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PROJECT FINAL REPORT

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1. Publishable Summary

1.1 Executive Summary

Digital Home Environment Energy Management System (DEHEMS) www.dehems.eu is a Europe-wide initiative (Framework Programme 7) led by Manchester City Council and involving partners (SMEs, academia, and municipalities) from across Europe. The project aims to help Europe to achieve its carbon reduction targets by supporting households in reducing their energy usage through better analysis and management of their energy consumption. Europe has a stated commitment to reduce CO2 emissions by 20% by 2020, with an option of increasing the target to 30% if the US, India and China agree to emissions targets[1].

The concept behind DEHEMS is to move beyond current smart metering energy 'input' models, that monitor the levels of energy being used by a household, towards energy 'performance' models that also look at the way in which the energy is used by bringing together sensor data in areas such as household heat loss and appliance performance. Data from different energy meter systems and supporting sensors (e.g. for gas and electricity), is been analysed against business intelligence on target efficiency, average efficiency rates and projected environmental conditions to provide practical information to the householder via a 'green online dashboard' accessible online.

Based around a series of science and technology objectives, the project concept is realised through the development of a sensor actuator network (SANET) system incorporating a user interface, middleware and energy measurement. The middleware composed of three loosely coupled systems addressing service demand, resource allocation within the SANET and service provision.

The DEHEMS Dashboard enables users to view their home energy consumption, alongside a community average, in real-time using an energy monitor taking readings every 6 seconds, providing a unique insight into how exactly the energy is being used. By enabling changes to usage profiles to be made remotely, users are able to change the settings on all of their emissions relevant services and appliances through an online control panel. Profiles are tailored by users to meet the needs of their individual situation, and services made accessible via multiple devices with broadband connections and updated in real-time. This has enabled access via the TV with an IP enabled set-top box as well as mobile, PDA and any PC connected to the internet.

[1] European Commission Press Office, 09/03/07

In addition DEHEMS included a pilot model for emissions trading at the household and neighbourhood level. This model was based on the workings of the UK Carbon Reduction Commitment and was discussed with the CRC implementation team within the UK. The system was developed / implemented using Living Labs over 3 cycles, which enabled the impact of the system to be tested as well as contributing to the overall methodology of Living Labs as supported by the European Network of Living Labs (ENoLL).

The exploitation of the project has lead to a number of initiatives in the energy monitoring field including commercial deployment.

Links to the repository for code and data relevant the project are available.

Figure 1 DEHEMS Logo

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Clicks and Links Ltd [United Kingdom]
Hildebrand Technology Ltd [United Kingdom]
Bristol City Council [United Kingdom]
Energy Agency of Plovdiv [Bulgaria]
University of Rousse “Angel Kanchev” [Bulgaria]
Birmingham City Council [United Kingdom]
University of Coventry [United Kingdom]
University of Salford [United Kingdom]
Obshtina Ivanovo Municipality [Bulgaria]
Institute e-Austria Timisoara [Romania]

1.2 Project Context and Objectives

Europe has a stated commitment to reduce CO2 emissions by 20% by 2020, with an option of increasing the target to 30% if the US, India and China agree to emissions targets[2]. DEHEMS will help Europe meet this target by supporting households to reduce their energy usage through better analysis and management of their energy consumption. Central to achieving energy conservation will be behaviour change in households, shifting towards more efficient domestic energy management. This has been evidenced in a range of research on energy conservation[3] [4]. Automated room temperature controls are estimated to offer potential savings of 20 to 30 kWh/m², a saving rate of 15%-35%[5]. At present, a key barrier to household action on climate change is the sense that the issues are so large; individuals cannot make a meaningful contribution to tackle it[6]. Directly measuring the impact of an individual household is currently very difficult, making it hard to genuinely personalise the impact an individual can have. This is an equally important issue from European Governments' perspective for policy around Personal Carbon Allowances and emissions trading for households[7].

It follows that behaviour change in individual households is critical to successfully promoting efficient domestic energy management. To date this has proved to be difficult. Individuals and households often feel overwhelmed by the scale of the problem and the perceived limitations of their individual responses. Appliances and systems that use energy are rarely networked or automated intelligently. The energy requirements for different appliances and devices are varied and making adjustments to settings to optimise environmental performance requires a major effort e.g. thermostat settings for heating, standby settings for appliances, temperature settings for washing machines and dryers etc. Where home automation has been installed, it is frequently at high cost. The advent of the 'internet of things' with household appliances, services and objects networked, opens a new opportunity to develop IP enabled solutions that are more user friendly and flexible than past electro-mechanical automation approaches.

This coupled with the cost of technical solutions that demonstrate household energy consumption in an accessible and meaningful way to individuals is the issue which DEHEMS chose to confront. The DEHEMS proposal has two key strands:

2 European Commission Press Office, 09/03/07

3 *Jackson, T., (2005) Motivating Sustainable Consumption. A Report to the Sustainable Development Research Network*

4 *Mobilising individual behaviour change through community initiatives, Centre for Sustainable Energy, Community Development Exchange, 2007*

5 Systematisierung der Potenziale und Optionen für den Gebäudebereich., Kleemann, M., Birnbaum, U. et al. (2001), Fraunhofer Institute

6 Jackson, T., (2005) Motivating Sustainable Consumption. A Report to the Sustainable Development Research Network.

7 A Rough Guide to Individual Carbon Trading, Simon Roberts and Joshua Thumim, Centre for Sustainable Energy, Department for Environment and Rural Affairs, 2006

The first had the objective of going beyond the state of the art - as current at the start of the DEHEMS project - in terms of defining and meeting user demands by creating and implementing a number of innovative technological approaches.

The second was to use Living Labs to simultaneously validate the technologies and change the behaviour of users by making them aware of how they could personally control and reduce their household energy consumption profile.

The project concept is realised through the development of a Sensor Actuator Network (SANET) system incorporating a User Interface, middleware and energy measurement. The middleware will be composed of three loosely coupled systems addressing service demand, resource allocation within the SANET and service provision. The system was developed using Living Labs over 3 cycles, testing the impact of the system. The science and technology objectives required for the delivery of the system are summarised in the Description of Work B1.1 – Figure 2.

A key aspect is to move beyond current smart metering energy 'input' models, which monitor the levels of energy being used by a household, towards energy 'performance' models that also look at the way in which the energy is used by bringing together sensor data in areas such as household heat loss and appliance performance. Data from different energy meter systems and supporting sensors i.e. for gas and electricity, will be analysed against business intelligence on target efficiency, average efficiency rates and projected environmental conditions to provide practical information to the householder in a 'green dashboard' accessible online. This includes:

- A real time carbon footprint assessment, that takes into account the sources of energy (e.g. if the householder has opted for 'green' energy packages),
- A real time household energy efficiency rating, analysing how the house is performing in terms of heat loss and the efficiency of appliances
- Recommendations for energy efficiency improvements based on the real time energy efficiency rating e.g. attention to specific windows that are not secure, replacement of appliances that are poorly performing for their category etc.
- Recommendations for different usage profiles that match householders usage needs more energy efficiently
- Recommendations for forward settings based on online information about developing weather patterns and past usage patterns during these times

The system enables changes to usage profiles to be made remotely. This will enable people to change the settings on all of their emissions relevant services and appliances through an online control panel. Profiles will be tailored by users to meet the needs of their individual situation. Services will be accessible via multiple devices with broadband connections and

updated in real time. This will enable access via the TV with an IP enabled set-top box as well as mobile, PDA and any PC connected to the internet.

Objective Title	Objective Description
O1. User Requirements for household energy management systems	• Define the environment and determine the motivating factors for households to change behaviour • Define the relevant policy priorities for senior decision makers in the municipalities • Define system requirements for ease of use and deployment environment • Define functional and systems requirements for service demand, broker and provider layers
O2. System Delivery	• Design, validation, development and testing of the system to realise the project concept
O2.1 User Interface delivery	• Capture of user demand and actions through a user interface. • Communication of sensor and actuator reports to user through User Interface
O2.2 Semantic Service Demand layer delivery	• Translation of user demand into machine concepts usable by the service broker
O2.3 Service Broker delivery	• Decision making on allocating resources available in the service provider layer to meet demand articulated in the service demand layer
O2.4 Semantic Service Provider layer delivery	• Presentation of sensor and actuator functions available to meet requirements expressed through service demand layer • Reporting of sensor and actuator activity back to user through user interface
O2.5 Service Measurement delivery	• Measurement of energy usage per appliance to be used by service broker as input into allocation decision
O3. Living Labs validation	• Validation and iteration of system through Living Labs cycles
O4 Living Lab analysis	• Analysis of Living Lab operations to provide inputs into system iterations and lessons learnt on household behaviour energy usage
O5 Dissemination and exploitation of results	• Dissemination of RTD findings to the range of audiences relevant to the project, including citizens, RTD arena and policy decision-makers • Exploitation plans for consortia partners detailing next steps using DEHEMS outputs for future academic, commercial and municipal activities

Figure 2 Scientific and Technical Objectives Extract B1.1 Description of Work

In summary, the project brings together three key facets (Figure 3), behavioural change and technology along with a broader community context. The community aspect provides a broader framework which expands the behavioural elements.

Figure 3 Three Key Project Facets

1.3 Key Scientific and Technical Results - Foreground

The DEHEMS Project was conceived five years ago. The need to reduce energy consumption is even more important now than it was at the start of the project. If a reminder were needed, it should be noted that at the time or writing carbon fuel costs are at an all time high.

At the time the proposal was made it was stated that it was a unique undertaking to develop a package of integrated, state of the art technologies. Additionally these would be developed and validated by using Living Labs methodologies to ensure acceptability of the technologies to prospective users. Intense user involvement from the start was seen as being critical given the objective of achieving permanent behaviour change whereby users could monitor and reduce their energy consumption over the long term.

Figure 4 Dehems Equipment – Data Collection Box

Figure 5 Dehems Equipment - Installation at the Meter

Progressing the State Of The Art

At the time when DEHEMS was conceived it was stated that there was nothing like it on the market. That still applies to a degree. True there are now more smart metering products available and there is a plethora of relatively cheap energy monitors. Whilst the market has matured in the last five years, it is still only superficially comparable with the DEHEMS offering.

