D9.8 Publishable summary of project results

Final version
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## History of the document

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<th>By partner</th>
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Publishable executive summary

The subject of the Proficient project, funded under the FP7 programme ‘Energy efficient Buildings’ (EeB), is Collective Self-Organised (CSO) housing. In CSO housing, a group of individuals organize themselves to realise their housing project, either newly built or retrofitted. The aim of the Proficient project, is to facilitate and promote CSO housing for energy-efficient neighbourhoods, creating new business opportunities for SMEs in meeting the specific demands of CSO housing.

Stakeholders in a CSO process

The work in the project is structured according to the needs and offers of three main stakeholders in a CSO process:

1. **End users**, which we assume to have organised themselves into a CSO (Collective Self Organised) group. With their desire to build or renovate a building, they represent the demand side of a virtual marketplace.
2. A number of **SMEs**, that may include an architect or process facilitator, but that may also include SMEs like brick layers, carpenters, and installers that have organised themselves into an SME network like a guild. With their ability to construct or renovate buildings, they represent the supply side of the virtual marketplace. As a group with all required expertise, the SME network offers an alternative to large construction firms that lack the flexibility to satisfy the specific needs of a CSO group.
3. A land owner or building owner, often a **municipality**, offering a plot of land or a building to renovate. This stakeholder generally has a supporting role.

This is illustrated in Figure 1 below.

![Figure 1: Three main stakeholders in a CSO process interacting in a virtual marketplace.](image)

CSO housing platform

The Proficient team has developed a web-based ‘CSO housing platform’ offering a number of supporting documents, tools and instruments for these three stakeholders and allowing the stakeholders to interact in a virtual marketplace.

Support for end users in the CSO housing platform

For the end users, CSO housing platform offers an organisational instrument (social media forum). It also offers a **tool** allowing a first calculation of **Total Cost of Ownership (TCO)**, helping a CSO group in the early design phase to get an estimate of the cost of mortgage, maintenance and energy of their building over a period of e.g. 30 years. This will provide an early understanding of the financial consequences of design alternatives such as nZEBs (near Zero Energy Buildings).
Buildings). Also available are a checklist of requirements and financial and regulatory information, schematically shown in the left of Figure 2.

Support for SMEs in the CSO housing platform

For the SMEs, the CSO housing platform offers an organisational platform as well as a number of organisational models, tailored to the needs of CSO. In addition, an optimised business model for CSO housing was developed, although details are not offered on the CSO housing platform due to its proprietary nature. This is illustrated in the right of Figure 2.

Interaction between stakeholders in a virtual marketplace

The three stakeholders can meet in a virtual marketplace, where demand and supply can be matched. To facilitate a successful interaction between the stakeholders, the platform offers a number of functionalities, shown graphically in Figure 3 below.

1. In the interaction between end users and municipalities, the CSO platform offers the possibility for municipalities to showcase their plots and buildings for CSO projects on a map. In addition, a Configurator will allow
municipalities or more generally: land owners, to upload the plot of land in a graphical environment (taken from GIS - Geographic Information System data), including e.g. restrictions on buildable area on the plot or maximum height or energy related requirements. End users can upload a design of their house, made with e.g. a user friendly package like SketchUp, onto the plot and rotate/move it about on their plot. This way, end users will be able to see their own as well as their neighbours’ designs to assess the look of all dwellings on the plot. It will help CSO groups in finding a common view on what they want to build (individual and common buildings).

2. To facilitate the interaction between end users and SMEs, the latter can offer their products or services on the CSO platform. In addition, a number of tools are available. An EeBB (Energy efficient Buildings Benchmarking) tool is downloadable to assess the different technological possibilities. An architect can produce a design with any major CAD package (as long as it supports the open standard IFC or Collada output) and place on the plot (possibly replacing earlier designs). In addition, an optimal package of energy efficiency measures can be determined by an Energy optimiser tool.

3. To facilitate the interaction between end users, SMEs and municipalities, the CSO platform offers a number of useful links to organisations aiming to support CSO groups and SMEs. Municipalities can provide information on local subsidies or other (financially) supporting schemes, promoting contracting work by local SMEs. The content will largely depend on the municipality involved. The current content is mainly in Dutch, focussed on the local market of The Hague.

Tools

An important feature of the CSO platform is its functioning as a decision support tool. To this end, a number of supporting tools are available through the CSO Housing Platform. These tools are not stand-alone tools. If a design of a building was made, e.g. by end users in SketchUp, the TCO tool can be invoked by a plugin in the user friendly sketching program SketchUp.

At a later stage, when the materialisation of the building (e.g. thickness of thermal insulation, type of windows) is known, the Energy optimiser tool can be used to optimise energy efficiency packages, using the IFC output file from the CAD design. As mentioned above, the design, if in IFC or Collada format, can be placed in the plot using the Configurator. The blue arrows in Figure 4 below shows the three links between a design and the tools developed.

Figure 4: Interaction between a design made and the TCO tool, Energy Optimiser tool and Configurator.
**New Business Models**

In order to enable SMEs to apply Energy Efficient Building (EeB) technologies on large (district) scale, several business models were developed, from which a franchise concept was elaborated as one of the exploitable results. According to this concept, a franchise company offers professional support for development, engineering, tendering and contracting issues. A RESCO (Renewable Energy Service COmpany) is part of the business model as an important element of the turn key solution offered to the client.

The analysis of the RESCO large scale district solution shows that the realisation is often suffering from pre-financing problems. The idea is to motivate the members of the CSO housing group to participate in the financial risk as well as the profits on a voluntary basis and provide the risk capital via crowd funding.

A clear example of how to identify the technology to optimise the business model comes from direct case studies that are described and analysed, such as the hydro plant realised by Proficient partner Becquerel in the Alpine village of Civago, Italy. In finding the optimised business case, there is the evidence that it is not necessary to adopt prototypes or pilot plants to get the optimisation. On the contrary, these solutions are far from the target of dealing with technologies that can easily be handled by SMEs.

The details of the new business model are proprietary as they are being commercially exploited as the ‘Friends’ franchise model by partner LLL.

**Dissemination and valorisation**

The results of dissemination are summarized in Table 1.

Table 1: Dissemination of the results.

<table>
<thead>
<tr>
<th>Type of dissemination</th>
<th>Quantity</th>
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</thead>
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<tr>
<td>CSO housing platform (<a href="http://www.cso.house">www.cso.house</a>)</td>
<td>1</td>
</tr>
<tr>
<td>Public website (<a href="http://www.proficient-project.eu">www.proficient-project.eu</a>)</td>
<td>1</td>
</tr>
<tr>
<td>Peer-reviewed academic publications</td>
<td>3</td>
</tr>
<tr>
<td>Peer-reviewed academic articles, not yet accepted</td>
<td>4</td>
</tr>
<tr>
<td>Seminar/conference papers</td>
<td>17</td>
</tr>
<tr>
<td>Professional publications</td>
<td>1</td>
</tr>
<tr>
<td>Invited talk/organized workshops</td>
<td>12</td>
</tr>
<tr>
<td>Community of practice events</td>
<td>7</td>
</tr>
<tr>
<td>Newsletters</td>
<td>3</td>
</tr>
</tbody>
</table>

In addition, the tools mentioned above are described in a document as a contribution to SET (Strategic Energy Technology) Plan through EERA (European Energy Research Alliance) and a contribution was made to the EU curriculum development in KIC InnoEnergy, by proposing a module called ‘Collective self-organised Housing project’, aiming to introduce students with the key concept of CSO housing project, process, characteristics and their application in practice.

