A Gaming and Social Networking Platform for Evolving Energy Markets' Operation and Educating Virtual Energy Communities

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Glossary of Acronyms

Acronym	Definition
ADMS	Advanced Distribution Management System
API	Application Programming Interface
BMC	Business Model Canvas
BMS	Building Management System
BO	Business Opportunity
CAPEX	Capital Expenditure
CBE	Competence Based Education
CBSM	Community Based Social Marketing
C&I	Commercial & Industrial
CIS	Customer Information System
CRM	Customer Relationship Management
DMP	Data Management Plan
DR	Demand Response
DoA	Description of Action
DSM	Demand Side Management
DSO	Distribution System Operator
EC	Energy Community
ECC	Energy Consumption Curve
EC-RTP	Energy Community Real Time Pricing
EE	Energy Efficiency
EIDaaS	Energy Information distribution as a Service
EMS	Energy Management System
EP	Energy Program
ESCO	Energy Services Company
ESP	Energy Services Provider
GDPR	General Data Protection Regulation
GSMaaS	Gamified Social Marketing as a Service
GSRN	Green Social Response Network
InEC	Innovation & Exploitation Committee
IBR	Inclining Block Rates
ICT	Information and Communications Technology
ILP	Individual Learning Plan
IPR	Intellectual Property Rights
KPI	Key Performance Indicator
LCMS	Learning Content Management System
LCOE	Levelized Cost of Energy
LO	Learning Object
M&V	Measurement & Verification
NGO	Non-Governmental Organization
NPC	Non Player Character
OPEX	Operational Expenditure

ORDP	Open Research Data Pilot
OSN	Online Social Network
P&L	Profit & Loss
P-RTP	Personalized Real Time Pricing
P2P	Peer-to-Peer
QoS	Quality of Service
QoE	Quality of Experience
RAT	Research Algorithms Toolkit
S/W	Software
SaaS	Software as a Service
ToU	Time of Use
VEC	Virtual Energy Community
VPC	Value Proposition Canvas

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Document History

This deliverable includes an updated version of SOCIALENERGY's business modeling and innovative value propositions based on the initial market analysis described in D6.1 (M6). It also includes an updated version of the so far dissemination and exploitation-related achievements of the consortium.

Table 1: Document History Summary

Revision Month	File version	Summary of Changes
03/11/2017	v0.1	Draft ToC circulated to the entire consortium.
16/01/2018	v0.2	Final ToC version and task delegations' plan has been agreed among all partners.
02/02/2018	v0.5	ICCS provides the 1st round of contributions regarding the Business Model Canvas and the Value Proposition Canvases.
28/02/2018	v0.7	ICCS and INTELEN provide the 2nd round of contributions.
15/03/2018	v0.8	All partners provide their final contributions and INTELEN compiles the pre-final version for internal review.
22/03/2018	v0.9	NRG and ICCS reviewed the deliverable and provided comments for enhancements to INTELEN.
28/03/2018	Final	INTELEN addressed the final amendments and forwarded to the Coordinator for submission in ECAS portal.

Executive Summary

The SOCIALENERGY architecture is *"modular by design"* in order for all subsystems (i.e. GSRN deployed by INTELEN, GAME deployed by NRG, RAT deployed by ICCS and LCMS deployed by SU-NIS) to be potentially exploitable as stand-alone commercial products in the future. The technical APIs for the interaction between the various subsystems have been appropriately designed in a way that any possible combinations of SOCIALENERGY subsystems to be commercially exploitable in the future (e.g. GSRN with RAT as one single product, GAME with RAT as another one, GSRN-GAME as another one, GSRN-RAT-LCMS as another one, etc.). This strategic decision at the design phase provides the flexibility to the consortium to decide how to prioritize its dissemination, communication and further exploitation activities towards commercialization. Of course, the default choice and ultimate objective of the consortium is to fully integrate all 4 subsystems into one single SOCIALENERGY S/W platform in the context of WP5 work. This way, the SOCIALENERGY product and associated services are expected to be competitive enough in order to enter the liberalized ICT/energy market and be sustainable as a product from a business perspective.

SOCIALENERGY is a multi-disciplinary S/W platform operated by an electric utility company or energy service provider (ESP) in the retail electricity market to accurately inform and effectively educate end users on energy efficiency in a user-friendly way. The concept of online social networks is exploited through the development of the Green Social Response Network (GSRN) concept, combined with behavioral economics models (such as peer pressure). These lead to the creation, dynamic adaptation and management of virtual energy communities (VECs) that aim to trigger very effectively behavioral changes towards energy efficiency. The self-evolving SOCIALENERGY game integrates several mathematical models and algorithms towards energy efficiency and education of users. An innovative hybrid demand response (DR) strategy is developed, which combines incentive-based and price-based DR through the use of advanced user engagement technologies and exploitation of financial incentives. Finally, a competence based educational (CBE) framework is introduced aiming to create the best 'individual learning plan' (ILP) for each individual SOCIALENERGY user and subsequently guide him/her through the whole online learning and user engagement process. The business goal of SOCIALENERGY S/W platform is to offer the required S/W infrastructure substrate for an electric utility/retailer/ESP to adopt any combination of state-of the-art behavior change programs according to its targeted business needs.

This report elaborates on the findings of D6.1 delivered in M6 and includes all the business modelling work according to the work progress in technical WPs 3 and 4. In section 1, the general context within which SOCIALENERGY S/W platform will be developed is described. In section 2, the description is more specific on the today's retail electricity market's needs, the state-of-the-art market conditions and ultimately the motivations behind SOCIALENERGY's business model.

The SOCIALENERGY Business Model Canvas (BMC) is presented in section 3. The focus is on one customer segment, which is the progressive electric utilities (or else Energy Service

Providers - ESPs). Quantitative figures including projections about costs and revenue streams provide an indicative view on the real market applicability and commercialization potential of SOCIALENERGY system.

In section 4, five (5) value propositions are presented. This is a short-list version based on which the consortium will focus during the first S/W integration phase. A Value Proposition Canvas (VPC) tool was used for the detailed analysis of each value proposition. More business cases (in the form of examples) for each value proposition are described in section 6.4, too.

An updated report of project's dissemination and communication activities is presented in section 5, while exploitation activities are reported in section 6. Finally, section 7 provides concluding remarks together with future research and commercial insights related to SOCIALENERGY's real market applicability in future smart grid markets.

1. Platform-based business modelling and innovations

The main objective of SOCIALENERGY is to develop, validate and demonstrate a gaming and social network platform for educating energy consumers and virtual energy communities towards evolving EU energy markets' operation. In SOCIALENERGY's virtual world, users are seamlessly educated via advanced gaming techniques in good practices and decision making related with energy efficiency. Subsequently, users are able to interact in SOCIALENERGY's "real-world" platform, which will facilitate the easy, rich and deep communication among involved stakeholders from individual energy consumers and virtual energy communities, to utilities, policy makers, and even other indirect stakeholders (such as electric appliance retailers and building renovators) that will allow them to: i) discover each other, ii) educate themselves in order understand the difficulties and challenges that each one faces and iii) finally interact and trade among.

SOCIALENERGY consortium has early recognized the need for the S/W platform under development to be not only a "technology platform", 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. With respect to the SOCIALENERGY's business modeling work, SOCIALENERGY S/W platform has been designed in a way that it:

- Follows a platform-based, multi-sided and customer-centric business modeling approach.
- Enables network effects and is able to absorb exponential digital growth mechanisms.
- Fosters open ecosystems with focus on application programming interfaces (APIs) enabling open, combinatorial and incremental innovation.
- Reflects 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, gamification, advanced data analytics, competence-based education, customer preferences, etc.

1.1. Need for platform-based innovation for Europe

In the survey work [1], S/W platforms are categorized into four different types, namely:

- 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, etc.
- 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, etc.
- Integrated platforms: a technology, product or service that is both a transaction platform and an innovation platform. Examples: Google, Facebook, Alibaba, Amazon, Apple, etc.

- 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, etc.

As a next step, it is useful to highlight some insights about the geographical status of the ecosystem development. The global survey in [1] 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 as illustrated in the following figure. Only 7% of the transaction platforms, 11% of the innovation platforms, and none of the integrated platforms originate from Europe.

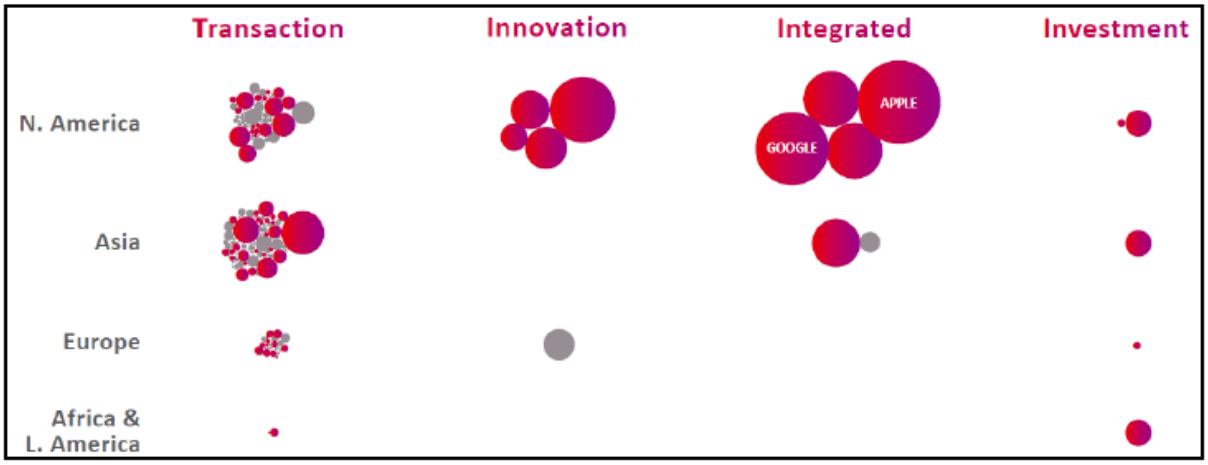

Figure 1: Platform companies by type and by region. Bubbles represent the size of the companies according to market cap as of December, 2015. Red colour refers to public and grey to private platforms [1]

Therefore, we consider it even more important to position the SOCIALENERGY S/W platform within the context of platform/ecosystem-based business model innovation.

1.2. Need for innovative S/W platforms in the energy industry sector

In [2], the trends in ecosystem/platform development are well summarized. The two main drivers for the growth in platform ecosystems are: i) changing customer expectations, and ii) digitization. The first one means that 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. Regarding digitization, [2] exhibits 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. 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 [2] 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 2, but in the context of the presented ecosystems' growth, we can certainly expect a similar development trend for the energy industry field as well.

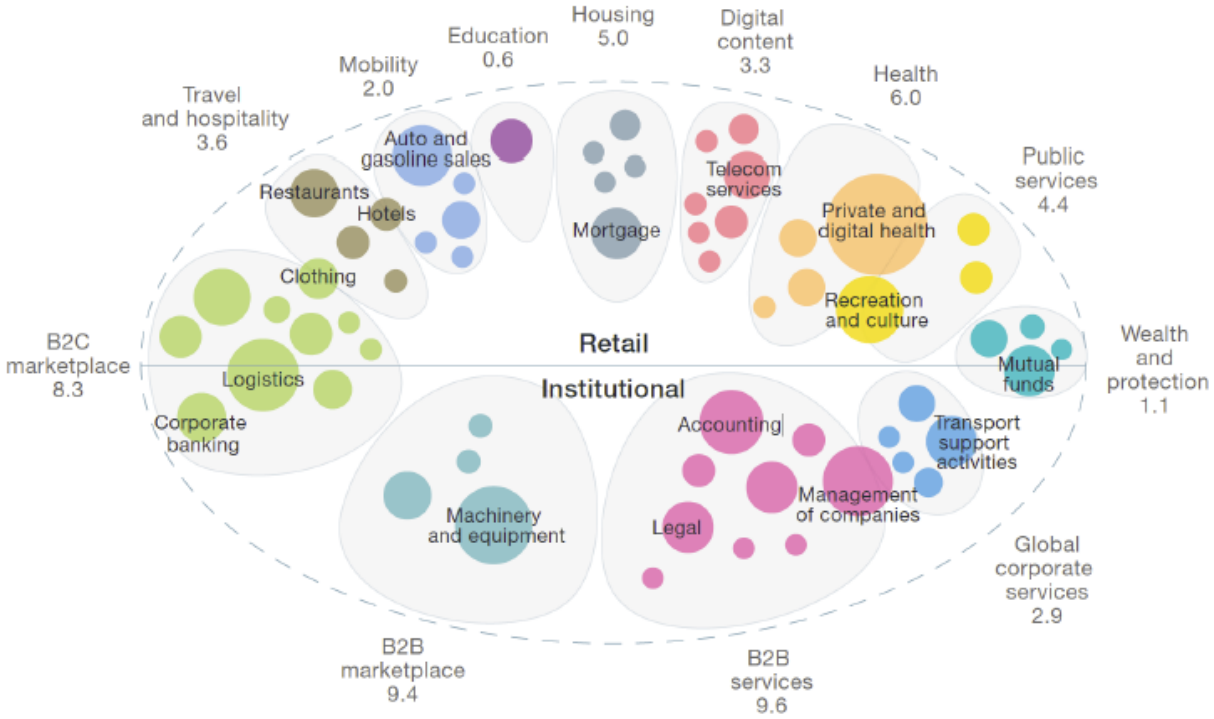

Figure 2: Estimated 2025 total sales for new ecosystems that are likely to emerge in place of many traditional industries, trillion dollars; Circle sizes indicate approximate revenue pool sizes [2]

SOCIALENERGY S/W platform is aligned with the basic principles of business and architecture modeling with the ultimate goal of introducing the respective products and services in the smart grid market at the end of project's lifetime.

1.3. Main features of S/W platform-based business models

A novel S/W platform should also have two main features: i) openness, and ii) be multi-sided. The concept of open platforms is well defined in [3], in which open platforms are described as consisting of several stakeholder groups. A first group represents the platform leader, who is typically one firm or multiple firms that develop the platform. 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, are called 'complementors', who may add to the technological core of the platform by innovating periphery components, which offer complementary products or services. The external stakeholders (i.e. '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. On the other hand, the platform leader's task is to design the S/W 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: 1) the platform leader can offer high quality by giving platform access to diverse set of 'complementors', 2) end users can enjoy increased variety of easier to access offerings and better quality, and 3) 'complementors' get access to a larger market or else all the end users who are registered in the platform. Through the described synergies, open innovation strongly contributes for joint value creation.

Regarding "multi-sided" feature, a good description of multi-sided S/W platforms is provided in [4], which 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. Authors in [5] 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. Moreover, the value of participation in the S/W platform is increasing when the number of participants and interactions gets higher.

In SOCIALENERGY S/W platform, all the above-mentioned principles were followed during the architecture design phase. For example, the platform leader role is represented by the electric utility/administrator user, the end users are the energy consumers and EC leaders and the 'complementors' are the various ESCOs such as building renovation companies, electric appliance vendors/retailers, etc.

1.4. Examples of digitally disruptive and platform/ecosystem-based revenue models

In the following table, an indicative list of the various categories of revenue models for platform-based business modelling is provided. SOCIALENERGY S/W platform initially aims at adopting a 'freemium'-based revue model incorporating also features from 'marketplace', 'experience' and 'network' revenue models. More details are provided in sections 2-4 of this report.

Table 2: Various categories of revenue models for platform-based business modelling [41]

Revenue model	Description	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, etc.
Freemium	Digital sampling where users pay for a product or service with their data, but it costs to upgrade.	Linkedin, Dropbox, Spotify, etc.
Free	"if you are not paying for the product, you are the product" model that captures consumers' attention and sells personal data	Google, Facebook, etc.
Marketplace	Provides digital marketplace that brings together	eBay, iTunes, App

	buyers and sellers in return for a transaction fee or commission	Store, Uber, AirBnB, etc.
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.	PeerBuy, AirBnB, Zipcar, etc.
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, gamified apps
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 time but lack the money for delivering product/services)	Uber, Taskrabbit, etc.
Network	Sale of interlocking and inter-dependent suite of products and services, the value of which increases as more are purchased. Makes consumers dependent.	Apple, Google

1.5. Overview of SOCIALENERGY's business plan and decisions made so far

SOCIALENERGY is a multi-disciplinary S/W platform operated by an electric utility company or energy service provider (ESP) in the retail electricity market to accurately inform and effectively educate end users on energy efficiency in a user-friendly way. The concept on online social networks is exploited through the development of the Green Social Response Network (GSRN) concept, combined with behavioral economics models (such as peer pressure). These lead to the creation, dynamic adaptation and management of virtual energy communities (VECs) that aim to trigger very effectively behavioral changes towards energy efficiency. The self-evolving SOCIALENERGY game integrates several mathematical models and algorithms towards energy efficiency and education of users. An innovative hybrid demand response (DR) strategy is developed, which combines incentive-based and price-based DR through the use of advanced user engagement technologies and exploitation of financial incentives. Finally, a competence based educational (CBE) framework is introduced aiming to create the best 'individual learning plan' (ILP) for each individual SOCIALENERGY user and subsequently guide him/her through the whole online learning and user engagement process.

The business goal of SOCIALENERGY S/W platform is to offer the required S/W infrastructure substrate for an electric utility/retailer/ESP to adopt any combination of state-of-the-art behavior change programs according to its targeted business needs. The SOCIALENERGY architecture is "modular-by-design" in order for all subsystems to be potentially exploitable as stand-alone commercial products in the future. The technical APIs for the interaction between the various subsystems have been appropriately designed in a way that any possible combinations of SOCIALENERGY subsystems to be commercially exploitable in the future (e.g. GSRN with RAT as one single product, GAME with RAT as another one, GSRN-GAME as another one, GSRN-RAT-LCMS as another one, etc.). This

strategic decision at the design phase provides the flexibility to the consortium to decide how to prioritize its dissemination, communication and further exploitation activities towards commercialization. Of course, the ultimate objective of the consortium is to fully integrate all 4 subsystems into one single SOCIALENERGY S/W platform in the context of WP5 work. This way, the SOCIALENERGY product and associated services are expected to be competitive enough in order to enter the liberalized ICT/energy market and be sustainable as a product from a business perspective.

A pre-final version of the overall plan for the pilot setup has been agreed among partners and IPR issues have already been resolved among the consortium (see more details in section 6). The pilots will be deployed in several electric utility home consumers, who will be very carefully selected. Initially, the pilot will be deployed to one utility (i.e. Protergia S.A., Greece - https://www.protergia.gr/en) and then, the procedure will be duplicated to other utilities from different EU countries.

The overall plan for the system integration, validation and testing is summarized in four discrete phases as shown in the figure below, namely:

- Planning phase (T0-T1)
- Integration & Preparation/Testing phase (T1-T2)
- Operational phase (T2-T3)
- Phased rollout (T3-T4)

All four phases will be sequential for each electric utility pilot partner and will be run in parallel for several utility companies, which is SOCIALENERGY's targeted customer segment.

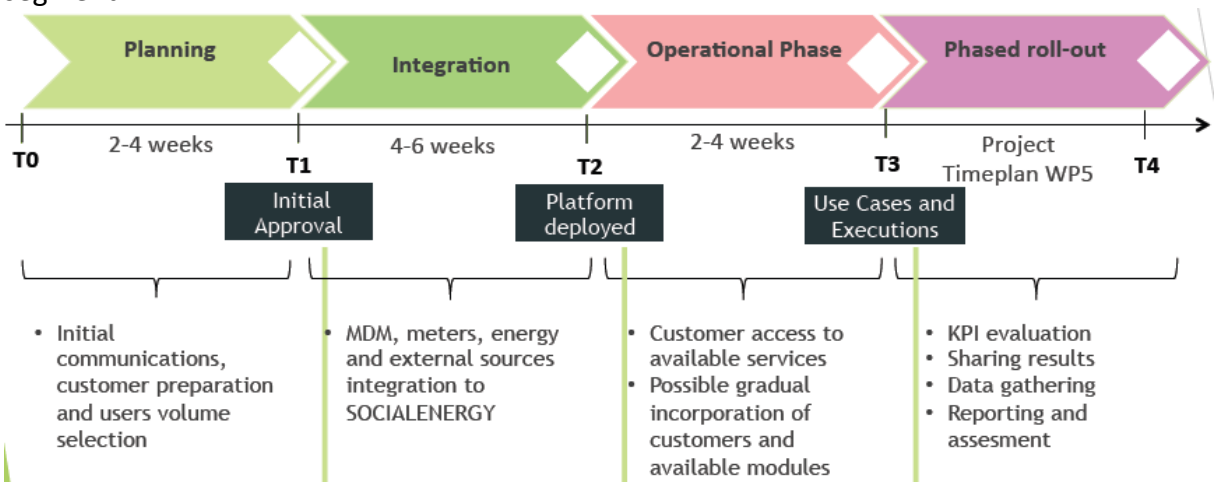

Figure 3: Pre-final version of the pilot testing plan

In section 2, an in-depth analysis of the existing market status that drives the business modelling decisions is provided. The core business model is explained in section 3, while the value propositions (in the form of business cases) are described in section 4. In section 5, a list of communication activities is provided towards engaging the customer segment and disseminating the project's innovations. Finally, in section 6, innovation management issues towards SOCIALENERGY's commercial exploitation are described.

2 SOCIALENERGY position in the retail electricity market and progressive utility business

In this section, we elaborate on the findings of D6.1 (M6) aiming at further analysing the market that SOCIALENERGY's products and services are targeting as well as 'going deeper' in the analysis of a progressive utility's business, which is the targeted customer segment.

