components is now shown in Figure 40. The diagram shows the estimated starting TRL of each component and the now finished TRL of each component. As it is shown, all components that have been developed from UMBRELLA have finished at TRL7 and up.

Please note that the components which are at TRL9 are those which are proprietary and are already existing and will be used to exploit the UMBRELLA products to their fullest potential, as such they are also shown here.

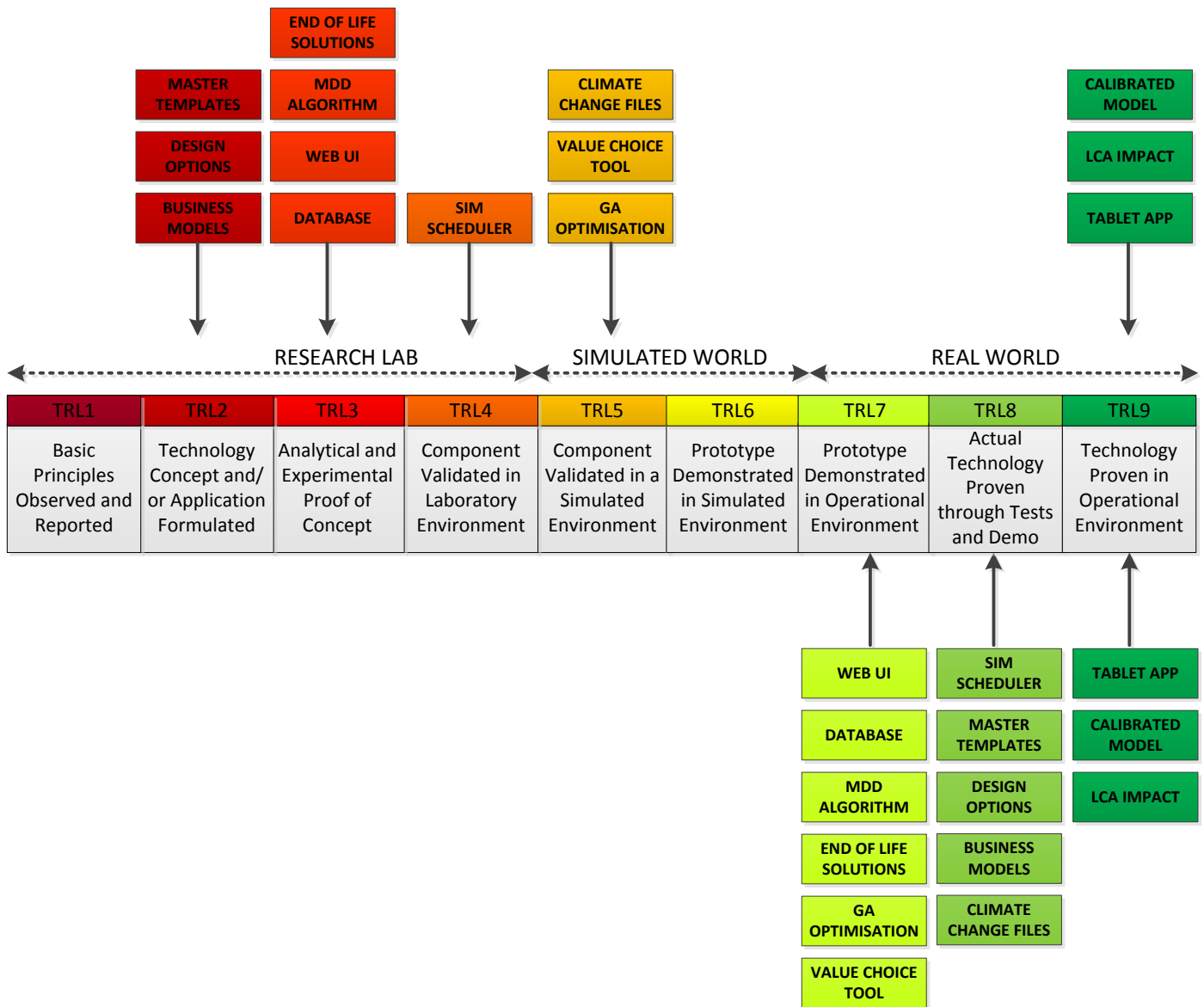


Figure 40 – Identified TRL’s of the Various UMBRELLA Components

Figure 40 illustrates the success of UMBRELLA to develop prototypes which are ready now for commercialisation, however it also illustrates that further work is required for those components within TRL7 and TRL8 to bring them to a commercialised product. This is mainly bug fixing, minor development to integrate the components within the overall software architecture, development to create the Hybrid tool using the UMBRELLA components and testing and refinement of the solutions in the real world. We plan to use known beta testers and preferred customers to aid us with this refinement between the end of the project and the launch of the final tool.

4.2.2.5 Sales Strategy (Confidential)

Now that the 3 products which we will bring to market have been identified, discussions have taken place between the consortium members as to how we will sell these products and ensure that partners will benefit without a complicated licence/royalty type agreement structure.

It has been decided that the Free tool will be exploited by IES. This will be done at cost to IES as there are fees associated with hosting the Free tool on a server and using space to run a simulation each time, i.e. each simulation run will cost a nominal fee. IES have agreed to bear the cost of the running of the Free tool as long as STAM and Solintel pass over the Web UI and Database for no financial return. As such, the following offering will be put in place for the free tool:

ONLINE WEB TOOL	FREE	WEB PREMIUM	WHO BENEFITS?
Access to Web UI	✓		No charge, therefore no return. IES as exploitation partner, will bear the costs of hosting the website and as such it will cost them to run this service.
Analysis for up to 5 Scenarios	✓		
Basic Business Models for up to 5 Scenarios	✓		
Analysis for further Scenarios (Pay per Simulation)		✓	Any money received from the Web Premium will go directly towards hosting and maintaining the site on a commercial server.
Analysis for further Business Models (Pay per Simulation)		✓	

Table 11 – Proposed Structure for Sales of the Free Tool

The tool will be offered for free for up to 5 simulation scenarios, however should a user wish to run more simulations for more buildings, they may purchase a Web Premium account. This web premium account will be a ‘pay per simulation’ model, roughly €0.60 per simulation and this will be used to contribute towards costs of hosting the free tool on the server. It is envisaged that the Free tool will still run at a loss even with this structure in place.

