SEVENTH FRAMEWORK PROGRAMME

Open Dynamic System for Saving Energy in Urban Spaces

D1.2 Pilot Integration Scenarios and dEPC Requirements – Public abstract

Deliverable data

Deliverable no & name	**D1.2 Pilot Integration Scenarios and dEPC Requirements**
Main Contributors	*ESO, ROM, MCC, TEL, CST, TNO, PRI, ADV*
Other Contributors	
Deliverable Nature	*Report*
Dissemination level	**PU** – Public
	PP – Restricted to other programme participants (including the Commission Services)
	RE – Restricted to a group specified by the consortium (including the Commission Services)
	CO – Confidential, only for members of the consortium (including the Commission Services) – **X**
Date	*22/04/2014 (Deliverable date: 18/07/2013)*
Status	*Final version*

Table of Contents

1 Executive Summary

This document reports the details and the requirements for the implementation of the Manchester city and "Municipality of Rome" XI Odysseus Pilot cases. It starts from the general background already described in D1.1 – Pilot Business Cases to identify technical features, requirements and constraints for improvement and optimization of the energy system of the two cities.

The document reports the Odysseus bottom-up methodology and the information and data for the Odysseus system for the two cases.

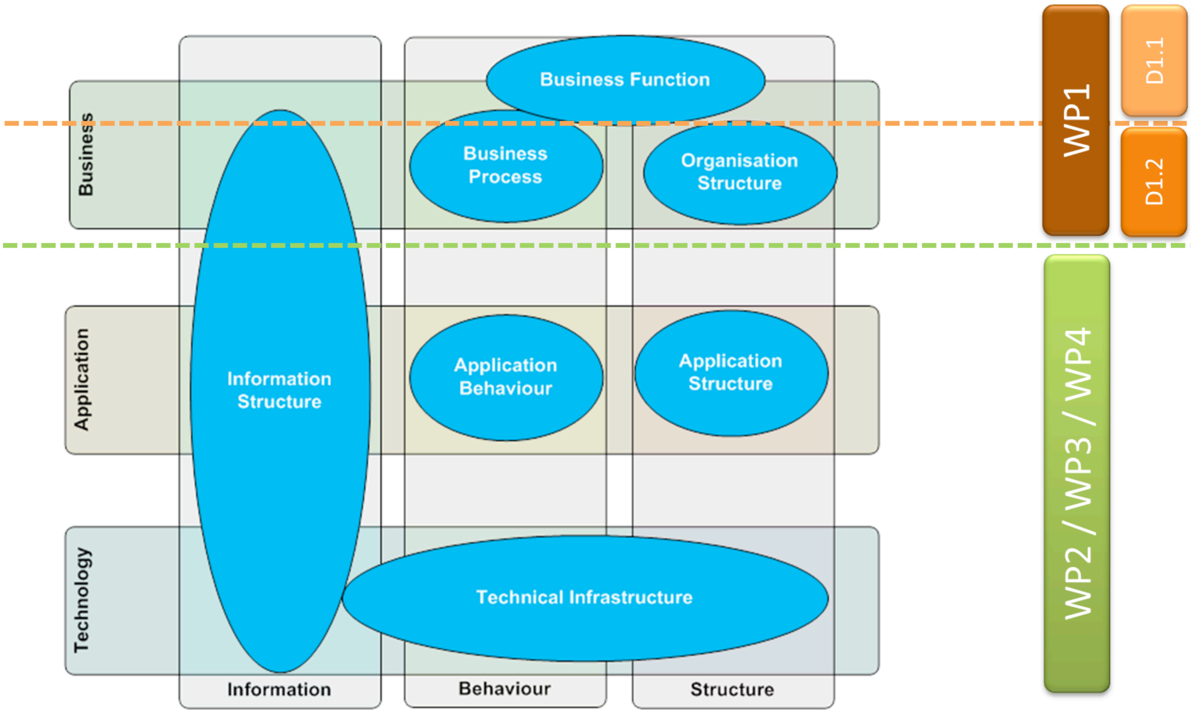

Figure 1 – Odysseus deliverable 1.2 high-level description

2 Introduction

2.1 Purpose, Intended Audience and Scope

The objective of this deliverable is to define in details the proposed integration scenario for pilot sites of Rome XI and Manchester. It provides the information structure required to store and use the holistic Energy Management Solution - hEMS (considering inputs from both project pilots).

