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

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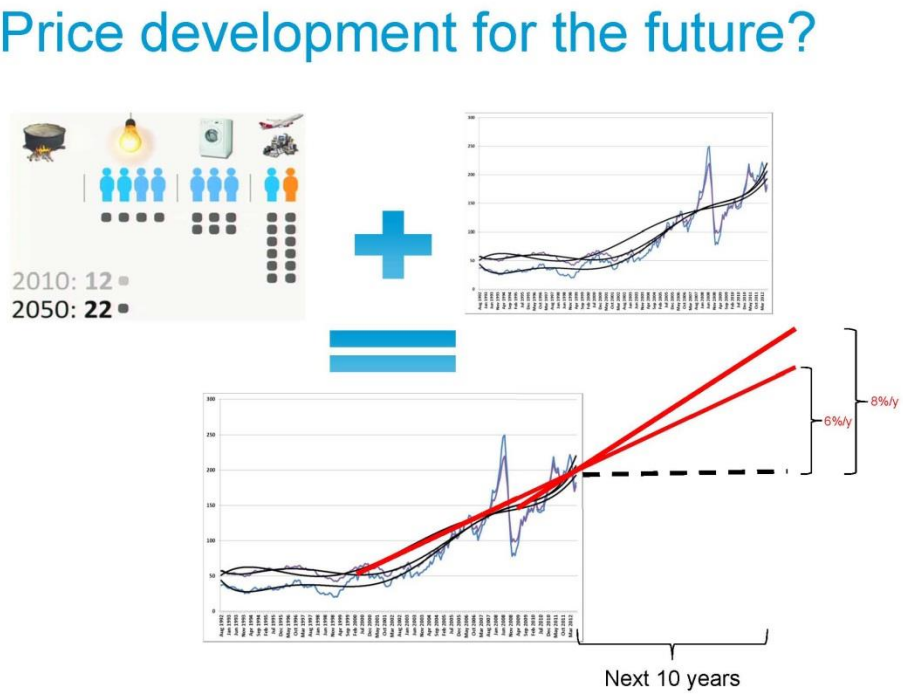
# Concept of Business Models

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# Table of contents

# 1. PUBLISHABLE EXECUTIVE SUMMARY

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

This work does not include expected revenue of profit information which shall be included in deliverable D1.5 at the end of EEPOS project, when field tests and EEPOS concept is more mature to produce information on expected costs and turn over.

**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 stakeholder's 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.

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 are 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 (or its partners) aiming for business growth on energy markets controlled by ICT systems 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. Currentlyfew neighbourhoods 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.

The EEPOS consortium will build on these achievements a more comprehensive structured descriptions of business models (D1.5) including value propositions, involved stakeholders, supporting ICTs, contractual principles ready for adaptation by specific organisations at the end of EEPOS project.

# 2. INTRODUCTION

## 1.1 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 are not yet rolled out in Europe.

The purpose to this document is to point out concepts of 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. Developed business models as well as the developed solutions (within the limits of ownership and property rights of EEPOS partners) are created firstly for generating income. The models are to be tested and adopted for business purposes amongst business partners.

ICT systems, energy brokering and management system, and the automatic and self-learning decision making platform together with behavioural changes will lead to saving energy costs and thus to increasing 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 will 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 at European level.

EEPOS project is also targeted to special groups such as SMEs and other smaller actors. Strategically important organizations are and have to seek partnering with SME companies when focusing their key role in energy management and decision support systems for energy positive neighbourhoods.

Table 1. Target group and their benefits (modified from 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.<br>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 related to 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.

## 1.2 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 30 (D1.5). For this first report, physical meetings were held according to plan, where participants discussed about report situation and homogenous advancement towards commonly accepted deliverable.

As the task leader YIT was assigned 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 assigned 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, YIT, 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. VTT proposed the modelling method, peer reviewed the report and suggested improvements.

Table 2: Task 1.4 time use (person months)

| PMs | VTT | FTM | YIT | 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** |

## 1.3 Baseline

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

The target of EEPOS is to develop concepts for new services and business models that will exploit the intelligent use of energy information. New concepts for business models consider the 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 appendix file.

The following table 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 ( modified from 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.<br>New business models for district level energy services related to smart grids & distributed energy production are under development.<br>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.<br>Business models are supporting energy trading between:<br>a) buildings within a neighbourhood,<br>b) buildings / neighbourhoods and the grids.<br>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.<br>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.<br>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.<br>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.<br>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. |

## 1.4 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).

The most important baseline of the following concepts for business models are the neighbourhood energy management scenarios of task 1.1 from which the industrial partners selected scenarios for business model creation. 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.

