3e-Houses
FINAL REPORT

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Project co-funded by the European Commission within the ICT Policy Support Programme		
Dissemination Level		
PU	**Public**	**X**
PP	**Restricted to other programme participants (including the Commission Services)**	
RE	**Restricted to a group specified by the consortium (including the Commission Services)**	
CO	**Confidential, only for members of the consortium (including the Commission Services)**	

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1. Introduction

The 3e-HOUSES project was a CIP ICT PSP funded project which has dealt with the integration of the most established ICT technologies in social housing, providing an innovative set of services for energy efficiency:

- real time monitoring and management of the energy consumption;
- integration of renewable energies;
- creating the resources to lower energy consumption.

These services have been implemented and tested by real users in four different locations: Two pilots in Sant Cugat del Vallès (Spain) and Leipzig (Germany). And two replicators in Bristol (UK) and Langenfeld (Germany).

These services allowed the integration of renewable energy and other sources of distributed energy. The project resulted in a reduction of around 20% of energy consumption in social buildings, by means of real time monitoring, management and control systems.

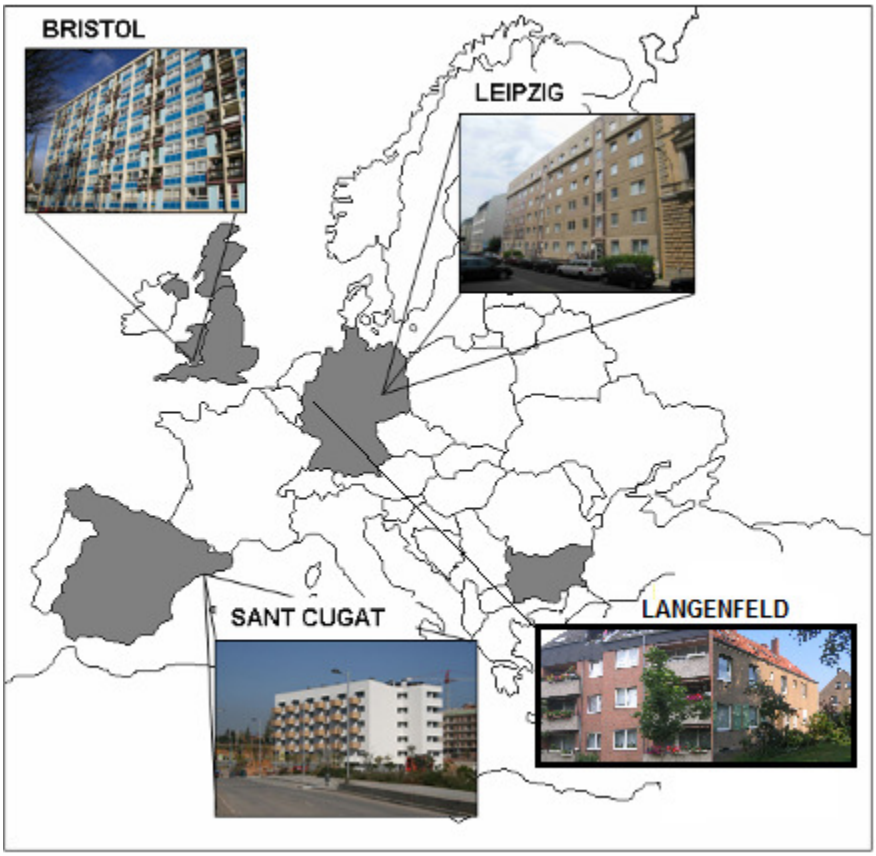

Figure 1. Pilots and replicators locations.

For the project purposes two kinds of users were identified:

- Operators: who were in charge of the service administration in the social housings.
- Tenants: who live in the buildings and who are the energy consumers and the end-users of the technology

The project ran for 40 months in total and included the participation of around 250 tenants in these four locations.

Among the most relevant results of the project were:

- The development of two different methodologies for energy efficiency measurement and impact assessment,
- The implementation of the technical solution in four different locations under a pilot-replicator scheme,
- The assessment of the energy savings in all these pilots and the analysis of the socio-economic impact of the project within different environments.

Further information about these results is provided below.

2. List of beneficiaries

	**GAS NATURAL FENOSA group** Gas Natural Fenosa, (GNF) is an integrated energy company that participates in the generation, distribution and retail business of natural gas and electricity. It operates in 23 countries and counts with over 21.000 employees. Within the project, three of its companies have participated: • Gas Natural SDG S.A. • Unión Fenosa Comercial S.L. • Gas Natural Soluciones S.A. Coordinator of the project and in charge of the dissemination and follow up of the technical solution in the pilots and replicators as well as the implementation in Sant Cugat pilot. Contact: Dr. Milagros Rey Porto (mreyp@gasnatural.com)
	**INDRA SISTEMAS S.A.** Indra is the premier Information Technology company in Spain and a leading IT multinational in Europe and Latin America. It is ranked as the second European company in its sector according to stock market capitalisation, and also the second Spanish company with the most investment in R&D. Within 3e-Houses they have been responsible of the technical coordination of the pilot in Sant Cugat and has been a very active partner in the dissemination of the project results. Contact: Mrs. Marta Arias Álvarez (mariasa@indra.es)
	**SPM Promocions Municipals de Sant Cugat del Vallès S.A** PROMUSA is a public owned company by Sant Cugat City Council. They are in charge of the promotion of social housing in the town and within the project they have been a key factor for the involvement of the users in their pilot. They have been in charge of the engagement campaign, the communication with the tenants and have been the first support channel for the users in the pilot. Contact: Mr Jordi Ribera (jordiribera@promusa.cat)

ennovatis Energiemanagement-Systeme	**Ennovatis GMBH** The primary goal of the company is the development of cost effective tools to increase Energy Efficiency and comfort in buildings. It holds patents in intelligent metering and model based monitoring. Their role in the project has been the coordination and execution of the pilot and replicator in Germany. They have had an important role not only in the technical side, where they have integrated their solutions, but have also been in charge of the engament and support of the project users. Contact: Mr Dan Hildebrandt (d.hildebrandt@ennovatis.de)
Bulgarian Housing Association	**Bulgarian Housing Association** BHA is an independent, private, non-profit legal entity, registered under the Bulgarian law for non-profit entities. Within the project they have acted as observer for the pilots and replicators, providing their knowledge on social housing in eastern Europe and being an actor for dissemination of the 3eHouses whitin their area of influence. Contact: Dr. George Georgiev (bulgha@gmail.com)
BRISTOL CITY COUNCIL	**Bristol City Council** The council of the city has been the main facilitator and coordinator of the replication pilot implemented in Bristol. They have been really active on the users' engagement and the dissemination of the activities performed within the project framework. Contact: Mr Kevin O'Malley (kevin.omalley@bristol.gov.uk)
KNOWLE WEST MEDIA CENTRE	**Knowle West Media Centre** KWMC is a registered charity and company limited by guarantee. KWMC performs a wide social, cultural and educational role in the community. A core element of this function is the location of the organisation in South Bristol. They have been a very important partner in terms of user engagement, providing support to them, feed backing the experience to other partners and elaborating the main audiovisual contents for the project consortium. Contact: Ms. Carolyn Hassan (carolyn@kwmc.org.uk)

IP performance	**IP-Performance LTD** IPP provides network infrastructure solutions to enterprises, service providers, universities and the public sector. They have provided the IT infrastructure to the pilot replication in Bristol. They've been responsible for the design and installation of the network in order to meet the interconnectivity requirements of the project, namely, between the smart meters and monitoring/controlling systems as well as Internet connectivity to the residents of the social housing complex chosen for the replication. Contact: Mr Paul White (pwhite@ip-performance.co.uk)
TOSHIBA Leading Innovation	**Toshiba Research Europe Ltd – TREL** Within 3eHouses the Telecommunications Research Laboratory (TRL) has been involved. They have been in charge of the technical implementation in the replicator in Bristol and providing the technical environment for the connectivity of the houses and their smart meters. Contact: Mr Mahesh Sooriyabandara (Mahesh@toshiba-trel.com)

3. Project objectives

The 3e-HOUSES project concept is the design, implementation and dissemination of 4 demonstration pilots, based on the integration of ICT technologies such as innovative control and monitoring systems, as well as Renewable Energies (RES) within social housing. This integration is focused on providing real time monitoring and control of energy consumption by providing information of how and where users consume energy.

The expected improvement in energy use was assumed to come from the following 4 aspects of the project:

- Energy consumption information for the operator. The continuous monitoring of the energy use has been the way to allow control systems to optimise energy performance.
- The use of embedded power production based on clean locally distributed and renewable resources without causing local instabilities in the electricity infrastructure.
- Energy feedback to the tenant and the stimulation of behavioural changes on the users of the energy in social housing.
- Demand response strategies for peak shaving and load shedding achieved by the integration of storage (EV) and conservation plans.

In line with this concept, **the main objective of this project has been to improve sustainability in European social housing, via ICT-based centralized monitoring and management of energy consumption and production, and to provide decision makers with the necessary tools to be able to plan energy saving and peak reduction measures**.

The project structure has been divided into 6 different work packages following the structure presented in the following figure.

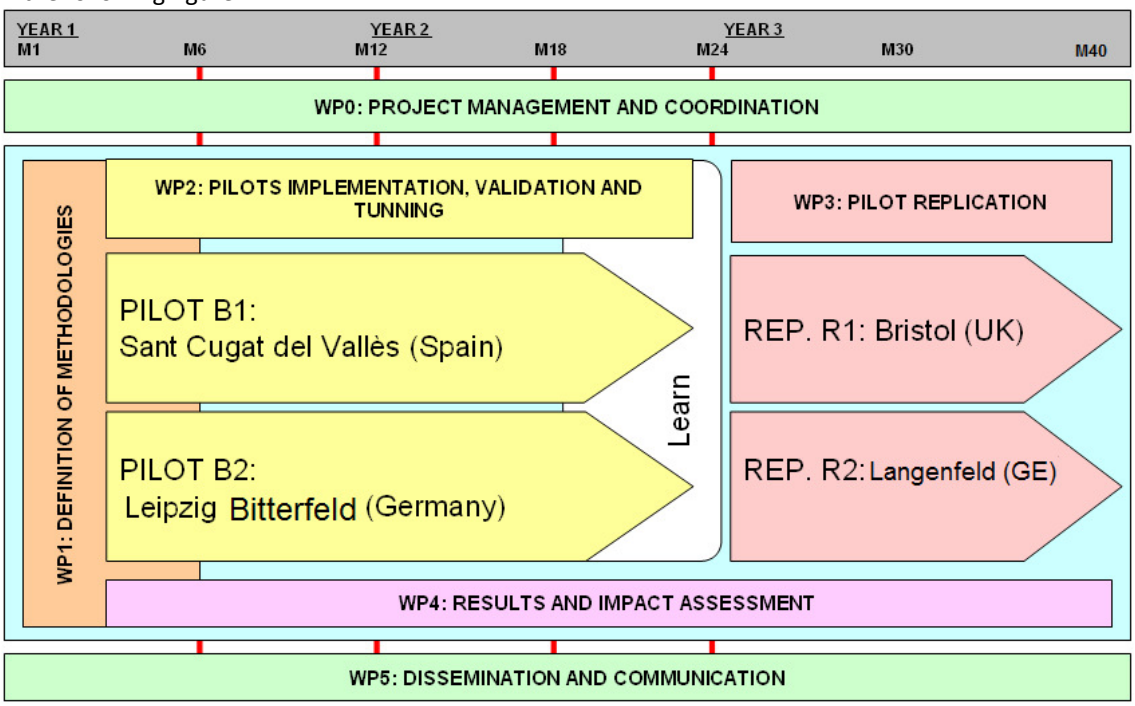

Figure 2. Work package and pilot/replicator structure.

The specific objectives of the 3e-HOUSES project have been:

- Definition of methodologies: To define the methodologies for measurement of energy consumption, for design the market campaigns to engage the tenants, and for evaluating the impact.
- Pilots design: To make the design and implementation of specific ICT systems defining the basics principles of future integration, and methodologies to measure the expected impacts.
- Pilots monitoring: To centralise the energy consumption and production monitoring, control and management in order to analyse the energy efficiency of the social housing. This objective has also allowed awareness-raising amongst users regarding the energy efficiency of the buildings they are using.
- Pilot implementation: To use the information collected during monitoring, to implement corrective/optimization measures and improve the energy efficiency of the buildings. This has been achieved thanks to the possibilities given by the innovative systems being validated in the pilot that have lead to a centralised control of the systems consuming or producing energy.
- Pilot validation: To show evidence and demonstrate the cost recovery based on the achieved energy savings and energy efficiency improvement.
- Replication of two pilots: To replicate the validated pilot experiences in other European countries in order to prove the replicability of the initiatives.
- Results and impact analysis: To make an overall assessment of the project results by putting together the results obtained from each of the pilots, in order to extract conclusions, best practice and enhancement of the pilots.
- Dissemination and promotion: To broadly disseminate the experience in order to raise public awareness and facilitate replication of the project.

4. Main challenges

4.1. Definition of methodologies

WP1 "Definition of methodologies", as the very starting point of the project, faced two main challenges, the first was in developing the consortium, the second related to specific work package objectives:

- Consortium team-building:. In the initial stages of the project, most partners had not collaborated in previous projects of this type. Different work cultures amongst partners: differences in internal reporting and different levels of feedback communications were all issues that needed to be resolved. There was even some inital reluctance from some partners to share objective viewpoints and remarks to different proposals (work plan, project logo, templates,), which, to a certain extent, delayed project progress in the first few months.

- Challenges linked to specific Work Package objectives.
  a. Development of a methodology for Energy saving calculation and for power demand curve peak shaving.
     Prolonged and in-depth discussions regarding the most appropriate methodology to perform accurate, trustworthy, verifiable measurement techniques and methodologies. There were different understandings by project team experts on energy efficiency about which types ofactivitiy should be included in the methodology for efficiency measurement

     There was also some discussion about the alignment with standardized international methods in the field,and other projects participating under the same thematic area, since several paths and options could have been followed (for more details please refer to Deliverable D.1.2. "Definition of Methodologies"). Our Methodology was taken as basis to define the common Methodology for European Projects and used as basis to define the eeMeasure SW.

     The IPMVP protocol, chosen by the 3eHouses consortium had to be adapted to the residential sector (subject to energy and water consumption measurements), since it had only previously been applied to the industrial sector. Loads of new technical, environmental, social and economic ratios had to be, for first, defined and introduced in the methodology. Additionally, several decision-making criteria had to be agreed upon internally among consortium experts on energy efficiency, with the other project consortia, and with the EC officer and experts in the field (implementability, accurateness, usefulness of the results, applicability to the type of project, etc).

  b. Definition of the impact evaluation methodology.

     Adittionally, and similarly to the difficulties in the definition of the Efficiency Measurement Methodology, initial technical discrepancies and viewpoints marked the point for debates and discussions prior to concluding on a common framework. Comprehensive questionnaires were drafted and discussed with several iterations of feedback on their contents, to try and ensure that all possible variables affecting the sample of participants had been taken into account. This included the social, technological and , educational context, checking that the whole plan was sustainable in a business sense and would, capture or foster customer loyalty.

  c. Engagement of participants.
     This was one of the toughest barriers that was faced in both the pilots and during the replicator's initialphase. The medium-to-low income and socioeconomic levels of the targeted groups, whose main daily worry at the time was not the environmental concern, neither their energy bill (in some cases the energy bill, or part of it, was paid by their "Landlords", the municipalities, comprised in the low dwelling rent), made it difficult to convince them to engage with the

project. Measurable, practical outputs in return for their participation had to be identified and offered: tablets.

Prior to project implementation there was a general disinterest in the topic of energy efficiency. Most of the tenants were also generally reserved and sceptic toward the new technologies which were presented to them.

Additionally, the German pilot marketing / engagement campaign had to be redefined and launched again, due to lack of participants. After the campaign was redefined and implemented, the results changed significantly.

4.2. Pilots design and execution

Although ICTs are a useful tool to provide in-depth information, they are also susceptible to frequent technical problems. For example, in the 3e Houses project, there were frequent interruptions in the running of the devices and the different communication systems.

Further to conversations with tenants, it was detected that many people are not familiar with the technology being introduced to their homes. For example, many participants could not use the tablet or had problems accessing their information via the Internet. In this sense we have concluded that providing detailed information about the running of the devices and offering different communication channels is very important to remove barriers.

The main challenges were different in both the pilot areas and are summarised separately below:

Spanish pilot

Diverse aspects had to be considered, to encompass the various different technical areas, namely:

- Analysis of the buildings and dwellings where the pilots were implemented: equipment, isolation and energy consumption.
- Functionality and features of the solution: measurement, data storage, monitoring, graphical outputs, reportingetcTechnical requirements associated with the desired functionality: i.e wireless, open, standard functionality.
- Full development and description of the ICTsolution. In order to provide the functionality and to fulfill the features defined: and ensure that the detailed specifications of the system/solution are described: data modelling, system architecture, physical and logical layers, communications layers, detailed description of measurement devices and actuators, Hardware and Software, (servers, databases, web and In-Home displays) etc.
- Analysis of the results: measurements, savings and their relationship with external variables (weather or socioeconomic factors).
- Engagement of tenants and promotion of their participation.
- Achievement of savings goals.

Different challenges have been faced in the development of this task:

- Analysis of initial energy consumption was very difficult because data was difficult to obtain:
    - To collect consumption data of two years previous to project start with a standard quality and homogeneous timeline, a manual treatment of the data was necessary.
    - Lack of baseline data.

