



BestRES

Best practices and implementation
of innovative business models
for renewable energy aggregators

Improved Business Models of selected aggregators in target countries

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www.bestres.eu



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This report has been produced within the BestRES project “Best practices and implementation of innovative business models for Renewable Energy aggregatorS”.

The logos of the partners cooperating in this project are shown below and information about them is available in this report and at the website: www.bestres.eu

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The legislative proposals presented by the European Commission on 30th November 2016 in its package "Clean Energy for All Europeans" (covering energy efficiency, renewable energy, the design of the electricity market, security of electricity supply and governance rules for the Energy Union) are expression of its exclusive right of legislative initiative. The Package was the starting point for the still ongoing ordinary legislative procedure which gives the same weight to the European Parliament and the Council of the European Union. At the end, the proposals of the Commission - each in a more or less modified form - will be adopted jointly by the European Parliament and the Council as European laws. The concrete proposals cited in this study still might change during the legislative process and shall be understood rather as a general description of an issue to be regulated than a finalized legal setting.

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List of abbreviations and acronyms

ACER	Agency for the Cooperation of Energy Regulators
aFRR	Automatic Frequency Restoration Reserve, see R2
BM	Business Model
BMC	Business Model Canvas
BRP	Balancing Responsibility Provider
CACM	Capacity Allocation and Congestion Management
CAPEX	Capital Expenditures
CCGT	Combined Cycle Gas Turbine
CHP	Combined Heat and Power
DR	Demand Response
DSM	Demand Side Management
EC	European Commission
DSO	Distribution System Operator
EED	Energy Efficiency Directive 2012/27/EC
EPC	Engineering, Procurement, Construction
ESCO	Energy Service company
EV	Electric Vehicles
FCR	Frequency containment reserve also R1
FiP	Feed-in-Premium
FiT	Feed-in-Tariff
GPRS	General Packet Radio Service
IEM	Internal Energy Market
ICT	Information and Communication Technology
LCA	Life Cycle Analysis
mFRR	Replacement reserve see R3
MSD	Ancillary Services Market in Italy
OTC	Over-the-counter
OPEX	Operational Expenditures
PPA	Power Purchase Agreement
TFEU	Treaty on the Functioning of the European Union

R1	Primary reserves also frequency containment reserve (FCR)
R2	Secondary reserves also frequency restoration reserve (aFRR)
R3	Tertiary reserves also replacement reserve (mFRR)
RES-E	Electricity generation from renewable energy sources
RTP	Real-time-pricing
ToU	Time-of-Use
TSO	Transmission System Operator
VPP	Virtual Power Plant

Executive summary

Within the BestRES project, business models identified in the report “*Existing business models for renewable energy aggregators*”¹ have been further improved allowing aggregators to offer new products and services.

In this context, the present report presents improved business models for aggregators in selected European target countries. These improvements address multiple aspects, such as a more competitive trading of renewable generation, better customer relationships and more integrated energy service provision (e.g. energy management, maintenance, etc.). Table 1 summarizes the identified improved business models. Business models in the target countries are sometimes very similar and lessons learnt from one country can therefore be used to further improve business models in the other countries

Table 1: Improved business models of all aggregators, including a short explanation

Aggregator	Improved business model	Explanation
Good Energy (UK)	Automation and control	Provision of hard- and software solutions allowing customers to automate their devices.
	“Peer-to-peer” (local) energy matching	Unite customers and generators on a local level and create value for both.
Next Kraftwerke Germany (Germany)	Dispatch flexible generation under changing market design on multiple markets	Increase value for generators by trading on multiple market places under changing market design, e.g. spot, balancing and reserves markets.
	Suppling „mid-scale“ customers with time variable tariffs including grid charges optimization	Time variable tariffs (especially grid charges) including monitoring will help consumers to benefit from market signals.
Next Kraftwerke Germany (France)	Providing decentralized units access to balancing markets	Distributed generators benefit from portfolio effects.
Next Kraftwerke Germany (Italy)	Market renewables on multiple market places	Forecasting quality can be increased by using live data and portfolio effects. Valorizing pooled generation at dispatch and balancing markets.
Next Kraftwerke (Belgium)	Trading PV and Wind power	Market the generation of renewable generators. As an effect of portfolio effects, benefits could be achieved.
	Using flexibility of customers as third party	This improved business model aims for customers whose supplier is not marketing flexibility. Flexibility can be valorized by an aggregator without changing the supplier.
Oekoström AG (Austria)	Demand Side flexibilization of small customers	Activates demand side potential of customers. Allows a shift to a more integrated energy service provider.

¹BestRES report “Existing business models for renewable energy aggregators” Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/>

	Invest and market distributed generation of customers in apartment houses	This improved business model aims in the market integration of solar generation of customers in apartment houses.
EDP (Portugal)	Activation and marketing of end user's flexibility.	Flexibility of customers will be activated and valorized on energy markets.
EDP (Spain)	Activation and marketing of end user's flexibility.	Flexibility of customers will be activated and valorized on energy markets.
FOSS (Cyprus)	Pooling flexibility for local balancing market and energy service provision.	Because the Cypriot markets are not opened yet, this improved business model uses aggregation for providing DSO services.

Business model canvases help us to visualize changes in the aggregators' business models in a comprehensive way. In order to allow the reader to understand the business models in detail, this report contains business models canvases for both current and improved aggregator business models.

The core of all aggregator business models is creating value and revenues by aggregation. Most aggregator business models (9 out 13 improved business models) aim to valorize aggregation at wholesale, balancing and reserve markets.



Figure 1: Future opportunities related to the "Clean-Energy-Package"

As Figure 1 illustrates, major changes in the electricity market design can be expected from the "Clean-Energy-Package": active customers, local energy communities, demand response, balancing markets, dispatching of generation and demand response, redispatching and curtailment. To achieve this transformation, new market participants and business opportunities for business model implementation are desirable. This report illustrates that the proposed improved business models are designed to address future market and regulatory needs.

1. Introduction

In the past, European electricity markets were designed around centralized fossil-fuel generation along national or regional borders. The electricity market landscape is however changing because a rising share of distributed generation increases intermittency and price volatility in the system. This requires a more flexible system with more flexible consumption. As highlighted in the state aid guidelines published in April 2014 by the European Commission, this implies that renewable sources are better integrated in electricity markets and rely less on subsidies as was the case in the past. Renewable energy aggregation can significantly accelerate the integration of intermittent electricity sources, enhance demand flexibility and decrease the reliance on renewable energy support schemes.

More aggregation and market integration can however not be achieved by single individual, commercial or domestic consumers since they would only have a limited impact. It is only through a coordinated steering of vast amounts and types of consumers and producers in a market that the use of distributed generation, demand response and battery storage can be effective. Abundant literature has been published regarding demand response management and more and more market players are active in this field but management of distributed generation and storage including electric vehicles is less developed. An explanation might be that this approach requires the extensive use of new technological solutions and ICT to directly control consumption and generation at lower costs.

For this reason, there is an important role for Renewable Energy Aggregators who act on behalf of individual producers and consumers and use technological solutions and ICT for optimization. They are defined as legal entities that aggregate the load or generation of various demand and/or generation/production units and aim at optimizing energy supply and consumption either technically or economically. In other words, they are facilitators between the two sides of electricity markets. On the one hand, they develop energy services downstream for industrial, commercial or domestic customers who own generation and storage units or can offer demand response. On the other hand, energy aggregators are offering value to the market players upstream such as BRPs, DSOs, TSOs and energy suppliers to optimize their portfolio and for balancing and congestion management. Furthermore, wholesale electricity markets might benefit from aggregation if appropriate incentives are present. A last option is that energy aggregators offer value to specific customers such as is the case for ESCOs. In this situation, the player downstream and upstream could potentially be the same entity.

1.1 The BestRES project

The main objective of the BestRES project is to investigate the current barriers and to improve the role of Energy Aggregators in future electricity market designs. In the first stage, the project has focused on existing European aggregation business models taking into account technical, market, environmental and social benefits. In the second stage, we have developed improved business models that are replicable in other countries in the EU considering market designs and with a focus on competitiveness and LCA. These improved business models will then be implemented or virtually implemented with real data and monitored in the following target countries: United Kingdom, Belgium, Germany, France, Austria, Italy, Cyprus, Spain and Portugal.

The BestRES project will last three years. It entered into force on 1st March 2016 and will end on 28th February 2019.

The target group, the Renewable Energy Aggregators, has been directly involved in the BestRES project consortium as partners:

- Good Energy, renewable energies aggregator active in United Kingdom
- Next Kraftwerke Belgium, renewable energies aggregator active in Belgium
- Oekostrom, renewable energies aggregator active in Austria
- Next Kraftwerke Germany, renewable energies aggregator active in Germany, France and Italy
- Energias de Portugal, renewable energies aggregator active in Spain and Portugal

The BestRES activities to be implemented in Cyprus will be carried out by FOSS, the research centre for sustainable energy of the University of Cyprus. This is due to the fact that there are no aggregators in Cyprus for the time being (2016) and no market entrants are expected until 2020.

The innovative business models to be provided during the project will be based on on-going business models available in Europe and adapted to the future market design by research institutions and energy expert partners such as the Energy Economic Group of the Technical University of Vienna (TUW-EEG) and 3E. The consortium also includes a legal expert, SUER (Stiftung Umweltenergierecht /Foundation for Environmental Energy Law), who will provide a relevant contribution to the development of National and European recommendations on the business models implementation.

The BestRES project is coordinated by WIP - Renewable Energies. The project communication and dissemination will be carried out by WIP with the support of Youris.

A short description of the BestRES project partners is provided in the following paragraphs.

WIP - Renewable Energies (WIP)

WIP - Renewable Energies has been founded in 1968 in Munich, Germany, and has been active in the renewable energy sector for over three decades, working with both industrial and public sector clients at the international level. The company's mission is to bridge the gap between research and implementation of sustainable energy systems. WIP's interdisciplinary team of professionals provides consultancy services to improve the grid and market integration of renewable energies. WIP offers project development, project management, technical supervision and realization of projects, which involve the co-ordination of international consortia. WIP counts more than 300 projects accomplished. WIP organizes international events in the field of renewable energies. Website: www.wip-munich.de



3E

3E is an independent consultancy and software service company, delivering solutions for performance optimisation of renewable energy and energy efficiency projects. We provide expert services to support project developers, asset managers, operators, investors and policy-makers and our key areas of expertise are solar, wind, sustainable buildings & sites and grids & markets. Bridging the gap between R&D and the market, 3E combines in-house innovation and partnerships with leading R&D centres. 3E's international team operates from Brussels (HQ), Toulouse, Milan, Istanbul, Beijing and Cape Town. The company has a project track-record of over 15 years in over 30 countries. Website: www.3e.eu



Technische Universitaet Wien (TUW-EEG)

The Energy Economics Group (EEG) is a department of the Institute of Energy Systems and Electric Drives at TU Wien, Austria. The core fields of research of EEG are: (i) system integration strategies of renewable and new energy technologies, (ii) energy modelling, scenario analysis and energy policy strategies, (iii) energy market analysis in general (competition and regulation), (iv) sustainable energy systems and technologies and (iv) environmental economics and climate change policies. EEG has coordinated and carried out many international as well as national research projects, international and national organizations and governments, public and private clients in several fields of research. Website: www.eeg.tuwien.ac.at



Stiftung Umweltenergierecht (SUER)

The Foundation for Environmental Energy Law (Stiftung Umweltenergierecht - SUER) was created on 1 March 2011 in Würzburg. The research staff of the foundation is



concerned with national, European and international matters of environmental energy law. They analyze the legal structures, which aim to make possible the necessary process of social transformation leading towards a sustainable use of energy. Central field of research is the European and German Law of renewable energy and energy efficiency. The different legal instruments aiming towards the substitution of fossil fuels and the rise of energy efficiency are analyzed systematically with regard to their interdependencies. Interdisciplinary questions, e.g. technical and economical questions, are of particular importance. Website: <http://stiftung-umweltenergierecht.de/>

Good Energy

Good Energy is a fast-growing, 100% renewable electricity supplier, offering value for money and award-winning customer service. Good Energy is proud to have been the first dedicated 100% renewable electricity supplier in the UK, with over 68,000 electricity customers - a mix of residential and commercial supplies - 38,000 gas customers and supports over 112,600 homes, business and communities generating their own renewable energy. We source our supply from a large and growing network of over 1,000 independent generators across the country, in addition to operating our own wind farms and solar farms. Website: www.goodenergy.co.uk



Next Kraftwerke Belgium (NKW BE)

Next Kraftwerke Belgium pools distributed renewable generation and flexible demand in a virtual power plant (VPP). We trade and deliver the aggregated power on the most relevant markets and, most importantly, we make the virtual power plant's flexibility available to the grid operator to support the management of the Belgian power system. Next Kraftwerke Belgium is a joint venture with Next Kraftwerke GmbH in Germany. Website: www.Next-Kraftwerke.be

NEXT

KRAFTWERKE

Next Kraftwerke Germany (NKW DE)

Next Kraftwerke Germany is the operator of a large-scale Virtual Power Plant (VPP) and a certified power trader on various European energy exchanges (EPEX). The concept of a Virtual Power Plant is based on the idea to link and bundle medium- and small-scale power producing and power consuming units. The objective is to smartly distribute supply and demand and to profitably trade the generated and consumed power. Next Kraftwerke's VPP now bundles around 3,000 medium- and small-scale power-producing and power-consuming units. Among other energy sources, it includes biogas, wind, and solar power generators. Next Kraftwerke also operates in Belgium, France and Austria. Website: <https://www.next-kraftwerke.com/>

NEXT

KRAFTWERKE

Oekostrom

Oekostrom AG is a holding company owned by about 1.900 stockholders. It was founded in 1999 aiming at building a sustainable energy industry, supplying customers with clean energy and supporting the development of renewable energy sources in Austria. All products and services of oekostrom AG represent an active contribution to climate and environmental protection and increase independence from fossil and nuclear energy sources. Oekostrom AG engages in the fields of power production, trading, sales and energy services and currently supplies 100 % renewable energy from Austria to more than 52.000 customers in all parts of the country. Website: <http://oekostrom.at/>

oekostrom AG

Research Center for Sustainable Energy of the University of Cyprus (FOSS)

The Research Centre for Sustainable Energy of the University of Cyprus (FOSS) was created in order to play a key role in research and technological development activities in the field of sustainable energy within Cyprus and at international level with the aim of contributing to the achievement of the relevant energy and environment objectives set out by Europe. FOSS is heavily involved in all spheres of sustainable energy spreading from sources of energy, smoothly merging RES in the integrated solutions of the grid, development of enabling technologies such as storage and ICT that will facilitate the seamless merging of sustainable technologies in the energy



system of tomorrow, the complete transformation of energy use by the effective introduction of sustainable alternatives in meeting the needs for mobility, heating and cooling and exploring ways of achieving even higher levels of efficiency in all areas of the economy. Website: <http://www.foss.ucy.ac.cy>

Centre for New Energy Technology (EDP-CNET)

EDP Group is an integrated energy player, with strong presence in Europe, US and Brazil and the third player in the world in terms of wind installed capacity. EDP is an innovative European Utility with an important presence across all the energy value chain, in Generation, Distribution, Energy Trading and Retail of electricity and gas. EDP owns HC Energia, the 4th Energy Utility in Spain and Energias do Brasil. EDP Centre for New Energy Technologies (EDP CNET) is a subsidiary of the EDP Group with the mission to create value through collaborative R&D in the energy sector, with a strong focus in demonstration projects. Currently, EDP has no activity as an aggregator, but, as the electricity sector evolves, EDP may consider aggregation either on the generation or supplier side through different companies within EDP Group. In the scope of this project EDP has chosen to focus on the supplying activity, therefore the information provided in this report is focused on the retailer side.



Websites: <https://rd-new.com> and <http://www.edp.pt/en/Pages/homepage.aspx>

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youris.com GEIE is an independent non-profit media agency promoting the leading-edge European innovation via TV media and the web. youris.com designs and implements media communication strategies for large research organizations and EU-funded projects and is able to establish permanent links between the research communities and the media. youris.com media products cover a wide spectrum of research areas including ICT, Environment, Energy, Health, Transport, Nanotechnologies, Food, Society, Gender and many others and are designed for large-scale distribution world-wide. Youris.com is a European Economic Interest Group (EEIG) based in Brussels with branch offices in Italy, Germany and France. Website: <http://www.youris.com>



1.2 Purpose/Structure of the document

The objective of this report is to develop and describe new business models of renewable energy aggregators in Europe. The document is structured as follows:

- Section 1 introduces the project.
- Section 2 briefly outlines the project methodology.
- In Section 3, we introduce new business model of aggregators. For this purpose, the current business model of the aggregator will be improved subsequently. Various business models to better accommodate aggregator BMs in electricity systems will be discussed.
- In Section 4, significant design aspects of improved business models addressing opportunities as defined in the “Clean-Energy-Package” (also called “Winter Package”) will be considered. Aggregator relevant elements are described. Additionally, a description how improved business models fit with these future opportunities will be provided.
- Section 5 concludes all design aspects of the improved business models covered by the consortium.

2. Methodology

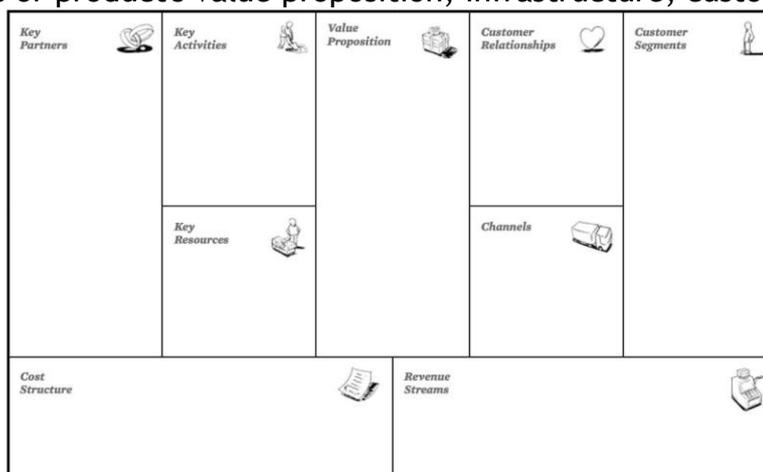
The definition of a business model (BM) according to Osterwalder et al. (2010) can be defined as follows:

A business model describes the rationale of how an organization creates, delivers, and captures value

In accordance with Osterwalder et al. (2010) and with the BestRES report “Existing business models for renewable energy aggregators”, a BM Canvas is a very well-known strategic management and entrepreneurial tool that is used to analyze business models for various businesses. It defines the following nine BM building blocks (see Figure 2) to describe a company’s activities:

- **Customer Segments:** An organization serves one or several Customer Segments.
- **Value Propositions:** It seeks to solve customer problems and satisfy customer needs with value propositions.
- **Channels:** Value propositions are delivered to customers through communication, distribution, and sales Channels.
- **Customer Relationships:** Customer relationships are established and maintained with each Customer Segment.
- **Revenue Streams:** Revenue streams result from value propositions successfully offered to customers.
- **Key Resources:** Key resources are the assets required to offer and deliver the previously described elements ...
- **Key Activities:** ... by performing a number of Key Activities.
- **Key Partnerships:** Some activities are outsourced and some resources are acquired outside the enterprise.
- **Cost Structure:** The BM elements result in the cost structure.

