

CONCRETE IMPLEMENTATION OF NEW ENERGY PERFORMANCE CERTIFICATES FEATURES: TESTINGS AND RESULTS IN NINE COUNTRIES-ONE STOP SHOPS

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eXTENDing the energy performance assessment and

certification schemes via a mOdular approach

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LIST OF ABBREVIATIONS

ADENE	Portuguese Energy Agency, Department of Buildings
AAECR	Romanian Association of Energy Auditors for Buildings
CDD	Cooling Degree Days
CRES	Centre for Renewable Energy Sources and Saving
DEA	Danish Energy Agency
DH	District Heating
EASt	Energy Agency of Styria
ENEA	Italian National Agency for New Technologies, Energy and Sustainable
	Economic Development
EST	Energy Saving Trust
HDD	Heating Degree Days
IEQ	Indoor environmental quality
MFH	Multi-family house
NAPE	National Energy Conservation Agency
SFH	Single family house
TREA	Tartu Regional Energy Agency



1 INTRODUCTION

The focus of the Horizon 2020 project X-tendo is the further development of energy performance certificate (EPCs) schemes in EU Member States. This should be done in two dimensions: on the one hand additional indicators are developed that add further relevance to EPCs. On the other hand, EPC handling should be improved to make it easier, more reliable and interconnected with other building related data. 5 features in each of the two dimensions are elaborated throughout the project. This includes the analysis of the theoretical background, the development of materials and methods, the testing of the features in concrete implementation projects, as well as the dissemination on developed ideas and materials.

The goal of the testing of the developed feature materials is to understand the practical viability and the challenges in the practical implementation of the developed ideas and materials in selected countries of the EU. Depending on the feature different types of tests and test projects have been performed. In-building tests apply the feature materials on concrete buildings, user tests consist of understanding the user perception related to the developed materials and ideas, system tests intend to understand the application of feature ideas and materials in related systems like EPC database systems.

The overall approach of testing and further developing feature materials is shown in Figure 1 and consists of the following steps:

- In the first phase of the project the feature leads (FL) developed beta versions of feature materials, hereby taking into account needs and feedback from Implementing Partners (IPs). An overview of FLs and involved IPs per feature can be seen in Table 1. These materials consist of different parts depending on the feature. In most cases these consist of guidelines, spreadsheets or program code in defined languages like sql or python.
- The beta versions of the feature materials have then been provided to the IPs to test their application in their national / regional settings. The IPs have performed different types of tests with or in the context of the developed materials. In some cases, especially for in-building tests of certain features, the tests also involved EPC assessors.
- After finishing the test projects, the IPs reported about their testing results in two different ways: on the one hand they filled previously developed questionnaires (see the annex for exemplary questionnaires). On the other hand, they wrote test result reports providing more details about the context and results of the test projects.
- The filled-out questionnaires as well as the testing results reports have been used as a basis to derive conclusions for the final reshape of the feature materials. They also serve as an input to guiding the implementation of the features in the different countries / regions.





Figure 1: Approach for testing feature materials in the X-tendo project

The following Table 1 gives an overview of the types of tests that have been performed for the different features in the different implementing countries. More details of the characteristics of each test project are described in the feature chapters.



	1. Striett re	Refiness	ton son	totor air	Pererey	S. E.P.C. da	· Building	recomment	9. Finaning dations	10. One sto options	The shops
						Feature le	ad partner				
Country	Imple- menting Partners	VITO	BPIE	NAPE	VITO	e-think	TU Wien	BPIE	TU Wien	ADENE	ADENE
AT	EASt	IB	IB		IB				Expert		
DK	DEA					Expert	S		IB	U/S	U/S*
EE	TREA	IB Expert			IB			U/S			
GR	CRES	IB Expert	IB Expert				S	U/S			
IT	ENEA				IB	IB	S				
PL	NAPE			IB U Expert		IB			IBS	Expert	
PT	ADENE		IB					U/S Expert		U/S	U/S* Expert
RO	AAECR	IB	IB		IB Expert	IB				U/S	U/S*
UK	EST				**		Expert		IB		S
	No of partners testing	4	4	1	4	3	3	3	3	3	1 stand- alone test*

Table 1 – Overview of testing activities by feature and implementing country / partner

*Feature 10 tests in DK/PT/RO are delivered alongside testing of feature 9 **Note UK test under feature 10 also relevant here

This report provides the summary of the outcomes of the testing activities for each of the 10 features in one or several implementing countries. This is mainly based on the analysis of the evaluation questionnaires filled out by the implementing partners, but also on the content of the testing results reports where these have already been available at the time of writing the document. The questionnaires hereby consist of general questions along the testing steps, questions on testing time and related costs, an evaluation against defined cross-cutting criteria (Quality and Reliability, User-friendliness, Economic feasibility, and Consistency with ISO/CEN standards) and final thoughts. The questionnaires slightly differ for the different types of test projects (in-building, system, user tests) and for the different features (composition of detailed questions for the cross-cutting criteria). Exemplary evaluation questionnaires for each of the three types of test projects can be found in the Annex of this report.

With this the report should provide a summary of the outcomes of the testing activities on the different features in the different countries, provide conclusions for further development of the developed ideas and materials towards the end of the project and beyond, explain the practicability and challenges in the implementation of the features in practice, and give guidance for organising similar test projects in the future.

The report first provides an introduction to the topic of the feature, the developed methodologies and materials and the performed testing activities. This is followed by the description of the testing results structured by the types of test projects. This includes a description of overall results, estimated time and costs and the different cross-cutting criteria. Finally, conclusions out of the testing activities are presented.



2 FEATURE 10: ONE STOP SHOPS

2.1 Introduction

One stop shops (OSS) are transparent and integrated advisory tools / venues, which will accelerate energy renovations by informing, motivating, and assisting building owners throughout the renovation journey, from beginning to end.