- To create a consumption data baseline from initial data, it was necessary to manage a huge amount of data and to make complex calculations:

  The calculation of the baseline required finding the related input variables, and to have consumption data during enough time to ensure a proper way to calculate the baseline. For example, initially the baseline was calculated daily, but finally it was calculated on a monthly basis, because this approach was more accurate.

- The development of a complex wireless monitoring energy system entailed difficulties:
  - Technical problems: a wireless solution caused difficulties due to occasional loss of communications, errors in sending data, etc, but we conclude these errors were minimal during the pilot.
  - To avoid interference with the old meters. Since the equipment installed is still used by the current service provider (electricity, natural gas and water), it was necessary to design and install new measuring devices.

- Monitoring, energy management and control of the energy consuming systems of the buildings

  To manage a huge amount of data it was necessary to develop a specific SW. This SW was developed for the project measurement needs aimed at:
  - Calculation of savings: introducing the baseline calculations
  - Control of measurement systems and communication: to have control on measurement system and equipment operation
  - Show the tenants their consumptions, savings, advices, tips, etc.

- The development of a proper methodology for demand response assessment (in the case of electric vehicles and ecopoints) forced an intense study on the subject and we had to find and evolve very complex statistical analysis methods.

- Show energy information and ecopoints campaign (for demand response purposes) to tenants in a friendly and understandable way was a challenge because the information was very technical and the target audience had a low level of knowledge of energy aspects.

- Two communication levels needed to be addressed (dealt with as part of ICT solution technical and functional specifications and further development):
  - User level: communicate energy and energy efficiency information to users
  - ESCO Level: analyze the energy profile and its evolution

- Tenant's participation has represented some challenges along the project:
  - The lack of motivation of the tenants. It seems that saving energy and money using the Internet platform to control energy consumption is not an argument that immediately convinces tenants to use the platform more often. The small energy consumption of the tenants reduced the motivation to save and some of them do not have energy efficiency awareness. This awareness increase during the project with the project activities developed with the tenants.
  - The technological handling of most of the tenants was not very high. Some of them did not even know what a tablet is and in an ICT project this is a main issue.
  - Technical problems along the project such as malfunction of the tablets decreased the motivation of the tenants.

- Finally, to achieve savings goals was very difficult. To meet this objective it was necessary to implement different strategies:
    - Install consumption reduction systems such as thermostats, standby killers, improve boiler control systems, etc.
    - Increase tenant participation with communications, meetings, etc.
    - Resolve technical incidences.

German pilot

During the design phase and execution of the German pilot we faced a number of challenges, which have been solved during the lifecycle of the project.

For the German pilot, ennovatis had to design a unique energy management solution for use within a a social housing environment. Here, it was necessary to chose equipment and installation technologies, which were reliable, robust and easy to handle. Prior to the 3e-Houses project, ennovatis installed smart metering equipment in the industrial sector or in office buildings, but not in private dwellings of residential buildings. Hence, the technical design of an energy management solution with a combination of new devices (e.g. smart thermostats) and existing ones (radio temperature sensors, Smartbox, electrical power meters) had to be created.

As the tenants (and also the building owner) didn't allow the installation of any technical equipment, which was connected by wires, one of the technological challenges for the planned solution was the requirement to design a wireless solution. In the case of the German pilot, wireless sensors to gather heating and water data were already installed in the dwelling, but temperature sensors and electrical meters needed to be wireless as well.

To achieve correct results in the calculation of energy savings it was necessary to have accurate baseline data. Unfortunately some of the tenants couldnt provide the necessary data from the previous years and therefore the baseline data needed to be calculated from a small range of monitored data. To handle the huge amount of gathered data and to calculate monthly energy savings for each household it was necessary to develop a database which was used especially for this purpose.

In the German pilot, use of the internet interface for the visualisation of energy consumption data was very low. Therefore frequent meetings, phone calls and newsletters were provided to keep the tenants participating during the entire pilot.
Tenants from the two pilot sites in Leipzig and Bitterfeld had already succeeded in reducing energy consumption before the 3e-Houses project was implemented. In winter time room temperatures were ranging between 15°C and maximum of 21°C Hence, no substantial energy savings could be achieved in these individual dwellings of the German pilot.

For the measurement of room temperature and humidity we installed energy harvesting sensors. Those sensors were powered with solar cells, which transformed the light in to electrical energy to transmit the measured data to the receiver. In some cases the daylight was not enough to provide continous data and therefore in some sensors batteries were added.

One of the biggest challenges in the implementation of the German pilot was the engagement of tenants. Both pilots have shown that in big residential buildings of social housing the level of interest in participating in energy efficiency projects was very low. Even the use of incentives, like free WiFi-access, free tablet-PC's, shopping vouchers or the opportunity to win a smart phone couldn't convince most of the tenants to participate in themanner expected. The opportunities to save energy and water in the individual households after the introduction of ICT-measures, like stand-by killers or smart thermostats or a tenant's internet portal were therefore limited.

Ennovatis contacted several existing customers such as housing cooperatives (which are responsible for the billing of the tenants) to find a building which suited the requirements of the project. Once a building was found the tenants were contacted and informed about the project. Surprisingly, the willingless of the tenants to participate in the project was rather low. After the first review meeting the EC requested an increase of the numbers of tenants in the German pilot. Following this target two other buildings in another city were included in the project. A detailed description of the experiences with the work of the tenants in the Spanish and German pilot as well as recommendations for further projects are given in D2.4.2 – report on the user participation and acceptance of the pilots – final and updated version.

There were also several barriers in terms of the technology which needed to be overcome. In some of the dwellings their were problems with the installation of smart thermostats on the existing heating radiators. Either it was problematic to close the valve completely, or the smart thermostat couldn't be installed at all, because the existing valves were not compatible. Furthermore we needed to install OCR devices to read data from existing analogue electrical meters, because the exchange of meters with smart meters exceeded the budget of the estimated costs of the pilot.

4.3. Replicators design and execution

Following on from the pilot's in Spain and Germany, a second set of deployments were planned for Bulgaria and the UK. The principle behind this second set of pilots was that they would replicate the form of the initial deployments but enhance the roll out and execution by building in the learning on what works well and what is less successful. The UK replication for instance mirrored the technology which had been successfully deployed in Spain but, as recruitment and engagement had proved a challenge for the pilots, adapted the roll out plan to allocate far more time to identifying and signing up participants.

The exercise of replicating the pilot activities was challenging, with unexpected difficulties faced and addressed throughout the entire process.

Failed Bulgarian Replication

The initial challenge faced was perhaps the most difficult for partners to resolved; very late in the planning process (December 2011) it became clear that, as a result of contractual issues and industrial action, the Bulgarian pilot could not be rolled out. Partners quickly considered alternative options including Toshiba introducing a Replication in Paris, UK Partners extending the Bristol replication or another Spanish replicator. It was agreed that the most viable and deliverable option was to run a Replication in Germany along similar lines to the original pilot.

Recruitment and Engagement

The UK Replication in particular had very challenging recruitment targets of 100 participants. It had become clear, from the experience of the pilots, that recruitment was more challenging than expected. Recognising this UK Partners began recruitment and engagement activities 4 months earlier than planned and managed to achieve the target for participating households. German partners were also able to recruit 37 households in the replacement replication in a very restricted amount of time.

Billing and Baselines

German partners were fortunate to have detailed measured usage data for most dwellings for water and heating since 2008. UK partners, who unfortunately did not have this luxury, approached all participants for billing data from their utility supplier. Unfortunately the billing periods varied significantly (quarterly to yearly), many bills were based on estimates rather than meter readings, and a large proportion of participants used 'pre-payment' arrangements with suppliers which required them to buy top up cards in advance rather than pay bills in arrears.

Installation and Support

The experiences of the two replicators varied greatly around installation and support. The UK Partners installed 100 stand-alone home energy systems, one in each of the participant's homes. The German replication was able to take advantage of centralised metering equipment in their Multi-Dwelling Units, concentrating equipment securely in non-public, utility rooms. As UK Partners were installing equipment directly into participant's homes extensive testing was undertaken to gauge the robustness, reliability and effectiveness of the kit. Test deployments were rolled out initially in a lab setting, then in an unoccupied home environment, and finally in five real home environments. Despite this comprehensive testing unexpected technical issues were encountered throughout the full deployment.

Interface Development

The main intervention for both the German and UK replications was the introduction of a tablet based interface that illustrated participant's energy use in real time. The German Replication reused the interface developed in the German Pilot, but this time supplied a tablet PC on which to view it. The UK Partners spent considerable time and effort enhancing the look and feel of then interface, focusing on making it fun and engaging and 'gamifying' the experience of using it. Several enhancements were made and widgets introduced to the interface throughout the UK Replication. Each was assess to evaluate their impact on users behaviour.

Tennants Participation

Although participants dropped out of both the UK and German replicators, the numbers were broadly in line with what had been expected (c.10-20% of total sample). The reasons given for withdrawing from the project included ill health, changes in circumstances reducing time to participate, moving house and occasionally frustration with the technology/ process. In the UK replication the 100 participants were split into 2 cohorts, one of which (the Knowle West group) was provided with more personal support, and the other (Dove Street group) who received more remote support. In general more active and visible support seemed to increase participation/ retention, with the result that 100% of the Knowle West cohort completed final questionnaires for the project.

4.4. Socio-economic impact studies

The 3e-Houses project was very ambitious in aiming to measure a wide range of different aspects to energy use, which added to the complexity and difficulty of the analysis.

The most complex part of the project was undoubtedly the people aspect since this was the most complex and unpredictable.

One of the biggest difficulties was recruiting willing households to participate. This resulted in a comparatively small sample that was not representative of the population as a whole so that no robust statistical analysis could be performed. The use of randomised controlled trials would have improved the reliability of the technical and socio-economic analysis, although, in view of the difficulty recruiting participants, repeating this project with a random sample could prove difficult.

Collecting sufficient historical data is crucial for accurately assessing energy savings. In view of the importance of determining an accurate historical baseline, it is clear that a longer monitoring period is needed prior to intervention; a longer period of monitoring post intervention would also be useful for determining the sustainability of the behavioural change. A longer period of monitoring would require a larger sample size to account for the proportion of drop-out that is likely to result.

It is important to note the great difficulty encountered in the UK replicator with gas metering technologies. A large proportion of the UK social housing contained old gas meters that could not easily be connected to the monitoring technology.

Problems that arose from malfunctioning of tablets in Spanish pilot or internet connections in UK replicator preventing tenants to view their energy consumption were big de-motivators.

Since the tenants were able to compare on the interface their energy consumption with the one from their energy bills, it is essential that the interface is reliable and accurate as any problems result in mistrust and reduction of motivation.

Households on low income are particularly already low energy users out of necessity and so it may be difficult to convince them of any benefit to using energy saving ICTs.

Many of the efforts put in by households to reduce electricity consumption can be difficult to notice at the aggregate level if the devices being controlled are relative low energy consumers.

In the UK, running SQL read queries across the whole recorded sensor dataset to enable live data display on the interface became noticeably slow after a few months. Query execution times increased from < 1s to > 8s. This created an unresponsive display which participants felt less engaged to use.

Due to the small sample sizes and the relatively low interface use in the Spanish and German pilots, it is not believed that a socio-economic breakdown of the pilot interface use can offer any meaningful conclusions.

Encouraging all the participants to return completed questionnaires proved difficult in all four pilots and replicators. This fact must be taken into account when considering the conclusions drawn from the attitudinal and behavioural analysis.

When comparing the energy saved against the age of the main provider in the household, no correlation was seen in the pilots or replicators. This is perhaps understandable as the age and number of the other occupants within the households may vary considerably.

The variety of buildings involved in the project in all three countries varies in type and quality. This variable is difficult to quantify in the analysis but has to be considered when judging the overall impact of the project.

It is difficult to make a clear prediction broadly across the EU27 member states due to the widely varied social, cultural and economic contexts across those regions.

4.5. Dissemination

The main aims of the dissemination activities of the project were to increase the reach and impact of the project, share experiences and good practicelocate potential future partners and attract public administrations or investors.

The objectives defined in dissemination were:

- Transfer the knowledge and experience obtained in the project to other Local and European stakeholders in Energy Efficiency.
- Promote the scalability of the project results.
- Promote the use of ICT solutions for energy efficiency in the building sector.

- Increase the citizen's awareness in energy efficiency.

To ensure the effectiveness of the dissemination activities communication and dissemination tools were developed. Partners of the 3e-HOUSES defined a communication and dissemination plan that assured an important impact of the project across Europe. The major focus was to ensure that the project's research and outcomes were going to be widely disseminated to the appropriate target communities, at appropriate times, via appropriate methods.

Finally, the communication and dissemination in WP5 had a special importance in 3e-HOUSES project in as it was the work package which allowed us to:

- Obtain the required collaboration from tenants
- Develop cluster activities with other EU projects to obtain common conclusions in energy efficiency and ICTs areas Inform all the interested stakeholders about the project performance and results and raise awareness about the results on energy efficiency achieved by the project.

4.6. The 20% savings target

In Annex I to Deliverable D.1.1 "Report of energetic assessment and total energy concept of buildings where the pilots will be implemented" "Explanation of how the savings in different categories of energy consumption are calculated to contribute to the overall target of 20% energy reduction" sent to EC in January 2011, we explained why we defined as target to achieve 20% of savings in the pilots and replicators of 3eHouses.

In this document we can find the following explanation:

"According to the experience from different other projects it expected that approximately 5% energy savings will be achieved through behavioural improvements, if the tenants use the internet portal and adjust their own behaviour following the instructions of technical experts. If intensive guidance is provided by experts in energy management, who give suggestions to the tenants, then it is expected to increase also the energy savings up to 8-10%. These savings can be supported by the use of smart thermostats as well as time switches or moving sensors.

With the assumption of an intensive use of the internet portal, which gives the tenants important information about their energy consumption and costs, it is expected that the tenants are able to reduce their energy consumption for heating and electrical energy by **approx. 8 %(**Figure 3 - estimation of energy savings with ICTs**).** This will be achieved by changing behaviour regarding the heating of their dwellings. In case of the consumption of electrical energy it is also expected that this will be achieved via change in the behaviour of tenants e.g. in switching off all standby-components during the night, or reducing the washing temperature of the washing machine.

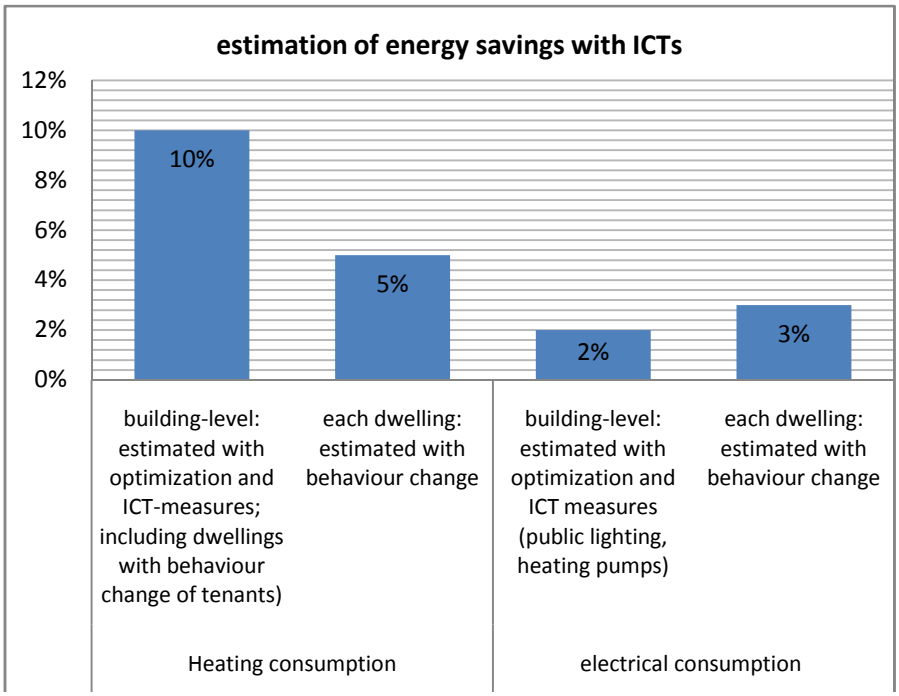

Figure 3 - estimation of energy savings with ICTs"

For the Spanish pilot the following potential savings were calculated:

Facility	Energy consumption	% Savings potential (%)	Savings potential (kWh)
Total Buildings Common Facilities	92.865	28,7%	26.643,79
Dwellings	433.589	19,05%	82.603,45
Total	526.454	20,75%	109.247,24

Table 1. Total estimated savings potential for the Spanish pilot

The building savings measures were focussed upon:

- Interior elevator lights: Install detector use/presence.
- Common hall lights use: reduce timings.
- Parking lighting: reduce timings.
- Technical boiler area: upgrade and optimize the control of the central boiler.
- Parking ventilation: the ventilation system was damaged and it was working continuously, we set this in automatic mode.

The dwelling savings considerations were focussed on:

- Heating Consumption: Installation of programmable thermostats. Programmable thermostats allow automatic control of the temperature (21 -20ºC during the day; 18-19ºC during the

night); the saving produced due to these systems versus nonprogrammable versions is about 5%.

