SET SUPPORTING ECONOMIC TRANSFORMATION

USING HYDROELECTRICITY TO POWER ECONOMIC TRANSFORMATION IN NEPAL

BRIEF

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ABBREVIATIONS

ADB	Asian Development Bank
DFID	Department for International Development
FDI	Foreign direct investment
GDP	Gross domestic product
GoN	Government of Nepal
GPFG	Government Pension Fund Global
ILO	International Labour Organization
IMF	International Monetary Fund
IPP	Independent power providers
ktoe	Tonnes of oil equivalent
MW	Megawatts
NEA	Nepal Electricity Authority
NIB	Nepal Investment Board
NR	Nepali rupees
NRB	Nepal Rastra Bank
PDA	Power development agreement
PDR	Lao People’s Democratic Republic
PPA	Power purchasing agreement
WECS	Water and Energy Commission Secretariat

KEY MESSAGES

- Hydropower can help Nepal decouple growth from rising carbon emissions and propel economic transformation.
- To do so will require creating agglomeration effects around hydropower development.
- Nepal should consider investing hydropower revenue to ensure that the country stays on a low-carbon economic growth pathway; to build the much needed transport infrastructure and power it with electricity; and to develop industries.
- There are important risks that could derail the benefits of hydropower development. These include financial volatility, corruption leading to further weakening of governance, and ineffective regulation.
- Universal coverage of transmission lines will be important for ensuring inclusive access to energy.

INTRODUCTION

Hydropower development is beginning to take off in Nepal. Improvements in investment policies, as well as the growing prospect of electricity trade with India and South Asia more broadly, have helped to attract increased investments. Nonetheless, at present electricity generated from hydropower meets only 1% of Nepal's total energy needs. The current total production capacity is about 665.11 megawatts (MW) per year, while economically feasible hydropower potential is estimated to be about 42,000-53,000 MW. The fact that hydropower meets only a minuscule part of total energy demand and production possibilities highlights the potential scale of both demand for and supply of hydroelectricity.

Translating potential into reality is the key challenge. Moreover, leveraging hydroenergy to power economic transformation in Nepal should receive priority. While the development of the hydropower sector is to be welcomed, policies on hydropower development exist in isolation, disconnected from the broader, national economic and social development agendas. It is important to see hydropower as a critical source of renewable energy to support the transformation of Nepal's economy.

Economic development has eluded Nepal because of a lack of meaningful economic transformation in which resources move from low to higher levels of productivity. There has been little improvement in agricultural structure and productivity, while the population has been growing, placing pressure on available farm-size. The industrial sector, which used to absorb surplus labour from the agricultural sector, has contracted. The services sector has been growing, but its capacity to absorb labour is low – partly because it demands skilled labour as opposed to merely surplus labour from the agricultural sector.

Overseas labour migration is providing a critical employment outlet and bringing in money to rural households to meet their consumption needs. Relying on overseas labour migration as a long-term employment strategy is risky, as the structure of the labour markets where Nepalis are employed and the demand for labour therein are evolving. Hence, generating productive employment opportunities in Nepal remains an important challenge. Without the growth of economic sectors that can absorb large amounts of labour, formal employment opportunities in Nepal will be limited to those who reside in urban areas and have some skills to offer.

Remittances are supporting growing urbanisation. This is a good trend as rural households relocate to access better education, health and lifestyles. However, the failure of policies and investments to keep pace with these changes is leading to pressures on the urban environment, infrastructure and services. At some point in recent history, urban development strategy was a part of the national development plan. However, such a policy focus seems to have disappeared, and with it the skills of urban planners.

Meeting these challenges will require resources. The hydropower sector could provide both the financial resources and the energy to bring about the much desired economic transformation in Nepal. But this will not happen automatically. Effective and responsive policies will be needed to manage the hydropower sector development, address problems and build strong, transformational linkages to the rest of the economy. In providing a brief overview of the issues, this paper aims to trigger a policy dialogue on the importance of connecting the hydropower and economic transformation agendas in Nepal.

The briefing paper is structured as follows. Section 2 highlights the constraints to economic transformation in Nepal. Section 3 looks at the hydropower production potential and revenue outlook. Section 4 discusses some of the critical issues that will influence the impact of the hydropower sector on economic development. Section 5 suggests how hydropower can support economic transformation in Nepal.

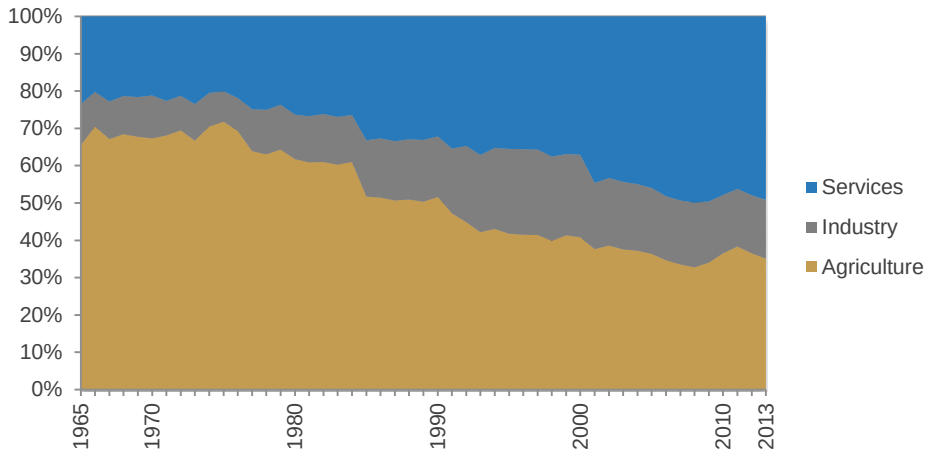
2. ECONOMIC TRANSFORMATION IN NEPAL

Energy shortage, weak transport infrastructure (including costly trade transit arrangements), and barriers for entrepreneurs are some of the key constraints to economic transformation in Nepal (Basnett and Pandey, 2014).

Structural economic transformation involves the movement of labour from low to higher productive activities. This can entail movement within a sector (for example from subsistence farming to high-value crops) or between sectors (for example from agriculture to manufacturing to services). The importance is in the returns labour accrues in terms of higher wages and the associated developmental benefits to the household, for example in health and education (McMillan and Rodrik, 2011). As such, structural economic transformation must be viewed in terms of productivity changes (within or between sectors).[1]

There have been structural shifts in Nepal's economy, but levels of productivity remain low and unchanged. Formerly dominated by agriculture, the economy has moved towards services. In the 1960s, agriculture accounted for around 68% of value added in gross domestic product (GDP); by 2013 the figure was 35%. The share of industry increased to around 20% in the 1990s but has since reduced to 16%. Services increased from 22% in the 1960s to 49% in 2013. Figure 1 shows the shift in Nepal's economy from agriculture to services based on the changing size of the economic sector.

Figure 1: Real value added by economic sector (percentage of GDP)



Note: Industry value added includes manufacturing value added. Source: World Bank, World Development Indicators (accessed October 2015).

The share of employment in each of the economic sectors has changed over time. Between 1991 and 2001, employment in agriculture fell from 81% to 66% of the total, and employment in industry increased from 3% to 13%. Between 1999 and 2001, employment in services increased from 15% to 20%. However, not all those who leave agriculture enter manufacturing or services; the majority leave the country to work elsewhere.

The development of the hydropower sector directly addresses the critical constraint to economic transformation – i.e. energy shortage. It also has the potential to decouple growth from rising carbon emissions through the use of renewable energy; to increase productive capacity; and to draw in foreign investment, expertise and technology. However, achieving such outcomes will require managing the risks, building strong linkages between the productive sector and hydropower, and ensuring that the benefits are broad based and inclusive.

