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OrbEEt

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Collaborative Project

D1.1 End-user & business requirements

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Description of the related task and the deliverable in the DoA	This task will establish the requirements of the entire OrbEEt framework in terms of business requirements – how to address customer business objectives by bringing added value to their core operations without disruptions – as well as end-user requirements – the functional and non-functional requirements encompassing user preferences and desires that will steer design & development for effective organizational behaviour change. In more detail this task will define a consistent set of requirements considering Pilot facilities, building structures, technological components and existing infrastructures/ networks, along with the requirements that will satisfy high rates of user acceptance. User and Business Requirements will be defined in collaboration with the pilot users of the project that will ensure the participation of the building occupants and employees in surveys that will define the specificities that need to be respected for the successful penetration of the OrbEEt technologies and concept in the every day activities and practices of the pilot organizations. A structured methodology, starting from the definition of representative business scenarios, respective use cases and involved actors will lead to the extraction of detailed business and user requirements that will subsequently guide the overall design and specifications of the OrbEEt framework, to be performed in tasks T1.2, T1.3 and T1.4.					
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1. PUBLISHABLE EXECUTIVE SUMMARY

This document aims to define the requirements of the OrbEEt framework. A detailed description of the followed methodology for the extraction of End user and Business requirements is provided at the beginning of the deliverable.

It has been prioritized the importance of the pilot buildings characteristics. The description of the four pilot buildings´ typology, singularities and limitations has set the boundaries for the OrbEEt framework implementation.

The business scenarios and the use-cases related to OrbEEt were developed taking into account the objectives of the project and the needs of the proposed platform.

Two main business scenarios are provided in this deliverable:

- The first business scenario deals with the real time visualization of building operation parameters, which derives into two main use cases that address the need of an enriched visualization of both building operation and business process ratings for facility managers and business analysts.

- The second business scenario deals with the establishment of an engagement framework towards a motivating social environment and the appropriate feedback provision mechanisms to ensure persistent energy saving behaviours. The use cases based on this business scenario have addressed the needs of providing personalized and actionable feedback to the participants (via smartphone game and intranet portal), defining generic actions towards stimulating a positive energy culture (through in-office displays), and encouraging players to discuss and share their performance and tips on how they reach their targets.

Based on these five use cases, functional and non functional requirements have been obtained. They were prioritized with respect to the importance and fulfilment of the project concept and goals.

- The first group covers all the operations and activities the OrbEEt framework must be able to perform. It has been divided into four main areas, which serve to describe the functionalities and architecture of each OrbEEt framework sub system: 1) Data acquisition, collection and processing; 2) Creation of the Systemic Enterprise Operational Rating framework merging the Business Process Modelling tool and the conventional Operational Rating methodology; 3) Estimation and visualization of Enhanced Display Energy Certificates; and 4) Behavioural change strategies to establish both intrinsic and extrinsic motivators.

- The second group covers the technical constraints of the system. A list of non functional requirements has been described with regard to hardware and software limitations (WSN, displays, intranet portal), ensure functionality of end-user interfaces (response time, workload, scalability), supportability (expand the platform and promote the creativeness of the end users), security needs, interface (rapid translation and maximize visual information), the need of available in-office displays and the accessibility to smartphone and intranet portal.

This document is structured as follows:
- Chapter 2 presents the Introduction of this document.
- Chapter 3 presents the OrbEEt project summary, objectives and main stakeholders.

- Chapter 4 presents the methodology for the extraction of End user and Business requirements.
- Chapter 5 presents the pilot buildings´constraints.
- Chapter 6 presents the OrbEEt Business Scenarios.
- Chapter 7 presents the Use Case descriptions.
- Chapter 8 presents the functional requirements.
- Chapter 9 presents the non functional requirements.
- Chapter 10 presents the conclusions of this document.
- Chapter 11 presents the acronyms and terms appeared in this document.
- Chapter 12 presents the annexes A1 and A2 of this document.
- Chapter 13 presents the reference list.

2. INTRODUCTION

2.1 Purpose and target group

This deliverable provides the representative business scenarios, respective use cases, and involved actors, in order to extract requirements that guide the specification of the Systemic & Enhanced Operational Rating Models, Organization Behavioural Change Framework, and both the software architecture and hardware infrastructure.

2.2 Contributions of partners

This report is led by SOLINTEL with the contribution of COVUNI, Balkanika Energy, BHOe, Erlangen, Asparrena and Pernik municipality.

SOL, Balkanika Energy and COVUNI were responsible for the definition of Business Scenarios and the description of related Use Cases.

The functional requirements were provided by SOL and Balkanika Energy while COVUNI contributed with the analysis of the non-functional requirements.

The four partners responsible for the pilots (BHOe, Erlangen, Asparrena and Pernik municipality) defined and described the building requirements with regard to their infrastructure, occupants and legal constraints.

2.3 Baseline

This deliverable is scheduled as an initial output from the project, establishing the requirements of the entire OrbEEt framework.

To aid in the preparation of Pilot Building Requirements, which must take into account the ethical rules of the EU and the countries where pilots are sited, this report reviews the Data Protection legislation of these countries, alongside the European Union Directives and HORIZON2020 regulations:

- *Austria- Data Protection Act 2000 (Datenschutzgesetz 2000 – DSG2000)*
- *Germany - Federal Data Protection Act, 2003 (amend. Federal Law Gazette 2009)*
- *Spain – Organic Law 15/99 (amendments : Royal Decree 424/05)*
- *Bulgaria - Personal Data Protection Act, 2001.*
- *European Union – Directives 95/46/EC & 2002/58/EC*
- Horizon 2020 Rules for Participation: Ethics Reviews (Article 14)
- Horizon 2020 - Regulation of Establishment: Ethical principles (Article 19)
- Model Grant Agreement: Ethics (Article 34)

2.4 Relations to other activities

This deliverable is provided in the very early stage of the OrbEEt project, and therefore the only available but critical input comes from the work performed in Task 2.1, whereby a detailed auditing of pilot site premises is being carried out.

The outputs of this deliverable will guide the overall design and specifications of the OrbEEt framework performed in Task 1.2 "Systemic & Enhanced Operational Rating Models

Specifications", Task 1.3 "Organization Behavioural Change Framework Design & Specifications" and Task 1.4 "Technology Framework Design & Specifications".

3. ORBEET PROJECT SUMMARY

3.1 Introduction

OrbEEt will establish a holistic organizational energy performance framework, that will boost standardized energy performance rating practices by incorporating business and behavioural information.

The fusion of these three currently disjoint worlds (Building Operational Rating, Business Process Modelling and Organizational & Behavioural Change) will be conducted by means of a trusted Systemic Enterprise Operational Rating framework that also presents the ability of real time building monitoring, continuous measurement of the impact of different activities on overall building energy performance, and relevant feedback aiming to trigger sustainable behaviours.

3.2 Objectives of the project

The three main objectives of OrbEEt are:

1) OrbEEt aims to leverage existing standards and methods of Building Operational Rating (OR) to deliver a mechanism for real-time extraction and calculation of detailed, fine-grained, dynamic parameters; subsequently providing continuous feedback on the present value estimation of the Building Operational Rating. More specifically, the OrbEEt framework will continuously capture and analyse real time building information from low-cost, off-the-shelf non-intrusive sensors and convert this into meaningful real-time energy rating information (real-time Display Energy Certificates).

2) OrbEEt aims to align the building energy data with organization operational activities and thus allow for a more systemic and holistic view over the organizational energy performance. Buildings will be treated as hosts of occupants and activities, rather than passive structures. Consequently, operational ratings will be calculated at the level of business processes and organizational units establishing direct accountability of the latter to the overall organization energy performance. This will be achieved through enhanced Display Energy Certificates, which is the core outcome along with the framework that generates them (Systemic Enterprise Operational Rating framework). eDECs depict high granularity and real-time information about the energy performance at various operational spatio-temporal levels.

3) Behavioural change will be triggered in the scope and context of organizational dynamics and business activities, treating occupants not only as individuals but also as members of an organizational ecosystem. The establishment and availability of enhanced DECs will facilitate the design and implementation of comprehensive behavioural change strategies that touch upon both intrinsic and extrinsic human motivators.

3.3 Primary actors in the OrbEEt system

Table 1. OrbEEt actors

Actor	Actor description
Building occupant	Building occupants are the participants of the project, they will be treated as organizational actors. They will be stimulated through eco-visualizations and in-display visualizations with timely and actionable feedback to ensure a persistent energy-saving behaviour.
Facility manager	This actor could be a facility owner, third-party company or a person responsible for the operation and maintenance of all the different systems within a facility (e.g., HVAC, lighting, etc). In the OrbEEt project, the facility manager is seen as a human operator interacting with OrbEEt system and is responsible for the continuous performance analysis (through the Systemic Enterprise Operational Rating framework), as well as the implementation of the necessary re-design and corrective actions.
Business analyst	The person who analyzes an organization or business domain, identifies organization's needs and assesses the organizational model. The Business analyst will achieve an improvement of the organizational efficiency through the systemic and holistic view over the organizational energy performance provided by the enhanced Display Energy Certificates.

It is important to note that the business perspective of the project is not the same for the whole group of stakeholders addressed. While, facility managers and business analysis are the main stakeholders that are of interest of OrbEEt framework towards the establishment of an energy efficiency environment, building occupants are directly affected by the interaction with the platform. Therefore, they are classified as follows:

-   Primary Stakeholders: Facility Managers and Business Analysis with direct business impact from the operation of OrbEEt platform

-   Secondary Stakeholders: Building Occupants through interaction with OrbEEt platform with no direct business impact

This categorization is provided to highlight the impact of the project to the main system stakeholders. Though the goal of the project is to examine the whole building ecosystem, addressing the different operational roles in premises.