The blocks can be combined into a BM Canvas, a visual chart with elements describing a firm's or product's value proposition, infrastructure, customers,



and finances.

Figure 2: The Canvas Business Model (source BestRES report “Existing business models for renewable energy aggregators” and Osterwalder et al. (2010))

BM of aggregators in European target countries have been developed within the scope of the BestRES Project. The BM Canvases are attached in the document’s appendix (see section 0 A.1 Current Business Model and 0 A.2 Current Business Model canvases within the Consortium). Improved BMs have been developed in collaboration with aggregators. Based on the aggregator’s current BMs, improved BMs could be developed in multiple ways: either by increasing the economic value or by entering new markets.

Figure 3 shows the applied methodology. Improved BMs result in changes of the BM Canvas, although not all BM elements have to be modified. Figure 3 indicates these changes in various color blocks. Most improvements are related to improvements in revenues or costs. After discussing the improved BM, the aggregators’ feedback was integrated. Finally, feasible improvable BMs are identified by the consortium and will be explained in depth in the following sections.

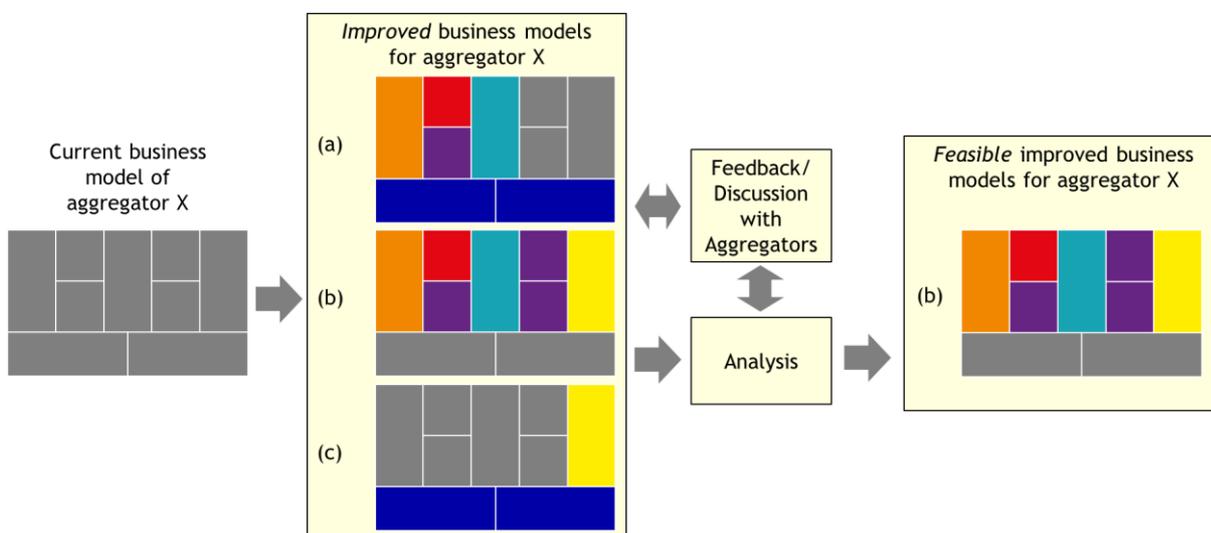


Figure 3: Methodology used for generating BM improvements. Most essentially was an iterative feedback from aggregators in target countries.

3. Improved Business Models for Aggregators in the BestRES Project

The content of this chapter describes improvements and the adaption of BM tasks for the market and financing options of energy aggregation in the target countries. The aim is to eliminate limitations indicated in the BestRES report “Technical, legal and regulatory barriers for optimal deployment and operations of current business models”². Various measures to better accommodate aggregator BMs in electricity systems have been discussed.

One important guideline for the improvement is the goal of limiting curtailment of RES-E power at times of voltage/frequency increase, as well as the enhancement of DSM, storage, VPPs to reduce the RES power injection as a function of local voltage level and/or frequency. At the same time, beneficial effects of local RES-E generation e.g. in times of high loads on the grid will be evaluated in improved BMs. The improvements of the aggregator BMs are focused to be close to the physical load flows in the electricity grid and to balance the volatility of RES-E locally. Therefore, the market options of improved BMs include the following exemplary benefits (see report BestRES “*Technical, market, environmental and social benefits of aggregation BMs within the consortium*” for a more comprehensive description³):

- **General benefits of aggregation:** improved security of supply and market integration, prosumer and consumer empowerment, CO₂ emissions reduction and boosted competition and innovation, more competition on the energy markets and therefore lower end-user prices.
- **Market benefits:**
 - For aggregators:
 - Portfolio optimization.
 - Increased market access with decentralized units.
 - Improve the relationship between prosumers and aggregators.
 - For providers of aggregation services: increased revenues and a reduced energy bill.
 - For users of aggregation services:
 - Access to cheaper reserves (and wholesale) markets for TSO/traders.
 - Lowering balancing costs for the BRP.
- **Technical and social benefits:**
 - Use for congestion management.
 - Develop new models and identification with the energy transition.
 - Use of frequency control.
 - Better understanding of prosumers, energy bills and markets.

² BestRES report “Technical, legal and regulatory barriers for optimal deployment and operations of current business models”: <http://bestres.eu/about-project/results/>

³ BestRES report “Technical, market, environmental and social benefits of aggregation BMs within the consortium”: <http://bestres.eu/about-project/results/>

All BMs will be improved from the aggregator's perspective. All BMs described in this report displays the aggregator's perspective, while the perspective of other market participant will be mentioned but not discussed in detail.

3.1 Current Business Models within the Consortium

Current business models (BMs) for renewable energy aggregators have been described in detail in the BestRES report "*Existing business models for renewable energy aggregators*⁴". This chapter summarizes BM descriptions by referring to the associated BM Canvas in appendix. Further information on BM canvas generation (e.g. a detailed description of all BM elements) can be found in the BestRES report "*Existing business models for renewable energy aggregators*" and in Osterwalder et al. (2010).

For the sake of simplicity, BM canvases of all aggregators are listed in Appendix 0 "A.2 Current Business Model canvases within the Consortium":

- **Good Energy (United Kingdom):** The BM of Good Energy can be found in section 0 (page 65).
- **Next Kraftwerke Germany (Germany):** Next Kraftwerke Germany's BMs for Germany are enlisted in section 0 (page 66).
- **Next Kraftwerke Germany (France):** Next Kraftwerke Germany's (France) BM can be found in section 0 (page 67).
- **Next Kraftwerke Germany (Italy):** Next Kraftwerke Germany has not implemented a BM in Italy up to this moment.
- **Next Kraftwerke (Belgium):** Next Kraftwerke (Belgium) current BM can be found in section 0 (page 68).
- **Oekostrom AG (Austria):** Oekostrom AG's (Austria) current BM can be found in section 0 (page 69).
- **EDP (Portugal):** The current BM of EDP (Portugal) can be found in 0 (page 70).
- **EDP (Spain):** EDP's (Spain) BM is enlisted in 0 (page 71)
- **FOSS (Cyprus):** Currently no BM is implemented in Cyprus. Therefore, no BM is available.

For purposes of comparison Table 2 (developed in the BestRES report "Existing business models for renewable energy aggregators") shows the matching of current BMs with aggregators. The aim of the following chapter is to improve these BMs according to multiple objectives. Therefore, elements in current BMs will be added or deleted.

⁴ BestRES report "Existing business models for renewable energy aggregators" Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/>

Table 2: Matching of aggregator BMs with aggregators in the BestRES project.

	Aggregator-supplier	Aggregator-BRP	Delegated aggregator	Aggregator as service provider	Prosumer as aggregator
Good Energy (United Kingdom)	X		/		
Next Kraftwerke Germany (Germany)	X	X	X		
Next Kraftwerke Germany (France)	/	X	X		
Next Kraftwerke Germany (Italy)					
Next Kraftwerke (Belgium)	/	X	X		
Oekoström AG (Austria)	X	X			
EDP (Portugal)	/				
EDP (Spain)	/				
FOSS (Cyprus)					

X=BM that is implemented in the beginning of 2016

/=BM that the aggregator is planning to implement in the short to medium-term (2 to 3 years)

3.2 Overview of Improved Business Models covered by BestRES

Within the next sections, improved BMs based on discussions with the aggregators are described. In summary, the following improved BMs have been identified:

Good Energy (United Kingdom) will provide customer energy services by the improved BM “Automation and control” on a very local level. The second improved BM “Peer-to-peer” (local) energy matching” allows them to increase welfare on a regional level.

In Germany Next Kraftwerke will improve their BM to “Dispatch flexible generation under changing market design on multiple market” and “Supplying „mid-scale“ consumers with time variable tariffs including grid charges optimization”. While the first BM aims to increase trading performance, the second BM will improve customer relation with a more integrated energy service provision.

For improvements in their BM in France, Next Kraftwerke will “Provide decentralized units access to balancing markets”. This will help renewable and distributed generators to increase profits and ensure the efficiency of market operations.

Next Kraftwerke just started its business in Italy. The first product will be “Market renewables on multiple market places”. Therefore in Italy, Next Kraftwerke will use its system in order to transmit live data of the assets to the VPP system. Thus, the forecasting quality can be increased and imbalance costs reduced. As a further improvement, Next Kraftwerke (Italy) plans to participate in the MSD with a pool of generation assets. This could enable renewables to participate in flexibility markets in Italy and increase revenue streams as well as contributing to system stability.

Next Kraftwerke (Belgium) will adopt parts of the Next Kraftwerke Germany strategy by implementing “*Trading PV and wind power from third party assets*”, while the improved BM “*Using flexibility of customers as third party*” will help to acquire new customers.

Oekoström AG (Austria) will implement “*Demand Side flexibilization of small customers*” and “*Valorize distributed generation of customers in apartment houses*”. Both BMs aim at residential customers.

EDP (Portugal and Spain) will market flexibility in their improved BM “*Activation and marketing of end user’s flexibility*”. Multiple industrial applications will be marketed on spot and balancing markets.

While energy markets in Cyprus are not opened yet, FOSS (Cyprus) will provide “*Local aggregation services for providing flexibility to grid operation including congestion management*”. Although this will be a very specific BM for Cyprus only, this BM helps to make aggregation services in Cyprus feasible.

To illustrate BM improvement, existing BM Canvases will be used as initial points. Subsequently new elements will be added to the BM Canvases. Of course, cancellation of existing elements may be necessary too.

3.3 Improved business models of Good Energy (United Kingdom)

As written in the BestRES report “Existing business models for renewable energy aggregators”, Good Energy is currently classified as “*aggregator-supplier*”, although implementing the BM “*delegated aggregator*” is planned in short to medium term. In the following section, possible improved BMs are qualified. In total, two feasible improved BMs for Good Energy have been identified:

- Automation and control and
- “Peer-to-peer” (local) energy matching.

While the first improved BM is more focused on activating flexibility (of generation and consumption) on a customer level, the second BM aims to enable the end customer (i) to visualize the origin of consumed electricity and (ii) actively procure electricity from specific plants.

3.3.1 Automation and control

Based on the current BM of Good Energy, “Automation and control” represents a significant shift to the BM energy service provider. For BM implementation, multiple add-ons have to be included, as shown in Figure 4. By providing end consumers with automation, multiple benefits could be achieved. Savings in energy costs seem to be the most beneficial for addressing the customer’s need. By enabling end consumers to activate flexibility via home automation systems, end consumers will be enabled to (i) reduce their electricity (and energy) bill and (ii) actively allow participation in energy markets.

Good Energy’s key activities address the development of algorithms, contract provisions, metering and billing issues. Costs for metering and billing seem to be the most important component of additional costs incurred by implementing the improved BM. The costs have to be covered by additional revenues. The most important revenue stream tends to be revenues from hard- and software provision additional to revenues for metering and billing. If the customer’s flexibility is successful on the market, further revenues could be acquired. A further advantage of this BM is the availability of existing soft- and hardware solutions. This fact by itself does not only help in implementing the improved BM much faster, but also reduces soft- and hardware development costs.

Besides monetary advantages, this BM could help to increase the aggregator-customer relationship. While there is a severe competition between energy suppliers, provision of energy services seems to be a way to promote the customer loyalty. In the end, this leads to monetary gains too and helps to integrate future products.

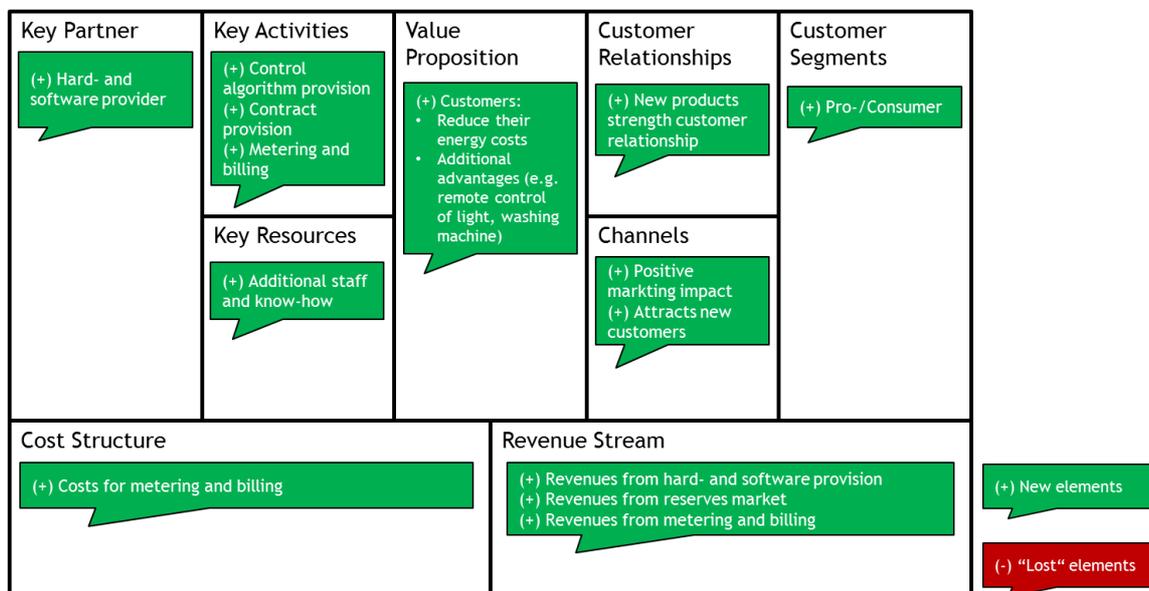


Figure 4: Improved BM canvas of Good Energy (UK) “Household automation and control”

This update/improvement allows Good Energy to adapt their BM towards an “aggregator as service provider” if flexibility is market on the consumer’s risk or

“*delegated aggregator*”, if flexibility is market on the aggregator’s risk⁵. An implementation of this BM will help Good Energy to diversify their portfolio and lower the risk.

3.3.2 “Peer-to-peer” (local) energy matching

The “*peer-to-peer*” concept is a very innovative way in introducing local energy markets. According to Hall and Roehlich (2015) the “Peer-to-peer” concept can be described as follows: “*The Peer to Peer archetypes use virtual platforms to enable consumers to buy directly from generators. The technical and organisation innovation that allows this to happen is relatively new and still requires a fully licensed supply partner to make sure consumers continue to receive power when the supply from the intermittent generators is low.*”

A possible concept including Good Energy as a licensed supplier is shown in Figure 6. Most important is the local matching of generation (provided by independent generators) and consumption (by customers). To ensure synchronized matching a software platform (including an operator) is needed. Not only matching of generation and consumption can be provided by such a common platform, additional information such as prices and the origin of electricity generation and consumption are visualized on a map. Similar to the food retail sector, the customer’s need in consuming “local products” could be satisfied. Figure 5 shows the simplified visualization of a peer-to-peer process. Piclo⁶ is an online platform that performs peer-to-peer energy matching for businesses. Good Energy is a partner ensuring continual balancing.



Figure 5: Peer-to-peer energy matching visualized on a map. Source: <https://piclo.uk/>

⁵ Detailed information describing aggregator BMs and the aggregator’s risk is available in BestRES report “Existing business models for renewable energy aggregators” Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/>

⁶ Source: piclo (2017) <https://piclo.uk/>

It is also essential to deal with over- and underproduction given that a significant amount of generation is provided by RES-E, which are characterized by volatile generation. For the sake of supplying the given demand, licensed suppliers have to be included in the “peer-to-peer” concept. This additional market participant helps in marketing the “peer-to-peer” communities’ generation and consumption⁷ as well as providing balancing services and financial clearing.

