Energy Data Innovation Network

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V.08	31.10.2017	Leticia Ozawa-Meida, Stoyan Danov	Incorporating feedback received from Strahil Birov and Carl Holland following the QA process

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Executive Summary

This deliverable is a progress report of findings and recommendations to determine whether Milestone 2.2 "Partner Public Authorities ready to use the system" has been reached or not.

It collects the following types of project findings (identified with each section):

- **Finding I - Targeted buildings (section 2):** It comprises the available buildings in the EDI-Net system receiving services from the Dashboard (Tool 1) and the Benchmarking tool (Tool 3).
- **Finding II - Targeted users (section 3):** It comprises the available users in the EDI-Net system in order to quantify the staff involvement level in user engagement and behavioural change.
- **Finding III - Service feedback (section 4):** It comprises the responses of each PPA (partner public authority) representative related to the usefulness and the achievement of initial expectations of the EDI-Net user services, any piloting issues and recommendations.

Besides compiling some initial project findings, this report takes advantage of the feedback provided by the PPAs through the online forum. This feedback has been used to produce **recommendations (section 5)** as targets for the project impact. The **conclusions (section 6)** discuss the progress of the partner public authorities in implementing and deploying the system and reflect whether the project is on target for achieving the aimed impact.

As a preliminary assessment of the feedback by the participating public authorities, Task T2.6 asked current users of the EDI-Net system through a questionnaire and short interviews whether or not the tools available satisfy their needs and initial expectations. The feedback of the PPAs on each of the following tools has been collected: the EDI-Net Dashboard (Tool 1), the EDI-Net Forum (Tool 2) and the energy action oriented Benchmarking tool (Tool 3).

The conclusion of that deliverable is that the initial expectations from the EDI-Net tools' preparation have been fulfilled and that the project is on track with achieving the targeted impact.

The involvement of targeted buildings at the core PPAs has been considerably overachieved, with 1,384 buildings introduced instead of the planned 687. The involvement of targeted users is close to the planned numbers for the current stage of the project, with almost 80% of the public officers and 65% of the public staff currently involved compared to planned numbers to be achieved at the end of the project.

The EDI-Net tools have been rated as highly useful, and the fulfilment of initial expectations is acceptable, as described in questionnaire results. However, as with all software, there are ongoing technical issues to be solved. These are being dealt with in meetings of the Technical Committee. Several functional issues, code bugs and glitches, have been already addressed, and few minor issues are being solved, thus bringing the tools at a technical level that is prepared for wider use by follower PPAs.

1 Introduction

This deliverable is positioned at the concluding stage of the EDI-Net system development and has the objective to assess if the project is on track to achieve the targets set in the Grant Agreement after the initial period of testing. Therefore, the document adopts a methodology based on collecting information through templates, the online forum, questionnaires, and interviews from the users/PPA representatives on the following issues:

i) The degree of deployment of the EDI-Net services in the three core PPAs in terms of number of buildings and available tools

ii) The degree of involvement of the targeted users in terms of usage and acquaintance with the EDI-Net services

iii) The degree of satisfaction with the solution in terms of usefulness and technical readiness to be used at large scale by the PPAs in the next project stage, as well as recommendations on necessary improvements.

The assessment of the objectives' achievement, with respect to the degree of deployment of EDI-Net and the involvement of target stakeholders, is conducted quantitatively by comparing the current status with the target figures set in the Grant Agreement. The assessment of the achievements, with respect to the degree of usefulness and technical readiness for wide-scale application, is carried out using mixed methods, i.e. by analysing the qualitative and quantitative information collected from questionnaires and interviews with the representatives of the core PPAs.

Given the evolving nature of the EDI-Net system (D2.2 – D2.5), the feedback from the experiences of using the EDI-Net tools and the recommendations provided by the involved stakeholders are being taken into account for further improvements of the services. This deliverable provides an actual picture of the current status of the project based on the PPAs' feedback and their short-term plans to increase impact through user engagement mobilisation campaigns. This feedback is valuable to the project, as it will allow the initiation of comprehensive staff training and at the same time the involvement of new partners for achieving the expected project impact.

According to the task related to this deliverable, *Task 2.6 Feedback from Partner Public Authorities*, the potential impact of the project and whether it is on target to be really useful need to be assessed. As defined in the Grant Agreement (Section 2.1, Part B), there are two types of expected impacts in the EDI-Net project:

- **Impact on policy and plans**: It represents the existing plans and policies and their monitoring and updates generated by the public authorities involved during the project. This includes the Action Plans Catalogue of the Covenant of Mayors which gathers all SEAPs (Sustainable Energy Action Plans submitted under the 2020 Covenant) and SECAPs (Sustainable Energy and Climate Action Plans to be submitted under the 2030 Covenant) submitted by the signatories and/or accepted by the European Commission. These documents are valuable information for public authorities and also publicly accessible through the website http://www.covenantofmayors.eu/actions/sustainable-energy-action-plans_en.html.

- **Impact in terms of capacity building**: It will assess the real improvement of the project reporting indicators like staff training and energy savings (estimated savings within the project related to the survey results obtained in tasks 7.2 and 7.3).

The impact of the project will reach beyond users and buildings and deliver impact in terms of policy and plans, and capacity building. One of the main purposes of the project is to help policy makers and financial decision makers realise they have a wealth of existing data and energy related information already being collected and stored in their organisations, which can be exploited with very little capital investment and with a better use of the expertise and human resources already within public authorities. Realising this project goal will inform future policy development and delivery at the public authorities.

EDI-Net will help public authorities deliver existing plans and policies, such as the SECAPs in the case of municipalities that are members of the Covenant of Mayors, and specific local and regional policy in the case of other public authorities. Delivering impact with regards to capacity building will be through the increased skills and capabilities of staff using EDI-Net services, measured through evaluation of people trained, usage statistics from the forum and help desk, and relating this to energy and water consumption savings achieved, and impact on policy.

1.1 Links to other tasks and deliverables

The expected impact results of the project will be evaluated in WP7, and this deliverable D2.6 can be considered as a working document to be used in the preparation of work in WP7. There are also other potential links with WP3 and WP5 where further user feedback will be collected.

The links to other tasks and deliverables of the project are described as follows:

WP3

- *Task 3.4 Feedback from operation of partner public authorities*: It consists of an analysis of the use of the different services in order to inform their operation. This task is also linked to the Help Desk service in WP8. Regular feedback is provided, focusing on operation and target audiences with assessment of testing targets and usefulness of the benchmarks.

WP5

- *Task 5.2 Local training workshops in 3 countries*, *Task 5.3 EU training and networking events* and *D5.3 Report of the training events held, including feedback from delegates (M36)*: The increased skills and capabilities of the staff related to the training workshops targeted in the tasks will provide results of staff training related to the impact in terms of capacity building.

WP7

- *Task 7.3 Baseline survey of Participant Public authorities* and *D7.2 Baseline survey report on the partner and participant public authorities (due on M18)*: Surveys have been conducted and the analysis is on-going. The deliverable will provide a picture of the attitudes of respondents before the implementation of the EDI-Net services.

- *Task 7.4 Mid-term interviews* and *D7.3 Mid-term interviews with participants (due in M30)*: The purpose is a continued monitoring process and obtaining feedback on the success of the capacity building. The interviews (focus groups) with different user types will be conducted in due course and reported in *D7.3 Mid-term interviews report* in M30.
- *Task 7.5 Final Evaluation of attitudinal and behavioural survey of Participant Public Authorities* and *D7.4 Final report and project evaluation (due in M36)*: The purpose is to measure changes in attitudes and behaviour change (through a second survey) and evaluate the effectiveness of the project in terms of knowledge transfer and capacity building.

1.2 WP2 findings

There are items that directly influence the initially defined impacts and can be easily identified through the EDI-Net system. These items are already identified as initial expectations in the Grant Agreement and are considered as "findings" of the project to help measure the impact in the WP7 tasks and deliverables (enumerated in 1.1). The findings that can be quantified in this WP are as follows (identified with each section):

- **Finding I - Targeted buildings (section 2):** It comprises the available buildings in the EDI-Net system receiving services from the Dashboard (Tool 1) and the Benchmarking tool (Tool 3).
- **Finding II - Targeted users (section 3):** It comprises the available users in the EDI-Net system in order to quantify the staff involvement level in user engagement and behavioural change.
- **Finding III - Service feedback (section 4):** It comprises the responses of each PPA representative related to the usefulness and the achievement of initial expectations of the EDI-Net user services, detected issues and recommendations.

The findings described above are used to collect data to allow comparison of the results regarding the initial expectations and amongst each Partner Public Authority.

Besides compiling some initial project findings, this report takes advantage of the feedback provided by the PPAs through the online forum. This feedback has been used to produce **recommendations (section 5)** as targets for the project impact. The **conclusions (section 6)** discuss the progress of partner public authorities in implementing and deploying the system and reflect whether the project is on target for achieving impact or not.

2 Finding I – Targeted buildings

This section describes the actual progress made with regard to the range of public buildings included in the EDI-Net project compared to initial expectations. The targeted or participating buildings reported in this section include those reported in the Dashboard and league tables (Tool 1) and/or those that estimate the energy saving indicators by individual building or PPA in the Energy benchmarking tool (Tool 3).

2.1 Current status

Table 1 compares the initial expectations of the project regarding the number of buildings to be involved in the EDI-Net project and the current status of deployment in the three core PPAs (up to September 2017). Initial expectation figures were extracted from a summary table in the Grant Agreement (part B, page 14) and represent the original number of potential targeted buildings in order to achieve the expected targets of the project. The current figures include the existing number of buildings that have provided their available half hourly and/or monthly data in the EDI-Net Dashboard (tool 1) and Energy benchmarking tool (tool 3) user interfaces.

As shown in Table 1, the expectations for target buildings in EDI-Net have been considerably overachieved. The total number of public buildings involved at the time of writing this deliverable (September 2017) is 1,384. This is twice the number of buildings stated in the GA (687 public buildings).

