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THE ELECTRICITY RETAIL COMPETITION UNICORN

WHY WE NEED ALTERNATIVE ESI STRUCTURES

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INTRODUCTION

Whilst electricity sectors used to be characterised by vertically integrated, state-owned monopolies, this market structure of the ESI is becoming increasingly rare. During the past ten years most African countries have either implemented some restructuring of the electricity supply industry ("ESI") or considered it as part of its energy policy. However, while more than 30 countries have some form of reform in place, the progress and nature of these reforms have varied widely.[1] These differences stem from the divergent motivations for instituting reforms and differences in circumstances.

This begs the question why reform is needed. In the pre-reform period, the four vertically related operations of the electricity supply industry ("ESI") – namely generation, transmission, distribution and supply – were primarily integrated in a single geographic monopoly, which was often (but not always) state-owned and if not, heavily regulated.[2] The utility model was largely adopted due to the economies of scale experienced in generation, but as technological innovation has increasingly improved the efficiency of smaller generation facilities, it is has now become generally accepted that competition is possible in generation and retail (supply over distribution networks). Transmission, however, is still predominantly thought of as a natural monopoly whilst opinion on retail competition is mixed. Generally speaking, competition is viewed as desirable in at least the generation markets, as it promotes sector efficiency, improves the ability of the ESI to recognize and respond to dynamic customer requirements, technological and managerial innovation, and the continued viability of the supply chain.[3]

In developing countries, there are other, additional, reasons for reforming the ESI. First, many of these countries suffer from generation capacity shortages. Second, they have to introduce reforms because their utilities are not viable. Capacity shortages stem from growing demand and the state's lack of resources to invest in infrastructure to meet this demand. The utility's lack of viability arises from a lack of operational and economic efficiency and a soft budget constraint of the utility that results in disappointing performance and a poor credit rating.

In general, the purpose of reform is to manage costs, improve efficiency and lower prices. Thus, in predominantly developed countries, reform of the ESI from a vertically-integrated, state owned monopoly to an ESI that is competitive where possible and regulated where necessary, largely unbundled, and has scope for private sector involvement (e.g. funding, competition for the market etc.) largely stems from the need to preserve, advance and optimize the industry. In developing countries, the additional purpose of reform is to expand access to electricity and to attract infrastructure investment. Efficient and equitable pricing is needed in both developed and developing countries.

TRADITIONAL MODELS OF REFORM

Reforms of the ESI in the international community began in the early 1980s.[4] In these early days of reform, among countries that had fairly well-developed electricity supply networks, a particular trend of reform began to emerge. The common characteristics included the general sequence of successful reform and the aspects of the reform. The aspects, in their successful

[1] OECD, African Development Bank (2004) *African Economic Outlook 2004*. OECD Publishing, July 2004, p. 46
[2] Joskow, P. L. (2008) *Lessons Learned from Electricity Market Liberalization*. The Energy Journal, Special Issue. The Future of Electricity: Papers in Honor of David Newbery
[3] Bacon, R. W. and Besant-Jones, J. (2002) *Global electric power reform, privatization and liberalization of the electric power industry in developing countries.* The World Bank, Energy and Mining Sector Board Discussion Paper Series, Paper No. 2, p. 4
[4] Kessides, I. (2012) *Electricity Reforms, What Some Countries Did Right and Others Can Do Better.* World Bank and International Finance Corporation, Investment Climate Impact Project, October 2012, Note No. 332, p. 1

sequence, are (1) Corporatisation and commercialisation of state-owned electricity monopolies to harden budget constraints and prevent political manipulation;[5][6] (2) Introducing legislation to provide legal mandate restructuring of the industry and to establish regulatory rules; [7] (3) Establish an independent regulator to monitor, assess and approve prices for access to networks;[8] (4) Facilitate the entry of independent power producers (IPPs) to promote investment in electricity generation;[9][10] (5) Vertical and horizontal restructuring to decouple competitive activities from natural monopoly activities to introduce a competitive environment and integrate transmission and network operations;[11] (6) Divestment of generation and distribution infrastructure from the state to private entities;[12] (7) Facilitating entry into the wholesale and retail markets.[13]