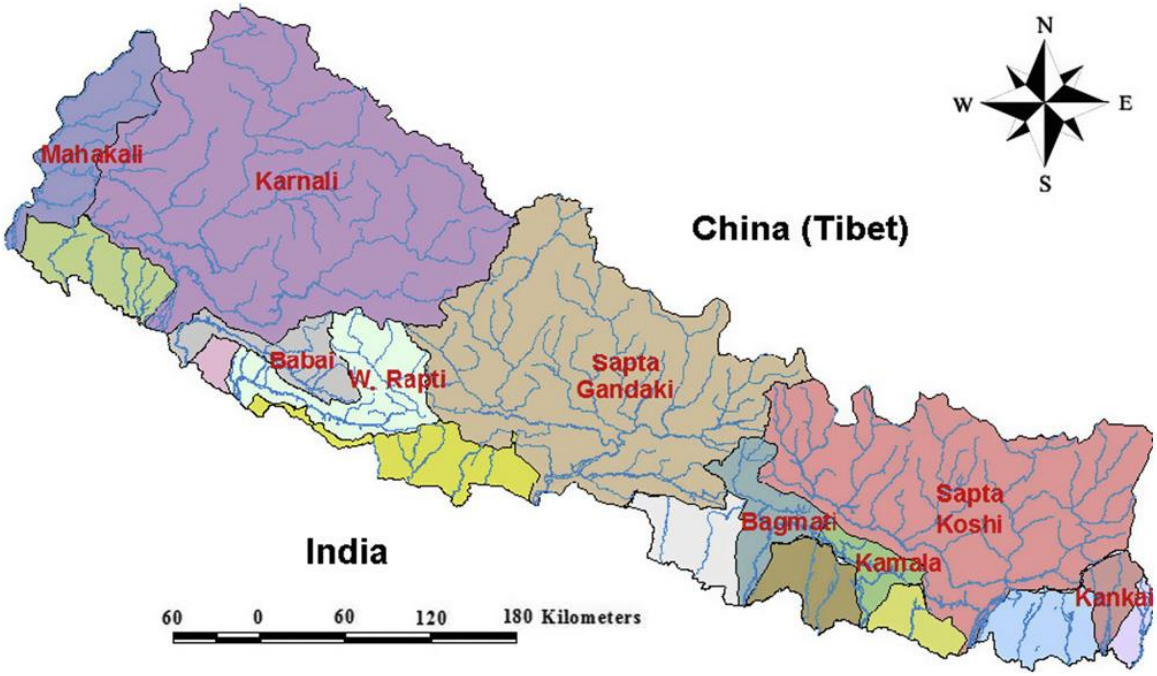
[1] Shifts in labour from one sector to another, or within a sector, cannot on their own be taken as structural economic transformation. The movement must be accompanied by increases in productivity. Caution must therefore be applied in assuming, without examining productivity changes, that a shift of labour, for instance from agriculture to services, results in structural economic transformation.

3. HYDROPOWER PRODUCTION POTENTIAL AND REVENUE OUTLOOK

The physical geography of Nepal makes it possible to meet energy demands with hydropower. The country's 6,000 rivers that are rain and/or snow fed. The country's topography adds to the river flows: the height above sea level changes from about 60 metres in the south to 8,848 metres in the north (at Mount Everest), within a distance of less than 200 kilometres (GoN, 1997).

Hydropower plants in Nepal use water running off rivers to generate electricity. The run-off from the country's rivers is 222 billion cubic meters per second and the annual mean stream flow from snow-fed major river systems alone is 4,930 m3/s (Sharma and Awal, 2013). Figure 2 shows the major river basin system in Nepal.

Figure 2: River basins of Nepal



Source: Sharma and Awal, 2013.

Estimates of hydropower potential in Nepal are wide-ranging (see Table 1). The most cited estimate of theoretical potential is 83,000 MW. More recent studies estimate it to be between 42,000 and 53,000 MW. The variation in estimates is because of different estimation techniques used, different data availability and differences between what is theoretically possible and what can be actually harnessed (Adhikari, 2006).

Table 1: Estimated hydropower potential in Nepal

Estimated hydropower potential	Source	Comment on quality
42,000-45,000 MW	Water and Energy Commission Secretariat (WECS), 2010	Report does not provide evidence for estimation.
53,836 MW	Jha, 2010	Uses more accurate hydrological, meteorological and topographical data and hydrological model than Shrestha (1966).
83,000 MW	Shrestha, 1966	PhD thesis. Data availability and resolution as well as estimation technique could affect the result (see Sharma and Awal, 2013).
200,000 MW	Pradhan, 2008	Author does not provide evidence for estimation.

Actual hydropower capacity (when a dam is actually producing electricity) varies substantially. For example, the 3.9 MW Trishuli hydroelectric power plants have a capacity factor of 68%, whereas the 5 MW Mailun Khola plant has a capacity factor of 87%; nationwide hydropower performance is about 59% (Sovacool et al., 2011). The actual capacity is influenced by natural, technical, financial and regulatory factors (Table 2).

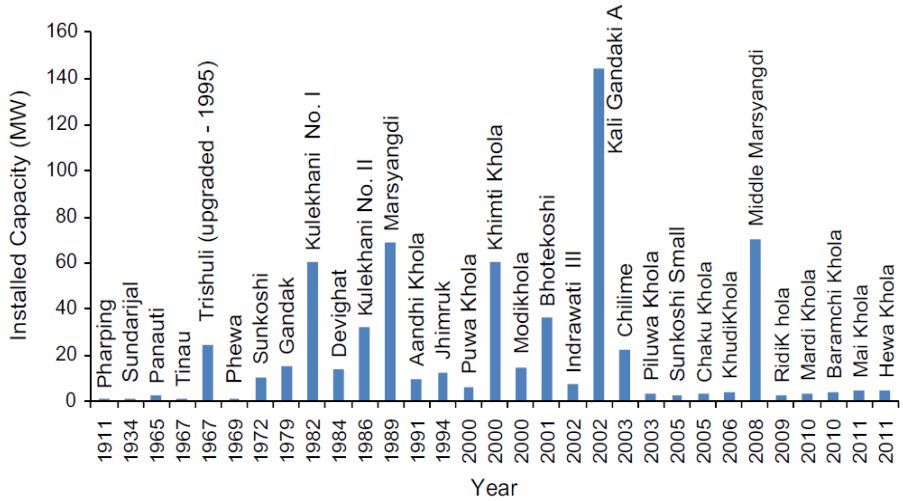
Table 2: Factors that influence capacity

Environment	Hydrological factor: There is very high seasonal variability in rainfall, with 80% of rain falling in the monsoon season (June-September).
	Sedimentation: Large amounts of silt are washed from the mountains and hills during high season, increasing silt levels in the reservoirs.
	Landslides are a common occurrence.
	The Himalayan Range is continuously shifting, with the mountains rising about 2 cm each year. This makes the terrain unstable and prone to natural disaster.
Financial	Available capital in the Nepali market is sufficient to produce only about 200 MW of electricity.
	Commercial banks and financial institutions have little interest in lending to hydropower projects.[a]
	Regulatory and political risks undermine foreign investments.
Technical	Adequate skilled manpower is not available.
	It is difficult to procure construction materials locally; the supplier base is shallow.
Regulatory	The electricity tariff structure is not in line with the costs of production.
	The institutional capacity of the National Electricity Authority is weak.
	A lack of coordination exists between relevant line Ministries.

(a) United Nations Development Programme, 2007. Source: Adapted from Sovacool et al., 2011.

Figure 3 shows the historical development of the hydropower sector in Nepal. The country currently has capacity to generate a total of 665.11 MW of electricity from installed hydropower stations. This meets approximately 1% of Nepal's total energy demand; 68% is met by fuel wood, 15% by agricultural waste, 8% by dung and 7% by petroleum.[2] All of these sources have an adverse impact on the environment, and petroleum imports place huge pressure on foreign exchange earnings.

Figure 3: Installed capacity



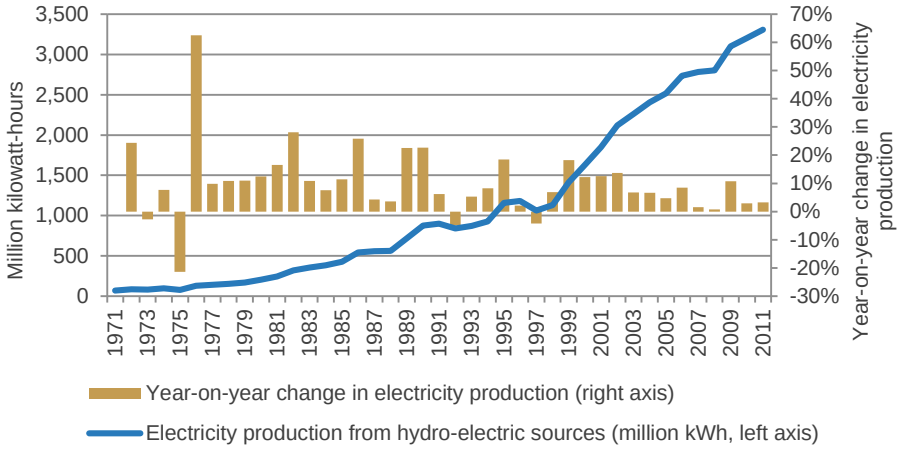
Source: Sharma and Awal, 2013.

