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Business model innovation in energy businesses: Driving factors, trends and implications for the future

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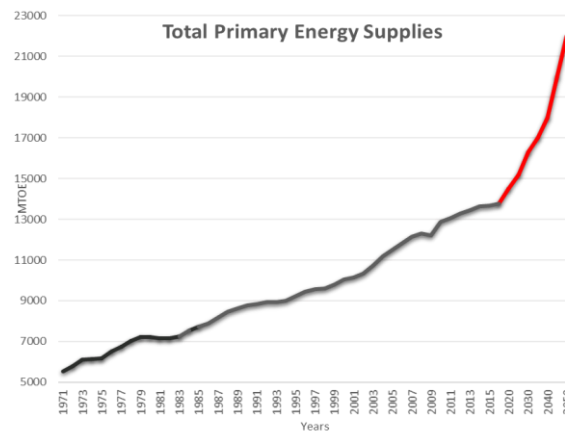
Abstract. The existing energy system is heavily centralized, where production and distribution systems are largely controlled by big utility companies. The issue of global warming, the need to reduce emissions, sustainable use of conventional hydrocarbons, and improvements in renewable energy technologies – both in terms of cost and performance – has highlighted the need to transform the energy market. The trend is further exacerbated by the advancement in technology. The transformation is said to have implications for the stakeholders involved in the process, including customers, utility companies, and regulatory bodies. The objective of this study is to explore the effect this transformation would have on the local energy system and the changes needed to be made to ensure the transition provides desired outcomes. Based on the findings, the study proposes changes companies need to make in their business models to adapt to the changing needs of the market as well as of customers.

Keywords: Business models, Disruption, Electricity, Prosumers, Transformation, Digitalisation

1 Introduction

Energy has long played an important role in the development and modernization of economies. The advancement that we see today would not have been possible without the ample supplies of energy. The existing energy system is highly centralized, in which energy production and transmission are controlled by big utility companies, often owned by the state [1]. This centralized energy system has helped us addressing the energy needs. However, has also raised a number of challenges that needs to be addressed moving forward [2]. Firstly, the excessive use of the hydrocarbons has caused emissions of greenhouse gases and global warming [3]. Secondly, hydrocarbons are not equally distributed, meaning a small portion of countries own majority of these resources and the rest of the world need to rely on import. The import not only requires huge amount of money but also causes concerns of energy security [4]. Thirdly, hydrocarbons are finite in nature, and the excessive consumption can lead to their depletion [5]. Therefore, it is important to use these resources strategically to ensure the sustainable consumption. Fourthly, the future energy outlook suggests that demand of energy

will continue to rise in the foreseeable future (figure 1), and this is where the concern lies [6, 7]. The consumption of hydrocarbons has helped us meeting the present day needs, however, continuing the same may have irreversible negative effect for climate and ecosystem [8]. The mounting energy needs of the future, and the vision of providing energy to those who have very little to no access would make it extremely difficult to follow the energy production and consumption patterns that we have adopted in the past [9]. Therefore, it is important to overhaul the existing structure and replace it with the system that can meet the rising energy needs at the affordable prices as well as in not harmful to the environment.



Source: OECD 2018; IEA, 2018

Figure 1: World total primary energy supplies

Renewable energy technologies (RETs) are believed to have the potential to produce energy in cleaner and environmentally friendly manner [10–12]. The recent reduction in the cost of technology, assistance from the governments in the form of subsidies and support schemes, and improved awareness on environmental issues have made renewables as a primary choice of energy generation [13]. Integrating renewables in the energy mix can certainly help countries in increasing the share of local and clean energy source [14, 15].

However, the change in the energy mix will not be as easy as it sounds. The transition from centralized to decentralized energy system, incorporating multiple sources of energy generation and involving modern information and communication technologies (ICTs) is likely to change the very nature of the market, consequently affecting the production and consumption patterns, as well as changing roles of the actors involved in the process [16, 17]. The transformation will have implications for all the stakeholders involved in the process, including, utility companies, consumers and regulatory bodies.

The following section provides an account on the objectives this study aims to achieve as well as presents the methods study has adopted. Section 3 presents the discussion based on the results while the last part presents conclusion.