4. METHODOLOGY

In OrbEEt project a methodology aimed specially to the extraction of End user and Business requirements has been developed. This methodology consists of four basic steps used to gather the ideas and judgements from the consortium partners with a high involvement of the four pilot representatives allowing us to build the requirements list based on the identified needs.
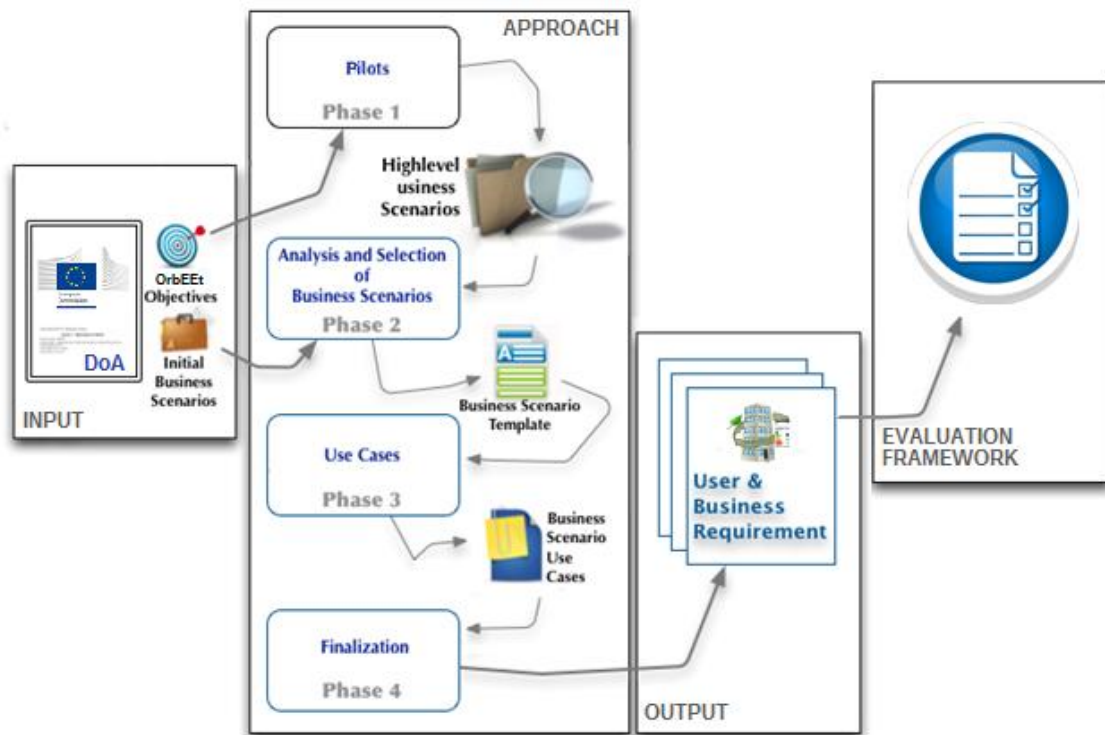
Figure 1 Overview on the User & Business Requirements definition approach

A further explanation of the above figure is presented below:

Step 1: Pilot buildings

The first phase of the process is the analysis of the four pilot buildings in the project: Interdisciplinary Centre for Health Technology Assessment (HTA) and Public Health (IZPH), Imperial Palace Innsbruck, Asparrena Town Hall and the Administrative building in Pernik. The purpose of this analysis is to obtain a better awareness of the characteristics of these building pilots. This assessment will provide a finer point of view to decide which technologies could be implemented or improved in OrbEEt in order to successfully fulfil its main objectives.

Step 2: Analysis and Selection of Business Case Scenarios

This phase is designed to define different Business Scenarios that enclose the entire OrbEEt domain based on the results obtained from the SoA and Pilot buildings analysis. In this case,

two different Business Scenarios were developed by taking into account the objectives of the project and aiming to describe the high level business perspective of the proposed framework.
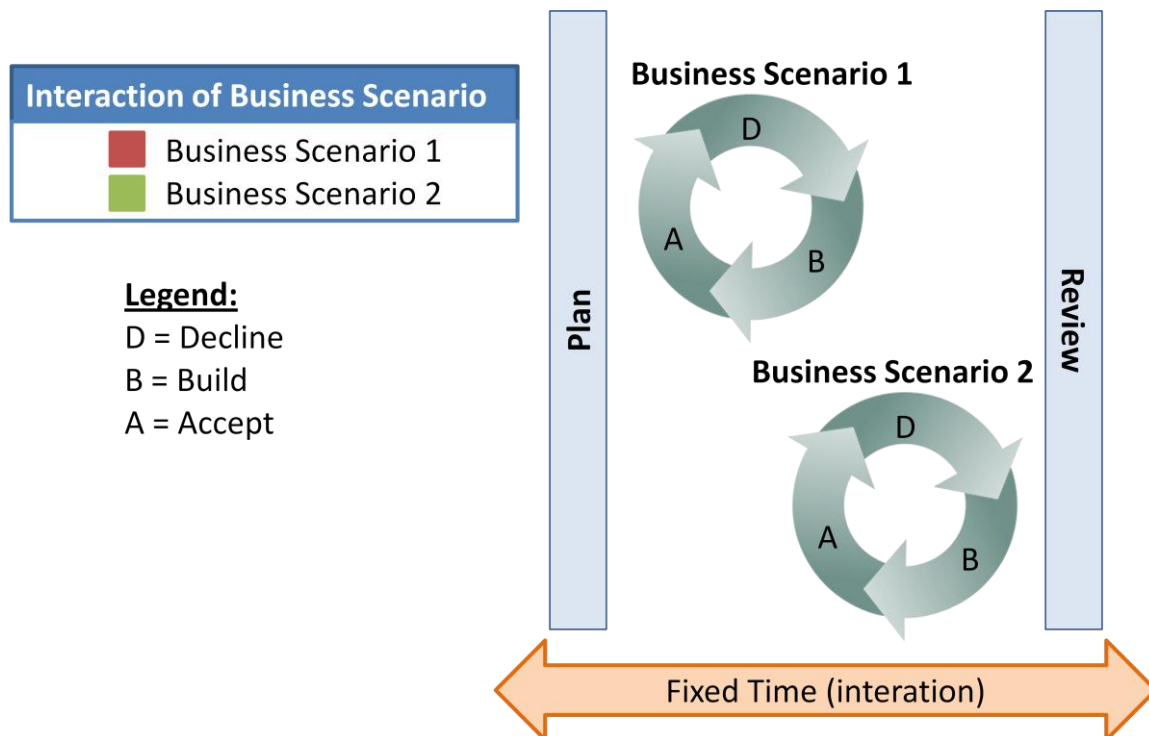
Figure 2 OrbEEt iteration framework

The final set of Business Scenarios was accepted after being reviewed by the partners, assuring that there were no duplications or overlaps and that both of them were in line with the project objectives.

Step 3: Use Cases

Following the definition of the high level Business Scenarios that set the application baseline for the implementation of the proposed framework, we further proceed with the definition of the main Use Cases, fully addressing the needs of the proposed platform. In this case, there were two Use Cases linked to the first Business Scenario and three to the second one, accounting for a total of five Use Cases.

A preliminary list of functional and not functional requirements was proposed to be further discussed with all the project partners. Among the non functional requirements, the pilot specifications set the constraints on the functionality of the OrbEEt platform.

Step 4: Finalization

In this last step, all feedback about the Business Scenarios, Use Cases and requirements list coming from the OrbEEt partners are gathered together and analysed in order to build the final output: the complete Business and User Requirements list.

As part of WP4[i], the Business Scenarios, Use Cases and requirements list will be evaluated and assessed in order to ensure the fulfilment of the requirements during the OrbEEt framework roll-out phase. An in-depth evaluation of how these scenarios and requirements

accomplish the objectives of the OrbEEt will be carried out and it will also serve to identify incorrect, incomplete or even missing requirements.

5. BUILDINGS CONSTRAINTS

The focus of this section is on the extraction of pilot site limitations (either topology limitations, organization limitations) to set the boundaries for the development of OrbEEt platform and further enable the prompt development and testing of OrbEEt framework.

The goal is not to extensively report the pilot sites selected for the project, rather to provide an overview of the selected areas along with the limitations which set the list of requirements.

5.1 Interdisciplinary Centre for Health Technology Assessment (HTA) and Public Health (IZPH)

Erlangen has selected the Interdisciplinary Centre for Health Technology Assessment (HTA) and Public Health (IZPH) as the pilot sites. The following six rooms are suitable for the project: *Director's office, Data management office I, Data management office II, Researcher's office I, Researcher's office II, and Meeting room.* A total of 12 regular staffs work in these rooms.

A list of pilot specific requirements have been defined to set constraints on the proposed framework.

5.1.1 Evaluation on office areas

Table 2. Office areas in IZPH

Number	Requirement	Obligation level
5.1	**Orbeet evaluation on office areas.** Due to the special character of the site, the evaluation of the framework should take place in office areas (no laboratory zones).	High

Director's office
The director's office contains two rooms, one for the director with an area of 22.06 m², and one for data manager with an area of 15.33 m².

Data management office I
The data management office I has an area of 38.37 m².

Data management office II
The data management office II has an area of 9.55 m².

Researcher's office I
The researcher's office I has an area of 13.47 m².

Researcher's office II
The researcher's office II has an area of 18.06 m².

Meeting room
The meeting room has an area of 23.40 m².

5.1.2 Occupants profiling analysis

Table 3. Occupant profiles in IZPH

Number	Requirement	Obligation level
5.2	**Occupants profiling analysis on pilot site.** The evaluation of the framework should consider this distinction on the workers office schedule involved in the selected pilot areas.	High

Director's office
Two regular staffs work in this office; the director takes the responsibility of the entire thing in IZPH. The data manager is in charge of data management and supports the director to handle the daily administration issues. **Working time:** director: Monday-Friday: 9:00-18:00; data manager: Monday, Wednesday, Thursday: 8:00-15:00, Tuesday: 08:00-19:00.

Data management office I
Four regular staffs work in this office, three staffs work for one project to collect data and record data. One works for another project to analyse data. **Working time:** two persons: Monday-Thursday: 8:00-17:00, Friday: 8:00-12:30; one person: Tuesday-Thursday: 8:00-13:00; one person: Monday: 8:00-13:30, Thursday: 13:00-18:00, Friday: 08:00-12:30.

Data management office II
Two regular staffs work in this office for one project to collect and record data. **Working time:** one: Monday-Thursday: 8:00-17:00, Friday: 8:00-12:30; one: Monday: 9:00-17:30, Tuesday-Thursday: 9:00-13:00.

Researcher's office I
Two regular staffs work in this office. **Working time:** one: Monday-Thursday: 8:00-17:00, Friday: 8:00-12:30; one: Monday-Friday: 9:00-15:00.

Researcher's office II
Two regular staffs work in this office. **Working time:** both: Monday-Thursday: 8:00-17:00, Friday: 8:00-12:30.

Meeting room
No regular staffs work here, but there are regular meeting every week.
    Monday: project meeting (10:00-12:00, seven participants)
    Tuesday: regular meeting (10:30-10:45, twelve participants)
          project meeting (18:00-19:00, 15 participants)
    Every two Wednesday: Young Research Tutorial (14:00-16:00, six participants)
    Small meetings are taken here if necessary.

5.1.3 Facilities in the office

Table 4. Facilities in IZPH

Number	Requirement	Obligation level

Number	Requirement	Obligation level
5.3	**Facilities in the office.** The evaluation of the facilities and the office equipment need to be considered. The framework should eliminate any disrupt on daily activities of the professionals in the site.	High

Director's office
One heating in each room, one window in each room, and one computer in each room, four fluorescent lamps in the director's room and two fluorescent lamps in another room.
There are two switches for the director's room, and one for the manager's room.