With regards to the buildings' typologies, a large number of health-related buildings (health centres and hospitals) have been incorporated in the project (10 times more buildings than expected). The number of office buildings is also higher than expected (2 times) as well as 'other' buildings (6.5 times) that include some more specific typologies such as police or firefighting headquarters, etc. The number of buildings of the remaining types defined in the GA is quite close to the initially sought at the beginning of the project.

In terms of initial expectations, the public authorities in Leicester and Nuremberg have incorporated the number of buildings (very similar or equal) to those originally proposed, and the Generalitat of Catalonia has integrated a higher number of buildings.

In the case of Nuremberg, the initial expectations have been surpassed. Thirty-one buildings are already available and modelled in the tools. The buildings were gradually incorporated, as initially there were some problems with the communication of consumption data from third companies (utilities and data providers), but the current target is as expected. Some buildings have not yet incorporated all energy sources; this will be added in the upcoming months.

Table 1: Current status of targeted buildings by building typologies (up to September 2017)*

Building group**	Leicester		Catalonia		Nuremberg		Total	
	Expected	Current	Expected	Current	Expected	Current	Expected	Current
Offices	23	15	239	385	6	6	268	406
Education	116	99	79	84	14	15	211	197
Social services	40	41	41	64	4	3	86	109
Culture & Entertainment	17	16	15	10	5	6	36	31
Health	0	0	45	471	0	0	45	471
Sports & Leisure	9	8	4	7	1	1	16	17
Car parks & Depots	0	10	3	2	0	0	3	12
Others	10	9	12	133	0	0	22	142
TOTAL	**215**	**198**	**438**	**1156**	**30**	**31**	**687**	**1381**

(*) Figures for initial expectations are extracted from the Annex Proposal Table 1 page 12.

(**) The different building typologies have been grouped in order to allow a better comparison between the results: a. Offices, includes administration, services and offices; b. Education includes kindergartens, schools and university buildings; c. Social services includes community centres and social services; d. Culture & Entertainment includes theatre/entertainment, cultural buildings, museums and libraries; e. Health includes Health centres and hospitals; f. Sports & Leisure; g. Car parks & Depots; h. Others.

In the case of Leicester, most of its buildings are active in the Dashboard and gradually being introduced in the Energy benchmarking tool (198 of 215 buildings have been incorporated). It is important to point out that the building portfolio in this council is constantly changing. Therefore, not all buildings originally identified in the proposal can be incorporated, since some have now been closed or sold. In addition, some buildings also had problems with the communication of consumption data from third companies (as in Nuremberg), but these problems are being solved. Due to constant changes in the building portfolio, it is realistic to consider that the current number of buildings have achieved the initial expectations.

In the case of Catalonia, 438 buildings have been incorporated into the system (mainly in the Energy benchmarking tool – Tool 3). Thirteen percent (57) of these buildings have also been uploaded in the Dashboard (tool 1). For the dashboard, the availability of hourly data with a high quality and integrity is essential. As mentioned in *D4.1 Overview of smart metering in Germany, Spain and the United Kingdom*, access to hourly data from the energy distributor in Spain is still complicated. At the proposal stage, it was anticipated that the Generalitat and the energy supplier would be able to provide the hourly data in almost real time or at least once a day. Although the legislation obligates the transfer of these data to the final customer, there is no clear and reliable channel to ensure that this takes place. In most cases, the available data are provided once a month. Profiling monthly data into hourly data does not make sense as it would not provide the visualisation of actual data, while the visualisation of monthly data in the Dashboard may not allow tracking some type of energy efficiency interventions in sufficient detail. Nevertheless, the EDI-Net tools have proven useful for particular type of interventions further explained in section 4.3 of this deliverable.

3 Finding II – Target users

This section examines the direct influence of the EDI-Net project (and services) on users based on the user requirements defined in *D2.1 Local Building – Database communication compatibility assured*. In section 1.3 of deliverable D2.1, the EDI-Net target users are divided into four user types: 1) energy managers, 2) decision makers, 3) building users and 4) finance professionals (with responsibility of energy-related decisions). These four user types are grouped differently in this deliverable to be able to track progress on impact based on the initial expectations described in the proposal and Grant Agreement (section 2, Part B, pages 18-21), as follows:

- Public officers: energy/facility managers and decision makers (including finance professionals)
- Public staff: building users (including staff & non-energy financial professionals) (e.g. teachers, doctors, nurses, janitors, administrative and professional staff)
- People directly influenced by the project: building users (less frequent users with little energy-related responsibilities, such as visitors to council offices, but this group can also include pupils, students, patients, etc.)
- Population impacted by the project: general public, e.g. school children's parents, patients' families, that can be influenced by interventions conducted in the participating buildings

It is important to consider that during the project life time and beyond it, different types of users' impacts can be expected, including but not limited to improvements in user engagement and behavioural change.

This deliverable focuses only on the evaluation of the initial impact of the three core participating public authorities: Leicester, Nuremberg and Catalonia. Progress of the impact of new partnerships will be reported in periodic reports as well as in *D7.4 Final report*.

3.1 Initial expectations

Table 2 illustrates the initial expectations of different user types committed from each core PPA in the EDI-Net system (top level) and their corresponding impact levels (bottom level) based on the figures proposed in the Grant Agreement (section 2, Part B, pages 18-21).

Table 2: Initial expectations of targeted users and expected project impact levels

Pilot site	Public officers *	Public staff *	People directly influenced by the project *	Population impacted by the project *
Leicester	191	1,057	92,450	15,776
Catalonia	389	2,154	188,340	358,657
Nuremberg	30	167	14,620	27,333
TOTAL	610	3,378	295,410	401,765
Impact level				

*Direct influence***	*>600*	*>3,300*	*0.3 million*	*>0.4 million*
*Impact within the project***	*>3,000*	*>100,000*	*0.6 million*	*>4.5 million*
*Potential impact beyond the project**	*>25,500*	*>0,5 million*	*>1.2 million*	*>6.6 million*

* As explained above, users types as defined in D2.1 were grouped differently to align with the figures presented in the Grant Agreement as follows: Public officers (energy/facility managers and decision makers including finance professionals); Public staff (building users including staff & non-energy financial professionals); People directly influenced by the project: building users (less frequent users, such as visitors); Population impacted by the project (general public)

** The impact levels are corresponding to different project stages as: a. Direct influence in the first implementation of the system; b. Impact within the project after staff training; c. Potential impact beyond the project after new partnership involvement.

3.2 Current status

The number of users presented in this section comprises the total number of estimated users currently using the EDI-Net tools, namely Dashboard (tool 1), online forum (tool 2) and Energy benchmarking tool (tool 3). As PPAs have different goals, interests and approaches to achieve their energy savings or carbon reductions, it is unrealistic to assume that the EDI-Net tools are used in a uniform manner across PPAs. For example, Generalitat de Catalonia focuses in great extent on the energy renovation of buildings. Hence, users are inclined to use the Energy benchmarking application (tool 3) for the management of the buildings. In Nuremberg and Leicester, the emphasis is on the use of near real-time data for detecting problems that are causing high energy consumption or to motivate users towards energy savings behaviours through the visualisation of data. Hence, these PPAs find the Dashboard (tool 1) to be a more appropriate tool for their purposes. Feedback about these tools is further discussed in section 4.

To estimate the number of current users involved in the EDI-Net project, representatives of each PPA provided the figures presented in Table 3. Where possible, actual figures were provided based on the number of staff or known visitors (e.g. pupils in schools) in particular buildings. It is important to note that the methodology employed to estimate the current and planned (in brackets) number of users differs from the methodology used in the Grant Agreement to estimate impact. The values in brackets represent the number of people influenced by the planned activities in “focus buildings” and it is explained for each case in the following subsections. It is expected that as more buildings are brought to actively use the system, the number of users may increase. As mentioned earlier, this deliverable attempts to provide an actual picture of the current status of the project based on the PPAs feedback and short-term plans to increase impact through user engagement mobilisation campaigns.

Table 3: Current number of users influenced by the EDI-Net system (up to September 2017) *

Pilot site	Public officers **	Public staff **	People directly influenced by the project **	Population impacted by the project **
Leicester	80	175 (700)	- (22,000)	- (13,000)
Catalonia	362	2,043	178,657	340,217
Nuremberg	30	10 (428)	- (3,875)	- (21,000)
TOTAL	**472**	**2,228 (3,171)**	**178,657 (204,532)**	**340,217 (374,217)**

* These results only collect the impact level in the first implementation stage: *Direct influence*.

** Public officers refer to energy/facility managers and decision makers including finance professionals, who have been informed about the project or could be using the services; Public staff refers to building users working in these buildings, such as staff & non-energy financial professionals; People directly influenced by the project refers to less frequent building users, such as visitors or have limited responsibility on energy use, such as pupils or students; Population impacted by the project refers to general public, such as citizens involved with the analysed buildings or have some relationship with other types of users.

3.2.1 Nuremberg

Public officers reported in Table 3 include energy and facilities managers in schools that have been informed about the project (e.g. through PPA representatives' presentations) and could be using the EDI-Net services either because they have decision-making or technical responsibilities over the buildings deployed in the system, or because they are using the services. Some of these managers can perform financial tasks and be responsible for more than one building. Some technical problems in the integration of the tools have caused delays in the full-range deployment of the services so far, as explained in section 4. However, the direct influence on staff and people directly influenced by the project (such as pupils) is expected to considerably increase in the following months. This influence will be further reinforced with the planned installation of TV screens showing energy data in some buildings as further explained below. The number of people expected to be engaged with or influenced by EDI-Net in the next couple of months is given in brackets in Table 3. As technical problems are being dealt with and the integration of tools (back-end) has been recently completed, PPA representatives are planning to engage with their users as follows:

- Conduct a meeting with staff of four schools in early November 2017 to explain how they can use the EDI-Net tools.
- Teachers could use the EDI-Net tools for energy projects with the students. It is expected that these activities will increase the active number of users of the tools. In addition, representatives can receive valuable feedback about the system from initial users.
- Based on the feedback from these four schools, engagement campaigns may be further rolled out to other buildings.

