EEPOS - Energy management and decision support systems for energy positive neighbourhoods

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Business Models, final version

Authors:	Olli Nummelin	CAV
	Janne Rasi	FTM
	David Lanceta	SOL
	Tapio Hirvonen	CAV
	Matti Hannus	VTT
	Florian Judex	AIT
	Arturs Purvins	DER
	Robert Kopetzky	ENO
	Emil Lezak	SOL

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1. PUBLISHABLE EXECUTIVE SUMMARY

The **Objectives** for this report was to specify concepts for business models for companies managing and working in energy positive neighbourhood. The business models are based in the scenarios defined in EEPOS deliverable D1.1. Out of these scenarios 11 business models was generated with significant information on money flows and stakeholders actions needed in order to implement the business and put into practise the business model.

Overall aim for the deliverable was to find out concepts for businesses for companies willing to increase their business opportunities working in an ICT driven environment in a field of an aerial scale managing of energy flows.

The work performed has resulted the following major achievements:

- Business models were created
- Action plan for each stakeholder can be found in business model canvas
- Information on expected revenue streams was written into business model canvases for each stakeholder involved in a specific business model
- Energy trading between buildings within a neighbourhood (buildings, neighbourhoods and the grids) has been considered in business models.
    - Each stakeholders business model includes both in business model canvas and explaining text section the energy trade information
- Performance validation methods and criteria are considered and written into business models
- Five business models were selected and analysed more in detail. Their business proposition was defined.

The **Intentions for use and impact** for the work done in this report is to specify concepts for business models that can be found when considering energy management and decision support systems for energy positive neighbourhoods. The energy flows in a neighbourhood is to be controlled by a NEMS-operator (neighbourhood energy management systems operator). According to work and research carried out the NEMS operator needs an IT-based decision making system. A company aiming for business growth on energy markets controlled by ICT systems must have (or partners must have) comprehensive knowledge on information flows within a neighbourhood grid (IT, electricity, heat etc.). Such challenges will lead to a desire for bidirectional information on demand and availability. Currently, not many such neighbourhoods for buying, producing and selling energy exist, but with increasing number of zero or positive energy buildings, the number of such regions will increase and therefor business opportunities are awaiting for companies eager to respond to the challenge.

Examining the business opportunities presented here and familiarising with other EEPOS documentation will give a company a comprehensive idea of what business opportunities shall be open for their reach when an energy positive neighbourhood management system is created and maintained.

Dissemination of this deliverable will be taken place as described in D7.3 Dissemination and exploitation task of EEPOS-project.
In this report The EEPOS consortium have updated five selected business models including value propositions, involved stakeholders, supporting ICTs, contractual principles ready for adaptation by specific organisations at the end of EEPOS project.

2. INTRODUCTION

2.1 Purpose and target group

This part of the work suggests new business model concepts focusing on the interface between buildings, neighbourhood and the grid and points out ways how enabling ICT solutions can yield to new services and new business models. EEPOS solutions for neighbourhood management and brokering will enable energy generation at the neighbourhood level together with enabling prosumers to sell their excess energy to the grid. A Service Broker can offer energy saving strategies to the customers and their integration in a company-wide product and service portfolio. This will also be used for reducing peak load at the grid level.

In some countries of Europe, e.g. in Italy, a large number of smart electrical meters have already been deployed. For instance, Italian legislation has recently been released, which forces gas utilities to deploy smart gas meters from large industrial consumers down to almost every residential customer by the end of 2016. In Germany, currently only around 100.000 smart meters are installed, mainly for testing and pilot reasons. Nowadays these systems are mainly used to only transmit the consumption data with different data protocols to the energy supplier for billing purposes. The biggest advantage of smart meters would be the constitution of smart grids, which is not yet rolled out in Europe.

The purpose to this document is to point out business opportunities for an integrated neighbourhood energy management system. Business model concepts presented in this report are based on EEPOS idea of a NEMS (Neighbourhood Energy Management System) operator with its partners who provide control of an energy positive neighbourhood with users consuming, producing and trading energy.

Aspects like interoperability and scalability will be mandatory and considered in the ICT solutions developed in the project. This approach assures the possibility to transfer the new ICT solutions developed to other neighbourhoods building and lighting areas with different characteristics. Companies in whole Europe may use the business models as well as solutions developed (within the limits of owner and property rights of EEPOS partners) for generating income, this involves also future NEMS operators and partnering business.

ICT systems, energy brokering, and management system in the automatic and self-learning decision making platform together with behavioural changes will lead to saving energy costs and thus to an increased interest in EEPOS kind of neighbourhood. Due to increased interest in living, investing and working in such neighbourhood, the companies addressing their R&D and business interest into EEPOS management systems increase their business opportunities aiming for profitable growth.

Since one specific target of EEPOS is to combine building construction with maintenance and energy management services for residential buildings, where the behaviour of end users is predictable by automated systems, an ICT or building systems company may aim at gaining a large market share for these services on the whole European level.

EEPOS project is also targeted to special groups such as SMEs and other smaller actors. Strategically important organizations may investigate business models considering possibilities to increase their market share acting in key roles in energy management and decision support systems for energy positive neighbourhoods.

Table 1. *Target group and their benefits (categorized as in EEPOS DoW)*

Target Groups	What benefits can we offer
Clients/ end-users/ prosumers	Possibility to participate in the Smart Grid and Energy market via a broker, leading to a stronger position. Savings on energy costs by selling excess energy and automatically monitored peek cost cut off.
Building owners	Possibility to utilize new services available via using neighbourhood energy management as well as increase value of buildings by providing less energy consumption.
European construction sector	New ways of working and new business opportunities in energy management. Opportunities for collaboration between the ICT sector, the buildings and construction sector, and the energy sector.
SMEs in the construction sector	New business opportunities and ways to collaborate with large companies of the sector.
Distribution system operators	Eased integration of renewables due to enhanced flexibility of prosumers.
ICT and BAS developers / planners	Information and solutions that can improve their products/services in the form of opening of a market for ICT-based district/community energy management systems. Insight into opportunities for collaboration between the ICT sector, the buildings and construction sector, and the energy sector.

As defined in EEPOS work packages Exploitation (WP6) and Requirements, specifications and business model (WP1) the EEPOS members will target research and actions with relevant communities to promote harmonized approaches and prepare ground for exploitation. Main target groups for bi-directional communication are potential clients and other stakeholders who are involved in neighbourhood level energy management and related RTD.

Business seeking companies should bear in mind the requirements for integration and harmonization of these business models with the trading mechanisms of the European electricity markets and of a specific country.

Specific issues involved with NEMS operation activities include: strategies for demand response price stimulation and demand side management control, balancing energy production and consumption between different housing companies in a district; business relationships with local and grid operators, using excess electric energy locally (e.g. for running pumps for district heating, ground heat pumps and charging vehicles) or feeding into grid; financing and ownership of local generation and storage; optimizing the energy mix between heat and power including primary energy factor; return on investments in less than 7 years; impacts of taxation and interest rates on the roles of stakeholders etc.

2.2 Contributions of partners

EEPOS task 1.4 was planned to start from the first month of the project. Two deliverables will be published in month 8 (D1.4) and month 32 (D1.5). For this second report, five business models were selected according to plan by industrial partners. The section was based on foreseen business potential. The potential was estimated based on feedback from demonstration work packages. Value propositions, as well as legal and contractual aspects were added to the previous report. Also list of involved stakeholders was updated and the business model was connected with EEPOS ICT architecture. Each selected business model was validated by an industrial partner and finally the whole report by external experts.

As the task leader CAV has been addressed to report on Publishable Executive Summary and Chapter 1 giving a reader a good understanding of the idea, baseline and possibilities utilizing the results of the project for the benefits of increasing one's company's market share using EEPOS methods.

The research partners were addressed to develop a modelling method. The method was discussed in a meeting on month 5 and as a conclusion the modelling method used in this report was chosen and introduced.

Based on scenarios from EEPOS task 1.1 the industrial partners FTM, CAV, ENO and SOL were main responsible to compose the business models. The non-industrial partners have been involved in validating the business models and giving effort to Acronyms, Terms and References. Special consideration of examining EEPOS related EU projects were also addressed to non-industrial partners VTT, AIT, DER.

***Table 2**: Task 1.4 time use (person months)*

PMs	VTT	FTM	CAV	AIT	DER	ENO	SOL	Total
D1.4	1	1,3	2,3	0,3	1	1,7	1,3	**9**
D1.5	0,5	0,7	1,2	0,2	0,5	0,8	0,7	**4,5**
T1.4 total	1,5	2	3,5	0,5	1,5	2,5	2	**13,5**

2.3 Baseline

Today very few related business model standards exists. Several EU projects ongoing are aiming together with EEPOS project to harmonize supporting ICT-technology. Business models generated are aiming to support changes in the energy sector and user / prosumer empowerment in energy trading adequately.

EEPOS target is to develop concepts for new services and business models that will benefit the intelligent use of energy information. New concepts of business models consider interests of different stakeholders in the energy sector and enable the use of provided energy information.

In Europe there are a number of projects related to EEPOS improving Energy efficiency and researching new business opportunities in both ICT and construction sector. The most attractive related EU projects in the field are described in Chapter 8. Plan for communicating with the projects can also be found at Chapter 8 appendix.

The following table 3 shows the project team's vision of current situation and describes the advantages which we think EEPOS shall bring.

***Table 3**: State of the art & advancements EEPOS offers (reference: EEPOS DoW)*

State of the Art	Expected advance that EEPOS will bring
There has been a progress regarding ICT-supported business models for neighbourhood operators during the last years, but still a big potential for improvements exists. In fact, energy positive neighbourhoods are an emerging concept. New business models for district level energy services related to smart grids & distributed energy production are under development. Furthermore, there are no real markets due to lack of motivation / incentives from the users' and prosumers' side. Hence, there is plenty of space for business opportunities at the neighbourhood level (New business for neighbourhood operators and energy service brokers).	New technologies and new business models will enhance the product portfolio of operators and service providers. In EEPOS the business models are based on the neighbourhood energy management as well as user/prosumer engagement via co-created methods with the aid of the decision making platform generated by delivering real-time information on pricing and actual energy used to end-users / prosumers. Business models are supporting energy trading between: a) buildings within a neighbourhood, b) buildings / neighbourhoods and the grids. This will give a change to open a market for ICT-based district / community level energy management systems with related services. In many cases there will be a separate service broker in addition to the management system operator. New models for ICT companies will be offered together with basic setting of business models to choose from.
Prosumers are really newcomers who can in addition of consuming also generate energy and supply their extra energy into the grid. At the moment, there are no real markets for prosumers due to lack of motivation, incentives and information etc. In addition, prosumers have to join forces with neighbourhood stakeholders to take the advantage of their excess energy. (New business for prosumers)	In EEPOS the elaboration of the new business models are based on user / prosumer information on tariffs and saving possibilities as well as user/prosumer engagement (co-creation) via the decision making platform to co-operate with neighbourhood stakeholders. EEPOS will pave the way for offering value adding services to the customer / prosumer like e.g. Demand Side Management with tariffs and saving possibilities.
One of the key bottlenecks of new energy markets is the lack of standards. An extensive joint and separated standardisation work is going on in different standardization bodies to correct the situation. The situation is the same as some decades ago for mobile phones. Markets opened just after the standards were accepted.	EEPOS contributes to standardisation developing data models for in house communication and neighbourhood energy management.

2.4 Relations to other activities

This report of business opportunities for ICT and construction sector companies may be used for finding new business opportunities. It also relates closely to other tasks and documentation of the EEPOS project. A company seeking opportunities to grow its market share may familiarize itself with the Business model report. In case an attractive business opportunity appears, they are able to look deeper behind the business model with the definition text and scenario behind it (EEPOS report 1.1).

Most important baseline of the business models are the neighbourhood energy management scenarios of task 1.1 from where the industrial partners selected a scenario to create a business model from. The business models were selected according to wide coverage.

The following figure describes the inter relations between tasks of Work Package 1 and with other work packages.