Data management office I
Two heating, two windows, three computers and one printer, twelve fluorescent lamps.
There are two switches.

Data management office II
One heating, one window, two computers, two fluorescent lamps.
There is one switch.

Researcher's office I
One heating, one window, two computers, two fluorescent lamps.
There is one switch.

Researcher's office II
One heating, one window, four computers, three fluorescent lamps.
There are two switches.

Meeting room
Two heating, two windows, eight fluorescent lamps.
There are two switches.

There is no cooling process in the center, just an electric fan in each room.
In the IZPH pilot areas there are no devices where to display the generic actions to improve energy efficiency operation of the building.

5.1.4 Visitor concerns

Table 5. Visitors in IZPH

Number	Requirement	Obligation level
5.4	**Visitors consideration on pilot site.** There is a need to distinguish the different types of usages for each space of the building.	High

Director's office
In the director's office, there are several meetings in the work days, all of them including participants and time formulated into protocol. The staffs occasionally go to the director's office to ask or inform something, or go to manager's office to pick up post can be seen as visitors.

Data management office I
The staffs who occasionally to pick up the printing documents could be seen as visitors, students who work for projects come to pick up and send documents could be seen as visitors.

Data management office II
The staffs work regularly in the office. In their working time, they also have interviews to do in the clinic. Patients and caregivers who come to receive interviews in this office could be seen as visitors. The time schedule mentioned above is recorded.

Researcher's office I
No visitors

Researcher's office II
No visitors

Meeting room
Students who work for projects will occasionally work in the meeting rooms. And the guests will wait in the meeting rooms. An occasional meeting will be taken place in this room.
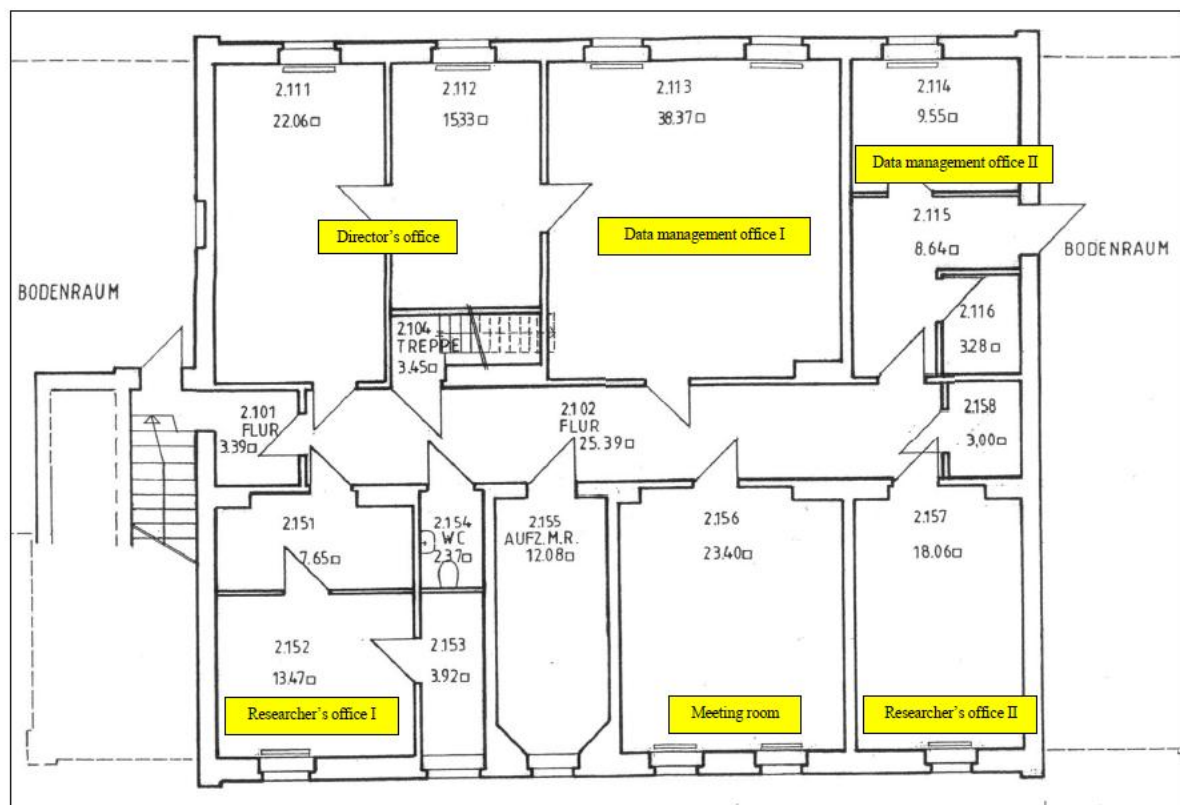
Figure 3 Floor plan of IZPH

5.1.5 Summary of pilot requirements

Table 6. Summary of IZPH requirements

Number	Requirement	Obligation level

Number	Requirement	Obligation level
5.1	**OrbEEt evaluation on office areas.** Due to the special character of the site, the evaluation of the framework should take place in office areas (no laboratory zones).	High
5.2	**Occupants profiling analysis on pilot site.** The evaluation of the framework should consider this distinction on the workers office schedule involved in the selected pilot areas.	High
5.3	**Facilities in the office.** The evaluation of the facilities and the office equipment need to be considered. The framework should eliminate any disrupt on daily activities of the professionals in the site.	High
5.4	**Visitors' consideration on pilot site.** There is a need to distinguish the different types of usages for each space of the building.	High

5.2 Imperial Palace Innsbruck

The Imperial Palace Innsbruck is located in the city centre of Innsbruck. The building has four storeys, one chapel and two large halls (two storeys high). 35 rooms have been selected, divided in the 3 set of areas with different purposes: museum (13 rooms with a total area of 685 m^2), event (8 rooms, 438 m^2) and office (14 rooms, 431 m^2).

In the Museum there is regularly one exhibition per time with around 300-350 visitors per day. 20 people (staff members) are working in the office rooms with a work schedule from 8:30 am to 4:30 pm.

As the museum is a building of special interest, a list of pilot specific requirements have been defined to set constrains on the proposed framework.

5.2.1 OrbEEt Evaluation in office, museum and event areas

Table 7. Areas in Imperial Palace Innsbruck

Number	Requirement	Obligation level
6.1	**OrbEEt Evaluation in office, museum and event areas.** Due to the special character of the site, the evaluation of the framework should take place in office, museum and event areas	Low

5.2.2 OrbEEt Evaluation possibility

Table 8. Evaluation possibility in Imperial Palace Innsbruck

Number	Requirement	Obligation level
6.2	**OrbEEt Evaluation possibility.** As the museum is open 24/7/365, the measurements could be done without any restrictions.	Medium

5.2.3 Conservation requirements

Table 9. Conservation requirements of Imperial Palace Innsbruck

Number	Requirement	Obligation level
6.3	**Conservation requirements.** Due to the fact that the Imperial Palace Innsbruck (inside and outside) is protected by conservation law, the placement of measuring devices has to be coordinated with the Federal Office of Conservation (principle: if it is removable then it is ok).	Low

5.2.4 Respecting the historic substance

Table 10. Historic substance of Imperial Palace Innsbruck

Number	Requirement	Obligation level
6.4	**Respecting the historic substance.** All project activities has to respect the historic substance, this means all activities have to be pre-evaluated in regards to its effects on the historic substance.	Low

5.2.5 Characteristics of historic buildings

Table 11. Characteristics of Imperial Palace Innsbruck

Number	Requirement	Obligation level
6.5	**Considering the characteristics of historic buildings.** The Imperial Palace Innsbruck was built end of 15th century existing buildings bought and merge to the Imperial Palace). Therefore the walls are at least 1 metre thick, which has an significant influence of the energy balance. The material and the quality vary within the entire building. There are mostly 2 casements (no double glazing) and no seal. The framework should take into account these special construction characteristics.	Low

5.2.6 Austrian conservation philosophy

Table 12. Conservation philosophy of Imperial Palace Innsbruck

Number	Requirement	Obligation level

Number	Requirement	Obligation level
6.6	**Respecting the Austrian conservation philosophy.** There are different conservation philosophy throughout Europe. Therefore all reconstructing and renovation activities (if needed) have to be verified with the Austrian Federal Office of Conservation	Low

5.2.7 Summary of pilot requirements

Table 13. Summary of Imperial Palace Innsbruck requirements

Number	Requirement	Obligation level
6.1	**Orbeet Evaluation in office, museum and event areas.** Due to the special character of the site, the evaluation of the framework should take place in office, museum and event areas	Low
6.2	**Orbeet Evaluation possibility.** As the museum is open 24/7/365, the measurements could be done without any restrictions.	Medium
6.3	**Conservation requirements.** Due to the fact that the Imperial Palace Innsbruck (inside and outside) is protected by conservation law, the placement of measuring devices has to be coordinated with the Federal Office of Conservation (principle: if it is removeable then it is ok).	Low
6.4	**Respecting the historic substance.** All project activities has to respect the historic substance, this means all activities have to be pre-evaluated in regards to its effects on the historic substance.	Low
6.5	**Considering the characteristics of historic buildings.** The Imperial Palace Innsbruck was built end of 15th century existing buildings bought and merge to the Imperial Palace). Therefore the walls are at least 1 metre thick, which has an significant influence of the energy balance. The material and the quality vary within the entire building. There are mostly 2 casements (no double glazing) and no seal. The framework should take into account these special construction characteristics.	Low
6.6	**Respecting the Austrian conservation philosophy.** There are different conservation philosophy throughout Europe. Therefore all reconstructing and renovation activities (if needed) have to be verified with the Austrian Federal Office of Conservation	Low

5.3 Asparrena Town Hall

Asparrena has selected 3 pilot areas, as the most interesting ones for the project: Public service office (29 m^2), Administrative office (25.2 m^2) and Mayor's office (28.5 m^2). The first two rooms are located in the ground floor, while the Mayor´s office is in the first floor.

5.3.1 Integration with district heating installation

Table 14. Integration with district heating installation in Asparrena Town Hall

Number	Requirement	Obligation level
7.1	**Integration with existing District Heating installation.** As a centralized heating through district heating installation (Gas) is already available we need to examine the possibility of integration with OrbEEt Platform	Low

The Town Hall of Asparrena has two different boilers running on natural gas. One of them, heats the ground floor and the corridor of the first floor (35 kW) and the other one, heats the first floor (25 kW). The same gas supply network provides gas to other public buildings as cinema and retirement home.

The total consumption of the Town Hall (Pilot Site) can be known through bi-monthly invoices. However, there are not consumption data for each Pilot Area (public, administrative and Mayor's offices).

The heating system of the building could be analyzed (size, type and quantity of radiators in each area; size of the areas; heating schedules...) to extrapolate the real consumption at Pilot Area level.

