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Reforming Small Power Systems under Political Volatility: The Case of Nepal

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Abstract

This paper assesses the electricity sector reforms across small power systems while citing Nepal as an example. The on-going political instability and increasing electricity demand make power sector reform in Nepal and similar small systems a more complex process. As international reform experiences provide plenty of lessons to learn; raising electricity tariffs and adjusting subsidies in the presence of an effective regulation body are important in the short and medium term. The creation of an effective regulatory commission is also more urgent than unbundling the sector in smaller systems though accounting separation may sometimes be desirable as in the present context in Nepal. In the long run as the system grows, vertical separation and competitive privatisation may be pursued together with the creation of a functioning wholesale market by horizontally splitting the generation segments.

Keywords electricity reform; small systems; political instability; regulation

JEL Classification L52; L94; Q48

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Reforming Small Electricity Systems under Political Instability: The Case of Nepal*

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Abstract

This paper assesses the issues and options in reforming small electricity sector reforms in general while citing Nepal as a specific example. Political instability and increasing electricity demand are two major complicating factors in power sector reform of small systems such as that of Nepal. Lessons from international experience with reforms suggest that measures such as raising cost-reflecting pricing, adjusting the subsidies, and independent regulation are important steps. In small systems, the creation of an effective regulatory authority is more important than unbundling of the sector. In the present context of Nepal accounting separation may be a desirable restructuring step given the present political and market condition. As the system grows, vertical separation of the system and horizontal splitting of the generation segment perhaps followed by privatization and competition in organized wholesale market can be pursued in the long run.

Keywords Electricity reform; small systems; political stability; regulation

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1. Introduction

The pioneers of electricity sector reforms in Latin American countries (LAC) such as Chile (1978-79) and Argentina (1992) inspired the notion of 'successful and comprehensive electricity reforms' in less-developed countries. Ever since, electricity reforms have been pursued or been on the agenda in developing countries. Although the reform aspirations and adopted models in developing countries were relatively similar; the institutional framework, regulatory arrangements, political ambience, sectoral conditions, and market structures among these varied significantly.

However, the electricity sectors of many developing countries, including Nepal, can be defined as 'small systems' (Kessides, 2004). Bacon (1999) defines a power system as small when the overall system peak load reaches up to 1000 MW. As of 2004, 60 developing countries have peak system loads that are below 150 MW; another 30 between 150 and 500 MW, and possibly another 20 are between 501 and 1000 megawatts. Moreover, the system peak load in Nepal is projected to increase to 2206 MW by 2020 and 3679 MW by 2030 (NEA, 2010). Thus, the system can be expected to grow larger with time from the current size.

The electricity sector in Nepal began undergoing major reforms after the establishment of Nepal Electricity Authority (NEA) in 1985. While the initial reforms followed the standard 'scorecard' type of reform in developing countries (see Bacon, 1999); the model has largely proven unsuccessful in the Nepalese context. After nearly two decades of experience with electricity reform in Nepal; the current structure and organisation of this hydropower dominated sector is regarded as being uncertain and unsustainable. Nepal is the second-richest country in hydropower after Brazil (Joshi and Khadka, 2009) and has a further 40 GW potential of technically and economically viable resources (EIA, 2010). However, the vertically-integrated system has developed only around 0.72 GW of generation capacity including those of the Independent Power Producers (IPPs). Distorted electricity tariffs, low access rate, frequent supply interruptions, and inefficiency in operation have been the trademarks of the Nepalese electricity sector along with other South Asian countries such as India, Pakistan, Bangladesh and Sri Lanka (Bacon and Besant-Jones, 2001).

Although a decade long Maoist revolution delayed the electricity reform process; the current performance of the sector as compared against the potential benefits has raised doubts about the reforms. The energy sector in Nepal is regarded as being 'resource rich but policy poor'. The political leadership changed 11 times in the last decade with Nepal being the world's most recent republic in 2008. Political instability has severely affected the predominantly state owned sector resulting in discontinued policies, uncertainty, and weak and often stalled implementation of reform. Although domestic and foreign

private participation accounts for 20% of the generation market; the country has failed to achieve notable progress in development of its hydropower resources than anticipated.

Reliable energy supply is necessary for stimulating economic growth in Nepal (Dhungel, 2008). Moreover, the direct and indirect contribution of the sector to the Gross Domestic Product (GDP), monopoly characteristics of the industry coupled with high politicisation of the sector imply that the electricity reforms lies at the heart of the economic growth policies in Nepal. The annual energy requirement is also expected to increase from 3859 GWh to 9563 GWh from 2009 to2020 (NEA, 2010). Hence, the need for a rational reform of the power sector taking into account the increasing political volatility and escalating energy demand is crucial for a country experiencing a wide-reaching change. However, the current performance of the Nepalese electricity reform to this date can present a major setback for an economy in the lurch towards an export-led economic growth.

The purpose of this paper is to assess the performance of the power sector reforms which garnered pace in the country after 1990. The contributions of this paper are two-fold. Firstly, this paper provides important electricity reform lessons from several monolithic state-owned and controlled 'small systems' in Asia and Africa reeling upon growing political instability. Examples of reform experience from South Asian neighbours[1] as well as successful international electricity sector reforms from Chile and Argentina and the hydroelectricity-rich Brazil will be used where permitted by the context. Secondly, this paper aims to fill in the existing gap in the literature regarding a comprehensive study of the power sector reform processes in Nepal over the years.

The paper is organized as follows. Section 2 presents the economic arguments related to reforms in small power systems. Section 3 briefly discusses the sequence and contents of the main electricity reform episodes in Nepal after 1990. In Section 4, the major economic, operational and environmental aspects of power sector outcomes from 1990 till 2008 is evaluated. Section 5 discusses the reform options addressing the concerns of high political volatility and growing electricity demand. Finally, Section 6 concludes with policy recommendations.

2. Reforming Small Electricity Systems

The demonstration effects from electricity reforms in a more politically stable Chile and a relatively socio-economically unstable Argentina and advanced economies like UK

[1] The South Asian neighbors include the member countries of the South Asian Association for Regional Cooperation (SAARC). The member countries include Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan, Sri Lanka and Afghanistan joining lately.