With increasing investment, electricity production from hydropower has begun to increase (Figure 4). However, demand still far outstrips supply. Furthermore, as Nepal's economy grows and energy consumption increases, the demand for energy will grow at an even faster rate. Total energy demand has

[2] http://www.sari-energy.org/pagefiles/countries/nepal_energy_detail.asp

been increasing at about 7-9% per year, despite the fact that only 40% of the population is connected to the national electricity grid.

Figure 4: Electricity production from hydroelectric sources and percentage change in electricity production



Source: Basnett et al., 2014.

Table 3, below, shows the energy consumption by sources (oil, biofuels and waste, and electricity) as well as at sectoral level. Total oil consumption was 1,100 ktoe, which adds to the large import bill. Transport accounted for about 65% of total oil consumption, while the sector had the lowest consumption of electricity. The question for Nepal is how much of this can be substituted by electricity – and in cooking and transport there are technical and affordability challenges. Industry is the third-highest consumer of electricity and lowest consumer of oil. Maintaining this trajectory as well as ensuring that the future energy needs of industry are met through renewable electricity will be important for Nepal's economy to stay on a green growth path.

Table 3: Energy consumption in Nepal (2012; in thousand tonnes of oil equivalent (ktoe) on a net calorific value basis).

	Oil	Biofuels and waste	Electricity
Total final consumption	1,100	8,184	279
Of which:			
Transport	711	0	1
Residential	148	8,081	127
Agriculture/forestry	121	0	6
Commercial and public services	106	51	39
Industry	10	54	100

Source: International Energy Association. http://www.iea.org/statistics/statisticssearch/report/?year=2012&country=Nepal&product=Balances

The Asian Development Bank (ADB) / Department for International Development (DFID) / International Labour Organization (ILO) (2009) estimated that in order to increase its electrification rate to the same level as India's,[3] Nepal would require investment of US $1.5 billion (at 2006 prices). For Nepal to increase both its electrification rate and its consumption level to those in India, investment of US$5.1 billion at 2007 prices would be required. Further investment would also be required for upgrading transmission infrastructure. In 2008/9 the government allocated US$163 million, which falls far short of what is required. Investment on this scale would require substantial foreign direct investment (FDI). However, between 2000 and 2011 average FDI inflows were approximately US$20 million (Basnett et al., 2014).

[3] Nepal's electrification rate is currently 60% of India's.

Looking at the current situation, there is a severe mismatch between the demand for and supply of electricity in Nepal (Table 4). Recent years have seen large investments in the hydropower sector that could potentially alter electricity supply (Nand, 2015; Gangol, 2014). For example, the Indian company GMR is proposing a US$1.4 billion investment to build a 900 MW hydropower station in Upper Karnali.[4] The experience from hydroelectricity development in the Arun River shows that what is planned and the actual electricity produced can differ due to factors mentioned in Table 2.

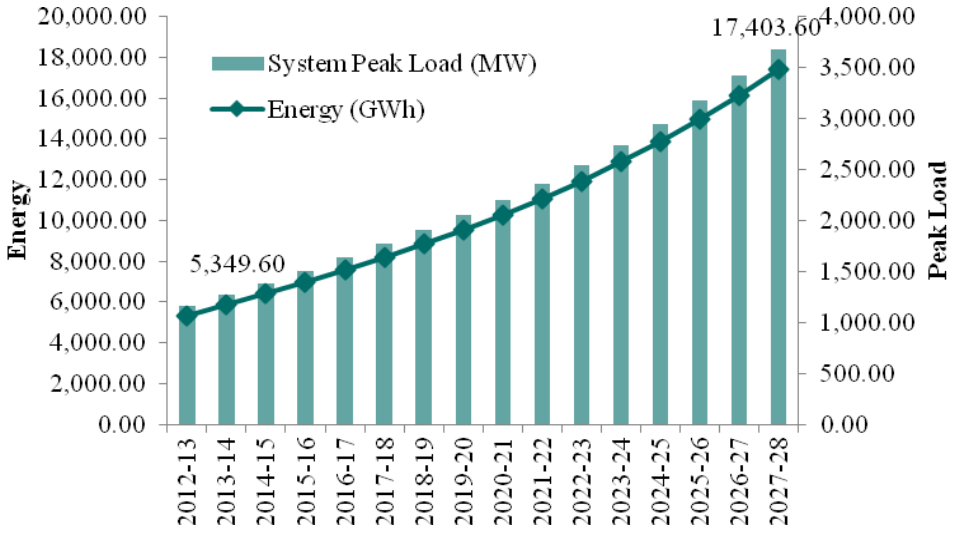
Table 4: Supply and demand mismatch

Annual peak demand	946.10 MW
Dry season generation	450 MW
Deficit (gap)	500 MW

Source: http://www.hidcl.org.np/nepal-hydropower.php (data for 2011).

The peak load forecast for the next fifteen years shows an upward trend, with load demand expected to triple between 2012 and 2028 (Figure 5). The current Nepal Electricity Authority (NEA) pipeline up to 2020 estimates that between 2,500 and 2,700 MW will be available by then, with peak load forecast at about 2,000 MW. While there would be excess energy in the wet season (when the potential maximum could be reached), the estimated 30-50% fall in production during the dry season means that even by 2020 the country's electricity demands would not be met throughout the year.

Figure 5: Electricity load forecast for Nepal



Source: NEA, 2012.

As hydroelectricity production in Nepal is run off the river and there are no storage dams, it is difficult to store electricity. This means that effectively managing supply and demand poses new challenges. Electricity trading arrangements with India have opened up the option of exporting excess supply during the peak-production period and importing during the low-production dry season, when energy demand peaks. And there is scope for extending the trading arrangement to the rest of South Asia, which faces severe energy shortages (Razzaque and Basnett, 2014).

Revenue collected by the Government from hydroelectricity has increased threefold over the last seventeen years. In 1993-94 the Government collected about US$858,000; the amount increased to US$2.45 million in 2010 (Balasubramanya et al., 2014).

[4] http://www.myrepublica.com/opinion/item/18247-hydroinvestments.html

4. KEY POLICY ISSUES

That Nepal faces a severe electricity shortage is well established. Load shedding or electricity outages can last for up to 21 hours a day in the dry winter season. This has adversely affected the productivity of the economy. Relying on traditional sources – fuel wood, petroleum, etc. – is not sustainable. Hydroelectricity offers a sustainable and renewable source of energy, as well as the possibility of decoupling economic growth from rising carbon emissions. The transport sector is one of the largest consumers of fossil fuel, and transport demand is likely to grow in line with – if not faster than – economic growth. Hence, electrifying transport will be central if Nepal is to decouple future growth from rising carbon. But there are important risks that policies need to take into account and manage effectively prior to their onset.

FINANCIAL VOLATILITY

Large investment inflows into hydropower generation in Nepal, along with the revenue from the export of electricity, could give rise to Dutch disease. Large currency inflows can put upward pressure on foreign exchange. As Nepali rupees (NRs) become expensive in comparison with the currency of trading partners, Nepali exports may become costly and less competitive. There is a lack of analyses on the chances of this happening due to investment inflows and electricity exports, but some projections can be made based on available information.

We know that large financial inflows, such as remittances, are putting upward pressure on Nepal's currency. Sapkota (2013) finds that there are strong indications of remittance-induced Dutch disease in Nepal. Large remittance inflows are considered to be leading to persistent appreciation of the real exchange rate (spending effect) along with a decline in the production of tradables and a shift towards production of non-tradables (resource movement effect), which Sapkota refers to as signs of Dutch disease.

