e-balance

Deliverable D1.6

Periodic Report 1

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Abstract

This Deliverable provides a brief summary of the progress of work and the management aspects of the e-balance project in the period M1-M12

Impressum

[Full project title] Balancing energy production and consumption in energy efficient smart neighbourhoods

[Short project title] e-balance

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List of Abbreviations

CMU	Customer Management Unit
DER	Distributed Energy Resources
DSO	Distribution Service Operator
FAN	Field Area Network
HAN	Home Area Network
KPI	Key Performance Indicator
LV-FAN	Low Voltage Field Area Network
LVGMU	Low Voltage Grid Management Unit
MU	Management Unit
MV-FAN	Medium Voltage Field Area Network
MVGMU	Medium Voltage Grid Management Unit
SGAM	Smart Grid Architecture Model
TLGMU	Top Level Grid Management Unit
TSO	Transmission Service Operator
WAN	Wide Area Network

1 Publishable Summary

The aim of the e-balance project is to investigate and develop an energy management system for balancing energy production and consumption that considers also non-technical aspects related to the socio-economic and legal context it shall be deployed within. The general technical solution shall thus be realized as a holistic approach, also covering the security and privacy aspects. It employs a hierarchical architecture of the management units that corresponds to the structure of the energy grid and enables decentralised control decisions.

Within the reporting period, technical and scientific work was focused on six work packages:

- WP2 addressed the definition of the use cases and the stakeholders' requirements. As a result of a study of social, economic and legal aspects we obtained a set of requirements that defines the technical solution.
- WP3 addressed the definition of the functional system specification based on the input from WP2. The requirements were mapped onto the functional blocks that make up the system.
- WP4 addressed the investigation of the communication part of the ICT solution. The communication platform is responsible for efficient and secure data exchange and management of the network of management units. The middleware that is the major part of the communication platform hides the communication details from the main energy management logic.
- WP5 addressed the research on the energy balancing mechanisms as well as the energy resilience mechanisms that constitute to the energy management platform. Further, security and privacy related aspects were also investigated.
- WP6 addressed the first definition of the methods for evaluation of the project results. In the reporting period we started defining the demonstrators.
- WP7 addressed all communication requirements of the European Commission, including maintenance of the project website (http://www.e-balance-project.eu/) and preparation and publication of the press release about the e-balance project. In the first reporting period the consortium has contributed to 5 conferences and workshops presenting the results of the work within the first year. Several publications (6) were submitted and already accepted for publication, several others were submitted.

The e-balance project faced some delays in the first half of the reporting period, but eventually the milestone and all the deliverables planned for this reporting period have been submitted within this period.

2 Progress of technical work and achievements

In the following sections we describe the tasks that were active in the reporting period, the work that was done as well as the results of the tasks. An overview on all tasks of the project is shown in Figure 1.

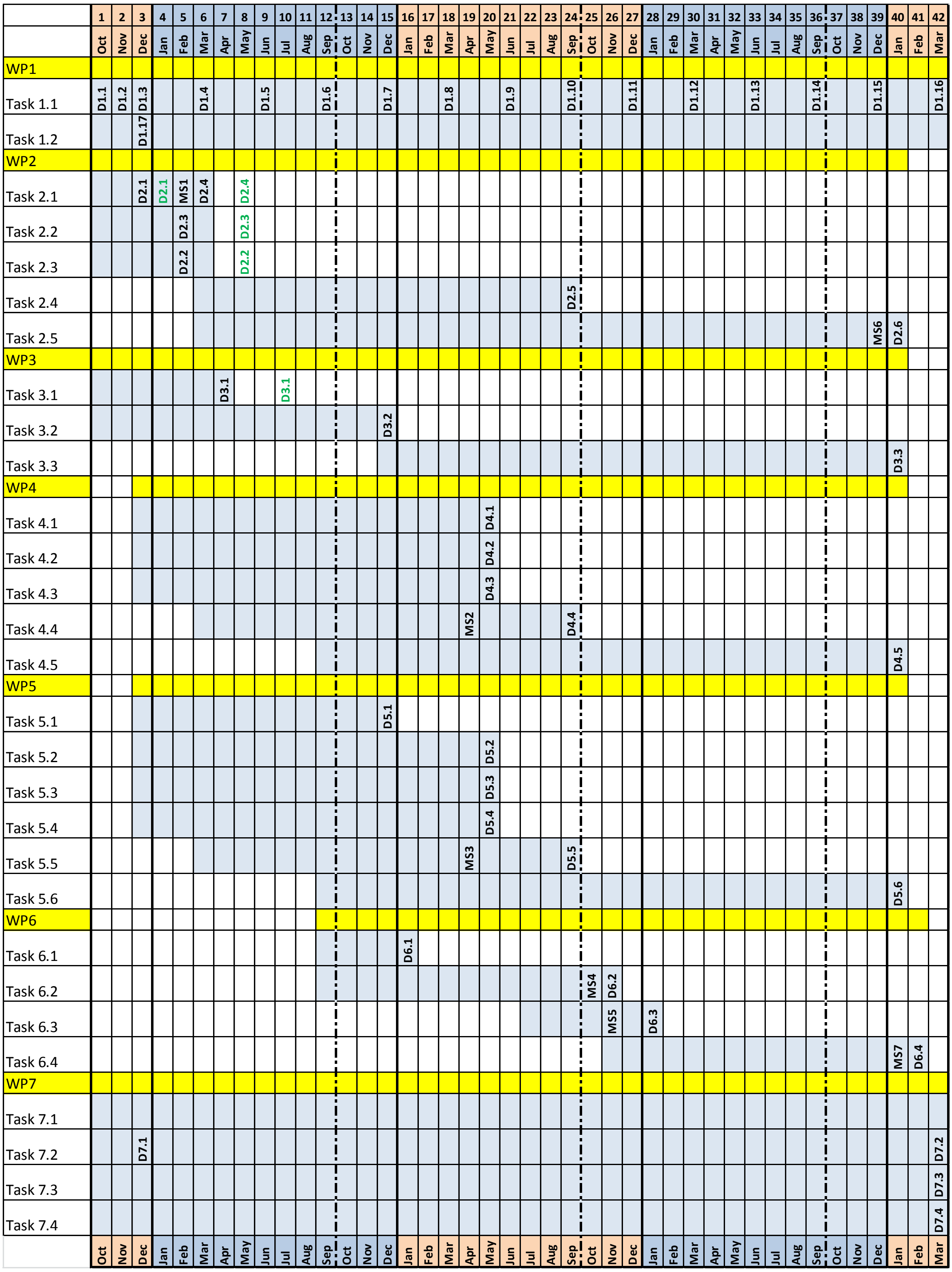

Figure 1: Project plan on the task level for the e-balance project

Figure 1 already reflects the shifts in the deliverable submission we experienced in the first reporting period. It shows the planned delivery of the results from tasks T2.1, T2.2, T2.3 and T3.1 and the actual delivery time in green.

It is also important to mention that all figures on effort plan are based on a linear effort allocation over the task duration. Since this does not necessarily express the actual effort allocation, some deviations may appear, especially due to the dependencies between different activities, but also due to internal resource availability changes like vacation or illness. However, this approach provides the simplest and basic measure to estimate the effort distribution.

2.1 WP2 - Use cases and socio-economic aspects (M1 – M40)

In this work package use cases will be defined. We will analyse technical as well as socio-economic use cases and the user studies (survey-based) will be realized and analysed. The aim of this analysis is to ensure proper definition of the overall architecture and features taking into account proper allocation of system components, the correct flow of information etc. In addition, this knowledge helps to identify where and which information is required and whether it needs to be protected against misuse or loss. From the user acceptance perspective, the technical and socio-economic aspects are essential for development of appropriate and holistic approach providing security and privacy means. Overall, WP2 defines the socio-economic framework for the technical solution.

The data will be collected online by use of our own IT and analytical resources. It includes preparation of online surveys and discussion platforms, implementation of scripts, programming, translations and distribution of invitations, data collection and analysis. Efforts of social researchers will be combined with IT professionals to ensure high level of data security, contingency and accuracy of the results.

The user study will be realized in two waves, the results of the first one (that was executed in the initial phase of the project) will provide us with the input for the system specification, where the results of the second one (that will be executed at the end of the project) will help us to evaluate the proposed system in general and against the changes in the users' needs.

WP2	**Reporting Period: M1-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	8.30	2.61	12.05	0.3	9.72	2.30	3.19	27.18	1.22	7.64	2.35	**76.86**
PM plan for Y1	9.24	2.44	12.07	0.0	9.22	2.22	3.62	28.27	1.22	9.33	2.44	**80.09**
PM plan total	**12.00**	**4.00**	**15.00**	**0.0**	**10.00**	**3.00**	**5.00**	**46.00**	**2.00**	**14.00**	**4.00**	**115.00**

2.1.1 The WP2 results in Y1

- Delivered deliverable D2.1 “Selection of representative use cases”
- Milestone MS1 “First user study performed and evaluated” reached
- Delivered deliverable D2.2 “Analysis of legal issues with focus on security and privacy”
- Delivered deliverable D2.3 “Market assessment and business models”
- Delivered deliverable D2.4 “Users and stakeholders requirements”

In the following the tasks are introduced and the accounted work and the results are described briefly.

2.1.2 Task 2.1 Use Case Definition (M1 – M6)

Description according to Annex I

This task defines stakeholder requirements and describes use cases within the context of the project. It covers:

• Classes of system participants and their interdependencies,

• The requirements of each class of participants regarding the amount and kind of data, reliability, security, privacy and functionality,

• User requirements study (survey based study in countries with different levels of SMART grid infrastructure and awareness in the population i.e. Poland, Portugal and in the Netherlands),

• Means to achieve the requirements of the participants (kinds of sensors, high level reliability and security features, kinds of devices and user interactions),

• Identification of city authorities and energy experts that can help us to validate our solution.

Work done

The task T2.1 addresses the use cases definition by the deliverable D2.1 and the identification of the stakeholders' requirements by the deliverable D2.4. Thus, first an overview on representative use cases addressed in other environments was performed. The related work study focuses on adopted use cases in similar energy efficiency projects, namely:

- SEEDS (Self-learning Energy Efficient builDings and open Spaces);
- EnPROVE (Energy consumption prediction with building usage measurements for software-based decision support);
- IMPROSUME - The Impact of Prosumers in a Smart Grid based Energy Market;
- MIRABEL: Micro-Request-Based Aggregation, Forecasting and Scheduling of Energy Demand, Supply and Distribution;
- NOBEL - A Neighborhood Oriented Brokerage Electricity and Monitoring System;
- SmartCities Málaga;
- Twenties;

Additionally, the outcomes of work done by international standard development organizations and other research & development projects were identified as related to e-balance project, namely:

- Smart Grid Coordination Group CEN/CENELEC/ETSI;
- ITU-T Smart Grid Focus Group;
- ETSI M2M Communications impact on Smart Grids

After the survey of selected use cases in similar initiatives it has defined use cases that were grouped in three main clusters: i) energy-balancing, ii) neighbourhood monitoring and iii) energy predictions and simulations.

The use cases have been defined by filling in a template. For this deliverable, a brief use case description is given, followed by the identification of the involved actors, the identification of events and the flow that defines the behaviour in the use case. In order to identify assumptions and pre-conditions, each use case specifies the dependencies to other use cases and clarifies the assumptions which enable the specified use case. Table 1 presents the e-balance use case template, used for the specification of e-balance representative scenarios.

Table 1: e-balance use case template

Use case identifier	**E-balance use case name**
Description	E-balance use case description
Actors	Identification of the related actors which interview within the use case
Flow	Identification of system and use case flows which affect the use case
Assumptions	(Optional) Identification of assumptions which influence the use case
Pre-conditions	(Optional) Previous use cases which directly influence the occurrence of the specified use case

Deliverable D2.1 identifies a selection of the most representative use cases with regard for the energy efficiency and energy balancing e-balance system. These use cases highlight the most relevant scenarios and functionalities and define the representative stakeholders of such energy management systems.

Twenty-eight (28) use cases were identified and described for e-balance system. These use cases accommodate several functionalities and are grouped in three main clusters:

- **Energy Balancing**: Energy balancing use cases include the promotion of energy efficiency in smart neighbourhoods, reducing energy generation produced by non-renewable sources. It also includes the management of loads and aims to reduce load diagrams instability, reducing the demand consumption peaks and promoting energy usage during excessive energy availability timetables.
- **Neighbourhood monitoring**: Neighbourhood monitoring use cases include the measurement of technical parameters from the energy distribution grid, which allow the assessment of energy delivery performance indicators and provide data towards enhanced monitoring applications, such as power flow and optimization of dispatching mode.
- **Energy prediction and simulation**: Energy forecast and simulation use cases address electrical grid modelling use cases. These functionalities focus on providing a simulation environment to simulate different levels of demand forecast and renewables generation, different levels of distributed generation and electric vehicles penetration and electrical grid behaviour assessment with different levels of energy storage penetration. Such functionalities aim to perform off- line studies which are expected to provide energy grid restrictions and limit operation scenarios.

Table 2 overviews e-balance use cases cluster in three groups: energy balancing, neighbourhood monitoring and energy prediction and simulation.

Table 2: Use cases cluster

Use case cluster	Use case title
Energy Balancing use cases	1. Strategy-driven decision on the use of produced energy
	2. Energy consumption priorities in case of energy delivery limitations
	3. Distributed generation balancing and resilience
	4. Energy consumption and production agreement/contract
	5. Strategy-driven decision on charging or discharging the energy storage
	6. Electrical vehicle as mobile energy storage or generator
	7. Customer interfaces for better efficiency and interaction
	8. Handling of current and historical customer data for improved safety and privacy
	9. Intelligent home appliance energy consumption balancing
	10. Additional sensors for appliance energy consumption balancing
	11. Microgrid energy balancing
	12. Multiuser privacy management in energy grid
Neighbourhood monitoring use cases	13. Neighbourhood power flows
	14. Distributed generation power flows
	15. Optimized power flow use case
	16. Economic dispatch
	17. Power flow state estimator
	18. Quality of supply measurement
	19. Energy efficiency measurement
	20. Fraud detection
	21. Losses calculation
	22. LV fault detection and location
	23. Fault detection on fused luminaires
	24. Fault prevention (LV)

Use case cluster	Use case title
Energy prediction and simulation	25. Demand prediction
	26. Prediction of renewable energy generation
	27. Energy storage penetration simulations
	28. Electrical vehicle and distributed generation penetration simulations

Social aspects of the proposed use cases were examined in the conducted first wave of quantitative user study. The scope of the study included: peoples' attitudes toward electric energy (importance of saving money and electricity, main problems related with electricity in households, importance of privacy, openness for data sharing and comparing energy profile with others). Additionally, the potential drivers and obstacles toward concept of energy management system were determined. The research was conducted in 3 European countries: Poland, Netherlands and Portugal. Locations were chosen on the basis of different natural and market conditions regarding development of electricity network and market maturity. The online interviews (CAWI) were conducted among consumers and prosumers of electricity in January 2014. Over 4500 interviews of average length 30 minutes were analysed in order to draw conclusions about the potential users' needs.

Within the social study framework following social issues were represented and analysed across the use cases enumerated beneath.

Use case	Related social issues
UC#1: Strategy-driven decision on the use of produced energy	GUI, privacy
UC#2: Energy consumption priorities in case of delivery limitations	GUI, privacy
UC#4: Energy consumption and production agreement/contract	GUI, business models, dynamic tariffs, privacy
UC#5: Strategy-driven decision on charging or discharging the energy storage	GUI, privacy
UC#6: Electrical vehicle as mobile energy storage or generator	GUI, business models, dynamic tariffs
UC#7: Customer interfaces for better efficiency and interaction	GUI, interface usability, amount of information to process, privacy, feedback channels, user engagement, gamification, user control and autonomy, comfort level vs influence
UC#8: Handling of current historical customer data for improved safety and privacy	GUI, privacy, data storage and security, data policies, trading data for benefits, control over data, openness for sharing data
UC#9: Intelligent home appliance e UC#9: Intelligent home appliance energy balancing	GUI, auto GUI, autonomy vs control of the user, control over appliances autonomy vs control of the user, control over appliances
UC#10: Additional sensors for appliance energy consumption balancing	GUI, autonomy vs control of the user, control over appliances
UC#12: Multiuser privacy management in energy grid	GUI, privacy, data sharing
UC#19: Energy efficiency measurement	GUI, privacy
UC#25: Demand prediction	GUI, privacy

As a next step, these use cases were broken down into a series of requirements that define the deliverable D2.4. This deliverable did also use our results from Task 2.2 and Task 2.3. Additionally, the results from our first user study covered by the milestone MS1 added to the overall results presented by both D2.1 and D2.4.

D2.4 describes the stakeholders' requirements and it will facilitate developments and implementation phases to be executed by project partners. A methodology based on a conceptual map of e-balance project was proposed. This conceptual map is a block diagram that shows all the stakeholders, potential management units and energy units. Going through each use case, any partner can see easily all the interconnections between stakeholders and devices/systems and realise potential requirements from the point of view of all the involved stakeholders. In addition, a template was designed to guide the elaboration of requirements and structure all the information in the same way.

The methodology used in deliverable D2.4 for requirements identification and description is based on 4 steps:

- **Selection of stakeholders and links**: For each use case, the procedure starts identifying stakeholders and management units in the conceptual map.
- **Connections for selected use case**: The arrows between each element allow identifying paths involved in the evaluated use case. All the stakeholders must be connected using all the possible paths (arrows). In this way, the researcher can realise the information/energy flows.
- **Self-questionnaire using the mentioned template**: For each requirement, the template offers several questions that should be answered with a description or selecting an option. This is the most creative step since the researcher should transform the connections identified in the conceptual map into descriptions required from the template. The different options and classifications help the researcher to think about new requirements. In addition, this questionnaire emphasises the prioritisation of requirements according to the security risk and the alignment with e-balance goals.
- **Validation step**: The requirement should be checked according to legal and technical barriers of each country. If some barrier does not allow its implementation, the researcher should come back to 3rd step until the legal and technical requirements are satisfied.

In D2.4 we identified 204 requirements classified by use case, stakeholder, priority and security impact. These requirements will be the main constraints that will be taken into account in the project developments (management units, algorithms, business models, telecommunications, etc.)

The requirements achieved based on the proposed methodology has allowed partners to understand better the use cases and describe use cases from all the points of view: technical, social, business model, ICT, etc. In addition, these requirements have been classified in order to identify which have the highest priority and are part of the e-balance base.

The defined list of requirements depends on the description of use cases, legal issues, social studies and business models. Therefore, any change of these concepts that happens during the project should be addressed to improve or modify related requirements. This activity is covered by the task T2.5.

