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STEP-IN

D5.3 – Energy Poverty Assessment and Reduction Tools Version V2

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Abstract: This deliverable contains an overview of version one of the STEP-IN ICT tools (e.g. the architecture, web platform and server).

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Glossary

Abbreviation / acronym	Description
DB	Database
LL	Living Lab
UI	User Interface, what the user sees on the screen.
Client	The web system which is used to enter or see data.
Server	This is what is used to allow users to reach the website. It's where the main code runs.
Users	The types of users and roles. For V1, only consumers, advisors, researchers and super administrator are implemented. Advisors and researchers act as administrators.
HTTP / HTTPS	HyperText Transfer Protocol. This is the protocol used for the communication between client and server. HTTPS is the secured variant.
HTML	HyperText Markup Language. That's a programming language used to develop web pages.
JavaScript (or JS)	A programming language used to create scripts, which allow a website to be dynamic.
CRUD verbs	The most commonly http used methods: POST, GET, PUT/PATCH and DELETE. CRUD stand for Create Read Update and Delete
SQLite	SQLite is the library used as SQL database engine. This is what we use to store and access data.
Angularjs	This is a framework used to develop reliable code in JavaScript.
D3Js	This is a library used to draw graph on the web app.
JSON	JavaScript Object Notation. It is a textual file format used to describe object (data) for a use in JavaScript.
CSV	A file format using commas as a way to create a tabular data structure

Executive Summary

This document outlines the implementations for version 2 of the STEP-IN ICT tools. This document provides a progress report for the second version V2 and is not the output deliverable itself for work package 5. The STEP-IN software tools and platform provides the actual deliverable. This document is primarily of technical nature and is of interest to those considering deploying or developing similar software tools and solutions.

Following on from discussions within STEP-IN it had been identified that the primary users of the first version of the ICT tools and platform during the first living lab cycle were the energy advisors. In the second version of the software tools, further functionalities were introduced to also provide access and information to the consumers on the platform. This further development is reflected in how the tools are designed and implemented. In this version of the STEP-IN ICT platform, freestanding advice has been integrated through a media centre where consumers can access general information specific to their country, region and city on how to improve quality of life regarding energy. The ICT platform also acts as a way for the energy advisors to collect data from individual consumers and then provide relevant advice to the individual consumer either through the energy advisor or to the consumer directly. This document outlines the further developed components and functionalities of the system, ranging from software architecture and its deployment, to the user interface with access possibilities for 4 different type of users (researchers, energy advisors, consumers, public) and its tools depending on the permission a user has. The system supports features from the uploading of consumption data from sensors and questionnaires, through analysis of energy consumption and behaviour to visualisation of energy consumption and advice reports for the individual consumer.

A short description of the overall architecture is also provided. A web-based platform was chosen as this avoids issues with the installation and updating of software and potentially makes the platform more widely available as the underlying IT requirements are quite small.

Introduction

This document is intended to summarise the ICT tools platform within STEP-IN which form the actual deliverable D5.3. It provides an overview of the progress of the ICT tools. The previous deliverable D5.2 provided an overview and first implementations of the architecture features. Both, D5.2 and 5.3 should be read in conjunction with D5.1, which documents the underlying requirements and platform design. It should be noted that version V1 of the ICT tools focussed primarily on data collection and interoperability to make information available to energy advisors (see also D5.2). Version V2 of the ICT tools focussed on the improvements of the web interface to improve usability, the implementation of an energy advice tool for individual advice of consumers and the implementation of a knowledge base for general advice to the public without having to log in. The iterative (V1-V3 cycles) process in the project means that lessons learned from the Living Labs and in particular the ICT tools have been used to improve the platform during version V2 (and will be also used for version V3). In particular this includes more behaviour change advice and also connections to third party systems such as energy analytics tools through the platform. Version V2 of the platform is a direct result of extensive work between the Living Labs and LIST, in particular around further feedback from the Living Labs and testing from identified users, mainly energy advisors and researchers but also feedback from consumer groups, of the platform. For example, during the early stages of the project it was intended for consumers to be the end users; however it emerged that many consumers will not have continuous access to mobile devices or the internet. Therefore, it was decided to focus on providing a platform for use by energy advisors. This was again corrected in version V2 as consumers now need to and can access the platform to retrieve their personal advice reports. The system is web based, which means that no installation for the individual user is required, and the users do not need to worry about updating any software. Instead updates will be available automatically on the individual servers of each Living Lab (LL).

STEP-IN is not the only project which is working with ICT tools to assist in understanding energy consumption and behaviour change. In the UK, and in particular Manchester, a national project LEAP has been established which developed a mobile app to gather data from energy vulnerable people. As this is linked to a funding program and energy advisors are already having made good experiences with this commercial application, Manchester LL decided to make use of this tool. Nevertheless, the STEP-IN platform is able to upload gathered data from other tools and provide additional tools and visualisation for other tools used in STEP-IN. As STEP-IN progresses, it will seek to build further upon best practice and the existing work of partners (in particular LIST) to provide a range of ICT tools to assist those who are facing challenges in managing their energy bills and consumption.

This summary report presents an overview of the objectives of V2 and the underlying architecture, it then explains the core components including the web interfaces, front and back end along with an overview of aspects such as user management and visualisation. It also includes an overview of deployment and data protection issues and concludes with some next steps.

1. Platform Description Reminder

1.1 Objectives

As specified in D5.1 and D5.2, WP5 focuses on designing and implementing ICT tools used by energy advisors, researchers, consumers and the public for the following tasks:

- To support data collection and integration in the Living Labs;
- To provide analysis to help in the understanding of energy poverty;
- To provide advice for the consumers;
- To find solutions for energy poor households.