In addition, representatives are also planning to show the data visualisation of the EDI-Net dashboard (tool 1) in display screens in two or three participating buildings by December 2017, for example, in a Cultural building (House of Arts) which is also a visitor information centre and receives a large amount of visitors. The

rollout of these screens may depend on the availability of hardware (metering devices as well as screens) and the ability to install them (due to the high workload of installers, especially at the end of a year).

3.2.2 Catalonia

The approach of the Generalitat to involve users in the EDI-Net project is described below.

An Executive Committee has been created for the energy renovation of buildings in the Catalonian region. This committee is constituted by agents within the administration with some influence in the decision making regarding the energy efficiency of public buildings. The committee is made up by five agents from the Department of Governance and the Catalan Institute of Energy (ICAEN by its Catalan acronym). The committee uses the EDI-Net tools (mainly the Energy benchmarking application – tool 3) to track the overall energy efficiency and global energy renovation measures of the organisation.

This committee is responsible for identifying key people within each department with influence in the decision making in energy efficiency within its department. The departmental groups meet every six months, and together they keep track of the state of energy consumption of their corresponding buildings and of the actions carried out in energy efficiency, all with the support of the EDI-Net Energy benchmarking tool.

The person responsible in each department has the task to involve key people within his/her department. In this case, the variability can be large since there are departments with 10 buildings under their responsibility and others with more than 2,000 buildings. Thus, each department according to its characteristics involves the energy responsible staff of each building or group of buildings, either by sub-department or geographic area. These people use the EDI-Net Benchmarking application (tool 3) to conduct their daily management and reporting of energy efficiency actions carried out in their buildings.

The EDI-Net Forum (tool 2) and the Dashboard (tool 1) are complementary tools used in this PPA, used only by some Catalonian users.

3.2.3 Leicester

Table 3 includes public officers that have been informed about the project and could be using the EDI-Net services for decision-making, technical responsibilities over the buildings, or to visualise energy data after a presentation introducing the services. These include: central energy managers in Leicester City Council (LCC), Estates Department staff in De Montfort University (DMU), local facilities managers where the tools have been previously introduced (in Smartspaces, for example), and from representatives of the Eco-schools where a pilot scheme is being introduced. Leicester City Council has a “bottom-up” approach to engage with local energy/facility managers of the participating buildings. This means that after introducing the EDI-Net services, representatives provide access to the tools upon request by the users. Meetings with groups of buildings (e.g. leisure centre, libraries, community centres) are planned in the forthcoming months.

Similar to the case in Nuremberg, technical problems in the tools have caused delays in the full-range deployment of the services as explained in section 4. The direct influence on staff and people directly influenced by the project (such as schools’ pupils, University’s students and visitors) is expected to increase considerably through the following engagement activities:

- The EDI-Net services are being introduced in at least 20 schools of the Eco-schools scheme this academic year that are or have previously been involved in an energy saving programme. A hands-on practical session to explain the use of the tools with these schools is planned in December 2017.
- The introduction of EDI-Net services in schools in Leicester can influence a variety of staff, such as the premises' officers, headteachers, financial and administrative staff, teachers and those responsible for the curriculum. Each school has between 450 and 1,500 pupils, who could be directly influenced by the project, as well as their parents and close relatives.
- In DMU, similar activities conducted in the Smartspaces project are planned for the EDI-Net project. For example, display of the smiley faces in TV screens in each building, posters of the smiley faces, and newsletters to environmental champions and Faculty Managers. It can be expected that the communication of the smiley faces via screens and posters can influence at least 20% of academic and administrative staff and 20% of the students. This communication is also expected to influence people visiting the university in Open days, conferences and students' graduations.

4 Finding III – Service feedback

At this first implementation stage of the project, an operational version of the EDI-Net system is available. All the functionalities for each service have been implemented.

Feedback from representatives of each PPA (Leicester, Catalonia and Nuremberg) was gathered to identify the usefulness of the EDI-Net services, their user-friendliness (how easy it is to use the system), and recommendations for improvement.

The method to collect feedback data from PPA representatives involved administering one questionnaire (Likert-scale and open-ended questions) followed by a telephone interview. Responses to the questionnaire and interviews allowed any potential issues to be detected or identifying differences in the use of EDI-Net tools across PPAs.

A template with three identical questions for each tool (Dashboard, Forum and Energy benchmarking) was developed and summarised below:

1. Please rate the usefulness of the service for your PPA (5 items Likert scale 1= Definitively not useful, 2 = Rather not useful, 3 = Neither useful, nor not useful, 4 = Rather useful, 5 = Definitively useful)

   Open-ended question (interview): Please provide a brief explanation of the rationale behind your response (e.g. benefits, attributes or problems preventing your use)

2. To what extent do you think that the service has fulfilled your initial expectations (e.g. in terms of functionalities)? (5 items Likert scale 1 = Below expected and not functional, 2 = Below expected with some major issues, 3 = As expected with some issues, 4 = As expected with minor issues, 5 = Fully as expected or above)

   Open-ended question (interview): Please provide a brief explanation of how your expectations have been fulfilled or not.

3. To what extent do you think that the service is prepared to be used by the PPA in large scale? (5 items Likert scale 1 = Not prepared, 2 = Prepared with minor issues to solve, 3 = Prepared with some issues to solve, 4 = Prepared with minor issues to solve, 5 = Fully prepared)

   Open-ended question (interview): Please provide some specific recommendations that could improve the service.

These questions are focused on receiving feedback from each PPA representative in line with the user requirements defined in D2.1, where F-R refers to functional requirements and NF-R refers to non-functional requirements. These four categories of user requirement are summarised as follows:

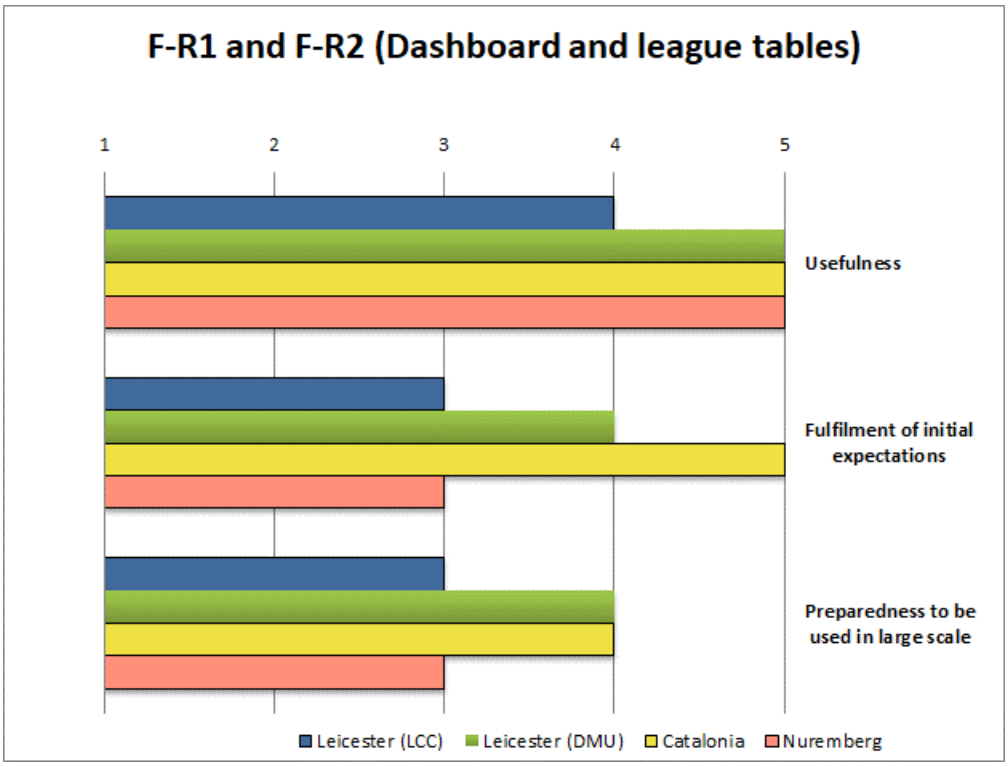
1. **F-R1 and F-R2 services:** Detailed PPA portfolio and summary reports regarding energy performance indicators provided in the dashboard and league table (tool 1).
2. **F-R3 service:** Online forum (tool 2) that facilitates information sharing between the different PPAs by either receiving energy saving tips for user behaviour, or by maintaining technical discussions related to energy saving opportunities or possible investment lines.
3. **F-R4 service:** Online energy benchmarking and certification application (tool 3) of the energy consumption of buildings to allow future energy efficiency investments and to monitor the energy savings.
4. **NF-R1, NF-R2, NF-R3 and NF-R4 services:** Non-functional requirements comprising the data management services, administration, notification and authentication systems of the PPA site.

The assessment of each category is analysed by questions 1, 2 and 3. The open questions following each main question are focused on examining the reasons behind each answer and seek for more insight and recommendations.[1]

4.1 Track energy performance in detail (F-R1) and Communicate energy performance in a user-friendly manner (F-R2)

Figure 1 illustrates the current perception of PPAs' representatives regarding the usefulness of the Dashboard and the league tables (tool 1) to track energy performance in detail (F-R1) and to communicate energy performance in a user friendly manner (F-R2). It also shows how the initial expectations have been fulfilled and what the perception is with regard to the preparedness to be widely deployed in their local authorities. The complete responses of the questions related to F-R1 and F-R2 from PPA representatives are presented in Table A1.1 in Annex 1, and are explained in the following subsections.

[1] In Leicester, representatives from the City Council and from De Montfort University provided feedback. Despite the fact that these organisations belong to the same public authority, responses are presented separately (in Figures 1-4) as their user experience may differ based on their organisational structure, local energy management practices and engagement activities.



Likert scales: **Usefulness of the service:** 1=Definitively not useful, 2=Rather not useful, 3=Neither useful, nor not useful, 4=Rather useful, 5 = Definitively useful; **Fulfilment of initial expectations:** 1=Below expected and not functional, 2=Below expected with some major issues, 3=As expected with some issues, 4=As expected with minor issues, 5 = Fully as expected or above; **Preparedness to be widely deployed in the PPA:** 1=Not prepared, 2=Prepared with major issues to solve, 3=Prepared with some issues to solve, 4=Prepared with minor issues to solve, 5=Fully prepared.