Accelerating energy renovations faces multiple barriers, including social (e.g. lack of awareness, low trust), technical (e.g. inadequate advice, incoherent renovation measures), financial (e.g. high investment costs) and market related (e.g. lack of reliable experts and tradespeople, split-incentive dilemma). To overcome these barriers, the EPBD calls upon Member States to consider transparent advisory tools to inform and assist consumers in energy efficiency renovations and related financial instruments. The concept of one-stop-shops (OSS) has gained traction as a solution to overcome market fragmentation on both the demand and supply side by offering holistic, whole-value-chain renovation solutions.

The key benefit of setting up an OSS is the possibility to overcome the manifold and simultaneous barriers related to residential building renovation. On one hand, the OSS acts as an intermediary that simplifies the fragmented offer of renovation suppliers, for example by aggregating designers, suppliers, installers and financiers into a single package for the homeowners. An OSS also supports the supply side of building renovation by mediating with the potential clients, using techniques such as organising offer packages, pooling the projects and managing the project implementation. The OSS is well placed to facilitate the implementation of locally developed projects and

More information about the feature can be found in the <u>introductory report</u> or on the <u>X-tendo</u> <u>website</u>.

F10 was tested in Denmark (DEA), Portugal (ADENE), Scotland (EST) and Romania (AAECR).

Denmark and Romania did a user test. Scotland did a user test (though with stakeholders internal to the OSS and focused on how systems could/should develop). Portugal did a user test and a system test with results primarily from the user test.

Context to testing – United Kingdom (UK)

Home Energy Scotland is a developed one stop shop, covering advice, financing and supplychain engagement for everyone living in Scotland. Home Energy Scotland is managed centrally by the Energy Saving Trust on behalf of the Scottish Government. Advice is provided at local level across Scotland by five local agencies covering areas as shown left.

The planned X-tendo testing activity for the OSS relates to advice. In Scotland the advice is provided over the telephone, by email and in-person by advice agents based in each of the local agencies.



Smart meters are being rolled out across Scotland providing householders with personalised access to their energy bills data on a half hourly basis. This can be used to provide advice on behaviour change and detailed advice on the bill saving impacts of installed measures. Energy Saving Trust has developed a pilot data interface to allow advisors to see householders' smart meter data when the householder gives permission for this.

Home Energy Scotland advice to householders in Scotland is already informed by the Energy Performance Certificate data for their home. EPC data and recommendations are based on an asset-based (i.e. standardised building performance) assessment. This is very different from the real energy use data available from smart meters.

Therefore, there is a challenge for advisors working with these two data sets and the Scotland test project will help develop systems to help advisors use both smart meter and EPC data in parallel.

Context to testing - Portugal

The Portuguese OSS has the goal to be compliant with the EPBD by setting up an accessible and transparent advisory tool for consumers and energy advisory services, on relevant energy efficiency renovations and financing instruments, and to convert the information present in more than 3 million improvement measures registered in the Portuguese EPCs into real savings, facilitating their implementation.

Context to testing – Denmark

The one-stop shop in Denmark is called BetterHome. The BetterHome is Danish national consultancy scheme (Voluntary and market-driven system). The purpose with the scheme is:

- Promotion of refurbishment of private residential buildings;
- Remove barriers make it simpler/ easier and more manageable for homeowners and create a scheme that the homeowners can trust.

The BetterHome scheme is an extension to the EPC scheme and can be based on an existing EPC for a building. The BetterHome calculations are also performed in the same tool as the EPC's, to ensure comparability and easy data transfer. The scheme also provides counselling through all of the building renovation process, and can support the homeowners through all phases of a renovation.

The scheme was developed by the Danish Energy Agency in collaboration with the building industry. It is regulated in the "Act on the promotion of energy savings in buildings".

The scheme consists of two market driven services:

1. The BetterHome plan – a screening of the building to give the homeowner an overall overview of expected investments and savings, and



 The BetterHome project – where the consultant help the homeowner from start to finish, first providing the screening of the building and then leading any commenced renovation project. This service resemble a "one-stop-shop" with the aim of promoting energy savings.

Context to testing - Romania

Romania does not have an operating one-stop-shop for building energy performance. In this sense, under the X-tendo project, Romania tested the one-stop-shop methodology considering the first steps needed to setup a one-stop-shop, in three different contexts: (i) using a blog/forum approach within a professional site, for a small fee at registration; (ii) using the energy efficiency departments at local authorities, for free, or (iii) using an existing platform that intermediates between customers and services offered by different companies, for a fee per request, if the platform host agrees.

The aim of the testing was to decide on OSS functionality with relevant stakeholders after a full inquiry. Linkages to geographical energy auditors lists, to financing mechanisms sites, to major companies performing renovation measures or providing renovation materials and/or technologies, and to local authorities responsible for monitoring and reporting renovation of buildings will be explored and evaluated.

Denmark (DEA)		Portugal (ADENE)			Romania (AAECR)			
User test name	User test type	Description	User test name	User test type	Description	User test name	User test type	Description
F10.UT.01.DK Interviews of house owners	Interview based on a structured approach with open questions.	A series of interviews of house owners that have performed energy renovations on their houses based on a BetterHome report.	F10.UT.01 Reason for joining OSS; F10.UT.02 OSS functionalities evaluation; F10.UT.03 User experience of new functionalities resulting from the system testion	Questionnaire; Questionnaire; Questionnaire	Evaluate with the stakeholders (companies, installers) their perception/ willingness to subscribe casA+; Evaluate with the stakeholders (homeowners) the available/future functionalities in casA+; Stakeholders involvement for feedback on the developed functionalities.	F10.UT.01 Options to implement OSSs	Local scale of the OSS (in the city)	Analyse barriers and recommend potential solutions to set-up OSSs.

