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*Caught Between Theory and Practice:
Government, Market and Regulatory
Failures in Electricity Sector Reforms*

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JEL Classification L52, L94, P00

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Caught Between Theory and Practice: Government, Market, and Regulatory Failure in Electricity Sector Reforms

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Abstract

The world-wide electricity sector reforms of the early 1990s have revealed the complexities of introducing market driven reforms and making them work in network and infrastructure industries. This paper reflects on the experience to date with the process and outcomes of market-based electricity reforms in less-developed, transition and developed economies. Evidence suggests similar problems facing the electricity sector of these countries though the contexts vary significantly. Many developing and developed economies continue to have investment inadequacy concerns and the need to balance economic efficiency, sustainability and social equity after more than two decades of experience with reforms. We also use case studies of three selected countries that in many respects represent the current state of the reform though they are rarely examined. Nepal, Belarus and Ireland are chosen as country-specific case studies for this purpose. We conclude that the changing dynamics of the electricity supply industry (ESI) and policy objectives imply that reforms evolve continuously and thus remain work in progress making their success or failure a complex function of micro, macro, and institutional factors.

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1. Introduction

A combination of political, economic and technological factors enabled a remarkable world-wide experiment of introducing market-based reforms and restructuring of the electricity sector starting the early 1980s (Pollitt, 2012). The importance of the electricity industry in social welfare and economic development implies that the outcomes of reforms in the sector are crucial. The centralized natural monopoly characteristics of the power systems also conceptually make them a public utility (Victor and Heller, 2007). Hence, the lessons of experience from reforms in the power sector matter and can serve as important economic and political tests for governments undertaking the reforms.

Ample amounts of financial resources and effort have been spent in electricity sector reforms across the reforming countries. However, the reform process demonstrates no clear theoretical and empirical consensus regarding the economic gains of reforms apart from improvements in technical and operational efficiency in the sector across many of the reforming countries. Reforms seem to have improved productive and operational efficiency in many developed and transition countries although allocative efficiency has deteriorated in the early reform process¹ (Jamash et al., 2005a). However, it is not clear whether the gain in productive efficiency resulted from technological improvements or from the adoption of reforms. In many developing countries, reforms seem to be largely ineffective in inducing efficiency improvements with minimal or no effect on poverty and income inequality.

The application and success of market-driven reform model in power sectors of less-developed countries seems to have been unsuccessful after more than two decades of reforms (Besant-Jones, 2006; Kessides, 2012). In transition economies, the reforms have been erratic, heterogeneous and marked by political reluctance resulting in slow

¹ The transition countries include 29 countries of Central Eastern Europe and Baltic States (CEB), South Eastern Europe (SEE), and Commonwealth of Independent States (CIS) based on European Bank of Reconstruction and Development (EBRD) classification.

implementation of reforms (Williams and Ghanadan, 2006). Similarly, there is a wide variation in the progress with the implementation of the model even in the EU while compliance with the directives does not necessarily imply a thorough-going electricity reform (Newbery, 2002; Pollitt, 2009a)². In the US, reforms have mainly not performed well even though major progress has been made in removing the costly price and entry regulation affecting almost every energy sector directly or indirectly over the last nearly four decades (Joskow, 2009).

Most notably, the UK, one of the pioneers of market-based reforms, has proposed a new electricity market reform signalling the desire for significant government intervention in order to meet the climate change objectives (DECC, 2011). As such, the UK reform experience has revealed the considerable complexities and difficulties in making market driven reforms work when the global trend towards electricity reforms is driven by orthodox ideologies and theoretical arguments in favour of market-oriented reforms since nearly two decades. The resulting regulatory failures in terms of investment inadequacy has been a concern in the liberalisation process in developed economies such as the UK even though the incentive regulation of the monopoly electricity networks has resulted in significant efficiency improvements (Helm, 2009). Likewise, the regulation of the electricity sector in developing and transition countries remain a major challenge in the transition to accelerating competition in the electricity sector as regulation suffers from weak institutional environment (Laffont, 2005).

However, market driven reforms are still on-going in many countries while the reform process in the electricity sector is regarded as not only possible, but also inevitable (Erdogdu, 2013). It is, therefore, necessary and timely to revisit the experience of the process and impacts of market-driven reform trend and draw lessons learnt in the aftermath of this remarkable experiment. In general, successful electricity reforms should enhance the efficiency of the sector, improve electricity access and reliability, improve service quality, reduce the price-cost gap through cost-reflective pricing and

² For example, Germany began the electricity market liberalisation process in 1998 without having an independent regulator in place. The energy regulator Bundesnetzagentur (BNETZA) was only created in 2005.

increase investments considering more than two decades' of reform in reforming economies (Sen and Jamasb, 2012). Hence, this paper reflects on the process and outcomes of liberal electricity reforms and examine whether evidence supports and verifies the motives of market-driven power sector reforms in less developed, transition and developed countries based on country specific case-studies.

The remainder of the paper is structured as follows. Section two provides a brief overview of the market-based reform model. Section three discusses the drivers of reforms in developing, transition and developed countries while the contexts of reforms are discussed in Section four. The country-specific case studies analysis on the reform process, progress and outcomes are presented in Section five. Section six details the lessons and policy implications of reforms in developing, transition and developed countries based on the case-studies. Section seven concludes the paper with suggestions for further research.

2. Overview of the reform model

The early 1980s gave rise to the 'standard textbook model' for organizing and restructuring the electricity sectors across many countries around the world. The model was based on market-oriented liberal policies and typically constituted of three fundamental components (Joskow, 2008). The first element involved the vertical separation or unbundling of the potentially competitive segments (wholesale generation and retail supply) from the natural monopoly segments (transmission and distribution networks). The model assumed that not all activities of the electricity supply industry are inherently monopolistic and electricity could also be generated and supplied by competitive firms in organised markets and not by the state. It was believed that vertical separation of these distinct activities would guard against cross-subsidization between competitive businesses and regulated businesses and discriminatory practices such as denial of access to networks (Joskow, 2006).