The Free tool will run for a trial period of 1 year. The costs required to run the tool, the number of users and the number of users signed up to the web premium account will be examined. It will also be examined whether or not the Free tool has been successful at engaging end users to use the Commercial tool. Following this trial period, it will be decided if the Free tool will continue to run or not. If it is continued to run, further developments and improvements will be made along with investigations as to how the Free tool could potentially make money, e.g. link to service/technology providers to promote their products through the free tool for a fee. These further developments will take both time and money to put in place and as such a commercial decision by IES whether to develop it further will be taken.

The route to market for both the Hybrid and Commercial tools is now illustrated as follows:

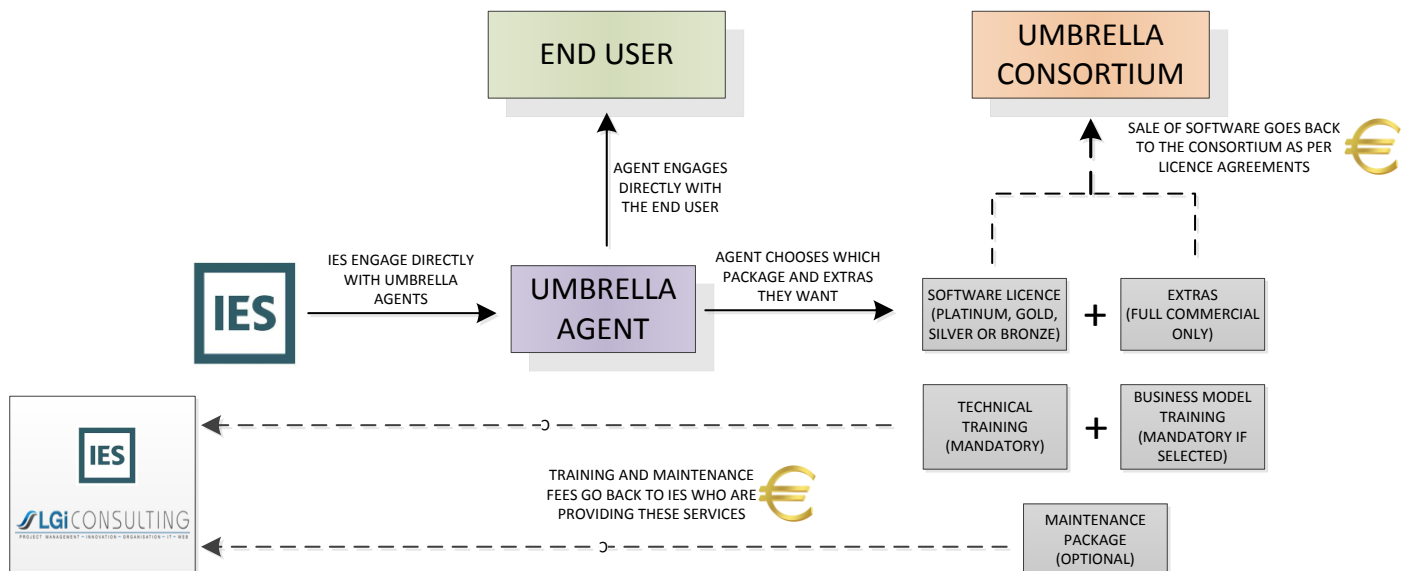


Figure 41 – UMBRELLA Route to Market

IES will be the main exploitation partner. All consortium members (including IES) have the option to be an UMBRELLA Agent and exploit the software across the EU. The Agent will purchase a licence for the software from the Bronze, Gold, Silver, Platinum options presented (either Hybrid or Commercial). Each

corresponding partner(s) who owns their part of that package will receive a return from the sale (note that costs of each package are still to be decided).

For the commercial tool, it is then up to the Agent to decide, which optional extras, they wish to purchase to offer to their client base. This will be based on the business of the Agent, how much they think their clients will want, what they wish to offer them etc. Each corresponding partner(s) who owns that optional extra will then receive a direct fee from the UMBRELLA Agent for use of the tool/database.

This structure ensures that there will only be licence/royalty agreements between those partners identified who own joint IP and this licence agreement is private and up to them to arrange/agree. For the sale of the software itself, there will not be a royalty paid back to all partners for each sale, it will only be the costs associated with the different levels of offering (Bronze, Silver Gold etc.) or the Optional Extras which will be a direct payment to the partner(s) owning that level of offering. This structure/offering is now shown in the following tables.

Finally, IES and LGI will also provide training (this is mandatory for all of IES proprietary software tools and we would like to keep this here also as this ensures the quality of the output) for both the technical software and business model database to the Agents at a cost. There will then also be an optional maintenance and support package which the Agent can choose to purchase if they so wish.

Once the UMBRELLA Agent has selected and purchased their software and received their training, they are then free to liaise directly with the end user to provide the service within their capabilities.