This deliverable is framed in WP1 requirements and analysis that is setting the scene for all the work-packages for both development and pilot demonstration and validation. The work-package is:

- Describing the business case for pilot demonstration.
- Describing the integration scenario and the energy information Requirements (that has to be stored and used in the new open dynamic (energy management) system.

The content of this document is dealing with the second point of the above list.

WP1 fully objectives are to:

- Define the clear business cases for the two pilot demonstrations.
- Identify the existing technical features of each pilot (type of energy nodes, ICT infrastructure, software applications/tools in use, etc.).
- Identify the requirements and constraints for improvement, and optimization/innovation potential.
- Define the derived (open) integration/communication scenarios.
- Define the (again) derived energy information requirements to be fulfilled by the foreseen dEPCs for the type of energy nodes identified.

Final output of D1.2 is to detail report cases requisites to be submitted as input in the Odysseus solution achieving the energy reduction and efficiency targets for the two cities. The pilots finally resulting will be first sample of the Odysseus system adoption for the energy and efficiency implementation in the Rome XI district and Manchester city.

2.2 Applicable Documents

AD(1). DOW ODYSSEUS (600059) 2012-09-26

AD(2). Rome Site Narrative case presentation (ppt)

AD(3). D1.1 – Pilot Business Cases

AD(4). D7.1 Odysseus Project Plan

3 Odysseus business actors

This section describes the actors at business level that are the final addressee of the Odysseus system and that in the end are responsible to take decision for the energy efficiency, based on the information Odysseus system is able to provide in support.

The following separate two paragraphs reports the Rome and Manchester as-is and to-be situation identifying the actors involved and the decision level based on the future adoption of the Odysseus system.

The information utilized from the Odysseus system is relevant at process and organizational level; the actors involved in the to-be scenario are interacting with the following Odysseus tools:

- Neighbourhood modelling tool
- Performance analysis tool (strategic level)
- Real-time energy management (operational level)

3.1.1 *Rome case business actors*

The actors involved in the Rome case are:

- The City energy managers (City energy department)
- The Facility manager (UOT)
- The Energy Utility (ACEA)

The decisions concerning energy efficiency in the district can foresee the following steps:

- Access to data
- Modification evaluation and case study (pro and cons)
- Simulation for the modification
- Decision approval
- Final execution of the decision

3.1.2 *Manchester case business actors*

The main stakeholders and actors involved include:

- Manchester City Council at policy level: elected members and senior management;
- Manchester City Council as an employer: technical staff;

- Users of the facilities: residents, businesses and visitors;
- Energy/utility suppliers, e.g. Electricity North West (ENW);
  - Partners of 'Manchester: A Certain Future': the Manchester Climate Change Action Plan;
  - Businesses and other facilities within the neighbourhood;
  - Partners of the Corridor Partnership.

3.2 Odysseus logical view

In the Odysseus approach, a neighbourhood is composed of a set of nodes that can potentially exchange energy through the energy network for an improved global efficiency. Typical nodes are buildings, power plants like PV, geothermal, CHP plants, storage plants, civil infrastructures like roads and tunnels with their lighting systems, electric vehicles and charging stations, etc. Each node is characterized by a dynamic Energy Profile Card (dEPC) that describes the energy-related capabilities of each relevant district node to generate, consume and/or store energy over time.

The figure below gives a logical view of the Odysseus architecture, showing the main components of the system, and the type of information exchanged between them.