The overall implementation decisions for the platform are discussed in D5.1 and first progress was described in D5.2. Therefore, the intention here is to focus on providing a summary of the advancements of ICT tool to be deployed for LL cycle V2 (see below). These are all provided in the context of the improved and adapted platform architecture, which needed adaptation according to GDPR rules and processing tools:

- Sensors integration and data uploads of consumer households;
- A central platform (described later) used to further implement the tasks raised in D5.1 and progressed in D5.2;
- The platform is deployed in each LL and connects to a data analysis engine to enable effective analysis of energy consumption patterns;
- Multiple types of device (smart phones, tablets, PCs) are able to connect to the platform to interact with it to send, gather and display information from it (e.g. questionnaires, diaries, sensors data, charts).

Feedback sessions have been organised to improve the usability and the design as well as new components such as the knowledge base, of the web interface. Furthermore, consumer access was added, so that individuals can access their personalised advice.

Within STEP-IN three versions of the software platform are planned. During version V1, the aim was to receive feedback before and during each version so that improvements can be made. In particular, the more focussed behaviour change elements will be developed with assistance from the consumers during V1 and rolled out in V2 and V3. During V2, ICT tools will be further tested with energy advisors and consumers and feedback will be implemented already during V2 where possible, as well as after LL cycle V2 to prepare for LL cycle V3.

2. V2 Addition Overview

2.1 Web platform

The following section describes the version V2 of the web platform which is still composed by the back-end (the server) and a front-end (the user interface). You can try the front-end at <https://step-in.list.lu>.

2.1.1 Back-end modifications

2.1.1.1 LL own servers

As described in 5.1 and 5.2, it was decided that each LL will be responsible of the running of its own instance of the server, the website and data storage. As it was not possible to deploy the prototype on each location for V2, we decided to deploy some test instances in Luxembourg, to let each LL try a specific instance of the website. Thus, they will be able to input some data and test the prototype in a close to real condition environment. For this we created a specific route for each LL to let them reach their instance of the tool.

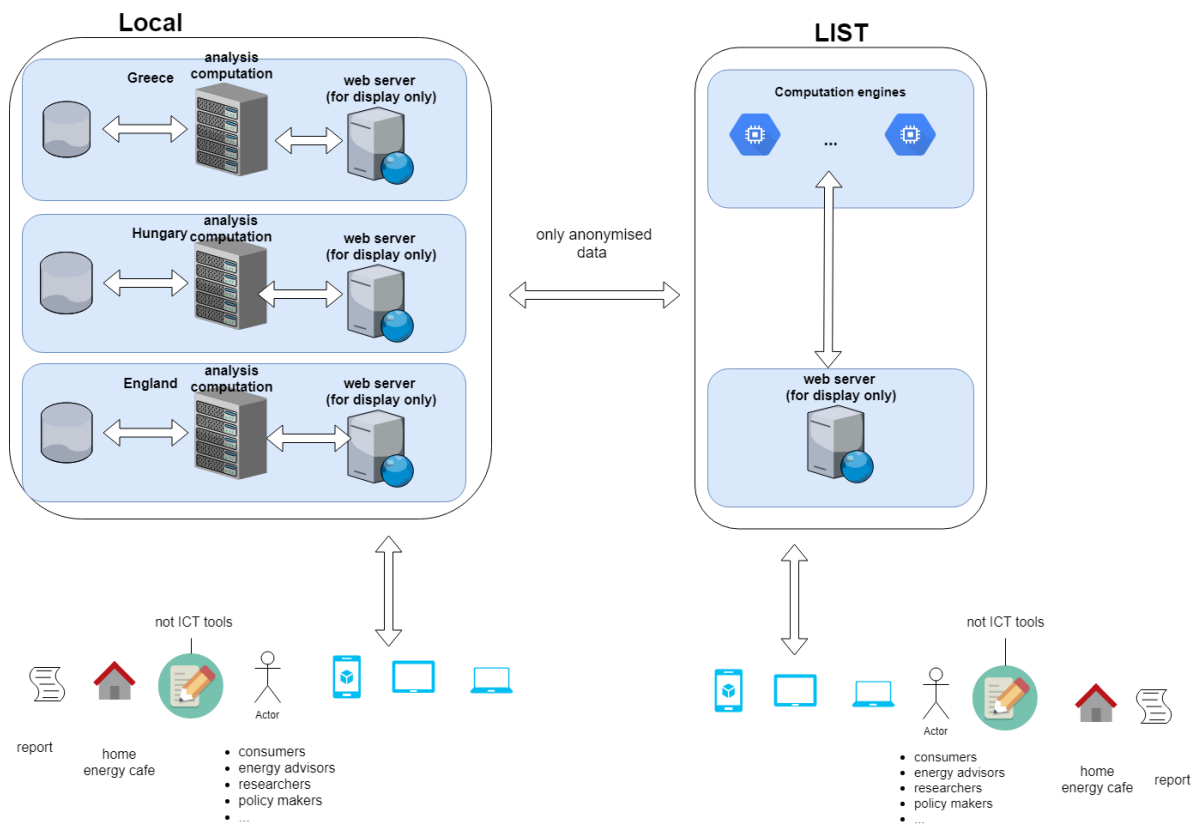


Figure 2-1: Adapted architecture for distributed deployment of the ICT platform.

As we wanted them to be able to navigate on the public content of the other LL, we added direct links to each LL specific instance on the navbar of the prototype to let user be redirected to a chosen instance (see 4.1.2.5).

2.1.1.2 Link to external tool concept

In D5.1 and D5.2, it was defined that the website will be able to use external tools to get results computed with data sent from the website. That means our server will contact an external server, which will be responsible to run the analysis algorithms and then reply with the result, which will be visible on the website.