Finally, a number of Key Exploitable Results (KERs) were identified. They are summarized in Figure 2 below.
### Table 2: Characteristics of five Key Exploitable Results.

<table>
<thead>
<tr>
<th>Key Exploitable Result</th>
<th>Lead (other) partner</th>
<th>TRL level</th>
<th>yrs needed for further development</th>
<th>Potential exploitation form</th>
<th>Business model</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Friends’ CSO housing franchise concept</td>
<td>LLL</td>
<td>6-7</td>
<td>1-3</td>
<td>Franchise concept</td>
<td>License agreement</td>
</tr>
<tr>
<td>Lifecycle Performance Assessment Tool</td>
<td>DMO (RDF)</td>
<td>7-8</td>
<td>1</td>
<td>Software license, implementation, training, consultancy.</td>
<td>SaaS (Software as a Service)</td>
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<td>(part of) CSO housing platform</td>
<td>TNO</td>
<td>5-6</td>
<td>1</td>
<td>Knowledge</td>
<td>License web-based provided information</td>
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<tr>
<td>Total cost of ownership tool</td>
<td>TNO</td>
<td>5-6</td>
<td>1</td>
<td>Application</td>
<td>Fee based app</td>
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<tr>
<td>Components of configurator</td>
<td>RDF</td>
<td>6-7, 8</td>
<td>1-3</td>
<td>License of components</td>
<td></td>
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### Conclusions

The project generated very useful results and disseminated them to relevant stakeholders, in particular end users and SMEs in a CSO housing process, academia and the general public. A number of the results are taken up for commercial exploitation by the partners.

The CSO platform can be found at [http://cso.house/](http://cso.house/). More information on the project can be found on the project website [http://www.proficient-project.eu/](http://www.proficient-project.eu/).
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1. Final Publishable summary report

1.1 Executive summary

The subject of the Proficient project, funded under the FP7 programme ‘Energy efficient Buildings’ (EeB), is Collective Self-Organised (CSO) housing. In CSO housing, a group of individuals organize themselves to realise their housing project, either newly built or retrofitted. The aim of the Proficient project is to facilitate and promote CSO housing for energy-efficient neighbourhoods, creating new business opportunities for SMEs.

The work in the project is structured according to the needs and offers of three main stakeholders in a CSO process: end users, SMEs and municipalities. The Proficient team has developed a web-based ‘CSO housing platform’ offering information and tools for each of these three stakeholders. A graphical image of the different stakeholders, and tools and information offered, is shown in Figure 5 below.

![Graphical image of the CSO housing platform with three main stakeholders in a CSO process and tools and information offered.](image)

The three main stakeholders are:

1. End users, which we assume to have organised themselves into a CSO (Collective Self Organised) group. With their desire to build or renovate a building, they represent the demand side of a virtual marketplace. For this stakeholder, a number of tools were developed such as organisational instruments (social media forum), a tool offering a first calculation of Total Cost of Ownership (TCO) of their building, checklists of requirements and financial and regulatory information.

2. A number of SMEs, that may include an architect or process facilitator, but that also include SMEs like brick layers, carpenters, and installers, that have organised themselves into an SME network like a guild. With their ability to construct or renovate buildings, they represent the supply side of the virtual marketplace. As a group...
with all required expertise, the SME network offers an alternative to large construction firms that do not have the flexibility to satisfy the specific needs of a CSO group. For this stakeholder, the CSO housing platform offers an organisational platform as well as a number of organisational models, tailored to the needs of CSO. In addition, an optimised business model for CSO housing was developed, but details are not offered on the CSO housing platform due to its proprietary nature.

3. A land owner or building owner, often a municipality, offering a plot of land or a building to renovate in a supporting role.

The three stakeholders can meet in a virtual marketplace, where demand and supply can be matched. To facilitate a successful interaction between the stakeholders, the platform offers a number of functionalities, of which the main one is the **Configurator**, where municipalities can offer plots of land, onto which end users and architects can upload designs of dwellings. They can then assess the look of all dwellings on the plot in the actual environment (taken from GIS-Geographic Information System data). In addition, an **EeBB (Energy efficient Buildings Benchmarking) tool** is downloadable and an **Energy optimiser tool** if available to generate an optimal package of energy efficiency measures, e.g. using the IFC output file from a CAD design.

The CSO platform can be found at [http://cso.house/](http://cso.house/). More information on the project can be found on the project website [http://www.proficient-project.eu/](http://www.proficient-project.eu/).
1.2 Summary description of project context and objectives

1.2.1 A short history of co-housing

The 1930’s were a time of modernization, with machines taking over intensive labour, and inventions like cars, airplanes and new trains reducing travelling time. In 1935, Scandinavian countries brought this modernism to the field of housing. New forms of collective housing were introduced with common child care, cooking and dining, and sharing household activities like groceries and laundry. The ideal was to increase employment of women and increase their participation in modern society.

After WW2 more and more people started to appreciate the idea of sharing certain amenities, and live together with peers. In the 1960s, free minded people started to adopt forms of living that included sharing of capital goods like housing, transport and more. Co-housing became a new phenomenon, living in a small community shaped according to democratic rules and standards. Communes are the most extreme variants, where participants agreed to give up a part of their autonomy for the sake of the larger community. Most communities adopted some set of guidelines to make life in a co-housing group social, beneficial and enjoyable, and based on the free will of individual members.

In the US, Canada and the Scandinavian countries, Co-housing initiatives have been particularly successful. Other western countries like Germany, Belgium, France and the Netherlands, often adopted collective housing forms for specific target groups, like elderly people.

Most of the current collective housing projects, some with a very long history, have been shown to pay a special interest in sustainability issues, its members trying to establish a green and healthy neighbourhood, to grow their own crops, reduce energy consumption, invest in renewable energy production, and reduce their ecological footprint by car sharing programmes etc. It makes these collectives an increasingly valued route towards a sustainable society.

1.2.2 CSO housing and co-housing

In addition to the theme of co-housing, Collective Self-Organised housing can have a different context in the case of renovation of existing buildings. Here, the essence of CSO housing is the commonly agreed approach on interventions on their building, generally aimed at improving energy efficiency. The target group consists of private owners of buildings (generally condominiums) or ownership based cooperatives, which do not necessarily have community intentions as in co-housing.

In both newly established communities and already existing CSO communities, Proficient aims to facilitate the decision making process of its members in order to enable them to work with SMEs on equal footing.

1.2.3 Objectives

The objectives are listed according to the work packages identified in the project

1. To clarify and improve the new process of collective self-organised (CSO) housing by analysing case studies and defining process models for new construction projects and retrofit projects, which include the methods for user participation and concurrent design, collective management, as well as the action plans and take-up strategies for CSO energy-efficient districts.

2. To clarify the market potential of CSO housing and to develop two sets of generic SME network business models accordingly – one set for new construction of energy-efficient residential districts and the other set for energy-efficient district retrofitting. Besides, SME business plans are also to be created modelling the organisational, technical and financial planning of a specific company operating in the field of CSO new construction/CSO retrofitting.
3. To translate the end user’s perspective –i.e. How to maximise value for money of the energy-efficient technologies while observing limitations relating to sustainability including social, economic and environmental limitations– into performance requirements used as the basis to procure the integrated product-service solutions from SMEs.

4. To identify and further develop the most effective technology solutions in the area of building systems, MEP/HVAC systems, and district energy systems, and simultaneously to prepare the most appropriate business case so SMEs can implement these technologies on a large scale.