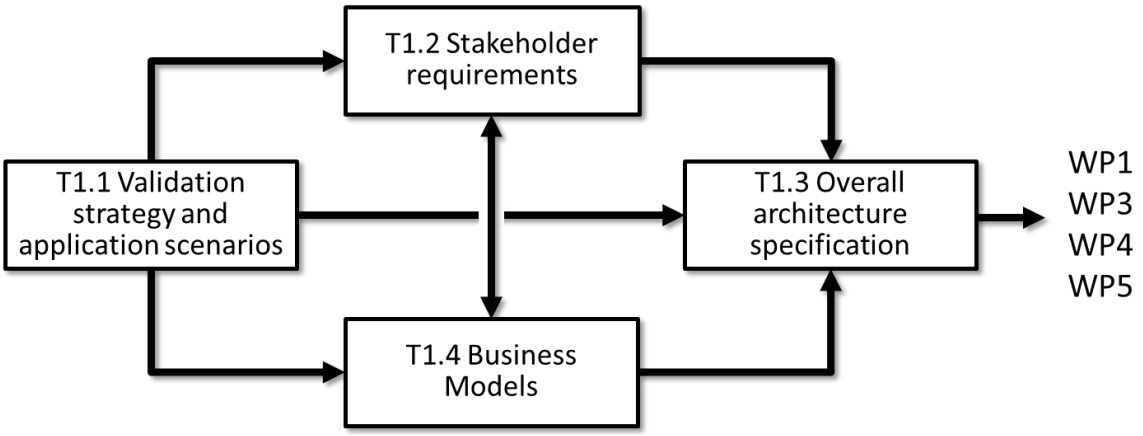


*Figure 1: Business models (T1.4) related to other activities in EEPOS project (source: EEPOS DoW)*

# 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 "Alex 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 will deliver the product/service to them is shown in the Customer section. On the very right side the model shows what actions the customer needs to take in order 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>Offer</th><th colspan="2">Customer</th><th></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.
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.

# 4. CONCEPTS FOR BUSINESS MODELS

The business model concepts presented here are created for business purposes. EEPOS will provide a company seeking for new business opportunities models on how to organize trade between different partners inside neighbourhood energy management system.

## 4.1 NEMS operator

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

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 at the neighbourhood level. This includes monitoring and predictive supervisory control.

By means 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 ACSs (Automation Control Systems). 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 the 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 ACSs.

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<br>Monitoring & service of network.<br>Trade energy.</td><td rowspan="2">Key partners<br>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<br>Maintain local heat & electricity grid.<br>Maintain local energy production equipment.<br>Maintain local building technical system.<br>Manage energy flows within neighbourhood.</td><td rowspan="2">Value propositions<br>Lower energy costs through high (neighbourhood) level energy use optimisation, bulk energy purchase from market and enabling the selling of self-produced renewable energy.<br>More green, sustainable, eco-friendly way of living by optimally utilising existing resources.<br>More affordable investment; comfortable and affordable way (reduced payback time) to start using solar-wind-other renewable energies.</td><td>Customer relationships<br>Automatic customer relations based on agreements made, complemented with personal assistance.</td><td rowspan="2">Customer segments<br>Locally segmented customers (housing companies).</td><td>Customer activities<br>Produce & consume energy.</td></tr>
<tr><td>Partner resources<br>EEPOS system, geothermal network, energy grid, ICT.</td><td>Key resources<br>Physical: NEMS infra, ICT, automation equipment (like sensors).<br>Intellectual: Brand, proprietary knowledge, special partnerships.<br>Human: Service & maintenance personnel.<br>Financial: ESCO principles.</td><td>Distribution channels<br>Direct sales to customer.</td><td>Customer resources<br>Energy grids, energy production equipment.</td></tr>
<tr><td>Partner cost structure<br>Network maintenance, ICT cost, energy trading costs.</td><td colspan="2">Cost structure<br>Costs from Key Activities and Key Resources, NEMS technology costs.</td><td>Performance validation methods and criteria<br>Low energy costs, short technology investment payback time.<br>Eco-friendly living environment (measurable options like refund from recycling of resources).</td><td colspan="2">Revenue streams<br>Monthly revenue stream (e.g. overall system maintenance monthly fee, service fee).<br>Demand based fee.<br>Fee according to agreement validation criteria’s (e.g. payback time for a specific investment net, saving earned split).</td><td>Customer cost structure<br>Fees,<br>service & maintenance of grid & own equipment.</td></tr>
</table>

## 4.2 Energy Prosumer

The 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.