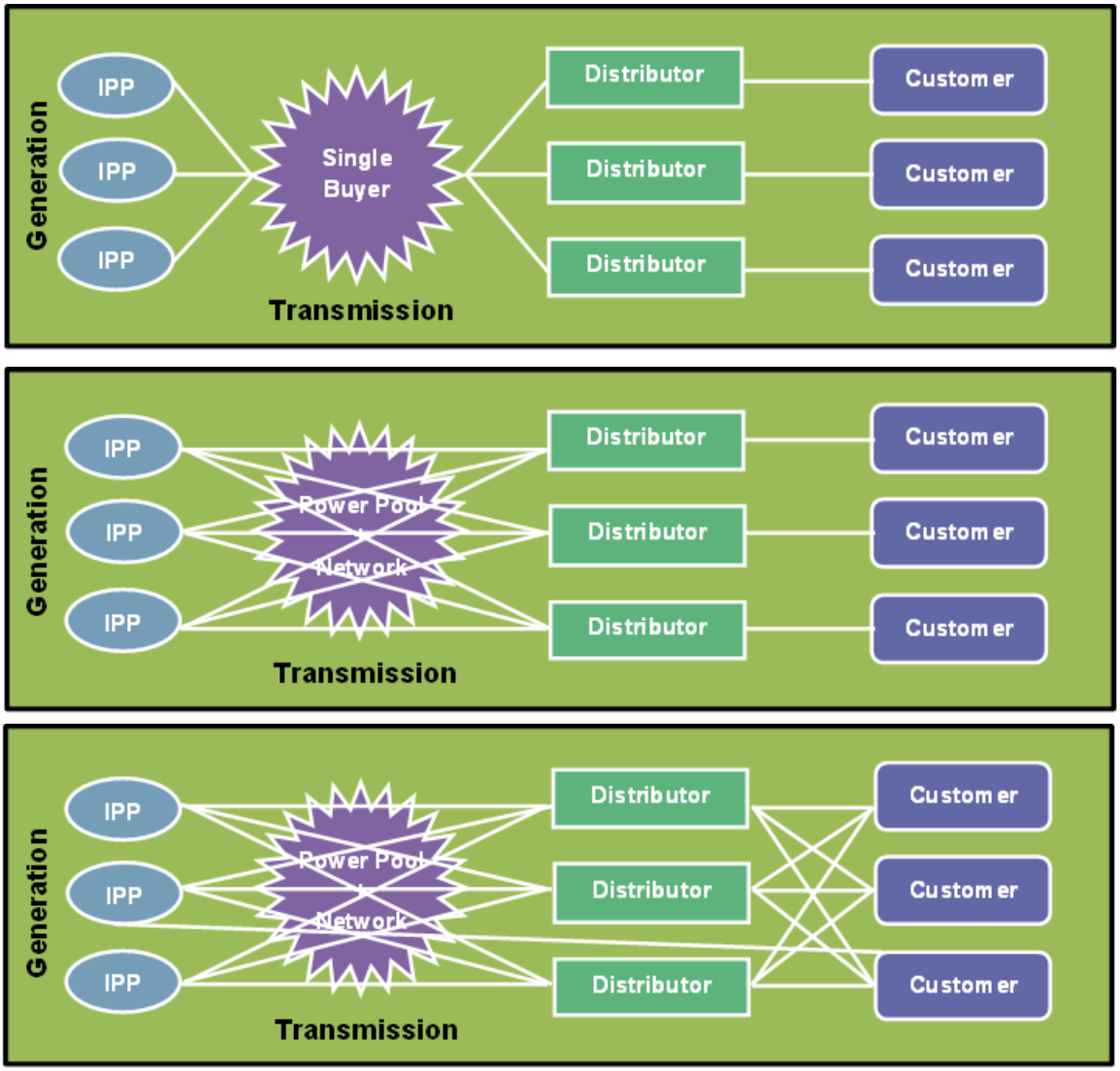
The ultimate outcome of the steps is typically the implementation of one of the following models of reform: (1) the single buyer model which represents the most basic level of reform and arguably acts as an interim phase for countries in the process of stimulating competition and moving towards one of the latter two models; (2) the wholesale competition model in which multiple distributors contract directly with power generators and compete for generated electricity; and (3) the retail competition model – the ideal competitive state, the unicorn – where, in addition to wholesale competition, distributors/retailers compete for end-customers.

All three models have some degree of competition in electricity generation and a monopolistic transmission company. In the single buyer model, the monopoly transmission company acts as a single buyer of generated electricity and the distributors purchase electricity from the single buyer to sell on to their customers. In the wholesale competition model, the transmission company is not the guaranteed off-taker.[14] Distribution companies contract directly with generators through a spot market and make long-term commitments to supply electricity in the forward market, whilst customers are locked to a particular distributor.[15] The retail competition model on the other hand allows customers to have access to all the competing generating companies, either through electricity retailers or directly.[16] Electricity generation and retail are deregulated, while transmission and distribution networks are subject to open access requirements or common carry regulations.[17]

The typical structure of each of these models is as follows:

[5] Joskow, P. L. (2008) *Lessons Learned From Electricity Market Liberalization*. The Energy Journal, Special Issue, The Future of Electricity: Papers in Honor of David Newbery, p. 12
[6] Kessides, I. (2012) *Electricity Reforms, What Some Countries Did Right and Others Can Do Better.* World Bank and International Finance Corporation, Investment Climate Impact Project, October 2012, Note No. 332, p. 2
[7] Kessides, I. (2012) *Electricity Reforms, What Some Countries Did Right and Others Can Do Better.* World Bank and International Finance Corporation, Investment Climate Impact Project, October 2012, Note No. 332, p. 2
[8] Ibid. 13
[9] Gratwick, K. N. and Eberhard, A. (2008) *Demise of the standard model for power sector reform and the emergence of hybrid power markets*. Energy Policy 36 (2008), 3948-3960, p. 3952
[10] Kessides, I. (2012) *Electricity Reforms, What Some Countries Did Right and Others Can Do Better.* World Bank and International Finance Corporation, Investment Climate Impact Project, October 2012, Note No. 332, p. 13
[11] Joskow, P. L. (2008) *Lessons Learned From Electricity Market Liberalization*. The Energy Journal, Special Issue, The Future of Electricity: Papers in Honor of David Newbery, p. 12
[12] Gratwick, K. N. and Eberhard, A. (2008) *Demise of the standard model for power sector reform and the emergence of hybrid power markets*. Energy Policy 36 (2008), 3948-3960, p. 3952
[13] Ibid.
[14] Kessides, I. N. (2004) *Reforming Infrastructure Privatization, Regulation and Competition*. The World Bank and Oxford University Press, Washington, D.C. and Oxford, p.150, available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2004/06/16/000012009_20040616143838/Rendered/PDF/289850PAPER0reforming0infrastructure.pdf [accessed on 18 February 2016]
[15] Ibid., p. 150
[16] Kessides, I. N. (2004) *Reforming Infrastructure Privatization, Regulation and Competition*. The World Bank and Oxford University Press, Washington, D.C. and Oxford, p.144, available at: http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/2004/06/16/000012009_20040616143838/Rendered/PDF/289850PAPER0reforming0infrastructure.pdf [accessed on 18 February 2016]
[17] Beato, P. and Fuente, C. (1999) *Retail Competition in Electricity*. Inter-American Development Bank, p. 6

Figure 1: The Single-buyer Model, The Wholesale Competition Model and The Retail Competition Model



Source: Genesis Analytics, Lovei, L. (2000)[18]

THE THING ABOUT UNICORNS…

The retail competition model has not been so liberally applied so as to be ubiquitous. There are very few cases of this model being actually being implemented, let alone implemented successfully. Retail competition has been implemented in Finland, Norway, Spain, Sweden, the United Kingdom ("UK") and in some parts of the United States ("US").[19]

In the UK, Ofgem's supply probe of the electricity sector revealed that retail competition has had (?) limited benefits for customers. [20] The same is true for Finland and Spain, where a lack

[18] Lovei, L. (2000) *The Single-Buyer Model, A Dangerous Path Toward Competitive Electricity Markets*. The World Bank Group, Private Sector and Infrastructure Network, Note. No. 225
[19] International Energy Agency (2013) *Competition in Electricity Markets*. Organisation of Economic Cooperation and Development. Available at: http://regulationbodyofknowledge.org/wp-content/uploads/2013/03/OECDIEA_Competition_in_Electricity.pdf [Last accessed on 25 February 2015]
[20] Finon, D. and Boroumand, R. (2011) *Electricity retail competition: From survival strategies to oligopolistic behaviors*. International Conference and Exhibition on Electricity Distribution, working paper submitted to Energy Policy. Available at: http://www2.centre-cired.fr/IMG/pdf/Finon_Boroumand_electricity_retailer_market_power_English_.pdf [Last accessed on 25 February 2016]

of customer switching activity is stifling competition.[21] In Sweden and Norway, where switching rates are comparatively high, competition in the retail market is not performing as well as can be expected.[22] This can be attributed to sporadic switching, the high cost of switching, the lack of appeal of new entrants to customers, and a low tolerance for innovation.[23] Switching rates in the US are fairly low, except for Texas.[24] In order to achieve a high propensity to switch, Texas introduced a price control that specifically favoured new entrants – established suppliers had to offer a standard rate set by the Public Utility Commission, the so-called "Price to Beat", whereas new entrants were allowed to price below the set rate.[25]

The thing about unicorns is that they are imaginary creatures. In the countries that have implemented a retail competition model, the markets are not exactly textbook retail competition models; have results that are either contrary to expectations or that have been achieved only through the implementation of additional measures. A 'natural' retail competition market structure is extremely rare.

SHORTCOMINGS OF THE TRADITIONAL MODEL IN DEVELOPING COUNTRIES

The traditional steps of reform outlined above became the standard which was used not only as a framework to understand the regulatory reform process but also importantly in a more prescriptive manner as a means for promoting reform in countries yet to undertake such restructuring.[26] In particular, the correct sequencing of steps in terms of commercialisation, corporatization and unbundling were seen as prerequisites to the introduction of competition via wholesale or retail models, [27] with the retail model seen as the 'gold standard' in terms of reaping the benefits from competition.

However, as we will discuss in detail below, these models of competition have a number of shortcomings when it comes to its application in developing countries: first, models of wholesale and retail competition are extremely difficult and complex to implement and second, the circumstances and constraints faced by developing countries are fundamentally different to those developed countries on which such models were based. We discuss each of these in turn below.

The complexity of the retail and wholesale models of competition

International experience shows that both the models of retail and wholesale competition are complex to implement even in the case of developed countries.