The second component of the model underscored the need and role of private ownership of the competitive segments of the ESI on the notion that private entities could better

allocate the scarce capital resources and ensure efficient management of the system. It was perceived that privatisation of state-owned electricity monopolies would create hard budget constraints and high-powered incentives for efficiency improvements and make it more difficult for the state to use these industries in order to meet costly political agendas such as patronage employment, unfavourable macroeconomic and redistributive policies and national revenue diversion to government budgets outside of the tax system (Joskow, 2006). However, private ownership of the sector in countries such as Japan, Germany and the US had occurred before 1980s and has been pervasive throughout the post-World War II period. Similarly, the success of the electricity reform in Norway with large local and regional ownership exhibits that privatisation is not an indispensable aspect of successful electricity reform.

The third component of the standard model stressed on the need to create powerful and effective new institutions in the form of independent regulators and regulatory agencies. An independent regulator would act as the custodian of public interests (Armstrong et al., 1994). It was expected that an independent regulatory authority with adequate staff, powers, duties and information about the costs, service quality and performance of the ESI will ensure a proper conduct in the industry by effectively implementing the incentive regulation of the monopoly segments in terms of the market entry, network charges and network access. Hence, it was assumed that incentive regulation of the monopoly electricity networks would mimic the outcomes of a competitive market (Littlechild, 1992). As such, the US already had independent state and federal energy sector regulators and private ownership since the early 20th century and some wholesale electricity markets prior to 1980s (Pollitt, 2011).

Chile was the first developing country to apply the 'standard textbook model' in 1982. The Chilean reform sequence involved the following steps: i) establishment of the electricity market regulator at the start, ii) corporatization of state-owned enterprise, iii) law for electricity sector liberalization, iv) unbundling (or vertical separation) of the main segments, v) incentive regulation of electricity networks, vii) establishment of a wholesale electricity market, viii) introduction of privatization and ix) introduction of private independent power producers (IPPs). The Chilean reform model was soon

followed by the UK (1990) and Norway (1991). The success of the model in these countries under stable political and economic conditions demonstrated the potential of introducing market-based reforms and incentive regulation to other countries around the world signalling the advent of modern electricity reforms. Figure 1 shows the market-oriented electricity reform steps in Argentina inspired by the popular reform model of Chile³. The notable difference between the sequencing of reforms in Argentina and Chile is the introduction of IPPs before privatization in the Argentine electricity market.

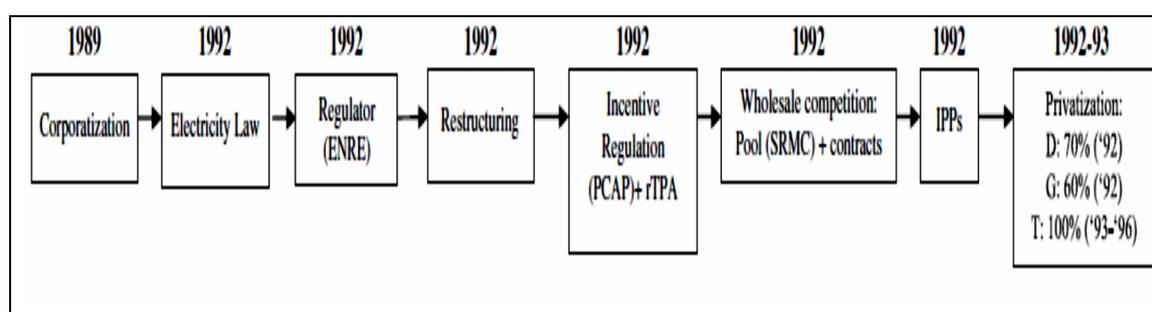


Figure 1: Electricity reform steps in Argentina

Source: Adapted from Jamasb (2006)

The remarkable pace and extent of the reforms imply that, by the end of 1990s, many advanced economies and around 70 developing and transition countries had adopted some market driven reform steps in their electricity sector (Steiner, 2001). The general tendency of reform in these countries involved the progression of the reform model from a vertically integrated state-owned monopoly towards an unbundled competitive market. Figure 2 shows that market-based electricity reforms involved progressively introducing and deepening competition at the generation, wholesale and retail level respectively. The single buyer model with IPP participation remain the dominant electricity model across many Asian and African countries while the majority of LACs have pursued creating a competitive wholesale and retail market based on the standard reform model.

³ PCAP stands for price-cap; rTPA stands for regulated third party access; SRMC stands for short-run marginal cost while D, G and T stands for distribution, generation and transmission respectively.