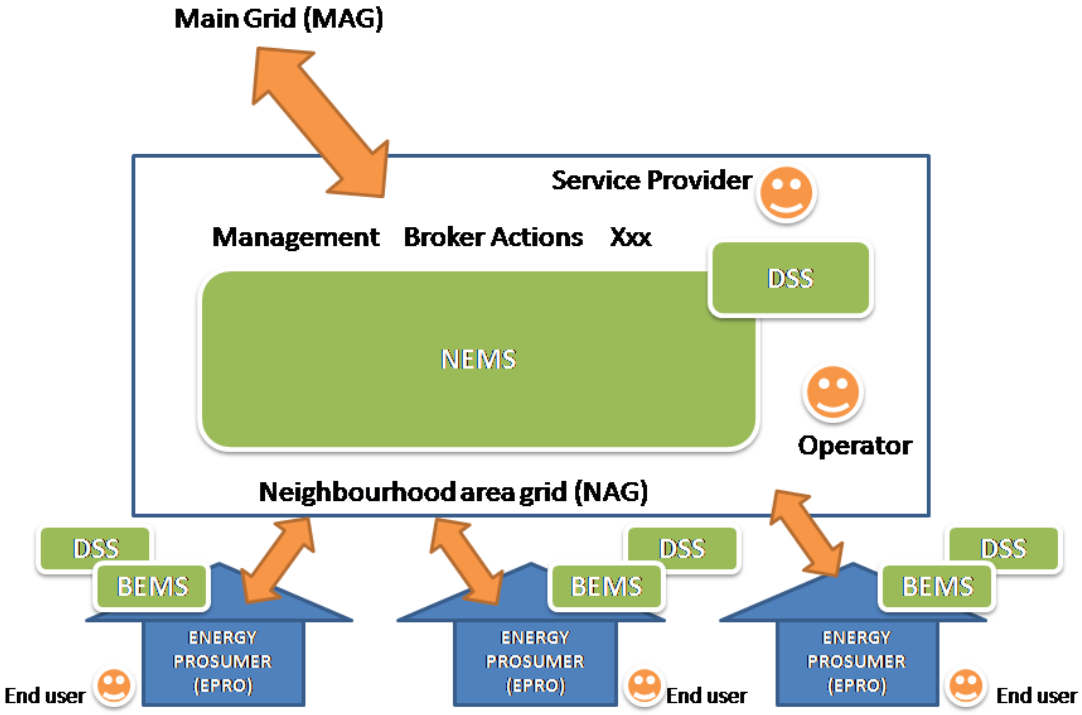


*Figure 2: Overview on key functions and their relationship in neighbourhood area grids (described in EEPOS DoW)*

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 have a mission critical role. This business model describes the approach for these stakeholders.

Table 6: Energy Prosumer business model

<table>
<tr><th colspan="3">Infrastructure</th><th colspan="2">Offer</th><th colspan="3">Customer</th></tr>
<tr><td>Partner activities</td><td rowspan="2">Key partners<br>NEMS operator.<br>Software company (developing ICT / NEMS).</td><td>Key activities<br>Developing trading platform (marketplace and agent-infra-structure) as service on the ICT Platform.</td><td rowspan="2">Value propositions<br>Offering a high quality marketplace environment with individual configurable software-agents which represent the needs of the EPROs and the Energy Service Companies are able to deal in real-time as representatives of their “owners”.</td><td>Customer relationships<br>Classical sell / service relationship (customer buys system and gets maintenance and service).</td><td rowspan="2">Customer segments<br>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<br>Developing environment,<br>ICT platform.</td><td>Distribution channels<br>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<br>Software maintenance (developers), Service Infrastructure (hotline, Training).<br>ICT infrastructure.</td><td>Performance validation methods and criteria<br>The amount of traded energy via the marketplace (compared to the overall traded energy).<br>The Time To Deal (TTD) (measured from the offer to the closing of a deal).<br>Both KPIs are measured automatically and validated continuously (against agreement).</td><td colspan="2">Revenue streams<br>Two different approaches for revenue:<br>a) customer buys system and pays a yearly maintenance / service fee;<br>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 of the 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 offer the basic 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 KPIs 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 use 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 the real estate manager to buy energy when prices are low and storages' states of charge are low. When prices go up the 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 7: 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<br>Monitoring & service of network.<br>Trade energy.</td><td rowspan="2">Key partners<br>External energy experts.<br>ICT experts (data communications).</td><td>Key activities<br>Trade energy.<br>Maintain system stability.</td><td rowspan="2">Value propositions<br>Profit from using the tools.<br>Green thinking.<br>Energy savings.<br>Customers may participate to the definition of the tool.<br>Innovative tools and processes.</td><td>Customer relationships<br>Strategic partnerships.</td><td rowspan="2">Customer segments<br>Building owners.<br>Real estate companies.<br>Facilities service companies.</td><td>Customer activities<br>Produce & consume energy.</td></tr>
<tr><td>Partner resources<br>EEPOS System.</td><td>Key resources<br>Energy brokering tools and technology.</td><td>Distribution channels<br>Personal sales.<br>Exhibitions.<br>Seminars.</td><td>Customer resources</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure<br>Maintenance and updating of software. Man power costs.</td><td>Performance validation methods and criteria<br>Monitor & optimize usage of customer energy.<br>System stability and availability criteria.<br>Energy savings measured compared to targets.</td><td colspan="2">Revenue streams<br>Percentage of the savings validated.</td><td>Customer cost structure</td></tr>
</table>