The main activities by the partners

IHP (3.0PM):	• Contribution to the use case definitions in D2.1 and review of the D2.1 deliverable • Contribution to the user requirements definition in D2.4 and review of the D2.4 deliverable
INOV (2.13PM)	• Contribution to the definition of the use cases and writing of D2.1 • Analysis of the use cases of D2.1 and contribution to D2.4 • Review of deliverable D2.4
EDP (7.2PM)	• Contribution and development of use cases; Contribution to user studies • Contribution to the use case definitions and editing D2.1 • Analysis of user study and identification of ways to explore social research data • Contributions and review of D2.4
UMA (0.3PM)	• Study of related research projects. Related work section of D2.1
CEMOSA (3.97PM)	• Collaboration of preparation tasks for deliverable D2.1 • Development of energy balancing use cases (especially Chapter 3): since the kick-off meeting, the related activities have aimed at developing different use cases for the chapter number 3 of D2.1, regarding energy balancing and especially focused on demand-side management • Review of Use Case Deliverable: comments and suggestions to improve or correct sections of the document and the whole approach of the use cases.

	Definition of user and stakeholders of the future e-balance system has also been proposed by CEMOSA, according to the EU Commission Task Force for Smart Grids • As leader of the deliverable D2.4, CEMOSA has planning the different tasks related to develop the document: slides introduced in the meeting of Lisbon, responsibility matrix and table of contents • As leader of the deliverable D2.4, CEMOSA has planned the different tasks related to develop the document. In order to facilitate the identification of stakeholders' requirements, CEMOSA has design the following content: a conceptual map that establishes all the relations between stakeholders, energy systems and e-balance facilities; an Excel format file to facilitate partners to define easier the requirements using common categories proposed by the current Smart Grid Architecture Model (SGAM) of CEN-CENELEC. So far, all the requirements have been collected and are being evaluated • Definition of stakeholder requirements for energy balancing and neighbourhood use cases. Compilation of all the requirements. Review of the compilation split into two stages. Coordination of the working group related to deliverable D2.4. Main editor of deliverable D2.4. Analysis and development of statistics and general results of the requirement collection. Participation in the social workshop organised by IPI in June
UTWE (1.6PM)	• Use cases Definition and review of deliverable D2.1 • Contribution to D2.4
ALLI (1.2PM)	• Introduction to demosite and T2.1 related discussions and preparations • Working out user requirements for deliverable D2.4 • Writing user requirements, as agreed during the Twente meeting, reading, editing and reviewing deliverable D2.4
IPI (2.58PM)	• Use cases described mostly from the social perspective which contributed to D2.1 chapters and contribution to the D2.1 chapter concerning review of existing R&D projects • Use cases described and reviewed mostly from the social perspective
LW (1.06PM)	• Contribution to the use case definitions • Contributions to deliverable D2.4 • Reviewing the deliverables in T2.1
LODZ (1.7PM)	• Contribution to the definition of use cases: EV vehicle, Microgrid, Demand forecasting. • Contribution to Related R&D projects
EFACEC (2.0PM)	• Contributions for the Use Cases Definition, particularly concerning Energy Balancing and the revision of the final deliverable

2.1.3 Task 2.2 Market Assessment and Business Models (M1 – M6)

Description according to Annex I

This task assesses the current market situation and from this and the partners' expectations defines the economic and socio-economic impact of the e-balance system.

• The mechanisms for accounting to be applied between different participants of the system, the legal regulations, pricing methods,

• Incentives and advantage for the users to increase the system acceptance and attractiveness, to get them using our system

• Methods to support users planning to build or equip a house or flat (e.g., consulting service).

Work done

The goal of Task 2.2 is to recognize all opportunities (organizational, social and economic aspects) in order to provide a new business model for e-balance system and to include them into real Smart Grid environment. The results were prepared in deliverable D2.3.

The aim of first phase of the study was:

- to assess the current state and recommendations for the energy market models and business models development for smart grids,
- to work out the basic indications for developing a new business model for employing functionality of e-balance system and its adoption in the commercial sphere of utilization in accordance to the consumers' needs (socio- economic aspect).
- to work out the proposition of the price mechanism for new services selected as a new business model for e-balance system
- to find some methods how to support the customers interested in smart solutions with e-balance.

The work will be continued in Task 2.5 since the e-balance system will be tested in demo sites (Bronsbergen and Batalha) and labs as well. The advanced analysis should be developed according to the framework's test beds, Triana mechanism and financial assumptions (as business cases).

A description of the business model for the e-balance system is made in D2.3. In this deliverable you can find a description for:

- business model background research results;
- the result of the assessment of current market, prices and regulation in Poland, Netherlands and Portugal;
- results from socio-economic analysis for e-balance customers' acceptation;
- SWOT analysis for each stakeholders involved in the e-balance system;
- the main goal of e-balance system and definition of new services;
- first financial cases, price mechanism and revenue models results of the analysis;
- consideration about the customers' incentives and supporting methods.

Table 3: Main results of deliverable D2.3

Results	Where in D2.3	Goal in DoW
Business model background	Section 1	Introduction to business model
The Assessment of EUC regulation	Section 2	Introduction to business model
The Assessment of the current market situation for business models and our approach to balancing mechanism	A1-A5 appendices	Market assessment
The definition of the economic and socio-economic impact of the e-balance system	Section 3	Socio-economic aspects
The mechanisms for accounting to be applied between different participants of the system, pricing methods for both services: The Energy Balancing Service and the Grid Control and Monitoring service	Section 4	Economic definition and accounting mechanism, pricing methods

Benefits for the users to increase the system acceptance and attractiveness, to get them using our system	SWOT analysis in Section 4	Economic backgrounds for benefits
Methods to support customers interested in applying smart solutions with e-balance	Section 5	Methods to support users planning to build or equip a house or flat

The reflection on the business model reached its first stage and resulted in the D2.3 preparation. As a result of the consortium research two main services have been pointed out: The Balancing Service and The Grid Control and Monitoring Service.

- **The Balancing Service** – this is the service which is to be a set of complex tools for balancing energy consumption and production in a smart way. The main goal is to optimize consumption and production using Triana Method for optimisation and dedicated stirring signals (prices, DSR and DSM mechanisms and special stirring impulses/signals) for energy buying/selling the electricity in case of oversupply of the electricity or lack thereof. The owner of this service will be the DSO but we are taking the aggregator's role or the retailer's role into account as possible co-owners, responsible for the implementation of the system and financial settlements.
- **The Grid Control and Monitoring Service** – this is the service where the main aim is to optimize energy efficiency processes. It allows to monitoring of the QoS and QoE in order to maximize the benefits and profits and/or to reduce the costs for all stakeholders. The following set of neighbourhood area services is considered: power flow recognition, sustain distribution grid monitoring, fault detection, location, isolation and restoration. The owner of this service will be DSO as a main technical operator for all segments of clients/customers and data domains in LV and MV. In this sense the e-balance system has to be an advanced EMS for grid control and monitoring services.

We considered and prepared analysis of two mechanisms for e-balance effective realisation:

- **Mechanism based on a free price competition** (Free price decision driven approach) where we can consider wholesale energy market prices (buying/selling) and retail prices (consumption/production) offered by the aggregator as a dynamic or ToU prices, calculated according to price signals from the market.
- **Mechanism based on automatic stirring signals** (without direct price signals) from the DSO/aggregator (Control driven approach/net metering approach) to consumer/prosumer.

In both situations the revenue model is based on the market mechanism. The lower price for consumer energy bought and higher price for prosumer energy sold give measurable profits from the energy saved/cost saved and it gives an additional value with efficiency effects for directly involved participants: consumers and the aggregator. The aggregator gets an income as a share of the customers' total profit.

The mentioned mechanism might have changed when we will start to consider the Triana method in detail as a main balancing mechanism in e-balance system.

When we consider the grid control and monitoring service price mechanism we recommend to develop the win–win strategy for both sides: consumers and system owner. The DSO/aggregator can have got the profit as a continuous profit flow from the services which they will be deliver to consumers. The high quality services of energy supply for customers will be provided. In this situation we recommend the charges calculated for mentioned services included in tariffs or fees from customers.

The success and effectiveness of the business model for the e-balance system depends on many implementation and commercialization details, and above all, very much depends on the market law and regulation of the markets in which it is to run. Commercialization model itself has not yet been clearly defined and is not the subject of research work of the e-balance project which also does not help to estimate clearly measurable and expected economic results of this model in practice.

Potential benefits, weaknesses, opportunities and threats (SWOT analysis) and discussion of the price mechanism (financial cases) of this business model has been developed and collected indicating a high potential benefits and potential opportunities for the development of other business services and applications supporting the mechanism of balancing consumption and production of electricity in the neighbourhood area. At the end we also prepared the consideration about customers' incentives and advantages. This idea will be refined and detailed within the project in order to become the part of the e-balance guidebook.

The basic canvas analysis as an overall description of business model for e-balancing service has been prepared as the introduction to T2.5.

Key partners:

- Smart meter supplier
- Energy market supplier,
- ESCO
- aggregators,
- ICT suppliers,
- smart devices suppliers
- city Municipalities

Key activities:

- Develop end user service for e-balancing and grid control monitoring
- Develop supported tools: energy production/consumption forecasting
- Advanced GUI tools
- Advanced sensor/smart appliances

Key resources:

- App,
- home GUI,
- smart plugs,
- sensors,
- ICT and SM appliances (AMI)

Value proposition:

- Real time many savings
- Real time insight in electricity market
- Real time bill/settlements
- Trigger when the energy consumption pattern is deviating from normal pattern
- Energy usage with smart appliances and sensors
- Energy usage strategy for high efficiency in home
- Advice in alternative energy product investments, service
- Alternative price schemes and rewards
- High QoS and QoE
- Decrease frauds and losses in the grid
- Increased energy efficiency

Customer relationships:

- Consumer binding,
- high service level
- contracts with aggregator, DSO, suppliers; weather agency etc.

Channels:

- ICT channels,
- PLS, wireless, communications,
- Internet app

Customer segments:

- Retail customers/ prosumers
- RES owners
- Customers who is interested in energy efficiency decreased cost,
- City municipalities,
- real estate's owners

Cost structures:

- Product costs
- Installation cost (recurring)
- Service costs (recurring)
- Smart infrastructure and SM costs
- sales

Revenue structures:

- Monthly fee
- Extra rewards for demand shifting
- Long term contracts with customers/prosumers

Figure 2: Basic canvas analysis as an overall description of business model for e-balancing service

The main activities by the partners

IHP (3.0PM):	• Contribution to the market study in deliverable D2.3 • Contribution to the business model related e-balance concept definition in D2.3 • Review of deliverable D2.3
EDP (1.5PM)	• Research of Business Models, namely in Expert Groups for Smart Grids in European Commission

	• Analysing and comments to deliverable D2.3 • Analysis and contributions for deliverable D2.3
CEMOSA (0.85PM)	• CEMOSA has collaborated on the definition of business models for grid operators, the SWOT analysis included in the corresponding deliverable D2.3 and the revision of the document
UTWE (0.3PM)	• Contribution to deliverable D2.3 • Review of deliverable D2.3
ALLI (1.03PM)	• Reviewing, commenting and adding to Section 3 of deliverable D2.3 and the price mechanism file, describing the market mechanism; translating the social questionnaire to Dutch • Reading, editing and reviewing deliverable D2.3
IPI (2.74PM)	• Preparation of sets of questions to address business issues in the planned user studies (sections of the questionnaires) • Market Assessment and Business Models described in collaboration with LODZ and IHP including social studies results in the deliverable D2.3
LODZ (2.98PM)	• draft version of “New Business Models - theoretical basis from management science” • Preparation of D2.3 “Market Assessment and Business Models” (draft versions from 0.3 to 0.11) with national appendices (5) • Contribution to the D2.3 and revision of the final document • Development of first principles for the preparation of business cases for e-balance system, according to T2.2 results

2.1.4 Task 2.3 Legal Issues and Regulations (M1 – M6)

Description according to Annex I

This task includes the study on the legal aspects and regulations that influence the system in question, i.e. limitations in existing market regulation in different countries (the Netherlands, Portugal and Poland) and changes in roles and responsibilities from a technical and societal perspective, i.e. how should this work in an ideal world.

Work done

The aim of this task is to understand and describe the current legal framework related to the incoming deployments of e-balance. The analysis was divided into two geographical levels the project is facing: at European level (Directives, Regulations and Standards) and Country level (countries on the e-balance scope: the Netherlands, Poland and Portugal). In addition, both levels have been evaluated under the main concepts the project is involved: energy, market and privacy (including security). This working plan has allowed partners to focus specifically on their background and their countries; obtaining a clear picture of the legal framework and a collection of the target regulations that e-balance consortium has to be aware to detect any change.

However, this analysis was not developed only to collect all the legislation documents and extract the main constraints; in addition some regulation/legislative changes have been proposed to implement successful smart-grids under the e-balance scope. The European analysis is based on the collection of all relevant Directives, regulations and standards involved with e-balance, whilst the country approach is based on a questionnaire that aims to answer the potential energy, market and privacy constraints in order to assure e-balance demonstrators are compatible with current country legislation and encourage its future integration.

The main results of this analysis have been a collection of legal constraints (energy, market and privacy), which will be taken into account along the project, and a list of suggestions or proposals for adapting the current regulations to a better smart-grid approach. The complete list of constraints and conclusions can be extracted from the deliverable D2.2. Some examples: power limitation for autonomous generation systems, non-discriminatory tariffs or anonymisation of customer information and parameters.

Several conclusions and recommendations are described in Chapter 6 of D2.2 that addresses 4 main areas:

- A new figure: the prosumer
- New market rules to use energy
- New appliances and devices for customers: electric vehicles and smart-meters
- Focusing on privacy and security

In order to be aligned with national and European regulations, the partners involved in this task should be aware of regulation changes regarding the three main concepts analysed: energy (mainly electricity), energy market and privacy and security. All the detected changes can be integrated and taken into account in the project developments.

The main activities by the partners

IHP (2.0PM):	• Contribution to the legal study on security and privacy in D2.2 • Contribution and review of deliverable D2.2
EDP (2.7PM)	• Initial study of major regulatory and legal issues in Portugal • Contribution to the legal study on security and privacy in D2.2
CEMOSA (4.3PM)	• As leader of the current task, CEMOSA has planning the different jobs related to develop the deliverable D2.2: slides introduced in the Lisbon meeting, responsibility matrix and table of contents • CEMOSA has planned the different activities related to identify the legal issues that involve the project's use cases defined in task 2.1. These activities have consisted of the following: o Coordination of the work team to develop the D2.2, i.e. the definition of steps, deadlines, etc. o Design of the template for the corresponding deliverable 2.2 (ToC, objectives, scope...). o Collection of information regarding regulations, policies, directives and standards at European level regarding energy, market rules and privacy and security. o Collection and distribution of national questionnaires aimed at detecting national legal issues. o Collaboration in the following sections of D2.2: introduction, challenges of legal framework, European sections and conclusions. • Main editor and reviewer of deliverable D2.2. Coordination of partners involved in the related activities (national legal questionnaires completion and general comparison). Writing conclusions.
UTWE (0.4PM)	• Contribution to the deliverable D2.2
ALLI (0.65PM)	• Researching legal barriers and translation of associated documents • Reading, editing and reviewing D2.2
IPI (1.99PM)	• Supporting Partners from other countries in searching of Polish regulations and directives related to SG and other issues legal relevant do this task • Legal Issues and Regulations for Poland described and reviewed in collaboration with other partners (LODZ, IHP) • Supporting Partners from other countries in searching of Polish regulations and directives related to SG and other issues legal relevant to Task 2.3 and D2.2
LODZ (2.08PM)	• Draft version of "Polish market regulations and standards" and references' gathering for: "Security and privacy on polish market" • Contribution to the Analysis of Legal Issues (D2.2 national sections). Modification and an actualisation of previous version: "Polish market regulations and standards" • Preparation of new version: "Legal issues and regulations" - national draft and preparation of the national answers (questionnaire)

2.1.5 Task 2.4 Validation of the proposed Use Cases an Business Models (M6 – M24)

Description according to Annex I

In this task the potential users of the proposed solution will be interviewed in order to obtain their early opinions.

This process is located between the two waves of the user study and includes face-to-face interviews with the users at the demo sites as well as interviews with external experts, e.g., suggested by the consortium or the advisory board. For the demo site users we will also prepare the portal to provide their feedback, so they can get more information and also provide their feedback on the technical and socio-economic aspects of the solution as well as the user interface means (GUI) even before actually using it.

Work done

The main aim was to discover relations between energy consumers' attitudes, needs and motivations related with energy saving, ecology and use of technologies in households to understand the most crucial requirements, reveal potential drivers of engagement in energy efficient behaviours and determine the possible obstacles for the designed system.

Our ambition was to make the system designers constantly aware of the end-user perspective, underlining role of user-centric design in the process.

The results of social study influenced the identifying main drivers and obstacles of adoption of energy management system. Segments presenting different attitudes towards saving energy and acceptance of the initial concept of the system were distinguished.

Descriptions of segments were analysed in the context of their needs and possibilities of coping with the designed solution. We created personas representing different types of users, emphasizing the most distinctive and typical features of each subgroup. General recommendations from social studies and personas were used in determining the general architecture and scope of functionalities of the system.

The main results are:

- Preparation and execution of the first wave of user study:
    - Desk research of the past and current available reports on SG, energy balancing and ecology
    - Definition of aims and scope of the user studies through discussions with project Partners
    - Preparation of the questionnaires and translation into national versions
    - Preparation of tender for fieldwork execution of the online studies
    - Scripting of the online questionnaires and setup of IT resources for the study
    - Coordination and supervision of collecting data from respondents
    - Analysis of the obtained data, preparation of tables and visualizations
    - Preparation of the report presenting general results of the social study followed by more detailed analysis (i.e. segmentations) to be used in work on the system design and dissemination activities.
- Preparation of input for deliverable D2.4 Users and stakeholders requirements (coordinated by CEMOSA)
    - Requirements described on the basis of 28 use-cases
    - The most critical requirements and use cases identified by relevance factor
    - Outcomes of this deliverable were included in high-level system architecture specification in D3.1

Next steps include:

- Preparation of the researches in the demo sites which will aim at validation of the initial ideas for the system architecture and functionalities as well as gathering feedback concerning the user's current experiences. This work will include validation of the proposed use cases and business models. It will be performed through individual f2f interviews and online discussion forum in cooperation with UTWENTE (Bronsbergen demonstrator) and EDP (Bathala demonstrator). *The preliminarily expected number of interviews to be conducted in both demo sites may be a subject to change due to expected difficulties of access to the respondents permanently residing in these locations.*

- Preparation of the in-depth interviews with energy market experts which will focus on evaluation of the system concept in order to obtain a multi-perspective assessment of project ideas.

