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Project Title:

ORganizational Behaviour improvement for Energy Efficient administrative public offices



OrbEET

Grant Agreement No: 649753

Collaborative Project

Public Summary

Deliverable No.	D2.1 Pilot sites' energy auditing & business modelling
Workpackage	WP2 Pilot Audits & Organizational Modelling
Task	T2.1 Pilot audits & Pilot operation
Lead beneficiary	BALKANIKA



1. PUBLISHABLE PUBLIC SUMMARY

This document aims to provide the initial detailed auditing procedure of pilot site premises that will be undertaken during the implementation of OrbEEt project. Understanding energy consumption is essential to achieve energy efficiency and builds the foundation for any measure to save energy.

Based on the building information modelling (BIM) and energy assessment's initial results, the business processes of the pilot organization are investigated. BIM is the process of generating and managing building data during its cycle of life using dynamic building modelling software in three dimensions and in real time, to reduce wasted time and resources in the design and construction. BIM and energy audits provide input for the scoping of the business process modelling (BPM) initiatives, which provides input for the SEOR methodology on how the building/rooms are used, what are typical activities and tasks performed.

It is intended that the energy consumed is based on a meter reading. The Operational Rating is derived by comparing the energy consumption of the building with the benchmark energy consumption of other buildings representative of its type. The OR is then a measure of the annual (CO₂) emission per unit of area of the building caused by its consumption of energy, compared to a value that would be considered typical for the particular type of building:

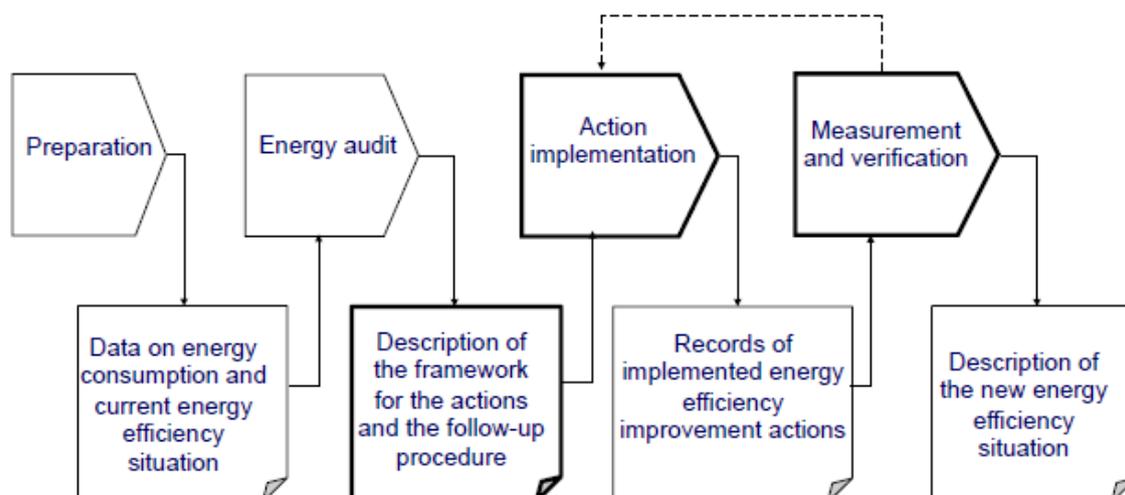
$$\text{OR} = (\text{Building CO}_2 \text{ emissions} / \text{Building area}) \times (100 / \text{Typical CO}_2 \text{ emissions per unit area})$$

This methodology applies to buildings, or parts of buildings designed, or altered, to be used separately. Within the project the building measurement is the Total Usable Floor Area. The **assessment Period is the one-year period (365 days) over which the energies used in the calculation of the OR are considered to have been used**, and is aligned with the measurement period of the main heating fuel used in the building.

