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## District Information Modeling and Management for Energy Reduction

# DIMMER

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Collaborative Project

**WP5**

**CSI**

**D5.2.3**

### Users identification: final model results

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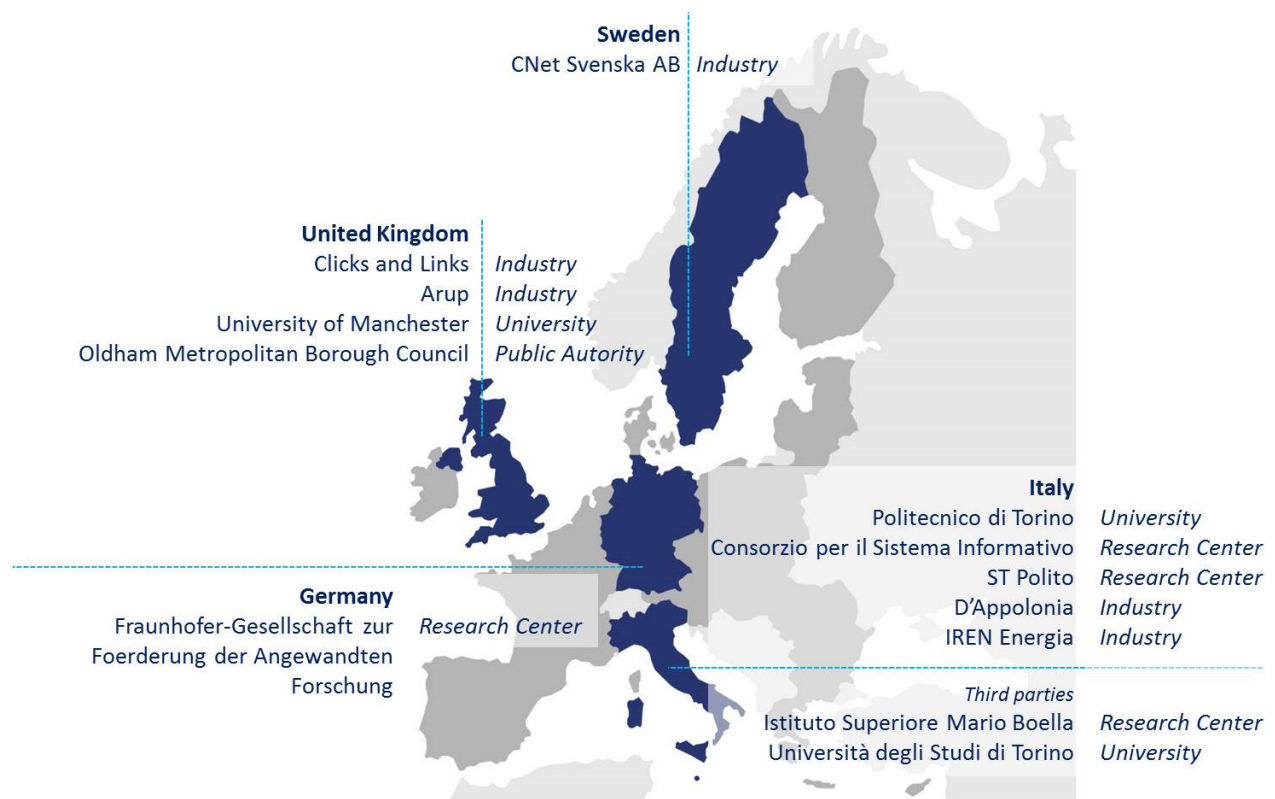
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## COPYRIGHT

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## ABBREVIATIONS

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<b>Acronym</b>	<b>Description</b>
CHP	Combined Heat and Power
CO <sub>2</sub>	Carbon dioxide
DH	District Heating
DNO	Distribution Network Operator
ESCO	Energy Service Company
ESOF	European Science Open Forum
EU	European Union
GM	Greater Manchester
IC	Istituto Comprensivo
ICT	Information and Communication Technology
IT	Information Technology
MW	Megawatt

## 1. EXECUTIVE SUMMARY

In the context of DIMMER, the Task 5.2.1 had the general aim of supporting the project about these aspects:

- Users identification;
- Users involvement.

A participatory approach has been adopted to this end, taking into account the theoretical and empirical methodologies linked to: social research, socio-technical systems theory, participatory planning and co-design approaches, education for sustainability and social accompaniment methodologies.

The following table describes the main activities carried out during the three years of the project and the main results obtained.

Activities	Results	Results descriptions
Social research - interviews and focus groups	Users' profiles	Users description: roles, energy practices, barriers to energy saving, informational barriers and needs
Participatory planning activities – co-design and validation meetings	User requirements	Description of the target users in terms of non-technical requirements
	Scenarios	<i>Mise-en-scene</i> of the required innovations for their development
	Use cases	Scenarios' components: single actions of target users' interaction with the visualization tools (described in D5.2.6)
Training and information in the pilot districts	Awareness-raising actions	Training for trainers in schools, information activities (the complete list of awareness raising and dissemination activities can be found in D.7.2.2)

Table 1: Activities and results

All activities carried out, the methodology and the main results are described in this deliverable, in order to underline how the social dimension and the human actors can influence ICT innovation processes for energy saving, with the opportunities, resources and limits they bring to them.





## 2. INTRODUCTION

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Chapter 1 *Executive Summary* synthetically lists the general aim, the methodological approach and the main results obtained by T5.2.1 during the three years of the project.

Chapter 3 *Objectives and methodology* presents the specific goals pursued and the approach chosen in order to do that.

Chapter 4 *Actions* describes all the activities carried out with district users and target users: social research, participatory planning and awareness-raising activities.

Chapter 5 *Users identification results* contains the users' profiles that describe users in term of: main responsibilities, goals and tasks, environment (of work or life), energy saving barriers and informational barriers and needs.

Chapter 6 *Target users' requirements and scenarios* contains the list of users requirements identified for each target user group and the scenarios developed which have driven the visualizations tools' development.

Chapter 7 *Conclusions* resumes the kind of actions carried out and the main results and indications obtained through them.

### 3. OBJECTIVES AND METHODOLOGY

One of the objectives of WP5 was the **creation of tools for involving users into energy related decisions**, as stated in the DoW. It was thus clear that at least some of the technological improvements DIMMER was expected to bring would have required the involvement of human actors. That was in order to obtain higher levels of effectiveness. **The identification of which groups or categories of human actors should have been the users of the DIMMER’s tools** was one of the specific objectives of Task T5.2.1.

The other objective of WP5 was the **classification of users depending on their energy and building usage**. That was in order to develop a model allowing **DIMMER’s innovations to be replicated and adapted to other urban energy districts**. This objective was to be reached through the identification of:

- the main fields of activities of building and district users;
- their motivations and barriers for energy saving;
- their level and kind of interaction with energy systems.

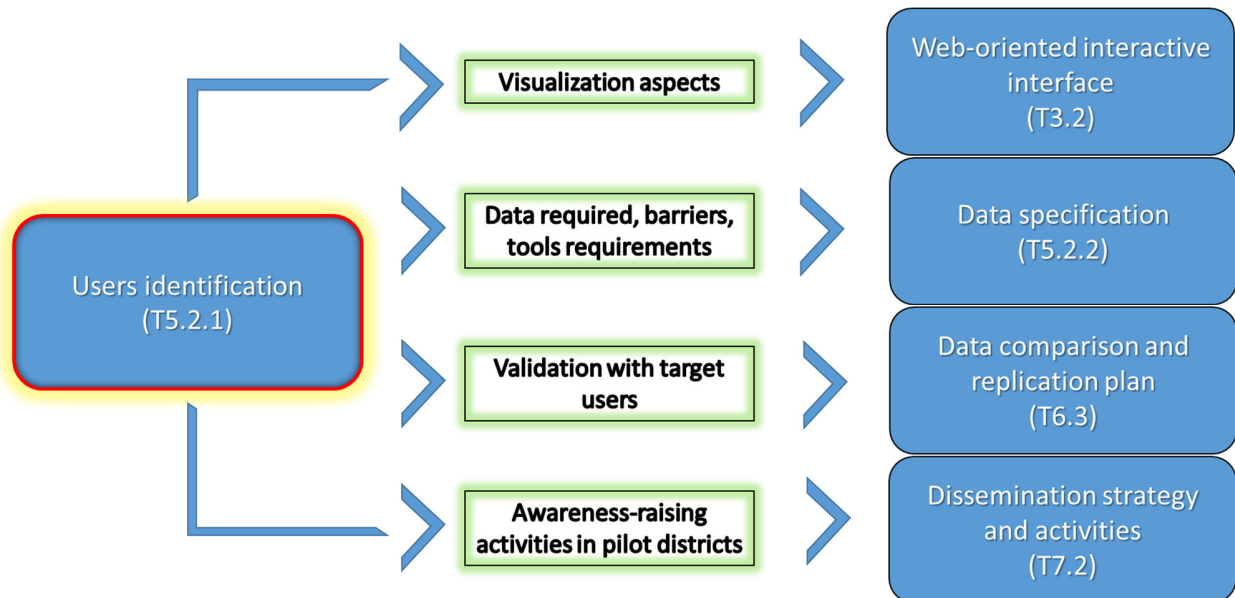


Figure 1: Relationship with other WPs and task

The relationship between T5.2.1 and other tasks of the same work package, as well as the relationship between T5.2.1 and other work packages, helps to clarify the role of this task. More precisely, it might be said that T5.2 was attributed (albeit not exclusively to it) **the management of the relationship with the sphere of human actors within the two pilot districts**. **The “users identification” task was thus added a “users engagement” task**. That is why the description of most part of the activities related to the direct involvement of people in the two pilot districts finds place in this report. However, the description of the results emerging from these activities is partly described here (chapters 5 and 6) and partly in other final reports (see Figure 1), according to the contribution given to specific WPs’ tasks.

Three theoretical and conceptual approaches are involved in this task:

- the concept of “socio-technical system”;
- a participatory approach for technological innovation;
- the concept of “energy community”.



### 3.1. Energy networks as socio-technical systems

**DIMMER was aimed at making energy systems smarter.** There are at least two possible interpretations of what smartness in energy systems means. The first one refers to the **introduction of (more) ICTs** into energy grids. The second one refers to the **improvement of energy systems performance**. Which are the performance of an energy system? The technical aspects of an energy system's performance may be quantified through appropriately selected indices (e.g. fuel costs, emissions, duration of service interruption, etc.). From the social point of view, it consists of properties such as understanding, awareness, competence, mutual trust.

The activities of T5.2.1 were based on the assumption that **energy grids are socio-technical systems**. Put differently, **they are assemblages of human and non-human elements**. Assemblages change over time due to changes of the elements they are composed of. Changes may refer to both the number of elements and to their qualities. For example, a new visualization tool can be considered as a new element that has to be integrated into an already existing assemblage. Understanding which consequences its introduction will bring to the assemblage (thus to its performance indices) would have necessarily required an understanding of which was the prior state of the assemblage.

That is what T5.2.1 was asked to do in the first phase of the project. It was what can be defined as “mapping of the socio-technical systems”. The identification of the users - the categories of people having an “energy role” within the pilot districts - derived from these first activities. It comprised of the identification of:

- the relationships between them;
- the barriers to change;
- their interactions with the energy systems in everyday practices;
- their informational needs.