In December 2009 the United Kingdom's Department of Energy and Climate Change announced its intention to have smart meters in all homes by 2020. However the debate continues in discussion with issues of protocols and data management still running. Smart meters are designed principally to meet the needs of energy suppliers. In the UK, for example, it is calculated that they will save suppliers €400m per year by reducing the cost of metering and disputes over billing. Whilst most meter electricity and gas in one unit, they usually only come with rudimentary visual display units. These, like energy monitors, allow customers to view real-time energy usage. This is not as sophisticated as the technologies developed by DEHEMS nor is it consumer focused.

Most of the energy monitors currently available are much simpler. Most will now send the information to a handheld visual display unit, where it will be re-calculated and displayed as real-time power usage (in kWh), cost (£/€) and greenhouse gas emissions (tonnes of CO2). In some cases they are offered free or are subsidised by energy suppliers.

The difference between these and the DEHEMS approach becomes apparent in D5.5 Hardware Deliverable which offers a compelling analysis of the various technologies available. The project has lead to a different solution by creating an opportunity to see what else was

available. The decision to go with Zigbee based upon IEEE 802.15.4 standards as opposed to using Power Line Communication (PLC) technologies was taken early in the project lifetime. The evidence which validates this decision becomes more obvious as the project develops.

Figure 6 Dehems Equipment – OCR Gas Reader

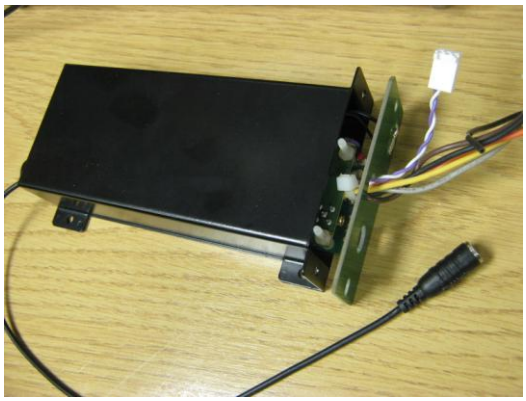

Figure 7 Dehems Equipment – Gas SMS Module

A unique feature of the DEHEMS offer is a proven ability to deal with time-series data. Currently readings are taken every few seconds and sent via the households own wireless hub to a central database. This enables users to access real-time information about their energy consumption. In addition homeowners can access this information online in a simple format that displays their electricity usage and perform analytics, such as calculating costs against the users' electricity tariff, or comparing their usage to the average for their group.

DEHEMS also had to deal with the monitoring and presentation of gas consumption data. D5.5 points out that this is not characterised by the availability of numerous competing devices, not least because the activity is intrinsically more hazardous. A small batch of functioning prototypes was produced and subsequently installed in a small number of households. There are clearly issues with using gas monitoring equipment as an add-on. It was also impossible to use it in Bulgaria for a number of technical reasons.

Gas figures have presented a challenge. Analysis has shown that the gas data is unreliable. This is due to a number of technical challenges that resulted in patchy coverage of households, and unreliable data from the commercial optical character reading devices that were used to take readings. In particular, many readings would be misinterpreted due to the display being part way through changing to the next value, and certain digits would often be confused even when they were displayed properly (for example, 0 and 6).

In order to clean up the gas data, analysis was carried out on individual raw data points in relation to adjacent ones in the time series in order to identify the majority of erroneous data points and either correct or discard them.

Given the quality of the data, it is considered that only quite general conclusions can be drawn from the quantitative gas data, and the majority of the research outcomes in relation to gas monitoring are derived from qualitative data gathered during the surveys and focus groups. However it is clear from the results shown in D7.7 and elsewhere in the project, that the inclusion of gas monitoring benefited the research objectives. Despite the issues with some of the gas monitoring installations, 36% of respondents (D7.7) indicated that as a consequence of being made more aware of their gas consumption it was significantly reduced.

Another feature in Cycle 2 and 3 was the development of a Facebook App. Deliverable D7.7 deals with this in some detail and concludes that Facebook users engaged more fully with DEHEMS during the project life cycle and also reduced their energy consumption more than non-Facebook users. Given the sample size, this has to be a tentative conclusion but it does offer an insight into the potential influence of social media in helping to modify behaviour and reduce energy consumption by individuals.

Figure 8 DEHEMS Facebook App

Another aspect of the project was the emissions trading pilot model, described later in this report.

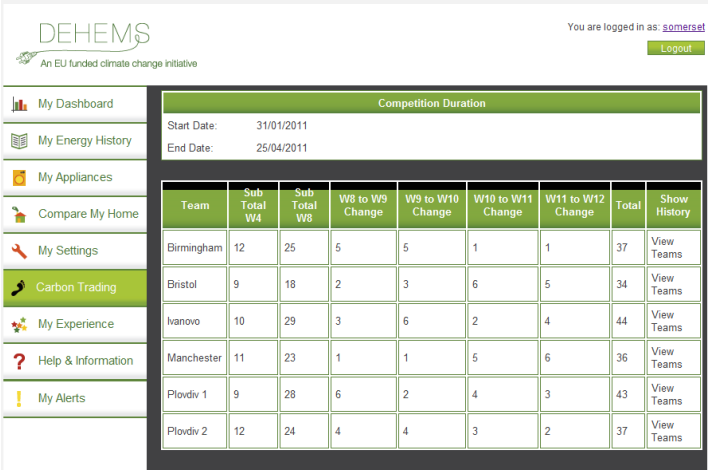

Figure 9 Carbon Incentives

The work done in D4.9 in the development of a control system simulator with components that can be used on line complements the electricity and gas consumption monitoring systems mentioned above. Taken together, this suggests that the DEHEMS consortium can reasonably claim that they have progressed the state of the art in terms of monitoring gas consumption in real-time and integrating it with electricity consumption for presentation in the DEHEMS dashboard.

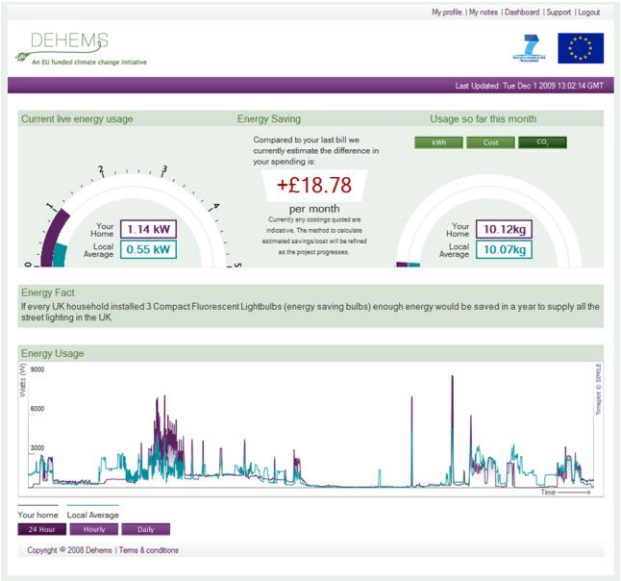

Figure 10 Energy Dashboard Used In Cycle 1

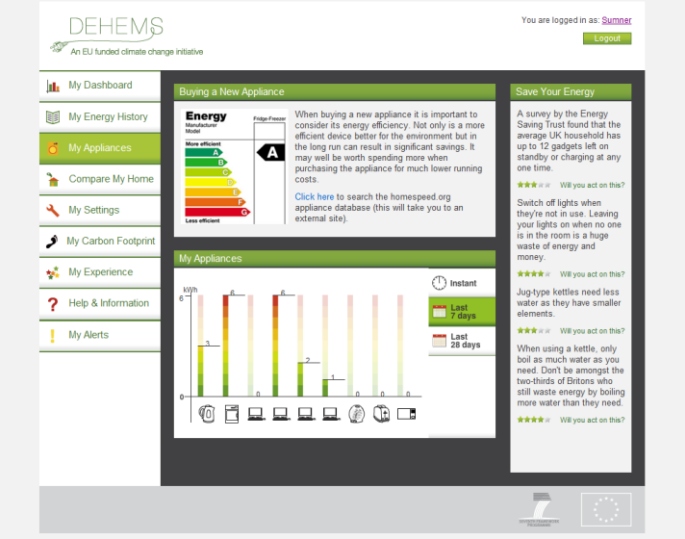

Figure 11 Energy Dashboard with New Design For Cycle 2

The end result is that people can make more informed decisions about energy management and change their behaviour in order to reduce electricity bills and minimize their environmental impact. Put simply, this and more has been achieved and there is still nothing on the market which has comparable functionality for a similar cost base. In addition the DEHEMS offer has been developed, tried and tested over the project life cycle with groups of users on a transnational basis.

Technical partner, Hildebrand are continuing this work via their relationship with IBM with additional testing undertaken with simulated loads to handle well in excess of 3,000,000 households utilising the labs at IBM for hardware and network resources

This indicates clearly that the DEHEMS offer is qualitatively different from most of the technologies that are currently available. For the purposes of this evaluation the conclusion must be that DEHEMS is still very much about state of the art as the section on dissemination and exploitation demonstrates.

DEHEMS aims to provide energy monitoring in the context of minimal cost of installation of additional equipment as well as finding non-invasive solutions. Using the thermal model of the house as well as information such as indoor temperature and outdoor temperature it is possible to estimate the thermal energy consumption of the property.

The applications were designed for use in simulations and redesigned to be used in off-line or on-line experimental identification and for inclusion in the web application. The first variants of the thermal model were realised under the form of a detailed white-box model. Taking into

account the constraints above, as well as challenge of obtaining data on the thermal behaviour of a building, the black-box and grey-box were evaluated in the second stage.