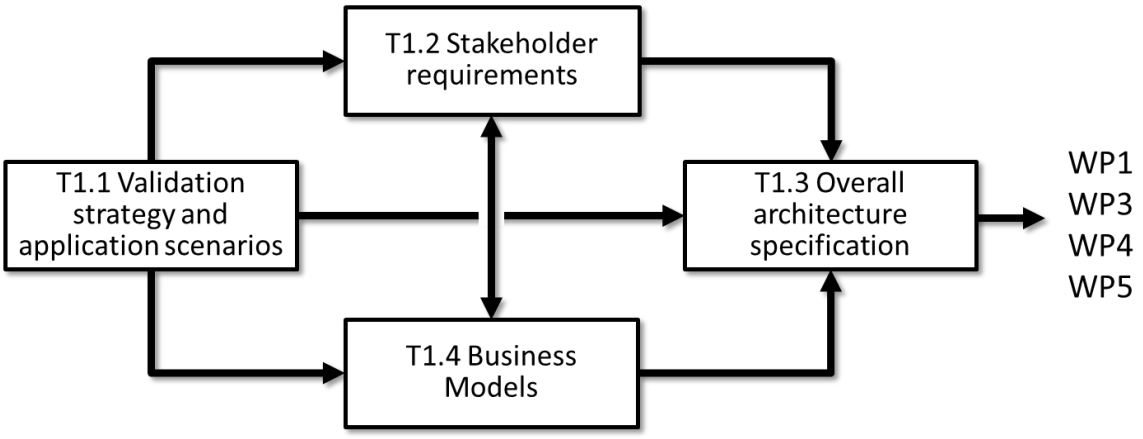

***Figure 1**: Business models (T1.4) related to other activities in EEPOS project (described in EEPOS DoW)*

3. METHODOLOGY

3.1 Scope of business concept models

In the context of EEPOS we are interested in identifying (potentially new) business opportunities in neighbourhood energy management using ICT as a key capability. We refer to such opportunities with the term "(concepts for) business model". The proposed models are ideas / templates from which promising ones can be selected for further elaboration. Using these models companies can derive specific, more detailed models. The models will be considered for exploitation planning by EEPOS partners and will also be promoted to other stakeholders.

3.2 Modelling

The EEPOS consortium considered it important to find a modelling method which makes it is easy to look at different stakeholders' involvement in the business model. As important was seen the possibility to see by a glance what kind of money flow is expected for an actor fulfilling the model. Furthermore, adopting a widely known methodology was preferred as it will make communication and exchange of ideas easier with various stakeholders.

Therefore the consortium members selected "Osterwalder & Yves Pigneur. Business Model Generation: A Handbook for Visionaries, Game Changers, and Challengers, free preview" as the basis of the modelling method [1]. The method was enhanced by:

- Performance validation methods and criteria as key considerations for EEPOS,
- Optional partnering and customer co-creation as suggested by Erwin Field [2].

The resulting template for business model description ("business model canvas") is shown as a table on the next page.

The Offer sections of the models show the Value propositions and Validation criteria's (e.g. what a company offers to the customers and how the value is measured). Who is the customer and how the provider deliver the product/service to them is shown in the Customer section. On the very right side the model shows what actions the customer must take to receive services/products. "Revenue Streams" box describes the revenue streams from the customer to the company selling services/products.

The Infrastructure side of the business models lists the key activities, resources and costs for making the service/product ready for delivery to the customers.

Partners are to be listed on left side of the business model canvas where a list of the key partners, their activities and costs are written down.

By reading through the canvas companies may discover their role in each kind of business model. By writing this kind of business model canvas to each partner of the whole delivery chain companies are able to look for their role and expectations from partners' point of view. Also each partner in the delivery chain may assess if they are concentrating on the right issues of the service/product delivery to the client.

On the next page the business model canvas with some more explanations is introduced.

***Table 4**: EEPOS business model canvas*
Gray cells: optional extensions for partnering (left) and co-creation (right). Light blue cell: suggested extension for EEPOS.

<table>
<tr><th colspan="3">Infrastructure</th><th colspan="2">Offer</th><th colspan="2">Customer</th></tr>
<tr><td>Partner activities</td><td rowspan="2">Key partners[1]</td><td>Key activities[2]</td><td rowspan="2">Value propositions[5]</td><td>Customer relationships[6]</td><td rowspan="2">Customer segments</td><td>Customer activities</td></tr>
<tr><td>Partner resources</td><td>Key resources[3]</td><td>Distribution channels[7]</td><td>Customer resources</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure [(4)]</td><td>Performance validation methods and criteria</td><td colspan="2">Revenue streams</td><td>Customer cost structure</td></tr>
</table>

1. We can distinguish between four different types of partnerships: Strategic alliances between non-competitors; Coopetition: strategic partnerships between competitors; Joint ventures to develop new businesses; Buyer-supplier relationships to assure reliable supplies.
2. Most important actions a company must take to operate successfully. Key Activities differ depending on business model type.
3. Most important assets required to make a business model work: physical, intellectual, human, financial. Key resources can be owned or leased by the company or acquired from key partners.
4. Most important costs incurred while operating under a particular business model: Creating and delivering value, maintaining Customer Relationships, and generating revenue all incur costs.
5. 'Value proposition' is for a specific customer segment (end-user). There are different propositions to different segments.
6. What type of relationship does each of our Customer Segments expect us to establish and maintain with them?
7. How a company communicates with and reaches its Customer Segments to deliver a Value Proposition.

3.3 The selection of five business models

Five business models were selected on closer look by industrial partners. The selection was based on interest of partners and if they find any realistic changes to exploit those models later on their business strategy.

Selected business models were evaluated based on seen business proposition. The business potential was estimated based on potential turnover and if it is realistic to expand business to attractive level. The estimate is based on 10000 apartment neighbourhood area. The potential is scalable when the model is based on energy saving and prising. Thus if the neighbourhood area have 50 000 apartments, the business potential is five times higher than estimated in the chapter 3. In the case of software business the scalability is far more complicates and the scalability must be estimated case by case. Basically the business potential was classified on five levels according to foreseen yearly turnover:

- 0: No business potential. The potential doesn't even cover the cost of business.
- 1: Low potential. Anticipated turnover below 100 000€. Business might be profitable if it can be connected with other business.
- 2: intermediate potential. Anticipated turnover between 100 000€ and 1 000 000€. Very good opportunities for local SME's. Basically we considered 100 000 as a limit to hire the one fulltime worker to operate the business
- 3: High potential. Anticipated turnover between 1 000 000 and 10 000 000€. The potential attracts larges companies.
- 4: Very high potential. Anticipated turnover over 10 000 000€ The potential enables to launch immediately new large-scale business

In addition each selected business models are shown in EEPOS context, and its legal challenges are described shortly.

All business models are described in the chapter 3. The selected ones have four extra chapters each.

4. CONCEPTS FOR BUSINESS MODELS AND SELECTED MODELS

4.1 NEMS operator

The following business model is based on NEMS operator overall activities.

Neighbourhood management and brokering will combine energy generated at the neighbourhood level and make matching with the grid thus enabling prosumers to sell their excess energy to the grid. Service broker can offer energy saving strategies to customers and their integration in a company-wide product and service portfolio. This will also be used for reducing peak load at the grid level.

Interface between buildings, neighbourhood and the grid will point out ways how enabling ICT solutions can yield to new services and new business models. The NEMS operator performs co-ordinated energy management and optimisation on the neighbourhood level. This includes monitoring and predictive control.

By involvement of forecasts for production / consumption rates, calculation of forecasts for customer reactions the NEMS operator may control and adjust ICT setting to pursue the optimal setting for each housing company with respect of customer expectations, consideration of local diversity, automating load shifting and use of storages, and energy brokering.

The NEMS operator decides on the activation of the resources offered by the individual ACS (Automation Control System). Activation of resources can be done by sending switching signals or time dependant energy tariff signals etc. The extent of automatic decision making level is up to the NEMS operator. By using sophisticated ICT software all information needed for load shift suggestions may come automatically. We suggest that not all decision making should be automated due to need for temporary instructions in at least some special cases like maintenance, extreme weather situations, incidents at neighbourhood, authority instruction changes etc.

Furthermore, the NEMS operator can provide metering and system services to the distribution system operator (DSO) or aggregate measurement data collected from the individual ACS.

On the area level there may be multiple energy providers and the NEMS operator will take care of the energy control and management on the neighbourhood level. Electricity will be delivered to buildings via a service broker. The NEMS operator must have a system where information about whole areal capacity of energy production exists, divided into smaller units like capacity of areal wind mills. Total capacity from different energy sources must be maintained online and up to date 24/7.

On the next page we define the basic business model for the NEMS operator. There is a good possibility to look for other business models than just NEMS operator from this basic model as the neighbourhood area energy management is based on NEMS operator activities.

***Table 5**: Basic business model for NEMS operator*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

monitor & service of network,
trade energy</td><td rowspan="2">Key partners

Strategic alliances between non-competitors

(NEMS technology provider (ICT company, hardware manufacturer), Electricity network provider, broker, municipality/public sector,
commercial entity,
construction company)</td><td>Key activities
Maintain local heat & electricity grid,
Maintain local energy production equipment,
Maintain local building technical system,
Manage energy flows within neighbourhood</td><td rowspan="2">Value propositions
<u>Lower energy costs</u> through high (neighbourhood) level energy use optimisation, bulk energy purchase from market and enabling the selling of self-produced renewable energy
More <u>green, sustainable, eco-friendly way of living</u> by optimally utilising existing resources
<u>More affordable investment</u>; comfortable and affordable way (reduce payback time) to start using solar-wind-other renewable energies</td><td>Customer relationships
Automatic customer relations based on agreements made, complemented with personal assistance</td><td rowspan="2">Customer segments

locally segmented customers (=Housing companies)</td><td>Customer activities

produce & consume energy</td></tr>
<tr><td>Partner resources

EEPOS system,
geothermal network,
energy grid,
ICT</td><td>Key resources
Physical: NEMS infra, ICT, automation equipment (like sensors)
Intellectual: Brand, Proprietary knowledge, Special partnerships
Human: Service & maintenance personnel,
Financial: ESCO principles</td><td>Distribution channels

Direct sales to customer</td><td>Customer resources

energy grids,
energy production equipment</td></tr>
<tr><td>Partner cost structure
network maintenance,
ICT cost,
energy trading costs</td><td colspan="2">Cost structure
cost driven (costs from Key Activities), physical and human costs (from Key Resources),
NEMS technology costs</td><td>Performance validation methods and criteria
Low energy costs,
short technology investment payback time,
Eco-friendly living environment (measurable options like refund from recycling of recourses)</td><td colspan="2">Revenue streams
Monthly revenue stream (e.g. overall system maintenance monthly fee, service fee),
Demand based fee,
Fee according to agreement validation criteria’s (e.g. payback time for a specific investment met, saving earned split)</td><td>Customer cost structure
fee,
service & maintenance of grid & own equipment</td></tr>
</table>

4.1.1 EEPOS related tools used in business model

This business case relates with the EEPOS application shown in the figure 2 below. These applications can help NEMS operator in the daily energy management business by new integrated features like, optimisation, monitoring and predictive control. However the EEPOS tools are integrated with the EEPOS system only and real business systems are running in parallel.