HYBRID COMMERCIAL TOOL	BRONZE	SILVER	GOLD	PLATINUM	WHO BENEFITS?
Purchase of the App	✓	✓	✓	✓	IES and TCD for Development, Update, Maintenance and Support
Credit Based Service for Running Simulations (per month)	Up to 50 simulations	Up to 100 simulations	Up to 300 simulations	Unlimited	
Access to MT's and DO's for Different Countries (user choice)	1 country	2 countries	3 countries	All	
Access to the Business Model Database	Optional	Optional	Optional	Optional	LGI and UCC for Development, and Updates

Table 12 – Proposed Structure for Sales of the Hybrid Tool

FULL COMMERCIAL TOOL	BRONZE	SILVER	GOLD	EXTRAS	WHO BENEFITS?
Purchase of the Base Software (DSM/calibrated model)	✓	✓	✓		IES for Use of Proprietary Software and Development of New Software as part of UMBRELLA
Basic Results File for Building Analysis (single scenarios)	✓	✓	✓		
Genetic Optimise of Results for Multiple Scenarios and Scenario Combinations		✓	✓		IES and TCD for Development of GA Algorithms and Integration
Value Choice Tool for Analysis Comparison and Weighting			✓		IES for Development of the DEFT Tool for Value Choice
End of Life Solutions			✓		Part of Gold Package as additional USP, no payback necessary
Detailed Business Model Analysis for Implementation				✓	IES for Proprietary software and NAPE for Costs Database
Life Cycle Costing				✓	IES for Use of Proprietary Software
Life Cycle Analysis				✓	DAPP for Development of Database
Future Weather Files				✓	BATH for Development of Weather Files
In-Use Optimisation				✓	TCD for Development of the In-Use Algorithm

Table 13 – Proposed Structure for Sales of the Commercial Tool

4.2.2.6 Prototype to Product Strategy (Confidential)

Currently the three tools are at prototype stage, TRL7 and TRL8. As such, there is still development that will be needed to bring these tools to TRL9 to be sold in the market. This is briefly outlined as follows:

1. Free tool
 - a. Update the Web UI to suit the proposed Re: Form branding and also make it more appealing as a commercial product
 - b. Merge the Web UI, database and sim scheduler onto the one platform (currently they are three separate platforms created by IES, Solintel and STAM)
 - c. Bug Fixing
 - d. Further customer feedback and changes as a result of the WP7 activities and reports
2. Hybrid Tool
 - a. Integrate with IES energy auditing app
 - b. Create function to modify the Master Template geometry file using the app to better represent the building geometry
 - c. Integrate with IES Rough Cut Profiling technology to understand the behaviour of the building better and modify the Design Options to reflect real in-use building behaviour
 - d. Integrate the MDD algorithm (TCD) to create a simplified value choice tool for the app
3. Commercial Tool
 - a. Polishing of Value Choice Tool, small functionality to be added
 - b. More rigorous testing of Optimise (using Genetic Algorithm) coupled with the Value Choice Tool and Bug Fixing
 - c. Beta testing and feedback from commercial users
 - d. Final Branding and Marketing