Table 2 – Description of F10 tests – One stop shops

Portugal (ADENE)			Scotland (EST)			
System test name	System test type	Description	System test name	System test type	Description	
F10.ST.01 New	Platform	New functionality on	F10.EST.ST.01	Systems test	The test aims to	
functionality on advice;	development;	automatic improvement measures proposals;	Test of new approach to training advisors		identify the future approach EST should take in developing	
F10.ST.02 New	Platform		working with		advice services	
functionality on financing	development	New functionality on information about funding opportunities and available incentives and bomeowneys feedback	EPC and Smart Meter data		delivery, including advisor training in the Home Energy Scotland One Stop Shop.	



2.2 Results of the testing activities

Overall results of system tests

The methodology of the system test in Portugal involved developing the module "Advice Centre", where the goal was to develop the 2 new functionalities (see User Test Results and "Discussion and Conclusions" below): automatic improvement measures proposal and information on financing and incentives.

These were tested through user testing; the respective results are therefore reported in the related chapter below.

Overall results of user tests

UK – Scotland

Test Methodology

Note: the UK user test was with internal OSS stakeholders to identify system improvements.

Testing was carried out through three focus groups and a questionnaire as follows:

- 1. Focus group with EST staff involved in managing and planning development of Home Energy Scotland services
- 2. Focus group with Advice Agency staff working on delivering the OSS advice "on the ground" across Scotland (see *context* above).
- 3. Focus group with advice agency staff to review and develop findings from the first two workshops
- 4. Questionnaire developed based on findings from the focus groups to priorities identified barriers and actions. Questionnaire was sent to all participants in the focus groups.

Results

The results and findings of the user test in the UK are summarised in the following Table 3.

Table 3: Summarised findings of focus groups

Barriers (external issues out of our direct control)	Issues (things we have potential to address better)
 Problems with EPC data quality, especially of historic EPCs SAP methodology underpinning SMAP and EPCs Smart meter data technical challenges – issues with the DCC 	 Managing consents Understanding customer needs and how they will respond to new technologies/tools/services Supporting householders with behavioural actions as well as installed measures

X-tendo

- Legal requirements around consent, GDPR requirements
- Policy/legal constraints on use of underlying EPC data and on use of Smart Meter data.
- Levels of customer interest/engagement/understanding
- (Customers are currently often more interested in what grant they can get than a detailed discussion of home energy performance)
- [Deep underpinning issues include factors such as level of Scottish Government commitment, energy prices etc.]
- Opportunities (External issues)
 - Ever-growing EPC data
 - Improvements to EPC processes leading to better quality EPCs.
 - Increasing numbers of people with Smart meters (to the modern SMETS2 standard which SMAP needs)
 - Increases opportunity for SMAP
 - More interest/awareness of carbon
 - Emerging opportunities for change of time of use and related measures:
 - Demand response
 - Batteries

- Customer groups who we've struggled reach/serve in the past:
- Tenants (for whom advice needs to be more behavioural)
- The most vulnerable customers
- Making tools more customerfacing/accessible to customers (e.g. SMAP was found to have too many security issues to be customer facing).
- Pressure on the time available and the level of the customers interest to convey appropriate information
- Need to gather baseline data before advice can be provided based on real energy data.
- Electrification of heat requiring new types of measures in homes, new types of advice

What can we build on/develop?

- More customer led engagement with more flexible support to householders reflecting their interest, profile.
- New approaches to the consents process
- Technical enhancements to tools ongoing investment and increasing tool integration
- Some highly advanced tools e.g. EST Home Renewables Advice tool.
- More piloting of SMAP enabling further testing.
- Additional services for specific groups of customers:
 - o Social housing
 - Customers with pre-payment meters
 - Vulnerable customers
 (beneficiaries of energy carriers)
- New types of advice/support services for new types of measures
- Tracking poor measures performance following installation
- Providing behavioural support following installation



Conclusions

Based on analysis of the focus group results, a list of next steps/priorities for action was identified. The below figure shows the priorities for next steps/key conclusions identified from focus groups, so all have some support, but the figure below shows which of the focus group attendees felt were the most important. These are described in more detail below.

Rank Options

- 1 Greater use of multi-channel c...
- 2 Training and development of ...
- 3 Improve consents process wit...
- 4 Use of new, especially proacti...
- 5 Researching and making grea...
- 6 Development a case managed...
- 7 Develop and advise on a Buil...



Figure 2: Prioritisation of next step actions developed following focus group activity in Scotland

- Greater use of multi-channel conversations and use of phone/email/on-line tools Home Energy Scotland developed as a telephone advice service and this remains the principal channel through which advice is provided. Online tools have increasingly been made available through the Energy Saving Trust website. Meanwhile advisors have begun to provide personalised advice through email. There is a potential for use of multiple channels with each customer, providing advice through different routes to better meet customer need.
- Use of a new, especially proactive approaches to engagement alerts, proactive communications (we call the customers); energy alerts when smart meter data shows usage goes high.
 HES has been a responsive service, new tools and data makes it possible for the service to become proactive, subject to consumer consent/interest.
- Training and development of more specialist advisors who are expert in interpreting smart meter data.
- The use of more complex data, from EPCs and smart meters, requires additional interpretation for it to be useful to the customer (this includes the issue that EPCs and smart meters provide very different types of information). This is likely to require additional training of HES advisors. (Though it was also identified that research was needed into the extent to which interpretation of data could be automated).
- Researching and making greater use of theory of behaviour change.
- Providing customers with additional data and insight (particularly more proactively) requires an understanding of what data will be useful and at what trigger point. Making more detailed use of behaviour change insight can identify how this can be delivered.
- Improve consents process with greater use of online consents agreement



- A key current barrier identified by advisors was that getting customers consent to access and analyse their data is a slow process with advisors reading out multiple, long agreements over the phone. Meanwhile, the smart meter data from SMAP, being sensitive personal data, requires particularly complex, multi-stage consents to access. And additional access to EPC data could be complex. A full solution to this problem was not identified, but one approach will be to put as much of the consents process online as possible, particularly in the context of a more multi-channel advice process (see above).
- Development of a case managed call process agree what areas the customer wants to have a conversation about, and then create an advice plan
- The use of additional data sets and channels (see above) will need to specific to each household that means the creation of a case managed call process.
- Develop and advise on a Building Renovation Plan that each home can have and can be used to structure advice.
- Scotland does not yet have a developed building passport/logbook approach integrated with OSS shop advice. A building logbook would help with the provision of more personalised advice.

