Ref. Ares(2019)3823001 - 14/06/2019

The DELTA project has received funding from the EU's Horizon 2020 research and innovation programme under grant agreement No 773960

DELTA

Project Acronym:	**DELTA**
Project Full Title:	**Future tamper-proof Demand rEsponse framework through seLf-configured, self-opTimized and collAborative virtual distributed energy nodes**
Grant Agreement:	**773960**
Project Duration:	**36 months (01/05/2018 – 30/04/2021)**

DELTA MARKET ANALYSIS AND PRELIMINARY BUSINESS INNOVATION PLAN

Report D8.6_v1

Work Package	**Dissemination, Communication and Exploitation Activities (WP8)**
Task	**Energy Market Analysis and Business Planning for DELTA-Solutions (T8.3)**
Document Status:	**Ready for peer review**
File Name:	**DELTA Report 8.6_v1**
Due Date:	**30 April 2019**
Submission Date:	**June 2019**
Lead Beneficiary:	**e7**

Public	
Confidential, only for members of the Consortium (including the Commission Services)	X

Authors List

Leading Author			
First Name	Last Name	Beneficiary	Contact e-mail
Klemens	Leutgöb	e7	klemens.leutgoeb@e-sieben.at

Co-Author(s)				
#	First Name	Last Name	Beneficiary	Contact e-mail
1	Christof	Amann	e7	christof.amann@e-sieben.at
2	Guntram	Preßmair	e7	guntram.pressmair@e-sieben.at

Reviewers List

Reviewers			
First Name	Last Name	Beneficiary	Contact e-mail
Sokratis	Katsikas	NTNU	sokratis.katsikas@ntnu.no
Alessio	Baiocco	NTNU	alessio.baiocco@ntnu.no
Fivos	Therapontos	EAC	ptherapo@eac.com.cy
Ioannis	Papageorgiou	EAC	ipapageo@eac.com.cy

Legal Disclaimer

The DELTA project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 773960. The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the Innovation and Networks Executive Agency (INEA) or the European Commission (EC). INEA or the EC are not responsible for any use that may be made of the information contained therein.

Copyright

Executive Summary

The **DELTA project** aims to unleash the demand response (DR) potential of small and medium-sized electricity prosumers (those who both produce and consume) in Europe. DELTA proposes a DR management platform that distributes part of the aggregator's intelligence into lower layers of its architecture, in order to establish a more easily manageable and computationally efficient demand response solution. This approach includes the development of the DELTA Virtual Node (DVN) where a large number of customers (small to medium consumers, producers or prosumers) which share key common characteristics in terms of consumption, generation and available flexibility amongst others is clustered.

Against this background, the **report pursues the objective** to provide a first market analysis, identifying the main needs of customers and presenting the most relevant customer segments. The market analysis serves then as basis for the elaboration of a business model for the DELTA-platform, including marketing and pricing strategy, cost-benefit analysis as well as risk analysis.

The **main elements of the analysis** can be summarised as follows:

- As a first step for the development of DELTA business models the heterogeneity of the different forms of flexibility markets is assessed, since these markets represent the sources for revenues related to the activation of DR-potential. Market design requires flexibility at different points, requested by different market participants with different, sometimes contrary, reasoning. This has to be kept in mind when market development for flexibility (demand response, DR) is forced. New, innovative business models will have to consider this as well
- A usual way to categorise DR business models is related to the different nature of the related income streams: Explicit DR or implicit DR. Following to the outcomes of the preceding specifies the following generic DR business models, which are generally appropriate for the incorporation of small and medium-sized prosumers: Explicit DR as stand-alone service; Explicit DR combined with EES; Implicit DR service for optimal use of time-of-use (TOU) contracts; Implicit DR including power supply; Microgrid Management.
- The generic DR business models point out to the future core customer groups of the DELTA-platform which consist of DR aggregators, energy retailers, EES providers, facility managers and microgrid managers.
- In addition to the core customer groups, we expect that individual elements of the DELTA-platform – such as the cyber security services, or the market price forecast, or the grid stability simulation engine –will be interesting also to additional non-core customers.
- The partial Business Model Canvas (BMC) assessment shows that there exist certain features that are relevant for each business model if applied to small and medium-sized customers. From the point of view of market penetration, these features should be in the development focus for the DELTA-platform. The most important features that are relevant to all generic DR business models are as follows: Handling of small and medium loads (control, monitoring, load shift etc.); automatic dispatch (under certain conditions); user clustering for automatic detection and classification of assets; self-subscription and self-assessment of switchable devices; precise load forecasting connected with the utilisation of accessible DR-potential; price forecast for different flexibility markets; administrative applications for user management, as well as applications supporting "smart contracts".

Table of Contents

List of Figures

List of Tables

List of Acronyms and Abbreviations

Term	Description
BEMS	Building Energy Management Systems
BG	Balance Group
BRP	Balance Responsible Party
BMC	Business Model Canvas
CAM	Control Area Manager
CPP	Critical Peak Pricing
DA	Day-Ahead
DoE	Department of Energy
DR	Demand Response
DSO	Distribution System Operators
DVN	DELTA Virtual Node
EE	Energy Efficiency
EES	Energy Efficiency Service
EEX	European Energy Exchange
ESCO	Energy (efficiency) Service Company
EU	European Union
FEID	Fog Enabled Intelligent Device
FLESCO	Flexibility Service Company
FM	Facility Management
Hz	Hertz
ID	Intraday
IT	Information Technology
kWh	Kilowatt-hour
OTC	over-the-counter
PV	Photovoltaics
RES	Renewable Energy Sources
RTP	Real Time Pricing
SEDC	Smart Energy Demand Coalition
SME	Small and Medium Enterprise
TOU	Time of Use
TSO	Transmission System Operator
US	United States

1. Introduction

1.1 Background of the DELTA project

The energy system is undergoing a paradigm shift as it evolves from the historic structure of centralised energy generation towards a network of distributed prosumers. Consumers are increasingly being encouraged and empowered to actively participate in the energy network with respect to consumption and generation. The future energy system will be a smart system, where all energy entities are given the opportunity to participate in the market place. This is reflected in the latest round of EU energy market legislation (European Commission 2018).

One of the main elements of energy transition implies an increasing share of renewable energy sources such as wind and solar in our energy mix, increasing volatility of the electricity system. However, that also implies that an energy system has to be managed in a more complex manner than it used to be. The supply of renewable energy is always subject to major fluctuations on a seasonal as well as on a daily scale and the future power network will require major investments in order to be able to cope with smaller and more decentralized generation units.

One important element in coping with the challenge of increasing need for flexibility is the demand side. If the demand side patterns are better adjusted to the supply patterns of the renewables this will reduce investments required on the supply to guarantee grid stability. This concept is called demand response (DR): Peaks and shortages of electricity supply are communicated to the consumers who reply by adapting their current consumption.

Technical solutions to realise the smart grid are already in place, but there is still a need for developing business models in order to make it economically feasible. There is some incentive for all parties involved to make use of demand response as it saves costs for consumers and for suppliers it can work as a tool to better balance their portfolio and optimise the sourcing costs. DR service providers also may be third parties that act as demand response aggregators, contracting directly with consumers, pooling together their demand response actions and selling them on the electricity market. Clarifying the roles and responsibilities of all these players needs to be accomplished in order to create a sound DR environment.

The **DELTA-project aims to unleash the DR potential of small and medium-sized electricity prosumers (those who both produce and consume electricity) in Europe**. DELTA proposes a DR management platform that distributes part of the aggregator's intelligence into lower layers of its architecture, in order to establish a more easily manageable and computationally efficient demand response solution. This approach aims to introduce scalability and adaptiveness into the aggregator's DR toolkits. One of the project's main innovations is the **DELTA Virtual Node** (DVN). The DVN is a cluster of customers (small to medium consumers, producers or prosumers) which share key common characteristics in terms of consumption, generation and available flexibility amongst others. The DVN transforms clusters of small to medium scale consumers, producers and prosumers into entities which can present much larger capacities for delivering DR services to the aggregator. Additionally, under the framework established by the DVN each customer will be equipped with a **fog enabled intelligent device** (FEID) which will gather and monitor energy related data from field devices, such as home appliances, distributed energy resources, storage components etc. The DELTA FEID will allow for real-time reporting of a prosumer's flexibility to the DELTA Nodes, while also being able to receive DR requests and distribute them to the facility's equipment.

1.2 Context of the report in the DELTA project and methodological approach of the report

In the frame of the DELTA-project this report aims at providing a first market analysis, identifying the main needs of customers and presenting the most relevant customer segments. The market analysis serves then as basis for the elaboration of a business model for the DELTA-platform, including marketing and pricing strategy, cost-benefit analysis as well as risk analysis.

The **work process** to achieve this goal is as follows:

- In a first step, the various forms of flexibility markets will be summarised, since the value of DR is placed on these markets and they represent the major sources of revenue.
- In the following chapter, the generic DR business models, which have been already presented in D2.1, will be further elaborated.
- Based on the main stakeholders involved in the implementation of the generic DELTA business models, we will identify the main customers segments for the DELTA platform.
- Finally, a partial Business Model Canvas (BMC) assessment will be provided. At this stage, we will focus on the part of the BMC which is directly related to the DELTA-Platform as a tool to support the incorporation of small and medium-sized prosumers into DR services, i.e. part called “key resources”. In order to be able to develop the aspect of key resources it is important to understand the main elements of the value proposition connected with a certain business model and to derive from there the key activities that need to be implemented by the DR service provider. The partial BMC will be performed for all five generic DR business models.

At the current stage, this is a **preliminary deliverable**, since the full market analysis needs to be based on a comprehensive assessment of DELTA business models – based on a full BMC assessment – which is due as part of D2.3 DELTA Business Models v1 (delivery date end of October 2019). Furthermore, a comparison with the results of D1.1 DELTA Requirements, Business Scenarios and Use Cases is crucial in order to detect eventual discrepancies. Against this background, the deliverable will be revised, if required, based on the outcomes of the other two deliverables (envisaged delivery date of the final D8.6-Report by end of November).

2. Different forms of flexibility markets

As a basis for the development of DR business models it is important to understand the **heterogeneity of the different forms of flexibility markets**, since these markets represent the **sources for revenues** related to the activation of DR-potential.