2.1. Digitization era for progressive electric utilities

The digitization era for electric utilities is tightly coupled with the development of inter-disciplinary software (S/W) platforms, whose main advantages and innovative characteristics have previously been presented in section 1. At the retail electricity market side, electric utility companies are gradually following this so-called 'digitization' path towards providing more effective and attractive energy services and establishing much more efficient communication pathways with their clientele and other smart grid market stakeholders [1]. This digitization trend is expected to enhance the active participation of consumers along the energy value chain, thus changing the nature of consumer engagement across the customer life cycle. Thus, digitization should be considered as part of every progressive utility's initiative [7] towards reducing its OPEX (e.g., educate consumers, encourage self-service or create value with new services) and its CAPEX (e.g., exploit a variety of advanced energy efficiency services and products).

As shown in Figure 4, there are three main driving forces towards the digitization era of electric utilities, namely: a) regulatory and policy shifts, b) changing market demand, and c) technological innovation. In particular, information and communication technologies (ICTs), which can cut through pre-existing layers of regulatory processes and business models to directly connect all stakeholders to the goods and services they want to purchase/sell, are gaining traction across liberalized energy markets. Nowadays, electric utilities are keen on prioritizing their CAPEX investments on energy efficiency-related assets, as the latter are much cheaper to implement than building new generating capacities. As stated in [8], the levelized cost of energy (LCOE) efficiency resource costs for utilities about 2 to 5 cents per kilowatt-hour, which is one-half to one-quarter the cost of other options like coal/gas/nuclear investments or solar/wind installation programs. As a result, the adoption of various digital S/W solutions sounds increasingly appealing for electric utilities as well as for their clients (i.e. energy consumers), who are increasingly keen on experiencing personalized energy services [9].

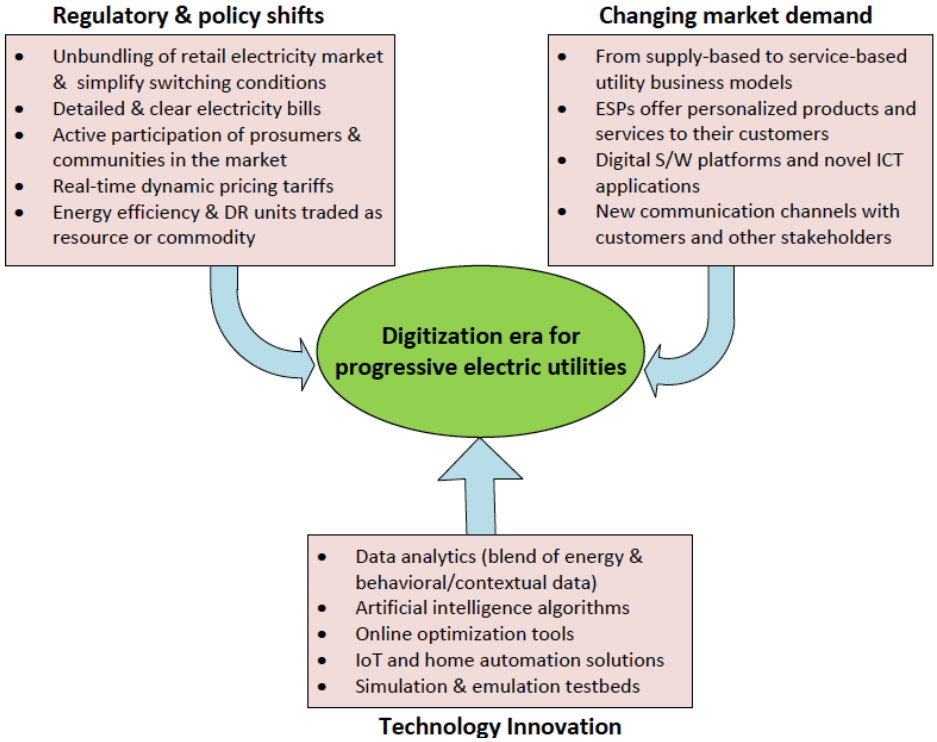

Figure 4: Confluence of 3 driving forces for the digitization era of electric utilities

Interestingly, the telecom operator industry's disruption paradigm, which took place a few decades ago, has several remarkable similarities with the various research, innovation and commercial trends of the electric utility industry. In Table 3, these similar characteristics are briefly summarized. Hence, the electric utility industry may adopt the good practices and "success stories" of the (mobile) telecom industry and possibly follow-up the respective "lessons learned" in order to experience an analogous market growth within the next years.

Table 3: Mapping of Telecom Industry's With Electric Utility Industry's Disruption Paradigms

Successful Practices	(Mobile) Telecom industry	Electric Utility industry
Unbundling of markets and assets	Telecom infrastructure is separated from telecom services	Generation & grid infrastructure are separated from retail market
Unbundling of physical network & geographic restrictions.	Mobility/portability among different locations and telecom providers	Virtual net metering, smart grid infrastructure is more flexible to facilitate geo-agnostic services
Detailed billing info and interaction with customers	Customers have control over their bill (e.g. hours of voice calls, MB spent, etc.) via web portals	Smart metering info, energy efficiency and savings KPIs, home energy reports via web portals
More elastic switching conditions among operators	Users can easily switch among operators and select the most beneficial option	Consumer has plenty of choices of utilities to select in order to minimize his/her electricity bill
Differentiated services (many programs) to choose	Only fixed, only mobile, IPTV, and any combination (e.g. dual, triple, quad play)	Consumer can select the energy program (EP) that best fits his/her own energy consumption needs
More context-aware services and communication channels with the customer.	Personalization services to customers (reporting, recommendation, notifications, etc.)	Personalization services to consumers (data analytics, reports, recommendations, energy tips, etc.)

Collaboration with cross-sector market stakeholders to realize new revenue streams.	Strategic business partnerships (via e.g. e-commerce platforms) with other sectors, including the energy sector	Strategic business partnerships (e.g. via e-commerce platforms) with other sectors, including the telecom sector
Prosumption of resources	Data prosumers: users may help the operator and get reimbursed (e.g. femtocells, D2D comm., etc.)	Energy prosumers: users follow-up behaviour change and demand response programs of the utility and get reimbursed
Community-based social marketing strategies	Operators offer family/company programs and encourage the interaction of users via the online social networks	Energy communities and exploitation of social networks to promote collaboration among users and electric utility's business

2.2. Research, innovation and commercial trends for novel business modelling in the retail electricity markets

As traditional electric utilities are gradually being transformed into Energy Service Providers (ESPs), new business models are required. Figure 5 presents the basic research, innovation and commercial trends that constitute a typical iterative process within a progressive utility's everyday business.

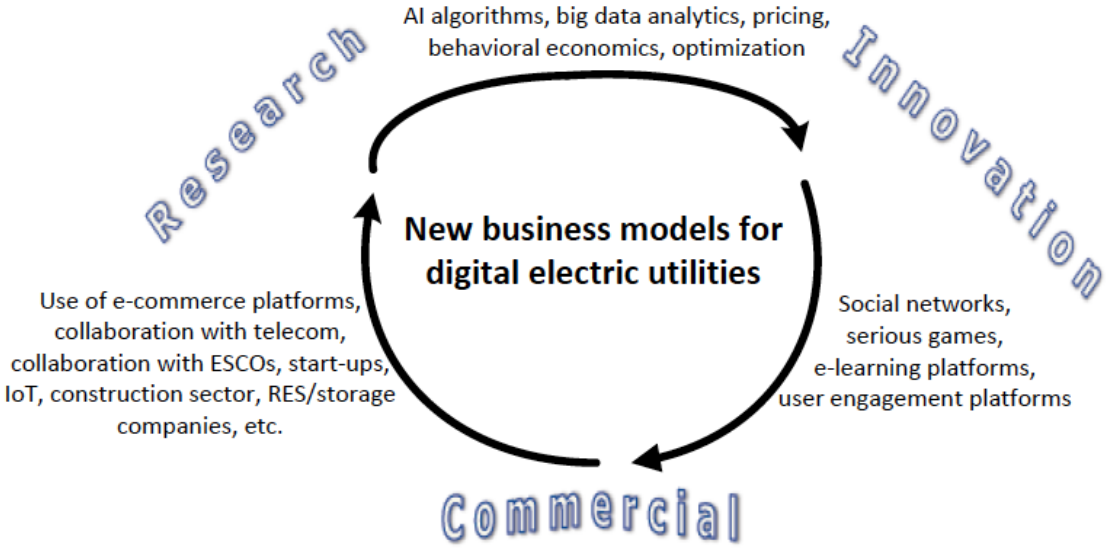

Figure 5: Research, innovation and commercial trends for novel business modelling in the retail electricity markets

First of all, research is needed in order to drive innovative solutions, such as the incorporation of artificial intelligence algorithms, big data analytics, behavioural economics approaches, socio-economic research and optimization tools, towards the development of advanced Energy Programs (EPs). EPs are contracts with end users that charge them not only based on the amount of energy they consume, but also according to the level of their energy efficiency (the pattern of their energy consumption curve and/or the level of their behavioural changes). Innovation means the novel exploitation (e.g. via optimal combination or enhancement) of already existing S/W solutions and systems, such as online social networks, user engagement platforms, serious games, gamification modules, e-learning platforms, etc. Thus, new products and services can be created in order to enhance the quality of service (QoS) and experience (QoE) that the utility provides to its customers.

Finally, innovation provides input for new ideas regarding further commercial exploitation from a strategic business point of view. For example, utilities can collaborate with a telecom provider to offer converged ICT-energy services or they can collaborate with various types of ESCOs. Use of e-commerce platforms is also an emerging commercial trend for utilities, which want to collaborate with cross-sell market stakeholders to realize new revenue streams. Ultimately, the real-life results from the utility's business and related analytics are then fed back into the research division to design new and enhanced tools towards meeting the updated customer segment's needs. This iterative process guarantees that the digital electric utility's business will be sustainably competitive in the liberalized electricity markets' framework.

Conclusively, a holistic S/W infrastructure together with a multi-disciplinary business model is required in order to cope with all the afore-mentioned challenges. Therefore, we propose the SOCIALENERGY S/W platform, which consists of several systems and S/W modules from various disciplines, including the ICT, energy efficiency, behavioral economics, socio-economic sciences, online social networks, competence based education, serious games and gamification sectors. The major contribution points of the proposed SOCIALENERGY framework can be summarized as follows:

- A multidisciplinary S/W platform is proposed in order to accurately inform and effectively educate end users on energy efficiency in a user-friendly way.
- An innovative hybrid demand response (DR) strategy is developed (towards EPs that offer effective Demand Side Management), which combines incentive-based and price-based DR through the use of advanced user engagement technologies and exploitation of financial incentives.
- The concept of online social networks is exploited through the development of the Green Social Response Network (GSRN) concept, combined with behavioral economics models (such as peer pressure). These lead to the creation, dynamic adaptation and management of virtual energy communities (VECs) that trigger very effectively behavioral changes towards energy efficiency.
- The self-evolving SOCIALENERGY game integrates all the aforementioned mathematical models and algorithms towards energy efficiency. This allows the emulation of a real residential home capable to: i) educate empirically end users in a very effective way and ii) offer a "virtual" pilot for experimentation purposes in order to accelerate development of effective energy efficiency services.
- A competence based educational (CBE) framework is introduced aiming to create the best 'individual learning plan' (ILP) for each individual SOCIALENERGY user and subsequently guide him/her through the whole online learning and user engagement process.

2.3. State-of-the-art on behaviour change programs in the retail electricity markets

In D6.1 (M6), we have already identified and analysed all SOCIALENERGY's competitors around the globe. Here, we classify the state-of-the-art behaviour change programs in order to further identify all the novel functionalities that are required to be implemented. As surveyed in [10], there is a plethora of behaviour change programs

implemented by progressive electric utilities, which can be classified in three major categories: 1) *information-based*, 2) *social interaction-based*, and 3) *education-based*. Nowadays, a utility may select to adopt one or more programs, but it does so in an ad-hoc manner. The SOCIALENERGY vision is to offer the required S/W infrastructure substrate for a utility to adopt any combination of state-of-the-art behaviour change programs according to its targeted business needs.

Table 4: Categorization of state-of-the-art behavior change programs

Category	Program	Description
Information- based	Home energy reports	Periodically sent to residential customers with feedback about energy use, tips, rewards, etc.
	Real-time feedback	About real-time energy use via dashboards, web interfaces, etc.
	Energy audits	Done online or in person (personalized evaluation of energy use in a home)
	Persuasive messaging	Written communications that use behavioural insights
Social interaction-based	Games/ competition	Try to achieve the highest rank compared with other individuals/ groups or reach game goals by reducing energy consumption
	Community based	Community-based social marketing, innovative community outreach strategies
	In-person strategies	Opinion leader, foot-in-the-door technique, public commitment, goal setting, guided group discussion, etc.
Education-based	Strategic energy mng	Train building managers, energy experts, etc.
	Training	Vocational, non-school-based education/training, etc.
	School/ university	K-12, college, campus, education of students on energy efficiency

Regarding state-of-the-art DR programs, these can be categorized based on [11] as follows: 1) mechanisms used for the loads' control (e.g. centralized vs. distributed control, load sheds vs. load shifts), 2) offered motivations to users (e.g., price-based vs. incentive-based), and 3) key performance indicator (KPI) that needs to be optimized (e.g., system's cost minimization, users' welfare maximization, utility's profits maximization, etc.). SOCIALENERGY platform exploits and advances state-of-the-art and thus disposes DR programs able to offer a very attractive trade off among the afore-mentioned KPIs.

Furthermore, gamification solutions apply game mechanics to motivate people to change their energy behavior and have been recently used by several utilities to improve customer engagement in energy efficiency and DR programs. According to [12] [13], real-life pilots have indicated energy savings of 3-6% among a sizable number of participants, while savings of more than 10% can be achieved in narrowly targeted programs.

Community based programs and the exploitation of online social networks (OSNs) to form virtual energy communities (VECs) are becoming increasingly popular during the last years. As a result, innovative concepts found in the international literature, like integrated

community energy systems [14], virtual microgrid/prosumer associations [15] [16], prosumer community groups [17] [18] and cooperative/ aggregated demand response [19] [20], have emerged. Being part of a VEC, the end users realize benefits additional to the case that each one optimizes her individual interests. This is mainly due to two reasons: a) the statistical multiplexing gains that a community offers towards achieving a collaborative goal, and b) the *peer pressure* induced among users within the OSN that inherently incentivizes each user to adopt a more energy-efficient behavior and lifestyle [21] [22]. At the same time, the energy system can realize considerable benefits, too, all of them related with the better matching of energy supply and demand. From a business perspective, recent marketing strategies that exploit OSNs have been proven very effective and highly increased the revenues of the companies that used them. Community Based Social Marketing (CBSM) targets the social context as opposed to the individual. It recognizes that human behavior is never isolated, but occurs under specific circumstances, with historically, culturally, economically and politically determined parameters [23].

Finally, a major lesson learned from recent real-life DR pilots around the globe is that users should be well educated on the complicated concepts of smart grid and liberalized electricity markets' operation. This is of utmost importance, because for example, it is useless for a utility to sell a new EP to its customers, if the latter do not fully comprehend the "pros and cons" of this particular choice. One of the latest advancements for educational and lifelong learning sectors is the adoption of competence-based education (CBE) frameworks. Competence means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations in professional and personal development [24]. An advanced e-learning platform that adopts a CBE framework aims at: a) allowing competency-based learning and assessment, based on a well-defined taxonomy of competencies, b) allowing the use of rich set of learning resources, activities and experiences related to achieving the needed competences, c) supporting various modes of assessment of learner's knowledge/competences and relevant grading according to achieved results, d) supporting individual learning plans (ILPs) in order to optimally guide the learner throughout the whole personalized learning process.

2.4. Motivation behind the SOCIALENERGY's business modeling

In Figure 6, the general idea of the proposed "Green Social Response Network" (GSRN) concept that SOCIALENERGY platform introduces, is illustrated. There are three main gamification steps: 1) gamify the user engagement in DR and energy efficiency programs, 2) gamify the process (e.g. VEC management, EP selection, etc.), and 3) gamify the results and feed them back to step (1). As depicted in the following figure, there is a perpetual information and knowledge flow among the 3 gamification steps in a way that all types of users (i.e., individual energy consumers, VEC leaders, electric utilities, ESCOs) are continuously educated towards understanding their role in the smart grid market/ecosystem and the needs/interests of all other related market stakeholders in a liberalized electricity market context. The proposed GSRN is called *"Green"*, because it facilitates and enables the use of clean energy and good practices on energy efficiency focusing on the residential sector. It is also called *"Social"*, because its users are able to participate in VECs and communicate with other peers who have the same interests, or even communicate with other commercial stakeholders to better understand their needs/interests. Finally, GSRN is

called *"Response Network"*, because it enables/facilitates efficient DR procedures to take place and motivates the individual energy consumers to change their behaviour in terms of the way they consume energy in their everyday lives. The result of this process will ultimately lead to environment-friendly use of energy resources, the efficient operation of liberalized electricity markets and the realization of new businesses and revenue streams from both new and existing smart grid market stakeholders.

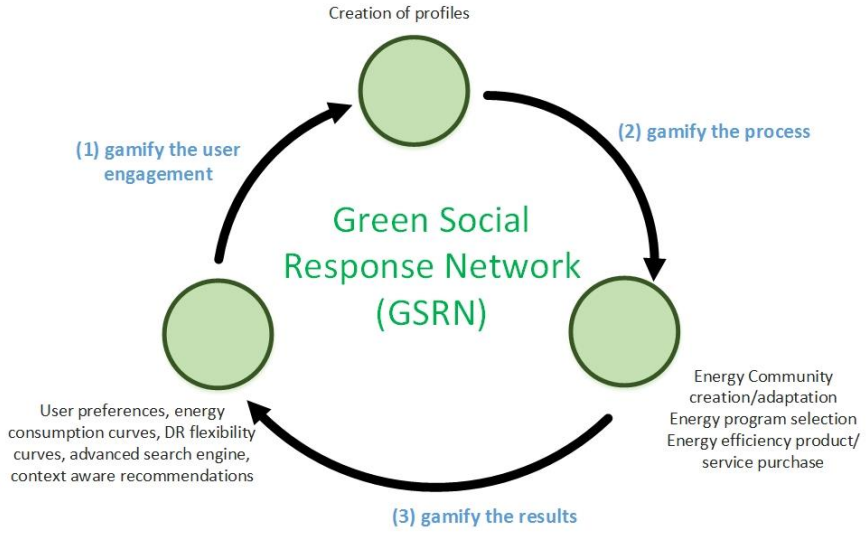

Figure 6: Green Social Response Network (GSRN) concept

According to several recent surveys undertaken by independent world-known consultancy companies and policy makers [1][7][9][11][12], the high-level business strategy objectives of a progressive utility (or else ESP) are summarized in Table 5 and each one of them is directly mapped to one of the five main SOCIALENERGY subsystems. In the next sub-section, all SOCIALENERGY subsystems are described together with their main functionalities and innovation points.

Table 5: Mapping of ESP's Business Objectives with SOCIALENERGY Subsystems

ESP's Business Objectives	Expected outcome	SOCIALENERGY subsystem
Build and strengthen a strong core of digital trust with clientele	Maximize customer satisfaction, minimize churn rate, cope with high competition in the market.	Core GSRN platform
Move from services to experiences via a cohesive personalization strategy	Customers are better and more efficiently engaged, because they deeply comprehend the services that are being offered by the ESP.	GAME, LCMS
Personalize at scale via the use of advanced research algorithms; adopt a hybrid strategy (i.e. blend of automated & manual processes)	Adopt automated processes (sophisticated algorithms) to quickly scale up personalized services. Adopt manual processes to get feedback from the customer, involve him/her in the process and ultimately upgrade automated processes.	RAT
Exploit the deep insight into energy use consumption to engage customers on cross-sell	New revenue streams via collaborations with stakeholders from sectors other than/not directly related with energy.	Virtual Marketplace/ EIDaaS

options that fit their needs		
Use rapid prototyping (i.e. modular and customizable S/W platform)	Cope with various various, diverse, volatile and dynamically changing needs of the liberalized energy market and customer segmentation.	APIs among all subsystems (modularity-by-design approach)

2.5. Overview of the proposed SOCIALENERGY S/W platform

SOCIALENERGY is a holistic S/W infrastructure to be used by today's progressive electric utilities towards the realization of their first steps in the digitization era of retail electricity markets.