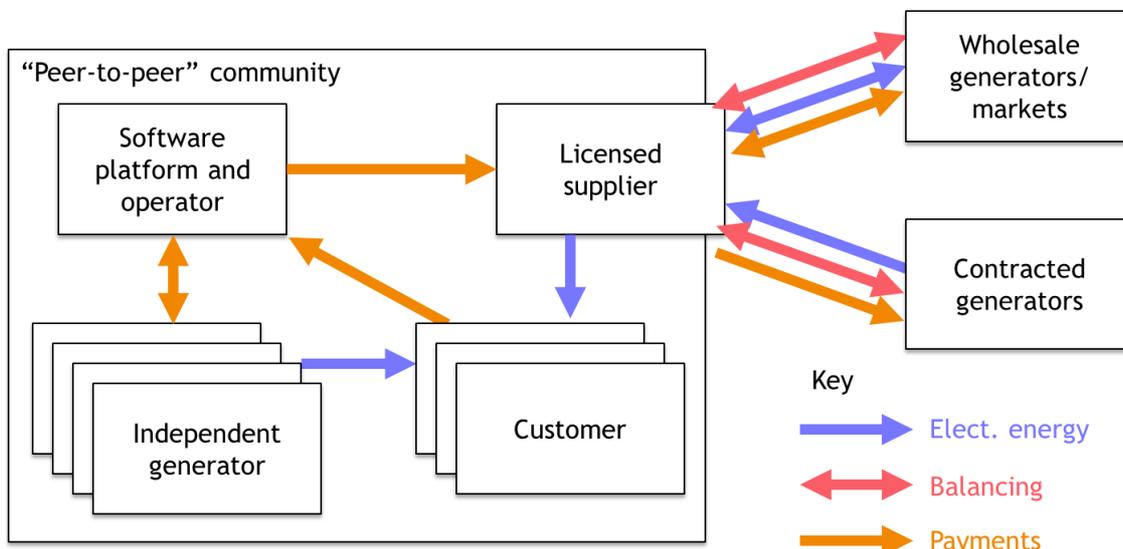


Figure 6: Concept of BM “Peer-to-peer” (local) energy matching”

The main part of Good Energy’s improved BM “Peer-to-peer” (local) energy matching” addresses the marketing of the peer-to-peer community’s generation and consumption as well as providing market access. Additionally, establishing and operating the peer-to-peer communities requires an essential asset: a software platform (as piclo⁸), which tends to be a conceivable part of Good Energy’s BM.

Figure 7 shows the BM canvas of operating a “peer-to-peer” community’s software platform and balancing. Key activities will be the metering and billing, balancing and contract provision. If Good Energy runs the software platform itself (currently not planned), this key activity has to be taken into account as well. Additional activities cause additional costs such as costs for balancing, staff, metering and billing. Apart from the pro- and consumers, generators and DSOs are equally key actors. Generators are enabled in selling their production either on local energy markets (provided by peer-to-peer communities) or wholesale markets. Customers do have the same freedom of choice, while their preference of favored generation source can be taken into account as well. Due to the rules of unbundling DSOs will not buy and sell generation via peer-to-peer communities. Cases of congestion could rather be solved by forwarding appropriate price signals to peer-to-peer communities. Currently “distribution

⁷ Selling overproduction and suppling underproduction by buying electricity at wholesale markets.

⁸ piclo (2017) <https://piclo.uk/>

use of system” (DUoS) charges are split into 3 time periods; Red, Amber and Green. These charges vary per distribution company (Source: utilitywise (2017); PCMG (2017)). Figure 8 shows the applicable time bands for selected companies⁹.

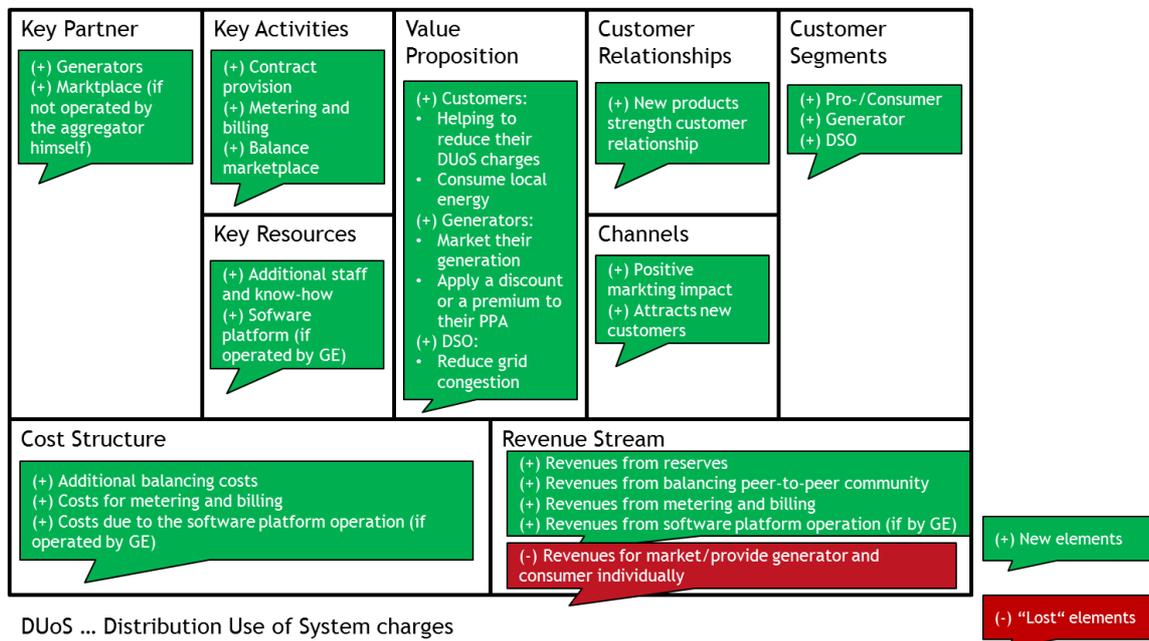


Figure 7: Improved BM canvas of Good Energy (UK) “Peer-to-peer” (local) energy matching”

Distribution Company	Band	Monday - Friday (including holidays)	Weekends
Western Power - Midlands, South West & Wales (EMEB & MIDE)	RED	16:00 - 19:00	
	AMBER	07:30 - 16:00 & 19:00 - 21:00	
	GREEN	00:00 - 07:30 & 21:00 - 24:00	ALL DAY
Western Power - Midlands, South West & Wales (SWALEC)	RED	17:00 - 19:30	
	AMBER	07:30 - 17:00 & 19:30 - 22:00	12:00 - 13:00 & 16:00 - 21:00
Western Power - Midlands, South West & Wales (SWEB)	RED	17:00 - 19:00	
	AMBER	07:30 - 17:00 & 19:00 - 21:30	16:30 - 19:30
	GREEN	00:00 - 07:30 & 21:30 - 24:00	00:00 - 16:30 & 19:30 - 24:00
	RED	16:00 - 19:30	

Figure 8: Applicable time bands for peak demand charges for selected distribution system companies Source: utilitywise (2017).

Most revenues could be achieved by balancing the peer-to-peer community as well as metering and billing the peer-to-peer community’s participants. Although

⁹ According to utilitywise (2017): “The fourteen local Distribution Networks (owned by six Distribution Network Operators - DNOs) take power from the National Grid and distribute it to end users. DNOs charges consist of: (i) The availability/capacity supply charge; (ii) Excess availability charge (applicable only if the agreed supply capacity is exceeded); (iii) Reactive power; (iv) Standing charge; (v) Unit rates - there are three time band periods in which these rates are split into; Red, Amber and Green. Energy suppliers use the time banding that are created by the regional distribution companies, these are different depending upon the company supplying that region but tend to be around the evening on weekdays”

any kind of peer-to-peer platform may attract new customers, opportunity costs caused by enabling generators and customers matching themselves, have to be taken into account as well.

The implementation of peer-to-peer concepts allows Good Energy to adapt their BM towards an “*aggregator as service provider*” and “*delegated aggregator*” if generation and flexibility is marketed at the aggregator’s risk¹⁰. In near future, this BM may attract only marginal groups of customers and generators initially but the possibilities are manifold.

3.4 Improved business models of Next Kraftwerke Germany (Germany)

Next Kraftwerke Germany (Germany) is currently (according to the outcomes of the BestRES report “*Existing business models for renewable energy aggregator*”¹¹) classified as “*aggregator-BRP*” and “*delegated aggregator*”. In the following section, improved BMs have been qualified. Two feasible improved BMs for NKW Germany (Germany) have been identified in total:

- Dispatch flexible generation under changing market design on multiple market and
- Supplying „mid-scale“ consumers with time variable tariffs including grid charges optimization

The first improved BM is focused on activating flexibility (of generation) on multiple market places such as balancing and reserve markets. The second BM aims to enable consumer participation on the electricity markets by forwarding an appropriate price signal as well as providing input for optimization algorithms.

3.4.1 Dispatch flexible generation under changing market design on multiple market

Next Kraftwerke has already a long-time experience in optimizing flexible decentralized generation in Germany. In the future, it is expected that the market design for aFRR products will change from weekly products towards shorter availability-periods and daily procurements. These changes (visualized in Figure 9) offer new possibilities for controllable decentralized units for balancing market participation.

¹⁰ Detailed information describing aggregator BMs and the aggregator’s risk is available in BestRES report “*Existing business models for renewable energy aggregators*” Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/>

¹¹ See above

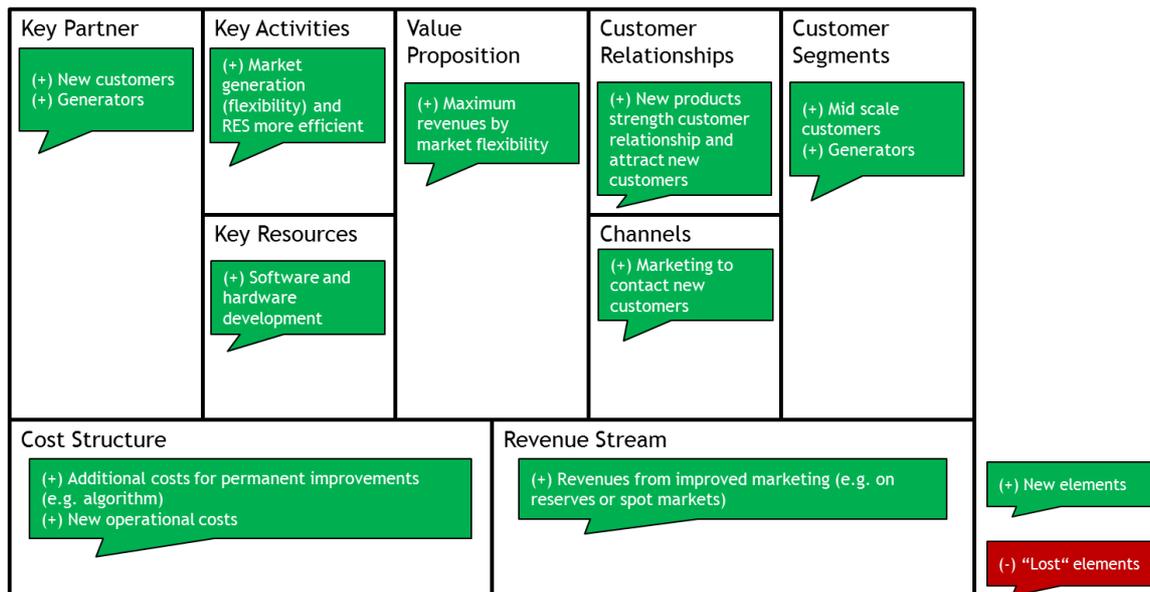


Figure 9: Improved BM canvas of Next Kraftwerke Germany (Germany) “Dispatch flexible generation on multiple market places”

The key activities of the current BM could be further improved by taking advantage of the changed market design and using the assets flexibility in the market where it is valued the most. However, the improvement requires sophisticated algorithms, which enables ongoing optimization and short term information processing. These improvements could optimize the flexibility revenues from decentralized generation capacities also in case they are dealing with certain restrictions such as heat supply obligations.

3.4.2 Supplying „mid-scale“ consumers with time variable tariffs including grid charges optimization

Supplying customers with time variable tariffs enables them to participate in electricity markets. Currently, Next Kraftwerke offers a couple of flexible power supply products, which could be differentiated in terms of pricing periods and frequency of price adaptations (see Figure 10). The flexible pricing refers to price signals from short-term wholesale markets such as Day-Ahead Market and Intraday Market. The prices are forecasted and periodically adapted by the Next Kraftwerke’s trading team. However, the electricity prices for end consumers are not only consisting of wholesale prices, but rather components such as grid charges and EEG surcharges are influencing the end consumer’s electricity bill. The improvement of the flexible electricity supply approaches the electricity costs in a holistic manner by optimizing further electricity costs components such as capacity tariffs or taking into account individual grid charges in accordance with § 19 Section 2 of the StromNEV¹². Individual grid charges can be applied in case the customer’s consumption profile can avoid high peaks in periods when load peaks occur in the grid. To sum up, the improved flexible supply optimizes wholesale prices and grid charges for the customer.

¹² StromNEV (2016) <http://www.gesetze-im-internet.de/stromnev/>

This approach causes further costs due to increased information processing but reduces the costs of the consumer and thus could make the product more attractive whereas the revenue stream for aggregator-supplier stays pretty much the same.

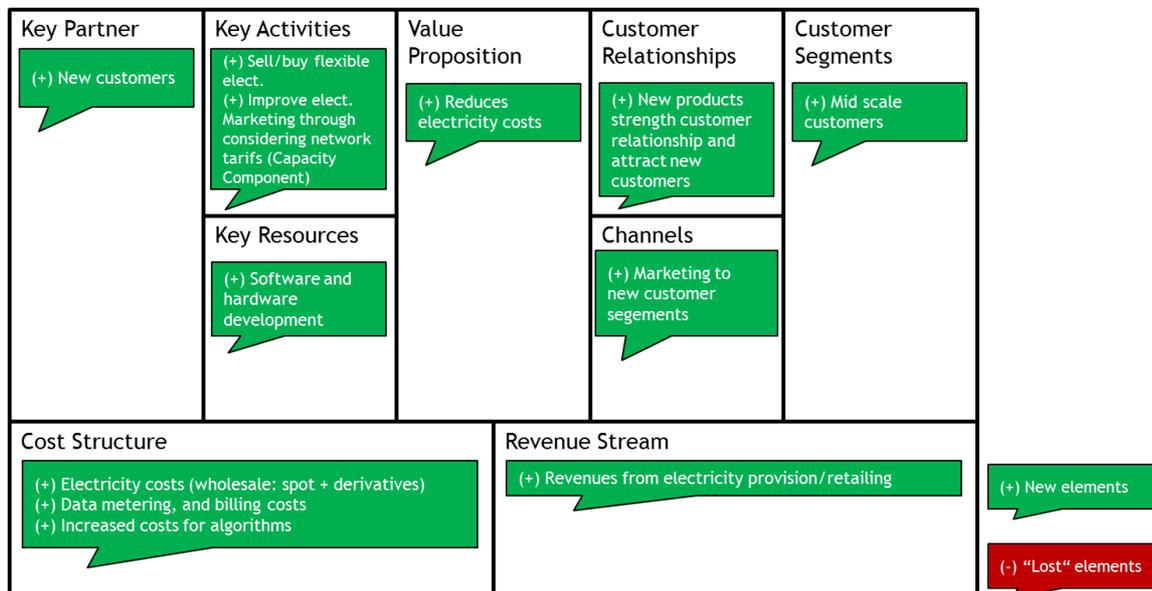


Figure 10: Improved BM canvas of Next Kraftwerke Germany (Germany) “Suppling „mid-scale“ customers with time variable tariffs including grid charges optimization”

3.5 Improved business model of Next Kraftwerke Germany (France)

Next Kraftwerke Germany (France) is currently¹³ classified as “aggregator-BRP” and “delegated aggregator”. One feasible improved BM for NKW Germany (France) has been identified: Providing decentralized units access to balancing and reserves markets. This BM mainly aims at improving the competitiveness of distributed generation by diversifying potential market places.

3.5.1 Providing decentralized units access to balancing and reserves markets

Next Kraftwerke offers trading services for renewable generation in France (see Figure 11). In order to increase the revenue streams, Next Kraftwerke aims to enhance market participation and flexibility provision. Currently, renewables which are subsidized by the *complément de rémunération* (market premium model) can be ramped down by Next Kraftwerke in case negative prices occur and hence cover that particular market risk for the plant operator.

¹³ According to BestRES report “Existing business models for renewable energy aggregators” Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/>

Next Kraftwerke wants to improve its services by enabling pooled controllable producers to participate in further flexibility markets such as ancillary services. However, the participation of aggregated units is still hampered due to market design barriers such as secondary market for aFRR as well as symmetrical activation. In case of favorable market design changes, which are already announced by the “Clean energy package”¹⁴ controllable renewables could participate in balancing markets and tap additional revenue streams.

Next Kraftwerke aims to offer a high quality of ancillary services in terms of activation speed for the TSO but also regarding maximized value for the plant operators. Therefore, a high quality of forecasting activities is needed in order to guarantee sufficient but also maximized balancing capacity out of the fluctuating availability of controllable renewables such as smaller scale hydro.

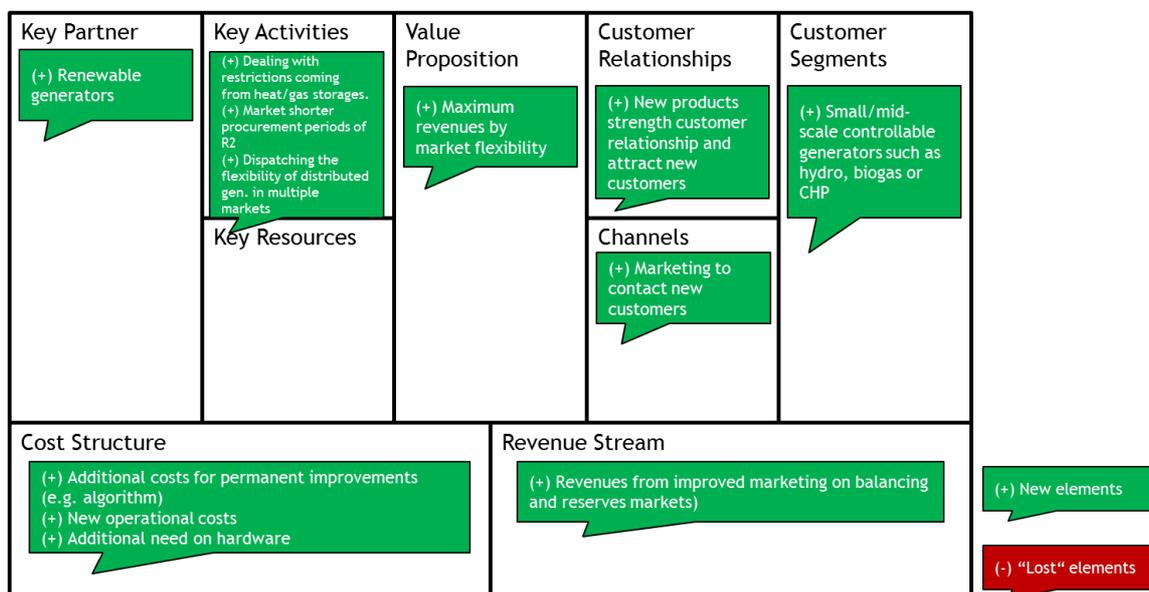


Figure 11: Improved BM canvas of Next Kraftwerke Germany (France) “Providing decentralized units access to balancing and reserves markets”

3.6 Improved business model of Next Kraftwerke Germany (Italy)

Next Kraftwerke Germany (Italy) is currently entering the Italian market. Therefore, each offered product has to be tailored to Italian market conditions. Next Kraftwerke’s first product will be the trading of renewable generation. In order to forecast renewable generation in an appropriate manner, Next Kraftwerke plans to use its technology to transmit live data. One further improvement of the BM for NKW Germany (Italy) could be the access to the MSD-Market for pooled units. The MSD market is the Ancillary Service Market and is operated by Terna, the Italian TSO. It is used for the procurement of secondary and tertiary reserve, changes of plant dispatch (Central Dispatch System) as well

¹⁴ <http://ec.europa.eu/energy/en/news/commission-proposes-new-rules-consumer-centred-clean-energy-transition>

as for releasing intra-zonal congestions. This market is currently limited to controllable producers with capacity above 10 MVA. Additional information, provided by Next Kraftwerke Germany, regarding the Italian Market could be found in Appendix “A.3 - A.3 Overview of the Italian Electricity Market”.