[21] Annala, S. (2008) *Functioning of competition in the Finnish retail electricity market*.5th International Conference on European Electricity Market, 2008 (EEM 2008), 28-30 May 2008, Lisboa, IEEE
[22] Defeuilley, C. (2008) *Retail competition in electricity markets*. GIS Larsen, working paper no. 5. Available at: http://www.gis-larsen.org/pdf/LARSEN_WP_5_VE.pdf [Last accessed on 26 February 2016]
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] Gratwick, K.N., and Eberhard, A., (2008), Demise of the standard mode for power sector reform and the emergence of hybrid power markets, Energy Policy, p. 3953.
[27] Gratwick, K.N., and Eberhard, A., (2008), Demise of the standard mode for power sector reform and the emergence of hybrid power markets, Energy Policy, p. 3953

Difficulties with the wholesale model. The implementation of a wholesale model is complex and requires certain minimum criteria are met to ensure successful implementation of such a model:[28]

- first, there must be sufficient independent generators to create a competitive market and encourage further entry;
- second, a fully functioning spot market/power exchange and forward market for electricity must be implemented to allow risks to be adequately managed and lower the incentive for spot price manipulation;
- third, there needs to be adequate, secure capacity to meet peak demand with sufficient reserves. Otherwise the market is likely to be susceptible to unplanned outages, surges in demand, strategic bidding and capacity withholding;
- fourth, a transmission network with sufficient capacity to which all suppliers have access to allow competition in the adjacent markets (via unbundling of transmission from generation);
- fifth, both long-term and spot and markets require significant customer numbers with the former helping to facilitate finance of new generation capacity and the latter providing sufficient countervailing buyer-power;
- finally, a credible regulatory body and framework to deal with any potential shortcomings of the market mechanisms put in place.

These requirements are significant. However, even with such pre-requisites in place, the wholesale model can still result in significant difficulties. Due to the competitive nature of the wholesale market, generators are not guaranteed off-takers, resulting in investor uncertainty. This, in turn results in stifled investment in generation capacity.[29] In addition, markets focused solely on the cheapest form of electricity generation, such as hydro power, are unlikely to provide incentives for sufficient diversification of power generation that is likely to be important in the long-run (such as in the eventuality of a drought).

Electricity cannot be viably stored in large volumes, so supply must meet demand instantaneously. Electricity demand is also highly price inelastic in the short term, resulting in minimal volume adjustments. Thus, shortening contract lengths can also lead to volatile prices as these fundamentals of electricity generation are by their nature subject to significant volatility in the short term.[30] What is more, prices also tend to be sticky and not fully correct themselves or not correct themselves at a fast enough pace. Finally, the wholesale model is relatively costly to implement compared to the single-buyer model and the entire operation can fall apart if not fully implemented.

The difficulties experienced are evident in the experience of Canada which attempted to introduce wholesale competition into its market in 2002. This introduction, however, coincided with the an unusually hot summer, which, in the context of a reliance on hydropower, resulted

[28] Kessides, I.N., "Reforming Infrastructure: Privatisation, Regulation and Competition, World Bank Policy Research report, Working paper no. 289852004, page 150-15 1 and Newbery, D (2002), Mitigating market power in electricity networks, p. 1-2, available: http://www.hks.harvard.edu/hepg/Papers/Newbery_mitigating.market.power_5-02.pdf.
[29] Newberry, D. (2002), *Mitigating market power in electricity networks*, p. 2, available at: http://www.hks.harvard.edu/hepg/Papers/Newbery_mitigating.market.power_5-02.pdf [Last accessed on 18 February 2016]
[30] Newbery, D (2002), Mitigating market power in electricity networks, p. 7, available: http://www.hks.harvard.edu/hepg/Papers/Newbery_mitigating.market.power_5-02.pdf.

in not only a peak in demand for electricity but also a severe shortage in capacity due to a lack of rain . As a result prices increased sharply and a mere six months after its introduction, the wholesale market was closed and a price freeze put in place. Ultimately, the Government decided to revert to the single-buyer model they had used before the implementation of wholesale competition.[31]

Difficulties with the retail competition model. Whilst the retail model introduces the greatest degree of competition into ESI it is also the most complex and costly of the three models under consideration.[32] That is, not only do all of the aforementioned conditions of the wholesale model apply but in addition, the prices for distribution network access and the competitive retail structure and trading conditions must be determined. When such conditions are not clearly and accurately specified, there are likely to be significant consequences.

This is demonstrated by the alarming experience in California where such reforms were attempted but ultimately resulted in huge spikes in wholesale spot prices such that state funds had to be used to bail out some of California's largest distribution companies.[33] The situation was driven by a number of factors that have been well-documented.[34] The most important of these included insufficient generation capacity, putting upward pressure on prices, the low uptake of competitive electricity services by end-customers coupled with difficulties in passing on high wholesale prices to consumers due to retail tariff regulation. As argued by Kessides (2004), this crisis demonstrated the significant market power that can be exercised by generators when supply is limited[35] and further:

"California's experience has shown that market liberalization under conditions of tight demand can lead to serious problems: market clearing prices would be politically unacceptable and would likely derail attempts at radical liberalization."[36]

The Californian experience draws some parallels with countries in Sub-Saharan Africa which are largely characterised by capacity shortage and hence excess demand with the expectation of rapid demand growth for electricity. This begs the obvious question – given the characteristics of developing markets is reform in the form of either wholesale or retail competitive markets the optimal policy? As discussed below, the different context and constraints of developing countries suggests that the narrow application of the standard retail and even wholesale models of competition may not be appropriate.