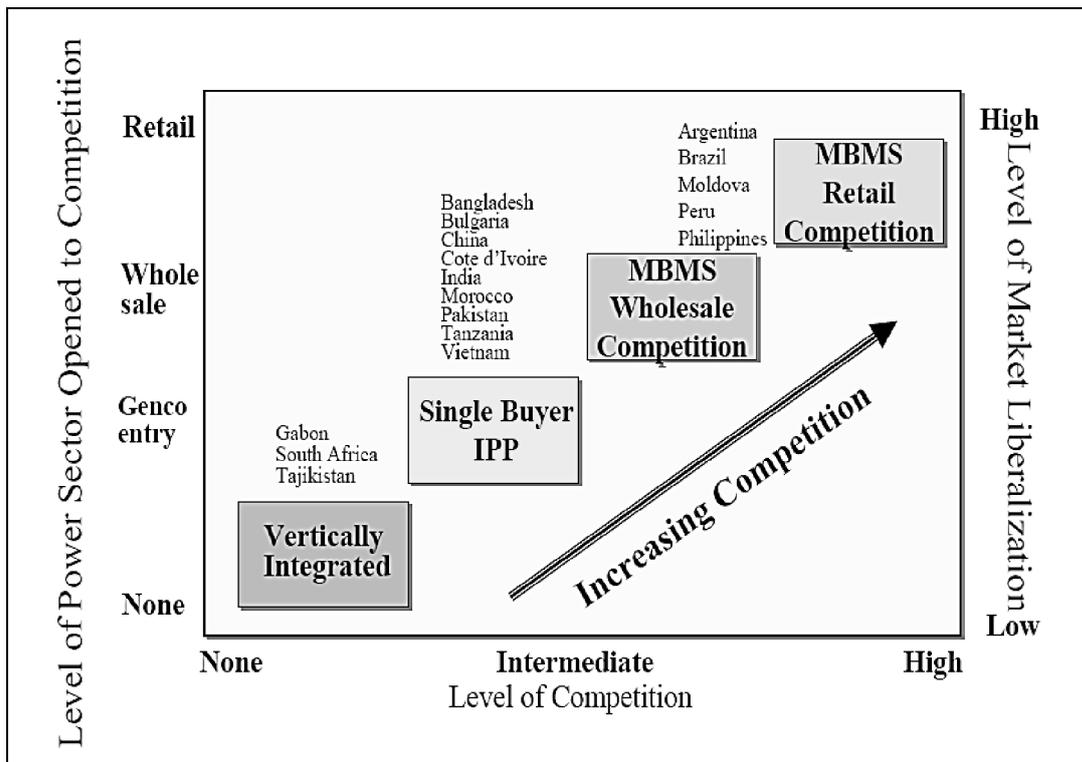


Figure 2: Electricity market models transitioning

Source: Adapted from USAID (2004)

3. Drivers of Reforms

The demonstration effect from early success stories was only one of the major drivers of electricity reforms around the world. The electricity sectors in the developed countries were characterised by excess capacity coupled with the use of expensive generation technologies and being productively inefficient and cross subsidies from residential customers to industrial users (Jamash et al, 2005a). In developing countries, reforms were driven by energy deficit, the operational and economic inefficiency of the state-led vertically integrated utilities, the inability of the state sector to raise adequate capital, the lack of electricity access across the population, the need to reform state subsidies for better allocation of resources and the desire to raise revenue for the state through the sale of state assets (Bacon and Besant-Jones, 2001).

The appeal of utility privatisation was particularly strong among the transition countries and the Latin American countries (LACs). These economies experienced massive market-oriented systemic changes in all sectors of their economy since the early 1990s. The structural change included macro stabilization, price liberalization, eliminating institutions of the communist systems and openness to international trade. These reforms were also termed as Type I reforms while Type II reforms included the design and enforcement of laws, regulation and proper institutions to support and nurture the functioning of the market driven reforms (Svejnar, 2002). Large-scale economic privatisation combined with the establishment of legal institutions in establishing well-defined property rights and contracts and anti-corruption agencies were the major hallmarks of the Type II reforms. Among the LACs, the first electricity privatisation took place in Chile in 1982, followed by Argentina in 1992 and some privatisations in Brazil. The appeal of privatisation grew following the early experiences in other LACs such as Peru, Colombia and Bolivia. Privatisation coupled with wholesale market competition and independent regulation remains the major elements of reform among the developing countries of Latin America.

The shift from a vertically integrated public monopoly to a competitive power sector by undertaking the structural, regulatory and ownership reforms was also strongly encouraged by the World Bank, International Monetary Fund (IMF) and other international financial institutions in developing and transition countries. The World Bank changed its lending policy in 1992 for the power sector development from traditional project lending to policy lending implying that any borrowing country should adopt the market-based standard reform model. This background explains the appeal of privatisation and market-oriented reform in developing and transition economies which, at times, preceded other necessary reform measures (Jamash, 2006).

The emergence of transition economies coincided with the world-wide power sector reforms. Hence, market-oriented reforms began soon after the collapse of Soviet Union and within the context of overall macroeconomic reforms in transition countries. In particular, large-scale privatization of the electricity sector was experienced in the context of broader economic changes among the transition countries indicating that

reforms should also be understood and explained in the wider macroeconomic context in these countries (Pollitt, 2009a). While the transition countries associated with the European Union made some progress in line with the EU electricity reform model, for other transition countries the incentives to implement reforms can be regarded as being mixed.

Similarly, in advanced economics particularly the EU, the motives for reform came as an initiative from the European Commission through two electricity directives in 1996 and 2003 (Newbery, 2002). The EU directive 96/92/EC laid down the foundations concerning common rules towards the creating of an internal market for electricity. The 2003 directive (2003/54/EC) established several key objectives to be achieved by 1 July, 2007 such as the creation of an independent regulator, 100% market opening to all customers including households, legal unbundling of the network segments from generation and supply and free entry in generation via a non-discriminatory network access to third-parties. In addition, the EU Directive 2009/72/EC underscored the need to mitigate the barriers to cross-border trade and expand interconnections towards creating an integrated single market for electricity in Europe.

However, the integration of small-island economies such as Ireland in the wider EU market currently remains an interesting political and economic challenge for Europe in the creation towards an integrated and common electricity market in Europe. The challenge of establishing an integrated market for electricity in Europe grows bigger when market integration goals have to be pursued along with the climate change and security of supply targets remains a political and economic challenge

However, the European reform model excludes some aspects of the standard model that are present in some of the leading reform countries. The directives have avoided requiring strict ownership change which is regarded as a sovereign matter and thus politically sensitive. It is not mandatory to privatise the state-owned assets as experienced under successful electricity liberalisation in Norway, Sweden and France although there is a major emphasis to increase private sector participation based on the standard or generic reform model. The ownership unbundling of transmission system

operation or transmission assets is not explicitly required in the EU directives though in many of the pioneer countries independent system operation now exist (Jamash and Pollitt, 2005).

Table 1 summarises the major drivers of electricity reforms across developing and transition countries in terms of 'pull' and 'push' factors. While the 'push' factors mostly include the unfavourable macroeconomic conditions; the 'pull' factors captures the incentives associated with adopting electricity reforms.

Push Factors	Pull Factors
<i>Macroeconomic events:</i> The 1970s oil crisis, Post-Soviet economy-wide market-based transition (1989), Asian Financial crisis (1997-1998), economy-wide liberalization and reform programs as initiated by the fiscal crisis.	<i>Capital raising options:</i> Privatization of state assets, greenfield private investment.
<i>Limited national fiscal ability:</i> High public debt, utility borrowing as a major proportion of national debt.	<i>Lending for institutional reform:</i> Macroeconomic stabilization lending conditional upon power sector restructuring, asset privatization (IMF), liberalisation and reform for new power sector loans (World Bank in 1993).
<i>OECD Deregulation:</i> New energy multinationals created as a result of OECD energy sector deregulation, provided investment opportunities for Europe and USA.	<i>Spill-over effects from international experiences:</i> Learning from pioneering reforms of power sectors in Chile, England and Wales and Norway in the 1980s and early 1990s.
<i>Investments constraints of the power sector:</i> No ability to self-finance, system upgrading and modernization required high projected electricity demand.	<i>EU accession:</i> Ppportunities to benefit from regional integration by reforming the power sector in accordance with the EU Directives.

