CONTROL AND OPTIMIZATION FOR ENERGY POSITIVE NEIGHBOURHOODS

COOPERATE

Deliverable D1.1

Report on Requirement and Use-Cases specifications

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Abstract This document specifies use cases and requirements for the COOPERATE neighbourhood integration platform.

Keyword list Energy Positive Neighbourhood, Demand Side Management, Demand Response, Neighbourhood Data services, Energy Positive Neighbourhood Use Cases, energy Management, Smart Grid

Document History

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Executive Summary

The objective of COOPERATE is to develop an open, scalable neighbourhood systems integration and management platform linking local monitoring and control functions with a cloud based service platform for the delivery of innovative energy management, security and other future services. The platform will enable the delivery of energy services, allows the management and trading of locally generated energy with grid based energy supplies, and links with other local and cloud based services such as security/safety and transportation in order to progress towards energy positive neighbourhoods.

This document describes a selection of use cases and requirements for the COOPERATE neighbourhood integration platform.

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1 Document Objectives and Content

The intent of this document is to summarise the COOPERATE consortium's efforts at identifying and specifying energy related and non-energy related use cases and associated application services for the COOPERATE neighbourhood integration platform. The document specifies the high level functional requirements, which are derived from the envisaged application services, for the neighbourhood architecture, software/data services, algorithms and other technical components of the COOPERATE platform. In particular, the document

- Defines specific terms that the COOPERATE project will use to create a common understanding of a neighbourhood and the ICT services in the COOPERATE platform and its uses within the scope of energy positive neighbourhoods. In **Section 2** we offer definitions on which future technical developments of COOPERATE will be based.

- Specifies energy and non-energy use cases. In **Section 3,** we detail energy related and non-energy related use cases and their associated application services. The energy related use cases focus on energy positive neighbourhoods following the definition in Section 2. Non-energy related use cases are defined in an attempt to demonstrate the usefulness of the COOPERATE platform beyond energy management.

- Specifies functional requirements arising from the neighbourhood application services description in Section 3. The requirements summarised in **Section 4**.

The COOPERATE consortium see the specification of use cases and neighbourhood services as a pivotal initial step in developing the COOPERATE platform. However, it is envisaged changes will be made to the platform specification during the course of the project.

2 Use case methodology and rationale

2.1 Introduction

As stated in section 1, the intent of this document is to summarise the COOPERATE consortium's efforts at identifying and specifying energy related and non-energy related use cases and their associated application services. This effort is best described as a Systems Engineering task where the objective is to identify functional user requirements for the COOPERATE platform based on domain expertise and stakeholder feedback. In developing user requirements we define 'what' is needed without identifying any specific design or technology, that is very different to technical specifications which define 'how' to meet those user requirements. This document is focused at the 'functional user requirements level' and effectively sits at phase 2 'Domain Expert stakeholders' of the IntelliGrid methodology [1] and to a some extent Phase 3 'Project Engineers' (see table 1 below).

Phase 1: Executives use Business Cases to approve projects in order to meet Business Needs. Although this step in the process involves executive decisions based on cost justification and other non-technical factors, from the IntelliGrid Architecture point of view, the key requirement for these executives in making decisions to approve projects is that they should require all IntelliGrid Strategic Vision issues to be addressed in the Business Cases.
Phase 2: Domain Expert Stakeholders describe their User Requirements through the formal Use Case process. Use Cases permit these experts to express their requirements in a formalized manner that can then be coordinated and solidified into more detailed functional and performance requirements in the next phase.
Phase 3: Project Engineers develop the more detailed functional and performance requirements from the Use Cases that were developed by the domain experts.
Phase 4: Project Engineers and **IT Specialists** assess applicability to the project of the standards, technologies, and best practices identified in the appropriate IntelliGrid Environments.
Phase 5: Design Engineers develop Technical Specifications based on Strategic Vision, Tactical Approach, & Standards

Table 1 - IntelliGrid methodology phases

The methodology followed to capture user requirements was based on the IntelliGrid methodology introduced above but was adapted taking into account pragmatic considerations such as time constraints, type of project, access to stakeholders etc."

For example, within Phase1 of the IntelliGrid methodology 'Executives' examine the business case for specific projects. Use-cases are not defined. Within COOPERATE Phase 1 was somewhat different, with the collective knowledge of the Consortium, specifically that of industrial partners and Manchester University (Business Models & Enablers WP lead), utilised in defining tentative use-cases for discussion with stakeholders as part of a workshop process. Additionally, the COOPERATE project engaged with the IREEN project [2] in sharing and sanity checking respective use cases. The IREEN project is an FP7 funded CSA tasked with developing an ICT roadmap for Energy efficient neighbourhoods. There were varying degrees of alignment and overlap between the COOPERATE use cases and a sub-set of the scenarios identified by IREEN, listed below. For example the 'Citizen and the City' scenario had originally been suggested within an IREEN workshop by a COOPERATE partner and was the bases for UC7 '*participatory sensing'*.

Additionally, the energy themes identified in the Neighbourhood level scenarios of IREEN were highly aligned to the COOPERATE context and where captured in the following use cases of IREEN

- Building Energy Management Services
- Heating and DHW in buildings controlled on a neighbourhood level (from the consumer point of view)
- Buildings and urban infrastructures maintenance
- Energy brokering of a neighbourhood
- Integrated planning tool of energy systems
- Intelligent integration of small scaled renewables and gas network.
- Intelligent based energy pricing system
- Home Energy Management System
- Urban Energy Enterprise
- Urban Energy Enterprise
- Citizen and the City
- Building and public spaces

The user requirements and use-cases that were identified by the consortium were brought forward for discussion in a stakeholder workshop held in Cork, Ireland and stakeholder interviews help in Paris, France (see Appendix 3). The objective of the workshop and the interviews was to receive feedback and align the use cases with the stakeholder interests. The use cases were presented as being tentative and participants/interviewees were actively encouraged to critique and think “out of the box” in terms of brainstorming alternative usages and in expressing needs from their perspective. The overall process followed for capturing use cases and requirements for the COOPERATE platform is illustrated in figure 1.

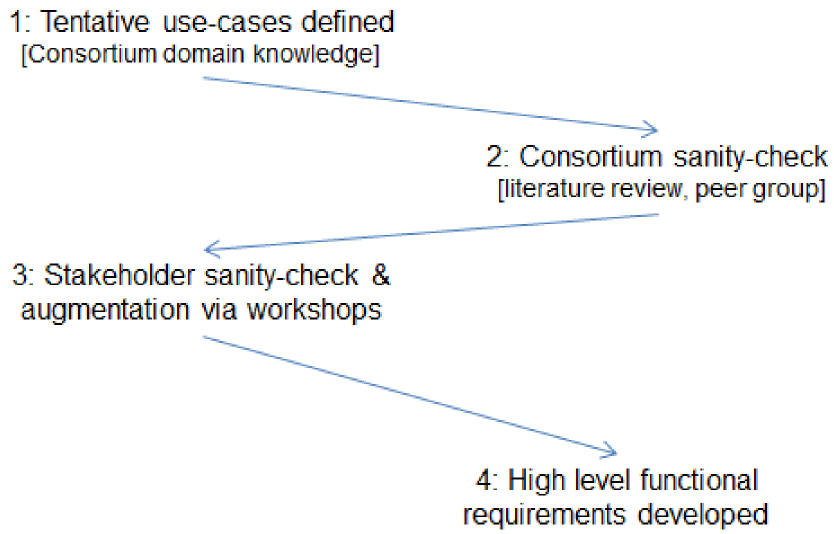


Figure 1 COOPERATE methodology steps

A means of capturing and presenting the use cases and the associated application services was developed which is similar to other use case templates such as the ‘Energy Information Standards (EIS) Alliance Customer Domain Use Case’ template.

Essentially the template was developed to capture answers to the following:

1. what is the challenge, need, goal that is addressed, a domain narrative
2. who is involved or should be involved
3. what is the service concept narrative
4. what are the key considerations
5. can the concept be illustrated
6. what is the potential economic value
7. what are the high-level ICT requirements

2.2 COOPERATE definitions

This section defines some definitions that are core to COOPERATE and warrant description within the body of the document.

Neighbourhood definition

Within COOPERATE a 'Neighbourhood' is defined as a group of households, business and public services localized geographically and used by a community on a daily basis.