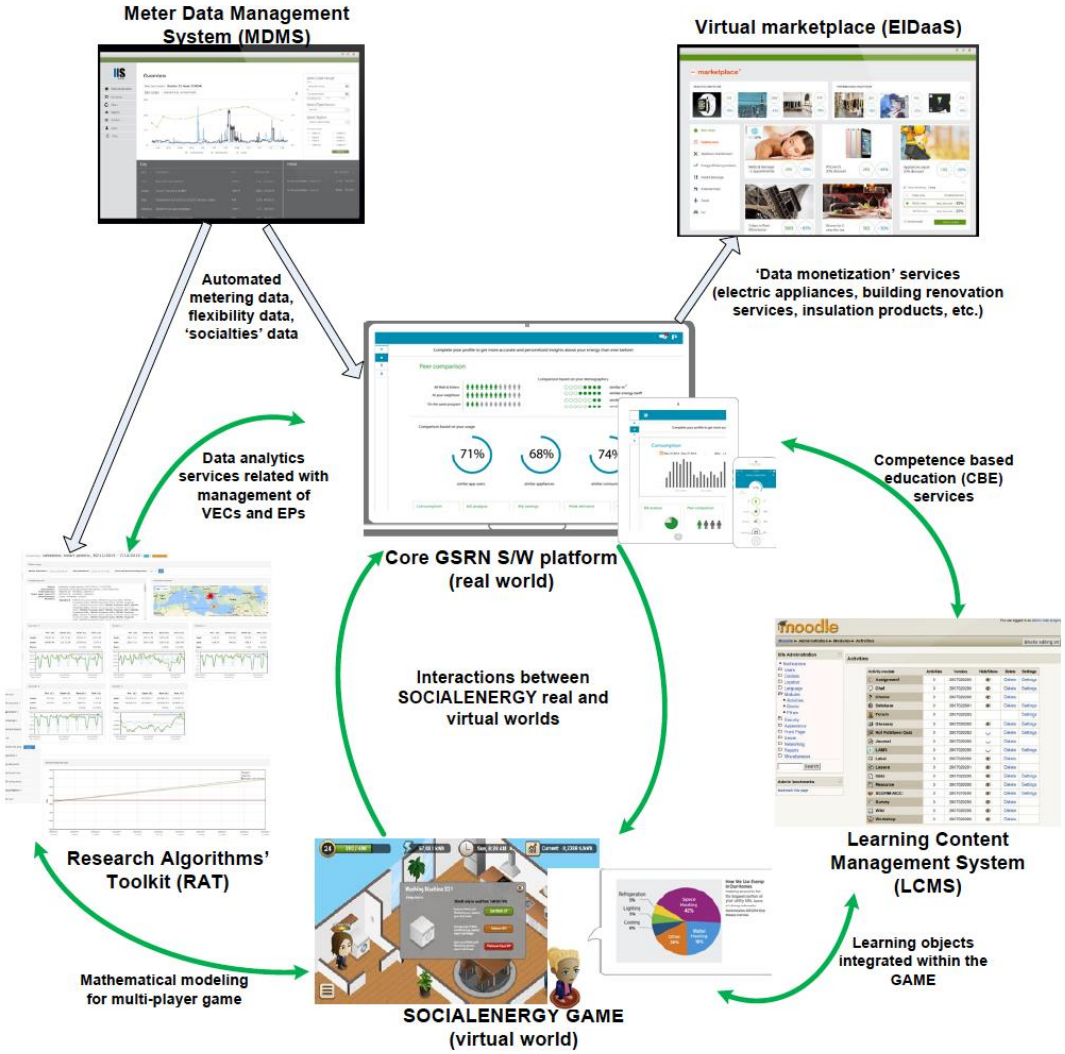

Figure 7: SOCIALENERGY architecture

As illustrated in Figure 7, SOCIALENERGY system comprises of six S/W components (subsystems), namely: 1) Meter Data Management System (MDMS), 2) the core GSRN S/W platform or else SOCIALENERGY's real world, 3) Energy Efficiency GAME or else SOCIALENERGY's virtual world, 4) Research Algorithms' Toolkit (RAT), 5) Learning Content Management System (LCMS), 6) Energy Information Distribution as a Service (EIDaaS) or else

virtual marketplace. MDMS is the SOCIALENERGY's database, where all energy metering data from all ESP's customers is collected together with all energy-related data models (e.g., electric appliance consumption models, disaggregation data, home energy labelling models, etc.).

2.5.1. Core GSRN S/W platform

All types of SOCIALENERGY users (e.g. individual consumers, VEC leaders/managers, electric utility/retailer user, ESCO user, etc.) are able to log in the system via the core GSRN S/W platform interface. A single sign-in procedure takes place and then the user is able to navigate in all SOCIALENERGY subsystems. Indicatively, through GSRN, an individual consumer can select an EP or participate in a VEC in order to select a community EP that fits its needs. A utility user (e.g. utility's CEO) is able to visualize the data of its entire customers portfolio and perform advanced administrative tasks, such as create new EPs, update reporting/recommendation rules of EP to its users, handle various business analytics, etc. A VEC leader can only have access to its associated VEC members' profiles and perform respective tasks.

GSRN platform consists of several S/W modules. '*Data Analytics*' module visualizes all RAT-API outputs and provides a visualized KPIs' dashboard to the users in order to allow them to check their overall performance. *'Energy module'* is connected to the MDM-API and RAT-API in order to visualize real energy consumption curves (ECCs) from users' meters and billing information respectively. *'Gaming profile'* module connects directly to the GAME-API and gets all relevant details from the game, regarding each specific user. User gets badges, leader board, performance, stages, points and all available GAME-API inputs. Finally, *'Socialties'* module is also working at the backend and is used to get user's social network information, as the user logs in the system. It is also combined with all other modules to provide personalization and further analytics. *'E-learning/training'* module is responsible for the integration and visualization of all educational material and relevant interactions coming from the GSRN-LCMS API. The rewarding mechanism works at the backend and computes the individual points for all users' activity in the GSRN. It also connects to the GAME-API in order to feed the *'User Profiling'* module with game leader-board and relevant points from the user's game performance. The mechanism is flexible for the administrator to design the point system based on users' stage, points and performance. Point system consists of two categories: *'Actual points'* and *'Experience points*', indicating activity and knowledge engagement correspondingly.

2.5.2. SOCIALENERGY GAME

After the SOCIALENERGY user (i.e. individual consumer) is logged in the GSRN, s/he uses the same credentials to start the game. The SOCIALENERGY GAME can be played by the user in a range of platforms, starting from a basic web-based implementation and possibly be extended to a mobile application, too. The GAME is an applied game on energy efficiency and combines characteristics from serious games and the classic entertainment industry. The player creates/enters a virtual world (i.e., virtual house) with all electric appliances and tries to maximize the energy efficiency KPIs by striking to find an optimal trade-off between the energy cost (according to the EP that s/he selected) and the discomfort incurred through

load shedding and shifting actions. Via the gameplay, the user is seamlessly educated in best practices about energy efficiency and this is done in an enjoying manner. Furthermore, the users can customize the GAME's settings and customize the virtual environment that is more appealing to them. As a result, GAME can also serve as a (near) real-life testbed to help in quantifying user's behavioural change through time, which is very important from both a research and commercial exploitation point of view. It should be noted that the GAME is also interacting with the RAT (by integrating all sophisticated mathematical modeling that modern EPs dispose, which provides the basis for the GAME's long-term success in the market). GAME also incorporates references to educational material (e.g. in the form of small pop-up windows) that the users can find in the LCMS and search for more details therein. Finally, the multi-player feature of the GAME, through the use of virtual users (bots), allows the users to be educated on the operation of community EPs and the additional benefits that the latter can provide to the users.

2.5.3. Research Algorithms' Toolkit (RAT)

From the GSRN S/W platform's web interface, the utility user (i.e. system administrator) is able to select the "RAT" tab and then a new window navigates him/her to the RAT's functionalities. The RAT subsystem is very important for SOCIALENERGY's operation because it provides all the intelligence that is required towards making SOCIALENERGY S/W platform competitive enough and commercially successful in a sustainable manner. It provides all the EPs' modeling and "data analytics" services mainly to GSRN and to the GAME (by integrating the sophisticated mathematical modeling in the energy pricing and game score calculations). Various research algorithms are executed regarding: i) the dynamic pricing models that are adopted in the various innovative EPs and ii) the VECs' creation and dynamic adaptation algorithms (required for the online management of VECs). RAT is also a planning tool for the system administrator to automatically analyze various business/strategy 'what-if' scenarios by running parameterized system-level simulations.

2.5.4. Learning Content Management System (LCMS)

LCMS is the subsystem, where the user/player educates herself both online (e.g. via the gameplay or by taking various learning courses) and offline (e.g. by consuming CBE-based material) to consolidate the new knowledge about good practices on energy efficiency. LCMS interacts with GSRN. Thus, the latter can provide recommendation services to the user according to the educational content that is mostly keen on watching next based on user's current educational profile and actions in SOCIALENERGY's real and virtual worlds. The role of the LCMS is important, because it provides to the user the opportunity to better comprehend the new concepts in the liberalized smart grid markets and inter-relate the "lessons learned" from the GAME with the real-life conditions. In this way, end users are able to efficiently interact with their electric utility company. LCMS adopts a CBE framework for energy efficiency. There are four main categories of competences: a) Energy-related end-user's knowledge on various theoretical aspects of smart grids, dynamic pricing, energy efficiency, etc. b) Personal willingness to act based on each user's activities inside the SOCIALENERGY platform, c) Social interactions behaviour based on the user's activity inside the VEC, and d) Energy-related end-user's skills based on the user's achievements (e.g. % of energy savings, % bill reduction, etc.).

2.5.5. Virtual Marketplace and Energy Information Distribution as a Service (EIDaaS)

Finally, via the 'virtual marketplace' component, SOCIALENERGY bridges the gap between energy consumers and multiple other market stakeholders related to the energy efficiency sector. Via the use of SOCIALENERGY platform, the profile of each energy consumer is created (e.g. energy consumption history, social networking activities, commercial actions' history, etc.). This profiling information can be exploited from stakeholders in order to: i) design energy efficiency products and services (e.g. offers for building renovation, insulation materials, etc.) more appealing to their audience, ii) allow VECs to contribute in the design of new or enhanced products/services by giving their opinions, iii) exploit VECs as cells within which group trading can be facilitated, and iv) generally sell Energy Information Distribution as a Service (EIDaaS) to whom it may concern in the long-term future. SOCIALENERGY has created an API through which it can commercialize this idea of "data monetization" service. Moreover, the virtual marketplace can host products and services from electric appliance vendors/retailers, building renovation companies, etc., so that the user can have an end-to-end experience on the way to achieve his/her energy efficiency targets. Ultimately, this business model can be very beneficial for the electric utility, too.

2.6. Intelligent data analytics services offered by SOCIALENERGY S/W platform

In this subsection, we analyze all the main functionalities of SOCIALENERGY's S/W platform, which are closely related with the adopted business model to be presented in section 3 and the value propositions (or else business cases), which are described in section 4. These data analytics services are the main drivers for the business exploitation of SOCIALENERGY's products and services.

2.6.1. Innovative Energy Programs' (EPs) modeling and KPIs

To design a new EP, a dynamic pricing model and algorithm are required. Let us consider a system, which consists of a utility and its *N* clients/energy consumers. Without harm of generality, in the retail electricity market, the utility provides electricity to its clients in order to cover their demand. Thus, utility participates in wholesale electricity markets and purchases the required amount of energy at a certain cost, which is time-variant and also a non-linear function of the aggregated consumption of all *N* end users (i.e., each incremental energy unit purchased costs more). Generally, the utility can minimize the cost of the energy that it purchases in the wholesale electricity market (i.e., the system cost) by giving incentives to its end users to "harmonize" the aggregated ECC (i.e., the demand curve of its entire customer portfolio) with the wholesale market prices. Utilities and end users (consumers) can mutually benefit from this system's cost reduction and the stability improvement that behavioral changes in the energy consumption can bring. Modern pricing schemes (or else EPs) should be able to trigger these behavioral changes (e.g., by motivating users to consume less during peak hours and more during non-peak hours). For example, in Real Time Pricing (RTP), prices are analogous to the dynamic ratio between the total energy production cost (i.e. supply) and the total amount of consumption (i.e. demand) [25][26]. A pricing scheme has to achieve an attractive trade-off among the following requirements

(KPIs): i) the end user's satisfaction, ii) the stability of the energy production/ transmission/consumption system, and iii) the utility's financial profitability. The first requirement is also referred to as '*user's welfare*' and is formulated as the difference between a utility function that expresses how much an end user values a specific consumption pattern and the cost of energy that s/he consumes. In the context of comparing different pricing schemes, the user's welfare expresses which pricing scheme leads to more competitive services in the open market [27][28]. The second requirement is also denoted as '*behavioral efficiency*' and expresses the capability of a pricing scheme to achieve the objectives that motivated it in the first place (e.g. load curtailments and shifts). Intuitively, behavioral efficiency of a pricing scheme expresses how friendly it is to a TSO/DSO (addressing issues related to energy network stability, efficiency and costs) and implicitly affects several financial metrics (e.g. investments in RES, energy storage and network upgrades). Usually, it is linked with minimizing the system's energy cost, as in [29][30]. The third requirement is also referred to as '*profit dynamics*' and represents the profit percentage per energy unit and the total revenues of the utility company. In other words, it expresses the financial growth potential of the company that exploits a specific pricing scheme (or else EP) [25][31].

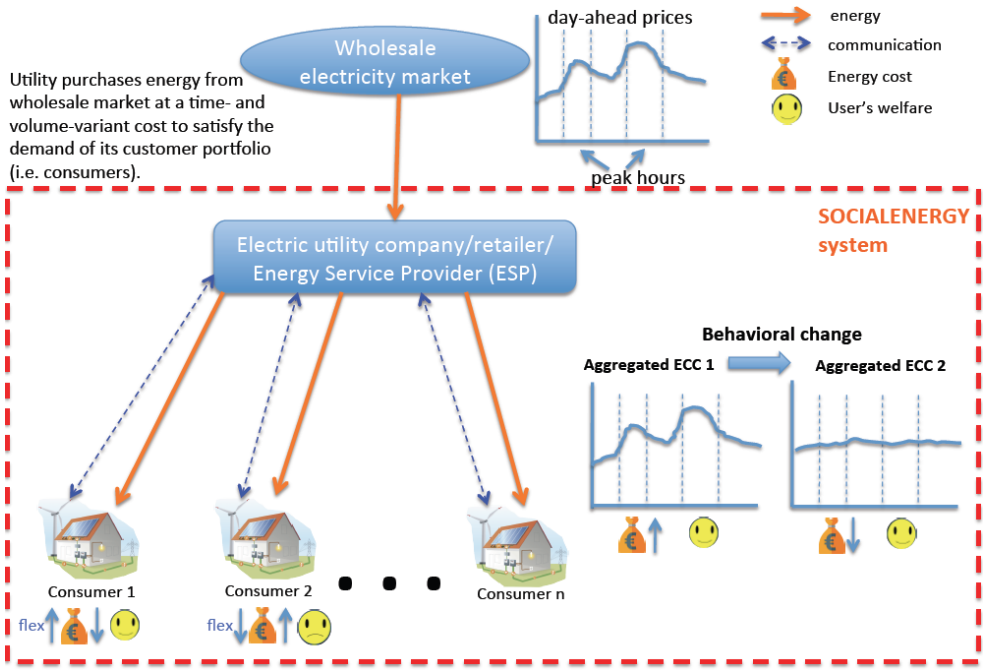

Figure 8: Advanced Energy Programs for behavioural change

A wide range of innovative EPs are integrated in SOCIALENERGY platform. In particular, SOCIALENERGY conducts research on the improvement of the behavioral efficiency of the EPs without sacrificing the rest of the aforementioned KPIs. For example, as shown in Figure 8, a behavioral change in the aggregated ECC can provide reduced energy cost for the system without sacrificing users' welfare due to the fact that some of them are flexible enough to undertake the changes in their individual ECCs and in return get reimbursed by the utility. Through SOCIALENERGY platform, the administrative user can perform exhaustive system-level simulations before deciding to release a new EP in the retail market. Similarly, an end user can also exploit SOCIALENERGY platform to dynamically invest (if it is beneficial for her/him) on a new EP that fits his/her updated needs. Finally, an end user can also play the

SOCIALENERGY GAME in order to comprehend the optimal behavior that one should have towards harvesting the maximum benefits from a certain EP.

2.6.2. Management of multi-parametric virtual energy communities (VECs)

In SOCIALENERGY system, VECs can be created in a bottom-up (and thus manual) way from the users themselves just like in traditional social network platforms. A VEC leader may also be the one that initiates and coordinates the process just like in web forums and other web 2.0 tools. However, VECs can also be created and dynamically adapted in an automated way via the use of clustering algorithms in order for both users and the utility to optimally exploit the benefits of VEC concept. In particular, a utility's portfolio can be categorized in several VECs based on qualitative characteristics such as demographics, geographical, socio-economic and other social norms-based metrics [32][33][34]. Given an already existing social graph, the goal of a clustering algorithm may also be to find such VECs that the total power consumption in each group of users achieves minimum variance [22]. VECs can also be created in a way that users' satisfaction, social network dynamics and the peer pressure that VEC members induce to each other are taken into consideration [21]. Other algorithms may take into account quantitative metrics for VEC creation problem. For example, the dominant VEC creation criterion can be the similarity factor of Energy Consumption Curves (ECCs) and/or the Flexibility Curves (FCs) of the users. In other words, users with similar ECCs and FCs increase the probability of performing better in a community-based EP. Another criterion would be to put together users that have the minimum deviation between their forecast and real consumption in order to minimize the imbalance penalties of a utility's portfolio [16][35]. Finally, for billing purposes, there are also intra-clustering algorithms, which can allocate the costs among the members of a certain VEC by applying various policies as shown in the work of some of the authors in [15].

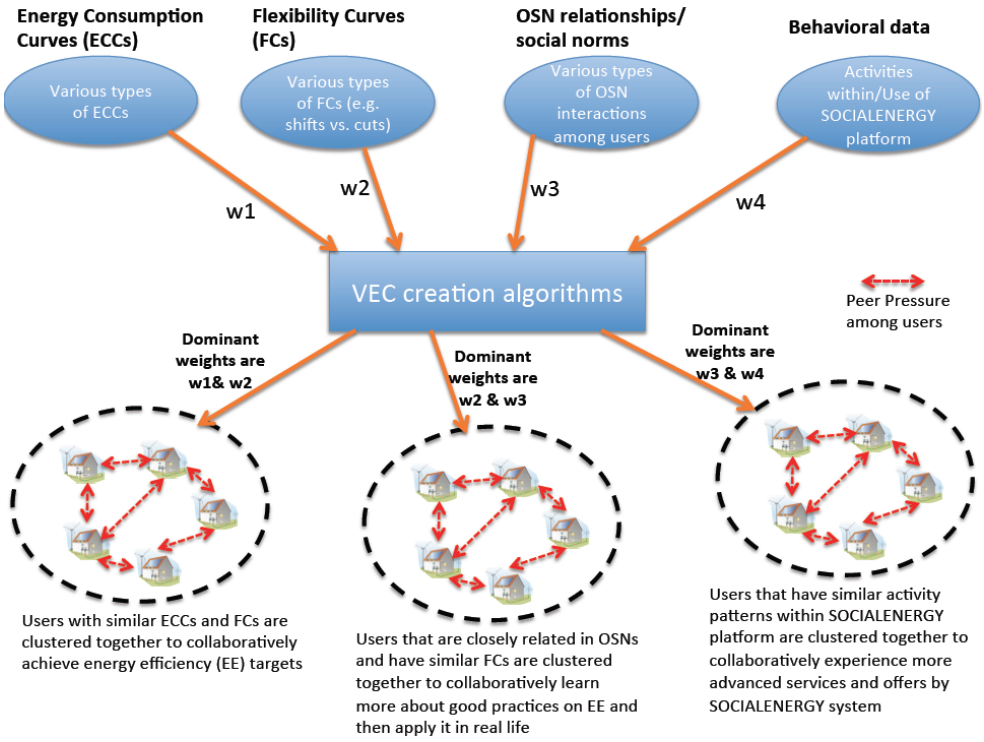

Figure 9: Multi-parametric VEC creation and dynamic adaptation

All the above-mentioned multi-parametric approaches for VECs' creation can be easily customized and integrated in SOCIALENERGY platform. A few clustering examples that we currently use in the SOCIALENERGY platform are illustrated in **Figure 9**. What's more interesting is that the administrative user can set specific thresholds based on which an end consumer can be recommended to switch to a different VEC that better fits his/her updated interests and needs. Users can also play the multi-player mode of the GAME in order to be seamlessly educated about the potential benefits and operation of community-based EPs.

2.6.3. Context-aware data analytics services, e-commerce and bottom-up organizational structures for social innovation and e-governance

The goal of SOCIALENERGY platform is to use the recent innovative concepts on e-commerce in order to trigger and possibly facilitate e-governance and consequently social innovation related activities in the future. There are five promising innovation fields towards this goal. The first is the exploitation of information beyond the e-commerce retailer's site towards personalized and accurate recommendations for products and services. In more detail, SOCIALENERGY envisages the exploitation of information from OSNs (e.g. activity, relationships, etc.) and content consumption platforms (e.g. YouTube). Its aim is to process, structure and annotate this information in a way that is tuned for the requirements of e-commerce personalization services.

Secondly, SOCIALENERGY envisages cross-domain e-commerce hyper personalized services that will offer a great opportunity to retailers to dispose their products/services beyond their company's site in a targeted/efficient and non-intrusive manner. In more detail, SOCIALENERGY envisages to provide: i) hyper personalized and non-intrusive e-mail personalization and couponing, ii) injection of e-commerce content (e.g. audiovisual content, couponing) and product/service recommendations through the environment of SOCIALENERGY to relevant virtual communities.

Thirdly, SOCIALENERGY targets the increase of e-commerce transactions through automatic and intelligent product/service assortment recommendation services for portfolio extensions that will be highly beneficial for e-commerce retailers. Towards this goal, there will be used information from: i) social network relationships' and activities' analysis, ii) communities in GSRN, and iii) LCMS.

Fourthly, an innovative service that SOCIALENERGY envisages to offer through GSRN is to advance existing e-commerce paradigm through collective e-commerce services and bottom-up collaborative crowd-funding services. This can be done through the development of a modern crowd-funding/investment system able to: i) ensure the scalable, self-organized and secure financial transactions, ii) offer to its users the capability to provide conditional funding (e.g. donate/invest in case that the number of investors and the total amount is higher than a threshold), iii) give the financial incentives to the members of SOCIALENERGY communities to participate in these activities, and iv) advertise the crowd-funding efforts through the SOCIALENERGY platform.