- Day Heating Consumption: during day, 17 dwellings have the temperature set point over 21ºC (22.47ºC). Reducing the temperature 1.47ºC will produce savings over 10.5%. The use of ICT increases the awareness of tenants about their energy consumption and the effects of reducing this temperature.
- Night Heating Consumption: during nightime 41 dwellings did not reduce the temperature set point. They can reduce it an average of 3.5ºC, resulting in savings of 24.5%. The use of ICT increases the awareness of tenants about their energy consumption and the effects of reducing this temperature.
- DHW: Reduction of cold water consumption. Increased awareness from the use of ICT technologies will have an impact in reducing hot water consumption. It is expected that ICT technologies will result in a decrease of 2%.
- Standby use: Reduction of 'standby' use. 57% of the tenants use standby in the TV and the use in other equipment are about 75%. The studies show that stand by consumes 3% of the electricity consumption in the Spanish homes, stand by use elimination would produce a saving of, at least, 1,5%. This measure will be achieved by the awareness from the use of ICT technologies.
- Dish washer: Reduction of dish washer use. Reducing the number of medium and large load programs as well as lowering water temperature would produce savings of, at least, 10% and 40% respectively.
- Washing machine: Reduction of washing machine use. Reducing the use of medium and large load programs and reducing temperature, would produce savings of, at least, 10% and 34% respectively.
- The implementation of ICT measures in solar energy systems andmeasures to improve the control of these systems, will result in an increase in the DHW share from solar energy of about 10%

All of these estimates were based on the energy audits developed in the pilots at the beginning of the project.

5. Results and conclusions

5.1. Definition of methodologies

- Due to the nature of our project which required the committed involvement of participants who were not initially enlisted as part of the project team, we found it was necessary to provide appropriate incentives. We also found that it is essential to monitor the extent to which these incentives meet the expectations of these participants.
  In the 3eHouses project, social housing tenants were the target participants, hence the incentives provided were things they would be eager to acquire such as tablets, free wi-fi, etc. Another factor which impacted upon the success of the engagement campaign of the target participants, was to carefully select a small geographical target area for pilot replication, as it is easier to concentrate the engagement campaing in a single neighborhood
- It it is also important to select the adequate target audience/participants in order to mitigate any technical barriers. In the 3eHouses project, a significant number of participants had no expertise or skills in the use of information technologies, or on technical aspects of the measurement devices and they required regular support and supervision especially in the initial stages of the piloting.
- The project results depends heavily on the interaction and feedback of participants. Communication is key. To ensure success, simple and easy to understand messages must be used.
- In order to gather bjective and accurate energy savings data, a standard guideline measurement is required, as well as the availability of reliable baseline data. Whenever possible, the availability of this data must be taken into account prior to chosing the target sample.
- Prior to making a decision on which measurement and impact methodologies to develop, due consideration must be given to what parameters and definitions need to be considered. Our consortium dedicated great efforts to this task, and shared the methodology with other projects in the same thematic area.We also developed the energy savings methodology even further to use as a basis for a Common European methodology (eeMeasure).

A definition of 2 methodologies was developed:

1) Methodology for Energy Efficiency Measurement. Methodology to quantify the energy savings and CO_2 avoided emissions achieved by ICT use was proposed and validated. These savings were also calculated with eeMeasure software, to allow **a standard comparable way of measuring savings** with other projects and initiatives.

2) Methodology for Impact Assessment. Methdology to provide a reliable socio-economic basis for the evaluation of the ICT based services. The efficiency and sustainability of technical solutions can be significantly increased by taking into account social potentials and barriers, therefore the impact assessment of these ICT based services include economic costs and benefits as well as psychological variables.

For further information check D1.2. Definition of methodologies WP1 final report in our website: http://www.3ehouses.eu/sites/default/files/3e-HOUSES_-_Deliverable_1_2_Definition_of_Methodologies_v12Annex.pdf

5.2. Technical design pilots and replicators

5.2.1. Technical description of pilots

The Spanish and the German pilot were set up in a quite similar manner. Both pilots were designed to measure the energy and water consumption data of the individual households of the participants in the project. Furthermore, the consumption data of the whole building was measured and stored in the databases of the software. To obtain the energy consumption data in the individual homes it was partly necessary to install additional meters or output modules, because not all of the existing ones did provide useful interfaces to connect to the data loggers. Additionally, the central heating systems of the pilot buildings were equipped with metering technology in order to improve the functionality of those systems during the pilot trials. After the installation of the measurement- and logging equipment in the pilot buildings the energy management software was set up and a web interface could be provided to the tenants and the energy manager of the ESCO. Tenants were able to access their individual energy and water consumption data which was frequently updated automatically. The households were also equipped with actuators such as smart thermostats or stand-by killers to provide the tenants opportunities to reduce their energy consumption actively. In both pilots the pilot team carried out information meetings and workshops to train the tenants how to use the technology and rise the awareness of energy consumption.

5.2.1.1. Technical description of the Spanish pilot

In the Spanish pilot the building energy management system was composed by these elements:

1. Concentrator (1 per building)
2. Submetring per building: electric energy consumtion, contribution of the solar panels.
3. Gateway (1 per dwelling)
4. Submetering consumptions per tenant: heat, water(hot and cold), electric energy, temperature, gas

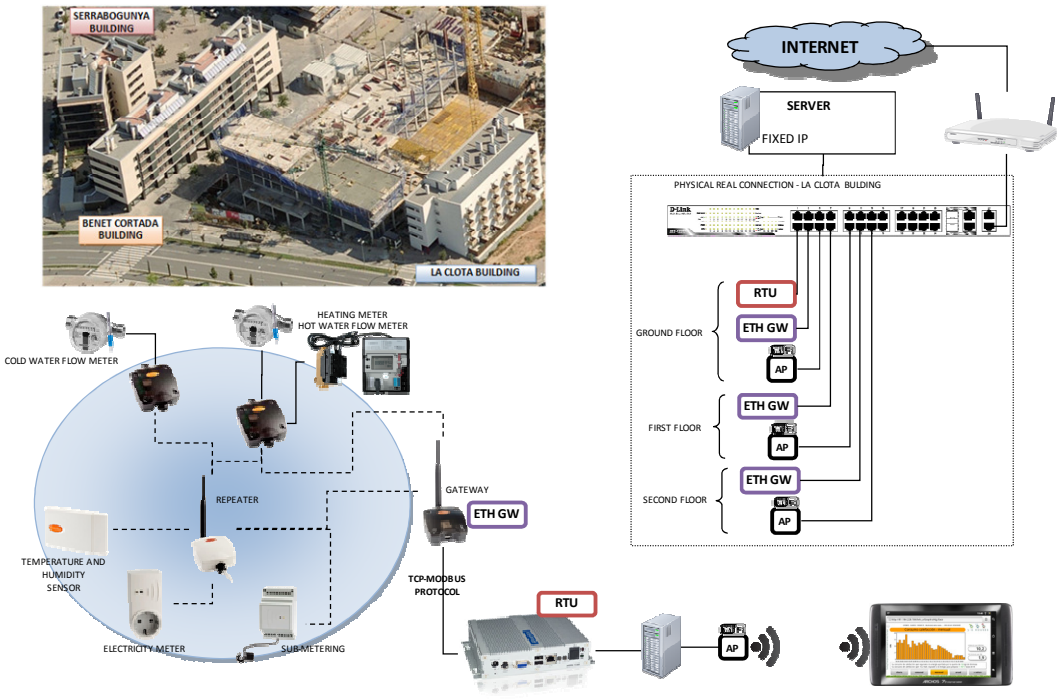

Figure 4. General functionality scheme of the Spanish EM solution.

The communication between the Gateway and submeterings Zigbee devices is Zigbee Wireless.

All of the data which was logged and stored in the Gateway and afterthat transfer to the concentrator (RTU) through a LAN installed in the building and using the Modbus TCP protocol, it means, wired. They are connected by an ethernet cable.

All of the data which was logged and stored in the RTU could have been used to present in the user web interface throught ADSL avalible in each building.

The general subject of the ICT solution is monitoring and energy management of the existing energy consumption systems of the buildings and dwellings.

The EM system was designed to provide mainly the following functions:

- Provide measurement data of heating, water and electric energy consumption to the tenants and the energy manager of the building (PROMUSA) an the utility (GNF) to change energy consumption behaviour (Phase I) and calculate energy savings with the measured data
- Monitoring (Phase I) and observation the influence of the actuators installed in buildings (automatic thermostats, presence sensors in lifts, timmer in garage lighting) (Phase II)
- Automatic monitoring of specific parameters in buildings (solar panel contribution) (Phase I)
- Automatic simulation of the EV intrgration (Phase II)

The energy management solution was designed to provide the following data via the web interface to the tenants:

- data of heat, water(hot and cold), electric and gas energy consumption of every dwelling, temperatures (inside/outside)
- tips for better consumptions

- CO_2 emissions for electric energy and heating energy consumption
- Distribution of consumptions in different uses.
- Information about ecopoints.

5.2.1.2. Technical description of the German pilot

In the German pilot the Smartbox is the "heart" of the building energy management system and was used to obtain energy consumption data from the existing sub metering system and related comfort data of each individual dwelling and the building itself (Figure 5). Additionally, the Smartbox is also connected to the heating system of the building and hence it is able to use the obtained data also for visualisation purposes. All of the data which was logged and stored in the Smartbox could have been used to present in the user web interface. If data was needed, which was originally not existing, from a meter or sensor (e.g. kWh from a gas meter) it was calculated with existing formula calculators in the Smartbox.

The general subject of the ICT solution is monitoring, energy management and control of the existing energy consumption systems of the buildings.

The EM system was designed to provide mainly the following functions:

- Provide measurement data of heating, water and electric energy consumption to the tenants and the energy manager of the building (ESCO WSL) to change energy consumption behaviour (Phase I) and calculate energy savings with the measured data
- Monitoring (Phase I) and observation the temperature and humidity regulation in the dwellings using window contacts and thermostatic actuators (Phase II)
- Automatic monitoring of specific parameters to send alarm messages in case of any malfunctioning of the heating system (Phase I)
- Automatic remote control of the heating system (main unit) with the replaced regulation unit which functions as an actuator to provide an optimized system with a low energy consumption including continuous monitoring (Phase II)

The energy management solution was designed to provide the following data via the web interface to the tenants:

- data of heat (in every room of the dwelling), water(hot and cold) and electric energy consumption of every dwelling
- costs of the above stated types of consumption
- CO_2 emissions for electric energy and heating energy consumption
- room temperatures of certain heated rooms in the dwellings
- relative humidity
- Status signals (open/closed) from the windows in relation to the heating energy consumption and room temperatures
- Outside temperature

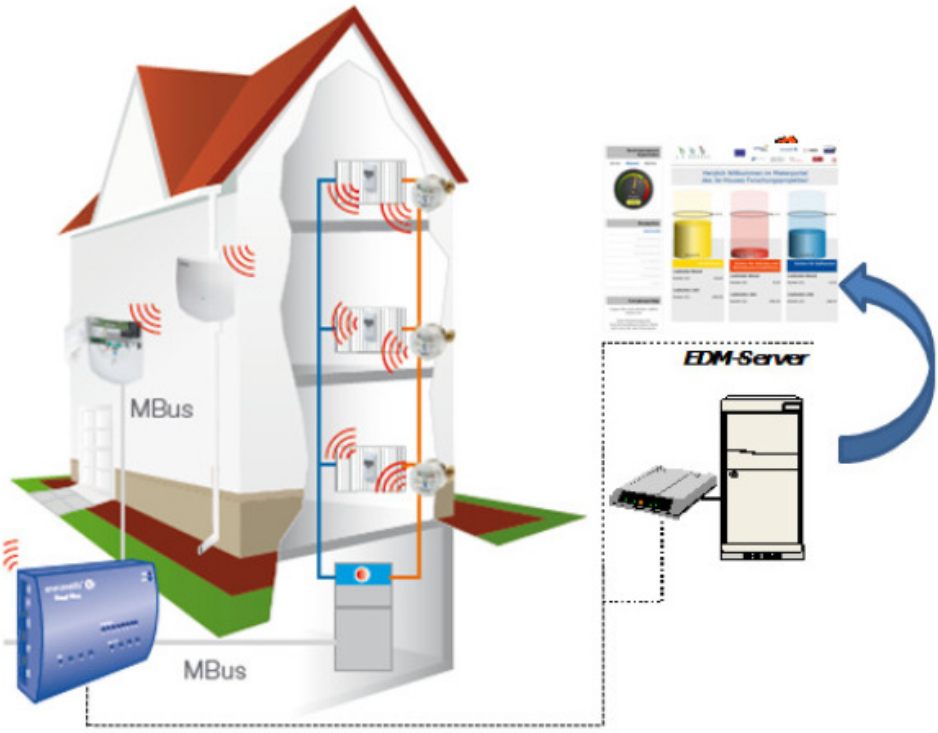

Figure 5. General functionality scheme of the German EM solution – Data logging with Smartbox and transmission to data server

To perform the analysing tasks in WP2 it was necessary to have a powerful software solution enabling individual collection, analysing and administration of different types of measurement data. The ennovatis Controlling Software solution was used in this project to fulfil all the requirements which are to be met for all measurements in this project. Automatically and permanently recorded data (e.g. weather, water, heat, electricity consumption and temperature) are stored via distance reading (GSM or TCP/IP) in the database of the software. The following features of Ennovatis Controlling are used in this project:

- Data collection
- Data administration
- Data analysing
- Load profiles
- Forecasting
- Benchmarks
- Saving potential
- Web-based reports

5.2.2. Technical description of replicators

The German replicator could obviously re-use their exisiting pilot solution design. For the UK replicator we wanted to use as much existing infrastructure as possible from both pilot projects, to maximise use of the existing expertise within the project. Although there are a number of competing Zigbee-based energy metering products, we chose to follow the Spanish pilot and use the same appliance and building metering equipment. The structure of the existing gas meters made using a non-invasive OCR technology a requirement. We chose to use the same OCR rechnology as the German pilot, which

needed to be integrated with the other Zigbee metering equipment. We used the participants' own broadband connection to transmit energy data back to the central server; a different approach to both pilots. This required a custom secure tunnel system including a small gatway box and software designed by IPPerformance.

The German pilot used individually thermostatically controlled radiators to improve control of heating. These appeared to be appropriate for a large proportion of the partipants in the UK, so we included these in our design.

5.2.2.1. Technical description of the UK replicator

Figure 6 shows the general design of the UK replicator equipment, although this did vary slightly between the two different house types in the study.

The sensors and meters communicated energy consumption and temperature data to the central Zigbee gateway, which (together with the secure tunnelling device) was plugged directly into the participant's own wireless access point. The radiator controls communicated on a separate proprietory wireless link, but this was only used for the configuration phase, once in use these devices acted autonomously.

The appliance meters plugged directly into the mains supply, and did not require specialist installation or separate battery power. The main feed meters drew power from the mains supply and had to be installed by a qualified electrician. The temperature and humidity sensor could be placed anywere in the main living area, and was battery powered with a predicted lifetime well beyond the timescale of the project. For the gas measurement two devices were required, an OCR device that generated pulses and a Zigbee pulse counter to tally and send the data. Both were battery powered and should function for at least the 12 months of the project. The outdoor solar and temperature detector was not fitted at every property, we used data from a single one installed at the ecohome location in central Bristol.

The data was stored in an SQL database in a server housed at the Toshiba laboratory. Data was collected using a number of logging processes that attached to the Zigbee collectors via the secure tunnel. Each collector device popped up as a separate port on the server, and could be interrogated directly for fresh data. The web server that provided the interface for the user's tablets also ran on the same machine.

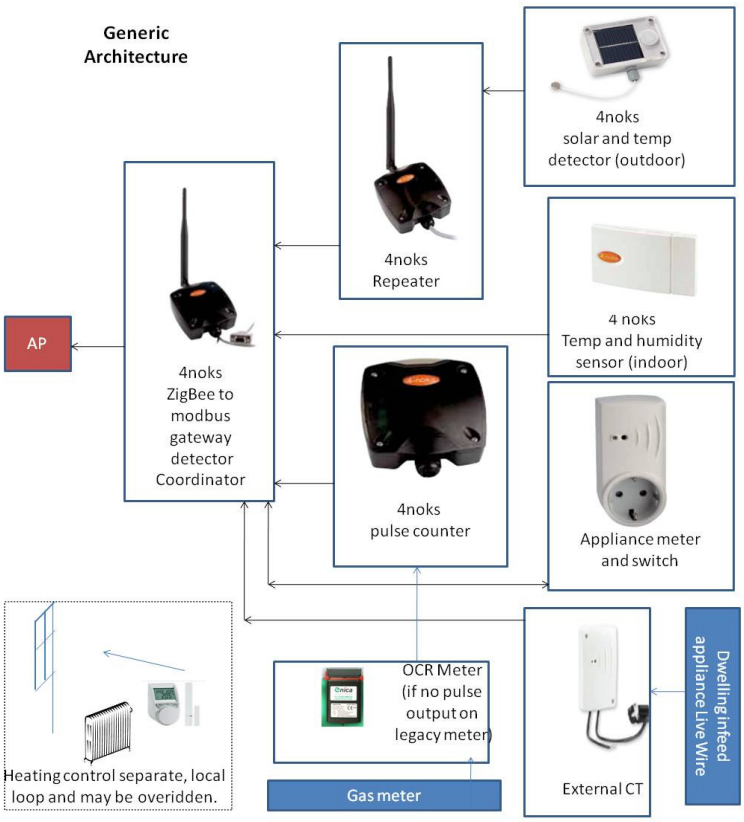

Figure 6 – Architecture of the UK Replicator

5.2.2.2. Technical description of the German replicator with a scheme (1 page as maximum)

The developed technical solution for the German replicator was the same as it was developed for the German pilot (see 5.2.1.2)

5.3. Pilots and replicators data analysis

The calculation of energy savings was performed in a similar way in all pilots and replicators. In several workshops and internal meetings it was decided to calculate the energy and water baselines and savings on a monthly basis. The calculation of the baseline and savings of CO_2 was done using the specific factors, which were different in each pilot, depending on the type of used energy.

