Published in the Slovak Republic
European Journal of Renewable Energy
Has been issued since 2016.
E-ISSN 2454-0870
2016, 1(1): 4-10

DOI: 10.13187/ejore.2016.1.4
www.ejournal51.com

Articles and Statements

UDC 004.4

'Sometimes, I feel as if we went a bit ahead of ourselves': Evaluating Ghana's Wholesale Electricity Market Model

Michael Asiedu [a, *], Linda Baah [b], Jacob Owusu Sarfo [c]

[a] University of Ghana, Ghana
[b] Ghana Grid Co. Ltd., Ghana
[c] University of Cape Coast, Ghana

Abstract

Electricity is very crucial to both national and international development. This current study explored the perceptions of transmission customers regarding the Wholesale Electricity Market (WEM) model in Ghana. A semi-structured interview data from 5 Transmission Customers were collected by researchers. In order to increase the chances of the WEM's successful implementation, the results identified excess generation capacity as key. On the contrary, in an environment of insufficient generation and a small market size, a WEM may lead to price hikes, unreliable and poor quality power supply. On the contrary, in an environment of insufficient generation and a small market size, a WEM may lead to price hikes, unreliable and poor quality power supply.

Keywords: Wholesale Electricity Market, Innovation, Success, Failure, Ghana.

Introduction

Both practitioners and scholars agree that electricity power is at the crux of industrialization, as it played an important role in the growth of most developed economies. Empirical evidence has associated power generation to the level of productivity, employment and government revenue generation. In this respect, countries with good power generation systems are often earmarked for higher productivity as a result of industrialization; higher employment rates as well as higher government revenue generation stemming from taxes and foreign exchange. In connection to this, both developing and underdeveloped countries have in recent times made attempts to restructure their power generation systems, which include generation, transmission and distribution of power; in order to improve their power situations. Therefore, governments have attempted to legislatively change the market structure of the electricity market across these lines (generation, transmission and distribution of power), in the order to increase the number of players as well as efficiency, cost, quality and reliability (Joskow, 2003).

In the wake of the recent power instability in the last decade, the government of Ghana enacted the Electricity Regulation 2008, which was to see to the establishment of a competitive

* Corresponding author
E-mail addresses: basiedum@gmail.com (M. Asiedu), lindabaah@gmail.com (L. Baah), sarfojo@yahoo.com (J.O. Sarfo)

WEM to facilitate wholesale electricity trading and provision of ancillary service on the National Interconnection Transmission System (NITS). This action was in reaction to the deteriorating industrial productivity and the heightening cost of power. This action suggests a business model innovation in the electricity markets, which will ultimately impact the number of players, generation of power and the contractual relationship between players in the industries. Consequently, this business model innovation is also expected to impact the cost, reliability and quality of power supply. The move to adopt the WEM can be considered as local and regional innovation in the electricity markets, especially in West Africa and Africa as a whole. Even though several restructuring activities in the electricity market has led to the privatization of the industry in most cases (Prabavathi, Gnanadass, 2015), the approach in Ghana considers the operation of a WEM system, which would comprise both bilateral and spot market operations but not concurrently.

Other models adopted across the continent are significantly different (Milciuviene, Tikniute, 2009). For example, Eberhard and Mtepa (2003) explain that the South Africa's restructuring model is a vertically integrated public utility, which has one dominant generator (ESKOM) directly supplying to customers. Hence, Ghana's decision to implement the WEM is an innovation within the local and regional context that can be emulated in the future should it be well implemented. With respect to the enactment of the Electricity Regulation 2008 in Ghana, several stakeholders have raised concerns about the appropriateness and timing of the Wholesale Electricity Market (WEM) business model innovation. In spite of the successful implementation of the Wholesale Electricity Market business model in some developed and developing countries; a cursory examination of the views of some practitioners and stakeholders suggests some skepticism with the implementation of the WEM model.

It is noteworthy that the adoption of the WEM signifies a significant shift from the monopoly market structure to a perfect competition. However, factors such as the limited number of power producers, long period of power plant construction, large size of capital investment, transmission constraints and transmission losses draws most restructured power market into an imperfect competitive market system more than a perfect competition market system. Despite these factors, the restructuring of the electricity market to a single market enhance competition, which ripple on to affect other factors such as cost and quality of power supply (Prabavathi, Gnanadass, 2015).