The grey-box model can be used to offer the user information like:

- comparisons with other similar users;
- comparisons with past consumption;
- how the thermal consumption is changed if the temperature set point is adjust by one or more degree(s);
- how the thermal consumption is changed by using different scenarios of temperature set point evolution;
- how the thermal consumption is changed if a model parameter is modified;
- how the thermal consumption is affected by: weather, occupants, appliances;
- the relationship between thermal consumption and comfort (thermal, visual, quality of air);

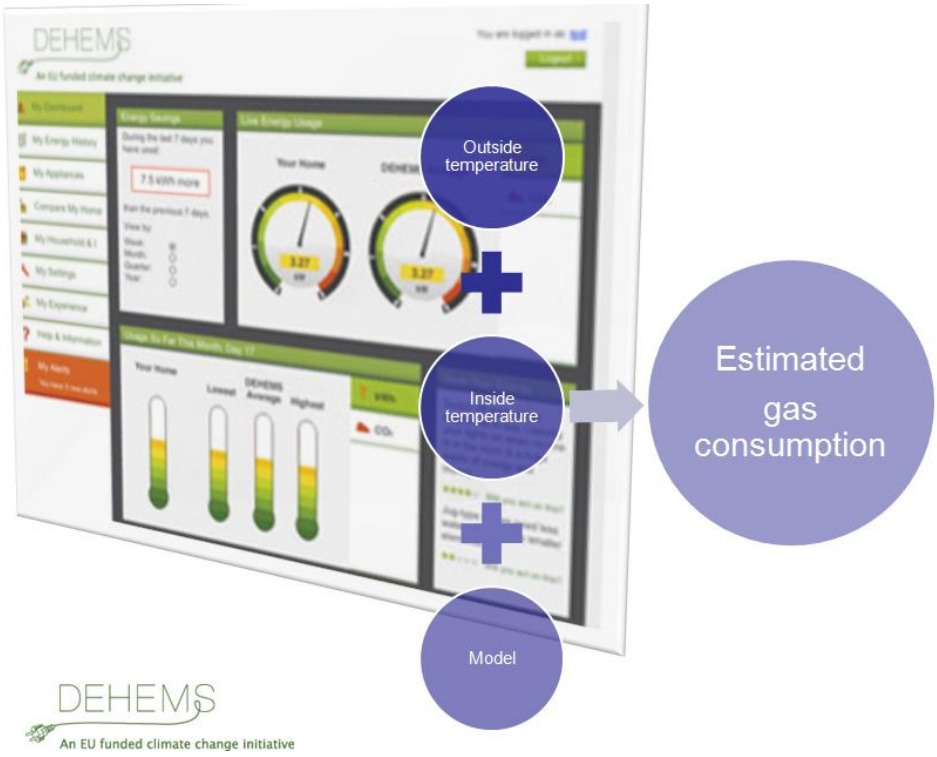

Figure 12 Estimation of Thermal Energy Consumption

Defining User Requirements, Role of Living Labs and User Driven Innovation (UDI)

It should be noted that for some that the desirability of involving users in innovation is not regarded as being a self evident truth. Where secrecy prior to product launch is seen as commercially desirable, involving users in innovation is anathema. Steve Jobs, the CEO of Apple Computer, has said, "It's really hard to design products by focus groups. A lot of times, people don't know what they want until you show it to them." BusinessWeek, May 25 1998.
The DEHEMS consortium chose to take a very different view.
User Driven Innovation (UDI) lies at the heart of the DEHEMS project. Living Labs are the essential delivery mechanism in this process which has a three phase developmental cycle. This starts with a UK pilot involving 50 households in the UK and ends with a deployment across over 250 households in the UK and Bulgaria by which time feedback from users via Living Labs had been integrated into the final product.

The experiences of User Driven Innovation (UDI) and participation in DEHEMS are available online:

http://vimeo.com/17569551
http://www.euronews.net/2011/02/09/energy-under-control/
http://www.youtube.com/watch?v=445mLvNw-SA&feature=player_embedded#at=12

By the close of Cycle 3 users are able to access a wide range of information from real-time household energy consumption and historical consumption together with an ability to compare their consumption patterns with others in a similar position. This being accessible via a digital photo frame and the web via a user-friendly GUI which they helped to create.

Living Labs in DEHEMS are presented as having a dual role. Behavioural change in terms of reducing energy consumption is seen in part a function of user involvement in the design process. In part this involvement also results in a sense of ownership.

In their paper *DEHEMS: A User-Driven Domestic Energy Monitoring System* Vasughi Sundramoorthy, Qi Liu, Grahame Cooper and Nigel Linge from the School of Computing, Science and Engineering at The University of Salford, United Kingdom and Joshua Cooper of Hildebrand Ltd United Kingdom - all members of the DEHEMS consortium - make the point in the abstract:

Persuasive energy monitoring technology has the potential to inspire sustainable energy lifestyles within the home. However, to effect positive ecological behaviour change, a more user-driven approach is needed for the development of the technology, where the design needs to be accompanied by study on user behaviours and motivations, and the prototype deployed and tested on large sample sizes to understand user preferences. We present DEHEMS, a

wide-scale energy monitoring system that undergoes three cycles of design, development and usability assessment so that it can help facilitate energy literacy and environmental awareness based on user preferences. Through real-world deployment, survey and focus group studies carried out in the UK, we present motivations and constraints for saving energy, user assessment of the DEHEMS pilot system and identify some critical user expectations and concerns. We describe how the usability analysis is then incorporated into the design of the next generation DEHEMS system and demonstrate that the resulting system achieves 8% reduction in energy consumption within the first week of feedback.

Living Labs are certainly part of the zeitgeist. Antti Peltomäki, Deputy Director General DG INFSO writing in the *Introduction to Living Labs for user-driven open innovation* DG-INFSO January 2009 makes the point that:

Living Labs are open innovation environments in real-life settings, in which user-driven innovation is fully integrated within the co-creation process of new services, products and societal infrastructures. In recent years, Living Labs have become a powerful instrument for effectively involving the user at all stages of the research, development and innovation process, thereby contributing to European competitiveness and growth.

Living Labs are seen as democratising the innovation process, not least because they reflect a bottom-up approach to the creation of innovative products and services.

Historically Living Labs can be seen as the most recent chapter in a narrative which seeks to understand the relationships between human beings and technology. Arguably this started with the Hawthorne Experiments in 1924 together with the work of Elton Mayor. Its antecedents within this intellectual tradition include organisational studies of socio-technical systems in the 1970's, CSCW Computer Supported Cooperative Work in the 1980s and more recently interest in Socio-technical design. Walt Scacchi Institute for Software Research School of Information and Computer Science University of California, Irvine, CA 92697-3425 USA defines the latter succinctly:

Socio-technical design is concerned with advocacy of the direct participation of end-users in the information system design process. The system includes the network of users, developers, information technology at hand, and the environments in which the system will be used and supported. The process includes the design of the human-computer interface and patterns of human-computer interaction. It stands in opposition to traditional system or software engineering design methods that focus attention exclusively or primarily to activities of system engineers who design the computational functions and features of a new system, and who use

computer-aided design tools and notations to capture and formalize the results of such a design process.

This is very close to the way in which DEHEMS sees the role of Living Labs in defining user requirements. Maintaining behaviour change in the long term may be more problematic, especially for those that have not been involved in the UDI phase. Whilst the quantitative evidence of behaviour change appears to be compelling in the DEHEMS deliverables, it may be influenced by factors such as a wish on behalf of participants and researchers to achieve a certain behavioural outcome. The vox pop quotes in the deliverables and the academic paper by Salford University / Hildebrand all suggest that this may be happening. That said, they also offer some very pertinent qualitative insights as to how users respond to the DEHEMS objectives.

The above is an observation and not a criticism. Given the nature of the DEHEMS project and the resources available it is difficult to see how alternative selection processes would have been viable. The use of control groups not involved in meetings and focus groups also illustrates a welcome awareness of the issue within the consortium. The evidence over the three cycles is compelling. It is clear that those responsible for the technological underpinning and development of the project responded positively and creatively to input from potential users and consumers.

There is an inevitability that, similar to all research projects involving participants, recruiting people to Living Labs or in a control group, they are alerted to what the project's aims and objectives. It could be argue that the control group also reduced their energy consumption because by agreeing to participate they also became self aware of their own situation. Within the project this was colloquially known as the "Dehems Effect".

The evidence in the deliverables is supported by interviews carried out during the course of the evaluation. With one or two exception, the majority of users in both the UK and Bulgaria committed themselves to the project with enthusiasm. In some cases to the extent that many of them even became competitively fixed on understanding and reducing their energy requirements.

Living Labs Methodology

The term Living Labs is generic. It was clear from the start that there was no off the shelf solution to setting up a Living Lab. The process had to be interactive and managed in such a way as to keep the users i.e. Living Labs members involved whilst at the same time not losing sight of the objectives of the project.

D8.5 documents the Living Labs methodology used by DEHEMS. The development of living Labs Methodology in DEHEMS is covered in a number of other deliverables:

D7.1 Report on Community Engagement Models
D7.2 Report on DEHEMS Implementation Model
D7.3: Operation of the Living Labs
D7.5 Project Cycle Analysis Report for Cycle 1
D7.6 Project Cycle Analysis Report for Cycle 2
D7.7 Project Cycle Analysis Report for Cycle 3

In terms of methodology it can be argued that the most suitable type of Living Lab format will be dependent on the type of ICT service or product that is being developed. In DEHEMS recruitment took place in a relatively ad hoc manner. The statistical ideal might have been to recruit Living Lab members at random with a control group against which the impact of the proposed interventions can be measured. In reality there are a number of constraints to implementing this approach. These range from the need for all users to have a fast broadband internet connection to knowledge of the existence of suitable users to recruit. In the case of DEHEMS Living Lab members were recruited via the participating Local Authorities in the UK and Bulgaria; hence they fall on different parts of the typological continuum.

DEHEMS is different in that members of Living Labs were actively collaborating in twin processes which are usually discrete. The first being the development of products and services, the second being the modification of their own behaviour as a result of using these same products and services that they had helped to develop.

This also highlights one of the dilemmas in recruitment policy, e.g. which objective is the most important? If behaviour change is the key objective people need to be recruited for the duration of the project so that attitudes and behaviour can be measured during each iterative project cycle. If the development of a product or service is to be given priority, a case can be made for recruiting different sets of users for each project cycle.

The DEHEMS Dashboard is a good example. The reactions of new users who are unfamiliar with previous versions of the product might be more useful to the developers because they would give a fresh, immediate reaction uninfluenced by the past. Whilst this might make the life of the developers easier, it would make the task of the social scientists carrying out a longitudinal study of behaviour change in the same people over three years impossible. DEHEMS demonstrates very clearly that there are no simple methodological solutions to Living Labs recruitment. Ultimately a methodological compromise is inevitable.

The work done in DEHEMS on Living Labs Methodology offers a guide which is essentially practical and gives examples from the DEHEMS experience. There is no single Living Labs methodology. One size does not fit all. Living Labs made a significant contribution to the overall success of the project.

