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Regulating for Sustainability in a Disruptive Environment Changing the Business Model?

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Regulating for Sustainability in a Disruptive Environment

Changing the Business Model?

Abstract

The global landscape for the electricity sector faces an unfamiliar and uncertain future with social, technological and economic developments increasingly impacting the energy landscape. Increased integration of renewable energy in the production mix, smart grids and the increased usage of electric vehicles are imposing challenges not only for the utility, but for those who regulate the sector. This revolution is the driving force behind electricity utilities investing resources to redefine their purpose and assess their value chain. The traditional business model of large centralized power plants distributing to customers over an interconnected grid is coming under increased pressure. In defining its future role, electricity utilities must meet the challenge of designing new business models to achieve better outcomes and avoid unwanted consequences associated with disruptive forces.

Regionally, while the potential for significant and immediate utility impact is currently low, the electricity value chain continues to evolve and the respective countries must begin to seriously address these changes in order to mitigate the potential impact of disruptive forces such as increased prospects for distributed energy resources. An additional challenge arises in countries that have state owned utilities as the existing legal and regulatory framework can be a barrier for these utilities to adapt their business models and implement their own strategies to evolve towards sustainability.

Regulators occupy a central place in the evolving electricity landscape and need to amplify their mandated roles by taking steps to proactively bring stakeholders up the learning curve. Key here, is fostering a regulatory environment which would encourage utilities to critically assess their value chain, and effectively help to shape the utility's business model. This paper seeks to address the role regulators can play in ushering state owned electricity utilities from a one-way network to an open and more flexible network and to highlight considerations for utility business models to make the transition into a dynamic operating environment.

Personal Biography

Kwylan Jaggassar-Eccles is employed as a Tariff Analyst with the Regulated Industries Commission (RIC), Trinidad and Tobago, which regulates the Water, Wastewater and Electricity Sectors. Mrs. Jaggassar-Eccles holds a BSc. in Mathematics with a minor in Economics and an MBA. She is a Certified Regulation Specialist (IP3) and has been employed with the RIC for seven (7) years.

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1.0 INTRODUCTION

The environment in which the power sector has operated has changed little within the past 100 years, especially in the Caribbean region. Basically, both state owned and privately owned electricity utilities provided electricity services and were regulated by various arms of the government and more recently by independent agencies. The utilities invested capital in generation, transmission and distribution activities, and got a return on their equity investment.

The last business model for the conventional power sector worked because the operating environment did not experience any major shocks. That model relied on two fundamental aspects to meet the regulatory goals of providing a safe and reliable electricity service at affordable rates: meeting growing energy demand and expansion of the asset base. Literature on electricity sector analysis now shows that potent new pressures are building on both the demand side and the supply side, which will force fundamental changes in the way that the electricity utilities plan, do business, and serve their customers. Many customers have access to new technology that can either save or produce electricity. Consumers are demanding new relationships with service providers, and new technologies are proliferating to meet those demands. Infrastructure for electricity generation is aging and faces expensive upgrades to meet energy efficient standards. At the same time, innovative energy service suppliers have emerged, disrupting the traditional relationships among legacy utilities, regulators, and customers.

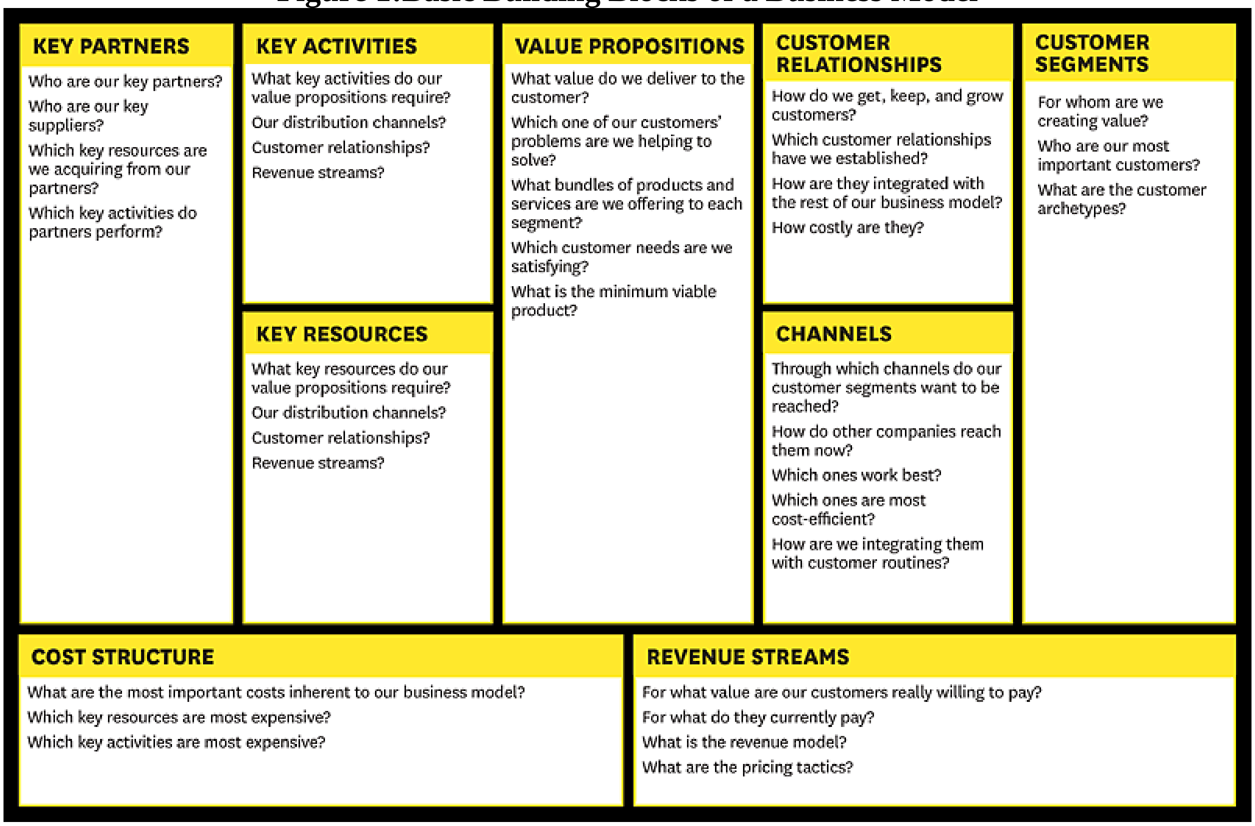
The electricity sector has not previously experienced viable threats to its core business services due to the solid economic value of the service and heavy customer reliance on electricity as a commodity. However, a combination of disruptive forces, dated regulatory policies and changes in consumer preferences has left the door wide open for alternative options in satisfying electricity demand to cast doubt on the relevance of conventional business models for the electricity utility.