Average baseline:

The cold water baselines and the electric energy baselines of the households and pilot buildings were calculated with the averages values of the historical consumption data, which was taken from energy bills or first months of measurements in the pilots. The average baseline was created using the actually consumed quantity of the medium during the year divided by twelve months (Equation 1). The result is a baseline on a monthly basis. All other baselines are also calculated on a monthly basis.

$$base_{\text{avg,m}} = \frac{\sum C_{\text{m}}}{12}$$

Equation 1. Average baseline

6. Equation symbol	7. Explanation
C_{m}	Consumption of a specific medium (e.g. cold water) during a specific month

HDD mean weighted baseline:

The heating baselines, and in the case of the Spanish pilot also the domestic hot water baselines, were calculated on a monthly basis from historic energy bills or first months of measurements in the pilot buildings using the means of heating degree days (HDDM). For the HDDM weighted baseline the total consumption was multiplied by a ratio of the HDDM of one month to the sum of all HDDM (Equation 2).

$$base_{\text{HDDM,m}} = \frac{\sum C_{\text{m}} \times HDDM_{\text{m}}}{\sum HDDM_{\text{m}}}$$

Equation 2. HDD mean weighted baseline

8. Equation symbol	9. Explanation
C_{m}	Consumption of a specific medium during a specific month
$HDDM_m$	Heating degree days (long term average) of a specific month

Energy and water savings:

All savings have been calculated in the same way using the following formula:

Savings value = Adjusted baseline value – Real consumption value

Equation 3. Calculation of savings

The following graph shows the way of the calculation of the savings:

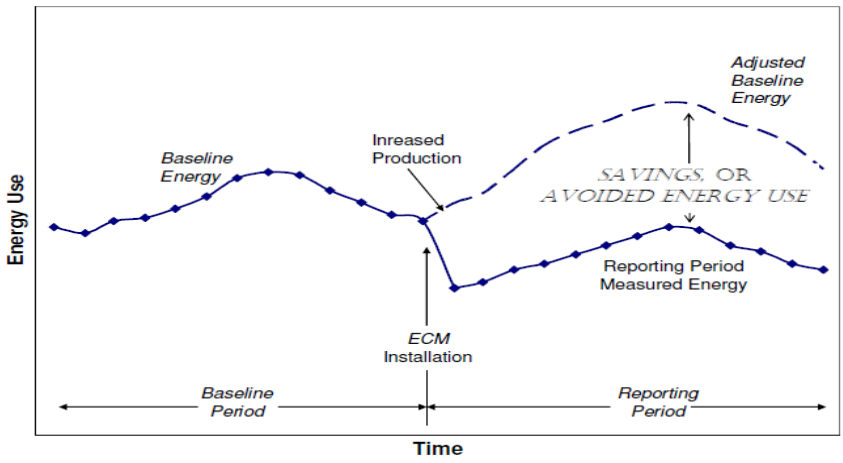

Figure 7. Savings calculation

Additionally to the calculation of energy savings with the internal software and tool of the partners the EC requested also the calculation of energy savings with the **eeMeasure software**. The eeMeasure software works with the same calculation algorithms, which were previously described. Hence, the results of the calculation of energy savings by using the eeMEasure software are very similar (expect of small rounding errors) to the results calculated by the project partners. To include the data in the eeMeasure platform and to publish a report, which includes all the results of the calculations the following steps are necessary:

a. The baseline data, which needs to be uploaded to the software must be transformed (e.g. from energy bills) in to a table calculation sheet in a eeMeasure specific format.
b. If a calculation model (e.g. use of heating degree days) shall be used, it has to be included in the table calculation sheet and uploaded as well.
c. The consumption data, which hwas obtained in the test period, an which shall be compared with the previously uploaded baseline data needs also to be transformed in the same type of table calculation sheet and uploaded to the eeMEasure platform.
d. After all data was uploaded correctly it is possible to create the saving results in the eeMeasure software which gives the possibility to
e. Publish the report automatically.

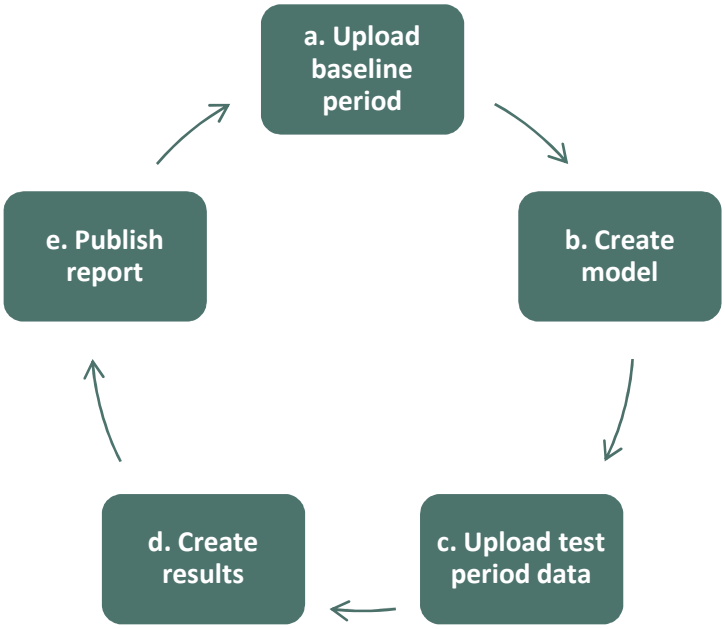

Figure 8. Savings calculation eeMeasure

For the UK replicator, we also analysed the data using our own methodology based on the project one, and directly using the eeMeasure software. Key points where we approached the analysis differently from the other pilots/replicator were:

- Our bill data was less reliable and complete and could not be used to create a robust baseline. We had to rely on measured data during a two month initial period before the tablet interface was introduced.
- Since we were installing the collection equipment directly in participants' homes and using existing broadband connections the data streams were less reliable. Our analysis had to work around missing days and weeks of information.
- These issues also pushed us into using weekly energy consumption estimates rather than monthly. Although this gave us a higher level of variance in estimates, our understanding of the level of variation was higher.

Whilst we achieved broad agreement between the two approaches, there were some differences between our savings estimates and those produced using eeMeasure. This difference is caused by a number of factors.

- The eeMeasure analysis used monthly rather than weekly data. This would have produced different/weaker models since you are fitting to just a couple of points – not possible to tell, however.
- eeMeasure gave some anomalous large savings values (which are suggestive of poor model fit), which were excluded from the final figures and would have affected the results.
- Our study had variation in the time period of the baseline, with some households havig intervention periods beginning in different months. This did not appear to be directly supported by eeMeasure. We had to split data set into different sub-populations, and rely on eeMeasure to combine them into a single saving value.
- Computing baselines from bill data directly outside eeMeasure would have given closer fit to comparison.

- The better agreement we achieved for the non-HDD dependent energy sources make sense since the modelling is simpler. However the Dove Street storage heating is not thermostatically controlled so does not fit a HDD linear model very well.
- Our total savings figures are based on totals across all dwellings, eeMeasure *may* be computing average savings levels between dwellings.
- We found the UK gas data a challenge to analyse directly, did not feel that reworking it using eeMeasure analyse would add much understanding.

5.4. Pilots and replicators results

The German and the Spanish pilot were implemented at the same time with different technologies, but with generally the same intention to: provide tenants with information about their energy consumption and support them to decrease consumption. The following points summarize the experiences of both pilots:

- The Spanish and the German pilot have shown that the use of ICT in households is a very useful tool.
- The implementation and running of a pilot involves a big challenge and requires a well planned process for the implementation.
- The German pilot did not achieve the 20% goal due to the already low energy consumption of participants, attributable to the economic situation of tenants in East Germany.
- Spanish pilot acheived the 20% goal.
- Tenants are not used to technology or energy saving topics and need to be well informed and supported throughout the project.
- The most effective saving technique was the optimization of the central heating system in one pilot building.
- Individual measures in people's homes are difficult to maintain and to monitor
- General commitment to participate in EE projects was low. Therfore incentives were necessary to get tenants involved.
- If tenants are provided with technology to save energy but also feel that they are fully involved in the project, it has a positive effect on their energy savings.
- Different generations of tenants require different contact options. Younger people maybe easily accessed via email or mobile phone, whereas elderly people prefer a personal contact and like to be visited at home.

The UK replication began considerably in advance of the German replication due to the delays caused by the failed Bulgarian replication. Both replications did manage to operate in full and had some common experiences;

- Recruitment and engagement can be hard and needs proper planning and plenty of time.
- Accurate, extensive baselines are important in calculating savings but proved difficult =due to billing issues (estimates/ pre-payment/ different periods) or the restricted length of measured baseline periods.
- Equipment needs to be robust and reliable to minimize inconvenience to participants, reduce support costs and to protect the reputation of the project.
- People's homes can be technology hostile environments- equipment can be regularly damaged, moved or disconnected deliberately or inadvertently.
- Tenants used the interface more often when provided with a mobile Tablet PC to do so.

- Stand-alone rather than centralized management systems have considerable overheads in deployment, management and support.
- ICT needs to be explained to the end users.
- The better the relationship with tenants, the better the results.

5.5.Socio-economic impact studies

Quantitative energy indicators
The focus of Work Package 4 was to provide a socio-economic evaluation of the ICT solutions in terms of their social, psychological and economic potentials and barriers. These included:

- Household occupancy
- Household profile (household make-up e.g. number and age of children)
- Level of education of main income contributor
- Age of the main income contributor
- Employment of main income contributor

Qualitative anecdotal and attitudinal evidence
Further anecdotal evidence was collected by the project partners who were in regular contact with the participants, whether face-to-face in workshops or participants' homes or by telephone call. This was found to be very useful in developing a deeper understanding of several variables:

- The level of engagement with the project
- Perceived physical and intellectual comfort with the technologies
- The usability and perceived reliability of the ICT solutions
- The reasons behind any observed energy saving and behavioural change

Socio-economic analysis of energy savings results
Non-heating electricity savings by age of the main contributor:

- All pilots and replicators - no correlation

Non-heating electricity savings by household profile:

- Spanish pilot - increased overall, except occupants living with friends decreased
- German pilot - decreased overall, except single and flat share increased
- German replicator - increased overall, except pensioners and single parent decreased
- UK replicator - increased overall, except couples with children decreased

Non-heating electricity savings by education level of the main contributor:

- All pilots and replicators - no correlation

Heating savings by age of main contributor:

- All pilots and replicators - no correlation

Heating savings by household profile:

- All pilots and replicators - no correlation

Heating savings by education level of the main contributor:

- All pilots and replicators - no correlation

Interface use overview

All three countries found it essential to provide a tablet interface to give tenants real time information on energy use as well as other data. Overall the interface worked successfully and the participants enjoyed using it. This is highlighted in the high interface use observed in the UK replicator. However, partners in the UK replicator were surprised to see some participants using the interface a great deal but not achieving much energy savings.

Interface use and the sustainability of interventions

As only one of the locations in the UK replicator received interventions, this provided an opportunity to assess the effect of interventions on the sustainability of interface use. Week 1 in the stacked graph below shows how the level of interest in the interface decreases fairly quickly – with twice as much interface use in the first month than in the second month. Knowle West saw a far greater and more sustained interface use than Dove Street, due because of the greater interaction with project partners through workshops and other communication.

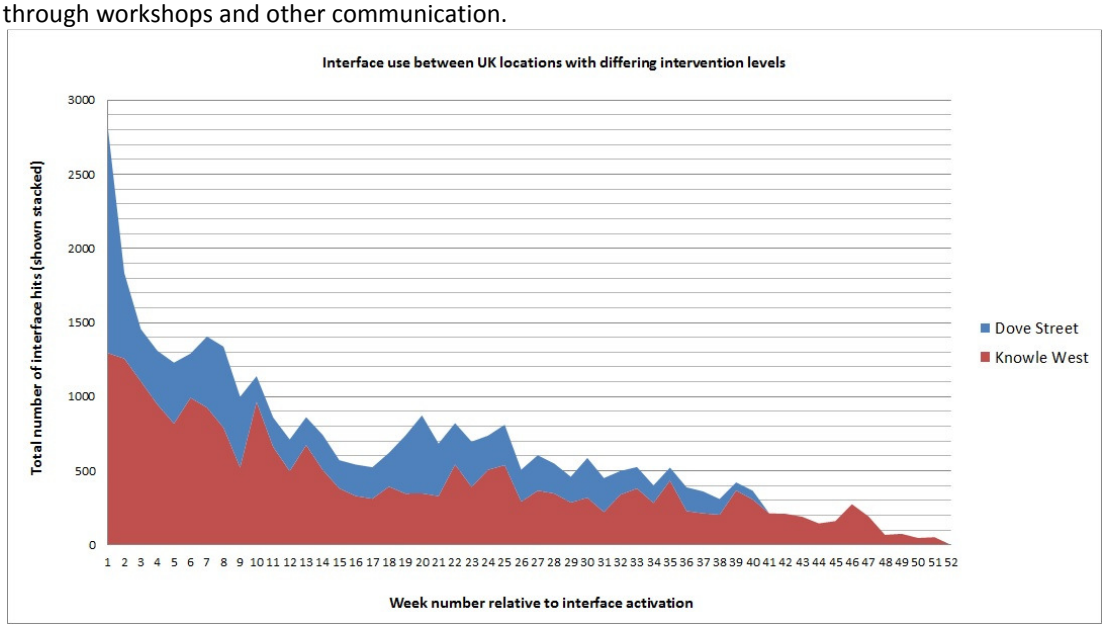

Figure 9. Difference in interface use between UK locations with different intervention levels.

Level of interface use in the pilots

The interface use in both the Spanish and German pilots was very low. The UK and German replicators, on the other hand, achieved a very high level of interface use from a larger number of participants, and this data is therefore able to offer some useful conclusions, as detailed in the following section.

The findings of the pilots illustrate how the quality of the relationship between the project co-ordinators and participants, and the level of technical support available, are crucial to achieving engagement with the project and thereby encouraging interface use. This was also especially noted in the Knowle West location in the UK replicator, which was co-ordinated by a well-known community organisation.

Interface use by demographic groups

Interface use and household occupancy:

- All replicators - households with two or more occupants saw greater interface use than those households with an occupant living alone

Interface use and household profile:

- All replicators - whilst households with children saw greater use of the interface, it is also apparent that retired, single person of couples used the interface more than any other

Interface use and education level of the main contributor:

- All replicators - highest educated participants used the interface the least, whilst the greatest and most sustained interface use is from those with the lowest level of qualifications

Interface design considerations

The socio-economic analysis indicated that the interest in the interface declined more rapidly with the increasing level of education of the participant – with those holding Master's Degrees losing interest much faster than those with just GCSEs. It is arguable that some people are content with a simple graphical representation of their energy use, whilst others have an expectation of gaining a greater detail of understanding. This indicates the difficulty in matching the level and graphic design of the information to suit to a varying target audience.

5.6.Dissemination

In the following table, presented in D.5.3. Dissemination Material with Project Results, the main results in dissemination of 3eHouses project are contained:

Quality objectives:	**Evaluation**		
Whole Consortium	Date: 17/05/2013		
General evaluation			
INTERNET			
Has each project partner achieved to spread of information about the project in 5 different webpage of my city/country?	YES		
ACTIVITIES AND PUBLIC ACTS			
As Consortium, have we gone to any EU/International energy efficiency in building event in which I have disseminated the project?	YES		35
As Consortium, have we participated in the communication campaigns with the tenants?	YES		20
As Consortium, have we participated in the Week marquee?	YES		
As Consortium, have we participated in the Final Conference at the end of the project?	YES		
As Consortium, have we participated in the organization of the press conference at the end of the pilot of my country?	YES		
As Consortium, have we participated in the organization of at least one of the seminars with stakeholders celebrated in the pilot of my country?	YES		29
Has each project partner participated in at least one fair related to the project?	YES		19
As Consortium, have we participated in one of the workshops with possible clients celebrated during the project life?	YES		11
PUBLICATIONS			
Has each project partner published at least 2 articles related to the project in energy efficiency as well as ICT for energy efficiency?	YES		33
As Consortium, have we published any article related to the project in a local magazine or newspaper?	YES		41
OTHER			
As Consortium, have we participated in any of the phases of the elaboration of the promotional video related to the project?	YES		
As Consortium, have we participated in cluster activities with other ICTs and energy efficiency projects?	YES		28

Table 2. Dissemination quality objectives

In summary, our dissemination numbers were:

- More than 50.000 attendees in public events regarding 3eHouses.
- Mass media diffusion to more than 3 million people
- Distribution of more than 100 thousand 3eHouses publications
- More than 14M visits to websites where 3eHouses appears

For further information about dissemination activities, check D5.3. Dissemination material with the project results (in www.3eHouses.com)

You can also access our dissemination video in our website: http://www.3ehouses.eu/energy-efficiency/news/3e-houses-project-video

5.7.Final energy results of the project

From Deliverable 2.5.3.Design, implementation and pilot validation WP2 final report - 3rd revised version we extract the following tables with information about savings in both pilots.