3.6.1 Market renewables on multiple market places

Although the improved BM of NKW Germany (Italy) in Figure 12 seems to be very extensive, compared to the other aggregators’ BMs, it has to be taken into account that NKW Germany is currently entering the Italian market. Consequentially starting a very new BM requires more efforts, than improving an existing one. Because the BM does not much differ in its basic principles from those in Germany and France, the description in Verhaegen and Dierckxsens (2016) describes many of those points. However, the market conditions vary in Italy compared to Germany and France and therefore detailed adjustments of the BM are necessary.

For instance, the Italian balancing market (see Zani and Migliavacca (2014)) is divided in six balancing zones (corresponding to the Italian day ahead market zones). Therefore, assets generating electricity do not have the same value; rather revenue expectations correlate with the asset’s spatial location. In addition, also the procurement design of the MSD-Market as well as the Intraday Market, which is only consisting of auctions, requires customization and improvements of the current BM of NKW.

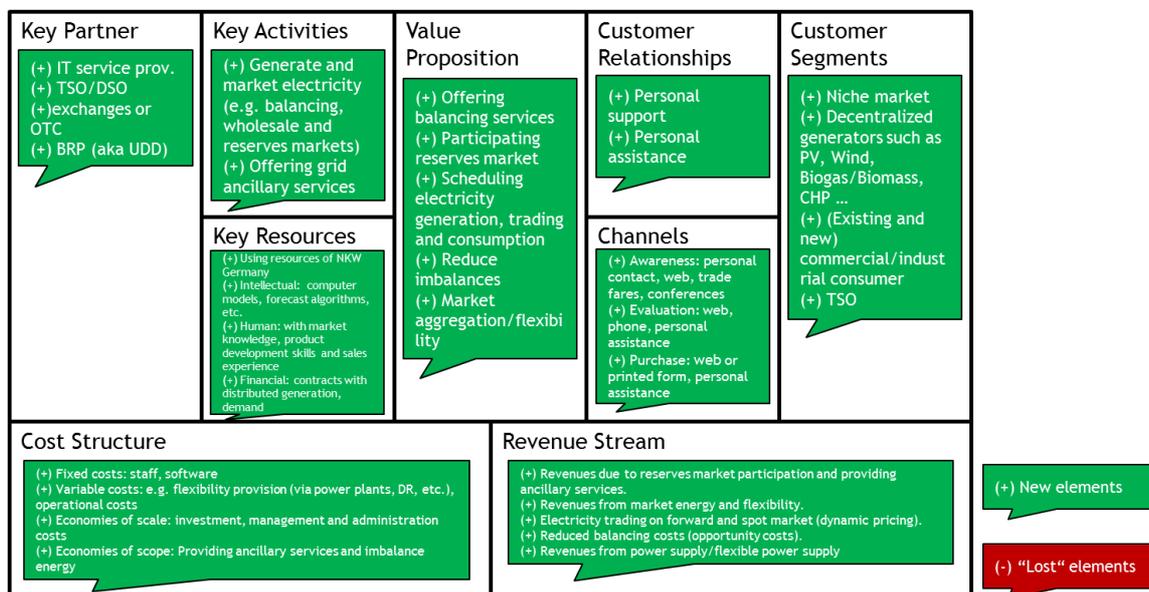


Figure 12: Improved BM canvas of Next Kraftwerke Germany (Italy) “Market flexibility on multiple market places”

3.7 Improved business models of Next Kraftwerke (Belgium)

Next Kraftwerke Belgium (Belgium) is currently¹⁵ classified as “*aggregator-BRP*” and “*delegated aggregator*”. In the following section improved BMs will be explained in detail, whereupon two feasible improved BMs for NKW Belgium have been identified:

- Trading PV and wind power from third party assets and
- Using flexibility of customers as third party.

The first improved BM is focused on marketing a renewable portfolio, while the second BM aims at the marketing of flexibility of customers (with existing supply contract) without being the supplier itself. The type of customers is different for each BM: The first BM is designed to meet the need of renewable generators entering the markets with a lack of understanding of the electricity market, while the second is developed for (mid to large-scale) end-consumers. The first BM follows the objective to transfer a successful BM of Next Kraftwerke Germany to Next Kraftwerke Belgium. Next Kraftwerke buys renewable power from PV and wind power producers and trades it on the energy markets by effectively using the data collected and processed by Next Kraftwerke’s virtual power plant.

3.7.1 Trading PV and wind power from third party assets

The virtual power plant (VPP) run by Next Kraftwerke and based at the Group HQ in Germany connects more than 4000 technical units. Large shares of the installed capacity in the portfolio is wind and PV. The VPP collects large amounts of data from renewable sources. Furthermore, Next Kraftwerke generates various forecasts (wind, PV, other generation, demand, prices...) for trading and portfolio management purposes that are equally processed in the VPP. This puts Next Kraftwerke in a perfect position to trade renewable energy resources. Being a successful trader for weather dependent renewables (PV and wind), Next Kraftwerke quickly grew a large portfolio for these two technologies.

Based on this experience it is a logical step to transfer this BM to Next Kraftwerke Belgium and target independent renewable energy producers with price competitive PPA contracts. Figure 13 shows the improved BM’s Canvas. The proposed values for renewable generators are multiple: (i) reduced imbalance costs (resulting in better PPA agreements), (ii) real time monitoring and (iii) better flexibility contract options.

There are three main barriers in trading RES from third parties:

¹⁵ According to BestRES report “Existing business models for renewable energy aggregators” Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/>

- The volume of renewable generators that look for a contract in the next years might be limited, because most generators might have closed PPAs for almost the complete project lifetime to have investment security.
- Long-term PPAs require hedging on the forward markets.
- In Belgium, most generators want to sell their green certificates along with the energy produced. The market of green certificates is either represented by a minimum price to the relevant authorities or by bilateral over-the-counter (OTC) trades. There is no common market place and there are furthermore only few brokers active on this market. This makes the market entry more time-consuming. Secondly, the certificates might be issued with a delay by the authorities, while the producer wants a pre-financing of these certificates resulting in a negative cash flow impact.

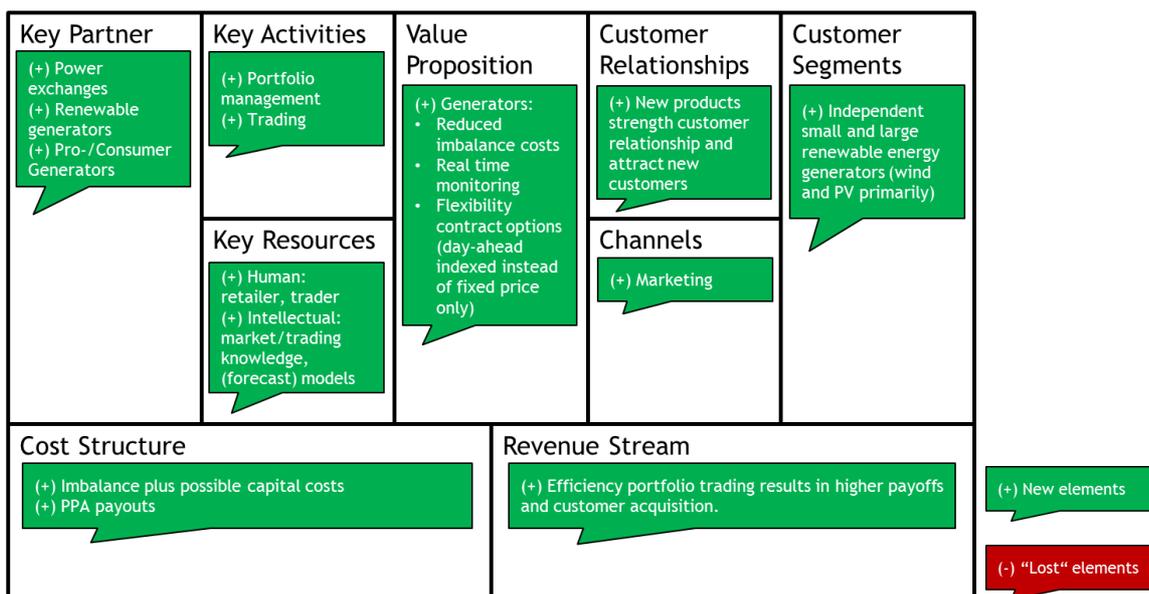


Figure 13: Improved BM canvas of Next Kraftwerke Belgium (Belgium) “Trading PV and wind power from third party assets”.

3.7.2 Using flexibility of customers as third party

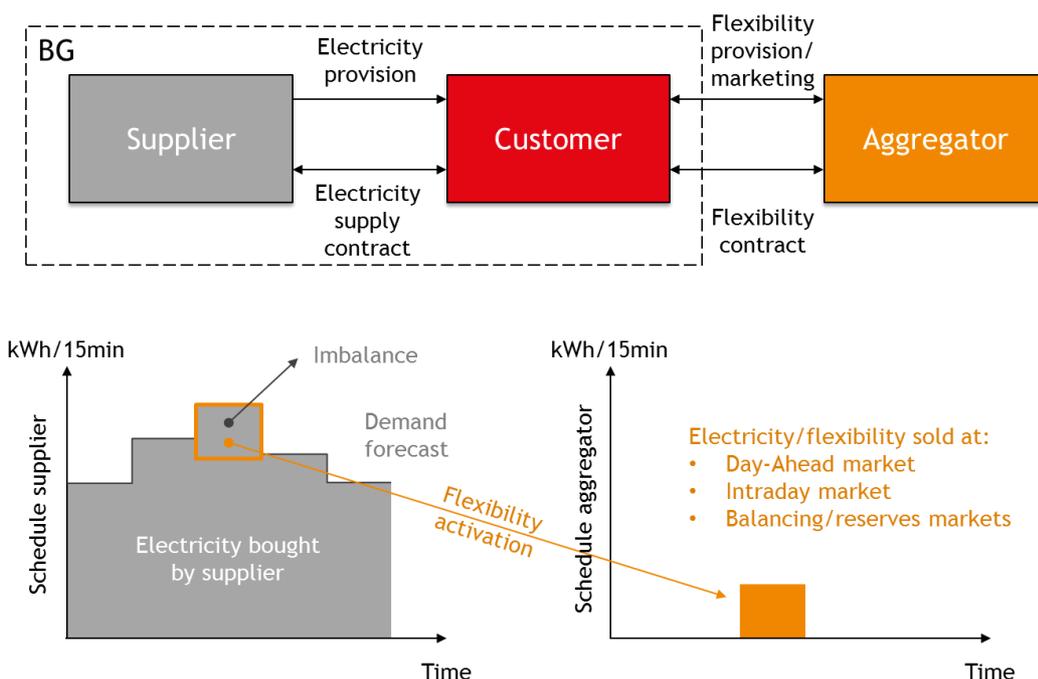


Figure 14: Concept of "Using flexibility of customers as third party"

The second BM addresses marketing of flexibility as shown in Figure 14. This BM targets customers with an existing electricity supply contract and with another balancing responsible party. If the customer holds any kind of flexibility and wishes to market it, an additional flexibility contract with the aggregator needs to be concluded.

This however means that the aggregator can typically not directly valorize the flexibility without also entering in a bilateral agreement with the supplier/BRP, for the following reasons:

- To fully valorize the flexibility, the activated volumes need to be transferred to the aggregator’s balancing group. He can then sell the volume to the markets.
- Even if the energy is transferred, meaning the BRP of the supplier is corrected for the transferred volume, the meter based on which the client is billed for the consumed/injected electricity is not automatically corrected as well. Therefore, a financial settlement might have to take place.
- If no transfer of energy is implemented, the aggregator cannot put the flexibility on the market as the impact of steering load or generation is only seen in the BRP’s perimeter.

There are some cases of reserve power in which the transfer of energy is not needed as there is either a positive impact or an insignificant impact on the BRP’s perimeter. This is for instance the case for upward reserve power products as the activation results in a positive imbalance. In this case, the BRP directly

benefits from the activation. The supplier however, might claim that a positive activation by the reduction of consumption leads in total to a lower annual consumption which again is a negative financial impact. Therefore, also for positive reserve power products this case is limited to products that are only rarely activated. Furthermore, symmetrical products as it is often the case for R1 can be exempted as any negative activation is leveled out by a positive activation at a later point in time and vice versa.

In Belgium currently there is a regulation in place that allows to contract positive tertiary reserve power and R1 products without the need of a bilateral contract with the supplier/BRP. In this regard, it should however be clarified that the aggregator for positive reserve power loses a part of the possible income in the form of positive imbalance that is attributed to the BRP as a windfall profit. The BRP is therefore also in a far better position to offer such reserve power products to his clients as he can then earn both on the reservation price and the imbalance income allowing to offer a better deal to the clients.

For “delegated aggregators” such as NKW Belgium the improved BM is not accompanied by big changes if one of the reserve power products without transfer of energy is targeted. If a transfer of energy is agreed on with the BRP/supplier bilaterally, there is additional costs for the administrative process. Figure 15 shows the BM Canvas for “Using flexibility of customers as third party”. Existing key resources could provide additional key activities like an extended flexibility marketing. Value propositions are manifold: Flexibility of consumers can be brought to the market without the need of changing the supplier. A supplier with a lack of market flexibility benefits from the BM as well because this activity could be outsourced to an aggregator. Therefore, the supplier’s BM does not require any changes.

The aforementioned costs for this BM highly depend on how flexibility is valorized: while participation in reserve markets does usually not result in additional balancing costs (for the supplier), other markets may be accompanied by compensation payments to the supplier. Compensation payments would reduce the profit of the aggregator.

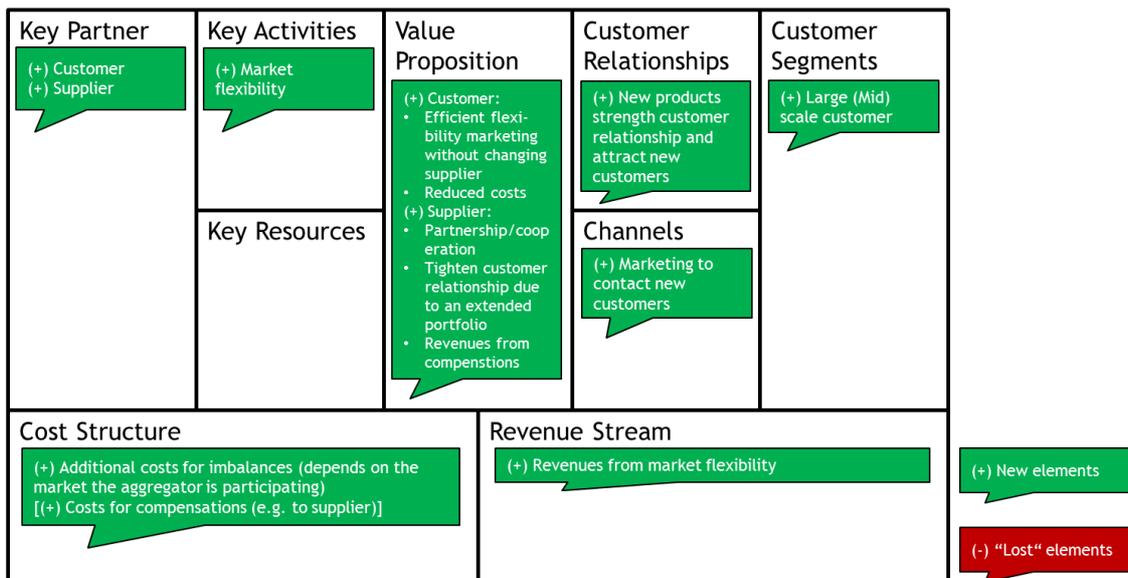


Figure 15: Improved BM canvas of Next Kraftwerke Belgium (Belgium) “Using flexibility of customers as third party”.

3.8 Improved business models of Oekostrom AG (Austria)

Oekostrom is currently classified as “aggregator-supplier” and “aggregator-BRP”¹⁶. In the following section, possible improved BMs are qualified. In total, two improved BMs for Oekostrom have been identified:

- Demand Side flexibilization of small customers and
- Valorize distributed generation of customers in apartment houses.

Both BMs are similar to each other. On the one hand, the improved BM aims to enable the customers to exploit their flexibility, on the other hand consumers inhabiting apartment houses are to be encouraged to invest in and consume RES-E (especially PV) on-site generation.

3.8.1 Demand Side flexibilization of small customers

Flexible tariffs are designed to incentivise shifting power consumption from high demand and cost hours to times with lower systems costs. In theory, such demand shifts generate a benefit for DSOs, suppliers and customers. DSOs benefit from more efficient infrastructure use, reducing congestion in high demand times and even avoiding investment in grid infrastructure. The customer can reduce his electricity bill by shifting demand to low cost times. The supplier could reduce purchasing costs when demand in high price peak hours is reduced.