Finally, SOCIALENERGY envisages the combination of collective e-commerce services with Community Based Social Marketing (CBSM) [23], which is an alternative to two

pervasive models about behaviour change (i.e. the attitude-behaviour model and economic self-interest model). The former suggests that informing individuals and convincing them to adopt a positive attitude towards a particular action will suffice for them to change behaviour. The latter assumes that individuals will always change their behaviour to maximize financial benefit. Neither of these older models have sufficed to close the gap between the energy savings we know are out there and the participation levels necessary to address them. CBSM, in contrast, targets a community (the social context) with all the respective benefits.

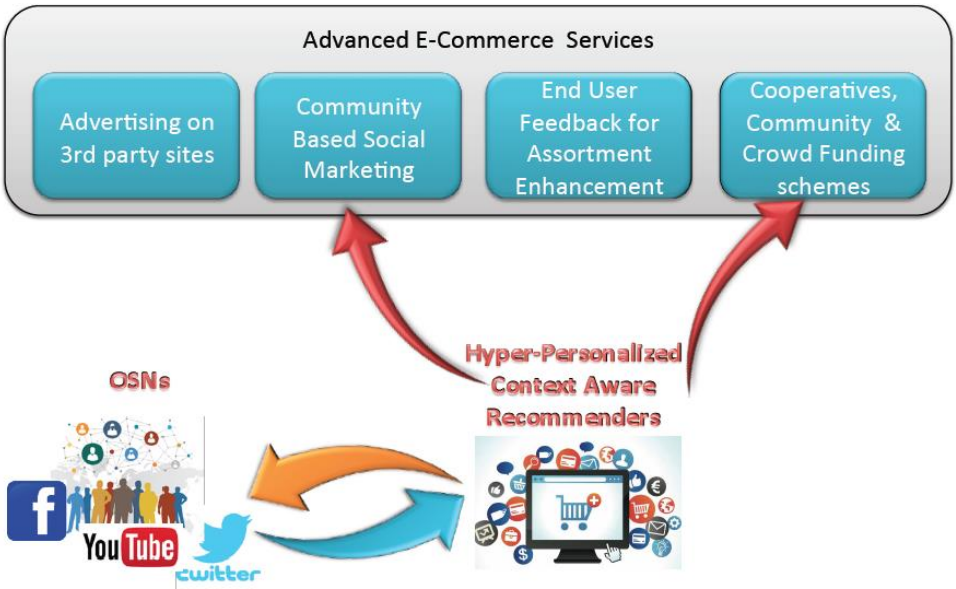

Figure 10: Advanced e-commerce and social innovation services

Figure 10 illustrates the advanced e-commerce services that SOCIALENERGY system envisages to implement and release in the market. Of course, cross-domain partnerships are required with various market stakeholders by following an appropriate business model, which is not the main priority of SOCIALENERGY's communication and business exploitation activities.

3 SOCIALENERGY Business Model Canvas

SOCIALENERGY consortium utilizes the Business Model Canvas (BMC), which is a well-known tool for business modeling [38]. In the previous version of this report (i.e. D6.1), an initial version of the BMC has been delivered. In this updated report, after receiving the feedback from the communication activities with potential customer segments, we strictly focus on the progressive utility (or else the Energy Service Provider - ESP) business.

3.1. Introduction to the Business Model Canvas

The 9 building blocks of the BMC are shortly introduced below:

1. Customer Segments: Who are we creating value for? It is of utmost importance to have customers in the heart of the BMC. So, we need to know all customer's needs in order to be able to satisfy them.

2. Customer Relationships: This building block has the most influence on overall customer experience with SOCIALENERGY (e.g. personalized customer support, automated/online services, specialized consulting, etc.). It also describes the connection between the customer segment and SOCIALENERGY, which ultimately leads to acquiring new customers and customer retention.

3. Channels: How do our Customer Segments want to be reached? How are we reaching them now? Generally, there are five phases of customer engagement, namely: a) awareness, b) evaluation, c) purchase, d) delivery, and e) after sales. SOCIALENERGY should find the right balance between different types of channels to maximize profits by effectively meeting customer's needs.

4. Value Propositions: What value do we deliver to the customer? Which customer needs and problems are we addressing? Performance, brand/status, price, risk reduction, usability? Value proposition is at the center of the BMC and is key to satisfying the customer needs, because it is the bundle of products and services that create value for a specific customer segment.

5. Key Partners and key suppliers; Key Resources from partners. SOCIALENERGY may not have all the resources for all activities in a business model itself, so key partnerships need to be formed.

6. Key Activities: for our value propositions, for our channels, for our customer relationships and our revenue streams. Generally, these key activities can be described as the most important things that SOCIALENERGY should do in order to make its business model work.

7. Key Resources: Physical, Intellectual (brand patents, copyrights, data), Human, Financial. In other words, key resources are the most important assets required to make a business model work. These resources can be either owned or rented or acquired from or shared with key partners.

8. Cost Structure: What are the most important costs inherent in our business model? Is our business more Cost Driven or Value Driven? Generally, costs are fixed, variable, costs incurred during economies of scale or economies of scope or both.

9. Revenue Streams: For what value are our customers really willing to pay? For what do they currently pay? Types: Product sale, Usage fee, Renting/Leasing, Licensing, Brokerage fees.

The figure below summarizes the business modelling work for SOCIALENERGY S/W platform as a whole. Figure 11 presents an updated version of the Business Model Canvas (BMC), whose initial version has been described in the previous D6.1 (M6). Please note that we focus on one customer segment that is progressive electric utilities (or else Energy Service Providers - ESPs). We also consider five distinct value propositions (or else business cases), which we extensively analyse in section 4.

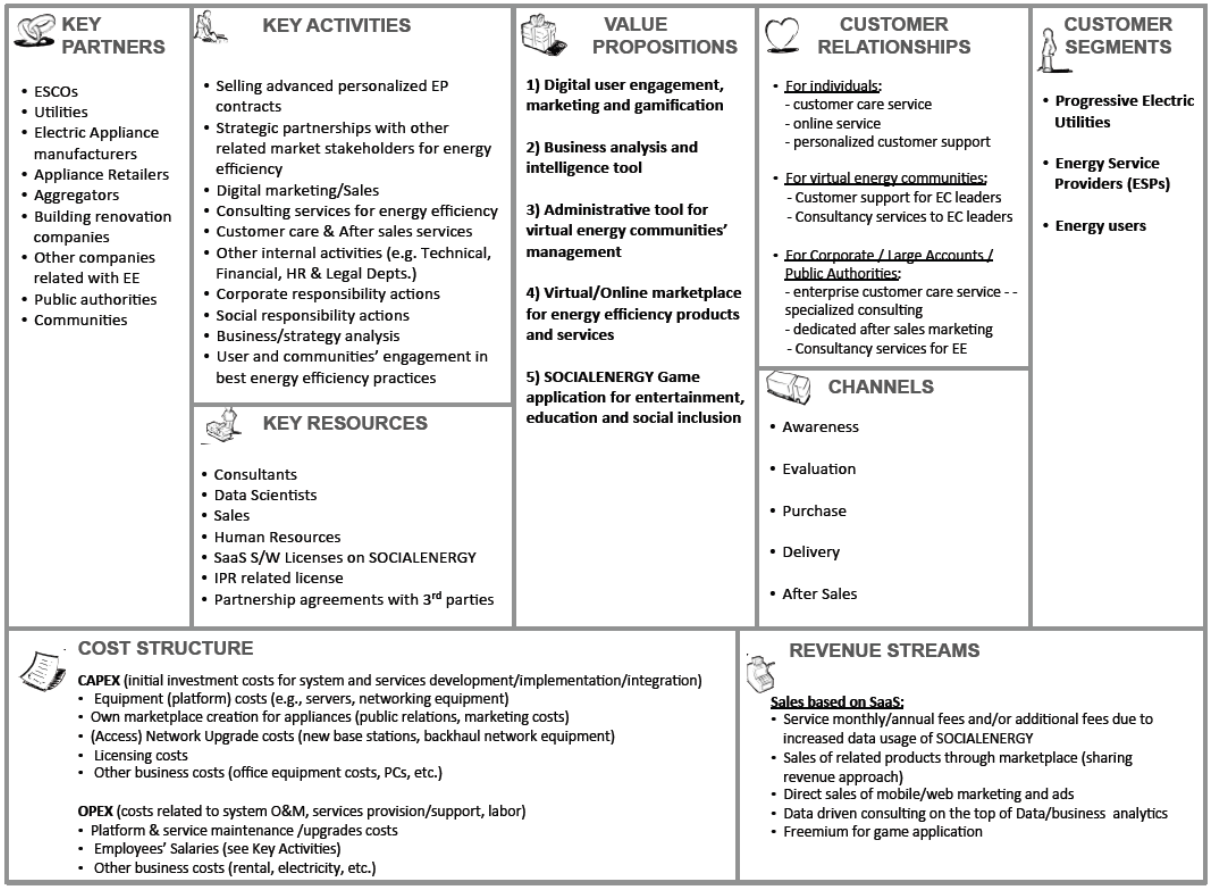

Figure 11: A high-level business model analysis of SOCIALENERGY (updated BMC version)

3.2. Business Model Canvas for the progressive electric utility customer segment

In this subsection, we analyze each one of the 9 building blocks in a sententious manner, focusing on the targeted customer segment, which is the progressive electric utility companies or else Energy Service Providers (ESPs). These two terms are used interchangeably throughout the whole report. Note that by the term "energy users", we

refer to individual players of SOCIALENERGY GAME, who may opt to purchase only the GAME and not the entire SOCIALENERGY S/W platform.

3.2.1. Customer segment

The typical question that needs to be answered here is "which are the main customer's needs and what does the customer want to do in order to enhance its business". The electric utility companies are increasingly keen on investing on data analytics towards releasing innovative services and products to their end users (i.e. energy consumers). They also want to enhance the quality of service (QoS) and experience (QoE) in order to keep their customers happy and satisfied. SOCIALENERGY S/W platform can be an asset for the electric utility business. It can also provide an efficient substrate towards bringing the customer segment closer to other related market stakeholders. This will ultimately lead to the development of novel B2B relationships and the realization of new revenue streams. More details about the reasons that the proposed S/W platform can be a powerful tool for the progressive electric utilities have already been described in section 2 above.

3.2.2. Customer relationships

Normally, the electric utility company does not have the expertise to offer technical support services to the end users, once the SOCIALENERGY S/W platform will be released in the market. This means that we should be able to provide this kind of services even for the employees of the utility. For example, the employees should be trained in order to understand most of the functionalities that SOCIALENERGY can offer. After this phase, customer support services should be provided by SOCIALENERGY. For individual energy consumers, personalized customer support service can be applied. The same is valid for the EC leader users, who need more advanced consultancy regarding the potential ways that they can fully exploit the extra benefits that SOCIALENERGY offers. Even for corporate user accounts, it is critical that advanced consultancy services are offered to energy efficiency/building managers towards helping them to apply good energy efficiency practices and thus lower their electricity bills. SOCIALENERGY can also offer guidelines to the electric utility for co-creating new revenue models with other market stakeholders.

3.2.3. Channels

The channels through which the customer segment will be reached is quite straight-forward. First of all, we need to persuade the utilities that our proposed business model can be very beneficial for their business. Once they are eager to find out more about SOCIALENERGY's innovations, we can offer targeted consulting services according to their specific needs. For example, one utility may opt for advanced business analytics and intelligence services, while it is not so much interested in the GAME. Another utility may find the GAME and LCMS parts interesting, while it may want to deploy only some basic data analytics services. In any case, the multi-disciplinary team of SOCIALENERGY can provide guidelines towards customizing the agreed business plan to fit the needs of the end users. The utility company can easily select all the S/W modules and respective functionalities that it wants together with respective costs online. It can also try for new features (e.g. in the form of 1-month DEMO) and if it finds them interesting, it can then proceed with the

purchase. As previously discussed, after-sales service will also be supported, especially during the initial phase of SOCIALENERGY's products and services release in the market.

3.2.4. Value propositions

We consider the following 5 (five) value propositions (or else business cases) for SOCIALENERGY S/W platform's commercial exploitation, namely:

1) Digital user engagement, marketing and gamification platform
2) Business analysis and intelligence tool
3) Administrative tool for Virtual energy communities' management
4) Virtual/Online marketplace for energy efficiency products and services
5) SOCIALENERGY Game application for entertainment, education and social inclusion

More detailed information and analysis about the above-mentioned five value propositions are provided in section 4.

3.2.5. Key partners

As usual, SOCIALENERGY needs to form partnerships because it hasn't got all the resources for all activities in the proposed business model. For example, a typical smart meter infrastructure is required in order for all the energy data to become available for our system. Moreover, specific B2B partnerships are required in the case of virtual/online marketplace (see more in value proposition no. 4). For example, partnerships with electric appliance vendors/retailers, ESCOs, building construction/renovation companies are required. As a result, the products offered by all these key partners will become available for purchase via the proposed SOCIALENERGY online marketplace. The success of this kind of partnerships will define new revenue models and respective revenue streams for the targeted customer segment. Of course, the key partners will also gain from this business model and subsequently they will be eager to pay an extra fee to the SOCIALENERGY platform for every transaction being made.

3.2.6. Key activities

All value propositions concern the same customer segment. However, each one of the 5 value propositions is targeted to a specific type of SOCIALENERGY system's user. For instance, the first value proposition is mainly targeted to the individual energy consumers. The second one is targeted to the administrative users, meaning the employees of the utility company. The third value proposition is targeted to the EC leader user interface, so respective key activities to engage the user should be put in place. The fourth value proposition is targeted to the ESCOs and generally all indirect market stakeholders, who want to take advantage of SOCIALENERGY's online marketplace. Finally, the fifth value proposition targets the game players, who are mainly keen on the offered gaming and gamification features and not so much on the SOCIALENERGY real world's functionalities. For each one of these sub-segments, respective key activities will be provisioned.

3.2.7. Key Resources

By the term "key resources", we mean the most important assets required to make the proposed business model work. The physical resources are H/W equipment inside each separate household and of course the H/W infrastructure that is required to host the SOCIALENERGY S/W platform. Regarding intellectual resources, Software as a Service (SaaS) and IPR-related licenses are required (see more details in section 6). Human resources include S/W developers, data analysts/scientists, energy efficiency consultants, financial/legal managers, salesmen, etc. Finally, financial resources comprise of the capital as well operational expenditures (CAPEX & OPEX), which are needed for the business setup and operation correspondingly. More quantitative figures are provided in the following subsections.

3.2.8. Cost structure

SOCIALENERGY project will create a fully exploitable SaaS (Software as A Service) platform that will be able to offer four (4) vertical product/services (either separately or in a combined bundle):

1) Data analytics Services
2) Games
3) GSRN Platform and Digital Engagement
4) Educational services

Each vertical service will engage a lead partner from the consortium and several partners as a backend support, if needed. Every service can be sold and offered individually or as a combined service together with other SOCIALENERGY's S/W modules. It will be up to the client to select the desired bundle of products/services from the SOCIALENERGY S/W platform's portfolio. This flexibility is important in the B2B SaaS enterprise market.

In order to be able to discriminate the vertical offerings, 4 (four) separate Profit and Loss (P&L) calculations were executed by the consortium and the relevant partners, in order to estimate the cost structures and operational expenses for each vertical proposition:

Data Analytics Services (RAT S/W module)

The offering will include Data as a Service and the implementation of various algorithms on demand for the prospective clients. The client will upload or integrate their data sets (either online or offline) on the Data Analytics backend and the platform will be able to perform calculations and produce results, based on the GSRN Analytics Admin Panel.

The operating expenses (OPEX) and required human capital for one projected year are shown in the figure below. In order for ICCS to lead and offer Data Analytics services, a total OPEX of 168K Euros/Year (including travel and Cloud/H/W equipment and fees) and 36 Person Months will be required to serve an initial client volume of approximately 5-10 businesses (B2B).

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EXPENSES (Europe)	One Year Projection												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Payroll	9,0 €	9,0 €	9,0 €	9,0 €	9,0 €	9,0 €	9,0 €	9,0 €	9,0 €	9,0 €	9,0 €	9,0 €	108,0 €
Apartment	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Office	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Finance Cost	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Legal Services	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Travel Expenses	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	24,0 €
Marketing	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Hardware/Equipment	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	36,0 €
Total	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	**14,0 €**	168,0 €
HR Headcount													
Integration Developer													
Product Developer (Software)	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Product Developer (UIX)													0,0 €
Sys Administrators													0,0 €
Energy Engineers/Consultants	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Data Scientists	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Account Mgt / PM													0,0 €
Content Manager (Marketing)													0,0 €
Financial Qtr													0,0 €
Salesmen													0,0 €
COO													0,0 €
Total	3	3	3	3	3	3	3	3	3	3	3	3	36,0 €

Figure 12: OPEX for data analytics services provided by RAT subsystem for one year

Gaming Services (SOCIALENERGY GAME)

The offering will initially include a desktop game (and then a mobile web app) to users and users will be able to play and engage. There will be a freemium model, where initially the game will be for free, but with some In-App purchases and marketing. At a later stage, more levels and stages can be unlocked by payment.

in .000

EXPENSES (EUROPE)	Projected One Year												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Payroll	20,0 €	20,0 €	20,0 €	20,0 €	20,0 €	20,0 €	20,0 €	20,0 €	20,0 €	20,0 €	20,0 €	20,0 €	240,0 €
Apartment	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Office	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Finance Cost	0,3 €	0,3 €	0,3 €	0,3 €	0,3 €	0,3 €	0,3 €	0,3 €	0,3 €	0,3 €	0,3 €	0,3 €	3,6 €
Legal Services	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Travel Expenses	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Marketing	6,0 €	6,0 €	6,0 €	6,0 €	6,0 €	6,0 €	6,0 €	6,0 €	6,0 €	6,0 €	6,0 €	6,0 €	72,0 €
Hardware/Equipment	0,5 €	0,5 €	0,5 €	0,5 €	0,5 €	0,5 €	0,5 €	0,5 €	0,5 €	0,5 €	0,5 €	0,5 €	6,0 €
Total	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	**26,8 €**	321,6 €
HR Headcount													
Integration Developer													
Product Developer (Software)	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Product Developer (UIX)	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Sys Administrators													0,0 €
Energy Engineers/Consultants													0,0 €
Data Scientists													0,0 €
Account Mgt / PM													0,0 €
Content Manager (Marketing)	2	2	2	2	2	2	2	2	2	2	2	2	24,0 €
Financial Qtr													0,0 €
Salesmen													0,0 €
COO													0,0 €
Total	4	4	4	4	4	4	4	4	4	4	4	4	48,0 €

Figure 13: OPEX for gaming services provided by the GAME for one year

The operating expenses and required human capital for one projected year are depicted in the above figure. In order for NUROGAMES to lead and offer Gaming services, a total OPEX of 321K Euros/Year (including travel and Cloud/HW equipment and fees) and 48 Person Months will be required to serve an initial client volume of approximately 1M end users.

GSRN Platform and Digital User Engagement

This offering will include the frontend GSRN Platform with MDMS subsystem, loyalty and virtual marketplace features for end user engagement to electric utilities. Utilities will pay under a licensing/SaaS subscription fee, based on their customer volumes. The operating expenses and required human capital for one projected year are shown below:

in .000

	Projected One Year												
EXPENSES (EUROPE)	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Payroll	15,0 €	15,0 €	15,0 €	15,0 €	15,0 €	15,0 €	15,0 €	15,0 €	15,0 €	15,0 €	15,0 €	15,0 €	180,0 €
Apartment	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Office	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	12,0 €
Finance Cost	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	1,0 €	12,0 €
Legal Services	0,8 €	0,8 €	0,8 €	0,8 €	0,8 €	0,8 €	0,8 €	0,8 €	0,8 €	0,8 €	0,8 €	0,8 €	9,6 €
Travel Expenses	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	2,0 €	24,0 €
Marketing	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	3,0 €	36,0 €
Hardware/Equipment	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Total	22,8 €	22,8 €	22,8 €	22,8 €	22,8 €	22,8 €	22,8 €	22,8 €	22,8 €	22,8 €	22,8 €	22,8 €	273,6 €
HR Headcount													
Integration Developer	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Product Developer (Software)	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Product Developer (UIX)													0,0 €
Sys Administrators	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Energy Engineers/Consultants													0,0 €
Data Scientists	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Account Mgt / PM	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Content Manager (Marketing)													0,0 €
Financial Qtr													0,0 €
Salesmen													0,0 €
COO													0,0 €
Total	5	5	5	5	5	5	5	5	5	5	5	5	60,0 €

Figure 14: OPEX for core GSRN services provided by the GAME for one year

In order for INTELEN to lead and offer GSRN engagement services, a total OPEX of 273K Euros/Year (including travel and Cloud/HW equipment and fees) and 60 Person Months will be required to serve an initial client volume of approximately 0,5 - 1M end users.