At present there is already excess liquidity in the financial system (International Monetary Fund (IMF), 2014). In other words, banks are holding cash above the level of deposit that the central bank requires them to have.[5] They take deposits, give interest to depositors, and lend with interest. They are also required by law to maintain a certain level of cash reserve. Anything above this required reserve and not lent in the banking and financial system is considered excess liquidity. Remittance inflows, although slowing, have contributed to this, and the Nepal Rastra Bank (NRB) has intervened to reduce the level of liquidity.

The scale of financial inflows in the hydro sector is likely to be much larger than remittance inflows. Moreover, revenue inflows are likely to peak seasonally – i.e. during the rainy season, when excess production will be exported. The scale and seasonality of revenue inflows places greater importance on policies to effectively manage financial flows and reduce volatility in Nepal's financial system.

The IMF (2014) points to the importance of equipping the NRB with adequate amounts of sterilisation bonds, increasing cooperation between the NRB and the Ministry of Finance, and strengthening the institutional setup for monetary policy. The World Bank is helping the Government of Nepal (GoN) to anticipate the macroeconomic effects of large-scale hydropower development and associated management challenges. Steps being taken include:

- modelling the macro- and microeconomic impacts of substantially increased power generation and trade over the short-to-medium term and building the capacity of GoN agencies to carry out such modelling and use it to assess trade-offs involved in alternative policy strategies (for hydrodevelopment, fiscal management, etc.)

[5] At present, the Nepal Rastra Bank requires commercial banks to have cash reserve ratio of 5%, development banks 4.5% and finance companies 4%. See: www.sharebazar.com.np

- providing analysis and models for managing the revenue from hydropower development and outlining a utilisation (public expenditure) strategy that maximises its growth and poverty reduction potential while avoiding macroeconomic imbalances
- providing analysis and advice to enhance the poverty reduction potential of envisaged hydro investments and sector reforms.

Bhutan provides some important lessons for Nepal, as it is also experiencing problems of excess liquidity generated by large revenue inflows from exports of hydroelectricity. According to Rahut (2007), the commissioning of the Chukha hydropower project (336 MW), revision of the electricity tariff from time to time, establishment of power intensive industries in the mid-1990s and the increases in the inflow of foreign aid have exploded the liquidity in the banking sector. At the end of 2007 Bhutan's total external reserves stood at US$ 537.6 million, almost equivalent to its GDP. A reserve of this magnitude is desirable, especially for Nepal, where the current account deficit (excess of imports over exports) is shooting upwards. But it also necessitates effective management so that it leads to investments that increase productivity and productive capacity. For example, Rahut (2007) finds that in Bhutan, as in Nepal, excess liquidity has not translated into increased credit to the private sector, and argues that it needs to be given policy priority.

Similarly, in the Lao People's Democratic Republic (PDR), revenue from hydropower and mining increased from 0.4% to 9.2% as a share of the GDP between 2003 and 2012 (Menon and Warr, 2013). This has led to appreciation of the currency and has reduced export competitiveness. Menon and Warr (2013: 18) argue that

> *there are losers from this process and it is tempting to suggest that these losers should be protected from loss. If the boom was temporary, this argument might be sustainable. But it is apparently not temporary. The adjustment in the structure of the overall economy means that non-tradables sectors will expand and traditional traded goods sectors will contract. [This is already being observed in Nepal owing to the remittance boom, as discussed above]. A more far-sighted policy response than protectionism is to assist those who are affected negatively to find productive opportunities in other sectors of the economy. This means retraining and adjustment assistance. Attempting to keep people in declining industries only perpetuates poverty and dissatisfaction.*

GOVERNANCE

Large investment and windfall cash flows from the sale of hydroelectricity can exacerbate already high levels of corruption in the country. They will also further increase rent-seeking incentives and will lead to a deterioration in governance. For example, in the case of Lao PDR, Menon and Warr (2013) find that the governance problem is accentuated by the absence of a need to tax the local population at more than minimal rates, because of the presence of revenues from resource extraction. The existence of these revenues makes it possible for the government to buy off opposition and, where necessary, provide the resources needed to suppress it.

Evidence suggests that natural resource booms can increase rent-seeking, financial volatility, resource grabbing and civil conflict (van der Ploeg, 2011; Torvik, 2002). But such outcomes are not set in stone, and they depend on the quality of institutions and the effectiveness of governance. For example, the United States, Australia and Canada have large natural resource sectors, which in turn have contributed to their countries' development. Good institutions allow for productive development and use of natural resources, and they provide safeguards against volatility.

Nepal is already observing the negative impact of the remittance boom on governance (Jones and Basnett, 2013). It is estimated that corruption generates about NRs 17.2 billion per year in the Nepali Government approval process for Nepalis wishing to work overseas (Manandhar and Adhikari, 2010). With a variety of actors organised to extract rents in Nepal and elsewhere, these flows create vested interests directly opposed to improved regulation and enforcement, able to draw on considerable resources with which to pursue their aims. The scale of the hydropower sector to the economy is likely to be much larger than

remittances, which is also an indication of the magnitude of the impact (positive or negative) that the hydropower sector will have on governance.

A recent ODI study (Basnett et al., 2014) on the constraints to economic transformation in Nepal found the following governance-related issues that are also relevant for the effective management of a natural resource boom in Nepal.[6]

- **Patronage and corruption.** Patronage is a system whereby positions of power are distributed according to loyalty and group membership and are then used to serve the interests of client groups (Jones, 2010). This system, already well embedded in Nepal, is finding more footholds because of political uncertainties and weak rule of law. This weakens formal governance systems and restricts the government's ability to regulate and manage the economy, and it causes serious problems for the provision of important public goods and common resources – for example, major road investments tend to be systematically underfunded because resources are distributed for political gain and there is a high level of leakage to contractors through corruption (Jones and Demenge, 2014).
- **Low accountability and effectiveness outside Kathmandu.** The notion that Nepal is a centralised country is a narrow reading of its history. Historically, strategies of neglect aimed at consolidating the power of ruling elites, mean that the centre has rarely enjoyed complete control of the various regions. There have been three major epochs in Nepal's history with regard to the relationship between the centre and the rest of the country: devolution governed by a single family (the Ranas), centralisation of power in the palace (and therefore, by virtue of the palace's location, in Kathmandu), and technical decentralisation.[7] More recently, there have been no local elections for over 15 years; the Ministry of Local Development centrally appoints the heads of all local government bodies. The lack of formal accountability mechanisms, or effective central monitoring of performance, limits the incentives for local governments to respond to the needs and preferences of their constituents (Jones, 2010). This problem is compounded by high turnover. For the areas outside Kathmandu, and especially more remote or politically tumultuous areas, this reduces the government's ability to provide infrastructure or services or to enforce contracts, and it creates opportunities for patronage and corruption (Dix, 2011). Combined with patronage and corruption and low capacity, these factors result in severe issues with policy implementation and enforcement.
- **Questionable bureaucratic culture.** The role played by the bureaucracy is in many instances actively part of governance failures in Nepal. Subsidiary markets for basic public services have emerged, with service providers outside government ministries arranging land registration, citizenship and passports for a fee. Professionals can arrange for ministry approvals on issues of high monetary value, and such service providers operate from established offices. Repeated transactions allow civil servants to build up trust in the external service providers and, importantly, to distance themselves from bribes. Even where subcontracting is formalised, competition in procurement processes is (formally or informally) based upon those who provide the largest commissions to government, often precluding adequate service delivery.[8] There is also less motivation to deliver policies and reform where is a regular supply of foreign-funded technical advisers and lucrative capacity-building opportunities. The burden of designing and drafting policies has thus been, in practice, subcontracted. Together, these indications suggest that government in many instances seems to sit on a comfortable position of rent extraction. This culture

[6] For further discussion on governance issues see Basnett et al., 2014.

[7] From the late 18th century, when modern Nepal was formed, to the late 1950s, when the process of modernisation began (as well as bouts of experimentation with democracy that were unsuccessful until the 1990s), Nepal was governed by a devolved, federal model maintained by the authority of hereditary rule at the centre. In the 1950s Nepal began to be centralised, partly because a small window of democratic change ushered in modernisation, but also because power began shifting from the Rana oligarch (who had used extended family to govern by a federal model), first to a democratically elected parliament and then subsequently to the palace (who until then was a mere figurehead). In the 1990s, when multi-party democracy was established, the process of decentralisation began, although this was largely technical rather than political.