Portugal

Methodology

In Portugal the testing approach was as follows:

- 1. Questionnaire to registered homeowners (Q1) and companies (Q2) on exiting OSS
- 2. New functionalities development
- 3. Questionnaire to registered homeowners on new functionalities user experience (Q3)



Figure 3: Testing Approach

For the homeowners' questionnaire the goal was to evaluate the following:

- Type of OSS user
- Evaluation of existing functionalities and impact on energy renovation
- OSS improvement and future functionalities

For the companies' questionnaire the goal was to evaluate the following:

• Type of company registered in OSS



- OSS Registration process and portal use
- OSS Membership and benefits achieved

Results Consumers

The questionnaire was filled by 463 registered homeowners in portal casA+, from a total of around 12.000 registrations (sample = 4%).

Figure 4 illustrates some results of Q1 regarding the OSS user type. The main conclusions from this questionnaire are:

- 77% of casA+ user's age is above 40 years, being most of homeowners aged from 40 to 49. Being this a digital platform we would expect a higher penetration of younger users, however, the ownership a house in the Portuguese context usually occurs at older ages, justifying this type of OSS user age range distribution
- 41% of the homeowners are placed in Lisbon or surroundings, suggesting that is necessary to improve portal casA+ communication channels and strategy to increase the national coverage
- 63% is graduated and 32% finished the high school
- 38% knew about casA+ through the internet and 38% knew through programs and incentives
- 68% reports that uses occasionally casA+, while 13% reports a monthly use and 13% a weekly use.



The existing functionalities and its impact on energy renovation was evaluated as follows:

The overall opinion regarding the OSS quality was very positive (with more than 67% of the respondents evaluating it with good, very good or excellent). The top 3 more positive evaluations were for image/graphic design (81%), objectivity and clarity of content (72%) and information/functionalities usefulness (70%). Other conclusions were as follows:



- 59% said that the available functionalities did not contribute to implement improvement measures in their homes, yet
- However, 53% considered that they will "maybe" use casA+ for that, while 32% considered that they will certainly use casA+ to implement improvement measures. 14% answered "No" due to financial availability, bureaucracy, waste of time and lack of transparency. This result highlights a problem with the OSS communication strategy since people are getting confused with the Environmental Fund application (which is independent from the OSS)
- 85% considered that improvements in energy performance have been achieved in their house after the implementation of the improvement measures carried out through casA+
- Other improvements (in addition to energy performance) were also achieved, as for example more comfort (37%), air quality (8%), bills costs reduction (27%), property value increase (24%) and others (4%)
- 50% considered the improvement measures proposed in the EPC and available in casA+, while 27% does not have an EPC issued.
- 66% identified their own improvement measures on casA+ to renovate their homes, while 14% did not know that functionality was available
- 57% said that there are improvement measures proposed in the EPC that have not yet been implemented

The following improvement and future functionalities of OSS have been identified:

136 respondents pointed out some opportunities for improvement. Some reported problems with the proposals coming from the installers, namely no number of proposals or even no answers from the installers when contacted by the homeowner. A large number of answers related difficulties on applying to the environmental fund platform for energy efficiency improvement measures. This is not directly related to portal casA+, but since the communication for this funding is coming through the portal, people get confused and think casA+ and the environmental fund platform are the same.

Considering future functionalities to be made available in casA+ (**Error! Reference source not found.**), the automatic proposals for improvement measures and the financial incentives information were considered the most useful ones and therefore were considered prior to be implemented in X-tendo OSS feature testing.





Figure 5: New features to consider in future development of portal casA+

Results Companies

The questionnaire for this evaluation (Q2) was available online from 2/11/2021 to 19/11/2021 and was filled by 168 registered companies in portal casA+, from a total of around 1400 registrations (sample = 12%).

Type of company registered in OSS:

- Most common companies registered in casA+ are directly related to the construction work sector (electricians, plumbers, windows installers, etc.), HVAC technicians and renewables installers.
- Installers' age range from 40 to 49 (50%), 50 to 59 (23%) or 30 to 39 (20%)

OSS Registration process and portal use:

- 90% of the registrations in casA+ was intentional
- 99% of the companies intends to keep the registry in casA+
- 48% knew about casA+ through programs and incentives, while 20% knew through ADENE the Portuguese Energy Agency and casA+ manager, and only 10% through the internet
- 41% visits casA+ weekly, 18% monthly and 31% occasionally
- 86% considers the overall quality of casA+ good, very good or Excellent
- 33 respondents pointed out some improvement as the registry process (simplify), allow for data export in editable formats, and improve companies searching engine



OSS Membership and benefits achieved:

- 68% reported to know about the different benefits available in different membership plans
- There is some confusion among the companies on the plan name they applied (suggesting that in the future it is necessary to clarify the different membership plans name to be more obvious)
- 50% of the companies said that the available functionalities in casA+ already allowed them to sign products and services to homeowners
- 46% of the products signed were the ones in the improvement measures available by the EPC and casA+
- The majority of companies (87%) did not assign any other products/services than the ones related to the EPC and casA+ identified improvement measures
- 76% considers the companies evaluation system implemented in casA+ an addedvalue for them
- 81% considers that improvements in buildings energy performance of their clients was achieved after the implementation of the measures available in casA+
- Other improvements were also achievers as for example thermal comfort (33%), air quality (8%), bills cost reduction (35%), property value increase (20%) and others (3%)

Conclusions

- From the homeowners' perspective: prioritize the development of functionalities based on the homeowners' expectations, promote a stronger communication strategy along the local Energy Agencies to disseminate the OSS and its services and explain better that casA+ is not the Funding Program, but an advice/support platform for energy renovation uptake.
- **From the companies' perspective**: to promote more webinars among stakeholders to explain better the benefits of casA+ and reformulate/simplify the membership plan.

