

# A business case for Smart Grid technologies: A systemic perspective

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## ABSTRACT

The digitalization of the electricity grid opens the way to bundle value added services to the electricity commodity, and possibly shift business value to electricity services in line with the notions of efficiency, conservation and sustainability. In this context, market forces should be mobilized within the boundaries of energy policy goals to contribute to the massive investments that are required to fulfill the Smart Grid vision. In this paper, we present a systemic perspective aimed at establishing technical and economic synergies that may improve the business cases of individual different Smart Grid technologies and contribute to reverse the consumption-driven paradigm of the electricity sector. Our analysis is supported by evidence from applications in the electric vehicle and smart meter ecosystems. Throughout the paper, an EU (European Union) perspective is primarily considered.

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## 1. Introduction

In line with strategic energy policy objectives (European Commission, 2007b), the European Commission (EC) has put forward its vision for a Smart Grid (EC, 2006, 2007a, 2011a) which entails a paradigm shift from the present electricity network, based on centralized generation and top-down distribution, to a new digitalized grid, increasingly based on a distributed and networked architecture. A new grid architecture is a key enabler for the penetration of new technological applications (e.g. electric vehicles, demand response), for optimal management and control of the electricity grid (energy savings, reduction of maintenance/operational/disruption costs) and for the establishment of an internal energy market (new business models, new market players, consumer inclusion) (EC, 2011b; Battaglini et al., 2010; WEF Report, 2009; Eurelectric Report, 2007, 2009; US DOE Report, 2009; Wolfe, 2008).

Present grid technologies, business models and regulations are out of sync with the requirements of the Smart Grid vision (WEF Report, 2009, 2010; Farhangi, 2010; Ipakchi and Albuyeh, 2009; EEGI, 2010; The Economist, 2009b). The challenge is to mobilize market forces within the boundaries of energy policy goals to provide the required massive investments over the next decades. The effectiveness of new business models and regulatory frameworks to combine the Smart Grid pieces together in a coherent system will significantly define the effectiveness of a market-driven modernization of the power sector.

Steering the transition to a new smart electricity system is a complex long term effort (Foxon et al., 2010; Verbong and Geels, 2010). A holistic analysis is necessary to establish technical and economic synergies and new regulatory measures that may improve the business cases of different technologies, enhance consumers' engagement and make energy efficiency and conservation a profitable proposition. In fact, in the current playing field each individual new technology faces significant barriers for its widespread market adoption against established business practices, consumers' habits and regulation. Market forces alone can take many years to fit new Smart Grid applications into existing systems. Also, moving away from a paradigm where market profitability is mainly about meeting the rising energy demand is a precondition to couple broad societal energy goals with a market driven deployment.

With this goal in mind, in this paper we will discuss how a new digitalized electric grid might (1) enable the uptake of new consumer-centric business platforms that offer a business case to several players that may not enter the market individually and (2) shift business value to electricity services in line with the notions of efficiency and sustainability. We support our analysis presenting evidence from two main areas of the turbulent and dispersed Smart Grid landscape: electric vehicles and smart metering. In this context, we will also highlight possible system-level downsides and distortions of the Smart Grid proposition that need to be tackled from an early stage, such as privacy concerns, dominant position of electricity service providers, inducing behavioral changes for consumers.

By leveraging on existing ideas on network effects and business platforms from other research areas (see e.g. Evans, 2003; Evans and Noel, 2008; Metcalfe and Miles, 1994; Katz and Shapiro, 1985), the main objective of this paper is to illustrate

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how the analysis of systemic effects can play a key role in offering a business case to Smart Grid technology and in providing some guidance to new policy interventions and initiatives.

The paper is organized as follows: [Section 2](#) discusses how ubiquitous IT capabilities might shift business value in the electricity system; [Section 3](#) presents two case studies of Smart Grid applications that will be used as a basis for subsequent analysis; [Section 4](#) discusses the role of systemic effects in creating business value in the two case studies presented. Finally [Section 5](#) presents the conclusions of the paper.

## 2. Platforms of tailored electricity services

A digitalized electricity grid with unprecedented monitoring and control capabilities will profoundly change the rules of the game in the electricity value chain. The possibility to measure in detail the electricity consumption, up to the final appliance, will create a link between every unit of electricity consumed and the service provided. The electricity bill at the end of the month might be detailed in terms of washing machine cycles, hours of TV, the comfort level provided by the air conditioner. Consumers will be more and more interested in the services that can be obtained through electricity, rather than in electricity per se. Also, electricity will be differentiated in terms of generation source (renewables or fossils), time of consumption (day/night), priority of supply (critical/non critical electricity service), power quality (low/high harmonic distortion) etc. In turn, it will be possible to segment consumers according to energy profiles and offer them a tailored supply of electricity to match their actual needs, preferences and economic constraints.