A more detailed methodological description of this phase can be found in par. 4.1, while the description of the results can be found in chapter 5.

In order to develop the visualization tools, other activities took place. They were aimed at defining which features the visualization tools should have had in order to make their insertion into the already existing assemblage easier and more fruitful. The selection of the target users was a key part of this phase. A more detailed description of it can be found in par. 5.2 and chapter 6.

### 3.2. The participatory approach to technological innovation

Once the energy relevant actors had been identified, some of their representatives were involved in co-design meetings. They were aimed at obtaining a users' evaluation of the preliminary version of the visualization tools. Then, the last step consisted of the involvement of representatives of the identified target users groups in validation workshops - that is, to events where the almost-finalized version of the visualization tools were tested by their potential users. Also awareness-raising events had been taking place in the two pilot districts starting from the second half of the second year of the project.

**The approach that was chosen combined the “research” and the “involvement” objectives.** Indeed, it was a **participatory approach**. In operational terms, it means that the involved people were not treated as disposable informants that could be “dismissed” once the interviews had been completed, thus once some empirical materials had been extracted from them. Many among the involved people participated to more than one event, while some of them took part to all kind of events with target users. In sum, they have been interviewed, then they participated to a focus group, to a co-design meeting, to a validation workshop. **Involved people was thus treated as partners of the project** and their levels of competence and skills were not aprioristically conceived as being worse or lower than professionals and experts'. **Involving users for the entire duration of the project** proved to be quite a challenging task. Nonetheless, it proved to be a fruitful approach as well.



### 3.3. Energy districts, smart grids and energy communities

DIMMER was aimed at creating a system to visualize, compute and simulate (if real data were unavailable) data about energy consumption and production at the district level. However, **a district is not a universally recognizable and well-defined entity**. The district level can be defined as the level situated above the building level. Unfortunately, such a definition does not make clear enough yet how much “above” a district is situated, so that **districts vary according to different actors’ perspectives**. For professional building managers a district is composed by the buildings they manage. For public administrators (e.g. city councils) a district is a neighborhood or whichever already recognizable section of the town. For the energy provider all the buildings connected to a given sub-ramification of the energy distribution network compose a district. These differences were to be taken into account in order to make them converge and merge towards **a new operational definition of what an energy district is**.

From this perspective, we worked to **make actors aware of their belonging to an energy community (or to an energy district)** whose performances are not only a consequence of the infrastructural and technical elements, but also of the practices of those who manage energy. The “simple” energy use is in itself part of the energy grid management because it has consequences on the grid performance and insofar as practitioners are given the possibility to understand how their practices impact on grid performance.

Being aware that everyday practices have an impact on a wider local energy system is a first and essential step to develop those visions and competences that are required for the establishment of local energy communities. In energy communities *“individuals take the role of citizens rather than consumers, and gain the capacity to work together with others to transform their energy infrastructure on the local level”* (Heiskanen E. et al, 2010)

Also the concepts of smart grids and cities (and especially **smart communities**) underline the **need of cooperation among all local actors** and the sharing of information at all levels to improve the effectiveness and efficiency of energy grids. Information about energy (e.g., production, distribution, consumption, best practices of consumption and so forth) has to be disseminated and shared as much as possible, in order to increase the level of awareness and the informed participation.



## 4. ACTIONS

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Social sciences are more and more asked to contribute to the development of technological innovations. It means that social sciences are not only asked to collect information that are useful for the understanding of the “social” world, what is usually referred to as social research. Social sciences, thus social scientists, are also asked to act within parts of the social world itself. They are asked to remove barriers and conflicts or to act as mediators in case of conflicts (social accompaniment to innovation processes); they are asked to act as mediators or facilitators between users and engineers/developers (co-design or participatory approach) and between different expert spheres (interdisciplinarity). DIMMER has taken up the challenge of integrating social sciences in technological innovation projects.

As written in chapter 3, this challenge does not only comprise the “users identification” task but also the involvement of people and stakeholders within the two pilot districts of Turin and Manchester. The actions undertaken in T5.2.1 are comprised under the following categories, which also substantially reflect their chronological order:

1. **Social research;**
2. **Participatory planning actions;**
3. **Awareness-raising activities.**

Following is a description of the activities that were carried out.

### 4.1. Social research: identification of the features of the socio-technical energy systems

Interviews and focus groups are among the tools social scientists usually use to take a picture of parts of the “social world”. The objects of investigation were the energy districts here depicted as socio-technical systems. People that were supposed to play a significant role in the energy networks of the two pilot districts (as energy producers, consumers, managers, etc.) were interviewed and/or participated to focus groups. The most part of these activities took place during the first year. Additional interviews were carried out also during the second year in order to refine and improve the users identification model.

Understanding the real energy systems in which DIMMER was going to operate was deemed to be particularly valuable in order to avoid the development of tools that were too generic and, thus, unable to meet the real needs of stakeholders in specific and given local contexts. This knowledge is critical for the development of innovations that are truly useful and relevant, thus based on the specific needs of the communities considered. The possibility to transfer innovations at the end of the project has to be based on an in-depth knowledge of this complexity, in order to be aware of the flexibility required by the DIMMER innovation to be replicable.

#### 4.1.1. Interviews

The carried out interviews were face-to-face meetings that lasted approximately 90 minutes each. They were semi-structured interviews, thus guided by an interview outline. They were typically led by a single interviewer and recorded by means of an audio-recorder.

#### Objectives:

Provide a description of users based on their energy-related activities:

- inside the buildings in daily practices;
- in managing buildings;
- in managing the energy production and distribution grid;
- at district level for what refers to regulatory and planning roles.

Interviews were thus aimed at understanding the features of the human actors currently playing a role in the overall energy network or in the energy systems of the buildings they are users or managers of:

- the energy-related roles;
- the skills and competences related to ICTs and energy;
- the information already received and the information requested;
- the used technical apparatuses;
- the relationships linking all actors with each other;
- the motivations and barriers with respect to energy saving.

**Number of interviewees:**

Fifty-nine people.

Interviews have been mainly concentrated in the Turin pilot. This was mainly due to the different features of the two pilot districts that led to a higher social complexity of the Turin pilot. In particular, the Turin sample buildings were both public and private, both from the services and residential sectors. All the Manchester sample buildings were owned and managed by a single institution: the University of Manchester. In the case of Manchester, all buildings served academic purposes, which led to higher similarities among building users compared to the Turin ones (see par. 5.1).

**Kind of participants:**

14 energy utilities professionals, 20 building managers, 19 building users; 6 public administrators and planners.

The energy utilities professionals that were involved were, for the most part, managers or employees of the relevant energy utilities of the two pilots. The building managers and the building users that were involved were people living in - or working in/for - the sample buildings of the two pilots.

Users categories	Number of interviews
Energy utilities professionals	14
Building managers	20
Building users	19
Public administrators and planners	6
<b>TOTAL</b>	<b>59</b>

*Table 2: Summary of the interviews carried out*

**Content:**

The main issues that were asked to facility and energy managers:

- To map the socio-technical system of the building(s) they manage;
- To describe their professional role and working practices;
- To collect their opinion about the ways to change and reduce energy use;
- To describe the relevant information they use in working practices;
- To identify the energy data they would like to receive;
- To suggest other possible participants for interviews (snowball sampling technique).

The main issues that were discussed with other building users:

- General information (e.g., age, profession, etc.);
- Social life and habits in their building/office/apartment;
- Knowledge and perception about the thermal/electric systems of their buildings;

- Perception and definition of comfort;
- Their energy-using practices;
- Attitudes towards change in energy use;
- Opinions about the role of technology for change.

The complete interviews outlines can be found in Appendix.

**Results:**

The main results are described in chapters 5 and 6.

**4.1.2. Focus groups**

The carried out focus groups were face-to-face group discussions involving two facilitators and 4-8 participants. Discussions were divided into time and content blocks. Focus groups lasted 90-120 minutes each. They were recorded by means of an audio-recorder.



*Figure 2: One of the first year's focus groups*

**Objectives:**

- Testing, by means of group discussions, the presence of conflicts and agreements about energy/thermal-related issues within some identified buildings;
- Understanding the ideas that the concepts of smartness and smart grid move;
- Deepening and sharing the results of the interviews.

**Number of focus groups: 5**

**Number of participants<sup>1</sup>: 32**

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<sup>1</sup> The number of participants does not include the members of the consortium.



#### **Kind of participants:**

11 building managers and 21 building users.

Participants to focus groups were people using and/or managing the building in which the focus group took place.

#### **Content:**

Focus groups were typically divided into sessions. The first was a brief explanation of the project. According to the context, additional explanations were provided. The other sessions were left to discussions about the following topics:

- Which were the opinions about the project main issues and aims;
- Which information about energy consumption could be useful for the context in which the focus group took place and why;
- Which information about energy consumption could be useful outside of the context in which the focus group took place (e.g., their own flat, the district) and why;
- What would participants do to get energy saving in the building, without compromising comfort;
- Which kind of information about energy could be usefully spread at the district level and how.

#### **Results:**

The main results are described in chapters 5 and 6.

### **4.2. Participatory planning actions: co-design and validation with target users**

Following the identification of the features of the socio-technical energy systems of the two pilot districts, a preliminary list of users' requirements was prepared. They consisted of both explicit requests coming from users and the implicit requests that could best improve energy district performances. User requirements were related to the target users that were identified within the consortium.

By "target users" it is meant the categories of people for which DIMMER applications will have been developed. Target users were chosen by the consortium on the base of a common thinking about the possibilities and the limits of technological impact on the real situations of the two pilots. The survey carried out during the first year offered the consortium a large amount of data for that specific purpose.

The identified users' requirements were subsequently used for the development of the first version of the visualization tools. At that stage, some representatives of the target users were involved in co-design meetings, which mainly took place during the second year of the project.

During the third year, the representatives of the target users took part to validation workshops. Validation workshops were aimed at obtaining a user evaluation of the almost-finalized version of the visualization tools.

#### **4.2.1. Co-design meetings**

They are meetings involving applications developers and groups of potential users. Two facilitators led the meetings, which lasted approximately 2 hours each. Various components of the visualization tools were shown and described to participants and their feedback were collected.





Figure 3: One of the 2nd year's co-design meetings

**Objectives:**

- evaluation of the first version of the visualization tools;
- collection of comments, suggestions and further requests from participants;
- refinement of users' requirements, scenarios and use cases.

**Number of co-design meetings:** 5

**Number of participants<sup>2</sup>:** 30

**Kind of participants:** see Table 3 below.

Users categories	Number of participants
Public administrators and planners	8
Building managers	18
Energy utilities professionals	4
<b>TOTAL</b>	<b>30</b>

Table 3: Summary of the co-design meetings carried out

**Content:**

The applications developers carried out the presentation of the visualization tools. They did it by means of navigation through and description of each functionality. Guided discussions among participants and evaluation activities followed this stage. Recommendations, suggestions and comments for future developments were collected as well.

<sup>2</sup> The number of participants does not include the members of the consortium.

**Results:**

Users' requirements can be found in chapter 6. A more detailed description of co-design meetings results in terms of applications development is in D5.2.6.