(1990) and Norway (1991) combined with significant technological progress in the sector has been one of the major driving forces for electricity reforms in developing countries including those with small systems. The burden of price subsidies, low service quality, low collection rates, high network energy losses and poor service coverage experienced under the monolithic state-owned and controlled system meant that these systems were no longer able or willing to support the existing arrangements (Joskow, 1998; Newberry, 2002; Jamasb, 2006). Nonetheless, the political, economic and institutional contexts can vary significantly across these systems.

Vertical and horizontal separation of the systems and large scale privatization was one of the main elements of electricity reforms in Chile and Argentina (Pollitt, 2008). The aim of vertical unbundling is to separate the potentially competitive generation and retail supply from the natural monopoly activities of transmission and distribution networks (Jamasb and Pollitt, 2005). Vertical separation is desirable to promote competition and forcing firms to provide their services at socially efficient prices (Kessides, 2004). However, the small size and low density of the market mean that the benefits of competition arising from vertical separation of the networks as well as economies of scale are limited in small power system like Nepal. The smallness of the market (in particular for small-island countries) cannot effectively allow the introduction of wholesale markets as only a small number of generating companies can be supported leading to oligopolistic market situations and susceptible to market power (Domah, 2002)[2]. Further, bundling many smaller electric companies by aggregating them under a monopsony regime via a single-buyer model (SBM) can allow the vertically integrated small power system to benefit from economies of scale. Hence, the transactions costs of full unbundling can exceed the subsequent efficiency gains in small electricity systems and competition may not be feasible and if feasible may not be desirable and effective in small systems.

On the other hand, the benefits of a vertically integrated entity can be significant in terms of potential economies of coordinating the incentives for investments across the monopoly networks and potentially competitive segments (Brenan, 1995). The choice between vertical integration and unbundling is between the economies of coordination and scope on the one hand with possible increases in transactions costs and the potential efficiency gains from competition and increased efficiency across small systems on the other (Klass and Salinger, 1995). The absence of mature, well developed networks and regulation combined with high investment requirements in networks can severely limit the gains from unbundling in small systems. From a social welfare perspective, the efficiency gains from competition (productive and allocative) in conjunction with the distributional equity concerns needs to be carefully weighted against the potential gains from economies of vertical integration in small systems.

[2] The geographical location can also prevent the possibilities of interconnection with other power grids as in island-based small electricity systems or a land-locked mountainous country like Nepal where connection to Chinese grid due to difficult geographical terrains is not possible. Thus, India remains the monopsony buyer of Nepalese electricity.

However, lessons from Chile and Argentina portray that careful regulation is essential under any electricity industry structure (i.e. vertically integrated or unbundled). Unbundling may imply fewer activities to be regulated but makes the system overtly sensitive towards regulatory efficacy while the costs of regulation in a vertically integrated small system can be significant compared to the benefits making effective regulation impossible (Kessides, 2004). The implementation of regulatory process is also difficult and costly because of information asymmetries (Joskow, 1991). Many developing countries reforming their small power systems also lack the necessary experience and skilled human resources limiting the scope and potential effectiveness of the electricity regulatory agencies (Pollitt and Stern, 2010).

Further, a resistant political and administrative culture under unstable political environment implies that effective regulation under insufficient institutional arrangements is difficult to achieve in naturally monopolistic small systems. The small electricity systems in Nepal and other South Asian countries are inefficient and suffer from institutionalized corruption and persistent rent seeking behaviour together with poor economic governance of the power sector (Smith, 2004).

3. Major Reforms Initiatives in the Nepalese power sector

Reforms in the Nepalese energy sector are primarily driven by motives to enhance the social welfare by efficient management of the available scarce resources. A large unused capacity and increasing demand imply that the economic logic behind the electricity reform measures in Nepal as with other power systems is to exploit the benefits from economies of scale. Whether the practice is in line with theory is discussed under Section 4. Nonetheless, a sequence of major electricity reforms initiatives was mooted after the creation of NEA by merging the Electricity Department, Electricity Boards and Nepal Electricity Corporation in 1985 in accordance with the provisions of NEA Act of 1984 (Thakur, 2002). The establishment of NEA eventually paved the way towards creating a legal framework and corporatization of the power sector through the formulation of the hydropower development policy of 1992 and enforced by the Water Resources Act and the Electricity Act with amendments made to the NEA Act of 1984 (ADB,1999). They are discussed as below:

i) The objective of the *Hydropower Development Policy of 1992* was to promote and facilitate hydropower development allowing for state, joint sector (public-private) and private sector development of hydroelectricity projects through licensees. The policy emphasized on intensifying electrification through small hydro plants and mass capacity installation with the necessity to extend proper distribution system in the rural areas. The importance of foreign investment in the hydropower sector was recognised by allowing foreign investors 100% capital investments. The implementation of the act

meant the need for an appropriate legal framework supported by more acts (NEA, 2010):

- The *Water Resources Act of 1992* provides appropriate legal arrangements for rational utilization, conservation, management and development of the water resources (surface and underground water) in Nepal.
- The objective of the *Foreign Investment and Technology Transfer Act 1992* was to promote and facilitate economy-wide foreign investment and technology transfer by making optimum use of natural and human resources in the transition towards industrialisation.
- The *Electricity Act 1992* was primarily promulgated to promote private participation in hydro power development. It provides for exemption of licences for any individual or corporate body undertaking generation, transmission and distribution up to 1000 KW capacity. Obtaining a licence was obligatory for any capacity above 1 MW in the electricity industry but monopoly was retained in the licensee distribution services areas (geographic monopoly) with third-party entry possible under conditions of unsatisfactory performance of the licensee. The Electricity and Tariff Fixation Commission (ETFC)[3] was established and NEA was made a licensee. The ETFC consisted of at least five persons among them representative of the Government, an economist and those involved in the generation, transmission and distribution of electricity and supply. NEA was required to act as a single-buyer via bulk-buying of power from generators at a purchase price sufficient to cover total investments in approximately 25 years after accounting for depreciation costs. The licensee was also allowed to export electricity subject to the payment of the export duty.
- The notion of fair and competitive industrial arrangements meant the formulation of the Industrial Enterprises Act 1992 with a view to create a congenial, straight-forward and encouraging industrial investment environment.

ii) The *Hydropower Policy of 1992* was revised in 2001 as the *Water Resource Development Policy* with a major objective of capacity expansion by attracting more investments. The policy also led to certain institutional arrangements in particular by inducting the ETFC to the regulatory body. Today, the enterprise level restricting at NEA means that the electricity industry as a whole runs under five core business groups for generation, electricity transmission and system operation, distribution, electrification and engineering services. The major objectives of the *Water Resource Development Policy* are to develop hydropower resources at economically efficient costs, to harmonise electrification with economic activities and to develop hydropower for export.