## 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 does not 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 want 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 8: 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<br>Monitoring & service of network.<br>Trade energy.<br>Energy brokering service.</td><td rowspan="2">Key partners<br>NEMS operator.<br>Energy experts.<br>Software vendor.</td><td>Key activities<br>Energy management.</td><td rowspan="2">Value propositions<br>Profitable tools.<br>Green thinking.<br>Energy savings.<br>Customers may participate in the developing.<br>Innovative tools and processes.</td><td>Customer relationships<br>Classical sell / service relationship (customer buys system and gets maintenance and service.</td><td rowspan="2">Customer segments<br>Energy experts working for: building owners, real estate companies, facilities service companies.</td><td>Customer activities<br>Produce & consume energy.</td></tr>
<tr><td>Partner resources<br>EEPOS System.</td><td>Key resources<br>Skilled and motivated staff.<br>Best tools and technology.</td><td>Distribution channels<br>Direct sales (account management).</td><td>Customer resources<br>Energy production equipment.</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure<br>Software development and updating costs.<br>Software (and related systems) costs maintaining the agreed availability level agreed with the client.</td><td>Performance validation methods and criteria<br>Availability.<br>Agreed level of measurements (saving optimisation etc.).</td><td colspan="2">Revenue streams<br>Monthly fee + additional billed hours.</td><td>Customer cost structure<br>User pays monthly fee for the service (x € per user or x € per site).<br>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's 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 (e.g. 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 developed software. However in some special cases the automatic settings may not be right due to some special reasons (like extreme weather situation, accident, fire etc.) and therefore 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.

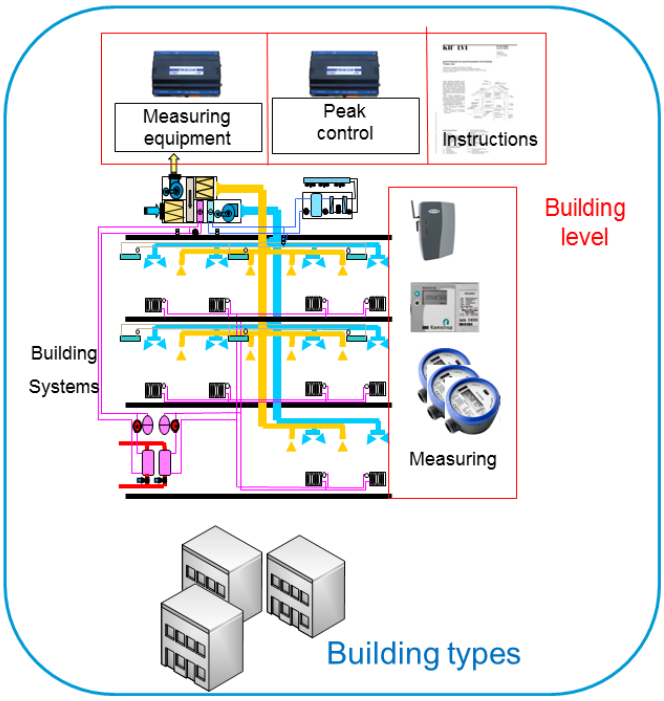


*Figure 3: Measuring and setting equipment in buildings*

Table 9: 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<br>Deliver information.</td><td rowspan="2">Key partners<br>NEMS operator.<br>Electricity provider.<br>Weather forecast company.</td><td>Key activities<br>Automatic & manual adjusting of settings.</td><td rowspan="2">Value propositions<br>Automatic adjusting of settings to save energy costs.</td><td>Customer relationships<br>Automatic.</td><td rowspan="2">Customer segments<br>Housing companies.</td><td>Customer activities<br>Basic settings.</td></tr>
<tr><td>Partner resources<br>Information delivery equipment.</td><td>Key resources<br>Electricity pricing information.<br>Weather information.<br>Self-learning software.<br>Personnel.</td><td>Distribution channels<br>NEMS operator channels.</td><td>Customer resources<br>Web program.</td></tr>
<tr><td>Partner cost structure<br>Maintenance of connections.<br>Collection and delivery of information.</td><td colspan="2">Cost structure<br>Software development.<br>Setting of software.<br>Personnel costs.</td><td>Performance validation methods and criteria<br>Savings of costs.<br>Agreed conditions of maintained buildings.</td><td colspan="2">Revenue streams<br>From housing company:<br>- monthly fee,<br>- software licence,<br>- split of savings.</td><td>Customer cost structure<br>Monthly fee.<br>Licence.</td></tr>
</table>

## 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 the NEMS operator and the software manufacturer. Furthermore, 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-set 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.

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.

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 manage energy consumption by setting limits to cut or delay one or many energy consuming activities.