Figure 1. Questionnaire's rating regarding the Dashboard and league tables (F-R1 and FR-2)

4.1.1 Nuremberg

Representatives in this PPA find the Dashboard (tool 1) a useful tool to track energy performance and communicate it in a user-friendly manner for the following reasons:

- The system provides recent and actualised energy data *'not from last week, but from yesterday'*. This is important for energy managers and building users who need to understand what happened the day before, and are able to remember the actions that caused a particular energy performance in the building.
- The energy data provided in the smiley faces and league tables are one of the best features as they allow comparing between buildings and ranked them according to their performance and based on actual recent data. It is expected that schools may find this feature very interesting.
- For technical staff that trust the system and understand the rationale behind the smiley faces, the system can allow them to easily detect recent problems (in meters or other anomalies) and investigate those problems in more detail.

The following recommendations for improvement were provided:

- Schools have requested the provision of two different baselines (selected and set by users):

  - A long period baseline for energy managers, that could be modified in a dynamic way (the longest as possible or in an accumulative manner). This would allow the system to adapt and compare to the improvements being conducted.
  - Flexible period selected by the users for users in schools and other buildings. This would allow users to assess the effectiveness of the energy projects (or campaigns) compared to the last year's performance.
- Provision of a short technical description of how the system works, for example, how the baseline is calculated or how the smiley faces are calculated. Representatives need to be able to answer these types of questions when training users.
- Some type of normalisation is needed when comparing buildings in the league tables, particularly in terms of date of comparison. For example, in schools competitions the comparison of buildings with different dates is not adequate if some buildings have problems with the meters or meter data transfer to EDI-Net. In such cases, the system should select the most recent date where all buildings have reliable data.
- It would be ideal to have alarms triggered by outdated data or that highlight problems in the meters of some buildings, so the user (energy manager) have the possibility to exclude those buildings from the league tables if the system does not have data for those buildings.

4.1.2 Catalonia

Representatives of this PPA considered that the Dashboard and league tables are very useful to provide advanced warning on possible malfunctions of equipment or abnormal consumption out of the scheduled working time, the possibility of near real-time comparison among other buildings of the same type and track the performance of the building over time. Despite there are some minor features that need to be fixed, representatives considered that the provision of services is satisfactory as the tool provides the required information to fix the detected malfunctions, and to identify and improve the performance gaps of each building and the ones among the same type of buildings.

For this particular tool, the Generalitat of Catalonia may need solve differences between numbers of buildings with hourly or monthly related incorporated in tools 1 and 3 (as explained in section 2.1). In the case of Tool 1 (dashboard and league tables) there are quite less than expected due to lack of buildings with hourly data devices. In the case of Tool 3 (EE benchmarking tool) the amount is higher than expected (almost the triple) because municipal representatives have been recently committed to provide more buildings with hourly data devices in order to add a minimum amount of buildings to the Tool 1. Through the combined use of tools 1 and 3 and further expansion of services to a wide range of users and buildings, PPA representatives expect to achieve a solid database of metered data and implemented energy efficiency measures.

Similar to the recommendations expressed by Nuremberg, representatives would like to be provided with a simple technical description of data entering, the outputs and indicators provided in the tool, and the normalisation and baseline calculation methods as well as the ability to select their baselines of consumption data.

4.1.3 Leicester

Representatives of Leicester City Council and De Montfort University considered the Dashboard and league tables as a useful tool due to the following features and functionalities:

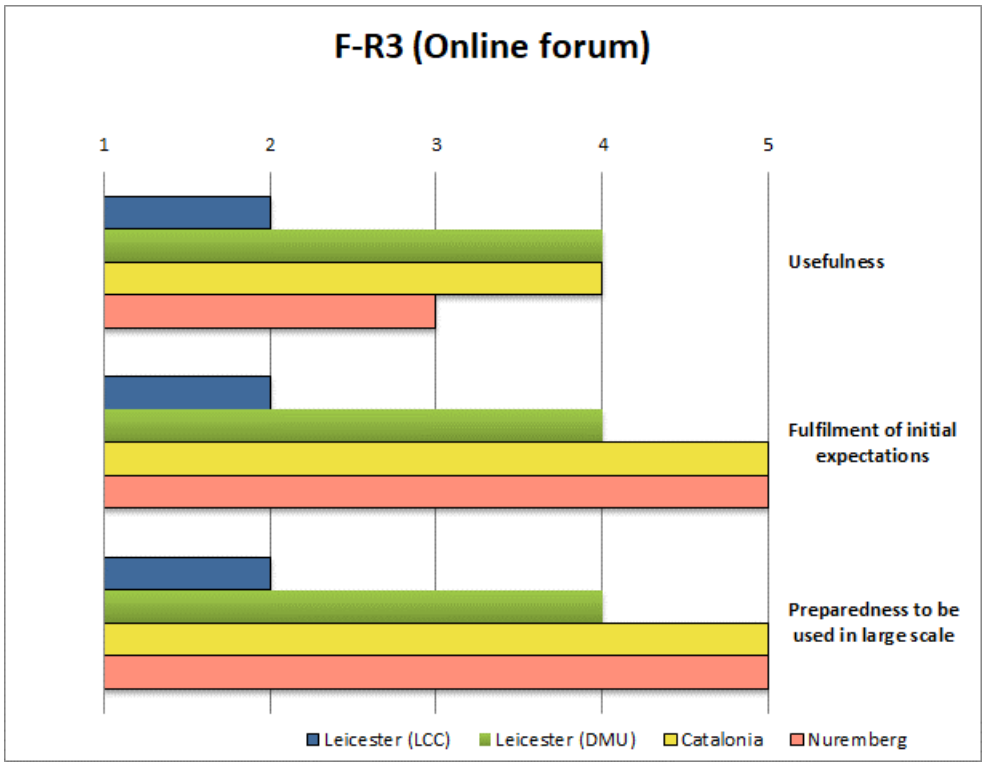
- Smiley faces and detailed graphs are a user-friendly interface that express the current energy data in a very simple and straight forward manner. In particular, the use of smiley faces can be very engaging to staff, other building users (such as students) and visitors.
- The tool allows quickly identifying problems in the metered consumption prompting to look to the particular issues in more detail.
- If the tool is consistently reliable, it is useful for local facility managers for their day-to-day energy management of their buildings and reduces energy wastage.

Some technical aspects related to data collection and display of current performance data for some buildings have prevented the organisations to deploy the services to larger number of users. Representatives agree that these issues have been largely rectified, but some minor issues remain for a small number of buildings. As explained in section 3.2.3, the organisations are currently starting to deploy their engagement campaigns among particular non-professional users in schools.

It was explained that due to the long experience of using half-hourly data (for more than a decade), the initial expectations of the council were particularly high, mainly with the integration of different systems dealing with energy and water data. Representatives considered that having all features and functionalities of different systems in one place would be valuable to increase the acceptance and use of the tools by diverse users in the PPA.

4.2 Facilitate communication between stakeholders (F-R3)

Figure 2 illustrates the current perception of PPAs' representatives regarding the usefulness of the online forum (tool 2) to facilitate communication between stakeholders (FR-3). The complete responses of the questions related to F-R3 from PPA representatives are presented in Table A1.2 in Annex 1, and explained in the following subsections.



Likert scales: **Usefulness of the service:** 1=Definitively not useful, 2=Rather not useful, 3=Neither useful, nor not useful, 4=Rather useful, 5 = Definitively useful; **Fulfilment of initial expectations:** 1=Below expected and not functional, 2=Below expected with some major issues, 3=As expected with some issues, 4=As expected with minor issues, 5 = Fully as expected or above; **Preparedness to be widely deployed in the PPA:** 1=Not prepared, 2=Prepared with major issues to solve, 3=Prepared with some issues to solve, 4=Prepared with minor issues to solve, 5=Fully prepared.

Figure 2. Questionnaire's rating of the online forum (F-R3)

4.2.1 Nuremberg

The PPA representatives consider that the Online Forum is working well and is a useful tool, especially relevant for expressing opinions and providing suggestions for further development of the EDI-Net tools. They considered that the "news alert" with an automated e-mail telling the user what happened when she/he was not logged in for a while is a very good feature. However, it is not expected that many users actively post comments in the forum for sharing best practices or for managing the solution of problems.

Representatives have requested colleagues in their department to use the forum, but energy managers are reluctant to use it as they prefer a face-to-face interaction to communicate, using phones or emails. Communicating via the online forum is a new way to work together that may be too modern or not adapted to the existing way of working for most part of staff in this public authority. Further efforts could be conducted to inform people and exchange knowledge by introducing people on how to use the forum, but results cannot be easily predicted as current users are reluctant to accept this new way of communication and adapt to it.

In the case of schools, it may also be difficult to predict. Potentially, younger generations of teachers may have more awareness, but this needs to be explored once the system has been rolled out in the four pilot schools.

4.2.2 Catalonia

While representatives in this PPA consider that the online forum provides an excellent tool where issues, questions and possible solutions to a wide extent of problems that arise in the daily management of buildings' energy performance can be commented and discussed, they also acknowledged that it needs more active use by participants. Representatives perceived that the forum is developed and fully prepared for a more intensive use. However, they considered that for communicating across participating public authorities, a possible language barrier may arise. Therefore, it was recommended to implement an automated translation feature that could translate posts from different PPAs into the native language of the corresponding PPA.