Demand flexibilization of small-scale customers could provide monetary advantages for both market participants: end-consumer and - as contracting

¹⁶ According to BestRES report “Existing business models for renewable energy aggregators” Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/> erhaegen and Dierckxsens (2016)

party - the aggregator. According to Bruyn et al. (2014) power to heat and cooling services seem to be very promising applications for shifting demand. Any kind of flexibility provision has to be triggered by market-based indicators such as price signals.

The improved BM allowing consumers to unveil their flexibility potential is shown in Figure 16. A couple of additional key partners are needed, such as price sensitive consumers, which tend to be the most important customer attracted by such a BM. For providing the customers with the price information and at a future stage, scheduling flexibility in advance a forecasting provider¹⁷ will be needed. For billing and metering issues, working with additional partners, especially the DSO (for obtaining smart meter data), are crucial.

Oekoström’s key activities pertain to customer acquisition and marketing the tariff for flexibility. To perform such a rollout additional staff and expertise have to be set up. This improved BM enables customers to participate in/on wholesale electricity markets by forwarding the wholesale price signal to them. By the operation of flexibility energy bills could be lowered.

Most important new cost elements of implementing this BM are metering and administration costs. Revenues are achieved by two sources: (i) supplying the customers with electricity and (ii) attracting new price sensitive, flexible and interested customers.

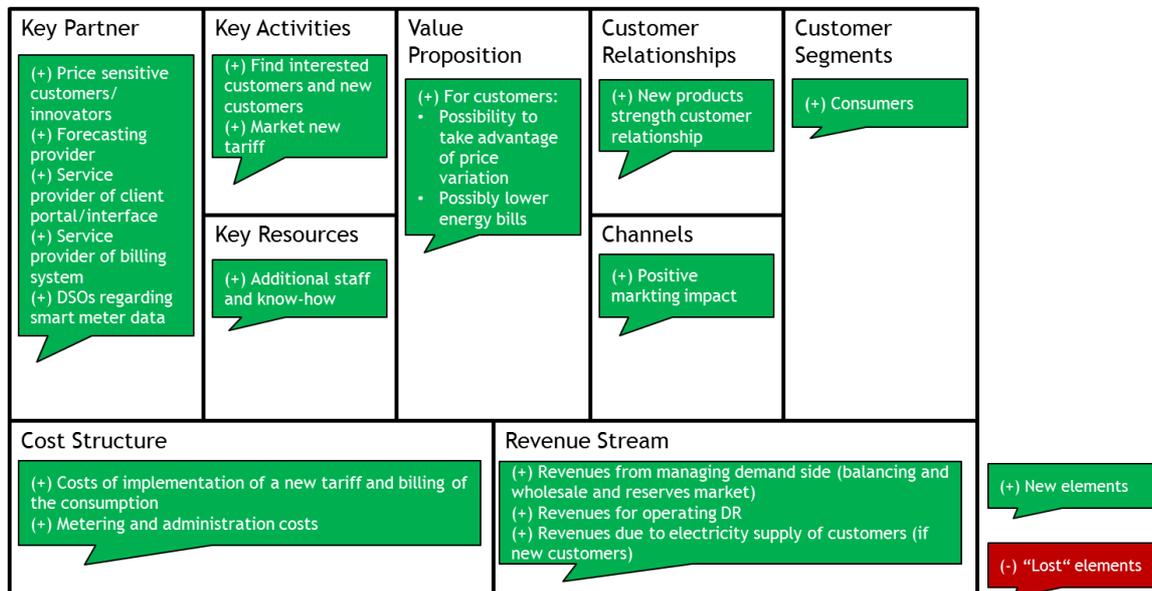


Figure 16: Improved BM canvas of Oekoström AG (Austria) “Demand Side flexibilization of small customers”.

The operating flexibility of small-scale customers does not have any effect in Austria for now, because this type of customers still gets cleared by a predefined load profile (called “Standardlastprofil” - “standard load profile”(SLP)). This

¹⁷ E.g. for electricity prices or renewable generation.



means that the supplier loses revenues when customers are shifting their loads, while the purchasing costs remain the same. Consequently, benefits on DSO level are still observed.

Another bottleneck may be the activation of DR. Although the provision of market based tariffs (such as real-time-pricing RTP) could be easily forwarded to customers, flexibility activation and operation is much more complicated. Additional hard- and software has to be provided (possibly by a third party). Therefore, the model focuses on effects that arise from customers' shifting loads as a reaction to the price signals. The model can be based on fully market based tariffs on the spot market or alternatively on price zones.

3.8.2 Valorize distributed generation of customers in apartment houses

Currently the most economical way of investing and operating PV plants on buildings is to maximize self-consumption. Thereby PV generation is used instead of consuming electricity from the grid. In most European countries, this BM is restricted to residential homeowners residing in single-family houses. Generation can be allocated to one metering point, only. For single-family houses, conventional metering devices are sufficient, while multi-story or -residents' buildings have a lack of smart meter devices as well as of a legal framework for allocating generation. There is, however, a huge potential on urban roofs.

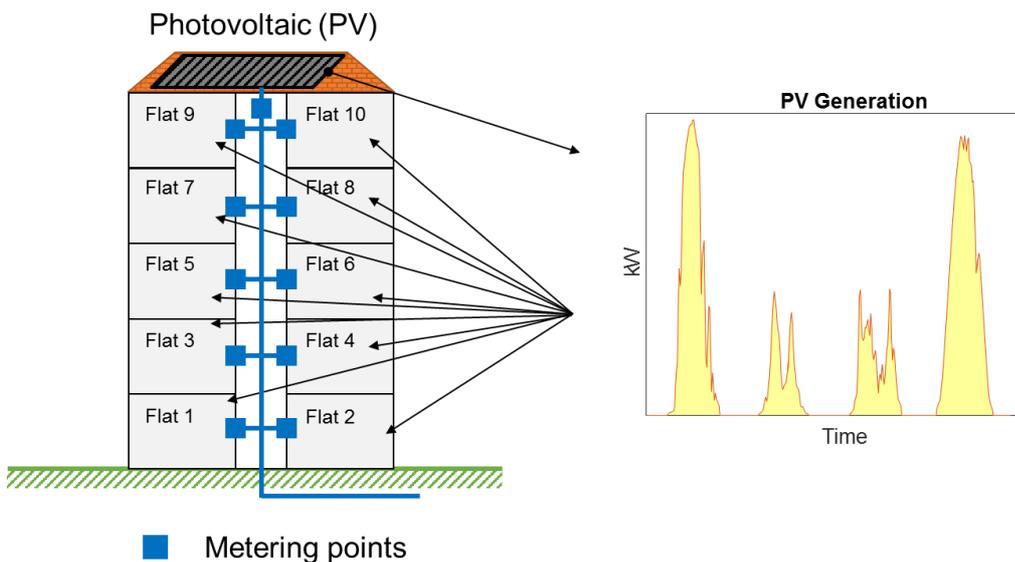


Figure 17: View of a typical multi-story building consisting of multiple apartments and a common PV plant.

Figure 17 shows a typical multi-story building consisting of multiple apartments and a common PV plant. Future BMs may address the question of how PV generation could be allocated to all participating flats.

Upon different framework designs, Oekoström intends to introduce an improved BM, briefly described in Figure 18. For implementing this BM additional key

partners are needed. Since this BM requires the construction of PV plants, manufacturers and constructors - or alternatively the owners of the PV generation sites - have to be included in future BMs. Another new key partner category will be partners from the real-estate sector, such as house/flat owners and property management companies. Because investments in PV systems are capital-intensive, investors (e.g. tenants) may play a role in the future too. Oekostrom’s key activities in running this BM will be to valorize PV systems. To raise economies of scale of PV generation the development of an (internal) standard helps in a more efficient way. The exact design of the BM depends on legal and regulatory possibilities that are subject to a new law enabling own consumption from common generation facilities. Smart meter infrastructure is a requirement for this BM. The DSOs are expected to be central actors in metering as well as in calculating the allocation of the generation. As a law has recently been passed at the moment of writing this document, procedural details are still unknown.

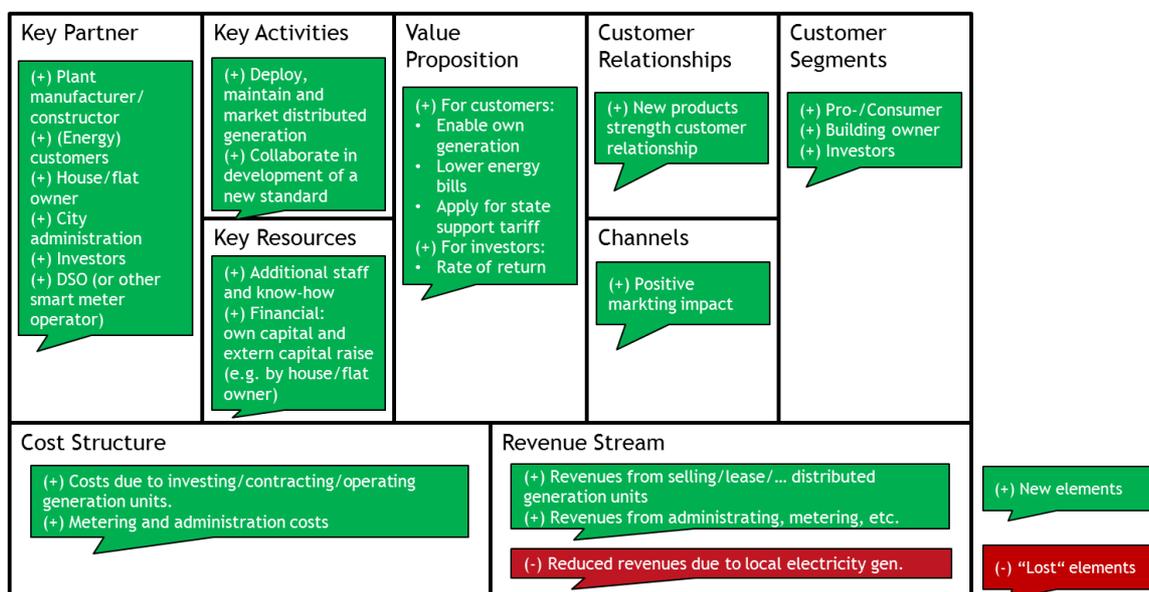


Figure 18: Improved BM canvas of Oekostrom AG (Austria) “Valorize distributed generation of customers in apartment houses”.

3.9 Improved business models of EDP (Portugal and Spain)

EDP is currently not classified as aggregator, having only energy retail activities, although implementing the BM “aggregator-supplier“ is planned in the short to medium term¹⁸. In the following section, possible improved BMs are qualified to achieve such a transition. In total, one improved BM for EDP has been identified: “Activation and marketing of end user’s flexibility”. The implementation of such a BM allows a transition of EDP’s BM towards an “aggregator-supplier” and “delegated aggregator”.

¹⁸ See BestRES report “Existing business models for renewable energy aggregators” Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/> for futher information.

The improved BMs of EDP proposed for Spain and Portugal are very close to each other. For the sake of simplicity, a double description of both BMs is avoided. Instead, the following section describes EDP’s improved BM for both countries. The proceeding analysis in following work packages will unveil the difference between Portugal and Spain, although the improved BMs may do not differ a lot.

3.9.1 Activation and marketing of end user’s flexibility

Figure 19 shows a concept figure indicating how EDP is going to conduct the improvements. Compared to other aggregators this BM mainly addresses the fact that EDP is supplying the customers with electricity in addition to marketing their flexibility.

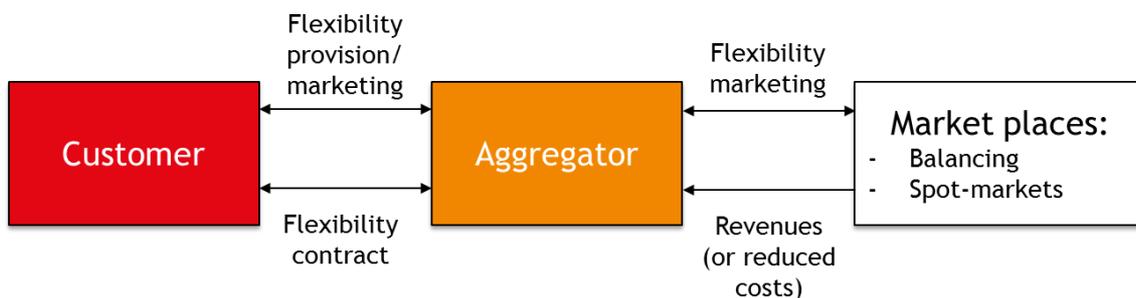


Figure 19: Concept of “Activation and marketing of end user’s flexibility”.

The most important partners will be pro- and consumers. Not only will the portfolio be balanced in a more efficient way, participation in balancing activities is feasible too. This enables the consumer to benefit from compensation of cost reduction from the supplier. The customer segment only addresses end-customers. Grid ancillary services are planned in future terms but in the moment not feasible for demand response, because of regulatory restrictions.

The development of this BM involves additional assets such as hard- and software along with additional staff and know-how. Costs occur due to flexibility acquisition and activations. For an economically viable BM revenues from market participation must exceed these costs.

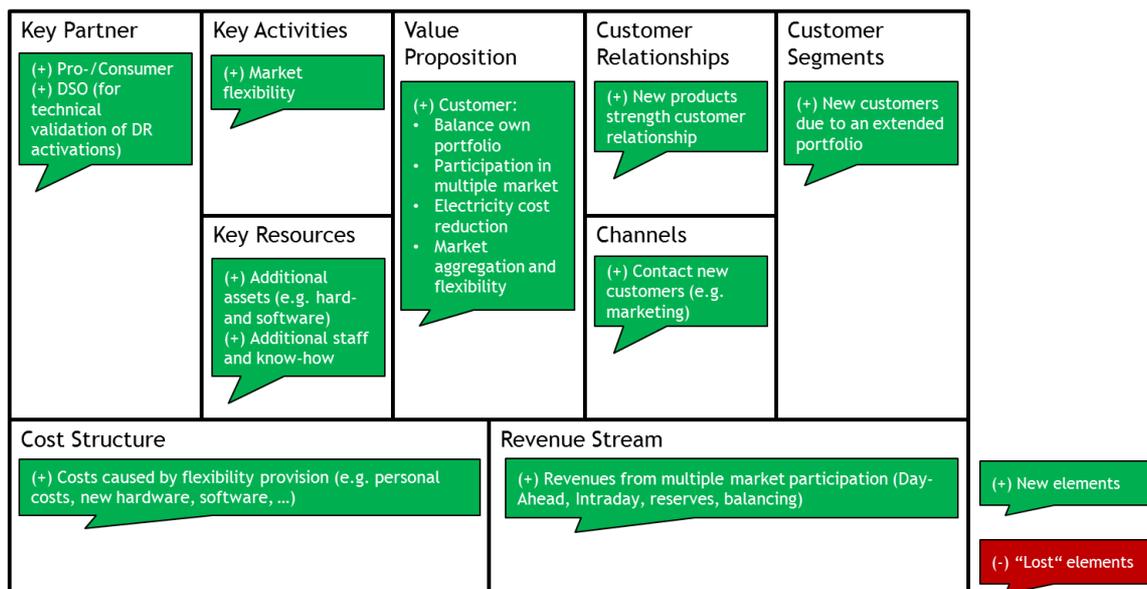


Figure 20: Improved BM canvas of EDP (Portugal) “Activation and marketing of end user’s flexibility”.

3.10 Improved business model for FOSS (Cyprus)

Possibilities for aggregators in Cyprus are very limited due the fact that electricity markets are currently not opened. However, an improved BM is developed in cooperation with FOSS: “Local aggregation services for providing flexibility to grid operation including congestion management”

3.10.1 Local aggregation services for providing flexibility to grid operation including congestion management

In Cyprus, TSOC is operating the transmission grid and has the responsibility of operating the market as well. TSOC has full responsibility of market operation. Currently markets are not able/ready to realize this kind of BM.

Cyprus is not a mature market in this sense. For this reason, the proposed improved BM can only be simulated but not implemented in real life. However, all referred activities have been planned to be operated within the university campus with FOSS (in full cooperation with the technical services of the University) being the aggregator and BRP aiming to achieve the most optimal operation of the whole campus. DSM and all local resources (PV, storage, heat pumps, etc.) will be included. This is possible since the campus is fed from a single grid connection. All PV generation and planned storage is within the university campus area, including EV charging points, which belong to the local DSO. In this respect, all market activities can be emulated in a smaller scale within the microgrid campus through simulations and actual measurements. Activities within the DSO control area can be simulated using real data.

Based on these realities the key partners are as follows:

- **DSO: Electricity Authority of Cyprus (EAC)** is *the end-user* of Demand response (DR) to be generated:
 - This means that the use of DR is intended for congestion management on ancillary services for the DSO.
 - A special tariff model has to be formulated to enable the DSO to pay for the DR.
- **BRP:** this role has to be an actual player within the territory of the DSO (purchasing and supplying energy and also selling ancillary services to the DSO)
- **Microgrid responsible party:** Aggregates DR of all connected prosumers in the microgrid and trades the available potential with the BRP (FOSS).
- **Prosumer** is a residential prosumer within the territory of the DSO,
 - have two smart meters installed, PV generation is measured separately
 - He has installed or is willing to install an Energy management system capable of controlling the processes and devices (consumption, production, storage) or is willing to give access for external direct control of individual devices

The aggregator not only bundles consumption and generation as flexibility, he will trade it too. Flexibility of all connected prosumers and the aggregated DR of the microgrid can be activated. Advantages for pro- and consumers are monetary (lowering the energy bill) and a higher degree of own-consumption. Grid operators (such as DSO and TSO) can be provided with ancillary services and power reserve, although some kind of activation signal and preliminary lead-time will be necessary. Costs of running this BM are multiple: flexibility provision costs, administrative and costs for additional assets (such as plants or metering devices). Revenues can be achieved by operating the flexibility on behalf of grid operators or providing energy services to customers. Therefore, the future market design has to be extended: (i) allow the grid operators to tender grid services and (ii) introduce the role of an aggregator.

The implementation of this BM helps to evaluate the technical potential of aggregators in Cyprus. This BM allows FOSS to implement their BM towards an “*aggregator as service provider*” and “*delegated aggregator*” if flexibility is marketed on the aggregator’s risk ¹⁹.

