*Smart system of renewable energy storage based on **IN**tegrated E**V**s and b**A**tteries to empower mobile, **D**istributed and centralised **E**nergy storage in the distribution grid*

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Authors:	**Smart Innovation Norway - Iliana Ilieva, Bernt Bremdal Lyse - Dagfinn Våge, Gunnar Crawford**

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Abbreviations and Acronyms

Acronym	Description
API	Application programming interface
BMI	Business model innovation
B2B	Business to business
COS	Cost of service
C2B2B	Customer to business to business
DER	Distributed energy resources
ESU	Energy services utility
EVs	Electrical vehicles
MBR	Market based revenue
NUC	Network use charge
PBR	Performance-based ratemaking
SCADA	Supervisory control and data acquisition
RAV	Regulatory asset value
SDK	Software development kit
SIM	Smart integrator model
SOTA	State-of-the-art
WP	Work Package
WPL	Work Package Leader

Executive summary

This report provides the INVADE project with an analysis of relevant business models for the energy storage market.

The application of new technologies and innovative business models has led to dramatic changes in industry after industry. We believe that new highly disruptive business models will also become effective in the energy industry, and we already see some market players that are gaining momentum using them.

The report is made up from four basic elements; a state-of-the-art (SOTA) analysis of existing business models, an analysis of new and emerging business models, an analysis of energy and storage business models and relevant examples of companies that use new business models.

At the end of the report we give our recommendations to the INVADE project, but also to the EU in general.

Our work has revealed that Europe has come far with respect to technology, but is seriously lagging behind US and Asia with respect to business model innovation. In particular, Europe is weak with respect to the new and highly disruptive multi-sided business models seen at companies like Apple, Facebook, Alibaba, Tesla and more.

For this reason, WP9 and WP3 see the INVADE project as being instrumental in recognizing that “platform” no longer means “technology platform” only, but truly embraces the idea that technology platform AND platform based business models are equally important and should therefore be developed in parallel and in close collaboration.

Our main recommendations are:

- Business models should be of the platform type, multi-sided and customer-centric
- Business models should enable network effects and be able to absorb exponential digital growth mechanisms
- Business models should foster open ecosystems with focus on APIs enabling open and combinatorial innovation
- Business models should reflect the most recent as well as the expected for the future trends in both technological and societal developments - e.g., the ones

related to digitalization, advanced analytics, complexity, customer preferences and Internet of Things (IoT).

1 Introduction

The aim of the INVADE project to deliver a “flexibility cloud”-based integrated INVADE platform that empowers energy storage and promotes consumer engagement could only be realized within the setting of innovative and competitive business models. This report will emphasize the beyond-state-of-the-art statement from the DOA (p.21): “Future business models will focus on the multi-dimensional value of storage rather than on cost of storage”. The business model needed should be able to cover the multi-sidedness of flexibility uses considering the wide spectre of customer preferences and be open enough to allow for enriched choice of services. All these features can be well exhibited by a platform type model. Observing the dramatic growth of companies that exploit the power of platform based business models we consider the INVADE platform as not only referring to a technology platform but equally important as a platform based business model.

Understanding the existing business models in the field is among the main objectives of WP9. However, given the major upswing of successful platform-based enterprises that revolutionize the field of business model innovation, it would be unrealistic to try to fit the INVADE platform only in the context of a mainstream business model canvas. According to Evans and Gawer (2016), platform ecosystems[1] get ground and shape the global economic landscape through the digitalization of products, services and business processes. Furthermore, the authors signify the expansion of platform business models from the typical social media, books, music and travel domains towards new areas, such as transportation, banking, healthcare and energy. Yet, as clearly indicated in Evans and Gawer’s (2016) study, Europe is considerably lagging behind (compared to, e.g., North America and Asia) when it comes to platform-based innovation. Still, Europe is defined as a major consumer of platform services, thus suggesting the urgency of expanding the scope of platform-based innovation on a European level. Considering the above trends

[1] Further in this report we use the terms platforms and ecosystems interchangeably as both referring to platform ecosystems.

as well as the fact that the INVADE platform is to be built upon Internet of Energy Things, Big Data analytics and visualization techniques, we are to design innovative and competitive business models with a particular focus and reference towards the ecosystem development. Of course, the essence of business model theory and relevant existing business models will be referred to as well to create an optimal environment for business model innovation that will ensure maximum impact of the INVADE project.

The current document aims to review both existing and emerging business models that are relevant for the INVADE project. It starts by providing a solid theoretical ground on business modelling in general and then proceeds to a state-of-the-art study of the ecosystem development that we expect the INVADE platform to become a part of. We elaborate on the types of platform business models and their geographical spread and provide a set of examples of digitally disruptive platform business models from both outside and within the energy and energy storage domains. Next, the report describes the end user perspective and the importance of customer-centricity for the INVADE business model design. The report is finalized by a set of recommendations for the design of competitive and innovative business models both for the INVADE project specifically and EU in general. With the above presented content, WP 9 and WP3 expect to make an early impact on WP4 Concept Design as well as on the other WPs.

2 SOTA of existing business models

In this chapter we will provide some theoretical basics from the field of business modelling. The essential parts of the traditional business models will be presented as we consider it important to set new innovative business models in the light of the predominantly applied business model canvas.

What is a business model?

Undoubtedly, there isn't a single recipe for the creation of a successful business model. The citation bellow from Margretta (2002) well signifies that issue.

"Creating a business model is, then, a lot like writing a new story. At some level, all new stories are variations on old ones, reworkings of the universal themes underlying all

human experience. Similarly, all new business models are variations on the generic value chain underlying all businesses."

Yet, the key parts of business models have been widely discussed in previous literature. The value chain that business models originate from consists of main two parts. Magretta (2002) describes them as a part associated with making something (e.g., design, purchase, manufacture) and a second one that relates to selling something (e.g., find/reach customers, transact a sale, deliver a product or a service). A new business model can trigger the creation of a new product or may aim to innovate the process of selling or distributing an established in the market product or service.

The key elements to define a business model (based on Baden-Fuller and Haefliger, 2013) include:

- Customer identification – Who are the target customers? What customer need is to be met?
- Customer engagement – What product/service will be offered to address the customers' need? At what level are customers engaged? (e.g., individually or through services for many)
- Value chain linkages – How will customers access the specified offer? How the value chain or network is organized?
- Monetization – How will value be captured and profit earned?

To shape a business model, decisions on the above questions should be made. However, most questions relate to a set of possible answers. Choosing various combinations out of the sets with answers would produce a different outcome for the business model. Furthermore, it may be very useful to make analogies to other industries' applied business models and refer to their successful practices for gaining competitive advantage.

The shortest and most accurate definition we have found is from Osterwalder and Pigneur (2010):

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

A more detailed specification of the "building blocks" to create a business model is provided by Osterwalder and Pignuer (2010). They define the business model canvas that consist of 9 elements: customer segments, value propositions, channels, customer

relationships, revenue streams, key resources, key activities, key partnerships and cost structure. The canvas is widely used as a template for facilitating managerial decisions and supporting start-ups, particularly when new business models are to be developed, or the existing clarified.

In addition, as described by Loock and Hacklin (2015), business models also encompass mental models and cognitive processes and structures. Focus on the customer perspective and local aspects of business models is therefore particularly important and will be elaborated on in detail in Chapter 5.

As we will see in the following Chapter 3 the recent trends in business model innovation point towards the emergence of business models that have some multi-layer (multi-dimensional) characteristics – e.g., flows no longer have a single direction, complexity is increased and the traditional value chain is transformed into value network (a system where all involved stakeholders co-produce value (Bortenschlager, 2014)).

While many eminent emerging business models rely on digitalization and two-way flow of data, their structure is hardly fitting the one designed by Osterwalder and Pignuer (2010). In this respect, and considering the projected integrated INVADE platform built upon Internet of Energy Things and Big Data analytics, we find it difficult to use the traditional business model canvas for INVADE. Thus, we will need to adapt the canvas to the features of a platform-based ecosystem. But let us first start by setting the ecosystem development in the light of the emerging business models.

3 SOTA of emerging business models

The trends in power system development, characterized by technological advances and regulatory ambitions to facilitate the utilization of distributed energy resources (DER) and the development of low-carbon energy systems push towards business model innovation in the energy field. Smart grid components such as advanced metering, local storage, distributed generation, EVs are becoming an important part of the end users' energy profile. Yet, to fully utilize on the smart grid components and harvest the associated with the smart grid environmental and economic benefits, a newer and more innovative look at the associated business models should be considered.

Reference points to the projected business model innovation (BMI) can be found in earlier literature. Burger and Luke (2016) provide an extensive review on business

models for DER. Their research focuses specifically on business models related to demand response and energy management systems, electricity and thermal storage, and solar PV. In total 144 business models are classified by Burger and Luke according to revenue streams, customer segments, electricity services and DER. Based on the classification the authors identify a limited set of business model archetypes for each DER category. Out of the analysis performed, Burger and Luke (2016) make some important conclusions. In particular, the importance of regulatory and policy environment, time-induced changes and free competition, as well as factors difficult to capture when reviewing the business model structures (such as company culture, execution of managerial decisions). The literature review provided by Hall and Roelich (2016) in their paper on business model innovation in electricity supply markets refers to the necessity of system specific accounts that link the sustainable business model innovation literature to empirical studies. The focus on the deployment of specific technologies in the energy value chain within business model innovation research is further stressed upon. More specifically, Hall and Roelich (2016) merit various literature sources for their research on the topics of energy storage, solar generation and electrical vehicle charging. In addition, Hall and Roelich (2016) define several more areas in which research on business models provide useful contributions, e.g., with respect to having both productive and disruptive effects within the energy markets field. Yet, what we consider to be the most disruptive phenomenon in the energy industry today is the emergence of platform/ecosystem based business models. Thus, the rest of this chapter will focus on that particularly important and critical for the industry as a whole topic.