4.2.3 Leicester

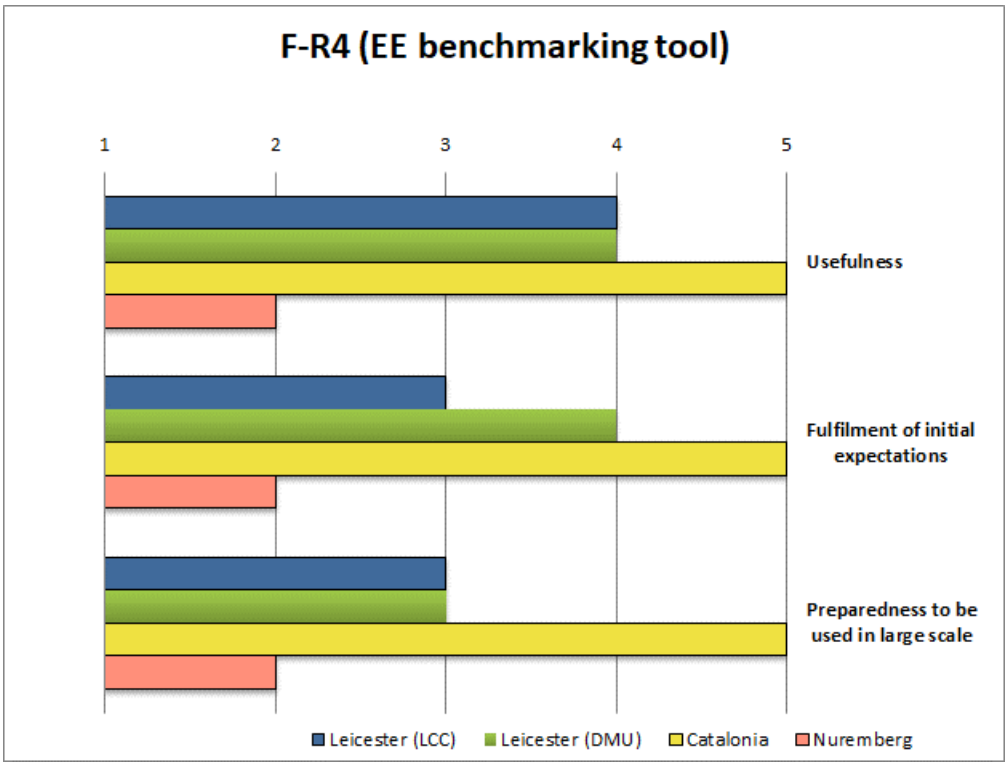
The representative of the council considered that the tool has been useful to communicate with project partners for the development of the tools. However, it is difficult to engage energy managers to use the discussion forum due to the way they are used to interact and work with each other. Central energy managers are located in the same working space, hence they prefer to communicate face-to face or through phone calls if they are located in other buildings. They also use an internal web system to communicate. In the case of staff, the representative perceived that staff are experiencing intense work pressure and time constraints due to budget cuts and strict scrutiny currently faced by UK local authorities. Although energy managers and staff have been informed about the online forum, they may not be ready to engage with the tool due to their existing way of work and the time/pressure constraints. In the case of schools, the use of the forum may work differently. This will be better understood once the pilot scheme is deployed in the schools.

In the case of the University, the representative considered that the forum provides an environment that enables staff and students to openly discuss energy related issues within their buildings. The representative also considered that this platform can be used to discuss a variety of topics related to energy use, such as behaviour change, education for sustainable development, internal environmental initiatives, etc. However, it was recognised that it is difficult to encourage staff and students to use the forum. Although some incentives have been used to improve engagement, the representative considered that this issue has not been fully resolved.

For further acceptance and use of this tool, the representative of the council recommended the provision of similar features of other fora, such as the Local Authority Forum, where users can find a variety of topics in a user-friendly structure, and people can download relevant material, such as recent policies, training material, etc.

4.3 Manage an Intervention Plan for energy efficiency (F-R4)

Figure 3 illustrates the current perception of PPAs' representatives regarding the usefulness of the energy efficiency (EE) benchmarking tool (tool 3) to manage an intervention plan for energy efficiency (FR-4). The complete responses of the questions related to F-R1 and F-R2 from PPA representatives are presented in Table A1.3 in Annex 1, and explained in the following subsections.



Likert scales: **Usefulness of the service:** 1=Definitively not useful, 2=Rather not useful, 3=Neither useful, nor not useful, 4=Rather useful, 5 = Definitively useful; **Fulfilment of initial expectations:** 1=Below expected and not functional, 2=Below expected with some major issues, 3=As expected with some issues, 4=As expected with minor issues, 5 = Fully as expected or above; **Preparedness to be widely deployed in the PPA:** 1=Not prepared, 2=Prepared with major issues to solve, 3=Prepared with some issues to solve, 4=Prepared with minor issues to solve, 5=Fully prepared.

Figure 3. Questionnaire's rating regarding the EE benchmarking tool (F-R4)

4.3.1 Nuremberg

Representatives are becoming familiar with the use of the Energy benchmarking tool (Tool 3), which is being populated with additional building data (such as floor area). However, energy efficiency measures still have to be added. Hence, the uptake of this tool by energy managers and financial officers is still unknown.

In direct conversations between CIMNE and Nuremberg, representatives of this PPA have provided several recommendations for this tool. In general, the small amount of mentionable energy efficiency measures (about 20-30 per year) provide value, but do not yet meet the PPA's expectations in full, as there is room for improvement, i.e. a simpler and smaller adaptation of this tool can be carried out for the particular case of Nuremberg. This adaptation will be initiated within the duration of the EDI-Net project. Moreover, there were small modifications proposed (some of them already implemented):

- Adjusting chart resolution
- Adjusting the date range
- Normalisation for the German model building
- Including possibility to add water consumption and units in the software (Euro currency)
- Adding a new area (field) to allow economic investment per measure and implementing a report of evaluation of savings and energy efficiency measures.

Other recommendations for improvement are as follows:

- Only pre-defined energy efficiency measures (EEM) can be inserted. In turn, all possible EEMs could be made available, while costs can be inserted for each EEM individually. Regarding costs of EEM, it should be possible to divide them into "costs for only energy related measures" and "costs incurred anyway" in cases where EEM are combined with other construction/renovation measures (e.g. windows are replaced with high energy standard windows, but a modernization was necessary anyway). In this case, the additional costs for the higher efficiency windows compared to standard windows are very interesting as well). For evaluations, it should be possible to subtract the latter costs from the overall costs. Indeed each EEM has a field named '%affectation' to describe this. However, if the EEM is set to 0%, it is not calculated.
- It is advisable that savings are presented in EUR and not only in kWh/y. It may be possible to add an area to create tariffs and associate the tariff to each building information to have an overview of the approximate savings in EUR, it would be sufficient to insert one average tariff for all buildings. In this way it may be possible to generate a report specific to energy amortisation over the lifetime of the measure (e.g. roof insulation has a lifetime of 40 years and has to pay off in this time). In this respect, the lifetime of every EEM has to be given, but with the possibility of adding this value to the measure. This could be a kind of return of investment (ROI) calculation; the result would be the ROI time in years on the one hand and the net present value (NPV) of the EEM on the basis of its lifetime (e.g. PV-system has an ROI of 6 years and a NPV of 20,000 EUR on the basis of a lifetime of 20 years). This is an important value for financial decision makers.
- It would also be advisable to see the performance of all buildings in Germany, divided by types of buildings and with the specific values in kWh/m²

4.3.2 Catalonia

Representatives in this PPA find the Benchmarking tool (tool 3) as the most appropriate for their needs, as it permits to monitor the evolution of the building stock performance with either hourly and monthly data availability. Representatives consider that this tool provides relevant information to energy managers, decision makers and financial officers. One of the priorities of the Catalonia PPA is to collect information about the implemented Energy Efficiency Measures (EEM) across their buildings, their associated costs and expected energy savings. Through this information, they can share knowledge among the stakeholders in order to improve decision-making in the future. The tool provides recommendations based on the most effective EEM in terms of energy savings and investments, which is considered very useful.

Some benefits highlighted by the representatives are:

- It provides easy and quick insight into how buildings are consuming energy, and compares them with their historic consumption profile.
- It allows identifying departments or types of buildings that require energy efficiency actions.
- It allows quick identification of buildings in the worst conditions (in energy consumption kWh/m^2) compared with their similar ones. This allows identifying problematic cases and paying special attention to the most negative cases.
- It allows us to keep a clear record of the Energy Efficiency Actions that have been carried out in each building (grouped in a way within the different organisational levels of the Government of Catalonia).

- It offers the possibility of analysing what have been the measures with the best real results in the buildings.
- It offers an initial set of recommendations or actions to be applied in each building to improve its energy consumption, including an initial approximation of the required budget to implement the measures.

The application as discussed above is useful, but some aspects of the application could be improved to increase its use in the public authority:

- Facilitate the analysis where the analysis period can be easily selected. Currently, the results of last year's performance compared to the current date are shown in a static way.
- Improve the analytics of each particular building to be able to identify as far as possible which subsystem needs to be actuated, for example, air conditioning, heating, or lighting. Recommendations should also be linked more to the subsystems with detected problems. Currently, it is still very generic.
- Include a data verification system that checks the data manually input by the users (basic data of the buildings and of the applied measures). It is necessary to have some type of verification that the data entered are within an expected range. Without verification, errors in the data entry can cause errors in the average values that are used in the recommendations.
- It should analyse in depth the set of measures to be applied and recorded in the application. In some of them it would be necessary to specify a few more specific fields, e.g. "change of heating system", and the user should be able to record the capacity of the equipment.
- It would be advisable to have some fields of description of buildings that would improve both comparisons and recommendations. For example, description of systems of heating and / or air conditioning, envelope, etc.
- It would be recommendable to have results of energy consumption in other units, not only in kWh, for example in €, CO2, etc

