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EU SMART GRID TRANSITION: ENERGY PROSUMERS & ESCO's BETWEEN ENERGY EFFICIENCY AND SOCIAL EFFICACY

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1. ABSTRACT

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Abstract

The research focusses on the complex impositions of Smart Grid deployment on the energy prosumers and their relationship with the Energy Services Companies (ESCOs). The research proposes a systemic analysis critically arguing against the aggregator fix proposed by the Universal Smart Energy Framework (USEF). The research furnishes a theoretical body to also contend with the EU thermodynamic exergy mindset towards prosumers. The outcome of the research is a novel knowledge-based classification of energy prosumers and a social system that follows an engineering rationale (VSM).

The study highlights the issue of smart grid deployment from the innovation management perspective. It focusses on the major pillars of evaluating a successful smart grid deployment from the managerial point of view. It further addresses the focal indicators to the social deployment of the technology, providing an amalgamation of a social theoretical framework to deal with energy prosumers. The study provides a technical discussion about major areas of debates from both policy and industry about smart grids and energy prosumers. It also suggests an alternative technical proposition that is found much suitable to the current EU situation.

The research is considered an exploratory effort towards understanding the complexity of the technological transition. The aim of the research is to assist both policy makers on the EU level and the energy stakeholders to make better decisions to manage the social transition effectively. The research also follows an innovative approach towards evaluating types of innovation employed by each segments of the research. The result is a new social system realization that can help with advancing more research in the area.

Key words

Complexity theory, Smart grids, social engineering, Critical system thinking, self-efficacy, physical efficiency and knowledge management.

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2. INTRODUCTION

2.1 Smart Grid Deployment and Energy Socio-Technical Participants

This study draws on the European Union Horizon 2020 agenda and plans for research in innovation and competitiveness on the topic of "Accelerating Clean Energy Innovation & Smart grids" (ACEI 2016)[1]. The EU Smart grid projects aims to envisage a technology driven electricity system with the consumers as a catalyst element in directing the future. Smart Grid technologies (SG), therefore, are a group of technical innovation geared towards increasing the capabilities of the energy system. In this research I plan to focus on the social adoption and change influenced by technical innovation. Simultaneously, I will refer to the Smart Grid as a Disruptive/Radical innovation, which will cause various organizational change that will directly affect the technical, economic and social systems in transition. Reason behind this framing is to zone down the vast array of topics which are included in Smart Grid adoption and social applications associate with energy innovation. This research denote more focusses on active renewable energy citizens also referred to as "Prosumers" as an element in energy transition. The goal of this effort is to practice an ideological contestation over social policy and stakeholder strategies over the European Union.

Smart Grid is becoming of a wide interest to technical energy societies and prosumers. As it is considered an enabling tool for energy prosumers. Providing them with a platform to buy, sell, use, store and measure their supply and demand. Only recently, EU policy have addressed the prosumers issue. Farther in response to the industry concerns, increasing growth of this segment and social pressure. In this juxtaposition we can clearly state that most of European Energy innovation is geared towards the technical operation aspect, security, engineering and mega-applications. This research contemplates on the lack of realism in the rational of energy stakeholders (especially ESCO's). While they continue to assume that, their normative approach dealing with the prosumer technical transition is effective. The industry current focus in addressing the prosumer topic under smart grids is more towards describing "How prosumers should behave", rather than understanding "How prosumers behave". The focal point of this research is to attempt to provide a positivist modelling to prosumers and proper means to interact with them. In order for this goal to materialize, social science and innovation management should address the prosumer topic in a similar fashion to that of the energy sector.

[1] COM(2016) 763 final https://ec.europa.eu/energy/sites/ener/files/documents/1_en_act_part1_v6_0.pdf

Therefore, this research aims at illustrating prosumers in a systemic manner. The benefit from using system theories is to better understand prosumers maturity level and organizational patterns. Doing so will pave the way to position them as a fit sub system/component in the energy system.

The interest in such topic is driven by the understandings of Moore's Law (Moore 1975) and his networks theory, in order to validate the promoted positive side of the Smart Grid in the current transition. Smart Grids (SG) are brought forth as a solution which are centered on increasing knowledge and information in the energy domain. While strong indications continue to support that prosumers trend will continue to grow far more than the current rate, the threat of misuse is also an issue. It is without contestation that technologies and Smart grids will increase the amount of information this segment can capture and manipulate. The things they can do will also grow exponentially if we contemplate on the concept of human organization and their economic growth, which as a result creates a space for innovation in a market. In this case, the hype will encourage more people to jump in also referred to as the "Band Wagon Effect". Increasingly corresponding to changing the technology and the economics to accommodate the new comers. The technological change will force large units to cooperate economically, causing a continuous increase of knowledge spill over. As a result this will potentially contribute to even more innovation and continuous change. This is just the tip of the iceberg of people attempting to optimize their own local patches of networks as they densely connect and interconnect. Simultaneously, prosumers digestion of boundaries and bureaucracy will continue to impose on the current settings of the energy system. These are some of many other elements that form a foundational base for a complex topic, limitedly the goal here is to understand prosumers adoption to change with technology deployment.

This research at its core aims to debunk the available physical innovation efforts that are taking place in the EU energy innovation. In an attempt to address the social axiom in Smart Grid transition and innovation. This effort endeavor to achieve a novel management perspective towards a better prosumer understanding, moreover assist ESCO' and energy inherent system/ incumbent to better manage and cope with competition. Smart Grids (SG) technologies and prosumers adoption will continuously change and affect the technological transition of the energy landscape. Therefore, it is important to provide energy stakeholders with tools to build their comparative advantage, instead of just expect them to be competitive in a market they already dominate. Policy makers should understand that a successful transition is only possible if the energy stakeholders manage to escape falling into strategic fads and transition pits.

2.2 Research lens on available efforts

The Smart grid research often is grouped under **THREE** main themes, which as a result apply to prosumer activity planning. **Firstly**, smart grid physical research, which is mostly engineering, technological and technical in nature. Various output with in this literature addresses (prosumers, energy community, neighborhood energy etc.) for their outputs. This encompasses (Lampropoulos, Vanalme et al. 2010) models of incorporating behaviors of large amount of small size prosumers in the power system planning. Including (Rathnayaka, Potdar et al. 2011, Rathnayaka, Potdar et al. 2014) innovative Approach to Manage Prosumers in Smart Grid with focus on Digital Ecosystems and Business Intelligence. In addition to (Grijalva, Tariq 2011) articulation a prosumer-based smart grid architecture which enables a flat, sustainable electricity industry. While (Da Silva, Ilic et al. 2014) expanded the impact of smart grid prosumer grouping, where he postulated on forecasting accuracy and its benefits for local electricity market trading. More importantly (Rodríguez-Molina, Martínez-Núñez et al. 2014) work towards positioning prosumers as entrepreneurs and their business value chain models.

Secondly, Demand Response (DR) and Demand Side Management (DSM) research. This body of knowledge focuses on innovation in energy Demand Side Management (DSM) via prosumer interactions in a Smart City Energy Marketplace (Karnouskos 2011a, Karnouskos 2011b). It also expand the energy market understanding for trading electricity in smart grid neighborhoods, which highly proliferated and articulated by Gellings (Gellings, Parmenter 2008, Gellings 2009, Gellings 2011, Gellings, Samotyj 2013, Gellings 2014, Gellings 2017). Where he furnished a clear integration structure for DG prosumers and their energy production in the system.

Finally, smart grid sustainability and management research, which are scarcely projected and not specific to Smart grids. Notably (Ritzer, Jurgenson 2010) focused on the role of capitalism created by prosumers calling it ‘The Coming of Age of the Prosumer’. Moreover (Ritzer, Dean et al. 2012, Carvallo, Cooper 2015) proliferated on the role of prosumers in future economy. Focusing on the role of sustainable communities in energy stability and sustainable energy supply. While (Fine, Gironda et al. 2017) studied Prosumer motivations and communication behaviors.

The topic of smart grids innovation and energy prosumers is mostly unaddressed from the innovation management literature, especially from a social science perspective. Noticeably most of the literatures addresses each topic on its own. This as a result contributed to the lack

of uniformity in the research of the topic of energy prosumers and their smart grid activities, causing it to be unbridged and consisting of various gaps. This study proliferate on the prevalent gap of addressing the prosumers organization structure under energy technology deployment. So far, there are no effort placed in segmenting or understanding prosumers functional trends, alignment within a movement and their communication patterns. Therefore, I have chosen to tackle the subject to understand the prosumers values and belief amalgamation. Attempting to understand how the technological transition would affect prosumers energy involvement? This research is positioned in a critical fashion to contrast with the energy industry and policy fixes of energy prosumerism rising culture. The social axiom will allegedly change the energy land scape in the future. Therefore, this study utilizes systemic approaches to build a conceptual social system.

2.3 Purpose of the study

The benefit of this study is that it proposes a chance to understand the type of competition prosumers introduce to the energy market. Energy incumbents, energy stakeholders and policy makers continuously address social axiom behavior as being opaque (Lutzenhiser 1993, Wilhite, Shove et al. 2000, Hollands 2015). Therefore, they are inclined to force the social component to fall in to steady state economy and their perceived physical equilibrium (Batty 2005b). There is an apparent parity in the way each group of the transition view prosumers despite agreeing on their valuable input. The purpose of this study is to alleviate some of the tension on the prosumer topic.

This study serves as a mean to draw on the concept of Trans-active energy proposed by C.W. Gellings to deal with the technological transition. Trans-active energy is one of the most explored concepts in the technical innovation effort. Gellings highlights that there is no need to reinvent the business models or creating new markets while the current tools available works. Innovation should focus on how to better address consumers and prosumers in a new way. The ideals of integrative supply and demand should also be explored, yet the focus on social dynamics and cognition as a system needs extensive attention (Gellings 2017). Therefore, my effort is going to be dedicated to better understand the social dynamic to farther illustrate the future growth of the energy prosumer phenomena. I intend to attend to it through the outcomes of their values, belief and norms, which is a theory developed by P. Stern. Simultaneously, model that in a manner that can be projected in a system understanding. Illustrating where they fit in the whole energy system. The generated system design will be analyzed farther to generate

prosumer segments or groups based on their values and believes regulated by Sorokin's System of belief theory.

This research first draws on big titles that envelop the Smart Grid as a goal from the social science and management perspectives. The following questions forms my understanding of my empirical evidence, where I illustrate the elements with which I considered in forming the skeleton of my later research questions. What constitutes a smart Grid? How ESCO view the physical transition? What are the current proposed solutions? And how fit are they? These questions outline and frame the problems with in the supra system. I furnish their answers in the literature review section of this study. Ultimately the juxtaposition of information onwards yields what my research question should address in the vast array of topic in the domain as following:

1. How energy prosumers shape the social transition?
2. How mature are their operations on the energy system?
3. What kind of systemic alignment do they project?
4. How can we segment prosumers?

Answering these questions on an EU level is expected to provide a system formation to prosumers from the socio-operational perceptive, purposefully explain some of the complexity involved. The outcome should justify prosumers views on emancipatory efforts and contribute to levelling the impacts of the current exclusionist strategies or/and policies that limits their capacity. The current means of dealing with prosumers seems to be problematic and can jeopardize the whole purpose of the EU smart grid plans on the long run. The systemic results of this research will furnishing the transition stakeholders with means to view prosumers as an effective market component. Also, provide a theoretic element to understand their decision-making process based on their beliefs. Hence, avoid strategic traps and fades while interacting with them as a competitive element in the market. Purposefully advancing better actions addressing the situation.

Hitherto, there is no research done so far that addresses the energy prosumers as a system. Let alone, the literature available does not have clear segments or classification for prosumers or the culture they represent. While, in the case of policy literature prosumers were not addressed as part of whole system dynamics. Therefore, this work can assist in providing more insight and drive more effort in this direction.

2.4 Key concept of the study and Rationale

Rationale

The core of this study is to work with complex systems rationale. Various theories were examined in the early stage to make a suitable fit to size and the data gathered for this study. I chose to follow critical system thinking methods (Flood, Jackson 1991, Jackson 2001), which allows a free utilization of duel methods or mixed system methods. The study uses the (Checkland, Poulter 2010) Soft System Methodology (SSM) to answer the whole system questions. Soft System Methods can assist in a more refined understanding of the problem in the current strategies. This provides a mean to adhere to my hypothesis, which draws on the Sherry Arnstein's "Ladder of Citizen Participation" (Arnstein 1969a). This refines my understanding of the degree of social power prosumers represent. The second phase, which reflect on the data analysis is geared towards describing the system interaction. I used the Viable System Modelling (VSM) (Beer 1984) to provide a strong illustration of the system functions, communication and recursion. The theoretic back bone of this design is strongly associated with Sorokin's belief system (Sorokin, Sorokin 1962) description and the Stern's value -belief-norms theory (Stern 2000, Stern, Dietz et al. 1999). This amalgamation of theories and methods can assist me in drawing on results and create a meaningful management framework and a social classification. All the theories and methodologies are relevant to study the complexity of energy prosumer landscape, which in the end aims at reflecting how prosumers relate to the energy environment. In order to fully conceptualize that in organizational fashion I rely on Emery and Trist proliferation on the causal texture of organizational environment, especially the concept of turbulence (Emery, Trist 1965, Emery, Trist 2012). This will describe a feasible desirable change in the current position in regards to the energy prosumers organization.

Key concept

The key concept behind this research capitalizes on a theoretical explanation that serves the purpose of conceptualizing the current state of the technological energy transition. I embrace Turner's theory of social interaction (Turner 1988), which mandates simplifying and pulling away from the details of the situations to purposefully capture what is "timeless and invariable". In this case it is the technological and engineering narratives of the transition. It is significant to mention at this point that the initial theorizing in system theories cannot be fully grasped

when removed from the situations that created them. Therefore, I utilize the physical understanding in honing my efforts towards the ability to visualize a socio-technical phenomenon. This serves as a fundamental process for abstracting models and proposition. This research will furnish a historical discussion of the mainstream rationale of the industry. I do not wish to become embroiled in them here. Instead, my purpose is to outline a strategic segmentation for developing a theoretical explanation that uses abstract systemic models to understand a social actions based on knowledge. It is arguably beneficial for policy makers, technical analysts and corporate business strategists.

The reason for choosing to explore Social System underpinnings are due to the uniformity of the current physical system based knowledge. The recent EU attempts to administrate and program the social production axiom of electricity under the technological transition have been heavily discussed (2017/C 034/07)[2] (TEN/583)[3]. The particular conditions within the EU strongly points to the need for conceptualizing Negawatts participants amid Smart Grid deployment. Three major events highlight this need: 1. The European Economic and Social Committee Directive (COM (2016)[4] 864 final) defines local energy communities and grants them corresponding rights. 2. Regulation (COM (2016) 861 final)[5] allowing small market participants and prosumers to continue to have the chance for a fair competition. 3. The talks on a new energy market design through the "Revision of the Renewable Energies Directive (TEN/622)[6]". Stressing on the fact that renewable energy and other decentralized technologies contribute to significantly increasing market liquidity is of importance to market design (Alfred 2017)[7] .

Therefore, a conceptual furbishment furnishes the theoretical development with a wider socio-culture context, further allowing rigor on (economic competition, defense requirements, unemployment, nudging, participation rates, and physical -risk). All the mentioned have created major controversy over the purposes of social involvement and energy prosperous communities. It is equally important for ESCOs to provide adequacy to their competitive

[2] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52016IE1190&from=EN

[3] https://www.eesc.europa.eu/our-work/opinions-information-reports/opinions/prosumer-energy-and-prosumer-power-cooperatives-opportunities-and-challenges-eu-countries

[4] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52016PC0864&from=EN

[5] http://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52016PC0861&from=EN

[6] http://www.eesc.europa.eu/en/our-work/opinions-information-reports/opinions/revision-renewable-energies-directive

[7] http://www.eesc.europa.eu/bg/node/53920

preparation programs. At the same time it is much relevant to practitioners who criticize the social science input to the complex realities of their daily practices. Due to the continuous division among rival theoretical alternatives and which are better positioned to solve the political, theoretical, and practical.

2.5 Structure of the Thesis

According to the sequence of my study of SG energy prosumers. I argue that the whole system smartness should not be conceived entirely from the simple view of a collective technical add-ons. In other words, the success of the SG technological transition does not depend entirely on the technological ad hoc of the technical innovation. Rather it should give more attention to the set of a socio-technical capabilities that enables the transition towards a true multi-scale and self-organized dynamics. That is mostly fit to address the complexity that Smart grids introduce to the electricity system. I here illustrate the structure of this effort, and the approach used in thinking and tackling the topic.

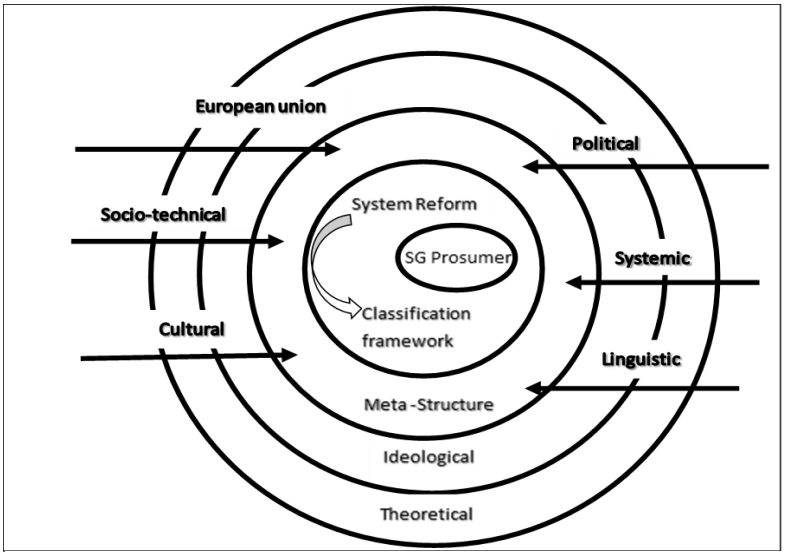

Figure 1: Thesis Structure Illustration

The thesis chapters are aligned in the following sequence. Chapter 2 will bring the smart grid to its basic service requirements, which allows more focus on its social goals and describe the smart grid and what does it strategically entail? Chapter 3 focusses more on the role of ESCOs and their business practice. Chapter 4 focus on the prosumer and social transition. Chapter 5 furnishes an extensive discussion of the current technical fixes to the prosumer issue, reveling the problematic implications of each solution. Chapter 6 describes the ideology of the research

and the methodology and methods of analysis. Chapter 7 present the research results and models. Chapter 8 delivers a furbishment of a segmentation and a working framework.

3. THEORATICAL BACKGROUND

3.1 Smart Grid Promise & Smart Grid Silver lining

Smart grid (SG) is generally conceived as a technical phrase. It is often mentioned to emphasize the series of technological advancement. In contrast SG is also a market term, it outlines the characteristics of technologies required to modernize the electricity delivery system functions. Moreover, describe the accommodation of high renewable penetrations in the utility systems (Komor, Hoke et al. 2014). SG technologies in principle are a stage to optimize and facilitate renewable energy technologies integration. Farther more maintain balance between functions and electricity demand and supply, which supports a better service delivery and assist with reliving electricity systemic issues. Increasing opportunities over the system by providing purposeful planed functions (Akhil, Huff et al. 2013). Smart Grid (SG) thus a technological innovation rhetoric that reflect the transformation of the electricity industry through catering Information and Communication Technologies (ICT) to the system deliverables. SG fundamentally introduces an uninterrupted two-way digital communication and plug and play capabilities. These features are pivotal for the success of the advanced metering infrastructure and investment goals of integrating consumers. This purposefully increases customer involvement and contributes significantly to lowering the cost of communication between stakeholders. Admittedly, assisting them with all generation and storage options, while enabling effective operations (DOE/NETL 2009).

Henceforth, the term Smart grid technology is often associated with energy economy and its technical application. The transformation of the electricity delivery system faces critical challenges in: 1.Strengthening the power delivery infrastructure. 2. Enabling digital social application to societies. 3. Attending to energy and environmental issues represented in Carbon footprint policies (COP). 4. Sustainable supply and demand of energy while reducing greenhouse emissions. 5. Deregulating and liberating electricity markets (especially in the case of Europe) (EPRI 2003). Therefore, the smart grid deployment process encompass different problems for different stakeholders. Smart Grid central purpose is to empower electricity system components by providing them with the verifiable mean to perform sought after transactions. This Allows Transmission stakeholders (TSOs), Distribution Stakeholder (DSOs) and Retailers (ESCOs) to perform functions coupled with data management to increase

communication capabilities. Such functions farther enhances their service deliveries, increase system efficiency and insures effective social benefits (Gellings 2009).

SG technologies are the focal point in revolutionizing the electricity industry. This include various technical innovation that is fundamental to the transformation. Innovation in this stance is usually incremental in its applications to make use of the available assets. Innovation focus is towards a sufficient Transmission & Distribution (T&D) automation, through concocting new means combining ICT and circuit infrastructure. The new features encompasses new methods to facilitate Dynamic Line Rating (DLR), Capacity Factors and systemic efficiency. The technical innovation increasingly need to contribute to the sought after evolutionary trajectory in facilitating: 1. Distributed Generation (DG). 2. Co-Generation technology that fits micro grids. 3. The pragmatic inclusion of renewables facilitating (PHEVs, BEVs, FCEVs … etc.) (Farhangi 2010). Smart Grid road maps strictly indicate the urgent need for innovation in various areas to deliver its promises. Innovation therefore gives a great attention to SG pyramid and IT infrastructures. Hence, the critical success of SG relies on its ability of bring together enterprise service bus, geo-informatics and CRM. The Technical innovation requirements in circuit technologies and substantial design are necessary in alleviating the limited capabilities of telecommunication infrastructure in wide area networks and backhaul that continue to persist.

The stated prerequisites mandates the phases of SG deployment. These phases insures the successful application of home area networks, plug electricity vehicles, energy storage and volt-var optimizing (VVO) application (Dabic, Siew et al. 2010). Altogether, SG technologies should undergo various stages before reaching its desired self-healing potential. The desired self-healing entails equipping the grid with real time measures to cut network loses and increase reliability. This as a result increasingly improve the current utility asset management, while enable synchronized inclusion of dispatchable intermittent renewable energy sources (i-RES) to power market structure (Perera, Nik et al. 2017). Allowing system operators to build operation and economic strategies based on accurate data (Momoh 2012), in order to meet the economic and technical limitations. The energy industry and experts have outlined SG characteristics to market use in the form of a set of Key Performance Indicator (KPI) as following: 1. it should enable Informed Participation by Customers. 2. Accommodate all Generation and Storage options. 3. Facilitate selling more than kWhs. 4. Provide Flexible Power Quality. 5. Bolster efficiency of assets and Operations. 6. Promote resilience facing disturbances, attacks and natural disasters (Dupont, Meeus et al. 2010).

3.1.1 Smart Grid in Europe

The EU SG projects revolved around the ideal of an intelligent electricity network, which allows integrated actions of all actors connected to the generation. This Includes customers and consumers who function on both sides of the supply chain. This inclusion increases electricity security through introducing competition towards liberating energy markets (Giordano, Gangale et al. 2011). As a result, EU Smart Grid action plans vary according to utility structure by regions. The European Smart Grid Task Force provided a unified definition for Smart Grids. They describe them as: Those electricity networks that can grant effective integration of behaviors and actions of all users connected to it (generators, consumers and those who do both). Consequently leading to a sustainable power system with low losses, higher quality and increased security of supply, while ensuring an economic efficient market operation[8].

Simultaneously, the EU SG project introduces a socioeconomic transformation that is aimed towards deregulated power market structure, which farther establishes the sought after competition in the electricity market. Ultimately through distributing cost component among energy actors achieving an economic balance. Concurrently involve consumers in the process to achieve system efficiency, considering consumer choice a safe guard for the process (Sato, Kammen et al. 2015). Nevertheless, the primary purpose of the EU SG project is to insure the energy supply in favor of customers. This is envisaged through linking stakeholders in interoperability modelling to insure transmission and distribution network connectivity, while maintaining sufficient electric power generation and separate energy sales business. This most affirmingly further furnishes the electricity system with needed flexibility, diversification, accessibility and reliable economic operability (IEA 2008). The previous caters to transforming electricity to an Over the Counter (OTC) tradable, which facilitates the integration of new elements within the energy market mix.

In the next sections I will attempt to form a clear understanding of what constitute the EU Smart Grid, since it is often unclear to everyone. Bellow I will draw on various concepts that contributes to the dispersed understanding of what constitute and governs a smart grid? In addition, how it is perceived?

[8] The Smart Grids Task Force (SGTF1) http://ec.europa.eu/energy/en/topics/markets-and-consumers/smart-grids-and-meters

3.1.2 The Energy Trilemma

Energy trilemma in the energy context is a model for energy decision making. It is the trajectory of goals for a sustainable development. It encompasses Economic Viability, Security of Supply and Environmental Protection (Brundtland 1987). When dealing with SG the trilemma underlines three dimensions: 1. Energy security. 2. Social equity. 3. Environmental impact mitigation (Gadonneix, Sambo et al. 2012). Energy trilemma is a valuable tool to communicate the energy axioms across stakeholders, countries, energy organizations and policy makers. It extends guidelines to direct socio-corporate strategies facilitating an energy transformation paradigm. It is important to highlight the mega trends that govern the energy transition at this point. The EU formed a composition of goals for the energy transition (Wyman 2016):

1. A technological breakthrough.
2. Climate change and resource management.
3. Demographic change.
4. Economic power.
5. Accelerating urbanization.

It is visible that all the above goals have the social component as a centric element. While energy trilemma and smart grid technologies are increasingly joint together in recent literature and analysis. Energy trilemma provides indicators to help policy makers and regulatory bodies' evaluate their performances. These indicators utilizes technology to facilitate change, they believe will better materialize the transition and reduce uncertainty. Furthermore, generate smarter economic policies and smarter security policies. So far policy makers focus their regulatory efforts on energy actors and market players. According to them this gives the ability to steer, support and track investments. The down serge of which is overlooking the human axiom of smart grid implementation, while in theory much of the smart grid's benefits are dependent on customer participation (Oliver, Sovacool 2017).

Despite the clear goals of what the evolutionary grid does. The problems associated with implementing have not been technical. Rather, it is the roles and responsibilities, which requires ample revision of mechanisms for attributing costs and revenues. Thus, the smart energy market transition should consider various associated aspects of technological impacts and setbacks that might take place in the future. There is a need for adopting change – management approaches with open path communication with stakeholders to avoid economic or fundamental backlashes (Vergriete, Juppe et al. 2016). It is important to highlight that Energy trilemma captures the

complexity of smart energy and SG energy transition in producing a sustainable energy system. It furnishes the EU with prerequisites for the successful implementation of a liberated competitive energy market. Certainly different understanding is needed for different national contexts. Enabling a better steering of innovation pathways towards some clear targets that are measurable to each country. Assisting them with a better outcome for their energy efficiency plans (Wyman 2013).

3.1.3 Energy Efficiency

Energy efficiency is an economic variable, which guides the consensus of various parties. It is a major pillar for combating GHG emissions and alleviate financial burdens on oil imports. It also governs the energy trade balances, while maintaining energy supply security to support economic growth (Rungruang 1993). Energy efficiency is an economic tool that instructs strategic decisions center to financial and technological innovation agendas. It helps achieving climate and energy sustainable goals, through improving competitiveness of industries by reducing energy costs. Technically the energy efficiency refers to the use of less energy input while maintaining an equal level of economic activity. This understanding holds a substantial value to policy cognition of energy as a service [COM/2011/370][9]. Due to these aspects, it became an attractive domain in energy policy. It conceptualizes benefits from redirecting energy costs to generate investments to support domestic economies (WEC 2013).

Energy efficiency despite being an important economic tool it does not come without problems, which is often considered a limitation in the context of SG technologies. Firstly, the rebound effect is one of the most debatable economic concepts that comes into interplay. The rebound effect (Jevons paradox) wide argument is that even with increased energy efficiency an economy wide reduction in energy consumption is not granted. The rebound effect sections the effect into direct and indirect rebounds based on economic activities. It also states the complex nature of energy saving and efficiency within climate change agenda policies. Continuously predicting that with the increased importance of energy over time as markets grows technologies like SG might not enforce behavior changes. Therefore, it is hard to estimate or validate the effects based on energy optimal scenarios alone (Sorrell 2007). Secondly, the polar views on indicators and energy quality surfacing the energy efficiency and smart grids debate between stakeholders of the transition. Energy managers and energy operators often rely on thermodynamic methods (physical thermodynamic and economic thermodynamic indicators).

[9] EU energy efficiency directive, 2011 https://ec.europa.eu/clima/sites/clima/files/strategies/2050/docs/efficiency_plan_en.pdf

While policy makers and investors often combine macroeconomic and Productivity Life Cycle (PLC) methods. The relevance of bringing up polarity is the issues it creates regarding evaluation and value judgement. The polarity even stretches to materialize in energy quality problems, implicit assumptions and joint production problems (Patterson 1996).

3.1.4 Electricity Market Transformation

Monopolies always have governed the electricity sector. Often monopolies operate under the Single-Buyer Model in its basic understanding of electricity markets. Single-Buyer Model refers to a number of technical, economic, and institutional factors that operates the supply and demand of the electricity flow. This include activities of (generation, transmission, dispatching and distribution), in an attempt to alleviate the impact of the laws of physics dominating the operation. Fatherly allowing a mean to translating electricity unites to financially tradable unites befitting to contractual arrangements. This facilitates the pricing and designing service models that consumers can understand (Lovei 2000). It is important to highlight that the economic transactions occur under two hypothetical market structures, which reflect different interests of the competing system. The operations under this dynamic produces the Whole Sale Model and the Retail Model (Bohi, Palmer 1996).

A) The Retail Model: Serves individual customers preferences. Hence originating the concept of retail choice.
B) The Whole Sale Model: Is more towards the transaction costs and cost effectiveness of transmission capacity regardless of social desirability. This separation gives the chance for operators to generate revenues and distribute risks on Life Cycle Investment.

The European Union realized that they could accomplish economic efficiency by embracing physical innovation. Considering SG technologies as an opportunity, governments do not have to protect generators from market risks in return for contracts or subsidies. This brought the discussion of embracing a Mandatory Competitive-Pool Model, which grants the liberalization of electricity trade. The reason behind the ongoing discussion of a Mandatory Competitive Model is the belief that it will diversify products and services allowing a sensitive wholesale price. What made the discussion of shifting from the single market regiments appealing is that the Mandatory Competitive-Pool was in line with the EU “Target Model” Plans. With this new paradigm shift the EU can achieve their “Market-Coupling” plans. Allowing generators and distributors in neighboring countries to sell and buy from the pool at ease (Keay 2013). The

European Union shape their perspective on liberalization around more services and lower prices, which considers the benefits of the end consumer. This is only possible if energy companies compete for customers with new market components. The liberalization goals encompasses internal and cross border competition under desired interconnected capacity, which is difficult to achieve with in the current market condition. (EC, COM (2015) 80 final, 2015). The interconnected capacity refers to a market that is able to identify cost reflective pricing, which reflects the variations in efficiency, cost structure of transmission and distribution networks. While being able to provide sufficient levels of security of supply (Jamasb, Pollitt 2005).

The EU vision of a consumer centered wholesale competition requires effective separation between transmission operators and generators. As a result this will increase the price of conversion and requires a unified technological frontier. The SG technologies attend to these goals, creating a frontier that is accessible to all market components. Most importantly deals with the elasticity of renewable energy resources in comparison to conventional ones. Especially in the short-term perspective of a Day-Ahead Market (DAM) and Intraday Market spot pricing. Smart grid technologies are centric in attending to data requirements for increased efficiency. Optimizing shared balance services across borders and electricity market integration (Newbery, Strbac et al. 2016). Despite the fact that SG technologies attend to the sought after EU goals. The complexity of the shift is technically and economically cumbersome. Apart from that, the argument of power over the new frontier is still unresolved yet. Simultaneously it is even harder to get all parties involved to agree to it, since the current market is structured in a top-down fashion.