To start with, it would be useful to understand why the emergence of new models that overtake old ones takes place. Wåge and Crawford (2016) provide a good answer to this question. Their book “Creating disruptive ecosystems” refers to business models as characterised by flows, components and infrastructure, where flows and components are often interlinked. In this context, new business models would overtake the old ones when existing components and flows are either removed, changed or added. A relevant example is provided with Tesla where the car component has been transformed into an Internet of Things component, inducing a change in the business model for the existing car industry. When it comes to the change in flows, Wåge and Crawford (2016) describe the step towards a new compulsory bidirectional flow. This step is significant because this flow is now not necessarily money but data. Good examples here are Facebook and the music sale through iTunes where the business models are centred around the

bidirectional flow of data. Having introduced the context for business model innovation we will now proceed to a more detailed description of the platform based ecosystems.

3.1 The ecosystem development

As mentioned earlier, the number of enterprises that leverage ecosystem business models has increased significantly. Not surprisingly, Evans and Gawer (2016) refer to our present as “The Age of Platforms”. Parker et al. (2016) define platform ecosystems as multi-sided marketplaces where value is created for all members of the network. Ecosystem participants utilise the specific platform technology to easily and efficiently connect and exchange value. Furthermore, as discussed by Korhonen et al. (2017), the platform should attract users, create an infrastructure and set the interaction governance principles in order to make the core interaction happen.

Additionally, platforms have some unique characteristics. Evans and Gawer (2016) indicate the presence of network effects as their central feature. What the authors mean by network effects is the fact that more users beget more users and this dynamic provokes a self-reinforcing cycle of growth. Another specific feature of platforms that Evans and Gawer (2016) stress upon is that platforms predominantly rely on digitalization – i.e., they capture, transmit and monetize data by means of Internet connectivity and that many successful platform companies are centred around a software engine. A more detailed description of the platform ecosystems is provided by Wåge and Crawford (2016) who focus on a new business model they call a disruptive ecosystem. It resembles a business ecosystem where companies compete, cooperate and thrive together, but can be in addition characterized by the following: two-way flow of data; use of software-enabled devices with embedded internet connectivity; ecosystem manager that controls both the hardware and the user interface, or just the interface; data analytics component; two-sided business model. As it will be described later in this report, the features of disruptive ecosystems can be discovered in various examples for business models that are of relevance for building up the specific INVADE platform business model.

In the work of Atluri et al. (2017) the trends in ecosystem development are well summarized. What they consider major reasons for the growth in platform ecosystems are the following:

- Changing customer expectations

Atluri et al. (2017) back up that reason with some excellently chosen words: “By creating a customer-centric, unified value proposition that extends beyond what end users could previously obtain (or, at least, could obtain almost instantly from one interface), digital pioneers are bridging the openings along the value chain, reducing customers’ costs, providing them with new experiences, and whetting their appetites for more”.

- Digitalization

Here Atluri et al. (2017) refer to the profound effects that digitalization has on the competitive landscape and exhibit the fact that data sets and sources become great unifiers and enable the creation of new cross-sectional competitive dynamics. As a result, a new environment is created where traditional industries face competition by other industries that they would never previously expect. According to Atluri et al. (2017), this new environment is to be governed by new rules, require new capabilities and be strongly dependent upon data.

To put the pieces into one whole – the ecosystem effects of cross-sectional synergies, enabled by the use of mobile Internet, advanced analytics and artificial intelligence, cater for a better and well customized delivery of services to increasingly demanding end users.

The projections made by McKinsey analysis on the world ecosystem development by 2025 is strongly indicative for the increase in both scale and scope that these particular business models are to experience. As it can be seen, the energy industry is missing in Figure 1, but in the context of the presented ecosystems’ growth we can certainly expect a similar development trend for the energy industry field as well.

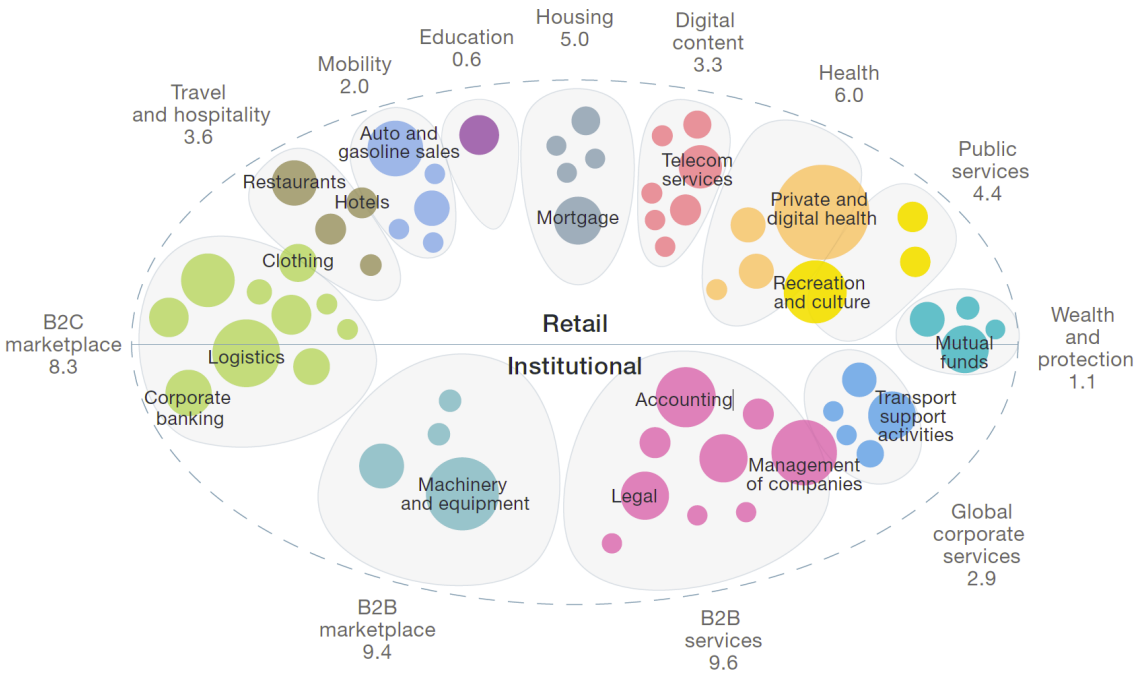

Figure 1: Estimated 2025 total sales for new ecosystems that are likely to emerge in place of many traditional industries, trillion dollars; Circle sizes indicate approximate revenue pool sizes (Source: Atluri et al. (2017); Original source: IHS World Industry Service; Panorama by McKinsey; McKinsey analysis)

Having introduced the main features of ecosystems and their key development trends we will now continue to more detailed descriptive criteria.

3.1.1 Open platform

The concept of open platforms is well defined in the work of Moser et al. (2017). In their study open platforms are described as consisting of several stakeholder groups. A first group represents the platform leader – this is typically one firm or multiple firms that develop the platform. As Moser et al. (2017) further explain the leader provides a technological system and performs the governance over the platform and its ecosystem. The governance performed has the purpose of aligning participants' behaviour and serves as a main incentive and control mechanism. Other stakeholder groups, referred to by Moser et al. (2017) as complementors, may add to the technological core of the platform by innovating periphery components. The goal of this periphery components is to offer complementary products or services (Gawer 2014). The external stakeholders (complementors) are allowed to participate in both the platform development and commercialization, thus making the platform "open". Customers who use the services and products can be denoted as the third main stakeholder group. Through participating in the platform ecosystem governed by the platform manager, the complementors are

competing for attracting users. The platform leader's task, on the other hand, is to design the platform in such a way that makes it attractive for complementors to participate and that gives grounds for the creation of network effects.

The synergies achieved by open platforms are threefold: the platform leader can offer high quality by giving platform access to diverse set of complementors; end users can enjoy increased variety of easier to access offerings and better quality; complementors get access to a larger market – all the end users hooked to the platform. Through the described synergies open innovation strongly contributes for joint value creation.

Observing the business models applied by some highly profitable start-up companies in recent years, we may certainly consider "open" platforms to be positioned among the most successful enterprise configurations. AirBnB, Uber, Spotify, Evernote are just a few examples in this respect.

3.1.2 Multi-sided platform

While "openness" is the important platform quality discussed in the subsection above, here we are to focus on another one – the platform's multi-sidedness. A good description of multi-sided platforms is provided by Yablonski (2017) who states that their value comes from the dynamic connection of the resources and actors involved and from the network effects between them. More specifically, multi-sidedness refers to combinatorial value creation where direct interactions between users and providers enable improved service for the benefit of all parties involved. Korhonen et al. (2017) elaborate further on this issue suggesting that "platforms should strategically invest in the capabilities, competence and creativity of users". This would empower customers and empowered companies would have a positive effect on the platform making it stronger and more resilient to competitors. As Korhonen et al. (2017) further explain, the value of participation in the platform is increasing when the number of participants and interactions gets higher.