The main activities by the partners

EDP (0.5PM)	• Identification of major activities and issues to validate and restate along the project, namely use cases and business models. WebEx meeting performed • Analysis of 3 new use cases
ALLI (0.13PM)	• Discussions regarding the outcome of the social studies • Minor translation activities regarding IPI questionnaire results. First look at usability of the use cases
IPI (13.54PM)	• Preparation of the user study • Preparation of the English and national versions (PL, PT, NL) questionnaires for the social studies • Scripting of online form in national versions and coordinating execution of the surveys in 3 countries • Data from social studies collected and analysed • MS1 Document describing main findings of the social researches prepared • Social studies results presented in Enschede • Further plans for analysis described and presented (analysis in progress) • MS1 Document describing main findings of the social researches prepared • Further social researches concerning prosumers in NL planned in cooperation with UTWENTE • Analysis of the data from social studies for ongoing dissemination activities • Segmentation analysis of energy consumers • Coding and analysis of the text data (open – ended questions) form social studies • Reviewing other projects (desk research) to collect information on social aspects of energy management systems and user engagement • Contribution to the user requirements
LODZ (0.56PM)	• Preparation of functional requirements and validation for selected use cases

2.1.6 Task 2.5 Use Case, Market and Requirements Restatement (M6-M40)

Description according to Annex I

During the course of the project, internal Research or Development, as well as external factors may influence the above specifications developed earlier on in the project – for example a new requirement identified, a change in regulation can happen or a business hypothesis prove not to be valid.

The second wave of the survey based user requirements study will be performed in Poland, Portugal and in the Netherlands in order to research the changes in the user requirements and energy efficiency related attitude during the project time. This will show how the social aspects are evolving and how fast this process is, depending on the country. The features of the proposed solutions will be also evaluated within the second wave of the user study.

Work done

Work has been developed in order to accommodate future restatements of use cases, business models and requirements.

A WebEx meeting was performed together with T2.4 in order to address use case, business models, regulations and requirements issues. In this WebEx meeting we identified the following topics to be aware and follow up

- Three new use cases addressing self-healing
- More detailed description of the use cases
- Regulation changes (e.g.: In Portugal self-consumption is now allowed)
- Business models definitions from EC.

The main activities by the partners

IHP (0.3PM):	• Use case analysis towards potential revision
INOV (0.48PM)	• Internal discussion in the project on a new use case on self-healing, which might be introduced in the use case restatement • Contribution for the possible evolution of use cases taking into consideration the self-healing and energy resilience approaches for MV
EDP (0.15PM)	• Initial study of possible improvements on use cases • Identification of major activities and issues to validate and restate along the project, namely use cases and business models. WebEx meeting performed
CEMOSA (0.6PM)	• New version of the conceptual map for stakeholders' requirements • Identification of necessities for legal issues restatement (European level) and stakeholders' requirement restatement (suitability with the system architecture)
ALLI (0.18PM)	• Internal discussions (Alliander and project partners) • IPI workshop
IPI (6.33PM)	• Use cases described and reviewed mostly from the social perspective which contributed to T2.1 • Planning of qualitative restatement studies in Bronsbergen and Bathala
LW (0.16PM)	• Evaluate survey and social aspects, theoretical backgrounds • Proposals for restatements for use-cases and requirements
LODZ (0.33PM)	• Contribution to the business cases preparation • Discussion and planning the restatement work regarding use cases redefinition, business models and market aspect
EFACEC (0.35PM)	• Contributions for the Use Case, Market and Requirements Restatement

2.1.7 Deliverables in WP2 the consortium worked on in Y1

- D2.1 "Selection of representative use cases" within Task 2.1 (M1-M3) - finished

D2.1	**Reporting Period: M1-M4**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	2.60	1.80	5.70	0.30	1.30	1.50	0.39	1.98	0.56	1.70	2.00	**19.83**
PM plan total	2.71	1.81	4.52	0.00	1.81	0.90	0.90	10.84	0.90	1.81	1.81	**28.00**

This deliverable aims to identify a selection of the most representative use cases for Energy Management Systems to be adopted in smart city environments. We start by identifying the energy balancing system functionalities and perform an overview on related Energy Management Systems (EMS). Further we describe the use cases for each group of functionalities considering their impact within the e-balance eco-system.

- D2.2 “Analysis of legal issues with focus on security and privacy” within Task 2.3 (M1-M5) - finished

D2.2	**Reporting Period: M1-M8**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	1.90	0.00	2.60	0.00	4.20	0.40	0.60	1.99	0.00	2.08	0.00	**13.77**
PM plan total	2.00	0.00	3.00	0.00	5.00	0.00	1.00	2.00	0.00	3.00	0.00	**16.00**

This document aims at identifying and analysing the most relevant legal issues (regulations and standards) related to e-balance aspects like energy use, energy market, privacy and security. Specific sections have been developed in order to describe the situation at European level and in target countries (the Netherlands, Poland and Portugal) and to compare the main factors that could encourage the successful deployment of e-balance systems or models, both technology and business models. Finally, a set of recommendations is proposed to be included in current legislation in order to support European energy objectives throughout using e-balance outcomes or general smart-grid solutions, especially in privacy and security issues.

- D2.3 “Market assessment and business models” within Task 2.2 (M1-M5) - finished

D2.3	**Reporting Period: M1-M8**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	2.80	0.00	1.50	0.00	0.85	0.30	1.03	2.74	0.00	2.98	0.00	**12.20**
PM plan total	2.21	0.00	2.21	0.00	1.47	0.74	0.74	4.42	0.00	2.21	0.00	**14.00**

This document aims at a market assessment and an overall preparation of the Business Model for the e-balance platform. For this purpose, EU documents providing guidelines for the development of business models have been analysed and the theoretical basis for the strategy of building models in management sciences has been developed.

The analysis of the business models for the e-balance platform includes a SWOT analysis, the overall price mechanisms and the proposed mechanisms for creating incentives for energy market participants.

This analysis is preceded by conclusions from the research of the socio-economic needs of the consumers in the area of the intelligent e-balance system, balancing of the local (neighbourhood) market or in the area of the Smart City.

- D2.4 “User and stakeholders requirements” within Task 2.1, Task 2.2 and Task 2.3 (M1-M6) - finished

D2.4	**Reporting Period: M1-M8**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.70	0.33	1.60	0.00	2.77	0.10	0.86	0.60	0.50	0.00	0.00	**7.46**
PM plan total	1.08	0.19	1.27	0.00	0.72	0.36	0.36	2.74	0.10	0.98	0.19	**8.00**

This document aims at defining the users and stakeholders’ requirements related to e-balance use cases, previously defined in deliverable D2.1. A specific and simple methodology has been developed in order to facilitate the description of these requirements. Finally, some statistics are shown in order to highlight the main aspects of requirements and address the efforts of e-balance consortium.

- D2.5 “Validation of the proposed use cases and business models” within Task 2.4 (M6-M24) - ongoing

D2.5	**Reporting Period: M1-M12**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.00	0.00	0.50	0.00	0.00	0.00	0.13	13.54	0.00	0.56	0.00	**14.73**
PM plan for Y1	0.80	0.00	0.40	0.00	0.00	0.00	0.40	5.60	0.00	0.00	0.00	**7.20**
PM plan total	2.00	0.00	1.00	0.00	0.00	0.00	1.00	14.00	0.00	0.00	0.00	**18.00**

This deliverable will provide the summary of the obtained feedback during the validation and actions we made, e.g., to integration of the improvements.

- D2.6 “Restatement of the selection of the representative use cases” within Task 2.5 (M6-M40) - ongoing

D2.6	**Reporting Period: M1-M12**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.30	0.48	0.15	0.00	0.60	0.00	0.18	6.33	0.16	0.32	0.35	**8.87**
PM plan for Y1	0.44	0.44	0.67	0.00	0.22	0.22	0.22	2.67	0.22	1.33	0.44	**6.89**
PM plan total	2.00	2.00	3.00	0.00	1.00	1.00	1.00	12.00	1.00	6.00	2.00	**31.00**

This deliverable will provide an evaluation of the use case definitions, as well as the requirement and business analyses done in the initial phase of the project and reasoning for the needed adaptations as lessons learnt during the integration and testing phase.

Deviations

The difference between the effort planned and the effort spent for the deliverable D2.1 is due to the fact that the most results by the partner IPI planned in task T2.1 were actually realised and reported in task T2.4 where they fit better from the project structure point of view. Similar, partner IPI spent less effort than planned for preparing deliverables D2.3 and D2.4, but the results by IPI were realised in task T2.5. This virtual underspending in the activities related to deliverables D2.1, D2.3 and D2.4 result in overspending in tasks T2.4 and T2.5 (deliverables D2.5 and D2.6).

Due to that we would like to transfer the remaining IPI resources from the finished tasks T2.1, T2.2 and T2.3 to T2.4 and T2.5 to cover the activities related to validation of the proposed solution. This issue is later addressed in Section 3.4 Deviations and Delay.

The partner EDP was leading and coordinating the preparation of the deliverable D2.1 and due to that spent more effort than initially planned for this activity. On the contrary, the partner EDP spent less effort in the other tasks (T2.2 and T2.3) that were finalized within this reporting period.

The partner UMA did not have initially any effort planned for deliverable D2.1, but was involved in the preparation of the document.

Partner LW spent less effort for activities related to deliverable D2.1, but was more involved in the preparation of the following deliverable D2.4.

The partner LODZ spent 33% less effort than planned for deliverable D2.2, but it was due to leading the deliverable D2.3, where more effort was consumed than planned. Partner LODZ had initially no effort planned for activities related to deliverable D2.5, but was involved in the preparation of the validation procedure.

The partner UTWE was more involved during the preparation of the deliverable D2.1, did a review of this deliverable and thus, spent more effort than planned. The partner UTWE also did not have planned any effort for deliverable D2.2, but was involved in the study on the legal context in the Netherlands. On the other hand, partner UTWE has spent less effort for deliverables D2.3 and D2.4.

The partner ALLI was more involved in the preparation of the deliverables D2.3 and D2.4 than planned, thus spent more effort in these activities. On the contrary, partner ALLI spent less effort for preparation of the deliverables D2.1 and D2.2.

The partner CEMOSA spent for deliverables D2.1, D2.2 and D2.3 less effort than planned, but this was due to leading the preparation of the deliverable D2.4 where more effort was consumed than planned.

The partner IHP spent more effort than planned for the preparation of the deliverable D2.3, but on the contrary was less involved in preparation of the deliverable D2.4.

Most of the effort deviations in the ongoing deliverables are due to linear planning. Some of the partners were not yet active in some activities. On the other hand, some partners did already some work ahead.

In difference of the effort planned and actually spent for all activities in the work package WP2 is minor.

2.2 WP3 – System specification (M1 – M40)

The goal of this work package is to develop a blueprint for building energy management systems that allow for balancing energy production and consumption on very local basis. In order to achieve this goal the needed components will be identified and specified. In addition the data flow between the components and the required features will be defined based on the results of WP2. WP3 defines the technical framework (identifies modules and defines interfaces between them) for WP4, WP5 and WP6. After evaluating the interaction of the components in early integrations in these work packages, the architecture will be refined gradually to ensure quality and consistency between the concept and the implementations and to guarantee that the architecture can be re-used by other projects or in case of commercial exploitation.

WP3	**Reporting Period: M1-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	5.96	5.14	3.10	5.40	0.40	3.80	0.90	3.35	5.20	0.47	3.51	**37.23**
PM plan for Y1	5.50	4.50	3.34	5.20	2.40	4.60	1.80	7.00	5.20	3.00	5.60	**48.14**
PM plan total	**9.00**	**6.00**	**4.70**	**6.50**	**3.00**	**7.00**	**3.00**	**19.00**	**8.00**	**5.00**	**8.50**	**79.70**

2.2.1 The WP3 results in Y1

- Delivered deliverable D3.1 “High level system architecture specification”
- Work towards the definition of the detailed system architecture specification in Task 3.2

In the following the tasks are introduced and the accounted work and the results are described briefly.

2.2.2 Task 3.1 Functional Specification (M5 – M24)

Description according to Annex I

This task specifies the system architecture on a high level of abstraction (the system model). This specification should be independent from the final platform and serves as an input for the research and technology development (RTD) work packages.

- Specification of the basic architecture of e-balance starting with a definition of fundamental design principles
- Specification the detailed functions that are necessary for e-balance to work (component definition)
- Definition of an efficient component interaction (interface definition)
- Respecting of existing solutions, open and industry standards
- Definition of the high level (abstract) models of both the energy management platform and the underlying energy system.

This specification will define the requirements for the components to be chosen in WP4 and WP5 for the respective platforms.

Work done

Within this task we defined the first high level specification of the e-balance system. The definition of this functional specification was driven by the outcomes from WP2. This task finished in M10 and its results are covered in the deliverable D3.1.

The deliverable D3.1 defines the hierarchical architecture of the management units within the energy grid and it also defines the functional blocks the management units consist of. These functionalities are defined by the use cases from deliverable D2.1, the legal and marketing context from deliverable D2.3 and D2.2, respectively as well as the overall set of stakeholders' requirements from deliverable D2.4. The deliverable D3.1 is a connection between the technical specification to be provided by deliverable D3.2 and the outcome from WP2. It also lists the stakeholders' requirements that are addressed by each functional block.

The functional blocks described in deliverable D3.1 belong either to the communication platform or the energy management platform. The deliverable defines also the interface between these two major system components.

The e-balance system architecture is compatible with Smart Grid Architecture Model (SGAM) framework [1], although it has been adapted to the objectives of e-balance by detailing the domains and components that are the focus of the project and omitting the others that are out of the scope of the project. For simplification of the representation, the three dimensional SGAM model was transformed into a two dimensional hierarchical model that is easier to handle. The Energy Grid level corresponds to the SGAM domains, the Market, Global Data Access and Operations correspond to the SGAM zones and the SGAM interoperability layers are distributed among the e-balance system components and their interaction with the energy grid components. In the system architecture the bulk generation and transmission levels are collapsed as they are out of the scope of the project. We also subdivide the Distribution level into two segments: Medium Voltage (MV) and Low Voltage (LV).

The deliverable D3.1 sketches also the data exchange between the management units located within the energy grid.

The main activities of the partners

IHP (3.94PM):	• Initial proposal of the system architecture • Further contributions to the functional system specification • Final review of the deliverable D3.1
INOV (3.44PM)	• Proposal of high-level system architecture for e-balance • Work on the system architecture for e-balance

	• Contribution to and review of deliverable D3.1
EDP (2.5PM)	• Initial proposal of system architecture • Contributions to the system architecture • Contributions to deliverable D3.1, namely for system architecture, grid control and monitoring
UMA (2.6PM)	• Communication middleware requirements • Analysis of the information flow between actors defined in deliverable D2.1 • Contribution to Section 3.2 of the deliverable D3.1: Data Storage Middleware • Architecture proposed to store data at different levels
CEMOSA (0.4PM)	• Revision and contributions of corresponding deliverables and system models • Review of deliverable D3.1 – general revision and validation of stakeholders' requirements within system architecture
UTWE (3.6PM)	• Contribution to the Functional Specification • Coordination of the preparation of the deliverable D3.1
ALLI (0.9PM)	• Researching possibilities for the LV simulations • Reading, editing, reviewing and discussing deliverable D3.1
IPI (3.35PM)	• Functional Specification – description of available smart appliances and possible applications in smart grid; description of existing energy management algorithms based on delivered articles
LW (1.98PM)	• Functional specification – related work evaluation, evaluation of hardware and software limits • Functional specification – review, proposals, evaluation of hardware and software limits, hardware considerations
LODZ (0.47PM)	• Contribution to the deliverable D3.1 Section 4.1.4
EFACEC (2.32PM)	• Contributions for the Functional Specifications – control and operations for the Energy Management Platform • Contributions for the Functional Specification – Information flows on control and operations • Contributions for the Functional Specification – Information flows on control and operations • Contributions for the completion of D3.1 "High level system architecture specification" deliverable, including revision

2.2.3 Task 3.2 Technical Specification (M1 – M15)

Description according to Annex I

This task will use the functional specification as above and define the technical details of the project including interfaces, available packages, common features, interface guidelines, message bus structures, parameterisation etc.

Work done

The aim of the technical specification is to define the technical building blocks (modules) that define the e-balance system together with their interdependencies. These possible technical modules are already identified and will be further researched in the technical work packages WP4 and WP5. The deliverable D3.2 defines the final shape of the e-balance ICT system.

In the reporting period we started with the mapping of the modules onto the functional architecture and with the refinement of the architecture. The technical specification will define the modules with finer granularity and will define the interfaces between them. We also started with the refinement of the data exchange, i.e., the definition of data sets required for each use case and their flow within the system.

The main activities of the partners

IHP (2.02PM):	• Initial analysis of security and privacy solutions • Definition of the technical specification
INOV (1.7PM)	• First proposal of mapping the high level architecture into an implementation of the communication network • Work on the mapping of the system architecture into the implementation of the communication network • Work on the choice of sensors for the architecture implementation • Work on the network architecture in the communication platform • Proposal for the definition of the data interface
EDP (0.6PM)	• Proposal of a high level technical architecture of a Smart Grid • Initial analysis of technical architecture of Smart Grid projects • Initial identification of major requirements regarding information flows and functionalities
UMA (2.8PM)	• Preliminary studies: physical data sources and sinks; hardware and software platforms • Use cases analysis • Analysis of the deliverable D3.1 in order to extract useful information to the technical specification
UTWE (0.2PM)	• Refinement of the system architecture
LW (3.22PM)	• Technical specification – related work evaluation, evaluation of influences with the use cases • Technical specification – review, evaluation of potential hardware and software basis • Hardware evaluations • Formulate and motivate event-driven communication concepts for the distributed architecture of e-balance, refine specification
EFACEC (1.19PM)	• Contributions for the Technical Specification – grid resilience and self-healing algorithms – as well as the assessment of their relation with the Use Cases

2.2.4 Deliverables in WP3 the consortium worked on in Y1

- D3.1 “High level system architecture specification” within Task 3.1 (M1-M7) – finished

D3.1	**Reporting Period: M1-M10**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	3.94	3.44	2.50	2.60	0.40	3.60	0.90	3.35	1.98	0.47	2.32	**25.50**
PM plan total	**3.50**	**2.50**	**1.90**	**0.00**	**0.00**	**3.00**	**1.00**	**7.00**	**2.00**	**3.00**	**2.00**	**25.90**

This deliverable specifies the high level architecture of the e-balance system. It provides a high level description of the components and the interactions between these components. The e-balance system consists of a hierarchical structure of energy management units, which naturally maps onto the grid infrastructure.

This high level definition of the communication and energy management platforms will be used as input for the work packages WP4 and WP5, respectively.