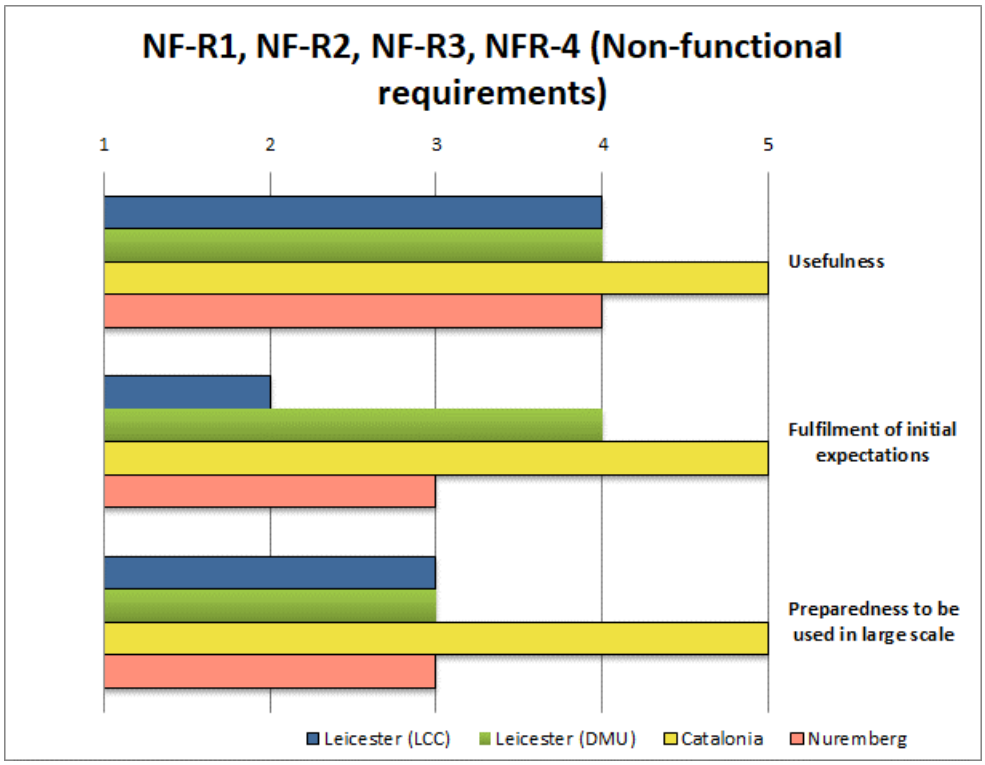
4.3.3 Leicester

In both cases, Leicester City Council and De Montfort University, the exposure to the EE benchmarking tool is recent. Hence, the tool is currently being populated with the required buildings' information (such as floor area by department, building type, age and other data). Representatives perceived that there could be several features in this tool useful for the organisations, such as information of the cost savings. In DMU, it is planned to use this tool to record actions taken on buildings such as the Bede Island building (Faculty and Technology), where specific energy efficiency actions have recently been completed. This will be used as case study material for the new partners joining the project. In this building, electricity savings of over 15 percent have been achieved through a combination of different actions such as more efficient lighting, better control of computers and advice to building users. Nevertheless, it is considered that once most of the required data are available in the tool, its functionalities and benefits can be better understood and assessed.

4.4 Non-Functional Services (NF-R1, NF-R2, NF-R3 and NF-R4)

Figure 4 illustrates the current perception of PPAs' representatives regarding the usefulness of non-functional requirements (NF-R): data services (NF-R1), system administration (NF-R2), status and notification

(NF-R3) and authentication (NF-R4). The complete responses to the questions related to F-R1 and F-R2 from PPA representatives are presented in Table A1.4 in Annex 1, and explained in the following subsections.



Likert scales: **Usefulness of the service:** 1=Definitively not useful, 2=Rather not useful, 3=Neither useful, nor not useful, 4=Rather useful, 5 = Definitively useful; **Fulfilment of initial expectations:** 1=Below expected and not functional, 2=Below expected with some major issues, 3=As expected with some issues, 4=As expected with minor issues, 5 = Fully as expected or above; **Preparedness to be widely deployed in the PPA:** 1=Not prepared, 2=Prepared with major issues to solve, 3=Prepared with some issues to solve, 4=Prepared with minor issues to solve, 5=Fully prepared.

Figure 4. Questionnaire's rating regarding the non-functional requirements (N-FRs)

4.4.1 Nuremberg

Representatives commented that the administrative tools are not meant to be used by *"all users"*. However, one recommendation that will facilitate administrative tasks is that when one meter is replaced by another one (i.e. the ID changes), it must be possible to add this replacement easily without losing the "old" data of the previous meter. This issue is absolutely crucial for the large scale roll-out.

It is also important to have the same login-data for the different services (dashboard, forum and EEM tool) to provide a better experience for the users.

4.4.2 Catalonia

Representatives considered that the data supplied by the tools are extremely useful for the PPA energy monitoring and planning. In this sense, it is useful having a "super-user" role that allows a wider view of the buildings' overall performance, position and improvement possibilities. Hence, they considered that the initial expectations of the services have been fully met and go beyond their expectations of use.

There was only one recommendation related to the automatic replication of buildings with hourly data from Benchmarking Tool (tool 3) to the Dashboard (tool 1) as presented in section 5 (Table 4).

4.4.3 Leicester

As to non-functional requirements, the representatives commented that the main data management services, administration, notification and authentication systems are only to be used by key individuals in the PPA and in DMU. Nevertheless, they also recommended to have the same login-data for the different services and having a clear and careful definition and structure of user rights and that certain administrative functionalities are fully implemented and tested, for example, ability or protection to 'overwrite' by other users.

5 Recommendations

This section summarises recommendations outlined in the Finding III (question 3 of the questionnaire template). As with any project associated with software development, technical bugs and glitches appear in testing of the different tools. The reporting and solving of these technical problems is important in order to minimise the likelihood that problems keep appearing when the system is deployed on a larger scale. Section 5.1 provides a brief summary of technical bugs, while section 5.2 summarises the recommendations for further development of the EDI-Net services.

5.1 Technical bugs

Several bugs and glitches have been detected during and after implementation of the operational platform. Most of them have been solved using the discussions initiated in the Tool 2 with the tag "Bugs" (https://discourse.edi-net.eu/c/software/bugs). The general bugs were corresponding to the Tool 1 and were identified in the D3.1 such as issues with uploading data, issues with viewing data, issues with configuring devices, issues with the way that data are displayed, issues with location and weather data, issues with data formats, issues with menu item names, issues with proportions of meters contributing to a virtual meter, issues with editing labels, issues with having too many smiley face graduations and issues with being required to reload pages to update information.

The major bugs have been resolved. Some minor ones and potential service improvement remain to be addressed on an origin basis, and are being dealt in a periodic basis (once or twice a month) via the Technical Committee web-based meetings. This committee is constituted by technical representatives of each PPA and the key software developers in DMU and CIMNE.

5.2 Recommendations for further development

Table 4 summarises the main recommendations for further development expressed by the core PPAs. It is important to note that the feasibility of the implementation of the recommended functionalities needs to be further analysed by the software development teams.

The feedback identified three main necessities for the integration mainly between the EDI-Net Dashboard (Tool 1) and the Energy benchmarking tool (Tool 3):

1. User integration: Through a same administrator user account all the three Tools will be connected in a same web platform.
2. Functional integration: This integration provides access to the different user interfaces. First, Tool 1 with a link to Tool 3, second, the Tool 3 to public league tables and forum (Tool 2) and, third, open in Tool 3 the public access in some tool sections.
3. Visual integration: The last integration is to perform a similar or same format to both Tool 1 and 3

Table 4: Summary of recommendations by functional requirement (and tool)

Tool and related functionality	Recommendations
Dashboard and league table (F-R1 and FR-2)	• Provision of baselines that can be selected and set by users • Provision of short technical description of how the system works (e.g. calculation of baselines, normalisation methods, data entering) • Set some normalisation for comparing buildings in league tables, particularly in terms of date of comparison. • Alarms triggered by outdated data or highlighting problems with meters in buildings.
Online forum (FR-3)	• Provision of automated translation between posts from different PPAs to minimise the language barrier
EE benchmarking tool (FR-4)	• Provision of performance results in a more dynamic manner • Provision of analytics of the building in a more disaggregated manner by subsystems • Include a data verification system that checks the data manually input by users • Ability of analyse in more depth the sets of measures. • Ability to have results of energy consumption in other units, not only in kWh, for example in €, CO2, etc • Insertion of all possible energy efficiency measures (EEMs) • Be able to differentiate “cost for only energy-related measures” and “costs incurred anyway” • Present savings in EUR and not only in kWh per year (perhaps using one average tariff for all buildings) • Ability to introduce further data (e.g. lifetime of measures) to calculate financial indicators, such as ROI, NPV. • Able to see performance of buildings in Germany by types of buildings and with specific values in kWh/m2
Non-functional requirements (N-FR1, N-FR2, N-FR3, N-RF4)	• It would be important to have a clear and careful definition and structure of user rights • Some administrative functionalities need to be fully implemented and tested, for example, ability or protection to ‘overwrite’ by other users. • Buildings with hourly data must automatically appear in both Dashboard and EE benchmarking tool • If a meter gets replaced by another one (i.e. the ID changes), it must be possible to add this replacement easily without losing the “old” data of the previous meter. • Refer to the comments and discussions made in the software section of the forum. There is usually a lot of information regarding glitches and bugs of the data management. • Having the same login-data for different services (dashboard, EEM tool and forum) for a better user experience. • Where possible, to integrate most of the features and functionalities in one place (system). • Improve the consistent reliability of the system

6 Conclusions

This deliverable concludes that the initial expectations from the EDI-Net tools' preparation have been fulfilled and that the project is on track for achieving the targeted impact. The involvement of targeted buildings at the core PPAs has been considerably overachieved, and the involvement of targeted users has been near the planned for the current stage of the project.

The EDI-Net tools have been rated as highly useful, and the fulfilment of initial expectations is acceptable, as described in questionnaire results. However, as with all software, there are ongoing technical issues to be solved. These are being dealt with in meetings of the Technical Committee. Several functional issues, code bugs and glitches, have been already addressed, and few minor issues are being solved, thus bringing the tools at a technical level that is prepared for wider use by follower PPAs .

The additional comments by the PPA representatives in the interviews reveal clearly the necessity of user training in order to improve the understanding of the tools' features and functionalities, which consequently will make the tools more useful. This is clearly evidenced by the rating of the Benchmark tool (Tool 3) showing sharp differences in the assessment between the PPAs that are extensively using and understanding the tool (e.g. Catalonia, giving the highest score of 5) , and those that are just starting using it and are still not very acquainted with it (e.g. Nuremberg and Leicester). It is important to highlight the most powerful features of the Benchmarking tool (tool 3), such as the targeted comparatives and recommendations by building typology, which should become visible in the tool with increasing the number of buildings in the system. In this respect, the 1,156 buildings in Catalonia give their PPA users a different perspective compared to that of PPAs with only a few buildings within the system.