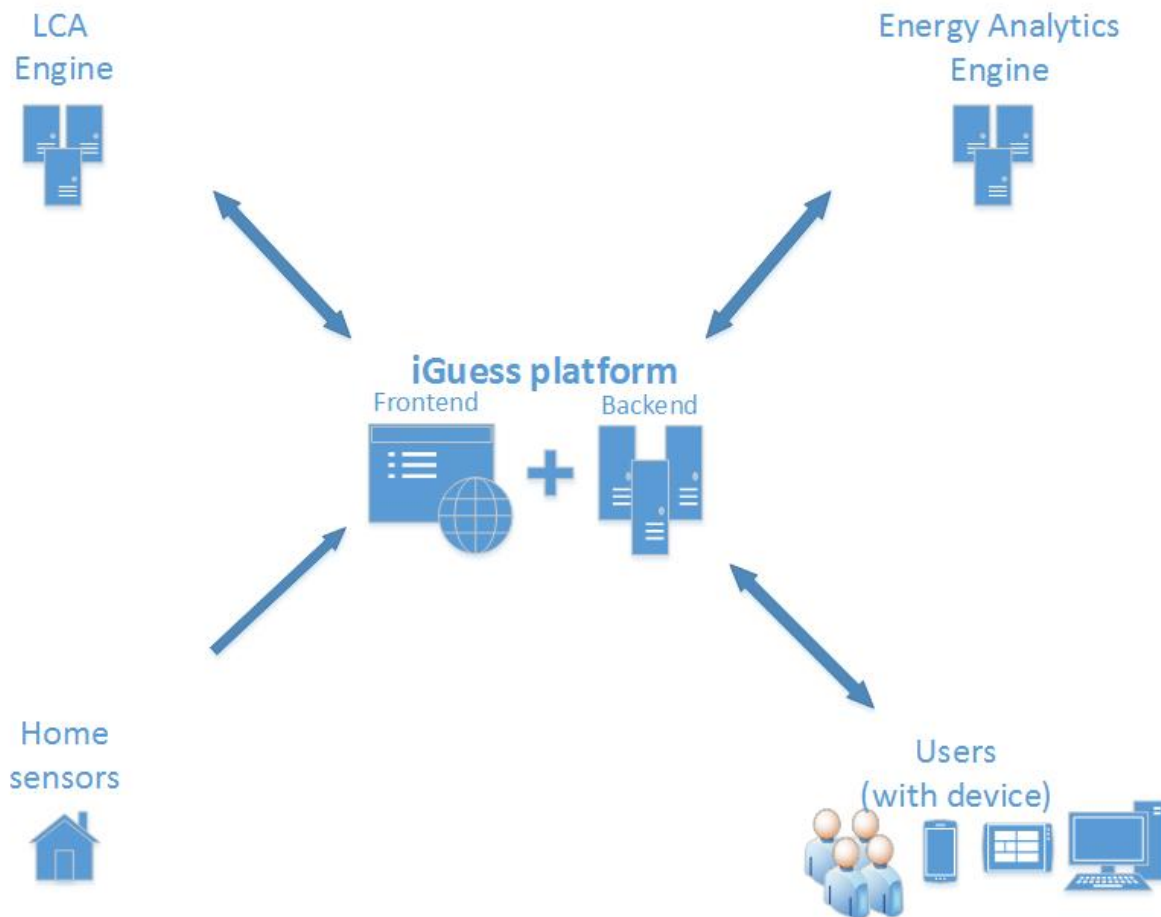


Figure 2-2: Architecture explaining the link to external tools.

Thus, we started to implement the link between tools developed at LIST in Python language and Brightway using a REST API. The same work was started to link the platform to computation engine created in Hungary, using R. The way the analytics engine made by Ariosz team works is describe in the schema below.



Figure 2-3: Workflow of the personal advice tool to provide a advice report as PDF to be viewed online or downloaded for offline viewing and printing on paper.

It takes the questionnaires values (in a CSV file) as input, then uses R to compute a PDF report based on algorithms developed by Ariosz.

2.1.2 Front-end Modifications

2.1.2.1 New look & feel

The web interface look & feel has been adapted to look like closer to the project website (<https://www.step-in-project.eu>).