Differing objectives, circumstances and constraints

The different circumstances and constraints associated with developing countries when compared to developed countries provides food for thought regarding whether such models are appropriate:

[31] Castalia Strategic Advisors (2013), pg. 22-23. and Electricity Distributors Association (2006), Ontario electricity market primer, p. 21-23.
[32] For example it has been reported that California's spot market for electricity cost $250 million. Kessides, I.N., "Reforming Infrastructure: Privatisation, Regulation and Competition, World Bank Policy Research report, Working paper no. 289852004, p. 153.
[33] Price Waterhouse Coopers (2013), Introducing competition in retail electricity supply in India, Forum of regulators pg. 20.
[34] See for example Wolak, F.A. and R. Nordhaus, (2000) 'An analysis of the June 2000 Price Spikes in the California ISO's Energy and Ancillary Services Market', California ISO Market Surveillance Committee, Sep. 6 and Joskow, P., and Kahn, E. (2002) 'A quantitative analysis of pricing behavior in California's wholesale electricity market during summer 2000: The final word', Cambridge CMI Electricity Project Working Paper 2.
[35] Kessides, I.N., "Reforming Infrastructure: Privatisation, Regulation and Competition, World Bank Policy Research report, Working paper no. 289852004, p. 164.
[36] Kessides, I.N., "Reforming Infrastructure: Privatisation, Regulation and Competition, World Bank Policy Research report, Working paper no. 289852004, p. 9.

- First, the developed countries in which reforms have been successful are characterised by electricity markets with excess generation capacity, almost universal access and restrained demand growth (due to slow and steady GDP growth). They also tend to have access to natural gas which allows for the entry of low cost, modest scale electricity generation.[37] This, as we have already mentioned, is not the case in electricity markets in many developing countries. In particular, access to electricity is far from ubiquitous with the IEA estimating that only 32% of the population in sub-Saharan Africa had access to electricity in 2014 and noting a significant shortage of generation capacity, with sub-Saharan Africa's grid-based power generation capacity at only approximately 90GW, 50% of which is in South Africa.[38] In such circumstances, the introduction of competition is likely to result in what Kessides (2004) terms 'politically unacceptable clearing prices.'

- Second, the motives for reform in Sub-Saharan Africa differ markedly in important respects to those countries that initially instituted reforms. In the traditional model, reform is promoted on the basis that increased competition will promote efficiency which should ultimately drive lower prices. However, electricity reform in developing countries often arises out of difficult circumstances including poor financial and technical performance, insufficient investment in and expansion of generation, distribution and transmission services and electricity tariffs to consumers that are, in fact, often priced below sustainable levels.[39] As a result some countries have, for example, in order to address an electricity supply crisis needed to introduce IPPs before regulators had been put in place or even before commercialisation of the state-owned utility.[40] Furthermore, the state cannot always afford to invest and maintain the utility and if finances are particularly tight, the state has an additional incentive to sell the utility in order to raise finance for other priorities.[41] These differences in the motivations for reform also bring into question the appropriateness of the traditional ESI models of competition.

- Third, to implement wholesale or retail competition it has also been noted that sophisticated legal and financial systems are required. In developing countries it may not always be the case that such frameworks are adequately advanced. In particular, it has been noted that private sector participation may only be possible in specific legal contexts.[42]

The above differences have sparked considerable debate as to whether in certain circumstances developing markets are in fact more suited to monopolistic provision or alternatively whether competition should be limited to competition *for* the market rather than *in* the market.[43] What is clear is that the standard model of reform was not the panacea it was thought to be and as noted by Gratwick et al. (2005):

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[37] *Kessides, I.N., "Reforming Infrastructure: Privatisation, Regulation and Competition, World Bank Policy Research report, Working paper no. 289852004, p.9.*

[38] IEA, (2014) Africa Energy Outlook: A focus on energy prospects in Sub-Saharan Africa, World Energy Outlook Special Report, p. 13.

[39] [39] Gratwick, K.N., and Eberhard, A., (2008), Demise of the standard mode for power sector reform and the emergence of hybrid power markets, Energy Policy, p. 3950, 3957.

[40] Gratwick, K.N., and Eberhard, A., (2008), Demise of the standard mode for power sector reform and the emergence of hybrid power markets, Energy Policy, p. 3957.