The proposed architecture will be refined in task T3.2 that will provide the detailed technical specification of the e-balance system.

- D3.2 “Detailed system architecture specification” within Task 3.2 (M1-M15) – ongoing

D3.2	**Reporting Period: M1-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	2.02	1.70	0.60	2.80	0.00	0.20	0.00	0.00	3.22	0.00	1.19	**11.73**
PM plan for Y1	2.00	2.00	1.44	5.20	2.40	1.60	0.80	0.00	3.20	0.00	3.60	**22.24**
PM plan total	**2.50**	**2.50**	**1.80**	**6.50**	**3.00**	**2.00**	**1.00**	**0.00**	**4.00**	**0.00**	**4.50**	**27.80**

This deliverable will outline the detailed technical specification of the entire system covering the all system levels and the interaction between the different grid levels.

Deviations

The effort deviation for partner UMA for both the deliverables D3.1 and D3.2 is due to the fact that partner UMA had initially no effort planned for activities related to deliverable D3.1, but was in fact involved in the preparation of this deliverable. On the contrary, less effort was spent on the ongoing deliverable D3.2 than was planned for the reporting period.

For deliverable D3.1, partner LODZ has prepared only a general view (description) of the correlation between selected use cases, important for the financial and economical settlements between final users and the owner/aggregator of the e-balance system on the management level. This initial framework will be used for developing the financial aspects further as the energy balancing mechanisms are developed. The remaining effort from task T3.1 will be spent in task T3.3 on the possible restatements and refinements.

The partner IPI reported most of the effort that influenced the deliverable D3.1 in task T2.4 and in task T2.5. These activities are in fact related to the validation of the proposed solution, but influence the system specification as well. This caused an underspending in activities related to deliverable D3.1. The remaining effort will be consumed in task T3.3 while preparing the restatement of the system architecture. We address this issue further in Section 3.4 Deviations and Delay.

The partner INOV has spent more effort for activities related to deliverable D3.1. It was due to the fact that partner INOV was very active while preparing the document and was leading the preparation of the part of the deliverable related to networking.

Partner EDP also spent more effort than planned for the preparation of the deliverable D3.1. Partner EDP was contributing to the part of deliverable on grid control and monitoring. On the other hand, in the reporting period partner EDP spent less effort for activities related to the ongoing deliverable D3.2.

Partner CEMOSA had initially no effort planned for the activities related to deliverable D3.1, but was eventually involved in the preparation of the document, by reviewing the connection to the stakeholders' requirements from deliverable D2.4, partner CEMOSA was responsible for. On the other hand, partner CEMOSA was not yet active in activities related to deliverable D3.2, but the effort planned for that will be consumed in the following reporting period.

The effort deviations for deliverable D3.2 are due to linear planning. The planned effort will be consumed in the following reporting period.

The deviation of the effort spent and effort planned for all the activities in work package WP2 shows an underspending of about 22%. This is mainly due to the underspending in activities related to deliverable D3.2, which is currently in its final stage of preparation and will be finalized in the following reporting period. We plan to focus on this deliverable, thus the remaining effort will be spent as planned.

2.3 WP4 – Communication Platform (M3 – M40)

WP4 is devoted to the development of the communication platform. In this work package, the modules for the communication layer of the system architecture are chosen, adapted and integrated into a common communication platform. Its tasks cover all the levels of the energy grid, i.e., communication with individual home appliances but also communication between higher level management units.

The primary objectives and goals of this work package are:

- Development of a communication platform for heterogeneous devices ranging from high performance computers in charge of running the energy production and consumptions models to resource-constrained battery-powered wireless sensor nodes.
- Integration of communication technologies for decentralized power management with increased local decision support.
- Real time requirements, security and privacy of the communication.

WP4	Reporting Period: M3-M12											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	4.58	4.55	1.65	11.50	0	2.4	0	0	4.65	0	1.92	**31.25**
PM plan for Y1	9.45	4.56	2.09	8.89	0.59	4.76	0	0	4.69	0	3.40	**38.44**
PM plan total	**21.00**	**11.00**	**4.70**	**20.00**	**2.00**	**14.00**	**0**	**0**	**11.00**	**0**	**8.00**	**91.70**

2.3.1 The WP4 results in Y1

- Design of the communication platform including protocol stacks, middleware and security/privacy mechanisms. This design includes a network protocol stack enough flexible to be able to fulfil the information flow requirements of e-balance in particular and grid control and monitoring systems in general. The design has to take care of security and privacy mechanisms and it is supported by a data exchange middleware providing a generic data interface which can be used by application layers.
- Study of
  - Initial identification of network protocols and communication technologies used in smart grid projects.
  - Identification of major security and privacy mechanism align with smart grid infrastructure and energy balancing technology.
  - State-of-the-art in the field of middleware for smart grids. Data exchange middleware and requirements.
  - Node energy consumption management algorithms.
  - Communication requirements of balancing algorithms.
  - Different resilience approaches.
- Evaluation of the following technologies
  - Networking layer: evaluation of possible hardware and software limits, identification of possible failure modes and effects.
  - Technical study and evaluation of potential security mechanisms for desired hardware. Security techniques in the Gateway context. Security evaluations in the mono environments.
  - Middleware implementation: tinyDSM.
  - ZWave, KNX and EnOcean, review and technologies.

  - wMBus integration and implementation.
  - Communication test in the 2.4 GHz and 868 MHz band. Study of the Arduino Board: Arduino UNO, Arduino MEGA, Datalogger, Real Time Clock, Solar panel.
- Specification of
  - Network protocol stack
  - Information flow requirements for grid control and monitoring
  - Security and privacy mechanisms based on the requirements from use cases
  - Data exchange middleware architecture and API taking into account the use case analysis. Generic data interface.
- Development of:
  - Communication protocols for sensor boards
  - Implementation of the tinyDSM compiler

In the following the tasks are introduced and the accounted work and the results are described briefly.

2.3.2 Task 4.1 Networking Layer (M3 – M20)

Description according to Annex I

This task is responsible for the development of the integrated networking solution that will support the energy balancing system, providing efficient and reliable communication between the system components.

The main activities are:

- Selection of communication technologies,
- Development of the protocol stack.
- Development of protocols for efficient and reliable real-time/near-real-time services and applications,
- Development of network reliability and self-healing mechanisms,
- Development of node energy consumption management algorithms,
- Planning of the deployment.

Work done

The networking layer provides the low level communication support to the e-balance system, interconnecting both physically and logically the relevant system entities, such as Management Units (MUs), sensors, actuators and smart meters. It will support the transmission of e-balance information flows between those entities, granting the performance required by the respective services, while minimizing the costs associated with network deployment and operation.

The objective of task T4.1 is to specify and to implement the networking layer. It started in M3 and will finish in M20 with the delivery of D4.1. Between M3 and M12, the following results were attained:

1. **Specification of the e-balance network architecture (introduced in D3.1 and developed further in Chapter 2 of D4.1):** Due to the different functional and security relationships between these entities, as well as their location in the system topology, different requirements and constraints are placed on the network layer in different points of the system architecture. This has led to the definition of a network architecture that closely follows the hierarchical structure that characterizes the system architecture, where different network areas were identified: Wide Area Network (WAN), Medium Voltage Field Area Network (MV-FAN), Low Voltage FAN (LV-FAN) and Home Area

Network (HAN). Communication between the top level grid MU, the MV grid MUs and LV grid MUs is accomplished through WAN technologies due to the large geographical scale associated with the regional character of distribution at the top levels of the grid architecture. Communication between the MV grid MU, MV field sensors/actuators and DER MUs is accomplished through the MV Field Area Network (MV-FAN). The character of the MV-FAN is more local since the sensor/actuator nodes are located in devices and/or power lines that constitute a grid subset that is directly connected to the Primary Substation. Connectivity between the LV grid MU, Smart Meters, LV field sensors/actuators and DER MUs is accomplished through the LV-FAN. Connectivity between the Customer MU, appliance sensors, actuators and device MUs is accomplished through the Home Area Network (HAN).

2. **Study of the state-of-the-art on communication technologies, protocols and standards (Chapter 3 of D4.1):** The study on the state-of-the-art was aimed to identify the communication technologies, protocols and standards that are suitable to apply in each network area. A comparative study of the communication technologies was made, taking into account the expected CAPEX and OPEX, as well as physical parameters such as communications range and supported data rates. The results are summarized in the following table.

Type	Subtype	CAPEX	OPEX	Maximum Bit rate	Range[1]	Network Area Suitability
Broadband Technologies	Optical fiber SONET/SDH	Low (hired service)	High (hired service)	160 Gbit/s	2-80 km	WAN (core)
	Optical fiber WDM					
	Optical fiber PON					
	DSL	Low (hired service	Medium (hired service	100Mbits/s	5km	WAN (access)
	DOCSIS	Low (hired service)	Medium (hired service)	172Mbit/s	28km	WAN (access)
	Satellite	Low (hired service)	High (hired service)	50Mbit/s	100-6000Km	WAN (access)
	Ethernet (1000BASE-LX)	Medium	Negligible	10 Gbit/s	5 km	LAN
PLC	UNB	Low	Negligible	100 bit/s	150 km	FAN
	NB	Low	Negligible	128 kbit/s (CENELEC-A)	Several km	FAN, NAN
	BB	Low	Negligible	500 Mbit/s	Tens of meters	HAN
Infra-structure-based Wireless Networks	2.5G (GPRS)	Low (hired service)	High (hired service)	85.6 kbit/s	Coverage dependent	WAN, FAN, NAN
	3G (HSDPA, HSUPA)	Low (hired service)	High (hired service)	42 Mbit/s downlink 5.76 Mbit/s uplink	Coverage dependent	WAN, FAN, NAN
	4G (WiMAX, LTE)	Low (hired service)	High (hired service)	299.6 Mbit/s downlink 75.4 Mbit/s uplink	Coverage dependent	WAN, FAN, NAN
RF Mesh	Broadband (IEEE 802.11n/s)	High	Negligible	6-600 Mbit/s	50-400m	FAN, NAN, LAN
	Narrowband (Silver Spring Networks)	Low	Negligible	100 kbit/s	Several km	FAN, NAN, HAN
	Narrowband (IEEE 802.15.4g)	Low	Negligible	1094 kbit/s	Several km (e.g., XbeePro 868 @ 24 kbit/s)	FAN, NAN, HAN

The main networking protocol stacks for Smart Grids were identified: WirelessHART / ISA100.11a, ZigBee, KNX, LonWorks, Z-Wave and Bluetooth Low Energy for the HAN, and a generic IP protocol stack on top of assorted communication technologies for the remaining network areas. It was concluded that the IP protocol stack will be able to better cope with the technology heterogeneity in the FAN and WAN network areas, not precluding the use of other protocol stacks with smart appliances within the more geographically limited HAN environment.

3. **Analysis of e-balance information flow requirements (Chapter 4 of D4.1):** The information flow requirements on the networking layer were specified, namely for the energy balancing and fault detection mechanisms. This resulted in raw coarse estimate of the generated amount of traffic (data

[1] Maximum ranges are usually achieved with the lowest bitrates only.

rate and message size), as well as the specification of the delay bounds for the respective components.

4. **Analysis of candidate communication technologies (Chapter 5 of D4.1):** Following the classification of communication technologies that resulted from the state-of-the-art study, a more detailed analysis was carried out to estimate the performance limits of the most likely candidate communication technologies, taking into account the information exchange patterns associated to the e-balance information flows (the latter will be described in D3.2).

   In the FAN, the networking layer is indeed expected to constitute the bottleneck. Three candidate technologies were considered, one from each type of technologies that was found suitable for FAN communication: PLC PRIME, IEEE 802.15.4 and LTE. Results on the maximum supported message rates and maximum latencies were obtained taking into account the data exchange patterns defined for the e-balance Data Interface: read, write, periodic reports and alarms. These results, plus the expected communications ranges, will now be compared with the requirements analysis in order to assess the suitability of each of these technologies to support the e-balance system.

   For the HAN, research was performed on the main communication technologies and their market appearance at the current moment. After identifying several technologies that were defined for that specific purpose (i.e., communicating with and controlling home appliance and in general user devices), we started studying and testing their features. Multiple home automation solutions use proprietary and closed protocols that exclude them from being directly used in a heterogeneous system without applying specific gateway solutions based on modifications done to devices and software provided by the vendors. Further, the energy consumption is a criterion that is very important for the success of the communication technology in the HAN area. It may cause for instance the exclusion of standard Wi-Fi for some functionality, even if it is the mostly spread technology. But, there are also works on the IEEE 802.11ah extension that is meant for Internet of Things applications. For the first tests we have chosen a set of standard-based communication technologies, namely KNX, Z-Wave, Bluetooth Low Energy and ZigBee, to name the most important ones.

5. **Specification of the networking layer (Chapter 6 of D4.1):** A preliminary specification of the networking layer was already attained. This specification includes the selection of networking protocol stacks and communication technologies. The communication technology environment will be heterogeneous even within each network area, since it is unlikely that a single technology will be able to comply with the requirements in every part of the WAN, FAN or HAN. IP over MPLS over optical fibre will constitute the core of the WAN. A combination of PLC, RF-Mesh and 3G/4G will be employed in the FAN. The ZigBee and/or KNX protocol stacks will be employed in the HAN. The integration between different communication technologies will be performed at network layer 3 by the IP protocol. The use of IPv6 is considered at least for the FAN, when based on RF-Mesh technology. The preliminary specification will have to be validated based on the results from analysis of communication technologies.

   The detection and localization of faults in the LV grid requires the transmission of alarms from the sensors in the FAN. In order to reduce the alarm explosion in case of a large scale LV failure, a mechanism to aggregate alarm notifications was developed for use in multi-hop communication scenarios, such as in areas where RF-Mesh is deployed. The developed aggregation mechanism is partly implemented at the middleware and partly at the routing layer of the network stack. Preliminary simulation results point to reduction of alarm traffic between 25% and 40%. Further simulation tests are now going on aiming at paper publication.

The main activities of the partners

IHP (1.04PM):	• Contribution to the networking layer definition and study on the available technologies • Research on communication technologies

INOV (3.56PM):	• Coordination of the task • Specification of the communication network architecture of the e-balance system • Communication technologies, protocols and standards analysis • Development of alarm aggregation mechanism with application in RF-Mesh based FANs • Preliminary specification of the e-balance networking layer
EDP (1.45PM):	• Initial identification of network protocols used in EDP, namely in Smart Grid projects • Contributions to D4.1 with focus on communication requirements
UMA (4.2PM):	• Study of proposed communication technologies and protocol stack • Contribution to D4.1 (HAN section): selection of communication technologies and specification of protocol stack. Study of proposed network architectures • Communication test in the 2.4 GHz and 868 MHz band • Contribution to the networking layer specification
UTWE (2.3PM):	• Contribution to networking layer requirements - investigation of communication requirements of balancing algorithms
LW (3.33PM):	• HAN devices: evaluation of possible hardware and software limits, identification of possible failure modes and effects • Evaluation of potential HAN communication technologies with desired hardware • Evaluation of wMBus integration and implementation • Evaluation of ZWave, KNX and EnOcean, review and technologies
EFACEC (1.52PM):	• Contributions for the networking layer requirements definition – information flow requirements for grid control and monitoring.

2.3.3 Task 4.2 Security and Privacy Mechanisms (M3 – M20)

Description according to Annex I

Security and privacy are key when it comes to acceptance of the energy balancing technology. This holds true for end users and operators. Since we are working on energy efficiency, low-power, resource constraint devices are the majority of the connected devices. Thus, here we focus on efficient means for providing security which is the basis for privacy. We are aiming at an integrated and scalable solution which is applicable for all types of devices. In the following we are listing technologies and ideas that need to be investigated concerning their applicability in this specific application area while taking into account the heterogeneity of the devices.

Work done

In this task we studied the available solutions for the different aspects of security and privacy that can be applied in the communication platform. These include mechanisms for the protection of the communication, but also for the protection and maintenance of the devices. Due to the diversity of networking technologies and devices this task relates on the input from other tasks in defining the final set-up of the security and privacy solution.

We focused in our study on the following aspects:

- Mechanisms for security and privacy,
- Node protection and maintenance,
- Trust and group management.

We also started with identifying the security and privacy requirements to be addressed in the communication platform based on the results from WP2.

For protecting the communication the usual cryptography-based solutions can be used. These involve the public key cryptography, the secret key cryptography or a combination of these. We identified a set of mechanisms and investigated the features they provide as well as the effort related to executing these. The latter is crucial for the correct allocation of security solutions on different hardware platforms in a heterogeneous system.

Mechanisms to be applied for protecting and maintaining the devices in the smart grid depend very much on the used hardware and software platforms. General solutions have been investigated.

Once the demonstrator set-ups are defined, the concrete solution providing security and privacy build from the general set of investigated mechanisms can be defined and integrated.

The main activities of the partners

IHP (1.92PM)	• Initial analysis of the security solutions • Analysis of security and privacy mechanisms based on the requirements from WP2 • Evaluation of security mechanisms
UMA (0.3PM)	• Study of mechanisms for security and privacy in the context of energy balancing technology
EDP (0.2PM)	• Identification of major security and privacy mechanism align with smart grid infrastructure
EFACEC (0.4PM)	• Preliminary contributions for the security aspects in the data exchange middleware
LW (0.58PM)	• Security and privacy mechanisms – review proposals and providing suggestions • Technical study and Evaluation of potential security mechanisms for desired hardware • Evaluation of security techniques in the Gateway context • Security evaluations in the mono environments

2.3.4 Task 4.3 Data Exchange Middleware (M3 – M20)

Description according to Annex I

In this task a common communication middleware platform for energy control and management will be designed and implemented. The middleware uses the developed communication protocols, security and privacy means. This platform will support the distribution of the information required by the algorithms developed for energy control and management. It includes:

- The well-defined interfaces the middleware provides
- A middleware for handling and distributed processing of the data in the network,
- Hierarchical data handling architecture corresponding to the system architecture,
- Data access interfaces according to the user class and data ownership.

Work done

In this task, a communication middleware platform for energy control and management is being designed and implemented. The activities carry out so far within the task 4.3 can be summarized in the following points:

- Analysis of different middleware. A study of the existing middleware approaches able to efficiently distribute data within a hierarchical and distributed system has been also carried out. The middleware proposals presented so far address the data distribution in smart grid in very different ways. Some of them suggests a decentralized data-centric information infrastructure, other approaches present service-oriented middleware to make efficient the communication between heterogeneous devices, and for instance, there are others which are based on the standard DDS where they claim that this communication model will finish replacing CORBA. It worth to highlight there not exist yet many middleware approaches focused on smart grid. Thus, it is very hot topic where there is still a lot of work to be done.