Energy Positive Neighbourhood definition

An 'Energy Positive Neighbourhood' (EPN) is defined as a neighbourhood which can maximise usage of local and renewable energy resources whilst positively contributing to the optimisation and security of the wider electricity grid.

Neighbourhood Energy Manager definition

A 'Neighbourhood Energy Manager' (NEM) is a prospective new role, different from what could be provided by an ESCO. The NEM has an operational role within the neighbourhood as opposed to a consulting role. It is envisaged the role would oversee independent facilities managers or may be a role that moves between them round-robin style. It is possible that neighbourhood energy management becomes a managed service where one NEM taking responsibility for many neighbourhoods.

The main responsibility of the NEM is to manage the energy for a neighbourhood involving multiple, independent and heterogeneous facilities. While much of the energy consumption/generation control will be handled automatically via the COOPERATE platform and associated services, the NEM takes a supervisory role as a human in the loop for handling unpredictable events and stakeholder management. The NEM is not a commercial aggregator and can issue commands/requests/incentives to reduce demand without having to know exactly the amount that demand will be reduced by (direct load control as opposed to demand response, all within the neighbourhood).

Software/Data services, application services and Use cases

The focus of COOPERATE is to develop an open, scalable neighbourhood integration and management platform linking local monitoring and control functions/services with a cloud based service platform to facilitate innovative energy management, security and other future services. In view of the above objective, at a simplistic level two core use case domains can be identified

- Energy-related neighbourhood management
- Non-energy related neighbourhood management

Energy-related neighbourhood management services address the challenges for energy management at the neighbourhood level including demand-side management and demand response.

Non-energy related management services address the challenges related to neighbourhood management in terms of security, transportation and dynamic communication services between individuals and neighbourhood or commercial services.

The COOPERATE platform is tasked with delivering application services that address the needs of the neighbourhood:

- *Use-cases* are narratives that describe how the application services are utilised in addressing specific needs. They can have a 1:1 or 1:N relationship with application services.
- *Applications services* are complex in nature and leverage software/data services with respect to service delivery.

The relationship between software/data services, application services and use cases is illustrated in figure 2. The use cases can leverage a number of application services to fulfil the challenges and goals for each use case. The application services can leverage a number of software/data services as well as other applications services.

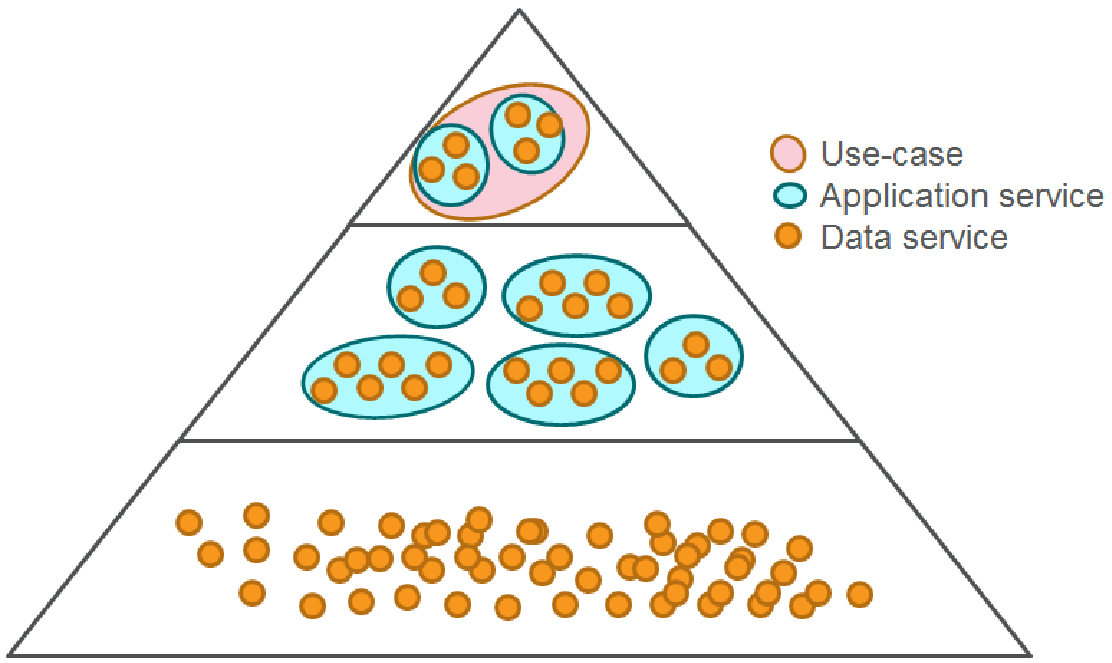


Figure 2 COOPERATE software/data service, application service, use-case pyramid

Taken as a whole, these application services will move the neighbourhood from a ‘data rich information poor scenario’ to one of ‘valued services’, where the neighbourhood acts as a key component of the wider grid in a way that is positive for the neighbourhood from a revenue and resource efficiency perspective.

3 COOPERATE use cases

The following sections succinctly describe the use cases and associated application services that will be developed for the COOPERATE platform. Each use case utilises a standard template that defines for each of the services:

- the **neighbourhood challenge / goal** i.e. the use case narrative
- the **key stakeholders and actors** involved
- the **service concept** built on the use-case narrative from a service perspective
- the **service key elements** that describe geography, scope, broad technical elements
- the **value proposition** that identifies the likely economic impact of the service
- the **high-level functional requirements** that describe what the platform should do

The use cases in the following sections are specified for a generic Neighbourhood Energy Management platform. It is envisaged that all use cases described here will be also demonstrated in one or both demo-sites of the COOPERATE project.

3.1 Energy-related Neighbourhood Use Cases and Application Services

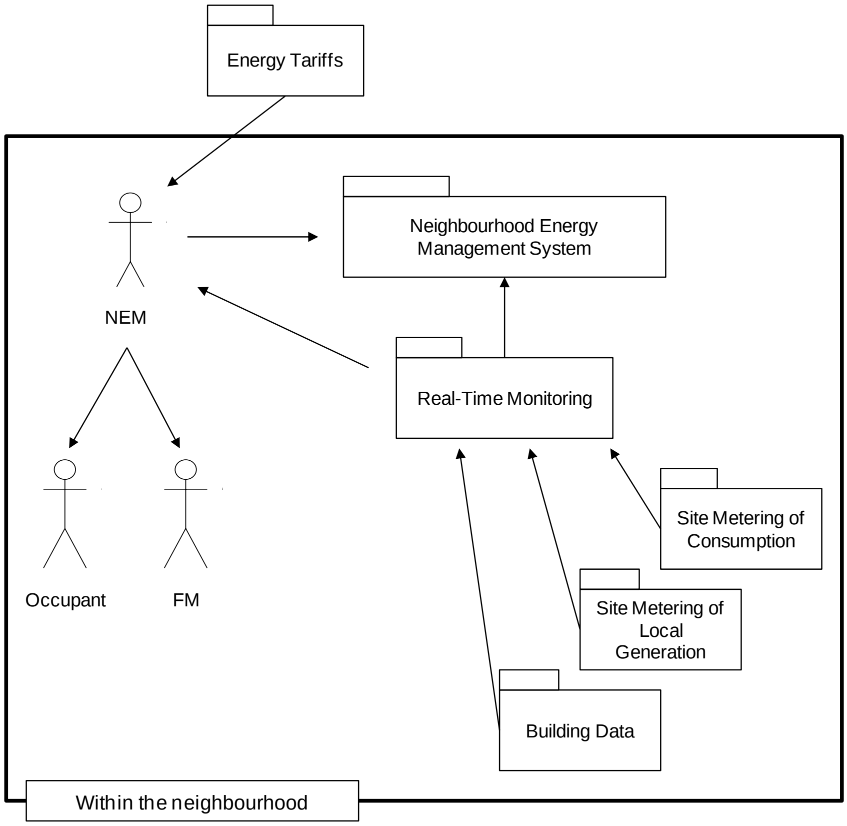
3.1.1 UC1 Real-time Monitoring of the Consumption of a Neighbourhood

Brief Description	Measure, aggregate and visualize the consumption of the neighbourhood in real-time.
Neighbourhood Challenge	The NEM of *SomeNeighbourhood*, Pierre, is chair of the NEM working group. The group includes representation from facilities managers, building owners and residential occupants. The working group had been focused on proliferating advances in building energy management and automation within *SomeNeighbourhood*. As a result most of the public and private buildings within *SomeNeighbourhood* are now equipped with BMS systems with many having Monitoring and Targeting (M&T) systems. In addition, many houses are equipped with Home Energy Management Systems (in France the regulation RT2012 imposes energy boxes in new houses). Those systems have resulted in increased efficiencies and provided real-time information to the Facility Managers and building occupants. However, the group is now firmly focused on extending capability beyond the envelope of the building. The premise being the neighbourhood could achieve greater resource security and efficiencies possibly revenues by managing energy at an aggregated level. The working group firmly agrees that the first step on evolution to what is deemed ‘energy positivity’ is to

securely acquire the energy and resource data for each building, to synchronise and aggregate that data thus establishing real-time baseline consumption monitoring at the neighbourhood level.