The thermostats to regulate the temperature of all the floors are inside the Administrative office (1st floor) and Mayor's office (2nd floor).

There are not air conditioning units in the Town Hall because of the typology of the building and the climatic characteristics of Asparrena.

5.3.2 Occupants profiling analysis

Table 15. Occupants profiles in Asparrena Town Hall

Number	Requirement	Obligation level
7.2	**Occupants profiling analysis on pilot site.** Two kinds of occupancy profiles (regular and occasional workers). The evaluation of the framework should consider this distinction on the workers office schedule involved in the selected pilot areas.	High

Public service office

- 2 Regular workers for public attention. One of them, is the responsible for the administration and internal tasks. The other one, is administrative auxiliary and the responsible for external tasks and public attention.

- Schedule: Monday to Friday. 8:00 - 15:00. Both of them.

- There are only occasional workers for the photocopier-printer, because every computer is connected to this device. They only come into the office to take printed documents or to make photocopies, so they can be considered as visitors.

- There are 12 fluorescent lights. 6 of them are controlled by 2 different switches and the other 6 are controlled by other 2 different switches.

Administrative office

- 2 Regular workers for administrative tasks and Secretary of the Municipality. One of them, is the responsible for the accounting department and administrative tasks. The other one, is the Clerk of the Municipality and the responsible of the Secretariat of the town hall.

- Schedule: Monday to Friday. 7:30 - 14:30. Accounting department.

Monday to Friday. 7:45 - 15:15. Secretariat of the town hall

- There are few occasional workers visiting this office and they can be considered as visitors.

- There is only one switch to control all lamps located in this office.

Mayor's office

- The Mayor is the governor of the municipality and he/she usually do most of his/her duties in this office. Besides office work, many different meetings are carried out in this Pilot Area.

- Schedule: Monday to Friday. 9:00 - 14:00 (open schedule)

- There are many occasional users of this office, because several meetings take place in there, but all of them could be considered as visitors.

- There are 6 fluorescent lights. 4 of them are controlled by 2 different switches and the other 2 are controlled by other 2 different switches.

5.3.3 Visitors consideration

Table 16. Visitors in Asparrena Town Hall

Number	Requirement	Obligation level
7.3	**Visitors consideration on pilot site.** In the "Mayor´s office" some short meetings are held. Therefore there is a need to distinguish the different types of usages for each space of the building.	High

Public service office

- There are many visitors every day at this Pilot Area, because it is the place for public attention/assistance in the Municipality. It would be impossible to register every visitor to this office manually and it would require ethical management, therefore it could be a good option the installation of a device to count the number of visitors to this Pilot Area, without registering personal data.

Administrative office

- There are several visitors every day at this Pilot Area, but less than in the first one. People usually come to the secretariat of the town hall to have short meetings, but almost all of them come through the same door that they use to come into the first Pilot Area. This favors the option of installing device to count the number of visitors in these Pilot Areas.

Mayor's office

- There can be several visitors in one day at this Pilot Area, but the next day it can be empty all the day. The usage of this office is not as regular as the others, for instance, the Mayor can be going in and out of the office, to speak with municipality workers or to attend a person. Therefore, in this office would not be so good idea the installation of a device to count the number of visitors and it could be a better idea, the development of a simple methodology to register (manually) different meetings in Mayor's office.

5.3.4 Integration with sign in / sign out document process

Table 17.Integration with sign in / sign out document process in Asparrena Town Hall

Number	Requirement	Obligation level
7.4	**Integration with sign in/out document process.** As a sign in /sing out process is delivered for the management of the spaces, it is good to integrate this information on the platform.	Low

Public service office

  - Either of the two regular workers at this office can manage a sign in/out document process for the Pilot Site, because of their schedule and their similar tasks.

Administrative office

  - Either of the two regular workers at this office can manage a sign in/out document process for the Pilot Site. As occupants profiling analysis explains, one of the workers opens the offices early in the morning and the other one, closes them late in the afternoon, so one could manage the sign in process and the other one, the sign out process, for both Pilot Sites.

Mayor's office

  - The Mayor of the municipality should manage an individual sign in / sign out document process, to have the opportunity to participate fully in the project.

5.3.5 Summary of pilot requirements

Table 18.Summary of Asparrena Town Hall requirements

Number	Requirement	Obligation level
7.1	**Integration with existing District Heating installation.** As a centralized heating through district heating installation (Gas) is already available we need to examine the possibility of integration with OrbEEt Platform	Low
7.2	**Occupants profiling analysis on pilot site.** Two kinds of occupancy profiles (regular and occasional workers). The evaluation of the framework should consider this distinction on the workers office schedule involved in the selected pilot areas.	High
7.3	**Visitors' consideration on pilot site.** In the "Mayor´s office" some short meetings are held. Therefore there is a need to distinguish the different types of usages for each space of the building.	High
7.4	**Integration with sign in/out document process.** As a sign in /sing out process is delivered for the management of the spaces, it is good to integrate this information on the platform.	Low

5.4 Administrative Building of Pernik

For the purpose of OrbEEt project, in the Administrative building of Pernik are chosen ten rooms. These rooms are located in two different floors – five rooms on the 1st and five rooms on the 3rd floor. The rooms are part of two different administration departments Municipality Accounting Department and Social Security Department.

5.4.1 Facilities in the office

Table 19.Facilities in the Administrative building of Pernik

Number	Requirement	Obligation level
8.1	**Facilities in the office.** The evaluation of the facilities and the office equipment need to be considered prior to the selection as the overall framework should take into account the daily activities	High

On the first floor of the building three of the rooms are used for Municipality accounting department. These three rooms have practically equal dimensions:

There are 2 office desks in each room, radiator and luminescent lighting 4x60 W. 5 employees occupy these rooms, allocated as follows:

- Room №1 – **Municipal Service**: The office equipment in this room is 2 computers and 1 printer;

- Room №2 – **Municipal Service:** The office equipment in this room is 2 computers and 1 printer; and

- Room №3 – **Accounting:** The office equipment in this room is 1 computer and 1 printer.

The Social security department taking place in the building consists of 7 rooms located on the first and third floor of the building. The two rooms located on the first floor are used for a **reception room** and **chancery** (storage of documents) of the Social security department.

The reception is equipped with 2 office desks, 1 computer, 2 radiators and luminescent lighting 4x60W. One of the external walls of this room is East orientated and the other one is Sought orientated, however at this time the room orientation doesn't affect the heating consumption as the heating system is working 24 hours per day, seven days per week. The employees use one computer for reports and filling of submissions.

The other five rooms of the Social security department are located on the third floor of the administrative building of Pernik. These rooms are used for Manager Room, Secretary Room, working room and accounting room. All five rooms have nearly similar dimension:

- Room №1- **Social assistance**: The Social assistance room is equipped with three office desks, one computer and one scanner machine. There is also a coffee machine and one radiator;

- Room №2 – **Accounting**: The Accounting room is equipped with 2 office desks with two computers, one printer and one radiator;

- Room №3 - **Technical Assistant of Accounting Director**: The Technical assistant room is equipped with 1 office desk, one computer, one printer machine, one fax device and one radiator;

- Room №4 – **Accounting Director**: The Accounting director room is equipped with one office desk, one computer, one printer, one copy machine and one radiator;

  Each of these four rooms has a single lighting source with luminescent lamps 4x60W; and

- Room №18 – **People with disabilities department and social services**: This room is equipped with three office desks, one computer, one printer and one radiator. The lighting in this room is performed with light bulb.

Both departments - Accounting and Social Security, don't have separate devices where to display and monitor the data generated for the purposes of OrbEEt project.

There is no air conditioning in the rooms.

5.4.2 Integration with district heating installation

Table 20.Integration with district heating installation of the Administrative building of Pernik

Number	Requirement	Obligation level
8.2	**Integration with existing District Heating installation.** As a centralized heating through district heating installation is available though not decentralized control is operated it is difficult to examine HVAC system in Pernik Site.	Low

The heating system in the building of the Pernik Municipality is centralized and it is working twenty four hours a day, seven days per week. Each room is heated by one cast iron radiator. There aren't any individual closing valves nor thermostats, therefore the decision making level of the occupants with regards to the heating of the offices is zero. The bills for the heating consumption are paid in regard to the occupied surface.

5.4.3 Occupants profiling analysis on pilot site

Table 21.Occupants profiles in the Administrative building of Pernik

Number	Requirement	Obligation level
8.3	**Occupants profiling analysis on pilot site.** Municipality accounting department has a reception room. Presumably, there will be two kinds of occupancy profiles (regular workers and occasional ""visitors""). The framework should take into account only regular works.	Medium

Regular workers:

Both pilot department areas have a regular work schedule.

- Schedule - **Accounting Department**: Monday to Friday. 9:00 - 17:30h

The activities performed in Room 1 of this department are processing and archiving of documents and cash payments. The employees use computers 8 hours per day and communicate with people on average of 4 hours per day.

The activities performed in Room 2 and Room 3 are processing, archiving and classifying of accounting documents. The employees use computers 8 hours and communicate with people on average of 4 hours per day.

− Schedule - **Social Security Department**: Monday to Friday. 8:00 - 12:00 and 13:00 – 17:00h.

The employees in the Reception room accept documents for social assistance. There is one computer used during the working hours for reports and fillings of submissions.

The rest of the employees in the Social Security Department use computers and other electronic devices during the whole working day for processing documents. Most of the rooms are interconnected with internal doors.

Total number of employees in both departments – 20.

Occasional "visitors":

− In the **Accounting department** of the Municipality, there are occasional visitors every day. This is the department occupying with appointments and termination of contracts. The overall duration of the visits per day is between 1 and 4 hours.

− The number of visitors in the **Social Security Department** every day is slightly bigger. The reception room on the first floor, being a place for public attention and assistance, is regularly visited by a grand number of people submitting documents, asking for information and notifications on social assistance. Another room visited intensively every day is the department of people with disabilities and social services. The duration of the visits in the other 5 rooms of the Social Security Department continue between one and three hours per day.

The total number of daily visitors of the Municipality vary thus it could be a good option to install a device to count their number, without registering personal data.

5.4.4 Replacement of office equipment

Table 22.Replacement of office equipment in the Administrative building of Pernik

Number	Requirement	Obligation level
8.4	**Replacement of office equipment.** The new office equipment will be changed. The OrbEET validation needs to take into account the energy consumption of these new devices (they might be more or less energy consuming). In the comparison with the historical electricity data, these differences need to be analysed to exactly know how much the energy-related participant behaviour has improved.	High

The available equipment is insufficient to perform the tasks in Social Security Department; therefore it will be fully replaced in three months from now with new one. The new

equipment will be tailored to meet the needs of the business processes performed. The number of sockets used will remain the same. Because the electrical installation in the pilot rooms is old in each room there are three to four wall sockets. The office equipment of each desk is normally connected through coupler with one wall socket.