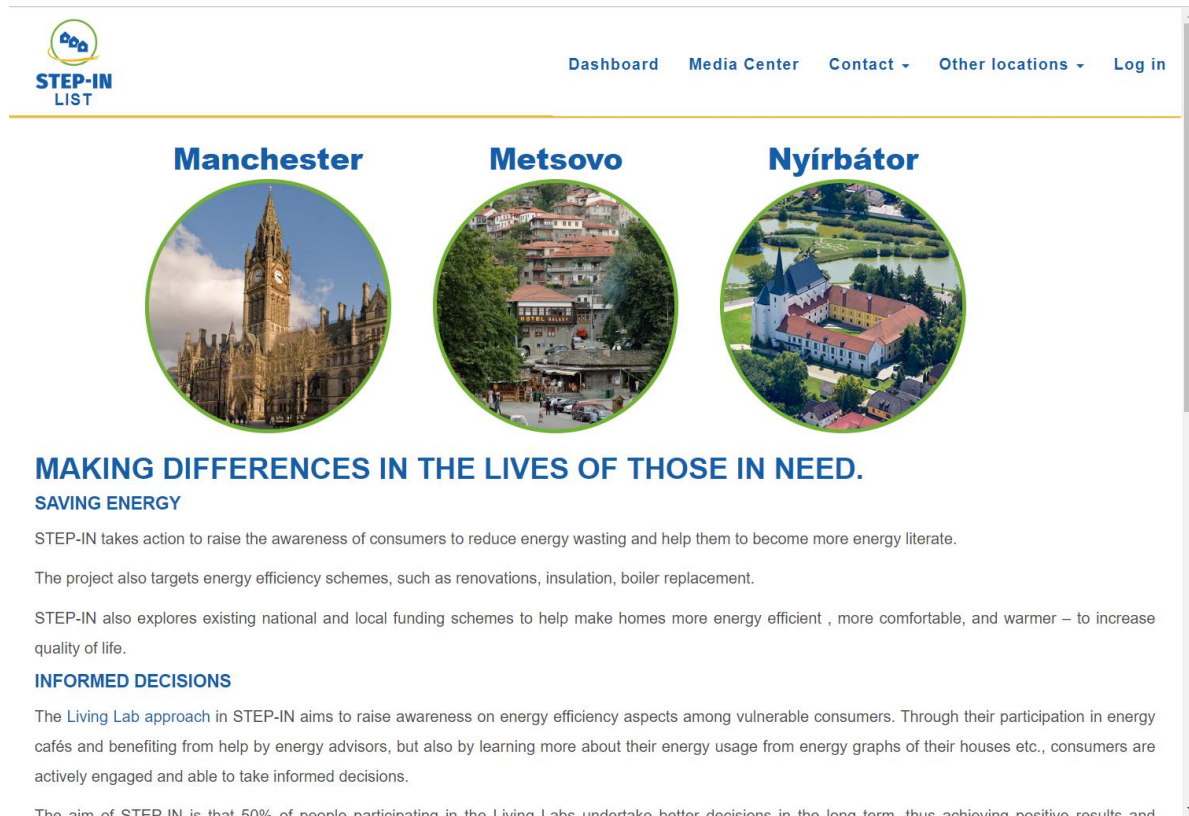


Figure 2-4: The STEP-IN ICT platform start page with its new design and links to the individual LL platforms.

We also changed the dashboard, which is displayed once you select an option. It is now displayed as a miniature version of the usual dashboard on the left-hand side of the page and will be always displayed at the same position while you scroll down a page. This change has been made to improve usability for the users.

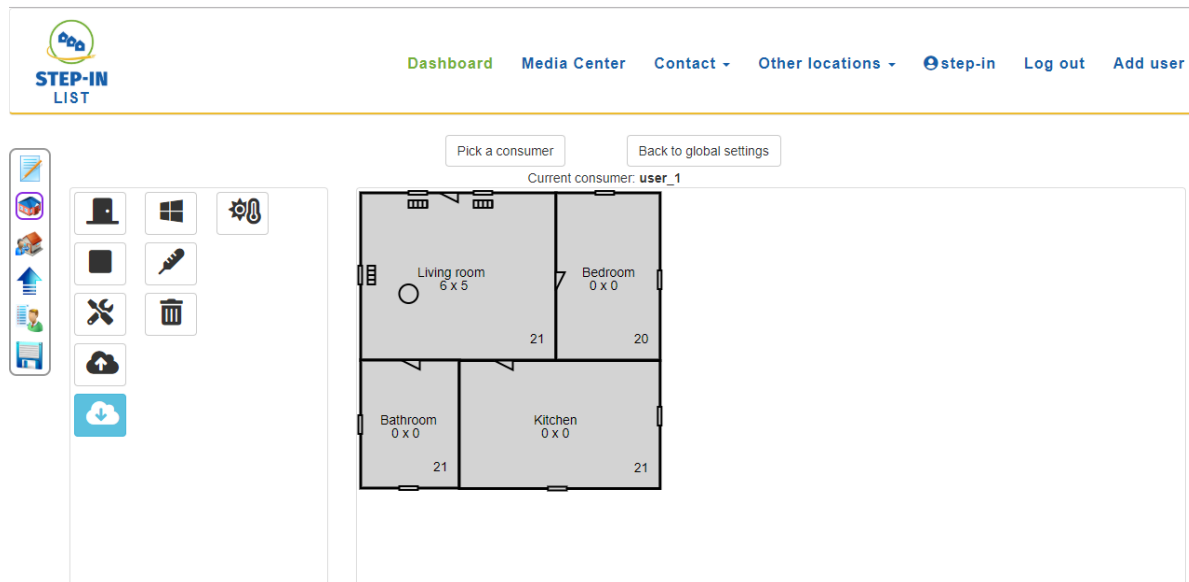


Figure 2-5: The new user interface with a simplified toolbar on the left hand side.

2.1.2.2 Translation

As requested by some LLs, we started to translate the content of the website to let it be more comprehensible by local users. This translation is for now really basic as it is made with google translate. You can see for instance what has been done for Hungary here:



Figure 2-6: An example of the translation capacity of the platform. Here a translation into Hungarian. The same exists for the mountainous LL, in Greek.

2.1.2.3 Public access

Because the web tool is supposed to be tried out by people (e.g. consumers) before adopt it, it has been decided to grant access to not logged users to multiple features of the website. Thus, it has been

decided to switch general advices' access to "public" and to later implement the possibility to get instant feedback about a consumption file uploaded by an unregistered user.

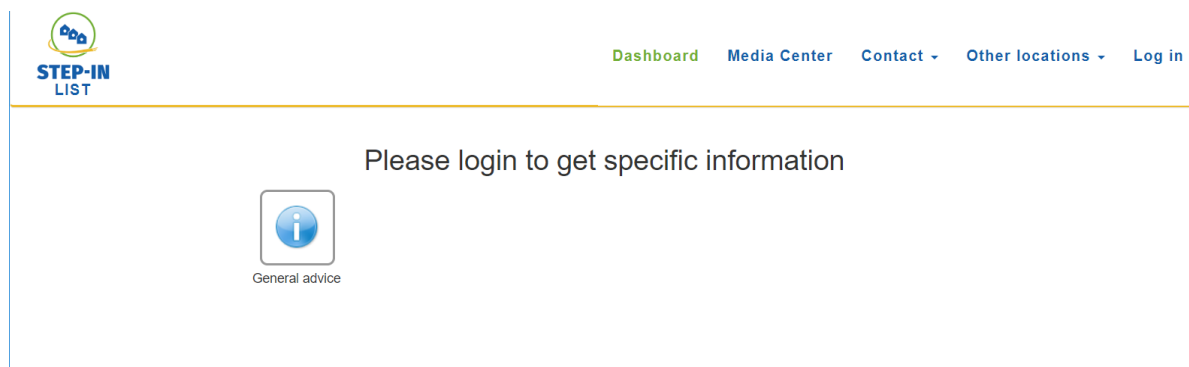


Figure 2-7: Access to general advice without login. For specific (personalised) information a user has to login.