Key stakeholders	NEM, Facilities managers, IT Technology providers, HEMS (Home Energy Management Systems), BMS
Services Concept	The task faced by Pierre and the working group is to develop a real-time monitoring application service that will integrate information from multiple energy systems, thus enabling increased awareness and decision support at all levels (NEM, FM and users/occupants). The service will be leveraged further in other application services such as UC2 - demand and generation forecasting, UC3 – grid –v- local optimization and UC4 - demand response services.

Concept Schematic



Service Key Elements

Pierre and the FM's need to monitor their energy consumption and identify the parts of the neighbourhood or buildings that are the key contributors to this consumption.

The service uses measured data gathered by the various energy management and HEMS systems [see challenge below] as well as real-time pricing information and calculates the instantaneous energy consumption and cost of energy consumed.

The information is produced by the neighbourhood management platform and is distributed to the NEM and the FMs on a regular basis i.e. weekly, monthly etc.

In addition, information and measurements from various sub-loads such as parts of the neighbourhood or buildings in the neighbourhood, is presented to Pierre and FM's to evaluate the key contributors to the consumption of the neighbourhood.

Value Proposition	The real-time monitoring of the neighbourhood is the first step for the other added value services such as DR or DSM. It is commonly admitted than the monitoring itself contributes to reduce up to 20% the global energy consumption (SEAI, 2005).
High Level System Requirements	The service requires: • Real-time energy measurements • Real-time pricing information • Interfacing with smart meters and BMS systems The service should have: • Means for visualization of the consumption to the NEM,FM and users • Means of messaging that allow the NEM to interact with the service i.e. input pricing or historical data. • Means of making single consumer data anonymous, e.g clustering

3.1.2 UC2 Energy Demand and Power Generation Forecasting

Brief Description	Forecasting the consumption of the neighbourhood and the local generation, hourly ahead, day ahead or year ahead helps the neighbourhood to manage efficiently the energy cost, the interaction with the grid and the market. If shared with the DSO, it is providing visibility to the Utility to better dispatch the power.
Neighbourhood Challenge	The NEM working group have been discussing the path to energy positivity for *SomeNeighbourhood*. They have heard a submission from a well-regarded local Research Institute that proposes that Neighbourhoods that forecasting their energy usage can better manage their consumption costs and better negotiate their energy contract with suppliers. They explain how forecasting local generation helps the neighbourhood to manage efficiently the local production, local direct consumption, storing and selling of energy to the grid. Pierre, suggests that although load forecasting at the utility level has long been mastered, load forecasting at the neighbourhood level is far less common, because a lower quantity of statistical samples may lead to a significantly higher impact from single users' consumption peaks, depending on how small the neighbourhood is. Pierre and the Research Institute suggest collaboration in establishing a localised demand and generation forecasting capability given the prohibitive nature of any

individual building owner or organisation trying to do so alone. The working Group agrees and project team is established.

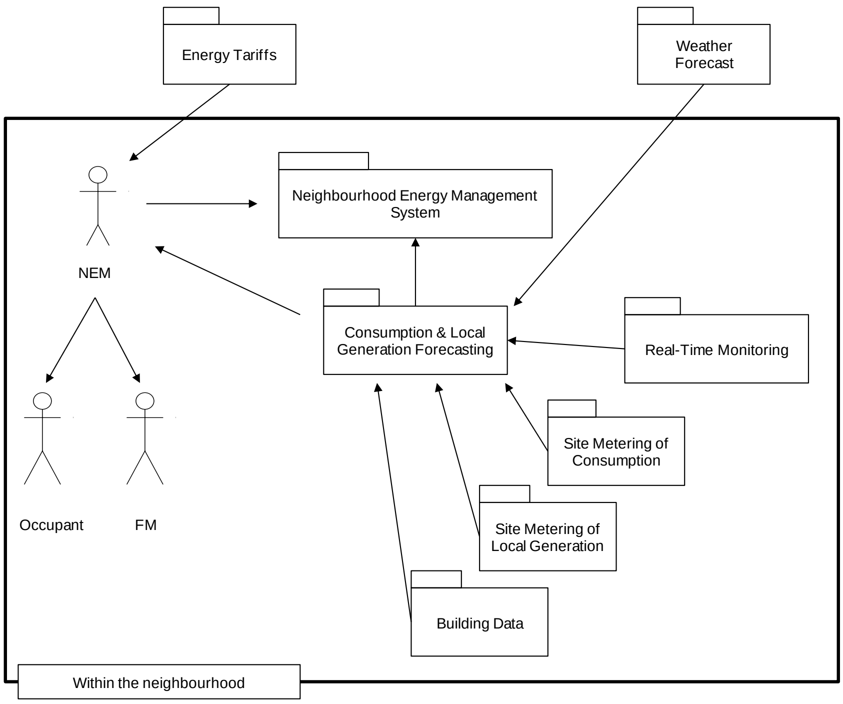
Key stakeholders

NEM, Facilities manager, Neighbourhood Users, Weather forecasting companies

Services Concept

The service will provide energy consumption and generation forecasting capabilities to the NEM, FM and users for assessing the future energy consumption and planning local power generation. It will be used to identify possibilities for improvements to the existing thermal and electrical systems operation in order to improve efficiency of the neighbourhood. The service will be used as an input for optimization UC3 and demand response UC4 within the COOPERATE platform, to predict in an optimal manner the future energy demand and cost.

Concept Schematic



Service Key Elements

Pierre has to model the forecast for the neighbourhood energy consumption and produce a plan for the local generation.

He uses the service to predict the future energy demand and production of the neighbourhood. The service uses for example weather information and historical and instantaneous consumption data from UC1 The energy consumption and future demand forecast for the neighbourhood is presented primarily to Pierre while that for a specific building is presented at FM level. Pierre and the various FMs in combination use the energy consumption forecasts for planning, contract negotiation and optimising operation.

Value

The ability to forecast energy demand and local power production

Proposition

will give the neighbourhood a powerful tool in negotiation of energy purchase contracts and should enable purchase of electricity, gas and fuel on more favourable terms. Reliable forecasts will also enable more reliable demand response, which will add value as reliability in demand response attracts a premium.

High Level System Requirements

The service should:

- Provide hourly energy demand forecast in day ahead mode (kWh)
- Provide yearly energy grid demand forecast (MWh)
- Provide hourly power generation forecast in day ahead mode (kW)
- Provide 15min intra-day demand and generation forecast (kWh)

The service requires:

- Ability to store and use historical data of the neighbourhood/buildings usage (set-points, time of operation, temperatures, energy consumption etc.)
- Ability to use weather and energy price forecasts
- Ability to interface and communicate with existing BMS systems

3.1.3 UC3 Optimization of Power Purchases versus On-Site Generation

Brief Description

The Neighbourhood is able to make the right decision at any time, between importing power from the grid and using the local generation.

Neighbourhood Challenge

As part of their ‘Energy Positive’ evolution Pierre and the NEM working group aim to build on the successful implementation of UC1 and UC2 application services, namely real-time monitoring and demand/generation forecasting. The objective is to use and manage neighbourhood on-site generation and storage capabilities to supply power at optimised cost and carbon intensity this is based on local generation cost, utility purchase prices and carbon intensity. They have held discussion with the local council, government agencies and the grid operator that have centred on the possibility of future credits being awarded to *SomeNeighbourhood* based on energy and carbon targets. Government have agreed to part fund service development.