Segmenting consumers according to their energy profile and attaching business value to the “attributes” of electricity (e.g. power quality premiums, green electricity premiums) and to the services it enables rather than simply to its supply is a fundamental change of perspective, which will be an underlying characteristic of the whole Smart Grid system. The digitalization of the electricity grid opens the way to bundle value added tailored services to the electricity commodity and possibly contribute to reverse the traditional consumption-driven paradigm of the electricity sector.

As business value will be increasingly attached to the information flows exchanged among grid participants, new business platforms typical of the new economy may emerge (Valocchi et al., 2010). In particular, multi-sided platform (MSP) is a business model that has gained prominent economic importance with the advent of Internet because it represents an efficient way to create business value out of the interactions among different consumer groups.

As stated in Evans and Noel (2008, p. 3), “A Multi-Sided platform provides goods or services to two or more distinct groups of customers who need each other in some way and who rely on the platform to intermediate transactions between them”. This business model is at the core of many successful enterprises in information and technology industry such as Youtube, Windows, Sony Playstation etc., but it has already been

around for quite some time (e.g. consider shopping-malls) (see [Table 1](#)) (Valocchi et al., 2010; Hagi, 2009; Evans, 2003).

Typically, the participation of members of one side increases as more members of another side join the platform. Therefore platform owners tend to have tailored mechanisms to incentivize the participation of different customer groups. In some cases, they may decide to charge only one side and provide the service for free to another side (e.g. users have free access to Youtube or Facebook, the more the users, the higher the advertisement revenues for the platform owner). MSPs have inherently a systemic nature as they are such that “without some or all of the parties involved none would get any of the benefits” (Valocchi et al., 2010). The fixed costs of establishing platforms require facing up-front costs and investment risks before the platform can pay back. However, once in place, the platform can provide benefits to all its participants through systemic effects.

## 3. Two case studies

In this section, two case studies will be presented to discuss the establishment of technological and business platforms in the new digitalized electricity grid. Electric Vehicle (EV) and Smart Home platforms have been chosen as they may represent key commercial applications that can boost the whole Smart Grid proposition. In both examples, aggregators represent the key contributors to create business value and bring together various players around a viable business case. The aggregators are deregulated energy players whose main role is to aggregate consumers and intermediate transactions with other energy players (e.g. DSOs, energy retailers) ([ADDRESS Project Deliverable D1.1, 2009](#)).

### 3.1. Electric vehicles and E-mobility service

The diffusion of EVs is a long-debated issue that has so far fallen short of expectations (IEA, 2011). In broad brushstrokes, the problem of diffusion of EVs can be depicted as a deadlock situation where all stakeholders are waiting for a breakthrough to ignite the process:

- Customers waiting for cheap and long-range EVs.
- Auto-makers waiting for a market for EVs.
- Power retailers looking for extra-revenues.
- Distribution System Operators (DSO) interested in “Vehicle to grid” (V2G, see e.g. Guille and Gross, 2009; San Roman et al., 2011) services but cautious about investments.
- Renewable generation companies interested in synergies with EVs to act as distributed storage system (see e.g. Lund and Kempton, 2008; IEA, 2010).
- Battery suppliers waiting for a stable market to further increase their research and manufacturing capabilities.

At present, the focus is on the main missing piece of the puzzle: a cheap and high range electric battery. Constant improvement of battery performances might eventually allow EVs to become competitive head-on (or with some initial incentives) with traditional fossil fuel cars in established markets. The drawback of this

**Table 1**  
Examples of multi-sided platforms.

Side 1	Platform	Side 2	Platform Revenues
Users	Windows	Application developers	Mostly from users, application developers kit are subsidized
Game users	Sony playstation	Game developers	Fees on games. The game console is sold below cost.
Users	Youtube	Advertisers	Advertisers
Buyers	Shopping mall	Retailers	Store rents; service fees to buyers

approach is that it is difficult to have several industrial players coalesce around unclear prospects and risky long-term investments.