5. To generate a set of supporting financial and regulatory instruments to encourage CSO housing process to create a conducive business environment for SMEs. This objective addresses guidelines on financial and regulatory instruments as well as the development of an energy performance assessment and analysis tool, which covers the lifespan of a sustainable building process.

6. To support the integrated design, procurement, and communication processes between clients/end-users and SME product-service providers by providing a comprehensive ICT tool based on the integration of BIM functionalities and the capabilities of Semantic Web, especially to accommodate optimal inter-operability of loosely-coupled design, engineering, and business applications.

7. To demonstrate and practically validate the project results through an active role of SME’s in demonstration cases and Communities of Practice (CoPs).

8. To disseminate and valorise the knowledge and the results obtained within the project, as well as to ensure the broad and sustainable impacts through a synergy with the EU programme KIC Inno Energy theme Built Environment and the contribution to the SET Plan through EERA.
1.3 Description of the main S&T results/foregrounds

1.3.1 Stakeholders in a CSO process

The results of the project are structured according to the solutions and offers of three main stakeholders in a CSO process:

1. **End users**, which we assume to have organised themselves into a CSO (Collective Self Organised) group. With their desire to build or renovate a building, they represent the demand side of a virtual marketplace.

2. A number of SMEs, that may include an architect or process facilitator, but that may also include SMEs like brick layers, carpenters, and installers that have organised themselves into an SME network like a guild. With their ability to construct or renovate buildings, they represent the supply side of the virtual marketplace. As a group with all required expertise, the SME network offers an alternative to large construction firms that lack the flexibility to satisfy the specific needs of a CSO group.

3. A land owner or building owner, often a municipality, offering a plot of land or a building to renovate. This stakeholder generally has a supporting role.

This is illustrated in Figure 6 below.

![Figure 6: Three main stakeholders in a CSO process interacting in a virtual marketplace.](image.png)

1.3.2 CSO housing platform

PROFICIENT has traced back the history of CSO Housing projects over the last decades, learning what the success factors of CSO Housing projects were. An important success factor is a successful collective process (idea sharing, decision making, participatory design), which may be facilitated by a process consultant. The CSO housing platform aims to support and facilitate the collective process by offering tools and instruments such as an organisational instrument (social media forum), a tool offering a first calculation of **Total Cost of Ownership (TCO)** of their building using, a checklist of requirements and financial and regulatory information.

For end users, disclosure of information on the CSO platform is further structured according to several stages through which a CSO group goes in the process from acquiring land to the construction of their dwelling and the operation and maintenance in the uses phase. The process is modelled after the process flow diagram developed in WP1, shown in Figure 7.
The main structure of the CSO platform, shown in Figure 8 below, reflects the identification of the three stakeholders and the main phases through which an end user goes.

Information provided ranges from practical information about how to form a CSO, to planning tools, technical solutions or financial models. The functionalities can be divided into five fields in which the websites can serve as a tool:

- communication;
- decision support;
- virtual market place;
- process support
- business models
1.3.3 Support for end users in the CSO housing platform

For the end users, the CSO housing platform offers an organisational instrument (social media forum), a tool offering a first calculation of **Total Cost of Ownership (TCO)** of their building, developed in WP4, and checklists of requirements and financial and regulatory information from WP5. Also, a review of available contracting forms carried out in WP3 is available. This is schematically shown in Figure 9 below.

![Figure 9: Graphical image of supporting documents and tools for end users](image)

1.3.4 Support for SMEs in the CSO housing platform

For the SMEs, the CSO housing platform offers an organisational platform as well as a number of business models tailored to the needs of CSO housing, illustrated by concrete strategies of existing companies (WP2). In addition, an optimised business model for CSO housing was offered (WP4), although details are not offered on the CSO housing platform due to its proprietary nature. This is illustrated in Figure 10.

![Figure 10: Graphical image of supporting instruments for SMEs.](image)
1.3.5 Interaction between stakeholders in a virtual marketplace

An essential and unique function of the CSO platform is its functioning as a virtual marketplace. In analogy with a traditional marketplace, i.e. a physical location where sellers and buyers meet and come to a mutual agreement. The virtual marketplace is offering similar functions, but on a virtual platform. The principle is that, divided into various stands, merchants and suppliers can offer their products for sale. So one stand would be offering a variety of plots of land for sale, by various owners and suppliers, while another stand could focus on sustainable energy solutions. Suppliers are enabled to sign in to the virtual marketplace, by filling out company details, service area, and detailed description of the products or services for sale. Suppliers/merchants are also asked if they are willing to participate in a consortium, for offering customers an integrated solution.

By means of queries, the demand from end users is offered support in search of the specific information they are looking for. Is it for example a specific insulation measure for renovating an existing exterior wall, or does the client require a fully integrated design and built solutions for a specific plot of land? In order to guarantee a high quality performance of suppliers offering products and services for sale, the virtual marketplace will allow customers to rate their satisfaction with the end result. This way, the suppliers with the best ratings will have a certain added value to offer, and suppliers with lower rankings have an incentive to improve their service or product quality.

The three stakeholders can meet in this virtual marketplace, where demand and supply can be matched. To facilitate a successful interaction between the stakeholders, the platform offers a number of functionalities:

1. In the interaction between end users and municipalities, the CSO platform offers the possibility for municipalities to showcase their plots and buildings for CSO projects on a map. In addition, a Configurator (developed in WP6) will allow municipalities or more generally: land owners, to upload the plot of land in a graphical environment (taken from GIS - Geographic Information System data), including e.g. restrictions on buildable area on the plot or maximum height or energy related requirements. End users can upload a design of their house, made with e.g. a user friendly package like SketchUp, onto the plot and rotate/move it about on their plot. This way, end users will be able to see their own as well as their neighbours’ designs to assess the look of all dwellings on the plot. It will help a CSO group in finding a common view on what they want to build for individual as well as common buildings.

2. To facilitate the interaction between end users and SMEs, the latter can offer their products or services on the CSO platform. In addition, a number of tools are available. To assess the different technological solutions, an EeBB (Energy efficient Buildings Benchmarking) tool is downloadable. At a later stage, an architect can produce a design with any major CAD package (as long as it supports open standard IFC or Collada output) to replace earlier designs on the plot. In addition, an optimal package of energy efficiency measures can be determined by an Energy optimiser tool.

3. To facilitate the interaction between end SMEs and municipalities, the CSO platform offers a number of useful links to organisations aiming to support CSO groups and SMEs. Municipalities can provide information on local subsidies or other (financially) supporting schemes, promoting contracting work by local SMEs. The content will largely depend on the municipality involved. The current content is mainly in Dutch, focused on the local market of The Hague.

The interactions between the stakeholders and tools offered to them are shown graphically in Figure 11 below.
1.3.6 Tools from the CSO Housing Platform

An important feature of the CSO platform is its functioning as a decision support tool. To this end, a number of supporting tools are available through the CSO Housing Platform.

**TCO (Total cost of Ownership) tool**

From studying the CSO housing process in the demonstration cases, it was found that a decision support tool based on Total Cost of Ownership (TCO) for CSO housing has most impact when it is applied in the early design stages, since the possibility to influence the design reduces rapidly as the design process proceeds. Therefore, the TCO tool developed in WP4 is tailored to the need of end users, typically being non-professionals, in the early design stages where few construction details of the building are known.