Key stakeholders

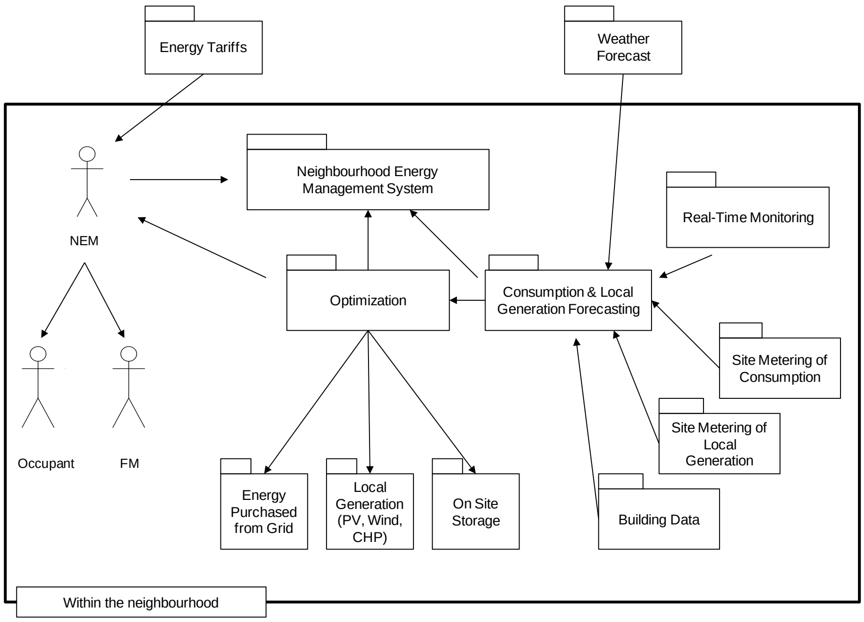
Neighbourhood energy manager, facilities manager, neighbourhood users, Energy Suppliers.

Services Concept

Pierre in collaboration with the FMs of the NEM working group is tasked with overseeing the energy consumption and energy generation systems in the neighbourhood. The neighbourhood consists of number of buildings with different local generation and storage systems (boilers, CHP, wind turbines, geo-thermal, water tank storages) or alternatively a district electrical and heating system.

The neighbourhood will operate in an optimal manner to minimize the energy consumption cost and balance peak or excessive demand by using the optimization application service. The optimization service will leverage other software/data services such as UC1 real-time monitoring, UC2 consumption and generation forecasting.

Concept Schematic



Service Key Elements

The NEM (Pierre) needs to balance his load and minimize the cost of the neighbourhood consumption.

Pierre may have a contract with the FMs that allows him to exchange energy with their building at all times or specific time periods. The contract also determines the payments and the actions of the NEM and FM for the transfer exchange.

The optimization service must leverage the monitoring service to determine instantaneous load of the neighbourhood, and the generation available as well as the forecasting service to predict the consumption and the available RES, storage and local generation in the future.

The optimization service then determines an optimal plan and set-points for the local generation system to satisfy peak demand by maximizing the output from RES and local generation, and minimizing the import from the grid when it is economically viable.

In the case where asymmetric demand rises between buildings, If allowed from the contracts with the FMs, the optimization service

	will determine in its optimal plan how to transfer energy from one building to another, based on cost and carbon criteria, in order to balance the asymmetric demand. The service takes into account the contract constraints and determines the payments for the energy exchange between the NEM and the FM. The optimal plan and set-points is implemented automatically or through Pierre at the times that his contract allows it. Alternatively Pierre or the management system informs individual FMs to implement the plan.
Value Proposition	The value proposition depends on the energy purchase contract of the Neighbourhood, and the country regulation. Currently in France, the renewable energy produced by industrial or residential sites is bought by EDF with an attractive price, not giving incentive to local consumption. But the regulation is about to change (La TransitionÉnergetique). In Ireland, it is currently more economically viable to use generated energy on site as an autoproducer rather than export to the grid. REFIT, offer tariffs for grid export of electricity produced by wind, hydro, biomass and anaerobic digestion but not for CHP unless it uses biofuel. REFIT tariffs may not be paid directly to power generators and grid exporters for <5MW due to complexity and charges such as connection, pass through charges, contract terms offered by suppliers etc. The project is most likely to impact on energy consumption reduction and CO2. The value proposition from the Neighbourhood perspective will be detailed during the implementation of the project.
High Level System Requirements	The service should • Provide optimal schedule for electrical and heating system • Provide optimal set-points for local generation system and storage The service requires: • Real-time weather and energy price forecasts • Real-time neighbourhood state monitoring of storage and local generation • Real-time energy consumption measurements • Electric and thermal load forecasts • Real-time interface and communication with BMS systems • Real-time optimization engine • Equipment models The platform should • Store and use historical data of the neighbourhood/buildings usage (set-points, time of operation, temperatures, energy consumption etc.)

3.1.4 UC4 Demand Response

Brief Description

The Neighbourhood is providing a flexibility service to the energy market, participating to DR programs, as a single entity. This is generating additional revenue for the neighbourhood.

Neighbourhood Challenge

The NEM for *SomeNeighbourhood*, Pierre has been tasked, by the neighbourhood board of management, with investigating the possibility of generating revenue for the neighbourhood by acting as a dynamic component of the energy grid. The basic concept being that *SomeNeighbourhood* would alter its energy load in response to requests from the grid by utilising local storage and/or generation capacity. The board, council and building owners are excited with the prospect of additional revenue being generated from the recent capital investment and the facilities managers that have talked with Pierre are excited about the technical challenge. Pierre establishes a project team to develop the capability which will ultimately be offered as an application service to the grid operator.

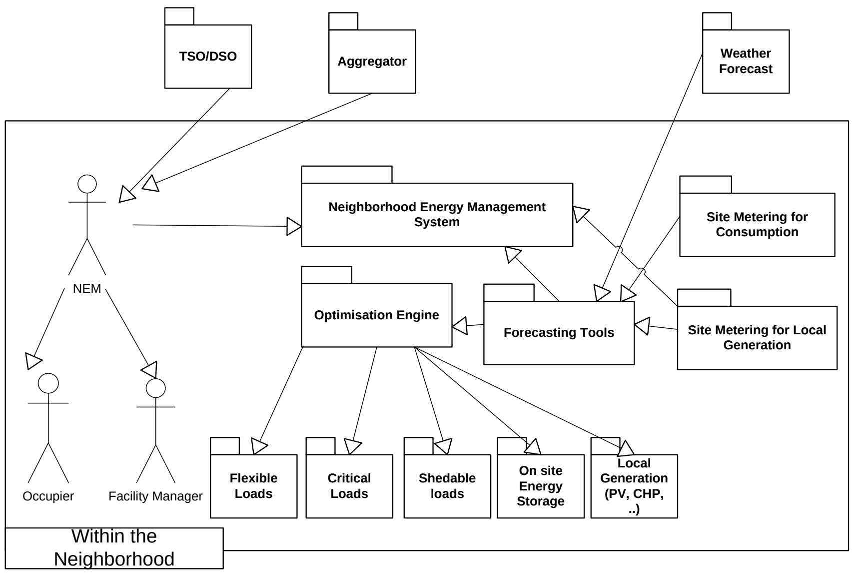
Key stakeholders

NEM, EMS/ICT Service Provider, TSO/DSO/Market, Aggregator.

Services Concept

The task faced by Pierre and his team is to oversee the operation of the neighbourhood infrastructure in acting as a flexible prosumer that can dynamically respond to price signals from the grid utility. The infrastructure includes on-site local generation, flexible load and storage capacity. The neighbourhood is connected to the grid and will act in an optimal manner in response to grid signals by utilising the demand response application service which itself leverages other services such as the real-time monitoring of UC1, the forecasting capability of UC2 and the grid –v- local purchase optimisation capability of UC3.

Concept Schematic



Service Key Elements

A signal comes from the grid to alter energy consumption (reduction or increase) in response to an event prompted by the DSO/TSO or an aggregator on their behalf.

The NEM Pierre has a balancing decision to make - reduce local demand or increase local power generation.

This demand response application service must leverage multiple services in determining the total load of the neighbourhood, the total generation available and/or sheddable load UC1 forecasted consumption and local generation UC2, weather data and the amount of flexibility available i.e. critical loads.