[3] The newly formed government in March, 2011 declared that ETFC will be dissolved. This is another example of policy discontinuity with changes in political leadership.

iii) *The Community Electricity Distribution Byelaws* 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 through the distribution institution, etc. The community electrification concept was introduced and regulation was passed for rural electrification. Alongside, the community shall also be responsible for distribution and sales of electric energy.

Hence, the reform objectives as reflected from various electricity reform measures as discussed above have primarily been the following:

- to attract foreign and domestic private investment
- to promote efficiency, fairness and economic principles in managing the sector thereby reducing the dependence on state support
- to rationalise and institutionalise sector activities through appropriate measures for the overall development of the sector
- to strengthen quality of supply at an affordable cost to consumers while allowing utilities to sufficiently recover their costs.

However, the political instability in Nepal has disrupted the gradual implementation of these policies and the objectives are still far from being achieved (NEA, 2010). During the 1990s, several South Asian countries including Nepal experienced political instability which directly affected the traditional state-owned utilities under political control. Persistent political instability, infighting and power struggles, corruption, inadequate social and economic benefits and weak governance in Nepal contributed to a loss of confidence in government and the political system as a whole since the restoration of democracy in 1991 (ADB, 2004). Due to violent insurgency, urgent issues such as poverty, utilities reform and rule of law can take a backseat and remain unaddressed. Political instability and changing priorities of different governments have resulted in 'almost-ready' decisions being repeatedly rehashed in the Nepalese power sector (Krishnan, 2007).

Political instability has also opened up new opportunities for unfair rent seeking and corruption in the form of licensing and approving unfeasible projects, signing of loss making power purchase agreements with the private sector and undertaking socially unfair activities at the cost of state utility for electoral and political purposes. Persistent political instability can also place practical constraints on timeframe for undertaking any reform 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). For instance, the 2004 election in Sri Lanka elected new members of Parliament who opposed the restructuring and privatisation of the power sector and thus halting reforms. Likewise, the state of Haryana in India missed reform milestones after a change of government in 1999 with similar trends observed in Bangladesh and Nepal. The most distinctive aspect in India has been the struggle to

achieve a framework that protects the sector from political instability and political influence (Sen and Jamasb, 2010). Overall, political instability has largely translated into short-term opportunism and corruption by the political elite in Nepal at the cost of long-term objectives of the sector leading to poor and unsustainable performance of the electricity sector.

The reform matrix in Table 1 below shows that major electricity reforms in a state owned and controlled system is only possible and sustainable under a politically stable environment given long term political objectives while complicated and lengthy reforms are not likely to work at times of political instability.

	Political Environment		
		Stable	*Unstable*
Political Objectives	*Temporary*	Quick short-term fixing	Rent seeking, opportunism and milk-skimming
	Long-term	Major sustainable reforms possible to undertake	Any reforms highly unlikely to be successful

Table 1: Reforms matrix
Source: Adapted from Bhattacharya (2007)

4. Two Decades of Power Sector Reforms

In this section, we analysed the performance of the Nepalese power sector by studying the economic, operational and environmental aspects of electricity sector bearing tremendous consequences to social welfare impacts[4]. The reform outcomes discussed below will provide a basis to gauge the success of the power sector reform program over the 20 years of reform.

a) Prices: Electricity prices in Nepal have been historically too low to cover the costs and the prices have not changed since the last decade. The power prices are not based on economic principles but rather on vested interests and political motives. Electricity is supplied to customers at highly subsidized rates creating distortions in demand. For example, the charge of per KWh of electricity supplied to a community wholesale consumer is 3.5 Nepalese Rupees[5] (NRs) while a small industry pays NRs. 6.60 per KWh of electricity consumed. Thus, the residential demand for electricity has escalated over

[4] Similar criteria to explore the success of power sector reforms can be found in Pollitt (2004, 2008); Nepal and Jamasb (2011).
[5] One Nepalese rupee is on average equivalent to about 1.35 Dollar cents (United States).

time as the population growth averages to around 2% since 1990. The NEA has a revenue rate of NRs 6.71 per KWh of electricity against the cost price (including transmission and distribution charges) of NRs. 9.05 per KWh of electricity. The under-pricing of electricity after accounting for a miscellaneous NRs. 0.43 KWh of income per KWh of electricity imply that NEA suffered a loss of NRs. 1.91 per KWh of electricity in 2009 (NEA, 2009). The price-cost gap has exacerbated the financial health of NEA with an overwhelming loss of NRs. 4681 million in 2009 (NEA, 2009). NEA also maintains a discriminatory power purchase agreements (PPA) policy among domestic and Indian companies. The Nepalese IPP's are paid NRs. 6.5 per KWh of electricity while the Indian IPP's are paid NRs. 10.72 per KWh.

Figure 1 shows that the residential sector with a market share of 95.5% of the total electricity consumers accounted for 42% of overall revenue collection of NEA while the industrial consumers with just 1.7% of total consumers stood for 35% towards NEA's total revenue in 2008/09 (NEA, 2009).

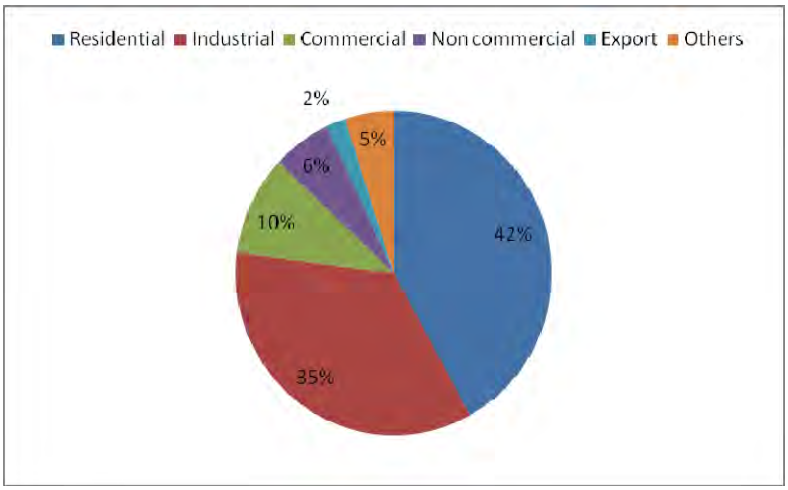

Figure 1: Revenue collection by consumer types
Source: NEA (2009)