One of the key activities that guides industry transformation through periods of disruptions is business model reengineering and adaptation, which, if executed appropriately, can foster a more resilient utility that responds with agility to changing circumstances. To meet the challenge of advising electricity utilities on the need for business model adaptation to achieve better outcomes and avoid unwanted consequences, regulators can take steps to quickly bring key stakeholders up the learning curve, create a robust, analytic record of progress and achievements, and quantify existing incentives.

2.0 BUSINESS MODELS

Fundamentally, a business model describes the rationale of how an organization creates, delivers and captures value[1] .The model should outline the firm's strategy to earn revenues, identify the customers for the product , how much and how often they are willing to pay for the product and how profits are expected to be achieved. Figure 1 below shows the basic building blocks used in designing a business model and covers four broad areas of a business, namely, infrastructure, service offering, customers, and financial viability.

Figure 1:Basic Building Blocks of a Business Model



Source: Business Model Generation Alexander Osterwalder & Yves Pigneur

The legacy electricity business models of the past can be described as umbrella entities investing in plant and property, delivering electricity to customers and earning a return. The utility operated as a vertically integrated, full-service monopoly provider where it controlled the generation, transmission and distribution (GTD) of electricity which was sold directly to consumers. Over time this model has evolved as utilities sought to diversify beyond the basics. The supply side of

[1] Alexander Osterwalder and Yves Pigneur, *Business Model Generation* (2009)

a modern electricity sector is now any combination of independent power producers, transmission companies and competitive retailors.

On the traditional demand side of the electricity sector, customers were required to pay a volumetric rate based on energy consumption and demand charges. Conventional electricity meters on homes and buildings reported monthly use at the end of the billing cycle which were read by meter readers and customers were charged for consumption according to a tariff schedule. Technologically, electricity provision was based on a passive one-way power grid with virtually no customer feedback or control. In the emerging environment, the demand side is progressively moving toward a more feedback oriented loop where customers are not just more aware of their usage and can thus change their consumption accordingly, but there is an increasing number of channels through which the electricity demand can be satisfied.

From a regulatory standpoint, public utilities have managed to remain operable despite fluctuating margins from changes in the operating environment. Whether investor-owned or state-owned, few utilities have experienced external pressures capable of negatively impacting the customer base and in essence, have been protected from the effects of a free market. Similar to the way that utilities have adapted to changes in the electricity sector, so too have regulators adapted different forms of regulation based on the desired regulatory outcomes at certain points in time.

Regulators transitioned from Rate of Return regulation, which was the preferred method of regulation in the United States before the 1980s, to Incentive-based Regulation. Various forms of price control under incentive regulation included the price-cap and revenue-cap approach with the main intention to encourage the utility to find lower cost ways of delivering service (productive efficiency), to make the best use of scarce resources that accrue the maximum benefit to society (allocative efficiency) and to develop new and more efficient ways of conducting its business over time (dynamic efficiency). Changing perspectives in utility regulation have now produced different forms of regulation. After 20 years of utilizing Incentive Regulation in the United Kingdom , the electricity regulator has now proposed the RIIO model[2] to address some of the short comings of the regulatory framework that had been observed over time.

[2] Introduced by the electricity regulator in the United Kingdom, the RIIO model defines Revenue set to deliver strong Incentives, Innovation and Outputs and is designed to drive smarter and more sustainable networks to deliver a secure and low carbon energy sector and long-term value for money for consumers.

Given the real potential for evolution of the electricity sector, the regulator's main goal going forward, should address delivering better regulatory outcomes. Any modifications to the regulatory framework or form of regulation has to facilitate the utility's transition to a more sustainable role in the evolving electricity sector.