- Analysis of the use cases. A deep analysis of the use cases have been carried out in order to better understand what is needed from the middleware point of view, i.e., which data structure the middleware has to cope with, security mechanisms, system to store data, etc.
- Analysis of smart grid communication standards. This analysis was carried out in terms of their applicability to support the e-balance middleware services. The results of this analysis are summarized in the following table:

Communication Scenario	Applicable Standards
WAN	IEEE C37.1, IEEE 1815, IEC 60870, IEC 61850, IEC 61968
Intra-Substation	IEEE C37.1, IEEE 1646, IEC 61850, Modbus
FAN	IEEE 1547, IEEE 1646, IEEE 1815, IEC 61850, IEC 62056 (DLMS/COSEM), M-Bus
HAN	ZigBee Alliance SEP 1.0 and 2.0, OpenADR 2.0, Modbus

- TinyDSM implementation of the TinyDSM Compiler. The tinyDSM middleware was designed to be applied on low power sensor nodes. It is configured using the tinyDSM Compiler to generate a tailor-made code for a given application to save resources. The tinyDSM Compiler takes a configuration file as input and generates the application specific parts of the middleware. The configuration defines the data items that are to be handled by the middleware, defines their types and also specifies how they shall be processed, e.g., it defines the replication area and the replication parameters. The handling of the data items is defined by a set of policy parameters. Setting the values of these policy parameters at compile time defines the final behaviour of the middleware. At run-time the defined data items can be then read or written vie the application API and the middleware processes the data instances according to the configuration. The tinyDSM Compiler allows also defining events and it generates the event detection mechanisms in the middleware. In order to allow us the use and evaluation of the tinyDSM we had to improve the stability of the tinyDSM Compiler and to implement additional policy parameters.
- Proposal of the first middleware architecture. A first draft of the middleware architecture where aspects such as data storage, communication protocol, management units discovery and data interfaces has been proposed
- High level API and Data Interface. After analysing the use cases two API have been proposed. First one is a generic data interface which contains 14 functions that are classified in four operation types: write operation, queries, alarms and reports. On the top of this data interface a high level API is located. This API will contain functions (e.g getEnergyPrice(…)) which will be more readable from the user point of view.
- Database System. Most the information distributed by the e-balance system has to be stored. Different storage systems have been analysed in order to know which can be the best solution for the e-balance system.
- Definition of the table of content for the deliverable 4.3. A first table of content has been proposed in order to start to work in the D4.3.

The main activities of the partners

IHP (1.62PM)	• Study on the middleware requirements • Concept for adaptation of the tinyDSM middleware to support the e-balance concept

	• Evaluation of middleware implementation - tinyDSM, implementation of the tinyDSM compiler
UMA (5.8PM)	• Preliminary studies: data exchange middleware for energy control and management. Work in plan • Analysis of the information data exchanged taking into account the use cases defined in deliverable D2.1 • Study of candidate protocols and communication paradigms for the WAN level • State-of-the-art study about middleware in smart grids – work in progress • Use case analysis. API definition (interfaces extraction). Middleware architecture first version. D4.3 table of contents

2.3.5 Task 4.4 Integration of the Communication Platform (M6 – M24)

Description according to Annex I

In this task the common communication middleware platform for energy control and management is integrated (in-lab integration) with the protocols and mechanisms developed in this WP. The integrated communication platform is evaluated according to a defined expected behaviour (test cards). For this purpose we will use the in lab demonstrators.

Work done

Inasmuch as development activities of other tasks have just started, the activities in this task are in their initial steps. These activities include:

- Study of integration methodologies,
- Definition of an initial integration plan,
- Definition of test cards.

The main activities of the partners

UMA (1.2PM)	• Initial activities towards the integration • Initial scheduling for an integration plan • Initial proposal for test cards • Preparation for the integration
INOV (0.99PM)	• Initial work on the implementation of networking protocols in prototype sensor boards • Continuation of development of communication protocols for sensor boards
UTWE (0.1PM)	• Appliance steering framework
LW (0.74PM)	• Determine enhancements for desired hardware • Preparation for HAN integration • Implementation tests of techniques

2.3.6 Task 4.5 Communication Platform Restatement (M12 – M40)

Description according to Annex I

During the course of the project, internal research or development, as well as external factors may influence the above architecture and specifications. Thus this task provides time for end-project activity to ensure a final iteration in which deliverables will be updated to ensure synchronicity with the factual final results for wider publishing.

Work done

This task started in the last month of the period and no significant progress has been made until works of other tasks of the work package has a higher degree of maturity.

The main activities of the partners

LW (0.02PM):	• Preparation for the restatement

2.3.7 Deliverables in WP4 the consortium worked on in Y1

- D4.1 "Detailed network stack specification and implementation" within Task 4.1 (M3-M20) – ongoing

D4.1	**Reporting Period: M3-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	1.04	3.56	1.45	4.20	0	2.30	0	0	3.33	0	1.52	**17.40**
PM plan for Y1	1.94	2.50	1.06	2.50	0.56	2.78	0	0	3.33	0	1.11	**15.78**
PM plan total	**3.50**	**4.50**	**1.90**	**4.50**	**1.00**	**5.00**	**0**	**0**	**6.00**	**0**	**2.00**	**28.40**

Detailed network stack specification and implementation: The networking mechanisms provide the low level communication support to the e-balance system, interconnecting both physically and logically the relevant system entities, such as Management Units (MUs), sensors, actuators and smart meters. It will support the transmission of e-balance information flows between those entities, granting the performance required by the respective services, while minimizing the costs associated with network deployment and operation. This deliverable presents the work done in the context of task T4.1, whose objective is to specify and to implement the networking mechanisms. The structure of this deliverable follows closely the methodology that was adopted to reach the e-balance network implementation.

The definition of the e-balance network started from the overall e-balance system architecture, from which the e-balance network architecture was derived. Preliminary studies were then carried out in order to identify the communication technologies, protocol stacks and standards that are applicable in each part of the e-balance network architecture, constituting potential candidates for inclusion in the specification. Additionally, networking requirements were extracted for significant use cases of e-balance, based on which the networking mechanisms were specified. This includes the selection of communication technologies and protocol stacks. It also includes the specification of additional algorithms and mechanisms that were developed within the project in order to improve network performance. A subset of this specification was then selected for practical implementation in the demonstrators, which is also described in this deliverable.

- D4.2 "Detailed security and privacy specification and implementation" within Task 4.2 (M3-M20) – ongoing

D4.2	**Reporting Period: M3-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	1.92	0	0.20	0.30	0	0	0	0	0.58	0	0.40	**3.39**
PM plan for Y1	3.06	0	1.00	1.94	0	0	0	0	0.56	0	1.11	**7.67**
PM plan total	**5.50**	**0**	**1.80**	**3.50**	**0**	**0**	**0**	**0**	**1.00**	**0**	**2.00**	**13.80**

Detailed security and privacy specification and implementation: This deliverable presents the specification of the e-balance security and privacy solution, including the selected technologies, protocols and algorithms. This deliverable also presents the detailed information about the design, implementation and evaluation of the e-balance security and privacy solution.

- D4.3 "Detailed middleware specification and implementation" within Task 4.3 (M3-M20) – ongoing

D4.3	**Reporting Period: M3-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	1.62	0	0	5.80	0	0	0	0	0	0	0	**7.42**
PM plan for Y1	3.06	0	0	3.06	0	0	0	0	0	0	1.11	**7.22**
PM plan total	**5.50**	**0**	**0**	**5.50**	**0**	**0**	**0**	**0**	**0**	**0**	**2.00**	**13.00**

Detailed middleware specification and implementation: This deliverable describes the specification of the e-balance middleware together with the detailed information about the design, implementation and evaluation of the e-balance data handling middleware.

This deliverable describes the specification of the e-balance middleware together with the detailed information about the design, implementation and evaluation of the e-balance data handling middleware. It describes the middleware architecture and different modules it is composed of, including the exposed API, implementation details and results obtained from the evaluation. It also provides a related work section where this middleware architecture is compared to other existing ones.

The deliverable takes into account the results from previous tasks, but mainly in the results obtained from the deliverable D3.2. The deliverable is structured as follows: Section 2 analyses the state of the art of middleware focused on smart grid infrastructures and generic high level distributed systems. Section 3 describes the middleware design based on the specification presented in the D3.2. Section 4 details the implementation of the middleware. Section 5 presents the evaluation of the middleware and finally Section 6 summarizes the main conclusions of the task T4.3.

- D4.4 "Implementation of an integrated communication platform" within Task 4.4 (M6-M24) – ongoing

D4.4	**Reporting Period: M6-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0	0.99	0	1.20	0	0.10	0	0	0.74	0	0	**3.03**
PM plan for Y1	1.29	2.03	0	1.29	0	1.84	0	0	0.74	0	0	**7.18**
PM plan total	**3.50**	**5.50**	**0**	**3.50**	**0**	**5.00**	**0**	**0**	**2.00**	**0**	**0**	**19.50**

Implementation of an integrated communication platform: This deliverable shall present the detailed information about the integration and evaluation of the e-balance communication platform.

- D4.5 "Restatement of the communication platform specification" within Task 4.5 (M12-M40) – ongoing

D4.5	**Reporting Period: M12-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0	0	0	0	0	0	0	0	0.02	0	0	**0.02**
PM plan for Y1	0.10	0.03	0.03	0.10	0.03	0.13	0	0	0.07	0	0.07	**0.60**
PM plan total	**3.00**	**1.00**	**1.00**	**3.00**	**1.00**	**4.00**	**0**	**0**	**2.00**	**0**	**2.00**	**17.00**

Restatement of the communication platform specification: This deliverable shall provide an evaluation of the technical specification of the communication platform components and reasoning for needed adaptions as lessons learnt during the integration and testing phase.

Deviations

The effort deviations for the ongoing WP4 deliverables are due to linear planning. They stem from the non-linearity of the actual effort allocation. The technical tasks involving investigations and conceptual work followed by implementation and integration usually involve different amount of effort depending on the phase and the switch between the phases is not easy to plan.

The numbers on effort spent by the partners for the activities related to the deliverable D4.1 show that partners INOV, EDP, UMA, LW and EFACEC are already very active with this deliverable, where partners IHP and UTWE still will catch up in the following reporting period. The total effort spent on the deliverable by all partners is within the plan.

The effort figures on the activities related to the deliverable D4.2 show that we did not reach the implementation and integration of the security solution yet. All the partners show underspending in the current reporting period. The remaining effort will be consumed within the following reporting period.

The overall effort figures for activities related to the deliverable D4.3 are exactly according to the plan with the partner UMA very active. Partners IHP and EFACEC will increase the efforts in the following reporting period. Partner UMA has spent on these activities more effort than was initially planned for the complete duration of the task due to the fact that the middleware is the main objective of this partner and the work package is led by partner UMA. This overspending will be monitored, so that the effort planned for the partner for the whole work package is not exceeded.

Similar, for the activities related to the deliverable D4.4 the effort figures show different involvement in the integration of the results from different tasks of the work package by the partners. Partners UMA and LW spent the effort according to the linear plan, where other partners focus on the work on individual components. The effort for the integration activities will be increased in the following reporting period.

As we did not start with the restatement of the communication platform, there are no efforts spent in activities related to deliverable D4.5. The only exception is partner LW who did already some initial work on the preparation for the restatement.

The overall effort spent for work package WP4 shows an underspending of about 20%. But as already mentioned, the remaining effort will be spent in the following reporting period as soon as we completely switch into the integration phase.

2.4 WP5 – Energy Management Platform (M3 – M40)

This work package researches, develops/adapts and evaluates all the mechanisms that will be used for the energy control and management. Moreover, this work package defines all the models that will be used to verify the designed mechanisms within the emulated real world scenarios in the energy platform test bed and in simulations. It also provides the final implementations of the developed mechanisms to be integrated in WP6 with the Communication Platform (developed in WP4).

In the framework of this work package the models for prediction of energy production and consumption will be developed. The production and consumption of the energy can take place on different time scales and on different geographical areas (e.g. local or regional predictions). Additionally the control mechanisms and actions will be researched and developed. Since development of these mechanisms requires an access to the prosumer’s data, provision of security and privacy mechanisms, securing the transferring and processing of the data, will also be done in this work package. Consistency with the security/privacy means developed in WP4 will be achieved by close collaboration and via the system architecture specification done in WP3.

This work package researches also concepts for interfacing, controlling and classifying the diversity of controllable devices, both consuming and producing energy.

WP5	Reporting Period: M3-M12										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	3.15	3.93	1.95	1.80	2.15	9.00	0.18	8.93	7.78	0	3.28	**42.15**
PM plan for Y1	6.90	4.44	3.52	8.71	6.27	11.41	0.56	6.43	7.78	0	11.94	**67.94**
PM plan total	**14.00**	**9.00**	**5.60**	**16.50**	**14.00**	**22.00**	**1.00**	**16.00**	**14.00**	**0**	**26.50**	**138.60**

2.4.1 The WP5 results in Y1

- Development of profile based balancing algorithm
- High level smart grid simulation environment (under development)
- LV resilience model
- Device steering framework
- Security and Privacy concept

In the following the tasks are introduced and the accounted work and the results are described briefly.

2.4.2 Task 5.1 System Models (M3 – M15)

Description according to Annex I

This task defines and implements the models used for the verification of the developed mechanisms.

Work done

- Study available modelling techniques
- Low level simulation model

  A low level simulation model is being developed that is based on the outcomes of three PhD theses [1][3][4]. This low level model of a neighbourhood (or several neighbourhoods) includes the preferences of individual prosumers, grid information, telecommunication information (communication traces) and economic information.

  As part of this effort, a user-friendly simulator is developed that enables the user to study the influence of the balancing algorithms (see Task 5.2), electrical vehicle penetration and PV penetration. Inputs to this simulator tool are smart meter measurements (we data from multiple countries), grid topology and cable properties (from Alliander) and prosumer preferences. This simulator will give the currents, voltages and power values for each node/cable, communication traces, money spent/earned by prosumers. As the simulator covers many of the relevant aspects (e.g. power flows, grid balancing, grid resilience, grid topology changes, penetration of DER), we can use it to verify many of the mechanisms and algorithms developed in e-balance.
- Exploring possibilities for data visualisation and interaction between Triana and Gaia in cooperation with Phase to Phase

There is an active collaboration with “Phase to Phase”, a company that produces software for calculation on energy grids (Gaia and Vision). The output of the simulator can be input to their visualization software to display the simulation results on a world map. Furthermore, the calculations of the E-balance simulation software were validated using the energy grid software of Phase to Phase.

- High level simulation model

  Next to the advanced Triana model, a high level smart grid simulation environment has been developed [5]. Within the Anylogic [6] simulation tool a neighbourhood with local generation by PV and energy storage has been modelled. The modular set-up of the model allows for easy expansion and adaptation of the simulated scenario. The model allows for a high level analysis of the energy flows within the simulated neighbourhood, and the energy flows between the neighbourhood (LV) and the rest of the grid (MV).

- LV resilience model

  Finally, we are developing a model to evaluate resilient energy supply strategies within the LV grid. In the scenario of a neighbourhood that is equipped with local generation and storage, the model allows you to compute the probability that the neighbourhood can supply its own energy, by balancing the local generation and demand, in case of a grid failure. This probability can be computed as function of the time at which the failure occurs, for an arbitrary grid repair time distribution.

The main activities of the partners

IHP (1.0 PM):	• Studies of the UTwente modelling techniques and contribution to the system models’ definitions • Analysis of the system model proposals
EDP (0.75 PM)	• Initial identifications of major components in Smart Grid projects • Identification of representative grids and collecting data, namely consumption data
UMA (1.8 PM)	• Study of Twente University modelling techniques. • Study of energy balancing algorithms. Study of proposals for system models.
CEMOSA (0.6 PM)	• Description of models (conceptual graphs) and current state of art analysis to satisfy use cases and project objectives
UTWE (5.3 PM)	• Coordination of system models • Contribution to system models, model development
IPI (8.85 PM)	• Study of Twente University modelling techniques. • Discussions with partners on the data for testing modelling algorithms • Collection of the data from project partners • Checking data quality and structure • Initial data analysis • Dealing with errors, missing data

2.4.3 Task 5.2 Energy Balancing (M3 – M20)

Description according to Annex I

This task selects, implements and evaluates the load balancing mechanisms for the energy control and management together with concepts for device classification and control. It uses the system models to select and verify the developed balancing mechanisms, i.e., implemented mechanisms are evaluated within a system model in simulation and emulation. The most appropriate mechanisms are implemented to be integrated in the prototypes. It covers:

- Analysis of available device control concepts to consider the different device profiles, features and parameters,
- Definition of the energy balancing mechanisms,
- Verification of the mechanisms,
- Implementation of the mechanisms.

Work done

- Literature study

  All involved partners studied the literature that is relevant to their role in this task, e.g. [1][3][4][7][8][9].

- Hierarchical energy balancing algorithm

  An algorithm that balances the energy over multiple levels of hierarchy is currently being developed. This algorithm minimizes the weighted sum of the energy costs and a deviation from a desired power profile. The algorithms are much more effective at balancing the neighbourhood distribution grid than the current state-of-the-art algorithms that only use a single steering signal. Further developments are required to speed up the convergence of the algorithm and to find a better connection between profile steering and market mechanisms.

- Electrical vehicle planning algorithm

  The hierarchical energy balancing algorithm uses different device planning algorithms for each device (class). We have developed a very efficient algorithm that finds the optimal plan for EV charging. This algorithm takes a weighted sum of costs and ability to follow a profile into account. The time complexity of this algorithm is quasilinear, i.e., O(N log N).

  A paper about this algorithm will be presented at the ISGT conference in October 2014 [10].

- Predictions of production and consumption

  The partners collaborated to get measurements from many sources. These are currently used to develop prediction algorithms that serve as input to the balancing algorithms. The predictors that are developed are: consumption prediction (24h ahead for non-controllable loads), flexibility prediction (24h ahead for controllable load), and generation prediction (24h ahead).

- Mapping to the use cases and management unit

  During a meeting, the consortium made sure that the algorithms map well on all the use cases, and thus coping with the project requirements that were stated in the DoW. An internal document was made to contain all links between the use cases and the algorithms under development.

  Furthermore, a mapping to the management unit and its components were made (in connection to task T3.2). The communication requirements of the algorithms are analysed and shared with the partners who are active in work package WP4.