The services triggered by the external signal, provides an action schedule that automatically or through Pierre (also based on the proposed business model) checks the feasibility of the proposed suggestions (constraints check) and takes appropriate action.

Value Proposition

Utilities provide incentives to electricity customers to reduce their consumption during periods of peak demand. Although the traditional approach for the business model is to compare DR against the historical amortized cost of a 'peaker plant' (usually combustion gas turbine – CGT), the value is also very much dependent on the regulatory context of each country. Some indicative figures are given here below in mature markets (the American Utility PJM) and European markets (UK and France):

USA PJM market: $75-100k per MW per year (PJM is operating 17GW of DR)

UK STOR Market: £40k per MW per year

France DR and reserve Market: €30-80k per MW per year

High level system requirements

The DR application services requires:

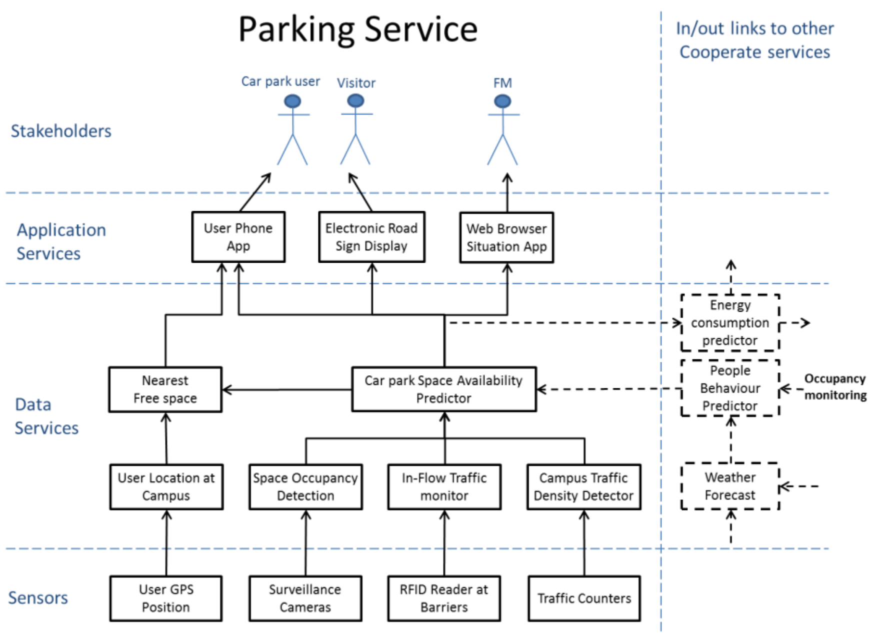
- A means of messaging between the system and the grid
- A means of messaging that can interrogate an optimisation engine that can itself request/receive in near-time data from various inputs with regard to local storage/gen capacity, local demand etc.
- An agreed rule based means of response/actuation
- A means of visualizing the optimisation output for Pierre the NEM on desktop &/or mobile type devices
- A means of messaging that allows Pierre to interact with the system i.e. over-ride an automated decision.

3.2 Non-energy Use Cases and Application Services

3.2.1 UC5 Parking Service

Brief Description	The Neighbourhood occupant and visitors have a real-time view of parking place availability. This UC can be expanded to electrical vehicle's charging point localisation.
Neighbourhood Challenge	Pat is the NEM of *AnotherNeighbourhood*. At the NEM working group an issue is raised by the FM for a local university asking if the group could use the established NEM platform and services in addressing a non-energy related issue. The FM explains how he and two other FMs have been approached regarding the 'out of control parking situation'. The FM explains how the university campus has a significant problem particularly during the 13 week teaching term of each semester which also affects local business, as parking problems can create negative impression for potential (important) visitors while local residents can create negative opinion of the students and the institutes operation. The NEM group agree to establish a sub- working group for extending the NEM platform to non-energy related use-case, with the first project being the establishment of a parking application service.
Key stakeholders	Neighbourhood occupants, visitor, workers
Services Concept	**Parking Advice Service:** Pat and the sub-group determine the service is to be offered through a smart phone app. The neighbourhood platform could store real-time parking space occupancy data in the operational NIM (or other suitable data base). The service could then use this data and recommend parking spaces to the service user. The service will advise users where parking spaces are available, avoiding that users drive needlessly around the campus and its surrounding areas to find parking space and thus having the added benefit of reducing energy consumption of cars in the area while positively impacting productive or valued time. **Preference-based Parking Service:** The service uses real-time parking space occupancy data and the location of the user based on smart phone localisation data (GPS while outdoors) to recommend parking spaces based on the users location, the users intended destination in the neighbourhood and the users preferences in terms of parking cost and walking distance from parking space to final destination.

Concept Schematic



Service Key Elements

The neighbourhood parking spaces are equipped with occupancy sensors. The users have smart phones with localization capabilities (such as GPS), through which they access the service

Value Proposition

The proposed parking advice service will improve neighbourhood perception of visitors that will eventually increase business value by increasing number of visitors. It will also help increase quality of life for the neighbourhood residents. The is an obvious energy payback in reducing fuel consumption.

High level system requirements

- Traffic counters installed at the main campus roads
- RFID Readers at all car park barriers
- Surveillance Cameras
- Optionally - Electronic road sign display at the main campus entrance

3.2.2 UC6 Security Service

Brief Description

Neighbourhood provides and manages the cyber security in the campus.

Neighbourhood Challenge

The NEM of *AnotherNeighbourhood*, Pat, and the NEM sub-group for non-energy services have just agreed on utilising the NEM Platform in establishing a security service. They had reviewed a successful submission from one of the FMs and a local firm. The FM proposed a security system is an essential part of any large infrastructure (such as a campus of a university, the campus of a large company, or a hospital campus). The FM explained how such systems usually comprises of two main parts, an access control system for managing the access to areas and resources within the organisation and a camera surveillance system monitoring unauthorised movement. Both systems are often totally independent despite obvious performance and cost benefits when integrated at the physical level as well as at the logical level she suggests. However, before being able to integrate and leverage both systems for access control, a new type of credential has to be introduced, the user's physical position. The FM suggests the user's physical position and his/her past trajectory can support the seamless authentication required to implement the services.

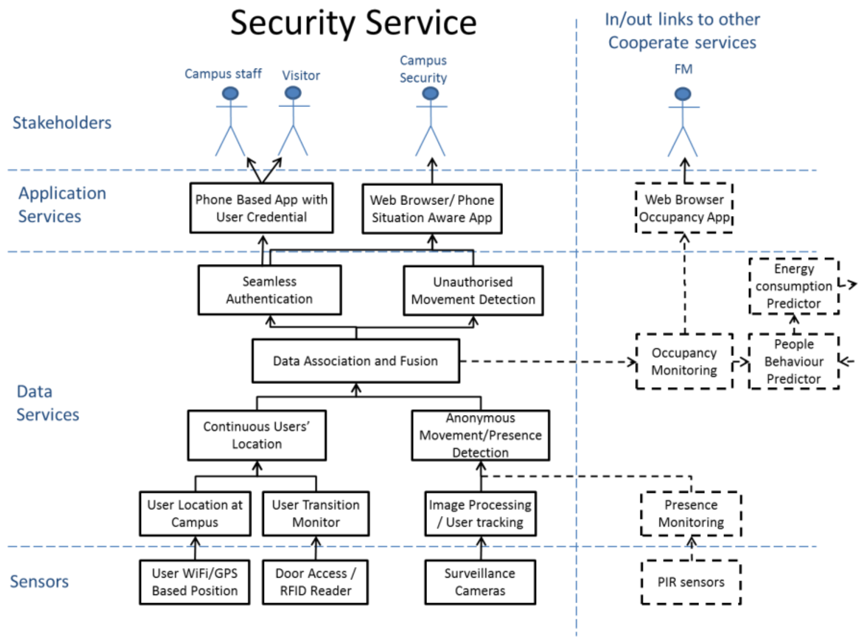
Key stakeholders

Neighbourhood managers (NEM), Neighbourhood users, Office worker, Business user, security company.

Services Concept

This service focuses on the high proliferation of smart phones, Wi-Fi networks and camera surveillance systems in neighbourhood environments to allow the introduction of mobile access credentials, which brings the user's continuous position into the security system as an essential part of the decision process of unobtrusive seamless access authorisation.