**4.2.2. Validation workshops**

They are meetings aimed at obtaining a final evaluation of the visualization tools. The carried out workshops lasted approximately 2 hours each. Up to eight members of the consortium were present at the meetings: two of them as facilitators, the other ones were computer scientists and developers ready to answer to technical questions. Participants were demonstrated how to use different functions, then they were left the possibility to freely navigate through the tools (more details in D6.3).



*Figure 4: Validation workshop with Public Administrators and Planners*

**Objective:**

Assessment of the visualization tools, carried out by target users representatives.

**Number of validation workshops<sup>3</sup> with target users:** 3 (one for each target users group)

**Number of participants<sup>4</sup>:** 28

**Kind of participants:** see Table 4.

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3 Other workshops with target users have been carried out in order to test the Multi Criteria Decision Analysis (see D4.2).

4 The number of participants does not include the members of the consortium.

Users categories	Number of participants
Energy utilities professionals	7
Building managers	10
Public administrators and planners	11
<b>TOTAL</b>	<b>28</b>

Table 4: Participants to validation workshops with target users

**Content:**

The workshops were divided into sections of assessment, each one dedicated to functionalities or aspects of the visualization tools. During the workshops with Building Managers and Public Administrators, participants were asked to compile a questionnaire containing questions (both close-ended and open-ended questions) related to each of the assessed functionalities as well as questions of general assessment of the visualization tools as a whole (more details in D6.3).



Figure 5: Validation workshop with Building Managers

**Results:**

As the validation workshops have been carried out as part of WP6 objectives, results can be found in D6.3.



Figure 6: Validation workshop with Energy Utilities Professional

### 4.3. Awareness-raising activities

Awareness-raising activities were carried out in the two pilot districts. They were devoted to spreading awareness about the issues of energy reduction as well as of the role that ICTs can play in improving energy efficiency at the district level. DIMMER was also presented and discussed as a key example of how ICTs can reach the objective of energy reduction together with an increased energy awareness among users.

Awareness-raising activities were mainly dedicated to building and district users (see par. 5.2). They took place in locations that were previously identified and mapped as “social hubs”. The term “social hubs” was used to refer to significant nodes and meeting and socializing places in the pilot districts. These “social hubs” were identified because they are places, associations and enterprises that are suitable to organize initiatives to spread awareness on energy saving and dissemination events.

An energy district is not only a section of a technical energy network. From a social point of view, it is also a community. The technical and the social networks share the same space, but they do not share the same nodes and hubs. In the technical network, substations are important because they distribute energy. However, these places are not significant for the social dimension. People do not meet and socialize at substations. The social community has its specific meeting places where knowledge and information are shared.

The list of the identified “social hubs” comprised many sites as diverse as: leisure, culture, sport and meeting places; public administrations and social services; associations, cooperatives; churches and parishes; foundations, local development institutions; schools or educational institutions; student services (Turin); libraries; hospitals and health services; performance, art and creative places; research institutions; academic institutions; schools and educational institutions; leisure and sports places; churches (Manchester).

### 4.3.1. List of the awareness-raising events

#### 25<sup>th</sup> November 2015

Where: Turin, Kindergarten Braccini.

Kind of event: Training for trainers.

Duration: Three hours.

Participants: Thirty-seven teachers and school assistants.

The program consisted of:

- how District Heating works in Turin;
- what is a peak of consumption;
- what is cogeneration;
- what DIMMER is developing - presented by IREN;
- energy saving best practices at the residential level (both thermal and electric energy) - presented by UNITO;
- distribution of leaflets.



Figure 7: Dissemination event at Braccini School

#### 24<sup>th</sup> – 27<sup>th</sup> July 2016

Where: Manchester, European Science Open Forum.

Kind of event: Exhibition & final dissemination event.

Duration: 4 days.

Participants: c 4,500 national and international delegates from over 90 countries including academics, early career researchers, innovators, educators, business leaders, journalists, and policy makers.

The program consisted of: exhibiting the main results of DIMMER along with other GM Low carbon projects.



Figure 8: Dissemination event at ESOF

**6<sup>th</sup> September 2016**

Where: Turin, IC Palmieri (4 primary schools).

Kind of event: Training for trainers.

Duration: Two hours and a half.

Participants: Eighty-eight teachers.

The program consisted of:

- The DIMMER project;
- Introduction to ecological issues;
- Good energy-saving practices;
- Distribution of leaflets.



*Figure 9: Dissemination event at IC Palmieri*

**11<sup>th</sup> September 2016**

Where: Turin, Bocciofila Concordia.<sup>5</sup>

Kind of event: Information activities.

Duration: Two hours.

Participants: eighty-two.

The program consisted of:

- distribution of leaflets on energy saving;
- discussion with visitors.



*Figure 10: Dissemination event at Bocciofila Concordia*

<sup>5</sup> Literally, a bocciofila is a place where the game of bocce is played. Bocce is a popular and traditional game in Italy. Despite of their name, bocciofilas are meeting places, whose activities are not only limited to the game of bocce.

### 26<sup>th</sup> September 2016

Where: Manchester, Greater Manchester Environmental Liaison Group.

Kind of event: Final dissemination event.

Duration: approx. 1 hour.

Participants: fifteen – twenty local municipality officers from Greater Manchester and larger public bodies including GM Fire, Transport for Greater Manchester and the Greater Manchester Waste Disposal Authority.

The program consisted of: the main results of Dimmer.



Figure 11: Dissemination event at GM Environmental Liaison Group

### 11<sup>th</sup> – 13<sup>th</sup> October 2016

Where: Manchester, Local Carbon Innovation Networks Conference.

Kind of event: Exhibition & final dissemination event.

Duration: 3 days.

Participants: c 1.200 national and international delegates including representatives Energy Network operators, Manufacturers, Academic institutions, Trade associations, Government agencies, Innovation funding bodies, Research facilities, Community/voluntary sectors, Energy producers, Media, Energy storage developers, Infrastructure utilities, Information technology, IT & communications, Technology developers.

The program consisted of: exhibiting the main results of DIMMER along with other GM Low carbon projects.

### November 2016

Where: Manchester, Greater Manchester Energy Group,

Kind of event: Final dissemination event,

Duration: approx. 1 hour.

Participants: fifteen - twenty people from the energy sector including academics, Electricity North West (DNO) Private and Public property portfolio owners, UK Government Departments, Local Municipality officers.

The program consisted of: the main results of DIMMER

The awareness-raising activities in the two pilot districts can also be considered as dissemination activities, which were mainly a task of WP7. The reason why they are described here lays in the fact that these were dissemination activities within the pilot districts. Others are described in D7.2.2.

## 5. USERS IDENTIFICATION RESULTS

### 5.1. The DIMMER's pilots from a social perspective

The identification and analysis of the social actors that interact with the energy networks began from the study of the socio-technical features of the DIMMER's pilots: the districts of Manchester and Turin.

**Clusterization of the buildings** within a district was considered as the starting point to identify the main users to be involved in the analysis.

The buildings within a district were classified according to their:

- **use: residential or services;**
- **ownership: public or private.**

Indeed, **building use has a relevant impact in daily practices** (and associated energy use profiles), while **ownership affects the level of power of building managers to address energy-related issues**.

From this point of view, the two pilot districts present different features:

**The Turin's district is an urban area** that includes **both residential buildings and buildings used in order to provide services**. The residential buildings - apartment buildings - are private, while the service buildings - schools, offices, university residences, etc. - are both public and private. The buildings and district management presents a multiplicity of forms and responsibilities carried out by different professionals, as well as diversified are the users of the buildings. Since both the ownership and the use of buildings is mixed, a wider analysis involving many different actors was required.



*Figure 12: One of the CHP plants serving the Turin pilot district*

**The Manchester district is a university buildings district** that is **part of a single, centralized and public administration**. The buildings are part of common heating, electricity and gas networks. The energy sources are diversified and include renewable sources. The district is close to the concept of "energy community". The actors involved in the management and



use of the buildings are far fewer than in the case of Turin. In fact, a single owner decides about all energy-related issues and the people using the buildings and the district - mainly employees, teachers and students - are effectively guests.



Figure 13: The Manchester pilot district

Paragraph 5.2 summarizes the main findings of the research carried out in the two described districts through the direct involvement of all categories of social actors interacting with energy systems and networks.

## 5.2. Identification of social actors and target users

The “social research” phase identified, contacted and studied all categories of social actors that have a role, more or less direct and professional, in the energy management of the considered pilots and in the energy management of an urban district in general.

The main identified families of these subjects are:

1. **Public administrators and planners** (Profile 1);
2. **Energy utilities professionals** (Profile 2);
3. **Building managers**;

Building managers can be further classified on the basis of the sector in which they operate - residential or services - and the type of skills and tasks they have in the energy-related fields:

- 3.1 **Building administrators** (Profile 3): they work in the residential sector and one of their task is the energy management of the buildings they are appointed administrators of;
- 3.2 **Energy and facility managers** (Profile 4): they are professionals of the service sector who are in charge of the buildings’ energy and technical management;
- 3.3 **Representative managers** (Profile 5): they are in charge of the activities carried out in the buildings. They are employed in the service sector. Examples: deans or directors of educational, health and commercial



services. Some of them have also tasks regarding the building technical management; some others do not have any task or skill in this field. Anyway, they are responsible for the activities and for the personnel. They can have an impact on the energy consumption by prescribing more or less sustainable daily practices to the building users.

4. **Building and district users** (Profile 6): they are citizens or people working or living in the buildings.

All the four categories of actors were involved in the project through various activities:

- The first phase of social research involved representatives of all the identified subjects;
- The project developed specific ICT applications for the first three categories of actors who are thus the DIMMER's target users;
- Building and district users were involved also in dissemination and awareness-raising actions.

The next chapter contains the profiles summarizing the characteristics of all the identified actors and describes their kind of interaction with their energy systems of reference.

## 5.3. Users profiles

### 5.3.1. Profile 1 - Public administrators and planners



#### Main responsibilities

Public administrators and planners are professionals having among their tasks that of reducing energy consumption, energy expenses, emissions due to energy consumption and production, with reference to the territorial level the institution they work for operates. They can either be part of the public administration, whether as elected representatives, employees or managers, or be external consultants. Planners are mainly professionals who support the public administrations. They can be urban energy planners, urban planners and district energy planners.

#### Goals and tasks

They are responsible for energy aspects at various levels. In general, they have to ensure the compliance of EU policies and targets and to define the local targets through local action plans for energy, aimed at reducing energy consumption and CO<sub>2</sub> emissions, and promoting the use of renewables.

Public authorities and related energy managers have the role to oversee the energy management of their buildings stock. It is important for public authorities to reduce the energy consumption of the public buildings stock. They can develop projects for:

- The refurbishment of public buildings, often favouring “minor but high-return interventions” (less costly measures compared with, for example, the installation of thermal coats);
- Replacing bulbs across their traffic-light network or other innovations characterized by the use of sensors and “smart” technologies.

Regarding the private sector, the local municipality is not able to intervene directly on energy saving, nonetheless it plays a role in reducing emissions. They can support the development of computerised platforms that gather data on energy consumption from the private housing sector.

Public administrators are also responsible for the policies on air quality – e.g. bike sharing implementation.

Finally, public Councils and related offices can become places through which citizens become aware of the energy-related issues, and places through which energy-saving results are disseminated.