3.1.5 EU Smart City/ Utility projects

IBM defines Smart cities as cities that are able to measure and influence more aspects of their operations. This is fulfilled through allowing technological advancement to facilitate the collection of more data points by permitting a free flow of information from a discrete system to another. The technological advancement of cities helps in increasing the interconnected transformation of the overall infrastructure (Dirks, Keeling 2009). That being said, it is important to stay vigilant to the fact that a smart city is a large organic system that depends on the integration of physical systems. It is a combination of instrumented and interconnected systems, which links physical systems to interactive systems. The interrelation between smart city core systems creates a "system of systems". Therefore, it is pivotal to view Smart cities as systems linked and relate to it as an organic structure (Moss Kanter, Litow 2009). A smart city

is an advanced stage of intelligence, where cities demonstrate strategic abilities to manage integrative innovation deployments (Deakin, Al Waer 2011). Therefore, smart city complexity applies to fuzzy concepts since it is an "urban labelling" phenomenon. This includes three core dimensions of implementation (human, institution, technological) (Chourabi, Nam et al. 2012). For that reason the EU horizon produced a lock in perspective in what they referred to as (Smart Cities and Communities lighthouse projects). The EU highlighted the social aspect of their projects (SCC-1-2016-2017)[10] to illustrate the very near to market strategies. This understanding was formed as a response to solutions at a district scale integration of smart homes, buildings and smart grids (electricity, district heating, telecom, water, etc.). The EU stretched their understanding to pave the way towards combining energy storage, electric vehicles, smart charging infrastructures and latest generation ICT platforms. As a result they managed to niche smart city labelled energy applications and differentiate it from other concepts that are also associated with energy efficiency, for example: circular economy labels that are adjacent to energy efficiency.

The basic understanding of a city is that it is a living creation in a continuous flux, with people governing its flux and activities through facilitating technologies. Accommodating people and nurturing the scene of society is important, while considering their economic activities is extremely vital for its success. The interdependability of each element on the other generates the feeling of human settlement (Chandler 1987). Smart cities concept revolves around measuring and stream lining operation through technological facilities. Therefore, introducing technological advancement to collect more data points between people and their economic activities is crucial for boosting their inter-connectivity. The increased inter-connectivity will simultaneously have a systemic effect, through allowing the free flow of information from a discrete system to another. The successful implementation of these features should altogether cause the effective transformation of the city infrastructure. A smart city provides a sustainable and efficient solutions for both citizens and businesses, which increases prosperity and continuously allowing them optimal use of the city finite resources (Albino, 2015).[11] Therefore, the strategic market transformation and economic success of Integrated Urban Development Strategies relies on the successful human element inclusion.

[10] Horizon 2020 Work Programme 2016 -2017. 17. Cross-cutting activities (Focus Areas). (European Commission Decision C (2016)4 614 of 25 July 2016).
[11] IBM smart city vision https://www-03.ibm.com/press/attachments/IBV_Smarter_Cities_-_Final.pdf

Nevertheless, the physical space between people and companies continues to disappear in modern urban spheres. Technology created closeness enables the interplay between both pillars of the economy. The success of this fusion depends on the demand of actual connection playing a vital role in developing a gateway between culture and markets (Glaeser 2011)[12]. These elements bolster the idea of a system challenge that needs an organic solution. The views adopted in constructing the smart city and smart grids follows a top–down order. It is mechanical in principle since urban designers view it in a physical approach (Kostof 1991). The mainstream urban and technological planner's digestion with available technologies is restricting. They continuing to treat cities as elements that are previously measured, characterized by the ability to manipulate and optimize toward calculated efficiency. In that sense they believe that the system equilibrium they created is equitable (McLoughlin 1969), (Perloff 1970). Smart grid technologies are also facing the same problem, as it is a part of the current models of urban governance and synergistic system approach. Focusing on specific controllable and the physical ecology of the system (Lang 2009). This contradicts the proposed civic centered benefits of the EU smart city ecosystem. Let alone the whole ideals of the smart grid as an empowering platform. Therefore, efforts should focus on redefining SG urban development as evolutionary rather than systemic. Geared towards more than a piece of skillful engineering system, which should yield more than a satisfactory optimization and successful planned economy. SG urban ecosystem should be treated as a social organism and a work of art. Proffering technological instruments to support natural evolution as an outcome of all component (Batty 2005a, Batty 2005b, Batty, Marshall 2009).

[12] https://ec.europa.eu/research/participants/data/ref/h2020/wp/2016_2017/main/h2020-wp1617-focus_en.pdf

3.2 The Physical Technology Transition

The smart grid transition is an electricity market upgrade towards lean data management and less supply and demand information waste (Corbett, Chen 2015). This provides energy market participants with smart controls, which supporting ancillary services and network expansions. SG technologies materialize the EU sought after smart power market in the path of market coupling (Neuhoff, Boyd et al. 2011)[13]. Hitherto, various researches revised the EU "Target Model" aggregate energy trade function for TSO and DSO with smart grid (Neuhoff, Ruester et al. 2015). There is little focus on the role of ESCOs as a balancing actor of the SG transition. Despite the great influence and pressure they practice on both policy and market operations. In this part, we will attempt to illustrate: What are the elements that concerns ESCOs in the transition? How do the retail companies and ESCOs operate? To farther, understand the boundaries and limitation.

3.2.1 The Role of ESCOs

ESCOs are companies that conduct various business activities delivering energy and utility services. The EU EED description profiles ESCOs based on their level of participation in the market (Energy Efficiency Directive (EED, 2012/27/EU). The size of business and operation often instruct what is an ESCO is depending on the region (Marino, Bertoldi et al. 2010). ESCOs therefore, are companies that handle risks providing sustainable energy services to their consumers. They are often in close associated with energy efficiency programs. They grantee the provision of supply under specific costs to the energy retail market and consumers (Bertoldi, Boza-Kiss et al. 2014). The Energy service sector fashionably functions as a medium, they deliver comprehensive turnkey energy efficiency services. They are paid a percentage of the saved energy based on indexed measures on performance. Therefore, they often involve in identifying, developing, designing, constructing, owning, financing, maintaining, and monitoring. Farther to insure reducing electricity and other energy costs (Bullock, Caraghiaur 2001). Should we be able to understand the systemic rational of ESCO adopting to SG transition, we are ought to understand the business models they operate under.

Energy Performance Contracting (EPC) is the major ESCO business model used. It capitalizes on the monetization of the client intangible energy efficiency improvements. These improvements are then transformed into tangible cash flows to the energy service company.

[13] https://climatepolicyinitiative.org/wp-content/uploads/2011/12/Smart-Power-Market-Project-Overview.pdf

This business approach allows ESCOs to distribute their risk over uncertainty (Vine 2005). The EPC has three types of practices under energy efficient performances (Langlois, Eng et al. 2013):

1. Shared Savings EPC: ESCO finances the total capital costs of the project; sometimes they can incorporate a third-party financier. This type is common used if the client is a utility company or a local institution.
2. Granted Saving EPC: ESCO have no financial liability. Clients bear the costs and only ESCO reimburses the client in cases of under-performance in energy saving of the project.
3. Chauffage: "The Greater Value-Added Approach" is a supply and demand contract offered by the ESCO, often the Client pays for the supplied energy. While ESCOs continue owning equity of the energy facility contracted for.

Financing is very much related to portfolio analysis and risk. Therefore, it is beneficial at this point to understand the financial structure. ESCO structure is made up of about 50% long-term debt, 45% common stock, and 5% preferred stock, while projects are usually managed on a long-term intervals. Hence, the high uncertainty nature of Energy Efficiency Projects (EEP) prevent ESCOs from getting access to insurance services. Therefore, they often self-insure since the financial nature of the business can seem to be complex and risk factors are high (Bullock, Caraghiaur 2001). The ESCOs also often aim to minimize risks over investments referred to as "Derisking", which involves various processes to insure financial continuity. The procedures involved are (Short, Packey et al. 1995):

1. Developing Net Present Value (NPV).
2. Total Life-Cycle Cost (TLCC).
3. Levelization.
4. Unadjusted & Modified Internal Rate of Return.
5. Simple Payback (SPB).
6. Discounted Pay-Back (DPB).
7. Benefit/Cost (B/C) Ratios.
8. Savings /Investment Ratios (SIR).
9. B/C Ratios related to Integrated Resource Planning.
10. Consumer/ Producer Surplus Analyses.

These procedures are important to encourage investments operating with in "Energy Only Markets". ESCOs synchronize their investments within guidelines of the European power

market regulated capacity payments for reimbursements. The major drawback of a very structured financial tools used by ESCO are:

1. **The Equity Finance Approach:** balances their cash flow to reduce future uncertainties. Simultaneously fortifying their derisking over energy efficiency projects.
2. **Scalability and lack of standardized strategies** due to the nature of their business.

It is important to highlight that community and resident consumers are just a small segment of ESCO business, yet this segment holds the greater Risk-Shifting with in their portfolio (Bertoldi, Boza-Kiss et al. 2014). Therefore, ESCOs often treat the social component (community and residential consumers) as a liability that increases their derisk efforts. To overcome that various large size ESCOs and Vertically Integrated Utility Companies resorted to either creating Energy Service Provider Company (ESPC) or push for M&A practices. The ESPC alternatively provide services for a fee and take no risks, allowing ESCOs to better manage their risk and mitigate revenues over time. This capital approach of practicing market dominance proved efficient until recently. The EU energy market components are transforming their business models to cope with the maturity of renewable energy generators. While ESCO strategic coping is still taking place, the current electricity market is becoming a “Bull Market”. This transformation forced them to aggressively get involved in RES investment, which adds to their uncertainty and caused their business alignment to change. As a result EU decentralization plans continue to struggle in achieving increased benefits to consumers.

SG technologies is introduced to farther enable the deregulation of the EU electricity market and balance competition. Hence, the Smart Grid introduction to the EU energy market mandates unbundling services. The unbundling ignores the vertically integrated nature of electricity related services. This means, that the production-consumption flexibility flux will fall out of the ESCO control in favor of whoever operate the smart grid platform. From the ESCO point of view, this will increase the consumers challenge to the top-down control logic of the traditional power supply. Giving more reasons for consumers of all sizes to produce power by themselves (Schleicher-Tappeser 2012a, Schleicher-Tappeser 2012b). Their concern revolves around the Smart Grid technologies technical functions associated with service unbundling. They believe it provides loose control features, which facilitate an increased autonomous involvement of citizens, increasing their entrepreneurial practices in the shape of prosumers. This is often referred to as "Aggregation of Consuming Communities" (Cavraro, Caldognetto et al. 2016), which causes a foreseeable increase in the amount of strategic risks to ESCO and

leverage their financial uncertainty. Simultaneously, as i-RES generation increases from the social component it correlates with the increase of social ability to form trading entities. This in their point of view causes what is referred to as the Grid Parity (Breyer, Görig et al. 2011), which is seen as problematic by the stakeholders of the transition and current energy trade markets. Unfortunately, ESCOs continue to deal with the growing momentum of social Distributed Generation (DG) and co-generation from the consumer services perspective. Continuously considering social generation as part of their energy efficiency frameworks. This is due to the fact that in various EU countries ESCOs own part or entirely own the grid. Nevertheless the policy trend supporting SG social transformation and available technological innovation is pushing towards social sufficiency. Therefore, ESCO's retaliate in the means of practicing pressure and increase the boundaries for including new social elements.

ESCOs & Demand Side Management

Demand Side Management (DSM) is a tool used to plan and implement various electricity physical activities. ESCO's uses DSM to generate desired load shape to meet efficiency goals. Fundamentally, ESCO's apply their business models on consumers regardless of their size. Forcing a unified treatment to their consumers to ensure profitability and projects scalability. ESCOs uses DSM to farther design and influence consumer's behaviors to fall into their desired efficiency (Gellings 1985). DSM designed balances in that sense insures a successful Return of Investment (ROI). The introduction of SG technologies causes ESCOs to stretch DSM tools to keep it with in their control. Demand-side Management (DSM) is increasingly becoming an umbrella term not limited to electricity. It also incorporates the management of energy of all forms adjacent to the conventional demand aspects. In other words, DSM encompasses all products and entities involved is energy activities including Natural Gas (LNG), government organizations, nonprofit groups, and private parties (Gellings, Samotyj 2013). This is an attempt from the conglomerate to nullify the unbundling outcomes of SG. Farther limiting SG technologies empowering features.

A farther understanding of DSM is needed to allow a better understanding of Smart grid transition. DSM contribute to SG physical transition through its five pillars in energy planning as explained by (Gellings 2009):

1. Influence consumer use.
2. Purposeful acquisition of overall project objectives. Including (reduction of rates, customer satisfaction and reliable target achievement).
3. Successful integration with supply side management parties (Integrated Resource Planning –IRP).
4. Consumer response Identification, not designed response.
5. Load shape shifting and technical balance of the system.

The figure bellow illustrates how DSM works and what aspects it handles from ESCO perspective:

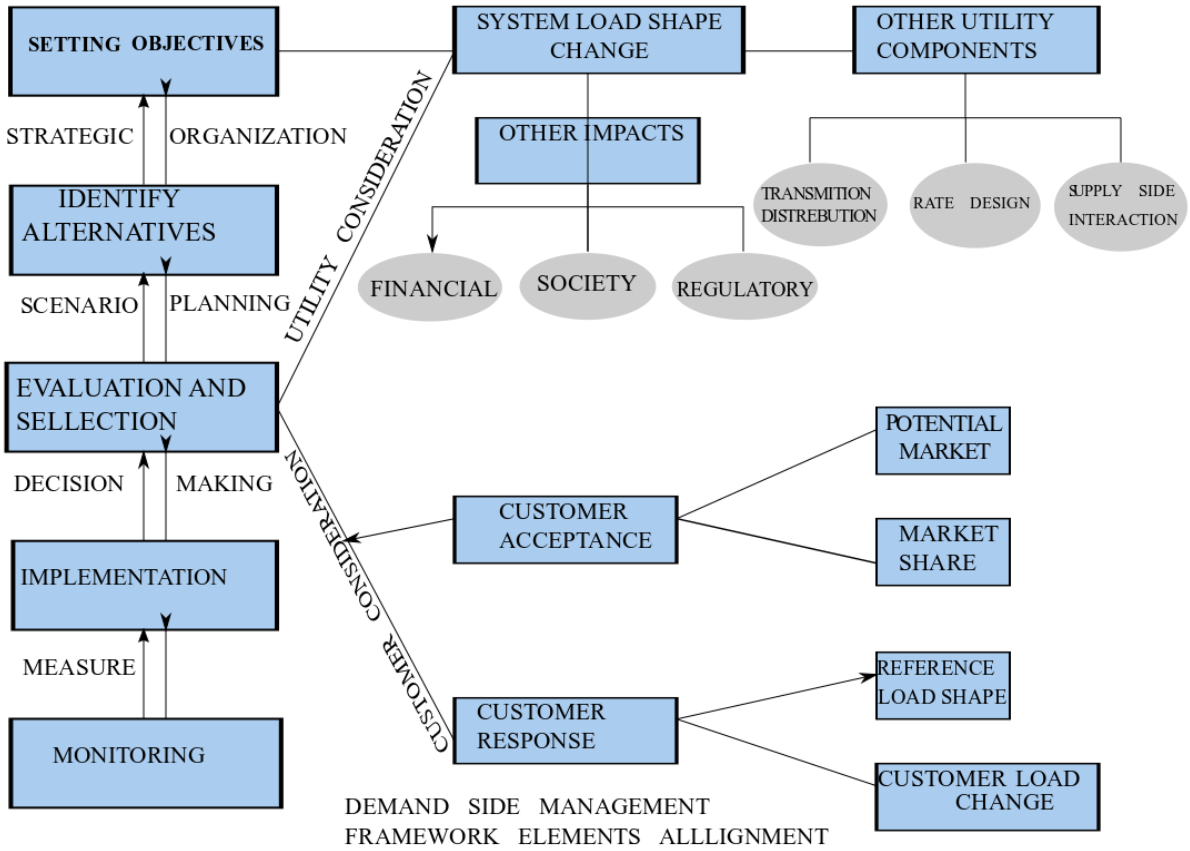

Figure 2: DSM Framework and market elements. Source: Handbook of energy efficiency and renewable energy (Kreith, Goswami 2007)

Figure 2. depicts the goals sought after from the physical perspective of DSM, which can be seen on the left. Energy operators often employ pragmatic orientation to set scenarios and strategies that are closely interconnected to fulfill the critical components of DSM. The utility understanding of objectives and constrains include long term forecast in order to identify and evaluate the demand and supply chains. The ESCOs term for that is “Integrated Resource

Planning", which helps them set their production costs and later determine rates. The decision making process is often made after the evaluation phase, where they balance between both their corporate and consumer goals. The utility consideration as seen in the model is mostly Physical-Financial in nature since it deals with electricity supply vectors, which gives them means to negotiate with governments on achieved goals. On the other hand the customer consideration part of the plan can be seen as purely Strategic-Competitive since it deals with the market. This insures their market position and market share through the customer's success in the implementation phase. Therefore, ESCOs often rely on that part of the plan in determining the methods they will use with their consumers. These methods can range from (educating the customer, direct customer contacts, trade ally cooperation, advertising and promotion, alternative pricing and/or direct incentives). As we can see from the methods they all revolve around the ideals of fitness. The measures are set based on the customer acceptance through marketing and demand response through physical control and reward schemes.

The importance of DSM framework as a tool is that it enables combining functions (planning, implementing and monitoring). ESCO capitalizes on DSM to fix their physical system anomalies (Strbac 2008):

1. Reduce energy generation margins (Efficiency Gap).
2. Enhance their transmission grid investment and reduce system entropy.
3. Technical boost of distributed network investment efficiency in other words (energy leveling).
4. Renewable Energy Optimization:

    a) Deal with flexibility, variability, non-controllability of i-RES generation with in their portfolios.
    b) Balancing demand and supply in a distributed supply system dominated by different forms of renewable generation

All the activities above envelopes energy consumers and participants. In an increasing tendency to modify their electric usage patterns and outcomes to meet the ESCOs demand goals. These activities enable communication to flow between the energy supplier and their consumers, with the intention of managing the demand on the energy infrastructure. However, this is generally not appointed as a major variable of DSM to a great extent (Gellings, Samotyj 2013). The above reveals the nature of DSM as a single party empowering tool to manage projects, adhering to previously set objectives. The Physical system operators often like to think of DSM as a solution

on its own to a system problem. Albeit it is a set of techniques integrated together to serve a purpose. It is pivotal at this point to underline the verticals DSM Integrates:

1. Energy Conservation and Efficiency Programs - often used for contractual consumers.
2. Demand/Load Response Programs (LRP) - scheduling and streamlining consumption of normal consumers.

It is also equally important at this stage to accentuate the two market based techniques governing ESCOs DSM use (Barbato, Capone 2014):

1. Contingency Programs or Emergency Demand Response program (EDRP):

A none-consumer sensitive program. Addressing supply shortages, or/and insufficiency in the electricity system. Its goals are to prevent blackouts such as (load limiters and frequency regulators). In other words, a mean for allocating and controlling supply resources.

2. Market / Price Based Program:

A consumer's sensitive program. Here service models are often designed based on consumption. Where effectiveness of the program cost takes place using "The Societal Cost Test" (SCT). Capitalizing on the electricity market price signals. Based on Rates/Real Time Pricing (RRTP), Time of Use (TOU), interrupted rates and demand bidding.

Smart Grid technology and DSM

To recap, SG as a set of technologies propose answers to some of the problems facing ESCO's transition. Alleviating some of the rigidity and normative approaches interacting with DSM tools in the following manner (Strbac 2008) & (Gellings 2009):

1. Deal with the lack of ICT infrastructure by introducing a comprehensive analysis. Farther supporting their cost benefit rational. While Smart meters introduce a wide-ranging of granular level information and communication.
2. Transform DSM from an industry based tool to a widely routine practiced by consumers.
3. Introduce competitiveness to DSM programs and bolster ESCO efficiency goals.
4. Assist with reducing the complexity associated with ESCO corrective control approach
5. Alleviate constraints imposed by the physical design. Shifting it from top down models to bottom up. Coping with new competition from Distributed Generation (DG).

6. Devise DSM with a dynamic facility. Replacing the individual demand response programs with a single service. Offering consumers, a better mean to manage their electricity load and compare their practices.

ESCOs & Demand Response (DR)

Demand Response (DR) is an economic tool used to determine the capacity value of resources. It is often used by ESCO to formulate efficient price signals. Moreover, it provides ESCOs with indicators for decision-making. It tells them if they should invest or not in a capacity and with what level of administration. DR therefore is considered a tool to appropriate standards towards desired equilibrium states. ESCOs refer to DR as a set of strategies to interact with consumers under the concept of price responsiveness. In this sense DR farther motivate demand reduction and manage dispatched capacity (Pfeifenberger, Spees et al. 2013). ESCOs major advantage of using DR strategies is to maintain the economics at optimal levels. This is often undergone through two different techniques:

1. **A Physical Technique:** Emergency DR with call-hour limits.
2. **A Market-Based Technique:** Economic DR with bid caps.

Based on these elements they structure their consumer service programs under two different groups:

1. Price-based demand response program.
2. Controllable demand response programs.

The EU and the Smart Energy Demand Coalition (SEDC) definition of DR is more towards the policy amplification of smart energy / smart utility goals. DR to them is a formulated tariff program, which is guided by incentivizing changes in electricity consumption patterns. Aimed at enabling responding to fluctuation in prices of electricity over time or/and design rewards. Serving the goals of inducing lower electricity use during peak load periods, consequently favoring grid resilience over consumer benefits (Coalition 2014, Bertoldi, Zancanella et al. 2016). It is obvious with this remark that policy and ESCOs uses DR in the same fashion, but with different goals. ESCOs uses DR programs for derisking purposes, shifting risks of use to consumers. While policy try to comply with to ESCO strategies, urging consumers to express knowledge, be aware of their consumption, and protect their choices. In other words, pushing consumers to be self-regulating on behalf of the system stability. Social energy knowledge become materialized as a topic of inquiry. Fundamentally knowledge has two unfolds/ levels that is relevant to DR program. This converts social operations under two categorized:

Implicit DR: Governing residential consumers and customer choice. They are not considered in the market mix. Even if they are participating consumers (prosumer) unless through an aggregator.

Explicit DR: Governing ESCO clients under the EPC schemes. Structuring remuneration based on achieving efficiency goals. Paying them incentives on their generation if there are any. Forcing them to comply with ESCO Cost/Benefit models to insure their profitability.

Even though ESCO's or energy retailers do not favor engaging in DR activities. There are times where they have to, under specific conditions to achieve specific outcomes (Langlois, Eng et al. 2013, Bertoldi, Zancanella et al. 2016):

1. Elude complex dynamics of the system. To avoid having to deal with new market element often referred to as "capacity administrator".
2. Keep scarcity pricing and Resource adequacy paradigm of the industry. Allowing easy retainement of various aspects of market efficiency.

Well established ESCO who do seriously involve in DR, often perform it to overcome challenges of reduced volatility of wholesale market prices. This actually means that they practice negating the market price signals to prevent momentum trading by competing renewable energy. By doing so they prevent removing the value of their generation portfolio, forcing the market to a conservative balance.

Smart Grid Technology & Demand Response

To recap, DR is increasingly seen as an innovative approach, brought forth to introduce lean and dynamic characteristics to Energy markets. Even though DR is not commercially active in the whole EU electricity markets in trading upward or downward consumption flexibility (ENTSO-E 2015).

Various literature addressed DR as an independent solution towards a better service and pricing especially in the EU, which I would argue against. Therefore it is important at this stage to access this statement from the whole system perspective. Alternatively, policy makers are ought to address DR innovation for what it really is. DR should be seen as one of many components of DSM. DR as a component serves in providing a dynamic improvement to alleviate power system stochasticity. It is not an independent solution (Gellings 2017). That being mention, there are various benefits of running DR techniques under SG DSM. Which is relevant to EU ESCOs resource adequacy perspective (Hogan 2013, Hogan 2015):

1. Integrating voluntary exchange consumers in Energy only markets. Through incremental actions to improve prices.
2. Reduce the impacts of price spikes generated from explicit reserve demand curve and VoLL costs.
3. Permitting multiple reserves in the demand curve.
4. Decrease future coasts introduced by including aggregator operations.
5. Increase reliability and insure grid resilience.
6. Removing ambiguity caused by differentiating between economic pricing driven by the scarcity pricing. Leverage ESCO market position through lowering prices.
7. Provide a better derisk approaches to protect ESCOs from hedging in electricity trade.

Smart Grid Innovation and Demand Response

Innovation should address the need for integrated frameworks. Energy stakeholder should invest in an integrated system, which is in line with renewable energy integration. This mandates balanced hybrid strategies of bottom-Up and Top-down, through the coupling of smart end user (Social element) devices and distributed energy resources. Creating an integrated platform for smart grid, which provides both parties with advanced controls and communication capability (Gellings, Samotyj 2013).

3.3 Socio-Technical Transition

3.3.1 SG Energy transition & Social Innovation

In the process of examining, the various literature published about Smart Grid energy transition and innovation. Especially the ones relevant to prosumers, Smart Energy technology deployment and social application. It can be obvious that there are limited attention given to the complexity of the social axiom, the social energy generation culture and prosumption. Much of the effort are rather geared to investigate "state-of-the-art" innovations, with the mindset of instructing people how to adopt to it. Continuously treating most of the social science innovation postulations as secondary, which is considered a display of a disciplinary bias. Stakeholder's priority is focused on physical science illustration, engineering application and rigid *ex ante* post Keynesian interpretation of the Principle of Effective Demand (Hartwig 2007). This continuously contributes to making the transition and energy innovation complicated to grasp, while increases the homogeneous nature of the representation of the topics. Ultimately impeding open innovation efforts in the energy topic and its social technological application (Sovacool, Ryan et al. 2015). The heavy emphasis on outdated Physical-Technical-Economic Model (PTEM) (Starr, Searl et al. 1992) is visible. Narrowing down the efforts of innovation to the physical systemic framing, incentives and taxation (Lutzenhiser 2014). Framing is beneficial but single framing cripple's progression. If we perceive the above mindfully from the innovation management perception, it only contributes more to horizontal innovation rather than endogenous innovation.

There are growing benefits in including a non-physical view to smart grid social deployment. Provides policies with social benchmarks to achieve social integration in energy system. Limiting the coincidence strategies often followed and instructed by alarms from physical stakeholders. Increased social acceptance at early stages of technology development influencing trust and preventing diversions. Significantly improving the impact of designed policies to assist different energy stakeholders to reach their goals from the adoption. While keeping social decision-making processes with the desired balances. Social dynamics are often similar in their creations and this gives the ability to generalize findings for wide applications (Stern 2017).

Most of the innovation within the Smart grid technologies are technical oriented. The current direction of R&D efforts geared toward fortifying the physical system. Considering human factor involvement as disturbance to its stability. From the innovation paradigm, it is important to note that after concluding the development innovation diffusion and innovation deployment

takes place. Both processes depend on the social and human capital digestion. The innovation adoption, which happens after the deployment, produces a series of innovation. Innovation adoption is vital for innovation to self-sustain and be useful. Different rates of adoptions and yielded characteristics represent the people responsible for it. Understanding the human morphology over SG technology is a catalyst element in making innovation reaches a critical mass (Rogers 2003). "The technology Gap" is a result of an autonomous adoption of the social elements that influences growth. This ideal was explained by Veblen analysis on the machine process and technological change (Veblen 1914) and later articulated to complex sciences by Moore (Moore 1975). It is also referred to as "Creative Destruction" by Schumpeter (Schumpeter 1954), which is also later supported by (Fukuyama 1999, Fukuyama 2001) postulation on "The Great Disruption". While Romer provided a sound analogy of what he referred to as "Idea Gap vs Object Gap", extending the concept to explain what can closely describe the SG technology situation today. Romer illustrated the split between the economic understandings of two group of patterns of economic thoughts. The main factor he relies on is the availability of knowledge, based on that he shared reasons behind the competition (Romer 1993):

1) The increasing trends of price taking and the demise of ideas in the system.
2) The extreme reliance on mathematics increasing the price taking competition.
3) Assuming that technological change and innovation are exogenous.

The above largely explains the case of the system parity between the ESCO and Prosumers on SG technology innovation.

3.3.2 The rise of "Energy Communities" competition

Excessive technological change and the demand for innovation brought forth by SG technologies. Especially with the granted ease of access to more information and communication technologies, the SG facilitates. Policy makers and energy stakeholders were confronted with the rise of knowledge-based socio-economy, which is coupled with community-based models. Realizing that this will continue to reshape the way people interact with the system subject for altering. Moreover, the social tendencies to form networks to communicate and facilitate their lives will expand with their access to technologies. They will increasingly participate in forming smart communities and smart social governance to facilitate their needs. Technology incumbents on other hand have a great interest in shifting to the

importance of cities and the opportunities entailing citizen engagement (Coe, Paquet et al. 2001). Due to that ESCO's and "Incumbent Utilities" were the first to adopt to the renewable energy and Smart grid technologies. It is evident that they are keen on the successful implementation of the Smart Grid. Although, their motives were toward investing in an inefficient power market. They can still see the potential incentive in connect their renewable assets with various DG resources, including social generated ones (Borggrefe, Neuhoff 2011). Therefore, ESCO's perform market intervention tools materialized in "obstruct and exploit strategies". They are confident of their ability in keeping the market controllable by using various physical tactics to balance markets at profitable rates such as: 1. Restraint power flows. 2. Maintaining electricity trade markets opaque to new entrants. These practices are majorly employed to limit the emerging competition the technology incumbents bring to the energy landscape. Unfortunately, the only element that is affected by these strategies are the social energy participants. Whom are often looked to their generation as voluntarily participation.

Appropriately one of the major concerns of EU policy makers is the urgent reform in the EU energy sector. Accelerating the shift to the competitive market requirements set by 2020. Therefore, an urgent energy sector reform is needed to meet EU smart growth index mandates. A fast implementation of smart grid will contribute to driving costs of renewable integration down. Through furnishing a more integrated networks and interconnected resources. To overcome large pockets of inefficiency found within the system. EU energy efficiency benefits greatly from the increased social inclusion. The EU referred to them as "energy inclusive societies", which allows more access to social economic activities and increase social energy prosperity (Gros, Alcidi 2014). These elements were the corner stone to the (2017/C 034/07)[14] directive. Focusing on the value of increased social equity and social ownership of i-RES and the technological advancement needed. The rise of social competition in the energy sector relevant to ESCO contexts of competition. Are prevalent in four different concepts supported by the EU:

1. Energy Prosumer.
2. Energy cooperatives.
3. Energy Union.
4. Energy Communities.

[14] European Economic and Social Committee on 'Prosumer Energy and Prosumer Power Cooperatives: opportunities and challenges in the EU countries' (own-initiative opinion) (2017/C 034/07)

It is important to note that the EU policy documents group these components under electricity prosumers (Sajn 2016). This can be understood from the way EU regulators perceive consumers in the context of "Green Energy Participants". EU regulations socio-behavioral understanding of prosumers activities under SG are explained through using two major theories, which are associated with environmental adoptive actions (Mengolini, Vasiljevska 2013):

1. The theory of planned behavior based on expectancy value theory, which reflects the capacity of their ability to perform.
2. The norm activation model, which is more entrenched with the view of self that is relevant to believes and in close association to societal values.

This provides them with means to illustrate active prosumers or energy participating consumers interaction with SG projects in the EU. Especially through community DSM and their engagement strategies. Results shows that the emerging trend provisioning prosumption feedbacks were economic based on self-gains. They tend to amalgamate individual oriented approached in to community oriented approaches to better benefit from their efforts. (Mengolini, Gangale et al. 2016). This finding farther supports the theory of Energy Return on Energy Invested (EROEI), which again falls in to a physical illustration of the second law of thermodynamics. This sums up the fixation of EU narrative to adhere to the physical understanding even on the social level.