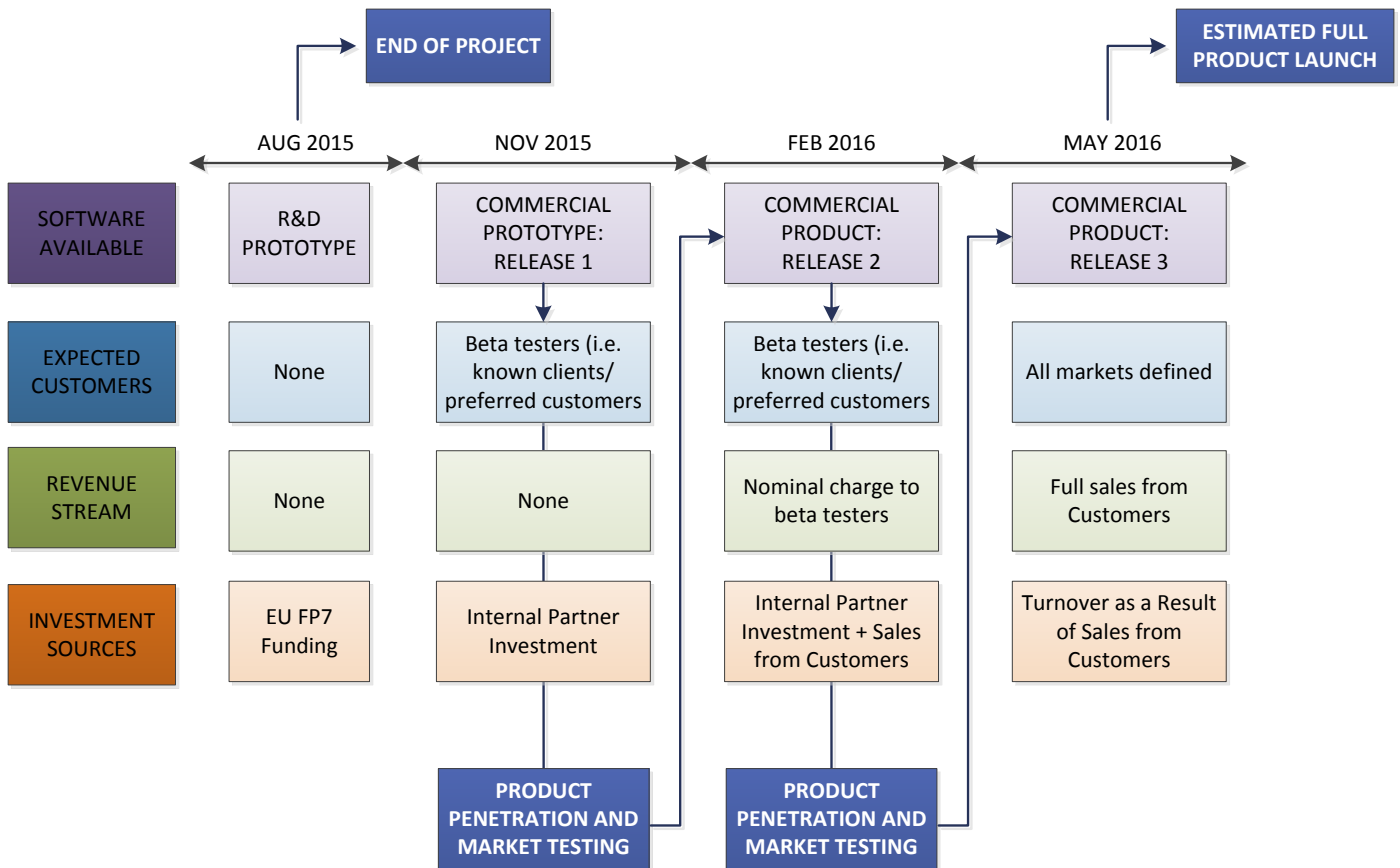


Figure 42 – Commercialisation Strategy

Currently the least amount of effort required to bring each of the above tools from a prototype to a product is the Commercial Tool. As such, this will be where the commercialisation will first focus. The Free tool will undergo some minor changes for re-branding but it will remain as it is for a trial period (time to be determined, 6-12 months). Based on the use of the Free tool during the trial period, a decision regarding further work will then be made. The commercial tool will be launched regardless as it does not rely on the Free tool, it only exploits it. The most amount of work to be completed is for the Hybrid Tool, however we see this as having a large commercial impact and therefore dedicated development time will be set-aside for it. A short strategy for the commercialisation period following the end of the project is now illustrated in Figure 9.

This is the shortest timeframe that we envisage, however overall all it is likely to be between 6 and 12 months before the Commercial Tool is released. Development work on the Hybrid tool will begin in early 2016, however as this will involve new development to integrate various tools together, we cannot estimate time to completion before we write a requirements specification. The Hybrid tool will be an added bonus of the UMBRELLA project, leveraging components developed. Realistically, the aim will be to complete the Hybrid tool by the end of 2016 with a launch in 2017.

4.2.2.7 Conclusion to the Exploitation Strategy

The UMBRELLA project has resulted in two very clear prototype products and a third potential product which will leverage many of the developments from the project. The first prototype to be brought to full commercialisation will be the Commercial Tool. There are two reasons for this: (i) it has the least amount of work to be completed as a commercial product; (ii) it is a commercial tool which will be a source of revenue and is therefore a higher priority. That is not to say that the Free tool is not important, as it is a market entry point for the Commercial tool and therefore development time will be assigned to it also. However, there is some work to be done to transfer the Web UI, database and simulation scheduler to a single platform and

also re-brand the site and make it more appealing to end users; as such, a trial period of the Web UI as it stands will be put in place to better gauge the interest for the Free tool and its power as a lead in for the Commercial Tool. Following a trial period (6-12 months), a decision regarding further development work will be taken. For the proposed Hybrid tool, a requirements specification will be written and further development to leverage various components from the UMBRELLA project to create a tool which targets a large market of building types will be put in place. The next steps are now outlined in Table 14:

Description of Work	Q3 2015	Q4 2015	Q1 2016	Q2 2016	Beyond Q2 2016
Put in place a development plan for the work to be done to bring each of the 3 products to commercialisation					
Prioritise the work so that the software can be sold as soon as possible and on a phased basis (i.e. new versions with new features added over a phased basis)					
Create Case Studies based on the 4 demonstration sites					
Put in place the licence agreements with the partners who own joint IP (i.e. IES and TCD, LGI and UCC, IES and NAPE)					
Agree the price structure, i.e. the core software, the various package offerings and the optional extras					
Agree who will be the first UMBRELLA Agents from the current consortium partners					
Create branding material					
Create marketing material					
Create other Case Studies for Marketing Purposes					
Brief IES Business Development Managers to sell the software to existing and new clients					
Create sales targets					
Advertise and add other UMBRELLA Agents from the existing pool of IES clients					
Offer the potential for UMBRELLA Agents in other countries					
Add other countries to the Design Options (as needed)					
Add other countries to the Future Weather Files (as needed)					
Development to bring tool from prototype to product					

Table 14 – Next Steps for Commercialisation

As a consortium we felt that we have developed a software which has a unique place in the market. There are no tools out there currently that integrate technical assessment of buildings to understand best design or retrofit options with the business models for how the end-user can easily and practically implement these options in real life.

The consortium is committed to exploiting the UMBRELLA project results and carrying out the necessary development and steps to go from a prototype to a commercial product. IES as exploitation partner are committed to making this happen. Watch this space!

Section A (public)

This section includes two templates

- Template A1: List of all scientific (peer reviewed) publications relating to the foreground of the project.
- Template A2: List of all dissemination activities (publications, conferences, workshops, web sites/applications, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters).

These tables are cumulative, which means that they should always show all publications and activities from the beginning until after the end of the project. Updates are possible at any time.

TEMPLATE A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES										
NO.	Title	Main author	Title of the periodical or the series	Number, date or frequency	Publisher	Place of publication	Year of publication	Relevant pages	Permanent identifiers ⁴ (if available)	Is/Will open access ⁵ provided to this publication?
1	<i>Building energy efficiency: a value approach for modelling retrofit materials supply chains</i>	<i>Dunphy, Morrissey, MacSweeney</i>	<i>Materials and processes for energy: communicating current research and technological developments</i>	<i>January 2013</i>	<i>A. Méndez-Vilas</i>	<i>Badajoz, Spain</i>	<i>2013</i>	<i>pp. 649-657</i>	http://www.formatex.info/energymaterialsbook/book/649-657.pdf	yes
2	<i>Identification and characterisation of the actors</i>	<i>Dunphy, Morrissey,</i>	<i>16th ERSCP</i>	<i>June 2013</i>	<i>ERSCP</i>	<i>Istanbul, Turkey</i>	<i>2013</i>		http://www.academia.edu/7564350/Identification_and_char	yes

⁴ A permanent identifier should be a persistent link to the published version full text if open access or abstract if article is pay per view) or to the final manuscript accepted for publication (link to article in repository).

⁵ Open Access is defined as free of charge access for anyone via Internet. Please answer “yes” if the open access to the publication is already established and also if the embargo period for open access is not yet over but you intend to establish open access afterwards.