Table 1: Drivers of power sector reforms

Source: Adapted from Nepal and Jamash (2012a)

4. Reforms Context

The initial context of reforms varied across the reforming countries that went under the wave of market-based electricity reforms. Resource characteristics and sector endowments, initial sector structure and institutional strength evolving the electricity sector differed across the reforming countries at the start of the reform process.

i) ***Size of the sector***: The size of the electricity sector is a crucial but often ignored concept in electricity sector reforms. The size of the system can influence the reform capabilities and reform options of individual reforming countries. Hence, not all reform elements prescribed by the standard textbook model can be suitably applied across all countries. For example, it is not clear if the smaller systems such as the Nepalese electricity sector also require or benefit from vertical separation and third-party access in a developing country context. Likewise, the integration of wholesale markets and deepening of competition through expanding interconnections is not clear in small markets and developed island states such as Ireland. This is because the scope for competition may be limited implying that the benefits of adopting a full reform package may be small in relation to the costs in small electricity systems. It is not appropriate to unbundle a power system with less than 1000 megawatts (MW) of capacity into many separate generation and distribution companies with the assumption that effective competition will develop (Besant-Jones, 2006).

However, the importance of sector size on the determinants and performance of reforms has not received adequate attention in the reform literature implying a considerable knowledge gap. Bacon (1999) provided important information on the extent of reforms possible in small electricity systems which clearly motivates studying the impacts of different stages of reform on performance among the reforming countries with varying sector endowments.

ii) ***Sector structure***: The initial sector structure at the time of reforms is a function of the sector's history, resource endowment and past policies. The initial structure defines the starting point of the reform process and is a given factor (Jamasp et al., 2005b). For example, the transition countries inherited the features of the command economy on to

the power sector which led to politically determined power prices, excess capacity and high levels of electrification at the start of economic liberalisation.

However, the reform measures adopted has a direct impact on the performance of the sector. Reforms take time to implement and produce the desired effects. Hence, it is important that the appropriate structure is envisaged from the start of the reform (Jamash et al., 2005b). For example, the transition countries adopted the market-oriented electricity reforms but did not effectively create suitable institutions to support the market driven reforms. Whether the reform in the electricity sector worked or not is a matter of empirical investigation and is clearly missing in the past literature studying electricity sector reforms.

iii) ***Institutional factors***: These factors refer to sector and economy level legal and regulatory framework that influence and support the continuity of the reform process in the electricity sector. According to North (1991), institutions are humanly devised constraints that structure human interaction at the political, economic and social levels, provide incentive structure of an economy, create order and reduce uncertainty in exchange. From an institutional economics perspective, institutions constitute two essential components: the institutional environment and institutional arrangement (Williamson, 1995). The institutional environment is concerned with macro-level 'rules of the game' which can be formal or informal while institutional arrangement focusses on micro-level governance mechanism. The institutional endowment of a country largely influences the institutional environment and includes five elements: legislative and executive system, judicial system, administrative system, informal rules and social and ideological character of the nation (Levy and Spiller, 1994).

The reforms and regulation of the electricity sector in developing countries tend to suffer from low levels of institutional environment in terms of limited regulatory capacity, limited accountability, limited commitment and limited fiscal efficiency (Laffont, 2005). The weak institutional environment implies that reforms and regulation of the electricity sector can be ineffective. Regulation becomes prone to political capture becoming a tool of self-interest within the government or ruling elite (Stiglitz,

1998). In contrary, developed countries have robust institutional framework and arrangements in place as they have high institutional endowment. This implies that implementing reforms and regulation of the sector is easy and feasible in developed economies. Whether reforms and regulation of the electricity sector in developed economies is effective or not requires exact empirical testing. This is because many developed countries have exhausted the reform steps under the standard model implying that current reforms are driven by the need to meet different national and regional objectives. For example, an isolated small island developed economy like Ireland with robust institutions in place faces major challenges to increase market integration with other wholesale electricity markets in Europe by expanding interconnections.

5. Analysis of the reform experience

Economic principles suggest that a reform should be undertaken if it will engender a net positive economic welfare impact. This implies that a social-cost benefit analysis (SCBA) prior to reform is can help to assess the effectiveness of reforms. A SCBA considers reforms and restructuring as an investment and compares the costs of investment with the benefit which is the change in actual and projected performance relative to a defined counterfactual of what would have happened in the absence of reform and restructuring (Jones et al., 1990). However, assessing the effectiveness of electricity reforms experience can be complex as it includes different interrelated steps, can occur in different forms or models and is a dynamic process (Pollitt, 2009). Electricity reforms are multi-dimensional activities with many interacting factors and a variety of impacts that a SCBA may inadequately capture. Hence, there exist other important applicable approaches to analyse electricity reform which can be classified into four major categories: econometric studies, efficiency and productivity analysis, macro studies and individual and comparative case studies.

Econometric studies can analyse well-defined issues and hypothesis tests through statistical analysis of reform drivers and performance. Performance metric regressions based on cross-section and panel data econometrics are applied for this purpose. Efficiency and productivity analyses are desirable for assessing the effectiveness with

which each agent's inputs are transformed into outputs in relation to best practice using frontier methodologies. Such studies reduce the need for rigorous data and especially when the data is challenging to collect.

Macro studies of reforms estimate their impacts using general equilibrium models of the economy. The advantage of the reform studies based on general equilibrium modelling is that these studies attempt to model the interaction effects of sector reform with non-reforming sectors and calculate the aggregate welfare effect directly. Likewise, single or multi-country case studies are desirable when in-depth investigation or qualitative analysis is needed. Case studies can examine the issues that do not easily lend themselves to rigorous quantitative analysis or could not be analysed due to lack of comprehensive data.