2 Objective and methods of the study

The objective of this study is to explore the effect this transformation could have for different stakeholders namely, consumers, regulatory bodies, and companies, and the changes needed to be made to ensure the stated objectives are met. This research is based on qualitative case study research design using both primary and secondary data sources [18, 19]. The complex nature of the subject and the objectives of the study required input to be taken from multiple actors and stakeholders involved in the process to ensure un-biasness of the results. Semi-structured approach was chosen to interview technology companies, energy utilities, regulatory bodies, governments, private financiers and expert from academia and industry to gather primary data. The approach has enabled us to gain a comprehensive understating on the state of the industry through interaction with the diverse voices, and exploring the subject from different angles. Altogether, fourteen interviews were conducted. Average duration of the interviews lasted approximately an hour. Secondary data has been collected using scientific publications, reports, utilities websites' and industry analysis. Data triangulation technique was adopted to enhance the accuracy of results [20]. Relevant excerpts are included to give a detail account and to establish a relevance between data and analysis [21].

3 Discussion

3.1 Energy Consumption: from consumers to prosumers

The decentralized nature of energy market, the integration of advance information and communication technologies, supportive policy frameworks and reduced cost of the renewable energy technologies have made it possible for the consumers to adopt the fuel of their choice [22]. A household can get electricity from a company of their choosing and is no longer bound to purchase from the local utility company. The purchase decision could be based on utility's pricing, services, their reputation, use of cleaner sources of energy generation or related factor that could positively influence customer's choice. As manager of a utility company stated "*One of the things this digital nature of the market has done is that it has given consumers a choice to select the electricity provider of their liking. This will make companies act in a manner that they become a preferred choice of customers, whether it is due to the cheap electricity, clean portfolio, or any other factor that appeals the customer*".

In addition, a consumer can now act as a producer as well by installing a solar panel at home to produce the power they need for their use. A consumer can use the energy needed at home and can transmit the excess energy to the grid for a price. Customer using solar PV stated "*the thing that I can sell electricity [to the grid] for a price fascinates me*". Similarly, production at home offers an opportunity to better manage their load and monitor the consumption patterns with the help of advance applications and software, ensuring the consumption can be peaked when the price is lowest. These changes have not only made consumer an important component of the value chain but also has strengthen its role as a prosumer, giving it a certain level of autonomy and power. As a customer affirmed "*the best part about is that I can monitor how much*

electricity the panel is producing, when is the peak time. I can schedule my consumption accordingly, by doing this I have optimized the production and consumption”.

3.2 Regulations: The need of new governance mechanisms

The transformation in the energy market has also highlighted the need of new regulations considering these decentralized and digital aspects of the system [16]. Firstly, the legal structure and regulatory system should be devised as such that it should facilitate the integration of distributed generation in the system. The longevity and certainty surrounding the regulatory regime is equally important to maintain the trust of stakeholders involved in the process. According to a legal expert “ *it is essential to have a supportive legal and regulatory framework that facilitate integration of self-generation to the main grid - be it at home or small scale distributed unit. It is legal framework that drive and facilitate the change.*”

Secondly, the use of sophisticated technologies and digital systems have made it inevitable to have a regulatory regime in place that can ensure the privacy of the grid and the measures necessary to protect it [23]. The decentralized nature of the market and modern distribution and transmission system could be prone to the outside attacks, and therefore, it is required to ensure a safety net is developed to counter the challenge. Thirdly, the use of service will generate a massive amount of data. It becomes vital to ensure the safety of data and consumer’s privacy is not compromised. Considerations such as where to store data, who owns the data, who can have an access to the data, how and on which condition the data can be shared. Inability to do so could having serious repercussions and may cause the issues of trust and can trigger reluctance among the users. A regulatory expert emphasizing on the issue stated “*the challenge concerning legal and regulatory body has two dimensions. One, to develop a strong security system to make sure that network is protected from security breaches and cyber-attacks. Second challenge is concerning the data. Data is as valuable as gold [...] or perhaps even more. It is therefore important to agree on who owns the data, where it will be saved, who will be able to access, and under what conditions it can be shared. It is important to be clear on this to keep customers’ trust. Failing to do so can lead to legal and ethical issues*”.