The TCO of a building project is determined by means of the common methodology Life Cycle Costing (LCC). The TCO tool only requires some basic inputs and the geometry of the buildings in the project to calculate the TCO for the individual dwellings and the common building(s). The geometry can be input manually, or via a 3D modelling tool (such as Trimble SketchUp). This is done by using the open standard for Building Information Modelling (BIM) called IFC (Industry Foundation Classes). A sample of what this model would look like is provided in Figure 12, where the different shades indicate separate dwellings. The use of the tool is currently limited to North-Western Europe due to the energy model that is used.
Feedback on the use of the tool showed that its use could be further improved by using regional data instead of national data. Using data from existing housing projects for further validation should increase the accuracy of the tool.

Although the absolute TCO values can never be 100% accurate yet in early stages, the relative values do provide the opportunity to compare different basic design options. Also, end-users will get a clear insight in the interrelationships between costs items like energy, construction and maintenance and how these costs could be influenced by changing the design, e.g. by choosing a near zero energy building.

More detailed information can be found in the public Proficient Deliverable 4.4 TCO decision tool for technology integration. The excel version of the tool is available at: [http://cso.house/new-construction/#btn42](http://cso.house/new-construction/#btn42), then click ‘End Users’, then ‘Project Initiation’, then ‘Design and requirements’.

**Energy efficient Building Benchmarking tool**

The EeBB (Energy efficient Building Benchmarking) tool developed in WP4 is intended to support SMEs in taking decisions regarding the implementation and adoption of building energy efficient technologies. The adoption of energy efficient building (EeB) technology in home construction is a major challenge but has the potential to make a dramatic impact on sustainable practices. When addressing these challenges it is important to emphasize how decisions are actually made, as opposed to how they should be made. The EeBB tool is based on the principles of Multi-Criteria Decision Analysis (MCDA), which can be used to assess the best balance of economy and efficiency by creating a more efficient construction process that will produce a more effective outcome. The intent of the EeBB tool is to empower owners and SMEs by providing a platform in which they can collaborate. Providing the homeowner with this additional footing allows the owner to more effectively define the scope of his project. At the same time, this gives SMEs the knowledge needed for guiding homeowners through their project.

The EeBB tool includes the assessment categories of building energy use (both primary and delivered energy), primary embodied energy, greenhouse gas emissions, energy system complexity, and energy cost. The development of the EeBB tool is intended to have an MCDA (Multi Criteria Decision Analysis) tool that will give a simple understanding of the consequences of CSO communities’ choices, be transparent in order to allow future users’ implementations, and be flexible to fit local markets’ characteristics.

On the basis of the environmental issues that are covered by other internationally acknowledged MCDA tools, such as BREEAM and LEED, the EeBB tool focuses on the issues of energy, emissions, energy system complexity, and cost. The energy issue is covered by providing the users with an overview of the possible energy savings given by multiple combinations of energy efficient technologies and building material alternatives. These cover the aspects of building insulation, shading, energy systems, and embodied energy of building materials. The emission issue is covered by estimating the current and future emissions as a result of the users’ choice of energy systems.

The above described issues are represented in simplified indexes that give a straightforward picture of the result of the taken decisions, as illustrated for a particular scenario in Figure 13 below. The scenario assessment is given by the sum of the scores obtained by each index, with a low total score corresponding to a good building performance. As the results (for energy, emissions, and cost) given in the EeBB tool are based on simplified calculations, the EeBB tool is apt for informing the CSO communities of the environmental and economic consequences of different decisions regarding their homes. In such a perspective, the EeBB tool is not intended to provide the users with a detailed analysis, but it usefulness lies in the possibility of comparing different alternatives of technological solutions for energy efficient buildings.
More detailed information can be found in the public Proficient Deliverable 4.2 *Benchmarking of existing EeB solutions at building and district level*. The excel version of the tool is available at: http://cso.house/new-construction/#btn12, then click ‘SMEs’, then ‘Concepts and Strategies’.

**Structural reliability assessment**

The current retrofitting trend is mostly driven by the need to upgrade the energy efficiency of the buildings given the monetary and energy-saving potentials, and further sustainable benefits behind these projects.

A practical methodology to determine the structural quality of existing residential buildings before making decisions for such energy-efficient retrofitting was developed in WP3. The expected target group for this methodology are both CSO groups planning a retrofitting project and the specialized SMEs who will perform such assessment. CSO groups will benefit from learning the importance of, and the reasons behind requesting an assessment of the structural quality of their building. Furthermore, CSO groups will learn what kind of information to expect from the experts, and what is expected from the CSO members during the study. For SMEs working on the retrofitting project, it is also useful to have a guide on how to proceed in most common cases and identify situations when further studies and tests are needed. The assessment of structural reliability aims to determine whether a structure is reliable to perform safely over a certain period (for example, its remaining service life).

The real issue to tackle is that often structural checks are completely disregarded until the retrofit has well started or even finished. Figure 14 shows what can be the effect. This is the case especially of “minor” retrofitting projects, which in fact can have significant effect on the building structure. However these effects aren’t always evident and are often ignored. The structural assessment helps CSOs to decide what interventions are feasible based on the results of the structural inspection of their building.
The most common starting point of any structural assessment work is a visual inspection of the building where defects, signs of deterioration and damage are documented. Deviations from the intended use during the design as well as alteration to structural and non-structural elements are also with the scope of a visual inspection. An overview of the visual inspection procedure and checklist on the main visual inspection methodology is provided with the purpose of helping CSOs to better understand the importance of such inspections.

Further complex structural assessment can be carried out depending on the needs of the project. Highly qualified structural experts should be engaged in such an assessment. The methods are discussed with the purpose of educating CSOs on the topic and raising awareness of their importance.

The methodology described focuses on housing structures subject to energy-efficient retrofitting, for example large panel buildings systems (LPS). From a structural system point of view, the focus of this methodology will be on concrete-based and masonry-based structures, which are the most common structural systems in the European housing stock subject to retrofitting and interventions.

More detailed information can be found in the public Proficient Deliverable 4.3 Structural reliability assessment. A checklist is available at: [http://cso.house/renovation-of-existing-buildings/#btn21](http://cso.house/renovation-of-existing-buildings/#btn21), then click ‘End Users’, then ‘Project Initiation’.

**Lifecycle Performance Assessment Tool**

The work on the Lifecycle Performance Assessment Tool in WP5 covers the design, development and testing of a software tool to generate optimized energy savings packages as a communication tool between CSO-representatives (and individual members/clients) and suppliers/contractor. As lifecycle performance assessment deals with more than just energy, we have chosen to combine an energy-optimizing tool with a software module for Maintenance Planning as well as a module for Life Cycle Cost Calculation (dealing with maintenance cost, energy cost, capital costs and running costs). The difference between the TCO tool discussed in the previous chapter and the Life Cycle Cost Calculation is that the latter is based on detailed knowledge of the materialization of the building and is therefore more suited in later stages of the design. The TCO tool is intended for the very first stages of design when detailed information on the building is still unknown.

The energy performance optimizer/simulator is used to select the optimal improvement measures to realize maximum energy savings given a certain improvement budget, or alternatively, advice on the cheapest solution to improve an existing house from energy level X (i.e. F label) to energy level Y (i.e. A label).
Linked to a database with improvement measures, the tool contains a database with suppliers and contractors that can execute the improvement measures. Improvement unit costs and guarantee conditions are specified by the specific supplier or sub-contractor of a specific improvement measure in the database. When the client has selected the desired or affordable energy improvement package, the tool automatically generates an offer to the client. As the suppliers and contractors have the responsibility to keep their information up to date, the tool functions as limited virtual marketplace with invited/selected participants.