Also of note, some recent discussions in extant literature reveal that Electricity Market transformations are often reactive measures adopted in response to severe economic and technological changes. As a result, they force countries to adopt a restructuring program as a contingency plan to their power supply issues, and are therefore undertaken without the right considerations (Milciuviene, Tikniute, 2009). Hogan (2001) argues that the adequate operationalization of a restructured electricity market requires a consideration of the power systems in place, its size, reliability, demand, technical and commercial regulations at play, and the sensitivity of the public to price changes.

Some studies attribute the success of the implementation of most electricity market deregulation exercises to the competition that the exercise drives (Prabavathi, Gnanadass, 2015; Outhred, MacGill, 2006). In this respect, Outhred and MacGill (2006) expansively explains that a failure to set up a system that would foster competition at the production and distribution stages would adversely affect the success of the implementation. Thus, they attributed the main purpose of most deregulation policies with the creation and fostering of competition across all the stages of production and distribution; which will be by increasing generators (both on the spot market and bilateral contracts), distributors, wholesalers as well as retailers in the electricity market.

Furthermore, peculiar to the Australian electricity market, Outhred and MacGill (2006) explain that financial support market systems are necessary for the successful implementation of a Wholesale electricity market system. This may be a critical success factor necessary for the implementation of the WEM in some developing economies like Ghana. The purpose of this research is mainly to provide in-depth understanding of the concept of Wholesale Electricity Market as well as reveal the factors necessary for the successful implementation of the WEM. The results of this research may provide some useful information to stakeholders in the industry.

Methodology

Research Design

A qualitative research design was used to gather information for the study (Creswell, 2013). Since, this is the first time Ghana is seeking to implement the Wholesale Electricity Market, an explorative research was appropriate as it unveils a lot of new knowledge about the event. The study ultimately depends on primary data from the transmissions customers in the WEM market.

Population

The study Population included the 30 Transmission Customers. However, the sample frame for the study was 27 because three of the transmission customer including Togo and Burkina Faso are not situated in Ghana. Thus, the study focused primarily on transmission customers directly connected to the NITS.

Sample size and sampling procedure

To adequately investigate this research project, 27 direct customers including industry, distribution companies in Ghana were selected. The current study reached saturation after the 5th transmission customer. Table 1 show a summary of respondent characteristics.

Table 1. Respondent characteristics

Respondents	Consumption rate	Sector
Transmission customer 1	50MW/mth & 32GGWh/mth.	Mining
Transmission customer 2	980,000kWh monthly	Manufacturing
Transmission customer 3	880,000kWh monthly	Retail distributor
Transmission customer 4	700,000kWh monthly	Manufacturing
Transmission customer 5	400, 000kWh monthly	Community transmitter

Tools for Data Collection

Data was collected through the use of semi-structured interview guide. The interview guide had 8 items comprising of 3 segments namely; demographic of the respondents, success factors and mitigating factors.

Data analysis

Interpretative Phenomenological Analysis was employed to analyses the interview data. Beginning from the 1st respondent, interviews transcribed and analyzed individually for themes. The data collection and analysis were done concurrently up to the 5th respondent, at which point, theoretical data saturation had been attained.

The transcription process included playing the recording as well as writing out the data. Additionally, the transcribed information was perused several times to identify any inconsistencies and errors. Preliminary comments were completed, with other related probing comments. This allowed for the observation of themes, until all five interviews had been duly analyzed (Smith et al., 2009).

Results

Data analysis resulted in the emergence of two master themes; (i) success factors for the WEM implementation and (ii) conditions that will facilitate the failure of the WEM.

In an attempt to improve the readability of these verbatim extracts, some slight modifications were made. In addition, transcripts have been presented using fictitious names like transmission customer one (1), in an effort to maintain confidentiality. Dotted lines were used at the start or conclusion of an extract to show that the respondent was either talking prior to or subsequent to the extract.

Table 2 summarizes the master themes identified in the course of analysis: in this respect, three superordinate themes were identified under each of the success and mitigating factors master themes.

Table 2. Master Themes and related Superordinate Themes

Master Themes	Superordinate Themes
Success factors for the WEM implementation	Number of players (suppliers) in the market
	More Spot offers
	Flexibility to switch –Bilateral Contracts
Factors that mitigate the successful implementation of the WEM implementation	Inadequate financial support
	Insufficient power generation
	Small market size- size of market

Discussion

Master theme 1: Success Factors for the WEM Implementation

From results, this study identified some factors necessary for the successful implementation of the WEM. These included; the number of players in the market, more spot offers and flexibility to switch from one wholesale supplier to another under the bilateral contracts.