#### Environment

Public administrators can work at district, municipality, province and region level. They have a twofold role:



- A planning, regulatory and "community" role: they can decide about incentives, energy and environmental policies and have a cultural and educational role for citizens. They are involved in local energy plans;
- As building owners, they are facility and energy managers. Example: the buildings stock of the Turin Municipality comprises around 830 buildings of which over half are used for education.

### Energy saving barriers

Energy saving barriers can be identified in several fields:

#### *Structural*

- Many public buildings are old and not energy efficient.

#### *Behavioural*

- Citizens' and public workers' confused perceptions: it is not sufficiently clear to them what the environmental benefits really are;
- The environment is not always at the top of the list of concerns for citizens and for the workers of public offices.

#### *Informational*

- Legislation generally makes it difficult to obtain energy consumption data also for public administrators;
- It is particularly difficult for public authorities to access information about private buildings;
- Public building's staff usually do not have access to the energy data or responsibility for monitoring it within their job duties. Information is not sufficiently shared among the individual departments within the public administration.

#### *Organizational*

- All leaders of the various areas and sectors of the public authorities need to be involved in order to achieve meaningful energy savings. Energy saving targets should be defined for every sector as part of a wider strategy.
- District authorities, when present, depend very strongly on the "centre" - whether local or regional or national level - for everything concerning environment and energy policy. For example, Borough Councillors do not have any active role in energy saving policies.

#### *Economic*

- Lack of financial resources to implement the policies;
- Not enough clear correlation between energy bills and savings.

### Informational barriers and needs

Public administrators' awareness and use of energy data depend on their roles. Some of them have access to data and this kind of professional can raise awareness about the role of buildings and building users on energy use. Some others do not have access to data: they do not receive any information because energy issues are not among their tasks.

For policymakers data analysis is essential and a wider availability of energy consumption data and other energy information would be desirable. Thanks to that, public spending could be reprioritized thus enabling saving to be achieved.

Improving buildings' consumption profiles would generate significant energy saving. To this end, buildings' energy patterns and usage profiles are needed.

They are also interested in "smart" technological solutions (like a complete building control system that guarantees optimal performances of the heating and lighting systems) and in tools that provide greater awareness of users behaviours.

The energy providers usually have real time consumption data, or high-resolution data. It would be useful to have access to this information, for public administrators too, in order to facilitate a good building management.

### 5.3.2. Profile 2 - Energy utilities professionals



#### Main responsibilities

Energy utilities professionals are professionals working in institutions managing, as efficiently and effectively as possible, energy production and/or energy distribution and/or (partly or in its entirety) the distribution infrastructure and networks. The energy utilities professionals may also use the services of external consultants.

In the “energy utilities” category it is possible to include:

- Energy utilities;
- Energy service companies;
- ICT enterprises developing applications for energy saving and energy management.

There are many different professional roles in energy utilities like, for example:

- Plant control engineer: he/she is mainly responsible for the processing of the (daily) provided production plan and the smooth and secure operation of the heat/power plants and the heat/power network;
- Production plan or shift leader: he/she is responsible to come up with and/or develop a production plan for all heat/power plants and auxiliary systems and provide this for the next day (electricity production specifications are provided by the manager of the national electric grid);
- Customer support: he/she is responsible for receiving and processing telephone calls from the energy provider customers.

#### Goals and tasks

Energy saving objectives are important for these reasons: they reduce operational costs, and decrease carbon footprint, improving energy utilities’ corporate social responsibility credentials.

On the other side, providers sell energy. Clients’ energy saving decreases their revenues. They can be compensated with the development and sell of services, like the ones for energy saving.

Energy consumption peaks are a problem for all energy utilities, as they prevent the power plant’s maximum exploitation to happen. Peak shaving strategies are being faced in two different, but complementary, ways: trying to change user demand and through technical arrangements.

#### Environment

Energy utilities are companies that operate in the sectors of electricity, thermal energy for district heating and gas, as well as in the management of integrated water services, environmental and technological services. Sometimes they manage the public lighting system, traffic lights and the electricity and heating systems of the Municipality’s buildings.

Some utilities are completely public, as the respective municipalities - or other public authorities - own them. Other utilities are private, other have a mixed ownership.

#### Energy saving barriers

Some energy utilities express a position of relative closure regarding the sharing of information with other parties (e.g. public administrators and building managers), due mainly to privacy issues. In this field, the technological innovations should



be accompanied by legislative and organizational innovations that would make it easier, or possible, to effectively disseminate information to promote energy saving.

Many energy utilities professionals think that users are not able to understand energy issues, as well as the proposed changes and advantages of new tariffs schemes. Building administrators prefer not to propose changes to householders, in order to avoid conflicts, even if they acknowledge the value of the commercial proposals.

The success of a remote control ICT-based system is highly dependent on how much information can be automated and how much it needs to be entered on a bespoke basis.

### **Informational barriers and needs**

Energy utilities are already collecting many data coming from sensors that are present along the distribution networks.

Energy utilities are interested in improving the remote control of the production and distribution networks. From this point of view, some important innovations they would appreciate are:

- Having a public cadastre of buildings with a special focus on updated volumes to be heated (for heating);
- Receiving feedback about comfort from buildings situated in the farthest parts of the grid (for heating);
- Having a tool allowing the examination of both a wide area scale and micro-level user's behaviors and in having a model related to how the micro-level influences the macro-level - and vice versa;
- Having a dynamic real-time model of the network, to replace static ones. The dynamic model will help to identify more promptly the problems in the network, by integrating existing information and enabling better diagnostic activities. This will help to faster identify solutions and make simulations of the entire network or of specific districts, in order to promote a systemic approach to the management of the network;
- Availability of algorithms to balance different generators and loads operating at district level;
- Different user interfaces available for different kinds of users;
- The balance between generic, pre-loaded information and tools to make specific decisions;
- A methodology for displaying energy flows, costs and interdependencies as an information and decision tool.

### 5.3.3. Building managers

Building and estate managers are professionals who are in charge of guaranteeing and improving the operability of the building(s) according to its/their intended use. The management of the aspects related to energy (consumption, emissions, costs and maintenance of energy systems) may be, or may not be, part of their tasks. They can be the owners, managers of the buildings or external consultants.

They can be:

- **Building administrators** (residential sector: they are appointed by house owners for the management of the buildings and related energy issues);
- **Building/estate owners** (public and private buildings. Examples: residential buildings, educational and health facilities, commercial buildings and services);
- **Real estate agents.**

We can classify them in the following three categories, analysed in the next pages' profiles:

Type of building	Professional	Role	Examples
Residential	Building administrators	They are in charge of the building technical management	Apartment buildings
Services	Energy and facility managers		Energy managers of: University, Municipality or other public or private bodies which deliver services
	Representative managers		Technical office responsible of: University, Municipality or other public or private bodies which deliver services
		They role is connected with the use of the building. They may have building management tasks or not	Primary school deans; directors of training, health, tourism and commercial services

Table 5: Categories of building managers

### 5.3.3.1 Profile 3 - Building administrators – Residential sector

#### Main responsibilities

Building administrators are responsible for the management of many aspects related to private residential buildings: maintenance, refurbishment, cleaning, functioning of elevator, mediation of conflicts among householders, insurance, water seepages, payment of building's bills (water, cleaning, electricity for common spaces, heating, lawing, etc.).

The building administrator contacts suppliers, pays the invoices, prepares the annual budgets, urges households to pay their due share of costs (e.g. heating costs). The majority of building administrators are professional. It means they normally are administrators of many or of several buildings.



#### Goals and tasks

Building administrators have to meet the requests of the households, in order their appointment to be renewed. They have to match comfort with energy saving. The apartment owners' meetings are the moment when almost all decisions are taken. Participants are the building householders and the building administrator. Building administrators can propose improvements like buying an efficient plant or planning refurbishment interventions. Residents can decide to change the provider or the rules of apportionment of the heating costs, for example with a fixed part depending on apartment cubic meters and a variable part depending on real consumption. Building administrators communicate householders' requests and complaints to the heating provider.

#### Environment

Their work concerns the private residential buildings. They can be part of a building administrators' association operating at local or national level.

#### Energy saving barriers

Several factors can reduce the capability of building administrators to promote energy savings:

##### Structural

- Structural and plants weakness of the buildings;
- Lack of basic instruments (e.g. thermometers) in many apartments.

##### Behavioral

- Householders' unsustainable practices and behaviors (e.g. high temperatures with windows left open);
- Conflicting subjective perceptions of comfort and wellness;
- Householders' different times of presence in the building, which implies difficulties in deciding the heating time-schedule;
- Building administrators have to manage conflicts among householders and try to avoid them. This fact can prevent changes. For example, the energy provider suggests building administrators to change the heating time schedule, mainly for reasons related to peak-shaving, but building administrators are reluctant to change in order to avoid complaints and conflicts.

##### Organizational

- Weak building administrators' associations.





### *Economic*

- Economic motivation for energy saving is prevalent for householders and the expectations related to the monetary saving are not always satisfied;
- The energy providers do not propose enough advantageous tariffs to reduce the peak of consumption.

### **Informational barriers and needs**

There are several information barriers affecting building administrators work practices:

- Digital divide: not all householders can use ICT devices;
- Not enough transparency in bills;
- Not enough control on consumption data – providers' meters are out of reach;
- Limited possibility to over-ride sensors and automatized energy systems, when present;
- The energy supplier should distribute the control on, and data about, the heating systems to other actors and to building administrators in particular;
- Difficulties in integrating data from different sources. Example: in Italy, some companies operate in the field of thermal metering by installing thermal valves. These data could be important in order to improve building administrators' control on consumption. Anyway, there is no exchange of information and data between the energy provider and thermal metering companies.

Building administrators could find useful the following information improvements for energy saving:

- Transparency of data and bills: it is important for them to have a clear picture about what the energy bill is made of and not just the final total amount;
- There is a lack of information and communication with the provider. Improved communication could prevent conflicts among householders.

### 5.3.3.2 Profile 4 - Energy and facility managers – Service sector



#### Main responsibilities

Both energy and facility managers are in charge of the building technical management. They are responsible for specifying, developing and overseeing the utilities infrastructure.

The *Energy manager* controls how energy issues (e.g. consumption, insulation, etc.) are managed in the buildings they are in charge of.

The *Facility manager* is responsible for:

- The management of technical-administrative personnel;
- Logistics (management of spaces and construction);
- Furthermore, he is responsible for day-to-day business related to building management systems, e.g. setting set-points and schedules.

#### Goals and tasks

These professionals have to match comfort with energy saving. Sometimes they are also required to reduce building GHG emissions.

*Energy managers'* goal is to ensure comfort for all users (students, researchers, workers) possibly reducing energy expenses.

To do that they can:

- Propose actions to the *facility manager* in order to save energy;
- Analyze environmental and consumption data and derive plans for ensuring comfort and keeping energy waste and energy consumption low;
- Use ICT systems/tools to analyze the energy performance of their buildings. They might also work with the building management systems and have some knowledge about building management systems' hardware, e.g. sensors and actuators;
- They do not consume energy personally, but the buildings they are responsible for consume energy, so they at least have some influence on the energy consumption of the buildings. They do not pay themselves for energy but it might be part of their job description to keep the energy bill of their buildings low.