According to Yablonski (2017) a successful multi-sided platform facilitates the creation and distribution of platform product or service through competition and/or cooperation of various stakeholders. In his work the main building blocks to form a multi-sided platform are visualized by the following Figure 2:

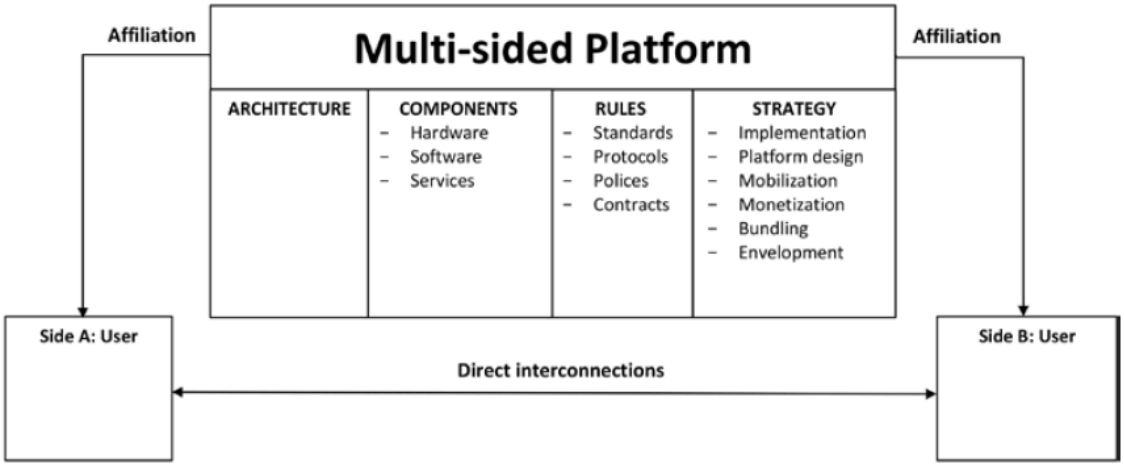

Figure 2: Platform building blocks (Yablonski 2017)

Within the above setting the reuse of platform components (hardware, software, services) enables the creation of new products/services. In the process the platform rules should be followed. In addition, Yablonski (2017) stresses upon the importance to tightly relate the multi-sided platform business model to the strategy. Yet, the significant value creation capabilities of multi-sided platforms lie in the direct interconnections between user groups within the platform which strengthen its competitiveness through combinatorial innovation. Amazon and Apple are good examples for multi-sidedness.

3.1.3 How platforms change competition

A good discussion on the ways in which platforms reshape the future of competition has been provided by Choudary (2017). The discussion he presents reveals that while the idea behind traditional competition relies on the exclusive supply-side right over a resource, platform competition is built on the exclusive access to the ecosystem around the platform and the data related to ecosystem interactions. This trend is closely connected to the topics of openness and multi-sidedness presented above. Typically, the platforms with the most active ecosystems and the ability to mine their interaction data will be the winners (Choudary, 2017). Collaboration can be considered as another major competition changing factor. In many cases, successful platforms do not maintain a pure “solo-game” approach, but instead try to strengthen their competitive positions together with others. The partnership between Nissan and Eaton in connection to the xStorage battery solution is a good example in this respect.

3.1.4 Platform typology and geographical status

Despite the fact that platforms are typically based on common underlying dynamics, the way companies organize and apply them in the market may be different (Evans and Gawer (2016)). In this connection, Evans and Gawer (2016) classify platforms into four different types, as present bellow.

- Transaction platforms – technology product or service that serves as an intermediary in the process of facilitating exchange or transactions between different platform stakeholders (users, buyers, suppliers). Examples: Yahoo, Netflix, eBay, Linkedin, Paypal, Airbnb, Uber
- Innovation platforms - a technology, product or service that serves as a foundation on which other firms develop complementary technologies, products or services. Examples: Microsoft, Intel,
- Integrated platforms - a technology, product or service that is both a transaction platform and an innovation platform. Examples: Google, Facebook, Alibaba, Amazon, Apple
- Investment platform - consists of companies that have developed a platform portfolio strategy and act as a holding company, active platform investor or both. Examples: Naspers, Softbank, Priceline

As a concluding remark in their global survey on platforms Evans and Gawer (2016) indicate that integrated platforms have gained dominant position in spite of their limited number. The trend is, however, that both transaction and innovation platforms evolve towards integrated ones.

Yet, it may be often difficult to state that transaction platforms do not include innovation and that innovation platforms are excluding transactions. In fact, all multi-sided platform embrace the various features. Thus, to follow the categorization proposed by Wåge and Crawford (2016) could be a more suitable approach. More specifically, they have divided platforms into the following three categories:

- Standard platforms – devices, user interfaces and sometimes also operating systems are controlled. Examples: Apple, Samsung, Google, Tesla
- Virtual - have software only and are enabled by the customers due to their popularity. Do not own the devices but still manage to gain control over them as

the customers are controlling devices on the platform's behalf. Examples: AirBnB, Facebook, Netflix

- Hybrid – built with a mix of own modules and modules delivered from large cloud providers (such as Microsoft Azure, IBM, Google and Amazon) Examples: eSmart Systems

As a next step, it will be useful to provide some insights into the geographical status of the ecosystem development. The global survey carried by Evans and Gawer (2016) discovers some major differences between regions with respect to platform enterprises' presence and development. Important to consider in this respect is that Europe is significantly lagging behind (Figure 3). Only 7 percent of the transaction platforms, 11 percent of the innovation platforms, and none of the integrated platforms originate from Europe.

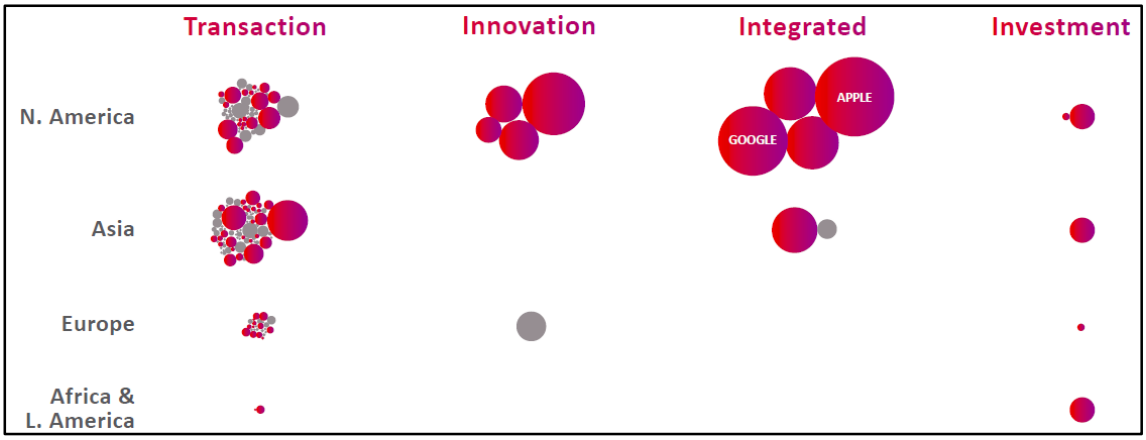

Figure 3: Platform companies by type and by region. Note: bubbles represent the size of the companies according to market cap as of 1st December, 2015. Red colour refers to public and grey – to private platforms. (Source: Evans and Gawer (2016), Original source: Global Platform Survey, The Center for Global Enterprise, 2015)

Thus, we consider it even more important to position the INVADE platform within the context of ecosystem-based business model innovation. Indeed, as noted by Atluri et al. (2017), the actual shape and decomposition of platform ecosystems varies by country and region due to the specific regulations, cultural customs and user tastes. But the economic effects associated with platform enterprises are indisputable and strongly suggestive for the right way to go.

3.2 Examples of digitally disruptive and platform/ecosystem based business models

This subchapter will focus on relevant examples from beyond the energy domain that reflect the move towards digitally disruptive and platform based business models which various companies undertake. iTunes Store - launched by Apple in 2003 - is considered by Wåge and Crawford (2016) to be the first disruptive ecosystem. In its business model Apple was systematically combining value network elements to cover all components – from creation to end-usage. The company had now control on both the device (the iPod) and the full value chain (from the content owner to the final consumer).

Marsden (2015) refers to the book Digital Transformation where Caurdon and Peteghem cover 10 features of "hyper-disruptive" business models as presented in Table 1 below:

Table 1: Platform business models' features behind digital disruption (Adapted from Marsden (2015), Digital Intelligence Today; Original source: Caurdon and Peteghem (2014), Digital Transformation)

Platform business model feature	**Main characteristic**	**Examples**
Subscription	"Locks in" through an ad hoc purchase of a product or a service and charges a fee for continued access.	Netflix, Dollar Shave Club, Apple Music
Freemium	Digital sampling where users pay for a product or service with their data, but it costs to upgrade.	Spotify, LinkedIn, Dropbox
Free	"if-you're-not-paying-for-the-product-you-are-the-product" model that captures consumers' attention and sells personal data	Google, Facebook

Marketplace	Provides digital marketplace that brings together buyers and sellers in return for a transaction fee or commission	eBay, iTunes, App Store, Uber, AirBnB
Access-over-Ownership	Temporary access to goods and services traditionally only available through purchase. Applies sharing economy and commissions actors that make profit by lending assets (home, car, capital) to borrowers.	Zipcar, Peerbuy, AirBnB
Hypermarket	Sheer market power and scale to beat competitors, often by selling below cost price	Amazon, Apple
Experience	Superior experience, for which customers are ready to pay	Tesla, Apple
Pyramid	Significant number of resellers and affiliates typically paid through a commission-only model	Amazon, Microsoft
On-Demand	Monetizes time and sells instant-access at a premium (people that lack the time pay commission to people who have the	Uber, Operator, Taskrabbit

	time but lack the money for delivering product/services)	
Network	Sale of interlocking and interdependent suite of products and services, the value of which increases as more are purchased. Makes consumers dependent.	Apple, Google

Undoubtedly, digitalization offers a heap of new possibilities for companies and the rapid growth and spread out of the exemplified enterprises is confirmative for this. Indeed, the volume of disruptive business models is much wider, but the above examples are strongly indicative. Common trend for all presented models is the particular usage of bidirectional data flow, data analytics, software component and internet connectivity. In this context of digital disruptions and successful business models, it is by no doubts to expect similar developments within the business models to operate inside the energy system as well. Some indicative examples will be provided in Chapter 4.