3.3.3 Energy Participating Consumer "The Energy Prosumer"

The energy prosumer is a consumer who produces electricity primarily for his or her own need. Some of them do have the expectation of selling their excess energy generation as well if they produce enough. They connect to the distribution network with small to medium installed capacity. This definition is valid for all size of prosumer activity and their various applications including those who operate micro-grids / community DG (EURELECTRIC 2015). The EU refers to energy prosumers whom are not involved in commercial energy production as "Energy Citizen". In this regards it is potentially expected by 2050 that 83% of the EU's households are to be operated under energy citizens, which will comprise roughly 187 million households. In other words, they will be involved in RES generation, undertake DR activities and/or energy storage. This breaks down into 113 million of potential energy production unite in the Negawatts segment. With SG technologies they will expect to favorably extend their electric

vehicle to provide demand flexibility, smart e-boilers and stationary batteries (Kampman, Blommerde et al. 2016). This includes four energy citizens' categories:

1. Individuals or households producing energy individually.
2. Individuals or households producing energy collectively.
3. Public entities.
4. Small enterprises.

This rational in devising prosumers based on the size of their contribution, while at the same time continue treating their economic input from the lens of "voluntary exchange". Will further keep regulators stagnant on means of compensation or financial rumination schemes. Therefore, so far prosumers are still being treated on reward and incentive fashion as following:

1. **Net Metering:** prosumers feed excess electricity into the grid and consume it later when they need to, paying only for the net difference. This is close to the concept of "spinning reserve" in energy market.
2. **Feed-In Tariffs:** Technology specific prosumers pay the retail price for the power they consume from the grid. Often offered a long-term contract, paid through kilowatts on the electricity bill. This include rapid and decreasing rate changes or yearly compensation with limited sealing. In other words, a "hedge contract".
3. **(FiTs) Feed-In Premiums:** European commission short-term market exposure of RES Electricity. Encourage RES producers to produce electricity when and where it is needed. As well as to make their production more efficient
4. **(FiPs) Competitive Auctions & Requests for Tenders:** This segment need to use the services of an aggregators or intermediate. Meaning that so far residential and small prosumers are not allowed to bid. This is attributed to the high costs of transactions.

The above only bolsters the continued practices of non-market-based net-metering schemes. Along with balancing costs excluding prosumers from full market integration. Smart Grids coupled with smart meters should allow prosumers to measure their participation in both production and consumption. Enabling them to separate their efforts base on the pricing of their excess electricity on the varying wholesale prices. Not failing to mention that these schemes are also in conflict with the optimization of consumption, generation and storage. Besides the inability to provide a sound framework for developing services for prosumers. Hence the fact that prosumers also practices their "customer choice". This gives ground to project prosumers interaction with their electricity in a cost –benefit attitude. Regardless of their size of energy generation.

3.3.4 Energy Prosumers and Smart Grid Transition

Energy market stakeholder including ESCO's along with energy policies still follows the (upstream) mindset of forecasting consumption in dealing with RES prosumers. Their perception is still dominated by Physical Technical Economic Model (PTEM), where they consider the behavior of human occupants of the system secondary. Relying on algorithmic analogies built on thermodynamics and technological efficiency, which assumes that consumer's and their derivative patterns are part of the hardware infrastructure. The focus on billing and costs usually substitutes the need to understand the relevance of areas such as the cost-effective outcome from the system perspective, human priorities towards services, convenience and well-being (Starr, Searl et al. 1992). Due to these reasons, they resort to provisioning and controlling in order to overcome dealing with prosumer interactions. Utilizing forced regulatory actions over the System, which can dramatically cause irreversible system disturbances (Palensky, Dietrich 2011).

Liberalization and Smart grid should not only be look at as an energy transition. Rather a technical change that transit both social inhibitors of the electricity system and its operators. It is important to make a proper alignment towards dealing with energy citizens, as part of the energy innovation hype or an energy culture movement. We are bound to bring the concept to its origin. Most of the literature about prosumers especially in the energy domain relates to prosumers according to Toffler's concept of "Externalizing Labor Cost" (Toffler 1981). In other words, shifting a significant work and risk to be allotted by the consumers in return for paying less for the services or become exempted from some of the financial liabilities. Putting consumers to work for part of their energy use or to save energy with in the efficiency framework is a materialization of "Human Work". In consequence, human techniques are developed by bringing their own ideological justification to the system. Consequently adding a new constraint on managing an additional complex element. It is important to highlight that the contact between individuals and techniques often exacerbate the public expectation of outstanding yields, which is an outcome of their placed effort and skills acquired. This illustrates the concept of a "Technical Societies" (Ellul 1964). As a result, it increases the modification of social psyche from the interrelation of techniques that serves the market equilibrium to "the equilibrium of whole man". The criteria of structural change are both inevitable and undeniable since the technical forces and the economic considerations impose them. Therefore, explicative frameworks like ones furnished by policy makers and business

conglomerates often are considered of mono-disciplines. While mono-disciplines cannot be pertinent tools to understand social development under the technological change. SG and prosumers should be looked at as a hybrid system development (Ellul 1964, Yolles, Frieden 2005).

European ESCO's and electricity retailers follows a segmentation tools that is category based. "GfK Energy Mentality Model" represent products offering based on consumer life style. The model uses martial and post material description to generic needs, which is a pure economic categorization. The four vertical of the model describe (Materialism –price oriented, Puritanism-security, Post-materialism- quality, Hedonism – passionate and pleasure) (Enke, Geigenmüller et al. 2005, W_stenhagen, Wuebker 2011). Despite segmenting consumers on their values, it does not reflect motivational outcomes and action patterns of each consumer group. This can be limiting in evaluating prosumers 'consumer choice" expectation. These consumers often associated with energy efficiency practices and some even take part in DSM activities. They possess a duel cognitive process. Since policy address them as part of the green energy and sustainability movements. It is suitable to refer to them as Green consumers at this stance. Green consumers decisions were found connected to self-efficacy. Interestingly it is the same self-utility concept that most of the energy conservation strategies drew on for the past 30 years in sustainable targets. The self-efficacy often encompasses (self-monitoring, Self-esteem and self-preference), which is often geared towards an outcome expectation that leads to a behavior (Lin, Hsu 2015, Ozaki 2011, Ozaki, Sevastyanova 2011). Self-efficacy is rather a process, which includes:

1. Perceived ability.
2. Comparison influences from social surroundings.
3. Framing and feedback.
4. Perception of controllability.

Those processes not only contribute to self-sensory actions. They also lead to motivation processes that correlate with activation behaviors. Farther producing inter and intra processes with in the self-effective system (Bandura 1993). Therefore, to stay grounded to the concept of competition and meta-behavioral analysis. It is much suitable to address the technological change and SG technology social adoption from the self-activation systems that reflect the social transition. The adoption of such lenses should yield a much fitting mean to segment prosumers and green consumers in transition.

Energy Prosumer under SG technologies should be recognized for what they truly are. As a social technical change not as part of a physical change. The SG social interaction subject is formally build on aggregating patterns. While this persists as a factor, SG will provide a chance for autonomous self-organization behaviors. This does not mean that self-organized systems are optimal in functionalities. Those social systems that are dependent on human decision-making processes involving information, often shows how resilience form within the limitation of the system. The ability to manifest gross biases and inefficiency reveal its physical adaptability. With the support of these abilities, they form self-sustaining activities. Ideally, this can support the fact that highly organized systems create disequilibrium over time. In other words, disequilibrium means that self-organization maturity over time and space moves away from proposed steady states and always far from equilibrium (Batty 2005a, Batty 2005b). Based on the previous illustration, energy prosumers should be classified to address the sociocultural dynamics. If policy makers are serious about addressing prosumers appropriately, policy should focus more on the identifier cultural attribute concept (Yolles 2002, Yolles, Frieden et al. 2008). Prosumers are not supposed to fall into categories based on their production. Rather they should classify under two major groups that interrelate in different manners. This is focal to facilitate the process of humanizing techniques for SG illustrating the polarity of values in human systems.

3.4 Physical- Technical Fixes for Socio-Technical Innovation

Emerging solutions with in Smart Grid evolution and Smart energy innovation tend to revolve around two major rationales or mindsets. Both are adequate for renewable DER and social incorporated dynamics of DR. Most of the technical solutions provided under energy innovation continue favoring physical approaches. Bellow we illustrate both streams and solutions:

3.4.1 Trans-active Energy (Socio-Physical Fix)

The solution capitalizes on the concept of dynamic integrated DSM. It stretches the DSM tools to form a market that facilitates incentives provided by ESCO and market operators. Considerably encouraging third parties in this context prosumers to bring DSM opportunities forward. Trans-active Energy envisions a multi-dimensional market wherein consumers, utilities and providers of all types can transact with anyone in the energy marketplace. In this proposition, DSM which is a tool familiar to ESCOs and energy stakeholders remains a centric element in the development. The successful transition to adopt to this solution requires full cooperation from ESCOs. It is important to consider their financial arrangement and risk factors. Allowing them to outline a new set of Value at Risk (VAR) than the ones in the existing power delivery infrastructure. Theretofore, innovation should aim at exploring transaction arrangements, which insures a smart adoption to smart grids (Gellings 2017).

3.4.2 Introduce Aggregators to the market (Physical-Systemic Fix)

Introducing a new market component to farther distribute the risk of the social component. This is the next step for EU policy to expand their market. An aggregator is a (direct/indirect) service provider who operates a set of demand facilities. Creating an electric load pool to sell as a single unit in electricity markets (Bertoldi, Zancanella et al. 2016). The solution provides a systemic answer to Smart Grid/Smart Energy-market design and trade for future flexible energy use (Volkerts, Verheij et al. 2013, Bliek, Backers et al. 2014, USEF 2015). Despite being a profound financial/Market solution, it can be useful as a ground step for liberating the market and introducing competition. The problem with this approach is that the EU will rely on ESCOs to train aggregators. Farther more aggregators will most likely be financial market specialists or commodity traders. ESCOs as a result will continue treating the participatory renewable generation as a secondary market. Continuing to give them advantage to buy cheap and sell with high price. Including aggregator profitability over distributed risks also called “Break Down pooling”. Hence, this will keep the status que and keep the prices high or even higher.

Bellow I will profile and explain the problems of the aggregator fix in favor for the trans-active fix.

Aggregate Demand Response & Aggregators

The SG technologies is based on the concept of systemic complex networks (Lee, Kim et al. 2014, Greening 2010). From this stand point Demand Response Resources (DRR) encapsulate the several features of a complex system as following (Greening 2010):

1. Leveraging ESCO capacity factors.
2. Decreasing the risks around newly introduced capacities.
3. System reliability enhancement.
4. Relieves constraints over congestion and transmission.
5. Price volatility reduction for operators.
6. Better mitigation of electricity market prices impact over consumers.

Although introducing Aggregators to the market mix can be a solution. It is important to state that it is a short-term solution. This type of strategic alignment will facilitate what is known for a “Platform Envelopment”. This means that the industry will retaliate against the increasing demand for equitable inclusion in the energy market from small Decentralized Generation (DG) and other contributors (Eisenmann, Parker et al. 2006, Eisenmann, Parker et al. 2010). Summing up Eisenmann’s postulation, it will pave the way for ESCOs and energy market stakeholders to increase bundling of services. Turning a proposition of a solution into a market entry barrier. While they will overtake pricing the platform and over rule all dynamics over it, which as a result will increase the “Multi-Homing Cost” of the platform. The previous turns SG technologies in to Platform-Mediated Network, which negates the goals sought after from it.

SG technology is a set of tools associated with a goal, which is augmenting energy capabilities to better coordinate electricity transaction and reduce costs based on acquiring accurate data. This is envisioned by bringing dynamics of Electronic Markets to the electricity domain. It is vital to remain true to the purposes of the innovation itself. This entails understanding the merits of electronic markets (Malone, Yates et al. 1987, Wigand 1997, Wigand, Picot et al. 1997, Wigand 2015):

1. Allowing increased communication of information in the same unite of time.
2. Enabling the electronic linkage between buyers and sellers.
3. Enabling an Electronic brokerage platform.

4. Enabling competitive advantages through facilitating innovative network design. Bolstering strategic deployment and cooperating between benefiting parties.

The introduction of aggregators' moves away from all sought after benefits from SG investments. Rather moving towards introducing an intermediary element to the market. Mediators will perform a profit-maximizing role to maintain traditional energy efficiency. Through reducing the costs of the transactions on one side if we are to compare it with out. Leaving the mediation phase extend without a time frame will continue bolstering the position of ESCO in the face of aggregated competition especially in the RES frontier. Allowing them to abridge the incompatibilities between the wholesale electricity market and the energy only market. Entrenching ideals of wholesale electricity markets being one-sided or locked in only on the supply-side. While overlooking the various benefits of balancing component of a price response by demand. ESCO in the EU will farther continue their bundled paradigm with disregard to the planned deregulated shift-causing barriers to the EU Demand Response expansion (Wellinghoff, Morenoff 2007).

Another opinion that supports the introduction of aggregators to the electricity market in the EU relies on reducing the increased complexities in trading process. Contributing to the standardization of electricity as a product. Simplifying evaluation and allowing the comparison of alternative offerings on the supply side. While this is true, it still has its negative impact on the market hierarchy. If they assume depending on aggregators to capacitate a wide segment of Negawatt and Kilowatt generators can pass without consequences. They should be prepared for dealing with the market losing its functionality if one of the elements drops out. In this case reinter-mediation will be needed to regain the market alignment functionality. Throughout reshuffling market components to acquire efficiency, choices or speed (Wigand 2015). In the case of renewable energy intermittency and DG, ESCO's along with other market operators often view the issues from the Value at Risk (VAR). Giving room to Business-Cycle-versus trend distinction strategic thinking. Their understanding of aggregate demand is a function of real balances and productivity. A dynamic DR supported by SG can represent a disturbance to their demand and supply if they do not appropriately manage it.

ESCOs & Prosumer Managed DER Competition

i-RES Prosumers are increasingly present as they increase in number and activities. They continue to present the energy landscape with factors like Energy Return on Energy invested (EROEI). Moreover, the increased trend of learning by doing often referred to as "Knowledge

spill over" by the innovation rhetoric can be seen problematic for the inherent system. ESCOs view the introduction of such variables as a possibility to increase competition. They believe that those two factors withstands with long run effects. From the competitive view point if prosumers are allowed to capital accumulation they will create a trend that is long lasting (Blanchard, Quah 1988). As their understanding is justifiable, instead of de-bundling ESCO's with Aggregators will push to bundle their services offerings to limit market entrances and halt the growth of such a trend. Since this growth will empower an even larger competition lead by technological and internet giants. Therefore, they will engage in an aggressive reduction of SG platform efficiency to limit the impact of new entrant's foreclosure strategies.

The above explains the strategic fashion of attempting to keep the energy market governed by the strong scale economics lows. Furtherly ESCO will push forward negating the effects of network engendering of economics of scale. Reducing the toll of network effects and prevent them from leveraging their fixed costs (Eisenmann, Parker et al. 2010). This type of actions often referred to as "Aggregate Demand Shock", which takes place when an economic activity is a consequence of imperfect competition. Aggregators under these strategic conditions further contribute to fortifying the position of ESCO's and energy system operators. Continuously colluding to keep their prices above marginal costs to farther eliminating risks based on their equilibrium perceptive (Rotemberg, Woodford 1992). Consequently affect prices increase rather than contributing to reducing it. Hence increases the impact of "Oligopolistic Pricing". Increasingly defies the whole purpose of SG as an aiding tool towards energy trilemma and a participatory platform of energy democracy, which farther increasing energy poverty as one of the goals. SG role as an empowering technology should support DR resources and programs in three major aspects (Rotemberg, Saloner 1986):

1. Finding alternatives to capitulate any attempts towards consolidation when demand is high. Alternatively leading to increased competitive gains to consumers and prices.
2. Setting highest level of profit with lowest level of output, which increases sustainability. Preventing electricity price war, protect markets from deviating and eliminate the possibility of creating multitude of equilibria over the platform.
3. Introduce unobservable shifts in demand, which induces ESCO's and large market players punishing behaviors. In attempt to curb the increased participation of renewable DG's entrance to the market.

The introduction of an aggregator that is observed in recent EU smart energy and SG frameworks. It not appropriately managed can lead to “Disinter-Mediation” and will impede the expected goals of the EU in coupled markets. The increased competition favoring consumer choices. Continuously ignoring participating consumer involvement in the electricity market mix. Will limit the facilitation of a successful shift from voluntary production to an increased value added over consumer production.

4. RESEARCH DESIGN & METHODOLOGY

4.1 Introduction

The previous chapters provided an orientation to the reasons behind the research. This study focuses on the needs to integrate and appropriately segment energy prosumers amid Smart Grid deployment. The previous is crucial before the European Union attempt to expose the energy market for competition. Especially when dealing with the problematic inclusion of aggregators, which facilitate a purposeful contribution to refuting the need for a new market design under SG technology transition. It is also relevant for energy stakeholders especially ESCO to better align their services to keep the whole energy market functional.

4.2 Research Problem

The study aims to draw on major problems of purely adopting a physical paradigm addressing the social aspect of energy production. Specifically resolving:

1. **Perspective:** What are the key theoretical frameworks that represent the conceptual lenses currently being used to describe and explain prosumers in the EU?
2. **Origins:** What are the foundations for the current proposed solutions that relate to prosumer integration frameworks?
3. **Processes:** What are the dominant concepts, topics, and themes that pertain prosumers processes being consistent with current systems (e.g., decision-making, leadership, cognition, values and norms)?
4. **Structures:** What are the main concepts, topics, and themes that explain the linkages between the macro-institutional structures (e.g., district, state, region, corporations), and the microstructures (e.g., Citizen, community, cooperatives, Union)?

All the above mentioned verticals contribute to the final outcome of this study, which is developing an innovative mean to view the social component as a system with in SG systems. Since the earlier discussion confirmed that SG technologies are to be conceptualized as a system of systems. Therefore, it was essential to analyze the existing knowledge in the literature review as a mean to contribute to my descriptive analysis. By doing so I have provided a lock in perspective to my endeavor to generate a new contribution to a much purposeful, efficient and sustainable integration of RES prosumers in the future. Consequently, this chapter strives to operationalize the intent towards a proper research design. This brings forth the earlier

discussed rationale section and key concept. This chapter serves to substantiate the choices made in my methodological choice and expand on them.

After reviewing various EU resources and literature on the SG innovation. The evaluation and comparison with various theories yielded the understanding that the currently available aggregator framework proposed by USEF is problematic especially for the EU. I believe that what is causing the current tendency to accept the aggregate fix is driven by the "Knowledge Sharing Dilemma" (Cabrera, Cabrera 2002). The inherent system continue to grapple with the social element input and their impact on the flow of their executive information and decision systems under SG. Interestingly this was extensively discussed by (Turban, Watkins 1986) in what they called the "Executive Information Systems", where were built on postulations on the topic by (Rockart, Ball et al. 1982) . The current stance is due to the strong reliance of the current energy system on physical tools, continuously lacking a proper proposition to deal with the social components on the system. The problem here seems to be mainly centered on knowledge and information, which is systemic in its nature. The question this research should cater to is why ESCO's and energy transition stakeholders should not consider prosumers as a threat to their integrated expert system? This is only possible through fashioning prosumers in a systemic manner so they can view them as fit enough for their decision support system. While explaining to them how this new system may function in their executive information systems.

4.3 Methodological rationale of the study

Taking in to consideration the critical relationship between theory and practice, which often energy stakeholder criticizes the social science academic community with. Also seen as divided over which among rival theoretical alternatives are better positioned to solve the political, theoretical, and practical problems of the field. Therefore, this research follows a critical paradigm to attempt pinning down some mutually befitting outcomes (Mingers 1980) . Since I have provided the theoretical component of Smart Grid transition as a knowledge base technology. Aimed at increasing accurate decision-making and assist with defining suitable electricity pricing and programs.

Prosumers introduction to the market mix has been rendered problematic by ESCOs especially. Since they bring unmeasurable or hard to measure elements to the competition. Prosumers are enclaved within three important cultures: the wider public (that assimilates and recreates purchase power), practitioners (who produces and transmit electricity), and trend momentum (who create knowledge to disturb the system). This illustration provides the social topic with a

post- positivist mind set, farther project features of a three world's theory. This research aims to give a great importance to consider the sources of controversy by aligning them in segments, based on their values and believes. The three cultures interpenetrate each other in a dynamic manner, they simultaneously create symbolic and material tensions that constrain or enhance development in all three. From the system point of view, they create "feedback loops". Therefore, it is important to map and reflect on the structure of such alignment. Such mapping and reflection extend far beyond what is really being transcribed, since they connect upon tacit meanings of knowledge and practice. This is fundamental in grasping and conceptualizing not only their value, but also the kind of outcomes worth struggling for. So far, there is no evidence in business administration literature that is dedicated to the value considerations of energy prosumers not even in marketing addressing megatrends.

The significance of this study can be argued on several grounds:

1. The study maps the central concept of social emancipation being in use in system theory. Providing theoretical perspectives to appropriate means to guide, explain, and interpret the energy prosumers.
2. The study provides a context to examine the theoretical, intellectual, political, and practical positions of emerging perspectives.
3. The study invites discussion of such pressing topics as part of the theory/practice gap, methodology, and negotiated spheres of interest. Suggesting that the theory /practice reconciliation is precarious, dissociated, and conflictual.
4. The results may make available important and useful information about topics, concepts, themes, and action. Moreover, they possibly participate with a framework for interpreting a newly emerging discussion.

4.4 Theoretical framework for the research design and methodology

4.4.1 Critical Theoretic Approach (CTA)

This entry describes the development of critical theory and its applications to a variety of research questions and as a methodology core. Critical theoretical approaches denote a strong emphasis on historical and social contexts. It is often utilized in a purposeful illustration and understanding of a social phenomenon (Denzin, Lincoln 2011). Therefore, embarking on critical theory approaches is foundational for analyzing social action, politics and other human endeavors can proceed. A research with the aim to assess the current state and the requirements

to reach a desired state, often draws on critical theory to facilitate a critique. The critique entails examining both action and motivation. Which describes current actions and anticipate or predict future ones. In application, it facilitates the use of dialectic, reason, and ethics as means to study the conditions under which people live (Given 2008).

Critical theory views the current state of the community and society as a specific phase in a long, continuous process (Boyd, Henning et al. 2017, Denzin, Lincoln 2011). Practicing critical approaches consider facts as being continuously influenced and affected by social, political and cultural factors. The focus of the critical paradigm is thus on an understanding and practical transformation of social circumstances for emancipation and reinforcement. According to the critical management science, which have had its origins in the 1970's. The early critique originated from Soft Systems thinkers who contested the assumptions about the primacy of rationality and the 'naturalization' of social relationships within mainstream management science (Jackson 1991). By the 1990's the 'critical edge' of critical management had moved, and both soft systems thinking and Marxist organizational theory were subjects of interrogation from alternative perspectives. Especially those derived from critical theory or postmodernism of resistance, gave the emergence of critical systems thinking. The critical management science or a critical approach encompasses a wide range of methods used for analysis. Therefore, in this section I will illustrate the methodological approached utilized reflecting the research paradigm.

4.4.2 Critical System Theory (CST)

The influence of system theory on management science and research became widely prevalent on the last half of the 20th century. The discipline development in hard -systems thinking and soft system –thinking, yielded an understanding of various types of systems that can reflect (natural, engineering and human social) systems. The system theory evolved due to its application to human systems to a much critical practice (Mingers 1980, Jackson, Keys 1984). The critical approach to systems thinking was based on the epistemic-logical and ontological views of Habermas (Jackson 1991, Jackson 1992). CST is defined by its commitment to three core values and commitments: critique, emancipation, and pluralism. It is often perceived that systems theory often uses mathematics to measure feedback loops of feed and stock in complex relations under General System Theory (GST) (Schwaninger 2006). Despite this prevailing fact non-mathematical system theories can be found in many different areas of studies.

CST according to Jackson as a term either used generically or to refer to a specific body of work that should adhere to three fundamental commitments: 1. Critique that yields awareness. 2. Emancipation. 3. Pluralism. Moreover he later expanded them to five commitments, in our case we will stick to the fundamental three for clarity. It is important at this point to highlight the debate between three leading system methodology streams. (Midgley 2003) argues that all these 'commitments' are in different ways unsupportable. Drawing attention to a theme that unites critical system thinking to enhance and support the critical reflection on decision boundaries. Through emphasizing on the need and utility of self-reflective practice. It is also thereafter addressed as a tool to give opposition to instrumental rationality and liberate it from rational control of powerful human ideas (Flood 1990). According to him the replacement of objectivist theoretical assumptions with subjective assumption are reasons to explaining the radical 'epistemic' shift that differentiates Soft Systems Thinking from Social Systems Theory. The 'epistemic' shift that differentiates CST from Soft Systems Thinking is the recognition that subjective experience includes 'false consciousness, which affects the nature of social reality. The false consciousness on the other hand is the assumptions behind commonly accepted explanations for social processes. They later develop alternative explanations derived from different (contrary) sets of assumptions also called self-reflection by (Freire 1972).

Under this distribution of thoughts, I will outline the validity of using the CST approach according to Jackson methodologic understanding. This study is based on the core principles of the approach:

1. **Critique:** the system subject to description represent different groups which none of them have a structured power. They have a mutual understanding of actions they perform. The conceptual trap of conformity is avoided by regards to mutual respect of the intent or goals attained.
2. **Emancipation:** Research aims to examine the stability and change through recognizing barriers to human potential empowerments and transformation
3. **Pluralism:** Employing different methods and theories that are coherent with various system perspectives.

It is vital at this stage to address the epistemic metaphors that underlines the selection of the system approaches that will be used. According to (Flood, Jackson 1991) five system metaphors, represent the gist of management and system theories:

1. **Machine:** represents the physical system and human role in them.

2. **Organic:** self- regulating and self -maintaining systems that supports an ecological feedback loop.
3. **Neuro cybernetic:** representing a system that demonstrate the ability to learn and communicate. Mostly capitalizing on information and its viability.
4. **Cultural:** representing an organizational culture that is engineered by decision makers.
5. **Political:** representing the powers and limits of actions often used in policies.

As this research requires the attention to the topic in hand which reflects an organic understanding to a cultural practice. I will expand based on these metaphors to outline our methodology and theory selection. It is vital at this point to be careful, however, to resist a relapse into "pragmatism". Since it is a common pitfall in management consultancy theoretically uncontrolled employment of systemic tools. Pragmatism is often prevalent due to the need to make an intervention. CST allows a combination of tools, therefore it should demonstrate efficiency and effectiveness of methods, models and techniques to serve research rational (Jackson 2001). Most importantly, a research should provide preliminary constitutive rule for the ease of access to generic systems methodologies. That is materialized through positioning the research rational whether it is functionalist, interpretive or radical (Checkland 1991). Checkland expanded that Systems methodologies are structured ways of thinking, related to different theoretical rationales. Therefore, it is considered a tool to improve the understanding of some real-world problem situations. Checkland outline the rational of employing CST as following:

1. Each use of a systems methodology should yield research findings as well as changing the real-world problem situation.
2. Systems methodologies should adhere to systems ideas (system, boundary, emergence, hierarchy, communication, control, etc.) and should draw on methods, models, tools and techniques.
3. Systems methodology choices should justify the rationale based on the nature of the research intent (functionalist, interpretive and radical).

The position of this research is to interpret a mega trend or a phenomenon. Giving weight to boundaries, hierarchy, communication and control features of a real world system problem. Based on this the selection of Soft System Methods, it is much suitable to the intent. Henceforth I will outline the mandates of research fitting to Soft System Methods (SSM) as following:

1. There is no assumption that prosumer interaction under smart grid is systemic in the real world. It is rather a systemic description of role of human agents in a hard system.
2. The outcome of the research is to yield Models or a framework, which represent possibly a human activity system.
3. Models will be used to interrogate perceptions of the real-world and to structure debate about changes which are feasible and desirable. Since the main theme is transition and therefore data is of dialectic nature.
4. Results are situated to facilitate Changes that might alleviate feelings of unease are evaluated primarily in terms of their effectiveness, elegance and ethicality.

4.4.3 Soft System Methodology (SSM)

Soft Systems Thinking is considered a response to the inability of engineering machine system thinking often referred to as hard system thinking in handling human and social aspects of problem situations. SSM gives value to necessary commitment from individuals involved in and affected by possible changes. Allowing a future human activity modeling that is used as a basis for guiding actual human activity in the world (Checkland 1991). In addition, Soft Systems Methodology relies on the dialogical version of System Dynamics, which reflects the principles of participation. So it is likely that the methods of SSM will be particularly user-friendly as part of a participatory practice (Midgley 2000). Hence, it is important to mention that my research is not of a dialogic nature. In other words, the data collecting process did not include dialogs between several interviewees. Rather the collected data were through interviewing each participant separately. That does not rule out that organizations in subject do communicate with each other on various levels. To avoid the methodological confusion, and remain clear to my outcome this research is not fully using soft system methodology models. Rather it uses the methodological framework and steps. SSM aims to generate a systemic learning process in which participants in the problem situation come to appreciate more fully alternative world-views (Jackson 2006). SSM provides tools to explain and judge a mess or complex situation. Farther providing a satisfactory judgement that aids with appropriating an intervention strategy through focusing on five major criteria (5 E's) to answer boundary questions of a social phenomenon:

1. **Efficacy:** Do the mean works?
2. **Efficiency:** Are the minimum resources used?

3. **Effectiveness:** Does the change help the attainment of the long term related to the stakeholder expectations?
4. **Ethicality:** Is the change a normal thing to do?
5. **Elegance:** Is the change aesthetically pleasing?

For this reason, I will utilize its framework and steps. Checkland's SSM framework in this research context assist in providing a system visual to a real world situation and facilitate a system thinking about the real world. Using his seven phases of analysis, which he described as "SSM cycle for learning for action" (Checkland, Poulter 2010). SSM seven steps are described as following:

1. The problem situation: unstructured
2. The problem situation: expressed
3. Root definitions of relevant system
4. Conceptual models (encompassing: formal system concept and other system thinking)
5. Comparison of 2 and 4
6. Description of feasible desirable changes
7. Actions to improve the situation

In this study context, I will not be using the LUMAS model in SSM, due to the different intention of my study. The LUMAS model will not allow describing a whole multi-level organizational knowledge system and the connections between actors. In addition, I am not in a position to propose a solution based on system intervention. Rather I only intend to illustrate the operation of the current status of prosumers. Aiming at projecting them in a system, which is autonomously functional. Therefore, for the functional alignment of my research, also to overcome the dialogic research needed for LUMAS. I will resort to use the "Creative holism" (Jackson 2006) to give more attention to the meta-methodology in using System of System Methods (SOSM).

4.4.4 System of System Methods (SOSM)

The System of Systems Methodologies heavily relies in its constructs on Habermas's epistemological theory (The theory of the nature of knowledge) proposed in 1972. Habermas calls his three world's theory the "theory of knowledge-constitutive interests". He indicated two fundamental conditions that underpins the socio-cultural form of life of humans (the work and the interaction). Based on this notion Jackson's System of Systems Methodologies aligns

systems approaches with the contexts for their use. The previous validates that SOSM supports its alignment with an epistemological theory of universal human participation in work and interaction.

Jackson and Keys' extended Jackson's understanding of SOSM (Jackson, Keys 1984) in their 'Grid of Problem Contexts'. To facilitate a Systems Methodology selection for the Management Sciences. They indicated that problems are of two natures (Simple or complex). Based on the context determining the type of the system and the methods used to define the outline of the SOSM methodology utilization (Adams, Mun 2005b, Adams, Mun 2005a). Systems are either simple or complex based on the organization of participants (Unitary, Pluralist, and Coercive). Each reflect their own sub-system, which outline as following:

1. Simple: Simple Unitary, Simple pluralist, Simple Coercive
2. Complex: Complex unitary, Complex Pluralist, Complex Coercive.