The main activities of the partners

IHP (0.5 PM):	• Analysis of the HAN level appliance control mechanisms • Analysis of energy balancing aspects in use-cases
INOV (1.5 PM)	• initial studies on the problem of injecting energy resulting from renewable production into the LV segment of the grid • Studies on the control of micro-generation for injecting energy into the grid • Studies on energy balancing mechanisms having in view the pilot demonstration
EDP (0.2 PM)	• Contributions for the Energy Management Platform: EDP experience with DG connected to DSO grid, namely in low voltage grids. Major challenges for DSO

	for dealing with DG
CEMOSA (1.55 PM)	• Assessment of energy balancing requirements the e-balance project needs to deploy the 28 use cases • Planning to carry out T5.2 activities – collection and definition of information (template), state of art of algorithms, energy balancing necessities for each use case, energy balancing necessities for the whole project objectives • Collection and definition of device types for the customer domain and layout of the customer domain • Assessment of energy balancing mechanisms for both LV and MV grids under the task "Energy balancing" • Assessment of energy balancing combined with energy resilience and the impact on Use Cases and on Demonstrators
UTWE (2.2 PM)	• Improved understanding of Demand Side Management and working on ideas about how to make energy balancing algorithms "fair" • Development balancing algorithms
ALLI (0.18 PM)	• Discussing balancing with respect to demosites and market models.
LW (6.11 PM)	• Energy balancing – definition of theoretical energy balancing mechanisms • Technology evaluation for energy balancing • Prepare prototype implementations, energy balancing evaluations
EFACEC (0.5 PM)	• Assessment of energy balancing mechanisms for both LV and MV grids under the task "Energy balancing"

2.4.4 Task 5.3 Energy Resilience and Self-healing (M3 – M20)

Description according to Annex I

This task selects, implements and evaluates the resilience and self-healing mechanisms for the energy control and management. It uses the system models to select and verify the developed mechanisms, i.e., the implemented mechanisms are evaluated within a system model. The most appropriate mechanisms are to be integrated in the prototypes. It includes:

- Definition of the energy resilience and self-healing mechanisms,
- Verification of the mechanisms,
- Implementation of the mechanisms.

Work done

- Literature study

  All involved partners studied the literature that is relevant to their role in this task, e.g. [11][12][13][14][15][16][17][18].

- Assessment of energy resilience and self-healing mechanisms in LV and MV grids

  The involved parties assessed the mutual aspects of grid resilience on both LV and MV grid levels. Besides, the scope of intervention, the implemented features and the nature of their communication support was also assessed.

  Self-healing, as a broad perspective for recovering a faulty grid, which is, in itself, a complementary feature for grid resilience, was also assessed for both LV and MV grid levels [13].

- Assessment of energy resilience and self-healing features suitability for use case support and demonstration deployment

The current nature of controllable actuators at distribution grid level, and specifically within the candidate demonstration sites of the e-balance project, led to the involved parties to focus mainly in the MV grid perspective.

Substation-centric and distributed approaches for MV self-healing were assessed and compared, namely at architecture level, communication physical supports and protocols [11].

- Voltage control (a resilience target) with balancing algorithms

  The impact of Dispersed Generation (DG) on the grid node voltage profiles may lead to over-voltages which may affect grid performance and regulatory limits to be observed.

  The involved parties are assessing the outcomes of Task 5.2 which, when combined with the resilience models designed in Task 5.1, will contribute for the design and implementation of combined (balancing/resilience) algorithms for voltage control aiming at mitigating the negative impact of DG [18].

- Low Voltage grid resilience using energy balancing

  The low voltage grid can be made resilient to under voltages, over voltages and overloaded cables and aerial segments by combining LV grid monitoring and power flow awareness – provided by LV sensors – with the balancing algorithms that are being developed as part of Task 5.2.

  Among other features, the involved parties designed and implemented prototypes for fault detection and fault location, as well as for fault prevention. Design of algorithms and their implementation are still in progress for fraud detection and losses calculation [12].

  Moreover, the overall LV grid resilience solution also provides Key Performance Indicators (KPI) – some of them still in progress – offering a more detailed awareness of the LV grid performance.

  The low level simulation environment that is developed as part of Task 5.1 is capable of detecting these problems, while evaluating the impact of all developed algorithms. Improvements to the resilience and balancing algorithms were made based on the outcomes of these simulations.

- Low Voltage grid resilience using different battery management strategies

  The LV resilience model developed in T5.1 has been used to evaluate various battery management strategies. The allocation of back-up energy within the available energy storage units allows for a trade-off between additional flexibility for balancing in normal operation and enhanced resilience in case of grid failure, which corresponds to a specific demonstration case, the micro-grid mode, considered in of the established Use Cases.

- Medium Voltage grid resilience and self-healing

  The medium voltage grid has been subject to resilience improvement which can be confirmed in the state of the art.

  Nevertheless, there are still plenty of alternatives and of combined approaches for deploying automatic procedures for grid service restoration improving the MV grid resilience – the so called self-healing – having in mind the constraints imposed by the telecommunications infrastructure, the nature of the primary equipment for grid switching and their ability for remote or local control with a certain amount of autonomy.

  Design of algorithms and their implementation are still in progress for combining grid performance improvement (grid topology improvement aiming at reducing losses and at mitigating operational risks) while keeping an accurate fault detection and location at MV grid level [14].

  Automatic grid service restoration comprising feeder protections, overhead switches, reclosers and secondary substations, among others, is currently being assessed. Substation centric and distributed peer-to-peer approaches are currently under assessment, together with the outcomes of WP4 as communication platforms (technologies and protocols) strongly impact on those approaches [15][16][17].

A special care is being taken into account regarding not only the ability of the MV grid to heal itself, but also to perform such healing having in mind any grid constraints or operational criteria, namely grid segment thermal limits, voltage node profiles, etc., meaning that, for instance, any load transfer within self-healing will be preliminarily subject to assessment prior to its operational deployment. The design of all these features is still in progress.

Finally, the overall MV grid resilience solution will also provide Key Performance Indicators (KPI), which definition is still in progress, contributing for a more detailed awareness of the MV grid performance.

- Mapping to the use cases and management units

  During the mentioned meeting, the consortium made sure that the algorithms map well on all the use cases, and thus coping with the project requirements that were stated in the DoW. An internal document will be made to contain all links between the use cases and the algorithms under development.

The main activities of the partners

IHP (0.45 PM):	• Contribution to the definition of the energy resilience and self-healing mechanisms • Analysis of energy resilience aspects in use-cases
INOV (2.43 PM)	• Research and development on an algorithm to control the feeder voltage when microgenerated power is injected into the grid • Continuation of the work in the inverter control algorithm for the control inner loop in a situation of injection of microgeneration power into the grid
EDP (0.9 PM)	• Definition of self-healing and resilience mechanisms; Study of different resilience approaches
UTWE (1.2 PM)	• Contribution to energy resilience and self-healing
EFACEC (2.78 PM)	• Contributions for the Energy Management Platform – Energy resilience and self-healing concept definition and its application in e-balance project according to WP3, considering the Use Cases defined in WP2 • Assessment of energy resilience and self-healing mechanisms for both LV and MV grids, as well as their impact on Use Cases and on Demonstrators • T5.3 task management • Design of energy resilience and self-healing mechanisms for both LV and MV grids under the task “Energy resilience and self-healing” • Assessment of energy balancing combined with energy resilience and the impact on Use Cases and on Demonstrators

2.4.5 Task 5.4 Security and Privacy (M3 – M20)

Description according to Annex I

This task selects, implements and evaluates the security and privacy mechanisms for the energy control and management. It uses the system models to select and verify the developed mechanisms, i.e., implemented mechanisms are evaluated within a system model. The most appropriate mechanisms are to be integrated in the prototypes. It includes:

- Definition of scalable security and privacy mechanisms,
- Verification of the mechanisms,
- Implementation of the mechanisms.

Work done

The main work item realized within this task so far covers the analysis of the input from WP2 in the security and mainly the privacy context of the energy management platform. These inputs include both the social aspects but also the legal aspects. These inputs are studied within the context of the technical requirements for the security and privacy in the smart grid.

Based on that study we proposed a security and privacy framework that combines flexibility with transparency. The first concept is built around the Data Interface that connects the Communication Platform and the Energy Management Platform. The Data Interface is data centric and allows exchanging defined data elements (variables) between these two parts of the e-balance system. This interface also provides access control for the data accesses. This means that the sources of the data access requests are identified and only allowed accesses are executed. The data access requests are generated by processes in the energy management platform that request data from the communication platform on behalf of some stakeholder. Thus, prior to the actual data access a process has to identify itself as well as the stakeholder it works for. The access to the data is granted or denied according to the data specific access strategy (privacy policy definitions) defined by the data owner (data source). The data owner may specify individual access strategy for each data item (variable) separately. This definition is stored and transmitted together with the data structure containing the value of the variable. This approach allows checking and enforcing the access policy without the need to obtain this policy from the data source. Additionally, it allows changing the access policy without affecting the data that was generated prior to this policy change.

The data structure containing the variable stores also the meta-data that is used to address the data in the middleware. This meta-data provides a multidimensional address space allowing identify the data in temporal and spatial domain.

Next steps involve implementation and integration of the concept.

The main activities of the partners

IHP (1.2 PM):	• The studies on the security and privacy requirements for the management platform • Analysis of the energy management platform level security and privacy mechanisms based on the system requirements • Analysis of security and privacy aspects in the use-cases • Definition of the initial security approach
EDP (0.1 PM)	• Initial identifications of security and privacy mechanisms
LW (1.67PM)	• Security and privacy – review of possible security mechanisms, evaluation of security mechanisms in the e-balance environment and of the security impact to the e-balance system • Technology evaluation for security

2.4.6 Task 5.5 Integration of the Management Platform (M6 – M24)

Description according to Annex I

In this task the common management platform for energy control and management is integrated (in-lab integration).

The integrated management platform is evaluated according to a defined expected behaviour (test cards). For this purpose we will use the in lab demonstrators before moving the platform into the real life demonstrators.

Work done

- Active development of a device steering framework

  A device steering framework is being developed. This framework should form a bridge between the balancing algorithms (Task 5.2) and the physical appliances.

The main activities of the partners

UTWE (0.3 PM)	• Appliance steering framework development

2.4.7 Task 5.6 Energy Management Platform Restatement and Revision of the System Models (M12 – M40)

Description according to Annex I

In order to provide very accurate system models, developed in Task 5.1, for future research and the community, in this task the system models will be revisited after feedback from the integration and evaluation tasks in WP6.

Work done

- No restatement or revision was needed in this reporting period

The main activities of the partners

IPI (0.14PM):	• Initial planning for revision of system models

2.4.8 Deliverables in WP5 the consortium worked on in Y1

- D5.1 “System models specification and implementation” within Task 5.1 (M3-M15) – ongoing

D5.1	**Reporting Period: M3-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	1.00	0	0.75	1.80	0.60	5.30	0	8.85	0	0	0	**18.30**
PM plan for Y1	1.92	0	1.46	3.46	1.54	5.38	0	6.15	0	0	1.54	**21.46**
PM plan total	**2.50**	**0**	**1.90**	**4.50**	**2.00**	**7.00**	**0**	**8.00**	**0**	**0**	**2.00**	**27.90**

System models specification and implementation: This deliverable defines the system models and provides the implementation of these.

- D5.2 “Detailed specification, implementation and evaluation of energy balancing algorithms” within Task 5.2 (M3-M20) – ongoing

D5.2	Reporting Period: M3-M12											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.50	1.50	0.20	0	1.55	2.20	0.18	0	6.11	0	0.50	**12.74**
PM plan for Y1	1.39	1.39	1.00	4.44	3.88	2.22	0.56	0	6.11	0	3.06	**24.06**
PM plan total	**2.50**	**2.50**	**1.80**	**8.00**	**7.00**	**4.00**	**1.00**	**0**	**11.00**	**0**	**5.50**	**43.30**

Detailed specification, implementation and evaluation of energy balancing algorithms: This deliverable shall present the specification and the detailed information about the design, implementation and evaluation of the e-balance energy balancing algorithms.

- D5.3 "Detailed specification, implementation and evaluation of energy resilience algorithms" within Task 5.3 (M3-M20) – ongoing

D5.3	Reporting Period: M3-M12											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.45	2.43	0.9	0	0	1.20	0	0	0	0	2.78	**7.76**
PM plan for Y1	1.39	1.94	0	0	0	2.22	0	0	0	0	3.33	**8.89**
PM plan total	**2.50**	**3.50**	**0**	**0**	**0**	**4.00**	**0**	**0**	**0**	**0**	**6.00**	**16.00**

Detailed specification, implementation and evaluation of energy resilience algorithms: This deliverable shall present the specification and the detailed information about the design, implementation and evaluation of the e-balance energy resilience algorithms.

- D5.4 "Detailed specification, implementation and evaluation of security and privacy means" within Task 5.4 (M3-M20) – ongoing

D5.4	Reporting Period: M3-M12											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	1.20	0	0.10	0	0	0	0	0	1.67	0	0	**2.97**
PM plan for Y1	1.39	0	1.06	0	0	0	0	0	1.67	0	1.67	**5.78**
PM plan total	**2.50**	**0**	**1.90**	**0**	**0**	**0**	**0**	**0**	**3.00**	**0**	**3.00**	**10.40**

Detailed specification, implementation and evaluation of security and privacy means: This deliverable shall present the specification and the detailed information about the design, implementation and evaluation of the e-balance security and privacy means for both.

- D5.5 "Implementation of an integrated management platform" within Task 5.5 (M6-M24) – ongoing

D5.5	Reporting Period: M6-M12											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0	0	0	0	0	0.30	0	0	0	0	0	**0.30**
PM plan for Y1	0.74	1.11	0	0.74	0.74	1.47	0	0	0	0	2.21	**7.00**
PM plan total	**2.00**	**3.00**	**0**	**2.00**	**2.00**	**4.00**	**0**	**0**	**0**	**0**	**6.00**	**19.00**

Implementation of an integrated management platform: This deliverable shall present the detailed information about the integration and evaluation of the e-balance management platform.

- D5.6 “Restatement of the energy management platform specification and revision of the system models” within Task 5.6 (M12-M40) – ongoing

D5.6	**Reporting Period: M12-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0	0	0	0	0	0	0	0.08	0	0	0	**0.08**
PM plan for Y1	0.07	0	0	0.07	0.10	0.10	0	0.28	0	0	0.14	**0.76**
PM plan total	**2.00**	**0**	**0**	**2.00**	**3.00**	**3.00**	**0**	**8.00**	**0**	**0**	**4.00**	**22.00**

Restatement of the energy management platform specification and revision of the system models: This deliverable shall provide an evaluation of the technical specification of the energy management platform components as well as of the defined system models and reasoning for needed adaptions as lessons learnt during the integration and testing phase.

Deviations

The most of the effort deviations for the ongoing WP5 deliverables are due to linear planning. The figures on effort spent for the activities related to the deliverables show that reaching the delivery date of a deliverable the consumed effort converges to the planned figures.

It is exactly the case with activities related to deliverable D5.1. We experience currently a slight underspending of about 15%, but the planned effort will be consumed within the first months of the following reporting period.

Partner IPI spent on the activities related to deliverable D5.1 already the amount of effort that was planned for the complete activity by this partner. This was due to the fact that IPI provides an analytic approach for predicting the energy consumption and production based on historic data that is needed for the system model.

Other partners active in activities related to deliverable D5.1 will catch up within the first months of the following reporting period.

In all activities related to deliverable D5.2 we experience currently an underspending of about 45%. This is caused by the focus on the system models (deliverable D5.1) after this activity is finished in the first months of the following reporting period, the partners will increase the effort spent on activities related to deliverable D5.2.

The overall effort spent by the partners for activities related to deliverable D5.3 is almost equal to the plan. However, the diversity of the involvement level is also visible here. All partners will increase the spending of the remaining effort in the following reporting period.

The overall effort spent by the partners on activities related to the deliverable D5.4 shows an underspending of about 48%. In the reporting period we developed the concept for the security and privacy approach and in the following reporting period we will implement, integrate and evaluate it, what will require the remaining effort planned for this activity.

We did not start yet with the integration of the complete solution for the energy management platform (activities related to deliverable D5.5) nor with the restatement of the energy management platform and system models (activities related to deliverable D5.6). Only partners UTWE and IPI did some initial work for these future activities.

2.5 WP6 – System Integration and Evaluation (M12 – M41)

In this work package we define the demonstrators, integrate, validate and evaluate the results. The integration of the subsystems developed in WP4 and WP5 will allow performing an early test to check the system behaviour.

The experience gained from the early integration in the laboratory will help in the adaptation of the detailed specifications and implementations done in WP4 and WP5 and will be fed back to WP2 and WP3 in order to ensure the compliance of the system specification with the final implementation.

The solutions researched and developed in the WP4 and WP5 will be integrated into real life demonstrators using the premises of EDP and Alliander in Portugal and Bronsbergen in the Netherlands, respectively. The demonstrator in Portugal will be focused on the management and control part in the distribution network including the required security and privacy mechanisms. The demonstrator at Bronsbergen will focus on the building automation and related energy management issues. The means for energy storage as well as production of renewable energy are available to the consortium at Bronsbergen. The evaluation will be done on the basis of the test cases defined using the use cases specified in WP2.

The third demonstrator will be based on our in lab test bed. In this demonstrator the real life will be emulated and will allow for differentiating the test cases with respect to the energy production and consumption patterns. Due to higher responsiveness and the ability to verify the proposed energy management platform against the collected real life data, the in lab demonstrator allows broad verification means not available in the real life sites. Further, the in lab emulation means will be used for evaluation of our platform against real life data provided by potential customers to estimate achievable benefits, depending on the target system parameters. This demonstrator emulates the real life behaviour and allows generating test situations not allowed or hardly possible in the two real life demonstrators.

WP6	**Reporting Period: M12-M12**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.20	0.73	0.90	0	0	0.20	0.75	0	0.13	0	0.50	**3.41**
PM plan for Y1	0.80	1.00	0.87	1.07	0.27	1.27	0.53	0	0.13	0	0.93	**6.87**
PM plan total	**11.00**	**18.00**	**14.00**	**16.00**	**5.00**	**22.00**	**9.00**	**0**	**2.00**	**0**	**19.00**	**116.00**

2.5.1 The WP6 results in Y1

- Initial work on the mapping of use cases on the demonstrators
- Work towards the definition of hardware and software platforms
- MV grid model of Bronsbergen demo site
- A pragmatic analysis of the use cases is made to identify the type of hardware required to fit e-balance into the Bronsbergen demo site.
- Contact has been initiated with an Italian appliance manufacturer and offers have been received. It is a still ongoing activity, as the number of participants who will be supplied with these appliances is not clear yet.
- Contact has been initiated with a Dutch inverter supplier. Again an ongoing activity due to the need for more information from the demo site.
- Contact has been initiated with the holiday park manager of the Bronsbergen site, contact with the association of owners is pending a more detailed specification of the demonstrator.
- Information regarding a similar Alliander project building an in-lab demo has been supplied to IHP.

- Preliminary identification of the LV feeders to be used at the Batalha test site.
- Preliminary identification of the use cases to be implemented at the Batalha test site.

In the following the tasks are introduced and the accounted work and the results are described briefly.