Emissions Trading Pilot

The DEHEMS description of work (DoW) states that the project will develop an:

"Emissions trading pilot model - Localised emissions trading, at neighbourhood and household level, is a policy objective across Europe…being the first project to implement this objective. It will establish a pilot model in Cycle 3 that enables neighbourhood markets in emissions with households being able to buy or sell according to pre-allocated emissions 'budgets' on the basis of actual (as opposed to estimated) emissions information."

Initial desk research was undertaken, as well as discussions with UK government departments (i.e. Department of Energy and Climate Change [DECC] and Environment Agency [EA]), and contact with experts. This was followed by the setting up a Carbon Trading Working Group. This included a number of project partners and external experts.

There were two parts to the objective: the creation of a model; and then the testing of it within households as part of Cycle 3. The challenge, recognised at the outset of the project, was that a key barrier to household action on climate change is the sense that the issues are so large; individuals cannot make a meaningful contribution to tackle it[8]. Directly measuring the impact of an individual household is currently very difficult, making it hard to genuinely personalize the impact an individual can have. This is an equally important issue for the European Governments' perspective for policy on "Personal Carbon Allowances" and emissions trading for households. There would also be a clear benefit in producing a model that only allowed trade in an "eco positive currency", rather than pounds or euros, which can simply be used to burn even more carbon. Ideally an emissions trading system needed to be a closed cycle and include all buyers and sellers.

DEHEMS developed a pilot model in Cycle 3 for emissions trading at the household and neighbourhood level with the ability to allocate budgets and then allow for household and neighbourhoods buying and selling allocation according to their own usage. This model was based on the workings of the UK Carbon Reduction Commitment and was discussed with the CRC implementation team within the UK. Whilst it may have been possible to only include households in such a model, a wider neighbourhood or city scheme would open up greater opportunity for trading, particularly with corporate or other institutions that are part the UK Carbon Reduction Commitment.

In terms of implementing the model within a project the size of DEHEMS, then the challenge was to create a realistic trading system based on the principle that there is a market in a scarce resource, and that households would be prepared to trade money or something else for that ability. Alternatively, it can be viewed as a mechanism by which householders can be

[2] Jackson, T. (2005) Motivating Sustainable Consumption. A Report to the Sustainable Development Research Network.

incentivised to reduce emissions by getting something of value, money or something else in return.

These considerations led to an implementation based on EcoPoints (ie. incentives) as detailed in D8.6. This was successfully devised and implemented as a competition (i.e. the Energy Team Challenge), and involved all 5 Living Labs, engaging with a total of 30 households over a 12 week period.

The challenge for the DEHEMS consortium was to operationalise this model in such a way as to engage the enthusiasm of people grouped in the Living Labs. Failure to do this would have simply resulted in the creation of an essentially academic model which was not perceived as relevant by intended participants. It was also necessary to construct a model where the rewards took the form of an eco-positive currency. Cash incentives could be spent on goods and services which lead to an increase in carbon emissions. The model which was implemented worked in this specific context. People participated and winners were duly rewarded.

1.4 Socio-Economic Impact and Wider Societal Implications

Evaluating the impact and legacy of a project at the moment of completion is challenging because it involves assumptions about the future. There are however some clear indications which demonstrate very clearly that the work carried out in DEHEMS will have a positive legacy.

For the purposes of evaluating the impact and legacy of DEHEMS it is useful to separate Living Labs from the development of the technological platform even though the two were integrated in the initial phase of developing user requirements.

Innovation and Behavioural Change

One of the principal objectives of DEHEMS has been to instigate and monitor behaviour change in terms of personal energy consumption. The Living Labs approach was adopted because the bottom up approach to developing innovative products and services had an obvious synergy with the philosophy underpinning DEHEMS.

The various iterations of the technology in the three cycles of the DEHEMS work programme clearly showed the impact of the Living Labs, particularly in the development of the dashboard. The users wanted a GUI that made sense to them and that did not necessarily accord with the initial offerings of the developers.

This involvement helped to develop a sense of ownership and interest in the project by many of the users. The initial impact, on a relatively small sample it should be noted, led to a significant drop of up to 10% in energy consumption in many households. Once the project was rolled out in the final stage in both the UK and Bulgaria similar results were found.

Living Labs methodology takes place over a limited time period. Teams of researchers are involved and the users are subject to close scrutiny. Not only is their energy consumption recorded but many of them are also required to complete questionnaires, attend focus groups and be interviewed. They may well do this enthusiastically. This raises a number of questions about the long term impact and the legacy of the Living Labs in DEHEMS.

Essentially this is a question of scalability and can be illuminated by considering the following two questions:

Can a similar impact be expected in behavioural change over the long term if users are not involved in developing the technology?

Over 250 households were organised in Living Labs in DEHEMS. 3 million household readings were included in the Hildebrand/IBM time-series data simulation. Such a massive difference does not negate the evidence gathered from the DEHEMS Living Labs. The UDI phase cannot be replicated in a programme involving 3 million households. The numbers involved in DEHEMS were entirely appropriate for trying to establish the optimum service and technical requirements for future deployment on a much larger scale.

Far better to deploy a system that has been trialled with meaningful developmental input from highly motivated users than to deploy one which is essentially a prototype which may reflect the assumptions of developers rather than users.

Is there evidence from DEHEMS Living Labs which suggests that positive behavioural change might form part of the long term legacy of the project?

One of the findings that emerged very clearly from the first cycle of DEHEMS in the UK - and later when the project was implemented on a larger scale in the UK and Bulgaria - was the lack of knowledge that users had about their own energy consumption. They wanted to reduce their consumption. To do this effectively they needed to know how much individual services and appliances cost to run.

At the start of the project 1000 people were asked to rank the household services that used the most energy if left on at full capacity from a list of typical appliances. 83% failed to identify the most power hungry services.

Initial results from the Living Labs were broadly in line with these findings. Most users had little idea of how much individual appliances consumed and when asked to guess were frequently wrong. This from a cohort whose interest in the subject probably predisposed them to agree to participating in a Living Lab in the first place.

It can safely be assumed that the wider population exhibits higher levels of ignorance about such matters. As energy prices increase it can be assumed that this will probably change. One example makes the point. According to research carried out by Dutch company Plugwise - whose products were used in the DEHEMS project - running a seven-year-old refrigerator cost €290 a year. A comparable, modern A-rated fridge would only cost €57.50 a year. Investing €230 in purchasing a new appliance would more than pay for itself within two years.

As energy becomes more expensive consumers will need to access information like this. Experience with DEHEMS Living Labs shows that when given the right information people can be motivated to change their energy consumption patterns, particularly when this is combined with user friendly, accessible technologies that give them a meaningful insight into their own behaviour. Part of the long term legacy of DEHEMS will be in reducing ignorance about energy consumption.

The Living Labs experience also highlighted other factors that need to be taken into account before large scale deployment. Reliance on household routers to transmit information about real time consumption may not be suitable for general use. Many of those who signed up for DEHEMS living labs were use to turning off their routers when they were not required. Similarly there were initially issues surrounding the longevity of the batteries that were initially supplied with the monitoring equipment. In Bulgaria particularly, energy suppliers

were reluctant to allow the equipment to be installed due to their ownership of the equipment.

The work produced during Cycle 3 looks at the issues surrounding behavioural change in detail. The fact that the samples are small has already been dealt with. One of the key findings is that there was little reduction in energy consumption in the course of Cycle 3. The real drop in consumption took place during Cycle 2. In Cycle 3 this reduction was maintained. In terms of the long term legacy of DEHEMS this is interesting. It suggests that once given an insight into the breakdown of their energy consumption via the DEHEMS dashboard and/or a plug monitor, people will seek to maintain their consumption at the reduced rate.

2. Use and Dissemination of Foreground

The project dissemination offers insight into the impact of the project and also give some indications as to what the legacy of DEHEMS might be.

The Reviewers have previously remarked that the quality of the academic papers produced during the course of the project has been high. In addition to producing academic papers DEHEMS has been brought to the attention of a wider EU public by presentations at conferences which had synergy with the aims and objectives of DEHEMS.

Producing and distributing information does not guarantee action as a consequence. However the broad range of outlets suggests wide interest. A more concrete indication of the exploitation of the results by the private sector gives positive evidence of success.

Technical Innovation: Impact, Legacy and the Future

The section, “Progressing the State of the Art” along with the evidence of dissemination and exploitation show clear evidence of genuine interest in developing some of the technologies that have been created in the course of the DEHEMS project. DEHEMS has already achieved considerable impact by successfully proving that it is possible to develop affordable technologies to enable homeowners to access information about their energy consumption on-line via a variety of user friendly devices.

In addition the DEHEMS offer means that they can access information about their carbon footprint, analyse how their house is performing in terms of energy efficiency and heat loss against a personalised benchmark, compare themselves with other similar users and carry out accurate monitoring of the relative efficiency of their individual domestic appliances. In order to do that a sophisticated but affordable back end has been developed which has been shown to work effectively and to be eminently scaleable.

There is still a considerable gap between the demonstration of a concept and the production of a commercially viable, sustainable solution. This applies particularly to the measurement of gas consumption. The impact is clearly observable. It is clear that people will want to make more informed decisions about their own energy consumption and management. The imperative coming from the need to both reduce energy bills and minimize their environmental impact. However, the legacy will only be guaranteed when the findings that emerge from DEHEMS are incorporated into the design and build of the next generation of smart metering and added value services. The evidence from Clicks and Links, Hildebrand and IBM (Europe) suggests that this process is already underway and gives cause for optimism.

Code and Data Repositories

The foreground from the project is available in a number of repositories. This includes both the code and the data generated by the project. Note that for the data, all identifying information has been removed from the data. These will be maintained for two years (Sept 2011- September 2013). The www.dehems.eu website will be maintained for the same period.

Hyper links are available in the table below.