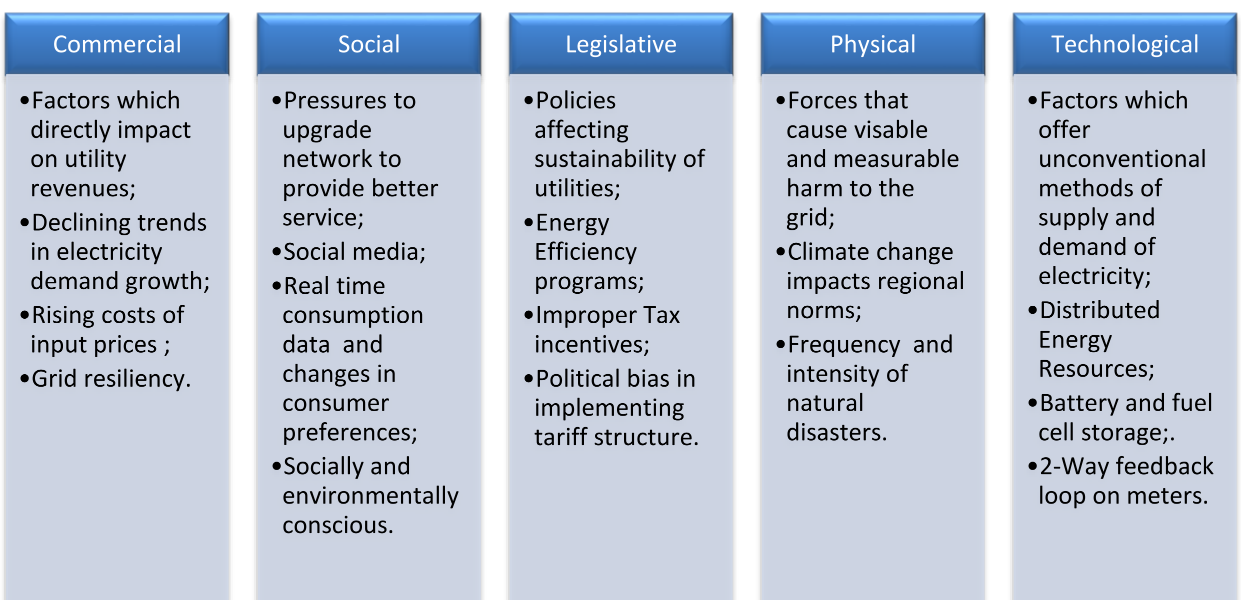
3.0 DISRUPTION OF THE ELECTRICITY LANDSCAPE

An overview of the electricity sector today reveals disruptive forces which are influencing the environment in which utility services are offered. These forces are most often those that can result in a breakthrough or a change in status quo which can transform the transactions and relationships between the supply side and the demand side. The disruptions can either affect the sector almost immediately or the effects can be delayed. They have the potential to permanently change the way utilities provide electricity services and also affect characteristics of consumption patterns, essentially impacting what were once reliable revenue streams for the utility.

3.1 Disruptive Forces

The nature of these forces vary widely and can be classified in a number of ways. For the purposes of this paper disruptive forces will be categorized by the general headings in Figure 2.

Figure 2:General Classification of Disruptive Forces



Commercial disruptive forces directly threaten the revenue source of the utility and also affects the cost of service in providing the service. Consumers are becoming more efficient in their consumption patterns owing to several factors such as more efficient electrical appliances and time-differentiated tariffs, which result in a collective decrease in demand for electricity and therefore lower revenues to the utility.

Factors that can lead to a social disruption are those that are driven by information sharing and the ability of consumers to better control when and how they use electricity. The role of media cannot be understated in its influence on social behavior as it relates to electricity consumption, as people across the world are able to communicate seamlessly and create demonstration effects in terms of electricity consumption behavior, tastes and preferences.

Legislative disruptive forces can arguably have a delayed effect in provision of service but also tends to be one of the more difficult forces to oppose. Certain aspects of Demand Side Management[3] (DSM) programs such as tax incentives and public policies to encourage renewable resource development and net metering, tend to result in lower electricity sales and put downward pressure on retained earnings which are required to support capital investment. As well intentioned as Energy Efficiency[4] (EE) programs are, they require capital injections in property and plant in order to have any meaningful impact. Essentially, utilities are being asked to finance investments that can lead to lower sales and profits. If financed through tariffs, it is possible that the cost of these programs may be passed on to customers. If the programs are not implemented and utilities do not adopt EE programs, plant equipment continues to run inefficiently, which can have trickle down effects on the rates customers pay. Both situations pave the way to cut into the long-term revenue streams of the utility.

Physical disruptive forces, such as those found in climate change, are unpredictable and historical weather trends are becoming unreliable for use in feasibility studies. In addition, extreme weather events and other natural disasters such as hurricanes are increasing in intensity and occurring more frequently, and which are powerful enough to cause catastrophic damage to energy grids. In 2017, hurricanes Harvey, Irma and Maria left devastating effects on Texas, Florida and the islands of Dominica and Puerto Rico respectively. Such significant damage has the potential to escalate

[3]The US Energy Information Administration (EIA) indicates that Demand-side management (DSM) programs consist of the planning, implementing, and monitoring activities of electric utilities which are designed to encourage consumers to modify their level and pattern of electricity usage.
[4] The basic concept of Energy Efficiency is basically the ability to achieve the same level services with less energy. This definition grossly understates the power of energy efficiency to provide benefits beyond energy savings for society and for the economy.

financial costs to restore the electricity grid of any country, more so for small island developing economies.

Technological disruptive forces are perhaps the most widely associated with causing changes in the sector and generally challenges the way society has come to view the supply and demand of electricity. Some of the Distributed Energy Resources[5] (DER) that have become viable threats to the traditional carbon-based generation approach include solar photovoltaics (PV), battery storage, fuel cells, geothermal energy systems, wind, micro turbines, and electric vehicles (EV). As the cost curve for these deploying these technologies improves and the potential for achieving grid parity becomes more realistic, consumers are presented with more feasible options to satisfy their electricity demands. This in turn makes customer reliance on the national grid less essential, which may directly threaten the centralized utility model.