[8] For example, in waste management, sourcing is based on which company 1) charges the lowest fee to end users, and 2) pays the highest commission to the local government body. This squeezes already tight margins in the sector and is commonly accepted to preclude honest businesses from entering the sector.

benefits senior officials, restricts the potential for reform, and restricts access to decision-makers to people who have been in their positions for a long time.

- **Crony capitalism.** Given the prevailing political and economic conditions, many see the surest way to personal success as patronage rather than innovation and hard work. This leads in many instances to an unmeritocratic private sector. Any large business investment requires strong political connections (and payments), which incentivises anticompetitive practices. This trend also encourages the 'dark economy' of smuggling, local mafias, etc. (Dix, 2011). Crony capitalism creates problems for micro/small, new, and women-owned enterprises, all of which lack power and contacts.

A more nuanced understanding of the causes of corruption is needed if it is to be pragmatically addressed. Khan (1998) argues that in the Indian subcontinent the problem is not corruption per se but political structures that generate growth-retarding corruption. He further argues (p. 20) that

> *if corruption is politically generated and if the political structure of societies determines the economic effects of the ensuing corruption, in countries where development is blocked the only long run solution may be to provoke a sustained public discussion of such arguments so that new political arrangements can eventually be constructed.*

REGULATORY DEFICIENCIES[9]

Regulatory deficiencies in Nepal have constrained broad-based expansion and investment in the hydropower sector in Nepal (Gangol, 2014; Shah, 2008). Addressing them will require reform of the institutions mandated to regulate the sector.

There is a perceived lack of support for energy projects below 500 MW. Those projects that are classified as above 500 MW benefit from streamlining effects that the Nepal Investment Board (NIB) brings to the process.[10] Smaller-scale independent power providers (IPPs) that do not benefit from NIB fast-tracking see the licence system as slow, potentially hindering the swift and profitable construction or operation of power generation plants.

There is no collaboration between the different agencies that are responsible for issuing all the various licences required to generate and distribute energy in Nepal. These range from visa requirements to approvals to deforest particular areas, as well as approvals of environmental impact assessments. Related to the slow licensing system is the fact that smaller IPPs may not benefit from power development agreements (PDAs) as much as larger energy producers. PDAs provide a set of guarantees that the finance institutions can use to 'secure' their investments, and they are a way of ensuring financing of energy projects. Smaller producers find the PDA process time-consuming and do not have the collaboration of the NIB in helping them smooth over the PDA drafting process.

The price offered by the NEA is deemed to be too low to make investments worthwhile. However, the fact that the NEA has managed to secure a large number of power purchasing agreements (PPAs) indicates that this may not be a determining issue in securing energy in the country. The fact that the NEA has a PPA pipeline of around 1,800-2,000 MW of additional energy capacity planned by 2018 may indicate that there are enough IPPs that are happy with the current process. The real constraint could be the fact that the NEA is not generating enough revenue to meet its financial obligations, and potentially excessive amounts of money are being spent subsiding energy tariffs at an unsustainable price – all of which leads to reduced revenues from NEA operations.

[9] This section draws on Alberto Lemma's contribution in Basnett et al., 2014.

[10] For instance, setting up a clear Project Development Agreement or facilitating the acquisition of licences through NIB's legal mandate to coerce line ministries to fast-track any licensing procedures that are required in order to bring an IPP project to completion.

This is exacerbated by the fact that the NEA has to negotiate for PPA prices[11] with IPPs that want front-loaded purchase rates (i.e. higher at the beginning of the contract) in order to recoup their investments and reduce uncertainty. Current PPA practices allow for a 5% decrease in rates for five years followed by a flat rate for 25 years. The IPPs see this as a high risk since PPAs are signed before production even begins and it may take at least 2 to 3 years before IPPs can sell their electricity to the market, mainly because of a lack of transmission lines in the system. The overall effect is that IPPs seek to reinforce PPAs in their favour, whilst the NEA sees more cumbersome PPAs as a disincentive to buy more power from IPPs. Essentially, the NEA is now in a position where it no longer seeks to sign new PPAs, since any additional PPA might result in a loss.[12] And IPPs are reluctant to invest in new energy since they are not guaranteed sufficiently quick access to markets.

There is also a land-use-arbitration issue. The private sector needs to accept the demands made by local stakeholders in order to proceed with power investments – which affect both power generation and power transmission projects and potentially result in higher production costs. Failure to accept all such demands can lead to severe hurdles to investment (e.g. localised worker strikes or disruption to construction operations). However, the reality may not be properly represented, as the power divide between local communities, the government and the private sector is not well documented. While there is a Compensation Fixation Committee in place (which helps determine the amount of compensation that landowners should receive when the government buys land from them[13]), the majority of negotiation issues arise in connection with compensation for land use rather than purchase.[14]

The NEA plays a dual role – acting as both a buyer and a generator of electricity in the country.[15] As the NEA produces and sells its own electricity but also buys electricity from IPPs, there may be disincentives for it to prioritise activities that may benefit its competitors. This could suggest that transmission lines for competitors are not prioritised, or that contractual agreements are not moved forward unless the NEA's electricity supply needs are met. An overarching regulator or regulatory framework could assign roles and responsibilities of generation, transmission and distribution. However, this would require an overall strategy for the energy sector. Reforms to the NEA would be highly contentious and hence would require broad political support in order to be fully effective.

INADEQUATE TRANSMISSION LINES

While investment in hydroelectricity has forged ahead, the provision of transmission lines to connect people and regions to electricity has lagged. Nepal's Water Resources Strategy 2002 set a target of providing 38% of households with access to electricity by 2017 and 60% by 2027. At 31.45%, Nepal's electricity transmission losses are the highest in South Asia (followed by India at 24.4%) for the year 2009 (Srivastava et al., 2014). In addition to lack of infrastructure, theft and NEA's inability to gather revenue owed also contribute to transmission losses.

There is not enough electricity being generated in the country, an issue that is compounded by the fact that the last geographical and hydrological survey that could clearly assess hydroelectrical potential was carried out in 2004 and has not been updated since (according to the NEA). The major infrastructure concern is the lack of transmission lines connecting energy producers to the distribution network, and this appears to be the critical pivot upon which the construction of power generators hinges. The reality is that electricity power plants remain idle, or there are delays in construction, due to absence of transmission power lines. The negative knock-on effect can be represented as follows:

[11] Only projects under 25 MW have a fixed PPA price.

[12] NEA's obligation to pay for profit losses if transmission lines are not set up could add to NEA's losses.

[13] Following the Land Acquisition Act of 1977 and the Land Acquisition Guidelines of 1993.

[14] Negotiating the use, rather than the acquisition of, the land, which is less regulated.

[15] NEA is essentially in competition with the IPPs from which it also buys energy – a potential conflict of interest which leads to inefficiencies in the market.

Source: Developed by Alberto Lemma in Basnett et al., 2014.

The lack of a transmission line halts the whole electricity generation process since it effectively provides negative financial confidence signals to any financial institutions that may be backing the power generation project. For those projects that have the financial capacity to build their own transmission lines, there are provisions in place, by law, that allow them to construct and use their own transmission lines. For those that rely on an NEA guarantee to construct transmission lines, there seems to be a long time lag between the NEA's guarantee of a transmission line and its actual construction. The NEA technically agrees to provide 5% recompense on all 'forecasted' profits that are lost by the power generation company, but in the view of power generators there have been no actual payouts where this has occurred.

NEA's financial situation is a major constraint to the construction of all the transmission systems that the grid needs. NEA's accounts (2012) show a loss over the last four years. In 2012 its losses amounted to US$ 86.5 million, and even greater losses were recorded in the preceding years. Another potential issue, and a common perception amongst stakeholders, is that the NEA may be constructing power lines only where the NEA itself requires them. Liberalising the energy transmission sector could help resolve such issues in the long term, but this should be a part of a wider reform of the NEA and of energy regulators in general.

Electricity transmission line systems in Nepal are inadequate and do not reach all power producers and users. The regulatory systems inhibit the NEA from constructing transmission lines for other IPPs, and the lack of a national energy strategy means that transmission lines are being built on an ad hoc basis rather than according to a long-term plan for growth.