The functioning of the Energy Optimiser tool can be best described following the subsequent steps from required input to output of results. The user starts by filling the input sheet according to a fixed format (Figure 15). The required data deals with general project information, specific data regarding components and materials including the corresponding quantities, all applied in the basic scenario (the data that is required to perform a standardized EPA (Energy Performance Assessment) according to the Dutch energy regulation. Together with this data, the user also formulates the improvement target (energy label improvement, energy savings or within an available budget).

![Figure 15 Data Input Screen of the Energy Optimiser.](image)

Several improvement measures are stored in the tool and can be chosen by the users. These measures cover different aspects of building energy retrofitting or energy efficient new constructions, such as thermal insulation of the building envelope, window technology, solar energy technologies, etc. Such measures can be selected by the users by means of choosing the economic budget window or the desired achievable energy and emission level. The tool automatically performs the calculation of the actual energy performance and the energy performance after improvement measures, including energy label, energy consumption and required budget by assessing all possible combinations of the selected measures. The results are used to calculated the ROI (Return on Investment) and Break-even Point of the proposed improvement package.

More detailed information can be found in the Proficient Deliverable 5.5 Lifecycle Performance Assessment Tool. However, the availability of this report is restricted to groups specified by the Proficient Consortium (including the Commission Services). The tool itself is available at: [http://demo.demobv.nl/RE_EnergyPerfSimulator/](http://demo.demobv.nl/RE_EnergyPerfSimulator/). Send an email to Proficient partner DEMO (info@demobv.nl) to request a login and a password.
**Configurator**

The interaction between end users and professionals would be greatly facilitated if proposed designs by professionals (e.g. of a house) could be modified by end users. With this in mind, a configuration tool was developed in WP6 that can add freedom/flexibility to a particular design. In this project, the application is limited to BIM (Building Information Modelling), but the tool can also be applied to other fields such as the automotive industry.

The configurator is a tool that combines all available information, such as the BIM designs (generally in CMO with Extensions format), libraries etc. and produces a 3D visualisation of it. Technically speaking, the Configurator is a client / server solution and is made up of two parts. The server part is connecting the BIM information and the client part is handling the user interaction. Server and client communicate via so called ‘JSON’ files (an open-standard format that uses readable text to transmit data objects).

As a use case in the Proficient project, the configurator was used in a specific application by the municipality of The Hague. In the ‘Veenweg’ project, a plot of land was parcelled out into 6 individual plots and offered for sale to end users. In this particular case, the plots were offered to individual end users rather than a CSO group, but functionalities of the tool are similar.

End users may select a typology from a matrix of possible housing typologies (developed in WP1), which the configurator can show in 3D in the actual environment taken from GIS (Geographical Information System) data supplied by the municipality. The number and geometry of the buildings (height, width, length) etc. can be modified by the end users to help them shape their ideas on what they want to realise.

![Figure 16: Left: Matrix of possible housing typologies, right: one particular typology in the actual environment of the Veenweg.](image)

The tool can be accessed through: ‘http://rdf.bg/tst/’. Selecting one of the typologies will place it on the Veenweg plot. The design can be edited by clicking the menu button on the top left (under the logo of RDF) and changing geometry values (see Figure 16). The design can be viewed from all sides by moving the mouse while pressing the left mouse button. A first indication of energy consumption (in m³ of Natural Gas and kWh electricity) are shown form a simplified TCO calculation.

For the ‘Veenweg’ plots, a number of architects were asked to provide sketches for possible designs. Approximately 50 designs from 21 architects were received and converted into CMO format. The CMO data were then modified using an existing commercial application, creating a design in the ‘dynamic CMO’ format. However, in this particular application, the architect’s designs contain no parametric information, which means that the designs (length, height, etc.) cannot be modified by the end users.
The site of the municipality of The Hague ([www.ikbouwindenhaag.nl](http://www.ikbouwindenhaag.nl)) offered the different designs to the end user through the configurator. When the end user selected a particular design, the configurator could show it in 3D in the actual environment of the Veenweg plot, shown in Figure 17.

Figure 17: Left: Selection of designs offered by architects for the Veenweg plots, right: one particular design in the actual environment.

The tool can be accessed through: `http://rdf.bg/tst/`. Selecting one of the designs will place it on the Veenweg plot. It can be viewed from all sides by moving the mouse while pressing the left mouse button. Users can visualize not only the geometry of the design but also the semantics (labels of components) and relations between objects. The tool can run the 3D simulation in any modern web browser on any kind of device, i.e. PCs, tablets and smart phones.

Feedback from stakeholders was mostly related to the quality of the visualization of the designs and missing functionalities such as shadowing and more advanced lighting effects. The first could be traced back to the issue of the large number of different Collada formats that were supplied by architects which had to be converted into CMO format. The missing functionalities refer to ongoing further developments which are outside the scope of Proficient.

RDF has contacted five potential third parties (software developers) to commercialise the configurator for municipalities and project developers. RDF will concentrate on developing the kernel while the third party should develop the user interface. An item on our wish list is for future users to be able to virtually walk around in their new environment. The configurator allows to be enhanced with such functionality, but the programming will be left to the third party.

Another enhancement is the application of textures to the surroundings, giving it a realistic ‘look’. This is illustrated in the left of Figure 18 for a showcase of the Kortenaer kade in The Hague. Shading of the buildings at different times of the day and season is a functionality that one of the software vendors contacted has already developed, illustrated in the right of Figure 18.
Figure 18: Showcase of the Kortenaer kade in The Hague with realistic textures applied to the GIS data. The picture on the right also includes shading.

Further development includes integration of the energy calculation function by the Energy Optimiser that was developed in WP5 by taking relevant data from any BIM model. Future applications that the municipality of The Hague is interested in include checks of e.g. noise levels from nearby roads and sustainability issues and automatic generation of building permits.

More detailed information can be found in the public Proficient Deliverable 6.4 *BIM Configurators & BIM Converters*.

**Links between a design and tools**

The tools developed in the project are not stand-alone tools. If a design of a building was made, e.g. by end users in SketchUp, the **TCO tool** can be invoked by a simple plugin in SketchUp. This way, end users will get a first insight in the costs of their building and compare different design options (e.g. an energy neutral design) in terms of Total Cost of Ownership, i.e. investment, mortgage, maintenance and energy bill.

At a later stage, when the materialisation of the building (e.g. thickness of thermal insulation, type of windows) is known, the **Energy optimiser tool** can be used to optimise energy efficiency packages, using the IFC output file from the CAD system. Finally, as mentioned above, the design, if in IFC or Collada format, can be placed on a plot using the **Configurator**. The blue arrows in Figure 19 below shows the three links between a design and the tools developed.

![Diagram](image-url)
1.3.7 New Business Models

The Guild model was explored in WP2 as a possible way for SMEs to organise themselves into an SME network, representing the supply side in a virtual marketplace. As a group with all required expertise to construct or renovate buildings, the SME network offers an alternative to large construction firms that lack the flexibility to satisfy the specific needs of a CSO group.

The business models for Proficient have to take into account the specific characteristics of a CSO group, whose members have strong ideas on what they want to realise and that want to participate in the process of shaping their housing (Participatory Design).

On the basis of an overview of the German well known “Hand-in-Handwerker” (HiH) model, factors were determined that positively affect the success and transferability to other business models. There appears to be a general need for a smart organised process that helps to overcome the lack of qualification at SME-level.

On a district scale, the issue becomes even more complex. Single SMEs or an SME network may lack the expertise to take on such a project. In order to enable SMEs to apply Energy Efficient Building (EeB) technologies on a large (district) scale, several business models were developed in WP2, from which a franchise concept was elaborated in WP4 as one of the exploitable results.