Concept Schematic



Service Key Elements

This application service enables the seamless authentication, where users provide authentication credentials only at the entrance to the premises and then their movement trajectories as obtained by the integrated tracking and surveillance system are used for subsequent authentication. For this continuous users' trajectories are considered in the follow up automatic seamless authentication as users require an access to other security areas and resources without being forced to enter the credentials again increasing

	working comfort and bringing a higher level of security and system accountability.
Value Proposition	Due to tight access control policies which exist at many facilities, users have to present their access card hundreds time per day. All users want a secure facility, often with the proven protection of intellectual property, but do not want to be restricted to the confined space of their offices. The users seamless authentication based on their physical location and past trajectory can deliver that.
High level system requirements	• Smart-phone based localization sub-system • Video surveilance sub-system • Electronic door access system • Passive presence detectors

3.2.3 UC7 Participatory sensing use-case & associated service

Brief Description	The neighbourhood provides communication between the neighbourhood actors (citizens, municipal authority, NEM, FM etc.) to increase citizen engagement in the up-keep, aesthetic, security, planning and operation of their neighbourhood to develop a “sense and pride of place”
Neighbourhood Challenge	The NEM for *AnotherNeighbourhood*, Pat, was approached by the local council to discuss a means of engaging neighbourhood citizens in the upkeep aesthetic, security and planning of their neighbourhood. Additionally, Pat was approached by Tom a building manager in charge of student accommodation within the neighbourhood. Tom is interested in using social media as a means of dialogue between his management company and the students, who Tom perceives as ‘not wanting to talk’ to him. Pat outlines at a council meeting, attended by Tom, the concept of the ‘citizen as a sensor’ and the idea of utilising ICT, primarily social media and mobile technology, as a means of reporting and as a tool that could aid the council in developing a “sense and pride of place”. Pat has suggested that Citizens of *AnotherNeighbourhood* could report on issues they see using their ‘smart phones’ and that the Council or Toms management company could utilise this information in terms of appropriate response. Pat has also suggested the neighbourhood could provide information to citizen smart phones and mobile devices that is tailored to their interests and that the council could receive opinion on civic matters for example planning applications via the same media. The council and Tom are fully behind the concept and ask Pat to implement
Key stakeholders	NEM, Building management company, ICT Service Provider, the Council, Citizens, local University

Services Concept

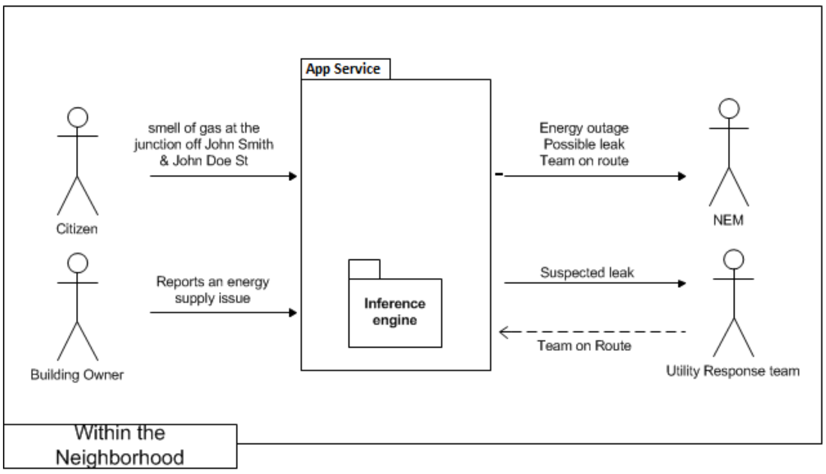
Pat meets with the ICT service provider to discuss the development of an application service that meets the various stakeholder needs. The two discuss possible levels to the application service. The ICT provider suggests there may be free or pay-to-know levels of information. The provider also suggests to Pat that the service could evolve over time and that he, the council and other agencies needed to consider what information they wanted to provide and could provide. The provider continues to outline basic ways in which the service could operate:

Citizen Push: could involve participatory sensing whereby individuals send information that maybe of interest to a municipal or utility, 'smell of gas at the junction off John Smith & John Doe Street' or an image taken by a citizen of a blocked drain, a burst main or a traffic situation is sent to the appropriate agency.

Citizen pull: It could be a pull request regarding topics of interest, 'send me air-quality info' 'what is the local pollen count forecast for today' or 'send be information regarding an issues effecting transport in the area' 'What is the Building Energy Rating of house X 'what is this planning application for', or a tourist asking 'what is the history of this building'.

City push: It could involve an info push whereby traffic or air quality data is pushed to as opposed to requested by the user based on predefined preferences. Or our tourist gets pushed historical data on buildings or shopping offers as they traverse the neighbourhood.

Concept Schematic



Service Key Elements

SomeNeighbourhood is the geographical area of interest. The service focuses on the high proliferation of smart phones and assumes the ability of users to utilise basic applications 'apps' on such devices. The service will utilise the COOPERATE platform to host the back-end capability of the service. Various agencies / utilities will need to sign up to utilise the service. From a technology perspective there will be a phone based application and a platform hosted service that will have different guises depending on what the user intends.

Value Proposition	The value proposition of this use-case and application services ties into the idea of creating a 'sense and pride of place'.

High level system requirements

The app should:

- Allow the user to input & edit contextual information preferences.
- Be specialised for agency users i.e. utilities, council staff etc.
- Allow users to send & receive messages / reports including pictures to the service
- Allow the user to identify specific agencies they wish to report to communicate with.
- Allow agency users to send specific feedback to reportees
- Interface with on board sensors - gyroscope, accelerometer, camera, temperature, microphone etc. the camera is essential

The Platform should:

- Store data securely
- Route messages to and between the appropriate end points.
- Allow for device user authentication & preference association
- Protect privacy of the user

The Service may:

- Allow for the anonymous roll-up & reporting of sensor data
- Allow for the sale of such data to third parties
- Store / track/ allow access to personalised incentivisation data

4 Functional Requirements Summary

This section summarizes the high-level functional requirements that have been identified in the use cases definition section. The requirements are listed below in three main groups:

4.1 Energy Management Application Services

This section summarizes the high-level requirements for the energy management application services that were defined in section 3.1.

4.1.1 Input Requirements

The applications services require:

- Weather and energy price forecasts
- Energy Contracts
- Real-time neighbourhood state monitoring of storage and local generation
- Ability to store and use historical data of the neighbourhood/buildings usage (set-points, time of operation, temperatures, energy consumption etc.)
- Ability to use weather and energy price forecasts
- Ability to interface and communicate with existing BMS, HEMS systems
- Real-time energy measurements
- Thermal and electrical load forecasts

4.1.2 Output Requirements

The application services should:

- Baseline consumption of the neighbourhood
- Real-time visualization of the consumption and local production ;load curve
- Provide hourly energy demand forecast in day ahead mode (kWh)
- Provide yearly energy grid demand forecast (MWh)
- Provide hourly power generation forecast in day ahead mode (kW)
- Provide 15min intra-day demand and generation forecast (kWh)
- Provide optimal schedule for electrical and heating system
- Provide optimal set-points for local generation system and storage
- Provide flexibility level available for DR (capacity and energy)

4.1.3 Platform and Interface Requirements

The applications services require

- A means of messaging between the system and the grid
- A means of messaging that can interrogate an optimisation engine that can itself request/receive in near-time data from various inputs with regard to local storage/gen capacity, local demand etc.
- A means of visualizing the optimisation output for Pierre the NEM on desktop &/or mobile type devices
- A means of messaging that allows Pierre to interact with the system i.e. over-ride an automated decision
- An agreed rule-based means of response/actuation

- An optimization engine

4.2 Non-Energy Management Application Services

This section summarizes the high-level requirements for the non-energy management application services that were defined in section 3.2.