[41] Besant-Jones, J. E. (2006) *Reforming Power Markets in Developing Countries: What Have We Learned?* The World Bank, Energy and Mining Sector Board Discussion Paper, No. 19, September 2006, p. 12. Available at: http://siteresources.worldbank.org/INTENERGY/Resources/Energy19.pdf [Last accessed on 19 February 2016]

[42] Gratwick, K.N., and Eberhard, A., (2008), Demise of the standard mode for power sector reform and the emergence of hybrid power markets, Energy Policy, p. 3953.

[43] Ibid.

"…it is arguable that almost half of the steps were not necessarily relevant to the conditions on the ground in most developing countries on which it (the standard) was brought to bear."[44]

EMERGENCE OF ALTERNATIVE MODELS: KENYA, BRAZIL AND CHINA

We chose the following examples of alternative reforms each for their different reasons. Kenya was chosen because it demonstrated a great example of a hybrid model, retaining state-owned generation while unbundling generation from distribution and transmission, and a reformed state-owned enterprise with private sector participation in generation. Brazil has the most advanced regulation of these examples and it was chosen because it faces challenges that are very similar to Sub-Saharan Africa's. China has a completely different model of partial privatisation that is interesting because its approach to partially privatised predominantly state-owned regional energy companies allows for private sector participation that does not follow the mould of a state-owned wires business with IPPs in generation, but rather an emphasis on the efficiencies private sector participation can bring to previously wholly state-owned companies competing at the same level in the ESI.

Kenya

Access to electricity in Kenya has been disappointing in its recent past. Low access to electricity infrastructure and other issues, such as unreliable and inadequate supply and high prices, are viewed as ultimately stemming from a shortage of installed power generation capacity.[45]

Competition in the electricity generation sector was introduced in 1996 in an attempt to address the adverse consequences of a severe generation capacity shortfall.[46] Furthermore, as electricity generation at that stage consisted primarily of hydropower – which had already reached its carrying capacity in Kenya and was vulnerable to drought – a need arose to introduce alternative sources of electricity.[47] So, in 1997, the first wave of IPPs was introduced into the market in order to supplement hydropower.[48] In light of the introduction of competition in the generation sector, the state-owned utility was unbundled and an independent regulator, the Electricity Regulatory Board ("ERB") was introduced.[49]

Kenya's Economic Strategy of 2003 noted that the electricity supply in Kenya was too expensive and unreliable and that a private-public partnership could solve this. As a result, the Kenya Generating Company ("KenGen"), which owns the state's generating assets, was later partially privatised in 2006 with 30% of the company's equity being offered on the Nairobi Stock Exchange.[50] The Kenyan government owned a 51% stake in the Kenya Power and Lighting Company Limited ("KPLC"), the transmission and distribution arm of the electricity sector, with the rest floated in the stock exchange.

[44] Gratwick, K.N., and Eberhard, A., (2008), Demise of the standard mode for power sector reform and the emergence of hybrid power markets, Energy Policy, p. 3953.
[45] Kapika, J and Eberhard, A, (2013), *Power-Sector Reform and Regulation in Africa*, HRSC Press, p. 1 – 3
[46] Eberhard, A. and Kapika, J. (2005), *The Kenyan IPP Experience*. Journal of Energy in Southern Africa, 16(4), 4-17, p. 5
[47] Ibid.
[48] Kapika, J and Eberhard, A, (2013), *Power-Sector Reform and Regulation in Africa*, HRSC Press, p. 21
[49] Eberhard, A. and Kapika, J. (2005), *The Kenyan IPP Experience*. Journal of Energy in Southern Africa, 16(4), 4-17, p. 5-6
[50] Kapika, J and Eberhard, A, (2013), *Power-Sector Reform and Regulation in Africa*, HRSC Press, p. 26

In 2008, KPLC's function for the planning, design and construction, ownership, operation and maintenance of new infrastructure in transmission and distribution was redirected to the Kenya Electricity Transmission Company ("KETRACO"), a fully state-owned entity.[51] This represents an interesting departure from the norms of privatisation advocated by traditional models of reform and even the partial privatisation model adopted by the Kenyan government. In this regard, KETRACO has been developed as state-owned entity in order to facilitate raising public and donor funding which would not be viable under a partially privatized structure.[52]

While many of the aspects of traditional reform were implemented in Kenya – namely, promoting entry, implementing regulatory oversight, and unbundling – the government stopped short of implementing all the steps of the traditional method of reform or either of the wholesale and retail models of competition fully. Indeed, Kenya has largely focused on implementing a variation of the single buyer model which includes the presence of state-owned companies in each of the parts of the ESI. Of particular interest in Kenya is that it has not only partially-privatised the former state-owned utility but that it has more recently introduced a fully state-owned entity for new transmission and distribution projects.

However, in spite of these divergences, reform of the Kenyan energy sector has achieved many successes, for example the introduction of significant present and forthcoming competition in generation. Installed generation capacity has increased from 0.8 million Kilowatts in 1996 to 1.9 million Kilowatts in 2012.[53] However, access to electricity has grown very slowly, albeit from a low base, with 23% of the population having access in 2012.[54] This perhaps indicates why the government has turned to public and donor funding for new transmission and distribution projects.