We use case-studies to analyse the progress and outcomes of market-driven electricity reforms across the less-developed, transition and advanced economies since the early 1990s. This is because electricity sector restructuring and privatisation is a complex process that involves mainly institutional and organisational issues, degree of intervention and the degree of competition such as unbundling versus vertically integrated structures (Anaya, 2010). The electricity sectors of Nepal, Belarus and Ireland are chosen for this purpose. Power sector reforms in these countries varied in terms of motives, context and system size. Nepal is a developing country in South Asia and has a small electricity system and suffering from increasing electricity demand with growing political instability. The Nepalese electricity sector also initiated reforms in the electricity sector since the early 1990s, often due to direct lending pressures from international financial institutions. Belarus is a transition country that experienced electricity reforms in the context of overall macroeconomic reforms in the economy. Furthermore, the transition countries are of special interest in the context of analysing the electricity reform process because they include a diverse mix of countries belonging to different stages of economic development and at different stages of the reform process. Ireland is an island economy aiming to deepen competition in the wholesale market through increased interconnections. The wholesale market in Ireland can be considered a small system as compared to other wholesale electricity markets in Europe.

Ireland initiated the reform process as a consequence of successful reform experience in the UK with the need to comply with the EU directives.

5.1 Nepal

Nepal (officially the Federal Democratic Republic of Nepal) is a less-developed landlocked economy in South Asia sandwiched by two of the world's fastest growing and energy hungry economies India and China with a geographical area of 147,181 square kilometres. The country has a population of about 27 million while the per capita income is about 1,200 US dollars in purchasing power parity (PPP) terms implying a low-income nation. The country has a low Human Development Index of 0.46 while the Transparency International perceives Nepal as one of the most corrupt countries in the world ranking 154 out of 182 countries in 2011.

Electricity sector reform process started in Nepal since 1985 with the establishment of Nepal Electricity Authority (NEA) (Thakur, 2002). NEA is a vertically-integrated (although functional unbundling exists) monolithic state-owned and controlled entity responsible for the generation, transmission and distribution of electricity across the economy. The establishment of NEA eventually paved the way towards creating a legal framework and corporatization of the sector through the formulation of the hydropower development policy of 1992 and was enforced by the Water Resources Act and the Electricity Act with amendments made to the NEA Act of 1984 (ADB,1999).

The Act led to the opening of the generation segment to the private domestic and foreign IPP's through non-recourse financing while also theoretically allowing NEA to function autonomously. The entry of the private sector in power generation imply that NEAs status was replaced from that of a sole monopoly player to that of a licensee with the responsibility of buying the privately generated power in accordance to a single-buyer model (SBM). In addition, the Community Electricity Distribution Bye Laws was introduced in 2003 with the objectives of promoting public participation in reducing non-technical power losses (such as theft) and institutionalising distribution, encourage

community management in the extension of distribution lines and promote rural electrification.

However, the outcomes seem to have contradicted the objectives after more than two decades of reforms. The vertically-integrated system has developed only around 0.72 GW out of potential 40 GW of generation capacity including the IPPs' generation indicating lack of investments in generation while the peak demand is also projected to increase to 2206 MW by 2020 and 3679 MW by 2030 (NEA, 2010). The electricity prices remain too low to cover costs and support system expansion and suffer from persistent cross-subsidization among domestic and industrial customers. The price-cost gap has exacerbated the financial health of NEA with an overwhelming loss of NRs. 4681 million in 2009 (NEA, 2009).

Likewise, the technical and non-technical electricity losses remain high in Nepal like in other South-Asian countries (Smith, 2004). The electricity losses amounted to 25% of the total generation in 2011 due to power theft and technical issues such as old grid infrastructures and lack of proper metering in the face of increasing national demand for electricity (NEA, 2012). In terms of electricity access, NEA currently serves 15% of the total population with electricity indicating low level of electrification under conditions of large disparity among urban and rural customers. Electrification rate in urban area is 90% where only 9% of the total population reside while the electrification rate in rural area is 5%. Thus, the Nepalese electricity sector resembles a monopolistic public utility suffering from chronic underinvestment and insufficient capitalization, politically-regulated low and distorted tariffs coupled with low access rate, frequent supply interruptions, and widespread financial and operation inefficiency.

The on-going decade long political instability led to discontinued policies, uncertainty, and often weak and stalled implementation of reforms in the electricity sector and thereby explaining the poor state of the sector. Persistent political instability has also placed constraints on timeframe for undertaking reforms as any reform that extends beyond the lifespan of the government becomes politically infeasible and thereby slowing down or stalling the reform progress as a whole (Bhattacharya, 2007). Hence,

political stability is essential because reforms imply changes in institutional arrangements while these changes can only sustain in the stability of the rule-makers. The government is the influential rule-maker in the Nepalese context. However, political instability is likely to continue in Nepal implying that the electricity sector will have to develop under unfavourable institutional environment and arrangements to achieve the long-term national economic objectives.

As such, tariffs reforms, increased private sector participation and improvement in governance mechanisms through the establishment of an effective independent regulatory body seem more urgent than unbundling of NEA in the present context (Nepal and Jamasb, 2012b). This is because the existence of effective regulatory body can facilitate private participation in the sector and act as a mechanism to protect the sector from political instability and also expand generation to meet demand by investing foreign and domestic private capital under conditions by setting fair terms for entry and access. However, it is necessary for less-developed economies like Nepal to have a cautious restructuring at first as effective regulation is a complex and difficult task facing any energy regulators even in developed economies. As the sector grows larger in the long run, complete vertical separation of the networks and privatisation of them is an option while accounting separation of the competitive and monopoly segments is desirable in the short term to promote transparency, accountability and prevent corruption in the sector.

5.2. Belarus

Belarus (officially the Federal Republic of Belarus) is a landlocked transition economy in Eastern Europe bordered by Russia, Ukraine, Poland, Lithuania and Latvia with a total area of 207,595 square kilometres. The country has an overall population of about 9.7 million while the per capita income is about 15,000 US dollars in PPP terms implying an upper-middle-income economy. The nation has a high HDI score of 0.76 while the Transparency International perceives Belarus as a corrupt country with a rank of 143 out of 182 countries in 2011.