The aim of the OR is to compare the annual energy consumption of the building with that of a building typical of its type. Within the project, we have addressed only daily activities and thus there is no need to define extraordinary cases not related to the overall building operation. . The factors of interest are therefore the annual energy consumptions of each form of energy, and the CO₂ conversion factor associated with each. The CO₂ conversion factors are therefore one of a number of resources needed for operational rating process

Building performance can only usefully be compared with other buildings that carry out the same or similar functions. The benchmark used is the Chartered Institution of Building Services Engineers (CIBSE). They have been prepared to represent building use under a number of standardized conditions. Therefore there is need to adjust the benchmark for location (weather region) and longer hours of occupancy.

One of the primary ways to improve energy conservation in buildings is to use an energy audit. The energy audit starts to play significant role in managing the energy expenses and basically consists of an analysis of the energy usage within a building or facility and its contained equipment to assess how much energy the building consumes and to evaluate what measures can be taken to make it more energy efficient.



Energy efficiency service process

The main goals of our Energy Audit are to identify areas/loads of major energy wastes therefore future gains. Furthermore, the basis for a continuous and efficient monitoring framework needs to be set that does not only calculates and reports savings but also provides the necessary detail of timely and relevant information from the buildings that will allow us to continuously interact with occupants and provide feedback and triggers more sustainable behaviours. Another important goal is to balance the need for detailed sub metering with keeping technology costs low.

The energy audit methodology has been developed based on the good European practices in the area of heat and electrical energy conservation. A more detailed presentation of this methodological framework is reported in D1.5 “Energy Measurement Methodology”.

Six criteria are taken into account in applying OrbEEt tasks to the four pilot sites, to wit:

Criteria	Imperial Place Innsbruck	IZPH	Asparrena Town Hall	Pernik Municipality
1. Total number of Workspaces	10	13	6	25
2. Offices	4	7	3	10
3. Plug Loads	20	13	15	60
4. Loads/WorkSpace	2	1	2,5	2,4
5. Central Monitors	2	2	1	2
6. Office Monitors (Tablets)	4	4	2	10

After selecting the scale the energy auditing and baselining methodology is implemented. Taking into account the business scenarios and end-users requirement subset of areas are selected for each pilot site of OrbEEt Project. The structure and the size of the buildings and other specifics are measured in order to calculate the losses or the gains of energy due to the structure of the building materials used. The analysis towards the definition of the baseline is then provided by taking into account annual billing data for the whole billing, further implementing the methodology for the extraction of baselines for each zone of the building selected for demonstration. The analysis is performed for each of the main types of energy in the building e.g. heating systems, electricity consumption. Afterwards the CO₂ emissions are calculated using the following formula:

$$E_{cP} = (\sum_{i=1}^m Q_i * f_i) * 10^{-6}$$

Where E_{cP} is the quantity of CO2 emissions, t;

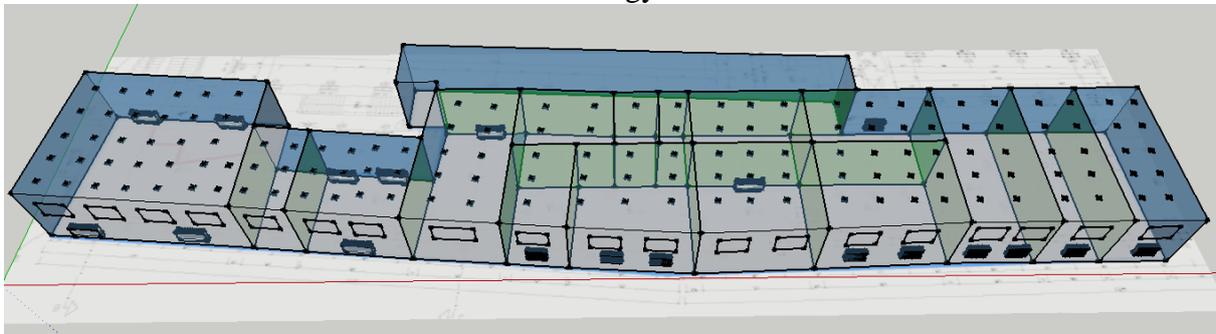
Q_i – the quantity of the i^{th} energy resource type, kWh;

f_i - coefficient of ecological footprint equivalent factor of the i^{th} energy resource type, g/kWh;

m – number of the energy resources used.