ENSURING ENERGY INCLUSIVITY

Lack of sufficient policy attention could lead to divergence in the benefits accruing from development of the hydropower sector. Geographical areas with hydropower production and transmission lines will benefit from electricity, while those that are not connected by transmission lines will be excluded from the benefits. Similarly, the financial redistribution of revenue collected from the hydropower sector is skewed to further benefit regions hosting large hydropower stations.

Hydropower revenue is largely concentrated in the Central and Western districts (Table 4). As part of larger political developments in Nepal, the Local Self Government Act (LSGA) was introduced in 1999 to improve equity by transferring administrative, fiscal, and resource management roles to district

governments (GoN, 1999). Two years later, the Hydropower Development Policy of 2001 formalised the sharing of hydropower revenues with district governments (GoN, 2001).

Table 5: Numbers of districts and hydropower projects, and hydropower revenues received from the central government, as a portion of budget allocations, by development region, Nepal, 2012

Development region	Number of districts	Number of revenue-generating projects	Hydropower revenue as % of budget allocation
Eastern	16	2	0.02
Central	19	13	1.04
Western	16	12	1.08
Mid-Western	15	1	0.12
Far Western	9	1	0.00
Sum of regions	**75**	**29**	**0.53**

Source: Balasubramanya et al., 2014.

At present, 50% of the revenue collected annually by the central government from hydropower projects is shared with districts (Balasubramanya et al., 2014). These transfers are in addition to any compensation and restitution payments made by project developers to affected communities. Balasubramanya et al. (2014) find that

> *most of the shared hydropower revenue is allocated to wealthier districts hosting hydropower projects, which also receive larger shares of central government allocations. Thus the current revenue sharing program does not improve the relative status of poorer districts without hydropower projects.*

Overcoming these distributional impacts will require a policy that is geared towards ensuring energy inclusivity – in terms of infrastructure (transmission lines), access to electricity, and distribution of hydropower revenue in a manner that leverages investments in geographical areas lagging in hydropower.

5. LEVERAGING HYDROENERGY FOR ECONOMIC TRANSFORMATION

The government can adopt a number of prudent policies on the management and usage of hydropower revenue. It can save, pay off debt, or invest. Investing in measures that will increase productive capacity will be the best use of the hydropower revenue. It will increase the potential for long-term inclusive and sustainable development, and it will help transform the economy. Investments should focus on decoupling growth from rising carbon emissions and on building transport and industrial infrastructure.

OPTIONS FOR MANAGING HYDROPOWER REVENUE

As revenues from hydropower flow in, it will be important to manage them efficiently and sustainably so they contribute to economic transformation in Nepal and do not generate financial volatility. A key issue is going to be whether the revenue should be saved, invested or both – and, relatedly, how funds should be saved and where invested. There are suggestive guidelines but no standard blueprints, because decisions are context specific, as are the expected returns on investments.

Many of the guidelines on managing natural resource revenues focus on revenues from non-renewable resources such as oil, gas, etc. (Bauer, 2014). The hydropower in Nepal is renewable energy, although the impact of climate change as well as natural phenomena such as levels of siltation, earthquakes, etc. can affect the longevity of a hydropower station. Bauer (2014: 1), in reviewing the various options available, suggests the following:

- Natural resource funds by themselves do not guarantee sound macroeconomic management. In fact, they may complicate budgeting and make public spending less accountable.
- Fiscal rules – multiyear constraints on government spending or public debt accumulation – can help commit successive governments to stable macroeconomic policy, which is necessary for growing and diversifying an economy. While some natural resource funds are governed by fiscal rules while others are not, fiscal rules generally improve government performance and public financial management.
- The design of fiscal rules should depend on context; no single rule is appropriate for every country. For example, if a country needs financing for development projects and has the ‘absorptive capacity’ to implement projects proficiently and efficiently then the government may wish to spend more and save less. However, the government may also wish to save a significant fraction of resource revenues to generate a buffer in case of economic disaster or unanticipated downturns in production or prices.
- In order to function properly, fiscal rules must be designed with specific objectives in mind (e.g. to address absorptive capacity constraints; to stabilise the budget), there must be political consensus on their suitability, and they must be enforced through independent oversight.
- Most natural resource funds have deposit and withdrawal rules, which usually operationalise a fiscal rule. Their details matter a lot since they can sustain or undermine fiscal rules.

Norway’s management of its revenue from natural resources is highly regarded. Table 5 lists some key features of what is widely referred to as the ‘Norway Model’.

Table 6: Key features of the Norway Model

- Norway uses the Government Pension Fund Global (GPFG) to manage and invest natural resource revenues.
- GPFG assets are not earmarked for any specific purpose, and no person or organisation has a direct claim on them.
- Transfers from the Fund can only be made to the state budget, and from there funds flow into the Norwegian economy.
- The size of any transfer is determined during the preparation of the annual budget according to fiscal policy guidelines.
- The intention of the guidelines is that, over time, withdrawals correspond to the Fund's anticipated long-run annualised real return of approximately 4%.
- In good economic conditions, when tax revenues are high, less than 4% of the Fund is spent; during bad economic conditions, more than 4% is spent to offset the cycle.
- By having a long-term commitment to the 4% rule, the Fund restrains the government from overspending.
- The distinctive characteristics include the Fund's large size, long time horizon, absence of specific liabilities, and its ownership and governance structure, including the demand for transparency.

Source: Chambers et al., 2011.

The dominant view on the efficient management of natural resource revenues is to save a large portion of the revenue for future generations. Collier et al. (2009) question this prescription in capital-scarce countries and argue for the prioritisation of investments. They argue that

> *a developing country may or may not be on a sustainable high growth path when it discovers natural resource wealth or an increment to it. The vast majority are not. If not, then natural resource wealth is an opportunity to make investments that move it toward such a path. If a country is on such a path then the discovery of natural resource wealth can be used to elevate both growth and consumption in the short to medium run. Revenues are likely to be volatile and there is a need to cushion the impact of this volatility, but not at the expense of preventing the domestic economy from benefiting from commodity booms.*

DECOUPLING GROWTH FROM RISING CARBON EMISSIONS

In theory, using hydroelectricity for production and consumption can help Nepal decouple growth from rising carbon emissions. It released 0.14 tonnes of CO_2 *per capita* in 2010 – less than 10% of the average for Asia (International Energy Agency, 2010).[16] The carbon intensity of its GDP is 0.4 kgCO_2/US$,[17] which is less than half of Asia's average of 1.06 kgCO_2/US$ (Ibid.). Relying on natural resources offers the prospect for Nepal to remain on a low-carbon pathway (Vidyarthi, 2014). Increasing household and overall national wealth will not require a matched increase in carbon emissions.

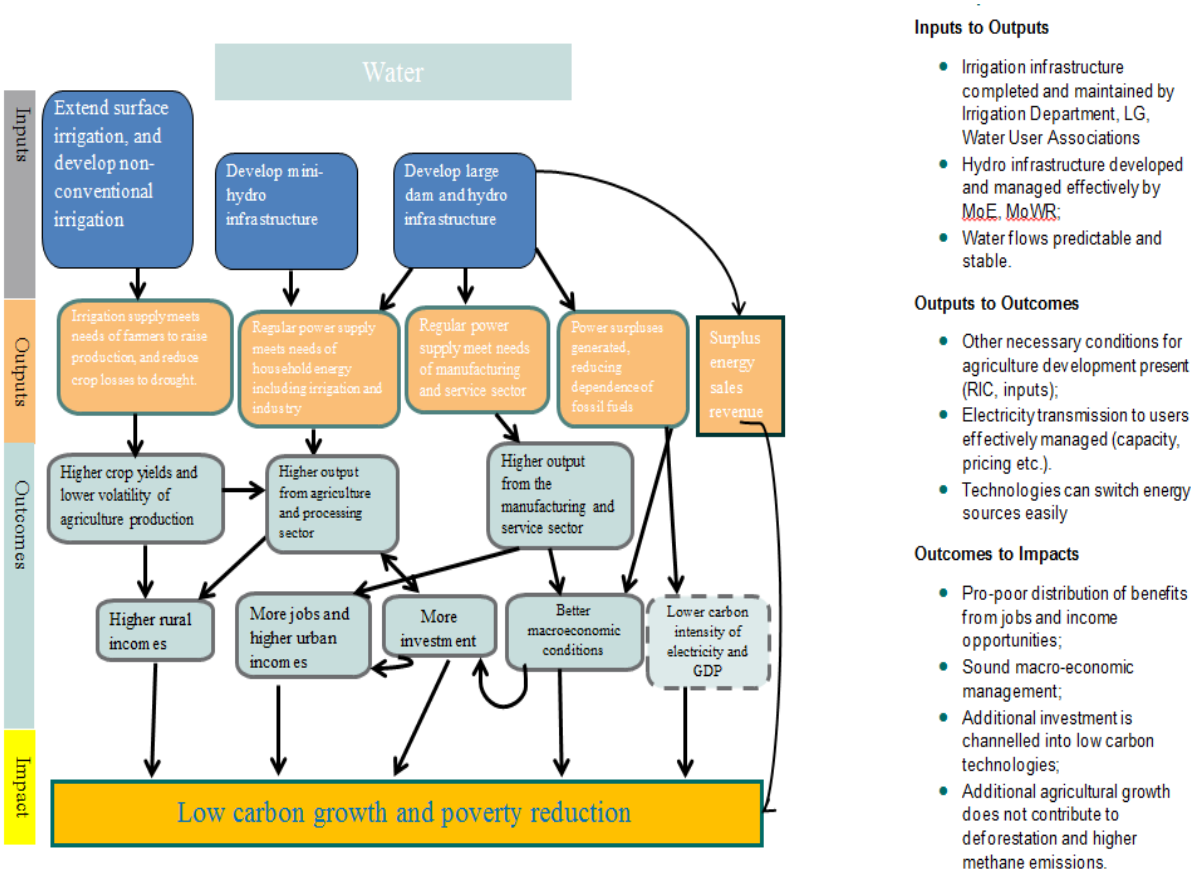
Hydroelectricity provides the greatest potential to decouple growth from rising carbon emissions in the following ways (see Figure 6):