5.4.5 OrbEEt evaluation of two different pilot areas

Table 23.Areas in the Administrative building of Pernik

Number	Requirement	Obligation level
8.5	**OrbEEt evaluation of two different pilot areas.** OrbEEt framework should consider (even exploit) the potential of these two separate areas (with slight differences in the business process and organization) within the same pilot building.	Medium

5.4.6 Summary of pilot requirements

Table 24.Summary of the Administrative building of Pernik requirements

Number	Requirement	Obligation level
8.1	**Facilities in the office.** The evaluation of the facilities and the office equipment need to be considered prior to the selection as the overall framework should take into account the daily activities	High
8.2	**Integration with existing District Heating installation.** As a centralized heating through district heating installation is available though not decentralized control is operated it is difficult to examine HVAC system in Pernik Site.	Low
8.3	**Occupants profiling analysis on pilot site.** Municipality accounting department has a reception room. Presumably, there will be two kinds of occupancy profiles (regular workers and occasional ""visitors""). The framework should take into account only regular works.	Medium
8.4	**Replacement of office equipment.** The new office equipment will be changed. The OrbEET validation needs to take into account the energy consumption of these new devices (they might be more or less energy consuming). In the comparison with the historical electricity data, these differences need to be analysed to exactly know how much the energy-related participant behaviour has improved.	High
8.5	**OrbEEt evaluation of two different pilot areas.** OrbEEt framework should consider (even exploit) the potential of these two separate areas (with slight differences in the business process and organization) within the same pilot building.	Medium

The focus on this section is the extraction of pilot specific limitations, expressed in the form of requirements to take into account in the rest of the project. As a main innovation of the project is testing of the proposed framework in different pilot areas, special interest is

delivered on the extraction of limitations that may pose difficulties on the evaluation of the proposed framework. Thus, it is critical to early extract the pilot specific limitations that will further enable the prompt development of the OrbEEt platform.

6. ORbEEt BUSINESS SCENARIOS

Identification and definition of business scenarios and use cases are fundamental steps towards delivering a complete architectural design of the OrbEEt project. This section presents OrbEEt's high level core business scenarios, and the subsequent respective detailed use cases derived in the scope of these scenarios.

Initially, taking into account the objectives of the project, two key business scenarios are identified in order to describe the high level business perspective of the proposed framework.

The two main business scenarios of the project are:
- Real time visualization of building operational rating
- Behavioural triggering towards the establishment of an energy efficient environment

The scenarios address the perspectives of different stakeholders (actors) as defined at the initial phase of the project, focusing on the high level description of business services to be examined within the project.

6.1 Real time visualization of building operational rating

The first business scenario examined focuses upon the continuous visualization of energy related parameters in tertiary buildings (offices, shops, hospitals,…). Due to the mass penetration of energy management systems, there is a high need for real time visualization of building operational parameters, such as operational ratings. Furthermore, by addressing the additional sources of information on tertiary buildings, there is a high need for correlation of this information to extract useful energy related information.

The description of the Business Scenario "Real time visualization of building operational rating" is shown in Table 2. It defines a baseline to provide real-time energy rating information addressing building aspects and organizational activities.

Table 25. OrbEEt scenario BS-01

BS-01	
ID	BS-01
Title	Real time visualization of building operational rating
Description	Operational rating process assesses the actual performance of buildings based on actual measured energy consumption. Display Energy Certificates (DECs) resulting from Operational Ratings are typically generated annually at the level of entire buildings to quantify the energy efficiency of building operations. The availability of historical as well as real time information describing the energy-related characteristics and states of the different sub systems of a building are needed towards the extraction of dynamic DECs for a continuous estimation of their constituent metrics and indicators. DECs shall be continuously updated using actual building measurements and addressing additional building aspects (operations) towards the provision of a more complex and dynamic approach for the extraction of Display energy certificates. Furthermore, user interfaces for the facility managers and end users shall visualize the enhanced Display energy certificates.

6.2 Behavioural triggering towards the establishment of an energy efficient environment

The combination of knowledge and motivation, properly complemented with an engagement strategy that considers public buildings as social systems and incentivizes action with rewards beyond financial ones, such as certification and recognition, is the most cost-efficient and effective way towards achieving and sustaining increased energy efficiency in workplaces and, more specifically, public buildings that incorporate organizational structures and activities heavily underlying the building energy performance.

The establishment of an engagement framework is a main business scenario of the project towards the establishment of an energy efficient operation in building premises. The narrative description of the Business Scenario "Behavioural triggering towards the establishment of an energy efficient environment" is shown in Table 3. It defines a baseline to motivate OrbEEt participants towards a more energy efficient behaviour through an integrated gamification framework that utilizes both intrinsic and extrinsic encouragement techniques.

Table 26. OrbEEt scenario BS-02

BS-02	
ID	BS-02
Title	Behavioural triggering towards the establishment of an energy efficient environment
Description	The power of games to immerse and motivate and the capabilities of games to change perceptions and views can stimulate a positive approach to games and new game genres. The gamification framework concept is based on scaffolded achievement of high level commitments and pledges by involving employees in workplace/ social collaboration activities. This framework can be further extended towards the establishment of a robust and motivating social engagement environment that could be further complemented with appropriate feedback provision mechanisms and techniques, towards ensuring persistent energy-saving behaviours and eventually leading to long lasting and consistent energy efficient business profiles. Behavioural change relies on the provision of timely and actionable feedback to the employees. User commitment, however, largely relies on engaging user experiences through eco-visualizations and in-display visualizations to find aesthetically pleasing ways to present the necessary information and feedback through several communication channels. Thus, different user interface shall be defined towards the engagement of end users on more energy efficient operations.

7. ORBEET USE CASES

Following the definition of the high level business scenarios that set the application baseline for the implementation of the proposed framework, we further proceed with the definition of the main use cases, fully addressing the needs as expressed by the end user of the proposed platform. The use cases are in-line with the business application of the project highlighting the main functionalities to be supported by the system. Therefore the goal of this section is to describe the flow of information for the main functional cases of OrbEEt Project focusing on the needs as expressed by system stakeholders.

Each Use Case includes a narrative description, pre-condition, the list of the related actors, OrbEEt systems involved and basic path. The selection of relevant Uses Cases is based on the Business Scenarios defined in the previous section.

- o **Use Case UC-01**: **Enriched visualization** of **building operational** rating for the facility managers

- o **Use Case UC-02**: Enriched visualization of **building operations** and **business processes** rating for facility managers and business analysts

- o **Use Case UC-03**: Gamification framework through the provision of **direct personalized feedback** about actions that can be immediately undertaken to improve energy efficiency.

- o **Use Case UC-04**: Behavioural triggering framework through the de**finition of generic actions** to improve energy efficiency operation of the building.

- o **Use Case UC-05**: **Social media** based **gaming**- comparative

The assignment of these five use cases to the pilot buildings will be developed in the deliverable "D2.1 Pilot Sites´ Energy Auditing & Business Process Modelling". In this deliverable a detailed auditing of pilots site premises including all building characteristics will be analyzed. This better knowledge of all the relevant building aspects will help the consortium to properly align the use cases to the pilots.

7.1 Enriched visualization of building operational rating for the facility managers

The narrative description of the use case "Enriched visualization of building operational rating for FM" is shown in Table 4. The goal of the use case is to address the need for continuous and real time monitoring of building operational rating. An enriched visualization of building status provides insights on the operation of the building to further support the establishment of an energy efficient environment.

Table 27. OrbEEt Use Case UC-01

Use Case - 01	
Title	**Enriched visualization of building operational rating for FM**
Relevant scenario	BS-01
Description (narrative)	In order for Display Energy Certificates (DECs) to become a valuable and more effective source of feedback towards sustainable behaviour, they need to present significantly higher granularity both in terms of space as well as time. DECs need to be produced in a more frequent (ideally near-real time) manner and also address devices involved in the everyday activities. The generation of such enhanced DECs requires

	continuous information flow about the energy consumption of many different loads in the building. The activation and use of loads represents the only reliable proxy for remote observation of the on-going activities. The objective is to obtain real time and historical data from the different metering devices of the building, and provide added-value processed reports on KPIs with different granularities for the stakeholders e.g., KWh consumed per building, per m^2, per device type; etc. It depends strongly on the equipment and monitoring systems currently installed in premises. In addition, there is a need for the visualization of energy related information that will further enable the facility manager to define outliers in the building and further proceed with the appropriate corrective actions towards the establishment of an energy efficient environment.
Pre-condition	• The detailed information about the BIM characteristics of the buildings is available. • The system has the capability to retrieve information (historic and in real time) on low level granularity (device level monitoring) • Internet access to enable real time capturing of information of the building.
Actors (stakeholders)	• Facility Managers
OrbEEt systems involved	• Information Management Layer • SEOR Engine • End User Interfaces
Trigger	The end user queries (through corresponding UI) to know the operational status on premises.
Basic Path	• The GUI expresses information needs to the SEOR engine. • The SEOR engine queries the data from Information Management Layer and process them towards the visualization of energy related information through the GUI
Post-condition	Energy report presented to the user through the UI.
Exception Paths	Information not available due to: • Lack of connectivity • Lack of information stored
Priority	High

7.2 Enriched visualization of building operations and business processes rating for facility managers and business analysts

The narrative description of the use case "Enriched visualization of building operations and business processes rating for facility managers and business analysts" is shown in Table 5. The goal of the use case is to address the need for continuous and real time monitoring of building operations and business processes rating. An enriched visualization of building status and processes provides insights on the operation of the building to further support in the business analysis.

Table 28. OrbEEt Use Case UC-02

Use Case - 02	
Title	**Enriched visualization of building operations and business processes rating for facility managers and business analysts**
Relevant scenario	BS-01
Description (narrative)	The eDECs need to present detailed information about the business processes performed in the pilot sites offices in order to show the energy

	consumption related to this activities. Business processes rating has to be shown in a comprehensive way so to trace the impact of the individual business processes and organizational units and thus facilitate further business analysis.
	The objective of Use Case UC-02 is to obtain real time data for the performance of the different devices used in the offices, and provide more detailed processed reports on KPIs.
	Furthermore, there is a need for visualization of the information related to the processes that will enable the facility manager and business analysts to define outliers in the offices and further proceed with the appropriate corrective actions towards the establishment of an energy efficient environment.
Pre-condition	• The detailed information about the BIM characteristics of the buildings is available. • The system has the capability to retrieve information (historic and in real time) from the different devices used • Internet access to enable real time capturing of information of the offices. • The detailed information about the business processes in the offices
Actors (stakeholders)	• Facility Managers; Business analysts
OrbEEt systems involved	• Information Management Layer • SEOR Engine • End Users Interfaces
Trigger	The end user and analyst query (through corresponding UI) to know the operational status on premises so to identify organization's needs and assess the organizational model.
Basic Path	• The GUI expresses information needs to the SEOR engine. • The SEOR engine queries the data from Information Management Layer and process them towards the visualization of energy related information through the GUI
Post-condition	Process report presented to the user through the UI.
Exception Paths	Information not available due to: • Lack of connectivity • Lack of information stored
Priority	High

7.3 Gamification framework through the provision of direct personalized feedback about actions that can be immediately undertaken to improve energy efficiency

The narrative description of the use case "Gamification framework through the provision of direct personalized feedback about actions that can be immediately undertaken to improve energy efficiency" is shown in Table 6. The goal of the use case is to address the need of providing personalized feedback to the OrbEEt participants to increase their energy efficient actions. A personalized feedback about the own energy consumption will work as a motivation game to achieve a behaviour change.