Brazil

Brazil's electricity reform appeared largely to be driven by an ever-growing awareness of the limitations, particularly financial limitations, of the state's sole involvement in the electricity industry.[55] The need for infrastructure investment and the government's precarious position for providing sustained financial support, illustrated the need for private sector involvement in the industry. Furthermore, and similar to Kenya's case, as a country reliant on hydro-electric power, the economy was exposed to the risk of electricity shortages during periods of drought.[56] Thus, there was a need to diversify the country's energy mix.

Brazil's initial reforms, referred to as the 'first wave of reform', followed the traditional model quite closely and culminated with the introduction of the wholesale competition model, which is characterised by a short-term spot market.[57] The presence of a spot market is supposed to minimise risk and encourage investment, but Brazil's energy system was overly reliant on

[51] CUTS International. *State of Electricity Reforms in Kenya*. Country Base Paper, CUTS International. Available at: http://www.cuts-international.org/ARC/Nairobi/REKETA/pdf/Country_Base_Paper-State_of_Electricity_Reforms_in_Kenya.pdf [Last accessed on 22 February 2016]
[52] Kapika, J and Eberhard, A, (2013), *Power-Sector Reform and Regulation in Africa*, HRSC Press, p. 26
[53] Energy Information Administration (2012) *Total Electricity Installed Capacity Kenya Annual.* Available at: https://www.eia.gov/opendata/qb.cfm?category=1816388&sdid=INTL.2-7-KEN-MK.A [Last accessed on 22 February 2016]
[54] World Bank Data, 2015, World Development Indicator (Access to electricity as a % of the population), available: http://data.worldbank.org/indicator/EG.ELC.ACCS.ZS/countries/KE?display=graph [Last accessed on 22 February 2016]
[55] Rosenzweig, M. B., Pabon-Agudelo, C, and Voll, S. P. (2001) *Power Sector Reform in Brazil: Challenges to Private Investment*. Project Finance International, 222, August 2001, Available at: http://www.nera.com/content/dam/nera/publications/archive1/3657.pdf [Last accessed on 21 February 2016]
[56] Karmacharya, S. B. (2008), *The evolution of Brazil's electricity market from textbook to regulated long term contracts*. Network Industries Quarterly, 10(2), 9-11
[57] Karmacharya, S. B. (2008), *The evolution of Brazil's electricity market from textbook to regulated long term contracts*. Network Industries Quarterly, 10(2), 9-11

hydroelectric power (largely because it was much cheaper than forms of generation, and therefore it was difficult to stimulate investment in other generation methods). This meant that the spot market price of energy was highly dependent on the cost of water, which is directly affected by its scarcity.[58] When water was abundant (which was usually the case), prices were very low; but during times of drought, the price would soar.[59] Price fluctuations, such as these, create uncertainty in a spot market. In this particular case, the spot price was subject to the vagaries of meteorology. Thus, contrary to the objective of reform to divert investment from public sources to private sources, there was no boom in investment in new diversified generation infrastructure. Then, in 2001, following a severe drought 1999 to 2001, the country was plunged into an energy crisis.[60]

The second phase of reform began in 2004.[61] In this phase, the government pursued a more centralised model with a larger role for government. This included the creation of new public institutions for coordinating and planning the expansion of the electricity system. However, the main change to the system was introducing long-term contracts between generators and distributors in a regulated auction setting and allowing generators to freely contract with consumers and other generators to sell generated electricity, along with introducing a monitoring mechanism to maintain the smooth progress of the system.[62] Thus, electricity companies would now compete for parts of the market (competition for the market) as opposed to competing in the market.

Brazil's step back from operational competition after pursuing the traditional wholesale competition model has important lessons for countries moving from away from the over-reliance on a single cheap method of generating electricity. If the cost of new generation – from sources other than the dominant cheap source – is higher than that of the installed capacity, then implementing a free market for electricity generation is difficult. Thus, while it is not necessary to rule out the use of the traditional wholesale competition model, the case of Brazil indicates that it is important to tailor the model to local conditions. However, there is still a major drawback of using this model in that the administrative burden of implementing and monitoring the model is high and requires expertise in regulating the various markets.

China

As with most developing country examples, the push for electricity sector reform in China can be traced back to supply constraints.[63] In response, the Chinese government in 1989 introduced competition and private investment into the electricity generation market and IPPs