- By increasing the amount of low-carbon electricity generated through hydropower, Nepal can remove a major constraint to growth across the economy (i.e. the lack of regular electricity) and potentially reduce imports of electricity and carbon-rich fossil fuels from India.
- Providing electricity in rural areas will help to expand the area of land under irrigation and further diversify the rural economy, allowing poor households to become more integrated in the economy.
- In the long term, surplus energy from hydropower can be sold to India to generate foreign currency reserves and reverse Nepal's trade deficit.

[16] Excluding China.

[17] Measured in 2005 dollars.

Figure 6: Using water resources for economic transformation: a theory of change



Source: Developed by Giles Henley in Basnett et al., 2014.

INVESTING IN ELECTRIC TRANSPORT INFRASTRUCTURE

Developing electricity-based mass transport is already part of the Government of Nepal's medium-term plan. For example, it plans to build an East–West electric railway link, and it is exploring options for connecting major urban centres (for example, Kathmandu and Pokhara) by electric railway. But the policies and plans on hydropower development, transportation and climate change exist in isolation, with no purposeful linkages to leverage the synergies between the three.

The high costs of transport, in addition to inadequate carrying capacity and connectivity, are constraining economic transformation in Nepal (Basnett et al., 2014). In an age of global value chains, moving goods cost-effectively between different production sites (within and beyond the border) will be important in expanding Nepal's production base (Basnett and Pandey, 2014). GoN has given increasing priority to addressing infrastructure deficiencies. However, the government's plans (some mentioned above) are limited to the exploration of options and statements of intent, while the implementation of policies continues to be slow and undermined by low capacity.

Shakya (2013) conducted an econometric assessment to analyse the impact of transport electrification in Nepal. The study considered three transport electrification scenarios: a shift of 10% of the road transport demand to the electric mass transport system in 2020 and (1) shift maintained at 10% (EMT10) until 2050, (2) shift gradually increased to 20% by 2050 (EMT20), or (3) shift increased to 30% by 2050 (EMT30). Findings were the following:

- The cumulative undiscounted real GDP at 2005 prices during the study period would increase by a percentage in the range of 2.6% under scenario EMT20 to 3.1% under scenario EMT30 as compared to the base case (no change in transport electrification, EMT10).

- Household welfare would increase under all the transport electrification scenarios, with an increase in the value of the cumulative undiscounted equivalent variation in income in the range of 25.3% under EMT10 to 147.9% under EMT30.
- The national economy would shift towards an energy-efficient path under the transport electrification policy with a decrease in energy intensity of GDP.
- The transport electrification policy would help the country to pursue a low-carbon development path: the average greenhouse gas (GHG) intensity during 2005-2050 would be 6,116.5 kg $CO_2e/10^3$ 2005 NRs under the base case, and this would be decreased by an amount in the range of 4.7% under EMT10 to 7.1% under EMT30.

To leverage these gains, Nepal will need to develop a transport electrification policy that is linked to the hydropower sector development policy. Furthermore, private investments could be leveraged to finance mass electric transport. At present the financial institutions in Nepal lack the expertise to design appropriate financial instruments to fund such large infrastructure projects (Shah, 2008).

INVESTING IN INDUSTRIAL DEVELOPMENT

A lack of industrial development has weakened economic transformation in Nepal (Basnett et al., 2014). Absence of effective implementation of industrial and trade policies and inadequate provision of infrastructure are the root causes. Hydropower revenues could be used to upgrade and modernise industrial zones that have not seen investment since 1988. According to the Asian Development Bank (ADB, 2010), there would be huge interest among manufacturing firms in India in investing in Nepal if the supply of electrical energy were secured, land for building manufacturing plants made available and trade infrastructure provided. The modernisation and development of industrial zones should be linked to hydroelectricity production.

The high cost and the shortage of energy in Nepal undermine production and value-added activities. Petroleum and electricity are the major sources of energy for non-farm production (with wood being an additional source for farm production). Consumers in Nepal pay on average US$0.093 per kilowatt-hour (kWh) – 115% higher than tariffs in India and Bangladesh, 43% higher than those in Pakistan, and 18% higher than those in Sri Lanka (Basnett et al., 2014). The shortage of electricity has led to producers using generators during power outages. This has huge cost implications for production. In the last 10 years, energy costs have increased on average from NRs 6 to NRs 24 per unit of output due to electricity shortage (Ibid.).

The expansion of hydroelectricity in Nepal will address a critical constraint to economic growth – energy shortage. However, the industrial sector in Nepal continues to decline because of years of neglect (Ibid.). Linking development of the hydropower sector with industrial development will help to increase industrial productivity, leading to economic transformation. For instance, Bhutan and Lao PDR are actively attracting energy intensive industries as part of their strategies to link the hydropower sector to expanding productive capacity.

6. CONCLUSION

The shortage of energy in Nepal has crippled economic development. The country faces up to 21 hours a day of electricity shortage during the dry season, when energy needs peak. The private sector has had to adopt inefficient alternative arrangements, and has to stop production in order to switch from the national grid to alternative sources of energy. The establishment of new businesses and industries has virtually ceased. For example, in the early 2000s a number of call centres were established to connect Nepal to the services value chain in India. However, the unreliability of the power supply increased risk and reduced profitability, resulting in the centres' closure (and loss of job opportunities for urban youth).

The increasing number of large-scale investments in hydropower have renewed the prospect of sustainably addressing energy shortage and triggering economic growth. But to view this as a panacea for Nepal's economic development woes would be complacent. While hydropower offers the possibility of transforming Nepal's economy, to do so it needs to be effectively managed. Moreover, the missing links between the hydropower sector and the broader economic and social development agendas need to be carefully identified and developed.

In seeking to contribute to the national dialogue on leveraging hydropower for economic transformation, this paper has reviewed some of the key challenges and discussed policy options for increasing the impact of hydropower on economic development.

Managing financial volatility, strengthening institutions to improve governance, addressing regulatory deficiencies, increasing investment in transmission lines, and ensuring energy inclusivity are some of the key challenges. Greater discussion is needed on options for the sound management of hydropower revenue so that it contributes to long-term development, and global best practices for managing natural resource revenue will need to be contextualised to Nepal so that they are fit for purpose.

Policy prescriptions for managing revenues focus largely on non-renewable sources, while hydropower – environmental, technical and financial constraints notwithstanding – is a renewable source of energy. This allows more ambitious thinking on how revenues are invested, and the goal of transforming the economy should define this thinking. In this paper we have argued that Nepal should consider investing hydropower revenue in ensuring that the country remains on a low-carbon economic growth pathway; in building much needed transport infrastructure and powering it with electricity; and in developing industries. The discussion of challenges and opportunities in this paper is by no means exhaustive, but the authors hope that it will help generate more national dialogue on the issue of hydropower and broader economic development than there has been so far.