3.3 Start-ups vs incumbents

Research shows that both start-ups and incumbent companies are adopting platform-based business models. Kohronen et al. (2017) study 34 platform start-ups who utilize digital platforms to connect producers and users in value creating interaction. The start-ups based their core interaction on different logics but the study clearly indicates that platform thinking and looking at platforms as multi-sided has found its roots within some of the start-up companies' strategies. As Kohronen et al. (2017) further explains, the investigated companies envisioned significantly increasing numbers of service providers attracted by the new markets, new business and new tools, with some of the platform enterprises also involving multiple customer groups.

Incumbents, on the other hand, are also starting to progressively adapt underlying business principles of platforms, as shown by Moser et al. 2017. In their study five

incumbents from different industry settings, which started to transform their core business into open platforms, were analysed. The authors concluded on three main approaches of incumbent companies that are transforming their businesses into platform ecosystems: 1) open platforms are built around the existing infrastructure and competence; 2) competitors do not get excluded and often become complementors of the open platform; 3) customers of the core business are transformed to platform users. Thus, the literature suggests that business model innovation aiming at the creation of platforms is increasingly being initiated both within start-ups and incumbent companies.

3.4 A glimpse towards the future

Earlier in this report (Subchapter 3.1) the key trends associated with the ecosystem development, as found in the literature, have been elaborated on. Yet, we consider it useful to present the major market tendencies that will set the grounds for platform business model development also with respect to the INVADE project. These will additionally serve as an excellent reference tool for the recommendations to be provided in Chapter 6. The trends are adapted from the work of Atluri et al. (2017)

according to whom future innovative business models will be positioned within the context of consumer marketplaces (of the type Amazon, eBay, Alibaba), but strongly impacted by the capabilities of big data analytics, processing power and artificial intelligence. These technological advances will provide for purchases accumulation and better insight in consumers' broader needs which will be consequently meted through effectively supported by technology network effects. The described setting of consumer marketplaces and technological advances gives ground for the establishment of B2B services that are to come closer to the creation of genuine communities with well-organized partnerships and highly sophisticated services. These are a vital part of the multi-sided platform business model that functions in a C2B2B form. Finally, Atluri et al. (2017) choose to stress upon the future trends related to personal mobility for which the cumulative impact of various mobility-related consumer interests (e.g., carpooling, ridesharing, vehicle connectivity) is to be decisive.

3.5 Adapting to a changing environment

Previous research has often been assigning business models a "cognitive" element. In other words, a business model could be perceived as a conceptual tool that resides in

the managers' mind and that is composed of simple rule for structuring value creation and value capture mechanisms (EMPOWER D2.1, 2015). The conceptual tools are thus defining the strategic choices and investments made by managers and are typically reflecting the trends and developments of the respective business environment. In this context, we may expect that CEOs of traditional industry line companies with well-established revenue streams will face off against companies and industries they never previously regarded as competitors (Atluri et al., 2017). Thus, a new strongly data-dependent competitive environment is created within which companies are often defined not by how they compete against traditional industry peers, but how efficiently they respond to the competitive actions undertaken by rapidly emerging platform ecosystems that encompass various businesses from different sectors (Atluri et al. 2017).

Further on, Atluri et al. (2017) elaborate on what should be the new priorities' focus of company leaders. Four priority areas are defined as critical:

- Adoption of an ecosystem mind-set based on broadened and multi-sectoral view on competitors and opportunities
- Strong focus on data – efficiency in storing, processing and analysing data with the aim to create useful business insight
- Emotional ties to customers – e.g., through the use of customized data offerings and digital engagement models
- Changing partnership paradigm that would allow a steady exchange with outside sources of data, ideas and services which contribute to innovation and associated customer attraction

Wåge and Crawford (2016) also provide some general advice for adapting to the changing competitive environment through the creation of disruptive ecosystems. What they refer to as important prerequisites are: particular interest in consumers, IT competence, Internet distribution (Over The Top), devices converted into IoT objects, bidirectional connectivity to enable two-way data flow, develop and publish API and software development kit (SDK) to enable a richer ecosystem.

Finally, we will refer to the work of Evans and Gawer (2016) who describe the implications for managers associated with the rapidly changing business environment. The authors acknowledge that the challenges are related to both creating platforms from scratch, as well as to enlarging them and maintaining them within an increasingly global setting. Thus, they refer to a few simple rules for managers: have a vision on what

problem the platform will solve (considering both consumers and complementors), integrated understanding of technology and business (e.g., related to where and how to design technological interfaces, degree of openness, pricing, type of complementors, governing), ability to articulate business models for ecosystem members. Still, according to Evans and Gawer (2016), the traditional question of product segmentation, pricing of products, supply chain management and distribution channels design remain as important. Finally, the authors' conclusions point towards the advantages of organizations that rely on cooperation across technological and business divisions and specialists that master both technological and business skills (contra siloed organizations and narrow specialists).

Having described the general types of business models applied, the transformations towards new business models and disruptive ecosystems, and lastly, but not least important - the way to adapt to the changing business environment, this state-of-the-art document will now focus on some particularly relevant examples related to energy and storage.

4 SOTA of energy and storage business models

This chapter aims to provide some general trends from the business model development in both energy and storage and to present some highly relevant examples with respect to the ecosystem development. These will shed light on various business model alternatives that may find application within the INVADE platform design.

4.1 The energy transformation and its impact on business models

According to PWC (2016) the energy value chain of the future will be more interconnected than ever before, forming an integrated ecosystem of highly interrelated unique elements. Further on, the study suggests that both incumbents and non-traditional entrants will be affected. While the first ones have to consider the increasing interaction between value chain elements in order to enrich and improve customer experience, the second will need to take the right choices to successfully fit within the integrated grid, without cutting-off customer relationships. The new market paradigm projected by PWC (2016) is comprised by the following elements: distributed generation, bulk generation, transmission, distribution, retail, customer, new entrants, micro-grids,

storage and demand response. Consequently, their study concludes on eight business models (as presented in Figure 4 below) that are expected to emerge individually or in combinations and that can be successful in the context of the undergoing energy transformation. The models are integrated to a different extent and include different combinations of product/service offers.

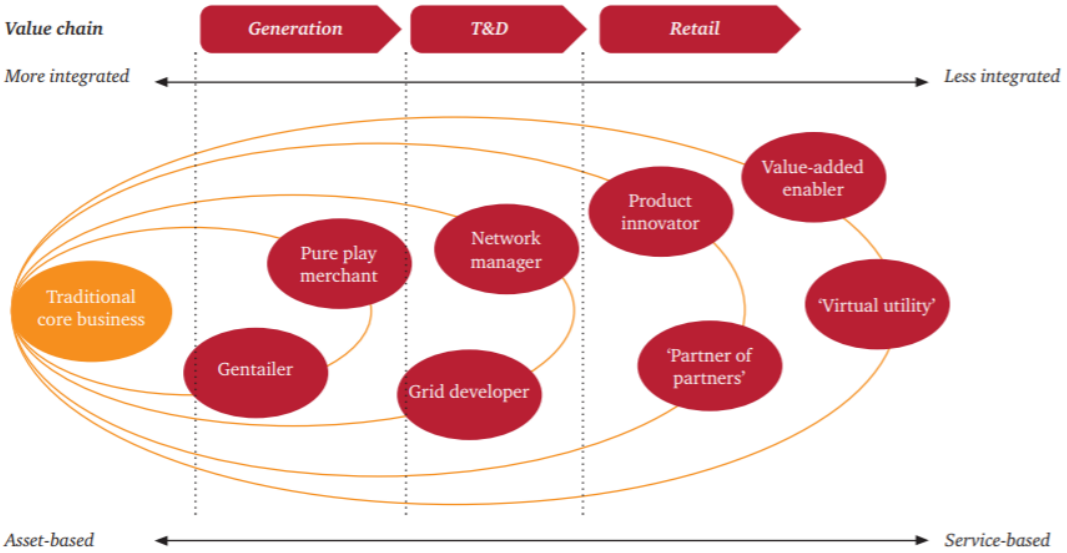

Figure 4: Various choices of business models (Source: PWC, 2016)

Referring to the above figure we may expect the establishment of ecosystems of various scope, functionalities and size. We could see the INVADE platform as a combination of the business models closely situated to the Retail part of the value chain: e.g., product innovator, partner of partners, value added enabler and "virtual utility". Thus, it would be useful for our further work on the INVADE business model to briefly present the relevant business models referred to by PWC (2016) (Table 2). Main characteristics of all four models are customer-focus and retail-based business with a competitive margin as a main profit. This is, in parts, the type of business model we project for INVADE as well.