For the purposes of this paper much of the discussion on the disruption of the electricity landscape will focus on examples of disruption by technological forces.

3.2 Point of Change in the Current Operating Environment

As consumers become increasingly aware of trends in the energy environment and possibilities for service satisfaction, their own preferences for electricity services and consumption are influenced, especially if the customer deems those options to personally be more economic and convenient. This consumer behavior change, driven by the prospect of more affordable renewable energy and less reliance on the utility to satisfy demand, encourages a move toward adopting alternate, off-grid electricity resources. (see Figure 3 below)

The net effect over time is that the customer base shrinks, or even with the same number of customers connected to the grid, there is a sustained decrease in demand as customers switch to renewable sources. This can have implications for the utility covering its fixed costs since the network still has to be maintained to deliver service to customers still fully dependent on the utility for service. Unless the utility has a tariff scheme which sufficiently allocates fixed and variable costs, any mechanism to recover lost revenues would come at a cost (usually in the form of an

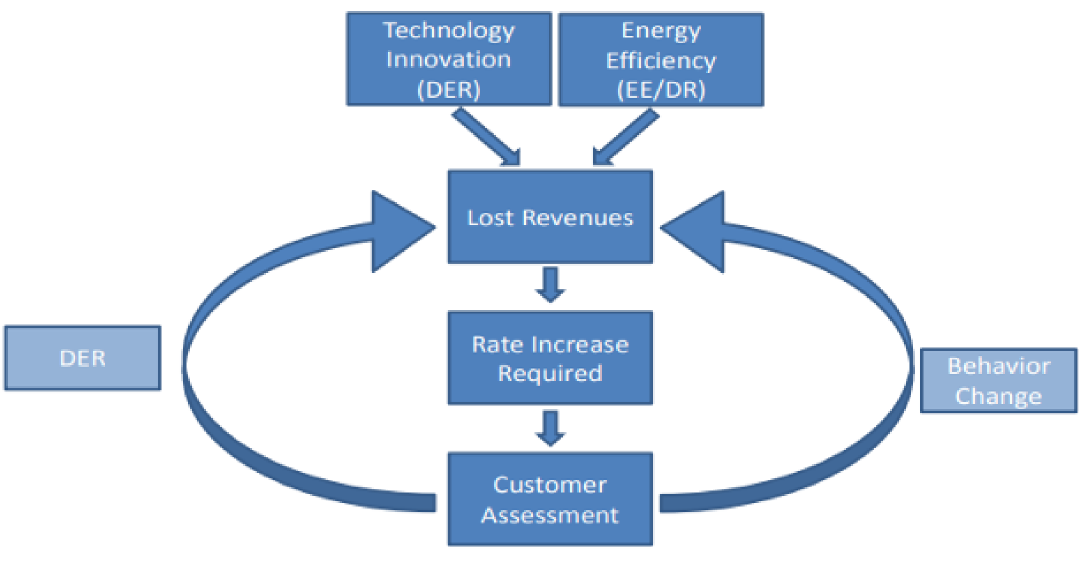
[5] As defined by the North American Electric Reliability Corporation (NERC), a Distributed Energy Resource (DER) is any resource on the distribution system that produces electricity and is not otherwise included in the formal NERC definition of the Bulk Electric System (BES).

increase in tariffs) to customers still connected to the network, who will then be more motivated to either find alternatives to reduce their consumption or their reliance on the grid.

Essentially the monopoly role of the utility is unraveling because new applications of technology are leading to a more competitive market for distribution of electricity and this in turn, is eroding the advantages gained from economies of scale and scope provided by the utility. Whereas in the past competitive efforts were centered on the generation and transmission industries, today, competition from new market participants is increasingly focused on much smaller scale, customer–side distributed generation.

Although there is uncertainty about the exact future of the electricity landscape there are some key changes that can be expected such as continued technological innovation in small scale electricity generation and satisfying end-user requirements. Also likely to continue, is the need for substantial investment to develop a smarter and more flexible network. For the utility, this likely scenario creates an energy trilemma that seeks to balance recovering costs of service, security of electricity supply and de-carbonization commitments.

Figure 3:Impact on the Operating Environment by Technological Forces



Source: Edison Electric Institute

3.3 Global Trends in DER

DER adoption is growing in the United States, due in part to state, local, and federal policies. According to the Federal Energy Regulatory Commission[6] , DERs accounted for about 2% of the installed generation capacity in the United States in 2016.

A number of studies have shown that wind and solar energy are the fastest-growing sources of power generation globally and according to Bloomberg NEF[7] (BNEF) both sources have just recently achieved the 1TW of wind and solar generation capacity installed. Including all other renewables, including hydropower, the total generation capacity installed would already exceed 2TW, having attained the 1TW mark about a decade ago. Most of the growth in the intervening period can be attributed to wind and solar.

Boosted by a strong solar PV market, renewables accounted for almost two-thirds of net **new** power capacity around the world in 2016, with almost 165 gigawatts (GW) coming online. This was largely as a result of booming solar PV deployment in China and around the world, driven by sharp cost reductions and policy support.

Wind power has comprised a sizable share of generation capacity additions in recent years. In 2016, it constituted 27% of all U.S. capacity additions and was the third-largest source of new capacity, behind solar and natural gas.