Number of Players (Suppliers) in the Market

A market consists of buyers and sellers. The number of generation companies available to supply power to meet demand was one of the key concerns of respondents. This is particularly true in these times of rolling blackouts in the country, which is mainly due to insufficient power generation to meet the demands of both industrial and domestic consumers. Currently buyers outnumber sellers on the market, and in comparison to the market for any other commodity, there is shortage of supply. Some respondents in expressing their frustration about the current power supply situation indicated that their current power supply has been reduced because of the shortage in power supply.

> *[…] we have been subject to about 33% reduction in the load. The real benefit of the WEM in my opinion will kick in when we have more supply than demand. (TC1)*

In other words, a successful WEM requires more producers of electricity than consumers. More generation companies [this refers more to thermal producer in the bilateral markets] will induce competition (Haas, Auer, 2006), which will in turn result in more efficiency in generators. In effect, generators will eliminate activities that do not relate directly to their operation in order to reduce their cost, so as to remain competitive in terms of price. Additionally, the need for increase in the number of generators as a precondition for effective competition in the WEM is also emphasized by several scholars (Haas, Auer, 2006; Outhred, MacGill, 2006; Prabavathi, Gnanadass, 2015)

More Spot Offers

A significant amount of offers on the spot market will generate competition among suppliers and therefore drive down the price of electricity on the spot market. Respondents indicated their reluctance to engage in spot market transactions during the implementation of the WEM, especially if the WEM is operationalized under the current generation portfolio (insufficient generation to meet demand). As it stands, the insufficient generation in Ghana implies that the hydro will become the only source of generation on the spot market, and is also going to be traded at a higher margin. It is in this respect that some scholars have suggested that increasing the number of offers on the spot market will stir up competition and reduce prices in the long run. To this, one respondent indicated that for WEM to have a positive impact on the cost of electricity, there has to more than one spot offer.

> *[…] we found the Nordic situation to be really exciting. However, they've got excess capacity to the extent that I understand (you will have a lot more information) they started with a lot of bilateral market and relations as opposed to spot. But today it's even*

flipped where today people are doing more Spot because it's more competitive than on the bilateral (TC1).

According to this respondent, this flip to the spot market without any challenges was because there were several offers on the spot market, making it more competitive. This view is affirmed in extant literature, as Haas and Auer (2006) asserts the need for competition to influence price and efficiency in power generation. Additionally, Outhred and MacGill (2006) called for an increase in competition from the production stage in the spot and bilateral markets, through to the distribution point, affirms this position.

Flexibility to switch – Bilateral Contracts

One other success factor identified by respondents is the ability to switch from one wholesale supplier to another, as well as the limited role of regulators in fixing price in order for the forces of demand and supply to work. Based on the premise of availability of sufficient generation, the bilateral contract must be structured such that a buyer is not bound by a power supply agreement, such flexibility will increase competition and hence present an opportunity for minimizing cost of power as much as possible. In this view, a respondent specified that

[…] The issue has to do with flexibility, where you are not bound by a PSPA, bilateral contract that you can opt out. TC4

Mater theme 2: Factors that Mitigate the Successful Implementation of the WEM Implementation. In contrast to the success factors mentioned above, the following conditions in the Electricity Supply Industry in Ghana will contribute to the failure of WEM's implementation. These include; insufficient power generation; a small market size and inadequate financial support. Some respondents acknowledge that a WEM in itself is not a bad idea. However, implementing a WEM under the current electricity supply environment characterized by the following factors will result ultimately in the failure of the system.

Inadequate financial support

This comes as a result of the pre-deposit arrangement policy for transactions on the spot market. In the WEM, transmission customers will be required by generators on the Spot market to pre-deposit for transactions in an attempt to reduce the risk of suppliers on the Spot market. In this respect some respondents expressed concern on them having to lock up funds that could have been used for other investments. One Transmission customer had this to say:

I think immediately I will say no, because I still think our market is not yet matured enough, because for us its actually money you are locking away. I know that there is a risk element for the supplier which we can also look at […]. TC 1

Additionally, most of the respondents also agreed that this policy will adversely affect their finances and will bring most transmission under a lot of pressure. For example, for transmission customer 5, aside admitting that the pre-deposit policy was a plausible one, the respondent also specified that will have some adverse impact on the finances.