*Facility Managers'* overarching goal is to save energy and keep the users satisfied. They:

- Receive advice from the *energy manager* on how to save energy;
- Are in charge of the building management system, i.e. controlling set-points, schedules etc. based on the information received from the *energy manager*;



- They work with the sensors/actuators of the building management systems and are responsible for their maintenance;
- Usually they carry out mainly organizational and operational activities. They follow suppliers, energy procurement, the maintenance and procurement of energy plants and obviously collect complaints and grievances with regard to the conditions of comfort;
- Measure, monitor and report on sustainability performance of the buildings they manage;
- Lead on the development and implementation of the university's (or other institutions') environmental and/or sustainability plan.

### Environment

An *energy manager* is employed in non-residential buildings such as universities, public and private offices, health and commercial services. He/she is responsible for the planning and management of building's energy systems.

A *facility manager* works in non-residential buildings such as universities, health services or office buildings. Typically, these buildings are equipped with some kind of building management system that requires an expert to work with.

While the *energy manager's* role is more that of an analyst, devising the plans to save energy, the *facility manager* is responsible for their execution.

### Energy saving barriers

Many factors can limit their capability to promote energy saving. They are:

#### Structural

- Building and plants weaknesses;
- Temperature differences between different areas of the buildings, causing complaints about comfort.

#### Organizational

- Scarce staff spare time to implement measures;
- Impossibility to attribute a specific responsibility to administrative units – as university's departments - because there is no specific data.

#### Behavioral

- It is difficult to please everyone ensuring comfort to the users;
- There are often conflicting goals for different building users.

#### Economic

- Too high cost of measures implementation;
- Energy providers' objectives and energy saving are often in conflict;
- Fluctuation of energy costs and consumption depends on many causes, from the changes in energy prices to the different seasonal weather conditions.

### Informational barriers and needs

Informational barriers are:

- No possibility to compare the consumption of different years adjusted to weather conditions;
- People should have the possibility to over-ride sensors and computerized energy systems, when there are. Information is considered useless if there is no possibility to act on the systems;
- Information has to be constantly provided, thus not only occasionally.



These professionals daily work with energy data. Anyway, they suggested several data as useful in order to improve their energy saving actions:

- having a benchmark in order to compare the building energy behaviour with other similar buildings;
- having a service allowing them to evaluate the consumption trend taking into account weather conditions;
- receiving frequent information about energy consumption from the provider.

### 5.3.3.3 Profile 5 - Representative managers – Service sector



#### Main responsibilities

A representative manager has a main occupation as dean of a school/kindergarten, health services' or student residence's director, for example. He/she is also responsible for the personnel.

Additionally, he/she can perform tasks of the facility manager and take the corresponding responsibilities:

- Management of spaces and construction (usually supported by a technical office);
- Management of the technical and administrative staff.

#### Goals and tasks

With respect to energy aspects, his/her main goal is to achieve a comfortable (and within regulations) environment in the building, which is mainly expressed by the comfort level experienced by the building users.

He/she consumes energy as the users of the buildings, but also may cause higher consumption due to inefficient management. He/she does not pay for energy. In public schools/kindergartens government pays the bills. Sometimes representative managers do not even receive the bills.

They can influence energy consumption by prescribing sustainable behaviours to the personnel, but they would need consumption data in order to evaluate the impact of the proposed changes.

#### Environment

A representative manager is a person performing management functions in non-residential buildings. His/her involvement in the building management is limited, as this is not his/her main occupation. He/she is not educated to operate complex systems, and is mainly interested in keeping his/her facility management activities at a minimum (to avoid distraction from the *main job*).

#### Energy saving barriers

There are several kinds of barriers to his/her possibility to work for energy saving. They can be:

##### Structural

- Buildings and plants weaknesses;
- Temperature differences between different areas of the buildings;
- Possible absence of thermometers and related differences in the perception of comfort among users.



#### *Organizational*

- Some of these professionals do not have any direct management of the building, but just a control on maintenance activities;
- Often managers do not receive any information about consumption because the control on this aspect is centralized;
- Lack of staff spare time to implement measures;
- Most of the time, it is not possible to attribute a specific responsibility to each administrative unit because there is no specific data to work on.

#### *Behavioral*

- Trying to ensure comfort to the users. It is difficult to please everyone;
- There can be conflicting goals for different building users.

#### *Economic*

- In public buildings workers and visitors often do not take care of saving energy because they do not pay for it;
- Incentives for energy saving interventions are weak;

#### **Informational barriers and needs**

The informational barriers are:

- Not all of these managers currently use ICT systems and tools;
- Technology is not enough. Energy saving is also an ethic-cultural matter. This fact underlines the importance of widespread awareness and education;
- They already receive a lot of information in their working practices, which is related to their many tasks. More information could be ineffective;
- There is a lack of awareness or confidence on energy saving technologies.

Information they need are:

- They ask for information about consumption to understand the impact of different practices;
- Interfaces have to be user-friendly;
- Schools and universities are educational agencies. They can raise awareness in children, students and workers, by using energy data, which need to be easy to use and attractive.

### 5.3.4. Profile 6 - Building users



#### Main responsibilities

In the *residential sector*, users are house owners and householders living in apartments. They have to pay their energy bills. They can report problems related to heating/energy to their *building administrator* or to the Customer Service of their energy/heat supplier.

In the service sector, buildings and district users are employees, students, service clients and citizens. They do not pay for the energy consumed and they do not have any role in energy consumption control.

#### Goals and tasks

*Residents'* goal is to keep thermal comfort in the apartments and to keep the energy bill as low as possible. They consume energy by heating and by using electrical devices.

*Service buildings' and district's users* have the main interest in comfort. They consume energy in daily practices. They can be involved in energy saving plans through educational actions.

#### Energy saving barriers

The two main differences between residential building users and users of service buildings is that house owners pay for the energy they use while workers and visitors of service buildings do not pay for it. A significant difference is also related to the energy information they receive and the power to decide about building's energy issues (i.e. refurbishment interventions, provider choice...).

It is possible to summarize the following barriers to energy saving in the two different sectors.

#### A. Residential sector

##### Structural

- Old windows and doors fixtures can cause energy dispersion;
- The age of the house and the position of the apartment influences heating energy needed to reach comfort;
- The age of the electric appliances conditions electricity consumption;
- The absence of temperature meters is common and this fact does not help raising awareness about energy consumption (heating).

##### Behavioral

- It is difficult to change adults habits and often younger people seem to be not sensitive to energy saving, especially regarding electronic devices consumption;
- There is a subjective perception of comfort and wellness;
- The propensity to check consumption is not universal and many users declare they do not have time to do it. These facts suggest that a better information is not enough in order to create awareness. It is important to develop sensitivity as well;
- Building meetings are a strategic occasion to develop awareness about energy consumption, but participation is not high and sometimes it is conflicting.



#### *Economic*

- Some people report no money availability for refurbishments; on the other hand, the economic motivation is weak for wealthy people.

#### **B. Services sector**

##### *Structural*

- Some buildings have a high thermal dispersion mainly due to the age of the building and the presence of old windows and doors;
- In many buildings, there are big temperature differences among areas;
- The age of devices influences energy consumption.

##### *Behavioral*

- Workers in public buildings are more concerned about their own comfort. At the same time, they have scarce control upon energy systems;
- Many workers in services ask for more autonomy in managing their comfort. Sometimes automatized systems are not appreciated if they do not give this opportunity to them;
- Air ventilation is a big trouble in some service buildings where most of complaints are about the need to improve it;
- The youngest (in general) seem to be not particularly concerned with the energy consumption of electric and electronic devices.

#### *Economic*

- In service buildings, less relevance is given to monetary factors as incentive that could lead people to save energy because users do not pay for it. A higher importance is attributed to education.

#### **Informational barriers and needs**

There is a significant difference between residential and service sectors concerning the energy information received and the way the users use it to change their consumption behavior.

Workers, students and service clients cannot realize how their single actions cause changes in the building consumption, because of the lack of feedback data.

Otherwise, users of residential buildings are more motivated to use information to reduce consumption because they receive information directly from the building administrator. Furthermore, they can get an economic advantage using the available information to reduce consumption.

The following are the information barriers emerged in the research.

#### **A. Residential**

- Clear, transparent and easy information is not available (e.g. in call-centers and web sites);
- No transparent and understandable information about providers offers;
- Bills/invoices are not understandable and a more frequent information about consumption is needed in order to avoid unexpectedly high bills;
- Even scientific information about energy good practices is contradictory;
- Liberalized market lead to less clear bills;
- Digital divide: some elderly people do not use ICT tools.

#### **B. Services**

- In some service buildings, no one receives any information about the energy consumption of the building (the management is external);





- Digital divide is an issue for elderly people;
- Energy systems used in buildings should be better known by building users.

Workers and residents assign an educational role to information, when comprehensible and direct. They consider important to know the effects of their practices in terms of costs and energy use. Schools require information about the environmental costs of energy consumption in order to raise awareness. They would like to know energy saving and to get answers to their questions and doubts on consumption.

They ask for more transparency regarding not only the final consumption, but also everything that lies under consumption, for example conditions of energy provisioning, real cost of energy and information on energy production.

Data on consumption need to be compared in order to be more meaningful – in different seasons and years or with similar buildings.

Information about energy consumption should be understandable for all, with short messages and not too frequent. People with no specific skills should be able to utilize interface as well. Information in form of gamification could develop competition and emulation processes for energy saving.

## 6. TARGET USERS' REQUIREMENTS AND SCENARIOS

The results of first year's activities also allowed for the identification of the users' requirements. They formed the basis upon which some preliminary scenarios were prepared. The scenarios portrayed hypothetical situations of users interactions with the visualization tools. They were aimed at acting as inputs for the first development of DIMMER's tools and applications, serving as guidance instruments for developers. The starting point was the question: what do we want users to be enabled to do in order to ensure that DIMMER systems and applications are actually useful to them? Scenarios were then shared and discussed among partners.



*Figure 13: Discussion within the consortium*

DIMMER would have developed not all the early-identified functionalities described in the scenarios. Indeed, a relevance and data availability assessment took place. Later, this process could also take advantage of the analysis of the feedback gathered during the co-design meetings and the validation workshops (see chapter 4). The assessment process led to the identification of the scenarios that would have concretely been developed through specific applications and for specific categories of users (target users). It is important to highlight that the presented scenarios were built upon the results of the research activities carried out in the two DIMMER's pilot districts. They would require to be readapted according to the specificities of other contexts, would DIMMER be transferred to other urban districts.

Users' requirements and some representative scenarios can be found in the next section. They are related to each category of the identified target users. Scenarios are instrumental in communicating – in an attractive and simple way - what DIMMER's applications allow users to do.

Scenarios depict the work practices enacted by specific users. Scenarios are composed of several actions, also defined as use cases. The list of the use cases developed by DIMMER can be found in D5.2.6.