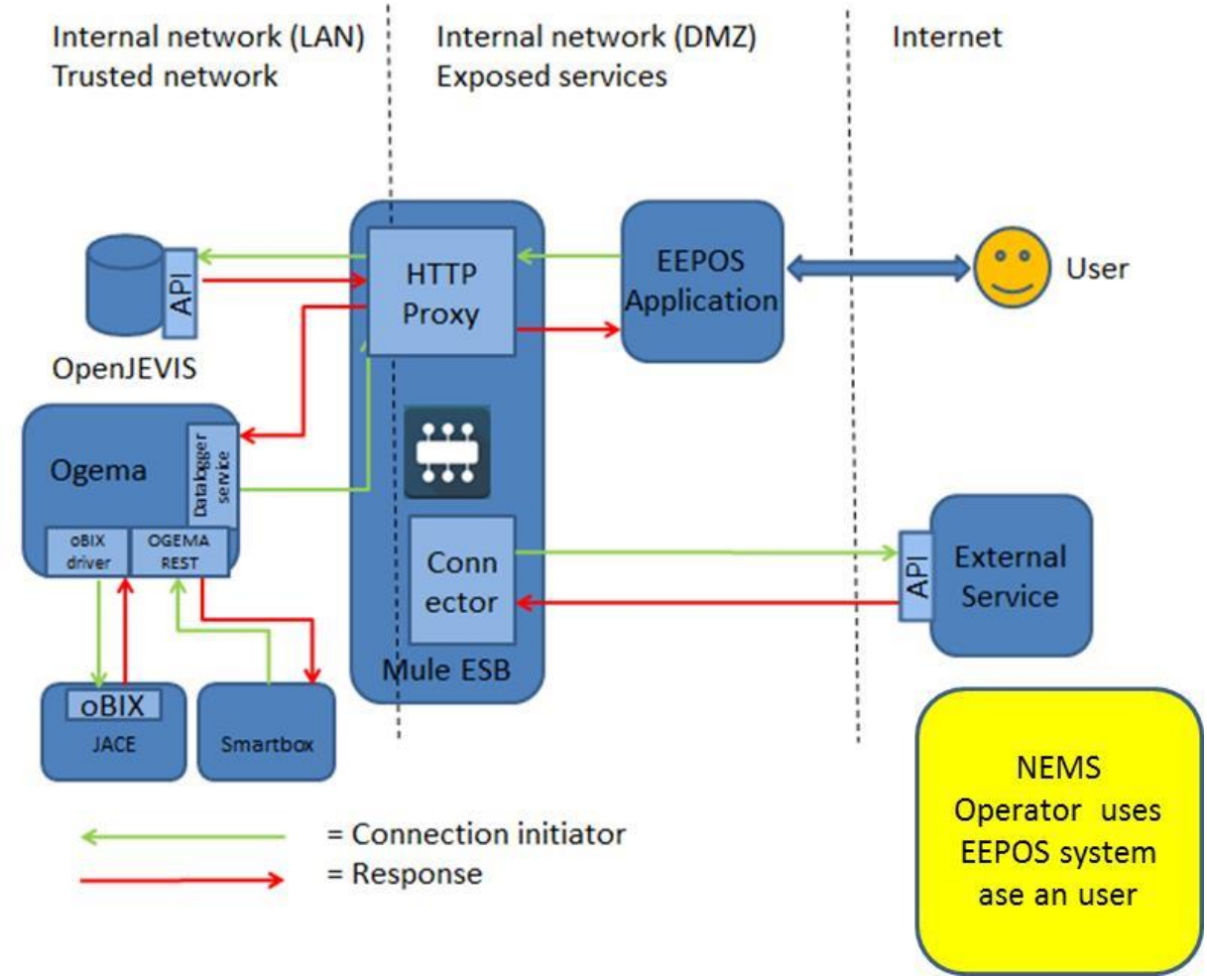

***Figure 2**: NEMs operator located in the EEPOS system architecture defined in D3.1*

4.1.2 Contractual and legal aspects

The role of NEMS operator is brand new. Thus the legal environment varies between European countries. Local regulation defines if it is allowed to trade electricity directly between end users and/or NEMS operator or if it is needed trade via power grid company. This a fundamental issue that makes huge effect on business opportunities. The tax treatment varies as well depending on country and on the ownership of the NEMS operator. Standardisation of European regulations and tax treatment would enable to wider business opportunities. The current situation preserves the role of NEMS operator on local level.

4.1.3 Business potential

We cannot see NEMS operator any remarkable independent European role yet because of local regulations. On the other hand NEMS operator business might be profitable when it is connected with other business, like 24/7 service desk. Any case NEMS operation business is barely profitable during the coming next few years on neighbourhood level as standalone business. The table 6 shows estimated NEMS operator business potential. Estimation parameters are shown in appendix 2.

***Table 6**: Estimated NEMS operator business case potential.*

Year	2016	2017	2018	2019	2020
Level of Business potential	0	0	0	1	1

However when the neighbourhood can be extended well into 10 000 apartment there will be remarkable business potential available, Linking neighbourhood areas together would resulted like the extension of area. In countries, like Finland this requires legislation changes.

4.1.4 Exploitation of business model

Caverion considers if 24/7 service desk business can be extended towards NEMS operator business.

4.2 Energy Prosumer

The described business model for Prosumer (energy consumer and provider simultaneously) enhances the basic NEMS-System with an intelligent trading component. The Scenario bases on an agent-based trading strategy for the Smart Grid, where each Energy Prosumer (EPRO) is represented by an agent who manages the actions of the EPRO. The Neighbourhood Area Grid (NAG) offers a balancing mechanism in form of a market place, where buyers and sellers of energy do the trading. The trading is limited to a given trading period which is divided into time frames.

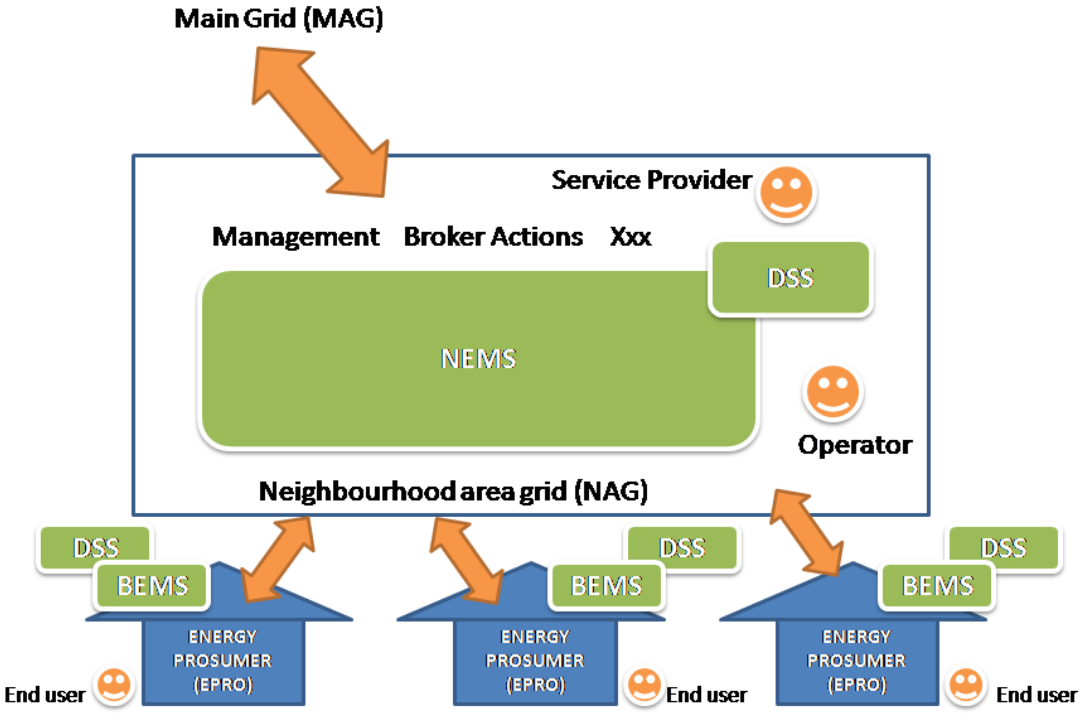

***Figure 3**: Overview on key functions and their relationship in neighbourhood area grids (described in EEPOS DoW)*

Besides the stakeholders being directly involved like the end user and the energy broker there are additional stakeholders necessary to build up a working environment for this scenario. The agent based trading approach is based on a high level of automation, therefore the system developing companies has a mission critical role. This business model describes the approach for these stakeholders.

***Table 7**: Energy Prosumer business model*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities</td><td rowspan="2">Key partners

NEMS operator
Software Company (developing ICT / NEMS)</td><td>Key activities

Developing Trading Platform (Marketplace and Agent-Infrastructure) as Service on the ICT Platform</td><td rowspan="2">Value propositions

Offering a high quality marketplace environment with individual configurable software-agents which represent the needs of the EPROs and the Energy Service Companies which is able to deal in real-time as representatives of their “owners”</td><td>Customer relationships
classical sell / service relationship (customer buys system and gets maintenance and service)</td><td rowspan="2">Customer segments

Owners/Maintainers of NEMS like Housing companies and Public authorities and NEMS operator taking advantage of high level services</td><td>Customer activities</td></tr>
<tr><td>Partner resources</td><td>Key resources

Developing Environment
ICT Platform</td><td>Distribution channels
direct distribution (key account business) supported by exhibitions and professional articles</td><td>Customer resources</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure

Software maintenance (Developers), Service Infrastructure (Hotline, Training)
IT Infrastructure</td><td>Performance validation methods and criteria
- the amount of traded energy via the marketplace (compared to the overall traded energy) and
- the Time To Deal (TTD) (measured from the offer to the closing of a deal)
Both KPI are measured automatically and validated continuously (against agreement).</td><td colspan="2">Revenue streams

Two different approaches for revenue:
a) customer buys system and pays a yearly maintenance / service fee
b) the system fee is calculated according the usage of the platform (e.g. 0,5 ct / traded kWh)</td><td>Customer cost structure</td></tr>
</table>

Software developers do not play a direct role in EEPOS NEMS implementation. However, the developed platform can be used as a part of their solution. This business model describes the infrastructure, offer and the customers for the central service being required for the agent-based trading approach. The trading platform is an enhancement to the NEMS ICT-Platform in the B2B (Business to Business) area.

The key activity is the development of the trading platform which consists of the marketplace and the agent infrastructure. The Platform is designed as a service-module using the infrastructure and interfaces offered by the NEMS ICT Platform. The main resources being required to build and offer such kind of platform are the system development tools (like Microsoft Developer Studio), the IT infrastructure and – as test environment – a workable NEMS-System with simulated EPRO's and Energy Trading Companies. Therefore the main costs for offering such a system are the personal costs for developers and the service personal as well as the costs for the developing and maintenance infrastructure (like server, communication costs, ...). The main partners to build the trading platform are the NEMS operator (as knowledge carrier) and the Software Companies which offers the base ICT-Platform.

The offer is a high quality marketplace environment with individual configurable software-agents which represent the needs of the EPROs and the Energy Service Companies (ESCOs). Using the platform the trading can be done automatically 24 hours a day. The software agent being configured by its "owner" acts as his representative and tries permanently to optimise the buy and sell of the energy being offered and used by the EPRO. In order to measure the quality of the platform and to validate the service two Key Performance Indicators (KPI) are defined:

- the amount of traded energy via the marketplace (compared to the overall traded energy)
- Time To Deal (TTD) measured from the offer to the closing of a deal in seconds.

Both KPI are measured automatically and validated continuously by the NEMS-operator.

Potential customers for this kind of platform are owners and maintainers of NEMS like Housing companies and Public authorities which uses the system to offer advanced services to their customers. The relationship between the Software Company and the customer is a classical sell / service relationship. The customer buys the system and gets maintenance and service. For the revenue we propose two different models where the customer can decide which model to take: One opportunity can be, that the customer buys the system and pays a yearly maintenance / service fee. The system cost should depend on the number of participants / agents being needed. That allows a lower price for smaller NEMS and to scale the price with the growing platform. An alternative can be a complete "value based" pricing model calculated according to the usage of the platform (e.g. 0,5 ct / traded kWh). This allows a high flexibility and complete transparency for the customer and also for the end user. As distribution channel for the system we propose from our experience the direct distribution (key account business) supported by exhibitions and professional articles.

4.3 Energy Brokering Tool as a service

This is a business model for Energy Brokering tool service provider.

Energy Brokering Tool enables the managers of the real estate with its own energy production to measure, calculate and monitor energy consumption and production. Energy is stored in local storage (batteries etc.) and this enables real estate manager to buy energy when prices are low and storages' states of charge are low. When prices go up manager can use the battery reserves to optimize costs.

In a normal case extra produced energy is stored to batteries until they are full. Then the left over energy can be sold to the grid. Energy stored in the batteries is used first when consumption is higher than production and the missing energy is bought from the grid. However this kind of local storage and intelligent software enables real estate manager to take the next steps towards energy brokering. Manager can purchase energy from the grid for local storage if market prices are profitable, and sell it later when the prices go up. Of course, the manager has to make sure his own real estate maintains its own energy consumption according to the plans. Intelligent software helps the manager to achieve this.

In this business model, an expert company offers tools and services for customers for a commission fee (percentage) from the savings generated by the usage of the system. Actual work is outsourced for external expert. If they can't generate savings they don't get paid. This kind of service is very easy to sell to customer since their risk is minimal and possible savings can be profitable. Actual risk is taken by the energy experts selling the service, they have to know which kind of buildings their customers have. If they can see potentially saving possibilities they can make an offer to owners that can benefit both parties.