2.1 The flexibility challenge in energy transition

It is widely accepted that flexibility is one of the major elements of the energy transition. With the growth of electricity produced in wind power plants or with photovoltaics, volatility in the electrical system increases accordingly. Transmission and distribution grids face new challenges as well (Figure 1). One of the basic requirements of electrical systems is the strict balance between production and consumption. This physical balance is one of the most challenging tasks of market players on the electricity market.

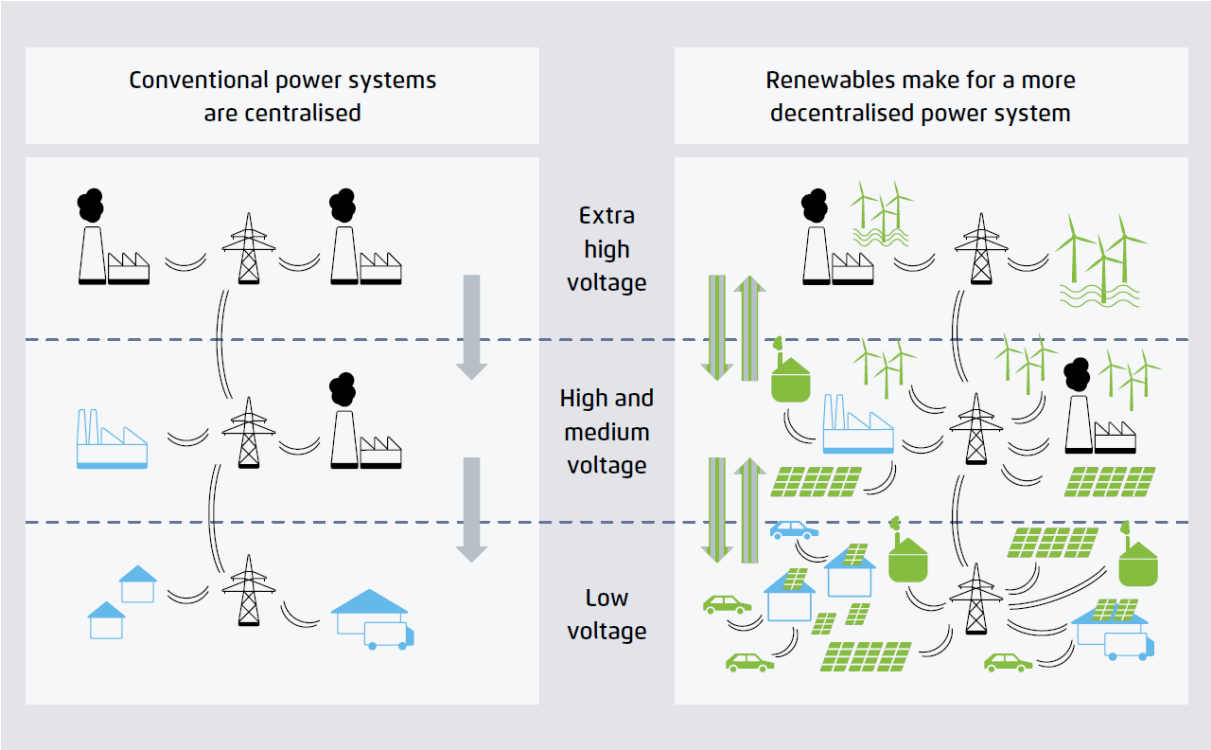

Figure 1: The flexibility challenge
Source: Agora Energiewende 2017, taken from Agora Energiewende 2019, A word on grids

Flexibility can either be offered on the production or on the consumption side (demand response, DR). However, flexibility is not only traded on a single marketplace.

This chapter gives an overview on different markets where flexibility is traded. All these markets have different market players involved, they follow a different reasoning and they try to solve different problems. Furthermore, they underlie different regulatory framework conditions.

2.2 Different classification of electricity markets

Depending on the focus there are several ways to classify electricity markets:

2.2.1 Regulation

One common way is to divide electricity market into a regulated area (i.e. operation of the grid), where market conditions are set by national and European regulation, further specified by national regulatory bodies and the liberalised area where market players compete to each other.
Main market participants in the regulated area are Transmission System Operators (TSOs), Distribution System Operators (DSOs), Control Area Manager (CAM). On the other side, the liberalised market, there are electricity production, trade and supply. In this area, market players are competing with each other. The major market participants in the liberalised European electricity system are the Balance Groups (BG), represented by Balancing Responsible Parties (BRPs). BRPs are financially responsible for their imbalance in the electricity market. Imbalance in this sense means any deviation of electricity production and consumption from the schedule reported to the TSO/CAM. All electricity producers, traders, suppliers and consumers (indirectly via their supplier) are members of a balance group.

Flexibility is needed and traded in both spheres, however, for different purposes and with different market mechanisms.

2.2.2 Time resolution

It is very common to classify the electricity market along the time resolution of market procedures (Figure 2), dividing electricity market into:

- Futures Markets,
- Spot Markets, and
- Balancing Markets.

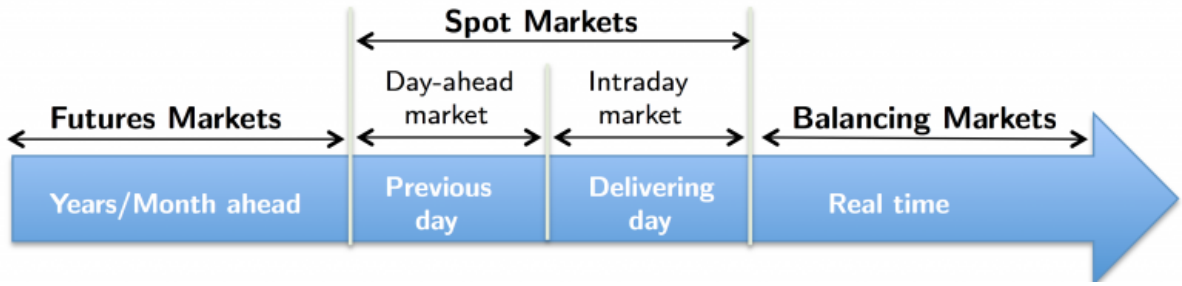

Figure 2: Market classification along time resolution
Source: incite 2019 (http://www.incite-itn.eu/blog/introduction-to-electricity-markets-its-balancing-mechanism-and-the-role-of-renewable-sources/)

One important thing to know is that the price per kWh traded increases from future markets towards real time markets, i.e. flexibility is more expensive than future products for the same period of time. Flexibility is commonly traded within the time frame of spot markets and balancing markets, i.e. from day-ahead to real time.

2.2.3 Organisation of electricity markets

Another very common distinction is the organisation of the electricity markets. Within the liberalised area, he largest share of energy is traded outside organized markets, so-called Over-the-Counter

(OTC) market. Products are not standardized and market players interact directly there. However, prices at OTC markets are tied to prices from organized markets which are integrated at the European Energy Exchange (EEX). EEX market is further divided into the forward market and the spot market. Within the spot market two main time frames are relevant: Day-ahead (DA) and Intraday (ID). Market for ancillary services, relevant for reliable and secure operation of the grids, can be considered an organized market as well. Products and criteria for market participation (prequalification etc.) are highly regulated, procurement of services is competitive. Flexibility is needed and traded in both types of markets.

2.2.4 Retail vs. wholesale market

Final consumers like residents, SMEs, and most of the industry are supplied with electricity from the retail market where electricity provider supply their customers with energy. Larger entities (e.g. energy intensive industry) and energy retailers (traders, suppliers etc.) trade their energy on the wholesale market, either on the EEX or bilaterally (OTC). A rather circular definition defines the retail market as any market where electricity is traded via a retailer and not on the wholesale market. However, a clear definition or criteria for a distinction is not available.

Flexibility is typically traded on wholesale markets, but final consumers are facing an increasing amount of flexible tariff offers. Future regulation will increase this market further.

2.2.5 Practical classification: Flexibility markets

As a kind of first summary, it can be stated, that common classifications do not help to come up with one single and clear definition of a flexibility market. It is rather the case that flexibility may play a role in all classifications but it is an extra task to define, how flexibility contributes to specific markets. For the purpose to understand flexibility markets, it is proposed to use a practical classification that is further elaborated below (Figure 3).

Flexibility (flexible loads) can be traded on different markets:

- Retail market
- Wholesale market (forward market, day-ahead market, intraday market)
- Balancing market
- Ancillary and system services markets
- Congestion management and redispatch
- Capacity mechanisms

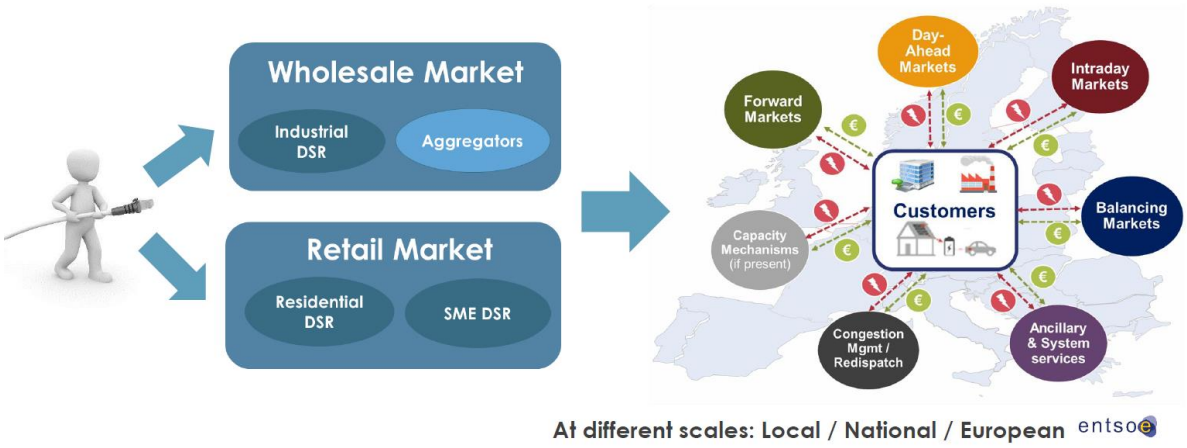

Figure 3: Flexibility markets; Source: ENTSO-E 2018 (Constantinescu, Norela: Transmission and Distribution Interaction: ENTSO-E, Presentation at the IRED 2018, Vienna)

2.3 Flexibility from different perspectives

The next question that will be discussed here is: What is the reasoning behind the different markets from different perspectives. In other words: which technical problems have to be solved with the use of flexibility?