Description	URL	Owner
Carbon Trading / Energy Team Challenge.	https://github.com/clicksandlinks/dehems_ct	Clicks and Links Ltd
DEHEMS Website Coding	http://www.energyhive.co.uk/assets/files/dehems.zip	Hildebrand
Semantic web - appliance ontology.	http://www.ontologyportal.org **Note:** Available portal when SUMO technical committee accepts ontology as a standard.	University of Coventry
Database benchmarking framework - sensor-data storage.	https://github.com/cipriancraciun/sds-benchmark	Institute e-Austria Timisoara
Processed data	http://usir.salford.ac.uk/id/eprint/19155 This is the processed data as used for analysis dataset, which combines both qualitative and quantitative outputs, was the basis for the evaluation report D7.7	University of Salford
Thermal model identification	https://github.com/UTCN-DMDM/DEHEMS https://sourceforge.net/projects/myfirst-project/files/	Technical University Cluj-Napoca
Hypertable Distributed DBMS	http://www.uni-ruse.bg/dehems **Note**: Hypertable DBMS is a column-store that stores each attribute in a database table separately, such that successive values of that attribute are stored consecutively. This is in contrast to most common database systems, row-stores, where values of different attributes from the same tuple are stored consecutively (i.e., column-stores store data column-by-column, while row-stores store data row-by-row).	University of Rousse Permission and password required – contact Prof Pavel Vitliemov pvv@manuf.uni-ruse.bg

Figure 13 DEHEMS Repositories for Data and Code

2.1 Section A

A1 List of Scientific Publications

A1: LIST OF SCIENTIFIC (PEER REVIEWED) PUBLICATIONS, STARTING WITH THE MOST IMPORTANT ONES										
NO	Title	Main author	Periodical Title or series	Number, date or frequency	Publisher	Place of publication	Publication Year	Pages	Permanent identifiers (if available)	Open Access Publication?
1	Multi-group QoS consensus for web services	Kuo-Ming Chao,	J. Comput. Syst. Sci.	77(2)	Elsevier	United Kingdom	2011	223-243	DOI: 10.1016 / j.jcss.2010.01.004	yes
2	Fuzzy Similarity Clustering for Consumer-Centric QoS-Aware Selection of Web Services	Kuo-Ming Chao	J. Comput. Syst. Sci.	N/A	Elsevier	United Kingdom	2009	904-909	DOI 10.1109 / CISIS.2009.202	yes
3	Ontology for Home Energy Management Domain	Nazaraf Shah	CCIS[9]	N/A	Springer	United Kingdom	2011	TBA	In press	yes
4	A Profile based Energy Management System for Domestic Electrical Appliances	Kuo-Ming Chao	ICEBE2010	N/A	IEEE[10]	United Kingdom	2010	pp.415-420	http://doi.ieeecomputersociety.org/10.1109/ICEBE.2010.23.	yes
5	Ontological On-line Analytical Processing for Integrating Energy Sensor Data	Nazaraf Shah	IETE Technical Review	Volume 26. Issue 5	IETE[11]	United Kingdom	2009	375-387	DOI: 10.4103/0256-4602.55271.	yes

[9] Communications in Computer and Information Science

[10] The Institute of Electrical and Electronics Engineers

[11] Institution of Electronics and Telecommunication Engineers

6	Service selection based on fuzzy TOPSIS method	Kuo-Ming Chao	N/A	N/A	IEEE	United Kingdom	2010	367-372	DOI:10.1109 / WAINA.2010.117	yes
7	Intelligent Interactive System for Collaborative Green Computing	Kuo-Ming Chao	CSCWD [12]	N/A	IEEE	United Kingdom	2011	In press	www.dehems.eu/cms/wp-content/uploads/2011/04/D8.3-paper2.pdf	yes
8	A User Centric Service-Oriented Modelling Approach	Kuo-Ming Chao	WWW Journal	N/A	Springer	United Kingdom	2010	N/A	Internal project identifier D8.3	yes
9	Monitoring Appliances Sensor Data in Home Environment: Issues and Challenges	Kuo-Ming Chao	CEC2009	N/A	IEEE	United Kingdom	2009	439 - 444	DOI 10.1109/CEC.2009.65	yes
10	A Model for Energy-Efficient Household Maintenance Through Behavioural Analysis of Electrical Appliances	Ciprian Pungila	ICEBE2010	N/A	IEEE	United Kingdom	2009	N/A	DOI 10.1109/ICEBE.2010.69	yes
11	Parameter identification and model based predictive control of temperature inside a house	Radu Balan	Energy and Buildings	Volume 43, Issues 2-3	ELSEVIER	Netherlands	2010	748-758	doi:10.1016/j.enbuild.2010.10.023	yes
12	Preference Ordering in Agenda Based multi-issue negotiation for Service Level Agreement	Fahmida Abedin	AINA 2009	N/A	IEEE	United Kingdom	2009	19 - 24	DOI: 10/1109 / WAINA.2009.168	yes
13	Application of a Model Based Predictive Control Algorithm for Building Temperature Control, Energy Problems and	Radu Balan	Energy Problems and Environmental	Book, ISSN: 1790-5095 ISBN:978	WSEAS[13]	Spain	2009	97 - 101	http://www.wseas.us/books/2009/lalaguna/EPREWA.pdf	yes

[12] Computer Supported Cooperative Work in Design

[13] World Scientific and Engineering Academy and Society

	Environmental Engineering		Engineering	-960-474-093-2						
14	Harnessing the Link between ICT Domestication and Behaviour Change for Carbon Footprint Reduction in the Home	David Kreps	N/A	Paper 279	AMCIS [14]2010	United Kingdom	2010	N/A	http://aisel.aisnet.org/amcis2010/279 http://usir.salford.ac.uk/10318/	yes
15	Database Architecture for the Internet of Things	Joshua Cooper	N/A	1569284 51	IETE	United Kingdom	2010	N/A	DOI: 10.4103/0256-4602.55270 http://tr.ietejournals.org/	yes
16	DEHEMS: A User-Driven Approach for Domestic Energy Monitoring	Vasughi Sundramoorthy	N/A	Nov 2010	Internet of Things	United Kingdom	2010	N/A	None	Yes Behind paywall in IEEE D
17	The Challenges and Design Concerns for the Domestication of Energy Monitoring Systems	Vasughi Sundramoorthy	Persuasive Computing	10 Issue:1 Jan-Mar 11	IEEE	United Kingdom	2011	20-27	10.1109/MPRV.2010.73	Yes Behind paywall in IEEE D
18	Thermal Modelling and Temperature Control of a House	Radu Balan	The Romanian Review Precision Mechanics, Optics & Mechatronics	Volume 39	INCDMTM[15]	Romania	2011	59-62	http://www.incdmtm.ro/editura/documente/sumar_rev39.pdf	yes

[14] Americas Conference on Information Systems

[15] National Research and Development in Mechatronics and Measurement Technique

19	Influence of Heat Capacity and Thermal Inertia on Heating Control for Reducing Energy Consumption	V. Muresan	The Romanian Review Precision Mechanics, Optics & Mechatronics	Volume 39	INCDMTM	Romania	2011	63-56	http://www.incdmtm.ro/editura/documente/sumar_rev39.pdf	yes
20	Influence of Heat Capacity and Thermal Inertia on Heating Control for Reducing Energy Consumption	V. Muresan	N/A	N/A	N/A	Romania	2009	N/A	None	yes
21	Multi-Agent Oriented Architecture for Data-Stream Processing in an Ambient Assisted Living System	Ovidiu Aritoni	N/A	N/A	IEEE	Romania	2009	N/A	None	yes
22	On Sensor Data Simulation	Alexandru-Ciprian Zavoianu	N/A	N/A	SYNASC	Romania	2009	N/A	http://doi.ieeecomputersociety.org/10.1109/SYNASC.2009.29	yes
23	Benchmarking Database Systems for the Requirements of Sensor Readings	Ciprian Pungila	Tech Rev 2009	vol.26 (5) http://tinyurl.com/3qs8lda	IETE	Romania	2009	Pages 342-349	DOI: 10.4103/0256-4602.55279	yes
24	Human behaviour changing based on the simulation of the temperature control of a house	Radu Balan	ICREPQ 201	N/A	ICREPQ	Spain	2011	N/A	http://www.incdmtm.ro/editura/documente/sumar_rev39.pdf	yes
25	Online System Identification in Thermal response of real buildings	Ciprin Lapusan	DAAAM 2010	N/A	DAAAM International	Austria	2010	21-22	http://www.daaam.com/daaam/Publications/Publications.htm	yes

26	DEHEMS: The Design and Implementation of Widescale Domestic Energy Monitoring, in: 'Environmental Energy and Structural Monitoring Systems (EESMS)	Qi Liu	N/A	Paper 1569328463	IEEE	United Kingdom	2010	80 - 86	10.1109/EESMS.2010.5634181	Not available online
27	Dynamic data driven smart home system based on a Service Component Architecture	Chi-Chun Lo	CSCWD2010	N/A	IEEE	United Kingdom	2010	N/A	DOI: 10.1109/CSCWD.2010.5471925	yes
28	A Bray-Curtis Weighted Automaton for Detecting Malicious Code Through System-Call Analysis	Ciprian Pungila	N/A	N/A	SYNASC[16]	Romania	2009	N/A	doi10.1109/SYNASC.2009.41	yes
29	A Model Based Predictive Control Algorithm for Building Temperature Control	Radu Balan	DEST 2009	N/A	IEEE	Turkey	2009	540-545	DOI: 10.1109.DEST.2009.5276699	yes
30	A reputation scheme with witness reasoning for service selection	Ping Wang	SOCA2009	N/A	IEEE	United Kingdom	2009	N/A	DOI: 10.1109/SOCA.2009.5410447	yes
31	Eco-Masculinities: 'How a masculine discursive subject approach to the Individual Differences Theory of Gender and IT impacts an environmental informatics project'	David Kreps	N/A	Paper 277 Lima, Peru 2010	AMCIS[17]	United Kingdom	2010	N/A	http://usir.salford.ac.uk/10318/	yes

[16] International Symposium on Symbolic and Numeric Algorithms for Scientific Computing
[17] Americas Conference on Information Systems

32	A model for estimation of the building thermal losses in the different rooms of a house using Matlab/Simulink	Pavel Vitliemov	N/A	N/A	N/A	Bulgaria	2011	N/A	In press	yes
33	Extension of Hypertable Query Language with aggregate operations	Milko Marinov	N/A	N/A	N/A	Bulgaria	2011	N/A	In press	yes
34	Homes across five European management tools cities get pioneering energy	Martine Tommis	Metering International	Issue 3/2011	Metering International	United Kingdom	2011	80 - 82	None	yes
35	Modelling, identification and temperature control of a house	Radu Balan	DAAAM 2010	Volume 21 No. 1	DAAAM International	Austria	2010	591-592	http://www.daaam.com/daaam/Publications/Publications.htm	yes
36	Advanced Control Algorithms for Energy Efficiency and comfort inside a house	Radu Balan	IFTOMM 2011 Congress	Paper A29-592 http://www.iftomm2011.org/Final_Program.pdf	IFTOMM	Mexico	2011	N/A	http://www.iftomm2011.org/Final_Program.pdf	yes

A2 List of Dissemination Activities

Included in the list of dissemination activities are conferences and events covering topics relevant to DEHEMS and energy management. Delegates from DEHEMS partner organisations are able to, and have, networked and promoted the aims, objectives and achievements of DEHEMS with other organisations and delegates.