3.3 Utility companies: Change in business models

Utility companies are also besetting with the challenge of transforming their operations to fight the competition [17]. Conventional utility companies have been used-to of integrating sources of powers based on their own portfolio. However, the increased concerns of global warming and climate change, and technological advancements has encouraged consumers to get power supplies from the companies who are matching their needs better. This warrants that companies needs to play an active role in building an image and raising the level of awareness among the target customer segments.

In addition to the challenge of reducing the carbon footprints, companies are also facing a fundamental change in their structure and operations – from a conventional utility to energy service companies.[24] Traditionally, electricity has been treated as a commodity, and companies only emphasized on the need of sustained electricity supplies to their consumers. However, the transformation would require companies to offer

a number of complimentary services and solutions that were unheard of in the past. The use of services and tools such as demand response management software, home automation and financial services will become an important part of companies' offering. Likewise, companies will have to develop and improve on various fronts including, offering multichannel services, detail consumption data, billing accuracy and transparency [25]. The industry expert stated *"electricity utilities that we or our parents are familiar will cease to exist. Instead companies offering a number of services such as financing, modern software with improved data on consumption, billing and so on will become the industry benchmark"*.

The transformation will also encourage electricity companies to develop collaboration with different actors in the ecosystem to improve the functionality as well as offer complimentary services. For instance, collaboration with storage facilities or use of ancillary services offered by the vehicle to grid technology will become ever more important in the future. According to the industry expert *"the increased use of electrification for everything will require that utilities, sooner or later, come out of their zone and start collaborating with other partners in the ecosystem to generate operational synergies"*

Similarly, companies will need to develop the understanding on usage of the vast amount of data generated in the result of the service. The use of data can help companies in offering set of services that can improve customer experience, can facilitate customer engagement and developing services to generate revenues. Manager of the electricity utility stated *"new services and offering will become an industry norm. Using the data and processing can help tailoring the services according to the customers' needs. We have already started thinking about how best to use the data and what valuable offering can be developed using these."*

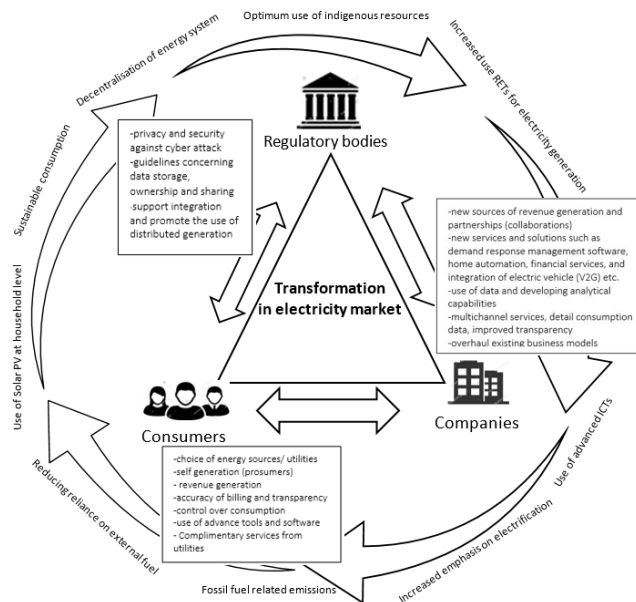


Figure 2: Transformation in the electricity sector

4 Conclusion

Electricity market is undergoing the process of change. The need of clean and environmentally friendly generation, the reduced cost of renewables, increase emphasis on the distributed generation and availability of advance information and communication technologies is transforming the electricity market. The transformation would have implications for all stakeholders, including customers, utility companies and regulatory bodies. Consumers will have a chance to choose the utility of their liking, manage their consumption better as well as can have a chance to act as a prosumer. For regulatory bodies, the challenge is twofold: one to ensure the system is resilient and can protect itself against the outside attacks. Second, devising legislations and guidelines on the protection as usage of enormous data, generated as the result of smart and digitally connected devices. Likewise, for companies challenge lies in integrating new services and develop innovative business model to better align with the industry needs. These business models needs to cater for the flexibility, new sources of revenue generation, ancillary services, improved customer services, increased focus on the advertising and public awareness.

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