The results from the feedback received by the PPA representatives regarding the different aspects of the impact assessed in the document are summarised below as findings.

- Finding I (targeted buildings) reveals that at the current stage the involvement of targeted buildings in the EDI-Net system has been larger - approximately twice - than the initially planned. In total, instead of 687 buildings of initial expectations there are 1,384 buildings incorporated into the system.
- Finding II (targeted users) describes the initially expected and planned number of users at the current stage of the project. Overall, the reported involvement of the targeted/planned users of the project has been adequate to this stage of service deployment at the PPAs, with almost 80% of the public officers and 65% of the public staff planned for direct impact within the whole project duration.
- Finding III (service feedback) explains the perception of the PPAs' representatives regarding the usefulness, fulfilment of expectations and preparation of the services to be used on a large scale. The feedback provided allowed evaluating the degree of preparation of the EDI-Net tools for the larger uptake of the services in the next project stage. Both quantitative and qualitative evaluation was possible, as the feedback was based on questions with Likert scale items, as well as on open-questions asked via semi-structured interviews with the representatives which provided further insight and aimed to clarify their responses.

Responses of the interviews highlighted that the PPAs have different goals and approaches to achieve the energy savings and carbon reductions, as well as differences in the access to consumption data. These aspects determine also different priorities in the use of the available EDI-Net tools. For example, Generalitat de Catalonia focuses to a great extent on the energy renovation of buildings. Important decision support is possible by monitoring and comparing the performance of large stock of buildings, hence, users find more appropriate for their purposes the Energy Benchmarking application (Tool 3). In Nuremberg and Leicester, the emphasis is on the use of near real-time data for detecting problems that are causing high energy consumption or to motivate users towards energy savings behaviours through the visualisation of data. Hence, these PPAs find the Dashboard (Tool 1) as a more appropriate tool for their purposes. Not only the difference in preferences, but also previous experience with the tools seem to have influenced the rating of the tools.

Some conclusions on the assessment for each of the tools are summarised below:

Dashboard (Tool 1)

The tool is rated with overall 4 (scale of 5) due to its usefulness to track energy performance in a user-friendly manner and especially because it works with recent and high frequency energy data (hourly, half-hourly data from previous day) which permits the users to remember and improve/correct rapidly the building management practices. But some of the main problems for the extended use at large scale are related with the unavoidable in practice errors in readings of some meters. Some contingency measures in this respect, such a normalisation of the buildings in the league table in terms of date comparison across buildings would improve the data presentation and increase the confidence of the users.

Online Forum (Tool 2)

The online forum has been rated at 3.75 (scale of 5). In particular, Catalonia and Nuremberg highly rated the tool in terms of the fulfilment of expectations and preparedness to be used at a large scale. However, the insight into the relatively lower rating in usefulness reflects the current reluctance of energy managers to use such new tools and ways of communication, rather than the technical usefulness of the tool. The conclusion is that the managers are more accustomed to face-to-face communication and phone calls, and the use of such tools would take more time for wider acceptance. High work pressures and time constraints on the managers in their day to day routine does not favour the rapid acceptance of the tool either, which requires to dedicate time for writing and reading. More concrete purpose and specific context in the application of that tool (e.g. reporting of problems, FAQ), as well as new ways to attract the users will be necessary to increase the usage of that tool in the future.

Benchmarking (Tool 3)

The Benchmarking tool has been rated overall 3.5 (scale of 5), with higher rate for the aspect of usefulness. The tool has been rated with the maximum 5 by Catalonia in all of the aspects (with long and wide experience in the use of this tool). From the additional information provided by the PPAs, it can be deduced that the low scorings of Nuremberg and Leicester are related to the only recent use of the tool and the initial population of relevant building data. A low number of buildings in the system or limited building data do not permit assessing the full capabilities of the tool. In contrast, the larger experience in using the tool in Catalonia and

the high number of buildings with information in the system has led to the highest score. In this respect it can be concluded that more training and a critical mass in the building stock of the PPAs will improve the user acceptance. This is a good premise for the wider uptake of the tool in the next stage of the project.

Annex 1. Questionnaire and interview responses

Table A1.1 - Responses to F-R1 and F-R2 (Dashboard and league tables)

1	**Please rate the usefulness of the service for your PPA**					
		Definitively not useful (1)	Rather not useful (2)	Neither useful, nor not useful (3)	Rather useful (4)	Definitively useful (5)
	Leicester (LCC)				X	
	Leicester (DMU)					X
	Catalonia					X
	Nuremberg					X
Please provide a brief explanation of the rationale behind your response (e.g. benefits, attributes or problems preventing your use)						
	Leicester	LCC • Useful tool to quickly identify problems in the metered consumption prompting to look to the particular issues in more detail. • If the tool is consistently reliable, local facility managers can find it useful for their day-to-day energy management of their buildings and reduce energy wastage. • In terms of smiley faces and detailed graphs, it is a user-friendly interface. DMU • Very simple and straight forward way of expressing current energy data • Use of faces is very engaging to staff, students and visitors • League tables allow competition between buildings across campus				
	Catalonia	• Advanced warning on possible malfunctions of equipment out of scheduled working time. • Possibility of real-time comparison among other peer buildings and performance evolution on the building itself.				
	Nuremberg	• Provision of recent and actualised energy data, and take a prompt action • Smiley faces and league tables are very good allowing comparison between buildings based on actual recent data. • Allowing easy and quick detection of problems (meters or other anomalies) and investigate problems in more detail.				
2	**To what extent do you think that the service has fulfilled your initial expectations (e.g. in terms of functionalities)?**					
		Below expected and not functional (1)	Below expected with some major issues (2)	As expected with some issues (3)	As expected with minor issues (4)	Fully as expected or above (5)
	Leicester (LCC)			X		
	Leicester (DMU)				X	
	Catalonia					X
	Nuremberg			X		
Please provide a brief explanation of how your PPA's expectations have been fulfilled or not:						
	Leicester	LCC				

		• High initial expectations due to long experience (more than a decade) of using half-hourly data. • Due to some technical problems, it has prevented us deploy and engage with a larger number of users at this stage. • Engagement with users in schools is being addressed. DMU The system is now working well although there were some initial issues with data collection and displaying current performance data for some of the buildings. This has largely been rectified.
	Catalonia	Even though some minor features are yet to be arranged, the provided services are satisfactory, as it supplies the necessary information to arrange the detected malfunctions and the performance gaps among the building itself and the peers' indicated performance indicators. The Catalonia PPA is also expanding the use to a wider range of users and buildings, in order to enforce the achievement of a solid database of measures and metered data.
	Nuremberg	There are still some important issues left: • The consumption data comes in two different formats, but it looks like only one format is currently processed by EDI-Net. • After a meter has been replaced by another one, there currently is no way to incorporate the replacement into a virtual meter without losing the historical data of the replaced meter; this is a crucial issue • The data of the different buildings in one league table is sometimes from different dates. • Other (non-professional) users are just being addressed. A first operational use of the dashboard is planned for November 2017.

3	**To what extent do you think that the service is prepared to be used by the PPA in large scale?**					
		Not prepared (1)	Prepared with major issues to solve (2)	Prepared with some issues to solve (3)	Prepared with minor issues to solve (4)	Fully prepared (5)
	Leicester (LCC)			X		
	Leicester (DMU)				X	
	Catalonia				X	
	Nuremberg			X		

Please provide some specific recommendations that could improve the service:		
	Leicester	LCC • Need of a consistently reliable system • Where possible, to integrate most of the features and functionalities in one place. DMU • Some minor data issues remain for a small number of buildings
	Catalonia	• Selection of baselines • Explanation of normalisation and baseline calculation methods. • Data entering • Explanation of outputs and indicators.
	Nuremberg	• Provision of two different baselines (with the ability to be selected and set by users. • Provision of short technical description of how the system works (e.g. calculation of baselines)

		• Set some normalisation for comparing buildings in league tables, particularly in terms of date of comparison. • Alarms triggered by outdated data or highlighting problems with meters in buildings.

Table A1.2 - Responses to F-R3 (Online forum)

1	**Please rate the usefulness of the service for your PPA**					
		Definitively not useful (1)	Rather not useful (2)	Neither useful, nor not useful (3)	Rather useful (4)	Definitively useful (5)
	Leicester (LCC)		X			
	Leicester (DMU)				X	
	Catalonia				X	
	Nuremberg			X		
Please provide a brief explanation of the rationale behind your response (e.g. benefits, attributes or problems preventing your use)						
	Leicester	LCC • Difficult to engage energy managers to use the discussion forum due to the way they are used to interact with each other. As central managers are located in the same working space, they prefer to talk with each other or through phone calls if they are located in other buildings. They also use an internal system to communicate. • For other building users, such as staff, they also face time constraints and pressure of work. DMU • Very useful tool to enable building users to discuss issues with each other • A platform which can be used for a variety of topics which relate to energy use e.g. behaviour change, education for sustainable development (ESD) etc				
	Catalonia	• Though it needs more active use from the participants, the Online Forum provides an excellent tool where to comment and discuss issues, questions and possible solutions to a wide extent of problems that can arise along the day to day management of the building energy performance.				
	Nuremberg	• Useful tool for expressing opinions and providing suggestions for further development of the EDI-Net tools • Currently not useful for the actual use in the EDI-Net services because of a problem of acceptance by the target groups				
2	**To what extent do you think that the service has fulfilled your initial expectations (e.g. in terms of functionalities)?**					
		Below expected and not functional (1)	Below expected with some major issues (2)	As expected with some issues (3)	As expected with minor issues (4)	Fully as expected or above (5)
	Leicester (LCC)		X			
	Leicester (DMU)				X	
	Catalonia					X
	Nuremberg					X
Please provide a brief explanation of how your PPA's expectations have been fulfilled or not:						
	Leicester	LCC • Comparing to other fora, such as the Local Authority Forum, it is advisable to be able to find a variety of topics that are for interest to				

		energy managers, and also to be able to download documents, such as policies or training material. DMU • The system and online forum is a very useful tool for staff and students to use. • There are difficulties in encouraging staff and students to use the forum, however some incentives have helped to improve engagement although this issue hasn't been fully resolved. • The forum provides an environment where staff can openly discuss energy related issues within their buildings.
	Catalonia	The Forum is developed and prepared to a more intensive use, despite the possible language barrier that may arise.
	Nuremberg	• The discourse software works very well and provides good tools and services; • The "news alert" with an automated e-mail telling the user what happened when she/he was not logged in for a while is such a very good feature