Table 29. OrbEEt Use Case UC-03

Use Case - 03	
Title	**Gamification framework through the provision of direct personalized feedback about actions that can be immediately undertaken to improve energy efficiency**

Relevant scenario	BS-02
Description (narrative)	Behavioural change necessitates the provision of actionable feedback to employees. There are two key end-user interfaces involved in providing personalised feedback: the smartphone game, and intranet portal. The visualization provided by these interfaces needs to present a real time energy consumption in an aesthetic, and potentially abstract (e.g. embedded in a fictional narrative game) way to engage OrbEEt participants to carry out actions that can save unnecessary energy consumption in their workplaces.
	The energy information display represents the unit´s eDECs and gives a clear idea of the equipment and systems that could be switched off.
	This personalized feedback will be compared with historical performance. Generic feedback will be generated to let the OrbEEt participant know about what corrective actions can be undertaken considering the specific business process.
Pre-condition	• Internet access, to enable real time capture of energy consumption of the working space.
	• The system has the capability to retrieve information (historic and in real time) on low level granularity (device level monitoring)
	• The intrusiveness in the personalized feedback is eliminated
Actors (stakeholders)	• Building occupant
	• Facility Manager
OrbEEt systems involved	• SEOR Engine
	• Gamification framework
	• End User Interfaces: smartphone game, intranet portal
Trigger	The building occupant is engaged by the game, and develops an interest in adapting their energy behaviour to meet the personalized feedback targets the game sets.
Basic Path	• The gamification engine periodically gets data from SEOR engine related to the real time conditions in premises
	• The engine analyses historical and real time data and based on the analysis, it generates personalized messages towards the promotion of energy efficient actions
	• The user specific GUI (mobile APP) will visualize these personalized messages
Post-condition	The end-user interfaces show which energy efficiency measures the OrbEEt participant should carry out.
Exception Paths	Information not available due to:
	• Lack of connectivity
	• Lack of information stored
Priority	High

7.4 Behavioural triggering framework through the definition of generic actions to improve energy efficiency operation of the building

The narrative description of the use case "Behavioural triggering framework through the definition of generic actions to improve energy efficiency operation of the building" is shown in Table 7. This use case will address the definition of the generic actions that work as a motivator engine for the energy-related behaviour change of the OrbEEt participants.

Table 30. OrbEEt Use Case UC-04

Use Case - 04	
Title	**Behavioural triggering framework through the definition of generic actions to improve energy efficiency operation of the building**
Relevant scenario	BS-02
Description (narrative)	Whereas Use Case 03 focuses on personalised feedback via the smartphone game and intranet portal, this case focuses on behavioural triggering through in-office displays. These are designed to reflect best-practices in changing peer-norms towards stimulating a positive energy culture in-office. These actions should be displayed in a graphical way, with theoretical comments about key aspects (D1.3) to bring a deep behavioral change: a practical action along with technical information about these EE actions (what/when/why to do, which consequences they have) to make the OrbEEt participants learn to act properly and in a reflexive manner.
Pre-condition	• The system has the capability to retrieve information (historic and in real time) on high level granularity (workspace profile) • Public screens are available in premises
Actors (stakeholders)	• Building Occupant • Facility Manager
OrbEEt systems involved	• SEOR Engine • Gamification framework • End User Interfaces: In-office displays
Trigger	Occupant views in-office display and discusses information and their thoughts with peers
Basic Path	• The gamification engine periodically retrieves data from SEOR engine related to the real time energy and business conditions in premises • The engine analyses historical and real time data and based on the analysis, it generates generic actions towards the promotion of energy efficient actions • Public screens will show these generic actions to improve energy efficiency operation of the building
Post-condition	The building occupant reads and learns energy-related best-practices
Exception Paths	Lack of in-office displays (available monitors to show the information)
Priority	Medium

7.5 Social media based gaming- comparative

The narrative description of the use case "Social media based gaming- comparative" is shown in Table 8. This Use Case will address the definition of the social media gaming to engage the participants to participate in a gaming motivational framework.

Table 31. OrbEEt Use Case UC-05

Use Case - 05	
Title	**Social media based gaming- comparative**
Relevant scenario	BS-02
Description (narrative)	Players are encouraged to share and discuss their performance against personalised targets through integration between the smartphone game and intranet portal. In doing so they are able to discuss and share advice and tips on how they reached their targets, and compare their performance against other users. Site managers can also access the portal to reflect on common problems and discuss possible solutions with participants. Operational rating results (real-time and average values), snapshots of energy efficiency (at different levels and granularity) will be shown through these communication channels.

	In order to make an operation results comparison, KPIs with different spatio-temporal levels will be provided. The aim of this gaming is to engage OrbEEt participants to persist in the behavioural change through a series of challenges and competitions.
Pre-condition	• Internet access to enable real time capturing of energy consumption
Actors (stakeholders)	• Building Occupant • Facility Manager
OrbEEt systems involved	• SEOR Engine • Gamification framework • End User Interfaces: Intranet portal
Trigger	The building occupant wants to visualize the comparison between the pilot sites energy consumptions, which represents how the energy related behavior change has taken effect; or, engaged by the game, the player wants to compete with other building occupants or help them by providing advice. An ultimate goal is to have drivers both through game mechanics (making energy activities fun), and awareness (visualising energy consumption in an accessible and understandable way)
Basic Path	End-user playing game achieves personalised targets (or faces problems achieving them) and is prompted to share/discuss via the intranet portal.
Post-condition	• The gamification engine periodically retrieves data from SEOR engine related to the real time energy and business operations in premises • The social gaming engine analyses historical and real time data and based on the analysis, it generates reports related to the performance of building occupants in a game like way, • OrbEEt participants, via a dedilcated app, are motivated to undertake more energy efficiency actions and improve his/her competition ranking. A social based game environment is provided to support the active enrollment of building occupants.
Exception Paths	• Lack of connectivity to intranet portal (unable to access via mobile web browser and unable to immediately access office desktop).
Priority	High

Following the extraction of Business Scenarios and related Use Cases the focus is on the extraction of system functional requirements addressing the methodological framework:

Business Scenarios→ Use Cases→ Requirements

The next section will provide the list of functional and non-functional requirements, focusing on the mapping of OrbEEt Use Cases with project requirements to further support the rest of the work on WP1, especially the definition of OrbEEt architecture.

8. FUNCTIONAL REQUIREMENTS

8.1 Introduction

This section aims to document the Functional Requirements, the operations and activities of the OrbEEt framework must be able to perform. The functional requirements will be divided into four main areas addressing the high level sub systems towards the definition of OrbEEt framework. The definition of functional requirements further enables the provision of a detailed reference Architecture for the OrbEEt platform.

- **Data management Layer**: The descriptions of the data to be gathered, and the ICT for data collection and processing will be addressed in the definition of functional requirements (section 6.2.1).

- **Systemic Enterprise Operational Rating framework**: The Functional Requirements of the SEOR to own the ability of calculating real time building energy performance tracing the impact of the individual business processes and organizational units will be documented in section 6.2.2.

- **Enhanced Display Energy Certificates**: eDECs will show real time energy performance information at various operational spatio-temporal levels. While the SEOR is the engine of this innovation, eDECs will be the interface between the SEOR and the end user to allow them to see the information. In section 6.2.3 the Functional Requirements for this visualization are defined.

- **Behavioural change strategies**: Behavioural change will be triggered stablishing both intrinsic and extrinsic motivators. The Functional Requirements of both channels for participants behavioural change (1) intranet portal which will provide detailed information about the information of all units; and 2) the Smartphone applications for the provision of real time feedback about actions that can be inmediately undertaken) will be described in section 6.2.4.

8.2 List of Functional Requirements

This section will serve to define the Functional requirements of each main area described above.

The obligation level appeared in the following tables indicates the relative importance of each requirement. The keywords "high", "medium" and "low" are interpreted as follows:
- High: These requirements are necessary to achieve the goals of the project.
- Medium: May be ignored if a valid reason exists, but the full implications of ignoring must be understood and carefully weighed before choosing a different course.
- Low: Optional requirements.

8.2.1 Data management Layer

This is the layer responsible for capturing and managing events from WSN of the system. To this end, a list of requirements is defined to support the prompt operation of the data acquisition framework.

Table 32. Functional requirements relevant to the Data Management Layer

Number	Requirement	Obligation level	Relevant to UC
1.1	**Low-cost plug meters and sensors** should be installed that automatically capture the electrical metering data and environmental conditions parameters.	High	UC1, UC2
1.2	**A wireless sensors network** should be installed to set the data management network of OrbEEt	High	UC1, UC2
1.3	Wireless Sensors **will have connection to a single master, namely gateway** which is the end point connection to OrbEEt cloud system	High	UC1, UC2
1.4	A **limited storage buffer** should be ensured on gateway level as the overall data management layer should be safely captured on a proxy server.	Medium	UC1, UC2
1.5	**Types of loads.** The captured real time energy data should address specific types of loads including HVAC, lighting and office equipment loads.	High	UC1, UC2
1.6	**Types of environmental data.** The captured real time environmental data should address specific parameters including temperature, humidity and luminance.	High	UC1, UC2
1.7	The sensing units must be able to capture events **with a minimum volume and time (15 minutes) granularity**	High	UC1, UC2
1.8	The data management network should ensure the **minimum latency on transmission** of sensing events	Medium	UC1, UC2
1.9	**Processing of the data.** The monitoring data should be appropriately processed and analysed taking into account the BIM aspects as space ID, equipment used and time of day.	High	UC1, UC2
1.10	Apart from Sensing also **limited control capabilities** should be ensured by the WSN network	Low	UC1, UC2

8.2.2 Systemic Enterprise Operational Rating framework

This is the layer responsible for extending and merging the Business Process Modelling tool and the conventional Operational Rating methodology to create the OrbEEt Systemic Enterprise OR framework that will generate the Enhanced DECs based on the stream of energy use data provided by Data Management Layer. OrbEEt shall extend the concept of DECs towards delivering certificates of significantly enhanced spatio-temporal granularity by establishing a dynamic model-based approach for a continuous estimation of their constituent metrics and indicators.