[58] de Oliveira, A., Woodhouse, E. J., Losekann, L. and Araujo, F. V. S. (2005) *The IPP Experience in the Brazilian Electricity Market*. Program on Energy and Sustainable Development, Center for Environmental Science and Policy, Stanford University. Available at: https://pesd.fsi.stanford.edu/sites/default/files/Brazil_IPP.pdf [Last accessed on 21 February 2016]
[59] Karmacharya, S. B. (2008), *The evolution of Brazil's electricity market from textbook to regulated long term contracts*. Network Industries Quarterly, 10(2), 9-11
[60] de Oliveira, A., Woodhouse, E. J., Losekann, L. and Araujo, F. V. S. (2005) *The IPP Experience in the Brazilian Electricity Market*. Program on Energy and Sustainable Development, Center for Environmental Science and Policy, Stanford University.p. 22. Available at: https://pesd.fsi.stanford.edu/sites/default/files/Brazil_IPP.pdf [Last accessed on 21 February 2016]
[61] Karmacharya, S. B. (2008), *The evolution of Brazil's electricity market from textbook to regulated long term contracts*. Network Industries Quarterly, 10(2), 9-11
[62] Melo, E., Neves, E. M. A. and da Costa, A. M. A. (2009) *The new governance structure of the Brazilian electricity industry: how is it possible to introduce market mechanisms?* 32nd IAEE International Conference: "Energy, economy, environment: the global view", 21–24 June 2009, San Francisco, USA p. 9. Available at: http://www.usaee.org/usaee2009/submissions/OnlineProceedings/papermeloelbia.pdf [Last accessed on 21 February 2016]
[63] Williams, J.H. and Kahrl, F. *Electricity reform and sustainable development in China,* 22 December 2008, p. 2 Available from http://iopscience.iop.org/article/10.1088/1748-9326/3/4/044009/pdf [Last accessed on 21 February 2016]

were allowed to sell their generated electricity to the grid for a competitive price.[64] Importantly, the national utility was still vertically integrated and operated in generation during this period.

In 1997, the state-owned electricity assets were transferred to a corporatized entity, the State Power Corporation ("SPC") in order to manage the electricity industry along market economy lines.[65,66] The SPC was unbundled in 2002 into five electricity generating companies, one transmission company and one distribution company, which were still to be state-owned.[67] The purpose of unbundling was to further breakdown existing monopolies by clearly separating the roles of state and business.[68]

China deviated significantly from the traditional model given that (1) state-ownership has persisted in all the markets of the industry; (2) the sequence of reform began with the introduction of competition in the generation market; and (3) independent regulatory oversight and unbundling was introduced much later in the reform process. The model implemented is similar to Kenya's in that it is a modified single-buyer model.

These reforms, although still on-going, appear to have been largely successful in terms encouraging investment in electricity generation with installed capacity having grown from 100GW in 1989 to 900GW in 2011.[69] However, critics of China's method of reform have noted a number of issues in the regulatory system, such as weak enforcement, inconsistency with energy regulation,[70] and a lack of independence from political authority.[71] Whilst clearly not perfect, China's case demonstrates that it is possible to achieve the objective of expanding installed capacity.

CONCLUSION

In this paper we have sought to assess the viable alternative approaches used by three developing countries to restructure their electricity supply industries without resorting to drastic structural unbundling or privatisation while still achieving their respective objectives. Before doing so, we first described what drastic structural unbundling and privatisation would look like, the lack of applicability of the champion model of this drastic method and the shortcomings of all the models that arise from this method.

We found that full retail competition is as commonplace as the mythical unicorn and demonstrate the lack of success of this model in practice that belies its status of highly-sought after and ideal ESI end-state.

Then we looked at the models of reform employed by Kenya, Brazil and China and their resulting (work-in-progress) structures. We found that although these countries have had

[64] Ibid.
[65] Nan, Y. and Moseley, M. *World Bank PPP Insights: The expansion of China's generation capacity*. July 2011. Available from http://ppp.worldbank.org/public-private-partnership/PPPInsights/China_Energy_v1n1.pdf [Last accessed on 21 February 2016]
[66] Wong, J. and Kong, W. C. (1999) *China's Power Sector*. Volume 12 of East Asian Institute Contemporary China Series, World Scientific, Singapore, p. 16, footnote 33
[67] Williams, J.H. and Kahrl, F. *Electricity reform and sustainable development in China,* 22 December 2008, p. 3 Available from http://iopscience.iop.org/article/10.1088/1748-9326/3/4/044009/pdf [Last accessed on 21 February 2016]
[68] Ibid. p. 2
[69] Nan, Y. and Moseley, M. *World Bank PPP Insights: The expansion of China's generation capacity*. July 2011. Available from http://ppp.worldbank.org/public-private-partnership/PPPInsights/China_Energy_v1n1.pdf [Last accessed on 21 February 2016]
[70] Qiu, X. and Li, H. (2012) *Energy Regulation and Legislation in China*, Environmental Law Reporter, (42): 678 – 693, p. 4
[71] Williams, J.H. and Kahrl, F. *Electricity reform and sustainable development in China,* 22 December 2008, p. 10 Available from http://iopscience.iop.org/article/10.1088/1748-9326/3/4/044009/pdf [Last accessed on 21 February 2016]

issues in implementing their reforms and the resulting structures are by no means perfect, they have been able to achieve their objective of engaging in reform: expanding installed capacity in Kenya and China, and diversification of the energy mix in Brazil.

Thus, we have found that both the motivation for reform and the country-specific industry characteristics matter in the development of a successful ESI reform programme.