Based on the empirical evidences provided earlier. I will argue that energy prosumers are participants operating under a complex environment. Where they propounded a unitary relationship. In other words, participants have shared interests, values, common agreement on means and ends, and engaged in a participatory decision-making. The complex unitary group is an ecological system (Watson, Watson 2011). This allows using methods as (general system theory, socio-technical system thinking and Viable System diagnostics). Based on the Jackson grid of problem context and Jacksons Creative holism concept, I can outline my meta-methodology of creative holism as following:

Table 1: Research meta-methodology of creative holism (Jackson 2006)

The meta-methodology of creative holism	
Creativity	Task: Understand energy prosumers competitive behavior and their ability to identify and manage functions and relationships. Establishing communicative affinity under SG technologies. While organizing information flow, and rationalizing and harmonizing growth, which allow them to align their external relationships in the energy market. **Tools:** Critical System Thinking (CST) Methods

	Outcomes: Support evolutionary learning theories in innovation, which suggest that a single coherent position can emerge from explorations of ideal (but feasible) scenarios. Initiating a start to acknowledge current 'mess' of issues rather than clearly defined Strategic alternatives.
Choice	Identifying the appropriateness of CST methodology as a generic methodology. Using Soft System Framework to address a System of system methods. Understanding that prosumers fall under the complex unitary category in the grid. We select Viable System method (VSM) as part of cybernetic methodology
Implementation	Viable system diagnostic (VSD) model for analysis.
Reflection	Fashioning the current energy prosumers organization in a systemic understanding, which reveals their organizational structure and communication channels over functions and space. This will make it easier to later describe them as a decision support system of the supra system and ease including them to the integrated expert system of ESCOs and the inherent system.

Table 1 illustrates utilizing Jackson's meta-method "creative holism" in this context. Further allowing me to learn about the various systems methodologies the complexity of the topic imposes. This gives a chance to explore methods and models that can be best used responding to the complex situation in hands. While not failing to address the turbulence and heterogeneity of the problem. Therefore, creative holism furnishes four paradigmic suggestions that are mandatory to consider (functionalist, interpretive, emancipatory and postmodern). In order to achieve this, I have summarized the (tasks, tools and outcomes) of each element of the Jackson's analysis under each creativity enhancing devices employed. This is necessary to successfully choose the right methodology for each problem from the various options available in system methods.

4.4.5 Cybernetic System Methods (CSM)

The cybernetic management view on socio-technical systems have yielded models and methods for organizational management, system diagnostics and organizational design. Using cybernetics methods provides this study with the needed integrative system methodology

sought after. I shall focus on Stanford Beer Viable System Model (VSM) (Beer 1984, Leonard, Beer 1994) for its distinctive features. The strength in the (Beer 1972) “viable systems model” is that it outlines the system as an entity that focusses on viability, increase the level of generality, proposing a theoretic evidence to management functions and their interrelations. VSM magnifies organizations as adaptable, which is important to reflect surviving a changing environment. The viable system is an abstracted cybernetic description that is applicable to autonomous organizations. It provides the ability to study of how actions by a system cause changes in the environment (Jackson 1988). The most salient aspects of Beer’s VSM that are relevant to our study are:

1. Self-Regulation: postulating on system adaptive mechanism. Which allows the system to keep itself under a balanced condition, within the limits of its structure and through information exchange with the outside world (Beer 1975).
2. Equilibrium/Balance: Identifying attitudes that constitutes the ability to provide an appropriate contribution to the needs of some or all supra-systems within the framework of reference systems (Beer 1975).

4.5 Research Design & Methodology

4.5.1 Research Design

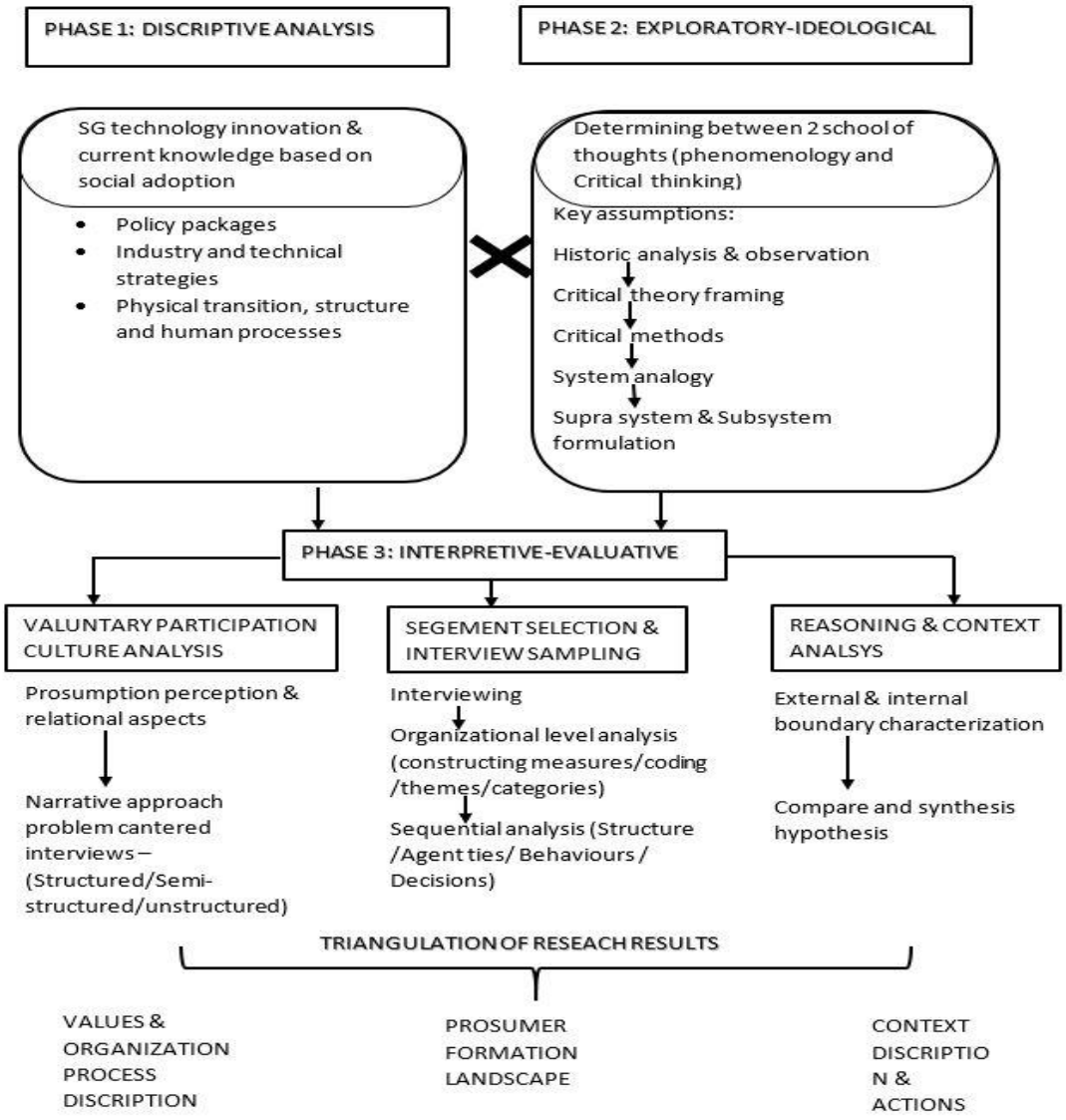

Figure 3: Research design phases

Figure 3 projects the phases that are involved in designing the research. Explaining the processes that yielded my current interpretive phase, which I will next expand in my methodological discussion. The outcomes is also illustrated in the research triangulation that are supposed to be met by our results.

4.5.2 Research Methodology

The following description of methodology justifies the methods that have been outlined to undergo this study. Primarily this study follows a Descriptive- Interpretive approach (Elliott, Timulak 2005). To better formulate the problems of this study a descriptive analysis was needed

to formulate an exploratory research question. These were, what are the problems facing the EU SG projects in integrating prosumers? The result from this synthesis lead to an ontological research question. How can the EU ESCOs better deal with prosumers under SG deployment? This confirmed that the best method to executing the research is qualitative approaches.

Qualitative approach best summarizes the intent of "Building a complex, holistic understanding that illustrates the views of informants, which is undergone in a natural setting" (Creswell 1994). This Qualitative study focuses on meanings as they relate in context. The process of determining which inquiry approach best used in this context was challenging. Therefore, it was best to rely on Naturistic Approach provided by (Schwandt, Lincoln et al. 2007). Hence the use of critical reflective inquiry was going to be very time consuming and restrictive. Although the data collection did not follow the processes fully, it was quite close.

Data collection

The data collection designed originally in the form of a questioner that is statistically coded. This was abandoned due to the very structured natures of the questions, which can be very highly technical. It was more important to understand the individual perception on prosumerism and relational aspects. Rather than determining their technical fitness over the technological frontier. Therefore, it was important to engage with representatives from all different prosumer groups and entities to collect sufficient information. The choice of narrative approaches was convenient to my interview segments. The process of selection and sampling was also time consuming. In order to not fall in to biases and pragmatic opinions. I had to diligently communicate and make screen calls with 25 EU SG transition organizations. This was important in the beginning to ideally obtain a general understanding of what should be addressed, furthermore support the hypothesis for SSM modeling. I considered this my first round of data collection, the process of screening the field included: 1. Promote the intent of the research via designated emails. 2. Followed by brief explorative calls with several energy experts and policy officers who expressed relevance or interest in the intent. The list included (EU Energy policy and regulation bodies, EU Energy innovation committees, EU energy innovation projects, EU Smart Grid research centers, Energy utility companies, energy cooperatives, Distributed Generation societies). The outcome of the first round were various opinions and policy documents and reports most of which are not yet published. At this stage, questions were generic as following:

1. What kind of involvement does your organization have with SG deployment?

2. What is the position of your organization in social energy participants supply chain?
3. How does your organization project prosumers or energy citizens? What is problematic?

The first round explored the soft aspects, such as leadership, transparency, communication and trust in the relation between supra and social sub systems. The second round of data gathering which is the final stage. A purposeful sampling segment were contacted to conduct interviews with. Specifically, those organizations that have strong relations with each other to insure a semi-dialogic relevance. Nevertheless, be involved in the smart grid topic that is relevant to my research triangulation. The purpose was to focus on gaining sufficient information for the VSM diagnosis. Questions were geared to understand the communication, what value it creates to prosumers and what are the limitations or boundaries. (ESCO's and vertically integrated utility companies were excluded, but were represented by an EU entity that represents them. My Qualitative data were gathered through interviews conducted via skype and on phone with five different experts at the organizations listed below:

1. Somso Energy academy- Denmark (Part of Somso energy community).
2. RESCOOP – Belgium.
3. Buendnis-Buergerenergie (BBEn) – Germany.
4. Euroelectric – European Union – Belgium.
5. European Economic and Social Committee.

The questions ranged between (structured/Semi-structured/Unstructured) as following:

Unstructured:

1. How would you describe prosumers from the light of your organization involvement? How would you describe their knowledge on technological platforms (SG platforms - Scanenergy, Trading – Energyshare, Energy Smart Tools- NOBEL)? What are the major drivers that makes a prosumer? To what extent do prosumers understand how the energy market works? How would you describe prosumer networks and maturity of their decision-making?

Structures and semi structured:

1. How fit is the current EU regulation and policy fixes concerning SG adoption and (social DER, energy communities, and COOPs)?

2. Does the current renewable energy market setting reduce entropy for social element inclusion?
3. How would prosumer social networks escalate with available technologies opportunities for (automated trading, micro grid cross trading)?
4. How would you describe the reinforcing loops of social energy actors? How do prosumer dense networks interconnect? How irreversible is their transition from voluntary participators to a member of a hierarchy network?
5. How social participants create growth based on their operations? Can their innovation cause the market to bifurcate in the future?

Duration of the interviews varied based on the time of the participant, in average each interview was over an hour. The total duration of interviews recorded were seven hours. This serves in achieving the think loud protocol for following analysis. The problem-centered interviews followed a narrative approach. The data collected filtered to generate codes for both SSM and VSM.

Data gathering limitations:

It was crucial to avoid system modeling jargon in the interviews, as this compromise the discussions and can cause confusion in responses. Since most of them are not involved in system practices. It took time to test and pilot Interview questions various rephrasing to ensure that I obtain sufficient information, while the interviewee can answer in a familiar language. Also, the need to clarify with my interviewee that I am looking at the system as a whole, in order to escape not branching to every detail of their operation or practices.

In order to achieve a full adherence to the naturalistic approach, participants should not be familiar with questions to insure a more flexible narrative. This element was jeopardized with one of my respondents. Where they state that they need to check the questions before hands. To overcome this, I sent him a generic question to keep the discussion in place during the interviews. Before doing that, I checked the ethical guidelines of the inquiry method. Secondly, extracting information from EU bodies policy officers had to follow a specific technique, which required familiarizing myself with policy packages beforehand. It was clear in the correspondence before the interviews, which they will not reflect on policies rather their opinions based on their field practices. Thirdly, some participants jeopardized the naturistic process at points when they finalized their thoughts and their time did not allow an extended illustration. Although the narrative is highly rich in knowledge and data. Finally, the energy

sector has proved very hard to extract data from either qualitative or quantitative. Due to the high technicality of the field and avoiding sharing their opinions in researches they are not part of. Especially that Smart grid deployment have yet been a controversial topic between stakeholders and opinions are highly biased. It is important to note that the number of interviews required for a VSM diagnosis cannot be predetermined. More data can always be required; it all depends on how much information the different interviewees can provide. Information cannot reach saturation in such a wide domain as this one. The data was close enough to illustrate the VSM five subsystems and six channels. Data collection in a topic like this can be endless. Along with highlighting the problem, that SSM should address.

4.5.3 Data Analysis

Since this study uses the concept of duel- methods/ System mixed methods. Where the Soft system method is used to assess a supra system problem. Pinning down what needs to be focused on in the wide topic of energy technological transition and Smart grids. Viable System method is used in this case to support a hypothesis drawing on the social stakeholder. Farther providing an operational formulation on this segment. Illustrating their communication channels, functions and structures using the VSM diagnostic. Therefore, the data had to go through a careful and organized coding process in order to manage outcomes successfully.

I have immersed myself in reading and rereading the data. Mostly the reading was guided by VSM, thus an inductive approach was used. Hence, the data had wide range of interconnections. The data analysis used a bottom – up approach to understand what is interlinked. The process of analysis started with specific observations based on the observation phase of data collection. It was then expanded to build measures, to begin with. Processing data that detects patterns and regularities that have highlighted as strategic fades. My hypothesis was projected since the beginning, my thought was to validate if the current prosumer trend will lead to a future energy market bifurcation in the EU. Therefore, data collected was a mean to either serve validation of my understanding or refute it. This does not limit the fact that part of the analysis did use a deductive rational to narrow the stretched theoretic understanding of the field. This was mostly used in the early stage of problem formulation used in the first round of data collection. The coding process of the second round of interviews is more vital to the outcome of this study. The first cycle coding process was mostly guided by exploratory methods using hypothesis coding. This served as filter to my interviews coding manual to highlight valid codes to draw upon, which facilitated formulating better eclectic codes that helped highlighting existing patterns, categories and themes. This aided a better code mapping process and operationalization.

The result was two different sets of categories, where one frame the problem from the supra system understanding and the second is more guided by the VSM for the meta-system of the study. Coding took different stages and it was guided by criteria provided by both SSM and VSM. The SSM coding process were guided by coding the values, attitudes and behaviors. Those codes were then themed in cognitive awareness, effective-objective, and actions - behaviors. The codes under each theme were generated to validate the belief system of prosumers. This constituted the big picture of the first cycle coding. These themes were then used to formulate categories that are fit to adhere with the five criteria of the soft system analysis. To evaluate (Efficacy, Efficiency, Effectiveness, Ethicality (moral) and Elegance) of the system under investigation. These were helpful to understand the positioning of prosumers in the energy value chain. Serving the illustration of how mature are prosumers in the SG adoption process and are they fit for organizational level analysis. This is where my second coding process took place. Where eclectic coding iterated the data, and linked the system investigated to a wider supra system categories. Allowing me to describe the root definition of the relevant system, which denote to the fourth step of the SSM analysis. At this stage VSM diagnoses is introduced to provide a system modeling. Aiming at a purposeful diagnosis of the organizational structure and communication patterns illustrating functions and vertical and horizontal communication channels. While demonstrating the recursive process in interplay. The coding process in this stage postulated on our second round of interviews utilizing data from interviews with cooperatives. As I attempt to monitor the subsystem to distinguish between threatening and non-threatening behaviors. Here I farther coded the behaviors and intent of the prosumer belief codes. This rigor coding was guided by VSM diagnostic. A meta-coding approach were used at this stage to understand the (S1) Implementation: how do they carry out operational tasks, the local environment, interactions between semi-autonomous units/ components, management and information flow? These codes were vital in farther projecting the (C1) which reflect the cooperation intervention channel, also giving insight to (C2) resource provision and accountability. I reeled information about the presence and functioning of (S2) from codes generated from their coordination and/or fluctuation in the system. The codes presented the relationships between the different prosumer units led to the insight on adequacy of (C3). Other codes that described the management of the participatory units provided an understanding of existing controls and boundaries useful to analyze (S3). The codes that represented future development or some growing trends enabled the demonstration of (S4). Other codes that were themed under mission, direction, values, emancipation and identity of the system served the presentation of a functioning dynamic of (S5). (C4) components and (C5)

reflect on the coordination of (S2) and (S3). While (C6) provides (S3) with direct access to unit to perform auditing and control activities. Farther illustration will follow as we describe our coding tables and themes in my description of the results.

5. RESULTS

5.1 Data Formation

To provide an over view and obtain an excellent sense of theoretic whole across an unorganized qualitative data. The data presented by my respondents needs a tentative clustering of topics. This provides the chance to bench mark data qualifiers, which assists surfacing observations. If I am to adhere with CST Methods proposed earlier, I am obliged to outline criteria's to evaluate my data. So that I can align my data findings with proposed theatrical argument. Furtherly, contributing to a sound base for a systemic description. Three selected criteria are chosen:

1. **Pro-sociality:** focusing on the socio-technical axioms of the data
2. **Efficacy:** focus on the value of contribution of prosumers to the supra- system
3. **Organization performance:** focus on decision making and structural axioms.

In addition to the above criteria relevant to the social analysis. I have to also consider the political guidelines identified by the analysis of the first interview round. Where majority of the respondents were representatives of EU policy projects and bodies. There are six major indicators visible that describe this pool of data in regards to energy prosumers:

1. **Energy poverty:** Addressing energy prosumers as part of the rural development.
2. **Economic competitiveness:** Evaluating energy prosumers from their economic output.
3. **Energy democracy:** The stated rights with admitted limitation of practice.
4. **Uncertainty:** Limiting the SG transition to current smart meter role out plans. Continuously relying on consumer acceptance studies. Aiming at enforcing policies on the technological accountability and effectiveness.
5. **Generality (Social Whole):** focusing on managing and regulating with little consideration for growth.
6. **Old integrative mechanisms:** relying on the traditional nudge approaches. Often used by politics to achieve national energy conservation plans. The nudge strategies represent the attempt to alter behaviors in a predictive fashion with no significant outlining of economic incentive for new sets of actions.

The second round of interviews facilitated in confirming the above indicators that governs the political understanding. My respondent who is a (Policy administrator from EESC), farther confirmed that the political understanding of energy prosumers had two folds:

1. The perception is more directed towards the policy process itself.

2. The intelligent need for policy as part of efforts to formulate and execute legislations.

5.2 Recording and Coding Data

SOMSO (Community Energy) – Denmark

Table 2 Codes table for SOMSO

Category	Sub-category	Related codes	Frequency
Mastery	Consistency	Maximization, innovation, competition, productive exchange, skill (financial, technical), reward, opportunity, maturity, iterate, awareness(policy, market, system, geographic context), mix and match	67
	Recognition	Contextual understanding, geography, short comes, reality vs projection, possibility vs reality, power (political, market position)	20
Modeling	Ability	Purpose, demography, goal attainment, integration, resource planning, Risk management, activity expansion, knowledge transfer, advocacy.	45
	Copying	Homogeneous, economic expansion, mix and match, not random, growth, trust, autonomy, agility, cluster, locality, solidarity,	42
Persuasion	Encouragement	Committeemen, responsibility, obligation, sense of living, stability, social benefit, patriotic, self-esteem, sufficiency, sense of settlement, conservation, self-	40

		regulation, ownership, green, self-concept.	

The codes in this part of the data focuses on the private prosumer. The descriptions outline their formulation in an energy community. My intention is to reflect on the content of the natural setting of the narrative. Where my respondent who is a (Projects manager), provided a detailed extension of the private actors. In an attempt to demonstrate their identity, maturity and values.

This notion will be further explained through codes that describe their intent (encouragement). It was noticeable that their motivation is towards complying with environmental policies primarily. The codes reflect to an extent the understanding that the trend started as a mean to engage in a "therapeutic community". Their purpose was to stage actions to deal with environmental and resource concerns, which were promoted by their local politicians at an early stage. This acknowledgment gives the moral obligation of their involvement. Surprisingly no signs of resistance were visible, apart from constraints they face by policies. Among other elements that denote themselves to the sustainability label. The evaluation coding was useful to measure elements such as ‘clarity’, ‘Reward’, ‘trust’, ‘contribution’, ‘locality’. These varied according to the questioned topic. Predominantly these codes have reported negative when addressing regulations either local or on the EU level. They reported positive only in contexts where the respondent described the social elements. It is vital to highlight the increased tendencies to express outstanding awareness of private prosumers local and geographic condition. Let alone expressing others of similar nature across the EU. Both on policy or mechanisms of execution. The narrative continue to express ambiguity when talking about the EU regulation targets. Despite being very much aware of them. The data showed a high tendency of knowledge spill over across practitioners and that can be understood from the 'copying' codes. Where all of the copying codes were positive. If I am to be vigilant about the narration as a mean to project the private prosumer contextual position. I am ought to express the strong exhibits in the data towards adoptive behaviors. While they continue to express their interactions as they try to overcome limitations. This is visible in the consistency codes, which have scored the highest frequency among the codes. These adoptive symptoms, which are highly visible in the narrative tend to describe a “Corrosive Community”.

Throughout the narratives it was noticed that a specific statement tend to be repetitive across the text. The statement tends to demonstrates discomfort and continuously being puzzled by the EU regulatory process or the legislative outcomes:

"There are a lot of issues depending on where are you in the EU, but the EU regulation tend to treat everyone the same way. There is a need to take in to consideration different regional contexts with in policies. Since each country has its own specific regulations and laws".

The repetition were often spotted in contexts of specific utility practices and local governments. The respondent described it as a practice impeding their activities growth. Also, we can derive from this notion that private consumers who have a high sense of awareness are transitioning to private prosumption. This can be visible from the codes that describes 'Recognition', where they continue addressing their identity and their power struggle with the system. It is also visible that versus codes appeared under this group of codes. Illustrating the contrasts between the reality and their projections. Another element that was visible from the data is the high understanding of contextual factors. Codes such as 'Risk', 'technical and financial capability', 'costs' including taxation, 'value to interested and affected parties'. These codes draw on the 'consistency' of their effort that is aiming at domestic growth. This serves to reflect the "modus operandi" of their efforts. This is an indication that energy community demonstrates a high level of efficacy across the energy output. This as a result reflect their awareness of their role in the physical system of the energy supply chain. While they continue to reflect the political participation as active enforcers of COP and as consumers. They do not denying the need for big utility companies. In contrast the lowest frequency denotes to the 'Recognition' of their participation in policy and market position, which state their increased deprivation of their political rights. It is also important to bring forth the orientation of strategies they represent. So far, they represent the ideals of (K- Strategists) whom are more geared towards conservation and providing for themselves. Hence, this can change with their expectations from innovation brought by SG and block chain technologies.

Since this research is aimed at illustrating different set of theories to appropriate ways to address energy prosumers under a technological transition. The main goal of the analysis is to process the data that detects patterns and regularities. Purposefully, highlighting what can be described as strategic fades on the utility side. Thus, the technique followed for this step is concept analysis (Gowin 1981, Novak, Gowin 1984). These approaches will help formulating the

conceptual requirement for SSM. Simultaneously, increase the organization of the coding approaches in to better alignments. The purpose of concept analysis as an initial step for coding data is to provide topic identification, coherence and suggest a conceptual category. First, theories often reveal a process that is prevalent by a set of concepts in the data. Consequently, figuring out concepts will make examining patterns easier. Second, identify position of each unite and sub-units described by the data. As following:

Category: Mastery **Category:** Modeling **Category:** Persuasion	**Concept 1:** Self-efficacy **Concept 2:** Feedback & framing **Concept 3:** Cognitive processes

The structuring of concepts facilitates the mapping of theories with which the systems gyrates around. The additional recording of concept's frequency or infrequency should allow debunking uncertainty of the social component. Had the coding focused on concepts such as values, ethics, equity, and morality would not have lent themselves easily for inclusion. Since the coding process followed effective methods and exploratory methods. Hence, tacit codes were generally included only as correlated codes under larger explicit headings with in evaluation coding. To farther illustrate, "values" have never been explicitly mentioned by any of our respondents. It was rather captured infrequently as an implicit sub-unit under motivation, movement, and knowledge transfer. Hence, the ideal of "Self-efficacy" was visible as a concept, which correlated typically not with "values" but with "communication," "planning" and "cognition". We can conclude from the furnished break down of this pool of data that the most suitable theory to describe this group is the “Attribution Theory” (Weiner 1972). As we can visualize the three major elements of it: 1. the locus. 2. The stability. 3. The Controllability.

Buendnis-Buergerenergie (BBEn) – Association of Citizen Energy (Germany)

Table 3 Codes table for BBEn

Category	Sub-category	Related Codes	Frequency
Generality	Action	Organize, unification of effort, goal attainment, activities to growth, modes of operations, economic expansion (size), alternative solutions, risk taking, decision making, iterative planning, bargaining.	77
	Attitude	Existential maturity, diverse representation, power, solidarity, locality, opposition, coping, competitive, management ability, focus, liberating, competence, struggle, unity, cohesion, movement.	98
Objectivity	Cognitive	Commitment objectives, purposeful behaviors, position, open innovation, trust, opportunities, confidence, and contrarians.	66
	Effective	Fragmented effort, homogeneous intent, reality vs projection, opposition, knowledge transfer, economic reward, problem solving, consulting, advocacy, cooperation, justice, identity.	53
Permanence	Artifacts	Political emancipation vs actual emancipation, mediation, autonomy vs efficiency, ownership, green policy.	22
	Disturbances	Utility power, limitations, compliances, fees, size vs goals, pressure, exclusion.	30

At this part of the data the natural setting have demonstrated a strong tendency to describe prosumers positions. Prosumers are either deliberately or indeliberately presenting a predisposition towards actions. It was hard to pin down the patterns embed, thus I had to filter the data based on:

1. Their existential relevance.
2. Objective attributes.
3. Perspectives related to conducts.

These filters made the data much easier to code according to the context. At this section we can notice prosumers organizations towards a significant market power.

My respondent at this part is a (projects manager) at the national social energy association. His contribution to the data reflects the impositions of the technical forces, policies and economic considerations. At this stage actions are not spontaneous. The narration represents a collective action towards reaching some sort of a collaborative representation. Here the demonstration is more towards maturity and rather well-established socio-technical entities. Compared to our first narrative which described private actors forming a COOP. At this stage they not only associate on means of operation and the density of networks they form, but also on a legal sense. As we can understand from the attitude codes 'existential maturity', which highlights the tendencies to evaluate their members whom they represent. In other words, prosumers at this stage should belong to a legal entity or are a cooperative to be part of the association. 'Diverse representation', describe the services the association present to their members. Both on EU, local and regional level. This serves as a mean for them to gain power and collude for significant position in the market. This description is supported by a strong frequency of codes such as 'power', 'solidarity', 'locality', 'unity 'and 'cohesion'. These codes indicate a strong tendency from their part to attempt forming a lobby. This increases their chances towards a set of cognitive naissances. Rather shown through codes like 'opposition', 'coping', 'liberating' and 'struggle'. It is important at this stage to describe the different sizes of members of such associations. Ranging from large national competitive cooperatives to small community enterprise in a village. Thus, codes such as 'competitive' and 'management ability' can differ accordingly. Over all the clear statement of their goals are more towards competing for growth. Not competing with utility, again having to incline that this competition is evident even if they try to avoid it. This brings into focus the codes 'competence', 'focuses' and 'movement'. Serving to facilitate an understanding that the more social support they have the higher their competence in arbitrating for power. It is important to highlight that the attitude codes varied between attitude object and attitude situation.

The attitude codes have lent themselves to expressing the actions, which can signify the result of such alteration. Codes that describe 'organization', 'unification' and 'modes of operation'. Tend to give themselves to networks formations. While 'goal attainment', 'growth', 'expansion' 'bargaining'. Explain material activities that either have a positive or a negative effect on the current situation. Notably when I used evaluation coding, codes were negative when narratives addressed utility activities and policy. Same codes demonstrated being positive

when addressing technologies, SG and activities of acquisition. Codes that represent mastery like ‘alternative solution’, ‘risk taking’, ‘decision making’, and ‘iterative planning’ farther supported prosumers consistency. Especially when topics as grids, tax, trading and policy were discussed. Both actions and attitudes are then subcategories under Generality as a category. Generality in this context expresses part of the criteria’s that are exerted on people forcing them to alter their structures. It refers to the magnitude of various domains they overlook. In other words, when everybody is involved in an activity individual actions are not important. This can to an extent represent their intention to collude or form a pressure unite. The alignment of these codes and categories furnish a strong relevance towards a set of beliefs determining values and behaviors.

Since we have established that beliefs have a strong visibility from the data. Also we have indicated the behavioral elements of prosumers. The need to understand their certainty elements remains. So, a need to reevaluate the cognitive axiom is needed. Codes such as ‘commitment objective’ is not formed randomly. Rather to operationalize a code referring to selling actions. This reflect the commitment and responsibility of the association towards their customers, whom they have an agreement with. I tried as much as possible to stick to the concept of action and reflect on it. Selling here comes in the sense of the services prosumer entities delegate to the association to perform on their behalf. So, it refers to the business and legal representation the association perform, which suggests a great shift in their situated cognition. The codes ‘purpose’, ‘position’, ‘trust’ and ‘confidence’. Are strong sign of representation, adhering to knowledge with great certainty. Especially when talking about recognition by EU policy and regulatory bodies as an outcome of their efforts. ‘Opportunity’ and ‘open innovation’ were mainly stated when talking about SG and block chain technologies. Reflecting a paradigm that assumes that social entities can and should use external and internal ideas as end means to markets and to advance their technological abilities. The code ‘contrarian’ is the most surprising finding in the data. It is the notion that reflected an 'investment strategy' often used by capitalists. This code is generated from narratives expressing patterns of thoughts dealing with the future, which indicates a strong direction in their situated cognition towards forecasting. This illustrates that they are past the level of “naïve scientists”.

It was only natural to follow the cognitive codes by the effectivity of such alteration. Allowing a better perspective to monitor their views. The effective codes are more descriptive, the code ‘fragmented effort’ serves to outline the current state of COOP’s and prosumers. ‘Homogeneous intent’ reflecting their identified goals, which also reflect on the other codes

‘justice’, ‘advocacy’. These strongly relate to democratic practice that they believe they are manifesting. Codes as ‘Opposition’, ‘knowledge transfer’, ‘problem solving’ are vital to describe their means of overcoming impediments forced on them by the strong utility grip and technocrats. ‘Cooperation’ as a mean among the members and ‘Consult’ as an activity. The association between the two codes is relevant as part of their “cross –counseling” culture. The cognitive and effective subcategories are then grouped under the category objectivity, which reflects the characteristics of the orienteers and their externalization.