2.1.2.4 Consumer access

Like the previous point, as the tool is also supposed to be used by consumers, it has been decided to put back the possibility for a user to see and download his own data. At this point, it is still questionable to let the user modify his/her information alone (like questionnaire values, room setup, etc...). To proceed, they just need to check the checkbox "wants to connect later" and provide their credentials when they create their account.

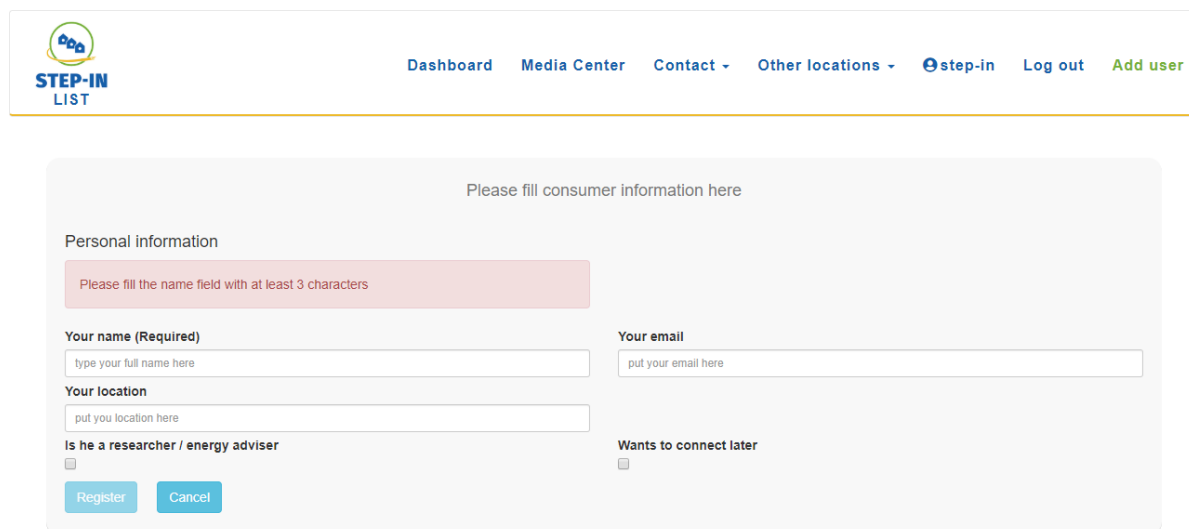


Figure 2-8: Registration or adding of new consumers. Note the check box "Wants to connect later". This enables the consumer to access his/her own data later.

To login, a consumer has to proceed the same way as an advisor or a researcher does, using the login page:

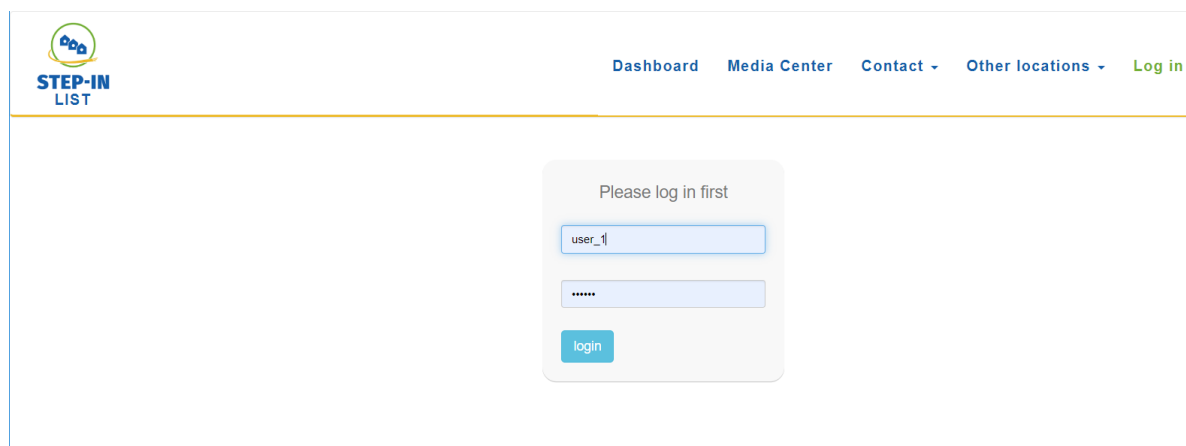


Figure 2-9: Login function. Depending on the role of the user more or less information and features are accessible.

2.1.2.5 Media Center

The Media Center section is a page where you can find all the documents provided for the users (consumers and advisors). There can be found some general information about energy consumption or about the project itself. It is planned later to allow the administrator to upload more documents directly on the website.

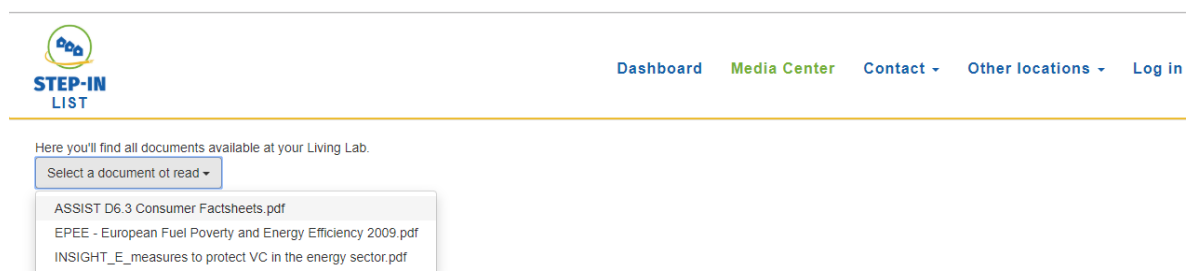


Figure 2-10: The Media Center with general information for the respected living lab.

Currently, selecting a document in the dropdown will let the user to download it.

2.1.2.6 Generic advice buttons

STEP-IN web platform is also supposed to let people get access to general information and advice about energy consumption. This is why we added a new page containing documentation as pdf files where consumers can easily find and download them. It has been decided to later implement the possibility for advisors to upload new documentation.