¹⁹ Detailed information describing aggregator BMs and the aggregator’s risk is available in BestRES report “Existing business models for renewable energy aggregators” Verhaegen and Dierckxsens (2016) <http://bestres.eu/about-project/results/>

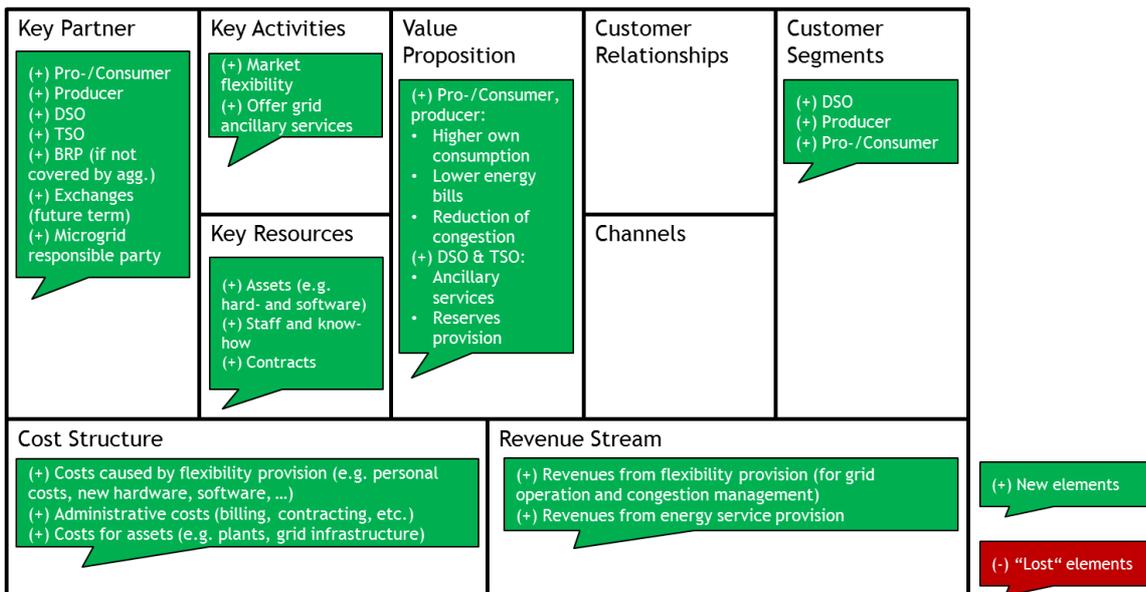


Figure 21 BM canvas for FOSS (Cyprus), “Activation and marketing of end user’s flexibility”.

4. Future opportunities related to the “Clean-Energy-Package”

Significant design aspects of improved BMs address opportunities defined in the “Clean-Energy-Package” (also called “Winter Package”). Two proposals are considered when developing improved BMs:

- “*Directive of the European Parliament and of the Council on common rules for the internal market in electricity*”²⁰ and
- “*Regulation of the European Parliament and of the Council on the internal market for electricity*”²¹

Aggregator-relevant elements are described in Section 4.1, while Section 4.2 indicates how improved BMs go fit with these future opportunities.

4.1 Aggregator-relevant elements of the “Clean-Energy-Package”

Interesting opportunities for aggregators are expected to be provided by the proposed “Clean-Energy-Package”. Within the BestRES project, the following opportunities (understandable as future areas of action or restrictions) for aggregators have been identified:

- **Active customers** participating in all markets, including the balancing markets through enhanced cooperation between transmission and distribution levels;
- **Local energy communities**, controlled by local shareholders or members and participating in all energy markets;
- As a key technology for flexibilizing demand, **demand response** should be enabled in all market places;
- **Balancing markets** should be opened and all market participant shall have access to those;
- **Dispatching of generation and demand response** is to be market-based, while priority dispatch for renewables is not intended in the proposal as a general rule;
- **Redispatch and curtailment**²² is imposed by the system operator preferably on market-based criteria.

This section specifies relevant paragraphs and briefly describes how they affect aggregator BMs. Although final formulation may change in the future, the draft version of the “Clean-Energy-Package” is an ideal basis for improved aggregator BMs.

²⁰ European Commission (2016a)

²¹ European Commission (2016b)

²² Understandable as changing the generator’s output levels.

4.1.1 Active Customers

As stated in Article 15 of the draft IEM Directive, Member States shall ensure that final customers will become “*active customers*” to generate, store, consume and sell self-generated electricity in all organised markets. Market participation shall be possible either individually or through aggregators. In both cases, active customers shall not be subject to disproportionately burdensome procedures and charges that are not cost reflective. Further, the energy installation required for the activities of the active customer may be managed by a third party for installation, operation, including metering and maintenance. Additionally, Article 21 of the draft Renewable Energy Directive implements the concept of the so-called “Renewable self-consumers”, which shall have the right, inter alia, to sell their excess production of renewable electricity.

Empowered customers seem to be a new opportunity for aggregators. Aggregators could not only provide market access; the operation of the customers’ flexibility may be a future opportunity too.

4.1.2 Local energy communities

Additionally, Article 16 of the draft IEM Directive introduces the concept of so-called “Local energy communities“. The Member States shall be obliged to ensure that these communities have the possibility to own, establish, or lease community networks and to autonomously manage them. Further, they shall have access to all organized markets either directly or through aggregators or suppliers in a non-discriminatory manner. This concept is accomplished by the Commission’s proposal to introduce so-called Renewable energy communities in Article 22 of the draft Renewable Energy Directive. A Renewable Energy Community, which fulfills the requirements set out in Article 22, shall be entitled to generate, consume, store and sell renewable energy.

The EC believes that local energy communities can be an efficient way of managing energy at community level - with or without a connection to distribution systems²³. In addition, aggregation seems to be one of many ways to enable energy markets access.

4.1.3 Demand response

A future framework for Demand response is foreseen in Article 17 of the draft IEM Directive. It states that the respective national regulatory framework of the Member States encourages the participation of aggregators in the retail market. It shall at least contain, inter alia, the right for each aggregator to enter the market without consent from other market participants. Further, aggregators shall not be required to pay compensation to suppliers or generators and a conflict resolution mechanism between market participants shall be introduced. Member States shall be obliged to ensure access to and foster participation of demand response, including through independent aggregators in all organized markets.

²³ Danish Energy Association (2016)

This article states that aggregators should get access to all retail markets without being obliged to pay compensation payments (contrary to some of the suggestions in Ofgem (2016)).

It is clear from the above that ancillary services open up and as a result, a more competitive market will be expected. Another important aspect of this article is the necessity of a conflict resolution mechanism between market participants, although it is presently not clear how this mechanism will be implemented. Another open-ended question addresses the arbitration board responsible for this kind of cases.

4.1.4 Balancing markets

Balancing markets are defined in Article 5 of the draft IEM Regulation²⁴. Specific relevance for aggregators can be seen in the Commission's proposal to guarantee the access to the balancing market to all market participants, be it individually "or through aggregation". In general, balancing market rules and products shall respect the need to accommodate increasing shares of variable generation as well as increased demand responsiveness and the advent of new technologies. Further, such markets shall be organized in a way that is taking account of the different technical capabilities of generation from variable renewable sources and demand response and storage. Additionally, it is proposed that the procurement of balancing capacity shall be non-discriminatory between market participants - individually or through aggregation - in the prequalification process.

As stated above, aggregators are according to the European Commission an important market participant enabling decentralized generation, demand response and storage technologies to access the market. The possibility of approving market participation of renewables and demand response technologies will (i) increase the competitiveness of these technologies and (ii) lead to more competitive balancing markets.

4.1.5 Dispatching of generation and demand response

Article 11 of the draft IEM Regulation states in its first paragraph that dispatching of power generation facilities and demand response shall be non-discriminatory and market based. Exemptions are foreseen in Article 11 paragraphs 2 to 4, which have to be read in context with the legal definition of *priority dispatch* in Article 2 para. 2 lit. s) of the draft IEM Regulation. Priority dispatch is still foreseen for generating installations using renewable energy sources or high-efficiency cogeneration with an installed electricity capacity of less than 500 kW or demonstration projects for innovative technologies. Article 11 para. 5 states that priority dispatch shall not endanger the secure operation of the electricity system and shall not be used as a justification for curtailment of cross-border capacities.

²⁴ European Commission (2016b)

The transition to a more flexible system could be provided by aggregators among others. Because any reduction of renewable generation will influence their economic feasibility, the need for feasible technical and market-integrated solutions is obvious.

4.1.6 Redispatching and curtailment

The Commission proposes new rules for redispatching and curtailment in Article 12 of the draft IEM Regulation. As a principle, Article 11 Para. 1 states that curtailment, redispatching of generation and redispatching of demand response shall be based on objective, transparent and non-discriminatory criteria. Further, the selection of curtailed or redispatched generation facilities shall be based primarily on the use of market-based mechanisms. In case of the use of non-market-based downward redispatching or curtailment Article 12 Para. 5 introduces specific principles which establish a certain order for redispatching and curtailment: (1) Without being explicitly mentioned, conventional installations shall be redispatched or curtailed first; (2) Then, combined heat and power plants follow in the second place and (3) renewable installations are named respectively thereafter.

The latter shall only be subject to downward redispatching or curtailment if no other alternative exists or if other solutions would result in disproportionate costs or risks to network security. As last resort, self-generated electricity from generating installations using renewable energies or high-efficiency cogeneration which is not fed into the transmission or distribution network can be curtailed if no other solution resolves network security issues. Finally, the Commission proposes a financial compensation for redispatched or curtailed RES installations, which shall be at least equal to 90 % of the net revenues from the sale of electricity on the day-ahead market that the generating or demand facility would have generated without the curtailment or redispatching request.

The draft Regulation imposes restrictions on when RES, high-efficiency CHP and self-generated power can be redispatched or curtailed. Operating flexibility can avoid the reduction of RES-E, such as reduced dispatch, avoiding redispatch and curtailment. Apparently, this can be achieved in multiple ways, e.g. through sectoral coupling or storage technologies.

4.2 Achievable business model improvements related to the “Clean-Energy-Package”

Table 3 indicates how the improved BMs match with future areas of action provided by the “Clean-Energy-Package”. In more detail, improved BMs do not only increase the aggregators’ product portfolio and revenues but also allow achieving political goals such as

- Enable customers to generate, store, consume and sell self-generated electricity etc.,
- Advanced balancing participation e.g. by pooling RES-E, demand response and storage and

- Avoid measures of redispatch and curtailment, especially of RES-E.

Although the “Clean-Energy-Package” is only in a proposal stage, it already indicates a trend of how the electricity markets are going to be expected to change in future terms. As described above, aggregation will be a fully integrated flexibility resource.

Table 3: Matching of future “Clean-Energy-Package” areas of action and improved aggregator BMs.

		Enable customers to generate, store, consume and sell self-generated electricity etc.	Balancing e.g. by pooling RES-E, demand response and storage	Avoid redispatch and curtailment, especially of RES-E
Good Energy (UK)	Automation and control	X	X	(X)
	“Peer-to-peer” (local) energy matching	X		X
Next Kraftwerke Germany (Germany)	Dispatch flexible generation on multiple market places		X	
	Supplying „mid-scale“ customers with time variable tariffs including grid charges optimization	X		(X)
Next Kraftwerke Germany (France)	Providing decentralized units access to balancing markets	(X)	X	
Next Kraftwerke Germany (Italy)	Participate in dispatch and balancing market (MSD and MB) with flexibility	(X)	X	(X)
Next Kraftwerke (Belgium)	Trading PV and Wind power		X	(X)
	Using flexibility of customers as third party	X	X	(X)
Oekostrom AG (Austria)	Demand Side flexibilization of small customers	X	(X)	(X)
	Invest and market distributed generation of customers in apartment houses	X		X
EDP (Portugal)	Activation and marketing of end user’s flexibility.	X	X	
EDP (Spain)	Activation and marketing of end user’s flexibility.	X	X	
FOSS (Cyprus)	Pooling flexibility for local balancing market and energy service provision.	X	X	X

X ... Improvement achievable by improved BM

(X) ... Expected improvement achieved by improved BM. Following tasks of WP3 and WP4 will show if this kind of improvement is achievable.

5. Summary and Conclusions

The objective of this report was to propose and evaluate improvements to existing aggregator business models (BM) across multiple criteria, such as increased competitiveness or reduction of RES-E curtailment. We learnt that improvements in accordance with these objectives are possible. Table 4 provides an overview of different improved BMs and their building blocks for each of the consortium's aggregators.

Table 4: Summary of improved business models within the consortium

 <p>United Kingdom</p>	<p>1. Household automation and control (UK)</p> <ul style="list-style-type: none"> • Value for the customer: <ul style="list-style-type: none"> ○ Energy costs reduction ○ Additional benefits (e.g. remote control of electronic devices) • Revenues from hard- and software provision. • Higher billing costs are to be expected. <p>2. “Peer-to-peer” (local) energy matching (UK)</p> <ul style="list-style-type: none"> • Unite customers and generators on a local level creates values for both. <ul style="list-style-type: none"> ○ Values for customers: <ul style="list-style-type: none"> ▪ Visualization helps customers to decrease their grid costs. ▪ Consume local energy ○ Values for generators: <ul style="list-style-type: none"> ▪ Market their generation ▪ Apply a premium to their power purchase agreement (PPA) • Additional costs (balancing, metering and billing) and revenues. • Opportunity: Individual marketing (generators) and supply (customers) might lead to higher profits. Future revenues by platform operation may exceed this opportunity.
 <p>Germany</p>	<p>1. Dispatch flexible generation on multiple market places under changing market design (Germany)</p> <ul style="list-style-type: none"> • Value for generators: <ul style="list-style-type: none"> ○ Maximum revenues by market flexibility

	<ul style="list-style-type: none"> • Additional costs for permanent improvements (e.g. algorithm) <p>2. Suppling „mid-scale“ customers with time variable tariffs including grid charges optimization (Germany)</p> <ul style="list-style-type: none"> • Value for customer <ul style="list-style-type: none"> ○ Reduce energy bill if consumption is linked to price signals from wholesale markets and grid charges. • Customers may wish to obtain flexibility marketing from Next Kraftwerke (combined product).
<p>NEXT KRAFTWERKE</p> <p>France</p>	<p>1. Providing decentralized units access to balancing markets (France)</p> <ul style="list-style-type: none"> • Value for generator: <ul style="list-style-type: none"> ○ Maximum revenues by market flexibility • Additional costs for permanent improvements (e.g. algorithm) • Additional need on hardware.
<p>NEXT KRAFTWERKE</p> <p>Italy</p>	<p>1. Trading renewables (Italy)</p> <ul style="list-style-type: none"> • Different market conditions compared to Germany and France cause higher market entry costs • Applying the proven VPP technology in order to increase forecasting quality • Participating in flexibility markets can increase the revenue stream • Different market conditions (MSD market) require new forms of aggregation • The market opening process needs to be followed.
<p>NEXT KRAFTWERKE</p> <p>Belgium</p>	<p>1. Trading PV and wind power from third party assets</p> <ul style="list-style-type: none"> • Value for supplier: <ul style="list-style-type: none"> ○ Reduced imbalance costs ○ Flexibility contract options • Costs occur from imbalance plus possible capital costs and PPA payouts

	<ul style="list-style-type: none"> • Revenues result from efficient portfolio trading and customer acquisition. <p>2. Using flexibility of customers as third party</p> <ul style="list-style-type: none"> • Value for customers: <ul style="list-style-type: none"> ○ Market flexibility without changing supplier • Value for supplier: <ul style="list-style-type: none"> ○ Cooperation/partnership with aggregators extend product portfolio • Current BM is not changed in a big way. • Contracts between supplier, aggregator and customer have to be well defined. • The requirement of fees/compensation payments have to be defined between aggregator and supplier.
<p>oekostrom AG</p> <p>Austria</p>	<p>1. Demand Side flexibilization of small customers</p> <ul style="list-style-type: none"> • Value for customers: <ul style="list-style-type: none"> ○ Possibility to lower energy bills. ○ Possibility for direct market participation. • Multiple new key partners are required in implementing this BM. • Allows a shift to a more integrated energy service provider. <p>2. Invest and market distributed generation of customers in apartment houses</p> <ul style="list-style-type: none"> • Value for customers: <ul style="list-style-type: none"> ○ Enable own generation (→ lower energy bills) ○ Apply for state support tariff (dependent on the applied model) • Value for investors: <ul style="list-style-type: none"> ○ Rate of return • Investing in (distributed) plants requires multiple partners as well as additional resources. • Attract customers for the aggregator-supply BM. • Additional revenue streams could be tapped • Customers with self-consumption demand less (grid provided) energy than those without self-consumption.

  Spain and Portugal	<p>1. Activation and marketing of end user’s flexibility.</p> <ul style="list-style-type: none"> • Enable an extended portfolio of flexible customers <ul style="list-style-type: none"> ○ Strengthen the relationship ○ Attract new customers • Additional human resources, hard- and software are required for BM implementation. → Higher costs • Advanced market possibilities will result in additional revenues
 Cyprus	<p>1. Pooling flexibility for local balancing market and energy service provision.</p> <ul style="list-style-type: none"> • Value for customers: <ul style="list-style-type: none"> ○ Higher own consumption ○ Lower energy bills • Value for the DSO & TSO <ul style="list-style-type: none"> ○ Ancillary services ○ Reserves provision • Microgrid operation could result in benefits for the grid as well as activate available flexibility.

5.1 Business model canvases are a useful tool to analyze and improve aggregator business models

BM canvases helped us to visualize changes in the aggregators’ BM in a comprehensive way. For a deeper understanding, this report contains detailed BM canvases for both current and improved aggregator BMs.

5.2 The development of improved business models for aggregation results in a certain degree of consolidation

As stated in Verhaegen and Dierckxsens (2016), a high variety of BMs is covered by the BestRES project. Table 4 shows that, within the consortium of the project, a variety of improved BMs could be developed and implemented. These improved models will result in a certain degree of consolidation between the BMs: Good Energy and Oekostrom currently focus on the “*aggregator-supplier*” model, while EDP plans to implement this BM in midterm. By implementing the improvements, a further development to “*aggregator as service provider*” and “*delegated aggregator*” is expected. Next Kraftwerke is focused on both the “*delegated*

aggregator” and *“aggregator-supplier”* BMs. Future improvements will extend their existing BM to *“aggregator supplier”* and *“aggregator-BRP”* (if not already implemented). Although FOSS is currently not an active aggregator, a future BM will address both *“aggregator as service provider”* and *“delegated aggregator”*.