Table 2: Business models of relevance for the INVADE platform (Source: PWC (2016)).

Business models	Main actions to engage in	Competitor threats addressed	Profitability drivers

Product innovator model	- Compelling product (from commodity to home device) - Opportunities to integrate superior products - Proficiency in customer acquisition and iteration through data analytics tools - Brand reputation and product expansion	- New entrants with energy products offerings - Incumbents and new entrants innovating on specific offers - Bundled offers to enhance attractiveness - Tariffs based on risk/reward opportunities for customers	- Low customer acquisition and operating costs - Diverse product portfolio - Partnerships to enhance product range - Retain profitable and high-volume customers and minimize switching
Partner of partners model	- Complete suite of services and identification of the right solution provider partners - A range of relationships with solution partners - Widened range of channels to market - Bundles of offerings targeted at the connected customer - Enhanced brand value	- Increased choice and complexity in the market in terms of technologies and providers - New entrants offering range of new energy and associated services - Incumbents and new entrants innovating on service delivery models	- Low cost of service, e.g. cross-selling multiple products to a single customer - High customer satisfaction by establishing clear customer service standards, pinpointing and quickly addressing customer pain points - Wide range of innovative yet convenient services
Value added enabler model	- Big data platforms - Educate on energy management options - Innovative methods for sharing customer benefit -Data analytics and data security protocols -Partnerships with data managers	- Low-priced/free behind-the-meter devices - Regulatory change preventing utilisation of customer data - Leverage of third-party brand for market entry	- Robust data analytics - Pricing of performance - Decision tools for customer adoption - High quality data security management systems and protocols
Virtual utility model	- Participation in distributed generation and storage projects	- New entrants offering products/services that increase customer	- Structure and pricing of a wide range of energy products

	- Partnerships with technology-based providers - Increased customer engagement via intelligent tools - Definition of future roles for incumbents together with regulators	engagement in managing their energy needs	- Energy trade - Partnerships with key value chain players

The work of TU-Austin (2017) elaborates on how the adoption and integration of DERs ushers the electricity system towards a more dynamic, decentralized and efficient one and thus impacts the traditional electric utility[2] business models. According to the authors utilities will need to consider alternative business models to remain viable and should aim to realize the potential of DERs. More specifically, the study examines six new utility business models and come up with following common themes:

- Adoption of performance-based-ratemaking structure that shifts the focus from the cost of service rate structure to revenues awarded for improving performance
- High customer engagement: e.g., customers can choose among energy efficiency programs, negotiate energy usage, generate own electricity and gain better control over their electricity bill
- Integrating renewables into the electric system is prioritized

However, a most important result to consider is that the business models included are predominantly relying on platform models - (five out of six in Figure 5). These are considered important with respect to customer engagement and enabling innovation. Yet, in two of the business models, some platform system disadvantages related to overwhelmed customers, the need for attracting providers and individual actions, or the danger of players running each other out of business push towards the use of hybrid approaches where platforms are applied but with some limitations.

[2] In the US electric utilities are referred to as companies that are normally responsible for generation, distribution and sale of electric power

Evaluation metric	Business Model					
	NY REV	CA	RIIO	LBNL	RMI	TE
COS to PBR Transition	●	◑	●	●	●	◑
DER Encouragment	●	◑	●	●	●	●
DER as Cost Reduction Tool	◑	◑	○	◑	◑	○
Customer Engagement	●	◑	●	●	○	◑
Platform Model	●	◑	○	●	◑	●
Fixed Cost Recovery	COS + Fixed Change	COS + Min. Bill	Policy + RAV	N/A	NUC + Tariff	COS + Access Fees
Profit-Making	PER+MBR	PER+MBR	PBR	MBR	PER+MBR	MBR
Role of DSO	None	Operation	Price Settings + Regs	Operation	Operation	Operation
ESU or SIM	SIM	SIM	SIM	Both	Both	SIM

● YES ◑ SOMEWHAT ○ NO

Figure 5: Comparative analysis of new business models. Source: TU-Austin (2017)

Next, we want to pay attention to one particular topic out of the energy transformation spectre: storage. As storage has a very central role within the INVADE project, its particular trends, in the light of business model development, have to be outlined.

4.2 Energy storage-specific business models

With the increasing share of intermittent renewables in the energy system, energy storage is needed to help maintain the balance between demand and supply. The needs may vary across the value chain and in time – from a few seconds to much longer time intervals, such as ensuring seasonal balance (Figure 6).

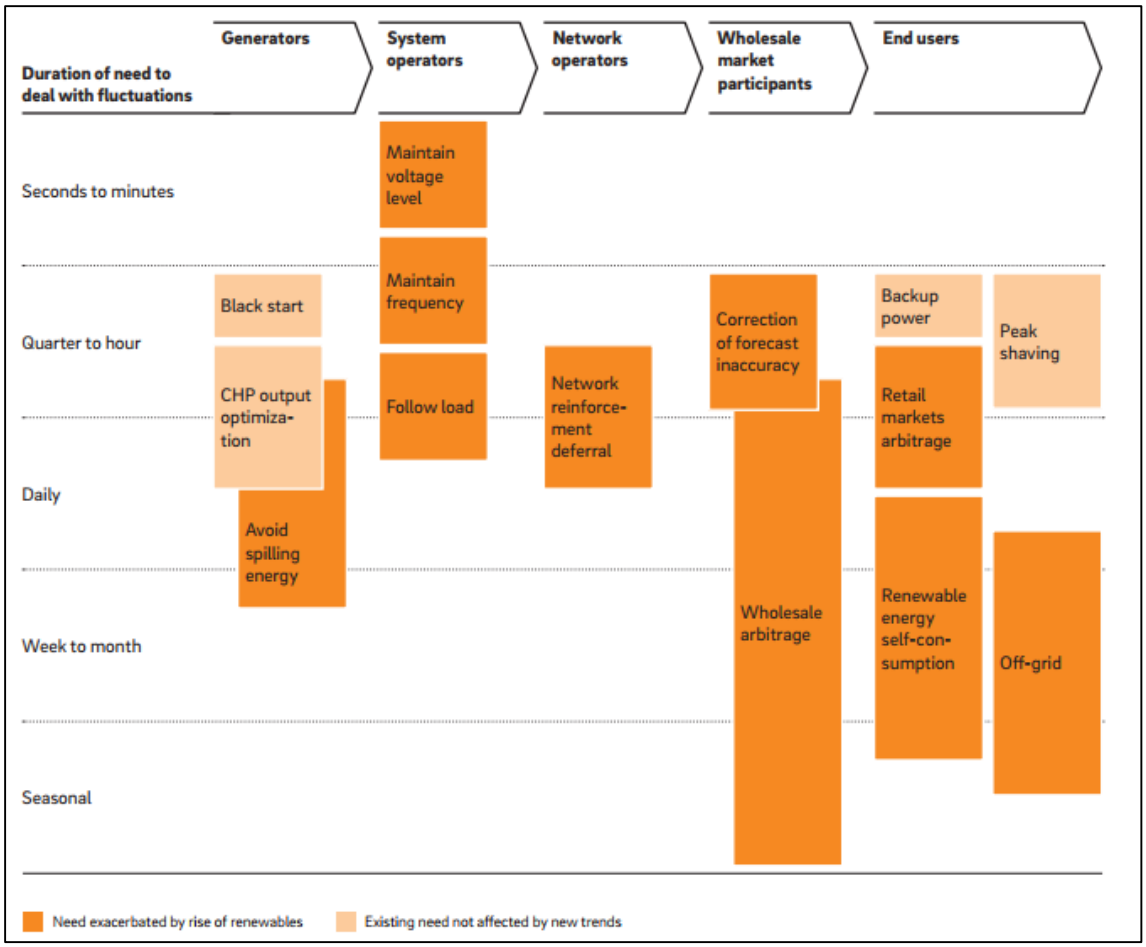

Figure 6: Storage needs along the value chain. Source: Berger, 2017

The accelerating development in the energy storage technologies with increasing storage capacities and decreasing costs gives grounds for disruptive business models to shape the energy storage market. Jansen (2016) refers to Energy Storage News' (2016) report where three primary approaches to sharing value between the energy system and the customer were identified.

- A "shared benefit" approach that refers to business models providing customers with an additional profit. This is typically accomplished by aggregating behind-the meter energy storage capacities to provide flexibility services
- A "storage for free" approach where business models rely on new financing schemes to overcome the barrier associated with costly initial investments. Such models can be targeting both commercial and residential customer segments and succeed in making their business offer perceived as different and attractive.
- A "community storage" approach for which business models are based on utility side of the meter assets that integrate offers for a wide range of value chain

stakeholders – e.g., DSOs, energy suppliers, commercial and residential customers, generators

Having analysed a wide range of examples from energy storage related business models, Jansen (2016) attempts to summarize the most influential success factors:

- Companies should be able to access the value from flexibility and power trading or build effective partnerships with the related players along the value chain.
- The use of smart software and data are crucial for innovation and are to become highly important for storage utilization
- Differentiated methods for achieving scale and for financing
- Importance of "daring to trial", implementing innovation and learning from it (rather than waiting for further reduction in the cost of energy storage)

Considering the above factors, Jansen (2016) expects some companies to transform from pure storage products manufacturers to smart energy solution providers with storage at the centre of the proposition. SonnenBatterie, Nissan's xStorage and Tesla's Powerwall are good examples for storage solutions that have pushed forward such transformations.