The screenshot shows the top navigation bar of the STEP-IN platform with links for Dashboard, Media Center, Contact, Other locations, and Log in. Below the navigation bar, a message prompts the user to login for specific information. A 'General advice' icon is displayed. The main content area features a document titled 'Consumer rights – how to avoid risks?' with the ASSIST 2GETHER logo. The document is divided into two columns of text. The left column asks 'What do I need to be aware of as an energy consumer?' and discusses the energy and gas vendors market. The right column asks 'Which actions can be deemed an unfair trade practice?' and discusses misleading consumer practices.

Please login to get specific information

General advice

ASSIST
2GETHER

Consumer rights – how to avoid risks?

What do I need to be aware of as an energy consumer?

The energy and gas vendors market, nowadays, allows free switching of the supplier. Each one of them wants to convince the consumer to use nobody else's but their services. Thus various marketing actions are on the table. Traditional advertising, special offers, incentives to conclude

Which actions can be deemed an unfair trade practice?

A prohibited practice can be misleading the consumer, e.g. with regard to the terms of the offer or the seller's identity. The seller must, in a clear and accurate way, present the commercial terms – if his/her messages are formulated in a way that could mislead an average consumer, we

Figure 2-11: An example for a general advice document displayed at the STEP-IN platform.

2.1.2.7 Personal Advice

As we started the implementation of the external tools like the one provided by Hungary, we were able to display the resulting report that contains some advice in the Personal Advice section. Currently this will provide advice based on a selected filled questionnaire.

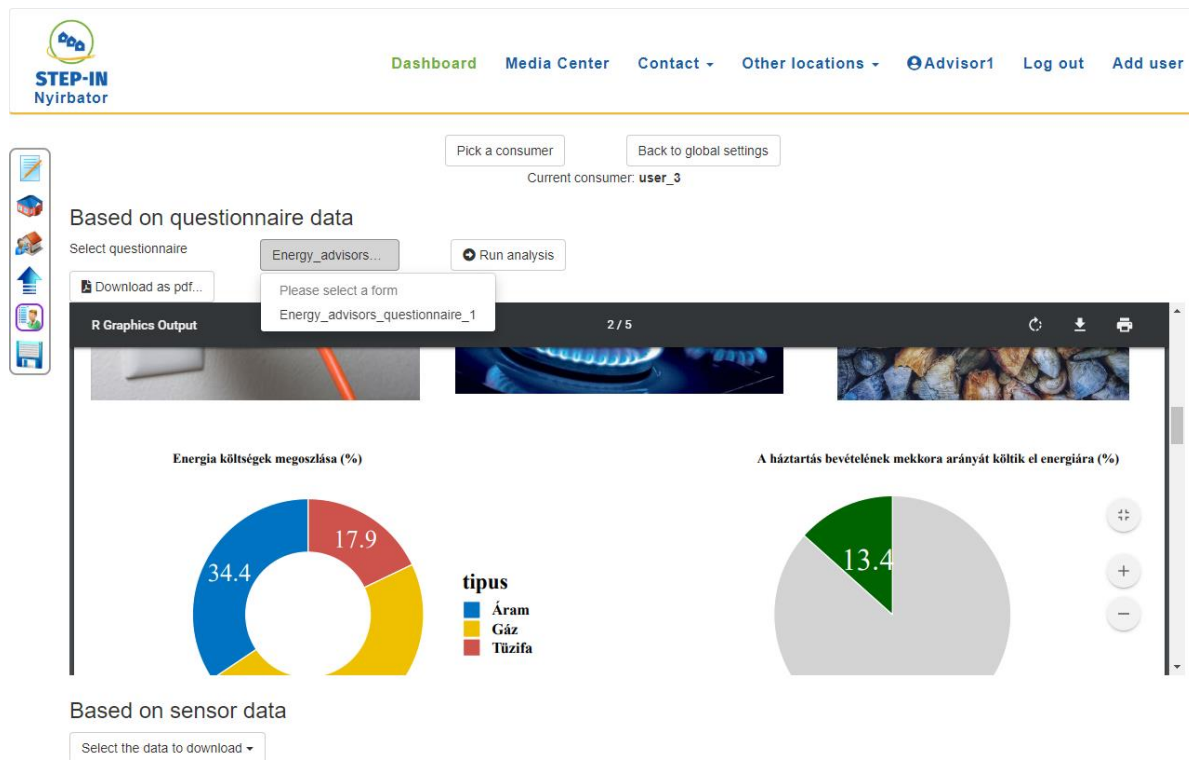


Figure 2-12: A personal advice report generated which can be accessed by the responsible energy adviser and the concerned consumer.

2.1.2.8 Living Lab buttons

As described in the Server part, the 3 LLs will have their own servers running their own instance of the web application, but there will be a “central” instance hosted at LIST to share anonymised data and / or result of the analysis. We decided that it will be used as a central hub able to redirect users to their local instance of the website and server. As we want users to be aware the project is being used / deployed at on multiple locations, we added a combo box in the navbar of the website to let people select which instance of the website they want to use.