2.5.2 Task 6.1 Definition of the demonstrators (M12 – M16)

Description according to Annex I

In this task the detailed definition of the demonstrators is performed, based on the use cases chosen in work package WP2, deliverable D2.1. This includes:

- Specification of the required functionality/modules for each demo site,
- Specification of different parameter scenarios for each demonstrator,
- Specification of the expected demonstrator behaviour for the validation procedure (test cards).

Work done

The work package has started in M12, i.e., the last month of the reporting period, and should be finished in M16. As such, the deliverable D6.1 that is the major outcome of the task is in its initial state and ongoing.

The first activity towards the definition of the demonstrators is to investigate if any (unforeseen) changes have occurred at the demo sites since the descriptions supplied in Annex I were formulated.

In order to determine the required functionality and modules needed for the demonstrators, a consistent matching of the use cases specified in D2.1, the architecture specified in D3.1, the communication platform defined in WP4 and the energy management platform from WP5 needs to be formulated.

We performed a check of the cumulated results delivered so far by the all work packages. A check performed from the demonstration point of view. The conclusion in M12 was that the architecture defined in WP3 and the system components from both WP4 and WP5 require a more detailed and specific formulation and, in some cases, restatement of the use cases defined in D2.1. This is required to provide a coherent description of the e-balance project and thus, to enable the definition of the demonstrators to match the work delivered so far. This activity will be realised within the task T2.5 (restatement of the use cases) and in parallel we can start with the assignment of use cases to the specific demonstrators. The translation to the required functionality and modules will be presented in D6.1, where the same activity on the general system architecture level will be covered in deliverable D3.2 as well.

The developed energy resilience and balancing methods require up to date grid models to facilitate proper analysis and aggregation of data. The research has shown that the Low Voltage (LV) models of the Bronsbergen demonstrators, readily available from previous projects, are insufficient for e-balance purposes. ALLI will work on more up to date models as a part of the specification of the demonstrator.

ALLI and IHP have looked into implementation options for the in-lab demonstrator at IHP.

EDP and INOV have worked for a more detailed definition of the demonstrator at Batalha site. The work is ongoing.

An important feature for the Bronsbergen demonstrator is the availability of controllable loads and or generation. These are currently not present at the site and will have to be acquired for demonstration, testing and development. Contact has been initiated with a Smart Appliance manufacturer and a solar inverter manufacturer. This is an ongoing activity.

The main activities of the partners

IHP (0.2PM):	• Initial proposal for the in-lab demonstrator

INOV (0.73PM):	• Initial proposal for the allocation of use cases into the demonstrators. Initial study for the configuration of demonstrators in Portugal and in The Netherlands
EDP (0.90PM):	• Contributions to definition of demonstrators
ALLI (0.75PM)	• Investigating the implementation of D3.1 at Bronsbergen, searching for usable Smart Appliances, investigating social aspects of demosite Bronsbergen, investigating the applicability of D2.1 use cases at Bronsbergen
UTWE (0.2PM)	• Contribution to the demonstrator definition
EFACEC (0.5PM):	• Contribution for the "Definition of the demonstrators" – performing backward tracing up to the Use Cases, coping with the specifications, the ongoing requirements definition and the mechanisms design

2.5.3 Task 6.2 Integration and set-up of the prototypes (M12 – M26)

Description according to Annex I

In this task the individual prototypes are integrated and evaluated. The integrated platform incorporates all the layers used in the individual prototypes, the communication platform, management platform and the specific underlying grid hardware.

Work done

The work done during the first month of this activity, mainly consisted in checking the contributions that will be given by the communication platform and energy management platform for the system integration.

The main activities of the partners

LW (0.13PM):	• First concepts of demonstration evaluated

2.5.4 Deliverables in WP6 the consortium worked on in Y1

- D6.1 "Specification of the demonstrators" within Task 6.1 (M12-M16) – ongoing

D6.1	**Reporting Period: M12-M12**										
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.20	0.73	0.90	0	0	0.20	0.75	0	0	0	0.50	**3.28**
PM plan for Y1	0.60	0.40	0.60	0.80	0.20	0.80	0.40	0	0	0	0.40	**4.20**
PM plan total	**3.00**	**2.00**	**3.00**	**4.00**	**1.00**	**4.00**	**2.00**	**0**	**0**	**0**	**2.00**	**21.00**

Specification of the demonstrators: This deliverable shall define in detail the demonstrator architecture and functionalities.

- D6.2 "Integration of the prototypes" within Task 6.2 (M12-M26) – ongoing

D6.2	**Reporting Period: M12-M12**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0	0	0	0	0	0	0	0	0.13	0	0	**0.13**
PM plan for Y1	0.20	0.60	0.27	0.27	0.07	0.47	0.13	0	0.13	0	0.53	**2.67**

PM plan total	**3.00**	**9.00**	**4.00**	**4.00**	**1.00**	**7.00**	**2.00**	**0**	**2.00**	**0**	**8.00**	**40.00**

Integration of the prototypes: This deliverable shall describe the actions taken for the prototype integration and the results of the integration.

Deviations

The efforts spent by the partners in the first month of the work package on the activities related to deliverable D6.1 are slightly below the amount of planned effort. It shows an underspending of about 20%, but as a sum it is only a single person month difference. With these activities we are actually good in plan and we will consume the remaining effort in the following reporting period.

We did not start with the activities related to the deliverable D6.2. Only partner LW did some initial conceptual work for this future activity.

2.6 WP7 – Dissemination and Exploitation (M1 – M42)

Efficient dissemination and exploitation are fundamental aspects in any research project, since the success of related activities contributes decisively to the short and long term success of the project. This WP has been responsible for ensuring that all these activities have been appropriately developed and managed throughout the project duration.

Moreover, this WP is responsible to monitor the regulatory and standardisation activities directly related to the research work, in order to assure the overall viability and coherence of the project results, and formulate guidelines for developing pre-normative documents for energy management systems.

This work package started in M1 of the project and finishes in M42. The work package consists of four tasks.

The objectives of WP7 during the first period have been:

- Produce and update the project website.
- Prepare material for dissemination (brochure, poster, etc.).
- Promote participation at relevant conferences, workshops, seminaries or related events.
- Publication of papers, press releases, and reports in relevant journals.

WP7	**Reporting Period: M1-M12**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.50	0.52	0.23	0	1.89	0.30	0	0.71	0.28	0.20	0	**4.63**
PM plan for Y1	0.57	0.57	0.86	0.29	1.14	0.86	0.57	0.57	0.29	0.57	0.29	**6.57**
PM plan total	**2.00**	**2.00**	**3.00**	**1.00**	**4.00**	**3.00**	**2.00**	**2.00**	**1.00**	**2.00**	**1.00**	**23.00**

2.6.1 The WP7 results in Y1

- A website devoted to e-balance has been established on 31st December 2013 (www.e-balance-project.eu) to disseminate the project. This is the deliverable D7.1 'Website available'
- Flyer and poster for promoting the project
- Participation in seven conferences, workshops, fairs or related events during the first year of the project; participation in four conferences at the beginning of the second period and there are one event more scheduled for the second period

- One article has been published in scientific journal Rynek Energii 3/2014 and two papers (Peer reviewed) have been published in proceedings
- Several press releases/news have been published in digital magazines and platforms
- Identification related FP7 projects to establish a procedure for the exchange of information and mutual collaboration
- Initial studies of the guidebook

In the following the tasks are introduced and the accounted work and the results are described briefly.

2.6.2 Task 7.1 Communication Plan (M1 – M42)

Description according to Annex I

This task develops a communication plan that aims to raise the profile of the project and to stimulate a high level of market, stakeholders and policy awareness through various actions at an international level, which includes liaison with relevant funder research projects, developers of similar and attractive technologies and potential user communities. Inter-project cooperation will focus on coordination and cooperation between EU and other projects, and activities within the energy domain.

Work done

The main activities within this task include:

- Research on similar initiatives and other communication possibilities
- Search and identification of other FP7 projects in order to explore the potential of synergy between e-balance project and these projects and exchange best practices, data, among other
- Initiate communication activities with other FP7 projects (workshop with ORIGIN, data exchange with e+)

The e-balance project is making an effort to cooperate with other projects. During the first period (M1-M12), the consortium has identified other EU projects, which have a degree of synergy with e-balance:

- CIVIS – Cities as drivers of social change
- COSSMIC - Collaborating Smart Solar-powered Micro-grids
- READY4SMARTCITIES - ICT Roadmap and Data Interoperability for Energy Systems in Smart Cities
- IURBAN - Intelligent URBAn eNergy tool
- BESOS - Building Energy decision Support systems fOr Smart cities
- INDICATE - Indicator-based Interactive Decision Support and Information Exchange Platform for Smart Cities
- SmartC2Net - Smart Control of Energy Distribution Grids over Heterogeneous Communication Networks
- SuSTAINABLE - Smart distribution system operation for maximizing the integration of renewable generation.
- PlanGridEV - Distribution grid planning and operational principles for EV mass roll-out while enabling DER integration

The main activities of the partners

IHP (0.22PM):	• Initial work on the communication plan • Representing the e-balance project at the EeB Impact Workshop in Brussels, on the 1st – 2nd of April, 2014 • Activities towards inter-project cooperation • Research on possible collaboration with other projects
EDP (0.15PM):	• Participation on ADVANCE Workshop on 19th September for dissemination of e-balance results in Madrid
CEMOSA (0.1PM):	• Identification related FP7 projects to establish a procedure for the exchange of information and mutual collaboration • Preparation of the next steps in dissemination/exploitation/standardization
UTWE (0.1PM)	• Review flyer and poster

2.6.3 Task 7.2 Dissemination (M1 – M42)

Description according to Annex I

This task includes the proactive dissemination of project information and results to a broad public audience. In particular this task includes dissemination plan, activities & reporting, based on agreed strategy and plan to promote project among market entities, policy makers, and scientific community.

Work done

Since the very beginning, the project has had a solid internet presence through a dedicated project website. The website was set online, according to schedule, at the end of December 2013. It is available on http://www.e-balance-project.eu/. The website served as a central tool for communication and dissemination purposes, providing relevant information on the projects activities and objectives.

Regarding the dissemination material, a first version of the brochure has been created electronically and uploaded in the website. In this regard, the e-balance partners have taken the advantage of disseminating the project in spite of the early project state.

e-balance leaflet

This leaflet was distributed in two events:

- 18th Science Picnic of Polish Radio and the Copernicus Science Centre (Science Fair), held in Warsaw (Poland) on 31st May 2014.
- CIGRÉ 2014 Technical Exhibition, held in Paris (France) from 25th to 29th August 2014.

Moreover, the consortium has prepared a poster for displaying in the conferences or events. The poster is also available to download on the website.

Other promotion channels: through the own websites of the partners, press release and news about e-balance project. Some examples are:

- "e-balance project" on the website of partners:

  EDP: http://newsletter-ase.efacec.com/NL29_14/RD2.html
  IHP:
  http://www.ihp-microelectronics.com/de/forschung/drahtlose-systeme-und-anwendungen/projekte/e-balance.html
  LODZ:
  http://zarzadzanie.uni.lodz.pl/Projektyeuropejskie/tabid/1686/language/en-US/Default.aspx
  UTWENTE:
  http://www.utwente.nl/ctit/research/research_projects/international/fp7-streps/e-balance/
  UMA:
  http://www.gisum.uma.es:3000/investigacion/proyectos_por_financiacion_internacionales/408#seleccionado

- Press release "EU Project e-balance: High efficiency to reduce the overall dirty energy production". Deliverable 1.1.

- "EU Project e-balance: High efficiency to reduce the overall dirty energy production". New, in December 2013, on the website Innovations report (Forum for Science, Industry and Business). Language: English.

  http://www.innovations-report.com/html/reports/energy-engineering/eu-project-e-balance-high-efficiency-reduce-dirty-224287.html

- "CEMOSA participa en el proyecto europeo e-balance" – New (in Spanish) published in two websites in February 2014:
  - Website of Spanish Construction Technology Platform (PTEC). http://www.plataformaptec.es/ver-noticia.php?id=1446
  - Website of Pnet, which is a collaborative platform focused on R&D in construction sector. http://www.pnetconstruction.es/headlines/stories/36-cemosa-participa-en-el-proyecto-europeo-e-balance

Regarding the participation of conferences, workshops, exhibitions, during this period, the consortium has participated in several events to present the results of the research and development related to e-balance project, see Annex A of this document.

The main activities of the partners

IHP (0.23PM):	• Project press release and web-site • Preparing publications
INOV (0.52PM)	• Preparation of an extended abstract for submission of a poster to the conference EuCNC 2014 • Contribution to an abstract for submission to the Medpower 2014 conference • Contribution for the publication and presentation at Medpower 2014
EDP (0.08PM):	• Abstract preparation for submission of a poster to the conference EuCNC 2014 • Contributions and review to brochure and posters
CEMOSA (1.79PM):	• Track and support of the dissemination activities of the whole consortium • Contribution to the abstract and the full paper for MedPower2014 • Preparation of the abstract to the 23rd International Conference and Exhibition on Electricity Distribution (CIRED2015) • Main editor of the poster to be displayed in events/workshops

	• Main editor of the flyer of the project. Collecting suggestions and improvements and editing the final version presented on Scientific Picnic in Warsaw • Design of on-line template (google form) to track the consortium dissemination activities • Preparation of the next steps in dissemination/exploitation/standardization
UTWE (0.2PM)	• Contribution to publications
IPI (0.71PM):	• Preparation of the presentation for SAB workshop Madrid (organized by ADVANCED) • Preparation of the poster *Attitudes toward EMS depending on Smart Grid development. Cross-country social study* for SP2014 Nice • Preparation of the article: *How to Balance the Energy Production and Consumption in Energy Efficient Smart Neighbourhood* for MedPower2014 conference – collaboration with Partners: IHP, CEMOSA, LODZ, INOV
LODZ (0.2PM)	• Paper submission and extended abstract preparation for MedPower2014 • Preparation of publications (three papers submitted and accepted)

2.6.4 Task 7.3 Dissemination and contribution to standards (M1 – M42)

Description according to Annex I

An active approach towards exploitation of results will be carried out within the project. Exploitation will be based on appropriate technology assessment as well as market condition and business opportunities analysis.

Another important component will be monitoring and contributing to standards bodies and to standards developments as may be appropriate.

Work done

IHP participated at the *"ETSI Smart Appliance Standard Workshop"*, on 27th and 28th May 2014 in Brussels (Belgium). Participation at the second meeting was cancelled one day before the meeting due to illness, but we observe this standardisation activity.

The main activities of the partners

IHP:	• Attendance at *"ETSI Smart Appliance Standard Workshop"*, on 27th and 28th May 2014 in Brussels (Belgium)

2.6.5 Task 7.4 Guide Book (M1 – M42)

Description according to Annex I

All the results achieved in the project relevant to the application of the developed energy management platform will be collected together in the form of a guide book. The guide book will explain the provided means to estimate the achievable energy savings. It includes the detailed description of the energy platform test bed together with the methodology to prepare the input data to represent a specific target deployment.

Additionally, the guide book will explain how to estimate the costs of the solution for both, installation and run time. This will be complemented by the description of the developed business models.

Work done

- Initial studies realized and notes taken
- Prepared some documentation for the HAN gateways.

The main activities of the partners

IHP (0.05PM):	• Collecting initial notes for the guide-book.
LW (0.28PM):	• Conception for integration of various power device producers and for encouraging power device producers to support balancing • Collecting initial notes for the guide-book.

2.6.6 Deliverables in WP7 the consortium worked on in Y1

- D7.1 "Website available" within Task 7.2 (M1-M3) – finished

D7.1	**Reporting Period: M1-M12**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.11	0	0	0	0	0	0	0	0	0	0	**0.11**
PM plan total	**0.17**	**0.17**	**0.17**	**0.17**	**0.33**	**0.33**	**0**	**0.33**	**0**	**0.33**	**0**	**2.00**

Website available: The website of the project is up and running.

- D7.2 "Dissemination activities" within Task 7.1 and Task 7.2 (M1-M42) – ongoing

D7.2	**Reporting Period: M1-M12**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.19	0.52	0.13	0	1.82	0.23	0	0.71	0	0.20	0	**3.81**
PM plan for Y1	0.14	0.19	0.19	0.10	0.19	0.24	0	0.19	0	0.19	0	**1.43**
PM plan total	**0.50**	**0.67**	**0.67**	**0.33**	**0.67**	**0.83**	**0**	**0.67**	**0**	**0.67**	**0**	**5.00**

Dissemination activities: This document summarizes our dissemination activities.

- D7.3 "Exploitation activities" within Task 7.1 and Task 7.3 (M1-M42) – ongoing

D7.3	**Reporting Period: M1-M12**											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.15	0	0.10	0	0.07	0.07	0	0	0	0	0	**0.38**
PM plan for Y1	0.24	0.33	0.48	0	0.29	0.38	0.29	0	0	0	0	**2.00**
PM plan total	**0.83**	**1.17**	**1.67**	**0**	**1.00**	**1.33**	**1.00**	**0**	**0**	**0**	**0**	**7.00**

Exploitation activities: This document shall describe the public part of the exploitation activities. If there will be confidential parts of the exploitation plans, they will be delivered separately to the EC and will be identified as such.

- D7.4 “Guide book” within Task 7.4 (M1-M42) – ongoing

D7.4	Reporting Period: M1-M12											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	0.05	0	0	0	0	0	0	0	0.28	0	0	**0.33**
PM plan for Y1	0.14	0	0.14	0.14	0.57	0.14	0.29	0.29	0.29	0.29	0.29	**2.57**
PM plan total	**0.50**	**0**	**0.50**	**0.50**	**2.00**	**0.50**	**1.00**	**1.00**	**1.00**	**1.00**	**1.00**	**9.00**

Guide book: This deliverable describes in short the Guide Book - a manual for third parties that contains the extract of the project results, covering the applicability suggestions for the proposed energy management platform including the researched aspects of energy efficiency, like social triggers for increasing the willingness to be energy efficient, the economic aspects - the proposed new business models, as well as technical aspects of the proposed solution with means to estimate the initial and running costs and improvement in the energy efficiency. Please note that the manual text is not part of the deliverable document; it is going to be a separated document to be disseminated among potential users (DSOs, city authorities, large energy producers with distribution capacities) to further increase the exploitation potential.

Deviations

The effort for the deliverable D7.1 (project website) was much smaller than planned, but the maintaining of the website and updating its content will consume effort from other tasks in this work package. Thus, we would like to shift the remaining effort per each partner to other activities in WP7, mainly to task T7.2.

The activities related to the other deliverables in this work package are distributed over the whole project duration with relatively small amount of effort panned. Thus, deviations in individual reporting periods are likely.