5.3 Flexibility will be valorized on multiple market places

The core of all aggregator BMs is to create value and revenues by aggregation. Most aggregator BMs (9 out of 13 improved BM) aim to valorize aggregation on the wholesale, balancing and reserves markets. Additional options are services for DSOs (improved BMs of FOSS and EDP) or local energy services for customers (improved BMs of Good Energy and Oekoström). Valorization on short-term energy markets is highly dependent on volatile market signals, while other possibilities (e.g. energy service provision to customers) are less affected by market related uncertainties. On the other hand, those other services are impacted a lot more by regulation and regulatory frameworks.

5.4 Improved BMs are designed to address future market and regulatory updates

As stated in chapter 4, major changes in the electricity market design can be expected: active customers, local energy communities, demand response, balancing markets, dispatching of generation, redispatching and curtailment. To achieve this transformation, new market participants and business opportunities for BM implementation are desirable. This document illustrates that the proposed improved BMs are designed in a way that addresses future market and regulatory needs. Aggregators tend to be constantly flexible market participants, helping to improve the European electricity system.

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Appendix A

A.1 Current Business Model canvases

A.1.1 Combined aggregator-supplier

<p>Key Partner</p> <ul style="list-style-type: none"> • Power exchanges: electricity trading • Commodity trader: fuel purchase • Generation Plant, energy storage and equipment manufacturer • IT services: data metering/submission • Grid operators: TSO, DSO • Other suppliers • Other aggregators • Balance Responsible Party (BRP) • Pro-/Consumer 	<p>Key Activities</p> <ul style="list-style-type: none"> • Generating, marketing and retailing electricity • Balance generation (and consumption) schedule. • Economic benefits due to aggregation. • Offering grid ancillary services. • Provision of energy services. • Construction plants and facilities. 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Retailing electricity • Energy service provision • Economic retail electricity retail prices • Green energy provision 	<p>Customer Relationship</p> <ul style="list-style-type: none"> • Personal support • Personal assistance • Depends on the type of customer 	<p>Customer Segments</p> <ul style="list-style-type: none"> • Usually mass market • (existing and new) residential and commercial/industrial consumers • Other suppliers (via power exchanges, OTC, ...)
<p>Key Resources</p> <ul style="list-style-type: none"> • Physical: office, assets (plants, fuel) • Intellectual: computer models, forecast algorithms, administration knowledge, project management • Human: operators, retailer, trader, management, technicians • Financial: electricity (buy/sell), fuels (buy), rights/(long-term) contracts 		<p>Channels</p> <ul style="list-style-type: none"> • Awareness: usually on a traditional way (postal, web marketing), personal contact • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance • Advantageous for incumbents. 		
<p>Cost Structure</p> <ul style="list-style-type: none"> • Value and cost driven business model: currently mainly cost driven due to high competition • Fixed costs: assets (investment and annual costs), staff, software • Variable costs: e.g. fuel costs, flexibility provision (via power plants, DR, etc.), operational costs • Economies of scale: investment, management and administration costs • Economies of scope: combined heat generation, data management (multi-utilities, energy service provision) 		<p>Revenue Streams</p> <ul style="list-style-type: none"> • Mainly due to retailing electricity (fixed and dynamic pricing). • Electricity trading on forward and spot market (dynamic pricing) • Revenues due to reserves market participation and providing ancillary services. • Revenues from market energy and flexibility. 		

A.1.2 Combined aggregator-BRP

<p>Key Partner</p> <ul style="list-style-type: none"> • Power exchanges: electricity trading • IT services: data metering/submission • Grid operators: TSO, DSO • Other aggregators • Supplier and Pro-/Consumer in- and outside the balance group • Balance Responsible Party (BRP) • Balance Group Coordinator (BGC) 	<p>Key Activities</p> <ul style="list-style-type: none"> • Balancing the generation of the balance group’s members. • Forecasting, preparing, and optimizing schedule. • Offering grid ancillary services. • Economic benefits due to aggregation 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Scheduling electricity generation, trading and consumption • Reduce own imbalances • Offering balancing services • Participating reserves market 	<p>Customer Relationship</p> <ul style="list-style-type: none"> • Personal support • Personal assistance • Depends on the type of customer 	<p>Customer Segments</p> <ul style="list-style-type: none"> • Usually niche market • Commercial/industrial consumers • Suppliers and other aggregators
	<p>Key Resources</p> <ul style="list-style-type: none"> • Physical: office, assets (plants, fuel) • Intellectual: computer models, forecast algorithms, administration knowledge • Human: operators, trader, management • Financial: electricity (buy/sell), rights/(long-term) contracts 		<p>Channels</p> <ul style="list-style-type: none"> • Awareness: supplier • Evaluation: web, phone, personal assistance, personal contact • Purchase: web or printed form, personal assistance, financial affiliation with supplier/aggregator 	
<p>Cost Structure</p> <ul style="list-style-type: none"> • Cost driven business model. • Without own generation → less assets. • Fixed costs: staff, software, office • Variable costs: flexibility provision, operational costs • Economies of scale: investment, management and administration • Economies of scope: providing ancillary services and imbalance energy 			<p>Revenue Streams</p> <ul style="list-style-type: none"> • Revenues due to reserves market participation and providing ancillary services. • Reduced balancing costs (opportunity costs). • Revenues due to balance group management/administration. 	

A.1.3 Combined aggregator-DSO

Key Partner <ul style="list-style-type: none"> • Grid infrastructure provider • Government/Politics • Regulatory body (due to monopoly status) • Supplier • Aggregator • IT services: data metering/provision (if not self-provided) • Other grid operators: TSO, DSO 	Key Activities <ul style="list-style-type: none"> • Electricity grid construction, maintenance and operation. • Providing key infrastructure • Ensuring grid stability (e.g. by aggregation) • Installing, maintain and operate “smart-grids” • Technical/economic benefits due to aggregation. 	Value Proposition <ul style="list-style-type: none"> • Electricity provision • Ensuring physical grid stability (avoiding black-outs) • Non-discriminatory grid access 	Customer Relationship <ul style="list-style-type: none"> • Unique position due to monopoly status. (e.g. contacting is made by customer’s too) • Personal support • Personal assistance 	Customer Segments <ul style="list-style-type: none"> • Mass market • Supplier • Pro-/Consumer • Government (because DSO are an infrastructure provider)
	Key Resources <ul style="list-style-type: none"> • Physical: office, assets for electricity transmission and distribution (e.g. grid, property) • Intellectual: Grid construction, maintenance and operation knowledge, administration knowledge, project management • Human: operators, management, technicians • Financial: rights/(long-term) contracts, grid tariffs and fees 		Channels <ul style="list-style-type: none"> • Awareness: Due to monopoly status, awareness is given; personal contact • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance, 	
Cost Structure <ul style="list-style-type: none"> • Value driven business model • Fixed costs: very high fixed costs (high entry costs) • Variable costs: operational costs • Economies of scale: investment, management and administration • Economies of scope: cost shifting between TSO-DSO 			Revenue Streams <ul style="list-style-type: none"> • Mainly due to electricity provision (regulated grid tariffs). • Revenues for establishing a grid connection to consumers and supplier (connection costs). • 	

A.1.4 Independent aggregator as a service provider

Key Partner <ul style="list-style-type: none"> • Generation plant, energy storage and equipment manufacturer • IT services: data metering/submission • Grid operators: mainly DSO • Supplier • Aggregator • Pro-/Consumers 	Key Activities <ul style="list-style-type: none"> • Provision of energy services. • Generating, marketing and retailing electricity (and heat). • Implementation of energy efficiency measures. • Economic benefits due to aggregation. • (Planning of) Construction plants and facilities. 	Value Proposition <ul style="list-style-type: none"> • Retailing electricity • Energy service provision • Economic retail electricity retail prices • Green energy provision • Local energy production • Enabling a certain degree of “energy-autarky” • Low “bureaucratic” energy service provision • Usually long-term contracts. 	Customer Relationship <ul style="list-style-type: none"> • Personal support • Personal assistance • Depends on the type of customer 	Customer Segments <ul style="list-style-type: none"> • Usually mass market • (existing and new) residential and commercial/industrial consumers
	Key Resources <ul style="list-style-type: none"> • Physical: office, assets (plants, fuel, etc.) • Intellectual: project management, computer models (e.g. control algorithms) • Human: technicians, retailer, management, operators, • Financial: fuels (buy), rights/contracts (e.g. long-term) 		Channels <ul style="list-style-type: none"> • Awareness: usually on a traditional way (postal, web marketing), personal contact • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance 	
Cost Structure <ul style="list-style-type: none"> • Value and cost driven business model • Fixed costs: assets (investment and annual costs), staff, software • Variable costs: e.g. fuel/energy costs, operational costs • Economies of scale: investment, management and administration • Economies of scope: combined heat generation, data management for energy service provision 			Revenue Streams <ul style="list-style-type: none"> • Revenues from long-term energy service provision (PPA, EPC). • Savings/revenues from energy efficiency measures. 	

A.1.5 Delegated aggregator

Key Partner <ul style="list-style-type: none"> • Power exchanges • Generation plant, energy storage and equipment manufacturer • IT services: data metering/submission • Grid operators: TSO, DSO • Supplier • Aggregator • Pro-/Consumers 	Key Activities <ul style="list-style-type: none"> • Provision of energy services • Generating, marketing and retailing electricity (and heat). • Implementation of energy efficiency measures. • Economic benefits due to aggregation. • Offering grid ancillary services. • (Planning of) Construction plants and facilities. 	Value Proposition <ul style="list-style-type: none"> • Retailing electricity • Energy service provision • Economic retail electricity retail prices • Green energy provision • Local energy production • Enabling a certain degree of “energy-autarky” • Low “bureaucratic” energy service provision • Usually long-term contracts. • Offering balancing services • Participating reserves market • Market aggregation/flexibility 	Customer Relationship <ul style="list-style-type: none"> • Personal support • Personal assistance • Depends on the type of customer 	Customer Segments <ul style="list-style-type: none"> • Usually mass market • (existing and new) residential and commercial/industrial consumers • TSO (for ancillary service provision)
	Key Resources <ul style="list-style-type: none"> • Physical: office, assets (plants, fuel, etc.) • Intellectual: project management, computer models (e.g. control algorithms) • Human: technicians, retailer, management, operators, trader • Financial: fuels (buy), rights/contracts (e.g. long-term) 		Channels <ul style="list-style-type: none"> • Awareness: usually on a traditional way (postal, web marketing) • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance 	
Cost Structure <ul style="list-style-type: none"> • Cost driven business model • Fixed costs: assets (investment and annual costs), staff, software • Variable costs: e.g. fuel/energy costs, operational costs • Economies of scale: investment, management and administration • Economies of scope: combined heat generation, data management for energy service provision 			Revenue Streams <ul style="list-style-type: none"> • Revenues from market energy and flexibility. • Revenues due to reserves market participation and providing ancillary services. • Reduced balancing costs (opportunity costs). • Revenues from long-term energy service provision (PPA, EPC). • Savings/revenues from energy efficiency measures. 	

A.1.6 Prosumer as Aggregator

Key Partner <ul style="list-style-type: none"> • Generation plant, energy storage and equipment manufacturer • IT services: data metering/submission • Grid operators: mainly DSO • Suppliers • Aggregators • Other Pro-/Consumers 	Key Activities <ul style="list-style-type: none"> • Provision of energy services • Generating, marketing and retailing electricity (and heat). • Implementation of energy efficiency measures. • (Economic) benefits due to aggregation. • (Planning of) Construction plants and facilities. 	Value Proposition <ul style="list-style-type: none"> • Retailing electricity • Energy service provision • Economic retail electricity retail prices • Green energy provision • Local energy production • Enabling a certain degree of “energy-autarky” • Low “bureaucratic” energy service provision • Usually long-term contracts. • Market aggregation/flexibility 	Customer Relationship <ul style="list-style-type: none"> • Personal support • Personal assistance • Depends on the type of customer 	Customer Segments <ul style="list-style-type: none"> • Usually niche market • (existing and new) residential and commercial/industrial consumers
	Key Resources <ul style="list-style-type: none"> • Physical: assets (plants, fuel, etc.) • Intellectual: project management, computer models (e.g. control algorithms) • Human: technicians, retailer, management, operators, • Financial: rights/contracts (e.g. long-term) 		Channels <ul style="list-style-type: none"> • Awareness: usually on a traditional way (postal, web marketing), personal contact • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance 	
Cost Structure <ul style="list-style-type: none"> • Value and cost driven business model • Fixed costs: assets (investment and annual costs), staff, software • Variable costs: e.g. fuel/energy costs, operational costs • Economies of scale: investment, management and administration • Economies of scope: combined heat generation, data management for energy service provision 			Revenue Streams <ul style="list-style-type: none"> • Revenues from market energy and flexibility. • Revenues from long-term energy service provision (PPA, EPC). • Savings/revenues from energy efficiency measures. 	

A.2 Current Business Model canvases within the Consortium

A.2.1 Good Energy (United Kingdom)

<p>Key Partner</p> <ul style="list-style-type: none"> • IT service provider • DSO • Supplier • Aggregators • Pro-/Consumer • TSO • Power exchanges or OTC (electricity trading) • Balance Responsible Party (BRP)[2] • Generation plant, storage and equipment manufacturer • Commodity trader (e.g. power, gas) 	<p>Key Activities</p> <ul style="list-style-type: none"> • Balance generation (and consumption) schedule - trading team buy and sell via OTC and wholesale markets • Generate and market electricity (and gas). • Retail electricity (and gas). • Forecasting, preparing and optimizing schedules. 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Retailing electricity and gas to domestic and business • Green electricity and gas provision • Scheduling trading and consumption • Reduce imbalances • Local energy production • Market aggregation • Supporting independent generators • Supporting community power • UK-sourced feed-in-tariff administration 	<p>Customer Relationship</p> <ul style="list-style-type: none"> • Personal support • Personal assistance • Working with communities. 	<p>Customer Segments</p> <ul style="list-style-type: none"> • Mass market • (Existing and new) commercial/industrial consumer • (Existing and new) residential consumer • Large businesses switching to decarbonize for CSR purposes • ‘Deep green’ customer segments and early technology adopters.
<p>Cost Structure</p> <ul style="list-style-type: none"> • Value and cost driven business model: currently mainly cost driven due to high competition • Fixed costs: assets (investment and annual costs), staff, software • Variable costs: e.g. non-controllable: fuel costs, distribution costs, data collection/aggregation costs, electricity (wholesale), balancing costs • Economies of scale: investment, management and administration costs 		<p>Revenue Streams</p> <ul style="list-style-type: none"> • Revenues from market energy. • Mainly due to retailing electricity (fixed and dynamic pricing). • Electricity trading on forward and spot market (dynamic pricing). • Reduced balancing costs (opportunity costs). • Revenues from Power Purchase Agreements (PPA). • Revenues from long-term energy service provision (ESCO). 		

A.2.2 Next Kraftwerke Germany (Germany)

Key Partner <ul style="list-style-type: none"> IT service provider DSO Supplier Aggregators Pro-/Consumer TSO Power exchanges or OTC (electricity trading) Balance Group Coordinator (BGC) 	Key Activities <ul style="list-style-type: none"> Providing grid ancillary services (e.g. reserve and capacity markets; R1, R2, R3) Generate and market electricity 	Value Proposition <ul style="list-style-type: none"> Offering balancing services Participating reserves market Scheduling electricity generation, trading and consumption Reduce imbalances Market aggregation/flexibility Providing high performance trading, unique platform and customer assistance 	Customer Relationship <ul style="list-style-type: none"> Personal support Personal assistance 	Customer Segments <ul style="list-style-type: none"> Niche market Decentralized generators such as PV, Wind, Biogas/Biomass, CHP, ... (Existing and new) commercial/industrial consumer TSO
	Key Resources <ul style="list-style-type: none"> Physical: Offices, control system, remote controls, servers, Intellectual: computer models, forecast algorithms, administration knowledge, project management Human: operators, trader, management, Financial: Contracts with distributed generation providers, Power Purchase Agreements (PPA), Electricity (buy, sell), 		Channels <ul style="list-style-type: none"> Awareness: personal contact, web, trade fares, conferences Evaluation: web, phone, personal assistance Purchase: web or printed form, personal assistance 	
Cost Structure <ul style="list-style-type: none"> Cost and value driven business model Fixed costs: staff, software Variable costs: e.g. flexibility provision (via power plants, DR, etc.), operational costs, balancing costs Economies of scale: investment, management and administration costs Economies of scope: Providing ancillary services and imbalance energy 			Revenue Streams <ul style="list-style-type: none"> Revenues due to reserves market participation and providing ancillary services. Revenues from market energy and flexibility. Electricity trading on forward and spot market (dynamic pricing). Reduced balancing costs (opportunity costs). Revenues from power supply/flexible power supply 	

A.2.3 Next Kraftwerke Germany (France)

Key Partner <ul style="list-style-type: none"> • IT service provider • DSO • Supplier • Aggregators • Pro-/Consumer • TSO • Balance Group Coordinator (BGC) 	Key Activities <ul style="list-style-type: none"> • Economic benefits due to aggregation. • Generate and market electricity 	Value Proposition <ul style="list-style-type: none"> • Participating reserves market • Scheduling electricity generation, trading and consumption • Reduce imbalances • Market aggregation/flexibility • Reduce production in times of negative prices. 	Customer Relationship <ul style="list-style-type: none"> • Personal support • Personal assistance 	Customer Segments <ul style="list-style-type: none"> • Niche market • Decentralized generators such as PV, Wind, Biogas/Biomass, CHP, ... • (Existing and new) commercial/industrial consumer • TSO
	Key Resources <ul style="list-style-type: none"> • Physical: Offices, control system, remote controls, servers, • Intellectual: computer models, forecast algorithms, administration knowledge, project management • Human: operators, trader, management, • Financial: Contracts with distributed generation providers, Power Purchase Agreements (PPA), Electricity (buy, sell), 		Channels <ul style="list-style-type: none"> • Awareness: personal contact, web, trade fares, conferences • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance 	
Cost Structure <ul style="list-style-type: none"> • Cost and value driven business model • Fixed costs: staff, software • Variable costs: e.g. flexibility provision (via power plants, DR, etc.), operational costs • Economies of scale: investment, management and administration costs • Economies of scope: Providing ancillary services and imbalance energy 			Revenue Streams <ul style="list-style-type: none"> • Revenues from market energy and flexibility. • Electricity trading on forward and spot market (dynamic pricing). • Reduced balancing costs (opportunity costs). • Revenues due to balance group management/administration. • 	

A.2.4 Next Kraftwerke (Belgium)

<p>Key Partner</p> <ul style="list-style-type: none"> • IT service provider • DSO • Supplier • Aggregators • Pro-/Consumer • TSO • Balance Group Coordinator (BGC) • Power Exchanges 	<p>Key Activities</p> <ul style="list-style-type: none"> • Offering grid ancillary services (e.g. reserve and capacity markets; R1, R2 (pilot) and R3) • Generate and market electricity. 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Offering balancing services • Participating reserves market • Scheduling electricity generation, trading and consumption • Reduce imbalances • Market aggregation/flexibility • Market electricity on short-term electricity markets 	<p>Customer Relationship</p> <ul style="list-style-type: none"> • Personal support • Personal assistance 	<p>Customer Segments</p> <ul style="list-style-type: none"> • Niche market • Decentralized generators such as PV, Wind, Biogas/Biomass, CHP ... • (Existing and new) commercial/industrial consumer • TSO
	<p>Key Resources</p> <ul style="list-style-type: none"> • Using resources of NKW Germany • Physical: Offices • Intellectual: computer models, forecast algorithms, administration knowledge, project management • Human: with market knowledge, product development skills and sales experience • Financial: contracts with distributed generation, demand etc. 		<p>Channels</p> <ul style="list-style-type: none"> • Awareness: personal contact, web, trade fares, conferences • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance 	
<p>Cost Structure</p> <ul style="list-style-type: none"> • Value and cost driven business model • Fixed costs: staff, software • Variable costs: e.g. flexibility provision (via power plants, DR, etc.), operational costs • Economies of scale: investment, management and administration costs • Economies of scope: Providing ancillary services and imbalance energy 		<p>Revenue Streams</p> <ul style="list-style-type: none"> • Revenues due to reserves market participation and providing ancillary services. • Revenues from market energy and flexibility. • Electricity trading on forward and spot market (dynamic pricing). • Reduced balancing costs (opportunity costs). 		