***Table 8**: Energy Brokering Tools service provider business model*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

monitor & service of network,
trade energy</td><td rowspan="2">Key partners

External energy Experts

ICT experts (data communications)</td><td>Key activities

Trade energy,
Maintain system stability</td><td rowspan="2">Value propositions

Profit from using the tools,
Green thinking,
Energy savings

Customers may participate to the definition of the tool.

Innovative tools and processes</td><td>Customer relationships

Strategic partnerships</td><td rowspan="2">Customer segments

Building owners
Real estate companies
Facilities service companies</td><td>Customer activities

produce & consume energy</td></tr>
<tr><td>Partner resources
EEPOS System</td><td>Key resources

Energy brokering tools and technology</td><td>Distribution channels

Personal sales
Exhibitions
Seminars</td><td>Customer resources</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure

Maintain and update of software,
Man power costs</td><td>Performance validation methods and criteria
Monitor & optimize usage of customer energy.
System stability and availability criteria’s.
Energy savings measured according to defined.</td><td colspan="2">Revenue streams

Percentage of the savings validated</td><td>Customer cost structure</td></tr>
</table>

4.3.1 EEPOS related tools used in business model

EEPOS project task 3.2 concentrates on Energy brokering tool. The connection with EEPOS overall picture is shown in the figure below.

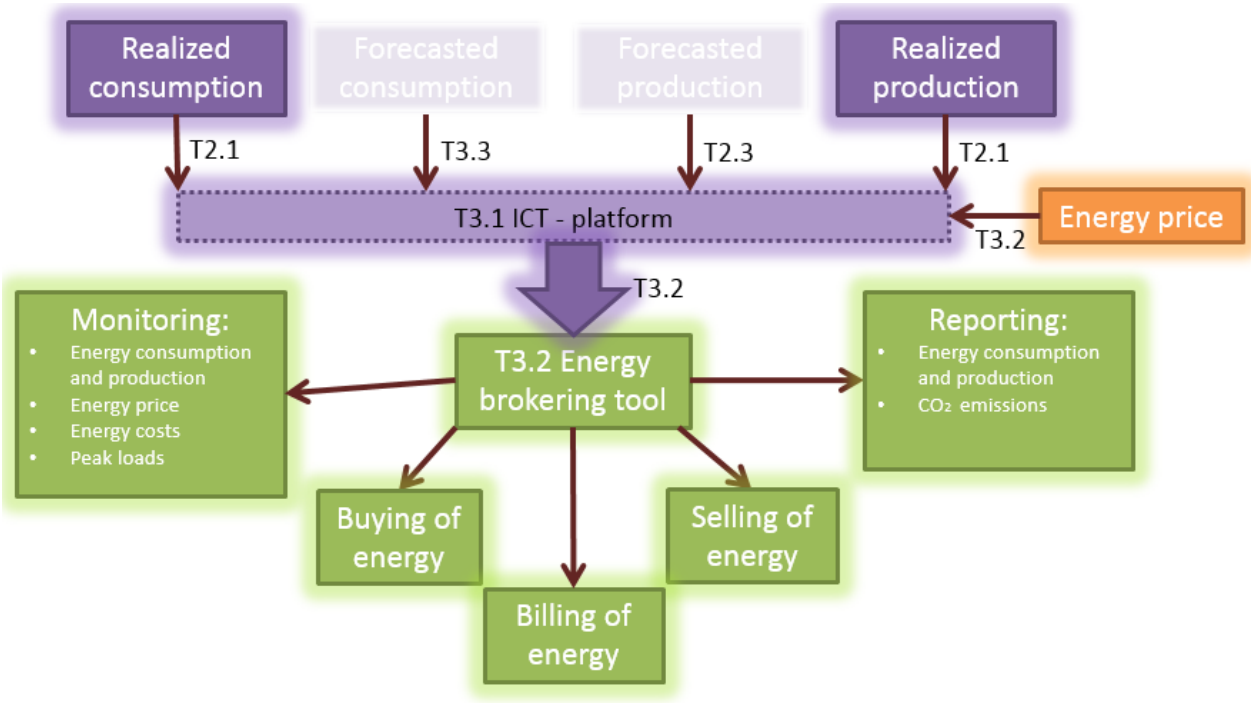

Figure 4: *Energy Brokering Tool utilizes ICT-platform (interfaces and database) to connect to building automation and/or metering systems.*

4.3.2 Contractual and legal aspects

In the first phase we are going to establish this business model in Finland which means that we are agreed to utilize national (Finnish) general agreements in ICT-sector.

Finnish legislation has also renewed in energy sector since the beginning of 2015. New law is based on EU directive (2012/27/EU). This also supports our business model.

In the second phase we are going to international market probably starting with Nordic and Baltic countries. At this point we naturally need to follow international requirements and agreements in our sector.

4.3.3 Business potential

EBT tool business potential varies according to different scenarios that describe how widely the tool can be exploited on the market, The table 9 shows the potential of the most likely scenario. Scenarios are described in detail in appendix 2.

Table 9*: Estimated Energy Brokering Tool as a service business case potential.*

Year	2016	2017	2018	2019	2020
Level of Business potential	1	1	2	2	3

4.3.4 Exploitation of business model

We have already exploited EEPOS-project results in our organisation. Our own integration platform has similar functions to EEPOS ICT-platform as we now utilize Mule ESB in our production.

Also some parts of Energy Brokering Tool (EBT) is already piloted in our existing customer projects. Our own product name for EBT is Fatman Frame – Demand. We ended up with this product name after discussing with our marketing and branding department. It enables wider use of software; we are planning to use Demand – module also for example waste monitoring.

At this point we are living "Scenario 1" and very close to achieving requirements for it.

4.4 Energy Brokering Tool as a (self-service) software

As in the previous business model this one uses Energy Brokering Tool software for energy management. However in this case the customer has his own energy expert working for him and didn't want to pay for external services. So the customer only pays monthly fee for the usage of the system and the tools provided.

This kind of approach is suitable for big companies who have their own experts and wants to keep all the decisions and knowledge in-house. This way, a customer can get all the benefits from savings for himself, however also all the risks come with the responsibility.

Marketing for this kind of product is much more difficult compared to previous service model, since the customer takes all the risks, whereas the vendor only provides the software.

***Table 10**: Energy Brokering Tools (as a software) business model for software developer*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

monitor & service of network,
trade energy</td><td>Key partners

NEMS operator,
Energy Experts,
Software vendor</td><td>Key activities

Energy management</td><td rowspan="2">Value propositions

Profitable tools
Green thinking
Energy savings

Customers may participate in the developing

Innovative tools and processes</td><td>Customer relationships

classical sell / service relationship (customer buys system and gets maintenance and service</td><td rowspan="2">Customer segments

Energy experts working for:
Building owners,
Real estate companies,
Facilities service companies</td><td>Customer activities

produce & consume energy</td></tr>
<tr><td>Partner resources
EEPOS System,
Energy brokering service</td><td rowspan="2"></td><td>Key resources

Skilled and motivated staff
Best tools and technology</td><td>Distribution channels

Direct sales (account management)</td><td>Customer resources
energy production equipment</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure

software development costs, update costs,
Costs to ensure software (and related systems) availability in case agreed by the client.</td><td>Performance validation methods and criteria
Availability,
Agreed level of measurements (saving optimisation etc.)</td><td colspan="2">Revenue streams

Monthly fee + additional billed hours</td><td>Customer cost structure
User pays monthly fee for the service. (x € per user or x € per site)
Additional expert services as billed hours (x € / h)</td></tr>
</table>

4.5 Software for automatic adjusting of building systems settings

This is a business model for ICT service provider / developer.

In order for a building to work at most optimum level the building systems must be adequately set. Usually the basic settings provided by the building systems or automation company will not cover all user and climate cases. Therefore the building most likely will not run as optimally in all climate and user situations as it should.

For correcting this problem an ICT developer may develop software that measures (reads) the building current conditions and compares the measurements to a pre-set list to see if adjusting will be needed. When adding together forecast of the use of building (like weather forecast and user behaviour forecast) with the list of adjustments the building may be adjusted for optimal performance in close future (eg. 2-10 hours). Also the system must have interface to spot power market to make reliable predictions about future consumption and energy price trends.

The adjustment should normally be done automatically by the software developed. However in some special cases the automatic settings may not be right due to some special reasons (like extreme weather situation or accidents, fire etc.) and there for manual adjustments must also be allowed. When using manual adjusting there shall also be a list of actions and basic settings for special situations.

Automatic adjusting of building systems setting to work optimally must have self-learning features. The system ought to be able to make suggestions and set feasible operational limits based on past performance of the system. History data should be stored for self-learning capabilities.

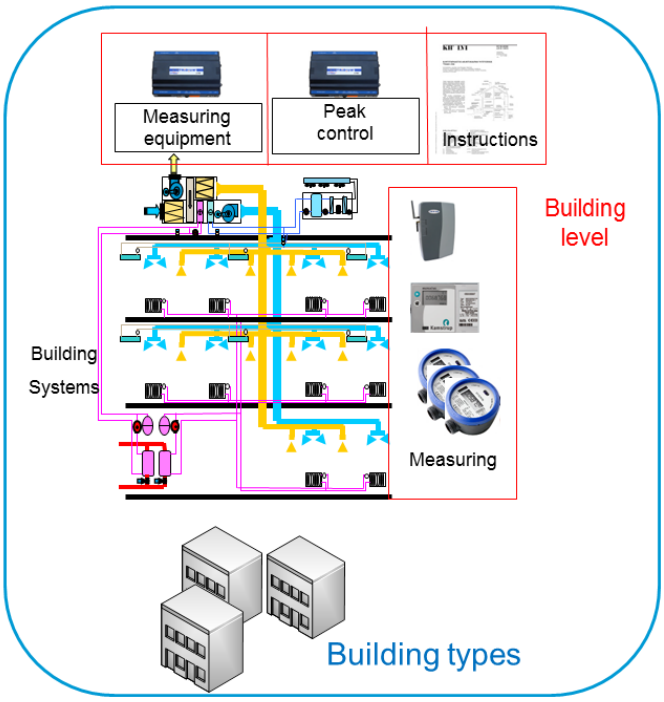

***Figure 5**: Measuring and setting equipment in buildings*

Table 11: *Software for automatic Adjusting of Building Systems Settings business model*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

Deliver information</td><td>Key partners

NEMS operator,
Electricity provider,
Weather forecast company</td><td>Key activities

Automatic & manual adjusting of settings</td><td>Value propositions

Automatic adjusting of settings to save energy costs</td><td>Customer relationships

Automatic</td><td>Customer segments

Housing companies</td><td>Customer activities

Basic settings</td></tr>
<tr><td>Partner resources

Information delivery equipment</td><td></td><td>Key resources
Electricity pricing information,
Weather information,
Self-learning software,
Personnel</td><td></td><td>Distribution channels

NEMS operator channels</td><td></td><td>Customer resources

Web program</td></tr>
<tr><td>Partner cost structure
Maintain connections,
Collect and deliver information</td><td colspan="2">Cost structure
Software development,
Setting of software,
Personnel costs</td><td>Performance validation methods and criteria

Savings of costs,
Agreed conditions of building maintained</td><td colspan="2">Revenue streams

From Housing company:
• monthly fee
• software licence
• split of savings</td><td>Customer cost structure

Monthly fee,
Licence</td></tr>
</table>

4.5.1 EEPOS related tools used in business model

The data (sensor data, adjustments made by end users and weather data) needed to analyse this business case is stored into database. The stored data was analysed to find out when building automation system works optimally and when predicative actions should have been made. Altogether the data gave information that we should heavily focus on automation instead of end users. According to data end users have done adjustments seldom. Moreover those cases tell more about faulty working system than end user's activity. Typically temperature was adjusted less than once in week.