Announced auction prices for wind and solar have continued to fall although average generation costs of new-built projects remain higher. Over the next 5 years global average generation costs are estimated to further decline by a 25% for utility-scale solar PV; by almost 15% for onshore wind; and by about 33% for offshore wind.

According to the EIA, governments in many countries such as China, Germany, the UK and the US have enacted policies encouraging plug-in electric vehicle sales (EV). These policies range from direct monetary incentives to time-saving measures. Unit sales of EVs were 1.1 million in

6 The Federal Energy Regulatory Commission is the United States federal agency that regulates the transmission and wholesale sale of electricity and natural gas in interstate commerce and regulates the transportation of oil by pipeline in interstate commerce

7 Bloomberg New Energy Finance, is Bloomberg's primary research service, covering clean energy, advanced transport, digital industry, innovative materials and commodities. The unit helps corporate strategy, finance and policy professionals navigate change and generate opportunities.

2017 and BNEF projects unit sales of all EVs to reach 11 million in 2025 and 30 million by 2030. BNEF projects that by 2040, 55 % of all new sales of automobiles will be EVs, and 33% of all vehicles globally will be electric.

Off-grid or micro grid renewable energy solutions support access to modern energy services in a timely and environmentally sustainable manner. According to the International Renewable Energy Agency[8] (IRENA), global off-grid investments in 2017 reached USD$284 million.

Globally, approximately 133 million people accessed lighting and other electricity services using off-grid renewable energy solutions in 2016. Countries in Africa and Asia accounted for most of the growth in off-grid power consumption over the past years, with more than 53 million people in Africa and 76 million in Asia now using such power sources.

Box 1 highlights some of the forward thinking by researchers on the energy sector. The literature suggests that the global market is embracing these disruptive forces and proactively taking steps to ensure a smooth transition to an unfamiliar operating environment.

8 The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future, and serves as the principal platform for international cooperation, a centre of excellence, and a repository of policy, technology, resource and financial knowledge on renewable energy.

Box 1:Input from Energy Sector Experts

Recently, governments in several countries have proposed policies that would discourage or prohibit the use or sale of non-electric vehicles in future years. The Norwegian government hopes to end the sale of petroleum-fueled vehicles by 2025. India's government announced that by 2030 only electric vehicles will be sold in India. The governments of France and the United Kingdom have stated that they will ban the sale of internal combustion engine vehicles by 2040.
~International Energy Outlook 2017~

Many studies have been published on future market demand for EVs by a variety of automotive and energy analysts, including Bloomberg New Energy Finance (BNEF), the International Energy Agency (IEA), UBS, Goldman Sachs and McKinsey, as well as Edison Electric Institute and the U.S. Energy Information Administration. Since this is a global market for sales of EVs with a highly integrated global supply chain, such studies usually study the global market demand for EVs — both light-duty and all-electric buses and others. Most studies conclude that China is and will continue to be the largest market for EVs over the next two decades, with the EU and North America following but growing briskly with at least 25 percent to 30 percent growth rates in the near future.
~ Lawrence Berkeley National Laboratory 2018~

As the world strives to cut carbon emissions, electric power from renewables has emerged as a vital energy source. Yet transport and industry will still require combustible fuels for many purposes. Such needs could be met with hydrogen, which itself can be produced using renewable power. Hydrogen provides high-grade heat, helping to meet a range of energy needs that would be difficult to address through direct electrification. This could make hydrogen the missing link in the transformation of the global energy system.
In the long run, hydrogen could become a key element in 100% renewable energy systems. With technologies maturing, actual scale-up should yield major cost reductions. The right policy and regulatory framework, however, remains crucial to stimulate private investment in in hydrogen production in the first place.
~IRENA 2018~

In its New Vehicle Zero CO2 Emissions Challenge, Toyota has set itself the target of achieving by 2050 a 90% reduction in new vehicle CO2 emissions compared to 2010. Towards this goal, Toyota will roll out the technology it has built up in the hybrid vehicle sector, adapting it to plug-in hybrid vehicles and to fuel cell and electric vehicles, which generate no CO2 emissions whatsoever. Toyota is committed to further accelerating its initiatives toward the development and widespread adoption of hybrid vehicles and other eco-cars.
~Toyota 2018~

3.4 Disruptive Forces in the Caribbean

For most islands, electricity rates are comparable to the rest of the world. The threat of disruptive forces and its impact on the Caribbean is thus a growing concern, especially when paired with the rising cost of imported fuel needed for power generation and the vulnerability to the effects of climate change. Added to this, a mix of political, institutional and socioeconomic issues continue to prevent DER development to a level that would create a competitive market for both state owned and investor-owned utilities. However, the Caribbean is in a prime position to capitalize on the opportunities posed by some disruptive forces. Many of the smaller islands depend on tourism and foreign investment for economic growth and affordable electricity rates are a key factor in attracting and retaining foreign business. Integrating DERs into small business and tourists oriented services may ensure more long-term, foreign investment in these smaller economies.

In addition to retail electricity as a revenue source, the utility stands to gain from internal research and development initiatives. By enacting sector polices where available and initiating government and social partnerships to facilitate applied research into generating electricity from alternative sources like solar and on-shore winds farms, the utility creates new key partners and value propositions. This action will also provide much needed capacity building within the region.