In order to enable SMEs to apply Energy Efficient Building (EeB) technologies on large (district) scale, the franchise company proposed offers professional support for development, engineering, tendering and contracting issues. A RESCO (Renewable Energy Service COmpany) solution is part of the business model as an important element of the turn key development offer to the client.

The analysis of the RESCO large scale district solution shows that the realisation is often suffering from pre-financing problems. The idea is to motivate the members of the CSO housing group to participate in the financial risk as well as the profits on a voluntary basis and provide the risk capital via crowd funding.

In addition, possible CSO Housing development and implementation of technology solutions rely on prefabrication and modularisation based on a BIM-like data model which offers the opportunity to follow a standardised communication and production process and to customise the offer to the client. The use of “dry” assembly techniques together with the presence of a digital model are the factors assuring and enhancing the adaptability and customisation of the CSO housing intervention, the flexibility of the typological scheme, and the integrated organisation of the process and the related players.

A clear example of how to identify the technology that optimises the business model comes from direct case studies that were described and analysed, such as the hydro plant realised by Proficient partner Becquerel in the Alpine village of Civago, Italy.

In seeking the optimised business case, there is the evidence that it is not necessary to adopt prototypes or pilot plants to reach an optimisation, on the contrary, these solutions are very far from the target of dealing with technologies that can be easily handled by SMEs. Standard systems are hence to be preferred. Additionally, it has become clear that the main innovation and, therefore, the real optimisation is found in the possibility of combining standard technologies with new development strategies, such as crowdfunding and/or e-commerce platforms, where a consortium of SMEs can establish the efficient commercial network.

In the end, in Civago, a solution was found in a hydro plant with shares owned by the citizens of Civago on a voluntary basis. The production and supply of green electricity to all the houses of the village on a collective basis allows a high standard of sustainability.
The details of the new business model are proprietary as they are being commercially exploited as the ‘Friends’ franchise model by partner LLL.
1.4 The potential impact

Europe is facing challenges related to the depletion of natural resources, climate change and a dependency on less stable political regimes for its energy supply. The built environment in Europe is currently responsible for around 40% of total energy consumption. Low energy buildings, zero energy buildings and Energy plus buildings will contribute to the Europe 2020 targets and an energy neutral built environment by the year 2050.

CSO housing projects have generally been shown to pay a special interest in sustainability issues, its members trying to reduce energy consumption, to invest in renewable energy production, and to reduce their ecological footprint by car sharing programmes. It makes these collectives an increasingly valued route towards a sustainable society, not only in terms of low energy consumption but also in terms of social values such as taking care of the elderly or disabled, in a society where government support is diminishing and leaving more and more to the self-reliance of its inhabitants.

Over the past years, SMEs in the construction industry have been suffering from an economic crisis and recovery in this sector is slow. New markets need to be explored as conventional construction markets were failing and have not yet recovered.

The aim of the Proficient project, is combine both objectives of sustainability and job creation by facilitating and promoting CSO housing for energy-efficient neighbourhoods, at the same time creating new business opportunities for SMEs. The latter are particularly suited to offer an alternative to large construction firms that lack the flexibility to satisfy the specific needs of a CSO group.

Road maps

A detailed analysis of the European housing market showed the different regional specificities that profoundly influence CSO new construction and retrofitting activities. In the analysis it was found that the institutional background in many Western and Northern European countries created a situation that – especially in the post-crisis climate – allowed the CSO new construction market to boom. It also noted that the lack of this institutional support in many Central and Eastern European member states makes such endeavours a challenge. As a result of the large differences between the Eastern and Western European housing stock, CSO retrofitting processes have a large potential in the former Soviet Block countries with their largely privatised housing stock, both on building and on district level. The challenge here is to persuade already established communities in taking up energy efficiency renovations of their homes. In the analysis it was also concluded that the municipality is a key player as a facilitator and enabler both in the new construction and the retrofitting area, but especially when it comes to district level interventions. Currently, on a building level under favourable institutional conditions, residents and SMEs can take the lead. This may change by the introduction of new business models.

With this background a roadmap was outlined for the retrofitting process model, grouping the phases through which a CSO community goes into two steps: initiation & persuasion and execution & operation. Given the generally bad energetic quality of the Eastern European building stock, there is a huge potential of energy savings as well as improvement of indoor comfort. This is demonstrated by the successful energy efficiency renovation carried out in the demonstration case of the Raab-Sol project in Győr, Hungary, achieving 30% energy reduction at a cost of € 9000 per apartment.

A road map and action plan was also produced for new construction. It can be used as a comprehensive road map that describes the lifecycle phases of CSO new district development and stakeholders’ roles. As such it can be used to analyse the EU and national housing policy and market contexts, but most importantly, it serves as the guiding tool of different stakeholders that allows not only increasing the number of such projects, but decreasing the time needed to complete one.
**Impact by dissemination and exploitation**

The impact of the project is ensured by **dissemination** and **exploitation** activities. The projects results are **disseminated** to academia, relevant stakeholders and the general publics through scientific papers, the CSO housing platform, and workshops. Dissemination is further increased by the establishment of Communities of Practice (CoP), the cooperation with local Chambers of Commerce, and the synergies with the ongoing EU programme KIC InnoEnergy and European Energy Research Alliance (EERA) that contribute to the SET (Strategic Energy Technology) Plan.

**Exploitation** is reflected in the Key Exploitable Results and their business plans. A web-based support instrument ‘CSO housing platform’ facilitates the take-up of CSO housing, a new business model ‘Friends’ is proposed to overcome the barrier of taking on complex CSO housing projects on a district scale and a number of technical tools have been developed, contributing to the market take-up of CSO housing, while at the same time generating income for the SMEs offering the tools (TNO, RDF, DMO).
1.5 Address of the public website

www.proficient-project.eu/
2. Project Logo, diagrams and/or photographs

Figure 20: Project logo.

Figure 21: Graphical image of the CSO housing platform with three main stakeholders in a CSO process and tools and information offered.
3. Use and dissemination of foreground

3.1 Dissemination

Over the duration of the project, a website and newsletter were used to communicate to the general public the development of our work as well as to share the best practices and knowledge developed.

Now that we are at the end of the project, an important dissemination vehicle is the CSO housing platform, where all practically useful results for the relevant stakeholders are being offered.

In addition, we have been actively engaged in activities such as attending and presenting the PROFICIENT project at conferences and seminars. Workshops and invited talks have also been conducted to disseminate knowledge developed in the project. In total, PROFICIENT project has produced three peer reviewed articles and four more with status ‘work-in progress which will be submitted in the near future (see Table 4 below). Seventeen papers were presented at conferences/seminars, fifteen workshops were organized. Table 3 summarizes all dissemination activities.