Table 10: 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<br>Provide information.<br>Maintain self-learning software.</td><td rowspan="2">Key partners<br>Power trading company.<br>Local energy producer.<br>ICT software developer.</td><td>Key activities<br>Automatic cut of high consumption.<br>Monitor high consumption.<br>Predict high consumption.<br>Maintain grid.</td><td rowspan="2">Value propositions<br>Limits are set to equipment in common areas (not controlled by inhabitants) → saving energy<br>Saving peak energy costs even when user needs to use energy consuming equipment.</td><td>Customer relationships<br>Pre-set & automatic (end users are advised to purchase the system for saving without inconveniences).</td><td rowspan="2">Customer segments<br>End user group.<br>Housing company.</td><td>Customer activities<br>Pre-set limits for cut of peak power.</td></tr>
<tr><td>Partner resources<br>Information from local systems, forecasts etc.<br>Software development methods and skills.</td><td>Key resources<br>Physical (grids).<br>EEPOS system.<br>Human.<br>Energy consuming equipment with the ability to cut.<br>Energy production equipment.</td><td>Distribution channels<br>Remote access to local control systems.</td><td>Customer resources<br>Remotely manageable equipment.</td></tr>
<tr><td>Partner cost structure<br>ICT development cost.<br>Monitoring cost (man power).</td><td colspan="2">Cost structure<br>Monitoring activity (automated).<br>Weather forecast (automated).<br>Maintenance of grid.<br>Adjustment of limits.</td><td>Performance validation methods and criteria<br>High peaks are cut without user inconveniences.<br>Limits are (measured to be) correct and within users' pre-set boundaries.</td><td colspan="2">Revenue streams<br>Selling the software or offering it as a service.<br>Brokering fee.<br>Split of savings (possibly).</td><td>Customer cost structure<br>Monthly or demand based fee.</td></tr>
</table>

## 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 to achieve NEMS goals and end users are not willing to participate in costs but are willing to use the tool.

Table 11: 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<br>Bi-directional data exchange.<br>Promotions.</td><td rowspan="2">Key partners<br>NEMS operator.<br>Energy broker.<br>Sponsors e.g. NEMS operator, ESCO, public authorities, companies.</td><td>Key activities<br>Maintain software.</td><td rowspan="2">Value propositions<br>Enable end-users to compare used energy costs & amount of energy with similar users.<br>Entertaining games with concrete trophy.</td><td>Customer relationships<br>Automated.</td><td rowspan="2">Customer segments<br>Private.<br>Housing companies.</td><td>Customer activities<br>Active use of tool.</td></tr>
<tr><td>Partner resources<br>Value adding information.<br>ICT.<br>Personnel.</td><td>Key resources<br>Software development methods & skills.<br>Web server.</td><td>Distribution channels<br>Download (or use) software from the web.</td><td>Customer resources<br>Internet connection.</td></tr>
<tr><td>Partner cost structure<br>Connections to tool.</td><td colspan="2">Cost structure<br>Software development costs.<br>Software update & helpdesk costs.<br>Web service costs.</td><td>Performance validation methods and criteria<br>Energy consumption measures.<br>Energy cost goals for NEMS operator are met.<br>By games specific energy consumption issue is focused and dealt with.</td><td colspan="2">Revenue streams<br>Licencing.<br>Monthly fee.<br>Sponsoring.</td><td>Customer cost structure<br>Monthly fee.<br>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 for 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 do simultaneous energy production and consumption (acting as a prosumer). The card has a credit that can be used to buy power. No other buying terms are allowed. All power consumed decreases credit according to real-time (buying) 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 (selling) 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 uses self-produced power only and sells 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 12: 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<br>Maintain equipment & software.</td><td rowspan="2">Key partners<br>Balance card provider.<br>Balance card operator.<br>NEMS operator.</td><td>Key activities<br>Purchase credit.<br>Produce power.</td><td rowspan="2">Value propositions<br>Control energy costs using balance card.<br>Consume no purchased energy when using sell-only mode.<br>Reduce energy costs using buy & sell mode.</td><td>Customer relationships<br>Automated process.</td><td rowspan="2">Customer segments<br>NEMS operator.</td><td>Customer activities<br>Buy surplus power.<br>Energy brokering.</td></tr>
<tr><td>Partner resources<br>Human.<br>Equipment.</td><td>Key resources<br>Power generation equipment.</td><td>Distribution channels<br>Energy network.</td><td>Customer resources</td></tr>
<tr><td>Partner cost structure<br>Maintenance of software.</td><td colspan="2">Cost structure<br>Maintenance of equipment.</td><td>Performance validation methods and criteria<br>No or low costs of energy used, reported to end user periodically by NEMS operator (or web report).</td><td colspan="2">Revenue streams<br>Sell power.</td><td>Customer cost structure<br>Buy energy</td></tr>
</table>

## 4.9 Automatic demand site management, NEMS-developer

This business model is based on the Neighbourhood Energy Management System (NEMS) as the basic system architecture for 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.