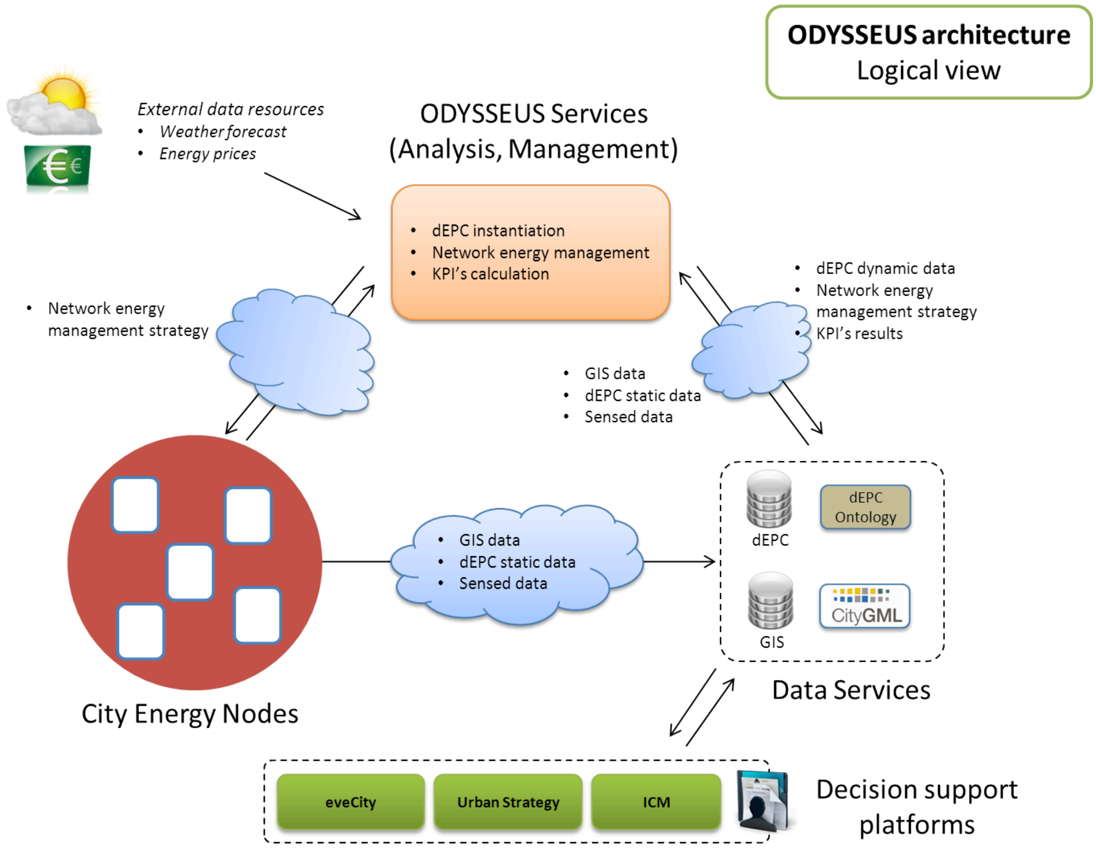

Figure 2 - Logical view of the Odysseus architecture

The main identified components of the Odysseus architecture are the following:

- City Energy Nodes (E-Nodes): they represent the different existing energy systems of the neighbourhood from which data will the aggregated on the Odysseus platform
- Data Services: the role of this component is to store data about the city nodes (GIS data, dEPC data) and the network energy efficiency (KPI), and to provide data services to other parts of the Odysseus holistic Energy Management System (hEMS).
- Odysseus Services: this component provides services for dEPC instantiation, holistic energy management at level of the neighbourhood, calculation of KPIs, etc. These are the core functional services of the hEMS solution to be provided by Odysseus project
- Decision Support Platforms: these are components of the hEMS for supporting decision making based on KPI's to Odysseus stakeholders

4 Odysseus behaviour: Business processes

This chapter reports business use cases and requirements description for the adoption (and development) of the Odysseus system for energy efficiency.

4.1 Manchester business use cases

The project aims at creating a core 'smart environment' within the Civic Quarter, starting with the two main buildings, the Town Hall Extension and Central Library, which will, in the short term, improve energy efficiency and reduce environmental impact, particularly CO2 emissions reduction, and, in the longer term, act as the central part of the new Civic Quarter Heat Exchange Network with other buildings in the immediate neighbourhood. This, in turn, is part of a long-term objective to extend this across the wider district, i.e. the Corridor Partnership area, in order to create a growing set of energy efficient neighbourhoods.

The Manchester use case centres on the deployment of an enhanced smart energy management system in order to maximise the optimisation of this system to enable a 29% reduction in CO_2 across the main complex and to begin to develop scenarios for identifying ways that the local neighbourhood could share energy systems across buildings. This is part of ensuring that the systems supporting the Town Hall complex are future proof and can take advantage of advanced digital technologies both hardware and software. Additionally, the complex is designed so that it can be easily connected to the proposed heat exchange network that is planned for connecting a number of additional buildings in the neighbourhood. This is supported by the development of a number of tools for generating digital data which can be used in analysing, evaluating and influencing energy use in the two core buildings and their environment, especially those linked to the development of the BIM system for the buildings. Current tools include GIS, CAD, Autodesk Revit, Navisworks Manager, Artra and Cadduct (M&E modelling). The sub-metering strategy is based on TM39 for managing the (approx. 450) sub-meters across the THC.