2.3.1 Flexibility from the grid perspective

The grid perspective is the most common when it comes to flexibility markets. Grid operators have to guarantee high quality, reliable and secure operation of transmission and distribution grid continuously. In order to do so, it is necessary that demand equals production all the time. Changes of this balance will immediately lead to a change in frequency (50 Hz), an increase of demand reduces the frequency and vice versa. In the European electricity system, transmission system operators (TSOs) are responsible for (transmission) grid operation, they have to keep frequency, voltage and load imbalances within narrow ranges of tolerance (Figure 4).

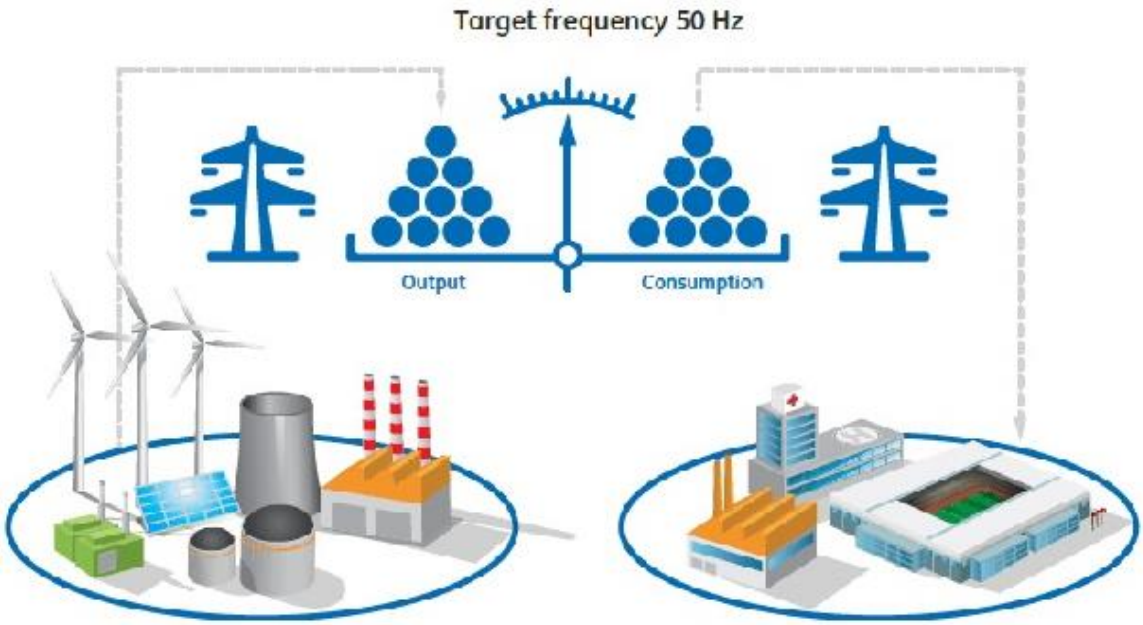

Figure 4: The target frequency of 50 Hz
Source: General Electric 2019 (www.ge.com/content/dam/gepower-pgdp/global/en_US/images/service/upgrades/jenbacher/primary-secondary-tertiary-balancing-power-operation.jpg)

For frequency control well established and clearly defined instruments within the so-called control energy market are available (Figure 5). Whereas control energy market was dominated by traditional power plants in former years, flexible loads are allowed to participate in this market since quite some time. These flexible loads can be offered directly (typically industrial loads) or via an independent aggregator (medium sized loads). While aggregation is allowed in most countries there are still a lot of regulatory and technical barriers as all market participants have to be approved.

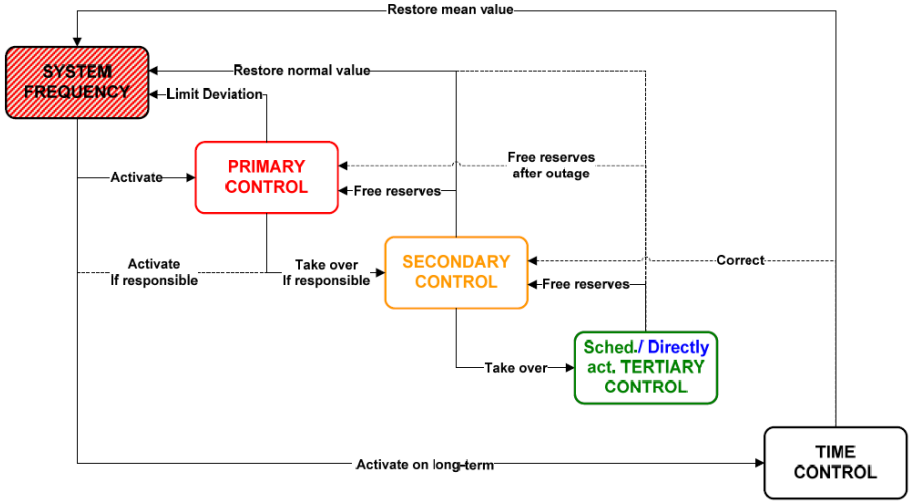

Figure 5: Control scheme and actions starting with the system frequency
Source: UCTE 2009: Policy 1: Load Frequency Control

Instruments or products for grid operation are called ancillary services (dena 2014, pp. 8f.):

- Operational management (feed-in management, congestion management, operational planning, data exchange etc.)
- Frequency control (instantaneous reserve, primary balancing capacity, secondary capacity, minutes reserve capacity)
- Voltage control (transformers gradation, control of reactive power, control of power generation plants)
- System restoration (black start capacity, capacity for island operation, co-ordination beyond grid level)

Relevant flexibility markets: tertiary control, secondary control, and - to a minor extent currently but with increasing relevance - primary control.

2.3.2 Flexibility from the perspective of energy production

One major reason for the need of flexibility is the increasing production of volatile renewable energy like wind power and electricity from photovoltaics. Depending on the weather and the time of the day and year, production changes dramatically within short time periods. This characteristic is reflected in the prices on wholesale markets, which are low in times when production is high and demand is low and vice versa - without any consideration of locality and grid load. There are even times with negative prices, i.e. clients receive money for consuming energy (apart from grid charges and similar fees).
Flexibility can help to increase the amount of energy from renewable resources in the energy system by shifting energy consumption towards times where production is high resulting in a reduced energy bill as high production typically correlates with low energy prices.
From a grid perspective, this relation may lead to problems in the operation of the grid when capacity of the grids is exceeded. TSOs will have to start congestion management measures like re-dispatch activities.

Relevant flexibility markets: Wholesale market (spot market, day-ahead and intraday markets)

2.3.3 Flexibility from the balancing/imbalance perspective

All market participants on the electricity market (producers, traders, suppliers, consumers) have to be members of a commercial balance group (BG). These balance groups are financially responsible for their own balance, i.e. the balance between production and consumption or buying and selling respectively. Deviations from the schedule to be reported to the TSO result in cost for imbalance and hence, balance groups are interested to reduce imbalances as far as possible. This can be done by procuring necessary energy or loads, i.e. flexibility, on short term markets, mainly on the intraday market. As balance groups are part of the open market area, flexible loads on the side of consumers can be used as well. The precondition of this is, that energy suppliers - as part of the balance group - offer delivery contracts with an option for load control.
In contrast to the grid perspective, the focus is on reducing imbalance costs by avoiding deviations from reported schedules. Grid conditions are only affected indirectly.

Relevant flexibility markets: Spot market, mainly intraday market; retail market with load control contracts for final customers.

2.3.4 A kind of summary: Flexibility from the energy system perspective

From the energy system perspective, the overall goals with respect to flexibility are:

- Decarbonisation of the energy production by increasing the share of volatile renewable energy resources (RES) and to increase energy efficiency (EE)
- Secure and reliable system operation by using flexibility to deal with volatility and to handle distributed production of RES (prosumers)

Flexibility is seen as an important means to reach these overall goals. However, as was shown above, market design requires flexibility at different points, requested by different market participants with different, sometimes contrary, reasoning. This has to be kept in mind when market development for flexibility (demand response, DR) is forced. New, innovative business models will have to consider this as well.

3. Generic DR business models for small and medium-sized prosumers

This chapter summarises and partly further elaborates the analysis performed in DELTA-Report D2.1_v1 (Leutgöb, Amann, 2018), since the generic DR business models identified in this report set the basis the market analysis with respect to the DELTA-platform. In this report, it has been analysed whether the current DR business models are appropriate for the participation of small and medium-sized prosumers, or whether there is a need for the definition of new or adapted business models that allow for the participation of small and medium-sized prosumers.

A usual way to **categorise DR business models** is related to the different nature of the related income streams: Explicit DR or implicit DR. Furthermore, we have to refer to the specific case of microgrids. Therefore, the Report D2.1_v1 specifies the following generic DR business models, which are generally appropriate for the incorporation of small and medium-sized prosumers

- Explicit DR as stand-alone service
- Explicit DR combined with EES
- Implicit DR service for optimal use of time-of-use (TOU) contracts
- Implicit DR including power supply
- Microgrid Management

3.1 Business Model "Explicit DR as stand-alone service"

In this business model, a DR Aggregator is bundling DR potentials from different clients, which are too small as stand-alone potentials to be offered to the various flexibility markets. The main characteristics of this business model are as follows (cf. Figure 6):

- The **aggregator acts as facilitator**. He has access to the DR potentials of clients and manages them towards the various flexibility markets. Depending on the regulatory framework he may offer the DR potentials either on the electricity balancing market (tertiary or secondary control markets) or he may participate with these loads in a balance group, represented by a BRP.
- The **income streams** originate from payments either from the TSO/DSO or from the BRP – in the latter case, these payments would reflect reduced balance power expenses in a balance group. Depending on the contractual agreement, the aggregator will usually pass on a certain share of these payments to the clients in his portfolio.
- The service of DR aggregation has **no interlinkage to power supply** or any other service to be provided for the client. In other words, this means that in this business model many interfaces need to be managed.