	<i>involved in the energy efficient building market</i>	<i>MacSweeney</i>							<i>acterisation_of_the_actors_in_volved_in_the_energy_efficient_building_market</i>	
3	<i>UMBRELLA Project</i>	<i>Kerrigan, Melvin</i>	<i>EeB Roadmap - EeB PPP Project Review</i>	<i>August 2013</i>	<i>Claire Hughes, Arup</i>	<i>London, UK</i>	<i>2013</i>	<i>p. 44</i>	<i>http://ec.europa.eu/research/industrial_technologies/pdf/eeb-ppp-project-review-2010-2011-2012_en.pdf</i>	<i>yes</i>
4	<i>Retrofitting solutions for future buildings</i>	<i>Kerrigan, Melvin</i>	<i>Advanced Retrofitting Solutions for Buildings</i>	<i>September 2013</i>			<i>2013</i>			
5	<i>Energy Efficiency in Commercial Buildings: Capturing Added-Value of Retrofit</i>	<i>Morrissey, Dunphy, MacSweeney</i>	<i>Journal of Property Investment and Finance</i>	<i>Vol. 32 (4), July 2014</i>	<i>Emerald Group Publishing Limited</i>		<i>2014</i>	<i>pp. 396-414</i>	<i>http://www.emeraldinsight.com/doi/abs/10.1108/JPIF-01-2014-0008</i>	<i>no</i>
6	<i>UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation</i>	<i>Battista, Musso, Barbagelata</i>	<i>Smart Energy Expo 2014</i>	<i>October 2014</i>	<i>Smart Energy Expo</i>	<i>Verona, Italy</i>	<i>2014</i>			<i>yes</i>
7	<i>Developing a Sustainable Housing Marketplace: New business Models to Optimise Value Generation from Retrofit</i>	<i>Dunphy, Boo, Dallamagiorre, Morrissey</i>	<i>40th IAHS World Congress on Housing - Sustainable Housing Construction</i>	<i>December 2014</i>	<i>IAHS</i>	<i>Funchal, Portugal</i>	<i>2014</i>		<i>http://www.researchgate.net/publication/269103645_Developing_A_Sustainable_Housing_Marketplace_New_Business_Models_To_Optimise_Value_Generation_From_Retrofit</i>	<i>yes</i>
8	<i>How innovative business models can boost the energy efficient buildings market</i>	<i>Boo, Dallamagiorre, Dunphy, Morrissey</i>	<i>40th IAHS World Congress on Housing - Sustainable Housing Construction</i>	<i>December 2014</i>	<i>IAHS</i>	<i>Funchal, Portugal</i>	<i>2014</i>		<i>http://www.researchgate.net/publication/269103720_How_Innovative_Business_Models_Can_Boost_The_Energy_Efficient_Buildings_Market</i>	<i>yes</i>
9	<i>Optimization of Construction Supply Chains for Greenhouse Gas Reduction</i>	<i>Dunphy, Morrissey</i>	<i>Optimization of Supply Chain Management in</i>	<i>March 2015</i>	<i>IGI Global</i>	<i>Hershey, PA (USA)</i>	<i>2015</i>	<i>pp. 280-310</i>	<i>http://www.researchgate.net/publication/274310075_Optimization_of_Construction_Supply_Chains_for_Greenhouse_G</i>	<i>no</i>

			Contemporary Organizations						as_Reduction	
10	<i>Development of a Procedure to Analyze Customers' Choice of Renewable Energy Heating Technologies: Application in Ireland</i>	<i>Dinh, Basu Kennedy</i>	<i>Journal of Clean Energy Technologies</i>	<i>March 2015</i>	<i>IACSIT Press</i>	<i>Singapore, Singapore</i>	<i>2015</i>	<i>pp. 312-316</i>	http://www.jocet.org/papers/2014-HK003.pdf	yes
11	<i>An MPC Based Control Strategy for the Findhorn Ecovillage</i>	<i>Staino, Aird, Kerrigan, Basu</i>	<i>UPEC 2015</i>	<i>September 2015</i>	<i>Staffordshire University</i>	<i>Staffordshire, UK</i>	<i>2015</i>			no
12	<i>Comparison of Conventional and Economic MPC in Smart Grid Applications (Paper n.262)</i>	<i>Staino, Basu</i>	<i>UPEC 2015</i>	<i>September 2015</i>	<i>Staffordshire University</i>	<i>Staffordshire, UK</i>	<i>2015</i>			no
13	<i>Comparison of Conventional and Economic MPC in Smart Grid Applications (Paper n. 360)</i>	<i>Staino, Basu</i>	<i>UPEC 2015</i>	<i>September 2015</i>	<i>Staffordshire University</i>	<i>Staffordshire, UK</i>	<i>2015</i>			no

TEMPLATE A2: LIST OF DISSEMINATION ACTIVITIES

NO.	Type of activities ⁶	Main leader	Title	Date/Period	Place	Type of audience ⁷	Size of audience	Countries addressed
1	<i>Flyers</i>	<i>UCC</i>	<i>UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"</i>	<i>April 2013</i>	<i>"Leading Environmental Innovation in Europe", Dublin, Ireland</i>	<i>Scientific Community, Industry, Other</i>	<i>> 50</i>	<i>EU</i>
2	<i>Other</i>	<i>NAPE</i>	<i>UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"</i>	<i>May 2013</i>	<i>"Spring School of Building Physics", Jelenia Gora, Poland</i>	<i>Scientific Community, Industry</i>	<i>> 30</i>	<i>EU</i>

⁶ A drop down list allows choosing the dissemination activity: publications, conferences, workshops, web, press releases, flyers, articles published in the popular press, videos, media briefings, presentations, exhibitions, thesis, interviews, films, TV clips, posters, Other.