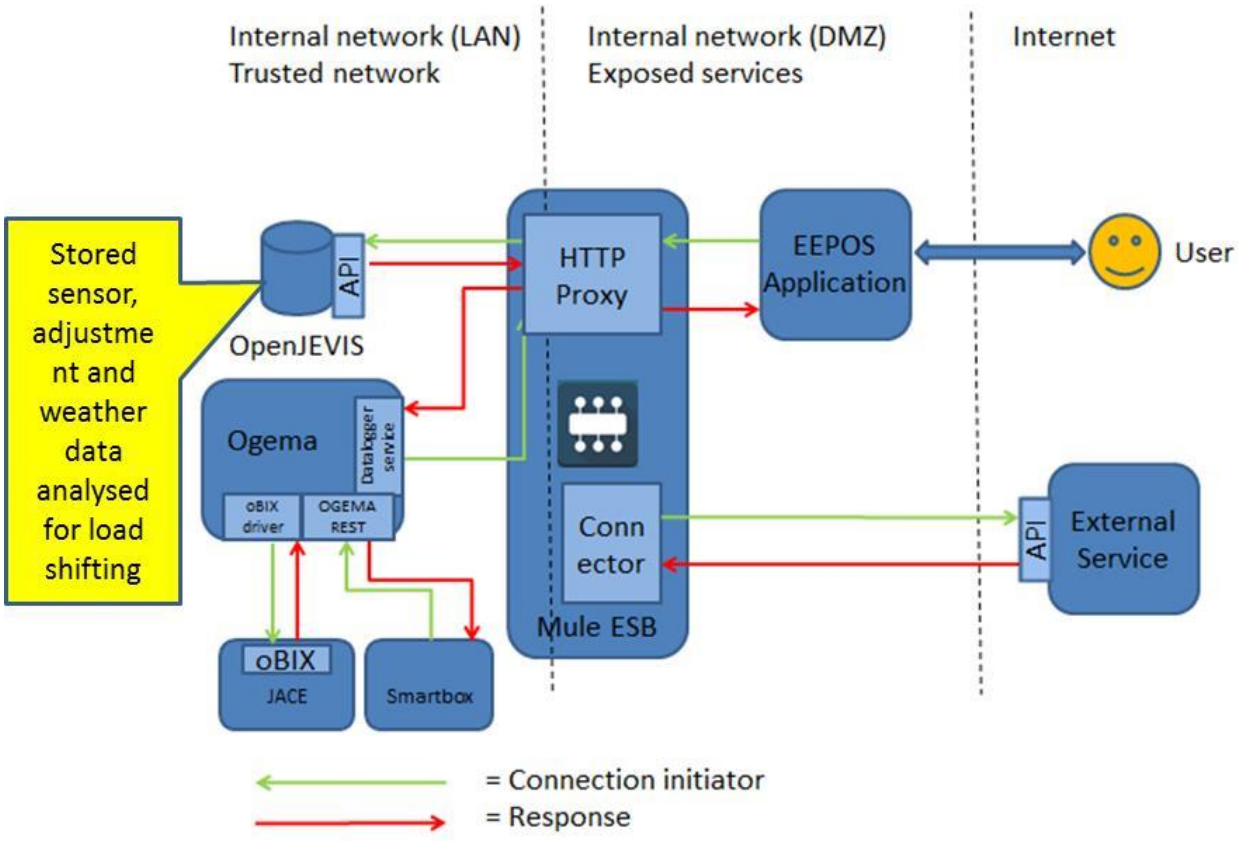

***Figure 6** : Automatic adjusting of software relation with system architecture defined in D3.1*

4.5.2 Contractual and legal aspects

As a legal issue in this business case is privacy. Effective predictive actions and self-learning features requires recording and analysis of people habits, when they are present, occupancy of apartment etc. This is a big barrier that prevents full-scale exploitation of this business case so far.

4.5.3 Business potential

The analysed potential is the demo case is up to 5% of energy used for heating and cooling when no sensitive information is used. If the sensitive information could be used, the saving potential could increase up to 8% of energy used for heating and cooling. The table 12 shows estimated automatic adjusting of building systems settings business potential. Estimation parameters are shown in appendix 2.

***Table 12**: Estimated Software for automatic adjusting of building systems settings business case potential.*

Year	2016	2017	2018	2019	2020
Level of Business potential	0	1	2	2	2

When the size of neighbourhood area(s) can be extended up to 10000 apartments that is equivalent to Merenkulkijanranta area multiplied with 40, there will be significant market potential.

4.5.4 Exploitation of business model

Caverion will continue development of load shifting business model to investigate if load shifting is exploitable in the facility stack that is under Caverion 24/7 control.

4.6 Software for automatic cut of high consumption with user pre-set limits

This business model elaborates business opportunity for an ICT software developer (may also act as a service provider) to build software that automatically (in advance) notices a potential peak load and directs the energy management system for cutting functionality without intruding the end-user comfort. The idea is to cut off such loads that do not necessarily affect the wellbeing of the end-user or limit their occupancy.

The software works in two ways:

1. Cut power
2. Boost local power generation

To make EEPOS system work optimally it must have self-learning features and connection to weather forecast and spot power market to make reliable predictions about future consumption and price trends and to be able to make suggestions and set feasible operational limits based on past performance of the system.

A software company creating automatic cut off systems may benefit not only from selling licenses of the software but also from creating a business model where split of saving is divided between NEMS operator and software manufacturer. Further on the software developer may act as a service provider offering not only the software for sale but run the software as a service.

In **common areas** local group of end users / housing companies pre-sets the limits for cut of peak power consumption. The limits are set to the equipment that is in common use and outdoor areas (equipment that is not controlled by individual inhabitants). Among this kind of equipment are:

- Air handling units
- Ventilation systems
- Electric car charge
- Outdoor lighting (dimming)
- Lighting of common spaces (dimming, shorter delay of switch off)
- De-ice heating etc.

During peak demand the price of power is extremely high. In order to cut the peak load, all necessary information concerning real-time tariff, power consumption and generation and estimated price trends is provided to the end-user. Based on this information the end-user can choose to cut or delay one or many energy consuming activities.

Local equipment for producing power shall be set to maximum power generation mode when peak cutting. If there is a storage possibility for energy before expected cut off, the possibility to load power shall be used. This option needs a lot of automatization and predicting of energy pricing together with local consumption.

In **private areas** ICT software will control basic features of automatic cutting like:

- Enable to cut or delay the consumption automatically based on pre-set limits and rule-sets e.g. delay the operation of washing machine, sauna, turn off stand-by consumption, dimming of lights.
- Discharge available energy storages up to pre-set limits

***Table 13**: Software for automatic cut of high consumption with user pre-set limits business model*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

Provide information,

Maintain self-learning software</td><td>Key partners

Power trading company

local energy producer

ICT software developer</td><td>Key activities
Automatic cut of high consumption,
monitor high consumption,
predict high consumption, maintain grid</td><td rowspan="2">Value propositions

limits are set to equipment in common areas (not controlled by inhabitants) → <u>saving energy</u>

Saving peak energy costs even when user needs to use energy consuming equipment.</td><td>Customer relationships

pre-set & automatic (end users are advised to purchase the system for saving without inconveniences)</td><td rowspan="2">Customer segments

end user group/ housing company</td><td>Customer activities

pre-set limits for cut of peak power</td></tr>
<tr><td>Partner resources
Information from local systems, forecasts etc.
Software development methods and skills</td><td colspan="2">Key resources
physical (grids),
EEPOS system,
human,
energy consuming equipment with the ability to cut,
energy production equipment</td><td>Distribution channels

Remote access to local control systems</td><td>Customer resources

remotely manageable equipment</td></tr>
<tr><td>Partner cost structure

ICT development cost,
monitoring cost (man power)</td><td colspan="2">Cost structure

Monitoring activity (automated)
weather forecast (automated)
maintenance of grid
adjustment of limits</td><td>Performance validation methods and criteria

High peaks are cut without user inconveniences.
Limits are (measured to be) correct and in users per-set boundaries.</td><td colspan="2">Revenue streams

selling the software or offering it as a service,
brokering fee,
(possibly) split of savings</td><td>Customer cost structure

Monthly or demand based fee</td></tr>
</table>

4.6.1 EEPOS related tools used in business model

There two main ways to use EEPOS tools in this business case.

Firstly EEPOS tools provide us exact follow up data collected by over 1000 sensors in the Finnish demonstration. The data is stored in database for analysis. This information covers realised energy consumption in hourly level. It helps us to understand the magnitude of power consumption that is shiftable without significant impacts on indoor conditions. Thus we can scale the size of neighbourhood are that is a conditions for reasonable business potential.

Secondly the data shows the level of end users activity. It tells how often they adjust conditions to meet better their preference. It provides us valuable information either can we rely on end user activity or should we concentrate more on automatic operations. According to tentative results end users low activity gives opportunities for automatic actions.

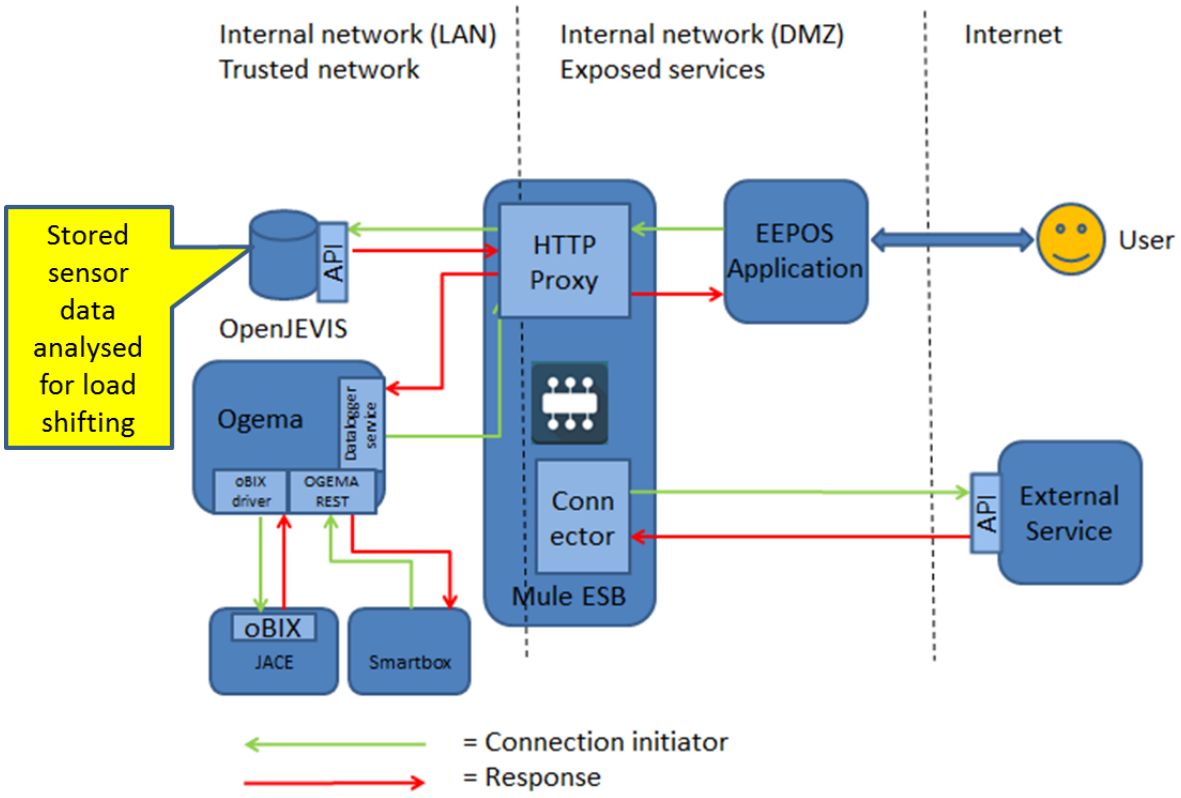

***Figure 7**: Automatic cut of high consumption relation with system architecture defined in D3.1*

4.6.2 Contractual and legal aspects

We have identified two main contractual and legal challenges that make effect on this business case and that have to be solved before business can be realised.

The contractual challenge is current contract of electricity purchase. The contract is between partly electricity company and end user and partly between electricity company and housing company today. Service provider role is unclear. How to agree profit-sharing and risk-sharing between electricity company, housing company, end user and service provider.

Another big issue is privacy. Lot of data collected by sensors is confidential. It's possible to conclude when people are at home and even create very detailed user profiles about their comings and goings. Naturally this is a privacy issue although the data could improve the energy efficiency.

4.6.3 Business potential

The business potential is calculated based on Merenkulkijanranta demonstration site. It is clear that both Klyyssi building, around 30 apartments, as well as the entire neighbourhood are over 200 apartments are too minor area for profitable load shifting business. The table 14 shows estimated automatic cut of business potential. Estimation parameters are shown in appendix 2.