Frost and Sullivan (2017) explore eight energy storage related business models across grid scale, residential and community segments. Similarly to Jansen (2016), they stress on the importance of business models that ease the capital expenditure burden in order to encourage consumers' participation. Further on, Frost and Sullivan (2017) divide the explored eight emerging business models into three classifications according to the different scale of energy storage systems that they utilize:

- Grid scale: based on TSO- or DSO-owned assets, third party-owned assets and shared assets
- Behind-the-meter: VPP-centred business models where VPP model 1 refers to a flexibility aggregator model, and VPP model 2 refers to a generation company aggregator model and technologies/service provider model
- Community scale: based on community energy trading system and district storage system

Previous studies merit energy storage for its significant potential in improving grid balancing. However, as noted by Liu et al. (2017), many factors, such as cost, policy and control efficiency, limit the spread of distributed energy storage. Thus, Liu et al. (2017)

propose the use of cloud energy storage that can provide energy storage services at a much lower cost. The solution will provide ubiquitous and on-demand access to a shared pool of grid scale energy storage resources. End users will be able to store and withdraw electricity to and from centralized batteries. Using simulation tools the authors prove that cloud energy storage is both feasible and economically beneficial and could be the core of a successful business model.

Berger (2017) refers to batteries as the linking pin in enabling sales of power between prosumers. According to his work storage will motivate for business model innovation within companies, increasing the range of services for decentralized energy supply, e.g., through local trade, demand-side management and the provision of ancillary services. Further on, Berger's study suggests that access to consumer's batteries can be used for personal portfolio management and trading operations. In addition, integrated offers with solar PV, battery and EV-charging are to be highly compelling for end users (real-life examples confirming this are provided in Table 3).

Having provided some general comments on business models related to energy storage, we will now continue to a more specific part with relevant examples from recent years. With respect to the INVADE business model to be developed, we are particularly interested in the platform ecosystems emerging within the energy storage field.

4.3 Relevant examples

This subchapter will be dedicated to examples of platform business models that could be of relevance for INVADE. Of course, the list of examples could be much longer, but we consider the selected ones as indicative enough with regards to this report's purpose.

Table 3: Relevant energy and storage examples for the development of INVADE's business model

Example (Company)	**Relevant product/service**	**Business model characteristics with relevance for INVADE**
Sonnen	- sonnenBatterie - storage technology that can utilize solar power and grid prices via intelligent energy management software	- A system that is easily integrated with new or existing solar installations and offers its

	- sonnenCommunity - members share their generated and stored energy with one other in a clean energy marketplace - sonnenFlat-Box - connects non-solar customers to the sonnenCommunity and grid services - sonnenFlat tariff - provides community members with energy at $0 for 10 years (Sonnen, 2017)	German users participation in the sonnenCommunity - Aggregate behind-the-meter energy storage and trade in the balancing market while sharing value with the customer through the “flat rate”
Nissan	- XStorage Home systems -the size of a conventional boiler; based on both new and recycled batteries from EVs that they sell through their partner – the US power company Eaton; profile product as British-made.	- Sell an integrated system that provide everything needed to manage and store energy at home - Scale the solution up to suppliers at the grid level who seek greater stability
Tesla	- EV as an Internet of Things product - Powerwall - solution for local storage; Can be efficiently combined with solar panels; suitable for both private households and commercial buildings; the battery can be mounted on the wall and stores electricity generated by the “solar roof” or may draw electric power from the grid at low prices	- Getting users “hooked” on its hardware, and then make money from selling additional services, of which supercharging is just one example - Delivers along the energy production-consumption value chain: from gigafactories and solar roof, to superchargers, EVs and Powerwall
Smartly	- Smartly Gateway – enables the efficient coordination of various smart systems, units and services at home (such as lightening, heating, EV-charging, ventilation, locking the doors)	- Platform solution that empowers customers and makes their life easier and safer - Integration of various services and use of partnerships with suppliers
Nest	- Nest – home management system - Works with a wide range of own or external but easy to integrate devices	- Platform solution that empowers customers and makes their life easier and safer

	(thermostats, cameras, alarms, lightening, etc.)	- Integration of various services and use of partnerships with suppliers
Centrica	- Hive – home management system - Includes Connected Home products (Boiler IQ, Hive active plug, Hive active light, Hive motion sensor, Smart meter and in-home display, Amazon echo, Hive window or door sensor, Hive active heating, EV charging point), accessories and add-ons	- Platform solution that empowers customers and makes their life easier and safer - Integration of various services
SmartEnergi	- Wide range of energy products: PV installations, retail contracts, renewable profile, energy usage control, energy production control, insurance - Percentage discount on the solar power technology and provide a mark-up payment on each extra (above the locally consumed) kWh electricity produced - Smart Neighbourhood - up to 10 neighbours can buy the overproduced local electricity at a 25% reduced price	- An “all in one” solution package to answer energy needs - Motivates through green profile local energy - Innovative retail contracts
eSmart	- A range of products based on big data and advanced analytics: connected grid, connected prosumer, connected health, connected drone, connected trading, connected city	- Intelligent analytics platform that captures, analyses, visualizes and converts real-time operational data into actionable insights to enable high quality operational performance
Siemens	- Siemens Spectrum Power™ Microgrid Management System - a powerful SCADA system for flexibility, reliability and expandability.	- Model-based applications support advanced microgrid optimization of the entire energy infrastructure system.
Schnieder electric	- Provides a wide range of energy related products and services, both hardware and software, installation, management and usage optimization	- An “all in one” solution provider of energy technology and associated services

	- Some relevant examples: microgrid management system, energy performance services, invoice and data management	
Senfal	- Software solution for energy management and demand response. It forecasts energy demand and prices on energy markets and based on that automatically manages assets	- Attracts with the opportunity for savings and insights into energy consumption and costs through a personalized dashboard in real-time
Kiwigrid	- Energy management solutions: home energy management system, industrial energy management system, intelligent metering system, virtual power plant system	- Platform providing energy management by connecting consumers, businesses and utilities with intelligent and adaptive solutions, thus optimizing their energy systems. - Utilizes partnerships - Attracts through energy community concept
Eon[3]	- Various energy and community solutions: (energy consulting, energy efficiency, energy generation, energy management, sustainable districts,	- Platform solutions that satisfy wide range of energy needs and attract through easy adoption and the possibility to transform flexibility into capital

[3] The following websites (accessed in the period August-September 2017) have been used as sources for the description of the companies (in addition to some previously referenced in the text):
http://w3.usa.siemens.com/smartgrid/us/en/microgrid/pages/microgrids.aspx
http://www.enfo.no/2017/05/03/innovation-project-with-agder-energi-design-of-a-local-flexibility-marketplace/
http://www.schneider-electric.com/b2b/en/services/energy-and-sustainability/metering-power-reliability-and-microgrids/microgrid-solutions/?
http://www.smartenergi.com/
https://senfal.com/en/
https://www.eon.com/en/business-customers/energy-management.html
https://www.esmartsystems.com/
https://www.hivehome.com/
https://www.kiwigrid.com/en/
https://www.smartly.no/

	smart mobility, eMobility for communities)	

The most common characteristics of the above presented examples can be summarized as follows: customer centricity, easy access to variety of offers, digitalization, platform models, community perspective. Communities/cooperatives are in their own good reference points for platform business models that are of importance for INVADE. An extensive work describing the developments towards energy cooperatives has been carried within the H2020 project EMPOWER. While EMPOWER D6.1 (2015) includes a detailed state-of-the-art presentation of energy cooperatives, EMPOWER D6.2 (2016) provides an in-depth discussion on the commercial aspects associated with communities, the value they create and the particular relevance of social sites and shopping clubs. A good question to pose in this connection would what is actually attracting the end user? What are the needs, motivation factors and considerations that make her take the specific choices? The next chapter will elaborate on these issues.

5 The customer perspective

5.1 The impact of technology

Technological development has opened a wide range of new opportunities for customers. We can refer to technology's impact within three different contexts. A first one would be the product/service that the technology in question refers to and the need it satisfies. A second would be the possibility that technology creates for the integration and interrelation of various offers to provide a single access point and an "all-inclusive" customer experience. And a third would be related to customers' perceptions and values: e.g., environmental considerations, local engagement, savings, freedom of choice.

As an example, the development within the field of energy storage makes it possible for this technology to be customized for home usage and thus contribute for partial or full electricity self-sufficiency. Software products applying big data and advanced analytics make it further possible to utilize the accumulated energy storage data in order to achieve savings through efficiently operating energy management system. EVs, on the other hand, would provide for an environmentally friendly car ride experience which can be

successfully integrated with home storage or other customized applications (e.g., the Tesla as an IoT object).

Undoubtedly, technology is in the core of the transformation to platform business models and the factor to enable customer empowerment. But while technology is developed to answer end users' needs, it has to do that considering the respective regulatory environment. New rules and regulations are trying to catch up with the rapidly evolving technology, but are often slowed down by the multiple social, economic, environmental and security aspects that need to be considered.