Table 3: Summary of dissemination activities

<table>
<thead>
<tr>
<th>Type of dissemination activities</th>
<th>No. of deliverables</th>
<th>Metrics</th>
<th>Impact/outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSO Housing Platform</td>
<td>1</td>
<td>Website visits</td>
<td>n/a</td>
</tr>
<tr>
<td><a href="#">www.cso.house</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Project website</td>
<td>1</td>
<td>Website visits</td>
<td>n/a</td>
</tr>
<tr>
<td><a href="#">www.proficient-project.eu</a></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Peer reviewed) Academic publications</td>
<td>3</td>
<td>Citation factors and other academic rankings</td>
<td>1) International Journal of 3D Information Management. – Impact factor 0.64 (2011 data)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>2) Town planning review – impact factor 0.69 (2015 data).</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>3) “Cohousing as New Instrument for Urban Refurbishment”, book chapter – Readership n/a</td>
</tr>
<tr>
<td>Work in progress (peer reviewed)</td>
<td>4</td>
<td>Citation factors and other academic rankings</td>
<td>n/a</td>
</tr>
<tr>
<td>academic publication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Seminar and conference papers</td>
<td>17</td>
<td>Audience numbers</td>
<td>2500</td>
</tr>
<tr>
<td>(Professional) non-academic</td>
<td>1</td>
<td>Readership</td>
<td>1) Newsletter for Scientists for Global Responsibility – Readership 1100.</td>
</tr>
<tr>
<td>publication</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Invited talk/organised workshops</td>
<td>12</td>
<td>Attendees numbers</td>
<td>600</td>
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<tr>
<td>Community of Practice events</td>
<td>7</td>
<td>Attendees numbers</td>
<td>355</td>
</tr>
<tr>
<td>Newsletters</td>
<td>3</td>
<td>Readership</td>
<td>n/a</td>
</tr>
</tbody>
</table>

In addition, the tools mentioned above are described in a document as a contribution to SET (Strategic Energy Technology) Plan through EERA (European Energy Research Alliance) and a contribution was made for the EU
curriculum development in KIC InnoEnergy by proposing a module called ‘Collective self-organised Housing project’, aiming to introduce students with key concept of CSO housing project, process, characteristics and their application in practice.

A list of all dissemination activities is shown in Annex I.
Table 4: List of scientific (peer reviewed) publications

<table>
<thead>
<tr>
<th>NO.</th>
<th>Title</th>
<th>Main author</th>
<th>Title of the periodical or the series</th>
<th>Number, date or frequency</th>
<th>Publisher</th>
<th>Place of publication</th>
<th>Year of publication</th>
<th>Relevant pages</th>
<th>Permanent identifiers (if available)</th>
<th>Open access provided to this publication?</th>
</tr>
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<tbody>
<tr>
<td>No.</td>
<td>Title</td>
<td>Main author</td>
<td>Title of the periodical or the series</td>
<td>Number, date or frequency</td>
<td>Publisher</td>
<td>Place of publication</td>
<td>Year of publication</td>
<td>Relevant pages</td>
<td>Permanent identifiers (if available)</td>
<td>Open access provided to publication?</td>
</tr>
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<tr>
<td>4</td>
<td>Exploring grassroots housing movement for energy efficiency district</td>
<td>Brouwer, J., Bektas, E., Soetanto, D.</td>
<td>Int. Journal of Sustainable Real Estate and Construction Economics</td>
<td></td>
<td>Inderscience Publisher</td>
<td>Olney, UK.</td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>5</td>
<td>CSO housing platform: Creating a virtual process support tool for the initial phase of collective self-organized housing development.</td>
<td>Klerk, S., Brouwer, J., Hasselaar, B., and van Vliet, N.</td>
<td>Int. Journal of Smart and Sustainable Build Environment</td>
<td></td>
<td>Inderscience Publisher</td>
<td>Olney, UK.</td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>6</td>
<td>Design principles and process models for emerging collective self-organised housing market</td>
<td>Brouwer, J., Bektas, E., DiGiulio, R., Pasqualis, M.B., Quentin, C., Savanovic, P.</td>
<td>Int. Journal of housing market and analysis</td>
<td></td>
<td>Inderscience Publisher</td>
<td>Olney, UK.</td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
<tr>
<td>7</td>
<td>Introducing collective self-organised housing scheme: options and barriers</td>
<td>H. Szemso, Gerohazi, E., Soetanto, D., MacDonald, M.</td>
<td>Int. Journal of Sustainable Development</td>
<td></td>
<td>Inderscience Publisher</td>
<td>Olney, UK.</td>
<td></td>
<td></td>
<td></td>
<td>No</td>
</tr>
</tbody>
</table>
3.2 Key Exploitable Results

A number of Key Exploitable Results (KERs) were identified, as the result of an ESS (Exploitation Strategy Seminar and subsequent elaborations. They are summarized in Table 5.

Table 5: Characteristics of five Key Exploitable Results

<table>
<thead>
<tr>
<th>Key Exploitable Result</th>
<th>Lead (other) partner</th>
<th>TRL level</th>
<th>time needed for further development</th>
<th>Potential exploitation form</th>
<th>Business model</th>
</tr>
</thead>
<tbody>
<tr>
<td>‘Friends’ CSO housing franchise concept</td>
<td>LLL</td>
<td>6-7</td>
<td>1-3 yrs</td>
<td>Franchise concept</td>
<td>License agreement</td>
</tr>
<tr>
<td>Lifecycle Performance Assessment Tool</td>
<td>DMO (RDF)</td>
<td>7-8</td>
<td>1 yr</td>
<td>Software license, implementation, training, consultancy.</td>
<td>SaaS (Software as a Service)</td>
</tr>
<tr>
<td>(part of) CSO housing platform</td>
<td>TNO</td>
<td>5-6</td>
<td>1 yr</td>
<td>Knowledge</td>
<td>License web-based provided information</td>
</tr>
<tr>
<td>Total cost of ownership tool</td>
<td>TNO</td>
<td>5-6</td>
<td>1 yr</td>
<td>Application</td>
<td>Fee based app</td>
</tr>
<tr>
<td>Components of configurator</td>
<td>RDF</td>
<td>6-7, 8</td>
<td>1-3 yrs</td>
<td>License of components</td>
<td></td>
</tr>
</tbody>
</table>

The "Friends" CSO housing franchise concept will continue development, but progress depends on co-financing support by the building supply industry.

The Energy Performance Calculation & Assessment Tool will be integrated as an autonomous module into the existing RE Suite for Real Estate Asset Management offered by DEMO.

Transfer of the CSO housing platform is planned to third parties that are interested in the continuation of (parts of) its development, in particular the Municipalities of Rotterdam and The Hague.

The TCO tool will be further developed by TNO and exploited as part of a set of fee based BIM bots.

The configurator will be further developed for the municipality of The Hague, iBuildGreen and other potential clients. Simultaneously, discussions are ongoing with third party software developers for the role of end user support. Components of the configurator and the BIM-interface will be integrated in the RE Suite.
4. Conclusions

The description of the results demonstrates that we managed to reach the objectives set out at the beginning. The results generated in the course of the project are very useful to stakeholders in a CSO housing process, in particular end users and SMEs. They were well disseminated to relevant stakeholders including academia and the general public in various ways. A number of the results are taken up for further commercial exploitation by the partners.