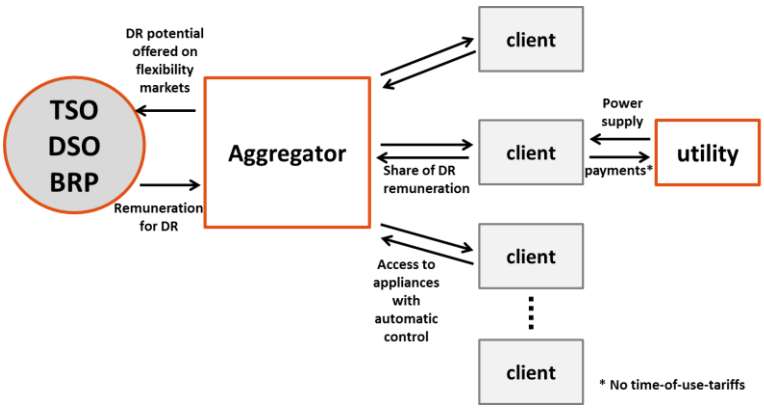

Figure 6: Business Model Explicit DR as stand-alone service

The business modell of explicit DR as stand-alone service is a standard approach widely used for commercial exploitation of large DR potentials, e.g. in industrial plants (typical case cement industry). The transferability to small and medium-sized prosumers depends on better and cheaper incorporation of small and medium loads from the residential and tertiary sector and on higher reliability of DR potentials which are achieved by bundling of small- and medium-sized loads. In particular this addresses the following factors:

- **Improvements to software solutions for aggregation** of small and medium-sized loads: Among other issues, there is a clear requirement to improve the functionalities related to bundling of small loads, to availability forecast as well as to automatic dispatching funtions.
- **Easy access to a large number of switchable devices** needs to be ensured (cf. the section above on latest market development regarding so-called smart devices): If, for example, the access would require up-grade of existing devices, the cost-benefit ratio of such activities would become negative very quickly.
- **Attractive value proposition to the clients:** A more detailed analysis of the user perspective, and namely of the users' willingness to participate in DR programmes (Leutgöb, Amann 2018) concludes that only a limited share of households will react to economic incentives for DR-participation, as the savings achievable for single households are expected to be quite small in most cases. In the tertiary sector the economic incentive has a higher weight than in the household sector, but in return comfort and availability consideration represent a more important barrier. Therefore, the value proposition thus needs to be adapted to the specific customer segment.
- **Distribution channels and customer relationships:** The aggregator needs to be able to address a large number of small and medium-sized customers at low cost. The distribution structure needs to achieve economies of scale very quickly, otherwise the sales cost will exceed the total achievable margin from the sum of single clients[1].

Altogether, we conclude that the business model related of explicit DR as stand-alone service has to cope with considerable barriers, mainly related to easy and cheap access to the clients as well as to the formulation of an attractive value proposition due to the fact that the service is offered as stand-alone service. Thus, the transfer of this business model to small and medium-sized customers will be rather difficult except for those customers that are somewhere between a medium and a large customer, such as large non-residential buildings. But even for this target group a combination of DR-services with other service components – as considered in the business models below – may be more attractive than the stand-alone service.

3.2 Business Model "Explicit DR combined with EES"

In its general approach, this business model is similar to explicit DR as stand-alone service – as described above – but the DR aggregation service is embedded into a more comprehensive energy efficiency service (EES). This approach, which is sometimes referred to as "**dual service**", is characterised by the following peculiarities:

- As described above, there exists a **trade-off between energy efficiency and demand response**, as load shifts in many cases will lead to an increase of energy consumption. Therefore, the main challenge of a dual service is to find an optimised solution for this trade-off on a day-to-day basis.
- EES and DR services require different fields of expertise and competencies. Whereas the core knowledge of EE service providers (frequently called ESCOs) is related to the operation of

[1] *This challenge of sales cost for overall profitability is similar to the one small-scale energy efficiency services are confronted with. It can by analysed by means of a multi-level contribution margin calculation (cf. Leutgöb et al., 2011)*

technical equipment, the success of DR service providers (usually provided by a DR Aggregator) is mainly based on a thorough understanding of the flexibility markets. Therefore, the combination of both services into one integrated offer is not easy and requires clear and transparent definition of the **ESCO's and the DR Aggregator's role**.

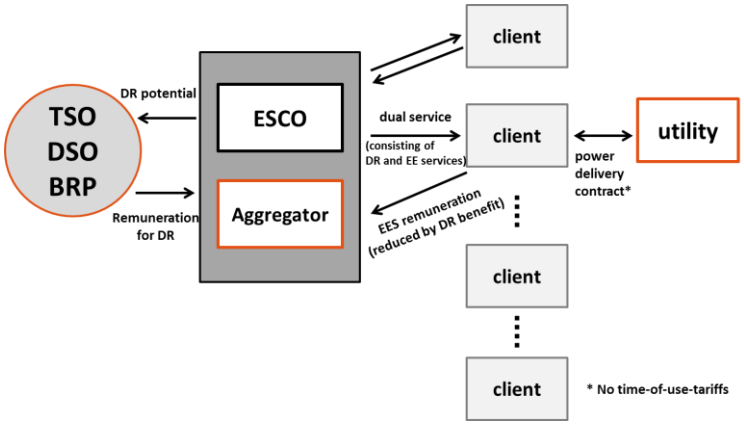

Figure 7: DELTA Business Model 1B Explicit DR combined with EES

Except of a few pilot projects, we are not aware that dual services are already offered on European markets. In any case, this business model is closely linked with the development of EES markets. If EES are increasingly offered also to small and medium-sized customers, DR-potentials could be harvested in this sector, too.
The business model of dual energy services can enforce further monetisation of energy savings by exploiting their potential to be used in the DR market (as soon as national DR markets reach maturity). Furthermore, the business model of dual energy services gives way to higher market penetration of EE-upgrades of buildings and installation of RES-systems both in the building/district and the grid scale facilitated by the provision of DR services (including system charges optimisation and direct grid services).
We expect that the business model can become successful in the medium term within the following framework and provided that the following preconditions are fulfilled:

- The package consists of **EES as guiding service** and DR as add-on service. There need to be clear rules for the collaboration between the ESCO and the DR Aggregator. In this context, the functionality of price forecasting gains increasing importance as it supports solving the trade-off between energy efficiency and load shifting in optimised way.
- The **main target groups will be the same as for the EES business**, which – because of transaction costs – are limited to customers with energy cost beyond 20,000 to 30,000 €/a in most European markets.
- The **project structure needs to be adapted to the specific customer**: The main structuring elements of an ESCO contract refer on the one hand to the detailed definition of responsibilities of the ESCO and the related interface to the responsibilities of the client, and on the other hand to the remuneration model – often subdivided into the guaranteed savings model and into the shared savings model. By introducing the DR-component into the project, the additional structural element of implicit versus explicit DR arises.

3.3 Business Model "Implicit DR service for optimal use of TOU-contracts"

This business model starts from the fact that already now a certain group of electricity customers have electricity tariffs with different price levels depending on the time of consumption – either **time-of-use (TOU) pricing,** or **real-time-pricing (RTP),** or **critical peak pricing (CPP)** (Cooke, 2011):

In EU countries electricity tariffs consist of one component related to electricity delivery and one component related to the utilisation of the grid, where the latter is defined by regulation. Therefore, the time-dependent structure of the tariff may relate either to one of these components or to both of them. For small and medium prosumers, the only time-dependent pricing model that is currently available on the market is TOU contracts, whereas RTP does not exist in this sector. We expect that in the near future more different and more differentiated TOU tariffs will be offered on the market. In addition, we may see in the near future CPP also for medium-sized prosumers, mainly if, for example, a customer with a larger portfolio will explicitly search for a time-dependent tariff for a whole pool of facilities.

The business model related to implicit DR service for optimal use of TOU contracts is characterised by the following elements and success factors related to the its application for small and medium-sizes prosumers:

- The service provider – in D2.1_v1 we have introduced the term **flexibility service company (FLESCO)**, corresponding to the widely used term ESCO – takes care of load shifts at the equipment of the client in a way that the client takes maximum benefit of an (existing) TOU tariff. The FLESCO's remuneration may be either fixed or performance-based.
- The economic advantageousness of the business model is depending on the **spread between high and low price in the tariff structure**. Only if the spread is sufficiently high the achievable savings will be attractive for clients to engage a DR specialist. If perhaps in future dynamic pricing models (CPP, RTP) will be increasingly available on the market there will be a higher need for external expertise.
- Implicit DR services for optimal use of TOU-contracts **can be offered as stand-alone services**. In this case, however, the disadvantages related to all stand-alone DR services apply (high transaction cost require quick achievement of economies of scale, and thus well-established distribution channels and customer relationships).
- We expect that the service will be more successful, if it is **embedded in services which are already offered on the market**. On the one hand, the service is strongly linked to the role of a technical facility manager, as they are usually aiming for a reduction of operating cost. On the other hand, there is an interlinkage with consultancy services related to the identification of the most attractive energy tariff.
- The **most promising target group** are medium-sized are those customers that have already outsourced the facility management to an external partner. In this case, the service may be offered as add-on to existing service elements (cross-selling potential). This approach will require, however, cooperation between facility management companies, which have a solid position at their customers, and DR specialists, such as DR aggregators.
- From the **technical point of view** there exist two crucial success factors for FLESCOs: i) know-how in operating facilities, easiest by means of master control systems (such as building management systems); ii) capability to manage information about price signals – potentially dynamic price signals –at the customers metering points for a larger number of customers.

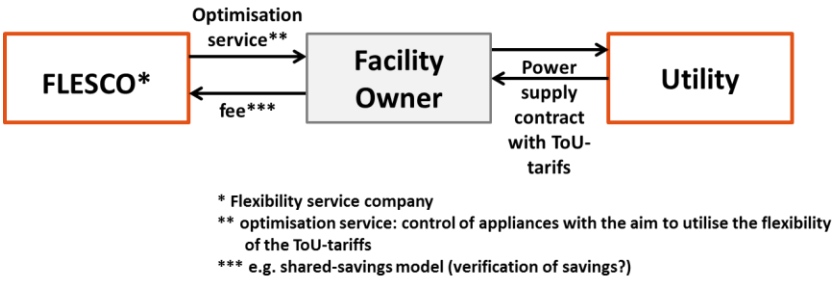

Figure 8: DELTA Business Model 2A Implicit DR service for optimal use of TOU-contracts

3.4 Business Model "Implicit DR including power supply"

This business model related to implicit DR including power supply combines DR services with the role of a retailer on the electricity market. The model is characterised by the following main elements:

- In addition to its usual function of selling electricity to customers, the **retailer has access to DR potential at the customers' sites** and is allowed to shift loads within the contractually agreed limits. Therefore, the business model goes beyond offering TOU tariffs, but includes active management of DR potentials at the customers.
- From the retailer's point of view, the access to **DR potential represents a value** as it may lead to savings both in wholesale prices and in balancing energy payments, since these prices are subject to high fluctuations depending on time of purchase. The more the retailer will be able to adapt the consumption patterns of his customer to the off-peak times on the market, the better will be his average wholesale price.
- In addition, the business model is particularly attractive for retailers that are also producers with a **high share of fluctuating renewables sources (wind, PV) in their supply portfolio**. By activating DR potentials, they can reduce the gap between supply and demand and thus reduce balancing energy payments.