***Table 14**: Estimated Software for automatic cut of high consumption with user pre-set limits business case potential.*

Year	2016	2017	2018	2019	2020
Level of Business potential	0	1	1	2	2

4.6.4 Exploitation of business model

Caverion will continue development of load shifting business model to investigate if load shifting is exploitable in the facility stack that is under Caverion 24/7 control.

4.7 End user collaboration tool

Building an "End user collaboration tool" software is a business opportunity for a software developer. Developer should have a NEMS operator as partner for defining of the web tool. The main functions of the EEPOS end-user collaboration tool software are to engage and motivate the end users in energy saving and shifting their energy consumption from peak hours to off-peak hours of the day depending for example on the available production status and the level of the storage capacity of the neighbourhood's renewable energy sources as well as SPOT market electricity price. When the tool is in use the possibilities to achieve agreed neighbourhood level energy saving goals increase significantly. The same applies to building level consumption goals.

Possible key functions of the end-user collaboration tool are as follows: end user energy performance reporting, benchmarking and guidance; neighbourhood discussion forums; energy saving games/contents in the neighbourhood; targeted energy saving group actions trough crowd sourcing. The ultimate target of the tool is to engage and motivate the end users for energy saving to shift their energy consumption from peak hours to off-peak hours of the day.

The tool is targeted to be used to improve the collaboration among the end-users related to energy saving. Costs for tool may also be covered by the NEMS operator in case it finds the tool worthy helping achieving NEMS goals and end users are not willing to participate to costs but are willing to use the tool.

***Table 15**: End user collaboration tool - Business model for Software developer*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

Bi-directional data exchange,
Promotions</td><td rowspan="2">Key partners

NEMS operator,
Energy broker,
Sponsors e.g. NEMS operator, ESCO, public authorities, companies</td><td>Key activities

Maintain software</td><td rowspan="2">Value propositions

Enable end-users to compare used energy costs & amount of energy with similar users,
Entertaining games with concrete trophy</td><td>Customer relationships

Automated</td><td rowspan="2">Customer segments

Private,
housing companies</td><td>Customer activities
Active use of tool</td></tr>
<tr><td>Partner resources
Value adding information,
ICT,
Personnel</td><td>Key resources
Software development methods & skills,
web server</td><td>Distribution channels
Download (or use) software from the web</td><td>Customer resources
Internet connection</td></tr>
<tr><td>Partner cost structure

Connections to tool</td><td colspan="2">Cost structure

Software development costs,
Software update & helpdesk costs,
Web service costs</td><td>Performance validation methods and criteria
Energy consumption measures,
Energy cost goals for NEMS operator are met,
By games specific energy consumption issue is focused and dealt with.</td><td colspan="2">Revenue streams
Licencing, Monthly fee,
Sponsoring</td><td>Customer cost structure

Monthly fee,
Sponsoring</td></tr>
</table>

4.8 End user balance card

Using End user balance card creates business opportunity for end users. Business model describes the roles of end user, NEMS operator and broker. All these roles are needed using balance cards.

End User / Inhabitant buys a balance card in aim to buy and sell power. When buying a balance card end-user or resident can enable simultaneous energy production and consumption (act as a prosumer). The card has credit that can be used to buy power. No other buying terms are allowed. All power consumed decreases credit according to real-time (buy) tariff.

There are two ways to earn more credit:

1. To buy more credit
2. To produce power.

Produced surplus power loads the balance card with power credit according to real-time (sell) tariff. In principle it does not matter how the power is generated – via solar panels, wind mills or diesel or gas engine-generator. In some cases, to stimulate renewable energy production more credit (better tariff) can be admitted for clean power production.

The balance card can be in two different modes:

1. Sell only. In this mode no power from outside is used. The end user use self-produced power only and sell the surplus power to the local grid.
2. Buy & Sell. This is the normal mode. Surplus power is sold to the local grid and deficit power is bought from the local grid

***Table 16**: End user balance card - Business model for end users*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

Maintain equipment & software</td><td rowspan="2">Key partners

Balance card provider,
Balance card operator,
NEMS operator</td><td>Key activities

Purchase credit,
Produce power</td><td rowspan="2">Value propositions

Control energy costs using balance card,
Consume no purchased energy when using sell-only mode,

Reduce energy costs using buy&sell mode</td><td>Customer relationships

Automated process</td><td rowspan="2">Customer segments

NEMS operator</td><td>Customer activities

Buy surplus power</td></tr>
<tr><td>Partner resources

Human, equipment</td><td>Key resources

Power generation equipment</td><td>Distribution channels

Energy network</td><td>Customer resources

Energy brokering</td></tr>
<tr><td>Partner cost structure

Maintain of software</td><td colspan="2">Cost structure

Maintain equipment</td><td>Performance validation methods and criteria

No or low costs of energy used, reported to end user periodically by NEMS operator (or web report).</td><td colspan="2">Revenue streams

Sell power</td><td>Customer cost structure

Buy energy</td></tr>
</table>

4.9 Automatic demand site management, NEMS-developer

The described business model describes the Neighbourhood Energy Management System (NEMS) as basic system architecture for the Demand Side Management (DSM). The NEMS performs co-ordinated optimisation on the neighbourhood level and can actively take part in energy trading with external parties on behalf of the neighbourhood members, who are not allowed for direct participation in energy trading.

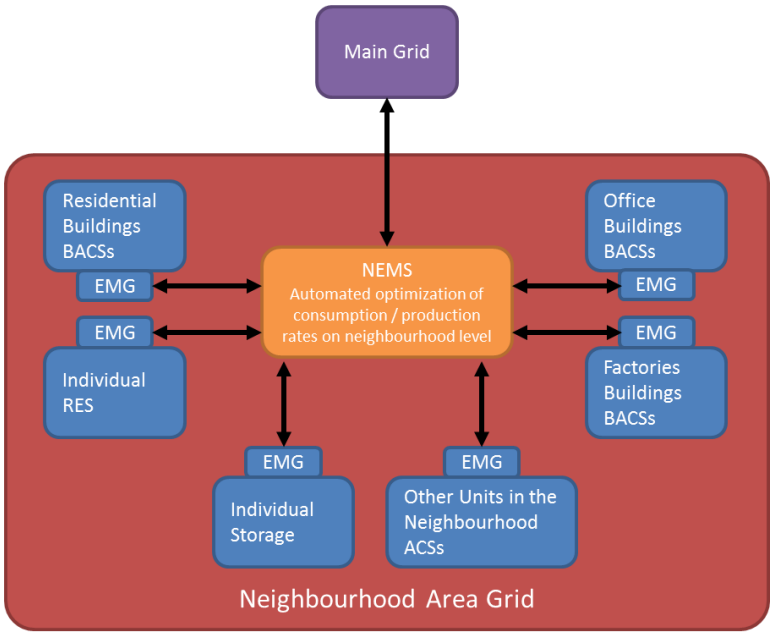

***Figure 8**: (from EEPOS report D1.1): Schematic representation: Automated DSM within the neighbourhood. EMG refers to Energy Management Gateway*

The functionality of the NEMS includes monitoring and predictive control (e.g. by involvement of forecasts for production / consumption rates, calculation of forecasts for customer reactions), consideration of local diversity, automated load shifting and use of storages, and energy brokering. A detailed description can be found in the Deliverable 1.1, Validation strategy and application scenarios.

***Table 17**: Automatic demand site management, Business model for NEMS-developer*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities</td><td rowspan="2">Key partners

Hardware Manufacturers,
Software Company (developing BACS / BEMS)</td><td>Key activities

Developing and supporting NEMS ICT Platform</td><td rowspan="2">Value propositions

Offering a high quality, open NEMS platform with the possibility to add additional services and interfaces</td><td>Customer relationships
classical sell / service relationship (customer buys system and gets maintenance and service)</td><td rowspan="2">Customer segments

Owners/Maintainers of NEMS like Housing companies and Public authorities</td><td>Customer activities</td></tr>
<tr><td>Partner resources</td><td>Key resources

Developing Environment
ICT Platform</td><td>Distribution channels
direct distribution (key account business) supported by exhibitions and professional articles</td><td>Customer resources</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure

Software maintenance (Developers), Service Infrastructure (Hotline, Training)
IT Infrastructure</td><td>Performance validation methods and criteria
Key Performance Indicators are
- Number of participants working with the NEMS at the same time (CeE - Concurrently enrolled EPROs)
- Availability Environment Classification (AEC): a high availability of 99.9 % or even more is required (AEC-4)</td><td colspan="2">Revenue streams

Two different approaches for revenue:
a) customer buys system and pays a yearly maintenance / service fee
b) the system fee is calculated according the usage of the platform (e.g. 5 EUR / EPRO / month)</td><td>Customer cost structure</td></tr>
</table>

This business model describes the development and maintenance of the central NEMS infrastructure in the B2B (Business to Business) area. The platform is open for enhancements with additional services and interfaces and has to meet high quality requirements.

The key activity is the developing of the central NEMS which consists of middleware, interfaces and services. The main resources being required to build and offer such kind of platform are the system development tools (like Microsoft Developer Studio), the IT infrastructure and – as test environment –workable Building Automation Control Systems (BACS) and Building Energy Management Systems (BEMS) with simulated (prediction of consumption and price) EPROs and Energy Trading Companies. Therefore the main costs for offering such a system are the personal costs for developers and the service personal as well as the costs for the developing and maintenance infrastructure (like server, communication costs, ...). The main partners to build the central system are the Hardware Companies for interfaces / platform integration and the Software Companies which offers the BACS and BEMS.

The offer is a high quality, open platform with individual configurable interfaces and services. In order to measure the quality of the platform and to validate the service two Key Performance Indicators (KPI) are defined:

- CeE (Concurrently enrolled EPROs): the Number of participants working with the NEMS at the same time.
- AEC (Availability Environment Classification) from EEPOS deliverable D1.1: a high availability of 99.9 % is required (AEC-4). The platform must be maintained continuously, 24-7 (24 hours, 7 days the week) must be ensured.

Both KPI are measured automatically and validated continuously by the NEMS-operator.

Potential customers for this kind of platform are owners and maintainers of NEMS (including NEMS operator) like Housing companies and Public authorities which uses the system to offer advanced services to their customers. The relationship between the Software Company and the customer is a classical sell / service relationship. The customer buys the system and gets maintenance and service. For the revenue we propose two different models where the customer can decide which model to take: One opportunity can be, that the customer buys the system and pays a yearly maintenance / service fee. The system cost should depend on the number of participants / EPROs being needed. That allows a lower price for smaller NEMS and to scale the price with the growing platform. An alternative can be a complete “value based” pricing model calculated according the usage of the platform (e.g. 5 EUR / EPRO / month). This allows a high flexibility and complete transparency for the customer and also for the end user. Also the offer as “System as a Service” (SaS) should be validated (as alternative to the classical selling approach): Selling the NEMS in the SaS model there is no physical need for distribution since it is not distributed physically and is deployed almost instantaneously. As distribution channel for the system we propose from our experience the direct distribution (key account business) supported by exhibitions and professional articles.

4.10 Automatic demand site management, NEMS-developer

The following proposed business model is from possible (and future) scenario proposed in final version of D1.1 described in following Scenario: Automated Demand Side Management (DSM) within the Neighbourhood. In this scenario, the energy generation and consumption on the neighbourhood level are automatically managed by the EEPOS system. Each unit (building, house, flat, ...) of the neighbourhood is equipped with an Automation and Control System (ACS), which can control different loads (e.g. heating/cooling devices, washing machines, …). Thus, besides their role of monitoring, the ACSs play an active control/optimization role on the building level.