5.2 Regulatory changes

Roger (2017) points out the great dependency on rules and regulations that the adoption of batteries at the retail level exhibits. As he further explains, the reimbursement of non-self-consumed solar PV energy and the access fee to the grid often determine whether investing in a battery represents an optimal investment or not. In this respect, batteries could be particularly profitable investment for regions where there is a large difference between feed-in prices for local renewable production and local electricity retail prices. In such settings promotion of self-consumption would raise the value of solar PV systems. On the contrary, in regions where the differences between retail prices and feed-in tariffs are small and where net metering is applied, energy storage would generate limited benefits as the cost of storage (although decreasing) is still substantial. Other important issues to consider in relation to regulatory changes would be the associated with utilizing storage on a higher level – e.g., a network of batteries could be providing balancing power to the grid, local grid services like congestion management and voltage control (INVADE D4.1, 2017) or could be used within a local market setting to facilitate exchanges between local producers and consumers of renewable energy. Roger (2017) further discusses on the topic stating that current network fees, which depend on volume rather than on capacity, could impede such local trade and a switch towards a capacity tariff could have a positive effect on enabling battery sharing at a larger scale. Another regulatory change to consider would be associated with community storage installations that allow for renting out battery capacity to consumers/prosumers.

Storage is just one aspect that regulatory bodies are to consider. In fact, the numerous technology enabled changes within the elements of the energy system are constantly being observed and analysed while considering the necessary regulatory updates. A

most central position in the regulatory authorities' considerations (in addition to the environmental ones) occupy the end users and their needs for security, equality and freedom of choice. Not surprisingly, a number of European projects have focus on data security with respect to smart metering. Customer protection and data security are particularly important in the context of platform business models, and even critical when considering their application within the energy system. And most importantly – setting the end-users in focus is particularly stressed upon within the so called "Winter Package" published by the EC in November 2016 and that consist of legislative measures to facilitate the transition to a clean energy economy.

5.3 General trends

So what are the things to motivate customers' choices and trigger ambitions for end user empowerment? The subchapters to follow will jointly contribute for finding the answer.

5.3.1 Transition: consumer to prosumer

The fall in the costs of renewable energy technologies, and solar panels in particular, has led to a considerable rise in the number of active energy consumers, who both consume and produce electricity (the so-called prosumers). The resulting two-way directional flow of power has a disrupting impact on the utilities' business models. Mouat (2016) elaborates on the topic, pointing out that for many business actors to manage energy consumption is seen as one of the biggest opportunity areas for cutting down on operating costs.

As technological solutions applying data analytics and artificial intelligence continue to evolve, consumers are empowered by both the tools and understanding necessary to control their energy usage. Indeed, as Mouat (2016) further explains, many customers, enabled by the convergence of new, widely available technologies, that can automate and monetize their energy resources, have begun to take more direct control of the cost, reliability and green mix of their power supply. The trend is being expanded upon with the arising prosumer communities which aim to produce and consume local renewable energy by establishing microgrids and thus reducing the use of more costly power (in terms of retail prices or grid tariffs, or both) delivered by the central grid. When energy storage is added to the described setting, consumer's degree of energy self-sufficiency is significantly increased. Mouat (2016) provides an estimate of approximately 3 million European energy users who generate power on their own. As adoption of small scale

generation technologies is rapidly increasing, prosumers' impact on the power grid will be immense and will require new business models that can contribute for dealing with pending grid challenges and associated flexibility needs. And these are some of the issues that the INVADE platform will help solving.

As both consumers and prosumers will be customers of the INVADE platform, we consider the use of "customer" as more proper and unifying, and thus rightfully chosen in the title of Chapter 5.

5.3.2 Changing customer preferences

The research program carried by Accenture (2017) gathered energy consumer insights from questionnaire-led interviews with over 80000 end users around the world. Accenture's study identified four major consumer trends: instant everything, hyper relevant, meaningful experience and collective consumption. It looks like the changes in customers' behaviour and preferences truly represent a most eminent driver for reshaping the traditional business model structures. To be able to position INVADE among the successful future business models we need to elaborate further on the customer trends presented above. And more precisely - what are customers interested in paying for?

The modern customer

Recent research suggests that customers are continuously being modernized making the market more challenging for consumer-goods companies (Zisper, 2016). Customers are becoming highly selective about what to use money on and their focus is moved to services (rather than products) and to premium market offers (rather than mass ones). Further on, they are looking for a well-balanced life where the key priorities are related to healthy choices, family engagement and meaningful experiences. The value of time increases with a busy lifestyle which makes the easy to use, automated and efficiency increasing solutions highly attractive. As a result, technology is gradually filling up end users' homes, transforming them into active users of life improving services. Banking, shopping, entertainment, home energy management and much more can now be realized by a few touches on the smart phone's screen. Undoubtedly, technology is a main enabler of changing energy consumption patterns, thus assigning customers with a central role in the energy system. But there are many more "under the surface" factors that are decisive for the modern customer's preferences.

Personal

Accenture's (2017) New Energy Consumer report suggests that end users are seeking highly personalized and seamless customer experiences. Even more – customers are willing to switch providers with the purpose of getting such an experience. The importance of individualized offers is well illustrated in Accenture's (2017) figure below.

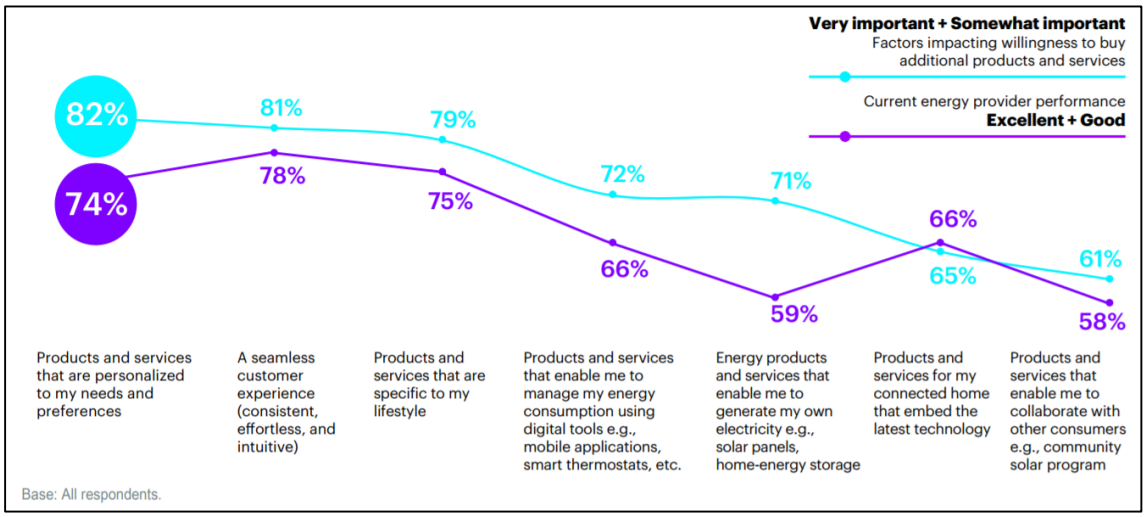

Figure 7: Incentives to by additional products and services from energy providers and their performance. Source: Accenture (2017)

Relevant and meaningful

Customers typically set high value on the ability to find clear and customized information. Furthermore, they require the products and services they pay for to be particularly designed for their user type and specific needs. In this way, a meaningful consumer experience is provided, and the product is perceived as helpful by making end users' life more efficient and easy.

Instant

Nowadays the real-time customer experience is being increasingly valued. Products and services that provide an instant response to customers' needs improve the level of comfort and security as perceived by the end users. Within the energy field, technological solutions have made it possible to provide a spectre of life quality improving and profit bringing real-time services. In particular, the ones related to home management systems, storage technologies to facilitate consumption/production balancing and energy flexibility, are highly important - and not only for the consumers' positive energy experience, but also for improving power grid operation. If energy consumers and prosumers get involved in the provision of flexibility, they can contribute for a cleaner

environment, and here is where the engaging factor to be described below comes into play.

Engagement and affiliation

End users would have different values and interest and to make an offer engaging for customers it should be designed so that it is easily identifiable with their needs and well adapting to their expectations. Furthermore, it should be provoking continuous engagement by answering their long-term visions and ambitions. Engagement and affiliation can often be attributed a social element – customers may show both engagement and passion for initiatives that provide clear social benefit – e.g., people with specific interests connect with each other to achieve a common goal or just for being attributed a status benefit (qualifying as "affiliated"). The increasing number of energy-related cooperatives constitutes a clear proof of the above claim. Being part of the sonnenCommunity (Table 3) or of some other energy cooperative (e.g., the Referenced by EMPOWER D6.1 (2015): Bürger Energie Berlin (Germany), Brithon Energy Cooperative (UK), Enercoop Bretagne (France), Coopérnico (Portugal), SEV-Südtiroler Energieverband (Italy), Som Energia (Spain), etc.) customers have some common goals – to be part of something valuable, to build connections, to gain certain status, achieve economic benefits, help the environment or just be part of a whole.

Emotions

Accenture's (2017) report proposes a transition from minimum viable product (rapidly built and delivered with just enough features) towards a minimum lovable product (such that provides both functional and emotional value, bringing together utility, engagement and simplicity). The authors believe that, by bringing together business, technology and human value, this type of product can be the key to success. Human emotions are, in fact, underlying all the above described customer preferences and this is confirmed by Accenture's conclusion on five dimensions that are indicative for why people love certain experiences: fun, relevant, engaging, social and helpful.