The savings achieve in **both PILOTS** are shown in the following table:

Whole project (6 buildings + dwellings) in Spain and in Germany	Total adjusted Baseline	Total Consumption	Total savings	Total savings [%]
Heating Consumption [kWh]	1.423.027,67	1.312.398,93	110.628,73	7,8%
Domestic Hot Water Consumption [kWh]	137.313,58	117.717,14	19.596,44	14,27%
Electricity Consumption [kWh]	312.095,24	244.746,77	67.624,02	21,67%
Total energy consumption [kWh]	**1.872.436,49**	**1.674.862,84**	**197.849,19**	**10,57%**
Cold water consumption [l]	6.012.027,48	5.610.088,36	401.939,12	6,69%

Table 3. Summary of energy and water savings in the Spanish and German pilot

Separating the results for pilots, in **SPANISH PILOT** we obtained:

Whole project (3 buildings + dwellings)	Total adjusted Baseline [kWh]	Total Consumption [kWh]	Total savings [kWh]	Total savings [%]
Heating Consumption [kWh]	646.025,82	525.258,58	120.767,23	18,7%
Domestic Hot Water Consumption [kWh]	112.755,86	89.902,23	22.853,63	20,27%
Electricity Consumption [kWh]	234.762,82	165.031,19	70.181,63	29,89%
Total energy consumption [kWh]	**993.544,50**	**780.192,01**	**213.802,49**	**21,52%**
Cold water consumption [l]	2.075.627,48	1.732.568,36	343.059,12	16,53%

Table 4. Summary of energy and water savings in the Spanish pilot

Savings for dwellings:

DWELLINGS	ENERGY SAVINGS [%]
DHW [kWh]	20,23%
Heating [kWh]	10,06%

Electricity [kWh]	31,52%
TOTAL [kWh]	**20,02%**
Cold water [l]	16,22%

Table 5. Summary of savings in all 60 dwellings of the Spanish pilot

and for the buildings:

BUILDINGS (BC + LC + SB)	ENERGY SAVINGS [%]
Electricity and gas [kWh]	22,28%

Table 6. Summary of savings in all three Spanish pilot buildings

Although some tenants did not achieve savings during the project, **total energy savings in dwellings (20%) and buildings (22%) were achieved in all types of energy consumption. The total energy savings achieved in Spanish pilot were 21,52%, more than the initially estimated 20%.** The ecopoints system (demand response strategies) had positive results on tenant's behavior.

In GERMAN PILOT we obtained:

Whole project (3 buildings + dwellings) in Germany	Total adjusted Baseline	Total Consumption	Total savings	Total savings [%]
Heating Consumption [kWh]	777.001,85	787.140,35	-10.138,50	-1,3%
Domestic Hot Water Consumption [kWh]	24.557,72	27.814,91	-3.257,19	-13,26%
Electricity Consumption [kWh]	77.332,42	79.890,03	-2.557,61	-3,31%
Total energy consumption [kWh]	**878.891,99**	**894.845,29**	**-15.953,30**	**-1,82%**
Cold water consumption [l]	3.936.400,00	5.610.088,36	401.939,12	10,21%

Table 7. Results obtained for the whole German pilot

For the dwellings:

DWELLINGS	ENERGY SAVINGS [%]
Heating [kWh]	0,83%
DHW [kWh]	-13,26%
Electricity [kWh]	-3,31%
TOTAL [kWh]	**-1,83%**
Cold water [m³]	2,96%

Table 8. Summary of energy savings in all 29 dwellings of the German pilot

For the buildings:

BUILDINGS LEIPZIG+BITTERFELD	ENERGY SAVINGS [%]
Heating [kWh]	-1,30%
Cold water [m³]	1,50%

Table 9. summary of savings in the German pilot buildings

Regarding the results achieved in German pilot, we can say:

- ✓ due to already very low energy consumption of tenants (specific heat consumption 22-53 kWh/m²a and German average 100 kWh/m²a) further reductions were difficult
- ✓ The installation of a new regulation unit for the heating system of the pilot building in Leipzig reduced the energy consumption of the whole building by 8,4%. Nevertheless, after the calculation of the summary of heating energy savings in all three pilot buildings in Leipzig and

Bitterfeld the overall heating energy savings of the whole pilot buildings remain as a negative value.

- ✓ Substantial savings only for heating in Leipzig, due to technical problems with smart thermostats no savings in Bitterfeld
- ✓ Generally no or low savings for electricity –> also results of German smart meter studies (e.g. Märkisches Viertel in Berlin)
- ✓ Low interest in the project

From Deliverable 3.5 final report, we have extracted the following tables with information about savings in both replicators.

The results achieved in **REPLICATORS** are:

In the case of **UK replicator** we obtained the following whole results:

Population	Type	Total Measured/MWh	Total ABL/MWh	Savings/MWh	Percentage Savings
Knowle West	Electricity (32)	134.7	141.8	7.12	5
	Gas (8)	107	147	39.7	23.8
Dove Street	Off peak	45.0	40.7	-4.2	-10.4
	On Peak	88.5	84.8	-3.6	-4.2
Total Bristol Replicator	**Total/MWh**	**375.2**	**414.3**	**39.02**	**9.4**
	CO_2/tonnes	161.1	168.1	7.0	4.2

Figure 10: Overview of UK replication results

Completely different results were achieved in Knowle West and Dove Street. In Knowle West **savings were higher, where 20% were achieved in gas consumption, while in Dove Street, nosavings were acheived.**

dwellings - Langenfeld	Total adjusted Baseline	Total Consumption	Total savings	Total savings [%]
Heating [kWh]	94.692,50	81.824,79	12.867,71	13,59
Electricity [kWh]	42.511,77	39.815,60	2.696,16	6,34
cold water [m³]	996,00	923,60	72,40	7,27
Total energy [kWh]	137.204,27	121.640,40	15.563,88	11,34
Total CO2 [kg]	28.894,44	26.996,16	1.898,28	6,57

Figure 11: Percentage energy savings German Replicator

Similarly, completely different results were achieved in both the German pilot and German replicator. Whilst in the pilot it was not possible to achieve savings, in the replicator, **savings of 10% were acheived.**

There are identifiable economic reasons which may explain why tenants are saving heating energy in their homes. The measured room temperatures in those dwellings for example, clearly show that many tenants in the German pilot lived in underheated rooms. In the German replicator, the heating energy consumption was higher and together with a generally better participation of the tenants the heating energy savings were subsequently also higher.

The total results achieve for pilots and replicators were:

TYPE OF CONSUMPTION		TOTAL CONSUMP. (kWh)	BASELINE (kWh)	SAVINGS (kWh)	% SAVINGS
ELECTRICITY	SPANISH	165031	234763	69732	29,70%
	GERMAN 1	79890	77332	-2558	-3,31%
	UK	240200	251200	11000	4,38%
	GERMAN 2	39.816	42.512	2.696	6,34%
HEATING	SPANISH	525259	646026	120767	18,69%
	GERMAN 1	787140	777002	-10138	-1,30%
	UK*	107000	147000	40000	27,21%
	GERMAN 2	81.825	94.693	12.868	13,59%
DHW	SPANISH	89902	112756	22854	20,27%
	GERMAN 1	27815	24558	-3257	-13,26%
	UK	-	-	-	-
	GERMAN 2	-	-	-	-
COLD WATER (l)	SPANISH	1732568	2075627	343059	16,53%
	GERMAN 1	5610089	3936400	-1673689	-42,52%
	UK	-	-	-	-
	GERMAN 2	923,60	996,00	72,39692	7,27%
TOTAL ENERGY SAVINGS		**2143877**	**2407841**	**263964**	**12,31%**
* in UK we consider only the gas consumption					

Figure 12: Total energy results

The total energy saving across the whole project (pilots and replication) was 12.31%. This result is consistent with several other projects developed so far that indicate that it is very difficult to reach the 20% goal. Possible reasons include:

- Electricity consumption is very difficult to reduce as people increasingly more devices (tablets, PCs, smartphones, etc.)
- The main area for energy savings was heating consumption (combined influence of user behaviour changes and automation control)
- The heating consumption can be reduced with the optimization of the central heating system
- Optimization of central systems has an effect on all tenants in the building
- Installation of actuators as dimmers, stand-by killers, window actuators, etc. has a positive effect.
- It is easier and most cost effective to design whole-building solutions.
- Higher usage of web interface results in higher energy savings for heating and lower savings for electricity
- ICT needs to be explained to the end users
- The better relationship with the tenants, the better the results are

6. Guidelines

The following activities can be used to reduce energy consumption in residential buildings in a cost effective way:

1. Use actuators that reduce the energy consumption without the intervention of the tenants in a automatic way, for example, to reduce wasting energy by adapting operation to meet the actual demand in central systems (e.g. heating and DHW).

2. Influence user-behaviour by making energy consumption more transparent. These actions are more effective if users have energy efficiency awareness.

   This fact was very remarkable during the project. The technological acumen of the tenants before the project in case of the Spanish pilot was not high. The education level was also relatively low, since 25% of tenants were only educated to Primary School level. However, when the information increased and the relevant issues regarding ICTs and energy consumption were deeply explained, the motivation and the efficiency awareness increased.

   If the energy consumption is to be reduced in individual households a "very easy to use and friendly"- technology is recommended to change the users' behaviour.

The main guidelines obtained during pilots and replicators are:

- The basis of any suggestion of any measures to reduce energy consumption need detailed measured consumption data. It is important to evaluate saving potentials and implementation costs before starting the project. The occupants need to be sufficiently high energy users for there to be some potential energy savings to be made. Moreover, the residents need to be above a level of more pressing day-to-day survival priorities and not be in receipt of financial subsidies for energy bills.
- It is very important to have reliable consumption data prior the installation of the pilot to ensure energy savings. A significant period of pre-intervention data collection increases the predictive power of the baselining model.
- Centralized installation options lower installation and maintenance costs. If installed in dwellings, discrete and self-contained technology could reduce support calls caused by accidental damage or disconnection.Therefore, a centralised block of flats is more cost effective and easier to deal with than separate houses.
- Furthermore, another opportunity for achieving savings in heating and DHW is to optimize the central system, improving operation of the system. Generally the potential for energy savings through optimisation of operation is between 10% - 20% depending of the state of the heating system (The Spanish pilot in La Clota boiler room realized a final performance of 90%). Adapting the operation increases the energy saving potential via ongoing commissioning, with a 5% saving in our German Pilot.
- It is useful for residents to be able to compare themselves with the neighbours (in an anonymous way) to give some peer pressure for continued behaviour change.

- Savings achieved through ICTs are higher when tenants are more aware of the energy consumption. The continuing education in energy efficiency is therefore crucial.

- The residents need to understand energy consumption in general so they can best understand what the interface is displaying and therefore save the most energy.

- Interface technology needs to be clear and easy to use and show energy in terms of money in order to be more motivating.

- Placing technology in homes should be accompanied with training and support and it should not be assumed that there is any level of experience or expertise in the use of the Internet. There should also be a simple printed guide on the technology with guidance on its use.

- Good and responsive personal support throughout the project may increase engagement. There needs to be a friendly and accessible coordinator in the form of a building manager, housing association contact or even community leader to act as a focal point and encourage continuation of the project or energy savings attitudes. There has to be periodic reinforcement of the message and encouragement brought about by communication amongst the neighbours and the central coordinator.

- Recruitment and engagement is easier in areas where already a sense of community cohesion, or a coordinating body to promote the project. The engagement of users did decrease over the lifespan of this project, but much less in communities where regular workshops and interventions were used.

- The method by which the residents can view their energy consumption needs to be appropriate for the socio-economic group in the building. The use of mobile phones (smart phones) and, where possible, local TV channels could be utilised as they are more within the comfort zone of social housing tenants. The interface used should also be user friendly and easy to understand. Use easy to operate and accessible mobile technology for the end user interface.

- ICT devices can also be helpful when adapting systems to individual needs.

- To identify inefficiencies and to propose efficiency improving measures with low payback times requires expertise. It is recommended that this expertise is provided by external consultants to the tenants. A simple contracting model could help to finance the necessary measures.

7. Success stories

7.1. Definition of methodologies

- Initial team building was key to successful resolution of difficulties and problems encountered throughout the whole project lifecycle.
- Thorough, comprehensive, accurate common methodology for energy consumption and measurement developed and implemented
- Thorough, comprehensive, accurate common methodology for impact evaluation developed and implemented
- We were able to reconduct the engagement campaign following difficulties within the German pilot.

7.2. Pilots design and execution

The pilots faced many challenges but were finally implemented successfully, which the following short stories can tell:

- Spanish pilot achieved savings above 20%. A new energy use awareness was created in the tenants promoted by the SW and the messages given from 3eHouses. Most of our tenants after the project believe that the energy efficiency is important.
- Currently, the Spanish pilot technology is still utilised and is used by the energy manager of the buildings to continue offering the possibility of achieve anergy and water savings to their tenants.
- The best saver of the German pilot received a Tablet PC, which was used as incentive for the tenants to participate in the project. The tenant was very much engaged and achieved energy and water savings during the participation in the 3e-Houses project.
- Some tenants of the NEUBI (building owner in Bitterfeld) received an “energy saving package” from the an energy saving team of the Caritas e.V., which is dedicated for tenants with low income. The package contains energy savings bulbs, timer, stand-by killers, sensors etc. and is for free for the tenants. The approach to order the energy saver team came from the project partner ennovatis, after having visualized consumption data available from the 3e-Houses project. With the energy saving package the tenant is now able to consume less, with the help of technology, which he normally couldn’t afford.
- Some tenants of the German pilot signalized after the project ended that their involvement has changed their attitude related to energy consumption and that they now try to conserve energy. Some tenants showed also interest for participation in future research projects.
- Remove of the technology in the individual homes of the participating tenants in the German pilot in order to install in the German replicator, but Smartbox control of regulation unit for central heating remained and is being used continuously Billing company WSL of the building owner uses ennovatis Controling software to analyse energy consumption of the pilot building (an other buildings as well) and to transmit individual consumption data of tenants in the billing software system
- NEUBI continues using ennovatis energy management techniologies to provide consumption data and monitore central heating systems

7.3. Replicators desing and execution

The replicators faced significant challenges throughout their initiation and operation, but were able to demonstrate considerable successes throughout;

- Although the planned Bulgarian Replication was not considered viable, partners pulled together to define and execute an alternative in Germany at short notice
- Both UK and German Replications were able to recruit and retain significant numbers of participants. Even after 16 months of involvement every single participant from Knowle West in the UK completed a final project questionnaire
- UK Partners were even able to help one participant to successfully challenge her utility bill. UK Partners prepared a report which he sent to her energy supplier and as a result she received a reduction on her bill.
- Across the whole UK Replication a total energy reduction of almost 10% was successfully achieved. The German Replication aachievedtotal energy savings of over 12%.

Future of the German Relication

The implementation of the 3e-Houses project at the housing cooperative Bauverein Langenfeld (BVL) in Germany has improved very much the relationship between the BVL and ennovatis. Ennovatis delivered a number of data loggers (Smartboxes) to the BVL in the year 2008, which were mainly used for the purpose of automatic read out and data transmission to the billing company. Now, after the existing energy management system was upgraded with additional meters and sensors, and the data was analyzed, the BVL decided to upgrade the existing technology with energy management software of ennovatis and implement a remote control of the district heating regulation system via the ennovatis Smartbox. Furthermore the BVL will continue to participate in the ongoing FP7 research project EEPOS and will be integrated as a demonstrator site in this project.

- The installed 3e-Houses technology (meters, sensors etc.) will remain in the buildings and will be used further on in a commercial version of a tenants internet portal, which will be provided by the billing company. The tenants and the building owner are taking advantage of it in order to have now also the possibility to monitor the electrical energy consumption of their homes.
- Also tenants of the German replicator in Langenfeld signalized after the project ended that their involvement has changed their attitude related to energy consumption and that they now try to conserve energy. Some tenants showed also interest for participation in future research projects.

Future of the UK Relication

Bristol, the site of the UK replicator, has been named as 2015 European Green Capital. This will hugely increase the City's profile and serve both as a platform to disseminate the findings from the 3e Houses Project, and a catalyst for similar projects. The City has also been identified as a "UK Government Smart City Demonstrator" and has received £3m to develop Smart City initiatives, which will include Smart Energy projects building on our experiences through 3e Houses.

Perhaps the most significant development for the future development of the 3e Houses project findings is that Bristol City Council has formed an Energy Services Company focusing on smart and sustainable energy. The City Council's ESCo are already taking an interest in Smart Energy Metering and Smart Grid technologies.

Participants in the UK Replication were offered the opportunity to have the 3e Houses equipment removed from their dwellings. 70% elected to retain the kit and so would be in a strong position to take part in future Smart Energy/ Smart Metering projects.

7.4. Socio-economic impact studies

Household case studies

To gain a full appreciation of the impact analysis performed above, it is important to understand the human aspect of the project in terms of the different household types and how the participants engaged with the project and interacted with the ICT solutions. This will provide a more in-depth understanding of the potentials and barriers for achieving behavioural change leading to energy savings. The sample for the case studies were chosen to cover a range of different household types, motivation and participation levels, and varying degrees of success in terms of energy savings, including where no energy savings were achieved.