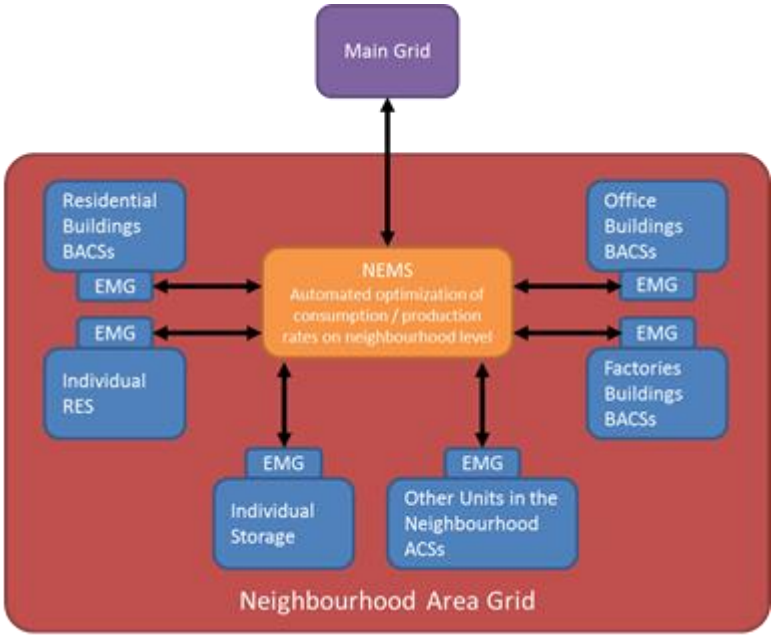

***Figure 9**: Schematic representation: Automated DSM within the neighbourhood*

As in our previously proposed Business model – we are characterizing the four elements of a business model – value proposition, revenue model, customers and services, and key activities and resources – identified and propose a set of basic normative requirements that need to be met for successfully marketing sustainable innovations, developed by EEPOS project (proposed Scenario Automated Demand Side Management, from final D1.1):

The value proposition – *energy management and optimisation on the NEMS level, energy trading with external parties* – provides measurable ecological and/or social value concerning economic value. Its reflects a business-society dialog concerning the balance of economic, ecological and social needs as such values are temporally and spatially determined. For existing services, a particular balance is embedded in existing practices of actors in the production and consumption system; for new services, such a balance is actively being struck among participants in the evolving alternative network of "Prosumers" and other associated actors.

The revenue model – *time dependant energy tariff based on monitoring and predictive control* – different kind of fees (in dependence of the energy source used (RES and/or conventional) motivates customers to take responsibility for their consumption and decision for taking part in NEMS (or not).

The customer and services – *End-user (residential and public districts), Brokers* – interested in environmentally friendly power (e.g. 50% of RES, 100% of RES, all wind or all-solar, etc.) may also be interested in energy efficiency services.

The key activities & resources – produce energy at NEMS level & management and optimisation & energy trading – allow to create and offer the Value Proposition (Use of RES) for the Customers (Residential and Public districts) with the Revenue Model (Fees based on demand).

These requirements are defined on purpose. For future research, more detailed and refined formulation may allow for empirical tests of their actual relevance. So far, they provide a basic set of normative principles for sustainable business models which need to be fulfilled in order to contribute to successful marketing of sustainable innovations.

***Table. 18**: Automated Demand Side Management, Business model for NEMS operators*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

Manage & monitor of energy network</td><td rowspan="2">Key partners
NEMS software developer
Facility operators,
Energy producer, traders & distributors,
Service & maintenance operators,
ICT developers & manufacturers,
Financial institutions & ESCO operators</td><td>Key activities

Produce energy at neighbourhood level,
Energy management and optimisation,
Energy trading with external parties</td><td rowspan="2">Value propositions

Co-ordinated energy management and optimisation on the neighbourhood level,
Take part in energy trading with external parties</td><td>Customer relationships

Energy brokering</td><td rowspan="2">Customer segments

End-users (residential, office and factories owners and tenants),</td><td>Customer activities

Produce & Consume Energy</td></tr>
<tr><td>Partner resources

EEPOS system</td><td>Key resources

Automation and Control system</td><td>Distribution channels

Neighbourhood level energy selling,
Energy trading with external parties</td><td>Customer resources
HEMS, BEMS
Neighbourhood grids & equipment</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure

Involvement of forecast for production/consumption rates,
Calculation of forecasts for customer reaction</td><td>Performance validation methods and criteria
Maintain energy trading activities as in agreement.
Sustainable business models (with relevant KPI’s agreed)</td><td colspan="2">Revenue streams

Time dependant energy (low cost) tariff based on monitoring and predictive control</td><td>Customer cost structure

Manage & Service grid & equipment (ACS)</td></tr>
</table>

4.11 Considering power and heat

The following scenario is from possible (and future) scenario proposed in Task 1.1 by Solintel, described in following:

The CHP plant on site, as indicated on the figure below, covers the heat demand (central heating and hot tap water) and the electricity demand of the district and delivers majority of the production of green electricity to the neighbourhood. Both electricity and heat are distributed with a direct supply line from CHP to end user (buildings).

The implementation of short term storage on district level, as a result of the scenario shall increase the supplied green heat. To completely optimize the ecological and economic benefits of the energy concept, an intelligent "conversation" between producer and end user is necessary. The black points on the figure below is a multiple cross points with the multi commodity networks.

The CHP knows at all times the actual consumption of the buildings and the dwellings (through BEMS) and is able to manage this information actively. The intelligent cross point at storage level leads the heat, at overproduction, to the storage and steers the heat from the storage back on the heating network when there is underproduction. In case of the electricity, the overproduction is steers to the MAG, to sell them to the grid operator by the Neighbourhood broker.

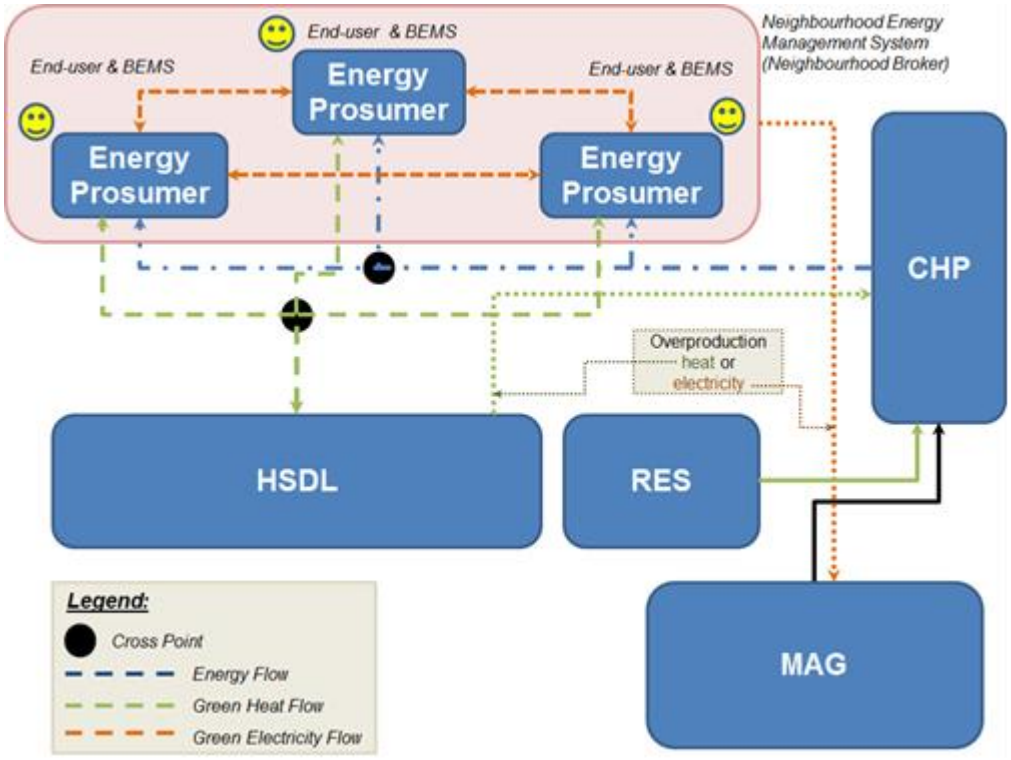

***Figure 10**: Overview of neighbourhood area grids and their relationship*

Based on these insights, the four elements of a business model – value proposition, revenue model, customers and services, and key activities and resources – identified and propose a set of basic normative requirements that need to be met for successfully marketing sustainable innovations, developed by EEPOS project (proposed Scenario N-4, from final D1.1):

The value proposition – *reasonable use and optimisation of RES and conventional sources* – provides measurable ecological and/or social value in concern with economic value. Its

reflects a business-society dialog concerning the balance of economic, ecological and social needs as such values are temporally and spatially determined. For existing services, a particular balance is embedded in existing practices of actors in the production and consumption system; for new services, such a balance is actively being struck among participants in the evolving alternative network of "Prosumers" and other associated actors.

The revenue model – *fees based on demand (permanently monitored)* – different kind of fees, in dependence of the energy source used (RES and/or conventional) motivates customers to take responsibility for their consumption and decision for the take part of NEMS (or not), giving them net benefits approx. 15-25%, measured by agreed cost-benefit measure on NEMS level.

The customer and services – *End-user (residential and public districts), Brokers* – interested in environmentally friendly power (e.g. 50% of RES, 100% of RES, all wind or all-solar, etc.) may also be interested in energy efficiency services.

The key activities & resources – *Produce and manage energy at neighbourhood level & Energy grids and equipments* – allow to create and offer the Value Proposition (Use of RES) for the Customers (Residential and Public districts) with the Revenue Model (Fees based on demand).

These requirements are defined on purpose. For future research, more detailed and refined formulation may allow for empirical tests of their actual relevance. So far, they provide a basic set of normative principles for sustainable business models which need to be fulfilled in order to contribute to successful marketing of sustainable innovations.

***Table.19**: Considering power and heat business model*

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities

Manage & monitor of energy network</td><td rowspan="2">Key partners

Prosumers;
Brokers;
Building, Energy & ICT companies (SMEs)</td><td>Key activities

Produce energy at neighbourhood;
Manage energy flows;
Trading with MAG.</td><td rowspan="2">Value propositions

Low cost energy through optimisation of RES & conventional sources;

Sustainable style of life by reasonable use of RES & conventional sources;

Affordable & feasible way of using new technologies, adapted to particular needed</td><td>Customer relationships

Relationship based on neighbourhood & broker agreements</td><td rowspan="2">Customer segments

End-users (residential & public districts);
Brokers.</td><td>Customer activities

Produce & Consume Energy</td></tr>
<tr><td>Partner resources

Energy efficiency experts</td><td>Key resources

Energy grid & equipment’s</td><td>Distribution channels

Local grids (direct sales)</td><td>Customer resources

Neighbourhood grids & equipments</td></tr>
<tr><td>Partner cost structure

User pays according the bill savings;
Trading with MAG;
ICT & grid maintenance costs.</td><td colspan="2">Cost structure

Monitoring local demand by remote control metering;
Invoice incentives.</td><td>Performance validation methods and criteria

Low cost of living;
Energy savings.</td><td colspan="2">Revenue streams

Fees based on demand, permanently monitored.</td><td>Customer cost structure

Manage & Service grid & equipments</td></tr>
</table>

4.11.1 EEPOS related tools used in business model

The main philosophy of the control system is to maximize the use of renewable energy within the district and make the whole system operate like an energy positive neighbourhood. The optimization carried out by the EEPOS system can be designed in many ways: e.g. to maximize the economic benefit, to minimise the CO_2 production, to reduce the maximum electricity peak power, to operate as an isolated system as much as possible, etc. It is important to stress that depending on the kind of operation allowed, access tariff, applicable taxes, and some other factors, the economic optimization can be very different to an energy efficient optimization.

In order to calculate the action that has to be performed at each time, the EEPOS system will have to foresee the RES generation, and the buildings' heating and electricity demands, the electricity price forecast has to be read from the grid operator site. Taking all these factors into account, the CHP optimized operation will be calculated in order to fulfil the optimization criteria that have been fixed. Storage can also be used to optimize the system.

The resulting optimized operation, where renewable energy is used within the district, will perform better under an energy efficiency point of view, and it should also perform better from an economic point of view, if the associated regulations are reasonable (see next section).