Social media platforms are becoming the preferred channel of information sharing (for both positive and negative scenarios) between customers and utilities. Utilities use various apps and websites for public education programs and to receive feedback from customers. Customers in turn use social media to communicate freely and informally with the utility about changes in consumer preferences and to garner support from other customers experiencing issues with delivery of service. With the wealth of information already available from utility customer databases and the potential for data mining, the utility can develop new perspectives on different customer segments, and how to deliver value to those segments.

Some of the DER initiatives in the Caribbean include:

- Barbados – Megapower, a company working on renewable energy projects in the Caribbean has now sold over 200 EVs and is currently generating approximately 1,500 kWh from solar photovoltaic (PV) systems;
- St. Vincent - St. Vincent Electricity Services, the Government of St. Vincent and other stakeholders embarked on the first solar and battery storage project which is expected to minimize the use of diesel for the generation of electricity and silence the diesel generators for 6 to 10 hours per day;

- Grenada – Grenada Electricity Services Ltd award-winning solar project in 2017 consists of multiple rooftop, car port, and ground-mount solar installations for a total capacity of 937 kilowatts (kW.

4.0 DISCUSSION

Due to the variable nature of DER there is a perception that customers will always need to remain connected to the national grid. However, based on the growth of energy production from renewable sources and greater penetration of DER at the distribution scale the possibility of independence from the grid is moving from impossible to plausible and more importantly, feasible. Technology has challenged the status of the utility as the sole provider of energy. DER such as micro grids, energy storage and EVs are increasingly available to a wider market. As these technologies become less expensive it may allow customers to produce and store their own power, effectively making them 'prosumers', and not just consumers.

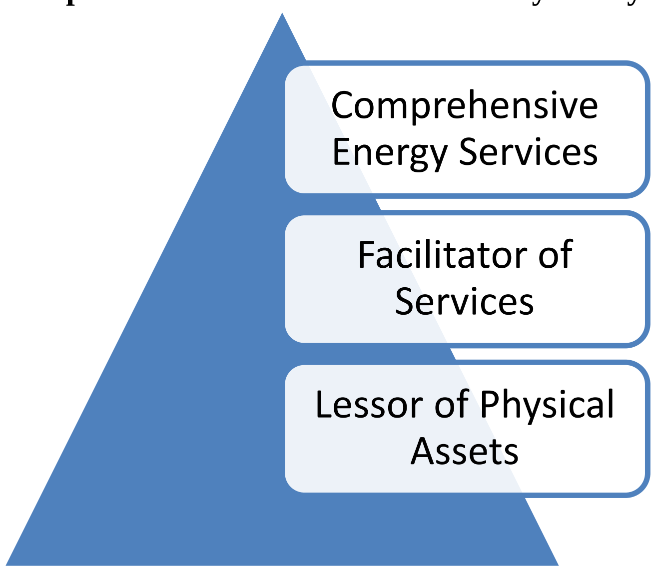
Left unabated, this trend poses a direct threat to a utility's revenue stability since utilities tend to have no control over any of these DER and are thus faced with the challenge of planning for this new reality. Other disruptive forces like escalating input prices and relying on real-time consumption data to curb demand can leave the utility stranded with heavy cash outflow and a decreasing cash inflow.

4.1 Future Roles

For utilities still operating as state-owned monopolies, there is very little financial incentive to pursue longer term, riskier innovations unless the regulatory environment directs them to do so. Even if utilities are motivated to respond to public support for sustainability and energy efficiency measures, the regulatory framework may constrain the flexibility of utilities to implement their own strategies and policies to adapt to these forces. Nevertheless, the shift in the evolving operating environment has created a powerful force to encourage and incentivize the utility to evaluate its business model for weak points as it relates to the sustainability of operations in its current state and perhaps to define a new direction of the utility given the presence of disruptive forces. Before a utility can address how to move in the chosen direction it must first identify its desired niche in the electricity sector value chain.

A number of hypothetical roles have been suggested for utilities of the future, with some of the most cited and widely discussed scenarios originating from sector experts and industry stakeholders. While there are many variations and names for the models, the basic understanding as shown in Figure 4, is that there are three likely business models for a utility to transform into given the evolving energy sector. The first is to transform into a comprehensive energy service utility and the second is to assume the role of a smart integrator, which focuses more on facilitating access to the grid. At an elementary level, there is technically one more role which the utility can assume which entails the utility being involved as only the owner of the physical infrastructure of the grid.

Figure 4:Spectrum of Roles for the Electricity Utility of the Future



4.1.1 Comprehensive Energy Services Utility

At the high end of the spectrum the utility's role is at a maximum level of involvement. In addition to maintaining its current role, the utility would expand its business scope and scale, thereby bolstering its revenue streams. The obstacle here would be to gain political consensus to mandate new responsibilities for the utility in order to meet financial and regulatory obligations.

Possibilities for compensation could include bundled services for new offerings which would enhance the value for the utility's consumers. In order to provide new services, the utility would be expected to diversify its service options in accordance with the new requirements of emerging customer segments. In this model, utilities would own and operate DER projects on the upstream side of the market and they would also offer 'customer –experience' services on the downstream side such as services for small scale PV generators, maintenance of residential EV charging stations and smart home management.

4.1.2 Facilitator or Integrator Utility

The middle of the spectrum creates a space for the utility to be involved as the owner and operator of the grid, and to foster productive partnerships with market participants wishing to connect to the grid. In this model the primary role of the utility would be to create an interoperable platform which would facilitate equal access for entities wishing to offer services on the grid. In addition to operating and maintaining the grid, the utility would also likely be responsible for developing plans for investment and upgrades. In this model, compensation to the utility is based on market prices since service providers would set their own rates under a fair competition structure.