A2: LIST OF DISSEMINATION ACTIVITIES (DATE ORDER)

NO.	Type of activities	Main leader	Title	Date	Place	Type of audience	Size of audience	Countries addressed
1	Website	MCC	www.dehems.eu - continually updated with relevant information relating to the project	September 2008	Manchester	Public	N/A	International
2	Presentation	UCluj	University of Cluj-Napoca	October 2008	Cluj	Academic	11-49	Romanian
3	Presentation	Hild	EU Event - ICT 2008	November 2008	Lyon	Municipality /EU	100+	European
4	Presentation	CL	NASA Workshop on Sustainable Urban Development	December 2008	San Francisco	Industry	100+	International
5	Conference	UCov	2009 IEEE Conference on Service-Oriented Computing and Applications	January 2009	Taipei, Taiwan	Academic	50-100	International
6	Presentation	Birm	DEHEMS project was presented in the Birmingham Environmental Partnership newsletter / meetings	February 2009	Birmingham	Municipality	50-100	UK
7	Marketing materials	CL	Leaflet and pop up stand	March 2009	N/A	Public	N/A	International
8	Conference	MCC	EUSEW 2009 EU Sustainable Energy Week	March 2009	Brussels	Municipality /EU	100+	European
9	Conference	MCC	EU ICT for Energy Efficiency - ICT4EE High Level Event	March 2009	Brussels	Municipality /EU	100+	European
10	Presentation	CL	Intellect's High Tech Low Carbon week	March 2009	London	Industry	50-100	UK
11	Conference	MCC	Eurocities Environment Forum	April 2009	Rotterdam	Eurocities	50-100	European

12	Conference	UCov	2009 IEEE conference on Advanced Information and Network Applications	May 2009	Bradford, UK	Academic	50-100	International
13	Presentation	IeAT	A SysML Approach for Ambient Intelligent Systems, Romania	May 2009	Timisoara, Romania	Academic	100+	Romania
14	Presentation	IeAT	Context-Aware Sensor Middleware for Assistive Platforms	May 2009	Timisoara, Romania	Academic	100+	Romania
15	Presentation	IeAT	Sensor reading: storing and querying benchmarks for existing database engines	May 2009	Timisoara, Romania	Academic	100+	Romania
16	Conference/ Presentation	CL	Cisco CUD Conference	May 2009	Seoul, Korea	Industry	100+	International
17	Conference/ Presentation	CL	OECD Conference on ICT and Energy Efficiency	May 2009	Helsingor	Academic	50-100	International
18	Demonstration	CL	Demos Social Housing event	May 2009	London	Industry	1-10	UK
19	Conference	MCC	Eurocities KSF Forum	June 2009	Reykjavik	Municipality /EU		European
20	Demonstration	MCC	Manchester Town Hall – Greener City	June 2009	Manchester	Municipality	50-100	UK
21	Demonstration	CL	COST ICT4EE 2030 forum	June 2009	Bruges	Industry	1-10	European
22	Event	MCC	EnvirEnergy 2009	June 2009	Manchester	Industry	100+	UK
23	Demonstration	MCC	Co2mmunity Event	June 2009	Manchester	Public	1-10	UK
24	Presentation	UCov	IEEE Conference on Commerce and Enterprise Computing (CEC)	July 2009	Vienna	Academic	50-100	European
25	Conference	MCC	Living Labs Annual Conference	June 2009	Lulea, Sweden	Municipality /EU	100+	European
26	Demonstration	MCC	Living Co2mmunities - A Low Carbon Communities	June 2009	Manchester	Public	50-100	UK
27	Meeting	MCC	Energy Review Group, hosted by Manchester City Council	July 2009	Manchester	Municipality	1-10	
28	Conference	UCov	26th British National Conference on Databases	July 2009	Birmingham	Academic	50-100	UK
29	Presentation	USal	1st International Workshop on Database Architectures for the Internet of Things (DAIT 2009 (in the framework of BNCOD 2009)	July 2009	Birmingham, UK	Academic	100+	International

30	Presentation	MCC	Private Sector Housing / Manchester Carbon Reduction Group	August 2009	Manchester	Municipality	1-10	UK
31	Presentation	IeAT	11th International Symposium on Symbolic and Numeric Algorithms for Scientific Computing (SYNASC 2009)	September 2009	Timisoara, Romania	Academic	100+	International
32	Presentation	MCC	Manchester Libraries	September 2009	Manchester	Municipality	1-10	UK
33	Presentation	MCC	Environmental Strategy Programme Board (Manchester's Green City Team)	September 2009	Manchester	Municipality	1-10	UK
34	Conference	MCC	Smart Cities / Living Labs	September 2009	Amsterdam	Municipality /EU	50-100	European
35	Presentation	CL	Ed Miliband, Government Minister	September 2009	Manchester	Government	1-10	UK
36	Presentation	CL	Manchester Commission for New Economy	September 2009	Manchester	Municipality	1-10	UK
37	Presentation	CL	Arena Housing Association	October 2009	Manchester	Industry	1-10	UK
38	Conference	MCC	Climate Change Action Plan Mini Conference	October 2009	Manchester	Public	50-100	UK
39	Conference	MCC	Eurocities Knowledge Society Forum (KSF)	October 2009	Brussels	Municipality /EU	50-100	European
40	Article	Birm	DEHEMS project was referenced in the Birmingham PostUK http://www.thefreelibrary.com/Smart+thinking+puts+city+on+the+energy-saving+map.-a0210068049 The press release was picked up in: Birmingham Post 20/10/2009; Birmingham Mail 19/10/2009; Birmingham Mail Extra 15/10/2009; www.24dash.com http://www.24dash.com/news/housing/2009-10-19-housing-association-pioneers-smart-energy-thinking	October 2009	Birmingham	Municipality	n/a	UK

41	Article	Birm	DEHEMS project was referenced in the Birmingham Post, UK http://www.thefreelibrary.com/Smart+thinking+puts+city+on+the+energy-saving+map.-a0210068049 The press release was picked up in: Birmingham Post 20/10/2009; Birmingham Mail 19/10/2009; Birmingham Mail Extra 15/10/2009; www.24dash.com http://www.24dash.com/news/housing/2009-10-19-housing-association-pioneers-smart-energy-thinking	October 2009	Birmingham	Municipality	n/a	UK
42	Article	Birm	DEHEMS project was referenced in the Housing News trade magazine http://www.housingnews.co.uk/westmidlands/dailynews.asp?week=19/10/2009#H236609	October 2009	Birmingham	Municipality	n/a	UK
43	Article	Birm	DEHEMS project was referenced in the Housing News trade magazine http://www.housingnews.co.uk/westmidlands/dailynews.asp?week=19/10/2009#H236609	October 2009	Birmingham	Industry	n.a.	UK
44	Presentation	Birm	Family Housings Eco-Village Project in Summerfield wins EUROCITIES award. A delegation including DEHEMS participants attend the award ceremony and present their projects. http://www.family-housing.co.uk/News_And_Events/Latest_News/Eurocities.htm	October 2009	Birmingham	Municipality / EU	50-100	UK
45	Exhibition	CL	Visby Agenda meeting	November 2009	Visby, Sweden	Industry	1-10	Sweden

46	Conference	MCC/ CL	Eurocities AGM	November 2009	Stockholm	Euocities	100+	European
47	Presentation	Cl / Hild	Department for the Environment and Climate Change	December 2009	London	Government	1-10	UK
48	Conference	MCC / CL	Information Communication Technology for Energy Efficiency (ICT4EE)	February 2010	Brussels	Municipality	50-100	International
49	Presentation	UCluj	Dehems Project – presentation/demonstration - University of the West of England	February 2010	Bristol	Academic	11-49	International
50	Conference	UCov	2010 International conference on Software and Data Engineering	February 2010	Malaysia	Academic	50-100	International
51	Conference	UCov	Workshop - 24th IEEE International Advanced Information Networking and Applications Workshops	April 2010	Perth, Australia	Academic	100+	International
52	Presentation	EAP	Regional debate on energy and climate change	April 2010	Plovdiv	Government	11-49	Bulgaria
53	Conference	MCC/ CL	Eurocities Knowledge Society Forum (KSF)	May 2010	Linkoping, Sweden	KSF Members	50-100	European
54	Presentation	CL	World Congress of Information Technology - WCIT	May 2010	Amsterdam	Academic	100+	International
55	Conference & Presentation	EAP	Energy and Climate Education	June2010	Plovdiv	Government	1-10	Bulgaria
56	Presentation	UCluj	Energy Efficiency - University of the West of England	June 2010	Bristol	Academic	11-49	International
57	Conference	Birm	UK Information Day 2010	July 2010	London	Government	11-49	UK
58	Conference	UCov	2010 ICGREEN – International Conference on Green Computing	July 2010	Athens, Greece	Academic	50-100	International
59	Presentation	UR	Professors and researchers from Perm Polytechnic University (Russia)	July 2010	Rousse	Academic	1-10	Russia
60	Conference	USal	16th Americas Conference on Information Systems	August 2010	Lima, Peru	Academic	100+	International
61	Presentation	USal	IEEE Workshop on Environmental Energy and Structural Monitoring Systems (EESMS)	September 2010	Taranto, Italy	Academic	100+	International
62	Presentation	MCC	ICT 2010	September 2010	Brussels	Municipality	100+	European