Educational Services (LCMS)

This offering will include the provision of the LCMS S/W modules to users and clients, under a B2B or B2C licensing approach. Users interested in taking the SOCIALENERGY LCMS courses will pay for them by using the SaaS platform. There could be some sort of subscription or one-off courses, according to the pricing policy and specific offers. The operating expenses and required human capital for one projected year is shown below. In order for SU-NIS to lead and offer Educational services, a total OPEX of 64K Euros/Year (including travel and Cloud/HW equipment and fees) and 36 Person Months is required to serve an initial client volume of approximately 100K end users.

in .000

EXPENSES (EUROPE)	Projected One Year												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Payroll	5,0 €	5,0 €	5,0 €	5,0 €	5,0 €	5,0 €	5,0 €	5,0 €	5,0 €	5,0 €	5,0 €	5,0 €	60,0 €
Apartment	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Office	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Finance Cost	0,2 €	0,2 €	0,2 €	0,2 €	0,2 €	0,2 €	0,2 €	0,2 €	0,2 €	0,2 €	0,2 €	0,2 €	2,4 €
Legal Services	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Travel Expenses	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	1,2 €
Marketing	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €	0,0 €
Hardware/Equipment	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	0,1 €	1,2 €
Total	5,4 €	5,4 €	5,4 €	5,4 €	5,4 €	5,4 €	5,4 €	5,4 €	5,4 €	5,4 €	5,4 €	5,4 €	64,8 €
HR Headcount													
Integration Developer	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Product Developer (Software)	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Product Developer (UIX)													0,0 €
Sys Administrators	1	1	1	1	1	1	1	1	1	1	1	1	12,0 €
Energy Engineers/Consultants													0,0 €
Data Scientists													0,0 €
Account Mgt / PM													0,0 €
Content Manager (Marketing)													0,0 €
Financial Qtr													0,0 €
Salesmen													0,0 €
COO													0,0 €
Total	3	3	3	3	3	3	3	3	3	3	3	3	36,0 €

Figure 15: OPEX for LCMS services for one year

Conclusively, for the total four (4) vertical SOCIALENERGY modules, a specific cost structure is defined, under a specific Profit & Loss (P&L) calculation that can be also used for fund-raising or business formation and budgeting.

3.2.9. Revenue streams

The revenue stream structure will follow the classical SaaS model, where revenues will come from licensing or subscription to the specific modules. The anticipated volumes are described below:

REVENUES (in thousans of EURO)	One Projected Year												
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
Vertical Markets													
Data Analytics (9,5K/month)	2,0 €	5,0 €	15,0 €	30,0 €	45,0 €	50,0 €	50,0 €	60,0 €	65,0 €	70,0 €	90,0 €	95,0 €	577,0 €
Games (1,7/user)	1,0 €	3,0 €	5,0 €	5,0 €	6,0 €	7,0 €	10,0 €	11,0 €	14,0 €	15,0 €	16,0 €	17,0 €	110,0 €
GSRN (20K/month)	0,0 €	0,0 €	20,0 €	20,0 €	40,0 €	40,0 €	60,0 €	60,0 €	80,0 €	80,0 €	80,0 €	100,0 €	580,0 €
Education LCMS	2,0 €	2,0 €	4,0 €	5,0 €	5,0 €	5,0 €	7,0 €	7,0 €	7,0 €	8,0 €	8,0 €	10,0 €	70,0 €
TOTAL (in thousans of EURO)	5,00 €	10,00 €	44,00 €	60,00 €	96,00 €	102,00 €	127,00 €	138,00 €	166,00 €	173,00 €	194,00 €	222,00 €	1.337,00 €

Figure 16: SOCIALENERGY revenue streams for one projected year

Based on the initial revenue projection calculation, for the four vertical offerings we have a SaaS price of:

- For data analytics 9,5K/month for a big corporation with more than 10,000 data sources (data volume to be analyzed).
- For gaming services, we estimate 1,7Euro/user for in-game adds and new level purchases.
- For GSRN, we estimate a 20K/month platform licensing for utilities of more than 100K consumers.
- For educational services, we estimate 14 Euros/year (1,1 Euro/month subscription) on average for one individual module to be taken.

Based on the above assumptions, we have the revenue projection graphs shown below, for the 4 vertical offerings:

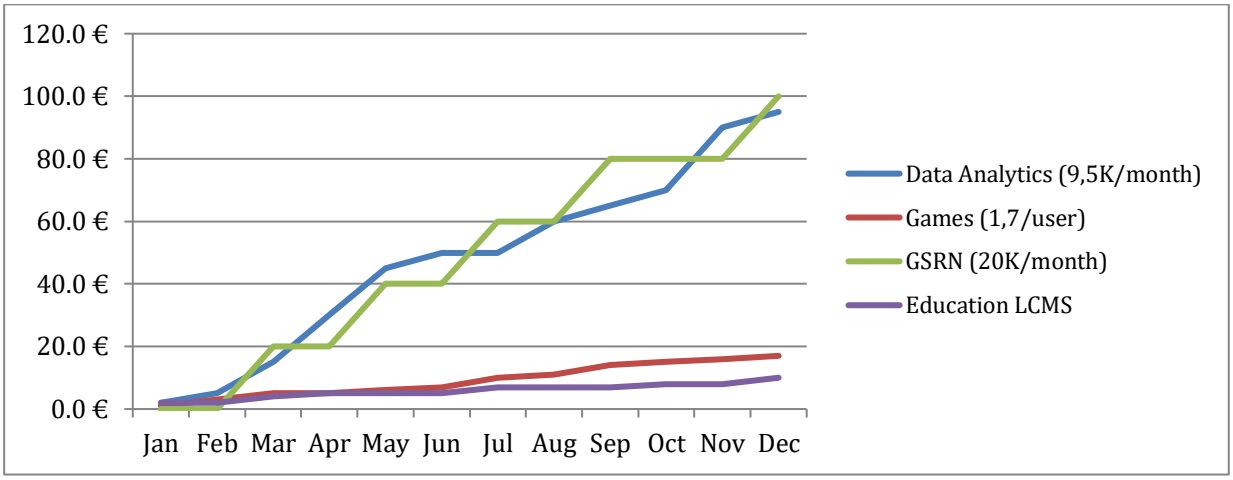

Figure 17: Revenue streams projection for the 4 vertical offerings (revenues in thousands of Euros)

The revenue streams can be combined or individually calculated. If combined, the total projected revenue for the GSRN full platform for one (1) year, could reach up to 1,3M Euros taking into consideration the following assumptions:

Around 5K users in LCMS, 5 Utilities on board with approx. 100K users each, more than 28K users playing the game and 10 big clients for the Data Analytics. If 5 utilities are the final target (0,5M users that will play games and educate themselves), then the approximate revenue in one year will be around **1M Euros. In the 2nd year the revenues will increase, since a full year will be calculated, so the initial revenues will be doubled (~2M Euros).**

4. Value propositions

As already explained, the focus of SOCIALENERGY project is on one single business model, which has been extensively analyzed in the previous section. In this section, we introduce the Value Proposition Canvas (VPC) as a tool to analyze the five (5) short-listed value propositions.

4.1. Introduction to the Value Proposition Canvas

From the BMC introduced in the previous section, the blocks 'Value proposition' and 'Customer segment' go hand in hand and are the heartbeat of each business case. The Value Proposition Canvas (VPC) functions like a plug-in to the BMC and zooms in on the value proposition and customer segment to describe the interactions between customers and product more explicitly and in more detail. The VPC gives a 'product/market fit' by connecting the value map to the customer profile. The value map has 3 BBs, namely: a) products and services, b) pain relievers, and c) gain creators. The customer segment has another 3 BBs, namely: a) customer jobs, b) customer pains, and c) customer gains.

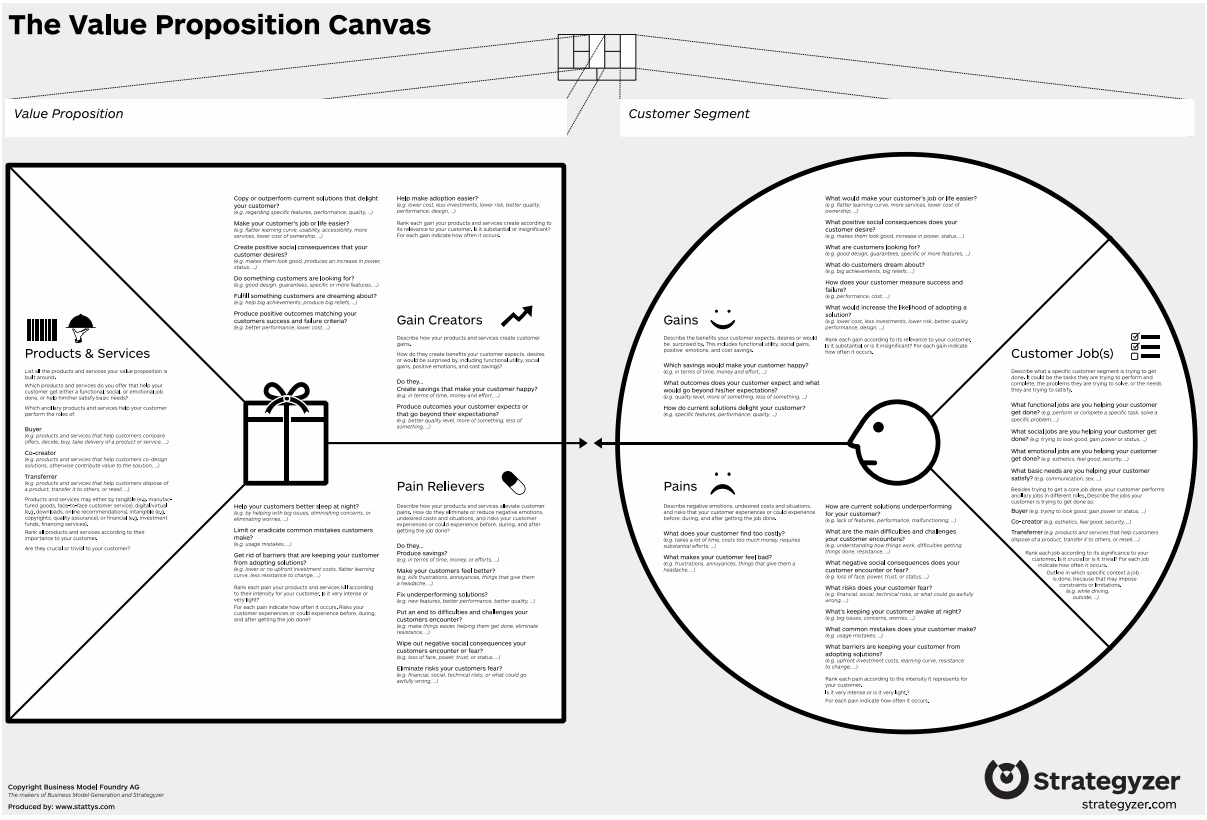

Figure 18: The 6 building blocks of the Value Proposition Canvas (VPC) [39] [40]

The table below presents the long list of SOCIALENERGY's value propositions, which has been agreed during the first 6 months of the project:

Table 6: Long list of SOCIALENERGY's value propositions (the current short-list version consists of 5 distinct value propositions)

SOCIALENERGY	Customer	Value proposition

component/ module/ service		
GSRN alone	Utilities Smart cities, Retail companies	Utilities and Smart cities can offer digital content and information on tariffs, energy and electrical appliance marketplace to the consumers/citizens
GAME alone	Utilities Smart cities ESCOs	Users can interact with a serious game to raise their awareness and to train themselves into various game scenarios and tasks related to energy savings
Combination of GSRN & GAME	Smart cities Municipalities Utilities	A complete platform to start engaging users for energy savings under a specific rewarding/loyalty scheme with various incentives
Combination of GSRN & RAT	DSOs TSOs Utilities EV companies	A platform capable of analyzing data and to take decisions, offer services on various smart-grid topics (load forecasting, DR, virtual energy community management, etc.).
Combination of GSRN & GAME & RAT	Utilities ESCOs DSOs	A platform capable of combining personalized gaming and advanced personalization of the end users for energy efficiency and behavioural energy programs of utilities and ESCOs
Combination of GSRN & LCMS & RAT	Utilities Smart cities	A digital content platform that can offer training courses to users and to analyze their knowledge potential.
Combination of GAME & RAT	Utilities DR aggregators	A great tool for DR aggregation, capacity management and for behavioural DR programs by using sophisticated mathematical modeling for the GAME design
SOCIALENERGY system	Electric utility	A complete consumer engagement platform to drive digital engagement of utility users, to reduce churn, to raise awareness and to produce new revenue streams, by analysing and monetizing data
SOCIALENERGY system	ESCO	A complete platform to drive behavioural energy efficiency and to support ESCO funding, justify savings and promote various rebates (retrofit services) for appliance replacements or home upgrades
SOCIALENERGY system	Community Energy Scheme (CES), communities, public authorities in smart cities	A great platform to drive Government policies on green citizens. Communicate to a Smart city (citizens), Government policies, green actions, create a “big data lake” for additional governmental services monetization and promote sustainability

After short-listing the table above, we consider the following 5 (five) value propositions (or else business cases) for SOCIALENERGY S/W platform's commercial exploitation, namely:

1) Digital user engagement, marketing and gamification platform
2) Business analysis and intelligence tool
3) Administrative tool for Virtual energy communities' management
4) Virtual/Online marketplace for energy efficiency products and services
5) SOCIALENERGY Game application for entertainment, education and social inclusion

4.2. Value Proposition #1: Digital user engagement, marketing and gamification platform

In this business case, we focus on the SOCIALENERGY services that the individual energy consumer is experiencing. The electric utility company wants to offer an online S/W platform to its users, through which the latter will be able to monitor their energy consumption, receive useful tips about ways to minimize their electricity bill, purchase beneficial energy programs based on their needs, etc. With this platform, utility aims at engaging its users, apply efficient online marketing policies and offer advanced personalized energy services to the end users. In a nutshell, this value proposition disposes the following features:

- Focus on the simple user interface (not the admin user).
- Focus on GSRN-GAME-LCMS and not on RAT & virtual marketplace.
- The utility just wants to offer this product to all its customers and is not so interested on the admin user interfaces and interaction with other market stakeholders (i.e. virtual marketplace).
- The energy consumer can continuously monitor his/her ECCs.
- The user is digitally engaged in the ESP's operations and can thus understand how s/he can lower his/her electricity bills (LCMS).
- The user can purchase Energy Programs via the platform and see all the billing information (integration with an online payment system).
- The user can get advice about energy efficiency via recommendations.
- The user can also run quick simulations and decide whether it is beneficial to invest on a new EP that better fits his/her updated needs.
- A gamified experience is offered to the end user.
- The user can play the GAME and thus be seamlessly educated in energy efficiency goals.
- The user enjoys a personalized behavioral education program.
- The admin user (utility) can better manage its customers' portfolio, reduce churn rate and attract new customers.
- The utility can apply its digital marketing and advertising via the platform.

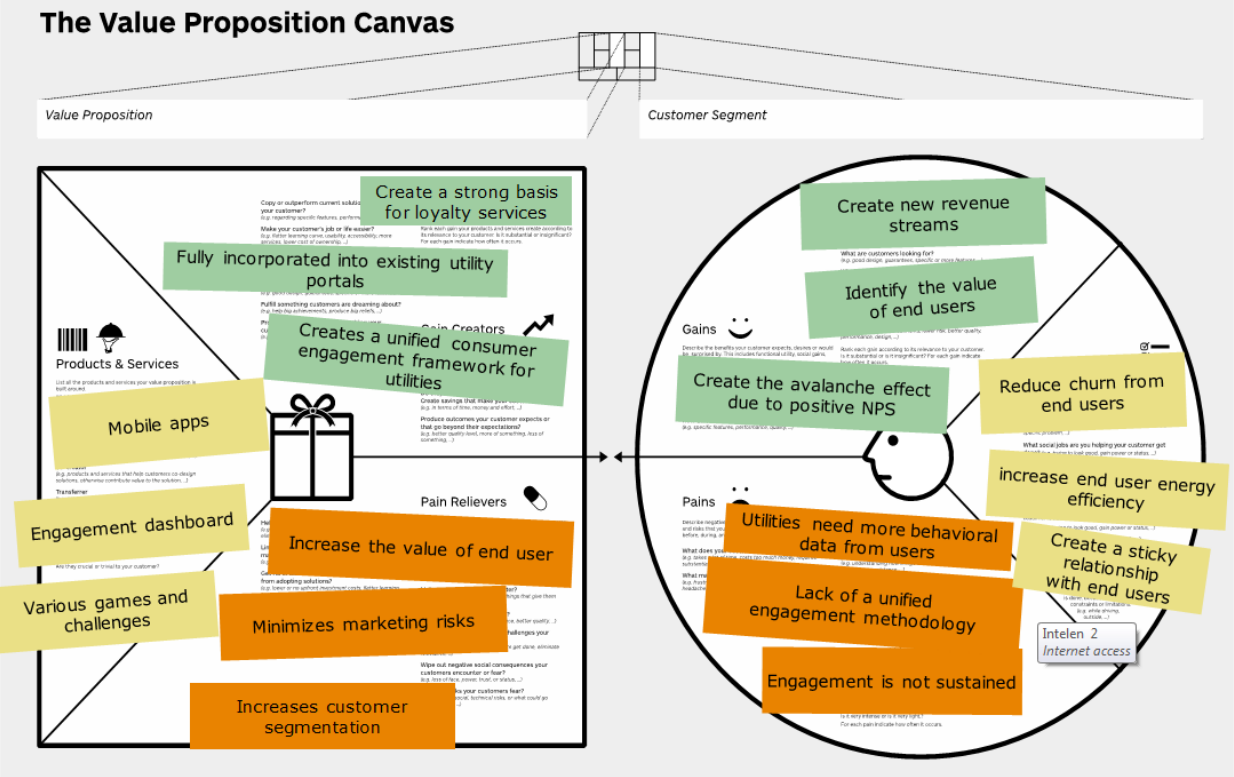

Figure 19: VPC for value proposition no. 1

Customer Jobs:

- Reduce churn for end users
- Increase end user's energy efficiency
- Create a sticky relationship with end users

Customer Pains:

- Utilities need more behavioral data from users
- Lack of a unified engagement methodology
- Engagement is not sustained

Customer Gains:

- Create new revenue streams
- Identify the value of end users
- Create the avalanche effect due to positive NPS

Products and Services:

SOCIALENERGY S/W platform as a:

- Mobile apps
- Engagement dashboard
- Various games and challenges

Gain Creators:

- Create a strong basis for loyalty services
- Fully incorporated into existing utility portals

- Creates a unified consumer engagement framework for utilities

Pain Relievers:

- Increase the value of end user
- Minimizes marketing risks
- Increases customer segmentation

4.3. Value Proposition #2: Business analysis and intelligence tool for progressive electric utilities

This value proposition focuses on the administrator user's interface and respective functionalities being offered by SOCIALENERGY S/W platform. More specifically, SOCIALENERGY platform can serve as a business analysis and intelligence tool for the progressive electric utility's CEO or business analyst, who wants to closely monitor the business process and analyze all ongoing business-related data in an intelligent way towards defining the strategy and policies of the business in the short-, medium- and even longer term future. This process is very important for a utility company/ESP because it wants to understand the behavior of its customers (i.e. end users) in order to keep them happy or extend its customer portfolio. Via the use of RAT subsystem's intelligence, the admin user is able to run exhaustive "what-if" system-level simulations to examine what is the best business strategy/scenario to adopt. For example, the utility company wants to know if (and how much) more profits can be realized in the case that all users who currently adopt a flat price tariff for their energy consumption, purchase a new Energy Program (EP) such as RTP, P-RTP or C-RTP. The next step would be for the ESP to activate its digital marketing strategies towards persuading its customers about the benefits that new EPs incur in order to engage as many as possible. It should be noted that this business case is more applicable in situations where the ESP prefers to do manually offers to its customers and not automated and online services via the platform.

Complementarily, the SOCIALENERGY platform is able to track the activities of the end users and provide comprehensive business analytics graphs to the administrative user. Subsequently, the admin user is able to generate context-aware recommendations based on the current and personalized needs of each customer. This is important because it can reduce churn rate and address the customers' needs in an automated and almost real-time fashion. The frequency of sending reporting/recommendation messages to energy consumers in order to keep them highly engaged without annoying/frustrating them is a also a case that can be analyzed and offered as a service to the admin user.

Finally, in this value proposition, the GAME is played for the admin user's perspective to understand the behavior of the customers and adapt the marketing/advertising policy correspondingly. Via the LCMS, the admin user can continuously monitor the ILPs of all users and adapt them according to the business analysis/strategy of the company. The figure below illustrates the main aspects of this value proposition.