A.2.5 Oekostrom (Austria)

<p>Key Partner</p> <ul style="list-style-type: none"> • IT and data service provider • DSO • Supplier (especially small generation plant owners) • Aggregators • Pro-/Consumer • TSO • Power exchanges or OTC (electricity trading) • Generation plant, storage and equipment manufacturer • Balance Group Coordinator (BGC) 	<p>Key Activities</p> <ul style="list-style-type: none"> • Balance generation (and consumption) schedule. • Generate and market electricity. (especially direct marketing of small wind and hydro PP) • Retail electricity. • Forecasting, preparing and optimizing schedules. • Natural gas business. • Generation project development. <p>Key Resources</p> <ul style="list-style-type: none"> • Physical: office, assets (plants) • Intellectual: computer models, forecast algorithms, administration knowledge, project management, contracts in marketing small generation. • Human: operators, retailer, trader, management, technician • Financial: Contracts with distributed generation providers, Power Purchase Agreements (PPA), Electricity (buy, sell, retail), Gas (buy, retail) 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Retailing electricity • Economic electricity retail prices • Green energy provision • Scheduling electricity generation and trading • Reduce imbalances • Local energy production • Market and trade aggregation/flexibility • Providing customers with local generation (e.g. SIMON). 	<p>Customer Relationship</p> <ul style="list-style-type: none"> • Personal support • Personal assistance <p>Channels</p> <ul style="list-style-type: none"> • Awareness: usually on a traditional way (postal, web marketing), personal contact, Brand value of oekostrom as leader and promoter of a sustainable energy system, publicity through initiatives against nuclear power. • Evaluation: web (including a crowd funding website), phone, personal assistance • Purchase: web or printed form, personal assistance 	<p>Customer Segments</p> <ul style="list-style-type: none"> • Mass market • (Existing and new) commercial/industrial consumer • (Existing and new) residential consumer: • Ecologically oriented, customers valuing local Austrian generation and quality products
<p>Cost Structure</p> <ul style="list-style-type: none"> • Cost driven due to high competition, but clients are eco-oriented and willing to pay a bit more for Austrian quality power • Fixed costs: assets (investment and annual costs), staff, software • Variable costs: electricity (wholesale market), green certificates, data collection/aggregation costs, balancing costs • Economies of scale: investment, management and administration costs • Economies of scope: data management 		<p>Revenue Streams</p> <ul style="list-style-type: none"> • Revenues from market and trade energy and flexibility • Retailing electricity. • Revenues from selling energy of own generation sites including PPA-selling generation from own sites (partly feed-in tariff). • Electricity trading on forward and spot market (dynamic pricing). • Reduced balancing costs (opportunity costs). • Revenues due to balance group management/administration. • Revenues from Power Purchase Agreements (PPA). • Revenues from selling PV module “SIMON” 		

A.2.6 EDP (Portugal)

<p>Key Partner</p> <ul style="list-style-type: none"> • IT service provider • DSO • Supplier • Aggregators • Prosumer • TSO • Power exchanges or OTC (electricity trading) 	<p>Key Activities</p> <ul style="list-style-type: none"> • Retail electricity. • Forecasting, preparing and optimizing schedules. 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Retailing/provision with electricity • Economic electricity retail prices • Scheduling, trading and consumption • Reduce imbalances 	<p>Customer Relationship</p> <ul style="list-style-type: none"> • Personal support • Personal assistance 	<p>Customer Segments</p> <ul style="list-style-type: none"> • (Existing and new) commercial/industrial consumer
	<p>Key Resources</p> <ul style="list-style-type: none"> • Physical: office, assets • Intellectual: computer models, forecast algorithms, administration knowledge, project management • Human: operators, retailer, trader, management, technicians • Financial: Electricity (buy only) 		<p>Channels</p> <ul style="list-style-type: none"> • Awareness: usually on a traditional way (postal, web marketing), personal contact, dedicated client manager • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance 	
<p>Cost Structure</p> <ul style="list-style-type: none"> • Value and cost driven business model: currently mainly cost driven due to high competition • Fixed costs: assets (investment and annual costs), staff, software • Variable costs: electricity costs (wholesale level), balancing costs • Economies of scale: investment, management and administration costs • Economies of scope: Data management (multi-utilities, energy service provision) 			<p>Revenue Streams</p> <ul style="list-style-type: none"> • Mainly due to retailing electricity (fixed and dynamic pricing). • Electricity trading and spot market (dynamic pricing). • Reduced balancing costs (opportunity costs). 	

A.2.7 EDP (Spain)

<p>Key Partner</p> <ul style="list-style-type: none"> • IT service provider • DSO • Supplier • Aggregators • Prosumer • TSO • Power exchanges or OTC (electricity trading) 	<p>Key Activities</p> <ul style="list-style-type: none"> • Retail electricity. • Forecasting, preparing and optimizing schedules. 	<p>Value Proposition</p> <ul style="list-style-type: none"> • Retailing electricity • Economic electricity retail prices • Scheduling, trading and consumption • Reduce imbalances 	<p>Customer Relationship</p> <ul style="list-style-type: none"> • Personal support • Personal assistance 	<p>Customer Segments</p> <ul style="list-style-type: none"> • (Existing and new) commercial/industrial consumer
	<p>Key Resources</p> <ul style="list-style-type: none"> • Physical: office, assets • Intellectual: computer models, forecast algorithms, administration knowledge, project management • Human: operators, retailer, trader, management, technicians • Financial: Electricity (buy only) 		<p>Channels</p> <ul style="list-style-type: none"> • Awareness: usually on a traditional way (postal, web marketing), personal contact, dedicated client manager • Evaluation: web, phone, personal assistance • Purchase: web or printed form, personal assistance 	
<p>Cost Structure</p> <ul style="list-style-type: none"> • Value and cost driven business model: currently mainly cost driven due to high competition • Fixed costs: assets (investment and annual costs), staff, software • Variable costs: electricity costs • Economies of scale: investment, management and administration costs • Economies of scope: Data management (multi-utilities, energy service provision) 			<p>Revenue Streams</p> <ul style="list-style-type: none"> • Mainly due to retailing electricity (fixed and dynamic pricing). • Electricity trading and spot market (dynamic pricing). • Reduced balancing costs (opportunity costs). 	

A.3 Overview of the Italian Electricity Market

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A.3.1 Market Structure

Relevant market actors & stakeholders

TERNA: Transmission System Operator

GME: Electricity market operator and platform for Ancillary Service & Congestion Market

GSE: Public market actor coordinating market access and subsidies for RES

AEGGSI: Italian Regulatory Authority for Electricity and Gas

Generation unit portfolio

With a peak load of 60 GW and a peak generation capacity of 124 GW Italy has a relatively large electricity market with big over-capacities. Due to a nuclear phase out in 1987 and a strong opposition against coal fired power plants, the Italian electricity generation mix is characterized by a high share of gas fired units and renewables.

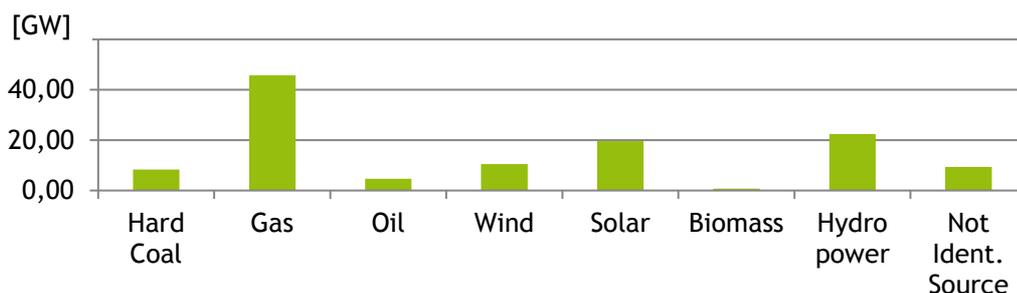


Figure 22: Forecasted production capacity by energy source in 2016 (source: ENTSO-E)

Bidding zones

Due to the restrictions and congestions of the Italian transmission grid, the electricity market is divided into 6 bidding zones. The major share of generation capacity is located in Northern Italy which is due to natural availability of hydro power and higher population density.

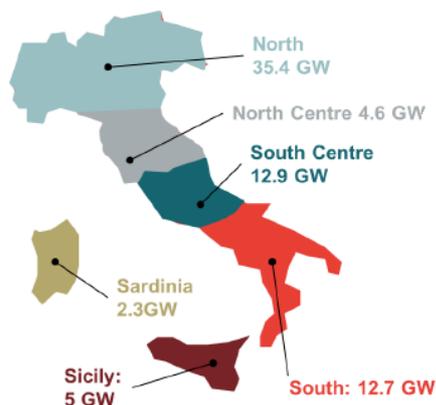


Figure 23: Bidding zones and generation capacity in Italy (2014, source: GME)

1 Overview Spot Market timeline

The **Spot Market (MPE)** operated by GME consists of

- **Day-Ahead Market (MPG)**
 - o Auction market, based on hourly block products
 - o 1 session, from 8 a.m. on D-9 until 12 p.m. D-1
 - o Supply offers are valued according to price zones, demand bids according to average (PUN)
- **Intra-Day Market (MI)**
 - o Modification of MGP bids
 - o 5 sessions (MD1 - MD5), between 12:55 p.m. D-1 and 11:15 a.m. D
 - o Bid selection analog to MPG, however, demand bids according to individual price zone
- **Daily Products Market (MPEG)**
 - o Continuous trading in two sessions: (i) 8 a.m. - 5 p.m. D-2 and (ii) 8 a.m. - 9 a.m. D-1
 - o 2 products: (i) unit price differential, (ii) full unit price
 - o 2 delivery profiles for each product: (i) baseload, (ii) peak load
- All market participants are also eligible for **PCE** which - despite being OTC - is also managed by GME.

Further Info at GME (Market Operator):

<https://www.mercatoelettrico.org/En/Mercati/MercatoElettrico/MPE.aspx>

2 Overview Dispatch & Balancing Market timeline

In addition, Terna operates the **Ancillary Service Market**, which is used for the procurement of secondary and tertiary reserve, changes of plant dispatch (Central Dispatch System) as well as for releasing intra-zonal congestions. It is divided into the **Dispatch Market (MSD, four sessions in DA)** and the **Balancing Market (MB, five sessions during delivery day)**.

Currently, participation in the Italian MSD and MB markets is still limited to “enabled units” (controllable and *relevant*, i.e. < 10 MVA). However, the MSD market is expected to be modified in 2017 (transitory phase RDE 1). This phase will open the market to aggregated non-enabled production or consumption units > 55 kW.

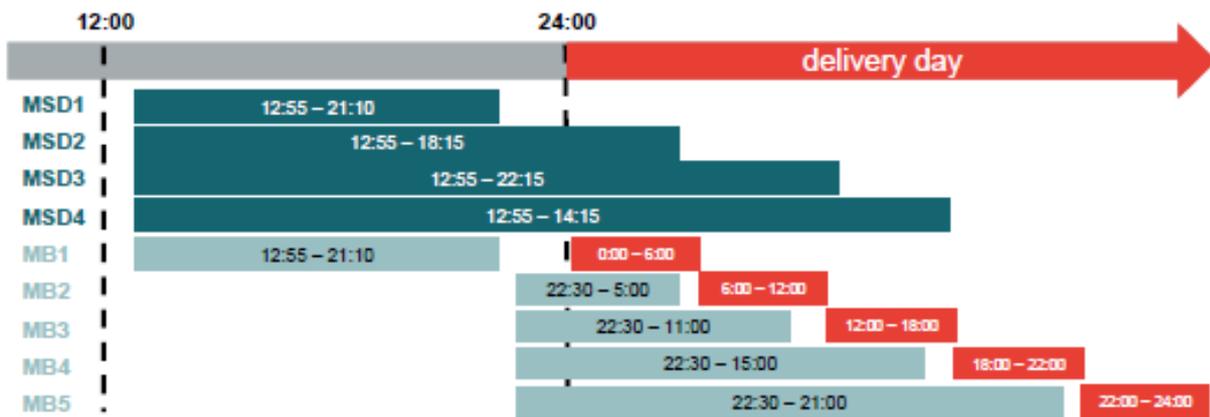


Figure 24: Trading timeline of Italian Dispatch (MSD) and Balancing (MB) Market Trading System and Imbalance Settlement

Italian electricity trade, scheduling and imbalance settlement significantly differs from other European markets. The equivalent to a Balancing Responsible Party is the *Utente di dispacciamento* (UDD) who overviews physically existing dispatch points, so-called *punti di dispacciamenti*.

Bids and offers in the Italian Power Exchange have to refer to a specific PDD. However, *non-relevant units* (< 10 MVA) can be aggregated into virtual PDDs as long as they are (i) located in the same bidding zone and (ii) based on the same energy source. For example, an 8MW PV plant in Milano and a 5 MW PV plant in Torino could be placed into one PDD (and therefore in one offer) whereas this would not be possible if one of them would be above 10 MVA or a hydro unit. **Imbalance Settlement** is done for individual PDDs as well. It differentiates between differentiates according to the characteristics (non-)controllable and (non-)relevant (</> 10 MVA). The following bullet points and tables present the imbalance pricing system how it is currently expected for 2017, according the most recent consultation (684/16) of the regulator:

- **Controllable, non-relevant (e.g. biogas):** time unit: 1h
 - Inside +/-15% tolerance (compared to zone): single pricing, based on MGP and MB average
 - Outside +/-15% tolerance: dual pricing
- **Non-controllable of any size (wind, PV):** single pricing, based on MGP and MB average; time unit: 1h
- **Enabled units (relevant and controllable):** single pricing system, based on MGP; time unit: 15 min

Source & Links

- Article 40.1-3 of AEEGSI Resolution 111/06

A.3.2 Price levels

Spot & MSD market price

Prices vary over the 6 different price zones in Italy In general, **MPG (day ahead)** as well as **MI (intra-day) prices** vary around **50 €/MWh** with price spreads of usually about **30€/MWh**, sometimes going up to about **80€/MWh**.

MSD prices for upward regulation are often above 100€/MWh; however, the MSD market will only open in the course of 2017 for participation of aggregated units.

Source and Links:

- Current Power Exchange pricing data is available on GME Website:
<https://www.mercatoelettrico.org/En/Esiti/MGP/EsitiMGP.aspx>

Overview of the RES tariff system

Marketing of RES is currently to a large extent done through the public market actor GSE which serves as UDD (Balancing Responsible Party) for non-relevant (< 10MVA) and non-controllable units in various support schemes (RID, TO, CIP6/92, TFO, SSP). GSE markets those units in MPG (day ahead) and MI (intra-day) market, whereas MSD participation through GSE is not possible.

Ritiro Dedicato (RID) refers not simply to a support scheme but rather to the marketing service of GSE in general. A unit under RID is usually also subject to other support schemes.

There is strong political will to reduce the costs which RES support causes to end consumers, households and SMEs. Since recently *Conto Energia* and *D.M. 6.7.2012* oblige units above 1MW to self-market - a threshold which should be further reduced to 0.5 MW.

Technical references

Project Acronym	BestRES
Project Title	Best practices and implementation of innovative business models for Renewable Energy aggregatorS
Project Coordinator	Silvia Caneva WIP - Renewable Energies silvia.caneva@wip-munich.de
Project Duration	1st March 2016 - 28th February 2019
Deliverable No.	D3.2 - Improved Business Models of selected aggregators in target countries
Dissemination level*	PU
Work Package	WP3 - Testing of improved business models
Task	T3.2 - Improvement of BMs of selected aggregators and in target countries and for technical benefits and market options
Lead beneficiary	TUW - EEG
Contributing beneficiary/ies	All partners
Due date of deliverable	31 August 2017
Actual submission date	31 August 2017

* PU = Public

PP = Restricted to other programme participants (including the Commission Services)

RE = Restricted to a group specified by the consortium (including the Commission Services)

CO = Confidential, only for members of the consortium (including the Commission Services)

v	Date	Beneficiary	Author
1.0	28/08/2017	TUW - EEG	Andreas Fleischhacker
2.0	30/08/2017	WIP	S. Caneva, S. Challet, P. Alonso