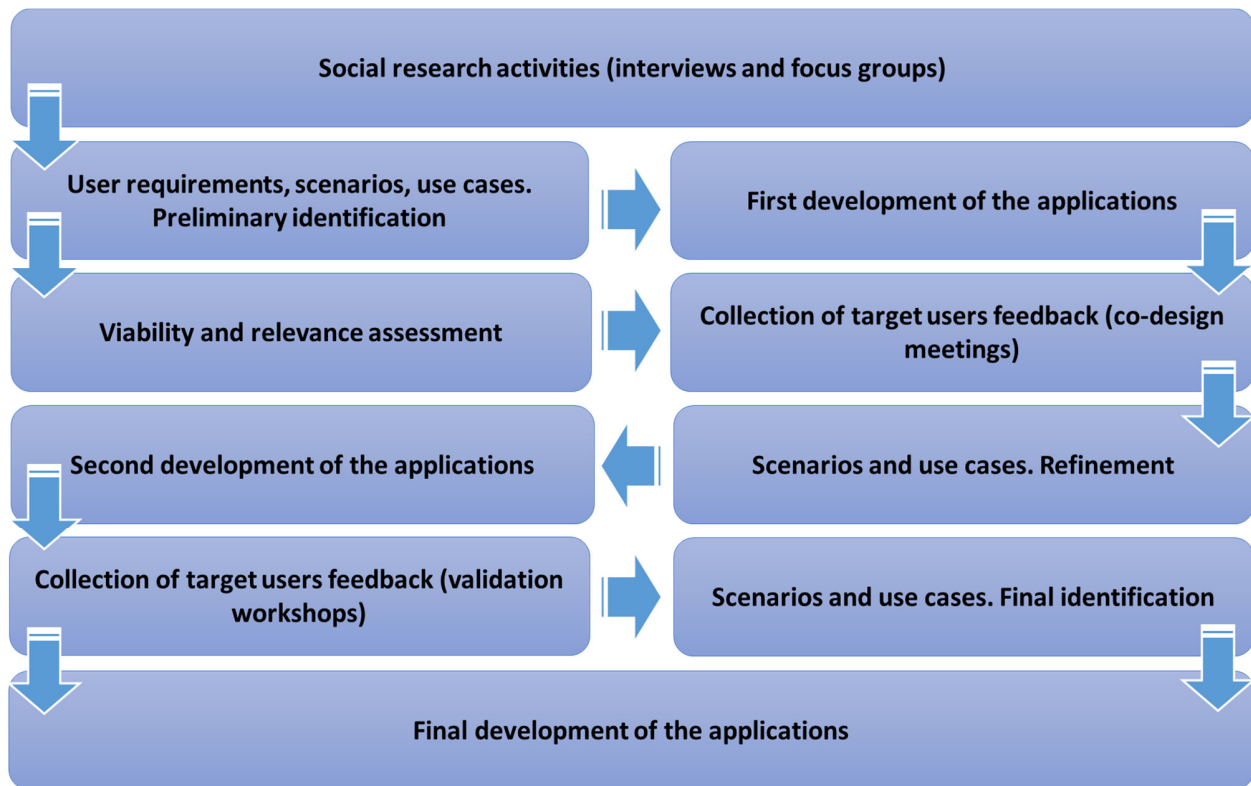


Figure 14: Process of definition of users' requirements, scenarios and use cases

## 6.1. Users' requirements

### 6.1.1. Public administrators and planners

- They are interested in (and/or they are asked to) improving the energy, monetary and environmental performances of the institution they belong to or they work for;
- They need to identify which are the most appropriate measures for energy reduction;
- They need to have easier access to data about the current situation;
- They need to make simulations of the impact(s) of different measures (e.g. buildings refurbishments, energy from RES, normative frameworks, etc.);
- They need to identify discrepancies between expected and actual results of the measures that were undertaken;
- They need to adjust the variations of energy consumption to external factors, in order to evaluate the actual effectiveness of the measures that have been adopted;
- They need to have the possibility to make reliable comparisons among areas (e.g. districts) and periods, in order to identify where measures are more needed and where there is a higher possibility of improvements;
- They are interested in spreading good energy consumption practices among the population.

### 6.1.2. Building managers

- They are interested in (and/or they are asked to) improving the energy, monetary and environmental performances of the buildings they manage. Monetary aspects are in general more relevant than the others are. However, the attention towards environmental issues may be present, especially for public buildings;
- They need to have easier access to more detailed and accurate data about the current situation of the building(s) they manage: energy consumption, energy distribution, indoor temperatures, air quality, etc. That is also in order to reply to complaints and to better orient the daily energy-consuming practices of building users;
- They need to easily identify anomalies (both structural and contingent) in energy consumption in order to adopt fast countermeasures;
- They need to be informed about changes in the factors affecting costs (e.g. variations of tariffs) and emissions (e.g. variations of energy mix);
- They need to make simulations of the impact(s) of different measures. For example, residential buildings managers need to show and present the results of these simulations to householders for approval;
- They need to identify discrepancies between expected and actual outcomes of the measures that have been undertaken;
- They need to adjust the variations of energy consumption to external factors (e.g. outdoor temperatures, occupancy rate, building volume, etc.), in order to evaluate the actual effectiveness of the measures that have been adopted;
- They need to have the possibility to make reliable comparisons and confrontations among buildings, parts of buildings, and periods, in order to identify where measures are more needed and where there is a higher possibility of improvements;
- They need to have benchmarks for the energy consumption of the buildings they manage in order to evaluate their energy performances;
- They want to improve communication with the energy provider (e.g. more transparency in bills, accessible meters, etc.).

### 6.1.3. Energy utilities professionals

- As private companies they are mainly interested in increasing revenues/profits;
- Secondly they are interested in displaying interest in environmental issues to public authorities, to customers and to the public;
- They need more accurate and detailed data about the distribution and consumption of energy in order to optimize and make more efficient the system(s) they manage as well as to avoid malfunctions, failures and related complaints;
- They are interested in peak shaving and, more in general, to balance energy offer and demand;
- They could take advantage of making people (public authorities, energy managers, building managers, householders) aware of peak-related issues.

## 6.2.Scenarios

### 6.2.1. Public administrator – Urban Renovation Sector

The head of the Urban Renovation Sector of the Municipality enters the DIMMER portal by using her credentials as ‘public administrator and planner’. She visualizes the 3D representation of the town. Every building has a different color depending



on its consumption/volume ratio. She excludes the non-residential buildings from the visualization and finds a massive concentration of orange/red hues in some social housing zones. She wants to check the trend of consumption in one of the social housing district where many major refurbishments have recently been carried out. She selects the area and asks DIMMER to visualize the annual thermal energy consumption of the last three years adjusted to outdoor temperatures. She notices that consumption has actually declined, albeit slightly less than expected. As the recent refurbishments might have led to a population increase in that zone, she wants to verify whether the increase in consumption is due to the population increase or not. She normalizes the thermal energy consumption for population but the buildings' colors of the buildings do not change significantly.

The Urban Renovation sector of the Municipality works on reducing the energy footprint of the town. She enters the “cost tool” and performs a citywide simulation of many interventions (photovoltaic panels, change of buildings' heating systems and requalification of thermal insulation). Some of the results she get from simulations are encouraging. However, given the high time of return of the investments, major revisions of the financing schemes would be needed.

### 6.2.2. Energy and facility manager – Service sector

The Energy Manager of the University Campus is at work on the DIMMER portal. He visualizes the graphs, showing the consumption of energy for the last year, both for the overall campus and for each building. In order to meet its carbon targets, the University Campus is planning to improve the energy certificate rating of the library from a D to a C. Indeed, it emerged that the consumption of the library was the highest, corresponding to one eighth of the overall consumption of the University Campus. He finds some anomalous values related to changes that have occurred in the ratio between winter and summer consumption that could be due to the air conditioners that have been recently installed in that building.

An analysis of the energy consumed by the building provided by DIMMER highlights that electricity consumption must be reduced (or electricity generation within the district must increase) by 90 MWh per year in order to reach a C energy certificate rating, which is not achievable with available energy infrastructure in the building. Nevertheless, DIMMER also provides an analysis of the energy infrastructure available in the buildings connected to the library through the electricity, heat and gas networks. This analysis also includes an estimation of the spare electricity (and heat) generation capacity in each building, and the available network capacity required to transport the energy to the library. DIMMER identifies the most convenient energy infrastructure that can be managed to deliver the 90 MWh per year required by the library (in addition to the energy losses throughout the network) and proposes the relevant operation scheme for this infrastructure. An improvement in the energy certificate rating does not guarantee a reduction in carbon emissions and costs, as carbon factors and prices vary with time. Accordingly, on top of providing the additional 90 MWh per year to the library, DIMMER is used to formulate an operational regime for electricity and heat infrastructure to also reduce carbon emissions and costs. DIMMER provides flexibility to prioritize either carbon or economic benefits. If the economic benefits are prioritized, DIMMER proposes a regime that provides the 90 MWh of electricity per year required by the building, while also reducing total carbon emissions by 1% and electricity costs by 5%. Otherwise, if carbon reductions are prioritized electricity costs can be maintained at the same level while mitigating emissions by 5%.

### 6.2.3. Building administrator - Residential sector

Maria is a professional building administrator. The apartment buildings that she manages have centralized heating system or are connected to the district heating network. Since the next apartment owners meeting is going to take place in a few days, she logs into DIMMER and opens the building of 23, Vienna Road. She controls the trend of consumption for thermal energy with values adjusted to outdoor temperatures. As confirmed also by the benchmarking service, consumption values are indeed relatively high if compared with buildings having equivalent characteristics.



She asks for a simulation of the effects of some refurbishments, in terms of level of consumption, cost and payback period. During the last few years, in many of the apartments of the building, landlords-tenants conflicts have been preventing the adoption of even the most basic energy improvement measures. However, the results she got through the refurbishment simulation tool demonstrate that changes are at reach and that should no longer be postponed. By means of the Community Portal tool, she gives notice of the results she got to the tenants of the building.

#### **6.2.4. Energy utility professional - District Heating utility**

The head of the Planning and Development Office of the local DH company accesses the DIMMER portal as "energy utility professional". He visualizes on a map the peak shaving index for all the buildings connected to the DH network. Results derive from simulations based on the parameters he set through the Energy Efficiency Engine. He identifies some optimal results in terms of reduction of primary energy use, CO<sub>2</sub> emissions and increased spare heat generation capacity. In this way, he gets the data allowing him to have a clearer picture of the zones toward which the DH network should expand first. He uses the data to produce a report that he will give to the Commercial Office. The Commercial Office too will benefit from all these simulations. Indeed, they considerably increase its possibility to work on the conception of new effective tariff schemes and new commercial offers for building administrators.

#### **6.2.5. Energy Service Company**

DIMMER identifies the automation needs required to optimally manage energy infrastructures in real time. DIMMER estimates that, should this infrastructure become automated, the University's campus could meet its current energy needs at lower carbon and economic costs, while providing valuable capacity services to the distribution and transmission networks, and energy services to the wholesale electricity and balancing markets. In light of this, an ESCo is willing to make an agreement with the University, which entitles it to a share of the revenue associated with the provision of capacity and energy services for the next 5 years in exchange for investing in the required automation infrastructure. This agreement benefits the University by providing it with automation infrastructure, lower carbon and economic costs and a share of revenue from the provision of services.

## 7. CONCLUSIONS

### 7.1. Actions carried out

In the three years of the project, T5.2.1. has provided support and suggestions to the other DIMMER’s WPs in term of:

- Users identification
- Users engagement.

**The actors interacting with an energy urban district** have been identified, beginning from the study of the two pilot districts in Manchester and Turin.