Based on the above presented customer characteristics we see the clear need for business models that to a high degree consider the proper level of digitalization to be implemented, the necessity for personalized products and services and for provision of immediate response, as well as offering diversified customer choices with help of partnerships and collaborations that enhance innovation. But undoubtedly customer centricity is to be in the very core of innovative business models and particularly decisive

for their success. Not surprisingly, the importance of setting customer in focus is a leading argument in the recommendation chapter to follow.

6 Conclusions and recommendations

The increasing adoption of DERs and storage systems along with technological disruptions within the energy sector pose challenges and create opportunities for both existing and new stakeholders. To adapt to the disruptive changes energy market participants would have to reconsider their business models. And for many power market actors the currently applied business models will have to evolve beyond the traditional energy economics structures. However, the way to go in order to succeed with BMI may not be clearly defined. There are many factors that need to be considered, reflecting technology, regulatory, market and consumer perspectives. Thus, a successful business model may have to undergo a number of iterations and modifications before it finally creates its desired value. Or, as stated in an article by Magretta (2002):

"Business modelling is the managerial equivalent of the scientific method—you start with a hypothesis, which you then test in action and revise when necessary."

Having observed a number of emerging business models we find a clear trend for centring them on customer interface that, based on digital solutions, enables flexible and efficient utilization of energy resources, as well as access to various services that satisfy basic customer needs and improve end user's experience. But, in line with the above citation, we should make clear that business models have to be adaptive to market developments and should follow tightly the various spectre of changes at the connected customer level – from technology to psychology. Besides, just as many energy companies have become unsure of the right market choices to make within the rapidly changing market environment, customers are equally unaware of the best choices to make as part of their energy decision-making. Or more simply said – consumers often do not realize their needs until they are being offered the product or service to satisfy them. This trend opens up for new business models, based on innovative customer offers that may be revolutionizing for the traditional customer-business relationship.

The previous chapters of this report have provided extensive description of the most recent trends related to business model development. In this final chapter we will present our recommendations for the INVADE business model specifically, and also suggest how

important it is for European projects and Horizon2020/FP9 to include platform and ecosystem based business models as part of their work.

To begin with, some highly relevant recommendations with a state-of-the-art character will be presented. Our vision for INVADE supports the approach suggested by Moser et al. (2017) – the innovative platform business model should disengage from the thought to protect the core business by creating a digital platform around the existing product and for which the access of competitors is disabled. Instead, the goal should be to create an open platform where competitors of the core product can become complementors, thus contributing for joint value creation. A similar claim is presented by PWC (2017) who stress the importance for companies to understand that future markets may often comprise of networks of participants (value network) engaged by new partnerships and collaborations.

In addition, as discussed by Roger (2017), energy storage is to be decisive for the business models of the future and companies who want to be profitable should own, operate and experiment with energy storage assets. Being able to balance demand and supply, energy storage will create the platform grounds for multiple new services and is not surprisingly defined as the “new business line” (Roger 2017). Also, storage is no longer a stand-alone hardware object, it is becoming equipped with software and connectivity, transforming storage units into Internet of Things objects, a trend that should be reflected in the generic business model.

The future business model impact factors, also of high relevance for the INVADE platform, have been well summarized by PWC (2017) and visualized in an adapted form in Figure 8. These factors are to be certainly considered in the process of INVADE’s platform business model development.

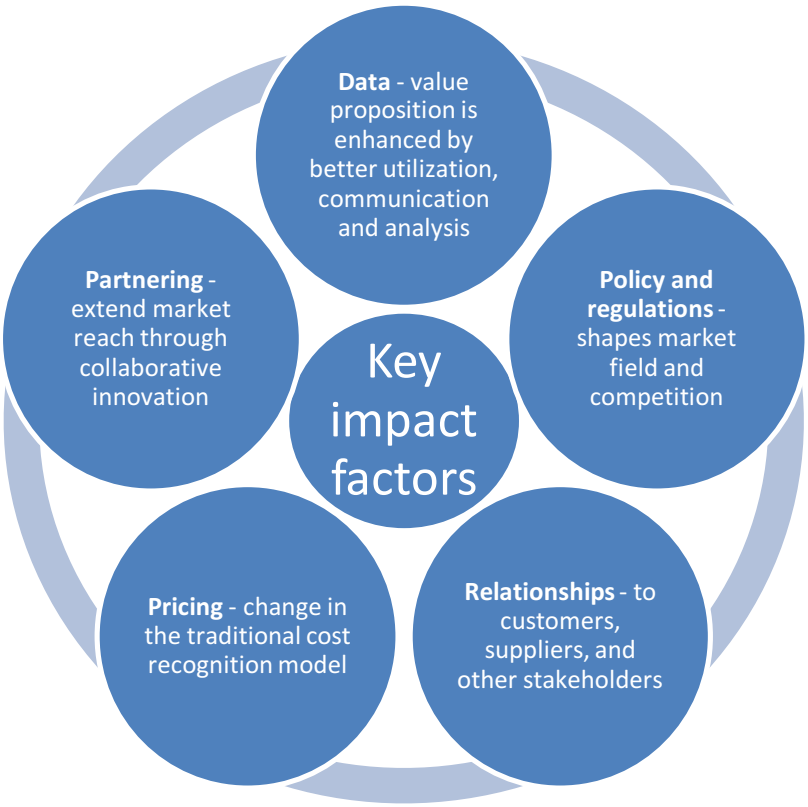

Figure 8: Future business model impact factors, Adapted from PWC (2017)

Other well suited the INVADE business model recommendations are provided by Accenture (2017). More specifically, they suggest continuous innovation and creation of agile culture that is aligned to digital strategy and that promotes a customer-centric approach, speed and experimentation, as well as digital leadership to navigate towards infinite disruption. Further on, Accenture's (2017) study points out the importance of implementing new IT that is agile and scalable through open, cloud-based and multi-speed technology architecture and allows for agile ways of working. Finally, the recommendations are complemented with the leveraging of new partnership approaches that support operations and provide new capabilities and with the establishment of new procedures for progress evaluation and measuring return on digital investments (e.g., innovative metrics for end user affinity and digital transformation key performance indicators).

In the context of the above found in the literature recommendations, our own INVADE specific recommendations are listed below:

- A platform business model that:
    - Is multi-sided

- Enables network effects
- Absorbs exponential digital growth mechanisms
- Fosters open ecosystems with focus on APIs
- Includes a wide customer domain (SW-agents, IoT units etc.)

- The model needs to be customer centric and applicable for all participants in the energy market, and particularly with respect to the pilot sites
- The business model should consider some unique choices for each pilot implementation based on each pilot's unique features
- The business model must be generic – it should be able to support each pilot, but also be able of supporting (and explaining) other use cases, even the ones coming from competitors
- The model must include the customer and her domain (devices, IoT, interfaces, agents) and be able to fit in itself sharing economy structures
- The model must support digitalization in energy markets (analytics, machine learning, apps, big data, cloud, IoT, devices, Internet, ecosystems)
- The model must be flexible regarding activation (remove/turn off the parts that are not relevant) but also to enable extensions
- The model must be able to support flexibility in roles (different components can have the same role (even simultaneously), or the role can alternate (prosumer).
- As the traditional business model canvas does not describe value networks and multisided platforms very well, a specifically customized for INVADE classification approached would be more appropriate
- The model must be able to support both value chains and value networks
- The business model will focus on the normal[4] condition in the grid

In summary, our vision for INVADE is based on platform business model, the success of which is achieved through governance of the platform ecosystems, taking advantage of

[4] With "normal" we refer to both the "green" and "amber" grid conditions as represented by the "traffic light" system discussed in INVADE D4.1 and INVADE D5.1 – i.e., we will not consider extreme grid situations ("red" grid condition).

network effects and open innovation, and through a strong focus on data utilization and customer-centric approaches. Exploiting internet connectivity, which has gained an unprecedented global scale, platform business models prove to offer enormous range of opportunities where innovation, software skills and commercial talent are combined to achieve maximum customer satisfaction, business profit and economic growth.

Next, our WP would like to contribute with some general recommendations on business model development which may be important to consider with respect to European projects and Horizon2020/FP9.

So far European projects have had a variety of technology platforms in focus, but very few of them have emphasised the importance of business model innovation. And there are, to our knowledge, none focusing on the type of business models that are currently conquering industries – namely, platform/ecosystem/multi-sided business models. Thus, our WP would like to suggest the following issues to consider when working on current and future Horizon2020/FP9 projects in order to further increase their desired impact on society.

- Recognizing the importance of working on technology solutions and business models in parallel is crucial for obtaining market adoption, and that this process will be iterative.
- The business models should reflect the most recent but also the expected in the future trends in both technological and societal developments - e.g., the ones related to digitalization, advanced analytics, complexity, multi-sidedness, customer preferences
- Platform business models that create communities and markets with network effects and that enable simple and well defined interactions and transactions among user groups should be strongly preferred
- Openness, combinatorial innovation and customer-centricity have to be prioritized within the platform business model design
- To succeed (as suggested by Moazed, 2016) the platform's core transactions should be facilitated through audience building, proper matchmaking, provision of core tools and services and well established rules and standards
- Capture the unique value of the project and use it as the essence of the business model creation

In our particular work, the uniqueness of the INVADE project is related to its overall structure and not the technology platform alone. But to make the project unique features successfully adapted to the market environment we should have an excellently designed business model on spot. This what our WP is going to produce, taking a starting position from the references, analysis and recommendations provided in the current document.

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