Table 33. Functional requirements relevant to the SEOR framework

Number	Requirement	Obligation level	Relevant to UC
2.1	**Definition of the business processes that have place in this environment –** what are the devices used per business process, what kind of operations, how many employees included in the business process performed taking into account the **BIM parameters** of each pilot case	High	UC2
2.2	Real-time measurement of the energy consumption of the devices installed (HVACs, PCs, Printers, Scanner, Copy machines etc.) and used to perform the everyday task of the employee through the **correlation of energy data with business processes**	High	UC1, UC2
2.3	Real-time measurement of context conditions during the everyday task of the employee and further **correlation of context data with business processes**	High	UC2
2.4	Real-time link between the measured data and the business processes delivered towards the **real time correlation of measured data to business processes**	Medium	UC2
2.5	The system should extend the concept of DECs towards delivering certificates of significantly enhanced **spatial granularity** by establishing a dynamic approach	High	UC1
2.6	The system should extend the concept of DECs towards delivering certificates of significantly enhanced **temporal granularity** by establishing a dynamic approach	High	UC1
2.7	The system should extend the concept of DECs addressing also the **operational granularity (different business roles)** by establishing a dynamic approach	Medium	UC2
2.8	The system should extend the concept of DECs by providing a **real time or near real time calculation** of Operational Rating Indicators	High	UC1
2.9	The system should extend the concept of DECs by addressing not only **energy** but also **business and comfort** related indicators	High	UC2
2.10	The system should ensure the calculation of indicators that are essential for the **visualization of energy & organizational information (eDECs) and the gamification framework** (along with the respective interfaces)	High	UC1, UC2, UC3

8.2.3 Enhanced Display Energy Certificates

By incorporating Energy Performance Metrics (as defined in the Operational Rating methodology) into the Organization Skeleton Activity Models, we eventually establish a higher granularity Operational Rating framework, in which overall building performance depicted in the respective Display Energy Certificate is broken down and further allocated to specific organizational processes, units as well as spaces, which in OrbEEt we define as Enhanced Display Energy Certificates. To this end, the enhanced Display Energy Certificates Evaluation Engine is responsible for estimation and further visualization of eDECs information through the OrbEEt Ambient User Interfaces.

Table 34. Functional requirements relevant to the OrbEET eDECs

Number	Requirement	Obligation level	Relevant to UC
3.1	Displaying the associated indicators taking into account **the role addressed** for each scenario (end users, facility manager)	High	UC1, UC2
3.2	**Displaying the associated energy data over thermal and lighting loads and other office equipment** – the **end user/facility managers** needs to be aware of the energy impact of his/her Devices therefore the information should be visualized.	High	UC1, UC2
3.3	**Displaying the associated energy data over business activities** – the **end user/ facility manager** needs to be aware of the energy impact of his/her business activities therefore the information should be visualized.	High	UC2
3.4	**Displaying the associated context preferences data over business activities** – the **end user/ facility manager** needs to be aware about the statistical analysis over environmental conditions	Medium	UC2
3.5	**Displaying the associated indicators addressing the need for different spatial granularity** – the **facility manager** needs to be aware about the operational rating on the different physical zones in premises	High	UC1, UC2
3.6	**Displaying the associated indicators addressing the need for different temporal granularity** – the **facility manager** needs to be aware about the operational rating on the different time period (annual, trimester, month, week)	High	UC1, UC2
3.7	**Displaying the associated indicators related to main business processes** – the **facility manager** needs to be aware of the business processes related performance of the devices	Medium	UC2

Number	Requirement	Obligation level	Relevant to UC
3.8	**Possibility to compare the energy performance of the building before the implementation of the OrbEEt project and after it** – the user/facility manager has the chance to dynamically compare the current status with previous status	Low	UC1, UC2
3.9	**Possibility to compare the energy performance of different semantic entities (zones, business processes, devices)** – the facility manager has the chance to dynamically compare the current status in premises	Medium	UC1, UC2

8.2.4 Behavioural change strategies

Table 35. Functional requirements relevant to the OrbEET Behavioural change strategies

Number	Requirement	Obligation level	Relevant to UC
4.1	**Smartphone-based game** interface promoting engagement with energy-saving behaviours and the OrbEEt platform. The game is envisioned as focussed on entertainment and enjoyment, helping scaffold users in a transition towards energy-awareness under which the intranet portal and office displays can be further utilised by them to achieve benefits.	High	UC3, UC4, UC5
4.2	**Intranet portal** providing personalised information to the user on their energy use, using meaningful data (4.4) which a user can understand and respond to.	High	UC3
4.3	**In-office display** representing sensor data in a way intended to stimulation behavioural change through the use of best-practices, such as adjusting peer-norms, and fostering collaboration and discussion.	Medium	UC4
4.4	Meta-layer translating sensor data along behavioural change guidelines for use in 4.1-3. This reflects the need to give sensor data meaningful attributes which a user can relate to their energy behaviour or business processes. It translates **atomic data** (e.g. the outside temperature of a given moment) **to data salient** to behaviour (e.g. the outside temperature over a week versus strategies employed by staff to maintain ambient inside temperature). To this end, a list of KPIs should be defined to trigger behavioural change framework.	High	UC3, UC4, UC5

Number	Requirement	Obligation level	Relevant to UC
4.5	**Participants´ time limitation** – the extrinsic motivators shouldn't be time consuming, not to hinder the performance of everyday activities of the employees. The range of users' involvement should be carefully assessed not to interfere strongly with their everyday work.	High	UC3, UC4, UC5
4.6	**Social Media Based Gaming** allows discussing and comparing players´ performances, and sharing advices and tips to reach targets.	High	UC5

The taxonomy of requirements in the respective high level components, as initially defined in the project, is provided to further support the definition of OrbEEt functional components as part of the architecture. To point out that the definition of the respective requirements is based also on the feedback from the pilot sites via pilot sites representatives.

9. NON FUNCTIONAL REQUIREMENTS

Towards the establishment of the OrbEEt platform, the non functional requirements are defined to set constraints during the development phase.

9.1 Hardware Requirements

These requirements address both the entities for capturing the context data from pilots and the devices used for visualization of energy information.

Table 36.Hardware requirements

Number	Requirement	Obligation level
9.1	**WSN network.** Towards the establishment of a WSN network, the focus is on the selection of a unified wireless solution. Though, the lack of a holistic framework may further mandate the establishment of more than one wireless network. In addition, and as a way to provide an easily transferable solution, the core part of the services should run as cloud services. Thus a mini – PC should be installed in pilot sites, acting as the gateway with the WSN and also interfacing with the rest of cloud based services.	High
9.2	**In-office displays.** For pilot sites, these are provided by the project. There are two main alternatives. Either an IP –connected TV to display the respective information thought a browser or a TV monitor connected with a local PC unit. The display is driven by a PC coupled to the display, providing an application which once launched updates the display at regular intervals with information from the OrbEEt monitoring technologies, formatted and configured to deliver on the behavioural framework to accommodate aspects such as peer-norms, competition, and collaboration.	High
9.3	**Smartphones availability.** This will be developed using Unity 5 for Android and therefore the specification and requirements match those of the game engine. Unity 5 also has the advantage of allowing games to be rapidly re-deployed to other platforms such as iPhone, however, focus is given in OrbEEt on providing an Android solution. To engage and immerse the user it is anticipated 3D content will be used within the game, and therefore a current-generation Android smartphone is recommended. With a view to long-term exploitation, the anticipation is employees will be motivated to use personally-owned devices to experience the game, reducing the overall cost of deploying the OrbEEt platform within a site. A non-exhaustive list of Android devices suitable for playing the game is provided as an annex (Appendix 1).	High

Number	Requirement	Obligation level
9.4	**Intranet portal.** This is envisioned as a browser-based environment providing information to the user, again derived from sensor data represented in accordance with the behavioural framework. To maximise exploitation potential, this will avoid the use of components requiring specific PC hardware (e.g. a high-performance graphics card). Therefore any PC capable of supporting web-browsing, representative of the vast majority of PCs in office use, will be compatible with the OrbEEt intranet.	High
9.5	**Internet / intranet access.** It is worth noting that as an information-based approach to behavioural change, OrbEEt requires the transfer of information between the three interfaces. Therefore, all three components will require access to the Internet during use. It is recommended that sites have WiFi access for smartphones and wired connections for desktops/in-office displays, though a user could utilise 3/4G to access the information services.	High

9.2 Software Requirements

Following the detailed presentation of hardware requirements, the related software requirements are also defined.

Table 37.Software requirements

Number	Requirement	Obligation level
10.1	**WSN network.** For the mini PC device, setting the gateway to the WSN network, the main constrain is to set a gateway with the respective libraries preinstalled to set up the WSN needed for OrbEEt purposes. Then, and on top of these libraries, a set of Java services should be developed to support interfaces with the rest of services.	High
10.2	**In-office displays.** To launch the information application the PC driving the display should be running Windows x86 or x64 (the planned build is a 32-bit binary supporting both 32-bit and 64-bit operating systems). It is not anticipated that any additional software installations will be required to launch the application. It is recommended that a recent version of Windows (7 onwards) is installed, as these versions will be used for testing, though it would also be expected the application will be backwardly compatible with earlier versions.	High
10.3	**Smartphone game.** Android OS 2.3.1 ('Gingerbread') or later.	High

Number	Requirement	Obligation level
10.4	**Intranet portal.** The browser-based approach will aim to support common browser options (Internet Explorer, FireFox, Opera, Google Chrome), though will be principally designed for Internet Explorer 11. It is not, however, anticipated to make use of features restricted to IE11 and should therefore be backwardly compatible with earlier versions and other browsers.	High
10.5	**Cloud based service.** In order to enable a high level availability of the system, the overall OrbEEt platform should operate as a cloud based service, minimizing in that way hardware costs.	Medium

9.3 Performance Requirements

With respect to the performance of the overall OrbEEt platform, including sensors and middleware, the following criteria are required to ensure the functionality of the end-user interfaces:

Table 38.Performance requirements

Number	Requirement	Obligation level
11.1	**Response Time.** Whilst all platforms convey information from sensors, the user is not expected to interact with a sensor in real-time, rather, they view data captured and analysed over time. Therefore, and reflecting again the benefit of designing a platform which can be deployed using existing hardware infrastructure at a site, real-time interactive (~0.1s) feedback from sensors is avoided in OrbEEt; however, the architecture should support near-real time (1-5s) querying of sensors and middleware to provide the user with up-to-date information without disrupting the user experience.	High
11.2	**Workload.** Core databases queried by the end-user interfaces through middleware should support an approximate total querying reflecting that feasible for a single server per-site running a standard DBMS solution (e.g. SQL). Anticipated workload would be representative of ~20 queries / min for in-office displays; 50 queries / min for an active intranet portal user; and 5-10 queries per launch of the smartphone game.	High