4.2 Rome XI business use cases

The pilot case Municipality of Roma XI is based on the use of the energy produced by the photovoltaic plant of Cesare Battisti school (Building A). Currently the energy produced by the photovoltaic plant of building A (Cesare Battisti school) is used for the consumption of the loads of the school as the energy produced in excess is given to the Acea network. The target is using all the photovoltaic energy produced for own use without giving back the remaining energy produced by the photovoltaic plant to the grid and therefore to simulate the transfer of electricity in surplus (especially during the summer when most of the school building is closed) from the building A of the Cesare Battisti school to the Cesare Battisti offices of building B for charging the batteries of electric bicycles. The case is illustrated by the following two diagrams that show the transfer of the surplus of electricity.

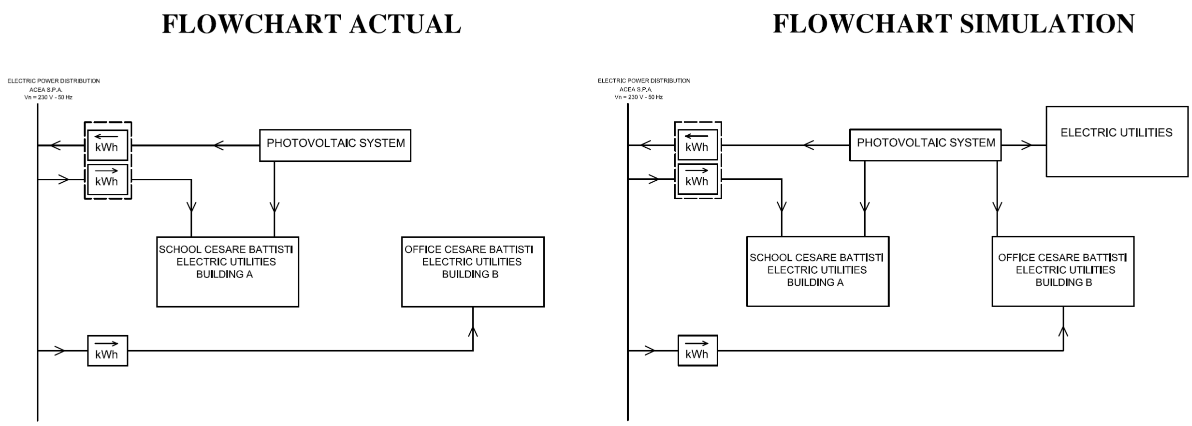

Figure 3 – Electricity surplus transfer diagram – Rome case

The solar panels energy surplus is returned to ACEA utility as default option.

5 Odysseus information structure

5.1 From "E-Node" to the concept of "EupP"

In previous section of this document both notions of "E-Nodes" and "dEPC" have been shortly introduced. In this section we will introduce the concept of EupP (Energy using and producing Products), which is the abstraction chosen to represent the different types of nodes and detail what a dEPC should contain.

5.1.1 *Node & e-Node definitions*

Following are introduced some key concepts and definitions for the node and e-node concepts being considered within the Odysseus project:

1. An E-Node is a physical component of a network, analogue to a system, that can produce, consume or store energy
2. E-Node level of granularity is linked with the dEPC concept. Examples of urban energy nodes to be considered are:
    - Building
    - Building flat (in case of multi-storey building)
    - Power station: fossil-fuel power station, solar plant, geothermal plant, windmill, CHP, etc.
    - EV charging station
    - Street lighting system
    - Centralized storage units (thermal, electrical…)
    - Energy hubs
    - Local production systems: boiler, µCHP, heat pump, RES, …
    - Lighting system
    - Energy consuming devices (e.g. washing machine, dishwasher, fridge, lift, computer, etc.)
    - Local storage units (thermal, electrical…)
    - Etc.
3. An E-Node can be part of another E-Node. E.g.: a boiler can be considered as a node that is part of another node formed by the building. However, this notion of "part

of" is not really an issue. What is essential to know is the possible connections between E-Nodes to exchange energy