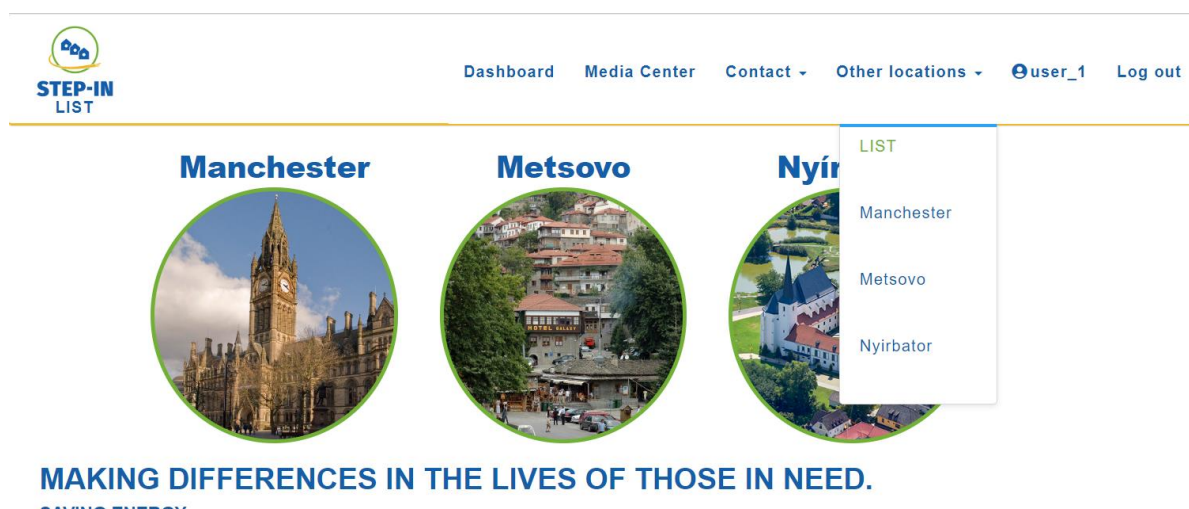


Figure 2-13: In case a user wants to view another LL or look at the overall STEP-IN web page he/she can use the switch in the navigation bar.

If a user changes the location in this combo box, he/she will be redirected automatically to the instance of the website of the selected location. A specific home page has been set up for each LL.

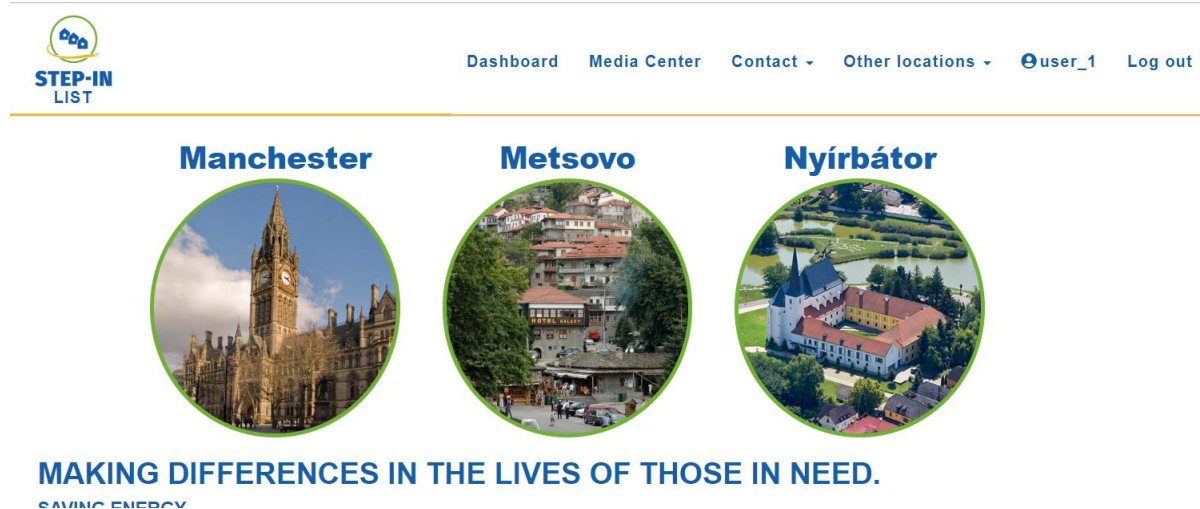


Figure 2-14: Locations can also be changed by clicking on the LL's photo.

Location can also be changed by clicking on one location circle from the LIST home page instance.

2.1.2.9 Questionnaire Builder

As a big part of the advisor is to gather information by means of questionnaires, which were already integrated in the V1 of the web application and as it is clear that the amount of available questionnaires will grow, it has been decided to add a feature letting advisors to create a questionnaire from scratch or starting from an existing one. Thus, a simple interface has been design with:

- A tree on the left allowing to follow the list of elements in the questionnaire,
- Some questionnaire item fields on the right used to design the current item,
- A small preview of the full current questionnaire at the bottom, used to see what has been built so far.