63	Presentation	CL	Chief Executive, Manchester City Council	September 2010	Manchester	Municipality	1-10	UK
64	Presentation	USal	Manchester's Science Festival at the Museum of Science and Industry	October 2010	Manchester	Public	100+	UK
65	Presentation	CL	IT in Action event with DEHEMS exhibit/stand	October 2010	London	Public	50-100	UK
66	Presentation	Birm	Low Carbon Innovation Group	October 2010	Birmingham Science City	Municipality	50-100	UK
67	Event	Birm	Beyond 2010 - 2-day International Conference	October 2010	Birmingham	Industry	100+	UK
68	Conference	UCluj	21st DAAAM International World Symposium University of Zadar	October 2010	Croatia	Academic	50-100	International
69	Marketing materials	CL	Project leaflet updated in line with project progress	October 2010	Manchester	Public	N/A	International
70	Conference	IeAT	International Workshop on Engineering Low-Carbon Business	November 2010	China	Academic	100+	International
71	Presentation	EAP	6th Conference National Conference of the Bulgarian Energy Agencies	November 2010	Plovdiv	Industry	50-100	Bulgaria
72	Conference/ Presentation	USal	Internet of Things	November 2010	Tokyo	Academic	100+	International
73	Presentation	Hild	2nd ACM Workshop On Embedded Sensing Systems For Energy-Efficiency In Buildings	November 2010	Zurich, Switzerland	Academic	100+	International
74	Video	Birm	http://vimeo.com/17569551	December 2010	Birmingham	Public	N/A	International
75	Video	Birm / USal	Birmingham Living Lab http://www.youtube.com/watch?v=445mLvNw-SA&feature=player_embedded#at=12	January 2011	Birmingham	Public	n/a	International
76	Article	Birm	DEHEMS project was referenced in Computerworld, http://www.computerworlduk.com/news/public-sector/3258236/birmingham-homes-test-smart-meters/	January 2011	Birmingham	Public	n/a	UK
77	Article	Birm	DEHEMS project was referenced in CIO News http://www.cio.co.uk/news/3258300/birmingham-homes-test-smart-meters/	January 2011	Birmingham	Public	n/a	UK

78	Article	Birm	DEHEMS project was referenced in Birmingham Newsroom http://birminghamnewsroom.com/2011/01/stunning-results-from-energy-savings-project/	January 2011	Birmingham	Public	n/a	UK
79	Article	Birm	DEHEMS project was referenced in 24dash.com http://www.24dash.com/news/housing/2011-01-24-homes-see-60-electricity-bill-saving-after-smart-meter-fitting	January 2011	Birmingham	Public	n/a	UK
80	Video	MCC	http://www.euronews.net/2011/02/09/energy-under-control/	February 2011	Manchester	Public	N/A	International
81	Conference	CL	Smart Cities Innovation	March 2011	Manchester	Industry	1-10	UK
82	Presentation	CL	EUSEW : Smart Cities / ICT4EE	March 2011	Brussels	Municipality / EU	50-100	European
83	Presentation	CL	Cheshire Greener futures event	April 2011	Nantwich, UK	Public	1-10	UK
84	Presentation	Birm	Delegation of 25 French students from Universitee Paris Est Marne La Vallee	April 2011	Birmingham (EcoVillage)	Academic	11-49	European
85	Presentation	Birm	Birmingham Energy Savers retrofit project to discuss their planned test bed of 50 homes to compare various energy saving technologies	April 2011	Birmingham	Industry	1-10	European
86	Presentation	EAP	Regional Debate of Energy, Environment and Climate, European Energy Days	April 2011	Plovdiv	Industry	1-10	Bulgaria
87	Publicity / National newspaper article	Birm	DEHEMS project was referenced in The Guardian (UK national newspaper)	April 2011	Birmingham	Public	n/a	UK
88	Conference	UCluj	ICREPQ (International Conference on Renewable Energies and Power Quality)	April 2011	Canary Islands, Spain	Academic	50-100	International
89	Presentation	UR	Presentation on project and demonstration of University of Rousse's research activities	May 2011	Varna, Bulgaria	Academic	1-10	Bulgaria

90	Conference	UCluj	COMEFIM – The 10th International Conference on Mechatronics and Precision Engineering	May 2011	Bucharest	Academic	50-100	European
91	Presentation	CL	Smart Metering 2011 conference	June 2011	Prague	Industry	50-100	European
92	Presentation / Demonstration	UR	Presentation to local government on DEHEMS project, including results and outcomes	June 2011	Sofia, Bulgaria	Municipality	1-10	Bulgaria
93	Presentation	UR / EAP	Uzana Polyan Fest (green ideas in action eco-fest organised to promote green projects in Bulgaria)	July 2011	Plovdiv	Municipality	50-100	Bulgarian
94	Report	MCC	Report for Citizens – D8.9 - Helping people to manage their energy consumption" (D8.9)	July 2011	Manchester	Public	N/A	European
95	Conference	MCC	The Report for Citizens submitted to the European Construction Technology Platform	October 2011.	Warsaw	Industry/EU	100+	European
96	Conference	Birm	Application submitted for stand at EC Innovation Convention	December 2011	Brussels	Municipality / EU	100+	European

2.2 Section B

Part B1 List of Applications for Patents, Trademarks

B1: LIST OF APPLICATIONS FOR PATENTS, TRADEMARKS, REGISTERED DESIGNS, ETC.					
Type of IP Rights:	Confidential Click on YES/NO	Foreseen embargo date	Application reference	Subject or title of application	Applicant (s) (as on the application)
Trademark	YES	01/01/2012	n/a	Energy Hive trademark, design and copyright	Hildebrand Ltd

Type of Exploitable Foreground	Description Of exploitable foreground	Confidential Click on YES/NO	Embargo date	Exploitable product(s) or measure(s)	Sector(s) of application	Timetable, commercial or any other use	Patents or other IPR exploitation (licences)	Owner & Other Beneficiary(s) involved
Home Energy Management / Smart Metering	Greenica – IT energy management solution	No	N/A	Energy Monitoring equipment and associated software application	1. ICT 2. Energy Management	Commercial use from 2010 onwards	None	CL (Owner)
Home Energy Management / Smart Metering	Energyhive – IT energy management solution	No	N/A	Energy Monitoring equipment and associated software application	1. ICT 2. Energy Management	Commercial use from 2010 onwards	Energyhive is covered by a trademark / registered design and copyright	Hild (Owner)
Research, Knowledge and Understanding	Increased knowledge, expertise, and collaboration, enabling participation in other similar projects on a local, national & EU-wide	No (Research & Scientific papers available within public domain)	N/A	Deploy technology brief and data from monitoring sensors as resource for platform and teaching material for students - Data has been archived for further data mining potential	1. Research 2. Academia	Ongoing	None	UCov, USAL, Cluj, UR and IeAT, MCC

User Acceptance	Use of Living Labs to test solutions	No	No	Successful use of living labs for a technical research project will enable Municipalities to participate in similar projects	1. Equipment proving 2. System / software proving	Report on Living Lab methodology for ICT Systems development written and available.	None	MCC, Bris, Birm, EAP, Ivob
Capacity Building within local communities	Involvement of Living Labs as part of Project	No	No	Capacity building within local communities has been strengthened by community engagement	1. Equipment proving 2. System / software proving	Now and Ongoing	None	MCC, Bris, Birm, EAP, Ivob
Energy Usage	Ability to monitor energy usage	No	No	Most households using less energy due to monitoring equipment = lower bills= reduced carbon	1. Energy Usage / Management	Over duration of project, but long term benefit expected due to improved awareness	None	MCC, Bris, Birm, EAP, Ivob
Use in Public Buildings	Extended use on larger scale	No	No	ICT Application is being recommended to local authorities for energy monitoring in public buildings	1. Energy Usage / Management 2. Public buildings	2011 / 2012	None	EAP, MCC

Part B3 Exploitation of Foreground

The foreground for the project is being exploited via two routes – commercial activities and further research. Full details of both the overall project and individual partner exploitation plans are detailed in the deliverable D8.9.

Details of the access to repositories for the use of the foreground may be found in Figure 13 of this document.

Commercial Activities

At the time of writing the two companies in the private sector which are members of the DEHEMS consortium are actively seeking to integrate aspects of their DEHEMS work in commercial applications for energy management and control.

Clicks and Links Ltd www.clicksandlinks.com has developed the Greenica (www.greenica.net) product. This has been successfully implemented into over 400 homes and small businesses (SMEs) throughout Manchester, and in 2011/2102 an enhanced system will be developed and implemented into a further 250 SMEs throughout the North West region of the UK.

Clicks and Links are also working with an established UK supplier of energy monitoring equipment, Current Cost, www.currentcost.com, to develop a future product as a joint venture. Current Cost are one of the leading companies in the UK market.

Evidence of a step change in exploitation of the outcomes of DEHEMS came in May 2010. This takes the form of a Press Release from IBM http://tinyurl.com/62dhwqc which announced the creation of a partnership between Hildebrand and IBM Europe to effectively exploit the technological and social possibilities opened up by the work undertaken as part of DEHEMS.

Hildebrand Ltd is the senior technology partner in DEHEMS www.hildebrand.co.uk and as their website indicates, they are actively promoting technologies which have their origins in the DEHEMS project. Their product, 'Energyhive' (www.energyhive.co.uk) is an energy monitoring project, which allows users to view household energy consumption via a web-based dashboard. The service collates household data at regular intervals via a number of energy monitoring units from within the home.

Of note here is the fact that work with DEHEMS stimulated additional research between Hildebrand and IBM into handling time-series data. This took the form of a proof of concept programme that simulated three million homes sending in readings once per minute. This was successfully run on a standard quad core, dual processor Intel server. This demonstrated that sophisticated energy monitoring of the type demonstrated by DEHEMS is eminently scaleable and can be done very cost effectively.

Energyhive is being used in Camden, London (UK) to provide household measurement of energy utilised from a district heating system. Exploitation of work carried out in DEHEMS is not restricted to member states of the EU. Hildebrand has been engaged to deliver the end user engagement technology for 50,000 homes in Australia's Smart Grid Smart City Project.

UK consortium members will continue to contribute to the smart metering debate. The proposed deployment of meters in the UK there will lead to heightened public and governmental (ie. local, regional, national and EU-wide) energy awareness, creating opportunities for marketing and promotion via presentations workshops and exhibitions.

Research Activities

As evidenced by each partner's exploitation plans (D8.9), many of the academic/university partners plan to further exploit the foreground research findings and knowledge generated as part of DEHEMS, as well as maintaining the momentum with ongoing and continued energy monitoring research. Examples of these include:

Partners from DEHEMS have continued Involvement in similar projects, at local, national and EU level. This includes EPIC (European Platform for Intelligent Cities – Project No. 270895), a platform which will combine the industrial strengths of IBM's 'Smart City' vision and cloud computing infrastructure with the knowledge and expertise of leading European Living Labs. The objective here is to ensure the development of a European 'innovation ecosystem' for sustainable user-driven web-based services for citizens and businesses. Utilising Energyhive, data will be stored on a cloud-based storage system and the newly gained information can be used by both citizens and cities for intelligent and informed decision making. This includes the continued application of Living Lab methodologies.