Based on the questionnaire results (Q1) it was possible to identify **2 new functionalities** as priorities for development and implementation:

- Automatic improvement measures proposal (Error! Reference source not found.): Indicates automatic improvement measures by analyzing the information on the energy certificate and suggests new improvement measures not yet identified. This new functionality is accessible in the user's private area, in the "Improve my home" tab, and will allow consumers to discover how they can increase efficiency and have more comfort in their home, also facilitating the request for a proposal for each appointed measure.
- Information on financing and incentives (Error! Reference source not found.): making available a page that gathers information on the Incentives and Support Programs in force, responding to the needs of its users. The new page presents some of the available incentives to promote buildings' efficiency and the adoption of good practices that encourage a better use of resources.



Romania

Methodology

Four types of tools were used in the testing approach: stakeholder mapping and interconnections; surveys to selected stakeholder groups; SWOT analysis; incipient business plan of the most preferable OSS option as identified through the survey.

For the surveys, contacts were selected from various relevant stakeholders. Questions were then developed, specifically for each targeted stakeholder groups. The survey content was sent to the list, with prior phone calls for motivation. The answers were analysed by number and agreement level per each question.

Results

The results showed that:

- The users found very attractive the idea of approaching a single source of information for everything they need in home renovation.
- With more than 90% agreement, homeowners answered that OSS services would help in house energy renovation,
- Public authorities answered that OSS would boost renovation rate and reduce energy poverty by simplified bureaucracy, standardized procedures and joint project groups.
- With more than 80% agreement, the EPC assessors believe that the OSS should develop a reliable database of works facilitating also a direct contact between clients and service providers,
- Bank employees are ready to provide real-time financing information to encourage loans for major renovation.

However:

• Almost half of the surveyed homeowners are not willing to pay for an OSS services and prefer an integrate reliable web-portal to find information for their house renovation.

Conclusions

The success of this feature depends greatly on the trust in the system built among all stakeholders, such as they are attracted and motivated to be part of the OSS.

Based on the surveys, the following SWOT analysis was carried out for the most preferred OSS solution: an internet platform with information on auditors and companies of materials / execution by localities / counties.

Table 4: Results of the SWAT analys	sis of the Romanian user test
-------------------------------------	-------------------------------

STRENGTH:	OPPORTUNITIES:



 It addresses a lenergy renovational in the provides a usynchronized at for all stakehold. It brings together relation to build. It prioritizes good feedback from lenergy renovational or loca. It allows statistics national or loca. It allows inter-databases (EPerproviders). 	arge industry: building on inique and potentially nd updated platform lers. her all stakeholders in ling renovation. bod services based on beneficiaries. ompetitiveness among tics and real data for l reports and by sector. pt under control by operability with other Cs, logbooks, service	 It allows the monitoring of the sector dynamics (growing or shrinking) and level of involvement or commitment of various actors. It identifies where there is need for more workmen. It identifies weaknesses in the renovation process. It may boost high quality building renovation by well concerted activities based on large collaboration among all stakeholders. It makes easy for authorities and decision factors to identify the level of implication of various stakeholders and take measures to motivate them more. It may dynamically grow in time as other databases are developed.
WEAKNESSES:	т	THREATS:
 Not easily stakeholders, es are not accusto Of limited use information i uncovered serv It will take consi sufficient stake such as to make 	accessible by all specially end-users that med to internet. e if not all relevant s included, leaving ces. derable time to involve sholders of all types, it work with efficiency.	 If not fully serviced, it may induce confusion and mistrust among stakeholders. Unfair distribution of works among service providers may lead to corruption and/or inefficient outcome (few or low-quality services). If not well administered, it may consume resources without a useful result on the market.

The services that the OSS should provide are the following:

- Interoperability with national/local databases, such as the EPCs, the EPC assessors, building logbook, relevant companies, where both consumers and service companies (including EPC assessors) can consult information significant for the activities to undertake;
- Tailored recommendations to improve energy efficiency for the house of the consumer asking for counselling, corelated with the relevant information included in the EPC (pre-existed or just required);
- Technical advisory, when consumers, energy auditors, material/equipment suppliers, and execution companies form teams for optimizing the final solutions to implement;



- Counselling on how to access the most favorable financing support, including subsidies or other incentives from public funds;
- Access to prices and special offers from companies;
- Access to feedback from prior clients on any other stakeholder involved in similar tasks.
- Examples of sound completed and monitored projects, if agreed by owners;
- Proper confidentiality about personal data and building owned in relation to other stakeholders.

If the most preferred OSS is the web-platform, it needs an administrator that must be paid. Therefore, some **pricing strategy** is needed. To motivate consumers to access the platform without being afraid of costs, it is advisable to have subscriptions for the service providers only, per time-period (e.g., for one month, 6 months, 1 year), with a starting free of costs period. In this manner, the service providers have the chance to evaluate the system efficiency and their advantages to be part of it. In addition, a small fee should be applied when accessing various databases, which will also support the development of those. The platform administrator must regularly update the platform and monitor its dynamics, and the balance between requests and offers. The result will suggest improvements to be made. In the end, a good management of the platform will impose the optimum pricing strategy.

The stakeholder Directory must be very well organized and transparent, allowing the consumer to choose herself/himself the needed service provider for the house renovation. On the other side, commitment and good practices must be assumed by the installers/companies.

- EPC assessors, energy auditors
- Material suppliers
- Equipment suppliers
- Installers/builders
- Financial advisors
- Legal framework advisors

Information must be allowed to be accessed in all directions, provided that confidentiality is respected (Figure 6). Pricing strategy, and marketing, operational and sustainability plans are to be addressed once the OSS is ready to be set.