Electricity reform process has been slow in Belarus since it declared independence on 25 August, 1991 and only includes some initial aspects of market-based reforms. The electricity sector is dominated by the state-owned and controlled holding company Belenergo created in 2006 comprising six regional power system enterprises responsible for the generation, transmission and distribution of electricity in Belarus. Belenergo serves as the single buyer of power including imported electricity while there are no independent power plants and producers. The reliance on imported energy (crude oil and natural gas from Russia) coupled with upward surging electricity demand imply that energy efficiency remains the core aspect of electricity reform in Belarus (Rakova and Pavel, 2005).

The 'Law on Energy Saving', enacted in 1998 and amended in 2006 sets out the need to promote energy efficiency as a matter of national priority while setting various targets in reducing energy intensity from 2005 levels. Likewise, the 'Law on Renewable Energy Sources' was adopted in 2010 that sets out the directions of state regulations concerning the use of non-traditional and renewable energy sources as the country aims to be energy independent and address its unbalanced fuel portfolio situations (REEEP, 2012). However, there is no clear and explicit 'electricity laws' in Belarus.

In addition, Belarus is planning to create a wholesale electricity market to be operative by 2015 motivated by the reform experience around the world. The details of creating a wholesale market is being laid down in new electricity bill as declared on 23 May, 2012 (BELTA, 2012). The creation of a wholesale market is expected to attract foreign direct investments, make spending transparent and reduce generation costs.

However, the Belarusian electricity market faces several principal concerns at present since various early attempts of reforms. Capacity shortage and security of supply concerns continue to evolve the electricity market as the electricity system mostly rely on imported gas as fuel covering 90% of the domestic demand while the remaining 10% being imported from Russia, Ukraine and Lithuania. The load forecast for 2020 is expected to reach 13,000 MW given the existing installed capacity of 8,247 MW when around 60% of the power plants have reached their worn out points of tightening

capacity (Zachmann et al., 2008). The electricity prices are politically regulated and well below the long run marginal cost of electricity supply (LRMC) and too low when compared to other transition countries (EBRD, 2004). This is particularly interesting for Belarus when electrification is generally not considered an issue among the transition countries with increasing emphasis towards economic and operational efficiency of the sector (Stern, 2009)⁴.

Electricity losses in the transmission and distribution networks reached 11.3% of power production in Belarus which was almost twice the OECD average of 6.8% (IEA, 2008). The electricity market lacks overall transparency due to vertical and horizontal integration of the industry coupled with the absence of any clear separation of government policy from commercial management and economic regulation of the electricity supply industry in Belarus.

The slow and politically reluctant reform process in Belarus indicates that the transition to market-based economic reforms was not a political choice but rather a consequence of past economic and political system to some extent. Nonetheless, Belarus needs to restructure and possibly privatize the sector in the path towards creation of a wholesale market and increase transparency. Further, privatization should be pursued only after creating an effective institution to govern the privatisation process in the form of independent regulators. An independent regulation shall ensure the opening of the Belenergo network to third parties on a clear non-discriminatory basis along with utilizing incentives for cost reduction without affecting service quality. The gradual increase in residential prices up to the LRMC level with no direct subsidies and cross-subsidies is essential to make the market sustainable.

Transition economies like Belarus experiencing overall-market based reforms in the economy need to harmonise the inter-sector reforms in the economy to make the reforms work (Nepal and Jamasb, 2012a). For example, adjacent reforms should be carried out to solve the structural problems in biggest electricity consuming sectors such

⁴ This is also reflected in the famous quote by Lenin in 1920 that 'Communism is Soviet power plus electrification of the whole country'.

as housing, utilities and industries to make the electricity reforms successful while deregulation of electricity prices should be supported by deregulation of gas prices under a competition policy framework.

5.3. Ireland

Ireland (officially known as the Republic of Ireland) is an island economy in Europe sharing its only border with Northern Ireland and encompasses an area of 70,273 square kilometres. The country has a population of about 4.5 million while the per capita income is about 39,000 US Dollars in PPP terms implying a high-income economy. The nation has a very high HDI score of 0.96 while the Transparency International perceives Ireland as a relatively corruption free country with a rank of 19 out of 182 countries in 2011.

Electricity reform process in Ireland is based on the EU Directives driven to integrate separate and national electricity markets into one since 2000. Ireland responded to the EU Directives by opening the market fully in 2005 from a 30% market opening in 2000 (Valeri Malaguzzi, 2009). Ireland achieved the institutional notion of market integration with the creation of an all-island Single Electricity Market (SEM). The Single Electricity Market Operator (SEMO) facilitates the operation of SEM and is a joint venture of the system operators between the Republic of Ireland (EIRGrid) and Northern Ireland (SONI). SEMO is regulated by the Northern Irish Authority for Utility Regulation (UREGNI) and Commission for Energy Regulation (CER) consisting of 2.5 million customers. SEM is a gross mandatory pool for any generator with an export capacity of 10 MW. The generators bid in their short-run marginal cost and receive the energy-only system marginal price.

The possibility to trade with dual currency (both Sterling Pounds and Euro) makes SEM a unique wholesale electricity market in the world. SEM is currently connected to Great Britain via the Moyle interconnector amounting to almost 4.7% (about 500 MW) of total SEM generation capacity. The all-island market is set to expand interconnections and improve market integration with GB with the operation of the East-West

interconnector (500 MW) connecting Ireland with Wales (De Nooij, 2011). Further, the regulatory authorities of France, UK and Ireland (FUI) have proposed to couple the day ahead wholesale electricity markets in these countries by 2014 in line with the EU policy of increasing electricity market integration (EIRGRID, 2012). As such, FUI is a regional electricity initiative among France, UK and Ireland. Ireland has also adopted an ambitious renewable energy target of as the island plans to generate 40% of its electricity from renewable energy sources by 2020 despite a severe economic downturn in the country (IEA, 2012). Electricity generation from wind will play an important role in the achievement of renewable targets with an already installed capacity of 2000 MW capable of powering about 1.3 million households in Ireland.