4.2.1 Input Requirements

The application services require:

- Occupancy data from neighbourhood
- Traffic and cark park data from neighbourhood
- Smart-phone based localization sub-system
- Video surveillance sub-system
- Electronic door access system
- User input and contextual information preferences

4.2.2 Output Requirements

The application services should:

- Provide information on parking space availability based on location, cost and user preference
- Provide seamless access authentication in the neighbourhood
- Provide user authentication and preference association
- Provide neighbourhood information to user smart phones and mobile devices based on interest and preference
- Provide agency specific feedback to reportees

The applications services may:

- Allow for anonymous roll-up and reporting of sensor data
- Allow for the sale of such data to third parties

4.2.3 Platform and Interface Requirements

The application service should:

- Allow the user to input & edit contextual information preferences.
- Allow users to send & receive messages / reports including pictures to the service
- Allow the user to identify specific agencies they wish to report to communicate with.
- Allow agency users to send specific feedback to reportees
- Interface with on board sensors - gyroscope, accelerometer, camera, temperature, microphone etc. the camera is essential
- Route messages to and between the appropriate end points
- Protect privacy of the user
- Store data securely

5 References

1. IntelliGrid Methodology for Developing Requirements for Energy Systems available online at http://webstore.iec.ch/preview/info_iecpas62559%7Bed1.0%7Den.pdf

2. IREEN, http://www.ireenproject.eu/3. Building Energy Manager's Resource Guide, SEAI, 2005

http://www.seai.ie/uploadedfiles/publications/Building%20Energy%20Managers%20Resource%20Guide1.pdf

3. Building Energy Manager's Resource Guide, SEAI, 2005

http://www.seai.ie/uploadedfiles/publications/Building%20Energy%20Managers%20Resource%20Guide1.pdf

4. National Energy Efficiency Action Plan 2009 – 2020, Department of Communications, Energy and Natural Resources, 2013

http://www.dcenr.gov.ie/Energy/Energy+Efficiency+and+Affordability+Division/National+Energy+Efficiency+Action+Plan.htm

6 Appendix 1 – Glossary / Definitions

Demand Response: the Federal Energy Regulatory Commission definition (FERC) defines demand response as - Changes in electric usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time, or to incentive payments designed to induce lower electricity use at times of high wholesale market prices or when system reliability is jeopardized.

Demand Side Management: describes load optimization initiatives at the consumer site, which are unknown in size and behaviour to the market. Demand Side Management covers the complete range of load-shape objectives, including strategic conservation and load management, as well as strategic load growth.

Real-time: within COOPERATE**,** if the response of a particular application is within suitable time constraints it is said to be ‘real-time’. It can vary greatly, depending on the application, from electrical systems where it may well be below 1 sec, to heating systems where it may be above 1 minute.

7 Appendix 2 - Roles/Actors/Stakeholders

Transmission System Operator (TSO): EirGrid in Ireland, RTE in France - A TSO is responsible for operation, maintenance and development of the transmission network in its own control area and at interconnections with other control areas, long-term power system ability to meet the demand, and grid connection of the transmission grid users, including the DSOs.

Distribution System Operator (DSO): ESB In Ireland, ErDF in France - A DSO is responsible for operation, maintenance and development of its own distribution grid and where applicable at the connections with other grids, ensuring the long-term ability to meet the distribution demand, regional grid access and grid stability, integration of renewables at the distribution level and regional load balancing (if that is not done by the balance responsible party).

Customer: Bouygues Construction and Bouygues Energy Service FM in Challenger site -Site/Building Owner or Facility Manager/General Manager or Occupiers

Energy Supplier: Electric Ireland [ESB], Airtricity, Bord Gais Energy, Energia; BGE, Energia, EDF in France - An energy supplier is a grid user who has a grid connection and access contract with the TSO or DSO, supplies electricity to the customers and may provide local aggregation of demand and supply.

Aggregator: Enernoc in UK, NovaWatt, Voltalis or EDF Commerce in France - An aggregator offers services to aggregate energy production/demand response from different sources and acts towards the grid (TSO, DSO and market interface) as one entity.

Regulator: CER In Ireland, CRE in France - A regulator is an independent authority responsible for the definition of electricity market framework (market rules), for setting up of system charges (tariffs), monitoring of the functioning and performance of energy markets and undertaking any necessary measures to ensure effective and efficient markets, non-discriminative treatment of all actors and transparency and involvement of all affected stakeholders.

Standardization bodies: IEC, CEN-CENELEC, etc. - Standardization bodies are responsible for standardization of all relevant elements and components within the electricity supply chain.

EU and national legislation authorities: EU and national legislation authorities are in charge of defining legislation and metrics for areas such as environmental policy, social policy, energy policy and economic policy. They are also responsible for the authorization needed to develop the electricity grid infrastructure.

Financial sector undertakings: Provide capital to other actors or invest themselves into the projects within the electricity supply chain (grid, generation, etc.); opportunities for ideas such as instigating a competition for flats/office units to reduce energy. As advance notice may be limited there is a need to use ICT to communicate the competition (input to architecture etc). These options will also be explored in the business case WP.

8 Appendix 3 – Stakeholders Workshop and Interviews

8.1 Objectives

The COOPERATE consortium organized a **Stakeholder Workshop in Cork Institute of Technology on March 11th 2013**, as it was suggested in its Description of Work (DOW), Work Package 1, Task 1.1 with the following objectives

- present COOPERATE's scope for an open, scalable neighbourhood service and management platform enabling energy positive neighbourhoods
- present the draft COOPERATE use cases and services of the COOPERATE platform that addressed
    - Energy-related neighbourhood management
    - Non-energy related neighbourhood management
- inform and seek feedback from the stakeholder community to help align the COOPERATE use cases and services with stakeholder interests

In support to this effort **interviews with various stakeholders took place in Paris throughout March 2013**.

Key stakeholders from the relevant areas participated in the workshop and the interviews coming from diverse areas such as energy providers, building automation, information technology, local authorities, research institutes and end users

8.2 Strategy

The key objective of the workshop and the interviews was to motivate and engage the stakeholder representatives to review, clarify and brainstorm on the COOPERATE use cases. The stakeholder representatives were requested to provide their specific, realistic and constructive feedback based on their line of business perspective and experience on two key questions:

- Are COOPERATE's use cases relevant and realistic based on the stakeholders perspective?
- Is COOPERATE going to make impact based on the stakeholders perspective? What Impact: business, social, environmental, other?

The template established in section 2.1 was followed for capturing and presenting the use cases and associated application services, which is based on similar templates such as the 'Energy Information Standards (EIS) Alliance Customer Domain Use Case' template. Essentially the template was developed to capture answers of the stakeholders to the following:

1. what is the challenge, need, goal that is addressed
2. who is involved or should be involved
3. what is the concept narrative
4. what are the key considerations
5. can you illustrate the concept
6. what is the potential economic value
7. what are the high-level ICT requirements

The workshop attempted to answer as many of the above questions as possible.

8.3 Outcome

In this section the summary of the key feedback that was gathered in the stakeholder workshop and interviews, is described in detail below. Following the template presented above, the feedback is listed based on each question described above.

A. What is the challenge, need, goal that is addressed

The following challenges, needs and goals were suggested in the workshop for all use cases:

1. **The focus of COOPERATE should be on the reduction of energy, balancing the load of a neighbourhood to reduce peak demand and to provide value to the grid operator** by turning on the demand at times that suit the grid. In CIT the targeted reduction of energy is 33% by 2020, in line with mandatory public sector 2020 targets.(DCENR, 2013).
2. **COOPERATE should target large energy users** – an example was given by Cork Council whereby their large energy users are inefficient pumps, for water production, waste water treatment processes, public lightning etc.
3. In addition COOPEATE could be used as a **model to demonstrate the viability of energy exchange** between different neighbourhood buildings/players.
4. **The COOPERATE platform services should ensure that users are aware and know how to impact their consumption**. – for example current M&T energy consumption information is confusing not well presented and and requires a lot of effort and on-site knowledge to find useful information. Trying to determine the load in a particular section of the building at a particular time may take several hours. The information should be presented in a user friendly way to reduce unnecessary effort.
5. Revenue generation through DR or other grid balancing services which may be provided from existing assets. For example, Parchment Square has 175 ampartments with underfloor electric heating which, under a suitable contract with an aggregator or other 3rd party, may be utilised in times of high/low wind production to balance power on the grid by either charging or turning off as appropriate.

B. Who is involved or should be involved

The actors/roles that were identified from the COOPERATE consortium were presented to the stakeholders and was agreed that all were relevant. The following actors/roles were identified as the most relevant and important for the use cases:

1. **The NEM and FMs**: it was suggested that the NEM should be independent and on of a higher level than FMs. FMs will probably remain the final decision makers at the building level and the NEM will establish an agreement with them determining the operations in the neighbourhood.
2. **The NEM** will drive the economical aspect and the coordination of all buildings' managers establish with each facility manager what the flexibility of consumption of each building is. Therefore, he will have an overview of the global flexibility of the neighborhood.
3. **Facilities managers (FM)** will remain the final decision makers at the building level. The NEM will not be able not manage directly the equipments in each

building, because of safety and comfort purposes, and to respect the energy efficiency contract between the FM and the building occupants.