These actors have been classified as follows:

- **Public administrators and planners;**
- **Energy utilities professionals;**
- **Building managers;**
- **Building and district users.**

Each one of these categories of users have been described (Users profiles, Chapter 5) based on the following features:

- Main responsibilities;
- Goals and tasks;
- Environment;
- Energy saving barriers;
- Informational barriers and needs.

Specific visualization tools have been developed for three of these categories: **the target users of the DIMMER applications**, described in the following table:

Target user categories	Included stakeholders	Description
<b>Public administrators and planners</b>	Public administrators at district, municipality, province, region level	Twofold role: - they have a planning, regulatory and "community" role: they can decide about incentives, energy and environmental policies and have a cultural and educational role for citizens. They are involved in local energy plans; - as building owners, they are "building managers" and energy managers.
	Planners: professionals who support the public administrations	They can be urban energy planners, urban planners and district energy planners
<b>Building/Estate managers</b>	Building administrators (residential sector)	They are appointed by homeowners for the management of the buildings and related energy issues
	Building/estate owners of public and private buildings	Ex.: residential buildings, educational and health facilities, commercial buildings and services
	Real estate agents	Professionals who sell and rent out property
	Building energy designers, energy designers, architects, building designers	They are involved in refurbishments and alternative (local) energy supplies (such as PV arrays) plans

Target user categories	Included stakeholders	Description
Energy utilities professionals	Enterprises that provide and sell energy and that manage energy grids and networks	
	Energy Service Companies	ESCOs
	ICT professionals	They develop applications for energy saving and energy management

Table 6 - Stakeholders included in the target users categories

The **target users** have been involved in a **participatory planning process** (Figure 15) – co-design and validation meetings, in order them to be the drivers of the development of the visualization tools and applications. This process has been carried out through the establishment and continuous re-shared definition of:

- **user requirements;**
- **scenarios;**
- **use cases.**

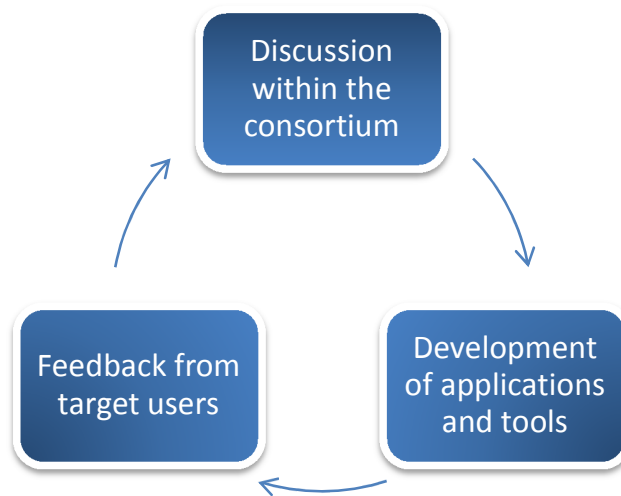


Figure 15: The participatory planning process with target users

The **Building users** have been involved in **dissemination and information actions** in order to improve their awareness of energy issues.

## 7.2.Results

The following diagram represents the main results of the work carried out by the task 5.2.1 about the **identification and involvement of users and stakeholders**. Users are the social actors who interact with energy systems at district level.



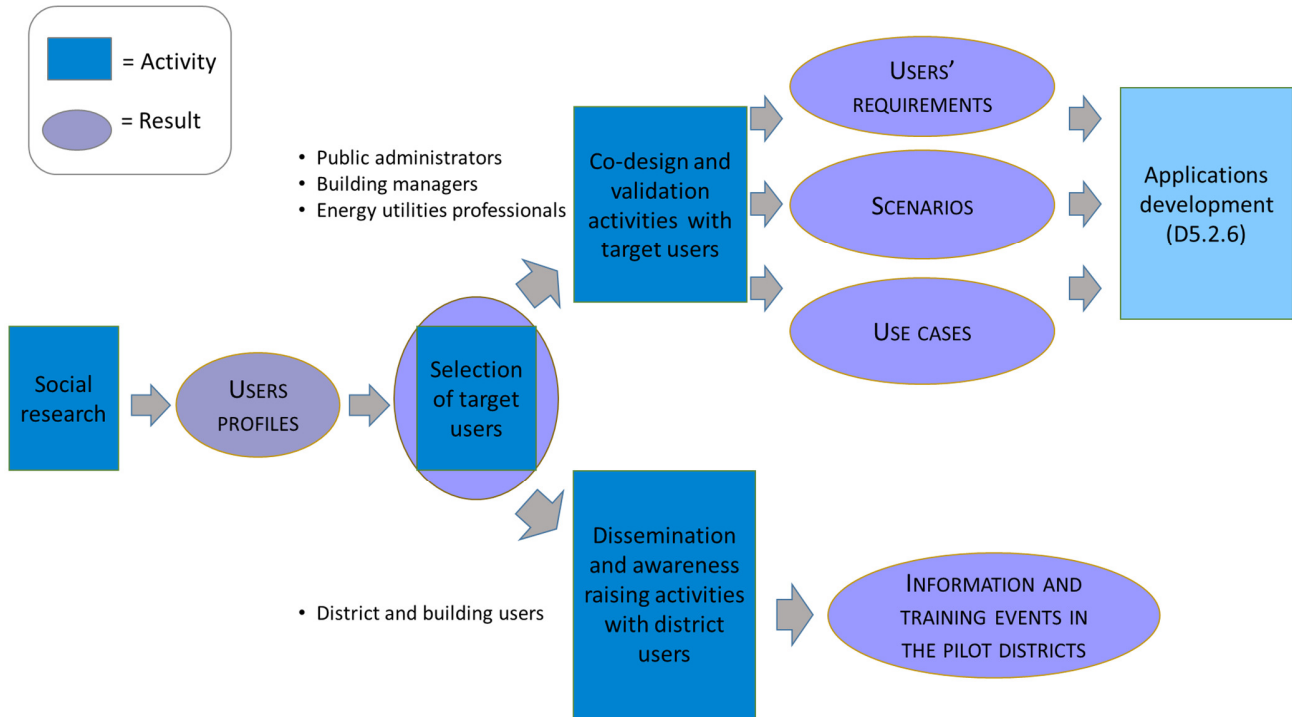


Figure 16: T5.2.1 results and activities

The following diagram represents the main results of task 5.2.1 about the **identification and involvement of users and stakeholders**. Users are meant here as the social actors interacting with energy systems at the district level.

The following are the aspects that turned out to be critical and extremely important in fostering ICT innovation processes aimed at energy saving, taking into account the social impacts and features.

All activities carried out with the human actors of the energy systems underlined that **there is not a unique and effective motivation for energy saving**. The economic motivation, despite being prevalent, is not valid for everyone or for every context. It is the case, for example, of offices workers that do not pay for the energy they consume at the workplace. In the same way, the economic motivation is not cogent for the wealthiest. Therefore, it is important to consider all kind of levers for energy saving - money, environment and health, in order to promote the required behavioral change.

**Energy saving barriers do not only derive from lack of information**. The **structural problems** of the buildings often affect their energy performance significantly and there are **asymmetries of access to energy data among different kinds of managers and users**. This means that material and organizational innovations need to be implemented together with ICT innovations.

The **awareness** of the need to save energy and the interest in environmental problems are raising and there is a **social request of information and education in this field**. Energy data should be used also for these purposes and not only for the automation of energy systems. For example, many people ask to know which are the best practices for energy saving in daily practices.



In this field, **ICTs can play an essential role**. The general tendency towards digitalisation is confirmed. However, digital divide phenomena can occur, especially with the elderly which are a considerable portion of the population.

A **critical aspect** concerning the share of energy information due to IC technologies is **data availability**. Several factors can affect data disclosure, mainly privacy issues and business decisions. Anyway, the availability of suitable data of sufficient quality is an essential aspect for the proposed tools and systems to operate effectively. Some solutions have been identified in the DIMMER project: the association of consumption with geometric data and the possibility of voluntary inclusion of building data by applications' users. Anyway, a deeper consideration of this aspect is required and research and policy initiatives should be undertaken in order to overlap this barrier.

Building managers and building users report a **lack of transparency** and ask to receive more and more frequent energy consumption data from the provider, together with easier and more readable bills and meters. At the same time, bills should allow comparisons among buildings and periods to be done.

Finally, **the district dimension** and in general the communal dimension of energy consumption are not felt as relevant neither by the building managers nor by the district users. Energy consumption is mostly seen as an individual matter, as well as the related practices. Only public administrators and energy utilities professionals have a wider view, which is due to their roles and competences. Anyway, in order **smart energy grids and smart energy communities** to be developed, it is important for people to become aware of the fact they are part of a wider energy community where they can play proactive roles. More projects and policies supporting this vision are still necessary.



## REFERENCES

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## ANNEX – INTERVIEWS OUTLINES

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### Building Managers - Facility and Energy managers

#### Personal details

- Age, gender, formal role related to the building.
- Since when are you been working on this building?

#### Mapping the socio-technical system

- Which are the actors using the building and how do they use it? [activities, roles, interactions]
- (TURIN) Which, among these actors, have a (formal and/or informal) role / carry out actions which influence, the thermal aspects of the building?
- (MANCHESTER) Who, among these building users, have a (formal and/or informal) role / carry out actions which influence the energy use in the building?

*[examples if necessary: decisions about thermal regulations, investments, maintenance, ventilation, use of chronothermostats, changing clothing, use of supplementary heat sources, control/check on consumption, decisions about changing energy supplier, communications with energy supplier, etc.]*

- Is there an energy manager for this building?
- (TURIN) Which are the external actors influencing the thermal management of the building?
- (MANCHESTER) Are there any external people influencing the energy use of the building?

*[e.g. home owners, investors, energy suppliers, public policies and directives, other agencies, associations,...]*

- Have there ever been disputes/disagreements on issues related to energy consumption or thermal comfort? How were they addressed?

#### Interviewee's working practices

- (TURIN) With reference to the thermal aspects of this building, what are your main tasks? Which actions do they comprise? How do you monitor energy usage and consumption?
- (MANCHESTER) With reference to the energy use of this building, what are your main tasks? Which actions do they comprise? How do you monitor energy usage and consumption?

*[by means of which tools, when...?]*

- Could you give me a description of the thermal features of this building? [of both structural aspects and heating system] What are its strengths and weaknesses? [try to take into account also seasonal and extraordinary events: climatic anomalies, failures, etc.; try to pay attention to the inclusion of comfort and energy/cost saving issues]
- How do you address the weaknesses and the problematic aspects? How do you come to know of failures and malfunctions and what are the actions you undertake in these cases?
- Are there other solutions you consider more appropriate but that you can't undertake? Which? Why?

#### Change

- (TURIN) In your opinion, what could lead/motivate the previously cited actors using this building toward a reduction in/optimization of the use of thermal energy?
- (MANCHESTER) In your opinion, what could lead/motivate the previously cited actors using this building toward a reduction in/optimization of the use of thermal energy?

*[not to be suggested: policies, incentives, education, technology, information].*



- And what could motivate you in this sense?