However, the Irish market faces several challenges despite adopting advanced electricity reform measures. It mostly relies on imported gas (around 90%) and oil from UK for electricity generation. Oil constitutes around 60% of national energy consumption. This indicates that Ireland faces one of the highest wholesale electricity prices in Europe besides Denmark and Germany in addition to resulting security of supply concerns (European Commission, 2011). This implies that the economic notion of regional market integration remains a far-fetched reality in Ireland. Wholesale market concentration is also high as the installed capacity share of the three largest generators in the Republic of Ireland amounted to 88% of the installed capacity at the end of 2009 indicating market power concerns and lack of competition in Ireland (European Commission, 2011).

The relatively small size of the market, lack of confidence in the regulatory regime and the dominance of the Irish market by the vertically-integrated and state-owned Electricity Supply Board (ESB) imply that Irish market has failed to attract new entrants after the start of liberalisation process started in 1999 (McCarthy, 2005). In addition, the current level of market integration between SEM and GB markets is only 0.17 (out of 1 where a value of 1 indicates full market integration) despite being physically interconnected indicating the inefficient use of the existing Moyle interconnector (Nepal and Jamasb, 2012c). Hence, the FUI market coupling can be a desirable solution for Ireland to promote efficiency in interconnector usage while other market coupling

possibilities should also be explored. Moreover, the transition towards a low-carbon economy can increase the reliance on imported gas as gas-fired power plants will be required to provide flexibility in electricity supply when wind power is not available.

Thus, the Irish electricity market is poised towards improving regional market integration in the face of growing amount of wind power in the energy mix. However, improving market integration requires greater investment in interconnectors under correct regulatory and market incentives for traders to effectively engage in trading via the interconnectors. The increasing role of wind power in the wholesale market may necessitate redesigning the existing market to support such transition. Expanding interconnections will enable SEM to effectively utilise the growing wind generation by exporting to the UK and other markets as there are physical limitations to the amount of wind that can be accommodated within the SEM. As such, it is desirable that Ireland also adopts the carbon price floor as Northern Ireland which shall also mitigate the discrepancies between these two jurisdictions (Newbery, 2012).

Further, increasing market integration between SEM and other markets in Europe will depend upon the harmonisation of several market design and institutional features such as gate closure timings, composition of wholesale prices, form of generation bids and market scheduling and dispatch. Harmonising these market and institutional features across other EU markets will be a major political and economic challenge for an all-island small and isolated wholesale market like SEM to improve market integration with the EU. However, adequate harmonisation between the two internal system operators (EirGrid and SONI) can be a pre-requisite to improve integration of the all-island electricity market with rest of the EU.

6. Discussions

The above case studies suggest that significant heterogeneity exists in the power sector process and outcomes across the developed, transition and developing economies. However, it is not clear from the analysis that the application of the market-driven

reform process has been a global success after nearly three decades of reforms and restructuring of the electricity sector. This necessitates a better understanding of the lessons and policy implications of electricity reforms based on liberal market-oriented policies.

The academics, policymakers and practitioners in favour of the standard reform model may generalise the success of reforms in pioneer countries such as NordPool, UK, Chile and other LACs like Argentina, Colombia, Brazil and Peru in concluding that the market-based reforms can be successful when implemented properly. These LACs preferred to pursue competition and privatisation of the electricity sector as opposed to the single buyer model with public ownership in most South Asian countries like Nepal. In contrast, those critical of the reform process can generalize the outcomes of the slow and unstable market-based reforms in Eastern Europe, Asia⁵ and Africa in concluding that the reform process has been costly, unsuccessful and economically wasteful. In addition, the severe market failures in the Californian electricity market during 2001-2002 cannot be ignored. Even Chile and Argentina have experienced power sector problems in the last decade although being the most illustrative examples of successful market-based reform in Latin America (Anaya, 2010). Hence, it is necessary to draw out relevant lessons and policy recommendations based on the reform discourse observed from experiences of different countries at different stages of economic development and at varying stages of the market-oriented reform process.

It is necessary in developing and transition countries to impose cost-reflective prices in order to make their electricity systems sustainable. However, this should be carried out in the presence of a cautious re-balancing mechanism between economic efficiency and social equity to offset the undesirable social effects of a hike in tariffs. For example, price adjustments can be done before privatisation rather than after privatisation for socio-economic reasons if privatisation of the electricity companies is considered as an option for reform in less-developed countries. However, as in the case of Norwegian reform, local and regional ownership of the electricity sector may work instead of

⁵ The Indian state of Orissa provides a clear example where the application of the market driven electricity reforms truly failed (Sen and Jamasb, 2013).

complete privatization in these countries lacking any comprehensive privatization experience.

The privatisation experience in some LACs also garnered public opposition due to the failure of liberalised reform process to deliver for the poor while being linked to bad governance and corruption (Roland, 2008). It also provides a lesson to have a proper regulatory agency in place when moving ahead with any contractual arrangements via PPAs between the IPPs and the incumbent (Gausch et al., 2006). Similarly, governance improvements are crucial to control corruption and the issues of non-payment. Improvements in governance are necessary to have the independent regulation in place in the case of reforms being adopted. Thus, corruption control together with skilled work force enrichment and carefully determined sustainable electricity prices may be more essential in developing and transition countries rather than the costly reforms as per the standard model. Therefore, the application and sequencing of electricity sector reforms in less-developed and developing countries will be largely country-specific depending upon individual country needs and priorities and should not be based on the *'keeping up with the joneses'* principles (Nepal and Jamasb, 2012b).

The early success stories also demonstrate that market-based reforms require the presence of appropriate institutions and effective governance mechanisms. Chile and Norway had well designed economic institutions in place to buttress market-based reforms in the sector. Hence, it is essential that appropriate governance mechanisms be put in place so that the social and institutional capacities of the country are able to support the reforms being implemented in the power sector of developing and transition countries. In addition, political objectives should not be prioritised at the cost of sound economic principles while the political-economy arrangements in these countries should facilitate the reform process in the electricity sector. A better understanding of the political economy evolving the energy sector needs to be developed to better inform the reform design process in developing and transition countries.

Social legitimacy and public acceptance of reforms are crucial factors in tackling the traditional problems of power theft and non-payment in most of the transition and

developing countries. Social legitimacy and public acceptance of reforms can increase if the adopted reform programs adequately reflect the local or country-specific economic, political and social conditions evolving the power sector rather than completely holding to a reform ideology that proved successful elsewhere.