The 'artifact ‘code aims to describe the energy system imposition on their activities and to reflect their limitations. Verses codes is used to contrast ‘political emancipation vs actual emancipation’, ‘reality vs projection’ and ‘autonomy vs efficiency’. These codes denote to reflect prosumers critical awareness of their difference and what value they present. More than once the code ‘mediate’ made a strong appearance as the narrative expressed the proposition by policy tending to favor aggregators. Hinting that they are already doing this and focusing on ‘equity’ as a social recourse for ‘green policy’ empowerment. The code 'disturbances' here represent elements they can’t fix in the current context. To further address limits of their performance which adds to the hurdles. ‘Utility power’, ‘System limitation’, ‘size vs goals’ are codes denoted to the energy stakeholders or current market operators. ‘Compliance’ as a code has a strong inference, reflecting that their actions abides to the legal frameworks. Even when they expressed the know how to maneuver in the grey areas of policy, they are grounded to not doing so. Another aspect of the same code is when talking about taxes and tariffs using the grids. ‘Exclusion’ as a code relates to their association with the market and market recognition of their position. Both 'artifacts' and 'disturbances' as described are elements they cannot control or deal with. This is a strong reflection on their endurance. Those are subgroups under 'permanence' as the last element of actions exerted on people activities. The highest frequency in the data were more towards describing the generality category. The least is the permanence. I can safely now say that prosumers subscribing to an association are far more resilient than expected. At this stage we can outline the concepts that govern the categories given from the data as following:

Category 1: Generality	Concept 1: Beliefs
Category 2: Objectivity	Concept 2: Techniques
Category 3: Permanence	Concept 3: Causality (cause and effect)

The structure of concepts at this level of the analysis demonstrates an emergence of a communication style, which increases the tendency to signal their separation from ideals of being only prosumers. In other words, they do not entirely project energy they produce as just a commodity. Also reflects that they are not content with their current situation of being voluntary contributors, which can be understood if we reflect on the previous notion of identity. It is at this point significant to draw on the strong relevance in the data, towards the technology adoption style at this stage. It was surprising to notice the ability to contrast between their activities and the utility, farther providing a description of their role in the supra system. The mirroring of a system description can be reported as prosumers signify the difference of their involvement as an "outcome oriented system" from the supra system which is "process oriented system". This ability to contrast entrenches the concepts of belief, consequently justifying their techniques. Allowing a mature understanding of causalities in their contextual cognitions. It is essential to note here that although they have strengthened their situated position as a system. They have not demonstrated any biases that can lead to resentment or judgement errors. So, there were no indication of resistance. Even when the respondent mentioned resistance, he strongly inferred that prosumers see it as harmful to the system whole. It is therefore, crucial to describe the theoretic base that describe this stage of organization, which have sufficiently related to the "Activity Theory" (Engeström 1999).

RESCOOP – Social Energy Union – Belgium

Table 4 Code table RESCOOP

Category	Sub-category	Related Codes	Frequency
Design	Building blocks	Activity, Services, Power, Planning, Goal attaining, Value, Trust, Equity, Viability	101
	Modularity	Engagement, Specialization, Initiation, Compete, Promote, effectiveness, network, influence, contrarian	81
Growth	Innovation	Exogenous, Endogenous, heterogeneous, urgency	23
	Characterization	Magnitude, Novelty, Valorization, Hierarchy, Role Identity, Articulate, Altruistic, Uniform, Movement, Lobbying	66

Fitness	Preference	Spectrum, Customize, Regional, Sovereignty, Conservation	29
	Functionality	Strategy & Management, Niche creating, Harmonies operation, Knowledge spill over, Dexterity, External Cooperation.	63

In this part of the data, the natural setting of the inquiry had distinctive features. At this level prosumers have a high tendency to manifest dynamics of adoption to contextual requirements. Most of the narrative is describing efforts of organizational networks across the EU. My respondent expressed the staggering number of members who have different focus under their umbrella. At the beginning the coding of the narrative was quite challenging to place in an appropriate formulation. What seemed to be remarkable at this stage is that a clear systemic alignment is visible. I had to render data as an architect (engineering codes), which is also referred to as processual codes. It is a requirement to apply physical (engineering) rationale, since the narrative was rich in technicalities drawing on different groups of stakeholders overlooking different projects. Not to fail mentioning the multilateral projects the organization itself undertake. Most of the inferences described different groups of energy linguistics, which was relevant to SG. Also contributed as a response to the political and inherent system criticism. I have coded visible schemas with in the text to lump them in expressive meaningful groups.

The coding at this stage followed a descriptive coding, which was followed by an evaluation coding. The codes ‘Activity’, ‘Planning’ were among the highest frequencies. In reference to social energy actors and COOPs demonstrated myriad activities both on regional and EU level. While ‘planning’ indicates future projects that are on their agenda both energy related and those of technological focus among their members. One description was in close connection with Smart grids and trading. The code ‘services’ indicates a paradigm shift of COOPs and energy community members of RESCOOP. They seem to demonstrate a strong business representation in dealing with their members or subject audience. Code ‘Power’ describe their ability to draw resources and amalgamate actions to participate in tenders and even acquire DSO’s, which naturally fulfill their stated ‘goal attainment’ further describing their achievements. The ‘Trust’ code was mostly positive when they talk about the public interaction and noted negative when referring to public opinion in utilities. ‘Equity’ represents the scope of social ownership and financial entitlement. The code ‘viability’ is formulated to describe their milestones or success

over space and time. ‘Value’ in this narrative is different from before, it describes their worth in both economic and domestic contribution. Therefore, I cannot evade expressing their outward statement of contribution. Those codes were categorized under “building blocks” as a mean to represent actions by interactors expressing a schema. Laying the ground for the following codes that represent the complexity in their actions. As a result of overcoming constrains with in their environment.

Codes that describes the degree of which actions are configured is at this stage evident. Codes like ‘engage’, ‘initiate’, ‘influence’ tend to give themselves to illustrating power manifests. Both in the environment they operate within and the level of confidence in their skills under an optimistic mindset. These codes recoded positive when they deal with customers and members of COOPs under subscription. ‘Engage’ is more toward seizing opportunities and participating in various technical domains such as DG, DER, and social DR Etc. The code ‘initiate' states their ability to create propositions and solutions. ‘Influence’ was often visible when talking about energy consumers in local areas and conservation, which is often criticized as a limitation from energy stakeholders in reference to social actors and prosumers. Prosumers perceive users or consumers as asset to their success. They consider the chances of recruiting people to a cause as an extension to their position as actors. Codes such as ‘Compete’, ‘Promote’, ‘Effectiveness’ are more visible when talking about strategic actions or market tools. Continuously drawing on power and the fortification of their position in their local roles yielding positive outcomes. ‘Compete’ recorded positive under the recent recognition of EU of prosumers and negative when talking about competing in the market with utilities and their monopoly. It is significant to note that this code is the highest in frequency among the codes with in this subcategory. Therefore, the code ‘Promote’ is natural since COOPs are business oriented establishments. Hence, in this context it is geared towards social responsibility and their obligation towards their community. ‘Effectiveness’ reflects their mastery and ample ability to draw on the nature of their system, which were highlighted earlier as outcome oriented. It also represents the ability to evaluate their ROI in some locations in the narrative. This can be understood from the repetition of the ‘contrarian ‘Code. The codes ‘Specialization’ and ‘Networks’ tend to form themselves on the division of resources and human capital. Where they can extend themselves, and save costs of operations. While ‘Network’ represent their awareness of the need to extend themselves to achieve goals. These codes reflect the degree of ability to connect to different components as means to interact, or exchange resources in some way while remaining adherent to a standardized interface. Surprisingly they are conscious of knowledge spill effect within

their network and they rely on it as a mean to connect. Therefore, I had to group these codes under the idea of "Modularity"

The codes that defines the innovation patters in the narrative were coded as they are presented. Coded for 'Exogenous', 'Endogenous' and 'Heterogeneous'. We can see at this stage the idea of innovation is much more defined in comparison with earlier statements, which were more towards describing an open innovation. The code 'Exogenous' is formed around innovative patters where they resort to associate or extend themselves to interact with external agents or bodies to facilitate their actions, especially in physical applications and technology solutions. 'Endogenous' describe extents of which they originate. While they seek for a creative solution, application and even policy from within their networks. This indicates the ability to maximize their mastery to overcome situational condition imposed on them by the supra system. This code has the highest frequency among the other types. The code 'Heterogeneous' describe efforts that materializes systemic outcomes. That are even relevant or connected with supra system stakeholders, such as DSO's and TSO's. They are even keen on taking part in EU funded innovation projects that combine energy market stakeholders. The code 'Urgency' is relevant here since it describes the agility of their innovation. Referring to the way they view and value time and their speed in taking actions and decision making. In order to support their justifiable need to innovate, it is therefore important to define their aptitude towards innovation. Codes such as 'Magnitude', 'Valorize' are again associated with power. 'Valorizing' is associated with the increase in the value of capital assets. This reflects the skill they acquired through understanding concepts such as value-forming labor in production, which indicate their ability to devise their human capital managing a physical asset. The 'Magnitude' code refers to their reference of size in operations, impact, members or associations. It has ranked higher in frequency in this subcategory. 'Novelty' is where they describe the ideas behind innovations when mentioned, as a mean to justify how different are they from what is currently available. Codes 'Hierarchy' and 'Uniform' describe their alignment. While it continues to bolster the tendency to classify effort and define weights of their contributions. 'Hierarchy' was mostly described when they talk about the level of maturity, which is a qualifier for participating in big activities. Illustrating that the size of members and the network they manage matter in shaping their activities. Here we can monitor the beginning of a class system. 'Uniformity' at this context reflect their consistency and their political process. As they continue doing what they do as a mean to express democracy, which mean that they have their own governing process and regulations as well. Codes representing moral reasoning and consistency of belief can be

visible in ‘altruistic’ and ‘Role Identity’. ‘Altruistic’ represent their moral obligation as a social component. Especially in reference to energy poverty, democratizing the energy practice and decentralization. ‘Role identity’ often was visible describing differences between prosumers and consumers. Serving in a way a mean to galvanize their activities based on beliefs. Codes that denote to cultural pressure, ‘Movement ‘was mentioned only once to relate to the code ‘Lobby’. The lobby code evaluated as negative when talking about the utility and positive when referring to true emancipation. Emancipation to them is seen through the right policy and their planned actions with policy efforts. The code ‘Articulate’ reflect the mean of expressing their proposed solutions generally, especially while talking about systemic pits and policy gaps. Both innovation and characterization are sub categories representing a category describing the incremental growth of social activities.

It was astounding that the narrative contains to an extent implicit description of patterns showing a linear transformation, if we denote it to change. The ideals can be expressed from a functional analysis of actions if we refer to it from the matrix of change, which we will not expand here. The codes that represents a practice are expressed as ‘Spectrum’, ‘Customize’ and ‘Conservation’. The code ‘Spectrum’ reflect the multiset of practices the union over look. Along with the activity of COOPs either economic (wealth and resources), political positions and social classifications of cohort. this code happens to be the highest frequencies in this subgroup of codes. The code ‘Customize’ represents the confidence in their ability to change existing practices in their social sphere, which target practices over time and space. This can be understood from their inferences to their consumers and their consumption. It is important to highlight that this aspect is often addressed as a limitation of the social component from the system perspective. This brings us to the ‘Conservation’ code, which we can note by now it is one of the most adhered to aspect of their participation. This also entrenches their belief and responsibility to the intent of their creation and organizations. The codes that describes the centralization within the organization effort are ‘Regional’ and ‘Sovereignty’. These codes indicates authority in regard to their plans and decision making process. It can also be relevant to relate it to the power axiom. The code ‘Regional’ is a phrase to describe extending roles and activities from the locality level to a wider scale. Although only mentioned twice across the narrative, it can still address policy efforts. The ‘Sovereignty’ was only visible at this level of the prosumer organization. It is a transformation from autonomy to a much situated and strong arbitration of political rights. While I try to have a meaningful categorization of these codes that are a result of policy influence. I refer them to the idea of “Preference” as a mean to describe

their decision-making behaviors. The codes that represented the structural functionality expressed in the narrative are coded in relevance to knowledge and operations. The knowledge related codes ‘Knowledge spillover’ represent the style of communication among all levels of the social structure and the level of availability and reliability. This can explain the degree of trust among members in these kinds of structures. ‘Dexterity’ describes the mastery of materializing knowledge and operationalize skills. It also relates to the division of labor and learning, which draws on the ideals of emancipation. This code is higher in frequency among this group of codes. ‘Cooperate’ reflect the level of which they associate with each other in decision making and execution. Also the identity they hold when associating with parties that are not among their own. This indicate the merits of loyalty and strength of their belief. Codes representing the operations reflects decision making effectiveness towards rewards. ‘Strategy & management’ are often visible when projects and actions are taken in response to limitations. Their predominant appearance recorded as positive when talking about growth, negative when talking about policy hurdles. ‘Niche creation’ was noted frequently, as well, which is understandable since COOPs are business oriented establishment. They rely on technological solutions and innovation to create a sense of blue ocean competition, which I found unexpected. This only mean that their intentions is not to battle the big utilities on a market share. ‘Harmonize operations’ reflects the gist of control over their own actions and decision-making process. These codes were then grouped under the category of ‘fitness’. As it reflects their outwardly expression of their maturity as participant for a toll gate inclusion practice.

Category 1: Design	Concept 1: Homotopy or Schemata
Category 2: Growth	Concept 2: Change
Category 3: Fitness	Concept 3: Recursivity

The juxtaposition of the various variables at this part of the analysis, reflects the composition of three major patterns that are interrelated. First, the transformation of prosumers actions at this stage, which relies on Schemata denoting itself to a physical concept. This project’s their attitude towards their system. I can state at this point that it is polynomial. Meaning that the level of reflection and demonstration are at the level of expressing their variable consistency in a co-efficient manner. As a result, this continuously support their cognitive ability to operate on their own fashion of planned economy. Thus, I associated their design functions to schemata, which is a bigger concept in order to not limit it to schemes, modules and modulars only. Hence, it also provides the chance to describe it in a physical manner. While I remain true to the critical approach of this study, I cannot skip the consequences of schemata in their behavior which was

also visible in the narrative. Therefore, I have included homotopy as an adjacent concept to describe the cognitive dynamic as an element that reflect their tendency to adopt to change. The Homotopy theory and applications is a set of methods that associate with embedded polynomial aspects of a system. This gives room for farther expansions to define prosumer cognitive activities as part of a wider system. This serves as a mean to evaluate deformities in their system due to the rules of the whole system and regulation impositions. In other words, their ability to digest a large problematic context and form it in simple processes which they know a solution for.

Second, the transformation of the size of their variability of interests. This is important to project that they are not producing out of fulfilling their needs at this stage only. This is shown through a strong demonstration of characteristics of their intent. This transformation describes the manner with which they shapes the innovation practices they undertake or participate in. As I have illustrated above that various components of change matrix were relatively visible in my analysis of the narrative. This gives weight to change theory imposition on their contextual activities. Although the data wouldn't have given it self willingly to surfacing this. The rigor of analyzing tacit embedded patterns did help a lot through various coding stages. This also can highlight that the social component is also in a transition period adopting to the market transition. Finally, the concept of fitness mostly hosted codes that are relevant to decision making processes. The concept of fitness here denotes their expressive manner to be acknowledged, as they seek to be trusted and seen worthy to be included in the bigger system. Another fold of this concept is the high level of knowledge spill over among interactors that produce fitness functions. The spillover effect is responsible for electing and considering which functions are fit to replicate based on its effective results. The replication process means that the practice that works is popularized and adjusted according to national contexts. Simultaneously indicating the recursive action of the population among which they operate or influence. This is a strong indication for their cultural dynamics and the conditions they consider in their value creation. These concepts if we are to remain true to theory. Tend to strongly relate to the evolution theory (Perez 2004). It better serves the ability to notice the spectrum jumps, the parallel search for best practices and continuous innovation.

EUROELECTRIC–Belgium (Institutional technician)

Table 5 Code table for EUROELECTRIC

Category	Sub-category	Related codes	Frequency
Power	Belief	Control, Position, Framing, Magnitude, Identity, Instrumental rational, Concerns, Doctrine, Adequacy, Contribution value, Judgement.	65
	Authority	Norms, conditional, Political choice, Characterization, Condition, Standards, Intervention, Confidence, Sanction, Rigidity, Oblivious, Abstraction.	87
Efficiency	System	System norms, Divergence, Administrative Efficacy, Conditions, Stability, Instrumental Planning, Scale Efficiency, Consequent Tracking, Forced Coordination , Normalization .	80
	Economy	Possibility of Extension, Identity prosumer, Industry Analysis, Scale Automated Economy, Consequences, Performativity, Planned Economy, Value Addition, Competition.	69

It was necessary at this point of the study to confirm or refute my hypothesis about ESCO's and their techniques. That is to exclude my analytic pragmatism or biases toward a component among others. The narrative is provided by two respondents who act as (economic and trend advisor at EUROELECTRIC). Where they provided a clear path to connect to my understanding of the tendencies of energy market actors. Hence my extensive discussions in the literature review. This will significantly support a whole system understanding, which is meaningful to my later system methods discussions.

The natural setting of the narrative is coded according to its value to the research. Further cohering to the position of ESCO's as a prominent actor that shapes the stock and flow of energy as a commodity. The codes prevalent in the narrative which denotes social representation refers to the stocks of beliefs. In this context describing the inherent stakeholders as part of a group communicating on a constructionist nature. Codes such as 'Identity', 'Rational', 'Doctrine', and 'Judgement' demonstrate the cognitive aspect of the industry. The 'Identity' reflects the

utility understanding of prosumer operations, which leads to the code ‘Position’ where we can see it is firmly situated and fixed. Adhering to a set of rules that is enforces over time and space, which reflect the sectors “*locus standi*”. This code is seen negative when talking about “active consumers” position in the market. The code ‘Instrumental Rational’ reflects the “*modus operandi*” of the sector and their ability to plan and stage actions according to their physical system. The ‘Doctrine’ code is strongly present, describing the belief elements of how things should work. Which as a result allows ‘Judgment’ and means to reciprocate based on their beliefs.

The previous stock of beliefs codes decodes the action part that is associated with beliefs. Those appearing under codes ‘Control’, ‘Frame’ , ‘Magnitude’ , ‘Failure’ and ‘Contribution’. The code ‘Control’ described explicit actions in response to any disturbances in the environment they govern. This being mentioned justifies the ‘Framing’ code, which is the highest in frequency among this group of codes. The framing as an action is a judging tool that yields a preposition if one is entrenched. This code proved negative in the narrative and highly suspicious of the social component actions. The code ‘Magnitude’ also deals with the perception of the social actors based on their weight and size, which is also negative from their understanding. What seemed interesting in this context is the noticeable reliance on statistics. Talking about the social actors from their economic value based on fixed ratio fashion. This means they don’t believe it will have a significant effect on their realm. Consequently, this leads to the ‘Contribution’ code, which also gyrate around the concept of social production value to the wide system. The ‘Failure’ code was surprisingly second highest in frequency in this group of codes, which indicate their position on the adequacy of this new component. Also, reflect the conspicuous actions from the industry to measure the extent in which they have to manage prosumers short comings. In other locations in the narrative it also represented the firm believe in the inability of social actors to stage efforts that is highly significant to positively impact the system. These codes have facilitated jotting down their beliefs, which became the title of the subcategory.

The alignment of the belief elements in the data, also gives a great relevance to describe the tactics and strategies they use. The codes ‘Norms’ , ‘Conditions’, ‘Conditional’, ‘Standards’, ‘Sanction’, and ‘Intervention’ represent the degrees of actions staged. These candidly describe different escalations according to the relevance and magnitude of encountered actions. I will sort them accordingly. The ‘Norms’ in this context refer to the agreed up on methods of operation in the market, which everyone should adhere to from the utility side. The

establishment of norms of operations mandates the ‘Conditions’ with which they expect participants to operate under, in other words (the rules of the system). Based on the previous two codes I can explain the causalities of actions. Meaning the cause and effect weights in their assessment, which is coded under ‘Conditional’ to describe the scenario based rational of the industry. The physical system stakeholders therefore have fashioned ‘Standards’ to relief themselves from risks. The code ‘Standards’ were the highest in this code group. This indicates the strict nature of inclusion. The code ‘Sanction’ express penalties or the consequences of not adhering to those standards. The code ‘Intervention’ was strongly present as means to take things in hands. Also indicating the collective nature of this group of system technicians. These codes tend to justify the ‘Rigidity’ code appearance in the narrative. Often appeared in the context of indifferent to social component outcomes, which leads naturally to code ‘Abstraction’ of social intent. What is interesting in this code is the frequent appearance expressing the intentional lumping of social actors under one umbrella as “Consumers”, which explain the code ‘Confidence’ in the wide scale of services they manage. Especially when talking about grids. The code ‘Characterization’ was often mentioned to reflect the mathematical and statistical nature of evaluating effectiveness. The previously mentioned codes can illustrate the attitude towards policies and the political effort, which are coded under ‘Political choice’ positioned as second highest in this group. This code only describes the concept of policies that is limited to “Democratization”. It strayed once from this description when talking about “Energy Poverty” and battling a class system within the energy system. This describe a strong political reason to justify their understanding. The code ‘Oblivious’ describes the rather strong physical understanding of the ideals of “citizen involvement” or “voluntary social participation”. Further indicating a tunneled vision or in other contexts a blinkered attitude. This group of codes illustrate only one thing, which can be obvious. The level of authority the inherent system employs in order to deal with its activities. Therefore, it was only rational to group both sub groups ‘Belief’ and ‘Authority’ under a higher category which represent the ‘Power’ of the system representation.

The codes which have demonstrated the functionality and decision-making processes of system technicians were also visible in the narrative. The codes ‘System norms’, ‘Divergence’, ‘Stability’ were jotted down as functions that describe the system activities. The code ‘System norms’ in this context are more geared towards the engineering actions of the system. Again highlighting the nature of how things should work. The code ‘Divergence’ is a description of operation that is seen as a threat by a component that is assumed to be unexperienced or

demonstrate lack of knowledge. This again justify the code ‘Stability’, which indicate the elements of desired security in operation to reduce the risks. This means that they are adamant about the functionality of the transition and preserving trading deliverables. The previous codes serve as a justification for system technicians decision-making processes based on perspective. The decision making processes are described by codes ‘Administrative efficiency’, ‘Instrumental planning’, ‘Scale efficiency’, ‘Consequent tracking’, ‘Forced coordination’, and ‘Normalization’. These codes wouldn’t have given themselves easily from the narrative. As they are considered a formulation of a tacit understanding of the industry. I merrily attempt to give them an appropriate description based on their systemic meaning. So, I will avoid diving into electricity technical jargon and remain true to the techniques. The code ‘Administrative efficiency’ in this context represent the need of the system to evaluate the organizational structure of the new component. This encompass two different influencers to decide and evaluate the dimension of the system centralization through assessing verticals such as socialization and standardization/formalization of prosumers. This process determine the manner with which the inherent system should administrative efficiency of their output. This code is the highest among this group of codes. It is obvious that the inherit system technicians have a high level of doubt in the social component being fit in such procedure. The code ‘Instrumental planning’ assumes fallacy in energy community planning. This is a natural outcome, given the failure code we have mentioned earlier. These codes hold a great meaning if we dive in to them. The instrumental rationality especially in decision making combines top-down and bottom-up approaches. Rendering this to the operator’s system, one can notice that they have already fixed tools to deal with bottom up communication. This justifies the following code ‘Scale efficiency’ this code is relevant in the context of optimality in regard to size. Meaning that the bigger the size of operations the more optimal it is. Therefore, under this paradigm any modifications regarding the size will ultimately reduce efficient optimality. The value for scale efficiency is the result of employing both aggregate efficiency and technical efficiency. From this explanation we cannot escape the thermoeconomic nature of this code, which can reflect the notion of entropy as an element. The code ‘Consequent tracking’ represent a mathematical tool to prevent fallacy across the system. Furtherly stretching decision making processes based on causalities. This is also justifiable given the previous code 'failure', continuously entrenching the inherit system technicians position on the prosumers effect on the system. The code ‘Forced coordination’ means exactly what it refers to. Synchronizing and bringing into line. The notion of coordination implies the reduction of autonomy of the participating components. The code ‘Normalization’ is also a mathematical tool used to achieve

and maintain the system functional at desirable conditions. Those codes that addressed both functionality and decision-making processes are then categorized under the category of ‘Technical System’.

The Codes that represents economic features with in the narrative, are coded as well according to social activities and industry economic mechanisms. The codes that are present relevant to a social opinion are ‘Value addition’, ‘Prosumer identity’, ‘Consequences’ and ‘Performativity’. The code ‘Value addition’ convey doubts in the type of services that the social component (prosumers) can provide autonomously without using the utility services. It also indicate a critical judgement on prosumers investments, which can come short if compared to utility secure funding. Current system operators and technicians still cannot see the social actors able to manage liabilities of maintenance. Although prosumers managed to keep their establishment functional, they argue that prosumers will have to deal with depreciating assets at a point. ‘Prosumer identity’ code here describe the frequency of ambiguity in prosumer’s intent to the system technicians, which can justify the existence of the following ‘Performativity’ code. The prosumer identity code is also prevalent as the highest frequency in this group of codes. This code describes where the system stands from their identity, which is totally opposite to how the social actor’s views identity. The inherent system technicians believe actions come first not the beliefs. Reason behind this position is that they think of prosumer beliefs from the principle of "agent problem", which reflect their economic and political position even farther. The code ‘Consequences’ in this context draws on the utility of social component, which indicate the questioning of prosumer morality or moral obligation to the system.

Simultaneously the codes describing the economic mechanism of the system are ‘Possibility of extension’, ‘Industry analysis’, ‘Economy of scale’, ‘Automated economy’ , ‘Planned economy’ , and ‘Competition’. The code ‘Possibility of extension’ is a description of how far the prosumer concept can get? It is to a great extent visible that the inherit system technicians are trying limit the prosumer concept to keep it within the democratization of electricity label. This can be understood from the nature of the code which reflect principles of welfare economics, which is not favored by the system operators. The code ‘Industry analyses’ represent the evaluation of prosumer profitability being unable to compete with ESCO prices. The narrative increasingly demonstrated schemata in expressing the new acts on prices undergone by system operators. This brings us to how they justify their previous claim based on ‘Economy of scale’ code, which allows them to save costs based on their increased production on a wider geographic area. As a result gives them more price competence for the

average consumer. This gives validity to the code ‘Automated economy’ and its advantage to their scale. Representing a steady state economy that is based on abundance or scarcity of products. Given the fact the various methods of production they reel, apart from renewable resources (fossil, nuclear … etc.). This code is the highest in frequency in this group of codes, which reflect the nature of the system technicians as (R-strategists). The code ‘Planned economy’ is highly associated with the previously mentioned code ‘Scale efficiency’. The code ‘Competition’ in this context was not in regard to social actors, rather on the technological frontier. Especially when talking about block chain and smart grid applications, where they are still trying to plan past the smart metering phase. Both the consumer codes and the economy codes are then grouped under one category ‘Efficiency’, which serves to reflect how the system view prosumers technical efficiency.

Category 1: Power	**Concept 1:** Hegemony
Category 2: Efficiency	**Concept 2:** Stagnation

The furnished discussion serves as a mean to support my previously intuitive analysis of the industry. As a result, I can demonstrate how the ESCO’s and later the supra system regulators (technicians) interact with prosumers. In this context ‘Power’ is different from the power expressed on behalf of the social parties. This case of power represents a group of people who have a strong situated say on matters. Therefore, we can strongly notice patterns such as: 1. the groping of the planner. 2. The ruling out of the contextual planning. 3. The abstraction of sociology. To construct these elements in their actual meaning of subscription, I am ought to take in consideration the fact that those technicians do manifest ideals strongly on the political area. I have chosen to address it from a state alignment reflecting the "polis" and everything that it represents. I define their elements of practicalities as “Hegemony”. This represents the extent with which this group affect regional and trans-regional policies, which is considered the major limitation for the social actors. The other aspect of the data folding established certain norms of progress from within the industry yielding a justification of the attitudes. The most salient argument here remains revolving around the degree of taking actions of this social actors seriously. Let alone permitting or allowing recognition for their abnormality in their approaches. Since their approaches transcends the level of an enterprise and represent a level of generality that is not clearly capital defined. These concerns can be understood if we reflect on the capitalist nature of the industry. In other words, norms of the sector are fundamental to the planning supported by enterprise perspectives. Yet the dynamic reassurance of production

continue being a function of the market conditions. The system norms in ESCOs context are complementary to each other, adding up to a practical synchronization of their actions. Therefore, it is challenging for them to conceive the localized norms of the social actors. In that sense it is visible that their decision making heavily relies on regulating. They regulate aspects of their economic techniques which defies the doctrine of the industry gate keepers, whom happens to be the ESCOs in this case. There is an interesting variable to this fact that most of those utility giants are to an extent a public sector owned by governments, which can illustrate the political involvement of the state in the role of public accounting in a transformation period. This can explain the margin of change between the intention and realization. The drawback of such concept is the conversion of administration into a framework, which have caused the techniques of these organizations to value scale and treat nations as a supplier of a working capital. Continuously dehumanize the social role which require a certain civic involvement. Based on this understanding I have chosen to give the notion of efficiency in this context to the concept of "Stagnation" to represent the degree of autocracy in the transition. The presence of both political and static position elements can draw themselves in to the concept of 'Too Big to Fail" problem, which often defies creating a dynamic competitive market.

5.2.1 Incorporating conceptual categories into frameworks

The outcome of my data analysis yields **eleven conceptual categories**. Each category was then formulated to sets an organizer concepts together with its embodied correlated concepts. The outlining of the Twenty One formed subcategories resulted in a conceptual map of **six composite frameworks** which joints all the elements of the study.

F1: Cognitive Frameworks: Decision-making Strategies, Comparativeness, identity and situated position.

Under this framework I incorporate: cognitive processes concepts from the prosumer side and concepts of stagnation from the industry side. Illustrating the objectivity and modeling ability of the social axiom with the authority concept of the system stakeholders. This framework facilitate defining each party and their actions. Under this framework we can purposefully identify elements of polarity between two types of technicians (the inherent system technicians and social emancipation technicians).

F2: Cultural Framework: Beliefs – Philosophic/political/ ideology, Systemic positioning.

Under this framework I incorporate: the beliefs of both components, attitude and norms, which than can largely draw on behavioral aspects and means to utilize knowledge.

F3: Processual Framework: Judgment - efficacy, techniques – Actions.

This framework lump concepts of self-efficacy and their subcategories from the social axiom. To identify the coping of social actors with the concept of hegemony of the system. Furtherly represent the agency behind their techniques.

F4: Knowledge-based Structural Framework: Education/ Knowledge- automated learning, continuum- mechanical.

Under this framework I incorporate: The knowledge spill over and growth from the social axiom alongside the similar patterns of the system. To illustrate the formulation of both understanding of efficiency, which is vital to farther understand the social schemata.

F5: Technical Framework: Transition, techniques, Innovation.

Under this framework I incorporate: the change perception from each side, actual actions and its imposition on innovation. Also assist with clarifying the later homotopic actions based on knowledge acquisition.

F6: Leadership Frameworks: Communication, Agency.

Under this framework I incorporate: the feedback and framing in both actors and recursiveness of the communication, which represent the total energy system component including the social actors.

5.2.2 Developing thematic components and abstraction of themes

The figure bellow illustrates the major elements that the general system revolves around, which both the energy stakeholders and prosumers aim towards. This serves to represents the polarity between the two actors. Only at this point one can see that elements such as Efficiency, Efficacy, Effectiveness and Ethicality are central to our understanding. They tend to be static, but it is not the aim of the illustration to represent the positive or negative impact of the elements involved. These elements are vital for our Soft System method (SSM). I will therefore construct my themes around the SSM 5 E's. This serves the purpose of observing the broad lines of the prosumer argument and Technological transition in this research. Each topic has their own subtopic and that can be understood from our extensive analysis.

As indicated earlier the concept of efficacy was strongly visible within the subcategories than others among the social narrative. Associating with attitudes, modularity, functionality, consistency and encouragement, which also correlates to the belief. The concept of effectiveness come second. The strength of frequency serves to correlate with ability, consistency, objectivity, design and growth. The concept of efficiency came third in the frequency and strength, which correlated with system, economic, fitness, permanence and persuasion. Finally, the concept of ethicality correlated with cognitive, belief, recognition and actions.