A different approach is to envision an entirely new system, rather than trying to make a new clean technology competitive in the current (fossil-based) system. In 2008, the Californian Start-Up Better Place has put forth a plan for providing mass-market EVs from 2011, relying on an innovative business model and on existing technology (Agassi, 2010; Lamonica, 2009; The Economist, 2009a; Marketwatch, 2010).

The underlying idea is a change in the car market paradigm. The company's focus is shifted from the product (the EVs) to the mobility service a car is able to provide, which is what consumers are typically interested in. The pledge therefore is to offer a mobility service through EVs which for the final consumer has a cheaper total cost of ownership (TCO) per km (i.e. including car, fuel and maintenance costs), than the one offered by engine cars for the mileage of an average driver. Better Place therefore intends to offer a subscription to the mobility service and sell the electric miles that are actually consumed. They also pledge to charge their batteries only with clean electricity and ensure that their car fleet is completely CO<sub>2</sub> neutral. It is worth stressing that, at present conditions, the Better Place business model still assumes that significant government subsidies for EV purchases are in place (as it is the case in Israel and Denmark (Boston Consulting Group, 2009) where the Better Place implementation is close to reach the commercial phase). An example of up to date cost comparison between the TCO of electric and traditional vehicles can be found in Elementenergy (2011).

Coherently with the idea that the company is selling a mobility service rather than a product, Better Place is retaining the ownership of the battery. In this way, apart from charging spots, they can also install battery swapping stations to extend the drive range and assume the risk of battery warranty under several charging cycles. The system is completed with software for intelligent battery charging schemes to avoid peak loads on the electricity grid and to locate the closest charging spot. In the future, the car batteries could also be used to sell energy back to the grid, creating a new source of revenues for the company and its customers and further reducing the cost per km of the mobility service (on this topic see e.g. San Roman et al., 2011; Sovacool and Hirsh, 2009).

Briefly the business model of the company consists of the following main elements:

- Subscription-fee based business model (Sell electric miles).
- Separate ownership of the battery (owned by Better Place and offered in lease) and of the car (owned by the consumer).
- Build an infrastructure of charging spots and battery swapping stations to ensure long range drive.
- Use only electricity from renewable energy sources (RES).
- Provide software for intelligent charging schemes.

Presently, Better Place has started the installation of charging spots and swapping stations in Israel and Denmark, has granted the collaboration of Nissan–Renault for EV manufacturing and has received consistent funding by investments banks. Clearly, many uncertainties and roadblocks still need to be addressed. However, no matter how successful the project will be, it is worth noticing that Better Place managed to move the EV concept from labs and pilots to commercial scale without relying on new technology but only on a new systemic perspective (Johnson and Suskewicz, 2009).

### 3.2. Smart meters and smart home service

Smart meters are key enablers for consumer empowerment and for the take-off of energy service markets in the Smart Home.

They will be used for billing purposes to quantify real-time consumption and generation, measure power quality, update instant electricity prices. However, as for electric vehicles, they should not be considered just as an additional component of existing electricity systems, otherwise their disruptive impact cannot be captured and their business case is negatively biased. By foreseeing the new system around smart meters, it is possible to exploit systemic effects and make sure that the deployment costs of smart meters are lower than the expected economic and societal benefits. Which systemic synergies can be exploited to create a whole system around smart meters which offers a business case for several players? Do consumers have compelling reasons to take an active stance and make their household an active node of the Smart Grid?

Home energy controllers have drawn a lot of attention recently (see e.g. The Economist, 2010; Hargreaves et al., 2010; ADDRESS Project, 2009) as they promise to complement smart meters and capture their disruptive impact, opening a whole new set of energy service applications in the smart home. These devices exchange monitoring and control data with smart meter, smart appliances, EVs, and sensors located throughout the home (Pedrasa et al., 2010). Through the intermediation of aggregators, home energy controllers become the gateway for consumers to access tailored energy services (e.g. demand response, green electricity premiums, energy monitoring etc.) without the need to perform daily and complex decision making on energy management (see e.g. ADDRESS Project Deliverable D1.1, 2009; Pedrasa et al., 2010). The intermediation of aggregators and the use of automatic home devices could contribute to mitigate consumer resistance to new services and products (e.g. green energy premiums, demand response) that is currently observed in the field (Diaz-Rainey and Ashton, 2008; Brennan, 2007; Jackson, 2005; Strbac, 2008).