b) Investments: Lack of investment in the generation segment implies that Nepal has only been able to currently utilize about 1.7% of its technically and economically viable hydro-electric potential capacity. A fundamental reason for under-investment is low power tariffs which are not sufficient to support the system-cost and capacity expansion. The domination of hydro plants implies that renewable energy forms the main source of power production in Nepal with thermal sources (especially diesel generation) contributing marginally. Nepal also solely imports 1.2 million tonnes of petroleum products from India as the country is devoid of any refining capacity[6] (NOC, 2010). Higher prices of petroleum products coupled with vulnerability in petroleum supplies have reduced the scope of adding capacity based on diesel sources. Coal

[6] The demand for petroleum products is set to increase by 20% on an annual basis.

imports have gone up due to liberal imports policy through license waiver on imports (Pokharel, 2007). However, this policy has had limited effect on thermal capacity additions as no significant new thermal capacity addition was added after 2000 as shown in Figure 2.

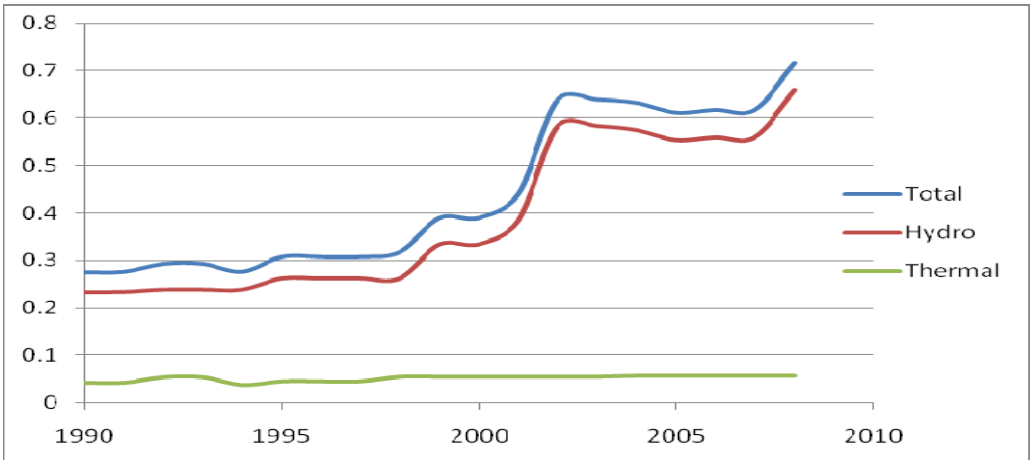

Fig 2: Total installed capacity by type (GW)
Source: Own compilation

Figure 2 shows that hydroelectricity (both NEA owned and IPP owned) is the major source of electricity generation in Nepal. The investments in hydro capacity accelerated post 2001 after the establishment of the Independent Power Producers' Association of Nepal (IPPAN) and slowed down after 2003 primarily due to widespread insecurity as the Maoist war intensified. The termination of war after 2007 again increased investments in generation. The capacity shortage in generation was apparent when demand for electricity surpassed 970 MW given an installed capacity of about 700 MW creating a severe power shortage in 2009. The peak demand is expected to reach 1700 MW by 2015 with additional capacity expansion of 170 MW by 2012 to be achieved (NEA, 2010). The projects to be completed include Chameliaya Hydroelectric project (30 MW), Khulekhani-III hydro project (14 MW), Trishuli 3-A project (60 MW), Rahughat hydro project (30 MW) and Upper Modi (40 MW).

c) Technical Network Energy Losses: Quality of power supply has been historically poor in Nepal and the inefficiency shows no signs of improvement. The power sector in Nepal has been plagued by high technical and non-technical losses over the years. The technical losses on average stand at above 20%. In 1979/80, overall electricity losses accounted for 31% of total power generation and increased to 35.7% in 1983/84 (Sharma, 1988). Figure 3 shows that since 1990 distribution losses have averaged around 20% of total power production. The losses reached a record level of 24% in 1997 and have decreased since then. The fluctuating level of losses over the years implies that power losses vary with the total amount of power supplied to the grid.

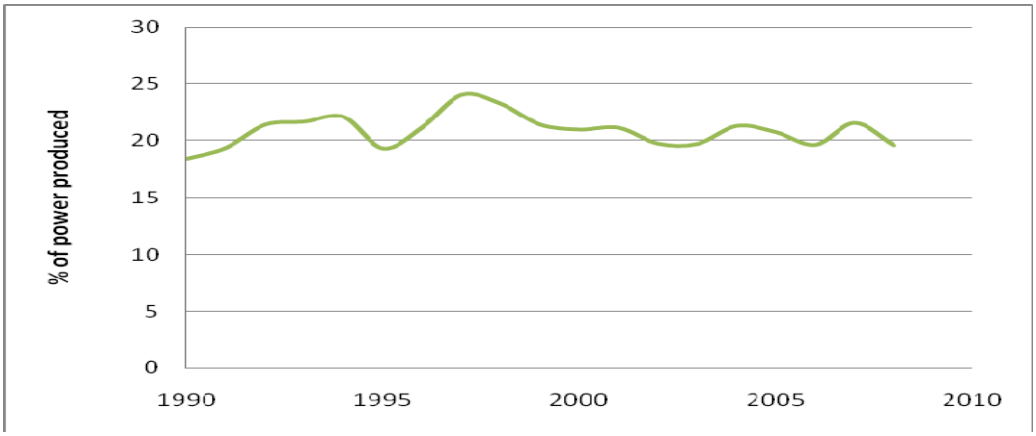

Fig 3: Electricity Distribution losses 1990-2008
Source: Own compilation

The high level of technical losses in distribution can be attributed to old grids that need to be maintained and upgraded and are in need of investments. The high technical losses also imply that system reliability is low with frequent unplanned power outages. Grid expansion has also been slow in Nepal while lack of transmission and distribution facilities is a major bottleneck for generation capacity expansion in the country. The politically determined low prices have barred the sector from generating adequate revenue to finance additional network expansion. The country currently has 1,980 km transmission lines and among the major transmission lines under construction are the Marshyangdi-Kathmandu 220 KV line (85 km), Khimti-Dhalkebar 220 KV line (75 km) and Tamakoshi-Kathmandu 220 KV line (80 km). The insufficient transmission capacity led to 28 system collapses throughout 2010 due to congestion (NEA, 2010). There are currently 34 Distribution Centres in Nepal and 37 Branch Offices of NEA spread over 49 out of 75 districts in Nepal.