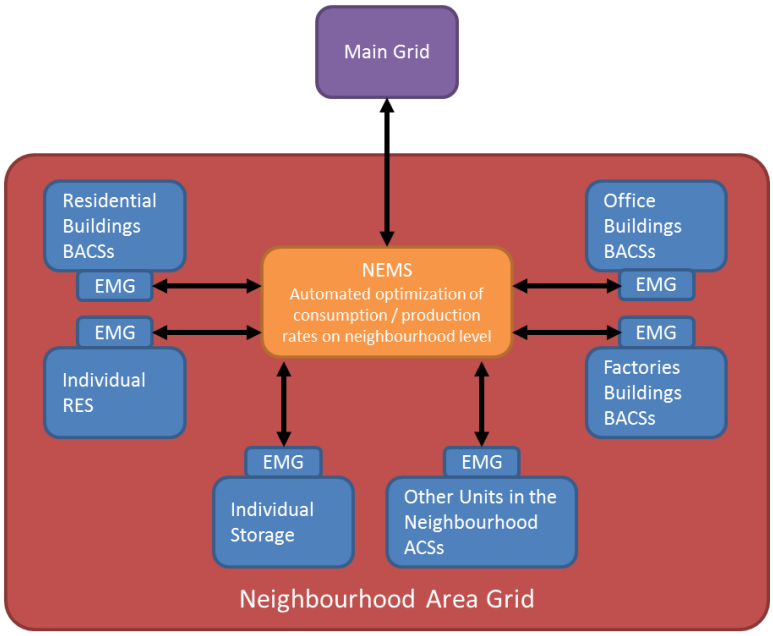


*Figure 4 (from EEPOS report D1.1): Schematic representation: Automated DSM within the neighbourhood. EMG refers to Energy Management Gateway.*

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 13: 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 rowspan="2">Partner activities</td><td rowspan="2">Key partners<br>Hardware manufacturers.<br>Software company (developing BACS / BEMS).</td><td>Key activities<br>Developing and supporting NEMS ICT platform.</td><td rowspan="2">Value propositions<br>Offering a high quality, open NEMS platform with the possibility to add additional services and interfaces.</td><td>Customer relationships<br>Classical sell / service relationship (customer buys system and gets maintenance and service).</td><td rowspan="2">Customer segments<br>Owners and maintainers of NEMS like housing companies and public authorities.</td><td rowspan="2">Customer activities</td></tr>
<tr><td>Key resources<br>Development environment.<br>ICT platform.</td><td>Distribution channels<br>Direct distribution (key account business) supported by exhibitions and professional articles.</td></tr>
<tr><td>Partner resources</td><td></td><td></td><td></td><td></td><td></td><td>Customer resources</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure<br>Software maintenance (developers).<br>Service infrastructure (hotline, training).<br>ICT infrastructure.</td><td>Performance validation methods and criteria<br>Key Performance Indicators are:<br>- Number of participants working with the NEMS at the same time (CeE - Concurrently enrolled EPROs).<br>- Availability Environment Classification (AEC): a high availability of 99.9 % or even more is required (AEC-4).</td><td colspan="2">Revenue streams<br>Two different approaches for revenue:<br>a) customer buys the system and pays a yearly maintenance / service fee,<br>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 hardware companies for interfaces / platform integration and software companies which offer 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 operators) like housing companies and public authorities which use 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 option 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 option 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” (SaaS) should be validated (as alternative to the classical selling approach): Selling the NEMS in the SaaS 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 Automated demand side management, NEMS operator

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.

As in our previously proposed Business models, 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; see Figure 4):

The value proposition – *energy management and optimisation on the NEMS level, energy trading with external parties* – provides measurable ecological and/or social 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 dependent energy tariff based on monitoring and predictive control* – different kind of fees (dependent 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 – production of energy at NEMS level, management, optimisation and 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 14: 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<br>Managing & monitoring energy network.</td><td rowspan="2">Key partners<br>NEMS software developer.<br>Facility operators.<br>Energy producers, traders & distributors.<br>Service & maintenance operators.<br>ICT developers & manufacturers.<br>Financial institutions & ESCO operators.</td><td>Key activities<br>Produce energy at neighbourhood level.<br>Energy management and optimisation.<br>Energy trading with external parties.</td><td rowspan="2">Value propositions<br>Co-ordinated energy management and optimisation on the neighbourhood level.<br>Take part in energy trading with external parties.</td><td>Customer relationships<br>Energy brokering.</td><td rowspan="2">Customer segments<br>End users (residential, office and factory owners and tenants).</td><td>Customer activities<br>Produce & consume energy.</td></tr>
<tr><td>Partner resources<br>EEPOS system.</td><td>Key resources<br>Automation and control system.</td><td>Distribution channels<br>Neighbourhood level energy selling.<br>Energy trading with external parties.</td><td>Customer resources<br>HEMS, BEMS.<br>Neighbourhood grids & equipment.</td></tr>
<tr><td>Partner cost structure</td><td colspan="2">Cost structure<br>Involvement of forecast for production/consumption rates.<br>Calculation of forecasts for customer reaction.</td><td>Performance validation methods and criteria<br>Maintain energy trading activities as in agreement.<br>Sustainable business models (with relevant KPI’s agreed).</td><td colspan="2">Revenue streams<br>Time dependent energy (low cost) tariff based on monitoring and predictive control.</td><td>Customer cost structure<br>Manage & service grid & equipment (ACS).</td></tr>
</table>

## 4.11 Power and heat provision to neighbourhood

The following business model is from possible (and future) scenario proposed in Task 1.1 by Solintel.