While smart meter data are used for billing metering and grid management purposes, home energy controllers might acquire, with consumers' consent, a broader set of data to build a detailed consumer profile for marketing purposes (a simplified architecture of the smart home metering/communication infrastructure is reported in Fig. 1). Consumer energy profile data might include consumers' energy preferences and behaviors (load flexibility and active demand history, level of green consciousness, willingness to try out new services or invest in micro-generation) and individual appliance consumptions. On the ground of this data, it is possible to segment consumers and further tailor energy services to their specific needs and requirements (Valocchi et al. 2007, 2009).

## 4. Discussion

In this section, we highlight and discuss some of the key systemic factors behind the two case-studies presented in Section 3. We show that MSPs are at the core of the two case studies, discuss the way that MSPs could provide business value and stress the need to actively promote consumers' inclusion and participation.

In this analysis, we will consider players with clearly defined roles, even if in certain real-world scenarios a given company may have more than one role.

### 4.1. Multi-sided platforms

#### ● Case study 1

The business model proposed by Better Place is a MSP. Better Place builds the physical infrastructure (charging spots and swapping stations) and owns the EV mobility (E-mobility) service platform. Better Place is the aggregator of the

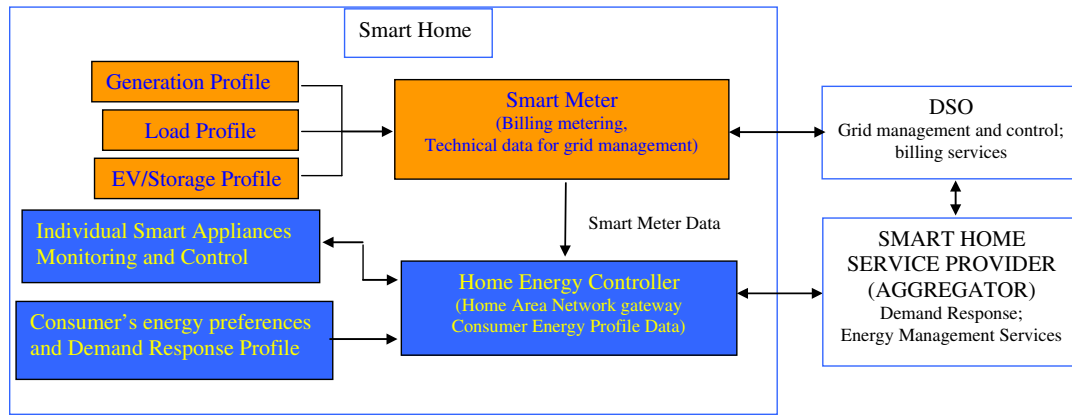


Fig. 1. Smart Home infrastructure—Fiscal/technical metering data and consumer profile data.

E-mobility platform and, by leveraging systemic effects, aims at creating a successful MSP that can multiply the initial investment to set up the platform.

The value of the platform depends on how many EVs it serves. Therefore Better Place's strategy is to lease the battery, reduce the up-front car costs, offer pay as you go subscriptions for RES electric miles, and have several consumers joining the platform. In this context, a commitment on guaranteeing energy savings, efficiency and sustainability to EV owners might represent a win-win proposition as it can attract consumers to the platform. The higher the EV base, the more interested other sides can get. More and more car manufacturers might join the platform, offer new EV models and attract new consumers. The platform is also appealing to power retailers to extend their power sale base and to battery suppliers interested in a stable growing market.

With higher purchasing power, Better Place can negotiate lower prices for energy supply and battery sales than individual consumers (Guille and Gross, 2009). Parking facilities or shopping centers can also get on board and stipulate deals with Better Place for the installation of charging spots or battery swapping station at their premises, and thus provide an attractive extra service to their customers (San Roman et al., 2011; Guille and Gross, 2009; Greentechmedia, 2009). The aggregated EV fleet is also appealing to DSOs because EVs can act as distributed generators to provide ancillary services to the grid or as controllable load to provide demand-response services (San Roman et al., 2011; Guille and Gross, 2009).

- Case study 2

With the smart metering infrastructure in place, MSPs may also emerge in the smart home domain with aggregators likely to play a key role. For sake of clarity, building on (Valocchi et al., 2010), let us consider the following illustrative example. A new company (an aggregator) intends to build a smart home service platform and subsidizes home energy controllers as part of a (possibly free) subscription to an energy management service package. Initially (Fig. 2a), the company builds a portfolio of consumers, collects detailed energy profiles and provides basic energy management services (e.g. energy monitoring, energy savings tips etc.).