The reforms have worked relatively better in economies like NordPool and the LACs despite some differences among their models, because they pursued home-grown reforms reflecting local conditions rather than being complete followers. Thus, it is not clear if the market-centred EU electricity reform model which is in a trial phase across the EU-25 is a suitable reform model for transition countries. As such, the development policymakers should not rely on formulaic economic or systems models for power sector reform.

In advanced economies such as the EU, increased investments in transmission networks and transmission infrastructures connecting the cross-border markets coupled with the efficient allocation and usage of transmission capacity are essential to improve the market integration process. This is particularly true for small regions and island states in the EU (Nepal and Jamasb, 2012c). The transition towards a less carbon intensive energy-economy, increasing digitization of the grid (so called smart grids), larger adoption of renewable energy and the growing integration of electric vehicles imply undertaking capital-intensive tasks of maintaining and re-designing the existing grid to accommodate these technological transitions in the networks.

However, the lack of adequate investments in both transmission and distribution networks is a major market failure of the modern day liberalised market structures in the EU built on the standard reform model. It is estimated that the transition towards a sustainable and smart energy economy will require an investment of about 200 billion euros in electricity and gas transmission networks (Vinois, 2012). Thus, the on-going quest towards the creation of a single electricity market will significantly depend on the ability of the EU electricity markets to innovate the required level of investments in the networks and cross-border infrastructures.

Increased investments and a significant rise in grid related capital costs will necessitate a rise in the consumer electricity bills. Rising end-user electricity bills can be a major concern even for countries like the UK where around 4.75 million households experiencing fuel poverty in 2010 (DECC, 2012). Hence, developed economies also face a major challenge to balance between economic efficiency and social equity as in less developed and developing countries. As electricity bills rise, more emphasis should be placed towards energy efficiency and innovation, the use of energy efficient technologies and demand-side management in advanced economies like the EU. The effective role of regulation to generate the required level of investments and mitigate the adverse impacts of electricity price rises would be equally important.

The lack of adequate network investments is a critical issue for less-developed and developing countries even though the current principal concerns with reforms is mostly associated on the generation adequacy and easing capacity shortage. It is inevitable that the existing grid in these countries cannot accommodate all electricity generated as generation continue to expand to meet the growing demand. Further, the gradual switch towards renewable energy sources will exert additional pressure on the existing grid in terms of integrating generation into the transmission and distribution networks unless re-designed and updated. For example, the simultaneous failure of three of India's five regional transmission grids left roughly 600 million people across twenty states without access to electricity over a period of approximately two days in July, 2012 (Sen and Jamasb, 2013). The blackout experience teaches a valuable lesson for developing countries to also invest in power infrastructures and effectively manage demand in meeting the growing electricity demand spurred by economic growth.

7. Conclusions

This paper has assessed the process and outcomes of market-driven reforms evolving the electricity sector of the less-developed, transition and developed countries based on country-specific case studies. The electricity sectors of Nepal, Belarus and Ireland were analysed. The reform process in these countries vary in terms of motives, context and

sector size. The case studies indicate that reforming the sector is a major economic, political and social challenge across all countries. Therefore, qualitative and quantitative evaluation of the reform process is difficult irrespective of the evaluation of reforms being a matter of empirical testing or a theoretical debate.

This study cast doubts on the net benefit of competition arising from implementing market driven reforms in small electricity systems. Hence, evidence is needed to assert the appropriateness of full adoption of the market driven reforms in small systems. Further research is required to estimate the relevant costs and benefits of electricity reforms in small systems using cost-benefit analysis. The use of SCBA in analysing the effectiveness of electricity reforms in developing countries is limited in the literature implying a considerable knowledge gap. Hence, undertaking a SCBA of reforms can offer useful policy guidance for developing and transition countries before implementing a comprehensive electricity reform.

The analysis also portrays mixed evidence of market-based reforms in improving access to electricity in developing and transition countries. Market driven reforms have significantly improved access in most of the LACs while the model has been less successful in South Asia in improving electricity access. In contrary, centrally planned models have been successful in delivering higher levels of electrification in transition countries. Universal electrification has also been successfully achieved in China despite a population over 1.3 billion. Hence, further research is required to assess the suitable model for improving electricity access in developing countries.

It is evident from the case-studies that the reform process remains a work in progress and a never-ending process across all countries. Majority of the less-developed and developing countries are still at some stages of the standard reform model. Developed countries have established a well-functioning wholesale spot market but are suffering from market power concerns coupled with the inability to sustain competition and lack of investments in the networks. Climate change and security of supply issues in the face of regulatory uncertainty have raised new concerns in advanced economies such as the EU who have already reached the advanced stage of the market-based reform process.

For example, recent reforms in the UK are being driven by capacity shortage concerns as is also present among the less-developed and developing countries.

However, the contexts vary. While cost-reflective pricing and privatisation in the presence of sound regulation can mitigate the capacity concerns in developing countries; developed countries such as UK need new market model and industry structure to increase the production and accommodation of renewable energy sources. This shall discourage fossil-based generation in the transition towards a low-carbon economy and meet the EU energy policy goals and environmental targets.

The reliance on market driven model and the extent to which it has been pursued also reflects a political belief in the efficacy of the markets. However, competitive markets with independent regulatory body have exhibited significant market and regulatory failures as observed among the EU electricity markets. In contrary, active involvement of the state in the sector across developing countries has often demonstrated severe political failures in electricity sector management and operation as evident among some transition and most South Asian countries. The electricity market model in EU has also demonstrated considerable stress in recent times in delivering the large scale investment needs in expanding electricity infrastructure in meeting the climate change targets and security of supply. This indicates the need to carefully assess whether the electricity market reforms and solutions should be replaced by greater state intervention.

Successful electricity reforms require coordinated progress on all aspects of the development process, namely political, macro-economic, sectoral, and financial to be successful. The interplay and intricacies between the economic, social and political factors complicates the reform process. Further, new economic, political and technological challenges will evolve the sector as market based reforms continue to progress (or halt) across all countries, though at varying speed. As such, it is clear that electricity reforms are an evolving and changing process rather than a one-off event. These factors lead to a unanimous conclusion that electricity sector reform will remain a complex process in all economies.

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