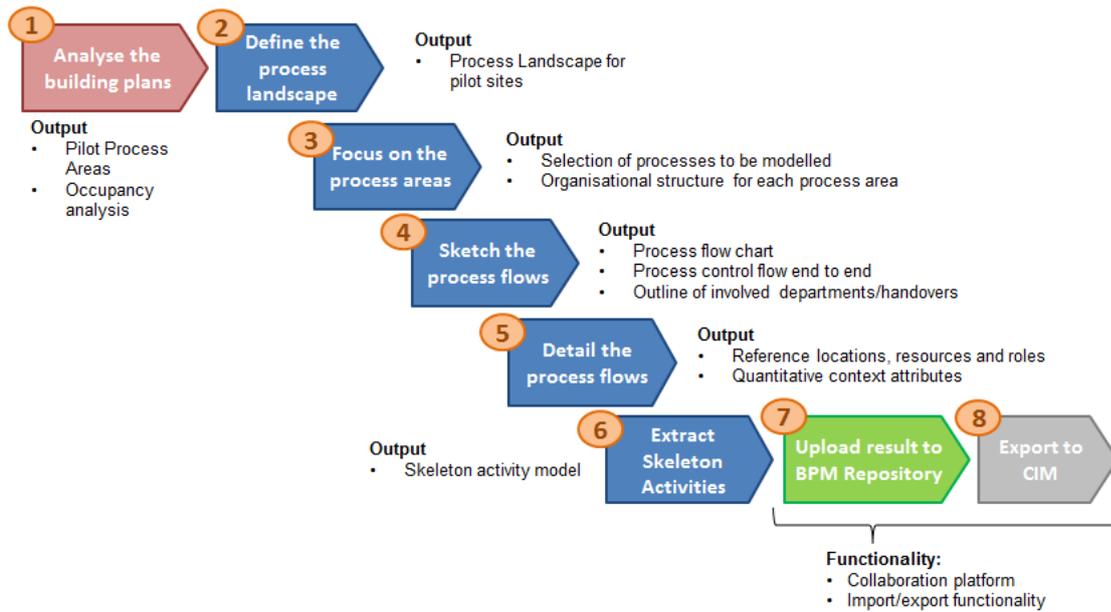
The current deliverable D2.1 analyses the performance of the selected areas in the four pilot sites thus defining the **amount of energy consumed** (from whole building energy billing data) or **estimated** (following a simulation based baseline) to meet the different needs associated with a standardized use of the building

A 3D sketch-up models of the premises of interest are created along with their gbXML models. Also the number of plugs and switches is investigated. Thus it will be possible to choose monitoring devices and develop a network with displays and intranet portal aiming to monitor and transmit data on the amount of energy consumed in near real time manner.



BHoE area for Museum purposes Sketch-up model

Central to the conceptual approach of creating the pilot site business processes is for the result to be modelling method independent. Method independent for the area of BPM means that the baseline approach developed is applicable to any kind of modelling approach for business processes (BPMN, EPC, BPMS, LOVEM, and the like) and allows integration of pre-existing models/information as available at the pilots' sites (stemming from other initiatives such as quality management audits, ISO certifications, risk assessments). The baseline of the work performed has been developed in the Adapt4EE project identifying the following phases.



Adapt4EE Pilot Business Process Modelling Procedure, adapted for OrbEEt

The BPM acquisition phase is performed using tool support provided by BOC. The technical architecture is setup to allow remote work, synchronization results continuously with an online, project interface.

BPM Technical Architecture