More information on the project can be found on the project website http://www.proficient-project.eu/.
<table>
<thead>
<tr>
<th>No.</th>
<th>Type of activities</th>
<th>Main Leader</th>
<th>Title</th>
<th>Date/period</th>
<th>Place</th>
<th>Type of audience</th>
<th>Size of audience</th>
<th>Countries addressed</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Website</td>
<td>LAN</td>
<td>Proficient Website</td>
<td>Ongoing – Quarterly updates</td>
<td></td>
<td>Public, Industry, Policy makers, academics, civil society, SMEs</td>
<td>n/a</td>
<td>EU</td>
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<td>2</td>
<td>Media</td>
<td>LAN</td>
<td>Proficient Newsletters #1 &amp; #2</td>
<td>Period 0-30 months</td>
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<td>Public, Industry, Policy makers, academics, civil society, SMEs</td>
<td>n/a</td>
<td>EU</td>
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<tr>
<td>3</td>
<td>Conference: National yearly conference in Housing Problems</td>
<td>STU-K</td>
<td>Methodology of structural reliability assessment</td>
<td>November, 2012</td>
<td>Hradec Králové, Czech Republic</td>
<td>SMEs, construction industry, housing associations</td>
<td>350</td>
<td>Czech Republic</td>
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<tr>
<td>4</td>
<td>Workshop</td>
<td>BEQ</td>
<td>Meeting: CSO housing through the application of new technologies at district level - Presentation of the hydro plant over Rumale River - Round table Community of Practice.</td>
<td>Saturday 26th of January 2013, 16.00</td>
<td>Civago, Reggio Emilia, Italy</td>
<td>SMEs, Civil Society, Policy makers, Academic, Local Authorities, Housing Associations</td>
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<td>Italy</td>
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<tr>
<td>5</td>
<td>Workshop</td>
<td>Demo, SBR, 3L, LCH, LAN</td>
<td>European Agency Transnational training Workshop</td>
<td>February/March 2013</td>
<td>Ile de France, Belgium</td>
<td>Proficient partners, KARIM partners, Policy makers, Industry, SMEs</td>
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<td>EU</td>
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<tr>
<td>7</td>
<td>Possibilities of energy efficient renovation of multi-family buildings</td>
<td>ENR/MRI</td>
<td>Community of Practice workshop</td>
<td>April 2013</td>
<td>Győr, Hungary</td>
<td>Property managers, policy makers, civil society, researchers</td>
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<td>Hungary</td>
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<tr>
<td>No.</td>
<td>Workshops</td>
<td>Organizers</td>
<td>Workshops on the different aspects of CSO Housing - &quot;Közösségben Élni&quot; (Community Living)</td>
<td>Date</td>
<td>Location</td>
<td>Participants</td>
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<td>8</td>
<td>Workshops</td>
<td>MRI</td>
<td>2013/14 Hungarian SMEs, Policy makers, Industry, Academic</td>
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<td>10</td>
<td>Workshop</td>
<td>LCH/SBR</td>
<td>Community of Practice workshop</td>
<td>September 2013</td>
<td>Lancaster, UK</td>
<td>Civil Society, SMEs, Policy makers, Industry, Housing Associations, Academic</td>
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<td>UK</td>
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<td>12</td>
<td>Intern. Conference on Construction and Real Estate Management 2013</td>
<td>TNO</td>
<td>Requirements of Decision Support Tools based on Total Cost of ownership for Collective Self-organised Housing</td>
<td>October 2013</td>
<td>Karlsruhe, Germany</td>
<td>Academic and Industry, SMEs</td>
<td>120</td>
<td>EU and international</td>
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<td>13</td>
<td>Media Article: Newsletter for Scientists for Global Responsibility</td>
<td>LCH</td>
<td>Environmental cohousing: a contribution to sustainable living</td>
<td>Autumn 2013</td>
<td>UK</td>
<td>Civil Society, Industry, Academic, Policy makers</td>
<td>1100</td>
<td>International</td>
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<td>16</td>
<td>Conference</td>
<td>BEQ</td>
<td>Environmental Assessment Conference: the Rumale hydro power plant. Official Workshop with Boards and Local Authorities.</td>
<td>February 2014</td>
<td>Bologna, Italy</td>
<td>SMEs, Policy makers, Academic, Local Authorities</td>
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<td>Italy</td>
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<td>17</td>
<td>Workshop</td>
<td>SBR/Gemeente Den Haag</td>
<td>Community of Practice/Business Creation workshop x2</td>
<td>March, 2014</td>
<td>The Hague, Netherlands</td>
<td>Civil Society, Policy makers, Industry, Housing Associations, Academic, SMEs, ESCOs, Local Authorities, Housing Cooperatives</td>
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<td>EU</td>
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</table>
2) Models and Market Change in Collective Self-Organised Housing | June 2014 | Oslo, Norway | Civil Society, SMEs, Policy makers, Industry, Housing Associations, Academic | 50 | Norway and UK |
<p>| 19 | Workshop: FP7 coordinators meeting. | TNO | Discussion on collaboration between PROFICIENT, UMBRELLA, EE-WISE, ENBUS projects on tools and business models | June 2014 | Amsterdam, Netherlands | Policy Makers, Industry | 10 | EU |
| 21 | Workshop: STU-K | Community of Practice workshop | September, 2014 | Prague, Czech Republic | Civil Society, SMEs, Policy makers, Industry, Housing Associations, | 30 | Czech Republic and EU |
| 22 | Conference: SB 14 World Congress | TNO/IAA | Suitable Design Methodology for Collective Self-Organised Housing Projects to Build Sustainable Districts | October 2014 | Barcelona, Spain | Academics, SMEs, Policy makers, industry | 100 | EU and international |</p>
<table>
<thead>
<tr>
<th>No.</th>
<th>Event Description</th>
<th>Organizer</th>
<th>Title</th>
<th>Session Date</th>
<th>Location</th>
<th>Participants</th>
<th>Contribution Ref.</th>
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<tr>
<td>23</td>
<td>Conference: 10th European Conference on Product and Process Modelling</td>
<td>MRI</td>
<td>Towards a new business model for collective self-organised housing interventions</td>
<td>September 2014</td>
<td>Vienna, Austria</td>
<td>Academics, SMEs, Policy makers, industry</td>
<td>50 EU</td>
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<tr>
<td>25</td>
<td>Workshop on the possibilities to introduce CSO housing in Hungary</td>
<td>MRI</td>
<td>Community of practice discussion</td>
<td>December 2014</td>
<td>Budapest, Hungary</td>
<td>Developers, policy makers, civil society</td>
<td>15 Hungary</td>
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<tr>
<td>26</td>
<td>Conference: 40th IAHS World Conference on Housing</td>
<td>TNO; LAN; MRI; RDF; 3L; DMO; IAA; SBR</td>
<td>Special “Proficient” conference track – 7 peer-reviewed conference papers delivered</td>
<td>December 2014</td>
<td>Madeira, Portugal</td>
<td>Academics, SMEs, Policy makers, industry</td>
<td>200 EU and International</td>
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<td>28</td>
<td>Conference: Nimble Spaces</td>
<td>LAN</td>
<td>Overview of Proficient project and expected outcomes</td>
<td>May 2015</td>
<td>Carlow, Ireland</td>
<td>Civil Society, SMEs, Policy makers, Industry, Housing Associations,</td>
<td>350 EU and international</td>
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<tr>
<td>29</td>
<td>REPLAN conference (Innovative Solutions to Urban Housing Challenges)</td>
<td>MRI</td>
<td>The potential role of CSOs in urban renewal</td>
<td>May 2015-2016</td>
<td>Budapest, Hungary</td>
<td>Academics, public sector</td>
<td>50 Hungary</td>
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<tr>
<td>30</td>
<td>Workshop</td>
<td>BEQ</td>
<td>Overview of Proficient Project, expected outcomes in terms of the creation of a Community sharing new and optimized business case (hydro plants). Community of Practice workshop</td>
<td>August 2015</td>
<td>Civago, Reggio Emilia, Italy</td>
<td>SMEs, Civil Society, Policy makers, Academic, Local Authorities, Housing Associations</td>
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<td>31</td>
<td>C4E Forum</td>
<td>MRI</td>
<td>Presentation: National subsidy schemes supporting the energy efficient renovation of multi-unit buildings in four CEE countries</td>
<td>June 2016</td>
<td>Balchik, Bulgaria</td>
<td>National, Municipal decision makers and experts on energy efficiency mainly from the Central and Eastern European region</td>
<td>200</td>
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</table>