The CHP plant on site, as indicated in the figure below, covers the heat demand (central heating and hot tap water) and the electricity demand of the district and delivers the 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 users (buildings).

The EEPOS idea of implementation 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 data and information sharing between producer and end users is necessary (these are shown by the black points in the figure below).

As the CHP uses EEPOS ITC system he at all times knows the actual consumption of the buildings and the dwellings (through BEMS) and is able to manage this information actively. The EEPOS system management at storage level leads the heat, at overproduction, to the storage and steers the heat from the storage back to the heating network when there is underproduction. Electricity overproduction is sold to the grid operator by the neighbourhood broker and steered into the MAG.

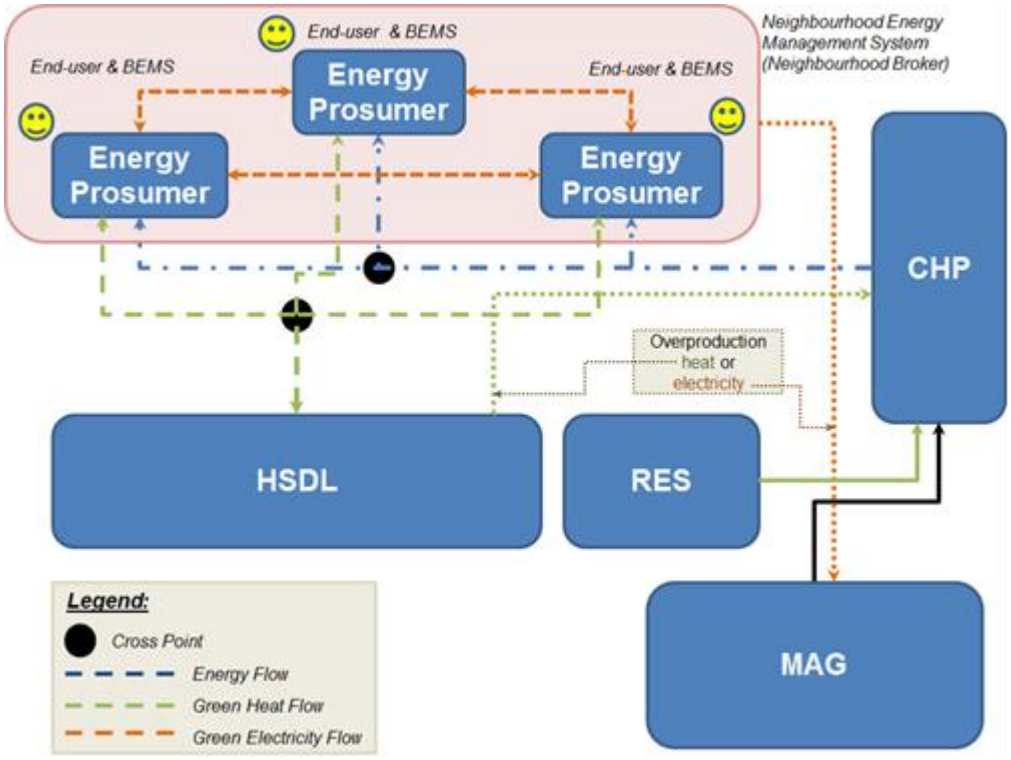


*Figure 5: Overview of neighbourhood area grids and their relationship*

Based on these insights, the four elements of a business model – value proposition, revenue model, customers and services, and key activities and resources – were identified to 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. It reflects to business-society dialog concerning the balance of economic, ecological and social needs. For existing services, a particular balance is embedded into 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)* – 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 consume energy* – 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).

CHP technologies are entering into more mature phase in relation to conventional methods of electricity production, but the gap is still considerable, which presents comparable additional risks.

Investment costs are also called capital or initial costs and consist of equipment and installation costs. The most important equipment costs of a CHP-plant consist of the prime mover, the generator and the heat exchanger (including taxes and transportation to site). The prime movers in the scenarios are micro-gas turbines (micro GT), reciprocating engines (RE) or gas turbines (GT).

| | Installed Costs | Operating & Maintenance Costs |
|---|---|---|
| Reciprocating Engines | 1000€-1800€ per kW | 0.010€-0.015€ per kWh |
| Gas Turbines | 800€-1500€ per kW | 0.005€-0.008€ per kWh |
| Microturbines | 1000€-2000€ per kW | 0.010€-0.015€ per kWh |

Table 15. Installed and Operating & maintenance cost estimation for each CHP prime mover with heat recovery for standard installations

The operational and maintenance costs consist of the fuel used, namely heating oil or natural gas, the electricity cost, the maintenance of the equipment and finally the penalty for CO2 emissions (only for large units). The fuel cost is related to international oil price and is (currently at spring 2013) around 115 $/US barrel. The price of the crude oil given by the international oil markets should be multiplied by a factor which takes into account the transportation costs, the distillation costs and the taxes.