#### Information in working practices

- Which information do you need to perform your tasks? *[How do you get it? From who? Through which medium? In which form? How often?]*
- If you would have to prioritize it, which information would you give the highest priority? And why?
- What are the weak points of the information you get? *[in terms of frequency, form, quantity, quality]*
- With reference to energy consumption, are there periodical reports you must produce or information you must give to other actors? Could you give/show us some examples?
- (TURIN) If it were possible to extend and improve the information (both inbound and outbound) about the thermal consumption of this building, what would be your suggestions?
- (MANCHESTER) If it were possible to extend and improve the information (both inbound and outbound) about the energy consumption of this building, what would be your suggestions?

*[Through which device? (Desktop, portable, smartphone...); By means of which virtual interface? (newsletter, website, apps...); How frequently? How should it be represented- texts, figures, graphs, images, sounds, symbols?]*

#### Participation to DIMMER

- *[After having exposed the objectives of the project]* Could you suggest other people or actors we should/could involve into the project?

## Building users – Householders

### Personal details

- Age, gender, occupation, formal role in the apartment building
- Do you live alone or with others?
- Are you home owner or tenant?
- Since when are you living in this flat?
- Did you plan to continue living in this flat? For how long?

### Utilization/usage and presence in the flat

- During a typical winter working day (referring to the last winter), who lives in the flat? In which hours of the day?

### Perception and knowledge of the thermal system

- Which kind of thermal system do you have in this flat/building?
- What are, in your opinion, the positive and negative aspects of this flat/building, with reference to the thermal system and its management? *[Including seasonal and extraordinary events]*

### Perception and definition of comfort

- In your opinion, how much is this flat warm during wintertime? And what about the opinion of the other members of the family/flatmates?
- During wintertime, how many degrees would you like to have in your flat? And how many in your office/work place? *[during both daytime and night time]*
- During wintertime, what do you wear while staying at home?

### Thermal practices

- Did it happen you to intervene on aspects concerning the thermal consumption or thermal comfort in this flat? Which was the outcome you obtained?



*[Read the following examples if necessary: changing temperature using valves, ventilating, setting chronothermostat, changing clothing, using a supplementary thermal source, deciding on investments, checking consumption, communicating with the energy supplier, move to another room of the flat...]*

- Did you think to intervene in other ways, but you never did it? Would you intervene in other ways if it could be possible?
- What do you do when the temperature in your flat is too hot or too cold?
- In case of malfunction or failure of the heating system, what did you do? *[If it never happened, “what would you do?”]*
- Do you use any device to set or to know the temperature in your flat, like internal/external thermometers, thermostats, valves? What's the temperature they show? Do you usually use weather forecasts in order to know the (following day/s) external temperature?
- Ask the interviewee to sort the rooms of his/her flat from the hottest to the coldest. In case, ask for the reasons behind the differences. *[are they due to physical features or are they due to deliberate decisions?]*
- Do you have double glazed windows or other types of insulation? Did you install them or where they already installed when you moved to the flat?
- When there is nobody at home, how do you set the heating? *[for a few hours, for 1-2 days, during vacation..]* What about night time?

#### Change

- In your opinion, what could lead/motivate people toward thermal energy savings? *[not to be suggested: policies, incentives, education, technology, information]* And what could lead/motivate you in this sense?

#### Technology for change

- Which ICT devices do you use? For which purposes? *[apps, shopping on line, social network, e-banking...]* In which occasions?
- Do you have access to any information about your heating consumption/bill in your flat/building? How does it come to you? *[in terms of form, support, frequency, quantity, quality]*
- If it were possible, would you like to receive/give extended and improved information about the thermal consumption of your flat/building and about thermal comfort? Which device would you like to use to visualize this information? Which kind of virtual interfaces would you prefer *[newsletter, website, apps...]*? How frequently? How should it be represented? *[texts, figure, graphs, images, sounds, symbols...]*

#### Participation to DIMMER

- Would you like to participate in the experimental/next phases of DIMMER project? *[feedback submission, active participation in meetings and working groups, sensors installation]*

### Building users - Workers and Students

#### Personal details and general information

- Age, gender, occupation, formal role in the apartment building
- How many people are working in this building?
- Since when are you working here?

#### Utilization/usage and presence in the flat

- During a typical winter working day (referring to the last winter), who uses this building? In which hours of the day?

#### Perception and knowledge of the thermal system

- Which kind of thermal system is there in this building?



- Which are, in your opinion, the positive and negative aspects of this building, with reference to the thermal system and its management? *[Including seasonal and extraordinary events]*

#### Perception and definition of comfort

- In your opinion, how much is this flat warm during wintertime? And what about the opinion of the other workers/colleagues?
- During wintertime, how many degrees would you like to have in the rooms you use? And how many in your house? *[during both daytime and night time]*
- During wintertime, what do you wear while staying in this buildings/your office? *[questions + observation]*

#### Thermal practices

- Did it happen you to intervene on aspects concerning the thermal consumption or thermal comfort in this building/your office? Which was the outcome you obtained?

*[Read the following examples if necessary: changing temperature using valves, ventilating, setting chronothermostat, changing clothing, using a supplementary thermal source, deciding on investments, checking consumption, communicating with the energy supplier, move to another room...]*

- Did you think to intervene in other ways, but you never did it? Would you intervene in other ways if it could be possible?
- What do you do when the temperature in your office is too hot or too cold?
- In case of malfunction or failure of the heating system, what did you do? *[If it never happened, "what would you do?"]*
- Do you use any device to set or to know the temperature in this building/your office, like internal/external thermometers, thermostats, valves? What's the temperature they show?
- Ask the interviewee to sort the rooms of the building from the hottest to the coldest. In case, ask for the reasons behind the differences.
- Do this building/your office has double glazed windows or other types of insulation?
- When the building is not used how is the heating set? What about nighttime?

#### Change

- In your opinion, what could lead/motivate people toward thermal energy savings? *[not to be suggested: policies, incentives, education, technology, information]* And what could lead/motivate you in this sense?

#### Technology for change

- Which ICT devices do you use? For which purposes? *[apps, shopping on line, social network, e-banking...]* In which occasions?
- Do you have access to any information about the thermal energy consumption/expenditures of this building? If yes, How does it come to you? *[in terms of form, support, frequency, quantity, quality]*
- If it were possible, would you like to receive/give extended and improved information about the thermal consumption of this building/your office and about thermal comfort? Which device would you like to use to visualize this information? Which kind of virtual interfaces would you prefer *[newsletter, website, apps...]*? How frequently? How should it be represented? *[texts, figures, graphs, images, sounds, symbols...]*

#### Participation to DIMMER

- Would you like to participate in the experimental/next phases of DIMMER project? *[feedback submission, active participation in meetings and working groups, sensors installation]*
- In your opinion which other people working in this building should/could be involved into the project?



## Energy utilities

### Operational personnel

#### General questions

- We need to explain district heating to other subjects. Could you please give us a simple description of it? [*how many plants, which kind of plants, which natural resources it uses, distribution pipelines, sub-stations, metering, malfunctions, contact-center, etc.*]
- What are the strengths and weaknesses of district heating in Turin?
- What have been the recent developments and what goals/developments are planned/expected for the near future?
- Could you tell us which are the main fields of activities / sectors / roles in Iren?
- You have signaled us some people / roles we should involve in the interviews. Why did you choose them? What do they do and what are their fields of interest and expertise?

#### Personal details

- Name, job title, professional career
- Since when you have been with Iren?
- Short description of the area of responsibility in the company.

#### Working practices

- Can you describe what your field of activity in the company mainly involves?
- What kind of interdependencies to other company departments exist?
- What kind of motivations or strategies in relation to your value chain/ business model are important?
- What are the most important tasks in the light of your field of activity?

#### Information in the workflow

- Which information is especially important for your job? Why?
- How do you obtain this information in your daily workflow?
- How (in which form) is this information represented? How often do you come across this information in your daily workflow?
- If you would have to prioritize it, which information would you give the highest priority? Why?
- If it were possible to extend the available information and improve it, what would be your suggestions? In which area of your activity do you think it would be most useful?
- Do you use special technical tools (hardware tools, computer software)? Which ones? Which technologies do they employ?
- What would be a reasonable improvement in the information management from your perspective?

## Executive positions

*President, IREN Group S.P.a.*

- Energy resources scarcity, energy security and climate change are taking an increasingly important and recognized role as issues that need to be tackled. Response strategies seem to coalesce around the concepts of "efficiency" and "intelligence" (smart city, smart grid). We intend to investigate how it is possible, from your point of view, to identify a company, a territory, a city that is structured according to these guiding principles.
- The innovation processes aimed to improve efficiency and energy savings bring into play actors at different levels: politicians/public administrators, private companies, universities and research centers, as well as citizens/consumers. We are interested in deepening which obstacles and constraints are placed on each one of these subjects, Iren included.
- We intend to discuss about the space and role social sciences might have in projects and processes that, like DIMMER, seem to have a predominant technological character.

*CEO, IREN Energia*

- Under which aspects does Iren Energia differs from the other companies of the same sector?
- What are the most important actors with whom Iren operated, either as part of its "ordinary" activities "ordinary" and in innovation paths (e.g. European projects). For which skills, knowledge and technology Iren looks for external collaborations?
- Could the Turin area be considered a favorable environment for the activities of Iren Energia?
- The district heating in Turin: strengths and weaknesses, constraints, recent and future developments.
- Could the emergence of the environmental awareness, linked to the problems of resource scarcity and climate change, facilitate or, on the contrary, hinder the activities of Iren? Is Iren adapting to them?

## Public Administrators

*Councillor for Innovation and Development, Public Works, Environment, Urban Green and Sanitation, Municipality of Turin.*

- Which are the competences, strategic lines and initiatives for the Municipality of Turin to foster energy savings in private and public buildings, also related to the issue of air pollution?
- Are there innovative projects at sight related to energy management of public buildings?
- Which information about district heating do you receive for the accomplishment of your tasks? And which energy information about Municipality's buildings. Are there supplementary or improved information and data you would like to receive?

*Energy Manager, Municipality of Turin:*

- Could you please describe your role and tasks as Energy Manager of the Municipality of Turin?
- Which information about district heating do you receive in the accomplishment of your duties? Which more or better information you would like to receive? And how?
- Based on the research activities conducted so far, we think it would be beneficial for the public buildings managers to receive information – at present they do not receive at all - about the energy consumption of their buildings. This is also due to their role as disseminators, as well as for the possibility to engage in virtuous competitions on energy reduction objectives. Do you think such an innovation could come to be useful? Do you think it could take place?





*Coordinator VI Commission of Borough 1 (Ecology, environment, public green spaces);*

*Coordinator II Commission of Borough 1 (Urban development, transport, private sector buildings);*

*Coordinator I Commission of Borough 1 (Public accounts and building stock).*

- Which are your tasks as Borough 1?
- Which are the activities the Borough 1 carry out about energy issues? Is the Borough 1 in charge of energy issues?
- Which information do you receive about the energy management of the Municipality of Turin's buildings. And which about district heating?
- Which supplementary information you would like to receive?

## **Building administrators associations**

*ALAC Torino and ANACI Torino*

- Could please give us some information about your association?
- Could you please tell us something about the situation of the building administrators associations? In Turin and in Italy?
- For what refers to the buildings connected to district heating, which information do you receive from IREN?
- Which information about the energy aspects do you give to householders?
- What could be done to improve both outbound and inbound communication about energy in order to make your tasks easier.