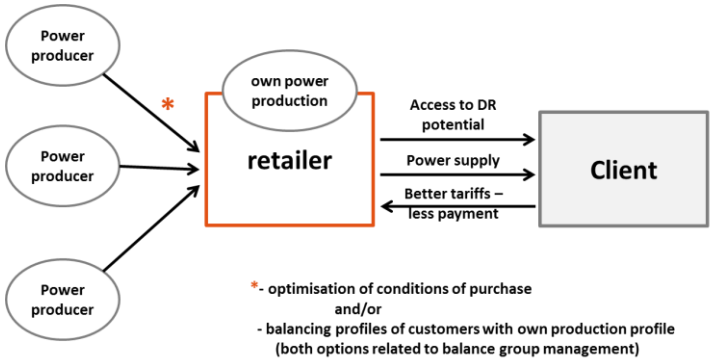

Figure 9: DELTA Business Model 2B Implicit DR including power supply

The business model has a high potential of transferability to small and medium-sized prosumers. The following factors, however, are important for successful market penetration:

- Generally, **retailers are in a good starting position** and can get comparably cheap access to DR-potentials as they have established working distribution channels and customer relationships (including billing) which may help them in offering DR as add-on to existing services.
- The **customer will require an incentive**, so that he is willing to grant access to his technical systems to an external party. The most obvious incentive is to receive a favourable electricity tariff. But for small- and medium-sized customers also non-financial incentives may be decisive – such as environmental considerations or enthusiasm for the most current technical developments.
- Because of comparably low transaction cost for retailers when accessing their customers, we assume that the business model may be also **applicable to the household sector**. Here the main barrier is the access to switchable devices in a way that they can be automatically managed (without manual interventions on a case-by-case basis). Taking into consideration the assessment on smart devices as presented above, the most relevant DR potentials in the short and medium term are heat pumps, air conditioners and possibly electrical heat storage

systems. Also, electric batteries might be relevant in this context, but their market is yet quite limited.

- To certain degree, energy retailers are able to play a role on increasing market penetration of smart devices. They could prepare and distribute **programmes where the (subsidised) sale of smart devices is combined with a special tariff** that allows for implicit DR. In the past similar programmes have been successfully implemented by utilities related to the dissemination of highly energy efficient appliances and they might be adapted to the case of increased DR participation of small and medium-sized prosumers.
- Furthermore, the retailer will require **suitable software platforms** that are to bundle and to dispatch automatically as many DR potentials at the costumer's side as possible. The retailer will have core interest in the platforms ability to synchronise the use of DR potentials with productions patterns – if the retailer is also an electricity producer – and/or with price signals on the wholesale market.

3.5 Business Model "Microgrid Management"

According to the US DoE Microgrid Exchange Group a microgrid can be defined a group of interconnected loads and distributed energy resources (such as distributed generators, storage devices, or controllable loads) within clearly defined electrical boundaries that acts as a single controllable entity with respect to the (macro)grid. A microgrid can connect and disconnect from the grid to enable it to operate in both grid-connected or island-mode (Berkley Lab, 2018).

- If operated in **island-mode** the microgrid manager has to ensure at each point in time that power supply is equal to power demand. In achieving this prerequisite, the exploitation of DR potentials including proactive operation of storage devices is decisive.
- If operated in **grid-connected mode** the microgrid manager can make use of the DR potentials available internally in the microgrid. He can either offer the loads in tenders of TSO, DSO or BRP (explicit DR) of optimised electricity cost by adapting the load profile of the microgrid to dynamic pricing (implicit DR).

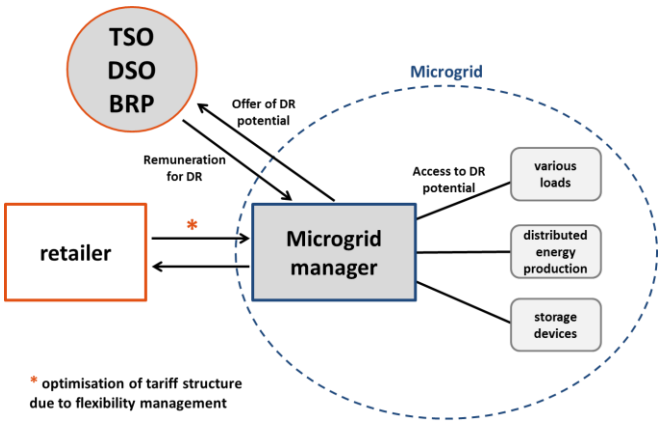

Figure 10: Business Model Microgrid Management

Microgrid management is a very relevant business model for the activation of medium-sized DR potential that qualify for formation of a microgrid. The most relevant application fields for this business model will be those cases where a complex demand structure is complemented by decentral renewable energy production on the site or nearby the site (e.g. university campus, green-field neighbourhood development, business parks etc.).

However, in practically all EU countries the **regulatory environment is a current blockage for microgrid development**. According to Energati (2018) Europe is accounting for just 9% of the global microgrid capacity. There are, however, several pilot microgrids, e.g. related to university campuses or to industrial and commerce centres.

A professional software solution for managing and dispatching the various loads is a "must" for microgrid managers, independently from whether they operate the microgrid in island-mode or grid-connected mode. The larger and more complex the microgrid the more relevant a professional platform is to enable dispatching the interconnected loads and distributed energy resources and to optimise the exchange with the external macrogrid.

3.6 Clusters of core customers for the DELTA platform

The generic DR business models as presented above point out to the core customer groups of the DELTA-platform. To sum up, the following stakeholders may become the most important users of the platform in the future:

- **DR Aggregators:** The DELTA-solution helps them to expand their business model to the segment of small and medium-sized prosumers in a cost-efficient way thus increasing the value which they are able to offer to the various flexibility markets as described in chapter 2.
- **Energy Retailers:** They utilize the DELTA-platform to ensure access to DR-potential as means of enforcing their position on the energy supply markets (wholesale market, balancing market) – due to the activation of DR-potential they may be able to achieve better purchase prices.
- **EES-providers and Facility Managers:** For this target group the DELTA-platform may be useful as a tool to extend their portfolio mainly towards implicit DR services since these are closely related to facility operation and optimisation.
- **Microgrid-Managers:** For the moment, this target group is rather small, but with changing regulatory framework – for example related to the so-called local energy communities – their importance may grow over time.

4. Partial Application of Business Model Canvas to the Services of the DELTA-Platform

4.1 Brief introduction to BMC Methodology

One of the most common tools for business model development is the so-called business model canvas (BMC, cf. Figure 11). The BMC provides a framework helps to structure business ideas and to evaluate their marketability, still being flexible for adaptations and the integration of new elements.

The general structure of the BMC consists of the following parts:

- The right side summarizes those **business model elements that are connected with the costumer**: customer relationship, channels for customer approach, customer segments and revenue streams;
- The left side is related to business model elements that describe the **internal situation and challenges at the supplier's side**: Key activities connected with the implementation of the business model, key resources required to implement the key activities, key partners and cost structure.
- Both sides are connected by the most crucial element of each business model, the so-called **value proposition**, which refers to the following key questions: Which problems at the customer's side is the service/product helping to solve? Which customer needs are satisfied by the service/product? What is the specific offering? What features or benefits match customer needs?

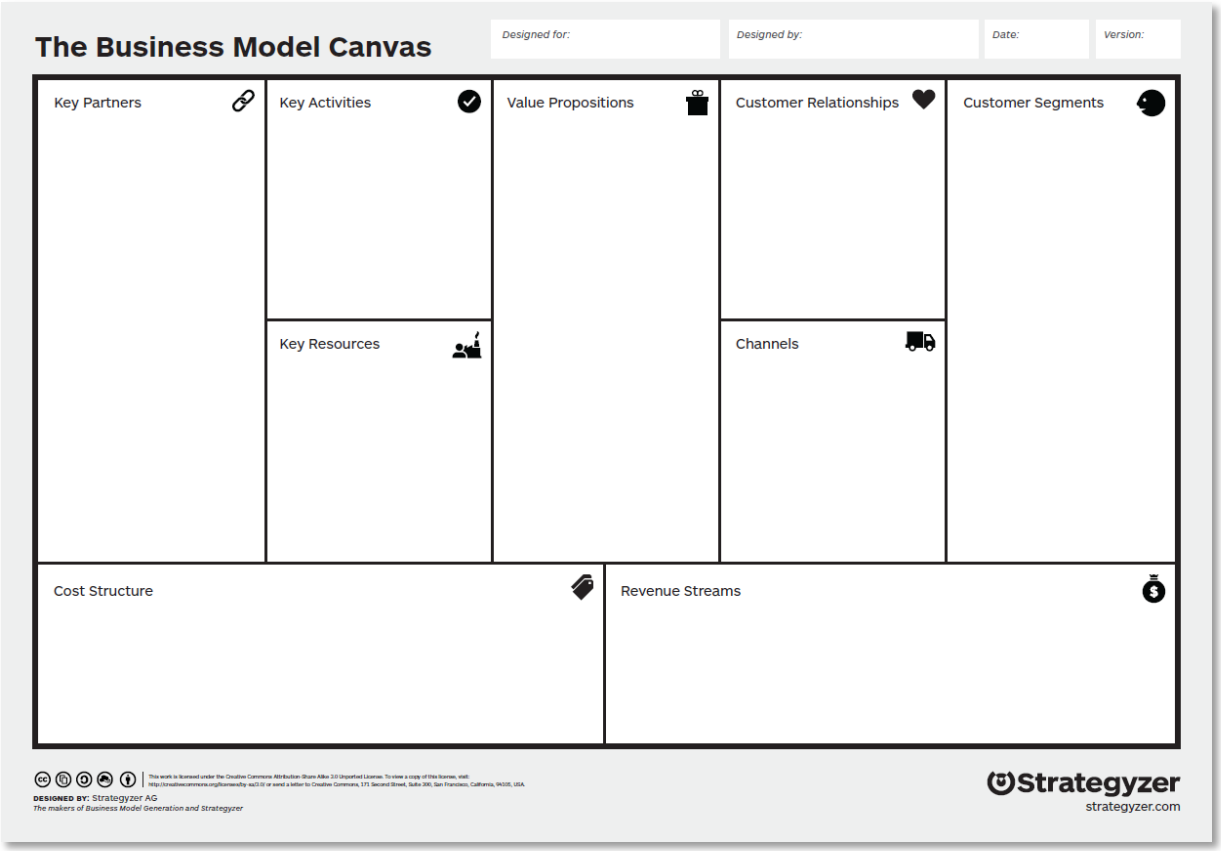

Figure 11: The business model canvas
Source: Strategyzer 2019(https://www.strategyzer.com/canvas/business-model-canvas)

At this stage of the work process we will not be able to apply the full BMC to the business models which have been developed so far and which have been summarised in chapter 3. We will focus on the part of the BMC which is directly related to the DELTA-Platform as a tool to support the incorporation of small and medium-sized prosumers into DR services, i.e. part called "**key resources**". In order to be able to develop the aspect of key resources it is important to understand the main elements of the **value proposition** connected with a certain business model and to derive from there the **key activities** that need to be implemented by the DR service provider.