⁷ A drop down list allows choosing the type of public: Scientific Community (higher education, Research), Industry, Civil Society, Policy makers, Medias, Other ('multiple choices' is possible).

3	Other	NAPE	UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"	May 2013	"Thermomodernization 2013", Warsaw, Poland	Scientific Community, Industry	> 30	EU
4	Other	LGI	UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"	June 2013	"CESB13", Prague, Czech Republic	Scientific Community, Industry	> 30	EU
5	Other	LGI	UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"	June 2013	"Innovation in energy efficient buildings and districts for smart built environment", Brussels, Belgium	Scientific Community, Industry	> 30	EU
6	Presentation	UCC	Identification and characterisation of the actors involved in the energy efficient building market	June 2013	"16 th ERSCP", Istanbul, Turkey	Scientific Community, Industry	> 30	EU
7	Other	LGI	UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"	October 2013	"Greencity", Marné la Vallée, France	Scientific Community, Industry	> 30	EU
8	Other	LGI	UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"	October 2013	"CONCERTO conference", Brussels, Belgium	Scientific Community, Industry	> 30	EU
9	Presentation	NAPE	How to reduce the maintenance cost of the building	October 2013	"Forum of public facility managers", Warsaw, Poland	Industry, Other	> 20	EU
10	Other	LGI	UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"	November 2013	"UNEP-SBCI Fall Symposium", Paris, France	Scientific Community, Industry	> 30	EU
11	Other	LGI	UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"	November 2013	"Batimat", Paris Villepinte, France	Scientific Community, Industry	> 30	EU
12	Poster	UCC	Potential for disconnect between energy efficiency and carbon emissions in building retrofit projects	February 2014	"24 th Irish Environmental Researchers' Colloquium, ENVIRON 2014", Dublin, Ireland	Scientific Community, Industry	> 50	EU
13	Other	LGI	UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation	February 2014	"AGRION Disrupt 100+", Paris, France	Scientific Community, Industry	> 30	EU
14	Other	EXE	UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation	March 2014	"EcoBuild", London, UK	Scientific Community, Industry	> 30	EU
15	Other	SOL	UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation	April 2014	"EERA Annual Congress", Brussels, Belgium	Scientific Community, Industry	> 30	EU
16	Workshop	IES	UMBRELLA - Business Model Innovation for	April 2014	"Industrial Technologies 2014",	Scientific Community,	> 30	EU

			<i>High Performance Buildings Supported by Whole Life Optimisation</i>		Athens, Greece	Industry		
17	Poster	STAM	<i>UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation</i>	June 2014	"ECTP-E2B Conference", Brussels, Belgium	Scientific Community, Industry	> 100	EU
18	Presentation	NAPE	<i>How to reduce the maintenance cost of the building</i>	June 2014	"Forum of public facility managers", Warsaw, Poland	Industry, Other	> 20	EU
19	Other	TCD	<i>UMBRELLA "Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation"</i>	July 2014	"SMARTGREENS 2015", Bangkok, Thailand	Scientific Community, Industry	> 30	EU, Far East
20	Flyers	STAM	<i>UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation</i>	October 2014	"Sustainable Places 2014" Nice, France	Scientific Community, Industry, Civil Society, Policy makers, Other	> 100	EU
21	Other	STAM	<i>UMBRELLA Booth</i>	October 2014	"Smart Energy Expo 2014", Verona, Italy	Scientific Community, Industry, Civil Society, Policy makers, Other	> 100	EU
22	Flyers	STAM	<i>UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation</i>	October 2014	"Smart Energy Expo 2014", Verona, Italy	Scientific Community, Industry, Civil Society, Policy makers, Other	> 100	EU
23	Poster	STAM	<i>UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation</i>	October 2014	"Smart Energy Expo 2014", Verona, Italy	Scientific Community, Industry, Civil Society, Policy makers, Other	> 100	EU
24	Workshop	STAM	<i>UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation</i>	October 2014	"Smart Energy Expo 2014", Verona, Italy	Scientific Community, Industry, Civil Society, Policy makers, Other	> 20	EU
25	Presentation	UCC	<i>Developing a Sustainable Housing Marketplace: New business Models to Optimise Value Generation from Retrofit</i>	December 2014	"40 th IAHS World Congress on Housing", Funchal, Portugal	Scientific Community, Industry, Civil Society, Policy makers, Other	> 30	EU
26	Presentation	LGI	<i>How innovative business models can boost the energy efficient buildings market</i>	December 2014	"40 th IAHS World Congress on Housing", Funchal, Portugal	Scientific Community, Industry, Civil Society, Policy makers, Other	> 30	EU
27	Flyers	STAM	<i>UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation</i>	March 2015	"Bahrain International e-Government Forum 2015", Sakhir, Bahrain	Scientific Community, Industry	> 50	EU, Middle East
28	Presentation	NAPE	<i>UMBRELLA - Business Model Innovation for High Performance Buildings Supported by Whole Life Optimisation</i>	August 2015	"Facility & Property Management - safe and economical property", Warsaw, Poland	Scientific Community, Industry, Civil Society, Other	> 20	EU
29	Poster	NAPE	<i>UMBRELLA - Business Model Innovation for</i>	August 2015	"Facility & Property Management -	Scientific Community,	> 30	EU

Section B (Confidential⁸ or public: confidential information to be marked clearly)

Part B1

The applications for patents, trademarks, registered designs, etc. shall be listed according to the template B1 provided hereafter.

The list should, specify at least one unique identifier e.g. European Patent application reference. For patent applications, only if applicable, contributions to standards should be specified. This table is cumulative, which means that it should always show all applications from the beginning until after the end of the project.

TEMPLATE B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.					
Type of IP Rights ⁹ :	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Application reference(s) (e.g. EP123456)	Subject or title of application	Applicant (s) (as on the application)

⁸ Note to be confused with the “EU CONFIDENTIAL” classification for some security research projects.