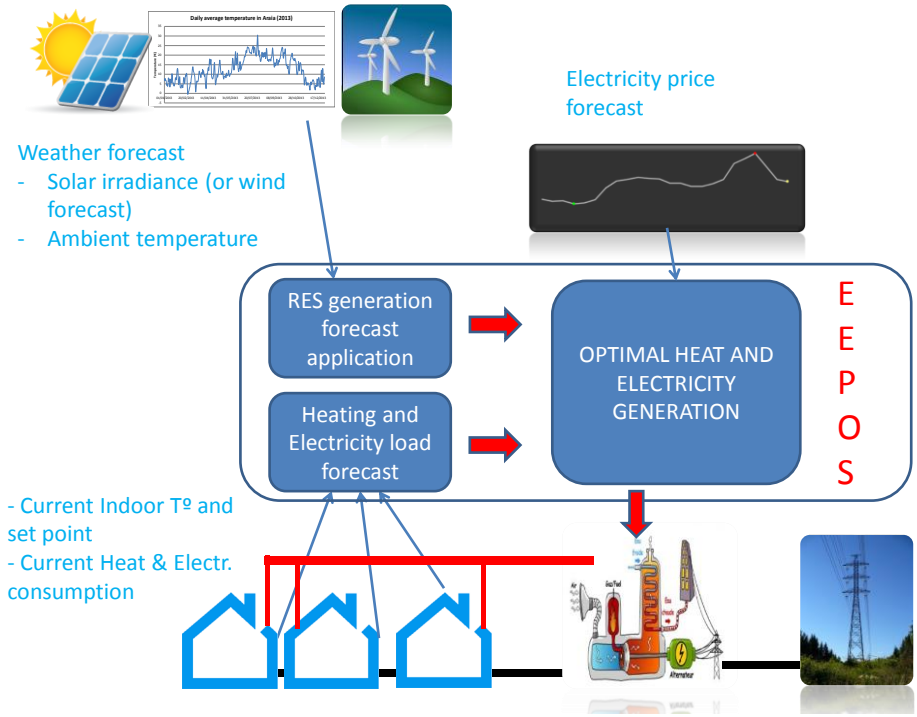

***Figure 11**: Power & Heat EEPOS system architecture*

4.11.2 Contractual and legal aspects

Legislation/regulation may impede the development of local energy initiatives like this one and/or their associated business models. In this kind of system, consumers are no longer merely passive, but they become active and produce electricity. Member States may attach conditions to the supply of electricity to households and small consumers and these conditions may be hard to fulfil, that is not possible for an individual consumer to deliver electricity to another consumer or for the local initiative to deliver electricity to the members in the initiative.

In some countries, prosumers producing electricity on their own roof (behind their own connection) pay taxes only on their net use of electricity (net metering). However, prosumers producing electricity on a shared roof or in a cooperative have to pay energy taxes on their total use of electricity, even when they produced part of the electricity.

In some countries there are specific regulations for direct electricity distribution lines and private and closed distribution grids in order to avoid the restrictions of the public grid. As there lines are not part of the public distribution grid, no supply license is needed in this case. However, some technical codes can impose that every household consumer have a separate connection to the distribution grid and they can say that different connections points on the distribution grid cannot be connected, without the approval of the Distribution System Operator.

Regarding the heat distribution part, for the stakeholders in district heating there are two bottlenecks: The operators have to invest money in expensive networks and in the heat supply system. On the other hand, consumers must be protected against the monopoly power of their suppliers. In some countries, there are regulations for the protection of small consumers against the monopoly power of their suppliers.

4.11.3 Business potential

Although this energy management system can help to use the local renewable energy sources, local regulations limit its development due to the previously explain restrictions. Aspects like the consumer free choice of supplier and every household having a separate connection to the distribution grid, limit the savings potential associated to this system.

In case it is proved that this system is able to save a considerable amount of energy, regulations could be changed in the future to allow it in some cases. However, it has to be said that residential buildings are not the best target for this kind of systems due the great amount of owners. Buildings/groups of buildings entirely owned by one company would be easier to engage in a long term contract.

It is important to notice that as new buildings are more and more insulated, investing in district heating is less and less profitable.

Considering that regulations are not going to change in the following years, the expected level of business potential is the following.

***Table 20**: Considering power and heat business case potential.*

Year	2016	2017	2018	2019	2020
Level of Business potential	0	0	0	1	1

4.11.4 Exploitation of business model

Currently, the model cannot be exploited in most part of Europe due to the existing regulations. It is expected that this will change in the near future.

5. FEEDBACK AND INPUTS FROM SELECTED STAKE HOLDERS

5.1 Workshops in Middle Europe

In m6 Ennovatis had the first (internal) workshop with our development and distribution departments to discuss the relevant business models for a soft- and hardware development company. The results have influenced the business models of Ennovatis being documented as Energy Prosumer and Automatic demand site management, NEMS-operator point of view.

For m18 and – dependent on the results - in m25 there are external workshops planned in Germany / Langenfeld to get feedback from the relevant stakeholders on the proposed business models. The intention is to bring together the key partners and customers and to discuss the concrete aspects with conceptual inputs, personal reflection and group discussions:

- Do the offered values fit the concrete needs of the stakeholder,
- Are the performance validation methods and criteria suitable as contractual basis for payments or guarantees or only useful for marketing purposes,
- Do the potential customer have the required resources or should the resources being offered (at least as an additional option) and
- Do the cost structure and revenue model fit the expectations and needs of the customer.

As participants we plan representatives of the key partners like the hardware manufacturers and at least one additional software company. As representative of the customers we will invite the Bauverein Langenfeld (BVL) as housing company, the Stadt Langenfeld as municipal customer and the Stadtwerke Kusel as energy producer. It's important to limit the group to not more than 10 participants to get effective discussions where each opinion can be taken into account.

The external workshops are planned for 2014 because then the project and especially the demonstrators are in an advanced state where the business models can be discussed near to the real world problems and challenges.

5.2 Workshops in Finland

In Finland two workshops were held in month 7. The first workshop focussed on the possibilities to install and follow up an EEPOS kind of system assembled in the neighbourhood buildings. Discussions were held amongst a building systems company and a constructor. As a partner Caverion (former YIT Kiinteistötekniikka, a building systems company) emphasised the interest of what possibilities there are for a wide variety of EEPOS systems to be installed in the planned Finnish demonstration site Nupuri.

The constructor did bring out their positive attitude on the measurement that EEPOS consortium planned on the area, but also brought out the concern of the unexpected delay of the building state of the area itself. Unlike described in documentation a high voltage ground cable was found to be passing the area where first buildings are planned to be build. There for there were discussions on moving the ground cable which would lead to unexpected delay of building project of the area. The alternative to keep a ground cable in place where stabilising is taken place is unapproved.

Workshop pointed out the possibility for building the Nupuri area little bit differently than first planned whereas the EEPOS system measurement equipment's and automatic systems for adjustments of the buildings should then be installed differently than originally was planned. Also the possibility for further delay of the area was brought out and discussions using the backup plan for Finnish demonstration was placed on the table. In the backup plan there already are housing companies with the possibility to install the EEPOS system to. The neighbourhood also has the possibilities to locally produce renewable energy and distribute it within the neighbourhood. The system installed in the backup area also can enable the addition and optimum management of extra renewable electricity generation capacity.

Further on the more detailed system specification both on measuring and equipment side of EEPOS system was discussed and clearly approved by constructor. The ideas to introduce an area level ICT system controlling energy management within the area was positively received and accepted.

A second workshop was held amongst constructor and a building systems company where municipal representatives were present remotely. In this workshop the ideas of EEPOS systems were discussed and all parties approved the necessity to find EEPOS kind of solutions benefiting the areal development thus decreasing the need for externally produced energy. The planned Finnish demonstration includes these steps. The plan with discussions and basic agreement of the systems to be installed was defined as Gate 1. Gate 1 steps shall be approved before proceeding to Gate 2.

In this discussion the problems on the initially planned Nupuri area also was discussed with not yet a clear decision on either green or red light for possibilities to go ahead with the original plan for Finnish demonstration site. EEPOS consortium is confident that what comes to Finnish demonstration, the project team is able to fulfil the specifications set to the demonstration should the Finnish demonstration take place in either original or backup area planned.

As summing to these workshops both construction sector companies and municipal authority are interested in the EEPOS system. Both parties are willing to test and approve energy management and decision support systems for energy positive neighbourhoods.

Next steps (Gate 2 definitions & validation) on Finnish demonstration:

- Confirm demonstration site
- Measuring specifications
- Discussions with stakeholders about systems installed
- ICT systems definition on selected site and configuration
- Workshop with stakeholders on planned systems approval
- Gate 2 business models approval workshop
- Instalments

6. CONCLUSIONS

As the environmental awareness in EU rise the governmental officials and energy planning authorities are willing to promote business driven neighbourhood energy solutions. EEPOS is offering versatile business approach for companies to enter the neighbourhood level energy management systems describing various concepts for business opportunities in neighbourhood.

EEPOS consortium has discovered concepts for business models worthy evaluating when running real life demonstration and in simulation testing. Expected out of these model concepts are new NEMS level business ideas and ICT solutions together with already standardised solutions that shall be installed in test environments. Concepts of business models can be used by EU-companies to review the interest of participating this new type of service/product line.

6.1 Summary of achievements

Today technical solutions exist for neighbourhood level energy management activities. Software solutions need to be developed towards more comprehensive automatic management NEMS related activities (e.g. weather information solutions guiding the BEMS systems etc.). The concepts of business models on this report offer a basic view to business solutions for software developers as well as for service providers to being able to adapt business opportunities and enter into neighbourhood level ICT system environment.

Consortium partners have succeeded to find concepts of business models on energy management and decision support systems for energy positive neighbourhoods. The business models selected and presented here are basic models companies attracted in energy positive neighbourhood platform and NEMS operations are able to adopt as business opportunities.

As an update after the previous report five business models were selected and examined more in detail. The selection was based on business proposition that industrial partners recognise. Their connection with EEPOS ICT structure was described and their business proposition was evaluated and they were validated by industrial partners.

The deliverable elaborates selected application scenarios from T1.1 into business model concepts supporting energy trading between buildings within a neighbourhood and buildings, neighbourhoods and the grids. Performance validation methods and criteria are descried of these relations. The business models are be presented here using established modelling methods.

Models for ICT sector, NEMS operator activities and services operators can be found in this report on chapter 3.

6.2 Relation to continued developments

This business model concept report together with market research and validation workshops with stakeholders shall verify the return of investment value the NEMS operation actors need to invest when entering into neighbourhood of BEMS level energy solutions development and services.

The concepts of business models are affecting EEPOS project overall architecture development as there is no idea for companies to build energy management systems that do not provide benefits to the involved stakeholders.

The concepts for business models presented in this report are working as guidelines on further and deeper inside business model generation and exploitation within industrial partners. As a final outcome each partner makes their own conclusion if they process defined business models as part of their daily business.

6.3 Other conclusions and lessons learned

Generating the ideas to the business models included in this report the consortium members discovered that there is remarkable European potential for further development of both different scenarios in energy positive neighbourhood systems as well as new business models. The business opportunities described in the chapter 3 are calculated on local basis. It is easy to see that when perspective is widening to cover national and European scale by increasing the size of neighbourhood area or linking neighbourhood areas together, the opportunities are expanded accordingly.

Consortium sees it very likely that for SME's there are opening attractive business opportunities as in most European countries the current restrictions (legal or practical) are disappearing and opportunities to sell power to the network as well as produce power using equipment suitable for small or private buildings (e.g. solar power, small wind mills etc.) are becoming possible in real life. However based on experiences from demonstrations sites there still are some main challenges to overcome before the new business can break through. The consortium members shall test not only the ICT solutions but also the relevancy of the business models described. It is recommendable to consider joining new business models together with existing business, like service business. The second way to contribute to success of new business is size of neighbourhood area. Demonstrated sites offers rather limited business opportunities. In practice magnitude of neighbourhood area should be 10000 apartments or more to insure sufficient business potential. In addition virtual neighbourhood areas should be considered where the neighbourhood area could be defined by some other factor, like customer, parallel with physical neighbourhood area. Before large scale breakthrough in marker regulation on regulations on European level must be harmonised. The business limitation caused by current regulation could be avoided also by using local energy storages that are out of EEPOS scope.

7. ACRONYMS AND TERMS

ACS ..... Automation Control System

AEC ..... Availability Environment Classification

BACS ..... Building Automation Control System

BEMS ..... Building Energy Management System

CeE ..... Concurrently enrolled EPROs

CHP ..... Combined Heat and Power

DoW ..... Description of Work

DSM ..... Demand Side Management

DSO ..... Distribution System Operator

DSS ..... Distributed System Service

EMG ..... Energy Management Gateway

EPRO ..... Energy PROsumer (consume & produce energy)

ESCO ..... Energy Saving Contract

HSDL ..... Heat Storage on District Level

KPI ..... Key Performance Indicator

MAG ..... Main Grid

NAG ..... Neighbourhood Area Grid

NEMS ..... Neighbourhood Energy Management System

RES ..... Renewably Energy Sources

RTD ..... Research and Technological Development

SaS ..... System as a Service

SME ..... Small and Medium (business) enterprise

TTD ..... Time To Deal

8. REFERENCES

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