Figure 6: Data/information flow suggested by the Romanian OSS user test

Denmark

Methodology

The user testing was done through persons interviews. From 2016 – 2019 the DEA collected 405 Better Home plans from which 24 was selected as meeting the criteria set for the study. The criteria for selecting suitable candidates for interview is the following:

- BetterHome plan issued from 2016-2019
- Building erected before 1980
- Building must have application code 120 or 130 from the Danish building code corresponding to a small family house or a terraced house
- \odot Building must have heated area of at least 100 m^2
- BetterHome plan must contain suggestion of replacement of windows or panes
- BetterHome plan must contain at least one re-insulation proposals
- Building without district heating or heat pump must contain suggestions for heat conversion
- Total budget for energy renovation must be larger than € 13.500 (≈DKK 100.000)

From this sample size 10 persons agreed to participate in the interviews, resulting in 8 homeowners actually participating.

The interview contains questions regarding the entire process around the BetterHome report. This includes the following phases:



- Planning by the homeowner
- Performance of the report
- Evaluation of the received recommendations

If a renovation has been performed:

- Financial solution
- Planning of the renovation
- Results and performance of implemented recommendations

The only challenge found in delivery of the test was that some participants withdrew their willingness to participate in the interview after we had obtained consent.

The interviews will result in a report that summarizes the findings, and draw conclusions based on the answers from the participants.

Results

Quantitative data:

The users did not rate the scheme themselves. Instead, the experts performing the interviews have quantified the interview results, by providing a score based on the responds from the interviewed participants. The following is the average score:

- Satisfaction with BetterHome-report: 3.0
- Satisfaction with BetterHome consultant: 3.4
- Overall satisfaction with the BetterHome-plan: 3.0

Scale of 1 to 5, where 1 = Very dissatisfied, 2 = Dissatisfied, 3 = Neither or, 4 = Satisfied and 5 = Very satisfied

In total, the specific BetterHome plans from the participants provide 34 proposals. Out of these, the homeowners implemented 10. There are 3 cases of larger investments concerning conversion to heat pump. The rest of the investments are minor, such as replacement of thermostatic valves, re-insulation and conversion to low-energy windows.

Qualitative data:

The users had different motivations when ordering a Danish BetterHome report:

- Lack of comfort
- Search for savings
- Energy overview
- Uncertainty about heating systems / Gain knowledge



Motivation:

Almost everyone refers to the fact that they have bought an older house and therefore needed good advice on where to start or move forward with improvements already started.

Satisfaction with the plan:

A satisfaction with the BetterHome plan scores 3.0. It covers the fact that some homeowners feel that they have been given a better overview of specific renovation options, but also that some others feel that they have not become so much wiser. They have been more confirmed in what they already knew.

The greatest satisfaction is expressed among the homeowners who have received the BetterHome plan for free and who at the same time have a larger and elder house. In any case, it is clear in these answers that there have been a special need to get an overview of possible energy savings.

Willingness to pay:

During the interview, it was also investigated whether the interviewee was missing elements in the BetterHome plan, eg monitoring of water consumption or monitoring of energy consumption. Most participants answered that it could possibly have some interest. It could be interesting with both the one and the other. Here, among other things mentioned like installation of wind turbines and analysis of actual electricity consumption. When asked if they were willing to pay an additional fee for this service, they were more reluctant and declined.

Recommendations for an improved OSS in Denmark:

- 1. **Digitized BetterHome plan**: It is an issue that the BetterHome report is outdated as the underlying conditions changes eg. Energy prices. It is suggested, that the BetterHome and the underlying parameters will be converted into an online version, making it possible to update.
- 2. Linking Energy Label and BetterHome plan: It is mandatory to acquire an EPC when selling or renting a house. In extension it could be valuable to offer house buyers a BetterHome plan to a favourable price, to show them the energy efficiency potential when the house typically is refinanced and renovated.
- 3. **Discount on new Energy Label:** When performing energy renovations described in the BetterHome plan, it should be possible to update the EPC at a reduced cost.



- 4. A clearer distinction between large and small issues: There should be a distinction between small energy renovations and larger deep renovations. Changing the faucet should not be presented among re-insulation or conversion to low emission windows.
- 5. **Financing offers must be able to be entered in the BetterHome plan:** The BetterHome does include cost and savings, and encourages the homeowner to begin the dialogue with a financial institute. The loan offers and consequences should be further integrated in the BetterHome solution. It should be possible to update the rate of interest and payback. This suggestion is more or less dependent on suggestion 1.
- 6. **Key figures in the BetterHome plan:** It is important to include key figures to help with the dialogue with the financial institutes. The key numbers and figures could help promote beneficial loan opportunities with energy recommendations.
- 7. **Discount on continued BetterHome consultancy:** None of the participants have used solution no. 2 from the BetterHome consultant. That could be altered by providing some discount on the second solution if the homeowners performed a minimum of energy renovations.
- 8. **Discount on follow-up BetterHome consultancy:** The BetterHome consultant could provide additional consultancy. He should then be able, under certain circumstances, to follow the energy renovation in the house. It could be financed by subsidies provided by the state or municipality.
- 9. **Direct discount on the BetterHome plan:** The willingness to pay for the solution was not very high based on the interviews. Existing subsidies on the market was not sufficient as well. It is then recommended that the subsidies are focused on reducing the cost connected to achieving a BetterHome report.
- 10. BetterHome plan proposal for the purpose of obtaining craftsman offers: The BetterHome report should be able to facilitate specific offers from craftsmen making it more concrete. An alternative solution could be to offer it as an add-on solution to the existing BetterHome solution.
- 11. **Special efforts towards first-time buyers:** The focus should be on first-time buyers with bad EPC's. Making them aware of the possibilities by getting a BetterHome report. With the right information or a discount the first-time buyers could be motivated into accelerate potential future plans of renovating their house.
- 12. Encouragement from the municipality and others: In addition to suggestion 11 the authorities could facilitate that municipalities and local entrepreneurs could contact homeowners with a low scored EPC. This could be as a public-private collaboration.