4. The **grid operator, TSO, DSO** is also an important role for the DSM and DR use cases.
5. **Users and building owners**: it was suggested to include Arus Lion a residential building with 25 rooms/occupants, (ARUS LION), which is a Cork City Council building in use 24hr from heating point of view, located 500m from CIT.
6. Fire Marshals, security teams can be added as additional roles for security services.

C. What are the key considerations

A number of key considerations were highlighted during the workshop:

1. User-related considerations:
   1.1. A user has two decisions to make: reduce overall consumption over time and be able to balance load in real-time.
   1.2. The developed services need to ensure that users know how to impact their consumption.
   1.3. The information provided to the user through the platform should be aggregated and broken down to an individual. This may lead to the need for GUI's to be customized to particular end-users.
   1.4. We need to define different dashboards interfaces at each level of the neighbourhood: end user dashboard, facility manager dashboard and NEM dashboard.
      - There is a real importance on how to communicate these data to make it understandable for each user and promote the grip of that tool by each kind of user.
      - The issue of choosing relevant data, comparing it, designing the dashboard (info graphics) is key to the acceptance of the Cooperate platform services.
      - Define which decision will be made at which level will help to define those elements for the end users, facility manager, NEM.
2. Energy-related management considerations:
   2.1. Any energy management use case should take into account procurement constraints/schemes and tariff structures for energy buy.
   2.2. The NEM will have to establish a contract with each FM determining the operations to be done in case of normal scenarios, and in case of exceptional scenarios the FM will have the last word.
      - Such a contract will have to specify how the FMs can be paid by the NEM for these actions, or the amount of the penalties in case of a non respect of their obligations.
   2.3. The platform should be able to collect and aggregate information from many different sources (sensors, social media etc.).
   2.4. The platform should be able to provide decision making at different levels of the neighbourhood (NEM, FM and user level).

2.5. An energy management service will have potentially bigger impact if the neighbourhood is connected to the electrical network which will give the opportunity to trade energy and contribute to the balance of the network.

2.6. For each optimization service, the question to keep in mind is: '*at which level is it the most relevant to take the decision?*'

- The best decision maker has to be defined considering or technical aspects (facilities managers or DSOs), comfort issues (end users), economical or ecological impact of the neighborhood minimization (NEM, building owners, energy providers…).

2.7. Stakeholders are interested with technologies that assist with retrofit decision making. Decision support systems for the NEM should provide long-term information to facilitate retrofit design.

2.8. Public lighting (PE) should be included in the study to see how management of PE can be incorporated in the IEM platform.

2.9. Standards such as ISO50001 should be considered.

3. Non-energy related management considerations:

3.1. Occupants in the neighbourhood buildings may be potential customers of businesses in the neighbourhood. Are there ways of using the data gathered for the energy system to provide additional services to these businesses? For example, residents and office workers in the Cork neighbourhood are potential customers of Leisureworld. Is it possible to use occupant information to increase footfall at off peak times?

3.2. National and international regulations for user privacy (for example in France the National Commission for iInformatics and Liberties rules) should also be considered.

3.3. Parking: Such a service already exists, and is to limited. We need to think in a more global way about mobility and explore also other alternative solutions as cycles, carpooling, especially from an energetic point of view.

3.4. Canteen: Maybe the fact that waiting a long time to have a place seems to bring enough inconvenience to dissuade people to come at peak hours if they know in real time what is the occupancy rate of the canteen and that they will need to wait. Having the information in your office is enough, and we don't really need to do a dynamic canteen food price offering. The main purpose is not to change people behavior but to smooth consumption by anticipation.

4. Legal considerations

4.1. Remains to define what could be the terms of the contract between the facility managers and the NEM, considering the contract that the NEM will have with external stakeholders (DSOs, energy providers or aggregators)

D. Can you illustrate the concept

The stakeholders were asked to comment on the viability to illustrate the use cases of the project and the following issues were discussed:

1. **COOPERATE is an ICT project and aims to demonstrate how cloud based ICT technologies can improve energy management in the neighbourhood context**. In the existing demo-sites there is not enough renewable sources or

storage to demonstrate complete energy independence from the grid. Full energy independece requires the installation of significant on site renewable generation and is limited primarily by finacial considerations. However, by focusing on reducing energy consumption and managing the load aggregated across a neighborhood of buildings, in an optimised autonomic or semi-autonomic way, energy costs for the individual participants in the neighbourhood may be reduced.

2. **There are issues for exchanging electrical energy in CIT as interconnectivity between buildings in Ireland and in many countries is only possible through the local grid**. The EU wide private wire ban prohibits installation of private electricity networks between buildings that are not fully owned by a single entity. Energy brokerage is an alternative means of sharing electricy between multiple entities in a neighbourhood.

It was suggested that **COOPERATE could serve as a model to demonstrate** (at least in simulations) **the viability of energy exchange between different neighbourhood buildings/players**. Systems (or tools) developed under COOPERATE may be used for assessment and selection of appropriate equipment size and type if neighbourhoods did wish to become fully energy independent i.e. assess retrofit potential. The neighbourhoods selected as demonstrators, particularly the CIT neighbourhood is representative.

E. What is the potential economic value

The stakeholder were asked to comment on the potential impact and economic value of the COOPERATE concept (as shown through the use cases) based on their own perspective. Although, did not directly quantified the level of the economic value they suggested that:

1. The energy-related management services will have **high impact on business value by offering cost savings, reduce energy consumption and will improve business through new technologies**.
    1.1. Better management can assist improve cash-flow.
    1.2. Technologies developed within COOPERATE will have high impact as they will deal with district-level multi-building energy management
    1.3. The COOPERATE platform can be used a common remote control point for BEMS systems offering services that are not currently included in legacy BMS systems.
2. The non-energy related management services will have a **high impact on improving the neighbourhood perception and quality of life** which can additionally lead to increasing business value.
3. All concepts can help increase awareness of users regarding the impact of their consumption and use of the neighbourhood's facilities and businesses.
4. All the interviewees agreed with the use case but the main issue is not the definition of the use case but the economical equation behind it. Today, nobody finds it. It will be a main topic for work package 6.

8.4 Workshop Attendees

Stakeholders

Alstom Grid	Ebrahim Mirshamsi
D'Appolonia	Francesco Cricchio
SEAI	Joe Durken
Parchement Square	Cathal O'Dwyer, Liam Flynn
Leisure World	Aylenne Moloney
University of Limerick	Emma Mooney
Cork City Council	Michael O'Brien , Pat Farrell
ACE Control	Ciaran O'Sullivan
Energy Cork	Kieran Lettice

COOPERATE Partners

CIT	Dirk Pesch, Martin Klepal, Christian Beder, Dave Hamilton, Martin Klepal
Intel	Keith Ellis, David Boundy
UTRCI	Kostas Kouramas, Marcin Cychowski, Sarah O'Connell

Groups:

Group 1:

Stakeholders:	Francesco Cricchio
	Michael o'Brien
	Ciaran O'Sullivan
	Kieran Lettice
	Aylenne Moloney
COOPERATE Partners:	Christian Beder
Secretary:	Marcin Cychowski
Facilitator:	Kostas Kouramas

Group 2:

Stakeholders:	Ebrahim Mirshamsi
	Joe Durken
	Cathal O'Dwyer
	Liam Flynn

	Emma Mooney
	Pat Farrell
COOPERATE Partners:	Sarah O'Connell
	David Boundy
	Dave Hamilton
	Martin Klepal
Secretary:	Dirk Pesch
Facilitator:	Keith Ellis

8.5 List of interviewed stakeholders

Stakeholders

ERDF	Anne-Marie Goussard
ERDF	Gaizka Alberdi
Bouygues Immobilier, real estate company	Guillaume Parisot
Bouygues Telecom	Martin Kaiser
Alstom	Said Kayal
End users	Anonymous

COOPERATE partners contacting the interviews

Bouygues Energies & Services	Patxi Etchebarne, Claire Mortureux
Embix	Yasmine Assef