Number	Requirement	Obligation level
11.3	**Scalability.** Beyond pilot sites, it should be possible to scale the OrbEEt platform to encompass an entire public building or site. In terms of data storage and processing, this should be accomplished using a single server for the majority of sites; for sites with very large volumes of users it would be anticipated a corresponding IT infrastructure would allow roll-out of the platform without requiring extensive further investment in database support. The primary limiting factor in scalability, therefore, is the need to deploy sensors to additional areas of a site.	High
11.4	**Accuracy.** The goal of the project should be to provide accurate results. One of the main objectives in energy efficiency projects is to define strategies that best fit on end occupants' behaviour. Towards this direction it is important for the project to ensure high accuracy level on final metrics and indicators, to enable the successive implementation of OrbEEt framework in pilot sites	High
11.5	**Reliability.** One of the main performance related parameter in software based solutions is the reliability of the system. This is a main requirement of the system, to ensure the high level reliability of OrbEEt platform, to further enable the functional implementation of the proposed framework.	High

9.4 Supportability Requirements

Table 39.Supportability requirements

Number	Requirement	Obligation level
12.1	**Expandability and stability of OrbEEt platform.** As a prototype, promoting the extensibility and stability of the OrbEEt platform through an ongoing support cycle is a key consideration. Clear documentation on the individual components seeks to provide future developers with a solid foundation to expand OrbEEt, whilst the outlined behavioural (D1.3) and technical (D1.2) frameworks provide a conceptual and technical overview of the system.	High
12.2	**Encourage users to be creative.** The system should promote and aid users in creating innovative workflows and practices to optimise their individual and organisational energy use. Hence, rather than seeking to predict these in advance, an approach is adopted whereby users are given targets and game-based incentives, then encouraged to be creative, rather than adhere to set or pre-specified approaches to successfully address challenges.	High

9.5 Security Requirements

Table 40.Security requirements

Number	Requirement	Obligation level
13.1	**Privacy.** Whilst personally-identifiable data is not required by the system, the possibility of it arising exists, e.g. a user may enter their name as a username, or voluntarily supply an email address to be contacted. Therefore, the standard affordances of data protection under the EU's Data Protection Directive must be applied. It is worth noting this is currently under review and final legislation will likely be passed within the OrbEEt lifecycle, therefore the system will be reviewed as legislature emerges, with pre-consideration given to likely clauses including privacy policy, governance, breach notification, right to be forgotten, and privacy by design.	High
13.2	**Physical Security.** Sensor installation should be accompanied by a health and safety re-assessment of the workplace, as whilst sensors are unlikely to be intrusive or create a trip-hazard, this should be at the discretion of the relevant health and safety officer(s) within the workplace rather than the technician responsible for installation. In terms of security, whilst theft is highly unlikely in a closed office, open public areas, including hospitals, routinely report missing or stolen equipment, therefore sensors should be wherever possible securely installed and insured.	High
13.3	**Access.** At the pilot stage, to ensure a robust experimental environment, users should be issued with an OrbEEt access login accompanied with standard information on best-practices for security (e.g. not sharing their login details). In wider exploitation, as there would not be anticipated to be negative repercussions from wider access within an organisation, it would be expected to transfer this to the same organisational login used on a site.	High

9.6 Interface Requirements

Table 41.Interface requirements

Number	Requirement	Obligation level

Number	Requirement	Obligation level
14.1	**Translation and localisation.** Notably, the need for consideration of the European context of OrbEEt places requirements on translation and localisation; in the first instance for the relevant pilot sites, and in the second for a wider pan-European user base in exploitation. This requires that interfaces are designed with a need for rapid translation without requiring expertise; e.g. holding text-based content externally rather than 'hardcoded' into the interface.	High
14.2	**Look & Feel.** A high-level requirement of the interfaces is to minimise the need for text-based content, also reflecting good game-design practice in the case of the smartphone game. Therefore, wherever possible, interfaces will visually and interactively convey information rather than provide text. In addition, the messages shall be clear and easy to understand	High
14.3	**Discoverability of system functionalities.** The User Interfaces shall be able to allow an easy discoverability of the actions available. This is a main prerequisite on the development of appealing user interfaces to enable the strong engagement of end users in the evaluation of OrbEEt system	High
14.3	**Customizability.** The User Interfaces shall be tailored to the end user needs (Building Occupants, Facility Manager etc...). The messages provided by the system shall help the users to increase their awareness taking into account the non-intrusiveness scope of the project.	

9.7 Availability Requirements

Table 42.Availability requirements

Number	Requirement	Obligation level
15.1	**Availability of the end-user components.** The in-office displays should be available throughout the working day to employees. The smartphone game and intranet portal should be accessible at any time, provided the user has an internet connection and valid login credentials. However, short outages in service would not be anticipated to detract from or harm the impact of the OrbEEt platform as a whole.	High

9.8 Assumptions / Constraints

Under the non-functional requirements outlined in this section, the following assumptions and constraints are worth noting:

Smartphone ownership. OrbEEt seeks to capitalise on the widespread personal use of smartphones and tablets; however in doing so it assumes users will have access to devices

which they either own personally or are provided by work. This assumption is reasonable given the increasingly widespread use of these devices, however, for the purposes of pilot sites the need exists to elicit their availability and support if needed the acquisition of further devices for the trial.

Basic IT proficiency amongst end-users. OrbEEt assumes a user will be familiar with basic smartphone usage and web-browsing. This is again a reasonable assumption particularly for office staff, but it may be a limiting factor in seeking to upscale the solution to a wider audience. This could, however, be addressed by training.

On-site management. A goal is to minimise the need for on-site management of the OrbEEt platform, however some limited time investment (e.g. a 20 minute session introducing the system and how to access it, and support ensuring in-office displays are configured and relaunched if necessary), is likely to be highly beneficial in ensuring the platform is known and used. Irrespective, it is noted in workplace interventions that buy-in and enthusiasm from senior staff can be critical in ensuring front-line staff use a system, and this is likely to remain true for OrbEEt.

10. CONCLUSIONS

This report establishes the requirements of the entire OrbEEt framework.

Firstly, two key business scenarios were identified in order to define the high level business perspective of the proposed framework. After setting the application baseline for the implementation of the framework, five main use cases were defined addressing the needs and highlighting the main functionalities to be supported by the system.

The project requirements were divided into two categories:

- The section about **functional requirements** contains the operations and activities that the OrbEEt framework must be able to perform. These requirements address the four main areas of the project toward the definition of the framework: Data management, Systemic Enterprise Operational Rating framework, Enhanced Display Energy Certificates and Behavioural change strategies.
- The **non-functional requirements** section is composed on the one hand by the four pilot building requirements and on the other hand by the definition of the qualities, attributes and restrictions that the OrbEEt solution must meet.

10.1 Relation to continued developments

The described use cases and requirements in this report serve:

- To define realistic specifications for the Systemic Enterprise Operation Rating framework and Enhanced Display Energy Certificates in Deliverable 1.2.
- To guide the specifications of an organizational behaviour change framework in Deliverable 1.3.
- To guide the definition of both the software architecture and the hardware infrastructure specifications in Deliverable 1.4.

11. ACRONYMS AND TERMS

OR	Operational Rating
DECs	Display Energy Certificates
eDECs	enhanced Display Energy Certificates
BS	Business Scenario
UC	Use Case
FM	Facility Manager
KPI	Key Performance Indicator
BIM	Building Information Modeling
SEOR	Systemic & Enhanced Operational Rating
UI	User Interface
GUI	Graphical User Interface
EE	Energy Efficiency
ICT	Information and Communications Technology
WSN	Wireless Sensor Network
HVAC	Heating, Ventilating and Air Conditioning
PC	Personal Computer
HTA	Health Technology Assessment
IZPH	Interdisciplinary Centre for Public Health
DBMS	Database Management System
IT	Information Technology

12. APPENDICES

12.1 Annex I

The goal of this section is to provide the template for the description of the use cases.

Use Case - ID	
Title	**The title of the Use Case**
Relevant scenario	Correlated Business Scenario
Description (narrative)	Describe the series of steps for the defined use case in a clear and concise manner.
Pre-condition	Define the main prerequisites for the prompt implementation of the respective Use Case
Actors (stakeholders)	All actors interacting with this Use Case
OrbEEt systems involved	The list of high level components assigned to this Use Case as defined in the initial version of OrbEEt Architecture
Trigger	The main triggering action, enabling the implementation of the respective Use case, typically triggered by the end users
Basic Path	A basic path defining the steps and the flow information from the implementation of the respective Use Case. This is the main input for the definition of architecture
Post-condition	The final results from the implementation of the respective Use Case
Exception Paths	Main exceptions, to be considered as alternative paths from the implementation of each Use Cases. This section will also document the noncompliance of Use Cases
Priority	A rating of the importance of each use case for the consortium

12.2 Annex II

The goal of this section is to provide the list of Android devices for the smartphone game.

ARMv7 devices (recommended):

- Google Nexus One, OS 2.1 and newer
- Google Nexus S, OS 2.3 and newer
- Motorola Droid, OS 2.1 and newer
- Motorola Droid X, OS 2.1 and newer
- Motorola Droid 2
- Motorola XT701 OS 2.1
- Motorola Xoom OS 3.0
- Motorola Defy
- HTC EVO 4G, OS 2.1 and newer
- HTC Droid Incredible, OS 2.1 and newer
- HTC Desire HD, OS 2.2 and newer
- HTC Desire Z (T-Mobile G2), OS 2.2 and newer
- HTC Desire, OS 2.1 and newer
- HTC Inspire 4G OS 2.2

- HTC Vision, OS 2.2
- HTC EVO 3D
- SE X10, OS 2.1 and newer
- SE Xperia Play, OS 2.3
- Samsung Galaxy S, OS 2.2 and newer
- Samsung Galaxy S (Fascinate), OS 2.1
- Samsung Galaxy S (Captivate), OS 2.1
- Samsung Galaxy Tab, OS 2.2
- Samsung Galaxy S2, OS 2.3.3
- Samsung Epic 4G
- LG Optimus 2X (T-mobile G2x), OS 2.2
- Viewsonic gTablet
- Archos 70 Internet Tablet
- Archos 43 Internet Tablet
- Archos 32 Internet Tablet
- Archos 101 Internet Tablet
- Nook Color
- NEC MEDIAS N-04C

ARMv6 Devices (supported):

- LG Optimus V (virgin mobile)
- Orange San Francisco / ZTE Blade
- SE X10 mini
- Samsung Galaxy 580
- HTC MyTouch 3G Slide, OS 2.1

13. REFERENCES

i Deliverable "D4.2 OrbEEt Validation Framework"