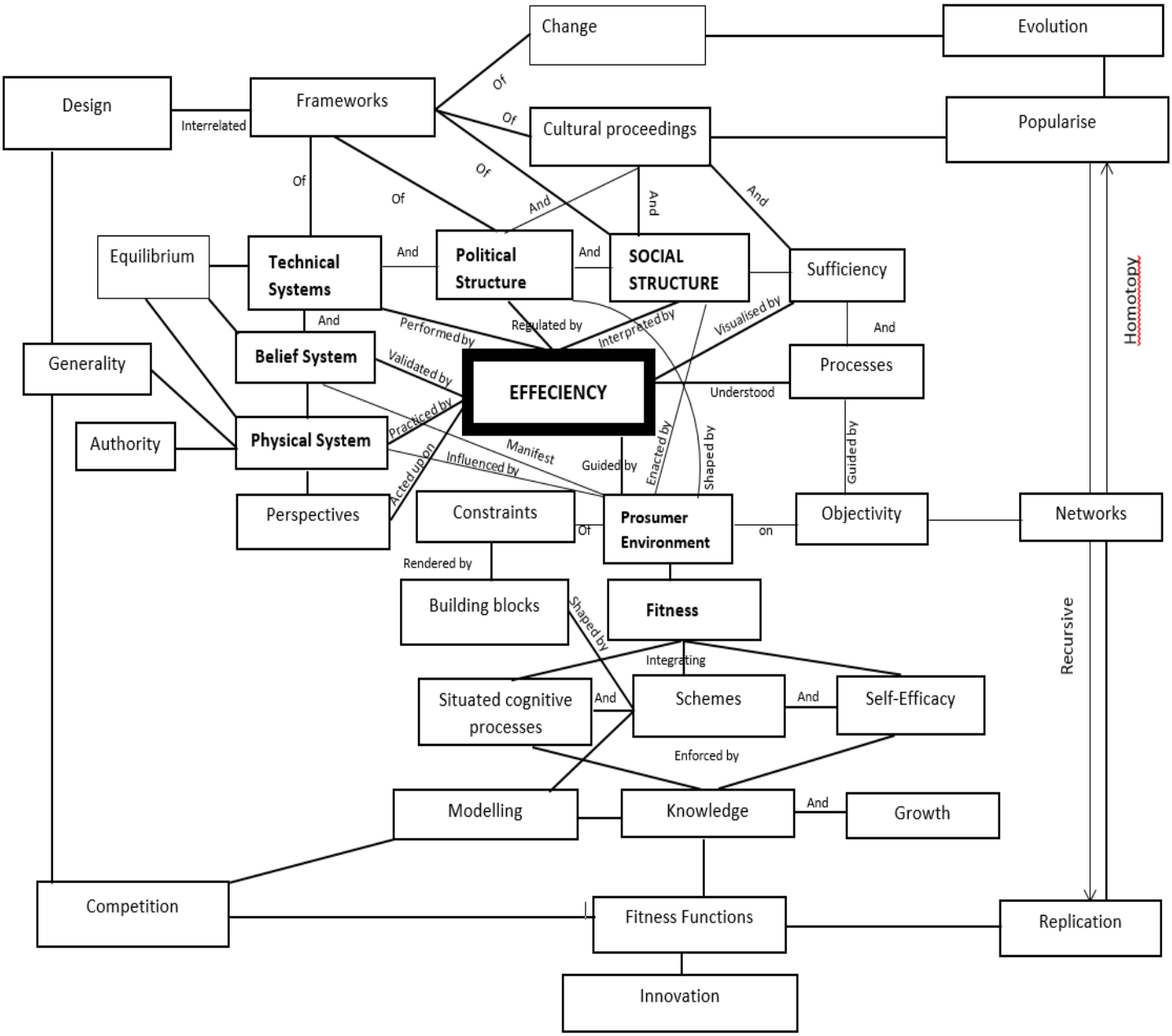

Figure 4. Thematic alignment and illustration of a complex situation

5.3 Thematic Analysis

Four central themes were extracted from the analysis, from the earlier drawn upon 6 conceptual frameworks. Those four themes will even be grouped to form two major central theme families. This will facilitate incorporating the previously mentioned 11 conceptual categories that shaped the major 8 theoretic outcomes of the analysis. Most of the concepts were adjacently interconnected in a complex manner. My intention was to project the dyadic manner of various frameworks providing a proper contrast. While continue adhering to the guide lines of intended Soft System Methods criteria (SSM). For example, the conceptual frameworks culture, cognitive and leadership were often combined under one major topic describing prosumers. Therefore, to appropriately illustrate a new understanding of prosumers. Such alignment should be broken down. To not only demonstrate the interconnectedness of these frameworks but also their dynamic interactions.

The thematic analysis proved challenging, due to the wide scope of the elements reported. For that reason the process of extracting themes can seem to combine and recombine elements. A thorough revision going back and forth the data pool was needed. This procedure was followed to pin down the consistency among the concepts, theory and themes. Ultimately to facilitate mapping the relationships and incorporate them into an appropriate theoretic framework in order to provide a way to join them thematically. Although the procedure was not the only way to conceptualize the theoretic domain thematically. This application allowed a better mean to possibly make sense of variations within the data. Hence, the process took a very traditional manual approach since software alternatives wouldn't have handled the social underpinning of each concept. The purpose here is to themes our findings to represent the prosumer system based on its salient three features: the belief, the knowledge and structure. At this stage we are expected to construct the root definitions of the relevant system subject to this study. As a principle I will continue drawing on Sorokin theory of belief, Moore's work on networks and Emery & Trist concept of complexity. The themes will farther segment the data findings based on its appropriate appearances according to these additional filters. Furtherly defining the conceptual frame works. This is a must, in order not fall into the trap of describing a social phenomenon from the data alignment.

Theme 1: Knowledge - Moral – Efficiency

This theme describes the group of prosumers based on their orientation. Insuring the continuous collectivity of contributions to a higher system. This group of prosumers encapsulate the

guidelines of their whole system nature. They relate to knowledge as center to their proliferation, while they continue to reflect on abilities towards the gist of the higher system. This group of actors is considered the regulator of a momentum for the rest of the system components. They have a moral obligation towards effective deliverables to the higher system. Their obligation is often towards both their social system and the system whole. Therefore, they insure the ethicality of their activities by being purposeful to both systems. In order for them to keep their dual identity, they rarely actively take a physical part in the physical activities undergone by their members (COOPs, Social enterprises, community generators and associations). This means that they are prosumers who are not part of the voluntary exchange nor part of a commercial prosumers. Although they do not practice means of activity expansion, they opt to materialize and implement. This is visible in the wide array of their activities that represent their members. In other words, they represent the techniques of experts who have already achieved technical mastery. This qualifies them to advice others both on the EU legal level and the system technical level. They represent a group of highly skilled entrepreneur like individuals. That is if one would like to apply them to the "Opportunity Nexus Framework" (Shane, Eckhardt 2003, Shane, Venkataraman 2000). In this context it is vital to highlight that I do not refer here to entrepreneurs as an activity or as a causal relation with change, rather as a function. From this stand on ward, their activities and motivation are to serve and steer. Since they also represent the concept of emancipation as a motif, they demonstrate three dominant production functions:

1. Vigilant of possibilities available of technological advancement, while remaining able to appropriate the utilization. In this regards it was visible they demonstrated strong prerequisites in their involvement with their members. This is to insure avoiding technological threats to the higher system. Examples are visible in strengthening social DSM, perfecting private contributors' grid application maturity, VPP understanding of participants…etc.

2. Cost neutral blue prints of technical alternatives and combinations. This is visible from their eagerness to take part in EU monitored projects. Also supervise initiatives by their members for example (wise grid, Rescoop plus).

3. Averting the logical pure production functions, constructing factual observation scenarios. Where they have strongly advocated that price alone schemes can be altered in a reasonable way to balance local grids and cut governmental expenditures. Another element can be jotted down is their high awareness of reality and projections of scenarios.

All the above can highly represent a Schumpeterian characteristic (Schumpeter 1954) towards their innovation functions. This group of energy prosumers arbitrates that SG technology adoption creates a state of free economy to overcome the hegemony of the energy service operators. They also indicate that they do understand the role of ESCOs and they do not wish to oust themselves from the safe energy generation chain. This element farther strengthens their moral obligation towards both energy supply and demand. The system efficiency is important for their operations geared towards sufficiency. Also, they identify and outline their system representation from simple energy consumers. Hence to overcome this mixture in judgement by both policy and the system technicians. They strongly believe that all problems will be resolved when all system occupants become technicians. This justifies their strong understanding of the social norms of consumption and motivation towards energy use. Continuously justifying their social decisions, which is later passed on to functioning unites to increase conservation awareness. This group is responsible for generating change factors and innovation also referred to "Creative destruction" in innovation literature. This can be seen from various planned applications among their members in alternative energy currency innovation, valorizing i-RES, DSM solutions... etc. In spite of all the above they refuse any practice to escape fees of utilizing the grids as a mean of service. Although they avoid system isolation, they still have their own take on that as well. They also attempt to collect enough capital to acquire part of local grids to insure continuity of their endeavor. This can be visible in expressing the acquisition of several DSO's. These prosumer technicians can be called the "Ideal Prosumers". Despite not being responsible of how the nods on the ground function, their feedbacks are highly regarded. It can be noticed through them expressing their manifestation of intent on the political level through using a stronger term than others "Energy Sovereignty".

Theme 2: Environment – Cognitive – Cluster

These prosumers poses a well-established practical understanding. They extensively employ a strong experience, which is honed over years of practice. This segment has a high role in examining innovation- driven transformation at a corporate industry level. Their agency revolves around the influence they exert on their local sphere. They are motivated by organizing efforts and forming solidarity among their outreach. Prosumers at this level established a knowledgeable endowment in specific domains. They often vary in specialty that can range from technical operations, technology, and energy management .etc. They have acquired the mastery to transform their knowledge from an exogenous form to apply it in the endogenous reality. The reason behind this is their perception of their identity and role. They stage actions

influenced by their attitude towards their goals. Often driven by the focus of their social surrounding. Their efforts usually materialize in striving to attract others to their cause. Those people often engage in creating COOPs, engage in existing ones or construct social solutions to assist social activities. They thrive to achieve optimum outcomes that are attainable. Measuring the possibilities they influence by originating simple engineered systems in line with their tacit abilities, depending on the level of exposure to the higher system. This segment is responsible for the genre and momentum of "Endogenous Growth & Agglomeration Effects" (Acs, Varga 2005). The kind of distortion they cause can have various effects on the economy. They often will adhere to a higher regional cause (COP, fossil free economy, Energy prosperity in the case of rural areas ... etc.). They will mostly abide to the regional policy framework, but will attempt tunneling into limitations. Therefore, the need to cluster is evident so actions are collective with other establishments that share the same goals. This can be clear from my finding that their ethicality is in line with their situated cognition. So, even though they know the grey areas of regulations, they still think that manipulating electricity locally is not something they would do. Since I have established their need to form clusters to enforce some sort of recognition, which will yield benefits on their networks or members. I can now draw on their interaction with technological change in a macroeconomic mindset. Prosumers on this level often influence people in their outreach in:

1. Promoting incomplete knowledge of the system influenced by the spillover of secondary knowledge. This does not mean that they will cheat or promote false knowledge. It simply means knowledge adequate to the reasons of the employment. This serves in cases of attempting to fund raise capital or create an alliance to change policy regarding bids for instance. Simultaneously remaining true to their community by explicitly justifying their actions since it is for the collective good.

2. Drastic and none drastic innovation periods across the development of fundamental technological change. Consequently causing the economy to move endogenously towards competition. This forces the other market components impedance by maximizing monopoly prices, which can be seen in their attempt to seek ways to be able to share energy to trade it with one another due to its high costs.

Luckily, they are aware of the dangers or level of divergence they will be exposed to if they tend to lock in the technological transformation. So, they keep opportunities with in scope and also think of the whole system benefits. This group of prosumers are likely to express their

political involvement to increase the community feel. Hence, the data have identified the visible symptoms of corrosive community. The increased feel of treated unfairly for adhering to the national political goals. Due to this they attempt to negotiate some of their associated aspects. For example, when it comes to grid they don't indicate being exempted from the tariff. Rather they would like a better tariff category based on the distance of the service point. Prosumer who function on a COOP structure or similar gives ground for "Path Dependence". This supports other finding in regards to energy innovation like (W_stenhagen, Wuebker 2011, Redding 2002). This segment is majorly responsible for forcing regional action towards a horizontal innovation, which fits the explanation by (Denti 2009) in the following manner:

1. Positive inter-temporal spill over call for public support.
2. Negative inter-temporal spill over call for taxation.
3. The negative business steal effect.
4. Consumers imply public aid.

This group of prosumers fulfill the needed momentum for fueling demand for more public involvement or facilitating a "crowd mentality". This explains their decision-making attitude and behaviors as contrarian investors. Also represents their political association with materializing change. Hence the visible use of terms such as justice and opposition in the narrative. They exert means to charge their understanding of liberating the community from the stagnant situation of them being consumers. Hence, the concept of "energy Democracy". These prosumers can be called "Pragmatic or speculative- active prosumers".

Theme 3: Knowledge – Belief – Reactive

This theme describes the group of prosumers whom also classified by their knowledge. The knowledge here is more towards the execution domain. Often driven by increasing the know-how of operation on the ground. Their knowledge aims towards private actors in a mean to allowing them the education and empowerment to accumulate resources. They represent a group of prosumers who strongly manifest their political rights as a function or as a causal relation to change they want to see. On this level prosumers actions represent a "knowledge spill over actor." Further harboring a response to the lack of information about energy application, pricing and technology. They facilitate and transform stock knowledge to available opportunities. Alleviating progress impediments forced in active citizens in their geographic outreach by demonstrating heavy reliance on tacit acquisition of techniques. They serve the purpose of rafting the barriers and magnifying opportunities at the base of the social pyramid.

This framing of behavior supports the knowledge based growth models mentioned in (Romer 1990, Lucas Jr 1988). They often drive their actions from their belief of emancipation. To illustrate this farther it is more associated with "Energy Poverty". Increasingly spreading knowledge on appropriating and regulating disciplines in consumption and production behaviors. Therefore, it is visible that they are more prone to act on conservation, self-regulating and planning for domestic balance. In much-advanced cases they might draw in social funds enough to create a domestic grid to serve their diverse resources. This type of prosumers often form associations or specialty centers to offer their local surrounding tools and platform to exchange discussions. Again, we can see that they manifest the intent for a democratic process that enriches and contribute to their locality. Those prosumers often have scaled their operations as mean to increase their local influence. Simultaneously they are active in the energy generation and transmitting practice. In their case unlike the COOPs they don't have clients as members, but they roll their sleeves on a wide array of energy productions. Since they don't aim for scale, their power is generated from the increasing number of nods with in their networks for a higher outcome of diverse resources. They often recruit politicians to their cause and accumulate enough capacity to associate with municipalities. In some cases, their growth extends to even acquiring the municipal operations or take over the role of production under the municipal supervision. They opt to associate with municipalities for financial funding or governmental licenses. This prosumer segment often expands their reach for energy generation to means beyond electricity. This means that they have a high level of mastery over the energy supply chain. As the research have found out in the case of SOMSO for example and they are a small community if we compare it others who does the same. They do not really orient themselves of the EU regulatory process until it affects their local functionality. This group of prosumers can be called "the Fundamental – Ascetic prosumers"

Theme 4: Effective – Situational - Culture

As I continue being confined to Sorokin belief classification, in an attempt to surface a postulation on Paul Stern's Value- Belief- Norm's theory. This Group of prosumers tend to adopt to a more a sensory material form. They focus on scientific evidence to support their values and believes. This group represent the "naïve scientist" in their situated cognition. Often influenced by the external measurements of a phenomena. They are often disregarded of the innate obligations of actions. Although they will refer to their actions as objective driven and describe quantified behaviors. They adjust knowledge to fit what they know, regardless of the unknown. Often coping with material science trends addressed by the leaders of their choice,

which can justify the power position and leadership of the prosumer groups explained earlier. This group of prosumers continuously reject facts that contradict their beliefs, which mirrors their efficiency accountability. Therefore, Faith in conventional systems have little value to them. They are representing a social system that is heavily guarded by scientific truths and knowledge they conform to. Interesting enough, the previously mentioned above prosumers groups are aware of this segment being existing among them, which can explain their continuous use of the “movement” expression.

This segment is more relevant to demonstrate the (values/action gap) by the consumers. Which means, that they form the mass of prosumtion network human capital. This explain the optimistic notions in narratives and the trust in their abilities in the labor division functions. Members of this segment are more concerned with the physical and sensory cohesion of action in societies. It is vital to mention that SG technology is an innovation that is yet to be deployed. This segment is more prone to harness the efforts and facilitate a "path creation emphasis". Therefore, it is important to understand the levels of deployment adoption and the effects of ideation spill over (Illustrated in the themes above). To form an understanding of path creation on various social element. Notably Roger’s framework of innovation diffusion (Rogers 2003) is most suitable to describe the order of adoption. Mostly concerned with reflecting the innovation decision process. Farther exposing the importance of social networks and their influence on more consumer groups. The Roger’s framework highlights (Previous experiences, individual utility, innovativeness and social norms) as prerequisites for a successful diffusion. Which is in line with our analysis. As the data can explain the staged adoption in the following fashion as they happen according to modules furnished earlier:

1. Acquisition of knowledge through social networks.
2. Formulating attitude based on beliefs.
3. Pick a position.
4. Actions or implementations (this element is in line with the Utility consumer choice principles).
5. Fortification of position.

Base on this sequence that supports or rejects the deployment. We can further postulate that consumers adopting to prosumers activation reflects a processual connection of “intent” and “mean”. This understanding farther gives ground to refute the mono-utility believe of prosumers often communicated by system technicians. Replacing it with the concept of

“Instrumental rationality”, which was earlier visible in the supra system stakeholders and ESCOs. This means that these groups of prosumers are more geared towards the mean rather the end. Largely reflecting their societies, cultures and subcultures. This finding agrees and is farther confirmed by (Etzioni 2010). In order to be coherent with theories for an even granular exemplification. My understanding is supported as part of value or belief system if they met the following elements:

1. Actions are imperative and are undertaken out of duty.
   This is visible from community energy private generation, which is currently seen by the inherent system as “voluntary”.

2. Universally applicable under comparable conditions.
   This also materializes from our finding the adoption to globalized approaches in their knowledge transfer. Seen by community energy (SOMSO100 Community, Project RESCOOP + and many more).

3. Tend to mandate a generalized behavior.
   This can be seen on the level of the Fundamental – Ascetic prosumers. Describing people in means of being coherent and creating solidarity, which were explained earlier as it shows resilient behaviors.

4. Demonstrates commitment not merely based on cost and benefits.
   Also seen as they have managed to cluster and organize under legal formats. Furthermore, even have managed to form pressure groups on regional and EU levels.

The previous illustration provides a strong support to consider the consumers of the prosumer activity as prosumers as well. This can be easily shaped by the current existence of voluntary participating energy citizens. Those whom have adopted sustainable actions that contributes to their moral utility towards their energy needs. This group’s understanding of efficiency is more geared towards “Sufficiency”. This contrasts to the system preference of “Adequacy”, which is a scale enforced comparative advantage measure. These consumers can be called the “Sensate Prosumer”. In the light of the previous reasoning. I will take the literately of farther expanding this group into two sub-groups. This is at this stage important to elaborate elements of my final Viable System Diagnostic (VSD), which will contribute to illustrating a better communication

channels. The following serves to magnify consumer embedded dynamics[15]. Active Sensate (Green Collars) and Passive sensate (Green Consumers). In this context we will rule out the cynical sensate since the trend are not yet extreme.

- Functional – Perceptive – Ethical

  This group of prosumers is the catalyst element for the spread of cultural change associating with a social mega trends. The social system changes according to their inherent potentialities. As an example, for this among others, people who subscribe themselves in to the EU promoted socio ecological transition goals. They believe in the political judgement as a central mean to actions towards achieving sustainable goals that is nationally promoted. This cannot be ruled out while we talk about SG technologies and the ability of societies to perform. As the data have included strong tendencies towards coping and encouragement, which reflects motivated agents. The Policy often looks to social participation from the perspective of exergy, which is the ability to physically undergo actions relevant to structured efficiency criteria. The exergy perspective is often structured institutionally by technicians that belong to a physical system. This statement complies with the political narratives in this research. It is relevant to say that this finding is in line with similar proliferation in this area by (Ayres, Warr 2005). Alternatively, I attempt to reflect on this group work on duel dynamics, as a mean to contend with the exergy notion. I resemble my outcome to draw on the elements that qualify in governing the identity of active sensate prosumers:

  A. Deliberation: This was demonstrated from our data especially in the community energy scale.
  B. Determination: This materialized in both analysis on community and association narratives.

  Renewable energy and regional sustainability are becoming a strong human capital attractor in local economies, farther promoted by the state. So, the ethicality is present as a cultural element. Therefore, it is fitting to address the human capital element as part of socio-ecological change associating with energy technological transition. In this regard the active sensate prosumers are

[15] The utilization of the expression ‘dynamic’ in this context dose not relate to the description of analysis. While the subject of the study does not include system dynamic analysis. Rather the use is entirely descriptive of the nature with which change occur. It is a mean to report that the findings indicates a latent existence of patters representing a dynamical system in response to change. Therefore, there are possibilities of interchangeable modifications in its measurable parameters with time. These changes subject to this system and the way they occur are not with in this study focus. This indicate that further work is yet to be documented and analyzed desirably by micro-economic focus in consumer research.

presented in the existence of “Green Collars”. Despite the varied definition of the term. Green collars are the labor often associated with an occupational skill and knowledge that associate with an environmental emphasis (Hatfield-Dodds, Turner et al. 2008). The specialization in this domain can tend to be stretched across various expertise especially in the energy field (bio or renewable energy, environmental services, energy efficiency, carbon foot print analysis... etc.) (Bowen 2012a, Bowen 2012b). The EU policy transitive on this matter favors the socio-metabolic regiments approach. This approach illustrate (Functional, cultural and technological) dynamics of this segment as labor accounted for growth (Fischer-Kowalski, Haas et al. 2012). Especially on the environment level it describes a goal driven category in the sense of “citizen labor”. The continuous reliance on the metabolic regiments continues treating the topic from the physical perspective of getting citizens to work. The findings of the analysis in this study can tend to contrast this perception. As I have illustrated the patterns based on the subcategory they belong to in the earlier theme. Although people patterns based on knowledge may reflect dynamic structures. Their ability to manipulate knowledge facilitates their construction of dynamics. Therefore, they do not often necessarily abide to the physical framing of the intent. The analysis has furnished several indications of power struggle, discomfort and at points opposition. Although it did not reach to the level of resistance, it still reveals clearly adoptive dynamics in association. This is visible in the description of the shift to “corrosive community”, which further justifies the conception of resilience. My argument comes in line with (Neisser 1988) work on social structures and knowledge. Reflecting on his postulation, I would concur that the problem with the socio-metabolic regiments approach is that it is a “Graded Structure Categorization”, which does not reflect the system complexity of the social activities. It does not recognize the malleability of the organization nature of social networks. It increases the adoption of the physical system rational in the quantification of human outputs. It is rather much adequate to explain the social malleability through reflecting on cognitive psychologies. The social cognitive psychology refers to human agents as processors of knowledge imposed or sought-after stimuli from social context (Neisser 2014). This inference justifies the visibility of the principle of the "agent problem" while coding our inherent system narratives. Also, explains the surfacing of homotopy associated with schemata with in the social narratives. As a result, we can make sense of elements in the analysis referring to prosumers entrenchment to their self-position. This comes naturally while one attempt to determine the level of which they interact with their situations and environment. Hence my expansion on the situation aspect within this theming. This means that it strengthens their position, furtherly fortifying their determination after a deliberate decision process. This also comes in line with (Neisser 1988,

Neisser 1989) conclusions as i continue outlining my findings with Neisser. I will qualify my understanding of this segment as elements of prosumer labor division capacity. As my findings have matched and fulfilled the five levels of self-knowledge that governs human ecological interactions[16]:

1. Ecological self that reflects the desire of growth and sensory rewards.
2. Interpersonal self-denoting interactions with influential others.
3. Extended self that denote interaction with society.
4. Private self that reflects individual motives.
5. Conceptual self which reflect position associated with consequence actions.

Those levels can tend to be even far complicated and complex in an environment cluttered with objectives, which often govern and describe this group. Therefore, in order to be able to describe the magnitude of their influence on SG technology social agency. It is much suitable to focus on the "situated cognition" that reflects the duality of the process in theory. This justifies some of our coding categories focusing on elements such as 'locality', 'artifacts', 'building blocks' and 'preference'. It is also important in this context that we relate to the human resources prosumers rely on or exert as "Task Specific". To address the various professions and specializations within this segment. While not ignoring the impositions of the "Cohort effect" of different human agency and ability of production, whether incremental or functional (Gibbons, Waldman 2004).

The situated cognition of social environment, motivation and knowledge. Within this context should describe a schematic subsystem. This is supported by the strong presence of the concept of schemata and homotopy. Which allows a better inscription of automatic and controlled feature of knowledge, experience and strategies. Which is highly reflected up on by our respondents explicitly. Bellow I will quote some of the strongest statements to illustrate:

RESCOOP:

"We do not go home from our morning jobs as engineers and high professionals; to simply become dumb. We continue to act as who we are in day time as members of our social initiatives and COOPs"

[16] The inference here to human ecological interaction does not refer to the earlier notion of evolution theory. It is merely to stay in line with the later subject of the system analysis, which the study relies on complex- unitary category in Jackson's complexity grid. Furnishing an adequate selection of theory in line with the desired outcomes.

SOMSO

"It is best to say that COOPs are managed in the evening. As we all have our daily jobs as professionals in various domains. You will be surprised if you know that corporate CFOs and General Managers of some big firms are active members in COOPs. They provide their expertise for free as a mean of being responsible"

BBEn:

"Let's say that people with good income see presumption as a way to save money and it's just the beginning of a trend in the private household in Germany. People often are professionals of various areas. Some of them are even experts working for the renewable energy sector in their day job. In western Germany for example people who work as engineers in the automotive industry. Have a lot of knowledge on the mechanical side. Another example on the local level, people who work in the building sector, participate in heating system design and implementation in south Germany. They involve in their cooperatives and charge nothing. They have even reached to the level of building co-generation plants"

While remaining true to illustrating the structural nods in the network of such broad segment. It is important to enabling the separation between specific cohorts. Hence the surfacing of the 'characterization' category in the results. I will adhere to the postulations of (Bless, Fiedler 2014) on constructing social realities. Continuously distancing myself from a pragmatic position in my analysis. Further avoiding personal conceptualization driven by the sense-making approaches often visible by business decision makers at firm level. Therefore, I will group Active sensate prosumers based on their demonstration of knowledge. The following task specification grouping bellow illustrate two generic sub-groups. This is important to farther omit implications imposed by cohort effect stochasticity, while it continues supporting the perspective – functional elements of the theme.

1. Explicit Active sensate prosumer

   This sub group best described as Automatic/spontaneous. Which often follows a 'top –down' structure. Comprising individuals who employ processes that are unintentional and requires little reflective resources. Yet they can engage their experience in a goal-oriented fashion. This description in a way similar to the one (Fiske, Taylor 1991) argued. This represent a wide range of electricity technicians, service providers and even blue collars attracted to opportunities in the renewable energy spread etc.

2. Implicit Active sensate prosumer (Motivated tactician)

   This sub group is more inclined to use extensive reflective processes. Due to their knowledge category they belong to “incremental producers”. In other words, mind workers or the professional and technical intelligentsia referred to in (Eckersley 1989). They often employ Controlled/systemic approaches. Reflecting their conscious regulation within the scope of their awareness of opportunities. They follow a (bottom – up) fashion. They assess their representation and motivation relevance to specific tasks they perform. This umbrella of prosumers in the segment is vast. It can include among others (scientists, researchers, policy makers, social steering groups, activists, business managers or owners, white collars and technology savvy populations, etc.).

- Random – External – Symbolic

  This describe the second major group of sensate prosumers. They are given the name “Passive Sensate prosumers”. The EU policy and literature uses the term ‘attitude–behavior gap’ to address the human action part of the 'Energy efficiency gap'. Simultaneously Energy stakeholders promote SG technologies as a consumer centered technology. Henceforth, this group of consumers of prosumer activities draws on several complex dynamics. Their existence addresses the consumer choice under specific groups. “Environmentalists”, “Environmental consumers” or “Green consumers” are labels often coined by energy system nudge or promotions. These labels describe citizens/consumers electricity purchase decision making activities committed to a moral action or obligation. This continues the framing mindset, while it serves as a marketing slogan. It is important in this stage to differentiate between them and the “sustainable consumers”. Since they are always fused together in political or industry campaigning. The "sustainable consumers" are those consumers who participate in energy regulated actions in energy saving plans, which are often the wide segment the inherent system relies their social measures upon. The problem here is the industry segmentation, which only focusses on the aspect of production. This means that its either ESCOs or entities who associate with them, and everybody else who only consume electricity.

  These passive sensate prosumers often addressed by ideation prosumers as part of their movement. They are energy consumers with a symbolic subscription. They form the magnitude of practiced consumer choice in favor of prosumer operations. Although their position in the culture can vary among members. Their awareness of being part of the movement become stationary favoring prosumer energy activity. This explains in a way the level of strategic moves expressed in the data by Rescoop respondent. Influencing this segment behaviors to becomes a

central component of their collective network. Often those who support a movement opt to impose their realm and behavior on others. They are willing to take some actions and bear coasts. Consequently as they extending themselves their value increases. The increase in their values correlates with their determination and level of involvement. This yields a strong reward being part of a set of specific beliefs of consequences and responsibilities, which is convenient enough to activate behavioral norms. The boundaries between individual agents in support of the cause and their activities are fuzzy (Snow, Rochford Jr et al. 1986). It is at this stage significant to draw on Stern's applied Value-Belief-Norm theory and its constituent model on environmentalist. Showing that despite the fact that not all supporters are active. They continue influencing relationships between pairs of variables at adjacent causal levels. Those of this profile are influential over the "Green energy choice".

Technological change and SG technology social adoption should address the self-activation system. Using the activity theory, which is strongly exhibited in the data. The activity theory constitutes a general conceptual system. Especially in Human computer interaction (HCI). It further describes the structure of activity hierarchy, objective-orienteers, internalization and externalization, mediation, and development (Kaptelinin, Kuutti et al. 1995). The employment of Activity theory with in this context farther relate to the envisaged complexity and reflect the cognitive actions. The activity theory unit of analysis is the activity which is a composite of (subject- actor, object - goal, actions, and operations- function). Actions are goal-directed processes that are often self-imposed towards fulfilling an object. They are closely related to the self-awareness outcomes, opportunities of a function and reward. It also supports the dynamic nature of the activity experiencing change.