d) Quality of Supply (non-technical losses): Electricity theft in particular is a serious problem across poor residential areas in South Asia where consumers do not have the ability and willingness to pay for electricity connection and energy usage. For instance, the per capita income of Nepal in 2010 was 211 US dollars while 42% of the total population are living under the poverty line as compared to Bhutan and Bangladesh. As a result, the T&D losses in 2000 across the South Asian region reached 27.5% from 25.2% in 1980 (World Bank, 2003). For instance, in 1998 the army in Pakistan found 10,093 instances of power theft and recovered 2.4 billion Pakistani Rupees in fines and penalties (Rizvi, 2000). Smith (2004) estimated that electricity theft in Bangladesh amounted to 14% of the total 35% T&D losses in 2003.

Non-technical losses in the form of electricity theft are a grave issue in many developing countries including Nepal. Lost earnings from power theft result in lack of profits and a need to expand generating capacity to offset the impact of power losses under

investments crunch. Generally, a system with 16% or more transmission and distribution losses (T&D) is plagued with extensive electricity theft (Smith, 2004). Figure 3 show that the distribution losses alone in Nepal have surpassed the 16% criterion indicating a serious problem of power theft. To some extent, the bourgeoning financial loss of NEA discussed above can be attributed to the high levels of electricity theft in the country resulting in lost earnings.

e) Rural Electrification: Rural electrification remains one of the major energy policy goals in Nepal as in other South Asian countries. Table 2 shows the electrification rates in 6 SAARC countries in 2008. Sri Lanka has been relatively successful in catering electricity to the rural sector which has translated into an overall high score in Human Development Index (HDI). Similar results can be inferred for other countries concerning electrification rate and overall level of human development. Electricity access and consumption is crucial towards human development in slow developing countries (Pasternak, 2000). Thus, the low levels of electrification status in Nepal also imply a low level of human development in the country.

Country	Electrification rate (%)			Population without electricity (millions)	Energy Development Index[7] (EDI)	Human Development Index (HDI)[8]
	National	Urban	Rural			
Afghanistan	15.6	22	12	23.8	na	0.349
Bangladesh	41	76	28	95.7	0.169	0.469
India	66.5	93.1	52.5	403.7	0.272	0.519
Nepal	43.6	89.7	34	16.5	0.107	0.107
Pakistan	62.4	78	46	68.4	0.281	0.281
Sri Lanka	76.6	85.8	75	4.7	0.277	0.658

Table 2: Electrification status in 2009
Source: International Energy Agency (IEA)

The rate of electrification rate increased from around 30% in 2005 to 43.6% in 2008 (IEA, 2008). However, the larger benefits of increased electricity access rate in Nepal are confined to the urban population across South Asia including Nepal.

Factors such as finance, governance, industrial organisation and policies can account for varying pace of electrification across much of the under-developed countries (Eberhard, 2004). The absence of proper electricity distribution infrastructures has also delayed

[7] EDI is devised as an index to better understand the role that energy plays in human development. The components are per capita commercial energy consumption, per capita residential sector electricity consumption; share of modern fuels in total residential sector, and share of population without access to electricity (IEA, 2009).
[8] HDI measures the strength of human capital in a country based on a comprehensive set of different categories.

the process of rural electrification in the country. The difficult geographical terrain and lack of incentives (such as low power prices) mean that the private sector is not willing to undertake the costly grid expansion in the country. Absence of rural electrification also implies an increasing pressure on forests (i.e. the natural source of carbon storage) for fuel woods. Fuel woods remain the dominant form of traditional and non-commercial energy source in Nepal[9]. In 2005, 78% of energy consumption was met through fuel woods while the residential sector consumed 90% share of overall energy consumption in the country (Bhandari and Stadler, 2011).

f) Imports: Electricity trade is a vital component of Nepalese economic growth plans. Being unable to utilize its own hydroelectricity potential, Nepal is engaged in power trade with India which has mostly involved imports. The dominant share of hydro power in generation and a poor energy capacity mix means that the sector is prone to shortage during drought seasons. Hence, NEA is obliged to import electricity from India at a price much higher than paid to the domestic producers to satiate the increasing domestic electricity demand. Figure 4 shows that, overall, Nepal is a net importer of electricity. Electricity imports peaked in 1999 which had a positive effect on economic growth and boosting industrial production due to the availability of electricity. Likewise, Nepal was a net exporter of electricity in 2003 which also had a positive effect on economic growth.

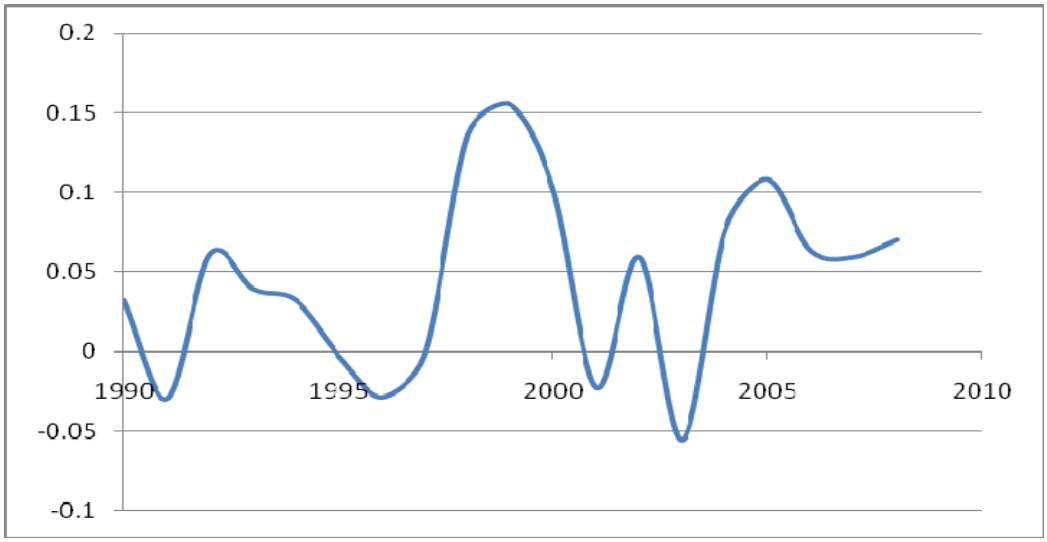

Fig 4: Net Electricity Imports in Billion Kilowatt hours (BKWh)
Source: Energy Information Administration (EIA)

[9] One reason for low EDI of Nepal is that energy consumption from fuel-woods is not included in such calculation.