The full BMC assessment for each single generic business model will be done as part of D2.3 "DELTA Business Models". After having available the full BMC assessment, it may be necessary to revise and further elaborate the partial assessment that is presented in the following chapter.

4.2 Value proposition, key activities and key resources differentiated by generic DR Business Models

4.2.1 Partial BMC for Business Model "Explicit DR as stand-alone service"

Main elements of value proposition

The DR aggregator acts as facilitator between the providers of DR potentials ("clients") – in the case of the DELTA-project we are mainly interested in client base of small and medium-sized prosumers – and the stakeholder of the flexibility markets. Therefore, the aggregator has to be successful on two different markets, i.e. it has to provide convincing value propositions to clients and stakeholder at both sides. The following description of main elements of value proposition for the business model "Explicit DR as stand-alone service" takes into consideration the intermediary position of a DR aggregator:

- **Additional revenues from various flexibility markets:** Additional revenues are the most attractive element of the value proposition to larger consumers that offer their DR potential via aggregators to the various flexibility markets (cf. chapter 2). Specifically for the extension of the business model "Explicit DR as stand-alone service" towards small and medium-size prosumers, we have to take into account, however, that the amounts per client will be very small under usual conditions. Therefore, we do not expect that the additional revenues alone will provide sufficient incentive to attract a larger share of the target group. This expectation is based on experience with respect to willingness to change utilities in a liberalized power market: Customers' switching rates differ largely between EU countries. Even though switching processes have been facilitated by regulation and the automation of processes in many member states, there still is a high number of customers – especially households – who remain with their incumbent supplier. Table 1shows switching rates for electricity household and non-household customers in 2017 for a selection of European member states.
- **Participation in energy transition:** Our impression is that the economic benefit has to be complemented by a non-economic benefit related to the importance of flexibility in the future electricity system. We think that there exists a certain share of small and medium sized customers that are interested to actively participate in the energy transition by making available their potential for load shift under certain conditions. From our point of view, there may be a certain analogy with the development of the market for green electricity as it has developed over the past 15 to 20 years. We have to underline, however, that also with respect to market success of green electricity there exist big differences between EU countries. Literature finds that markets have grown significantly in recent years and the products are now available in many more countries. Those countries where green electricity tariffs have been on sale for longer periods of time have also seen significantly increased consumer uptake. Table 2 shows the percentage of household customers enrolled in green electricity tariffs in 2014 for selected EU member states.

- **Supplementary elements of value propositions:** Some of the customer segments may be interested in supplementary services that may become part of a more comprehensive service package. For example, facility owners or managers may be interested in remote supervision of systems and devices with respect to operability and availability. This aspect will gain importance in some of the other business models, but also for the business model of "Explicit DR as stand-alone service" it may contribute to an attractive value proposition under certain conditions.
- **Value proposition to flexibility markets:** With respect to value generation on the flexibility markets the main value proposition is that DR potentials of small and medium-sized prosumers can be activated at very low (practically zero) *variable* cost. From our point of view, this characteristic is the main factor of competitiveness compared to other participants of the flexibility markets, such as peak load power plants. At the same time, the business model "Explicit DR as stand-alone service" suffers from a high level of fixed cost – mainly transaction cost related to access to clients and cost for securing connectivity in legacy equipment.

Table 1: Switching rates for electricity household (%; by metering points) and non-household (%; by eligible volume) customers in 2017 for selected countries
Source: CEER 2018

	Switching rates for electricity customers in 2017 [%]	
Country	**Household customers**	**Non- household customers**
Portugal	18,5	27,7
Great Britain	18,2	16,4
Germany	9,6	13,0
Austria	4,3	7,5
Greece	2,6	6,6

Table 2: Percentage of households enrolled in green electricity tariffs in 2014 for selected countries [%]
Source: MacDonald, S. and Eyre, N., 2018

Country	**2014**
Germany	17%
Belgium	37%
Finland	2%
France	1%
Netherlands	63%
Slovenia	0,2%
Spain	4,4%
Great Britain	2%

Derivation of key activities

Based on the description of main elements of value proposition, we derive the following key activities to be implemented by the aggregator in order to ensure the success of the business model:

- From the technical point of view, the first key activity is the **bundling of small and medium-sized DR potentials** to a larger DR pool which is ready to offer on the various flexibility markets.
- In this context, the **precision of forecast of available loads** is a crucial success factor, since each kWh that can be offered on flexibility markets influences the revenues.

- Furthermore, there is a need to **check the general DR potentials** of various systems and appliances at the client either through site-visits or remote.
- Another core activity consists of "simple" **administrative tasks** related of small and medium-sized DR potentials. This refers to the administration of the entrance process of load to a DR pool as well as the withdrawal. Furthermore, the regular up-date of basic characteristics of the available loads and the disbursement to clients have to be administered.
- With respect to the different market places of flexibility markets, the aggregator has to have a **clear overview and regular up-date on the development of prices** as well as on **eventual changes of the market rules** the at the.
- From there, the aggregator has to **optimize the sales strategy** for the switchable loads in his portfolio. On the one hand, this refers to the selection of the most suitable market place (cf. chapter 2), on the other this relates to best possible formulation of offers (timing, price, amounts…).
- If the DR service includes **supplementary services** as described above (e.g. remote supervision of systems and devices with respect to operability and availability), the aggregator has to implement the related activities (regular control, identification of mal-functions, communication with the client etc.)

Derivation of key resources

The extension of the business model "Explicit DR as stand-alone service" towards small and medium-sized prosumers requires a very high level of digitisation and automation. Otherwise the comparably small number of switchable loads per client and the related small amount of revenues could not cover the fixed amount of transaction cost. Therefore, the aggregator will require as **major key resource high-level IT-platform** that comprehensively supports the key activities as described above. Against this background, we conclude that the DELTA-Platform has fulfil the following features and functionalities in order to reflect the requirements of the main value propositions related to the business model "Explicit DR as stand-alone service":

- **Handling small and medium loads:** Solutions are required that make use of existing infrastructure through suitable interfaces and that facilitate participation of all types of medium and small loads, including residential clients, e.g. through a **well-developed approach for self-subscription**.
- **User clustering**, allowing for automatic detection and classification of assets without consuming resources during equipment installation and commissioning, e.g. based on **self-assessment of switchable devices** and of technical conditions for shiftability.
- **Load forecasting:** Requirement to allow for more accurate load forecasts, enabling near real time assessment of future availability assets to improve revenue from availability declarations.
- **Individual price forecasting tools** for each significant market, allowing stakeholders to better monetise their assets.
- **Grid stability assessment**, with the aim to achieve a holistic view of the grid status.
- **High-level of interoperability** to ensure easy access to clients' devices on the one hand and for easy exchange with the various stakeholders of the flexibility markets.
- **Secure management of contractual agreements ("smart contracts"):** Time-resources spent for the conclusion of contracts as well as all activities related to monitoring of contract implementation (including billing) represent a considerable share of transaction cost if we talk about small and medium-sized clients. Therefore, digitisation related to facilitation of contracting activities is crucial from the point of view of transaction cost.
- **Administrative applications** for user management (communication with clients, complaint handling etc.), payment transactions etc.

Many of the aspects described above have been already addressed as intended competitive advantages developed in D2.1 "Energy Market Analysis and Regulatory Guidelines Specification", but some features have been enhanced or added.

4.2.2 Partial BMC for Business Model "Explicit DR combined with EES"

Main elements of value proposition

In this business model the DR Aggregator provides a complementary service that enriches the core energy efficiency service (EES). Therefore, we assume that the main drivers behind the value proposition of this business model are related to the EES, such as (Bachner and Leutgöb 2018):

- **Outsourcing of non-core activities** to an external EE expert who provides a complete one-stop service
- **Comprehensive analysis of energy saving potential** and derivation of suitable EE improvement measures
- **Technical quality related to the implementation** of EE improvement measures
- **Transfer of technical risks** to the external EE expert by means of saving guarantees and a remuneration element that is coupled to the achievement of guaranteed savings.
- Professional approach related to **measurement and verification** of energy savings
- Services connected to **value retention and maintenance** of buildings systems and other devices
- Incorporation of users in EE activities taking into account the **compliance with agreed user comfort levels.**

The additional value proposition related to the **DR element in the one-stop service package** refers to **additional cost savings** that are shared between the service provider and the client.

With respect to value generation on the flexibility markets the observation made for the business model "Explicit DR as stand-alone service" apply (cf. chapter 3.1), i.e. the competitive advantage of DR potentials of small and medium-sized prosumers is the very low (practically zero) variable cost.

Derivation of key activities

When activating the DR potential as part of an EES project the EES provider generally implements the same key activities as a DR aggregator in the business model "Explicit DR as stand-alone service". There exist, however, a few peculiarities related to this business model:

- The core markets for EES are larger and medium-sized customers since transaction cost is usually too high for small customers. Therefore, during **energy audit** which is the usual starting point of any EES the service provider has the **possibility check the shiftability of devices and systems**, consisting of an assessment of the amount of loads to be shifted as well as of the technical access for external control of the loads. Therefore, we may expect certain cost-reducing synergies if DR services are provided in connection with EES.
- There is a need to **integrate DR activities into EE improvements measures** and in some cases, we will observe conflicting goals in this context: Some of the DR actions may lead to an increase of energy consumption compared to optimized system operation. Therefore, there the service provider will have to take decisions on prioritizing a certain set of measures under certain conditions.