In a second phase (Fig. 2b), assuming that the smart metering infrastructure and the active demand market are in place, the aggregator gives incentives to consumers to join active demand programs and offers its base of consumption flexibility to DSOs and energy retailers. Energy retailers get on board to buy active demand services and acquire consumers' profiles to provide tailored energy packages and services.

Consumers have the benefit of lower electricity bills, energy retailers optimize purchase and sale strategies, DSOs utilize a new tool for efficient management of the grid.

In a third phase (Fig. 2c), smart appliance manufacturers join the platform to offer customizable devices (e.g. also through remote updates of the device software) which automatically adjust to consumer's preferences and consumption profile. Software firms also join the platform to offer application and content services for the home energy controller (e.g. energy management widgets). The increased variety of available services might attract more consumers and players, further increasing the profitability of the platform.

#### 4.2. Building the platform and reaping its business value

As highlighted in the previous section, starting MSPs typically requires up-front costs which are paid back only when a sufficient number of participants have joined. Who takes the lead to build the EV or Smart Home platforms? How to assemble the platforms? We argue that a physical and a service MSP need to be established to harvest the systemic benefits of both the E-mobility and Smart Home platforms.

- Case study 1

In the E-mobility platform, the physical MSP is composed of the charging and swapping infrastructure equipped with communication and billing capabilities. The service MSP is the mobility service (electric miles) offered to participants by the mobility aggregator. In the Better Place project, Better Place owns and manages both the physical and the service platforms. However this may not be necessarily the case.

In particular, whether the charging infrastructure is to be a regulated asset is still a debated issue (e.g. see Berst, 2010; Eurelectric, 2010; Greentechmedia, 2010). It can be either considered as a post-sale service (like a fueling gas station) and built and owned by a private company (as in Better Place Project). Or it can be considered as an extension of the distribution grid (like a telephone booth in the phone infrastructure) and built by DSOs through a direct governmental intervention to socialize the costs (e.g. Caleno and Scuro, 2010). For sake of simplicity, in the rest of the paper we will assume that the E-mobility physical infrastructure consists only of charging spots and is a regulated public utility asset owned by DSOs. We underline that this hypothesis does not hinder the main functions of the E-mobility provider as conceived in the Better Place business model.

As owner of the physical MSP (Fig. 3a), the DSO provides authentication, management and real-time control for the networked charging stations and collects usage fees from other

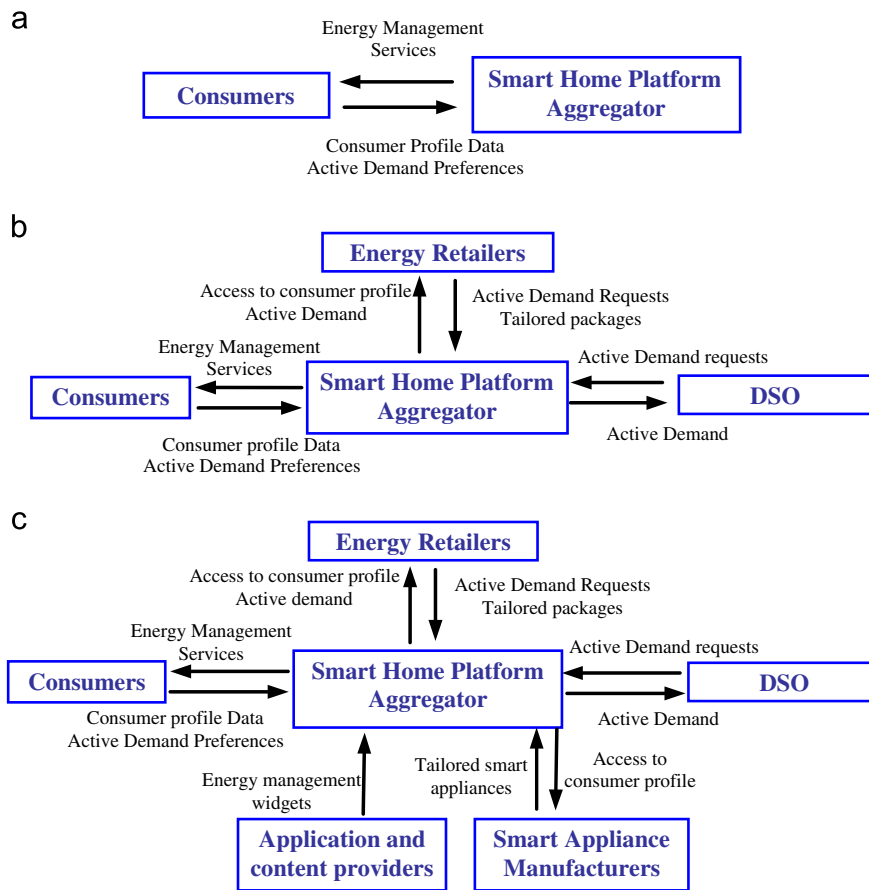


Fig. 2. (a) Set-up of a Smart Home platform, phase 1—illustrative example. (b) Set-up of a Smart Home platform, phase 2—illustrative example. (c) Set-up of a Smart Home platform, phase 3—illustrative example.