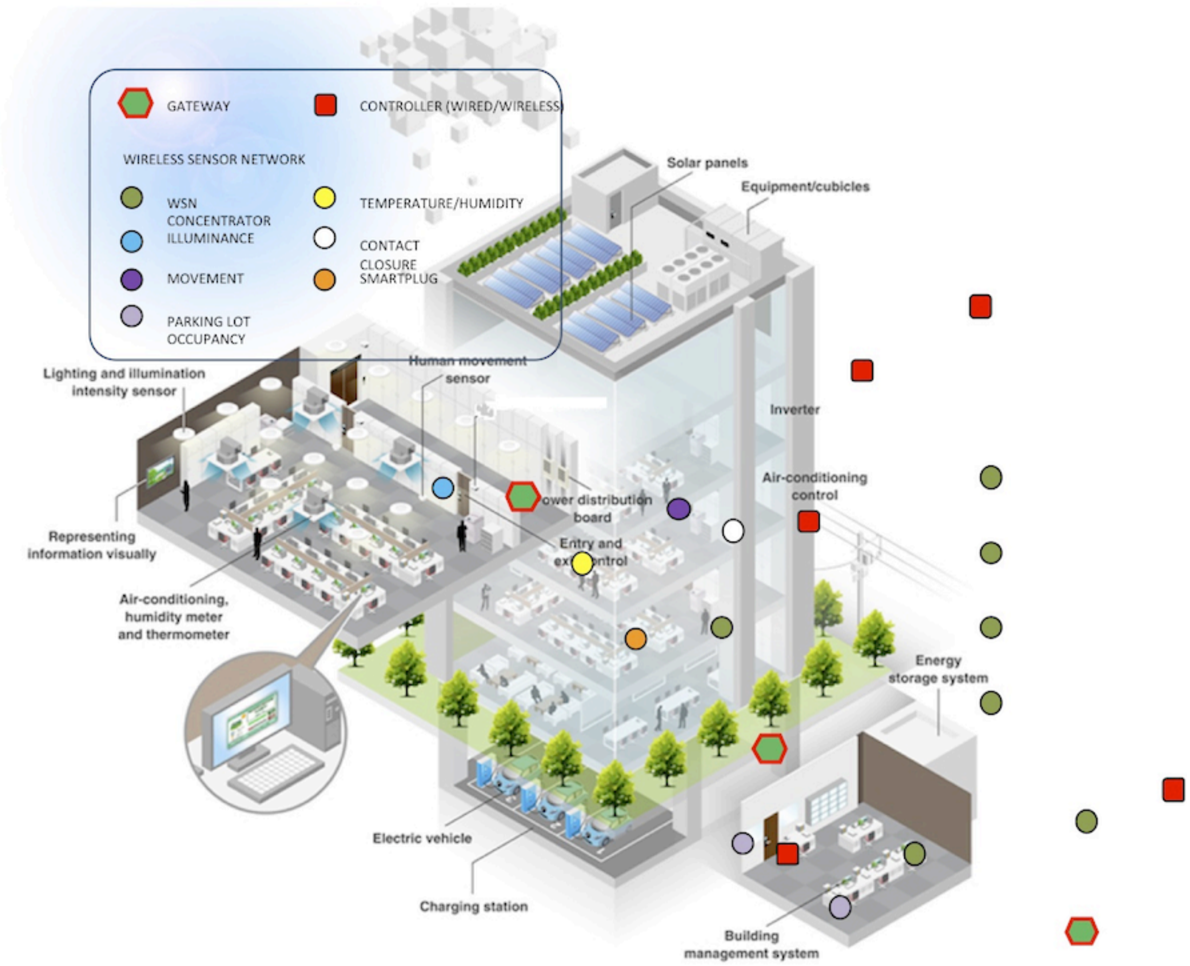

Figure 4 – E-node definitions

The figure above illustrates a particular E-Node case, a "building" E-Node, some of the main energy systems that are part of the building are identified and can be considered themselves as E-Nodes within the "building" E-Node.

Preliminary E-Node definition has been discussed as per the following proposal points:

- We have many types of Networks; one type is an Energy Network or E-Network. If such E-Network is managed then we call it a Grid.
- Such Grid/E-Network consists of E-Nodes, E-Connections and the E-Flows (electricity, heat-water, heat-air, gas) over them.
- E-Connection and E-Flow info is attached to E-Nodes making E-Node the central concept.

- E-Nodes can be on several decomposition levels (examples: Neighborhood as E-Node, Neighborhoud Element as E-Nodes, Device as E-Node etc.).
- E-Nodes have production, storage and consumption profiles (potential zero for 2 out of 3).

Conclusions

This document resumes the description of business requirements for the development of the Odysseus solution that will be deployed and validated in the context of the Manchester city and "Municipality of Rome" XI pilot cases (that are fully desscribed in D1.2).

This document reports also the methodology followed by the Odysseus project to achieve the description of the pilots and go through the holistic solution implementation of the Energy Saving requirements in the two cities.

This document reports also the initial proposed integration scenarios for pilot sites of Rome XI and Manchester, fully described in D1.2 to provide the information structure required to store and use the holistic Energy Management Solution (considering inputs from both project pilots).