Case Study 1: Bristol (UK Replicator)

"The whole family has been involved in this project..." When the Griffiths family saw an advert about the 3e Houses project they were keen take up the challenge of saving household energy. Father Steve is a true eco-warrior, involved in other environmental projects and keen to cut his carbon footprint. Partner Nina also wanted to save money and find out exactly what they were using. With two teenage sons aged 17 and 19 living at home – they found the project was a good way of the whole family being involved in energy saving. Steve says: *"The main thing has been finding out what the boys use in their rooms, with the Xbox left on, TV and stereo and how much it costs. It's made them cut back and they don't leave things on standby now."* The family has taken the project to heart – attending every workshop and checking their usage on the tablet daily. They now switch everything off when not in use and have even cut washing down to just twice a week. And despite the UK experiencing the coldest spring in 50 years - they have managed to cut their bills by up to £24 a month. Nina says: *"I've thoroughly enjoyed all of it – I liked the workshops, finding out how things worked and how other people were saving..."*

Case study 2: Längenfeld (German Replicator)

"I switch the tablet on every day... and watch my consumption." Pensioner Michael Gurk has checked his energy usage more than any other participant in the German project – switching his tablet on as soon as he gets up. As a retired couple, he and his wife joined the project to keep energy costs down, although they had never been high users. They attended a meeting after seeing a poster in their apartment block and were particularly interested in the technology – which they have found 'very useful'. Michael explains*: "I've a better overview, where I can spend, or save something or not because I can watch my consumption every day. It is very helpful to see the actual prices. I can see where I used more and where less."* The couple also found that during the project they had used less energy than the previous year, although they hadn't really changed their behaviour. Michael says: *"I will take care that it stays like this and can use the web tool perfectly for this purpose."* And he has found one of the main benefits of using the tablet has been passing the message of energy conservation on to their grandchildren. He says: *"My wife and I are already taking care not to waste energy. From the beginning I used energy saving bulbs, which we're still using... but I can show my grandchildren if they keep the light on the whole day!"*

Case study 3: Sant Cugat del Vallès (Spanish Replicator)

"I think the incentives are a good way to engage people." Thirty-four-year-old Christian Buesule lives in a small one-room flat in a block of apartments. He is a sound technician and loves music, often practising at home. This means that besides the typical energy appliances, he also owns a lot of devices that are high-energy consumers - such as sound systems and an electric piano. Christian was not very interested in energy issues at first but became more motivated after the project started. Although he didn't use the interface much to look at his energy consumption, he was keen to use all the devices to reduce his energy. He says: "I have changed my behaviour a little. For example, I close the terminal grid when I'm

not using my electrical music equipment.“ He also used the regulating thermostat during the winter, which has made him reconsider his habits around heating. Although his energy consumption was lower than the Spanish average at the beginning of the project, he managed to achieve savings of 35%. Christian has been extremely involved in the project from start to finish. He says: “This has been a good experience. Now I’m more conscious of energy issues and I’m concerned about saving energy in my home.”

7.5. Dissemination

The project had major impacts in terms of dissemination:

- 3eHouses Consortium attended more than 35 local, national and international events where details of 3eHouses were presented.
- 3eHouses consortium published the results of the project in 33 papers in energy efficiency and ICTs magazines.
- 3eHouses partners during the project life attended 19 fairs to promote the achieved results.
- The project consortium held a week marquee with conferences about ICTs and energy efficiency in Sant Cugat in May 2013, involving several European Projects and also organizing visits to our pilots and replicators.
- 3eHouses consortium published the results of the project in 41 articles in national and local magazines.
- During the project life the 3eHouses website received more than 9100 visits.
- 3eHouses was promoted in several radio programs and on TV.
- Engagement and communication campaigns were developed in all our pilot and replicator locations, the contact and involvement of the tenants was continuous.
- A press conference regarding the final project outputs was held.
- All 3eHouses partners developed networks with policy makers, public administrations, social houses owners, etc. trying to learn from other stakeholders and promote the results achieved.
- During the projects the tenants of pilots and replicators have received letters, telephone calls, physical visits to their homes and questionnaires.
- 3eHouses partners developed several activities (meetings, personal visits, etc.) to increase the participation of their tenants.
- During the pilot lifecycle leaflets and brochures were produced for the tenants of Pilots B1 and B2, replicators R1 and R2 and also posters for conferences and fairs.
- 3eHouses partners have developed a promotional video of the whole project and individual videos of pilots and replicators.
- 3eHouses project partners participated in cluster activities with other ICTs and energy efficiency projects. The main objective is to share experiences, discuss lessons learnt and conclusions from all these projects. These messages were sent to different stakeholders: policy makers, public organisations, social houses owners, companies, etc.
- We are continuing to participate in working groups with other projects: Methodology workshops (3eHouses consortium defined the first version of the methodology to calculate energy savings and the socioeconomic evaluation methodology) that created eeMeasure Software; WS in Smart Cities Expo 2013; European Workshop on ICT for Energy-Efficiency in

Buildings; WS on Setting the Agenda for Sustainable living; 2nd European Workshop on ICT for Energy-Efficiency in Buildings; etc.

8. Public deliverables

No.	Name	Description
D1.2	Definition of methodologies WP1 final report	Especification of the methodologies used to perform the calculations of the savings in the pilots and replicators of the project and the socioeconomic assessment. (http://www.3ehouses.eu/sites/default/files/3e-HOUSES_-_Deliverable_1_2_Definition_of_Methodologies_v12Annex.pdf)
D2.4.1	Report on the user participation and acceptance of the pilots (rev18)	Report on the user participation and the acceptance of the pilots that have being implemented in Sant Cugat and Leipzig. Two versions, the D.2.4.2. is the final and complete document. (http://www.3ehouses.eu/sites/default/files/3e-HOUSES_Deliverable_D_2_4__May2012_v25_1.pdf)
D2.4.2	Report on the user participation and acceptance of the pilots (rev24)	
D2.5.2	Design, implementation and pilot validation WP2 final report (rev12)	Summaries of the results of the pilots of the project (Sant Cugat and Leipzig-Bitterfeld), including information about the dwellings, the technical solution adopted, kinds of monitored information,etc. Two different versions, the last one is the complete and final document. (http://www.3ehouses.eu/sites/default/files/3e-HOUSES-D253_WP2-finalreport.pdf)
D2.5.3	Design, implementation and pilot validation WP2 final report - 3rd revised version	
D2.6	Savings calculated with eeMeasure	Results of the calculations of the pilots making use of the eeMeasure tool. (http://www.3ehouses.eu/sites/default/files/D2_6_Savings_calculated_with_eeMeasure_v6.pdf)
D3.4	Guidelines and best practices for the replication of the pilots	Provide a best practice handbook to anyone interested in carrying out a similar project. This is based upon the experiences of the pilot projects in Spain and Germany but especially on the replications of these in the UK and Germany. A breakdown of the recommended process to follow and potential problems are presented. (http://www.3ehouses.eu/sites/default/files/D3.4._-_Guidelines_and_best_practice_for_the_replication_of_the_pilots.pdf)
D3.5	Pilots replication WP3 final report	Brief summary of how the replicators were designed and implemented, the challenges that were faced, and a brief analysis and discussion of the results from each area. (http://www.3ehouses.eu/sites/default/files/3e_Houses_D3_5__v_0_10.pdf)
D4.1	Guidelines and best practices for energy efficiency in social houses	Recommendation guidelines and best practices for the implementation of the energy efficiency solutions based on the impact assessment performed. The report is intended for the European Commission, policymakers, stakeholders, multiple occupancy building managers, and other persons or groups interested in implementing or promoting energy saving measures and ICT energy management systems. (http://www.3ehouses.eu/sites/default/files/3eHouses_D4-1_Guidelines_and_best_practices.v23.pdf)
D4.3	Questionnaire for each pilot building (rev 0)	Definition of the content of questionnaires for each pilot building that need to be distributed among the participating tenants before and after installation of smart energy monitoring devices Collection of the results of filled out questionnaires that serve as a base point for further analysis and evaluation of applied ICT measures. (http://www.3ehouses.eu/sites/default/files/3e-HOUSES_-_Deliverable_4_3_V_5fina.pdf)
D4.3.1	Annex to D4.3 - Update on the questionnaires for the replicators R1 and R2	
D4.4	Evaluation and impact assessment WP4 final report	Summary of the overall evaluation and impact assessment of the data gathered in the pilots and replicators based on a range of indicators described in the developed research tool and elaboration of final

		conclusions (http://www.3ehouses.eu/sites/default/files/3eHouses_D4-4_Evaluation_and_impact_assessment_final_report_v20.pdf)
D5.2	Project Web Site	http://www.3ehouses.eu
D5.3	Dissemination material with the project results	Different sets of promotion materials such as letters, posters, leaflets, presentations, etc. (http://www.3ehouses.eu/sites/default/files/3e-HOUSES_Deliverable_5_3.vf_.pdf)
	Final report	Document with the summary of all the findings, recommendations and conclusions of the project. (http://www.3ehouses.eu/sites/default/files/3eHOUSES_FinalReport_vf.pdf)

9. Annexes

Dissemination events

The following list is an exhaustive enumeration of the dissemination events taken place during the project lifetime.

Event - Action	When	Where	Comments
GNF			
Leaflet distribution	01/05/2010	S. Cugat,Spain	information about the 3eH project
Barcelona Digital Global Congress 2010	20/05/2010	Barcelona, Spain	Project presentaction
Spanish pilot presentation to tenants	06/05/2010	S. Cugat,Spain	Meeting to engaging campaign in Spanish Pilot, Informative sessions for pilot A
Workshop in Europen Commission	01/06/2010	Brussels, Belgium	Workshop of methodology project
Smart Homes 2010	24-25 /09/r 2010	Vienna, Austria	Project presentation on speaking slot for the assistants.
ICT for sustainable homes Conference Nice	17-19 /11/2010	Nice, France	Project presentation on speaking slot for the assistants.
Conference about the importance of the ICT in energy efficiency	23/02/2011	Madrid, Spain	The 3e houses and a description of the Spanish pilot was exposed.
GENERA Energy and Environment International Trade Fair	11 -13 /05/ 2011	Madrid, Spain	300 leaflets were distributed
Workshop on methodologies	17 /05/2011	Brussels, Belgium	Methodology for Impact Assessment of 3e-Houses
Workshop on methodologies	17 /05/2011	Brussels, Belgium	Methodology for Impact Assessment of 3e-Houses
Informative Meeting	6/062011	SantCugat, Spain	Information meeting and delivery tablets
IV ICT and Sustainability Forum	29-30 /06/2011	Sevilla, Spain	The 3e houses was presented in Smart Cities session.
Smart Homes 2011	4-6 /10/2011	Amsterdam, Netherlands	Project presentation on speaking slot for the assistants.
ICT for Sustainable Homes	24-25 /10/2011	Nice, France	Project presentation on speaking slot for the assistants.
Smart City Expo World Congress	29/11/2011 2/12/2011	Barcelona, Spain	Explanation of the project with a poster on the stand and in the corporate leaflet produced for this conference.In addition the project was explain in a conference.
Energy Efficiency: Way for the Sustainable City	21/12/2011	Seville, Spain	Project Presentation in a forum with participation of Universities, public administrations, and public corporations.
Postal mailing to the tenants of Spanish Pilot	01/01/2012	S.Cugat, Spain	Report on delivery of the new tablets and provide questionnaire about electric vehicles.
Postal mailing to the tenants of the social houses in Spanish Pilot	01/03/2012	S.Cugat, Spain	Report about Eco-points program

Event - Action	When	Where	Comments
Satisfaction survey to tenants	01/03/2012	S.Cugat, Spain	Knowing the degree of satisfaction of residents with the project and changes in energy efficiency.
Workshop on methodologies	02/05/2012	Brussels	WS on methodologies to calculate savings
Press Conference about the final results of spanish pilot	22/10/20 12	S. Cugat,Spain	INDRA, PROMUSA and GAS NATURAL FENOSA presented to the mediums the final results. At the event was assisted El Pais, Agencia EFE, Europa Press, Cugat.cat and Diari Sant Cugat.
Press release about the final results of spanish pilot	22 /10/2012	Barcelona, Spain	Press release sent to mass media
Smart City Expo World Congress	13-15 /11/2012	Barcelona, Spain	Explanation of the project with a information on the stand produced for this conference.In addition the project was explain in a conference.
Smart City Expo: ICT for energy mangement in buildings: Experience in Europen Porjects	13/11/20 12	Barcelona, Spain	Milagros Rey participated in the session about Projects ICT R&D for energy management in buildings. She explained 3e-Houses Project
Smart City Expo: Elevator's spicht	13/11/2012	Barcelona, Spain	Milagros Rey participated in the Smart City Expo
Smart City Expo: Press release	13/11/20 12	Barcelona, Spain	Press release sent to mass media
INDRA			
Workshop in Europen Commission	1 /06/2010	Brussels, Belgium	Workshop of methodology project
Institute IMDEA Networks - AETIC - UC3M Technology Transfer event	10/11/2010	Universidad Carlos III of Madrid. Leganes Campus	Project Presentation in the frame of Technology and innovation transfer and dissemination in a forum with participation of Universities, public administrations, and public corporations.
Going Green 2013 Congress	07/05/2013	Universidad Politécnica de Madrid (UPM) y de la Escuela Técnica Superior de Ingenieros de Telecomunicación (ETSIT) Avenida Complutense nº 30, "Ciudad Universitaria". Madrid	We try to form, inform and raise awareness and interest among degree and Ph. D. students Europe wide. Indra is not only participant of this event, but also spongor.
Indra Web New: "WEEK MARQUEE (ICT SOLUTIONS FOR ENERGY EFFICIENCY IN RESIDENTIAL BUILDINGS)"	22/04/2013-23/05/2013	Indra Web Page (English and Spanish)	Indra Web is visited by hundred people from diverse organizations pertaining to the Scientific World, as well as to the economic sector, which we expect will imply that great dissemination of the event will ve eased.
Ennovatis			
German pilot presentation to tenants	May/June 2010	Leipzig, DE	Meeting to engaging campaign in German Pilot, Informative sessions for pilot B
Workshop	Sep/Oct 2010 Feb 2011	Leipzig, DE	
Seminars	May/June 2010 January 2011	Leipzig, DE	1st seminar during installation phaseI, 2nd after end of pahse I. last seminar at the end of the project.
leaflet distribution	July 2010	Leipzig, DE	information about the 3eH project

Event - Action	When	Where	Comments
German pilot presentation to tenants	14/07/2010	LWB-Kiosk, Leipzig, Germany	Meeting to engaging campaign in German Pilot, Informative sessions for pilot B
Project presentation	16/06/2010	Baugenossensc haft Biberach eG, Biberach, Germany	2nd engaging campaign Project presentation to potential costumer
Project presentation	18-19/11/2010	Plaza-Hotel, Nice, France	participation in the Confernce, information exchange with other CIP-projects
Project presentation	25/11/2010	Neue Bitterfelder Wohnungs- und Baugesellschaf t, Bitterfeld, Germany	3rdengaging campaign Project presentation to potential costumer
Workshop on methodologies	17/05/2011	Brussels, Belgium	Methodology for Impact Assessment of 3e-Houses
Attendance to fairs / enertec2011	25-27/01/2011	Leipzig, Germany	presentation of the 3eH project on the ennovatis stand on the fair
European WS on ICT for EE in buildings	08/06/2010	Dublin, Ireland	experience exchange of the different ICT projects in the FP7-call of the EU
Seminar 1: Germany: Ennovatis, 1st Seminar during installation	26/04/2011 06/05/2011	pilot buiildings, Bitterfeld, Germany	knowledge transfer and information of the usage and function of smart thermostats
Seminars with local stakeholders / IHK Symposium	01/03/2012	BioInnovationCentre, Dresden	short presentation of the europe project 3e-Houses, our experience in the creation of the proposal and description of the steps and dates, our experience in the project organisation and settlement
Workshop with tenants Leipzig	07/12/2011	LWB-Kiosk, Leipzig, Germany	mainly Q&A about the current problems, general information about ICT and collection of impressions of the tenants internet portal
Workshop with tenants Bitterfeld	09/02/2012	Tenants Café, Bitterfeld	mainly Q&A about the current problems, general information about ICT and collection of impressions of the tenants internet portal
Workshop on methodologies	01/05/2012	Brussels	WS on methodologies to calculate savings
PROMUSA			
Leaflet distribution	01/05/2010	S. Cugat,Spain	information about the 3eH project
Spanish pilot presentation to tenants	06/05/2010	S. Cugat,Spain	Meeting to engaging campaign in Spanish Pilot, Informative sessions for pilot A
Spanish pilot presentation to other public administration	01/02/2012	S. Cugat,Spain	Submission of technical pilot to other Spanish administration that currently are working on energy efficiency projects
Presentation of 3e-Houses project main objectives and results in the architechtural university	01/05/2012	S. Cugat,Spain Barcelona, Spain	Promusa explained the 3e- Houses main objectives and results.Representatives of the council told the strategic activities in order to Smart City
Project 3e-houses in the energy week in Catalonia	01/06/2012	S. Cugat,Spain Barcelona, Spain	Explain the 3e-Houses project, the objectives and the technical solution adopted. Increasing the citizen´s Increasing the citizen´s awareness in energy efficiency

Event - Action	When	Where	Comments
3e-Houses and spanish pilot presentation in international World Congress	01/11/2012	S. Cugat,Spain Barcelona, Spain	Promusa collaborated in the organitzation of the meeting "ICT for energy management in buildings. Experience in European Projects"
Bristol City Council			
Council Leaders Brief	Monthly	Bristol	Regular updates given to Council Leader. She continues to prioritise this work at a time of cuts in the Council.
Experience sharing with DeHEMs project	01/04/2010	Bristol	Sharing learning with a similar EU funded FP7 project called DeHEMs
Experience sharing with CHARM project	30/04/2010	Bristol	Sharing learning and taking guidance from a similar EU funded project CHARM
Beyond 2010 'Green Digital' event stand	20 -21/10/2010	London	Promoting the work of the project at a National ICT event
Presentation to Toshiba	19/11/2010	Bristol	Promoting 3e Houses to very senior executives from Toshiba in France and Japan
International Green Energy Summit	9 -10 /06/ 2011	Bristol	The 'summit' brings together innovation-oriented energy companies, institutions and experts from Hannover from Bristol and across Europe
BCC Internal Energy Information Exchange 1		Bristol	Presented the plans for UK pilot to Council leader and senior leadership team at BCC
BCC Internal Energy Information Exchange 2		Bristol	Presented the progress of the UK pilot to Council leader and senior leadership team at BCC
Met Neighbourhood Services Tenants Participation Team	24/11/2011	Bristol	Met with the manager and members of Neighbourhood Services Tenant Participation Team to explain the aims of the project and to develop any joint workings
Meeting with Bristol Water	09/12/2011	Bristol	Outlined 3e Houses project to Patric Bulger of Bristol Water (who agreed to install smart water metering in one of our blocks)
Met with tenants from Dove Street	20/12/2011	Bristol	Attended the Dove St Tenant Group Christmas Party to promote the 3E Houses Project. Copies of the leaflets were given out.
Telephone conference with Hitachi	21/12/2011	Bristol	Outlined 3e Houses as part of our broader Smart City Programme
Meeting with IPL	05/01/2012	Bristol	meeting with IPL to discuss 3e Houses and other smart city projects
Attended Neighbourhood Partnership (Cotham) Forum Meeting	10/01/2012	Bristol	Attended the Neighbourhood Partnership (Cotham) Forum Meeting to promote the 3E Houses Project (attended by 50 people). Copies of the leaflets were given out out.
Meeting with ETI	16/01/2012	Bristol	Spoke with ETI about 3e Houses project and the potential to build on the research
Met with Local Policing Team	17/01/2012	Bristol	Met Local Neighbourhood Policing Team to explain the aims of the project and gain his support in delivering the project.
Meeting with Cardiff City Council	21/02/2012	Cardiff	Outlined Smart Cities plans and progress of 3e Houses work to Cardiff City Council International Officer and Digital Lead.