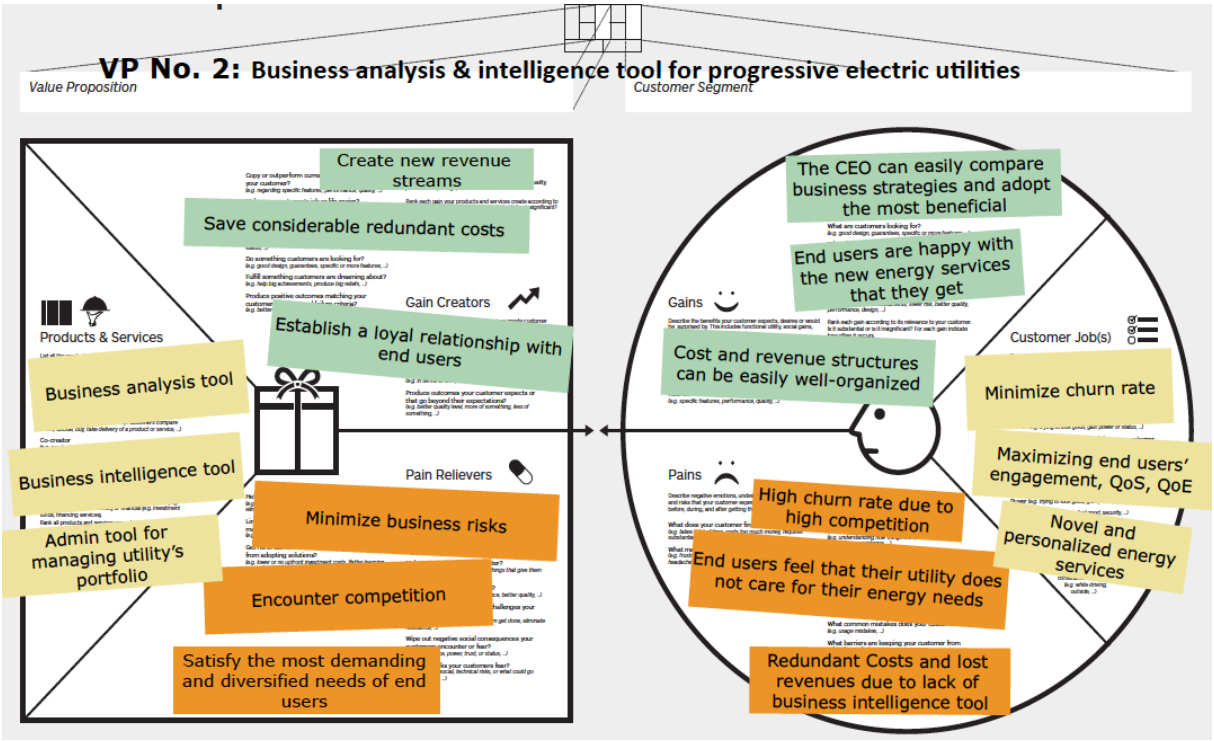

Figure 20: VPC for value proposition no. 2

Customer Jobs:

- Minimize churn rate
- Maximize end users' engagement, Quality of Service (QoS), Quality of Experience (QoE)
- Offer novel and personalized energy services
- Inter-relate new business planning with ongoing business processes and results
- Create the new products and services via the use of system-level simulations

Customer Pains:

- High and unpredictable churn rate due to high competition in the retail electricity markets
- End users feel that their utility company/ESP does not care for their energy needs
- Redundant costs and lost revenues and business opportunities due to the lack of an business intelligence tool
- Manual operation of business analytics data and minor interconnection with ongoing business processes

Customer Gains:

- CEO can easily compare business strategies/policies and adopt the most beneficial one
- End users are happy with the new energy services that they get
- Cost and revenue structures can be easily well-organized
- Automate the business analytics and intelligence processes

Products and Services:

SOCIALENERGY S/W platform as a:

- Business analysis tool
- Business intelligence tool
- Administrative tool for managing utility company's/ESP's portfolio

Gain Creators:

- Reduce operational costs by saving considerable redundant costs
- Retain current revenue streams and create new ones
- Establish a loyal relationship with end users

Pain Relievers:

- Minimize business risks
- Encounter competition by other ESPs in the retail electricity market
- Satisfy the most demanding and diversified needs of end users

4.4. Value Proposition #3: Administrative tool for virtual energy communities' management

This value proposition focuses on the EC leader user interface, community energy programs and management of the energy resources of a set of consumers. From the utility company's/ESP's perspective, it is important to organize users in groups and facilitate bottom-up organizational structures and e-governance. The main rationale is to let the end users create experiences for themselves and also actively participate in the design of new services and products according to their continuously changing needs. In the SOCIALENERGY S/W platform, virtual energy communities (VECs) can be created, dynamically adapted and managed by both a company's employee and an individual EC leader, who wants to create his/her own social network inside the SOCIALENERGY ecosystem.

An EC leader can be just an individual who wants to coordinate the operation of a VEC, a professional user who manages multiple commercial buildings (e.g. supermarkets, hotels, bank offices, retail offices, etc.) or a public authority's employee (e.g. smart city, university campus, business park, etc.), who also wants to manage the energy consumption and electricity bills of multiple buildings, which belong under the same ownership.

For an ESP, it is important to effectively engage user communities and promote corporate responsibility, trigger and facilitate social innovation, bottom-up organizational structures, etc. It is also important to group the needs of its customer portfolio and thus be able to apply more effective collective e-commerce services with Community Based Social Marketing (CBSM) approaches. Members of a VEC can communicate with each other online and continuously compare their ECCs and other energy efficiency activities. VECs are also allowed to contribute in the design of new or enhanced products/services by giving their opinions (cf. bottom-up structure), while VECs may be exploited as cells within which group trading can be facilitated. Multi-parametric approaches for VECs' creation can be easily customized within the SOCIALENERGY platform, such that the EC leader can adopt the mostly preferred approach. The utility user can also recommend/introduce new EPs to VECs and tips to its customers by applying clustering and data analytics algorithms, etc. Via these

data analytics, the utility can operate more efficiently (i.e. no need to send too many personalized messages, but targeted enough to groups of customers with the same behavior).

Via the multi-player gameplay, the VEC members can be efficiently educated in C-RTP energy programs and the benefits of forming a VEC from both financial and social points of view. Finally, via the use of LCMS, EC leader can educates the users in good energy efficiency practices for the sake of local community's goals.

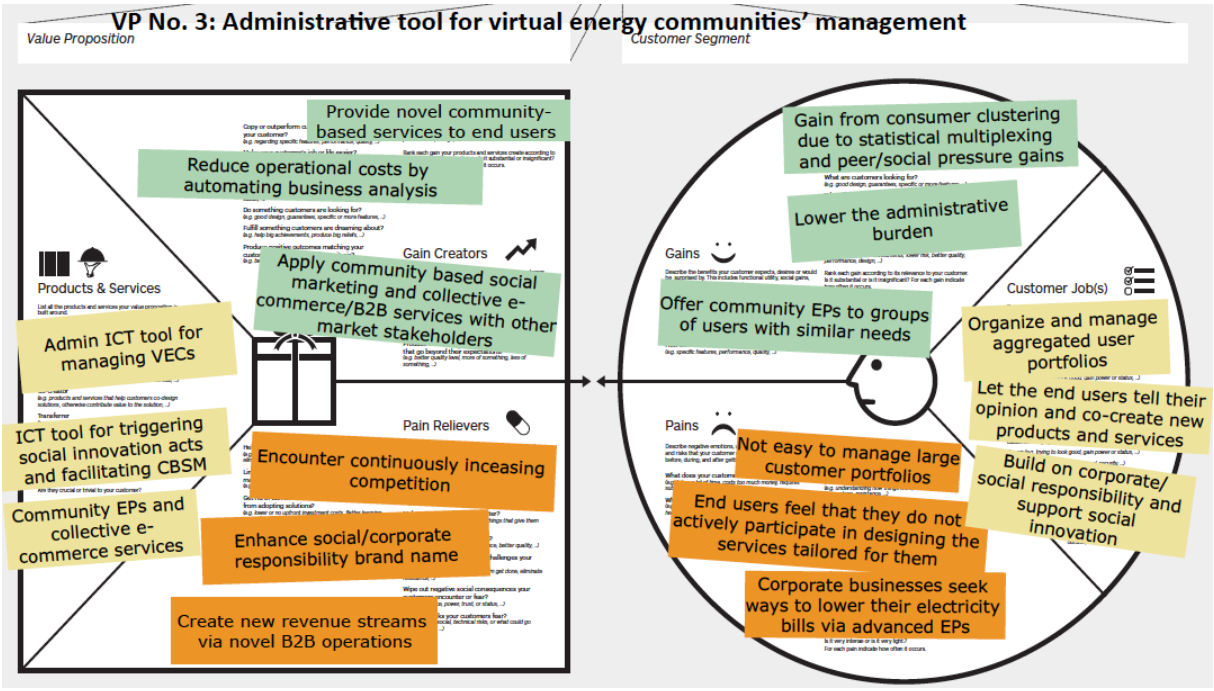

Figure 21: VPC for value proposition no. 3

Customer Jobs:

- Organize and manage aggregated user portfolios
- Let the end users tell their opinion and co-create new products and services tailored for their needs
- Build on corporate/social responsibility and support/trigger social innovations

Customer Pains:

- Not easy to manage large customer portfolios and address the individual needs of every end user
- End users feel that they do not actively participate in designing the services tailored for them
- Corporate businesses (with many large commercial buildings and large energy consumption) seek ways to lower their electricity bills via advanced EPs

Customer Gains:

- Gain from consumer clustering due to statistical multiplexing and peer/social pressure gains

- Lower the administrative burden fro managing a large number of end users on an individual basis
- Offer community EPs to groups of users with similar needs

Products and services:

- Admin ICT tool for managing VECs
- ICT tool for triggering social innovation acts and facilitating Community Based Social Marketing (CBSM)
- Community EPs and collective e-commerce services

Gain Creators:

- Provide novel community-based services to end users
- Reduce operational costs by automating business analysis
- Apply community based social marketing and collective e-commerce/B2B services with other market stakeholders

Pain Relievers:

- Encounter continuously inceasing competition
- Enhance social/corporate responsibility brand name of the electric utility company
- Create new revenue streams via novel Business-to-Business (B2B) operations

4.5. Value Proposition #4: Virtual/Online marketplace for energy efficiency products and services

Regarding this value proposition about the virtual/online marketplace, the proposed business case aspects can be summarized as follows:

- The utility company wants to understand the needs and communicate better with other energy efficiency sector stakeholders such as electric appliance retailers/vendors, building renovation companies, construction companies, smart home automation/IoT vendors/retailers, etc.
- The focus is on cross-sales & e-commerce personalization services to realize new revenue streams via strategic collaborations between the utility and various other ESCOs and companies related with energy efficiency sector.
- The virtual marketplace can host products and services from electric appliance vendors/retailers, building renovation companies, etc., so that the user can have an end-to-end experience on the way to achieve his/her energy efficiency targets.
- Exploit the deep insight into energy use consumption to engage customers on cross-sell options that fit their needs.
- Bridge the gap between energy consumers and multiple other market stakeholders related to the energy efficiency sector. 'Win-Win' market situations are realized as all involved actors can benefit from the participation in the virtual marketplace.
- The utility company can generally sell Energy Information Distribution as a Service (EIDaaS) to whom it may concern in the long-term future (cf. "data monetization" service).
- Mainly GSRN but also LCMS and GAME are exploited from the ESCO's perspective.

- In the future, individual energy consumers could also ask for offers (e.g. for house renovation/upgrades) and the proposed SOCIALENERGY platform could be the mediator.

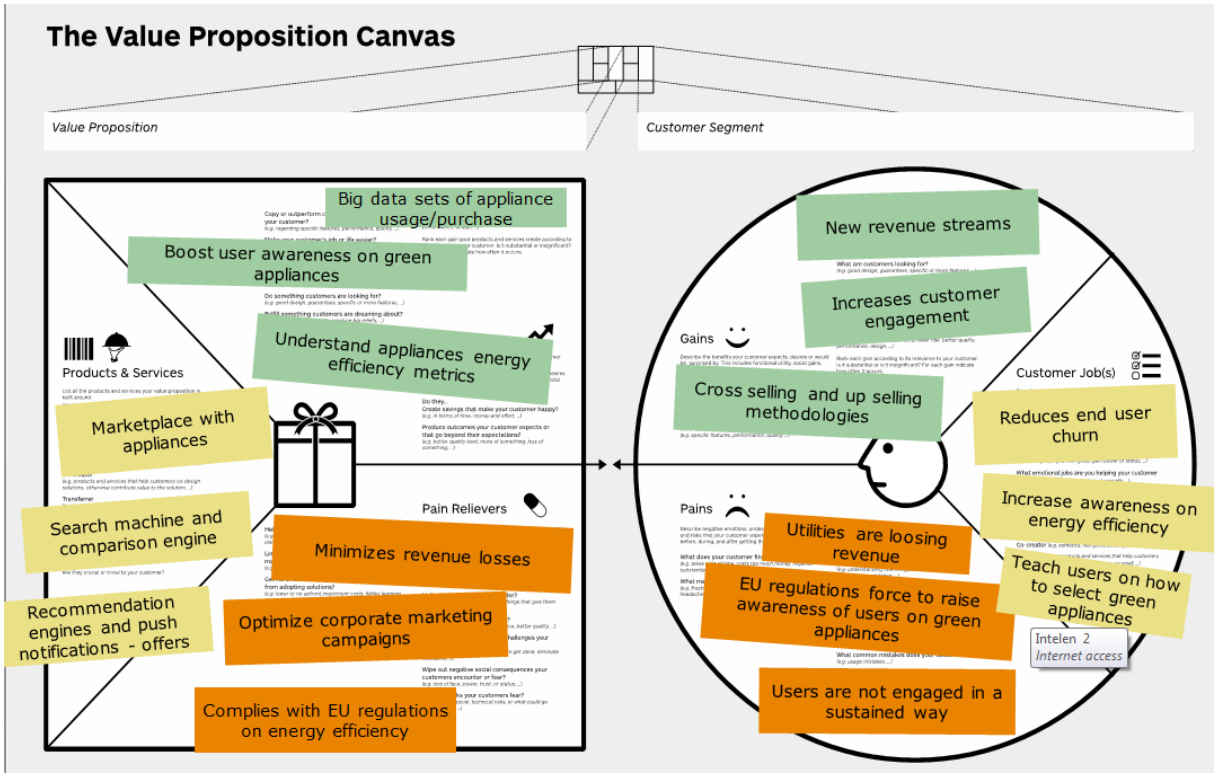

Figure 22: VPC for value proposition no. 4

Customer Jobs:

- Reduces end user churn
- Increase awareness on energy efficiency
- Teach users on how to select green appliances

Customer Pains:

- Utilities are losing revenue
- EU regulations force to raise awareness of users on green appliances
- Users are not engaged in a sustained way

Customer Gains:

- Create new revenue streams
- Increases customer engagement
- Cross selling and up selling methodologies

Products and Services:

SOCIALENERGY S/W platform as a:

- Marketplace with appliances
- Search machine and comparison engine
- Recommendation engines and push notifications - offers

Gain Creators

- Big data sets of appliance usage/purchase
- Boost user awareness on green appliances
- Understand appliances energy efficiency metrics

Pain Relievers

- Minimizes revenue losses
- Optimize corporate marketing campaigns
- Complies with EU regulations on energy efficiency

4.6. Value Proposition #5: SOCIALENERGY Game application for entertainment, education and social inclusion

This value proposition is aimed towards the energy consumers (i.e. individual end users), or those who are going to interact with SOCIALENERGY game. In fact, the game application as a result of the SOCIALENERGY project can be approached to a number of customer segments regardless whether they are dedicated to a specific domain, genre or a platform. Depending on the final outcome and different commercialization approaches, SOCIALENERGY Game can bring an added value to the users with dedicated attitudes towards energy efficiency and emerge in heavy playing as committed gamers, or as a standalone application on the market place to be exploited separately and be inclusive enough to offer light, casual and social gaming attitudes.

Thus, we recognize that the value proposition of the SOCIALENERGY Game can involve several gamer mentalities (based on the classification of Kallio et al.[1]) namely:

- Committed gamers – those who are deliberately using GSRN and the Game due to being socially attached to the problem. These players want to learn more about the market, play more often and tend to have longer sessions in comparison to an average user.
- Causal gamers – these are the players who engage in the gaming activities from time to time and not absorb all the attention or interest in the gaming environment. The sole purpose of the SOCIALENERGY game would be occasional entertainment only.
- Gaming companions or social gamers – types of players who prefer to play together with other individuals for the sake of competition, result comparison, or simply for sociable gaming. For this, certain gamification approaches were adopted and presented to the user in form of leader boards. Simple collaborative gaming is introduced with the use of NPCs, but conceptually the game is designed to support real multi-user interaction in virtual environment and can be introduced during the commercialization stage.

In contrast with the previous 4 value propositions, a reverse approach in the business process is followed. Initially, the end users play the GAME and then, after their engagement in the GAME, they start purchasing all other SOCIALENERGY products and services. Nevertheless, the focus now lies on the Gameplay and how to engage the end users of an

[1] Kallio, K.P., Mäyrä, F. & Kaipainen, K. (2011). At Least Nine Ways to Play: Approaching Gamer Mentalities. Games and Culture, 6(4).

electric utility company/ESP or any other household into simulation. Inter-relate gameplay with GSRN-LCMS services is provided in order to incentivize users to purchase more advanced versions of the GAME and enjoy the best platform's services at the minimum cost. The utility company can also use the GAME as part of its corporate and social responsibility actions towards educating the society on EE issues and for social inclusion purposes in cooperation with a public authority, educational institute, etc.

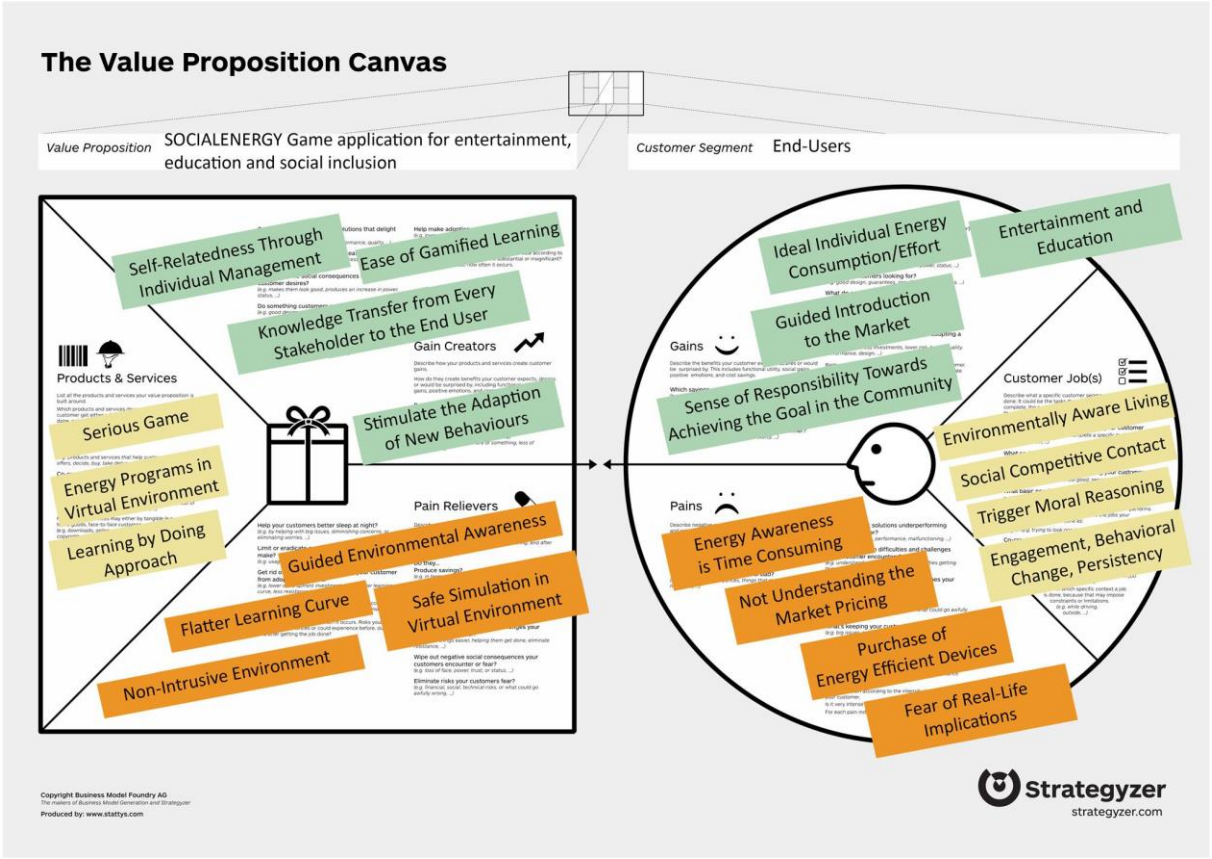

Figure 23: VPC for value proposition no. 5

Customer Jobs:

- Engagement, behavioral change and persistency through entertainment
- Trigger moral reasoning
- Social competitive contact
- Environmentally aware living

Customer Pains:

- Fear of real-life implications
- Purchase of energy efficient devices
- Lack of understanding of the market pricing
- Energy awareness is time consuming and boring

Customer Gains:

- Entertainment and Education
- Ideal individual energy consumption/effort
- Guided introduction to the market

- Sense of responsibility towards achieving community goal

Products and Services:

- Serious Game
- Energy Programs in virtual environment
- Learning by Doing approach

Gain Creators

- Ease of gamified learning
- Self-relatedness through simulation and individual management
- Knowledge transfer from every stakeholder to the end-user
- Stimulation and adaptation of new behaviors through entertaining applied game

Pain Relievers

- Safe simulation in virtual environment
- Flatter learning curve
- Non-intrusive environment
- Guided environmental awareness

5. Report on the Dissemination & Communication Activities

SOCIALENERGY dissemination and communication activities are presented in eight (8) main categories, namely:

- Academia-oriented publications and events
- Presentations and participation at major international events
- Industry-oriented communication activities
- Open access SOCIALENERGY reports, data and software
- Communication activities of SOCIALENERGY products to interested stakeholders
- Training activities and academic dissemination
- Cooperation and mutual dissemination activities with other related EU projects
- Other general public dissemination actions

5.1. Academia-oriented publications and events

Regarding academia-oriented publications and events, there are three main sub-categories, namely: a) international journal papers, b) international conference papers, and c) organization of SOCIALENERGY Special Sessions at international conferences. More details per dissemination item are provided below:

5.1.1. International journal papers

J1 – N. Doulamis, A. Doulamis and E. Varvarigos, "*Virtual Associations of Prosumers for Smart Energy Networks under a Renewable Split Market*", IEEE Transactions for Smart Grid, vol. PP, no. 99, pp. 1-1, 2017, **DOI:** 10.1109/TSG.2017.2703399, http://ieeexplore.ieee.org/document/7924428/.