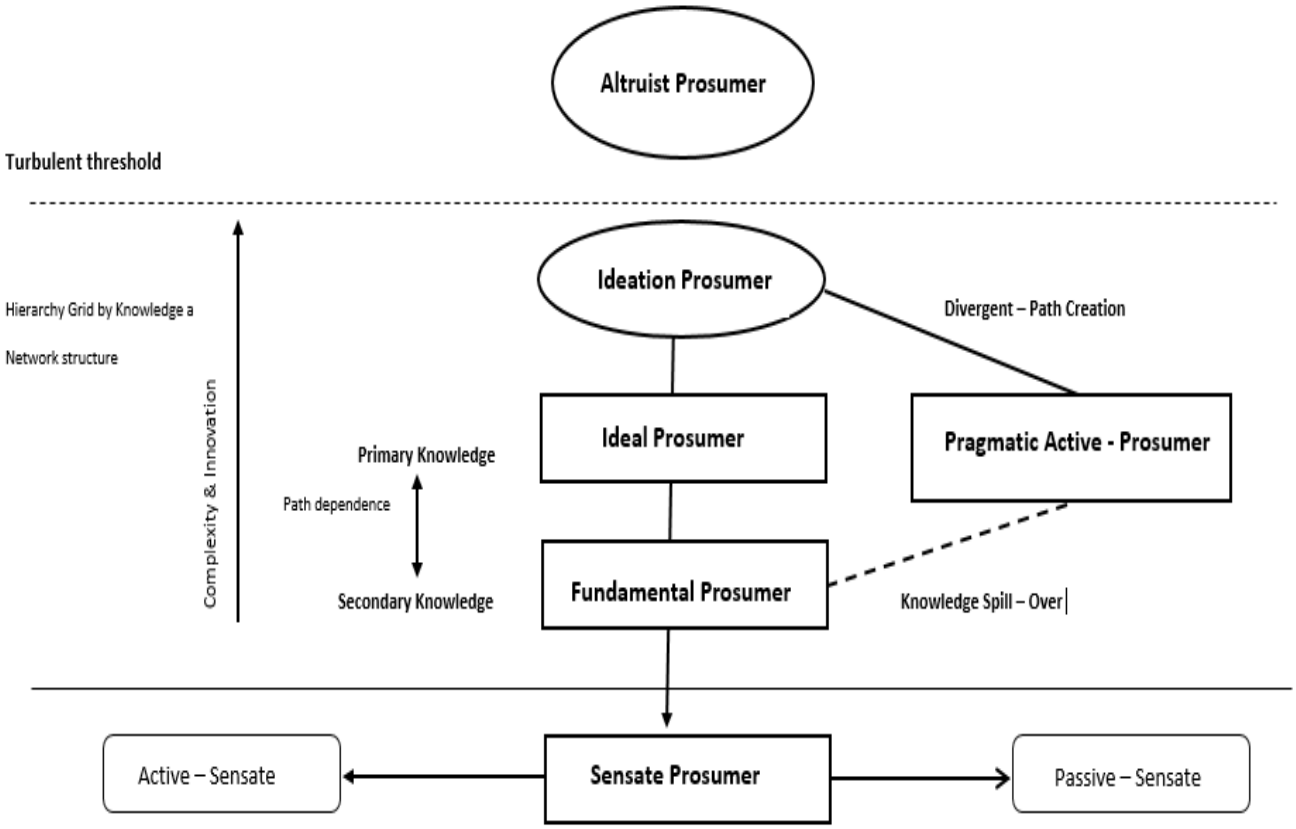

Figure 5. Energy Prosumers Classification Grid & their Organizational Structure

5.4 System Analysis

So far, I have tackled the first stage of my sought after (SSM) analysis in the literature review. Where I have extensively expressed a situation that seemed problematic, which reflect the SG deployment aftermath and ESCO's prosumer relations. I will now express the problematic situation of the aggregator fix in the lights of my findings. Now at this phase of the analysis I stage the problem subject to this research analysis.

Stage 2. Expression of the situation unstructured:

<u>The proposition of introducing an aggregator and SG</u>

The EU policy makers along with stakeholders of the inherent system have been heavily discussing the introduction of a new component to the energy market. This is due to the established norms of progression that have been illustrated extensively earlier. The justification for this move is to maintain the efficiency of the system. This contributes to entrenching the already stagnant position of the electricity supra system actors. Furtherly increasing the likelihood of extending dealing with prosumers as a divergent element. This move is confronted

by increased discomfort by the social energy actors, which were highly visible in the data and findings. Especially among the social system technicians with in the Ideation prosumers. While it is still unclear on the regulatory side the time frame of such a barrier being persisting.

The introduction of an aggregator is seen as a mean to extend system technicians establishment of norms. This kind of legislative actions transcend the level of the private enterprise and attain the level of the general. As it was illustrated earlier that generality is visible in both party narratives. It can be noticed that the competition here is not over power over market. Rather between technicians of both systems. A divergent force seen from the utility framing, which presented by system technician and the Ideation prosumers aiming for recognition. In contrast, the current norms of prosumers can be seen essential to a successful SG transition. Even farther to protect the efficiency of the whole system in response to the expected technological competition in the future. The current Prosumer norms demonstrate obvious utility, which is extensively illustrated earlier in this study. Therefore, there are better ways of coordinating them or permitting them their full efficiency. The need persists in integrating them into a plan that accommodate them appropriately. Allowing them a practical representation of their system norms. Planning so far is strongly fixed on real pricing and wagging i.e. incentives, tokens, and remuneration schemes. Meaning that it still follows the economy of scale and the size of production. Hence, the previously focused ESCO plans we have discussed earlier in the study.

Next, I will illustrate the general system with and without the aggregator. Since earlier in the study I have illustrated the negative impact from different economic and technological views. In this illustration I will draw on one of the strong finding in the analysis, which is the relevance of evolution combining seen from their growth categories.

Stage 3. Formulating root definitions of relevant systems of purposeful activity:

At this stage of the analysis the primary tasks are farther processed. Each task is described in a root definition for what it entails. The description of tasks is a formal constitution of their constituency and activities. While also include the informal ones that are central to the system identity. This extends the views of what the system should be like or accomplish. Through applying Checkland's six factor analysis (CATWOE), which tackle the Customer, Actor, Transformation Process, Weltanschauung, Owner and Environmental Constrains as following:

Consumer: in this case they are the ESCO's and inherit system technicians.

Since I have stablished that the system fashion their plans according to automized economy. Even more strongly abide to the ideals of quantity and price to reflect on efficiency and social needs. Therefore, the planning represent the second aspect of their economic technique of intervention. Hence, the data have staged intervention as one of the salient aspect of decision making in response to divergence. Simultaneously, technicians apply their technical instruments with no sentimental motives to human actions. In this case we describe the system technicians both on the legislative and industrial analysis. While they continue to apply abstracted views of sociology. They believe that the need persists to apply more control to avoid the inquisition of prosumers intentions, which continues to remain opaque to them. This strengthen their situated cognition to remain true to their tools to avoid taking the liberty of adequating plans adherent to contextual planning. Their actions represent the notion of evaluating the margin of chance between intention and realization, which strongly demonstrate a strategic fade. This understanding is manifested in the data in administrative efficiency, probabilistic conditions, instrumental planning, scale efficiency, forced coordination and normalizations. Continuously being imbued with principle origin to the physical techniques. Therefore, their belief is centered on the application of the physical instruments, while the social strata is poorly delimited. Hence, elements like regionalism and locality is of no high significance to them. It is astounding that they interact with geography and political representation as one unit. This geopolitical unit is considered more of an enterprise with certain services and specific functions in there schemas. They often referred to these schemas as energy scenarios, which is strictly an energy upstream operation term. To them regions should be profitable and yields a maximum efficiency as well. More or less it is a segment with in their allocated capital that needs to be administrated. This justify the judgement elements in the data. They rely on public accounting in their understanding of public, which generalize consumers in two segments according to their contracting types. All the above yields in their political obligation to leveling or streamlining their supply and demand. Thinking they are creating a social balance and preventing class segregation among the system operations. Therefore, their attitude with politics is also administrated. They treat civil representatives as objects that should be also included in their efficiency plans.

Since the inherent system technicians have a uniform perspective of geopolitics, regulations are often generic on the EU level. This allows them more power over regional customized plans according to regions and local members of the electricity conglomerates. These often depends

on their agreed condition of system equilibrium. This understanding can serve to reflect their attitude towards the SG transition. They state that the technological transition is clear to them from their system point of view. Simultaneously, treating the transition in a mechanical manner towards a greater efficiency. Allowing them to more control and a greater use of voluntary generation through the smart meters and smart DSM. The only aspect they continue to worry about is the growth of technology giants' knowledge of the domain and their impact on the system security, which also reside in their comparative advantage according to scale. Also, being suspicious of undefined monetizing technologies like automated trading and block chain technology. Since it remains unclear which direction these applications are heading towards. These can help characterize their innovation patterns which are both incremental and endogenous in nature.

Actor: In this case they are the prosumers of the social technicians.

Prosumers initially are private citizens exposed to two opposite political nudges. One is national, described in the political macroeconomic agenda of applying a steady state economy (Post –Scarcity economy). In this regard energy conservation campaigns that is also price driven. This is not only in the energy sector this can stretch to various municipal activities and resources. The other one, is the EU regional sustainability and environmental nudge. Both propaganda apparatuses are present over the past four decades. The problem in the case of energy prosumers at this stage of the transition is that both campaigns might cancel each other out from a political view. If we depend on a pure political definition, the appearance of two political propaganda apparatuses cancels each other. While this remain true from the political science perspective. Nevertheless, this is not the case in the public or individual perspective. The problem resides in the disturbance in the situation of the individual exposed to both of them. Hence, the strong focus of this study on situated cognition. Both nudges are equally skillfully concocted. Unfortunately, they are aligned in a correlated fashion to motivate the private person to choose to act out of obligation and interests. This correlation contributes to forming contradictions between beliefs and enacted material measurable actions. What seems to be visible in the case of energy prosumers is that they started to report and express their understanding of the noted contradiction on the political level. This was the result of years of actions which seem to have resulted or forced them in new a direction of political choices. It is vital here to not ignore the capital invested in meeting their national obligation and their stationary position as abiding citizens working for the best of their nations.

The previous can explain the duality of human practices between the concept of society, which is state related and the concept of community as the facility with which they optimize their local patches. The community they form galvanize the type of involvement based on a different set of norms. This takes place according to their feel of belonging to a specific culture of their choice. The Problem here which seams stationary is the different underpinnings of the conception of community between state politicians and community leaders. In this case since we are discussing a technological transition. I should highlight that the direct product of technological advancement is that it gives different modeling of social relations and political organization. This is due to the collective ownership of assets that serves to strengthen their ties as a community, which was highly visible in code equity entitlement within the data. Their conception is built on cooperation and equality as they practice democratic processes in management, consensual values and a visible secular self-governance at high stages in the prosumer order. Their moto is often environmental and geared towards conserving resources to assist the government. Although they have no problems with the taxation entailed, they have their own opinions of how to make things better for everyone. They have demonstrated elements such as flexibility, adoptive, and resilience dealing with system norms imposed on their activities. These elements should not be seen from policies as monastic. Rather it tends to be obvious that they have reached the stage of a "Total community". Based on the previous notion of what type of community they form. The concept of scale as a comparative measure from the system generate their feel of lack of trust in both politics and the inherent system.

The policy continues missing the essence of their motivation and power structure. It is important to know that for them the size does not differ to the community whole. Although the power as an element was visible in the data. It rather denotes to the power of expanding their activity and accumulating enough momentum to be recognized. Also, we can notice the features of building a global community on a local base. Communities build distinctive features of certain conciseness of the mutual consecutiveness of people regardless of the magnitude of it. This explains their need to exchange energy among each other as a means of community belonging and curbing their needs. It was not in a trading financially generating capacity fashion, although they would not mind a financial return. This takes us to the concept of belonging, while it can to an extent support the rural area framing from policy makers. The principle here is that the concept of this community has passed this level. They have fashioned their practices which were local at a point to a belief that can be copied even in the urban contexts. We might not see this any time soon, but it will be materialized as soon as the technological resources allows it.

The community here shifted to a "group-based –organization" that follows a democratized practice. This realization justifies my earlier choices of “autonomous division” to reflect on their style in decentralizing. The decentralization techniques they have formed here is a response to the EU regulation and their regional digestion of energy agendas. They have grown in complexity and in size enough to form what sociologists refer to as “Creative effervesce communities”.

Ideation prosumers have demonstrated maturity over structure and on electricity system knowledge. So, it is safe to say that prosumers envisaged within a purposeful plan become a mean of social integration. This conclusion acts as a propellant towards a more inclusion in the technical society. Their actions are in line with legislation to maximize their social beliefs and participate in political emancipatory actions. Their needs are more collectivized and are not imbued by social pressure. It is important to realize that applications done by a private person is usually applied in a pure state, which often contains a mixture of moral elements. This is prevalent in their belief of justice and communal merits to build energy-sufficient territories in their dwellings. It is important to note at this stage, that the previous juxtapositions have demonstrated strong evidences to support the ideals of the “Topological Social Choices and Space” (Chichilnisky 1980). The current situation imposes limits on the pure techniques they endow when it shouldn’t. They are aware that their subscription to the wider system is vital. While continue to acknowledge that undertaking a systematized number of techniques can seldom create a sturdy structure if separated from the whole system. Therefore, and due to the coercive feel from the wider system they had to cluster and segment themselves based on knowledge and experience. This was important in their construction of a prosperous function that yields resilience to groups whom subscribe themselves to the path. They have passed the stage where they might gravitate unrealingly to superficiality of opportunities which are unstructured. Their structures prevent them from normal consumer behaviors which weavers between unreasoning fear and false security.

Transformation

Prosumers especially the Ideation groups are conditional in their value creation. This factor serves them in creating elements of their blue print, which is then practically manifested in plans and goals. As discussed earlier as the evolution symptoms manifest in their actions. Their evolution condition can be illustrated as following:

- The appropriate designs after rigorous study of the space.
- They concoct schemes based on their design lay outs.
- They allot interactors to schemes, which is explained in division of labor.
- They iterate schemas based on their interactors in building blocks.
- They allocate interactors to specific fields.
- The interactors illustrate limitations and constraints according to the environment.
- Constraints mandate actions which they require to make decisions.
- The collectivity of constraints yields their fitness in handling them.

Therefore, the innovation types they demonstrate are quite extended and they reel in whatever it takes. The consequence of their innovation are the schemas and module fashioned outcomes, which are then populised through the spillover effect. This process yields different fitness functions that are converted to replicate processes. Therefore, since they have displayed an evolutionary behavior we can denote that to a culture. I have revealed earlier that a class system already do exist over the energy system, which is not on the financial or increased staple of a commodity. It is rather on the base of knowledge and familiarity of the energy system techniques and practicalities of operations. This reveals that the power the social actors enforce on education, learning and building ties is the most significant to address than the physical outcomes. This conclusion makes the notion stated by the inherit system technicians of preventing the creation of a class system over the energy system subject for contestation.

The continuous exclusion will tend to increase prosumers feel of isolation. Transforming them with the technological transition to the stage which they do not wish to be at. The stage of altruist prosumers which is defiant to the system and wishes to replace it. This I have illustrated in figure 5, explaining this shift according to complexity theory and the turbulent field associated with the transition. Where dynamic properties arise not only from their interactions but also collectively against the field itself. In an attempt to create a free economy to fulfill the ultimate political reason from their involvement, which is their rights towards emancipation. Prosumers ultimately will draw appropriate means to standardize their practical norms and intellectual uniformity as their culture mature.

Weltanschauung (World – Systems Analysis)

The outlined analysis of narratives with in this study can project a three-world understanding. The Three worlds that are visible in this analysis are connected and interrelated in various

aspects. As our findings have supported the visibility of homotopy among groups with means. Despite the different outlining of each system unfolding on the Smart grid technological transition. The Three worlds visible from our analysis share, add and limit each other in different respects as part of a continuum.

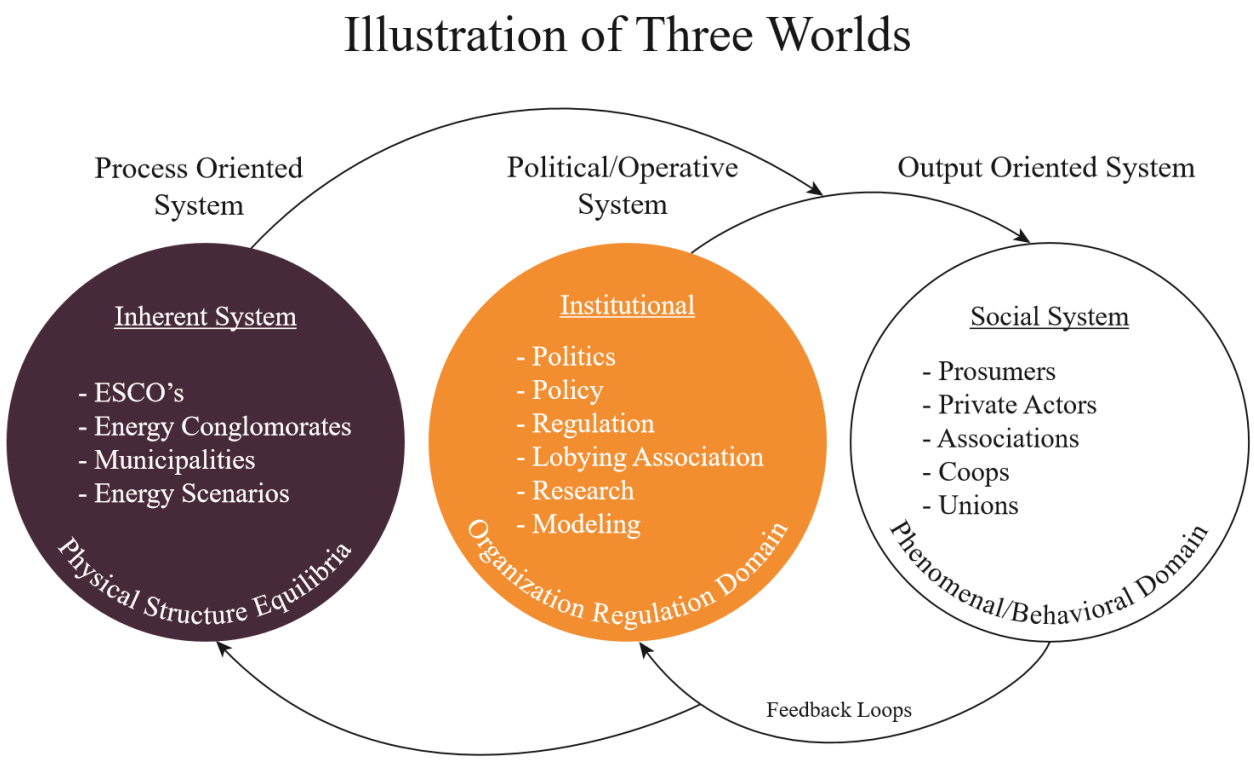

Figure 6. The three worlds over the energy system

The political realm, the institutional real (Current energy stakeholders and their representative technicians), the social actors (prosumers and their representing technicians). I will examine the outcome of my analysis to Checklend & Davies's Weltanschuung (Checkland, Davies 1986) attributes, which together can collect in three forms of world views as following:

1. **Appreciations:** The analysis have reflected different views of the SG transition situation with both cognitive and evaluative aspects. This defines the reflective attitudes of various stakeholders of the transition.
2. **Appreciative systems:** The analysis provided a generalized version of the appreciation in regards to Smart Grid, efficiency and social participation. This in return allows to projecting different accounts of a variety of situations.
3. **Presuppositions:** The results have furnished various expectations that are changeable by exposure to knowledge.

4. **Concepts:** The results have provided a theoretical structure, further allowing to grasp the situation of prosumers and SG technologies (Attribution theory, Activity theory, system theory, homotopy type theory, theory of change, theory of self, Evolution theory and theory of planned behaviors).
5. **Conceptual system:** The concepts provided an outlined in an interlock fashion.
6. **Prejudice:** The study have been through about pragmatic elements. The ill-thoughts were filtered to remain focused on the main concepts with no biases. To avoid evaluating elements that can change with the change of a wider set of information. The analysis was grounded to ingrained elements of the topic of technological transition and social actor's transformation in the current energy system.
7. **Value:** The analysis reflects sets of values, attitudes and beliefs to form the ideological foundation for a value system.
8. **Value systems:** each world revolve around a set of values that were heavily discussed and illustrated.
9. **Constraints**

   The table below list the major prosumer and electricity inherent system owners constrains in regards to the social actor environment. I will address three spheres of constraints (EU policy, regional legislations and Strategies).

Table 6 Impositions of realms over the prosumer environment

Sphere	Prosumer environment constraints
EU Policy	The current EU regulation despite positive recognition of the social energy actors and prosumers. Still addressing them from a generic and undefined perspective. Continuously applying a physical approach towards dealing with them.
	The EU energy trade regulations treats all energy social actors uniformly. With disregards to implications that this might lead on the regional level.
	The undefined structure of the EU regulations on the green initiative and environmental projects in regard to the social participation. Consequently causes the regional regulations to lack practicality regarding technical implementation towards social energy generation.

	The increased reliance on taxation on the EU level regulations on entering in to the activity. Has no regards to each national taxation or VAT schemes which differs from one country to another.
	The topic of the aggregator remains expressed as a phase. While a time framework is not yet drawn for their existence.
Regional Legislations	Limiting their locational activities by scale measures in some countries (Tenders, cooperative sanctions, feed in terrify limitations).
	Prosumers activities and enterprises are projected as charity organizations rather political economy actors. This is due to continuously being fixed on the energy poverty concept.
	Regulatory fixation on licensing as a condition to participate in energy sharing or trading. While they see themselves as stakeholders of a social business run by normal citizens, hence the energy democracy label. They are not interested in engaging in capitalistic acts.
	Not allowing prosumers in various countries to make benefits or participate in current proposed platforms funded by EU. While continue relying on normal consumers to evaluate the effectiveness of these platforms.
Strategies	The introduction of an aggregator with no clear identification of their role on the social actor side. Often define that from existing energy markets (Ancillary, capacity, intraday ... etc.). Structuring their actions only from system stakeholder.
	The regional strategies are often limited to focusing on the prices alone. Prosumers often come shorthanded on helping people to work on demand side of energy markets.
	Energy trading continue being stagnant on tokenism and reward schemes for large consumers and continue ignoring prosumer generation capacity.
	Increasing difficulties even on the notion of sharing energy of different forms among each other.

Phase 4. Build conceptual models of the system named in the root definitions

- **General system Illustration**

  In this stage I will build on the basic understanding of the system I have depicted earlier in the comparison. To break down the SG environment I am ought to expand the component of the social system neutrally without the aggregator involvement. Bellow I structure the general system desired and sought after.

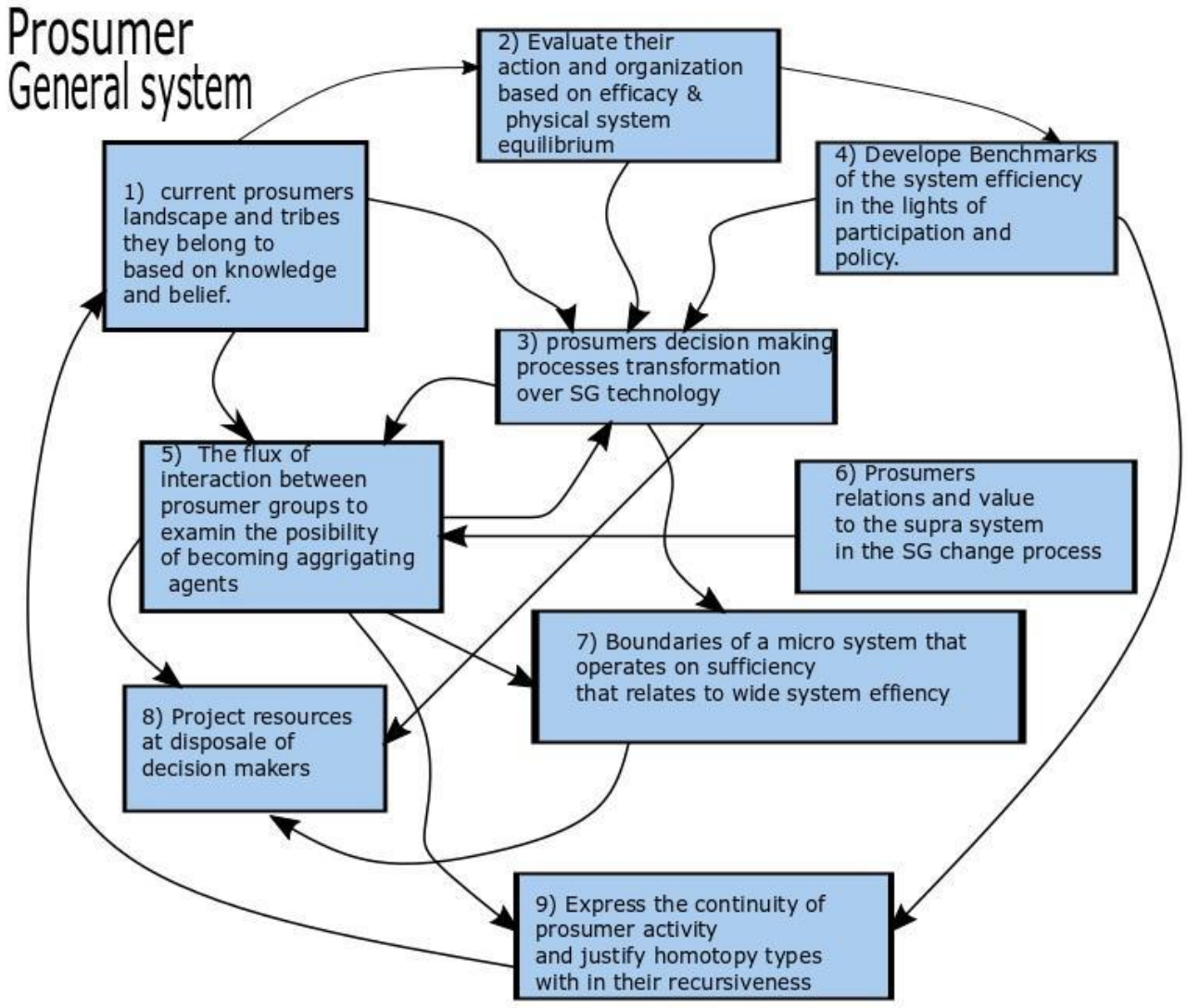

Figure 7. Prosumer General System unstructured

- **Viable System Modeling**

  I have established the existence of recursion among prosumers from my data, as an element subscribing to evolution in response to transformation and change. Therefore, at this stage I will expand to describe and compare functions at different organizational levels based on the segmentation/ classification I have furnished. This will give the chance to valorizing and magnifying prosumers locality in their behavior and beliefs. VSM is most useful to describe a system of interactors with shared agreement about their entity and have uniform cohesion of boundaries and share the same basic goals (Beer 1984). Viable System Diagnostic serves as a first step to identify system activities. The elements of the diagnoses as the system demonstrate elements that qualify its utilization as following:

1. Prosumer system undertaken implementation of tasks.
2. Prosumers fashion coordination
3. Prosumers utilize internal control of their tasks
4. The manifest intelligence and development over their design. This can be justified by innovation.
5. They practice decision making capacities and their fore strategies, which impact policy change. Since I have stablished the eligibility of the prosumer system to be expressed through VSM. I will go ahead and start devising the system components.

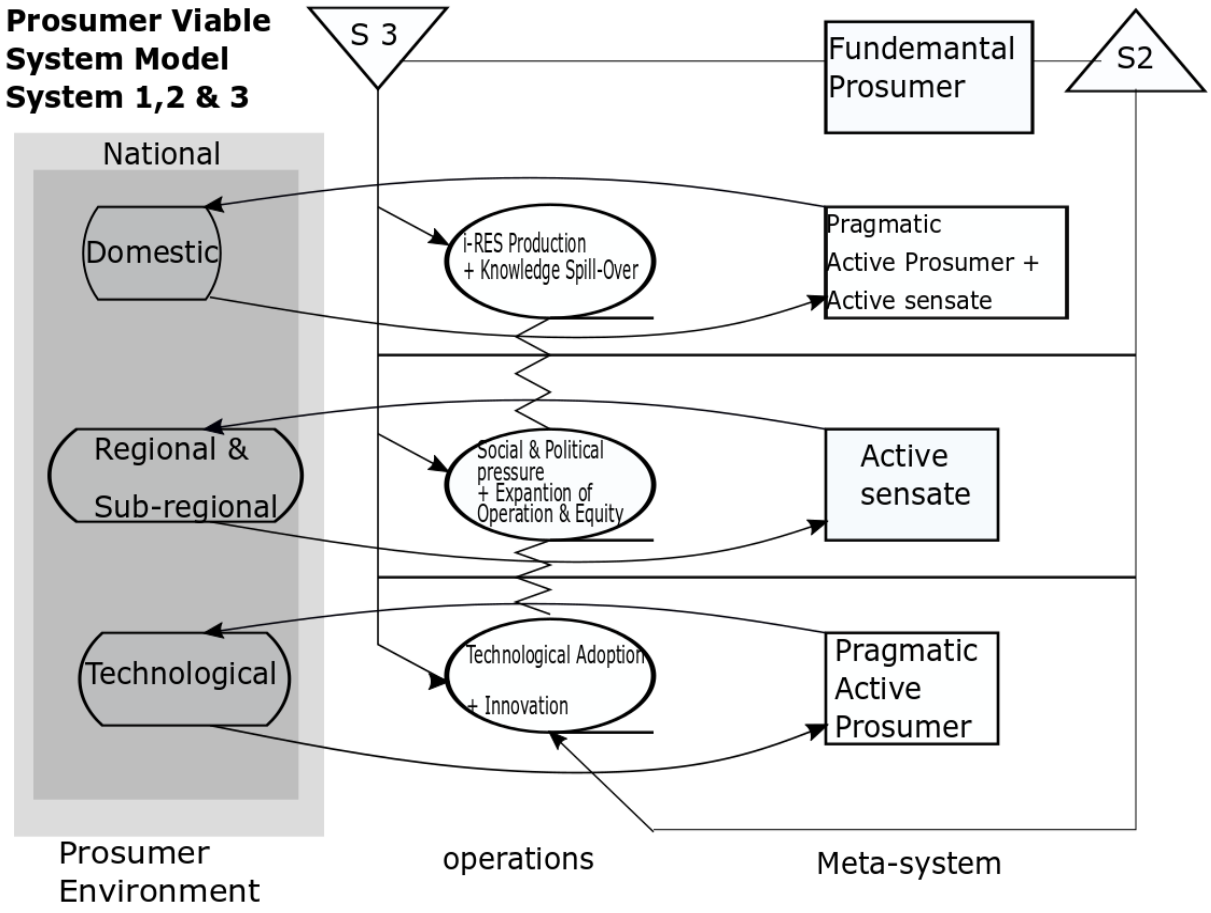

Figure 8. Prosumers VSM Modeling internal network

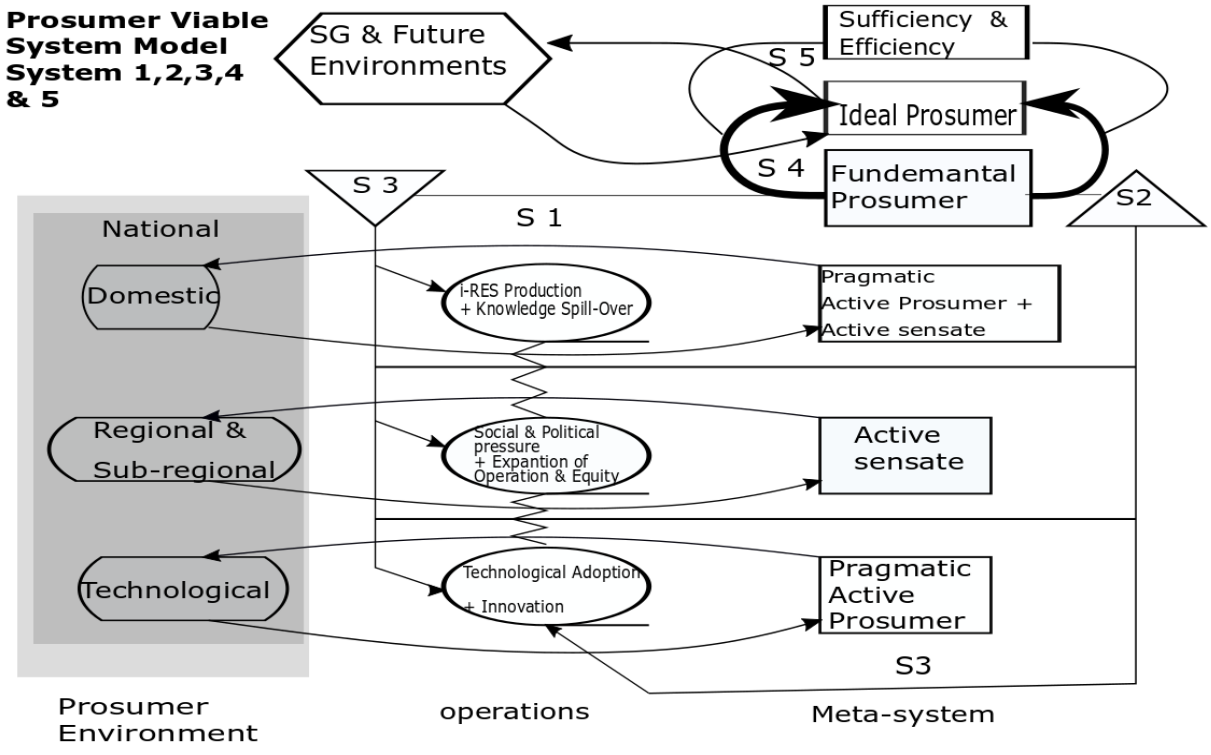

Figure 9. Prosumers VSM Modeling alignment with the supra system

Phase 5. Compare models with real world situations

The result from the comparison between both current reality and what can a prosumer outcome-oriented system present can be fully projected at this stage. It can be seen that the system is missing on great opportunities in a non-capitalist component who is adherent to the wide system efficiency. It is safe to say at this point that their outcome is geared to manifest a political right to serve their countries and the environment. They are also continiously being critically about what SG technological divergences can cause to the whole system stability. The local autonomy in managing part of the resources they produce is what they arbitrate. The future will hold changes for this group of actors. It is visible that they are also in the state of transition. I would strongly argue that it is the time to negotiate their integration in well-designed plans. The political reality in Europe keeps on changing and the technological impositions also will bring upon the system transformation that are still seen by stakeholders as uncertain.