As a facilitator of the grid the utility has many options to earn revenue including fees for access to grid, offering auxiliary services, performance based incentives and under limited conditions, providing DER services. One of the main differences between the utility as a provider of energy services and the utility as a facilitator is that the customer interacts with more stakeholders and vendors in the second scenario. The utility would only facilitate competition, operate the meters and aggregate billing for the customers.

4.1.3 Lessor of Physical Assets

At the low end of the spectrum, utilities have few incentives to take risks that come with rapid rates of change or innovation. At the base case, the utility's role would be to lease the physical infrastructure for delivery of electricity service and rely on market participants and customers as its channels for revenue streams. In this model, the utility does not offer services for DER, but instead only owns the poles and wires and is compensated on its capital investments through a cost of service approach. The market participants, who essentially are the customers of the utility, include, but are not limited to, transmission grid operators, distribution companies who manage the grid, and retail providers who sell directly to customers.

Each of these three models outlines a very different role for the utility in terms of its responsibilities and revenue streams. In deciding the direction of the utility going forward there are a number of opportunities and challenges associated with each model which are outlined in Table 1.

Table 1: Opportunities and Challenges in Model Selection

Model Description	Pros	Cons
Comprehensive Energy Services	Expand business segments by buying innovator firms; creates new sources of revenue since utilities are allowed to own utility scale DER and storage.	Involves political buy-in to amend legal mandate of utility; regulatory intervention would determine the extent that the utility would be able to access smart meter data for tariff setting.
Facilitator	Utility is not solely responsible for satisfying customer complaints; supports innovation and customer choice.	Designing a market to meet customer needs without discriminating against non DER participants; can be saddled with uneconomic areas of service.
Lessor	Reap the benefits of a competitive market since participants need the grid to offer services; utilities are indifferent to prosumers or consumers.	Ability to amass capital for long term investments; model promotes a rigid and inflexible utility.

4.2 The Trinidad and Tobago Scenario: Electricity Utility Business Model Reengineering

The Trinidad and Tobago Electricity Commission (T&TEC) is a fully owned state enterprise that falls under the purview of the Ministry of Public Utilities. T&TEC's current mandate is essentially the transmission and distribution of electricity in Trinidad & Tobago, with limited generation capacity retained in Tobago, and is by law the sole retailer of electric power in the country. T&TEC's other activities surround operation and maintenance of the country's existing electrical transmission and distribution network and also planning and executing expansion of this network to meet the expanding needs of its customer base. T&TEC is also responsible for the provision and maintenance of public lighting including street, highways, thoroughfares, bridges, parks and other such public places. Currently, T&TEC's customers are metered and depending to customer class, tariffs are based on a kilowatt hour consumption, demand charges and customer charges.

This paper does not attempt to expressly choose a new model for the local context, but to suggest the benefits attached to either of the emergent models. Further, it highlights the opportunities in the potential operating environment to ease the transition into the evolving energy landscape. Table 2 identifies specific elements in the local context which need to be considered in reengineering the electricity business model.

Table 2:Business Model Analysis in the Local Context

Essential Building Block	Elements to Transition	Implication
Key Partners	Other utilities; EMA; RE storage suppliers, local conglomerates.	General consensus from local stakeholders, working relationships with other jurisdictions who have already taken steps to make the transition; partnering with the 'influencers' of the energy landscape to champion the utility .
Key Activities	Micro and small RE generation initiatives; technology procurement, hosting DER marketplace.	Legal means to import/manufacture equipment related to DER; act as 3rd party in linking customers with vendors
Key Resources	Talent pool from educational and vocational institutes e.g. UWI, COSTAATT[9]; Green Energy institutes and financers .	Local labour to install and maintain service points; platform to interact with sector experts and potential investors .
Value Propositions	Lower electricity bill for better service (different energy service options), advocate of green energy; price bundles.	Customer perspective of being in control of a service that they really want and is affordable to them can lead to customer retention and continued revenue streams.
Customer Relationships	Feedback loop; customer base assessment.	Identification of new customer groups and the services they are most interested in vs the cost to deliver; willingness of customers to share their meter data.
Channels	Social media; direct contact; customized software.	Channels should be easily accessible and reliable ; data mining capabilities of software , control tools for utility to better manage distribution.
Customer Segments	Small scale DER for underserved areas.	Micro grids allow the utility to fulfil its obligation for universal access to electricity and at the same time avoids the capital required to expand the grid beyond what was planned for.
Cost Structure	Current cost of service and estimated revenue requirements based on the different models	Identification of services which do not bring value to the utility and which can be offered another way.
Revenue Streams	New or enhanced services; willingness to pay.	Positions the utility to provide a service that the customer deems useful and cost effective.

[9] University of the West Indies, College of Science Technology and Applied Arts of Trinidad & Tobago

5.0 ROLE OF THE REGULATOR

In a disruptive environment there are certain issues which the regulator may be obligated to address in accordance with its mandate.

One of the disruptive forces mentioned above concern the issue of climate change and over the last decade, there have been several global initiatives that mandate percentage reduction in carbon emissions (overall and by sector) and countries that have signed on to these agreements have been given timelines within which to meet these targets. Regulators now have to ensure that its utilities incorporate into its planning function, clear steps on how it intends to achieve these reductions. Moreover, as part of its review of cost submissions by utilities, the regulator must consider the allowance of costs for activities such as rebuild of generating units and investment in steam turbines. These types of investments would help achieve environmental objectives and also reduce the cost per kWh of energy generated in the medium to long term.