This paper introduces the concept of dynamic clusters of energy prosumers created through information and communication technologies (ICTs) and are called Virtual Associations (VAs). VAs support the prosumers' active participation in the market, the dynamic formation of the clusters to maximize prosumers' profit and participation, and the fair competition among the VAs and among the prosumers. A fair sharing scheme is proposed that favors the most competitive VAs and prosumers, without excluding less competitive ones from the market. Different algorithms to form VAs are examined based on a min-max optimization strategy and fair sharing. Fair sharing provides: a) incentives to the VAs to increase their competitiveness, b) increased prosumers' participation and c) dynamic interaction with the market. Experimental results obtained on realistic traces reveal the advantages of the proposed energy community creation algorithms.

J2 – G. Tsaousoglou, P. Makris, E. Varvarigos, "*Electricity Market Policies for Penalizing Volatility and Scheduling Strategies: the Value of Aggregation, Flexibility, and Correlation*", Elsevier Sustainable Energy, Grids and Networks (SEGAN) Journal, vol. 12, pp. 57-68, December 2017, https://doi.org/10.1016/j.segan.2017.09.004

This paper presents a method of quantifying the value of energy prosumer's flexibility and provide insights for a future policy of effectively compensating prosumers for their flexibility. The possibility of cooperation among prosumers in a certain geographical area is also studied, showing that it can lead to more intelligent and profitable operation of the system as a whole. Finally, the value of energy prosumption profiles' correlation is studied, too. As a general conclusion, we show that the cooperation among prosumers (i.e. clusters of prosumers or else virtual energy communities' formation) lead to less energy costs compared to the case when each prosumer acts individually. The results of this research have been integrated in SOCIALENERGY RAT subsystem.

J3 – K. Steriotis, G. Tsaousoglou, N. Efthymiopoulos, P. Makris, E. Varvarigos, "*Real Time Pricing in Environments with Shared Energy Storage Systems*", under review in Springer Energy Efficiency Journal, September 2017.

This paper presents the business case in which an Energy Service Provider (ESP) owns a shared Energy Storage System (ESS) that could be exploited from its end users taking advantage of the fact that a shared ESS is more efficient than the operation of many individual ESSs (i.e. personal ESS case). Thus, we propose a shared ESS aware Real Time Pricing (RTP) model that achieves a very attractive trade-off in terms of the ESP's and end user's interests. We also compare our system with its predecessors (traditional RTP without storage and RTP with storage but without shared ESS) and we witness its superiority. The proposed scheme achieves much higher behavioral efficiency without sacrificing at all users' welfare and ESP's profit dynamics.

J4 – G. Tsaousoglou, N. Efthymiopoulos, P. Makris, E. Varvarigos, "*Personalized Real Time Pricing for Efficient and Fair Demand Response in Energy Cooperatives and Highly Competitive Flexibility markets*", under review in Springer Journal of Modern Power Systems and Clean Energy, November 2017.

This paper contributes to the well-known challenge of active user participation in demand side management (DSM). We propose a Personalized – Real Time Pricing (P-RTP) mechanism design framework that fairly allocates the system's cost reduction only to the users that provoke it. Our mechanism achieves significant reduction of the system's cost without sacrificing at all the welfare of electricity consumers. Fair allocation of monetary benefits among all participating users is also ensured, which is very important in highly competitive flexibility market environments as well as in cooperative communities.

J5 – P. Makris, N. Efthymiopoulos, E. Varvarigos, V. Nikolopoulos, A. Pomazanskyi, B. Irmscher, K. Stefanov, K. Pancheva, "*Digitization era for progressive electric utilities: A novel business model through an inter-disciplinary S/W platform and open research challenges*", under review in IEEE Access Journal, November 2017.

This position paper describes the SOCIALENERGY S/W platform and the respective business model and value propositions. It also provides important research and innovation insights and challenges to be addressed towards the proposed Green Social Response

Network (GSRN) concept and the exploitation of SOCIALENERGY system as part of more complex systems for the 2030 smart grid era and beyond.

J6 – I. Mamounakis, N. Efthymiopoulos, P. Makris, D. J. Vergados, G. Tsaousoglou, E. Varvarigos, "*A novel pricing scheme for managing virtual energy communities and promoting behavioral change towards energy efficiency: the SOCIALENERGY project approach*", under review in Elsevier Electric Power Systems Journal, January 2018.

In this paper, we propose a Community Real Time Pricing (C-RTP) scheme together with an Energy Community Formation Algorithm (ECFA), where users are clustered in virtual energy communities (VECs) according to: i) their level of flexibility in modifying their energy consumption, and ii) their relationships in Online Social Networks (OSNs). We show that C-RTP with ECFA can achieve considerable reduction in system's energy cost, while simultaneously resulting in a greater aggregated users' welfare than with the state-of-the-art real time pricing. C-RTP also adopts a much fairer pricing policy as each user is rewarded exactly according to her individual contribution in reducing system costs, thus promoting further the desired behavioral change.

J7 – K. Steriotis, G. Tsaousoglou, N. Efthymiopoulos, P. Makris, E. Varvarigos, "*A Novel Behavioral Real Time Pricing Scheme for the Active Energy Consumers' Participation in Emerging Flexibility Markets*", under review in Elsevier Sustainable Energy, Grids and Networks (SEGAN) Journal, January 2018.

As we argue in this paper, the energy pricing schemes proposed so far (e.g. Real Time Pricing) do not provide strong enough financial incentives to consumers to modify their energy consumption habits, and are therefore unfair and unable to effectively trigger behavioral changes. Based on this observation, we develop a Behavioral Real Time Pricing (B-RTP) scheme, which offers an easily adjustable level of financial incentives to participating users by fairly rewarding the ones that make desirable behavioral changes in the way they consume electricity. Performance evaluation results demonstrate that the proposed B-RTP scheme affects the behavior of the consumers much more efficiently than RTP, outperforming the latter in all widely adopted metrics. B-RTP is able to reduce energy cost from 6% to 30% compared with RTP by slightly increasing in the same time end users' welfare from 1% to 3%.

5.1.2 International conference papers

C1 - I. Mamounakis, D. J. Vergados, P. Makris, E. Varvarigos, N. Doulamis, "*A method for clustering RES prosumers towards creating target aggregated prosumption profiles based on recursive predictions*", 12th IEEE PES PowerTech Conference, Manchester, UK, 18-22 June 2017, DOI: 10.1109/PTC.2017.7981174, http://ieeexplore.ieee.org/document/7981174/

Dr. Prodromos Makris has presented this paper in 12th IEEE PES PowerTech Conference at Manchester (UK), which took place on 18-22 June 2017. The paper focuses on the problem of finding the set of prosumers, whose aggregate prosumption profile can best fit a given target pattern requested by a smart grid market actor. A linear autoregressive forecasting algorithm and a genetic clustering algorithm are proposed, which can easily

adapt to the requirements set by the various SOCIALENERGY use cases. Numerical results show that the SOCIALENERGY S/W platform (i.e. Research Algorithms' Toolkit – RAT developed by ICCS team) can produce clusters (or else virtual energy communities) in real time improving the average deviation from the target pattern by up to 50%.

C2 – I. Mamounakis, D. J. Vergados, P. Makris, E. Varvarigos, "*Communication costs versus smart grid system performance for energy prosumers' participation in liberalized electricity markets: A trade-off analysis*", 32nd International Union of Radio Science General Assembly & Scientific Symposium (URSI GASS 2017), Special Session on "Communications for the Smart Grid" (invited paper), Montreal, Canada, 19-26 August 2017. 10.23919/URSIGASS.2017.8104964, http://ieeexplore.ieee.org/document/8104964/

This invited research paper was presented in the 32nd URSI GASS conference in Montreal, Canada on 21st August 2017. In this paper, we studied the trade-off problem between data communication cost and smart grid system performance for energy prosumers' participation in liberalized electricity markets. This work was an extended version of the work undertaken by ICCS team in the context of FP7-GA-619547 VIMSEN project. Within SOCIALENERGY context, this work studied the trade-off for the communication among the S/W agents (i.e. between each consumer and the SOCIALENERGY platform) regarding the dynamic pricing towards realizing the various proposed DR energy programs in an efficient way.

C3 – P. Makris, N. Efthymiopoulos, D. J. Vergados, E. Varvarigos, V. Nikolopoulos, J. Papagiannis, A. Pomazanskyi, B. Irmscher, K. Stefanov, K. Pancheva, A. Georgiev, "*SOCIALENERGY: A Gaming and Social Network Platform for Evolving Energy Markets' Operation and Educating Virtual Energy Communities*", accepted in IEEE ENERGYCON 2018, Limassol, Cyprus, 3-7 June 2018.

This paper will be presented in IEEE ENERGYCON 2018 under the Special Session on "Digitization era for the smart energy grid: Innovative S/W platforms, services, applications and business models", which is organized by ICCS. It is a position paper that describes the work progress in SOCIALENERGY project so far and disseminates its results to a targeted academic audience of the conference.

C4 – K. Steriotis, G. Tsaousoglou, N. Efthymiopoulos, P. Makris, E. Varvarigos, "*Development of Real Time Energy Pricing Schemes that Incentivize Behavioral Changes*", accepted in IEEE ENERGYCON 2018, Limassol, Cyprus, 3-7 June 2018.

This paper will be presented in IEEE ENERGYCON 2018 and it is a a Behavioral Real Time Pricing (B-RTP) scheme, which offers an adjustable level of financial incentives to participating users, rewarding desirable behavioral changes (in the form of their Energy Consumption Curve). Our evaluation results compare RTP and B-RTP, showing that our proposed B-RTP affects the behavior of the participating users much more efficiently than RTP, outperforming the latter in all widely adopted metrics.

C5 – I. Mamounakis, N. Efthymiopoulos, G. Tsaousoglou, D. J. Vergados, P. Makris, E. Varvarigos, "*A Novel Pricing Scheme for Virtual Energy Communities Towards Energy Efficiency*", accepted in IEEE ENERGYCON 2018, Limassol, Cyprus, 3-7 June 2018.

This paper will also be part of the Special Session organized by ICCS and INTELEN in the context of IEEE ENERGYCON. It is actually a shorter version of the previously mentioned journal paper 'J6'. ICCS will have the opportunity to demonstrate various functionalities from SOCIALENERGY S/W platform such as the Energy Community and dynamic adaptation, the context-aware recommendation service and other data analytics services offered by the RAT subsystem.

5.1.3. Organization of scientific SOCIALENERGY special sessions and/or workshops at international conferences

SS1 - Special Session on "Digitization era for the smart energy grid: Innovative S/W platforms, services, applications and business models", organized by SOCIALENERGY project, chaired by E. Varvarigos (SOCIALENERGY Coordinator) and V. Nikolopoulos (INTELEN CEO), IEEE ENERGYCON 2017, 3-7 June 2018, Limassol, Cyprus. http://www.energycon2018.org/

ICCS coordination team together with INTELEN organized an academic special session in the context of the 5th IEEE International Energy Conference and will be held between 3-7 June 2018. It is organized by the IEEE Cyprus Section, the IEEE PES Cyprus Chapter, and the KIOS Research and Innovation Center of Excellence of the University of Cyprus, in partnership with IEEE Region 8. ENERGYCON covers a broad range of electric power and energy systems topics and is open to contributions that are related to the theme "Towards Self-healing, Resilient and Green Electric Power and Energy Systems". The special session/track organized by SOCIALENERGY project aims to discuss new emerging research and commercial trends regarding the "softwarization" of the smart grid as well as gaming/gamification and educational approaches with respect to energy efficiency.

5.2. Presentations and Participation in major international events

P1 – ICCS presentation of SOCIALENERGY project in FP7 VIMSEN project industrial workshop, Athens, 13 January 2017, http://ict-vimsen.eu/images/Open_Data/workshop_presentations.pdf (see slides 260-281).

Dr. Nikolaos Efthymiopoulos presented the SOCIALENERGY project in an industry-oriented audience in Athens. Potential collaborations with other related projects have been discussed and respective foreground knowledge has been exchanged.

P2 – ICCS presentation of SOCIALENERGY project in a business day event called PANORAMA, Athens, 17 March 2017, http://www.pan-orama.org/efthymiopoulos-nikolaos/

Dr. Nikolaos Efthymiopoulos (ICCS) together with Dr. Vassilis Nikolopoulos (INTELEN) have participated in this business day event in Athens disseminating SOCIALENERGY's ideas and receiving valuable feedback from the participants.

P3 – INTELEN presentation in Energy and Commodities Conference, 12-13 May 2017**,** http://www.energycommodities.gr/default.asp?la=2.

INTELEN was a speaker. Presentation of INTELEN's engagement platform and connection with SOCIALENERGY project (gamified energy efficiency).

P4 – NUROGAMES participation and communication activities in Brussels Sustainable Energy Week, 19-25 June 2017**,** http://www.eusew.eu/

NRG engaged in a number of B2B meetings with relevant stakeholders of the energy market that further triggered one-on-one follow up calls discussing further collaboration on the project level and after the project end.

P5 – SU-NIS participation at major national event, on 26 June 2017, SOCIALENERGY project presentation by SU-NIS during the meeting of Bulgarian scientists with Director – General for Research and Innovation in EC: Robert-Jan Smits.

SU-NIS presented in front of Bulgarian scientists community and Director – General for Research and Innovation in EC Robert-Jan Smits project SOCIALENERGY together with its main objectives and activities.

P6 – NUROGAMES participation in Gamescom 2017, Cologne, 21-25 August 2017, http://www.gamescom-cologne.com/gamescom/index-9.php

Exploring the potential of SOCIALENERGY Game as a standalone product, NRG has engaged with a number of publishers to make them aware of the game under development. Further demonstrations are agreed upon final product readiness.

P7 – INTELEN participation in Ashoka, Energy Poverty Conference 2017, Athens, 22 September 2017**,** Schneider Electric Foundation**,** http://tacklefuelpoverty.com, http://www.cnn.gr/oikonomia/epixeiriseis/story/98556/h-ashoka-greece-sti-maxi-gia-tin-katapolemisi-tis-energeiakis-ftoxeias.

INTELEN presented SOCIALENERGY project towards offering solutions to the energy poverty problem from a socio-economic perspective.

P8 – INTELEN participation in European Utility Week, Amsterdam, 3-5 October 2017**,** http://www.european-utility-week.com/.

INTELEN was an exhibitor and presented SOCIALENERGY project. Presentation of the SOCIALENERGY Project and exhibition of SOCIALENERGY impact at INTELEN's stand.

5.3. Industry-oriented communication activities

IC1 – INTELEN presentation to ENGIE Laborelec regarding energy analytics and SOCIALENERGY impact. ENGIE Laborelec lab, Brussels, http://www.engie.com/en/commitments/reasearch-innovation/research-laboratories/laborelec

INTELEN was a speaker at the workshop. Presentation to ENGIE Laborelec regarding energy analytics and SOCIALENERGY's potential impact.

IC2 – NRG direct engagement with the Senior Manager of Deloitte Limited Innovation and Entrepreneurship Centre, which launched an Accelerator, working closely with ESCOs and a number of other stakeholders of energy market. http://www.ariscy.com/

5.4. Open Access SOCIALENERGY reports, data and software

Regarding the open access SOCIALENERGY reports, data and software, there are three main sub-categories, namely: a) public SOCIALENERGY reports and deliverables, b) open access datasets, and c) open access SOCIALENERGY software and user manuals.

Regarding (a), all SOCIALENERGY deliverables (together with all other dissemination material like scientific papers) are made public in the project's website (see the "Downloads" tab[2]), so as everyone may have access and download the respective material.

Regarding (b), each SOCIALENERGY subsystem will provide open datasets to be used mainly for research purposes. For more details about the structure and contents of these datasets, please see the Data Management Plan – DMP in D6.1 (M6). These datasets will be made publicly available after the end of the first S/W integration phase (expected in M20).

Finally, regarding (c), the consortium's strategy is to have a basic version of S/W prototypes fully accessible to anyone interested in understanding the basics about the whole system's operation and experiment with its innovative functionalities. In particular, a comprehensive user manual will be available for every subsystem and the system as a whole in order for everyone to be able to start experimenting with the platform's functionalities. This material will be made publicly available after the end of the first S/W integration phase (expected in M20). This is done in order to further disseminate the project's results (i.e. SOCIALENERGY foreground knowledge). However, the final version of S/W prototypes (especially regarding the GSRN and GAME components) will be kept in "closed/restricted access" in order to boost the commercial exploitation activities of the two companies and protect the respective IPR.

[2] http://socialenergy-project.eu/index.php/downloads

5.5. Communication Activities of SOCIALENERGY products to interested stakeholders

The first S/W integration and validation activities of SOCIALENERGY system will end in July 2018 (M18). As a result, the communication activities with specific customers are expected to take place right after the accomplishment of milestone 5 "Pilot setup plan and release of first SOCIALENERGY system prototype". The consortium has already created a list of targeted customers (i.e. progressive electric utility companies) and will start live demonstrations of SOCIALENERGY products and services after M20.

5.6. Training activities and academic dissemination

TA1 – Spring Scientific Session of the Faculty of Mathematics and Informatics, Sofia University (SU-NIS), 25 March 2017.

SU-NIS team presented SOCIALENERGY subsystems and work progress related to LCMS. Discussed with lecturers, students and interested parties were the LCMS functionalities and SE competence framework.

TA2 – Prof. Manos Varvarigos presentations in the context of academic lectures at the Monash University, Department of Electrical and Computer Systems Engineering, 2017-2018.

During academic year 2017-2018, Prof. Manos Varvarigos included many SOCIALENERGY-related presentations and lectures in his academic program.

TA3 – ICCS team presentations in the context of academic lectures, National Technical University of Athens (NTUA), School of Electrical and Computer Engineering, 2017-2018.

During academic year 2017-2018, ICCS team made several SOCIALENERGY-related presentations and lectures in the NTUA's BSc and MSc program.

TA4 – ICCS team undertook one (1) training event in the premises of the National Technical University of Athens (hands-on experience workshop on the first release of SOCIALENERGY RAT toolkit, 15 BSc/MSc and PhD students attended), March 2018.

Once the first stable version of the RAT S/W toolkit has been released, ICCS team organized a training event for a total of approximately twenty BSc/MSc students, who had a hands-on experience with the RAT.

5.7. Cooperation and mutual dissemination activities with other related EU projects

RP1 – H2020 RAGE project: SOCIALENERGY is closely following-up RAGE project activities as the latter is closely related to serious games development and is EU project flagship in this field. SOCIALENERGY exploits NRG and SU-NIS participation in RAGE for foreground knowledge dissemination and interaction between the two consortia. NRG follows the good practices and libraries for the efficient development of SOCIALENERGY GAME.

RP2 – FP7 VIMSEN project: SOCIALENERGY exploits ICCS background knowledge from VIMSEN project on research algorithms, which are used as input for the project. The VIMSEN DSS platform (TRL 5) is used for testing the various functionalities of SOCIALENERGY and as a good basis for the further development of RAT. Moreover, energy consumption datasets from real users are used in cooperation with VIMSEN consortium.

RP3 – H2020 ENTROPY project: SOCIALENERGY exploits INTELEN's foreground knowledge in gamification and user engagement. Our project is closely following-up [ENTROPY] results and the ways that pilot tests are set up including the appropriate key performance indicators that will be used for the real-life trials. INTELEN is also using related background knowledge and liaisons for the development of GSRN platform.

5.8. Other general public dissemination actions

All the above-mentioned dissemination material is periodically uploaded to the official SOCIALENERGY project's website: http://socialenergy-project.eu/index.php

Twitter and facebook accounts have been created. In the project's youtube channel (https://www.youtube.com/channel/UCiV4pEupQDoZ0vif3HXSemQ), the consortium partners have already started releasing the first DEMO versions showcasing the S/W implementation progress so far. The first newsletter has also been released to targeted commercial stakeholders, who may be interested in purchasing SOCIALENERGY products and services in the near future.

6. Report on the exploitation activities

6.1. SOCIALENERGY project's exploitation strategy

The SOCIALENERGY architecture is **"modular by design"** in order for all subsystems (i.e. GSRN deployed by INTELEN, GAME deployed by NRG, RAT deployed by ICCS and LCMS deployed by SU-NIS) to be potentially exploitable as standalone commercial products in the future. The technical APIs for the interaction between the various subsystems have been appropriately designed in a way that any possible combinations of SOCIALENERGY subsystems to be commercially exploitable in the future (e.g. GSRN with RAT as one single product, GAME with RAT as another one, GSRN-GAME as another one, GSRN-RAT-LCMS as another one, etc.). This strategic decision at the design phase provides the flexibility to the consortium to decide how to prioritize its dissemination, communication and further exploitation activities towards commercialization. Of course, the default choice and ultimate objective of the consortium is to fully integrate all 4 subsystems into one single SOCIALENERGY S/W platform. This way, the SOCIALENERGY product and associated services is expected to be competitive enough in order to enter the liberalized ICT/energy market and be sustainable as a product from a business perspective. **The "modular by design" approach provides flexibility to our system to be commercialized taking into consideration the diversified needs of all our potential customer segments.**

6.2. Overview of the business planning results so far

So far, a draft business plan has already been put in place in order for the SOCIALENERGY project to have an indicative view of the costs and revenues, which are anticipated to be incurred by SOCIALENERGY commercialization after the end of project's lifetime. In D6.1 (M6), draft quantitative figures have been presented regarding the revenue streams and the market size as well as a SWOT analysis. Moreover, the 4 SOCIALENERGY subsystems have been described together with each partner's exploitation plans.