Prime mover and generator lifetime maintenance cost is equal to 10% of the cost of purchase of the prime mover and the generator. Heat exchanger maintenance cost is equal to 2% of the cost of purchase of the heat exchanger.

The value of heat varies greatly between plants, particularly with regard to: type of heat produced (steam, hot water, hot air); source used and price of energy for separate production

of heat; purpose of heat consumption (industrial processes, heating, technical use of operation of unit, etc.); sector where heat is used (industry, households, services, district heating, etc.).

In the CHP field the choice of the most profitable investment is not a simple task. Moreover the words "profitable investment" can be seen in different points of view (i.e., investor point of view, CHP manager point of view and others). The neighbourhood operators, NEMS operator particularly, should consider what's best for the whole neighbourhood whilst the investor of the investment may not always firstly agree with the calculation benefitting the whole neighbourhood level. Many economic parameters must be evaluated in order to find the solution that best fits all these points of view.

Table16: Power and heat provision to neighbourhood - business model for CHP operators

<table>
<tr><th colspan="3">Infrastructure</th><th>Offer</th><th colspan="2">Customer</th><th></th></tr>
<tr><td>Partner activities<br>Manage & monitor energy network.<br>Trading with MAG.</td><td rowspan="2">Key partners<br>Brokers.<br>Building, energy & ICT companies (SMEs).</td><td>Key activities<br>Produce energy in neighbourhood.<br>Manage energy flows.</td><td rowspan="2">Value propositions<br>Low cost energy through optimisation of RES & conventional sources.<br>Sustainable life style by reasonable use of RES & conventional sources.<br>Affordable & feasible way of using new technologies, adapted to particular needs.</td><td>Customer relationships<br>Relationship based on neighbourhood & broker agreements.</td><td rowspan="2">Customer segments<br>End-users (residential & public districts).</td><td>Customer activities<br>Consume heat and power in an optimized way.</td></tr>
<tr><td>Partner resources<br>Energy efficiency expertise.</td><td>Key resources<br>Energy production equipment.<br>EEPOS system.</td><td>Distribution channels<br>Local grids (direct sales).</td><td>Customer resources</td></tr>
<tr><td>Partner cost structure<br>Trading with MAG;<br>ICT & grid maintenance costs.</td><td colspan="2">Cost structure<br>Monitoring local demand by remote control metering.</td><td>Performance validation methods and criteria<br>Low cost of heat and power.<br>Energy savings.</td><td colspan="2">Revenue streams<br>Fees based on demand, permanently monitored.<br>User pays according to savings.</td><td>Customer cost structure<br>Costs for heat and power use.</td></tr>
</table>

# 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 customers have the required resources or should the resources being offered (at least as an additional option)?
- Do the cost structure and revenue model fit the expectations and needs of the customer?

As participants we plan to involve 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.

# 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 when entering the neighbourhood level energy management systems operations, 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. Examples 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.

The business models selected and presented here are basic models that companies attracted in energy positive neighbourhood platform and NEMS operations are able to adopt as business opportunities.

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 described for these relations. The business models are presented here using established modelling methods.

## 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 more deep inside business model generation. More mature business models with test results given by EEPOS project shall be presented at the end of EEPOS project as deliverable D1.5.

Further on the findings on EEPOS project may be used in standardisation of neighbourhood energy management systems. As some EEPOS consortium members have been involved in standardisation committees the consortium acknowledges issues like data exchange protocols and KPIs, require much more detailed information when described as basis for standardisation.

## 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 huge potential for further development of both different scenarios in energy positive neighbourhood systems as well as new business models.

Consortium sees it very likely that for SME's there are opening attractive business opportunities as in most European countries the 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. The consortium members shall test not only the ICT solutions but also the relevancy of the business models described. Information and update of business models shall appear in EEPOS report D1.5 at the end of the project.

The business models shall be tested. Tests shall be carried out in simulation and partly in real life environments (partly tested in real life as a whole business model). The validation of business models will be taken place when testing or by workshop experts, not only by the systems but also by the rationality of stakeholders participating neighbourhood energy management systems activities, as described by EPPOS project.

Possibility to run a number of "business games" where participants play the roles of different stakeholders and negotiate contracts about new services/systems shall be inspected. This shall require proper planning and moderation.

# 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

HEMS ..... Home Energy Management System

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

SaaS ..... System as a Service

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

TTD ..... Time To Deal

# 8. REFERENCES

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[2] Erwin Fielt (2010): An Extended Business Model Canvas for Co-Creation and Partnering. http://fieltnotes.blogspot.fi/2010_12_01_archive.html