⁹ A drop down list allows choosing the type of IP rights: Patents, Trademarks, Registered designs, Utility models, Others.

Part B2

Please complete the table hereafter:

Type of Exploitable Foreground ¹⁰	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application ¹¹	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
	<i>Ex: New superconductive Nb-Ti alloy</i>			<i>MRI equipment</i>	<i>1. Medical 2. Industrial inspection</i>	<i>2008 2010</i>	<i>A materials patent is planned for 2006</i>	<i>Beneficiary X (owner) Beneficiary Y, Beneficiary Z, Poss. licensing to equipment manuf. ABC</i>
Commercial Exploitation of R&D Results	The UMBRELLA A Free Toolset via the online dynamic web portal	YES	Q3-Q4 2016	Software	Architectural, Engineering and Construction Industry	n/a	n/a	IES LGI UCC DAPP STAM TCD Solintel NAPE E++ BATH
Commercial Exploitation of R&D Results	Full UMBRELLA A Toolset	YES	Q3-Q4 2016	Software	Architectural, Engineering and Construction Industry	n/a	n/a	IES DAPP STAM TCD BATH
Commercial Exploitation of R&D Results	Dataset of New Business	YES	Q3-Q4 2016	Dataset	Architectural, Engineering and Construction	n/a	n/a	LGI UCC

¹⁰ A drop down list allows choosing the type of foreground: General advancement of knowledge, Commercial exploitation of R&D results, Exploitation of R&D results via standards, exploitation of results through EU policies, exploitation of results through (social) innovation.

¹¹ A drop down list allows choosing the type sector (NACE nomenclature) : http://ec.europa.eu/competition/mergers/cases/index/nace_all.html

Type of Exploitable Foreground ¹⁰	Description of exploitable foreground	Confidential Click on YES/NO	Foreseen embargo date dd/mm/yyyy	Exploitable product(s) or measure(s)	Sector(s) of application ¹¹	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
	Models for the next generation of energy efficient buildings				Industry			
Commercial Exploitation of R&D Results	Energy Efficiency Dataset	YES	Q3-Q4 2016	Dataset	Architectural, Engineering and Construction Industry	n/a	n/a	IES STAM NAPE
Commercial Exploitation of R&D Results	End of Life Solution Set	YES	Q3-Q4 2016	Dataset	Architectural, Engineering and Construction Industry	n/a	n/a	DAPP
Commercial Exploitation of R&D Results	MDD and In-Use Algorithms	YES	Q3-Q4 2016	Algorithms	Architectural, Engineering and Construction Industry	n/a	n/a	TCD
Commercial Exploitation of R&D Results	The UMBRELLA Interface	YES	Q3-Q4 2016	Software	Architectural, Engineering and Construction Industry	n/a	n/a	IES Solintel STAM NAPE E++ LGI
Commercial Exploitation of R&D Results	Future Climate Dataset	YES	Q3-Q4 2016	Dataset	Architectural, Engineering and Construction Industry	n/a	n/a	BATH

In addition to the table, please provide a text to explain the exploitable foreground, in particular:

- Its purpose
- How the foreground might be exploited, when and by whom

- IPR exploitable measures taken or intended
- Further research necessary, if any
- Potential/expected impact (quantify where possible)

4.3 Report on societal implications

Replies to the following questions will assist the Commission to obtain statistics and indicators on societal and socio-economic issues addressed by projects. The questions are arranged in a number of key themes. As well as producing certain statistics, the replies will also help identify those projects that have shown a real engagement with wider societal issues, and thereby identify interesting approaches to these issues and best practices. The replies for individual projects will not be made public.

A General Information *(completed automatically when Grant Agreement number is entered.*

Grant Agreement Number:

314343

Title of Project:

Business Model Innovation for High Performance Buildings

Name and Title of Coordinator:

Integrated Environmental Solutions (IES)

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)?

- If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports?

No

Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 'Work Progress and Achievements'

2. Please indicate whether your project involved any of the following issues (tick box) :

No

RESEARCH ON HUMANS

- Did the project involve children?
- Did the project involve patients?
- Did the project involve persons not able to give consent?
- Did the project involve adult healthy volunteers?
- Did the project involve Human genetic material?
- Did the project involve Human biological samples?
- Did the project involve Human data collection?

RESEARCH ON HUMAN EMBRYO/FOETUS

- Did the project involve Human Embryos?
- Did the project involve Human Foetal Tissue / Cells?
- Did the project involve Human Embryonic Stem Cells (hESCs)?
- Did the project on human Embryonic Stem Cells involve cells in culture?
- Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?

PRIVACY

- Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?
- Did the project involve tracking the location or observation of people?

RESEARCH ON ANIMALS

- Did the project involve research on animals?
- Were those animals transgenic small laboratory animals?

• Were those animals transgenic farm animals?	
• Were those animals cloned farm animals?	
• Were those animals non-human primates?	
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	
• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	
DUAL USE	
• Research having direct military use	0 Yes 0 No
• Research having the potential for terrorist abuse	

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator	2	2
Work package leaders	2	3
Experienced researchers (i.e. PhD holders)	4	6
PhD Students	0	0
Other	19	22

4. How many additional researchers (in companies and universities) were recruited specifically for this project? **6**

Of which, indicate the number of men: **6**

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project? Yes No

6. Which of the following actions did you carry out and how effective were they?

- | | Not at all
effective | Very
effective |
|---|---|---|
| <input type="checkbox"/> Design and implement an equal opportunity policy | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> |
| <input type="checkbox"/> Set targets to achieve a gender balance in the workforce | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> |
| <input type="checkbox"/> Organise conferences and workshops on gender | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> |
| <input type="checkbox"/> Actions to improve work-life balance | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> | <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> <input type="radio"/> |
| <input type="radio"/> Other: <input style="width: 200px;" type="text"/> | | |

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

Yes- please specify

No

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

Yes- please specify

No

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

Yes- please specify

No

F Interdisciplinarity

10. Which disciplines (see list below) are involved in your project?

2.1¹²:

5.4¹²:

Associated discipline¹²:

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? (if 'No', go to Question 14) Yes No

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

No

Yes- in determining what research should be performed

Yes - in implementing the research

¹² Insert number from list below (Frascati Manual).