However, in recent times the increasing reliance on imported electricity from India has highlighted the security of supply risks. The Nepal-India Power trade consist of 100-150 MW with Nepal on the net importing side. In the future, the potential benefits from electricity trade to Nepal can be large as the fast growing and energy hungry India has decided to import a minimum of 10,000 MW by 2020 from South Asian countries.

g) Energy Intensity: The energy use per unit of GDP is increasing in Nepal after 1990. The increase in energy consumption is due to an expansion in residential and industrial customer base. Figure 5 shows that although population growth rate has slowed down over the years; increasing trend in energy intensity is spurred by an increase in overall GDP growth rate. The fall in GDP growth rate is also marked by a fall in increasing intensity for respective years emphasizing the critical role of energy consumption in economic growth.

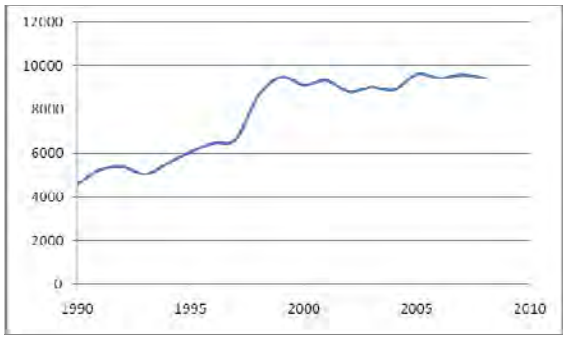

Fig 5(a): Energy Intensity (2005 USD) Source: EIA

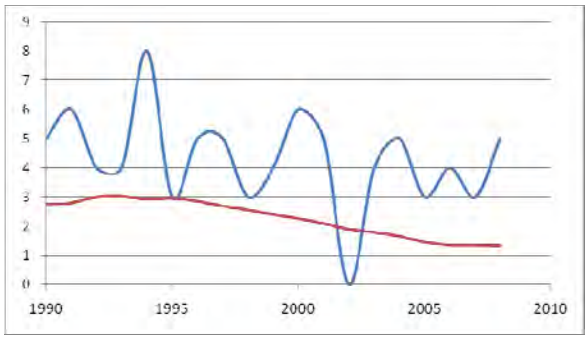

Fig 5(b): GDP and Population Growth rate (%) Source: EIA

In recent times the GDP growth and energy intensity is not symmetrical due to insufficient energy available in the country. On the other hand, the absence of any appropriate demand-side management (DSM) policies means that available energy is not used efficiently.

Thus, the empirical evidence of power sector performance has starkly defied the logic of power sector reforms in Nepal. The performance of the Nepalese power sector after 20 years of reform resembles the conventional problems of a monopolistic public utility suffering from chronic underinvestment and insufficient capitalization, politically determined low and distorted tariffs coupled with poor operational and financial performance as reflected in various studies (see Munasinghe, 1992; Schram, 1993; Jamasb et al., 2004). Thus, the current performance of the sector has belied the theory behind reforms. A low political commitment to reforms coupled with weak implementation of necessary measures due to political instability explains the widening gap between theory and practice behind electricity sector reforms in Nepal.

Table 3 outlines the status of power sector reform in Nepal which suggests that the electricity reform model has been fairly simple over the years. The Nepalese electricity model vastly coincides with reform models in other South Asian countries like Bangladesh, India, Pakistan, and Sri Lanka (Bhattacharya, 2007).

	IPP introduction	Independent regulation	Reform enacted	Structure of the market	Generation ownership	Networks ownership (transmission / distribution)
Sector Status	1992	1994	No	Vertically integrated, Functional unbundling introduced	Dominant state ownership	Completely state-owned

Table 3: Power sector reform status in Nepal
Source: Nepal Electricity Authority (2010)

5. Reform Options

The state-owned and politicised power sector reform in developing countries with small power system has been a difficult and complicated process (Williams and Ghanadan, 2006). Chile and Argentina pursued the deepest and most radical reforms while electricity reforms in Brazil were more cautious and gradual with almost a textbook approach (Dutta and Menzes, 2005). Mexico, on the other hand largely maintains the vertical integration in the power sector while allowing private generators to participate in new capacity additions as in the Nepalese context (Rossellon and Halpern, 2001).

Lessons from Brazilian electricity reforms suggest that the creation of a truly competitive market can be difficult when almost 90% of the electricity is hydropower as in Nepal (Schaeffer and Salem Szklo, 2001). This is because hydropower technology often implies production conditions characterised by large economies of scale and therefore a regime close to that of a natural monopoly (Gabriele, 2004). The dependence on hydropower also means a vulnerable supply and frequent blackouts during drought years with added problems of political instability as experienced in the modern day Nepal. The section below discusses some electricity reform options based on the issues in the Nepalese context which can be of general relevance to other small power systems.

5.1 Adjusting electricity prices and subsidies

In competitive electricity markets, prices convey the correct signals and carry appropriate informational efficiency as they reflect the actual cost of providing the service as well as the long-run marginal cost of new capacity irrespective of the political environment. Economic theory also suggests that cost-reflective prices is desirable as it leads to net social welfare gains although assessing the distributional impacts of tariff adjustment is a complicated task (Chang, 1997). However, the electricity prices in Nepal are below the cost level in order to maintain social peace as the government controls the price. The inability of the sector to finance the system on its own due to underinvestment and the growing losses of NEA indicate that adjusting electricity prices towards supply costs is necessary in a small system which is in a transition to becoming large. A two part tariff design where a fixed payment is added to the system marginal income (such as capacity payments) can ensure the sustainability of the system as widely practised in most Latin American countries. Cost reflective prices can also eliminate the system's deficit financed by the whole population and free up resources which can be used to improve access in poor and rural areas via electrification (Jamasb, 2006).