3	**To what extent do you think that the service is prepared to be used by the PPA in large scale?**					
		Not prepared (1)	Prepared with major issues to solve (2)	Prepared with some issues to solve (3)	Prepared with minor issues to solve (4)	Fully prepared (5)
	Leicester (LCC)		X			
	Leicester (DMU)				X	
	Catalonia					X
	Nuremberg					X

Please provide some specific recommendations that could improve the service:		
	Leicester	LCC • Energy managers and staff may not be ready to engage with the online forum as discussed above. We have told them about this tool, but each user choose to use it or not. However, it is advisable that the topics are nicely structured to make it more user friendly. • In the case of schools, it may work differently, but we cannot guarantee a wide use as it will depend on the users. DMU • See raised above regarding engagement.
	Catalonia	• Automated translation between the posts from different pilot sites could be implemented, as the language barrier can suppose a barrier.
	Nuremberg	• It is not expected that many users actively post comments in the forum for sharing best practices or for managing the solution of problems. • The online forum is a new way of communication and working together that may be too modern compared to the existing way of working for most part of the staff • In schools, it is difficult to predict. Potentially younger generations of teachers may have more acceptance of the tool.

Table A1.3 - Responses to F-R4 (Energy benchmarking tool)

1	Please rate the usefulness of the service for your PPA					
		Definitively not useful (1)	Rather not useful (2)	Neither useful, nor not useful (3)	Rather useful (4)	Definitively useful (5)
	Leicester (LCC)				X	
	Leicester (DMU)				X	
	Catalonia					X
	Nuremberg		X			
Please provide a brief explanation of the rationale behind your response (e.g. benefits, attributes or problems preventing your use)						
	Leicester	LCC • Our exposure to this tool is recent. It seems that there are several features in the tool that can be useful for the council, such as information of the costs savings. However, as the tool is currently being populated with building data, such as floor area, departments, etc. , we need to understand better its functionalities and benefits. DMU • We are just starting to populate this tool with relevant data from the University buildings. Hence, the main functionalities are yet to be better understood and benefits to be identified (see response below).				
	Catalonia	• This tool provides relevant information to energy managers, decision makers and financial officers. • Provision of a range of EE measures to be implemented in the building and its associated costs and expected savings. • It allows knowing easily and quickly how buildings are consuming energy, and compare them with their historic consumption profile. • It allows identifying departments or types of buildings that require energy efficiency actions. • It allows a quick identification of buildings in the worst conditions (in energy consumption kWh/m^2) compared with their similar ones. This allows identifying problematic cases and paying special attention to the most negative cases. • It allows us to keep a clear record of the Energy Efficiency Actions that have been carried out in each building (grouped in a way within the different organisational levels of the Government of Catalonia). • It offers the possibility of analysing what have been the measures with the best real results in the buildings. • It offers an initial set of recommendations or actions to be applied in each building to improve its energy consumption, including an initial approximation of the required budget to implement the measures.				
	Nuremberg	• Just recently, the synchronisation between the dashboard and the benchmarking tool has been set up. Now all buildings are available and some data (e.g. floor area) have been incorporated – however, energy efficiency measures etc. have to be added. • Getting financial decision makers to use this tool will require a lot of effort in convincing them of the added value of the tool. • The tool may need a lot of adaptation for the case of Nuremberg.				

2	**To what extent do you think that the service has fulfilled your initial expectations (e.g. in terms of functionalities)?**					
		Below expected and not functional (1)	Below expected with some major issues (2)	As expected with some issues (3)	As expected with minor issues (4)	Fully as expected or above (5)
	Leicester (LCC)			X		
	Leicester (DMU)				X	
	Catalonia					X
	Nuremberg		X			
Please provide a brief explanation of how your PPA's expectations have been fulfilled or not:						
	Leicester	LCC As mentioned above. DMU • The energy efficient measures tool will be used by De Montfort University to record actions taken on buildings such as the Bede Island building (Faculty and Technology), where specific energy efficiency actions have recently been completed. This will be used as case study material for the new partners joining the project. For example, in this building savings of over 15 percent in electricity consumption has been achieved through a combination of different actions such as more efficient lighting, better control of computers and advice to building users				
	Catalonia	The benchmarking service is an extremely useful operation tool, which can be put in practice immediately to a wider audience.				
	Nuremberg	It was initially expected that the impact of EEM could somehow easy be calculated based on already available data; due to the small number of mentionable EEM in Nuremberg, it seems to be not feasible to create an estimation of the impact of EEM only based on our own experience; our experts will rather rely on their own experience gained in own projects and drawn from the own expert network				
3	**To what extent do you think that the service is prepared to be used by the PPA in large scale?**					
		Not prepared (1)	Prepared with major issues to solve (2)	Prepared with some issues to solve (3)	Prepared with minor issues to solve (4)	Fully prepared (5)
	Leicester (LCC)			X		
	Leicester (DMU)			X		
	Catalonia					X
	Nuremberg		X			
Please provide some specific recommendations that could improve the service:						
	Leicester	LCC • The comparison of energy data is constantly for 12 months. It is advisable to be able to change the comparison period. DMU • No further recommendations at the moment, we need to understand better the functionalities of this tool.				
	Catalonia	• Provide results of performance in a more dynamic manner where the period of analysis can be easily selected.				

		• Provide analytics of the building in a more disaggregated manner (e.g. subsystems such as air conditioning, heating or lighting, that need to be actuated. • Recommendations should also be linked more to the subsystems with detected problems. Currently, it is still very generic. • Include a data verification system that checks the data manually input by the users (within an expected range). Without verification, errors in the data entry can cause errors in the average values that are used in the recommendations. • Ability of analyse in more depth the set of measures. For example, "change of heating system", the user should be able to record the capacity of the equipment. • Add some fields of description of buildings that would improve both comparisons and recommendations. For example, Description of systems of heating and / or air conditioning, envelope, etc. • Ability to have results of energy consumption in other units, not only in kWh, for example in €, CO2, etc
	Nuremberg	• Insertion of all possible energy efficiency measures (EEMs) • Be able to differentiate “cost for only energy-related measures” and “costs incurred anyway” • Present savings in EUR and not only in kWh per year (perhaps using one average tariff for all buildings) • Ability to introduce further data (e.g. lifetime of measures) to calculate financial indicators, such as ROI, NPV. • Able to see performance of buildings in Germany by types of buildings and with specific values in kWh/m2 Minor issues: • Adjusting chart resolution • Adjusting the date range • Normalisation for the German model building • Including possibility to add Water consumption and units in the software (Euro currency) • Adding a new area (field) to allow economic investment per measure and implementing a report of evaluation of savings and energy efficiency measures.

Table A1.4 Responses for NF-R1, NF-R2, NF-R3 and NF-R4

1	**Please rate the usefulness of the service for your PPA**					
		Definitively not useful (1)	Rather not useful (2)	Neither useful, nor not useful (3)	Rather useful (4)	Definitively useful (5)
	Leicester (LCC)				X	
	Leicester (DMU)				X	
	Catalonia					X
	Nuremberg				X	
Please provide a brief explanation of the rationale behind your response (e.g. benefits, attributes or problems preventing your use)						
	Leicester	LCC The main data management services, administration, notification and authentication systems are only to be used by key individuals in the PPA. DMU These main elements e.g. management service, administration, notification and authentication systems will only be used by select members of staff within the organisation.				
	Catalonia	The data supplied can be of extreme use, and the super-user role allows having a wider view of the buildings' overall performance, position and improvement possibilities.				
	Nuremberg	The administrative tools are not meant to be used by "all users". Some improvements have been made to make the services more useful. However, there is still some room for improvement (see below).				
2	**To what extent do you think that the service has fulfilled your initial expectations (e.g. in terms of functionalities)?**					
		Below expected and not functional (1)	Below expected with some major issues (2)	As expected with some issues (3)	As expected with minor issues (4)	Fully as expected or above (5)
	Leicester (LCC)		X			
	Leicester (DMU)				X	
	Catalonia				X	
	Nuremberg			X		
Please provide a brief explanation of how your PPA's expectations have been fulfilled or not:						
	Leicester	LCC • It would be important to have a clear and careful definition and structure of user rights • Some administrative functionalities need to be fully implemented and tested, for example, ability or protection to 'overwrite' by other users. DMU • The system is functioning well with some minor issues still to be resolved. Data services and admin systems are working well. Pleased with the current functionality of the system				
	Catalonia	The services are accomplishing the initial expectations and, in general, are over our expectations of use.				
	Nuremberg	Different login-data for the different services (dashboard, EEM-tool, forum) can be confusing or annoying for the user				

3	**To what extent do you think that the service is prepared to be used by the PPA in large scale?**					
		Not prepared (1)	Prepared with mayor issues to solve (2)	Prepared with some issues to solve (3)	Prepared with minor issues to solve (4)	Fully prepared (5)
	Leicester (LCC)			X		
	Leicester (DMU)			X		
	Catalonia					X
	Nuremberg			X		
Please provide some specific recommendations that could improve the service:						
	Leicester	DMU • As previously stated there have been some data issues in relation to the data for some buildings being several days behind real time. However these issues are being resolved and the system is functioning well. Once these issues have been completely resolved the system will be ready to be promoted across the organisation				
	Catalonia	• Buildings with hourly data must appear in Dashboard				
	Nuremberg	• If a meter gets replaced by another one (i.e. the ID changes), it must be possible to add this replacement easily without losing the “old” data of the previous meter. • Please refer to the comments and discussions made in the software section of the forum. There is usually a lot of information regarding glitches and bugs of the data management as well.				