Yes, in communicating /disseminating / using the results of the project

11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	<input type="radio"/> <input checked="" type="radio"/>	Yes No
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12. Did you engage with government / public bodies or policy makers (including international organisations)

- No
- Yes- in framing the research agenda
- Yes - in implementing the research agenda
- Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

- Yes – as a **primary** objective (please indicate areas below- multiple answers possible)
- Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)
- No

13b If Yes, in which fields?

Agriculture Audiovisual and Media Budget Competition Consumers Culture Customs Development Economic and Monetary Affairs Education, Training, Youth Employment and Social Affairs	Energy Enlargement Enterprise Environment External Relations External Trade Fisheries and Maritime Affairs Food Safety Foreign and Security Policy Fraud Humanitarian aid	<input checked="" type="checkbox"/>	Human rights Information Society Institutional affairs Internal Market Justice, freedom and security Public Health Regional Policy Research and Innovation Space Taxation Transport	
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13c If Yes, at which level?		
<input checked="" type="checkbox"/> Local / regional levels <input type="checkbox"/> National level <input type="checkbox"/> European level <input type="checkbox"/> International level		
H Use and dissemination		
14. How many Articles were published/accepted for publication in peer-reviewed journals?	3	
To how many of these is open access¹³ provided?	0	
How many of these are published in open access journals?	0	
How many of these are published in open repositories?	0	
To how many of these is open access not provided?	3	
Please check all applicable reasons for not providing open access:		
<input checked="" type="checkbox"/> publisher's licensing agreement would not permit publishing in a repository <input type="checkbox"/> no suitable repository available <input type="checkbox"/> no suitable open access journal available <input type="checkbox"/> no funds available to publish in an open access journal <input checked="" type="checkbox"/> lack of time and resources <input checked="" type="checkbox"/> lack of information on open access <input type="checkbox"/> other ¹⁴ :		
15. How many new patent applications ('priority filings') have been made? <i>("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).</i>	0	
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	0
	Registered design	0
	Other	0
17. How many spin-off companies were created / are planned as a direct result of the project?	0	
<i>Indicate the approximate number of additional jobs in these companies:</i>		
18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:		
<input checked="" type="checkbox"/> Increase in employment, or <input checked="" type="checkbox"/> Safeguard employment, or <input type="checkbox"/> Decrease in employment, <input type="checkbox"/> Difficult to estimate / not possible to quantify	<input checked="" type="checkbox"/> <input checked="" type="checkbox"/> <input type="checkbox"/>	In small & medium-sized enterprises In large companies None of the above / not relevant to the project

¹³ Open Access is defined as free of charge access for anyone via Internet.

¹⁴ For instance: classification for security project.

- 2.1 Civil engineering (architecture engineering, building science and engineering, construction engineering, municipal and structural engineering and other allied subjects)
- 2.2 Electrical engineering, electronics [electrical engineering, electronics, communication engineering and systems, computer engineering (hardware only) and other allied subjects]
- 2.3. Other engineering sciences (such as chemical, aeronautical and space, mechanical, metallurgical and materials engineering, and their specialised subdivisions; forest products; applied sciences such as geodesy, industrial chemistry, etc.; the science and technology of food production; specialised technologies of interdisciplinary fields, e.g. systems analysis, metallurgy, mining, textile technology and other applied subjects)

3. MEDICAL SCIENCES

- 3.1 Basic medicine (anatomy, cytology, physiology, genetics, pharmacy, pharmacology, toxicology, immunology and immuno-haematology, clinical chemistry, clinical microbiology, pathology)
- 3.2 Clinical medicine (anaesthesiology, paediatrics, obstetrics and gynaecology, internal medicine, surgery, dentistry, neurology, psychiatry, radiology, therapeutics, otorhinolaryngology, ophthalmology)
- 3.3 Health sciences (public health services, social medicine, hygiene, nursing, epidemiology)

4. AGRICULTURAL SCIENCES

- 4.1 Agriculture, forestry, fisheries and allied sciences (agronomy, animal husbandry, fisheries, forestry, horticulture, other allied subjects)
- 4.2 Veterinary medicine

5. SOCIAL SCIENCES

- 5.1 Psychology
- 5.2 Economics
- 5.3 Educational sciences (education and training and other allied subjects)
- 5.4 Other social sciences [anthropology (social and cultural) and ethnology, demography, geography (human, economic and social), town and country planning, management, law, linguistics, political sciences, sociology, organisation and methods, miscellaneous social sciences and interdisciplinary, methodological and historical SIT activities relating to subjects in this group. Physical anthropology, physical geography and psychophysiology should normally be classified with the natural sciences].

6. HUMANITIES

- 6.1 History (history, prehistory and history, together with auxiliary historical disciplines such as archaeology, numismatics, palaeography, genealogy, etc.)
- 6.2 Languages and literature (ancient and modern)
- 6.3 Other humanities [philosophy (including the history of science and technology) arts, history of art, art criticism, painting, sculpture, musicology, dramatic art excluding artistic “research” of any kind, religion, theology, other fields and subjects pertaining to the humanities, methodological, historical and other SIT activities relating to the subjects in this group]

2. FINAL REPORT ON THE DISTRIBUTION OF THE EUROPEAN UNION FINANCIAL CONTRIBUTION

This report shall be submitted to the Commission within 30 days after receipt of the final payment of the European Union financial contribution.

Report on the distribution of the European Union financial contribution between beneficiaries

Name of beneficiary	Final amount of EU contribution per beneficiary in Euros
1.	
2.	
n	
Total	