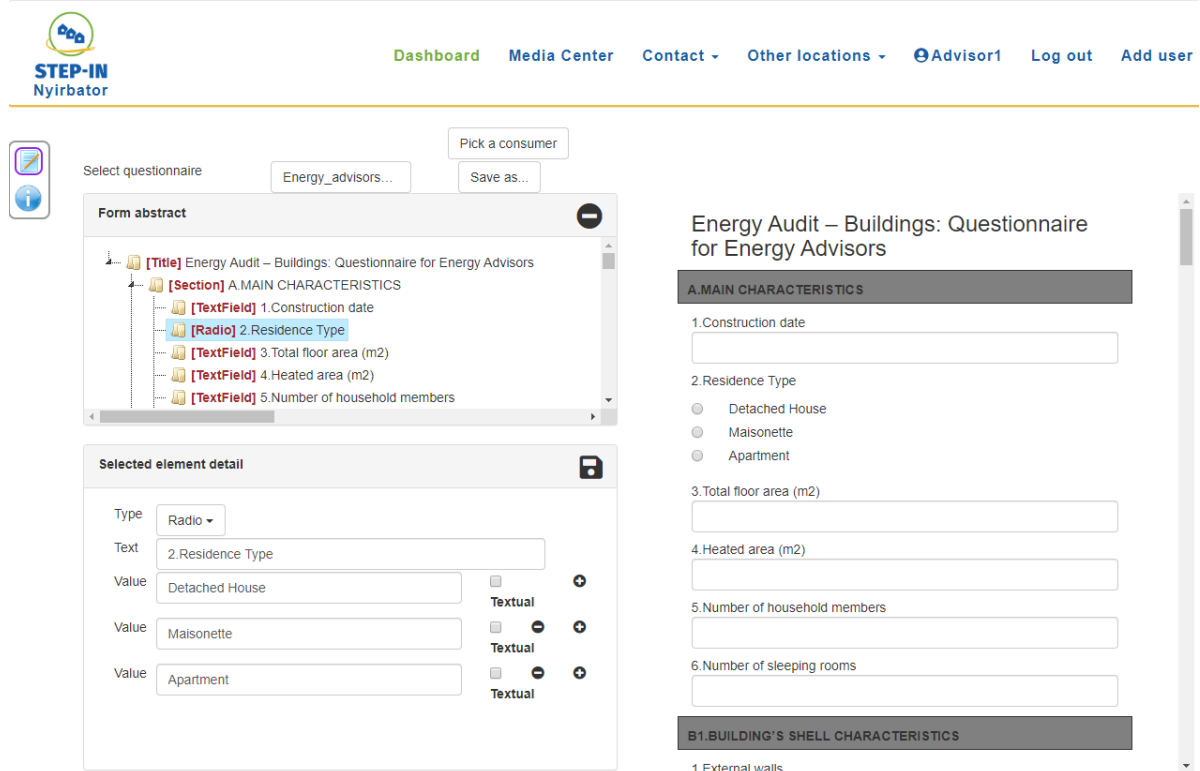


Figure 2-15: Questionnaire tool which allows Energy Advisors to produce and modify existing questionnaires.

2.1.2.10 Contact scheduler & reporter

In order to schedule and track contacts between advisors and consumers, we designed a page letting an advisor filling detail about the contacts. There he/she can input:

- The schedule the contact;
- The type of contact (which can be a phone call, an email, or something else like a home visit);
- The topic;
- The result of the contact;
- and the tasks raised during the contact.

The screenshot shows the 'Home Visit Report' form in the STEP-IN Metsovo application. At the top, there is a navigation bar with 'Dashboard', 'Media Center', 'Contact', 'Other locations', 'step-in', 'Log out', and 'Add user'. Below the navigation bar, there are two buttons: 'Pick a consumer' and 'Back to global settings'. The current consumer is identified as 'user_1'. The form title is 'Home Visit Report'. The form fields are: 'Date of the contact*' (26/09/2019, 15, 22), 'Contact type:*' (Select a Type), 'who initiate the contact:*' (Select an initiator), 'Topic' (empty text area), 'Results' (empty text area), and 'Tasks' (empty text area). A 'Send report' button is located at the bottom of the form.

Figure 2-16: Home reports can be filled in by the energy advisor during his/her visit and can be sent to the respected LL platform to store in the database and linked to the respected consumer.

All this information is then stored in the database (DB) and can be accessible at any time by the advisor or by the consumer himself.

The screenshot shows a list of reports at the top: 'Questionnaire', 'Sensor data', and 'Home Visit Report'. Below the list, there are two date-time filters: '2019-09-17 10:34' and '2019-09-17 10:34'. The 'Home Visit Report' form is selected and shows the following details: 'Date of the contact*' (17/09/2019, 10, 34), 'Contact type:*' (Email), 'who initiate the contact:*' (Energy advisor), 'Topic' (Some topic), 'Results' (Some results), and 'Tasks' (some task). A 'Download report' button is located at the bottom of the form.

Figure 2-17: Reports stored in the DB can be downloaded by a permitted user.

2.2 Data protection

In order to preserve privacy and reduce the risk of any data protection policies being broken, each LL is responsible for the storage and use of the data at their location. Furthermore, identifiable data will neither be exchanged between LLs nor with LIST. To further protect users, data will only be referred to using an ID, and not a name or similar piece of data. This should ensure that when data is exchanged it will not be possible to identify who provided the data, also the table(s) storing any personalised information can be removed when the data is sent between locations.

More detail about ethics and data protection are available in D7.3 and D1.3¹.

2.3 Reuse of existing tools and methods

The platform reuses many existing elements from previous work from LIST. For instance, the credentials system, the general layout of the page, the map system and the libraries used for the prototype are the same that are used in the LIST developed iGuess platform. Compute engines used as a service are also implemented on the same basis as used in iGuess (they can be to compute layers). New features that were requested by the LLs were the developments of the floor map section and the integration of an improved analysis and report engine developed at the Hungarian partner Ariosz and integrated by LIST. Furthermore, the existing LEAP mobile app at Manchester LL is going to be evaluated on how linking to the STEP-IN platform can be done.

2.4 Next planned improvements after V2

Some further aspects of the platform will be added during the lifetime of project, including the following:

- It is still planned to add further visualisations (simple graphs or combination of multiple ones);
- A map which can display aggregated data (gathered during V1, V2 and V3 of the LLs);
- It is planned to further connect external tools and integrate LCA impact assessment tools to analyse data from questionnaires or data from sensors in a more aggregated approach per LL and across LLs;
- We will add the possibility to add documents to the Media Center and the General advice part of the web platform directly on the website;
- We will add a way to get instant feedback (as a report compute by the external tools) for not registered users.

¹ Both D1.3 and D7.3 are confidential reports.

3. Conclusions

This document has presented an overview of the ICT tools developed for version V2 of the STEP-IN LLs. For version V2, the ICT tools have been improved for usability, energy analysis and personal advice as well as including a knowledge base (media centre). This enables now multiuser access for researchers, energy advisors, consumers as well as the public. As LL cycle V2 and future LL operate improvements will be added based on feedback and review. The document outlined the core features along with issues relating to aspects such as data protection, which ultimately influenced the deployment model. The approach leverages existing components, tools and techniques and adds some new features, such as energy advice engines. Furthermore, as it is web based, it does not require the installation of an application and can run on any Internet enabled device with a suitably sized screen. A web-based approach avoids problems connected to installing or updating software. This potentially increases its uptake and use in STEP-IN and outside.

4. Bibliography

Nodejs documentation: <https://nodejs.org/en/>

Angularjs documentation: <https://angularjs.org/>

Related project website: <https://edi-net.eu/en/home.html>