Derivation of key resources

With respect to the provision of DR services – as part of an EES package – the key resources are very similar to the ones required for the business model "Explicit DR as stand-alone service" (cf. 3.1). There exist, however, a few features that are specifically relevant in the context of this business model:

- The platform should be able to support the **comparative impact assessment of EE improvement measures and DR activities** with an optimization algorithm for those cases where the DR activity may potentially lead to an increase of energy consumption.
- The impact assessment needs to be done in the **design phase** as well as in the **operation phase**. In the design phase the investment decision has to be taken: Does it pay off to invest into controllability of switchable loads? In the operation phase the EES service provider has to decide on the actual activation of the DR action taking into consideration its potentially antagonistic impact on energy savings.

4.2.3 Partial BMC for Business Model "Implicit DR service for optimal use of TOU-contracts"

Main elements of value proposition

Depending on the exact shaping of the services provided under the business model "Implicit DR service for optimal use of TOU-contracts" we assume that the following elements of the value proposition will be decisive for market success:

- **Cost reduction through selection of the optimal TOU tariff** depending on the load shift potential at the client's site: In general, most clients do not have a good overview on various forms of tariffs available on the market, and in particular, they have difficulties to assess whether a TOU tariff pays off for their specific case of consumption pattern. Therefore, there is a need for tariff consultancy which actually is already available on many markets – e.g. in the form of organization of tariff tenders for pools of small and medium-sized consumers[2]. Taking into consideration the additional cost saving potential emerging from TOU tariffs there is an even larger need for consultancy since the tariff structure has to fit to the given consumption pattern on the one hand, and to achievable potential for load shift on the other hand. We assume that most small and medium-sized clients will be overstrained by the complexity of this task so that the provision of orientation is expected to be a powerful element of value proposition in this context.
- **Making full use of the cost saving potential of TOU tariffs by adapting the facility operation** in line with the conditions of the TOU contract: In addition to providing an overview on the tariff landscape, a further important value proposition of the service provider FLESCO (flexibility service company) is the capability to adjust the facility operation in a way that the client benefits fully from the cost saving potential offered by the TOU contract. In the case of a simple TOU rate the adjustment of facilities will be done once covering a longer period of time, whereas in the case of more dynamic pricing (RTP or CPP) the adjustments need to be done as regular part of facility operation.
- Starting from the adjustments of facilities as described above, the way is paved towards more **comprehensive facility management services**. Actually, we think that most promising application of the business model "Implicit DR service for optimal use of TOU-contracts" is its integration into facility management (FM) as a profession that encompasses multiple disciplines to ensure functionality, comfort, safety and efficiency of the built environment by integrating people, place, process and technology[3].
- Similar to clients for explicit DR business models as described above (cf. chapters 4.2.1 and 4.2.2) we think that **participation in energy transition** will be a convincing argument also for this business model related to implicit DR. Many clients will wish to demonstrate themselves

[2] In Austria, for example, the Association for Consumer Protection (VKI) regularly organises a tender among electricity and gas suppliers for which households are pooled in order to achieve wholesale prices (cf. https://vki.at/energiekosten-stop?vki-cc=accepted)

[3] cf. definition of the term "Facility Management (FM)" according to IFMA (International Facility Management Association): https://www.ifma.org/about/what-is-facility-management

as innovative and resource-friendly at the same time so that an offer that addresses these aspects may fall on good soil.

Derivation of key activities

From the value proposition as described above we can derive the following key activities of the FLESCO:

- **Permanent market observation**, mainly with respect to TOU-tariffs, in order to keep track with the most current development on the market
- **Assessment of demand profiles and potential for load shift**, either through site-visits or remote
- **Selection of most beneficial tariff** for a given facility, based on a comparison between load profile (taking into account potential load shifts) and tariff structures: This activity may include the active search among suppliers, e.g. by means of a competitive tender.
- **Facility management services** related to the operation, control and monitoring of technical systems, with the aim to utilize the saving potentials of a given tariff by shifting loads to low-cost periods (late night, weekend, etc.)
- **Permanent updating of tariffs applicable to single costumers:** This aspect is most relevant for the case of dynamic price models, but also the TOU-tariffs more stable patterns change over time and require new assessment of the situation and adjustment in operation
- **Administrative tasks** related to management of a larger bundle of small and medium-sized customers, including communication with the client, calculation of service fees, invoicing, etc.

Derivation of key resources

In order to be able to implement the key activities as described above the FLESCO that operates on the market of small and medium-sized customers has to have access to the following key resources – part of which can be covered the solutions provided by the DELTA platform:

- **Tool for easy and cost-efficient load profile assessment** including impact assessment of load shifts: For small and medium-sized prosumers the tool needs to be able to work with limited data set, e.g. based on metering data (preferable from smart meters) and basic description of technical systems supplied behind the meter.
- **Tool that supports the automatic comparison between load profile and tariff structure**, preferable with automatic detection of cost saving potential from adapting the load profile through utilising DR-potentials at the client.
- **Database that keeps updated tariff structure at different clients:** This feature is crucial for the case of dynamic pricing and requires communication with the electricity supplier.
- **Bundling of loads** across one client, potentially incorporating various sites of the same client if the tariff applies different sites.
- **Easy access to technical systems at the clients' side:** In general, this refers to the possibility of remote control so that the FLESCO can quickly react to changes in the tariff regime.
- Whereas for stable TOU-tariffs we assume, that adjustment can be made manually, for the case of dynamic pricing, the FLESCO needs to have available **algorithms for automatic adjustments** in system operations.
- **Secure management of contractual agreements ("smart contracts"):** If the service is provided without a more comprehensive facility management contract, the conclusion of contracts as well as all activities related to monitoring of contract implementation (including billing) represent a considerable share of transaction cost if we talk about small and medium-sized clients. Therefore, digitisation related to facilitation of contracting activities are crucial from the point of view of transaction cost.
- **Administrative applications** for user management (communication with clients, complaint handling etc.), payment transactions etc.

4.2.4 Partial BMC for Business Model "Implicit DR including power supply"

Main elements of value proposition

The following elements define the value proposition of the business model "Implicit DR including power supply" to small and medium-sized prosumers:

- **Reduction of energy costs** through a more favourable energy tariff – in turn for allowing access to and load shift of selected facilities. We assume that only a limited share of small and medium-sized customers will respond to the promise of cost reduction since the savings will be limited in most cases (cf. chapter 4.2.1)
- Similar to the product of green power we think that a certain share of small and medium-sized customers will be interested in **participating actively in the energy transition** (cf. chapter 4.2.1)
- In addition to the two core value propositions as described above the service provider may try to **enrich its service by additional elements** that might be attractive for some of the potential customers, such as services related to monitoring, optimisation and related efficiency improvements of a technical system that is embedded in the DR service - e.g. for the case of a heat pump remote control can contribute to higher efficiency in operation as well as to access to DR potential

Derivation of key activities

When implementing the business model "Implicit DR including power supply" to small and medium-sized prosumers the retailer needs to implement the following key activities:

- **Energy trade:** This in not specific to the business model as it represents the core business of any energy retailers – the innovative aspect is that the energy trade decisions have to take into account the retailer's increased flexibility through its access to DR-potential at his clients.
- **Assessment of demand profiles and potential for load shift**, either through site-visits or remote, with the aim to offer the additional service only to those customers that have available sufficient DR-potential
- **Handling the operation of large amount of small and medium-sized DR potential:** Depending on the price developments on the wholesale markets and depending on production cost (if the retailer is also a producer), the retailer has to utilise the accessible DR-potential in an optimal way.
- If the service package includes additional elements with respect to **monitoring, optimisation and related efficiency improvements of a technical system**, these activities become key activities as well.

Derivation of key resources

Many of the key resources required for this business model are very similar to key resources needed for "Explicit DR as stand-alone service". Therefore, the DELTA-Platform has to fulfil the following functionalities and features in order to support the key activities as describe above (cf. chapter 4.2.1 for partly more detailed description:

- **Handling of small and medium loads** (control, monitoring, load shift etc.)
- **User clustering** for automatic detection and classification of assets
- **Self-subscription and self-assessment** of switchable devices
- **Precise load forecasting** connected with the utilisation of accessible DR-potential
- In addition, it seems important for the retailer to have available a tool that support the **permanent matching** of price relation on the wholesale markets with accessible DR-potential, so that energy trade decision can reflect the increased flexibility of the retailer.

- **Administrative applications** for user management, as well as applications supporting **"smart contracts"**.

4.2.5 Partial BMC for Business Model "Microgrid Management"

Generally, we think that the position of a microgrid manager is rather similar to a FLESCO's position as described for the business model "Implicit DR service for optimal use of TOU-contracts" in chapter 4.2.3.

We would assume, however, that a microgrid manager is more a specialist for a specific microgrid, which is of larger size and usually also more complex than an ordinary facility (complex demand patterns in combination with multitude of switchable devices and various sources of decentralised on-site production). Furthermore, we think that under certain conditions, a microgrid manager can offer explicit DR-potential on various flexibility markets (cf. chapter 2) In this case the microgrid management would be very similar either to the business model "Explicit DR as stand-alone service" or to the business model "Explicit DR combined with EES" (cf. chapters 4.2.1 and 4.2.2)

As a consequence, the value proposition, the key activities and the key resources required will be practically the same as for the above-mentioned business models.

4.3 Value Proposition of DELTA Platform for non-core target groups

The DELTA platform comprises of a large number of individual DELTA hardware and software components interrelated to each other. These components can be found in the architecture of the DELTA project (Figure 12). The most important of these components are grouped under:

- Virtual DELTA Node
- DELTA Aggregator/Energy Retailer
- Innovative Customer Engagement Tools
- DELTA Cyber Security Services

Even though the DELTA platform will be developed as a comprehensive product with the purpose to develop the market for demand response (DR) services, some of the DELTA components can be used for selective purposes, laying the ground for supplementary business cases – beyond the application of the DELTA-platform as a key resource for the generic DR business models as described above.

At this stage of the project, it is not entirely clear, which components will have the largest potential for future business; however, some can be selected that are most likely to be on this list. However, this is only a first selection to be further elaborated.

In a first step, possible application and a first sketch of the value proposition of these components are described. In order to define reliable business cases, it will be necessary to analyse the market where these components can be used as stand-alone or as supplementary product or component.