With respect to dissemination and exploitation of the project results, thus activities related to deliverable D7.2 and D7.3, respectively, we see a trend towards overspending in the first aspect and underspending in the latter. Thus, we would like to transfer some of the planned effort from deliverable D7.3 to deliverable D7.2. We will address this issue further in Section 3.4 Deviations and Delay.

The deviation with respect to the effort spent on activities related to deliverable D7.4 are due to the fact that the focus on the work on this deliverable will be rather in the second half of the project runtime. However, some initial activities were already present in the current reporting period.

3 Project management and administrative issues

WP1	Reporting Period: M1-M12											
Participant	**IHP**	**INOV**	**EDP**	**UMA**	**CEMOSA**	**UTWE**	**ALLI**	**IPI**	**LW**	**LODZ**	**EFACEC**	**TOTAL**
PM spent in Y1	1.91	0	0	0	3.00	0	0	0	0	0	0	**4.91**
PM plan for Y1	3.00	0	0	0	3.00	0	0	0	0	0	0	**6.00**
PM plan total	**8.00**	**0**	**0**	**0**	**3.00**	**0**	**0**	**0**	**0**	**0**	**0**	**11.00**

The project has successfully started with the kick-off meeting in Frankfurt (Oder), Germany in October 2013. All financial and administrative issues have been solved and the Consortium Agreement (CA) has been signed by all partners in February/March 2014. The EC has transferred the first payment to the coordinator, which arrived on August 26th, 2013. The respective shares to be transferred to the partners have been calculated and the amounts were transferred on September 19th, 2013 – first tranche and on May 14th, 2014 the second one.

To keep the work on e-balance project on track, the consortium decided to meet quarterly. During the meetings the status of each partner was reported and also the plans for the next months were elaborated. The dates of the meetings were set before deadlines of the deliverables in order to discuss their structures and to distribute the editorial work among the partners. Additionally several teleconferences were arranged, what helped to monitor the progress.

All planned communication issues have been met properly. The shared project workspace and email lists for scientific (scientist@e-balance-project.eu) and administrative (admin@e-balance-project.eu) issues have been set up. Templates for deliverables and presentation slides in MS Word and MS PowerPoint have been designed and released by IHP. The project logo has been designed by EFACEC. Following the communication guidelines from the EC, a projects factsheet and a press release have been prepared and published on the project's website (http://www.e-balance-project.eu/).

The progress of the e-balance project was reported to the EC quarterly. Three reports (Q1-Q3) containing the status of each partner and efforts spent were prepared and submitted to the PO.

3.1 Status of Deliverables and Milestones

Table 4 shows the status of deliverables which were submitted in the reporting period of the project according to the Annex I "Description of work".

Regarding the Milestones, Table 5 shows all Milestones planned for the current reporting period.

Table 4: Project deliverables in the reporting period

Del. no.	Deliverable name	Version	WP no.	Lead beneficiary	Nature	Dissemination level	Expected Delivery Date	Actual Delivery Date	Comments
1	D2.1 "Selection of representative use cases"	1.0	WP2	EDP	R	PU	M3	7.02.2014	
2	D2.2 "Analysis of legal issues with focus on security and privacy"	1.0	WP2	CEMOSA	R	PU	M5 (M8)	6.06.2014	The delivery date in brackets expresses the new delivery date agreed with the PO after recognizing the problem. It affects all the following deliverables.
3	D2.3 "Market assessment and business models"	1.0	WP2	LODZ	R	PU	M5 (M8)	2.06.2014	We extended the scope of the deliverable to include also the assessment of the current market situation, what is also expressed in the extended title of this deliverable.
4	D2.4 "User and stakeholders requirements"	1.0	WP2	CEMOSA	R	PU	M6 (M8)	6.06.2014	
5	D3.1 "High level system architecture specification"	1.0	WP3	UTWE	R	PU	M7 (M10)	31.07.2014	

Table 5: Project milestones in the reporting period

Milestone no.	Milestone name	WP No.	Lead beneficiary	Expected Delivery Date	Achieved Yes/No	Actual Delivery Date	Comments
MS1	First user study performed and evaluated	WP2	IPI	M5	Yes	31.03.2014	The milestone is summarized by an internal document. It presents a preliminary outcome of the first user study. The results of the user study are constantly analysed from different perspectives.

3.2 Resources and Spending

A quick overview of the planned vs. reported efforts of the project beneficiaries in the reporting period is shown in Table 6. The plan figures were determined as linear portion for the first 12 months of the tasks from the total efforts over the runtime of the project. The figures show an underspending of about 20% for the first reporting period. The reason of the deviation is that the linear planning does not respect higher efforts for actual implementation and integration later in the project. That is why from project management view the budget spending is well in line with the contracted efforts.

Table 6: Overview of the spent vs. planned efforts of the project beneficiaries

Participant		IHP	INOV	EDP	UMA	CEMOSA	UTWE	ALLI	IPI	LW	LODZ	EFACEC	TOTAL
WP1	spent Y1	1.91	0	0	0	3.00	0	0	0	0	0	0	**4.91**
	plan Y1	3.00	0	0	0	3.00	0	0	0	0	0	0	**6.00**
	plan total	**8.00**	**0**	**0**	**0**	**3.00**	**0**	**0**	**0**	**0**	**0**	**0**	**11.00**
WP2	spent Y1	8.30	2.61	12.05	0.3	9.72	2.30	3.19	27.18	1.22	7.64	2.35	**76.86**
	plan Y1	9.24	2.44	12.07	0.0	9.22	2.22	3.62	28.27	1.22	9.33	2.44	**80.09**
	plan total	**12.00**	**4.00**	**15.00**	**0.0**	**10.00**	**3.00**	**5.00**	**46.00**	**2.00**	**14.00**	**4.00**	**115.00**
WP3	spent Y1	5.96	5.14	3.10	5.40	0.40	3.80	0.90	3.35	5.20	0.47	3.51	**37.23**
	plan Y1	5.50	4.50	3.34	5.20	2.40	4.60	1.80	7.00	5.20	3.00	5.60	**48.14**
	plan total	**9.00**	**6.00**	**4.70**	**6.50**	**3.00**	**7.00**	**3.00**	**19.00**	**8.00**	**5.00**	**8.50**	**79.70**
WP4	spent Y1	4.58	4.55	1.65	11.50	0	2.4	0	0	4.65	0	1.92	**31.25**
	plan Y1	9.45	4.56	2.09	8.89	0.59	4.76	0	0	4.69	0	3.40	**38.44**
	plan total	**21.00**	**11.00**	**4.70**	**20.00**	**2.00**	**14.00**	**0**	**0**	**11.00**	**0**	**8.00**	**91.70**
WP5	spent Y1	3.15	3.93	1.95	1.80	2.15	9.00	0.18	8.93	7.78	0	3.28	**42.15**
	plan Y1	6.90	4.44	3.52	8.71	6.27	11.41	0.56	6.43	7.78	0	11.94	**67.94**
	plan total	**14.00**	**9.00**	**5.60**	**16.50**	**14.00**	**22.00**	**1.00**	**16.00**	**14.00**	**0**	**26.50**	**138.60**
WP6	spent Y1	0.20	0.73	0.90	0	0	0.20	0.75	0	0.13	0	0.50	**3.41**
	plan Y1	0.80	1.00	0.87	1.07	0.27	1.27	0.53	0	0.13	0	0.93	**6.87**
	plan total	**11.00**	**18.00**	**14.00**	**16.00**	**5.00**	**22.00**	**9.00**	**0**	**2.00**	**0**	**19.00**	**116.00**
WP7	spent Y1	0.50	0.52	0.23	0	1.89	0.30	0	0.71	0.28	0.20	0	**4.63**
	plan Y1	0.57	0.57	0.86	0.29	1.14	0.86	0.57	0.57	0.29	0.57	0.29	**6.57**
	plan total	**2.00**	**2.00**	**3.00**	**1.00**	**4.00**	**3.00**	**2.00**	**2.00**	**1.00**	**2.00**	**1.00**	**23.00**
TOTAL	**spent Y1**	**24.60**	**17.48**	**19.88**	**19.00**	**17.16**	**18.00**	**5.02**	**40.17**	**19.26**	**8.31**	**11.56**	**200.44**
	plan Y1	**35.46**	**17.52**	**22.74**	**24.16**	**22.89**	**25.11**	**7.08**	**42.27**	**19.31**	**12.90**	**24.61**	**254.05**
	plan total	**77.00**	**50.00**	**47.00**	**60.00**	**41.00**	**71.00**	**20.00**	**83.00**	**38.00**	**21.00**	**67.00**	**575.00**

3.3 Project Meetings and other Key Events

During the reporting period M1-M12 project meetings were organized and executed. In all project meetings representatives of all consortium partners were present. The regular project meetings have ensured a close cooperation between all tasks and partners. The list of meetings executed in the reporting period is shown in Table 7.

Table 7: Project meetings and other key events

Event	Date/Venue	Purpose	Participants
Project Kick-off meeting	October 29th to 30th, 2013 Frankfurt (Oder), Germany	Initial project meeting, kick-off of the e-balance project, introduction of the partners and their core competences and role in the project. Project meeting schedule. PMC meeting	All partners except ALLI
Project quarterly meeting	December 17th to 19th, 2013 Lisbon, Portugal	Discussion on project progress and achievements in WP2, WP3 and WP7. Kick-off of WP4 and WP5. Visit to demo-site. PMC meeting	All partners
Project quarterly meeting	March 9th to 12th, 2014 Enschede, the Netherlands	Discussion on the project progress and achievements in WP2, WP3, WP4, WP5 and WP7. Visit to demo-site. PMC meeting	All partners
EeB Impact Workshop	April 1st to 2nd, 2014 Brussels, Belgium	Representing the e-balance project in the cooperation and clustering activities	IHP
Project quarterly meeting	June 25th to 27th, 2014 Warsaw, Poland	Discussion on the project progress and achievements in WP2, WP3, WP4, WP5 and WP7. PMC meeting	All partners
Project quarterly meeting	September 24th to 26th, 2014 Malaga, Spain	Discussion on the project progress and achievements in WP2, WP3, WP4, WP5 and WP7. Kick-off of WP6. PMC meeting	All partners
Project meeting	October 30th to 31st, 2014 Lisbon, Portugal	Discussion on the project results so far from the demonstration perspective. Identification of required refinements and restatement	All partners

3.4 Deviations and Delay

Deviations

We identified some management issue mainly related to the activities related to the user study in work package WP2. Partner IPI reported these activities mainly in task T2.4 what is correct from the perspective of the work package WP2 structure, but causes deviations in the effort spending. Due to that we propose to extend the duration of the task T2.4 to cover also the second user study at the end of the project (until M40) and shift the efforts related to the user study to this task.

This change in the effort plan does not change the overall effort planned for IPI, nor for the work package. It only changes the distribution of effort between the deliverables D2.1, D2.2, D2.3, D2.4 and D2.6 and the deliverable D2.5.

Further, in work package WP7 we identified a trend in overspending in activities related to dissemination while underspending in activities related to exploitation. There will be increased effort spending on the latter later in the project, but we would like to transfer at least the amount of effort that was planned for the current reporting period for exploitation activities to dissemination. Additionally, we would like to shift the effort planned for the website and not consumed for deliverable D7.1 to dissemination activities as well.

The Table 8 presents the new distribution of the person-months between the affected deliverables. And as already mentioned the amount of the person-months planned for each partner per work package does not change.

Table 8: **Proposal for new PM allocation over deliverables in WP2**

No.	Title	Delivery in project month (DoW/new)	Estimated indicative person months (DoW/new)	Percentage effort change
D2.1	Selection of representative use cases	M3 / M4	28PM / 19.83PM	-29%
D2.2	Analysis of legal issues with focus on security and privacy	M5 / M8	16PM / 13.77PM	-14%
D2.3	Market assessment and business models	M5 / M8	14PM / 12.20PM	-13%
D2.4	User and stakeholders requirements	M6 / M8	8PM / 7.46PM	-7%
D2.5	Validation of the proposed use cases and business models	M24 / M40	18PM / 33.74PM	+87%
D2.6	Restatement of the selection of the representative use cases	M40 / M40	31PM / 28PM	-10%
D7.1	Website available	M3 / M3	2PM / 0.11PM	-95%
D7.2	Dissemination activities	M42 / M42	5PM / 8.89	+78%
D7.3	Exploitation activities	M42 / M42	7PM / 5PM	-29%

Delays

We experienced some delays at the beginning of the project, but we are working on limiting the influence of this initial delay to the further work. These delays were due to the underestimated temporal effort related to the preparation (editing and reviewing) of relatively large non-technical deliverables, mainly related to the legal aspects. Unfortunately, these deliverables were located on the critical path, causing a waterfall effect. We reported this issue to the PO and got a permission to shift the delivery of the affected deliverables.

The main reason for delays in submission of the quarterly reports (Q1-Q3) was the problem with getting reliable data on resource consumption. The partners needed about 4 weeks to gather the information about efforts spent in the reporting period and after that some time was needed to integrate all the inputs into one document.

References

[1] CEN-CENELEC-ETSI Smart Grid Coordination Group, "Smart Grid Reference Architecture," November 2012.

[2] A. Molderink, On the three-step methodology for Smart Grids, CTIT PhD thesis Series No. 11-196, University of Twente, Enschede, 2011.

[3] V. Bakker, Triana: a control strategy for Smart Grids, CTIT PhD thesis Series No. 11-215, University of Twente, Enschede, 2012.

[4] M. Bosman, Planning in Smart Grids, CTIT PhD thesis Series No. 11-226, University of Twente, Enschede, 2012.

[5] J. Delamare, B. Bitachon, Z. Peng, Y. Wang, B. Haverkort and M. Jongerden, „Development of a Smart Grid Simulation Environment," in UK Performance Engineering Workshop (UKPEW'14) [Accepted for publication], Newcastle, 2014.

[6] Anylogic, November 2014. [Online]. Available: http://www.anylogic.com/.

[7] C. Joe-Wong, S. Sen, S. Ha en Mung Chiang, „Optimized Day-Ahead Pricing for Smart Grids with Device-Specific Scheduling Flexibility," IEEE Journal on Selected Areas in Communications, vol. 30, nr. 6, pp. 1075-1085, 2012.

[8] M. Pipattanasomporn, M. Kuzlu and S. Rahman, „An Algorithm for Intelligent Home Energy Management and Demand Response Analysis," IEEE Transactions on Smart Grid, vol. 3, nr. 4, pp. 2166-2173, 2012.

[9] Smart Energy Collective, „An introduction to the Universal Smart Energy Framework (USEF)," [Online]. Available: www.smartenergycollective.com.

[10] T. van der Klauw, M. E. T. Gerards, G. J. M. Smit and J. L. Hurink, „Optimal Scheduling of Electrical Vehicle Charging Under Two Types of Steering Signals," in 5th IEEE/PES Innovative Smart Grid Technologies Europe (ISGT Europe) , Istanbul, 2014.

[11] A. Bernardo, N. Silva, A. Carrapatoso, G. Ockwell, "Preventive assessment for combined control centre and substation-centric self-healing strategies," in 21st International Conference on Electricity Distribution - CIRED, Frankfurt, 2011.

[12] P. Djapic, C. Ramsay, D. Pudjianto, G. Strbac, J. Mutale, N. Jenkins, R. Allan, 2007, "Taking an active approach", IEEE Power and Energy Magazine, vol. 5, issue 4, 68-77

[13] N. Silva, D. Marsh, A. Rodrigues, J. Pecas Lopes, A. Madureira, 2009, "New control and management architectures for active distribution networks", PowerGrid Europe 2009

[14] J. Rosa, L. Abalroado, J. Sousa, P. Marques, R. Oliveira, P. Gama, F. Ramalheira, M. Morgado, J. Duarte, "EDP distribution automation (r)evolution," in 21st International Conference on Electricity Distribution - CIRED, Frankfurt, 2011.

[15] S. Kwon, C. Chu, J. Cho, S. Yoon, "Development of IEC 61850 based feeder IEDs for self-healing operation in distribution network," in CIRED Workshop, Lisbon, 2012

[16] C. Angelo, P. Selejan, "Technologies of the self-healing grid," in 22nd International Conference on Electricity Distribution - CIRED, Stockholm, 2013

[17] E. Coster, W. Kerstens, T. Berry, "Self-healing distribution networks using smart controllers," in 22nd International Conference on Electricity Distribution - CIRED, Stockholm, 2013

[18] N. Silva, N. Delgado, N. Costa, A. Bernardo, A. Carrapatoso, "Control architectures to perform voltage regulation on low voltage networks using DG," in CIRED Workshop, Lisbon, 2012

Annex A

This section presents the dissemination results in Y1.

Event name	Type (*)	Role	Date and Venue	Partner/s
Greencities & Sostenibilidad. Smart Solutions to Urban Sustainability	Conference	Speaker	2-3 October 2013 Malaga, Spain	UMA
4th Workshop on Impact of the Energy-efficient Buildings PPP	Workshop	Speaker	1-2 April 2014 Brussels, Belgium	IHP
18th Science Picnic of Polish Radio and the Copernicus Science Centre (Science Fair	Fair	Booth	31 May 2014 Warsaw, Poland	IPI
ZET_2014 National Conference	Conference	Speaker	20 June 2014 Nałęczów; Poland	LODZ
CIGRÉ 2014 Technical Exhibition	Exhibition	Booth	25-29 August 2014 Paris, France	EFACEC
Advanced 3rd SAB Workshop	Workshop	Speaker	19 September 2014 Madrid, Spain	EDP, IPI
30th Annual UK Performance Engineering Workshop (UKPEW'14)	Workshop	Speaker	19 September 2014 Newcastle, UK	UTWENTE
International Conference 'ICT for sustainable places' (ICT4SP) (1)	Conference	Poster	1-3 October 2014 Nice, France	IPI
18th LEIBNIZ Conference of Advanced Science (1)	Conference	Speaker	16-17 October 2014 Lichtenwalde, Germany	IHP
9th Mediterranean Conference on Power Generation, Transmission, Distribution and Energy Conversion (Medpower2014) (1)	Conference	Speaker	2-5 November 2014 Athens, Greece	LODZ, IHP, INOV, CEMOSA, IPI
Energetyka Prosumencka w Wymiarach Zrównoważonego Rozwoju (EPwWZR14) (1) (two papers)	Conference	Speaker	5 November 2014 Gliwice, Poland	LODZ
23rd International Conference and Exhibition on Electricity Distribution (CIRED2015) (2)	Conference	Speaker	15-18 June 2015 Lyon, France	CEMOSA, INOV, EDP, IHP

(1) These dissemination activities are actually related to events beyond the first reporting period, but they have been realised within the period.
(2) This dissemination activity will take place during the second period, but the abstract submitted have been accepted and the consortium is working on the full paper.