The equipment used in DEHEMS will be used by postgraduate students at Salford University. The university houses a department dedicated to energy management including Europe's first and only Energy House that has been reconstructed in a fully environmentally controllable chamber, in which climatic conditions can be maintained, varied, repeated and patterns monitored (http://www.energy.salford.ac.uk/energy_house).

Results from DEHEMS will be used to create educational web applications in the ongoing project "Flexform" (Mechatronic platforms for flexible education and training), project which is founded by Social European Fund and the Government of Romania.

Salford University has identified six cross-cutting University wide themes, of which Energy is one. These themes are interdisciplinary in character and cover activities across Teaching and Learning, Research and Innovation and Enterprise and Engagement. The Energy Theme has been developed in response to the energy challenges and has four sub themes.

University of Rousse plan to continue research in appliance energy performance metrics and standards; energy measurement protocols; Living Labs models.

The University of Coventry has initiated strategic "Grand Challenge" which provides a platform for multiple disciplinary teams across faculties and departments to address the identified themes and Energy Efficient (Low Impact) Building is one of key themes in the challenge.
The IeAT team intends to use parts of the DEHEMS development for the MOSAIC project, by porting parts of the current development in a Cloud-based environment, in order to validate the mOSAIC platform.

Collaboration – for example the universities of Salford and Cluj are collaborating on a new bid, as are Rousse and Salford. New research projects will undoubtedly emerge. British Gas (largest vendor of energy and related services in the UK) has recently shown interest in Salford's Energy House. Also, by the evolving nature of energy management / monitoring, partners will continue to develop working relationships with each other, as well as other energy savings and interest groups,

As a result of the above and other research led activities, this will lead to the continued publishing of technical journals and scientific papers, as well as participation at exhibitions and workshops in the field of home and building energy management. For example, the University of Salford have said that they will aim to publish post project to incorporate cycle 3 findings.

One of the key successes of DEHEMS has been the creation of one of the largest energy monitoring test-beds, totalling 250 households across 5 cities in Bulgaria and the United Kingdom. Despite the inevitable challenges with deploying new and leading-edge hardware and software technology, householder's commitment, energy awareness and constructive feedback has been creditable. It has been very much a positive scenario. By improved understanding and involvement, householders from across all 5 Living Labs have managed to reduce their energy usage, whilst via focus groups, questionnaires and general dialogue, they have been able to influence many aspects of the project throughout the 3 cycles, as well as championing the efficient use of energy within their communities. Furthermore, via the 5 Living Lab partners, experiences and lessons learnt from DEHEMS are already contributing and effecting local and regional strategic action plans for deploying smart metering technologies.

3. Report on Societal Implications – EU Questionnaire

A General Information *(completed automatically when **Grant Agreement number** is entered.*

Grant Agreement Number:	**224609**
Title of Project:	**Digital Environment Home Energy Management**
Name and Title of Coordinator:	Mr Dave Carter

B Ethics

1. Did your project undergo an Ethics Review (and/or Screening)? • If Yes: have you described the progress of compliance with the relevant Ethics Review/Screening Requirements in the frame of the periodic/final project reports? Special Reminder: the progress of compliance with the Ethics Review/Screening Requirements should be described in the Period/Final Project Reports under the Section 3.2.2 *'Work Progress and Achievements'*	***NO***
2. Please indicate whether your project involved any of the following issues (tick box) :	***YES***
RESEARCH ON HUMANS	
• Did the project involve children?	no
• Did the project involve patients?	no
• Did the project involve persons not able to give consent?	no
• Did the project involve adult healthy volunteers?	no
• Did the project involve Human genetic material?	no
• Did the project involve Human biological samples?	no
• Did the project involve Human data collection?	no
RESEARCH ON HUMAN EMBRYO/FOETUS	
• Did the project involve Human Embryos?	no
• Did the project involve Human Foetal Tissue / Cells?	no
• Did the project involve Human Embryonic Stem Cells (hESCs)?	no
• Did the project on human Embryonic Stem Cells involve cells in culture?	no
• Did the project on human Embryonic Stem Cells involve the derivation of cells from Embryos?	no
PRIVACY	
• Did the project involve processing of genetic information or personal data (eg. health, sexual lifestyle, ethnicity, political opinion, religious or philosophical conviction)?	no
• Did the project involve tracking the location or observation of people?	no
RESEARCH ON ANIMALS	
• Did the project involve research on animals?	no
• Were those animals transgenic small laboratory animals?	no
• Were those animals transgenic farm animals?	no
• Were those animals cloned farm animals?	no
• Were those animals non-human primates?	no
RESEARCH INVOLVING DEVELOPING COUNTRIES	
• Did the project involve the use of local resources (genetic, animal, plant etc)?	no

• Was the project of benefit to local community (capacity building, access to healthcare, education etc)?	no
DUAL USE	
• Research having direct military use	no
• Research having the potential for terrorist abuse	no

C Workforce Statistics

3. Workforce statistics for the project: Please indicate in the table below the number of people who worked on the project (on a headcount basis).

Type of Position	Number of Women	Number of Men
Scientific Coordinator		1
Work package leaders	3	3
Experienced researchers (i.e. PhD holders)	2	6
PhD Students	1	4
Other	7	1

4. How many additional researchers (in companies and universities) were recruited specifically for this project?	11
Of which, indicate the number of men:	8

D Gender Aspects

5. Did you carry out specific Gender Equality Actions under the project? | | No

6. Which of the following actions did you carry out and how effective were they?

	Not at all effective				Very effective
❑ Design and implement an equal opportunity policy	○	○	○	○	○
❑ Set targets to achieve a gender balance in the workforce	○	○	○	○	○
❑ Organise conferences and workshops on gender	○	○	○	○	○
❑ Actions to improve work-life balance	○	○	○	○	○

○ Other:

7. Was there a gender dimension associated with the research content – i.e. wherever people were the focus of the research as, for example, consumers, users, patients or in trials, was the issue of gender considered and addressed?

○
N

E Synergies with Science Education

8. Did your project involve working with students and/or school pupils (e.g. open days, participation in science festivals and events, prizes/competitions or joint projects)?

N

9. Did the project generate any science education material (e.g. kits, websites, explanatory booklets, DVDs)?

N

F Interdisciplinary

10. Which disciplines (see list below) are involved in your project?

Y Main discipline 1.1
Y Associated discipline 2.2 | Y | Associated discipline 5.1

G Engaging with Civil society and policy makers

11a Did your project engage with societal actors beyond the research community? *(if 'No', go to Question 14)* | Y |

11b If yes, did you engage with citizens (citizens' panels / juries) or organised civil society (NGOs, patients' groups etc.)?

Y Yes- in determining what research should be performed in the Living Lab
Y Yes - in implementing the research

Y	Yes, in communicating /disseminating / using the results of the project	
11c In doing so, did your project involve actors whose role is mainly to organise the dialogue with citizens and organised civil society (e.g. professional mediator; communication company, science museums)?	N	

12. Did you engage with government / public bodies or policy makers (including international organisations)

Y	Yes- in framing the research agenda
N	Yes - in implementing the research agenda
Y	Yes, in communicating /disseminating / using the results of the project

13a Will the project generate outputs (expertise or scientific advice) which could be used by policy makers?

Y Yes – as a **primary** objective (please indicate areas below- multiple answers possible)

Y Yes – as a **secondary** objective (please indicate areas below - multiple answer possible)

13b If Yes, in which fields?

Consumers Y		**Energy Y** **Enterprise**		**Information Society Y**	

13c If Yes, at which level?

Y Local / regional levels
Y National level
Y European level
International level

H Use and dissemination

14. How many Articles were published/accepted for publication in peer-reviewed journals?	**36**
To how many of these is open access[18] provided?	**36**
How many of these are published in open access journals?	**12**
How many of these are published in open repositories?	**24**
To how many of these is open access not provided?	**0**
Please check all applicable reasons for not providing open access:	
❑ publisher's licensing agreement would not permit publishing in a repository ❑ no suitable repository available ❑ no suitable open access journal available ❑ no funds available to publish in an open access journal ❑ lack of time and resources ❑ lack of information on open access ❑ other ……	

15. How many new patent applications ('priority filings') have been made? *("Technologically unique": multiple applications for the same invention in different jurisdictions should be counted as just one application of grant).*		**None**
16. Indicate how many of the following Intellectual Property Rights were applied for (give number in each box).	Trademark	**None**
	Registered design	**None**
	Other	**None**
17. How many spin-off companies were created / are planned as a direct result of the project?		**None**
Indicate the approximate number of additional jobs in these companies:		

18. Please indicate whether your project has a potential impact on employment, in comparison with the situation before your project:

Y	Increase in employment, or	Y	In small & medium-sized enterprises
	Safeguard employment, or		In large companies
	Decrease in employment,		None of the above / not relevant to the project
	Difficult to estimate / not possible to quantify		

[18] Open Access is defined as free of charge access for anyone via Internet.

19. For your project partnership please estimate the employment effect resulting directly from your participation in Full Time Equivalent (*FTE = one person working fulltime for a year*) jobs:	4

I Media and Communication to the general public

20. As part of the project, were any of the beneficiaries professionals in communication or media relations?

N

21. As part of the project, have any beneficiaries received professional media / communication training / advice to improve communication with the general public?

N

22 Which of the following have been used to communicate information about your project to the general public, or have resulted from your project?

	Press Release	Y	Coverage in specialist press
	Media briefing		Coverage in general (non-specialist) press
Y	TV coverage / report		Coverage in national press
	Radio coverage / report		Coverage in international press
Y	Brochures /posters / flyers	Y	Website for the general public / internet
Y	DVD /Film /Multimedia	Y	Event targeting general public (festival, conference, exhibition, science café)

23 In which languages are the information products for the general public produced?

Y	Language of the coordinator	Y	English
Y	Other language(s) - Bulgarian		

4. Annex I – D8.7 Project Report for Citizens

D8.7 is published as a report to be made for public dissemination. It has been made available on www.dehems.eu and Wikipedia.