Event - Action	When	Where	Comments
Meeting with BRE (Building Research Establishment)	24/04/2012	Bristol	Outlined and discussed progress of 3e Houses
Meeting with Prof Ian Craddock, University of Bristol	03/05/2012	Bristol	Discussed 3e Houses project, and potential to repurpose data streams to telecare application
Meeting with the Environmental i-Net for South West England	03/05/2012	Bristol	Met with Martin Bigg of the SW England i-Net (Innovation Network) to explain the work of 3e Houses and the potential for further technology innovation in this sector
Meeting with Nick Tune of UK Building Research Establishment	13/06/2012	Bristol	Meeting with the Building Research Establishment to discuss 3e Houses and latest innovations in sustainable building energy management
Interview for inclusion in Smart Cities in Europe book and website	29/05/2012	Bristol	http://www.smartcitiesineurope.com/2011/12/bristol-united-kingdom-working-closely-with-the-users-of-systems/
3e Houses input into Bristol's European Green Capital Bid	19/06/2012	Bristol	Outlined the successes, challenges and opportunities of 3e Houses to include in Bristols European Green Capital application
Met with Millie Zhang of Guangzhou Municipality in China to explain the Smart Energy programme in Bristol including 3e Houses	26/07/2012	Bristol	Invited to submit the Smart City programme, including the 3e Houses work, to the Guangzhou Award competition
Briefing and experience sharing with SoLa project	31/07/2012	Bristol	http://westernpowerinnovation.co.uk/So-La-Bristol.aspx
Presented 3e Houses, partnership with Knowle West and user engagement strategy to UK Trade & Investment Smart Energy Conference in Weymouth	08/08/2012	Weymouth	Spoke to audience of 70 people live and 50 by video link up at major Smart Energy investment conference
Bulgarian Housing Association			
Presentation of 3E Houses project at seminar organised by REQUEST project	26/01/2011	Sofia	Sharing experience with a EU funded project called REQUEST
Presentation to tenants from prospective pilot buildings	4/03/2011	Sofia	Meeting related to engaging campaign in Bulgarian Pilot
Experience sharing with ICE WISH Project	to take place in month 38-40	Sofia	Sharing experience with a EU funded project ICE WISH
Presentation of 3E Houses project at SPREAD Sustainable lifestyles Project conference on SUSTAINABLE LIVING	24-25/05/2011	Cologne, Germany	International conference rganised by SPREAD Project
Meeting with tenants from the changed pilot building with data on energy savings, in order to obtain awareness.	14/11/2011	Shumen	Meetings related to engaging campaign in Bulgarian Pilot
Meeting with tenants from the new pilot building with explanation of monitoring system to be installed.	19/11/2011	Shumen	Meeting related to engaging campaign in Bulgarian Pilot

Event - Action	When	Where	Comments
Meeting with tenants from the changed pilot building with data on energy savings, in order to obtain awareness.	15/12/2011	Shumen	Meeting related to engaging campaign in Bulgarian Pilot
Meeting with tenants from the changed pilot building with data on energy savings, in order to obtain awareness.	26/12/2011	Shumen	Meeting related to engaging campaign in Bulgarian Pilot
Meeting with tenants from the changed pilot building with data on energy savings, in order to obtain awareness.	19/11/2011	Shumen	Meeting related to engaging campaign in Bulgarian Pilot
Project presentation at Plovdiv Technical Fair - exhibition of the municipalities	16/01/2012	Plovdiv	joint promotion event together with municipalities
Presentation of 3E Houses project at the 2nd European Workshop on ICT for Energy-Efficiency in Buildings website	01/05/2012	Sofia, Bulgaria	International event
Presentation of 3E Houses project at the international conference: Architecture and Quality of Life	11/05/ 2012	Sofia, Bulgaria	International event,organised by the Bulgarian Chamber of Architects and the ACE (Architects Council of Europe)
Presentation of 3E Houses project at a joint conference organised by REQUEST project	12/10/2012	Sofia, Bulgaria	Seminar,organised by the State Agency for Sustainable Energy Development
Presentation of 3E Houses project at a Seminar at the New Bulgarian University	16/04/2013	Sofia	Seminars with local stakeholders
Clustering conference - Sharing experience with a EU funded projects ICE WISH and BECA	17/05/2013	Rousse	Clustering conference - Sharing experience with a EU funded projects ICE WISH and BECA
Toshiba Research Europe Limited			
Status Report to EU Business Divisions	Regularly	Bristol/London/Paris/Japan	Regular updates given to Council Leader. She continues to prioritise this work at a time of cuts in the Council.
Status Report to Global Smart Community business Division	Regularly	Bristol/London/Paris/Japan	Sharing learning with a similar EU funded FP7 project called DeHEMs
Experience sharing with internal smart grid R&D projects	Regularly	Bristol	Sharing learning and taking guidance from a similar EU funded project CHARM
3e-Houses Presentation at Toshiba Europe "Smart Community Business Meeting" at TOEL	01/01/2011	London	3e-Houses introduction at the Toshiba Europe Smart Community Business meeting at TOEL HQ in Londin
3e-Houses Presentation at " Smart Grid Tria" project planning meeting	01/04/2011	Paris	3e-Houses introduction to the european smart community companies participating in NEDO funded smart grid trial in France.
3e-Houses Presentaion to Toshiba Systems France			3e-Houses introduction to theToshiba Systems France - European business division dealing with smart community business
Experience sharing with other Toshiba's EU smart community projects	Regularly	Bristol/London/Paris/Japan	Promoting the work of the project at a National ICT event

Event - Action	When	Where	Comments
Presentation to SGSG (Smart Grid Stakeholder Group of Europe)	11/03/ 2011	Munich	Promoting 3e Houses to very senior executives from Toshiba in France and Japan
Presentation of 3E Houses project at seminar: "Sustainable way of reduction of energy dependancy and fuel poverty" organised by MEP Mr. Vladko Panaiotov	27/04/2011	Sofia	Seminat organised by MEP with international participation
Metering Europe Event	4-6/10/2012	Amsterdam	Demonstartion of 3eHouses HEMS solution to a range of utilites and equipment maufacturers
ETSUK Trade Event	13/10/2012	Bristol	Presentation of 3eHouses project and concept to delegates
Toshiba RDC Fair	17-18th November	Tokyo, Japan	Demonstration of 3eHouses HEMS solution to Toshiba Corporation.
3e-Houses presentation to Landis+Gyr	4/11/2012	Zug, Switzerland	Presentation of 3eHouses project o EU biggest smart meter vendor.
Presentation of paper at IEEE SmartGridComm conference	05/11/2013	Taiwan	Kalogridis, G.; Dave, S., "PeHEMS: Privacy enabled HEMS and load balancing prototype," *Smart Grid Communications (SmartGridComm), 2012 IEEE Third International Conference on* , vol., no., pp.486,491, 5-8 Nov. 2012
Phone conference with business unit, Toshiba Systems France	08/04/2013	Bristol	Discussion of UK home energy market, with reference to 3eHouses data
Bristol Ecohome volunteers session	02/05/2013	Bristol, UK	Presentation of project to exhibition volunteers, enabling them to disseminate further on our behalf in future.
IP Performance			
Attendance at Green Energy seminar hosted by Bristol University and organsied by EAUC	20/07/2011	Bristol University	Seminar promoting green energy particualrly in further education
Presentation of 3e-houses with UK partners to delegates from Hanover	09/06/2011	Knowle West Media Centre	Conference arranged by Bristol City Council
Exhibition at IP Expo	18-20/10/2011	Earls Court London	Major IT trade show. We produced posters to promote 3e-houses
Exhibition at IP Expo	18-20/10/2011	Earls Court London	Major IT trade show. We produced posters to promote 3e-houses
Exhibition at NextGen	15-16/11/2012	UWE Bristol	Displayed posters, distributed leaflest, answered questions
Exhibition at BE	14-16/02/2012	Earls Court London	Displayed posters, distributed leaflest, answered questions
Exhibition at UCISA	14-15/03/2012	Celtic Manor, Newport UK	Displayed posters, distributed leaflest, answered questions
Networkshop	3-5/04/ 2012	University of York , UK	Displayed posters, distributed leaflest, answered questions
Production with TRL academic paper which was subsequently published at IEEE PES in Berlin	14-17/10/2012	ISGT Berlin	We co wrote the paper but did not attend the conferencec
Attended NextGen in Bristol	17/07/2012	Bristol, UK	Displayed posters, distributed leaflest, answered questions
Week Marque in San Cugat & Bristol	w/b 20/05/2013	SantCugat & Bristol	Displayed posters, distributed leaflest, answered questions
Promotional video for 3e-houses with KWMC	w/b 20/05/2013	SantCugat & Bristol	Promotional video
Knowle West Media Centre			
3 E Houses exhibition stand at KWMC event for Bristol Big Green Week showcasing sustainable	01/06/2012	Knowle West/Bristol	Stall promoting the work of 3 E Houses at Bristol-wide event Midsummer Night's Green as part of Bristol Big Green Week.

Event - Action	When	Where	Comments
energy projects			http://www.kwmc.org.uk/index.php?article=734&department=5
Energy Saving Workshops for Knowle West participants	June and July 2012	Knowle West	Sharing energy saving tips with participants and showing them how to use the interface to add their own. The aim was to help them look at ways of reducing their household consumption
Exhibition Stand and talk promoting 3E Houses at NexGen Conference	01/07/2012	Bristol	Promoting and demonstrating the work of 3E Houses at a National ICT event
Experience sharing with CHARM project	01/07/2012	Kiingston University/England	Experience exchange and information sharing with the university who ran a similar project (CHARM) using ICT to encourage energy reduction in households, including the Bristol area.
Four training workshops on tablet/interface for Dove St participants	July/August 12	Dove St and Little Cross House, Bristol	Workshops for Dove Street and Little Cross House tenants to show them how to view their energy online via the Electric Footprint interface and use the Toshiba tablets.
Workshop with Knowle West participants to introduce new average energy consumption interface application	01/10/2012	Knowle West	Workshop for Knowle West participants to introduce a 'comparison to average consumption' application so users can compare their usage to others in the project to motivate them to try and cut their usage.
Presentation to MEP Brussels	01/09/2012	Brussels	Meeting with Graham Watson MEP to update him about progress of project and ask for support from Commission fro energy saving initiatives
Presentation to Barcelona trade Mission	Sept./2012	Knowle West/Bristol	Visit from a delegation from Barcelona organised by UK Trade and Industry - presentation to them about 3 ehouses and Community engagement
Attended UK/Spain Trade and Industry event	November 212	Barcelona, Spain	Attended Smart networking event atGuild International organised by the British Consulate and UK Trade and Investment
Particpation in Workshop at World Smart Cities Congress	01/11/2012	Barcelona	Particpated in Experience of Eu Projects workshop on Energy efficiency. Committed to sharing results and findings from EU projects
Attended networking event - West of England Carbon Challenge "How to turn your team on"	01/11/2012	Bath/UK	Learnt about cutting edge research from the University of Bath, looking at how to use energy data to engage and motivate staff. Dr Sukumar Natarajan, Deputy Director Research Unit on Energy and the Design of Environments (EDEn) at Bath University presented the findings from two exciting experiments on how to make energy consumption much more visible (visual approaches to smart meters). These experiments have taken place at Buro Happold offices in London and Bath.
Shared best practice with members of the Bristol Green Capital group at the March Green Mingle	01/03/2013	Bristol	Attended networking event with other environmental organisation / green businesses. Shared best practice and spoke to other attendees about the project.
Shared best practice with members of the Bristol Green Capital group at the April Green Mingle	01/04/2013	Bristol	Attended networking event with other environmental organisation / green businesses. Shared best practice and spoke to other attendees about the project.
Shared best practice with members of the Bristol Green Capital group at the May Green Mingle	01/05/2013	Bristol	Attended networking event with other environmental organisation / green businesses. Shared best practice and spoke to other attendees about the project.

Event - Action	When	Where	Comments
Preparation of Ecohome visit in Bristol to showcase 3 E Houses Project as a part of Week Marquee event	01/05/2013	Bristol	Inviting university researchers, energy organisations, housing associations with an interest in energy saving methods to share the technical solution.
Workshop with Knowle West participants to introduce gas consumption on interface application	01/01/2013	Knowle West	Workshop for Knowle West participants to introduce a 'gas consumption application to motivate participants to cut their usage. Also showed attendees their yearly usage on a graph and a chart of their vampire power to work out where they were wasting energy at night.
3 E newsletter sent out to all participants via interface	01/01/2013	Knowle West	Send newsletter out via the 3E interface to inform about changes to interface; keeping equipment online; forthcoming workshop and survey; what other participants say about the project. Aim is to keep participants engaged and informed about the project
3 E newsletter sent out to all participants via interface	01/04/2013	Knowle West	Send newsletter out via the 3E interface to inform about: end of the project, final survey, 3 E Film, collection of equipment, end of the free internet and letter from BCC. Aim is to keep participants engaged and informed about the project and how it ends and motivate them to fill in the final survey.
Final survey sent out to all participants via interface and post	01/04/2013	Knowle West	Final survey sent to participants via the 3 E interface and post to be accessed on Toshiba tablets and sent back online. Paper copies also sent out for people to complete if they preferred. Questions around behavour/attitude are the same as in the initial survey and half way surveys to analyse change as a result of the project. rParticipants' attitude to project and energy reduction to be recorded at end of the project.

Press and media appearances

The following list is an exhaustive enumeration of the dissemination press and media appearances taken place during the project lifetime.

Type	Partner	Title	Media	Date	Comments
Article	GNF	Pioneering project in Europe that aims to reduce 20% energy consumption	www.construible.com	01/06/2010	Magazine online about sustainable construction
	GNF	3e-HOUSES project	El Instalador	01/12/2010	Magazine about technical installations in tertiary, industry and residential sectors
	GNF	3e-Houses Project	La Razón	13/06/2010	Magazine about new construction in Spain
	GNF	3e-Houses Project	Revista Nuevas Tecnologías	01/11/2010	magazine of energy efficiency, sustainability, renewable and technical management of the facilities.

Type	Partner	Title	Media	Date	Comments
	GNF	3e-Houses Project	www.canaleficiencia.com	01/10/2010	Exclusive web energy efficiency of Gas Natural Fenosa
	GNF	Europa potenciará las ciudades "inteligentes y ecológicas"	El País www.elpais.com	24/05/2010	General magazine
	GNF	Spanish Pilot	ARA	06/09/2011	
Article	GNF	3eHouses Project-Energy Efficiency	Energy Wisdom Program 2012-2013 EUROELECTRIC	01/11/2012	Report of EUROELECTRIC- MEETING THE 2050 CHALLENGES
Article	GNF	General Project	EJECUTIVOS	01/10/2012	Review in Article on energy efficiency in Gas Natural Fenosa
Article	GNF INDRA PROMUSA	Results of the project	Infopower	01/10/2012	Article about the results of Spanish Pilot
Article	GNF	General Project	Greensavers.pt	16/11/2012	Interview María Pérez
Article	GNF INDRA PROMUSA	General Project	EL DIARI DEL VALLES	29/10/2012	Brief new about the spanisk pilot
Article	GNF INDRA PROMUSA	Results of the project	Eseficiencia.es	16/11/2012	Article about the results of Spanish Pilot
Article	GNF INDRA PROMUSA	Results of the project	La Razón	27/12/2012	Article about the results of Spanish Pilot
Radio	GNF INDRA PROMUSA	General Project	La Cope	30/12/2013	Interview Josep Codorniu
Article	GNF	General Project	Metro	24/01/2013	Interview María Pérez
Article	GNF INDRA PROMUSA	Proyecto europeo 3E-Houses	INFOPOWER	01/10/2012	Paper in Infopower.
Article	GNF INDRA PROMUSA	Control the consumption of electricity, gas and water is possible thanks to the 'smart homes	La Razón	25.09.2011	Project presentation at a Sunday supplement of national newspaper. Energy special edition
Press conference	GNF PROMUSA INDRA	Presentation of the pilot 1	All local and national press/media	31/05/2010	
Press conferenc	GNF PROMUSA	Results of the pilot 1	All local and national	04/07/1905	At the end of pilot 1