However, a tariff increase also means debasing the economic welfare of the already poor population in the country and hence is politically sensitive. Experience from Peru suggests that carefully designed targeted subsidies that address the undesirable social impacts and while limiting the impact of price distortions can reduce the overall impact of price increases (Revolo, 2009). The reform experience is Chile also shows that a competitive allocation of government direct capital subsidy to private electricity distribution companies to cover some portion of the investment costs has been very successful in intensifying rural electrification whereby the state, private investors and all users contribute to funding rural electrification (Jadresic, 2000). Rural electrification rate in Chile is over 90% (Millan, 2007). Utility subsidies have often poorly been targeted in South Asia and have failed to reach the poor as shown by the Indian experience where only a quarter of one billion dollar subsidies for water services reached the poor households (Foster et al., 2000). However, the use of targeted capital subsidies practice in Chile and Peru suggest that it is possible to strike a balance between economic efficiency and social equity across the developing world.

5.2 *Restructuring the electricity sector*

NEA currently remains a vertically integrated utility responsible for the generation, transmission and distribution of electricity in the country. Functional unbundling has been introduced as a mechanism to facilitate internal unbundling dividing NEA into 3 segments: generation; transmission and substation; and distribution and consumer services. While functional unbundling exists on paper, it is necessary to have an accounting separation of the potentially competitive segments and the monopoly

segments. Accounting separation can improve much needed transparency and accountability in operation of the sector to attract foreign investors as well as prevent domestic corruption.

Slow and non-transparent decision making process is one of the key areas of concern in the sector (Krishnan, 2007). However, an outright separation of the network in ownership terms in the interim period is not desirable in the absence of any effective regulatory framework while the size and density of the market is small. Given the political instability, delegating decision making authority to the appropriate lowest levels of the government can facilitate timely action in a state owned vertically integrated entity like NEA.

Although the generation segment is open to private investors, barriers to entry still exist in terms of discriminatory network access to independent power producers. NEA as a single buyer tends to favour its own generation thus distorting competition and discourages new entry in generation. Non-integrated private firms are thus unable to compete for consumers in the market. Eliminating entry barriers in terms of non-discriminatory network access can spur private generation to meet the growing electricity demand. Though NEA can remain vertically integrated in the short-run while clear rules for access to networks and appropriate charges should be set in the form of regulated third-party access (rTPA) against negotiated third-party-access (nTPA) to avoid disputes, uncertainty, and corruption. Further, an independent system operator (ISO) can be created with time to take charge of dispatch and grid operation under clearly defined rules for access to the grid.

in the long run, as the systems grows larger unbundling of NEA can be pursued firstly by commercializing NEA's generation, transmission, distribution and support segments followed by privatization of each of these entities in the presence of an effective regulatory body. Lessons from Chile suggest that there is a need to separate generation from both transmission and distribution to avoid hold up problems for other generators in larger electricity systems (Pollitt, 2004). Argentina learnt lessons from Chile and pursued vertical separation and creating a competitive market allowing customers to switch suppliers while no hold-up problems exist in generation (Millan, 2007). However, the relative merits of vertical separation can vary across different systems and should be judged cautiously in every case (Pittman, 2003).

5.3 Need to involve the private sector

Economic theory suggests that privately owned electricity sector is more efficient than the state owned ones primarily due to their profit motives (Baumol, 1996). However, the empirical evidence on the merits of privatization in the context of electricity reforms are inconclusive (Mota, 2004; Jamasb et al. 2004). Hence, a viable option to mitigate the effects of increasing political volatility in the Nepalese power sector from increasing

political volatility would be to completely or partially privatize the sector. The bureaucratic influence in power sector decision makings will be minimized with increasing private ownership. Private ownership coupled with competition and effective regulation of the transmission and distribution networks can result in cost efficiency, reduced technical and non-technical losses, competitive prices and enhanced revenue collection (Newberry, 2002). Privatisation of existing assets will also raise revenue for the cash-strapped government with large foreign debts. However, the limited experience of the Nepal with the privatisation process may require the assistance of international agencies such as World Bank or international Monetary Fund (IMF) to monitor the process as experienced in the electricity reform context in Cameroon (Pineau, 2002).

At present, private participation in the Nepalese power sector is only possible as an independent power producer which gathered pace after the establishment of IPPAN. 26% of the total electricity was served by the private sector in 2010 (NEA, 2010). However, the inability of NEA, to strike a favourable PPA with the IPPs due to political resistance to increase end user tariffs in 2011 imply that 1700 MW of hydroelectricity construction projects is being stalled (IPPAN, 2011). Thus, it is necessary that NEA buys power from the private sector at full cost with a fair financial return while raising the end user electricity tariffs to meet the escalating electricity demand in the country. In the short run, private participation through IPPS needs to be bolstered with appropriate incentives for the private sector to participate in electricity generation. Given that both foreign and domestic investors are risk-averse, only a high risk premium can coax the private sector to undertake major investment decisions in the electricity sector operating under political instability. This is because political instability adds a risk premium to foreign and domestic mode of finance. A high risk premium will also necessitate an increase in the low existing end consumer's tariffs across the small systems.

Electricity reform lessons from Nicaragua suggest that assessing appropriate risks and designing suitable risk premium forms an integral reform component to lure private sector investments to the energy sector (Mostert, 2007). However, the transition towards larger power system in the long run can allow the privatisation of the individual segments. The hydroelectricity dominated Norwegian electricity sector reform experience illustrates that privatization is not a pre-requisite and can wait until the structure, regulation and ownership of the distribution is clear (Jamasb, 2006). Meanwhile, the Chilean experience also suggest that total privatizations in the electric sector can be carried out according to the country's framework of economic and social development based on market principles and the subsidiarity of the state (Morande and Raineri, 1997).

Moreover, privatisation in the Latin American countries (LAC) proceeded quite fast as the LAC contributed to about 40% of the total value of energy privatizations in the world during the 1990s (Gabriele, 2004). The experience of Chile and Argentina though

suggests that large scale privatization, if occurred under a robust institutional framework, can be beneficial in terms of enhancing sectoral efficiency. The strong legal protection and observance of private property rights as a legacy from the military rule of the past with appropriate regulatory framework as in Chile can deliver benefits in a politically unstable country with small or medium electricity system (Estache et al., 2000).