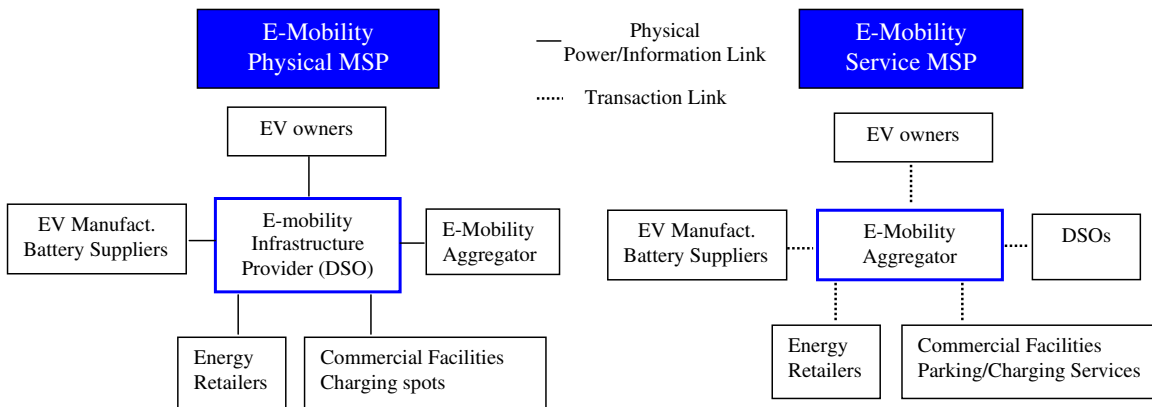


Fig. 3. E-Mobility MSP (a) Physical MSP, (b) Service MSP.

participants. In Fig. 3a, commercial facilities (restaurants, garages, hotels, shopping malls etc.) are included in the physical MSP as they might pay a connection fee to the DSO and install charging spots to offer charging services to their customers (San Roman et al., 2011; Guille and Gross, 2009; Greentechmedia, 2009). Once the E-mobility MSP is running, physical platform owners (DSOs in our assumption) might recover investments through (1) Fees from platform participants, (2) Operational savings through V2G Services, (3) Regulatory Incentives to install charging spots and perform the necessary grid updates to keep up with charging requests. The E-mobility aggregator is the owner of the E-mobility service MSP (Fig. 3b), in charge of aggregating EV owners and

intermediating transactions (E-mobility service subscriptions, V2G services etc.). Once the platform is up, new business opportunities may be built on the information flows among the platform participants. For example, with the intermediation of aggregators and consumer's consent, EV manufacturers might use consumers' profiles to tailor their marketing strategies; commercial facilities may use the on-board EV display for location-based advertisement to EV drivers with low battery charge passing by their premises.

• Case study 2

In the smart home example, the service MSP (built around the home energy controller) is owned by the aggregator (Fig. 4b—for sake of simplicity, only the main platform players have been

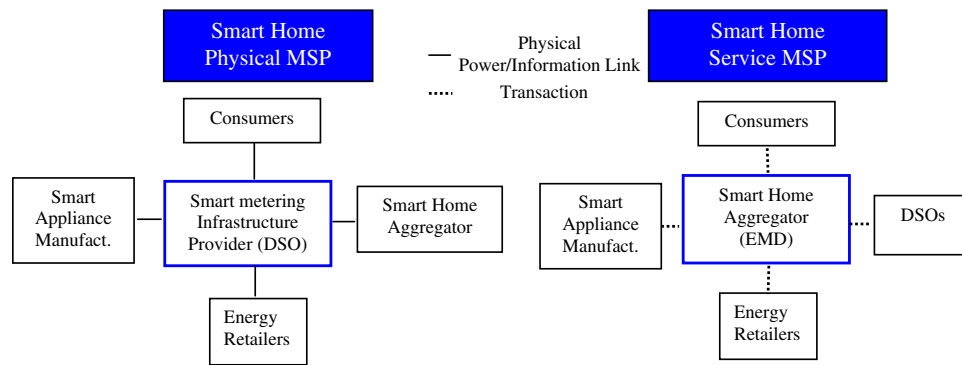


Fig. 4. Smart Home MSP (a) Physical MSP, (b) Service MSP.

reported), whose key function is to provide the access and the incentives to consumers to actively participate in the electricity service market and consider new technologies in their home (micro-generators, EVs, smart appliances). Potentially, the business value of the service platform can be significantly higher than the investment needed to establish the platform.