As discussed earlier, the increased uptake DER poses challenges to the utility earning revenues and therefore, its sustainability over time. The regulator may also need to consider options for stabilizing revenue streams for utilities so affected. Therefore, the regulator must give serious consideration to the use of revenue caps or revenue decoupling, as an approach to breaking the link between sales of the utility and its revenues. Since profit margins of utilities are tied to sales, there is no incentive for utilities to support any renewable energy technology that makes consumers less reliant on the grid. Also, when customers who utilize DER experience interruptions in RE supply, they return to the utility grid for their energy needs. Revenue decoupling addresses these issues by removing incentives for the utility to push for increases in sales to generate more profit and to eliminate variability in utility revenues due to factors such as customer growth, weather, etc. There are a number of ways that revenue decoupling can be implemented and the regulator would have to consider the pros and cons of each option, specific to their jurisdiction.

The regulator also has an important role with respect to incentivizing a steady uptake of DER via appropriate pricing of energy for these sources. One challenge that is faced in pricing of RE is the rapidly declining costs in the technology, which can result in windfall profits to RE investors and unfair burden on consumers, if rates are not allowed to adjust over time. A number of approaches including fixed price, fixed price with inflation adjustment and front-loaded are available for use. At a higher level, the regulator also has to decide whether it is appropriate to use a cost-based or value-based approach to tariff setting. Another consideration for regulators on the tariff setting approach is the need to develop a tariff structure that would reflect the cost of service and value provided to DER customers. Key here would be the mechanism to address off-peak service, service as a back-up supply and the options to sell DER resources back to the utility or other external providers.

Another key decision the regulator has to take is the approach to feasibility studies conducted by the utility for potential DER resources. These studies are essential for the planning and development of DER projects but the framework to fund these studies through tariffs may be a complex process and the regulator has to balance the interests of both the utility recovering its costs to conduct the study and the customers who will benefit from DER services.

Additionally, depending on country-specific legislation, some regulators may have a critical role in taking part in the procurement of DER, and the administration of licenses to small-scale generators. Concomitant with these responsibilities are matters related to interconnection disputes, which the regulator may be required to mediate.

At a policy level, the regulator may need to adopt a proactive approach by the process to inform and encourage policymakers and other key stakeholders of the need to take decisive action in this regard;

i. Establish a broad framework to guide its intervention;
ii. Broadly outline the stakeholder engagement process;
iii. Facilitate technical workshops with experts;
iv. Advocate for a policy statement or policy guidance from government so that utilities and stakeholders have more certainty;
v. Emphasize market transformation and new utility portfolio approach;
vi. Research and assess best practices and applicability to local context;
vii. Establish the process for rate design and incentives for various DERs.

In the electricity sector the economic structure, the business model and the form of regulation are inextricably linked. Where the traditional business model usually required the regulator to determine simple cost based rates, evolution of the sector has created gaps in the rate review process that now calls for the regulator to determine rates based on a number of scenarios such as new generation sources and power storage options.

Regardless of the business model alternatives chosen by utilities, regulators can reinforce their role by presenting options to effectively transform utilities from serving unmanaged loads, using traditional infrastructure, to dynamically managing a platform that provides ratepayers with the greatest benefits at the lowest cost, while also maximizing consumer options.

6.0 FUTURE CONSIDERATIONS

The annual hurricane season in the Caribbean is often a time of uncertainty and anxiety for both the utility and its customers as the physical electricity network faces potential damage from excessive wind, rain and flooding. The resulting power outages are not only financially burdensome and an inconvenience but they can also be dangerous where emergency evacuations are required. The implementation of micro grids can offer a backup electricity supply when the central grid fails and can provide a reliable level of service to customers until power from the grid is restored.

Micro grids provide efficient, low-cost, clean energy and enhance local resiliency of the grid. They provide a dynamic responsiveness that is sometimes necessary to deal with customers who have been without basic necessities as a result of harsh weather conditions. Serious considerations should be given to establishing micro grids in the most poorly served and remote areas of the utility network. In addition to experiencing frequent outages when the grid is functioning normally, in times of severe weather events, rural and remote areas are more likely the last to have grid-power restored due to their location, blocked roadways and delays in clearing of vegetation and debris among other things.

The characteristics of this particular niche make it an ideal customer segment for the utility to target with respect to diversifying services offered. By facilitating an uninterrupted supply of service, the utility profits from a financial stand point and by targeting the services to the customers most in need the utility fulfils its mandate for universal service.

7.0 CONCLUSION

Disruptive forces enable future, focused leaders to erode or empower competitive advantage. The signs of disruptive forces approaching are clear, what is not clear is where, when or the extent of the impact. It requires great insight, analysis, discussion, creativity and leadership to fully harness the power of a disruptive force or to implement mechanisms to combat associated negative outcomes. Utility leaders cannot wait until the individual components of disruptive forces are having an effect. They need to understand how the strategic advantage they build their business on today, might be eroded or enhanced a decade from now by an evolving electricity sector.

As regulators, it is no longer safe to make decisions based on being averse to risk and it should no longer be the norm to take a reactive approach to a rapidly changing electricity environment. Emphasis must be placed on strategic inflection points as opportunities for utilities to experiment and to retrofit their networks. Regulators are also in a prime position to bridge the gap between innovation and practice, essentially providing a platform for utilities to recognize disruptive forces and help them to adapt and embrace the changes.