Type	Partner	Title	Media	Date	Comments
e	INDRA		press/media		
Article	INDRA	The social network to save energ	La Razón	25.09.2011	Project presentation at a Sunday supplement of national newspaper. Energy special edition
TV report	GNF	Smart Meters	TV3	01/07/2011	
TV report	INDRA	Intereconomía Business (Digital Business) TV Program	Intereconomía	13/10/2011	
Article	GNF INDRA PROMUSA	General Project	Gas Actual	22/10/2012	Description of 3e-Houses
Press Conferenc e	GNF INDRA PROMUSA	Presentation of the final results	All local and national press/media	22/10/2012	INDRA, PROMUSA and GAS NATURAL FENOSA presented to the mediums the final results. At the event was assisted El Pais, Agencia EFE, Europa Press, Cugat.cat and Diari Sant Cugat.
Radio	GNF INDRA PROMUSA	Final Results and ICTs	Catalunya Radio (News)	22/10/2012	60 homes reduced their energy consumption thanks to EU project
Radio	GNF INDRA PROMUSA	Final Results and ICTs	Catalunya Radio (Program El café de la Republica)	22/10/2012	60 homes reduced their energy consumption thanks to EU project
Article	GNF INDRA PROMUSA	Final Results and ICTs	Expansión Cataluña	23/10/20012	El programa 3e-Houses, impulsado por Gas Natural Fenosa e Indra, disminuyó un 20% las emisiones de los hogares de Sant Cugat
Article	GNF INDRA PROMUSA	Final Results and ICTs	Finanzas.com	22/12/2012	Proyectan un dispositivo doméstico para gestionar mejor y ahorrar luz y gas
Article	GNF INDRA PROMUSA	Final Results and ICTs	Vilaweb	22/12/2012	Habitatges de Sant Cugat redueixen un 31% el seu consum elèctric amb un programa pilot de la UE
Article	GNF INDRA PROMUSA	Final Results and ICTs	Cugat.cat	22/10/2012	El projecte 3e-houses redueix la despesa energètica de les llars un 20%
Article	GNF INDRA PROMUSA	Final Results and ICTs	lavanguardia.com	22/12/2012	Viviendas de Sant Cugat reducen un 31% su consumo eléctrico con un programa piloto de la UE
Article	GNF INDRA PROMUSA	Final Results and ICTs	totsantcugat.cat	22/12/2012	60 habitatges estalvien 250 euros anuals
Article	GNF INDRA PROMUSA	Final Results and ICTs	totsantcugat.cat	22/12/2012	60 habitatges estalvien 250 euros anuals
News Agency	GNF INDRA PROMUSA	Final Results and ICTs	Agencia EFE	22/12/2012	Proyectan un dispositivo doméstico para gestionar mejor y ahorrar luz y gas

Type	Partner	Title	Media	Date	Comments
News Agency	GNF INDRA PROMUSA	Final Results and ICTs	Europa Press	22/12/2012	Viviendas de Sant Cugat reducen un 31% su consumo eléctrico con un programa piloto de la UE
News Agency	GNF INDRA PROMUSA	Final Results and ICTs	ACN	22/12/2012	60 habitatges de Sant Cugat estalvien 250 euros anuals participant en un projecte de control del consum energètic
Article	GNF INDRA PROMUSA	Final Results and ICTs	Econoticias.com	23/12/2012	Viviendas de Sant Cugat reducen un 31% su consumo eléctrico con el programa 3e-Houses
Article	GNF INDRA PROMUSA	Final Results and ICTs	20 Minutos Barcelona	23/12/2012	Estalviar en llum i gas
Article	GNF INDRA PROMUSA	Final Results and ICTs	El Periódico de Cataluña	30/11/2012	Ahorrar 256 euros en energía
Article	GNF INDRA PROMUSA	Final Results and ICTs	El Mundo (Ed Cataluña)	30/11/2012	3e-Houses otros innovadores
Article	GNF INDRA PROMUSA	Final Results and ICTs	Diari de Sabadell	24/10/21012	Gas Natural Fenosa e Indra impulsan un proyecto de ahorro energético en Sant Cugat
Article	PROMUSA	Eficiencia en manos privadas para un complejo público	El periodico	17/05/2011	Eficiencia en manos privadas para un complejo público
		La eficiencia de consumo energetico llega a los hogares	La región de Ourense	14/11/2011	La eficiencia de consumo energetico llega a los hogares
		La eficiencia de consumo energetico llega a los hogares	Atlántico	14/11/2011	La eficiencia de consumo energetico llega a los hogares
		Así son los hogares inteligentes	Diario de Castilla la Mancha	14/11/2011	Así son los hogares inteligentes
		El control de las facturas en casa	Viva Campo de Gibraltar	26 setembre 2011	El control de las facturas en casa
		Los hogares inteligentes controlaran el consumo de luz, gas y agua	Diario de Pontevedra	16 09/2011	Los hogares inteligentes controlaran el consumo de luz, gas y agua
Article	INDRA	Final Results and ICTs	canaleenergia.com	04/12/2012	Se explica a los lectores cómo el uso de las TICs ha demostrado que se puede ahorrar (términos económicos), en base al ahorro energético

Type	Partner	Title	Media	Date	Comments
Article	INDRA	Final Results and ICTs	casadomo.com	08/01/2013	Amplio reportaje explicando el proyecto y los resultados conseguidos en base a la utilización de TICs para la información en tiempo real del consumo energético, y de agua
Article	ENO	Lösungen für energetischen Modernisierungsbedarf/3eHouses	VDI-Ingenieur Nachrichten / Issue 02/2011	01/07/2011	national technical Magazine of the VDI, Germany
Article	ENO	3eHouses Forschungsprojekt in Leipzig	Sachsen Sonntag / Issue 31.07.2011	31/07/2011	local city magazin
Article	ENO	3eHouses Forschungsprojekt in Leipzig	HLH-Magazin issue 10/2011	01/10/2011	very well known national technical magazine about HVAC technology
Article	ENO	3eHouses Forschungsprojekt in Leipzig	Moderne Gebäudetechnik	01/08/2011	national technical magazine about HVAC technology
Article	ENO	Energieverbrauch messen	WSL-Wohnzeit (issue 5/2011)	August/ September 2011	LWB customers magazin (2-monthly)
Advertisement	ENO	Leipzig TV			Local TV station
Press Conference	ENO	Results of the EE project	Exhibition (building topics)	04/07/1905	At the end of pilot 2
Press release	ENO	Forschungsprojekte für die Wohnungswirtschaft	Ennovatis - Energienachrichten	February 2011	Ennovatis publishes an energy efficiency paper 4 times a year
	ENO	3eHouses Forschungsprojekt in Leipzig	Leipziger Volkszeitung	01/05/2011	Local, daily newspaper
Article	ENO	3eHouses Forschungsprojekt in Leipzig	Kreuzer Leipzig	October 2011	local city magazin
Article	ENO	3eHouses Forschungsprojekt in Leipzig	Leipziger Internetzeitung	October 2012	local internet site
Article	ENO	3eHouses Forschungsprojekt in Leipzig	Sueddeutsche	December 2012	national daily newspaper
Article	ENO	Energie sparen mit intelligenter Technik	VDI-nachrichten	October 2012	National technical paper (weekly)
Advertisement	ENO	Leipzig TV			Local TV station
Press Conference	ENO	Results of the EE project	Exhibition (building topics)	04/07/1905	At the end of pilot 2

Type	Partner	Title	Media	Date	Comments
Article	ENO	3eHouses Forschungsprojekt in Leipzig	Mitteldeutsche Zeitung	28/04/2011	regional newspaper
Article	ENO	ennovatis als Partner des Forschungsprojekts 3eHouses	Wohnungswirtschaftsblog of IP-Dialog	14/07/2012	Blog about different housing topics
Video-Channel	ENO	ennovatis youtube-Channel	3eHouses Video	13/07/2012	Youtube-Channel of t he ennovatis GmbH
Article	BHA	3E Houses project	www.cac-bg.org	May 2011	Overal presentation of 3E Houses project
Article	BHA	3E Houses project	www.publics.bg/	May 2013	Presentation of 3E Houses project as a tool for minimising of utility spendings in housing
Radio interview channel Shumen	BHA	How to minimize energy costs in houses?	Radio Shoumen	9 December 2011	An interview with project experts took place in relation to establishment of a pilot activity at Shumen university student accommodation
Article	BHA	3-E Houses Project	national newspapwer "24 Hours"	May 2013	national newspaper
Article	BHA	3-E Houses Project	National newspaper "Monitor"	May 2013	national newspaper
Article	BHA	Energy efficiency in condominium buildings	Newspaper Sega"	May 2013	national newspaper
Article	BHA	3-E Houses Project for reducing of energy costs	Magazine "Real estates"	May 2013	national magazine
Article	BCC	Introduction to the Project	"Our City"	04/07/1905	The city Council´s newspaper which is sent to every household in the City
	BCC	Feature about participants involved in the project	"Bristol Evening Post" http://www.thisisbristol.co.uk	04/07/1905	Bristol´s commercial daily newspaper
	BCC	Results and findings	"Western Daily Press"	04/07/1905	The regional morning newspaper for the South West of England
	BCC	Technology and results	"IT Now"	04/07/1905	British computer Society Magazine. The magazine for IT professionals in the UK
	BCC	Results and findings	"Energy Management"	04/07/1905	The industry magazine dedicated to energy management
	BCC	Results and findings	"Sustain magazine" http://www.sustainmagazine.com/	04/07/1905	Publication dedicated to Sustainability, Business and the Built Environment

Type	Partner	Title	Media	Date	Comments
Article	BCC	Results and findings	"Energy and environmental management magazine" http://www.eaem.com.uk/	04/07/1905	Magazine covering current energy and environmental management issues
	BCC	Results and findings	"Green Futures" http://www.forumforthefuture.org/greenfutures	04/07/1905	Publication by UK environmental pressure group Forum for the Future
	BCC	Results and findings	"Inside Housing" http://wwwinsidehousing.co.uk	04/07/1905	Online publication focused on Social Housing
	BCC	Results and findings	"Social Housing magazine" http://www.socialhousing.co.uk/	04/07/1905	On and offline presence focusing on the issues of social housing
	BCC	Results and findings	"Sustainable development UK" http://www.govnet.co.uk/publications/sduk	04/07/1905	Publication on UK environmentally friendly development issues
Press release	TREL/BCC	Not yet defined	TBD	03/07/1905	Publication oin UK
	TREL	News Article - Nikkei, Japan 27th June 2011)	Nikkei	03/07/1905	Publication in Japan
	TREL/BCC	Not yet defined	-	04/07/1905	Publication in UK
Press release	TREL	Not yet defined		04/07/1905	Publication in Japan
Conference publication	TREL	Conference Publication	Kalogridis, G.; Dave, S., "PeHEMS: Privacy enabled HEMS and load balancing prototype," Smart Grid Communications (SmartGridComm), 2012	04/07/1905	IEEE Third International Conference on , vol., no., pp.486,491, 5-8 Nov. 2012 doi: 10.1109/SmartGridComm.2012.6486032
Conference publication	TREL	Conference Publication	LeBlond, S, "3eHouses: A smart Metering Pilot in UK Living Labs", IEEE PES ISGT Europe 2012.	04/07/1905	IEEE PES ISGT Europe 2012.
Article	TREL	Technology Magazine Article	LeBlond, S; Lewis, T; Sooriyabandara, M, "Towards an Integrated Approach to Building Energy efficiency: Drivers and Enablers". IEEE PES ISGT Europe 2011.	04/07/1905	IEEE PES ISGT Europe 2011.
Article	IPP	Wii-Fi & Zigbee	www.ip-performance.co.uk		Paper on potential inteference of Wi-Fi and Zigbee data transmission when

Type	Partner	Title	Media	Date	Comments
					in close proximity
Article	IPP	Get Smart'	Linux Magazine	05/07/1905	Article on use of reverse tunnels in smart meters
Article	KWMC	3-E Houses Project	The Knowledge Newsletter Issue 50 http://www.knowlewest.co.uk/newsletters	01/12/2011	Piece about project in local newsletter (6,500 copies printed) Digital version available to read on local community website (www.knowlewest.co.uk)
Online	KWMC	3-E Houses Project	The Knowledge Newsletter Issue 50 http://www.knowlewest.co.uk/newsletters	01/12/2011	Piece about project in local newsletter (6,500 copies printed) Digital version available to read on local community website (www.knowlewest.co.uk)
	KWMC	Join the 3-E Houses project'	Knowle West Media Centre website http://www.kwmc.org.uk/index.php?article=708	01/09/2011	Article on KWMC website
	KWMC	Reduce your energy use with the 3-E Houses project'	Knowle West website http://www.knowlewest.co.uk/2011/11/reduce-your-energy-use-with-the-3-e-houses-project/	01/11/2011	Article on the local community website - a site facilitated by KWMC
	KWMC	3-E Houses project	Knowle West Media Centre Facebook page www.facebook.com/knowlewestmedia	Ongoing	Regularly posting messages encouraging residents to participate
	KWMC	Reduce your energy use with the 3-E Houses project'	Knowle West Media Centre Twitter feed www.twitter.com/knowlewestmedia	Ongoing	Regularly posting messages encouraging residents to participate
	KWMC	Using technology to encourage sustainability'	Energyshare website http://www.energyshare.com/future-fit-bristol/blogs/using-technology-to-encourage-sustainability/	01/09/2011	Mention of 3-E Houses in an online blog encouraging people to support a retro-fitting and sustainability project entitled Future Fit Bristol.
Article	KWMC	3-E Houses Project	The Knowledge Newsletter Issue 51 http://www.knowlewest.co.uk/newsletters	Issue covering February - May 2012	Update about the progress of the project in local newsletter (6,500 copies printed) Digital version available to read on local community website (www.knowlewest.co.uk)
E-bulletin	KWMC	Project update	KWMC E-bulletin June 2012	01/06/2012	Update about the project included in monthly e-bulletin, sent to over 500 supporters of KWMC
E-bulletin	KWMC	Project update	KWMC E-bulletin July 2012	01/07/2012	Update about the project included in monthly e-bulletin, sent to over 500 supporters of KWMC

Type	Partner	Title	Media	Date	Comments
Article	KWMC	Feature about participants involved in the project	The Post www.thisisbristol.co.uk	01/11/2012	KWMC is in conversation with a features writer at the local newspaper to produce a piece about 3E Houses and the participants' experiences around energy reduction.
Article	KWMC	National Press Story	Range of publications with an interest in environmental and energy news	01/11/2012	KWMC have prepared a story covering the aims and impact of 3 E Houses, to coincide with news about rising energy prices.
Article	KWMC	Feature about participants involved in the project	The Post http://www.thisisbristol.co.uk/Tenants-given-help-cut-bills/story-18617976-detail/story.html#axzz2ShCNxzNu	01/03/2013	Feature about 3 E Houses and the impact it's had on participants in Knowle West.
Article	KWMC	Project summary	The Knowledge Newsletter Issue 57 http://www.knowlewest.co.uk/newsletters	Issue covering May - July 2013	Summary of the project, updating residents of the final stages.
E-bulletin	KWMC	Project summary	KWMC E-bulletin April 2013	01/04/2013	Summary of the project, updating residents of the final stages, included in monthly e-bulletin, sent to over 500 supporters of KWMC
Online	KWMC	3 E Houses project	Knowle West website http://www.knowlewest.co.uk/directory/3e-houses/	01/01/2013	Section of local community website dedicated to project, containing images and comments from participants
Article	KWMC	National Press Story	Range of publications with an interest in environmental and energy news	01/04/2013	KWMC is approaching national and trade publications with a story about the end of project booklet and film, to share best practice.

Materials

The following list is an exhaustive enumeration of the materials created for the dissemination of the project as well as the engament campaigns:

Material	Comments
Project website	http://www.3e-houses.eu
Leaflets and brochures	Different leaflets and brochures have been designed for each pilot and replicator, including information in German, Catalan, Spanish and English and customizing the information displayed to the reality of each location. http://www.3ehouses.eu/sites/default/files/leaflet_3eHouses_conferences.pdf; http://www.3ehouses.eu/sites/default/files/E3_housesleaflet_Knowle_2.pdf; http://www.3ehouses.eu/sites/default/files/3E_houses_booklet_FINAL_low_res.pdf http://www.3ehouses.eu/energy-efficiency/documentation?page=2
Posters	Used for pilot promotion four different versions have been employed. http://www.3ehouses.eu/sites/default/files/Poster-3eHouses-conferences.pdf; http://www.3ehouses.eu/sites/default/files/Poster_3-EHOUSES_germanpilot.pdf;
Logo	The one used in the heading of this document has also been employed for any

	project official communication.
Sheets / Letter Sheets	Used for the direct communication with the tenants involved in the project.
Leaflets and posters for conferences	Different leaflets and posters were issued for those conferences and events in which the project was presented. http://www.3ehouses.eu/sites/default/files/3E_houses_booklet_FINAL_low_res.pdf http://www.3ehouses.eu/sites/default/files/leaflet_3-EHOUSES_spanish.pdf
Week marquee leaflet	Including the schedule of the event and presentations: http://www.3ehouses.eu/sites/default/files/3eHouses_Congress-v2.pdf http://www.3ehouses.eu/energy-efficiency/documentation
Best practices guidelines	Short guide including relevant information for dissemination of the project results http://www.3ehouses.eu/sites/default/files/3E_houses_booklet_FINAL_low_res.pdf
3e Houses USB sticks	Storage devices preloaded with the 3e Houses handbook, and displaying the 3e Houses logo. Circulated to project partners and all UK Participants
Videos	Different videos for promotion have been created and uploaded to YouTube. http://www.3ehouses.eu/energy-efficiency/news/3e-houses-project-video

All the materials are described including a scanned version in Deliverable 5.3. and links to be downloaded from 3eHouses website.

Evaluation of dissemination activities

An exhaustive evaluation of all the dissemination activities has taken place within the project framework, in D.5.3. Dissemination Material with Project Results, that can be found in our website.
The indicators have been grouped into internet, activities & public acts, publications and other categories, and every single partner in the project has provided its figures. As a summary, which can provide a good overview of the project dissemination here are some numbers:

- 45 external websites have mention 3e-Houses projects.
- The project has been present in events with an overall of over 50k visitors.
- The project has been present in national, regional and local media since it very beginning reaching a potential audience of several million.