The physical MSP (the smart metering infrastructure, which is necessary to provide fiscal/billing capabilities to all the players involved in the service MSP) is very likely considered a regulated asset and typically built by DSOs (Fig. 4a) under regulatory incentive schemes. The deployment of smart metering infrastructure brings by itself significant operational savings to DSOs through improved operational management of the grid (e.g. remote reading, outage management, load forecasting etc.). Moreover, once the Smart Home MSP is running, DSOs might further recover investments through (1) Fees from platform participants, (2) Operational savings through Active Demand (e.g. voltage regulation, power flow control, ancillary services, smart load reduction for grid maintenance).

By comparing Figs. 3 and 4, a few considerations can be made.

First of all, the set-up of the physical infrastructure requires substantial up-front and possibly risky investments that might however pay back once the platform is up and running. Systemic effects resulting from the establishment of MSPs may create a business case for several participants who may not enter the market individually. New regulation should encourage and strengthen platform synergies.

Secondly, in both case studies, the characteristics of the physical and service MSPs are similar and platform participants play similar roles. Therefore, similar principles may guide business strategies in different platforms and successful business models may be applied across boundaries in the Smart Grid system, mitigating investment risks.

For example, for both platforms, consistent business value is created by tailoring electricity services to consumer profiles. The key element of the aggregator's strategy is to build a portfolio of consumers as a base to launch the service MSP. As platform scopes and functions may overlap (e.g. compare active demand for smart homes and V2G services for E-mobility), by leveraging its portfolio of consumers an aggregator can widen its business and enter new service platforms (e.g. build a portfolio of consumers for the smart home MSP and then use it as a base to enter the E-mobility MSP).

Finally we remark that the shift of business value from electricity supply to electricity services may contribute to move the electricity sector away from a consumption-driven paradigm. Platform profitability is not directly coupled with electricity power flows, rather on the establishment of synergies and transaction

links among platform participants to offer new electricity services and products.

For example, as the platform profitability depends on the number of consumers and players involved, aggregators have an interest in attracting consumers by offering (possibly free) energy conservation and efficiency services to mitigate the home and E-mobility electricity bills. Also, direct provision of electricity services bundled with the electricity commodity (e.g. E-mobility service; remote management of home temperature/comfort level) allows platform consumers to compare the cost of electricity services from different providers, rather than the costs of kWh. This might lead service providers and manufacturers to jointly pursue efficiency (e.g. by means of more efficient devices with learning capabilities) and conservation (e.g. smart devices with built-in capabilities to bid in the active demand market) to reduce the service price and attract consumers.

For DSOs, new revenues coming from the provision of platform services (e.g. dispatching services, provision of metering data etc.) could encourage the active pursuit of energy efficiency measures by making up for declining electricity sales. EC (2011a, 2011b) explicitly stresses the need for new regulation to support DSO transition from volume-based to service based business models.

#### 4.3. Consumer-driven approach

An active role for consumers is a precondition for the success of the Smart Grid. As shown in the two case studies, new business platforms might have a natural incentive to establish strong links with consumers and mitigate their resistance in actively participating in the Smart Grid.

To ensure platform value, aggregators rely on continuous relationships with their consumers rather than by offering access to services (e.g. Better Place business model relies on the subscription of a multi-year contract). Through consumer segmentation, they can (1) offer more tailored energy services to meet consumers' needs with possibly a higher rate of acceptance of new products and services (2) target energy-savvy and wealthy consumers as early adopters of new technology (Valocchi et al., 2009).

For consumers, Smart Grid service platforms offer interesting opportunities, but also risks and downsides. In the new business arrangement, consumers have the possibility to influence the electricity system via active selection of providers (energy retailers, aggregators etc.) and power options (e.g. green electricity and power quality premiums), via active consumption management (e.g. demand response), via self-generation. New players (e.g. aggregators) and new devices (e.g. home energy controllers) can provide consumers with simpler compelling means to take advantage of these options. However regulation should carefully

monitor the structure of the market and avoid that an increase of product differentiation increase the power market of sellers.