5.4 Independent and effective regulation

Lessons from the Asian financial crisis underscore the need for a properly designed and managed regulatory system with independent regulatory agency when economic regulation of prices is based on a contract regulation via PPAs between the IPPs and the incumbent (Stern, 2000). Furthermore, lessons from the Latin American utilities privatisation suggests the need to have a proper regulatory agency in place prior to moving ahead with any contractual arrangements (Gausch et al. 2006). Although independent regulation was theoretically introduced in 1994 with the establishment of ETFC; the commission cannot be considered to be independent given the political nature and terms of regulatory appointment, public source of funding of the regulatory body and low participation of the politically unaffiliated regulators in designing regulatory content such as tariff methodology (Stern, 1997). A single-buyer model such as NEA requires stringent regulatory requirements for its efficient operation and investment as the problems can be serious for state-owned single buyer companies operating in countries with imperfect markets and governance with wide-scale corruption (Stern, 2000). There is no explicit regulation on anything else besides the generation prices in the Nepalese electricity sector while there are no regulatory procedures for handling major macroeconomic shocks.

The dominant position of the Ministry of Energy with its twin role as owner and decision maker in all spheres of the power sector implies that electricity sector regulation is not independent from vested political interests and thus making the whole regulatory process ineffective in Nepal. As a result, decision making suffers from political influence and instability often lengthening and delaying the decision making process (Krishnan, 2007). An effective regulatory commission as the guardian of public interests should balance and protect interests and welfare of all stakeholders thereby creating a level playing field for all stakeholders in undertaking major investment decisions.

An independent regulatory body requires adequate staff with particular and specialist skills comprising economists, lawyers, accountants, financial analysis and engineers to make regulation effective. By doing so, the institutional continuity of the regulatory system will depend upon the regulatory staff and not on the ruling span of the political party. Hence, there is a need to establish an effective independent electricity regulatory body in the country for electricity reforms to work effectively. Lessons from Chile and

Argentina also show that government ministers should not be involved in approving or implementing regulatory decisions and should be properly delegated to an independent regulatory agency like CNE for Chile and ENRE for Argentina (Pollitt, 2008). However, the existing constraints on skilled human resources in Nepal imply that appropriate training of the staff of the new regulatory bodies and agencies is required to overcome any incompetency and inefficiency in the regulatory process.

Nonetheless, the expansion of the system in the long run together with the unbundling and privatisation of sector may necessitate sophisticated regulatory arrangements of the monopolistic transmission and distribution networks in the form of incentive regulation for the overall sustainability of the system. However, it is recommended to have a cautious and planned restructuring of the sector in a first place as effective regulation is a complex and difficult task facing any energy regulators.

5.5 *Sequencing of reform measures*

While the sequence of electricity reforms should be consistent with the needs and specific characteristics of the sector such as resource availability and institutional endowments; there seem to be some consensus with regard to the sequence of the main reform steps as a part of a good reform design. According to the generic reform model suggested by Bacon (1999), the key elements of reforms sequence are: i) effective regulation and an independent regulatory body with proper electricity law, ii) restructuring which first involves separating and regulating distribution networks followed by the separation and regulation of the transmission networks and finally creating a wholesale market by horizontally splitting the segment and iii) privatizing generation, transmission and distribution segments. Most LACs including Chile and Argentina have generally followed the model suggested above although in Brazil some privatization followed suit before the establishment of the regulator.

The Nepalese power sector requires an effective independent regulatory body from the outset while unbundling can be deferred to a later date depending upon the future size of the system. The presence of sound regulation can thus facilitate private participation in the sector as a mechanism to protect the sector from political volatility and also increasing power production to meet demand by employing private capital. The reform experience of the transition economies comprising countries from Southern and Central Europe and the Former Soviet Union also suggest the presence of mass corruption due to ill-guided large scale privatisation in the absence of an effective regulatory body (EBRD, 2001). Consequently, establishing a strong electricity regulatory commission is more urgent than unbundling NEA in the present context.

6. Conclusions and Lessons Learnt

It is evident that reforming small electricity systems like NEA and other low income countries across the globe is a complicated issue especially under the twin conditions of growing political instability and rapidly increasing electricity demand. While the conditions and institutional arrangements vary across small systems; it is necessary that need-based reforms relying on individual country's ability and resources receive foremost priority. In that sense, electricity reforms can be simpler to implement rather than being carried away by complex and sophisticated reforms attempted elsewhere which does not address the local conditions. A cautious and gradual reform process based on a piece-meal approach with constant self-adaptation through error corrections as in the Brazilian context is more suitable for many small systems.

As such, electricity reforms across the small systems can be two-staged. In the short and medium term, focus should be towards tariff and subsidies restructuring and creating an effective independent regulatory body. The regulatory authorities should design a framework which includes clear regulatory objectives coupled with designing the regulatory mechanism and implementing contracts and property rights for ownership purposes. IPPs entry should be facilitated and encouraged by minimizing unnecessary market and non-market barriers while providing appropriate entrepreneual incentives. The role of the state should be limited and be based on the principle of subsidiarity prioritising economic logics before vested interests and personal gains as learned from the electricity reforms in Chile.

As the system grows larger in the long run, focus can be towards complete vertical separation of the networks and privatisation of them while creating a wholesale market by horizontally splitting the generation segment. Moreover, accounting separation of the segments is encouraged in the short term in order to promote transparency and accountability. It can thus be inferred that in small systems like Nepal involving the private sector under proper regulatory body and raising electricity tariffs could lead the sector towards recovery and self-sustainability.

Electricity sector reforms in advanced industrial societies like UK and Norway also suggest that resources should be driven towards building institutional capacity and economic governance. This will promote transparency and limit the practice of theft and corruption in the sector while also making the system resistant to frequent political shocks. Likewise it is vital that electricity reforms in small systems should primarily be based upon a thorough assessment of economic costs and benefits as an effective way to manage the scarce economic resources properly. Although the role of state is still crucial and important across small systems; it is necessary to redefine and revisit this role in the light of market-oriented reforms so as to insulate the sector from political instability and increasing electricity demand across small systems.

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