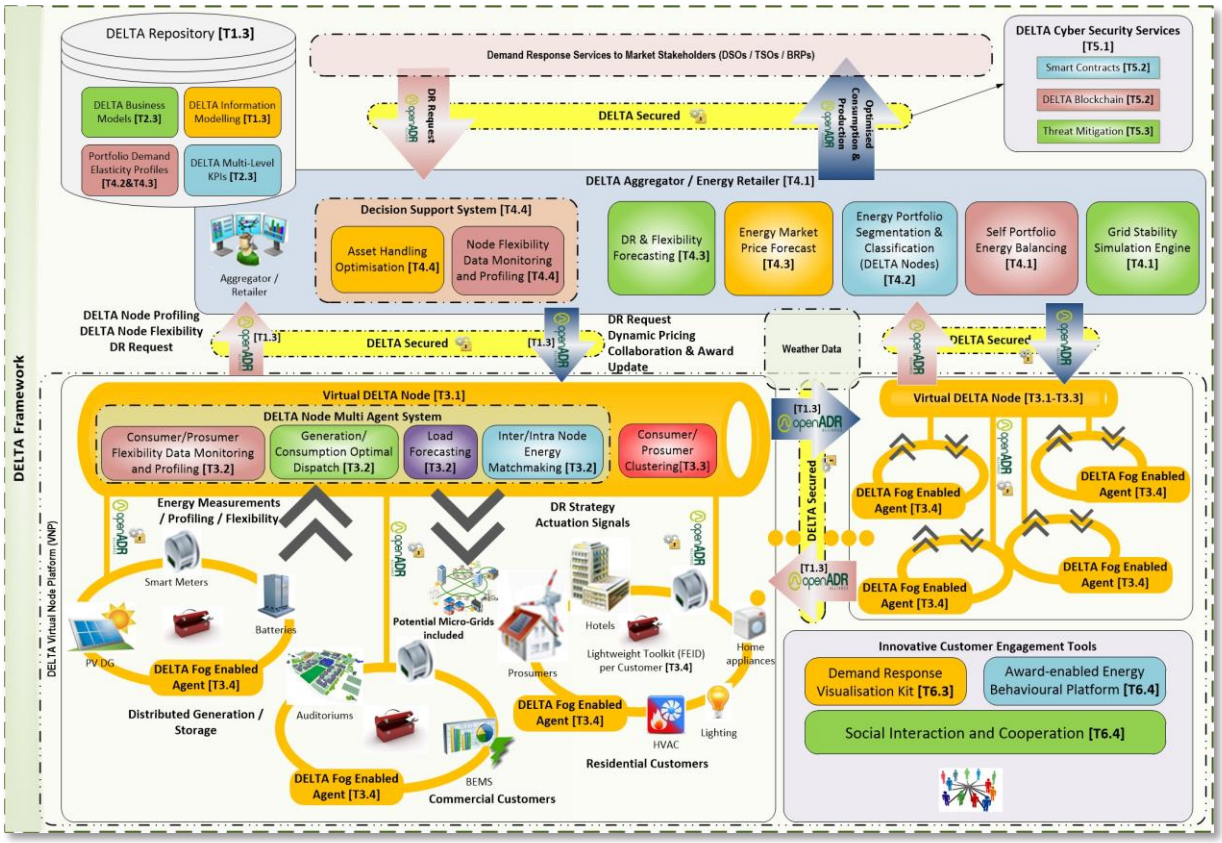

Figure 12: DELTA Architecture

4.3.1 Lightweight Toolkit (FEID, fog-enabled intelligent device; T3.4)

The FEID will be developed in the DELTA project. It will be responsibility for real-time monitoring and for control of smart devices or building energy management systems (BEMS). It will have self-learning capabilities and it will be able to handle DR signals that can trigger DR activation.
This tool is likely to become an important element of optimisation of flexible tariffs that, unlike for the aggregation with the DELTA platform, can also be used as stand-alone solution for prosumers.

4.3.1 Load Forecasting and Dispatch Optimisation Tool (T3.2)

Load forecasting is one of the crucial elements for assessing the benefits of DR. For larger loads, site visits with detailed energy auditing are necessary to define DR strategies. For small and medium loads, where transaction costs and effort to establish a DR agreement is decisive, automated forecast of the load and dispatch optimisation is an important element for participating in DR programs or for the use of TOU tariffs.

4.3.2 Innovative Customer Engagement Tool (T6.3. and T6.4)

This tool encompasses 3 innovative components:

- A real-time context-aware demand response visualisation kit
- An award enabled energy behavioural platform
- A collaboration platform

The innovative customer engagement tool is an added-value service visualising DR information and applying pervasive learning and gaming mechanics for co-operation and social interaction of customers.
Focusing on DR application, this tool can be applied is several other fields like in energy efficiency programs etc.

4.3.3 DELTA Cyber Security Services (T5.1)

Cyber security is of highest relevance for all applications where data are produced, handled and exchanged. Hence, DELTA cyber security services can be used for a big variety of applications, not limited to DR or any other energy application.

4.3.4 Further DELTA components with potential for supplementary business cases

Several other DELTA components are likely to have a reasonable potential for supplementary business cases, either as stand-alone solution or as components within different systems or services. Pars pro toto the following components can be mentioned:

- Energy Market Price Forecast (T4.3): With the further establishment of dynamic energy prices, reliable forecasts of prices will gain additional meaning.
- Grid Stability Simulation Engine (T4.1): Grid stability is one main critical element when it comes to an increase of volatile energy production and demand.
- ...

Business cases for these components will be further developed in the course of the development of the DELTA-platform.

5. Preliminary conclusions and description of next steps

From the assessment performed in the context of this deliverable we can draw the following preliminary conclusions:

- As expected, the generic business models lead to a quite **broad field of different value propositions, key activities and key resources** which are required the underlying services.
- In spite of the heterogeneity observed, there exist **certain features that are relevant for each business model** if applied to small and medium-sized customers. From the point of view of market penetration, these features should be in the development focus for the DELTA-platform. The most important features that are relevant to all generic DR business models are as follows:
    - **Handling of small and medium loads** (control, monitoring, load shift etc.) including automatic dispatch under certain conditions
    - **User clustering** for automatic detection and classification of assets
    - **Self-subscription and self-assessment** of switchable devices
    - **Precise load forecasting** connected with the utilisation of accessible DR-potential
    - **Price forecast** for different flexibility markets
    - **Administrative applications** for user management, as well as applications supporting **"smart contracts"**.
- The **implicit DR business models** – mainly the business model "Implicit DR service for optimal use of TOU-contracts" require some specific features that relate to the observation and **continuous up-date of tariffs** at the clients' side.
- In addition to the core customer groups related to the DR business models, we expect that **individual elements of the DELTA-platform** will be interesting also to additional non-core customers, such as the cyber security services, or the market price forecast, or the grid stability simulation engine.

The **next work steps** for the further development of this deliverable from a preliminary version – as presented here – **towards a full DELTA Market Analysis** are envisaged as follows:

- Detailed comparison of the results of the preliminary BMC analysis as performed in this deliverable with the outcomes of **D1.1 DELTA Requirements, Business Scenarios and Use Cases**: Is there a discrepancy? Does the preliminary market analysis point an eventually required adaptation of DELTA requirements and use cases? The comparison refers mainly to the part of key resources derived from value propositions and key activities.
- Implementation of a full BMC analysis as part of the development of **D2.3 Delta Business Models v1** which is due by end of October 2019. The full BMC will include a comprehensive elaboration of the remaining areas of business model development: assessment of revenue streams; performance of detailed customer segmentation; analysis of relevant customer relationships and most suitable distribution channels; evaluation of useful partnerships; assessment of cost structure.
- **Revision of D8.6_v1, if required,** based on the outcomes of the work steps described above (envisaged by end of November).

6. References

Agora Energiewende 2019. A word on grids. Berlin:Agora Energiewende.

Bachner, D., Leutgöb, K., 2018. Draft Guidelines of European Technical Quality Criteria for Energy Efficiency Services, November 2018, Deliverable of the EU-project QualitEE, www.qualitee.eu

Berkley Lab (2018), Website Microgrids at Berkley Lab, https://building-microgrid.lbl.gov/microgrid-definitions, 10 Oct 2018

CEER 2018. Performance of European Retail Markets in 2017.

Cooke, Douglas (2011), Empowering Customer Choice in Electricity Markets, International Energy Agency, Information Paper, Paris, 2011

dena, 2014. dena Ancillary Services Study 2030. Berlin: Deutsche Energie-Agentur GmbH (dena) – German Energy Agency.

Energati Quaterly (2018), Web-Magazine http://publications.engerati.com/engerati-quarterly-feb#!/microgrids, February 2018

ENTSO-E, 2018. Constantinescu, Norela: Transmission and Distribution Interaction: ENTSO-E, Presentation at the IRED 2018, Vienna.

European Commission 2018. Market legislation. Retrieved from: https://ec.europa.eu/energy/en/topics/markets-and-consumers/market-legislation

General Electric 2019. Retrieved from www.ge.com/content/dam/gepower-pgdp/global/en_US/images/service/upgrades/jenbacher/primary-secondary-tertiary-balancing-power-operation.jpg [06.06.2019]

IFMA, 2019. What is Facility Management? Houston, TX: International Facility Management Association. Retrieved from: https://www.ifma.org/about/what-is-facility-management [06.06.2019]

incite, 2019. Introduction to electricity markets, its balancing mechanism and the role of renewable sources Retrieved from: http://www.incite-itn.eu/blog/introduction-to-electricity-markets-its-balancing-mechanism-and-the-role-of-renewable-sources/ [06.06.2019]

Leutgöb Klemens, Amann Christof et al. 2018, Energy Market Analysis and Regulatory Framework Specification, Report 2.1_v1 submitted under the DELTA-project, November 2018

MacDonald, S., Eyre, N., 2018. An international review of markets for voluntary green electricity tariffs. Renewable and Sustainable Energy Reviews 91: 180–192.

Strategyzer, 2019. The Business Model Canvas. Retrieved from: https://www.strategyzer.com/canvas/business-model-canvas [06.06.2019]

UCTE, 2009. Policy 1: Load Frequency Control and Performance.

VKI Association for Consumer Protection. Energiekosten-Stop2019. Available from: https://vki.at/energiekosten-stop?vki-cc=accepted