Another element of concern is consumers' privacy. Consumers must have the choice over the amount of involvement in the electricity market (e.g. by setting restrictions in the home energy controller settings) and must receive all necessary information to make informed decisions. A lack of transparency on privacy issues might severely hinder the participation of consumers and the profitability of energy platforms and of Smart Grid investments.

Finally we remark that system complexity and the required behavioral changes might discourage the involvement of some users (e.g. elderly people) or provoke anxiety in others (e.g. obsessive tracking of energy consumption and real-time pricing Hargreaves et al., 2010). Policy-makers can play a key role in promoting awareness to protect low income and vulnerable consumers.

#### 4.4. Open vs. closed platforms

Interoperability is essential to enable new business platforms to emerge. However, should the platforms be fully open or a certain degree of control is needed?

The charging infrastructure and the smart metering infrastructure are likely to be considered as regulated assets of public utility. In that case, the owners of the physical platform (typically DSOs) have the regulatory role of ensuring technical functioning and non discriminatory physical access to all parties.

Service MSPs should be competing in the free market and, to a certain extent, platform control should be a commercial decision of the platform owner. Open platforms can be profitable to attract new players on board, foster competition in the platform ecosystem and enable participation of players in different competing platforms (multi-homing) (Evans, 2003). For example, in order to stimulate the entrance of new players in the nascent E-mobility service market, Better Place is committed to ensure that their charging/swapping network will be available for recharging to consumers of other mobility providers (just like roaming for cell phones) (Lamonica, 2009).

In some cases, however, platform owners might need to exert regulatory control of the platform to ensure, through rules and constraints, "the health of the platform ecosystem" (Boudreau and Hagiu, 2008). When no control is exerted, degradation of the platform may arise as a consequence of low quality services provided by undesired platform participants, cyber-security threats etc. Also, fully open platforms may enable value creation for competing platforms, as participant groups can switch provider and platform with minimal inconvenience. However, by exerting high level of platform control, successful MSPs may have an interest in locking their platform and take advantage of dominant positions (Evans, 2003; Hagiu, 2009). Therefore, apart from ensuring transparency for consumers, regulation should focus on specific anti-trust regulations for pricing and investments in MSPs. However this is a complex matter as, due to the very nature of MSPs, platforms owners tend to have different pricing and regulatory measures for the different customer groups to incentivize their participation in the platform.

In the Better Place Project, the unique car-design requirements to fit swapping stations makes it less likely for consumers to be attracted away to MSPs established by other mobility providers. On the contrary, critics point out that, with swapping stations, Better Place is betting against battery performance improvements and is limiting the participation to its physical platform to EV manufacturers and battery suppliers that comply with swapping station requirements. This may relegate Better Place to niche markets, like high mileage fleets in densely populated areas (e.g. cabs) (Wiederer and Philip, 2010). However, in the early

phase, swapping stations are especially useful to solve the "range anxiety" problem, attract consumers and make the nascent E-mobility MSP thrive. Eventually, battery improvements might even eliminate the need for swapping stations but would not alter the main elements of Better Place E-mobility service business model (i.e. electric miles, battery leasing and EV software). In this perspective, the installation of swapping stations, which limits the interoperability of the platform, can be considered simply as a (possibly transient) regulatory instrument in the MSP strategy (see e.g. Boudreau and Hagiu, 2008 for more examples) to make E-mobility platforms take-off.

## 5. Conclusions

In this paper, we have discussed the need for a system-level approach to integrate the Smart Grid components into coherent systems in a way that energy policy goals and market profitability are ensured. In particular, we have analyzed, which synergies can be exploited to create a whole system around smart meters and electric vehicles and offer a business case for several players. We have highlighted how new business arrangements might leverage technological/business synergies, foster investments and shift business value to electricity services in line with the notions of efficiency, conservation and sustainability. Finally, we have stressed the need to anticipate and tackle from an early stage downsides and possible distortions that come with the establishment of new technological and business arrangements, such as privacy concerns, dominant positions in new business platforms, and demanding behavioral changes for consumers.

Further research should focus on discussing policy recommendations and regulatory measures that can contribute to capture the disruptive value of new business models and platforms, ensure that energy conservation, efficiency and sustainability are actively pursued in the electricity market and guarantee fair allocation of costs and benefits among all stakeholders, especially consumers.

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