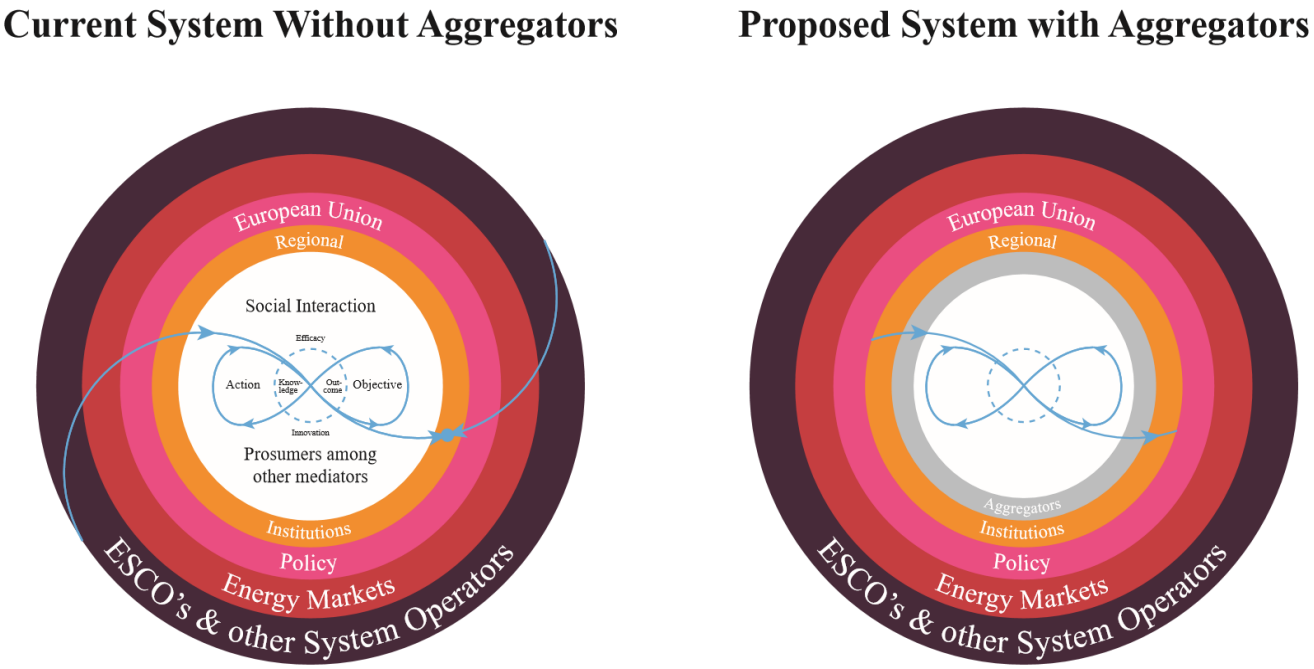

Figure 10. The prosumer system with and without aggregator

The above illustrates the differences between the communication and interaction between each layer of the energy system whole. Currently the situation can seem to be balanced as I the flux of the social component is still received by the whole system. Communication can be hindered as I show the point or nod where communication is interrupted in the institutional sphere. I have referred to it as a symptom of turbulence, here the level of citizen participation comes into play

in negotiating deals. The situation with an aggregator is simply extremely an exclusionist option, it will prevent them from communicating with the supra system. Hence, I would argue that this exclusion will create what I can call the "Energy Enclaved Prosumer/Community", which can pose a great danger to the system whole. Especially while the electricity system whole tries to solve i-RES "Duck Curve" problem and the proposition that SG technologies provides a practical solution.

Phase 6. Define possible changes which are both possible and feasible

The changes we can heavily focus on from our comparisons are sectioned according to each world as following:

1. Political:

My political reflection with reference to change will mostly draw on (Arnstein 1969b, Arnstein 1969a) Ladder of Citizen Participation. That is to illustrate the study finding in regard to power of prosumers tribes we discussed earlier since it appears to sync with the concept. Prosumers at the current stage are demonstrating the elements of partnership, delegated power and citizen control. The partnership here is manifested in the organized power-base behavior that represents their subscription to a knowledge class. Providing that the Ideation prosumers groups are the ones accountable for shaping the direction of the path dependence. They have shown abilities to allocate financial resources and manipulate their technical mastery to forward plans to operate on different levels. Interestingly some are even powerful enough under their COOP's to participate in tenders to acquire DSO's. This indicate the level and skill of their labor division and economic capacity. They apply their beliefs in energy democracy through the democratic process they undergo in choosing boards of COOPs and levels of responsibilities. Therefore, the delegated power does also manifest in their decision-making processes and managing style. These elements strongly indicate the maturity of their actions to avoid conflicts within their enterprises. This allows them to achieve a greater ROI and autonomy over their dispersed different resource structure.

The above yields the citizen control, which points out the position with which they are at currently. The citizen control can help accessing the fitness of the aggregator solution for social energy participation. Farther justifying their diligence in staging actions on EU level and national agendas through lobbying. In addition to demanding means of control that guarantees their ability to govern a program or an institutional shift in position. It can be noted that they are tenacious on being allowed to charge at policy and managerial aspects limiting their

emancipation. The act of negotiating conditions under social pressure continue to demonstrate their need for recognition, which serves their moral enactment and identity position as a systemic part of a systemic whole. They are refusing the generality of an “outsiders” forcing them to change what they create. Their business model successfully represent a concept close to the “Neighborhood Corporation”. Therefore, the continuity of their business requires eliminating intermediaries between them and supra system. While both policy makers and the supra system stakeholders are viewing them on the very basic level of therapy and manipulation, which is against what they believe. Prosumers at the Ideation level will argue that this attitude is fit for their consumers, as we have established that their classification mandates the existence of service or knowledge recievers. The policy and the inherent system must offer them more than a level up on tokenism. They cannot be dealt with similar to an active consumer who successfully saved his energy use.

2. Energy stakeholders (ESCOs and system technicians)

ESCO’s and energy conglomerates needs to alter their views of prosumers as a divergent element in their system efficiency. Prosumers will continue being a consumer segment to ESCO’s especially in the grid services. Therefore, ESCO’s need to devise a meaningful interaction with prosumers based on their subscription to a consumer tribe. As this study have provided an argument that the current consumer segmentation models used by ESCO’s is only limited to energy consumers. Prosumers should be perceived as service consumers not as a commodity consumer, with relevance to what they present in the means of opportunity for their system stability. ESCO’s should opt for allowing those different levels of emancipation in their activities and find new measures towards inclusion. This is possible by devising strategic plans agreed upon based on various supra system thresholds towards making them an intermediate. This will ultimately reduce the whole system entropy and narrow the chances of advancing towards turbulent fields in the social system, which I have illustrated earlier in my contrast. Purposefully allowing the flow of information to continue preventing undesirable data manipulation and spill overs under Smart grid deployment. This should be considered one of the security aspects taken in consideration since block chain and automated trading is enveloped with high uncertainty. Add to that the opportunity the current stagnant position from prosumers will present for internet and technology competition. It is important for ESCOs to familiarize themselves with the idea of the technology concept of Continuous Inclusion (CI). So far based on the results of this study finding prosumers have proven that they do not resent ESCOs economic models nor aim for disturbing the physical system whole.

Phase 7. Action to improve the problem situation

The expected plan should take into consideration the social DSM models Ideation prosumers use, while benefit from cooperating with them against technological anomalies. They also need to acknowledge them as a substitution for aggregators. As they can structure their own capacity aggregation unit locally and regionally. The merit of integrating them, is highly beneficial for ESCOs competition expected with the technological encroachment of the energy business. In this case the system technicians should address the technologies as the divergence not the social actors. It is safe to say at this point that SG technologies will only influence a different segment of opportunists not prosumers at this point. Hence, it should be also noted that the complexity of the domain increases with SG and the introduction of aggregators. Continuously forcing the social system towards turbulence. This means that at a point it can create resistance and prosumers beliefs changes towards the altruist presumption to alleviate the feel of coercion.

Technologies such block chain and automatic trading are often constructed on the concept of Continuous Integration (CI) of their users. This is the often used modules of the technological counterpart. CI ultimately allows them means to get around and construct schemes according to their adoption to the big data design space. The previous is relevant to illustrate the level of irreversibility of the situation, if the technology competition started to gain momentum and create fitness functions that constructs niches in the environment. The (CI) approach is the strongest weakness in the current energy operator's strategies. The fact that prosumers have demonstrated schemata and the ability to trace homotopy types from the narrative, interestingly reveals Ideation prosumer's understanding of social programming. Although prosumers technological innovation is a comfort at this stage, it cannot be trusted to remain the same on the long run. Prosumers at the current stage are making sense of these technological solutions before falling into the ICT pit of exploitation of their efforts. Albeit the current situation, being steadfast on going forward with the aggregator plan can be advantageous to the technology competitors. While the system stakeholders want to believe that the aggregator is a staged compliance element to encounter social technological misconducts, the outcomes of this research can prove otherwise.

The ESCO's still would want to focus their process-oriented system on efficiency equilibrium, with disregard to the notion that prosumers fashion their outcome-oriented system on sufficiency. The economic modeling that is heavily relying on thermoeconomics should also be

trimmed down to deal with prosumers under SG. The market should not be always working on Pareto efficiency equilibrium rather on the Pareto optimality (Pareto 1935, Pareto 1974), which will yield strong outcomes for the energy conglomerate. It cannot continue on the merit of supporting the idea of you lose I win. Furthermore, adopting to Gelling's concept of Trans-active dynamic integrated DSM is vital at this stage. It will hold a strong merit to ensure that prosumers and their sub groups limit market entry for new entrants.

5.5 Summary of the Key Results

The results of this research have established its finding based on two different analysis following critical methods. The thematic analysis of my elementary and secondary data collection have debunked the opaqueness that enveloped the energy prosumer topic. Yielding an original way to classify them as part of ESCO consumer segments. Whilst the system analysis provided means to illustrate the complexity of the SG deployment and strategies attempted to deal with the social component. This purposefully provided the support for my hypothesis of them creating a system with in a system. Farther illustrating and supporting the concept of SG as a system of systems and actions that seen as problematic. Simultaneously proving that the current situation will not cause the electricity market to bifurcate. Hence, the move forward with the aggregator fix will definitely cause bifurcation eventually.

The outcome themes represent a mean of segmentation of energy prosumers. It reveals a “Knowledge - Based Class System” among the social actors. The themes help illustrating four major groups of prosumers and their sub-groups that strengthen the culture or as they refer to it as a movement. It is at this phase important to highlight that the four segments belong to two prosumer tribes based on their beliefs and cognition. The Ideation prosumer tribe include (Ideal prosumer, Pragmatic or speculative- active prosumers, the Fundamental – Ascetic prosumers). The Sensate Prosumers tribe reflects the consumers that digest the ideation spill over knowledge which include (Active sensate prosumer, Passive Sensate Prosumers). They then act as an additional knowledge spillover effect agent to the normal energy consumers.

The outcome of the Soft system analysis (SSM) provided a three-world projection of the current situation with and without aggregators. Farther capitalizing on the segmentation in understanding how prosumers function with in their ecosystem. This assisted a mean to distinguish between three different set of cognitive decision making at every sphere of the energy system whole. The ability these findings provides can be of assistance to the electricity system stakeholders to animate and better view the SG market. In addition, critiquing the

aggregator solution and contending with ESEF framework on the matter. The results of this research break down the salient features innating prosumers actions. The analysis suggests separating or distinguishing the component parts of actions, cognition and identity based on the belief, the knowledge and structure. Fatherly, supporting the surfacing theories that comes to play in this party of the electricity supply and demand chain.

The results of the analysis justify the major theories that governs the relationship among values, beliefs, norms of this energy component. The theoretic skeleton that were strongly manifested in the data have demonstrated the magnitude of complexity of this component. The Attribution theory reflect the bottom of their pyramid. Activity theory also reveals the means with which they enact and perform. The system theory reflects the dynamic of communication and mean in which they build schemes and manipulate knowledge, which then can give the homotopy type theory a ground for farther analysis. The change theory is present in the flux with in the activities and means to innovate. Therefore, it can be clearly visible that they have demonstrated all innovation types in the analysis. The evolution theory is present on the premise of the culture they subscribe and build, which explained my discussion of thresholds and turbulence. This can further be digested to the identity theory and the theory of planned behaviors based on how they structure their efforts and their conditions of value creation. At this point I cannot denote what weigh more heavily in this highly interchangeable theoretic playground. Since the research aims to critic the current physical approach. The main goal of this study is to put a corner stone of a new perception of prosumers as a system that can fit in the physical system understanding.

I cannot as well skip the strong sociological foundations expressed from the data since political and economic factors are subject. The study has found that the social actors (prosumer) cognitive stand from the system. This is seen from the symptoms of a “corrosive societies”, which explains the coping mechanisms towards the whole system. Let alone give ground for the theory of resilience as a new component to study in the lights of demonstrating a “Total Community”.

6. DISCUSSION & CONCLUTION

6.1 Summary of the study

The focus of this study was aimed at show casing the active renewable energy citizens as an element of Smart Grid (SG) transition in the EU. Originally the intention was to reveal the social adoption and their innovation in response to change in the electricity system. As we have stablished that SG technologies in this case is to be considered a disruptive innovation. Where it will affect the current organization and economic behavior of the social energy participants. The study also served a mean to critic the normative approaches imposed by the physical system to model and deal with prosumers. In the extensive discussion this study present it served to illustrate the fitness of the current proposition of introducing aggregators to the market. As I have discussed the aspects that yields the understanding of this being a strategic fade and will contribute to an undesirable transitional pit.

The study fulfilled the original purpose of its initiation, by providing answers to the research questions it tackles. This is through providing a novel mean to illustrate prosumer organization structure under the SG technological deployment. Which is shown in the classification of prosumers according to value, belief and norms. Serving the purpose of fashioning them as a set of consumers to the supra system operators. Allowing them to see the belief system they hold with in their functional trends. The research also met the element of projecting the type of system prosumers represent. Reviling the level of maturity of their actions and moreover their situated cognition in regard to change. The systemic outcome of our research animates their alignment, organization structure and communication styles. This serves the purpose of positioning them as a systemic part of a systemic whole and fulfills the main ideal of Sg as a system of systems. Purposefully expanding the chances for the market stakeholders to better means to segment them and strategies. While the research heavily argued the need to oust the attempted aggregator plan, also refuted the conventional exergy understanding of prosumers. This gives more room for the argued trans-active energy ideals that is much in line with DSM, since I have demonstrated their fitness in technical functions.

6.2 Key Results

The research reviled different sets of concepts with which support my initial arguments. The Smart Grid (SG) KPI’s as we furnished earlier mandates social aspects in addition to the technical ones. The current policy projection of the SG technological change and prosumer

topic ostensibly continue to gyrate around the energy trilemma indicators, energy poverty and the physical approaches associated with them. The outcomes of this research prove that the later approaches will hinder achieving some the KPIs sought after. Limiting the accommodation of all DG and Storage options, hampers facilitating selling more than kWhs, prevent allowing customers to information and bolstering efficiency of assets. The current situation of the transition seems to limit the appropriate social integration needed in favor to mega projects. Finally, it will prevent promoting the sought-after resilience facing disturbances, attacks and natural disasters, which should include the prosumer activities. All the above is to be projected as the outcome of the inherent system physical obstinance.

The outcome of the research supported the fitness function needed for the inherent system to consider the efficiency measures of the social actors. Although they are bound by efficiency their goals are towards sufficiency. Prosumers as the research showcased have demonstrated mastery over DR, DSM and technical execution. Prosumers competence and activities especially the ideation groups should be considered as a Meta-system component with in the systemic whole. They already subscribe to a classification, so they should not be treated based on categorization. The study finding strongly arbitrate that they should be included in Energy Performance Contracting (EPC) by ESCOs. This is due to the earlier discussed situated cognition along with their systemic alignment. The argument of this research concluded that the aggregator solution is going to increase the turbulent fields in the prosumer system forcing them to diverge with their innovative applications. The growth functions we have found and the evolution indicators we have manifested in the discussion are enough reason to be alarmed. The study also found that prosumers take on DR serves to fill in some of the DSM functions for the system whole, which so far is useful for the supra system operators and stakeholders.

The findings stress on the different types of systems that are embroiled in the systemic whole. Therefore, there are different intakes at the current time of the best type of innovation that should be used with SG technologies. The study has clearly demonstrate that prosumers do in fact employ all types of innovations in their operations. The study is not directed to understand why that is, but the analysis provided a sensible justification. Therefore, the general conception of them being all at the same melting pot is highly refutable according the results. This gives ground for arguing against creating a new market or originating a special space for them, which is currently a topic discussed by the institutional technicians and policies. The study proved that they are already consider themselves part of the solution, separating them from the whole chain is increases the system entropy. The maturity differs among different prosumer tribes so a whole

judgement is not fit especially under SG technologies coming to interplay. The findings also yielded the understanding of ideation prosumers should be treated as service consumers to ESCOs rather just an end product consumer. This is due to the fact that they work for the benefit of the system whole and they don't think of competing in the market. The results strongly demonstrate that the best mean to interact with the prosumer topic is through integration system solutions. Although this study did not attend to that, yet there are various indicators that can be employed from the findings to help form change functions towards integration preferably guided by Yolles methods.

The results also illustrate the suitable theories to deal with the prosumer topic as a social system not from the physical system lens. Prosumers cannot be seen as divergent for their actions, since we have fashioned them in a functional system, so they are not mere individuals. The study also provided a theoretic argument against the aggregator fix and supported that with a systemic analysis of the results. This serves as a foundation for considering the trans-active DSM solution proposed by Gellings. I purposefully furnished enough reasons to not view prosumers at this stage of the deployment as a threat or a competitive element. This is as long as they haven't reached the altruistic prosumer threshold. Also, the concept of tokenism is not at all suitable at this stage. Rather ESCOs should consider partnership to bolster their position in the market with real competition and insure their business continuity.

The study also provided other findings that were not expected. Which is the level of diversion and parties responsible for it in regards to the knowledge spillover. This will assist decision makers in both policy and business to provide better measures. Another finding is the appearance of a new social engineering element of the homotopic type of prosumer knowledge recursions. This is a new field of research all together. I believe that this is important for the physical system technicians to study the homotopy type of each group, if they decided to continue moving on with the aggregator fix. Let alone the sociological description of their cognition, their position of the whole system and growth.

6.3 Evaluation of the study, future study & managerial implications

Advancing a social path in the Smart Grid transition

This effort serves the purpose of research initial goals in exploring the case of active renewable energy citizens. The research segment that were subject are representative organizations that handle wide areas in the social and energy arena. Despite my continuous failure to collect

extensive quantitative data to support my hypothesis in the beginning. This pool of qualitative data serves remarkably to refine and define what should be studied in the area. The research design utilizing mixed system methods of analysis allowed a rigorous filtering of the linguistic data. Although the narrative is prolific it only captured the expert's opinions from all three realms involved in the transition. Therefore, more work should be geared towards digging out the actual energy citizens rather than organizations that represents them. By doing so a more detailed realistic picture can be mapped of the SG transition, producing a factual information on what is actually taking place and the magnitude of the operations. The study also lacks the involvement of one major stakeholder of the transition which is the ESCO. I have extensively explained earlier the difficulties I have faced in collecting the data in the domain. Another aspect that seems to be important is the entanglement of more than one domain in one research which can shorten the explanation of each one when needed. This research targets social complexity in a complex industry therefore at points it can be seen as scattered. More work is required in quantifying and scaling this energy/electricity segment. My effort can only serve in projecting what seems to be important to quantify and refuting some of the existing strategic pits in the current propositions. Since the research on SG social innovation management, Prosumer Knowledge Management, Energy Change Management and Strategic Management of prosumers is still of scarce.

The results have laid ground to illustrate that despite the general conception of prosumers actions being dispersed. Prosumer do express uniform representation in the way they reflect their action. The most interesting observation that prosumers at the ideation class have managed in a way to find means to structure themselves so far. Potently avoiding what is referred to by Kauffman as "complexity catastrophe". This finding explains the network structure of the increasing numbers of unites with in each prosumer network. Which can explain the symptoms of growth mentioned in our result. Although my findings didn't explain how the network structure prosumers govern escaped the complexity catastrophe. It can be a very important topic of research in social organization and management. How did they manage to escape problems with in networks as they grow? Surely not only due to the continuous manifestation democratic practices. What enforced the naturally organization towards an "autonomous division" structure? Which can explain the hierarchical structure outcome of this research. Another topic that is associated with change management can be the topic of "Ripple Effect" and how prosumer structures performances and functions responded to complexity of their environment.

Finally, the research major finding, which is the homotopy type theory and its application on knowledge and social application. This open a new venue of research in innovation and knowledge management, let alone mathematics and economics. The need for physical science to add the social recursion of information is evident with the increased complexity present in the technological spaces. In addition this effort should give a chance to extend research in the area of organic system solutions in physical approaches. This study can be stretched to map down the change management needed to explain the feed loops in each system and furnish an extensive analysis of the current situation to provide answers and strategic moves. Furthermore, this study gives ground for further research in replacing the equilibrium concept with a more ecological concept in energy to increase resilience in front of competition. This being explored will motivate more research in economics using the Pareto optimality ideals in the energy economy.

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8. APPENDEX

List of technical definitions

Transmission System Operator (TSO)	Is the EU fashioned term for the energy stakeholder whom are responsible for the safety, stability and reliability of energy supply for an area and/or country. This party of the electricity system in the EU often are non-commercial organization, neutral and independent. While taking in consideration the geographic subscription to markets. In the EU they are represented through ENTSO-E network.
Distribution System Operator (DSO)	Is an EU fashioned term for the energy stakeholder whom is responsible for operating, ensuring the maintenance, developing the distribution system in a given area. This party ensures power delivery to the end-user. They transmit power from plants or generation hubs through the central grid and the transmission net to the end-user. Therefore, they often have strong interconnections with other systems for them ensure long term ability of the system to meet their area demands. In the EU regulation often define levels of their maximum profits, which ensures that stable and reasonable prices are maintained. Every distributor has a monopoly over a specific geography to secure profits.
Transmission & Distribution (T&D)	It is a strategic business development techniques term to describe a wide interconnected system of equipment built around large centralized generation plants. It allows the current inherent system to cope with the de-centralized, distributed generation and storage that is forced on them by policy. Especially the role outs of renewables and 'micro-grid' technologies. These strategies allow utilities and ESCOs to augment their distributed generation to pragmatically combine their traditional central-station systems with micro-grids. This gives them the chance to amalgamate old and new infrastructures for better flexibility as to reliability, economy and fit to extreme aesthetic and user demand requirements than traditional systems.
Dynamic Line Rating (DLR)	It is a technology used to dynamically increase the maximum amount of electric current a conductor or device can carry before sustaining immediate or progressive deterioration. It determines the over headline ability to dissipate the heat produced in the environment. Technically calculating factors in the environmental conditions such as the value of ambient temperature, solar radiation, and wind speed and direction.
Distributed Generation (DG)	It is also called the district/decentralized energy. It is the electricity generation and storage activities and

	application undergone by a variety of smaller dispersed capacity generators. The term also stretches to include those who are connected with a micro-grid network. DG is often managed through DER systems, which are decentralized, modular and more flexible technologies. Since they are located close to the load they serve.
Plug- in Hybrid Electrical Vehicles (PHEV)	It is part of the transportation electricity evolution plans. Those vehicles combine a gasoline or diesel engine with an electric motor and a large rechargeable battery. The battery often allows both recharging and discharging by being plugged in to an external source of electric power.
Battery Electrical Vehicles (BEV)	A vehicle that runs exclusively on electricity via on-board batteries that are charged by plugging into an outlet or charging stations.
Fuel Cell Electrical Vehicle (FCEV)	Is a vehicle that uses an electric-only motor. Although being similar to BEV it stores energy differently. Instead of recharging a battery, it rather stores hydrogen gas in a tank. The fuel cell often combines hydrogen with oxygen from the air to produce electricity. The electricity from the fuel cell then powers an electric motor, which powers the vehicle combustion engine.
Volt-var Optimization (VVO)	It is a technique used for managing voltage levels and reactive power. In order to achieve an increased levels of gird operation efficiency by reducing system losses, peak demand or energy consumption or a combination of the three. These tools are often associated with Conservative Voltage Reduction (CVR). Therefore, it is considered a control tool to increase efficiency gains by reducing in the system voltage. The distribution system measures the successful outcomes of the process by the success in trimming the energy consumed by end-use equipments.
Intermittent Renewable Resources (i-RES)	Are those energy resources that are not constantly available for an immediate electricity transfer and are outside the direct control of storage by the conventional generators. Despite the fact that Intermittent energy sources may be predictable, it cannot be immediately dispatched to meet the demand of the electric power system. Therefore, a combination of wind and solar is needed to overcome the magnitude of sudden power generation shortfalls or excesses. This required to make those resources ready as a reserve available for grid operators instant response in case of balancing the grid.
Green House Gas (GHG)	Greenhouse gases are compounds that are able to trap heat in the atmosphere resulting from human activities, these gases are the fundamental cause of the greenhouse effect. It is also the foundation for GHG accounting strategies based on the traceability of those compounds in the atmosphere.
Day-Ahead Market (DAM)	It is an economic term to describe electricity both power and energy as a commodity that is tradable. The trading

	platform / market is often regional or where contracts are fashioned between seller and buyer for the delivery of power on the following day. The price are often set and the trade is agreed upon based on fluctuation of prices on availability or scarcity of produces.
Ancillary Services/Market	A technical term that expresses services necessary to support the transmission of the electric power from the sellers to the purchasers. While given the obligations of control areas and transmitting utility to maintain reliable and interconnected operations. This as a result creates a trading platform that is often seen as a market.
Intra-Day Market (IDM)	It is a trading tool that supplements the day a head market and helps secure the necessary balance between supply and demand in power markets. Creating a market where buyers and sellers can trade volumes close to real time. This helps in bringing the day ahead market back to balance.
Energy Performance Contracting (EPC)	A creative financing tool for capital improvement. That allows funding energy upgrades from the revenues of cost reductions. An external organisation often an (ESCO) implements a project to deliver energy efficiency, or a renewable energy project. This allows the supra system access to the stream of income from the cost savings, or the renewable energy produced to repay the costs of the projects ESCOs execute including the costs of their investment. Essentially the ESCO will not receive its payment unless the project delivers energy savings as expected.
Energy Efficiency Projects (EEP)	Are projects designed to reduce energy consumption of social and other public facilities that are often in line with the global or regional GHG plans.
Net Percent Calculator (NPC)	Is a financial term that associate with Net Percent Value (NPV). It is the difference between the present value of the future cash flows (positive and negative) over the entire life of an investment to the present and the amount of the investment. The Present value of the expected cash flows is then calculated by discounting them at the required rate of return. This analysis is used extensively in finance and accounting to evaluate the value of the business and investments. This allows a better control over security, capital, cost reduction programs and any cash flow activity.
Total Life Cycle Cost (TLCC)	A financial term that refers to the total cost of ownership over the life of an asset. This determines various elements of revenue, depreciation and management.
Simple Pay-Back (SPB)	It is an accounting tool that is related to time in capital budgeting. It refers to the period of time required to recoup the funds expended in an investment, in other words the time required to reach the break-even point. It helps with determining the following: the asset life span,

	the additional cash flows, cash flow complexity, profitability over time, value of money, Individual asset orientation and Incorrect averaging of the investment under investigation.
Benefit Cost Ratio (B/C)	Is a financial and economic tool to indicate the cost-benefit analysis of investments. The goals of this tool to ultimately summarize the overall value of the investment over a project or a proposal. The ratio is them calculated on the benefits of a project or proposal to the investor to expressed in monetary terms in relevance.
Saving Investment Ratio (S/R)	It is a financial method to facilitate the evaluation of the ROI of a project. The core of this tool is adjacent the thermoeconomic disciplines. It takes into measures the total energy savings over the present value and improvements, then divide that by the upfront cost of the investment.
Discount Pay Back (DPB)	It is a financial tool used to evaluate the desirability over time of the investment. It is the time period required for an investment to discount its cash expense or liability in covering the initial outlay of the project. Therefore, the shorter the discounted payback period, the more desirable the investment.
Demand-Load Response Program (LRP)	It is a group of techniques used for energy conservation and efficiency programs employed by DSM. They are a group of switch off actions undertaken in response to electricity supply position and wholesale market price of electricity. This is undergone by end users in response to the utility request, through regulating use over non-essential and non-critical loads. This purposefully can lead to save the system network from exceeding its peak rating.
Emergency Demand Response Program (EDRP)	It is a voluntary participation approach that allows wholesale electricity market participants to enlist retail end user components who are able to provide Load Reduction by curtailing Load or by shifting Load onto a Local Generator when needed during an emergency. This practice includes: Load-Serving Entities, An individual retail customer, Curtailment Customer Aggregators and Curtailment Program End Use Customers.
Societal Cost Test (SCT)	It is a financial tool used in attempting to measure the net cost/benefit to society over a program or portfolio of programs. In other words, it is the Total Resource Cost Test of the society added value with their cost and benefits. Where the benefits to society are called externalities to the investment party.
Rate /Real Time Pricing (RRTP)	A method of pricing energy based on either the actual market value or the utility's cost for energy at the time when it is used. The pricing of electricity is often fluctuating across the day based on the varying amounts

	for energy depending on the time of use and the quantity needed at that time. This pricing mechanism allows consumers the ability to adjust their electricity usage accordingly to the supply prices to save money.
Time of Use (ToU)	It is a rate scale that is often part of electricity rate plans. It allows further segmenting energy rates based on the time the energy is being consumed based on the peak and off-peak periods of the day. It helps consumers to track their expenses over their electricity bills.
Value of Lost Load (VoLL)	It is a monetary expression to indicate the costs associated with an interruption of electricity supply over the social whole.
Physical Technical Economic Model (PTEM)	An engineering-centric approaches towards energy efficiency, measuring the required energy efficiency that is previously estimated over a production rationale. This means that they base their estimates on a set of inputs that are assumed to affect the output levels. Any deviation from that production function mindset are considered random and inefficient. Therefore, new technologies are the considered a centric and only driver of greater efficiencies as long as those technologies are economically viable.
Neggwatts	It is a theoretical unit of power representing the saved amount of electrical by consumers. This saved energy is considered a direct outcome of a successful strategy with consumers conversation plans, which as a result increases efficiency. The increased of this energy unite both by consumers and prosumers can then create what is called the Neggawatte Market.
Distributed Energy Resources (DER)	They are systems that can comprise multiple modes of power generation and storage components. In the case of renewables, they are referred to as hybrid power systems.
Demand Response Resources (DRR)	A set of techniques that influence reduction in demand, which is designed to reduce peak demand or avoid system emergencies. It is argued that these techniques are beneficial in including better capacity factors for existing capacity, reducing the requirements for a new capacity, enhances the reliability, relieving the congestion and transmission constraints, reducing price volatility, mitigating market power and lower electricity prices for consumers.
Duck Curve	It is a statistical illustrating a gap of the renewable power problem to the system. The graph depicts the power production over the course of a day. Illustrating the timing imbalance between peak demand and renewable energy production. In many power markets the peak demand occurs after sunset, when solar power is no longer available.