SOCIALENERGY consortium has a pretty clear business and exploitation plan for SOCIALENERGY system as a whole, which is realistic with current utilities' and ESCOs' business, gaming and converged ICT/energy markets. As a result, the estimated financial figures, which are presented in section 3 are based on real financial data according to existing client base of INTELEN and the company's experience with the targeted customer segment. However, this is only the starting point, as SOCIALENERGY aims to constitute the platform that will not only mediate the future energy market but also will harmonize demand and production in it through its very innovative and advanced features like the game, the support of sophisticated research algorithms for dynamic energy pricing and management of virtual energy communities, and the development of LCMS, which will guarantee the long-term user engagement and continuous learning of good practices on energy efficiency. The development of the final fully-detailed quantified business plan with respect to its ambitious objectives will take place in the subsequent WP6 deliverable (i.e. D6.3 in M30).

The consortium has also agreed upon legal plans and licenses to make sure that the project's Intellectual Property (IP) is protected. There is also a strategy that incorporates the balance between presenting results that interest the targeted customer segment (i.e. electric utilities/ESPs) and protects the consortium's IPR. This strategy also addresses exactly how the licensing agreements to exploit the results among the consortium partners are distributed. Initial financial allocations have been agreed among all partners and are based on each S/W module's weight per business case being assumed. Detailed datasets with respect to all the envisioned business cases and value propositions will be incorporated in D6.3 in M30.

Note: It should be noted that the financial figures of the project's business plan (i.e. the cost structure and revenue streams) presented in section 3 refer to the period after the end of project's lifetime. The ultimate project's milestone is to bring SOCIALENERGY S/W platform at TRL 8 that is one step away from commercialization. Until M30, the consortium's objective is to have the final business plan and exploitation agreement in place as well as preliminary commercial agreements signed with real customers.

6.3. SOCIALENERGY consortium agreement and exploitation agreement

Apart from the SOCIALENERGY consortium agreement, which was signed at the start of project's lifetime, an extra agreement has already put in place, which focuses on the exploitation and commercialization aspects of the project's assets and foreground knowledge.

As already discussed, it is apparent that the flexibility choice of selecting any combination of SOCIALENERGY subsystems to match specific customer segment's needs provides enormous boost to the exploitation activities of all partners of SOCIALENERGY consortium. Therefore, the exploitation agreement signed by all partners provides an excellent basis for synchronizing the next commercialization steps of the consortium. Below, we provide some important notations taken from the confidential exploitation agreement signed among all SOCIALENERGY partners.

First of all, there are some important terms that need to be defined. By the term *"SOCIALENERGY Assets"*, we mean the set of Methods, Reference Architectures, Software Platforms, Domain Knowledge and Components as well as their instantiations into a number of Industrial Trials experimentations. *"Product"* means any product or service, which could be commercialized on the basis of the SOCIALENERGY Assets. *"Commercial Business Opportunity"* means that one Party has the opportunity to sell SOCIALENERGY assets for a final customer on the market, which is third party and is not any of the Party. *"Internal Use of Opportunity"* means that a Party (or a affiliated entity of the Party) is the final customer of the SOCIALENERGY solutions for its own Business activities. Both *"Commercial Business Opportunities"* and *"Internal Use Opportunities"* are generally referred as *"Business Opportunity"*.

In the context of the Project, the Parties (i.e. partners) have produced Foreground in the form of a range of individual exploitable components. Some of components have been produced by one sole Party, while others have been produced based on the joint

collaboration of several Parties. The purpose of the Exploitation Agreement is to establish the terms under which the Parties will exploit business or internal opportunities, which may derive from the SOCIALENERGY assets, once the EU financed Project will be finalized.

The Exploitation Agreement remains valid until the expiration of a period of twelve (12) months from the date on which the Grant Agreement is terminated (the "Final Date"), and shall be thereafter renewed for one (1) year period, each Party being entitled to terminate its participation, after the "Final Date", at any moment by sending to the other Parties a termination notice in this respect, which shall take effect at least sixty (60) days after the date of the termination notice. Notwithstanding anything to the contrary, in case of termination, the rights and obligations deriving from this Agreement will be maintained until finalization of all Business Opportunities carried out by one or more of its Parties in accordance with the conditions provided therein.

The Exploitation Coordination Committee (ECC) is responsible for: a) the definition of the strategy for the exploitation of any Product and foster business relationships and alliances with third parties, b) the adaptation of the terms of the Agreement to the necessities of the exploitation, c) review Business Opportunities presented by a Party, d) the follow-up of the issues regarding the Parties (participation, determination of defaulting parties, etc.).

Regarding each "business opportunity" that may come up in the future, a specific set of procedures and steps in the implementation phase have already been defined. Each party's rights and obligations and revenues' distribution/sharing policies are pre-determined, too. It should be noted that nothing in this Exploitation Agreement limits the Party to exploit independently and out of this Agreement any of its own Intellectual property Rights related to the Products, which has been developed under the Project by it, or to exploit independently and out of this Agreement other solutions/products present in the market and in competition with SOCIALENERGY solutions. Upon the occurrence of a new *"Business Opportunity" (BO)*, the Proposing Party should present to the ECC a fully detailed dossier including a BO Value, with financial projections and assumptions (which for the avoidance of doubt shall be based on final price list proposed by the Parties, owners of the affected SOCIALENERGY assets for this particular BO), together with a description of the activities in which the involvement of the other Parties could be necessary (such as professional services or similar activities with financial conditions at which such involvement is expected by the Proposing Party). In case one or several Parties shall be involved in a Business Opportunity, they shall, together with the Proposing Party (and any third party, if need be), enter into specific arrangements to implement the concerned Business Opportunity. The BO Value is the sum of affected SOCIALENERGY assets prices and sum of prices of all additional professional services or products included in the BO, (this latter price to be negotiated directly with the impacted Parties), included in BO value all the costs and after the deduction of the discounts based on CDL, but it refers the value before taxes.

The income distribution scheme to be determined for each Business Opportunity shall recognize for each participating Party: a) sales efforts, and therefore the related commission for such investments, b) the value of the IPRs made available by a participating Party for the concerned business opportunity, c) the costs / investments dedicated by one

Party for: i) the evolution of any IPR; and ii) any additional knowledge needed, d) deployment and/or operation cost. It is specified that the values assigned to these items with respect to one Party in the Implementation Arrangements regarding one Business Opportunity, shall also, unless otherwise agreed by the participating Parties, be applicable for any further Business Opportunity for which such Party participates.

Residual issues like the ones related with liability and confidentiality issues and other general clauses are also defined in the confidential Exploitation Agreement.

7. Conclusions

Conclusively, the consortium has now reached Milestone 4, meaning that the consortium has released the initial version of SOCIALENERGY functionalities via the delivery of D3.1 ("Initial version of GSRN platform functionalities") and D4.2 ("Initial version of SOCIALENERGY's virtual world functionalities") in M15.

7.1. Real market applicability of SOCIALENERGY platform

In its current form, SOCIALENERGY platform can be directly exploited by today's electric utilities and ESPs in the retail market as a stand-alone product based on the business model proposed in this report. Its "modularity-by-design" feature offers the flexibility to the targeted customer segment to customize its own S/W platform based on the business strategy and the type of its customer portfolio's needs. For example, a utility may opt only for the GSRN-GAME solution, while another one may opt for a GSRN-RAT-LCMS solution, etc. SOCIALENERGY aims to constitute the platform that will not only mediate the future energy market, but will also harmonize demand and production in it through its very innovative and advanced features like the game, the support of sophisticated research algorithms for dynamic energy pricing and management of VECs, and the development of LCMS, which guarantees the long-term user engagement and continuous learning of good practices on energy efficiency.

7.2. SOCIALENERGY's Market Applicability in the 2030 Smart Grid Era & Beyond

What's more interesting regarding the SOCIALENERGY's business modeling and further commercial exploitation is that the proposed platform can only be one subsystem in a more enhanced future system, which will be an important part of the smart grid ecosystem. This fact can be an additional advantage towards more efficient results in the ongoing communication activities with the targeted customer segment. In particular, SOCIALENERGY platform is designed in a way that it can be easily integrated as a S/W component in much more complex systems of the 2030 smart grid era and beyond. Table 7 provides a summary of possible SOCIALENERGY system's extensions in order to serve various business models of several emerging market stakeholders in the future.

Table 7: SOCIALENERGY's Market Applicability in the 2030 Smart Grid Era & Beyond

Stakeholder	Complex SG system of 2030 era & beyond	Possible SOCIALENERGY extensions
Future utility / ESP	Transactive Energy platforms [36], Energy Cloud platforms [7], P2P Energy Trading platforms / community energy system [37]	Include RES/storage assets, blockchain technologies, direct energy exchanges among users, energy prosumption resources' management, advanced scheduling algorithms, etc.

Distribution Services Orchestrator	Advanced Distribution Management System (ADMS) [7]	Interaction with ADMS and DER/storage management S/W, big data analytics to handle huge volumes of data coming from the grid, AI algorithms
Smart building managers / IoT service provider	Advanced Building Management System (BMS) and building automation platforms	Cyber-physical interaction between the real and virtual worlds may be elaborated via the use of a mixed/ augmented reality application
E-commerce service provider	Advanced virtual marketplaces, e-commerce platforms, online advertisement campaign systems	Extend the proposed virtual marketplace component to involve many more stakeholders and include more advanced functionalities
Policy maker	E-governance tools for collaborative smart citizens' participation in decision making processes	Integrate SOCIALENERGY with an e-governance/policy modelling platform for energy efficiency
Public authority / organization	Advanced e-learning & lifelong learning platforms.	Integrate SOCIALENERGY with an e-learning platform for energy efficiency
Private investment fund	Advanced techno-economic tools for boosting, securing and managing the risk of private investments in RES, storage, energy efficiency	Include RES/storage models, more advanced energy labelling models for buildings/electric appliances/cities, weather models, prediction models, etc.
Energy efficiency service providers	Advanced recommender platforms deployed by electric appliance vendors/retailers, building constructors, etc.	Extend the proposed EIDaaS with more advanced models according to the stakeholder's needs and business model.

SOCIALENERGY S/W platform can serve as a perfect substrate of a future transactive energy or peer-to-peer (P2P) energy trading platform operated by a progressive electric utility/ESP. As today's DSOs are gradually transformed into distribution service orchestrators, SOCIALENERGY could also be integrated in an Advanced Distribution Management System (ADMS), whose responsibility will be to continuously provide 'stability as a service' by deploying various tactics such as: interrupting the electricity supply to electric vehicle recharging stations, sourcing power from embedded combined heat and power generation, tapping into grid-scale storage, sending RTP signals to consumers, applying Volt/VAR/frequency control methods, etc. SOCIALENERGY could also be a part of a cyber-physical system via the use of a mixed/augmented reality application deployed by a smart BMS in collaboration with an IoT/telecom service provider. The proposed 'virtual marketplace' component could also be considerably enhanced and be integrated in e-commerce service provider's platform. Policy/decision makers could also exploit SOCIALENERGY as part of an e-governance and policy modeling platform for energy efficiency. Other forms of "social innovation" can also be boosted such as the opportunity for end users to collaboratively participate in the design of a new policy, EP, product, EIDaaS, etc. or learn about good practices on energy efficiency in a collaborative and socially inclusive manner. Finally, as private investment funds need strong techno-economic tools to be able to secure and manage the risks of the whole investment lifecycle, SOCIALENERGY could be a good basis for providing such kind of services in the future.

7.3. Next plans

The next plans for the following period are:

- Consolidate the most important results from D3.1 and D4.2 and start integrating them in SOCIALENERGY system (March – June 2018).
- Prepare the 1st version of SOCIALENERGY S/W prototype and a good-quality DEMO mainly for communication purposes (July 2018).
- Communicate the new product and services to the customer segment and also disseminate project's results to targeted audiences.
- Receive valuable feedback from potential customers and subsequently enhance the S/W development until the end of 2018.
- Start pilot testing with Protergia S.A.[3] real energy consumers to test our system in real-life conditions (early 2019).

[3] https://www.protergia.gr/en

References

[1]. P. C. Evans and A. Gawer, “The Rise of the Platform Enterprise: A Global Survey”, The Centre for Global Enterprise, January 2016.

[2]. V. Atluri, M. Dietz, N. Henke, “Competing in a world of sectors without borders”, McKinsey & Company, 2017.

[3]. D. J. Moser, C. H. Wecht, O. Gassman, “Open Platforms at Incumbents”, 28th ISPIM Innovation Conference- Composing the Innovation Symphony, Vienna, Austria, 18-21 June 2017.

[4]. S. Yablonsky, “Multi-dimensional platform innovation: from IT platforms to leadership platforms”, 28th ISPIM Innovation Conference- Composing the Innovation Symphony, Vienna, Austria, 18-21 June 2017.

[5]. H. M. E. Korhonen, K. Still, M. Seppanen, M. Kumpulainen, A. Suominen, K. Valkokari, “Start-ups innovating digital platforms: Towards successful interaction”, 28th ISPIM Innovation Conference- Composing the Innovation Symphony, Vienna, Austria, 18-21 June 2017.

[6]. Massachusetts Institute of Technology (MIT) report, “Utility of the future: An MIT Energy Initiative response to an industry in transition”, December 2016.

[7]. Navigant Research White Paper, “Defining the Digital Future of Utilities: Grid Intelligence for the Energy Cloud in 2030”, June 2017.

[8]. M. Molina, P. Kiker, S. Nowak, “The Greatest Energy Story You Haven't Heard: How Investing in Energy Efficiency Changed the US Power Sector and Gave Us a Tool to Tackle Climate Change”, ACEEE Research Report U1604, August 2016.

[9]. Accenture Consulting report, “New Energy Consumer: This time it gets personal” https://www.accenture.com/ca-en/_acnmedia/Accenture/next-gen-5/insight-new-energy-consumer-2017/Accenture-NEC2017-Gets-Personal-POV.pdf, June 2017.

[10]. R. Sussman and M. Chikumbo, “Behavior Change Programs: Status and Impact”, American Council for an Energy-Efficient Economy (ACEEE), Report B1601, October 2016.

[11]. J. Vardakas, N. Zorba, C. V. Verikoukis, "A Survey on Demand Response Programs in Smart Grids: Pricing Methods and Optimization Algorithms," IEEE Communications Surveys & Tutorials, vol.17(1), pp. 152-178, 2015.

[12]. F. Grossberg, M. Wolfson, S. Mazur-Stommen, K. Farley, S. Nadel, “Gamified Energy Efficiency Programs”, ACEEE Report Number B1501, 2015.

[13]. Yu-kai Chou, “Actionable Gamification: Beyond Points, Badges, and Leaderboards”, 2015, [Online] Available: http://www.amazon.com/Actionable-Gamification-Beyond-Points-Leaderboards-ebook/dp/B00WAOGY4U

[14]. B. P. Koirala, E. Koliou, J. Friege, R. A. Hakvoort, P. M. Herder, “Energetic communities for community energy: A review of key issues and trends shaping integrated community energy systems”, Renewable and Sustainable Energy Reviews, vol. 56, pp. 722-744, April 2016.

[15]. N. Doulamis, A. Doulamis, E. Varvarigos, "Virtual Associations of Prosumers for Smart Energy Networks under a Renewable Split Market," IEEE Transactions on Smart Grid, vol. PP, no. 99, 2017.

[16]. D. J. Vergados, I. Mamounakis, P. Makris, E. Varvarigos, “Prosumer clustering into virtual microgrids for cost reduction in renewable energy trading markets”, Elsevier Sustainable Energy, Grids and Networks (SEGAN), vol. 7, pp. 90-103, September 2016.

[17]. A. J. D. Rathnayaka, V. M. Potdar, T. Dillon, O. Hussain and S. Kuruppu, "Goal-Oriented Prosumer Community Groups for the Smart Grid," IEEE Technology and Society Magazine, vol. 33, no. 1, pp. 41-48, Spring 2014.

[18]. A. J. D. Rathnayaka, V. M. Potdar, T. S. Dillon, O. K. Hussain and E. Chang, "A methodology to find influential prosumers in prosumer community groups," IEEE Transactions on Industrial Informatics, vol. 10, no. 1, pp. 706-713, Feb. 2014.

[19]. G. Ye, G. Li, D. Wu, X. Chen and Y. Zhou, "Towards Cost Minimization With Renewable Energy Sharing in Cooperative Residential Communities", *IEEE Access*, vol. 5, pp. 11688-11699, July 2017.

[20]. K. Ma, G. Hu and C. J. Spanos, "A Cooperative Demand Response Scheme Using Punishment Mechanism and Application to Industrial Refrigerated Warehouses," IEEE Transactions on Industrial Informatics, vol. 11, no. 6, pp. 1520-1531, 2015.

[21]. A. Mani, I. Rahwan, A. Pentland, “Inducing Peer Pressure to Promote Cooperation”, Nature Scientific Reports, vol. 3, Article number: 1735, 2013.

[22]. Q. Huang, X. Li, J. Zhao, D. Wu and X. Y. Li, "Social networking reduces peak power consumption in smart grid," IEEE Transactions on Smart Grid, vol. 6, no. 3, pp. 1403-1413, May 2015.

[23]. C. McPherson Frantz, B. Flynn, S. Atwood, D. Mostow, C. Xu, S. Kahl, “Changing Energy Behavior Through Community Based Social Marketing”, In: Leal Filho W., Zint M. (eds) The Contribution of Social Sciences to Sustainable Development at Universities. World Sustainability Series. Springer, Cham, pp. 259-272, 2016.

[24]. M. Mulder, “Competence Based Vocational and Professional Education: Bridging the worlds of work and education”, Springer International Publishing, Switzerland, 2017.

[25]. P. Samadi, A.-H. Mohsenian-Rad, R. Schober, V. W. S. Wong, and J. Jatskevich, “Optimal Real-Time Pricing Algorithm Based on Utiltiy Maximization for Smart Grid”, in Proc. of First IEEE International Conference on Smart Grid Communications (SmartGridComm), Gaithersburg, MD, USA, Oct. 2010.

[26]. N. Li, L. Chen, and S. H. Low, “Optimal Demand Response Based on Utiltiy Maximization in Power Networks”, in Proc. of IEEE Power and Energy Society General Meeting, Detroit, MI, USA, Jul. 2011.

[27]. N. Yaagoubi, and H. T. Mouftah, “User-Aware Game Theoretic Approach for Demand Management”, IEEE Trans. on Smart Grid, vol. 6, no. 2, pp. 716-725, Mar. 2015.

[28]. Z. Wang, and R. Paranjape, “Optimal Residential Demand Response for Multiple Heterogeneous Homes With Real-Time Price Prediction in a Multiagent Framework”, IEEE Trans. on Smart Grid, vol. 8, no. 3, pp. 1173-1184, May 2017.

[29]. W. Tang, S. Bi, and Y. J. (A.) Zhang, “Online Coordinated Charging Decision Algorithm for Electric Vehicles Without Future Information”, IEEE Trans. on Smart Grid, vol. 5, no. 6, pp. 2810-2824, Nov. 2014.

[30]. S. Althaher, P. Mancarella, and J. Mutale, “Automated Demand Response From Home Energy Management System Under Dynamic Pricing and Power and Comfort Constraints”, IEEE Trans. on Smart Grid, vol. 6, no. 4, pp. 1874-1883, Jul. 2015.

[31]. L. P. Qian, Y. J. A. Zhang, J. Huang, and Y. Wu, “Demand Response Management via Real-Time Electricity Price Control in Smart Grids”, IEEE Journal on Selected Areas in Communications, vol. 31, no. 7, pp. 1268-1280, Jul. 2013.

[32]. H. Allcott, “Social norms and energy conservation”, Elsevier Journal of Public Economics, vol. 95 (9-10), pp. 1082-1095, 2011.

[33]. S. N. A. U. Nambi and R. V. Prasad, "Toward the development of a techno-social smart grid," IEEE Communications Magazine, vol. 54, no. 11, pp. 202-209, November 2016.

[34]. A. Cassidy, M. Strube and A. Nehorai, "A framework for exploring social network and personality-based predictors of smart grid diffusion," IEEE Transactions on Smart Grid, vol. 6, no. 3, pp. 1314-1322, May 2015.

[35]. G. Tsaousoglou, P. Makris, E. Varvarigos, “Electricity Market Policies for Penalizing Volatility and Scheduling Strategies: the Value of Aggregation, Flexibility, and Correlation”, Elsevier Sustainable Energy, Grids and Networks (SEGAN) Journal, vol. 12, pp. 57-68, December 2017.

[36]. USA National Institute of Standards and Technology (NIST) report, “GridWise Transactive Energy Framework, v1.0”, January 2015.

[37]. C. Zhang, J. Wu, C. Long, M. Cheng, “Review of existing Peer-to-Peer Energy Trading Projects”, Elsevier Energy Procedia, vol. 105, pp. 2563-2568, 2017.

[38]. Osterwalder, A., & Pigneur, Y. (2010). Business Model Generation. *self published*. Retrieved from http://www.consulteam.be/media/5985/businessmodelgenerationpreview.pdf

[39]. Osterwalder, A., Pigneur, Y., & Tucci, C. L. (2005). Clarifying business models: origins, present, and future of the concept. *Communications of the Association for Information Systems, 15*(1), 1–43. doi: 10.1.1.83.7452

[40]. A. Osterwalder, Y. Pigneur, G. Bernarda, A. Smith, “Value Proposition Design: How to create products and services customers want”, Wiley, 2014, available online at: http://noahc.me/Value%20Proposition%20Design.pdf

[41]. https://digitalintelligencetoday.com/the-10-business-models-of-digital-disruption-and-how-to-respond-to-them/