[…] I will fully support it, because it guarantees transactions and ensures that they can be implemented. But in our current situation I think it will put additional pressure […]. TC 5

This view is affirmed in extant literature. For instance, Outhred and MacGill (2006) explains the importance of a financial market dedicated to the WEM. To further accentuate this point, the author also explains that Australia for example has two financial markets supporting their WEM system.

Insufficient Power Generation

As indicated in the above discussion the success of any market depends mostly on the availability of the product. Unavailability in generation under a WEM may result in the shortage of

power supply and thus allowing generators in the market to make their product available at uncompetitive prices. For example, one respondent notes that the invisible hand of demand and supply can only help with producing competitive prices if enough power would be generated by power producers:

> *When you have enough, where people's demand is met and they have excess or surplus - then the factors of supply and demand comes here. And price would be determined on that basis. Which I have always felt will take us a long time to achieve this because of our shortfall in energy. TC4*

This view is affirmed in extant literature as Haas & Auer, (2006) note that excess generation and distribution capacity is necessary for the success of WEM; consequently, the opposite is true for the market.

Small Market Size

This size of Ghana ESI according to some respondents, is not ripe for a WEM. The size of a market affects the level of competition in a WEM. In this respect, the respondent indicated that the small size of the market. This was confirmed by the response below;

> *[…], I think it's a good step, but I think our market is small… sometimes, I feel as if we went a bit ahead of ourselves (TC1).*

Extant literature has emphasized the size of the market in relation to wholesale consumers and end-users as a major contributor to success of the WEM. For instance, Haas & Auer (2006) and William Hogan (2001) explain that a large end-user market is important for the success of a wholesale market.

Conclusion

Ghana's electricity in its transition from a partial monopolistic market to a competitive market, has seen some major milestones. These include; setting up of regulatory agencies, deregulation, unbundling of the transmission from generation to form an independent transmission company and the establishment of a Wholesale Electricity Market under the Legislative instrument LI 1937. This qualitative research sought to determine the impact of the WEM on Transmission Customers. Five (5) Transmission Customers representing five Bulk Customers connected to the National Interconnected Transmission System were interviewed. These transmissions customers are participants in the WEM. In relation to the objectives of the study, two (2) master themes and their subordinated themes were identified.

The result indicated that the concept of the wholesale market for electricity in Ghana is a laudable idea. However, the provision of the law, most especially, the elimination of Hydro power generation from bilateral contracts will present challenges and make the cost of electricity procured from other sources via the bilateral contracts high. In order to increase the chance of the WEM's successful implementation, the current study identified excess generation capacity; more generation offering on the spot market and the ability to switch from one bilateral contract to another as the success factors that have to be ensured. Additionally, the current study suggests that some of the positive impact envisaged from the successful implementation of the WEM includes; competitive price for power resulting in lower electricity cost to Transmission Customers, reliable and quality power supply. In other words, a successful impact of the WEM will lead to an improvement in production, distribution and sale of electricity power. On the contrary, in an environment of insufficient generation and a small market size, a WEM may lead to price hikes, unreliable and poor quality power supply.

Recommendations

The results of the study have implication for industry, policy and research. Based on the results, the study makes the following recommendations.

Several foreign investors have been reluctant to invest in the electricity supply market of Ghana because of the size of market compared to other neighbors like Nigeria and Cote D'Ivoire.

In this respect, government should endeavor to roll out policies that will facilitate and attract investment into the industrial sector of Ghana.

Additionally, much effort should be channeled into ensuring availability of excess generation to meet demand. Additionally, in order to improve and to positively affect cost and generation of power, government may consider increasing the spot offers by allowing some private generators to participate in the spot market.

In order to increase chances of the WEM surviving and favorably affecting the participants of the market, there is a need for the government and other stakeholders to consider providing adequate financial support for WEM. This may be done by dedicating some financial institutions to the support of this market or creating a favorable environment for private financial institutions to consider venturing into sectors.

Even though the current study did not consider assessing the knowledge of the transmission customers' knowledge and awareness of the WEM, a cursory observation shows a low level of awareness. In this regard, future and further studies may consider assessing the awareness and knowledge level of transmission customers with regard to the WEM; as this may be critical to the success of WEM. Again, future studies may consider a census approach, where all 30 transmission customers in the country should be considered using a mixed method to provide a comprehensive analysis of the implementation of the WEM.

Conflict of Interest

The authors declare that there was no conflict of interest.

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