Cross cutting criteria

Note many detailed questions on cross-cutting criteria were less applicable to Romania, where the test project involved exploring the value of the OSS approach in general, rather than an exploration of specific, detailed approaches to building on EPCs in existing or planned OSS systems.



Quality and Reliability

All testing countries agreed that the purpose of the OSS approach (either initiating a OSS approach as in Romania, or in developing it as in DK/UK/PT) is to provide additional reliable information, including fundamental technical knowledge where appropriate, needed to take decision on building renovation measures.

In terms of training, Portugal is primarily considering development of new online tools/functionalities so staff/assessor training is not required. In Denmark there is a focus on building a more trained assessor workforce able to advice homeowners using the Better Homes Report. In the UK the feature would require additional training of OSS advisors to enable them to make better use of EPC and other data.

User-Friendliness

All countries indicated that part of the (enhanced) OSS functionality would be to present data in a user-friendly way, including graphical formats (see Portugal results) and maximising the value of digital approaches to show how results change as e.g. energy prices change (see Denmark results).

Multiple benefits – at least as far as cost and carbon and thereby limiting fuel poverty – are also indicated as an important consideration in delivery. ADENE found from their questionnaire that home owners implementing measures using the OSS service identified that additional benefits included: more comfort (37%), air quality (8%), bills costs reduction (27%), property value increase (24%). Retrofit companies identified that customers benefited from thermal comfort (33%), air quality (8%), bills cost reduction (35%), property value increase (20%).

Economic Feasibility

The question of economic feasibility depends on the economic and delivery model adopted for the OSS service.

The willingness to pay for in-home assessments remains a challenge. E.g. the Danish results state that "The willingness to pay for the solution was not very high based on the interviews." Danish experience also shows that paying additional costs for more advanced services is challenging – e.g. in Denmark householders were in principle interested in advice on water saving or on real energy use, but weren't willing to pay for this.

However, is unlikely that a new or enhanced OSS, drawing on EPC data, would add directly1 to the headline cost of the EPC to the homeowner. Thus, Romania state that "The OSS

¹ Note that, in part, the Portuguese advice agency ADENE is funded by a levy on EPCs.



includes EPC services and not vice-versa," and Portugal reports, "It complements the EPC, and it is free for homeowners to use it."

In many models of an OSS – which involve at least some degree of public financing - it is likely that the additional functionality would add to costs to the public sector.

All the enhanced services considered in the testing in PT, DK and UK involve additional data from the base EPC. However, in all three cases the concept is that this would be an additional, separate data collection to the EPC process: in the UK the data would come from smart meters; in Portugal from the homeowner using an online tool; in Denmark from a separate assessment visit as part of the Better Homes service.

2.3 Conclusions and discussion

The OSS Feature is overarching/crosscutting with other X-tendo Features that would be delivered in an OSS concept as shown in the figure below.



Figure 7: Overlap of the OSS feature with other features in X-tendo

Based on the results available so far, all the tests reconfirmed the value of the OSS approach. Enhanced usage of EPCs in OSS delivery is important to this:

- Romania Results showed the overall value of a possible OSS approach results data did not so far did not assess in detail how EPC delivery would fit in the model.
- Denmark The context is that the Better Homes Service has data compatibility and builds from the EPC.
- Portugal The Portuguese OSS is closely integrated with EPC delivery e.g. people would use new online tools based on the results of their EPC. The key functionalities identified as a priority are: a) building on EPC data to indicate automatic improvement



measures by analysing the information on the energy certificate and suggesting new improvement measures not yet identified and b) providing new financing advice.

• Scotland – The Scottish test identified how EPC data could be used alongside other datasets (especially Smart Meter data) in providing more motivating, personalized and effective advice for households. However, costs – to the public sector – are likely to be higher for the OSS delivery to do this and taking this forward will depend on Scottish government budgets and commitment.

Moving beyond the provision of reports to supporting action remains a challenge across the OSSs. EG in Denmark the householders involved all took up a stage 1 assessment, but none wanted to take advantage of the stage 2, whereby the assessor would work with the householder on getting quotes for measures etc. The consultant who undertook the testing wrote in their Report, "In summary, the results of the eight interviews are in line with the results of the survey that Niras conducted in 2016. Here, it was found that the BetterHome consultancy had had an impact on the homeowners in a number of areas and that the BetterHome consultancy had helped to qualify the homeowners' knowledge about renovation and energy consumption. In addition, it was concluded that the BetterHome consultancy had only had a minor impact on the renovation process (financial management, budget, and time schedule), and that very few of the homeowners had used the consultant to manage the renovation they had completed. Not least the latter is more than confirmed by the current interviews, where no one has used the BetterHome consultant for anything after the preparation of the BetterHome plan."

In Portugal, 59% of householder respondees said that the available functionalities did not contribute to implement improvement measures in their homes, yet.

The identified next steps for improving the services and tightening the integration with EPCs should help with making action more possible – e.g. in results from all countries (other than Scotland) the emphasis put on additional support with financing options will be very important – see also Feature 9. Similarly improved and more accurate recommendations as was tested in Portugal (and see also F8) will be key.



3 ANNEX

3.1 Questionnaires

Table 5: Exemplary questionnaire for in-building tests

General questions and testing steps	
Provide a short summary of the test you are carrying out. Please describe in your words.	
Overall, how easy or difficult was the feature to implement? Please select an option.	
How easy or difficult was it to explain the feature to the assessor and/or other stakeholders	s
involved in delivering the test? Please select an option.	
List all of the planned steps for implementing the feature. Please list performed tasks in each	ch
step	
Were you able to perform each step? Please select an option for each step	
[Only answer this question for options you selected "No" or "In part" in previous question]	
Why were you not able to perform or complete these steps? Please describe in your words	•
[Only answer this question if you were able to perform the step and you faced any	
challenges]	
Did you face any challenges in steps that you were able to complete (for those you answere	ed
"Yes")? Please describe in your words.	
Overall, how feasible is it to include the feature as part of a standard EPC assessment? Plea	se
select an option.	
Explain your answer to the above question. Please describe in your words.	
Testing time & costs	
How much time (in minutes) did it take to perform each step	
What are the approximate costs incurred in each step? Please specify the positions as well	as
an approximate estimate. (Costs per EPC)	
Cross Cutting Criteria	
Quality and Reliability	
Are the calculation methods clearly described?	
Is the required input data clearly asked?	
Is the user provided fundamental technical knowledge needed to understand the deta	ails
of the feature?	
Is training of experts/assessors needed for the feature?	
Are the results shown transparently?	
Does the user have access to formulas/application interface?	
Does the user have access to weightages for the calculation of results?	
Are measures foreseen to ensure that data collected is verified (e.g. completeness,	
accuracy timelines etc.)?	
Is training of experts/assessors needed for the feature?	
User-friendliness	
Are the technical terms used provided in a glossary?	
Are the references to documents provided?	
Is the stepwise description for feature assessment provided?	
Are the results presented in graphical way?	
Did you consider the impact of graphical results on the user?	



		Does the evaluation of the feature consider flexibility to adapt the methodology to
		different building types?
-		Are the multiple-benefits (health, energy, cost saving etc.) of the feature studied?
	nomic feasibility	
		Does this feature increase EPC costs?
		Does the methodology require additional data to the one already included in current
		EPC derivation?
		If additional data is required, does it take longer than 1 hour to gather them?
		Is an additional on-site visit or measurement needed?
	Con	sistency with ISO/CEN standards
		Have any national regulations been used in the methodology of this feature? If yes,
		which one?
		Is the data used for the feature already covered by the current EPC?
Final thoughts		
	Do you have any suggestions for improving this feature? For example, the description,	
	recommendations, modules, or calculation methodology. Please describe in your words.	
	Do you have any other comments? Please describe in your words.	



Table 6: Exemplary questionnaire for system test

Questions		
Provide a short summary of the test you are carrying out. Please describe in your words.		
Overall, how easy or difficult was the feature to implement? Please select an option.		
List all of the key changes you planned to make to the existing 'back-end' EPC systems to		
enable the feature. Include all changes, whether they were successfully implemented or not.		
Please put a small description (5 words or less) for each change in a cell.		
Were you able to perform each planned change? Please select an option for each change.		
[Only answer this question for options you selected "No" or "In part" in previous question]		
Why were you not able to perform or complete these steps? Please describe in your words.		
What are the major challenges in implementing the new feature? Please describe in your		
words.		
What are the main advantages of the feature? Please describe in your words.		
Explain the major areas of monetary cost in implementing the new feature. Please describe in your words.		
What can be done to minimise the monetary cost in each area? Please describe in your words.		
Cross Cutting Criteria		
Quality and Reliability		
Are the calculation methods clearly described?		
Is the required input data clearly asked?		
Are the results shown transparently?		
Does the user have access to formulas/application interface?		
Does the user have access to weightages for the calculation of final results?		
Are the specific requirements to carry out the assessment outlined for assessors?		
Is training of experts/assessors needed for the feature?		
Are the qualification requirements clearly outlined for experts/assessors?		
User-friendliness		
Is the stepwise description for feature assessment provided?		
Are reporting templates used?		
Is the calculation/process description provided in guidelines?		
Does the tool have stepwise description of the assessment?		
Economic feasibility		
Does the implementing need additional infrastructure in the form of servers, programs,		
? If so, are these costs higher than €1000 to purchase, according to a rough		
estimation?		
Are there high skills (for example: IT and programming knowledge) required to		
implement and handle the feature?		
Consistency with ISO/CEN standards		
Have any national regulations been used in the methodology of this feature? If yes,		
which one?		
Is the data used for the feature already covered by the current EPC?		
inal thoughts		
Do you have any suggestions for improving this feature? For example, the description,		
recommendations, modules, or calculation methodology. Please describe in your words.		
Do you have any other comments? Please describe in your words.		



Table 7: Exemplary questionnaire for user tests

Questions		
Provide a short summary of the test you are carrying out. Please describe in your words.		
List all of the planned steps for delivering the test. Please put a small description (5 words or		
less) for each step in a cell.		
Were you able to perform each planned step? Please select an option for each step.		
[Only answer this question for options you selected "No" or "In part" in previous question]		
Why were you not able to perform or complete these steps? Please describe in your words.		
[Only answer this question if you were able to perform the step and you faced any challenges		
Did you face any challenges in steps that you were able to complete (for those you answered		
"Yes")? Please describe in your words.		
How well did the users understand the feature? Please select an option. (Only answer if a		
question regarding perception was in the questionnaire)		
What did the test tell you about how much users find the feature useful? Please select an		
option.		
What did the test tell you about how much users liked or disliked the feature? Please select		
an option.		
What did the test tell you about how users would use the information provided in the new		
feature? Please describe in your words.		
List the headline quantified results from your test, for example, the percentage of users who		
found the feature useful. Please describe in your words. (Please provide at least the top 3		
findings)		
Did users make any suggestions for changing the feature? Please describe in your words.		
New questions		
Please describe the participation in the survey (number of participants, potentially split to		
different target groups; share of returned questionnaires)		
Please describe the objective of the survey		
Please describe the main questions asked		
Please describe the main findings of the survey		
Please provide us with quantitative results in the form of additional xls file as much as		
possible (e.g. anonymised filled questions or aggregated results of the survey questionnaires		
Testing time		
How much time (in minutes) did it take to perform each step		
Final thoughts		
Do you have any suggestions for improving this feature? For example, the description,		
recommendations, modules, or calculation methodology. Please describe in your words.		
Do you have any other comments? Please describe in your words.		



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