The development of hydropower sector should be seen as an integral part of Nepal's energy strategy that shifts the economy from non-renewable sources. In that regard, future work should consider the following:

- An energy strategy that efficiently blends different sources of renewable energy (solar, hydro, wind, etc.).
- The earthquake of 25 April 2015 and its aftermath with recurring landslides provided a powerful reminder that the generation of energy must be made resilient to natural disasters.
- An updated estimate of the availability of renewable energy is required to improve planning, policies and investments.
- There is a need to ensure robust linkages between various Government policies, such as on Land, Forest, Investment, that directly and/or indirectly impact the development of the hydro sector.

REFERENCES

ADB (2010) *Nepal: Promoting Private Sector Participation in the Power Sector*. Technical Assistance Consultant's Report. Manila: Asian Development Bank. Available at http://www.adb.org/sites/default/files/project-document/75402/41025-012-nep-tacr.pdf.

ADB/DFID/ILO (2009) *Nepal: critical development constraints*. Kathmandu: Asian Development Bank, Department for International Development/UKAID, and International Labour Organization.

Adhikari, D. (2006) 'Hydropower development in Nepal', *NRB Economic Review* 18(4).

Balasubramanya, S., Giordano, M., Wichelns, D., and Sherpa, T. (2014) 'Sharing hydropower revenues in Nepal, over time and across districts and regions', *Water Resources and Rural Development,* 4: 104-111.

Basnett, Y. and Pandey, P.R. (2014) *Industrialization and Global Value Chain Participation: An Examination of Constraints Faced by the Private Sector in Nepal*. Economics Working Paper Series No. 410. Manila: Asian Development Bank. Available at http://www.adb.org/publications/industrialization-and-global-value-chain-participation-examination-constraints-nepal.

Basnett, Y., Howell, J., Jones, H., Henley, G., Lemma, A. and Pandey, P.R. (2014) *Structural economic transformation in Nepal: A diagnostic study submitted to DFID Nepal*. ODI Report. London: Overseas Development Institute. Available at http://www.odi.org/publications/8500-structural-economic-transformation-nepal-diagnostic-study-submitted-dfid-nepal.

Bauer (2014) 'Fiscal rules for natural resources funds: How to develop and operationalise an appropriate rule'. Policy Brief, Revenue Watch Institute and University of Columbia.

Chambers, D., Dimson, E. and Ilmanen, A. (2012) 'The Norway Model', *The Journal of Portfolio Management,* 38(2): 67-81.

Collier P., Ploeg, F., Spence, M., and Venables, A. (2009) *Managing Resource Revenues in Developing Economies*. OxCarre Research Paper 16, Oxford Centre for the Analysis of Resource Rich Economies, University of Oxford.

Dix, S. (2011) *Corruption and Anti-Corruption in Nepal: Lessons Learned and Possible Future Initiatives*. Norad Report 18/2011 Discussion. Oslo: Norwegian Agency for Development Cooperation. Available at http://www.norad.no/globalassets/import-2162015-80434-am/www.norad.no-ny/filarkiv/vedlegg-til-publikasjoner/corruption-and-anti-corruption-in-nepal-lessons.pdf.

Gangol, P. (2014) 'Foreign Direct Investment in Nepal's Hydropower Development', *Hydro Nepal: Journal of Water, Energy and Environment* 14: 41-42.

GoN (1997) *Nepal power development project sectoral environmental assessment, vol. 1*. Kathmandu: Ministry of Water Resources and Ministry of Population and Environment, Government of Nepal.

GoN (1999) 'Local Self-Governance Act, 2055 (1999): An Act Made to Provide for Local Self-Governance'. Kathmandu: Government of Nepal. Available at http://faolex.fao.org/docs/pdf/nep74262.pdf.

GoN (2001) 'The Hydropower Development Policy, 2001'. Kathmandu: Ministry of Water Resources, Government of Nepal. Available at http://www.moen.gov.np/pdf_files/hydropower_development_policy_2001.pdf.

International Energy Agency (2010) *World energy outlook 2010*. Paris: International Energy Agency (IEA). Available at https://www.iea.org/publications/freepublications/publication/name,27324,en.html.

IMF (2014) *Nepal Article IV Consultation*. IMF Country Report No. 14/214, International Monetary Fund (IMF).

Jha, R. (2010) 'Total Run-of-River type Hydropower Potential of Nepal', *Hydro Nepal: Journal of Water, Energy and Environment* 7: 8-13.

Jones, H. and Basnett, Y. (2013) *Foreign employment and inclusive growth in Nepal: What can be done to improve impacts for the people and the country?* London and Kathmandu: Overseas Development Institute and Centre for Inclusive Growth (http://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/8449.pdf).

Jones, H. and Demenge, J. (2014) *Roads in Nepal: What Can Be Done to Improve Their Impact on Inclusive Growth?* Joint Working Paper. London and Kathmandu: Overseas Development Institute and Centre for Inclusive Growth.

Jones, S. (2010) *Policymaking during Political Transition in Nepal*. Working Paper 2010 – 03. Oxford: Oxford Policy Management (http://www.opml.co.uk/sites/default/files/wp2010-03.pdf).

Khan, M. (1998) 'Patron–Client Networks and the Economic Effects of Corruption', *The European Journal of Development Research* 10 (1): 15-31.

Manandhar, N. and Adhikari, J. (2010) 'Study of issues on the recruitment of migrant labour in Nepal'. Unpublished.

McMillan, M. and Rodrik, D. (2011) *Globalization, Structural Change and Productivity Growth*. NBER Working Paper No. 17143. Cambridge, MA: National Bureau of Economic Research. Available at http://www.nber.org/papers/w17143.pdf.

Menon, J. and Warr, P. (2013) 'The Lao Economy: Capitalizing on Natural Resource Exports', *Asian Economic Policy Review* 8(1): 70-89.

Nand, M.S. (2015) 'Development of hydropower in Nepal – a good opportunity for investors', *Journal International Association on Electricity Generation, Transmission and Distribution* 28(1).

NEA (2012) *Nepal electricity authority annual report 2012*. Kathmandu: Nepal Electricity Authority (NEA). Available at http://www.nea.org.np/images/supportive_docs/AnnualReport12.pdf.

Pradhan, G.L. (2008) 'Electricity: Domestic Consumption Versus Export', *Hydro Nepal: Journal of Water, Energy and Environment* 3: 16-18.

Rahut, D.B. (2007) 'Bhutan: Dutch Disease and Possible Alternatives Available,' *Economic and Political Weekly* 42(22).

Razzaque, M. and Basnett, Y. (eds) (2014) *Regional Integration in South Asia: Trends, Challenges and Prospects.* London: Commonwealth Secretariat (http://publications.thecommonwealth.org/regional-integration-in-south-asia-1028-p.aspx).

Sapkota (2013) 'Remittances in Nepal: Boon or Bane?', *The Journal of Development Studies* 49(10): 1316-1331.

Shah, A. (2008) 'Banker's Perspectives on Hydropower Development in Nepal: Problems & Prospects', *Hydro Nepal: Journal of Water, Energy and Environment* 2: 9-12.

Shakya, S.R. (2013) 'Economy-wide implications of low carbon electricity based mass transport in Nepal', *Journal of the Institute of Engineering* 9(1): 142-165.

Sharma, R.H. and Awal, R. (2013) 'Hydropower development in Nepal', *Renewable and Sustainable Energy Reviews* 21(C): 684-693.

Shrestha, H.M. (1966) 'Cadastre of hydropower resources', PhD thesis, Moscow Power Institute, Moscow, Russia.

Sovacool, B.K., Dhakal, S., Gippner, O. and Bambawale, M.J. (2011) 'Halting hydro: A review of socio-technical barriers to hydroelectric power plants in Nepal', *Energy* 36(5): 3468-3476.

Srivastava, L., Misra, N. and Hasan, S. (2014) 'Promoting Regional Energy Cooperation in South Asia', in M. Razzaque and Y. Basnett (eds), *Regional Integration in South Asia: Trends, Challenges and Prospects.* London: Commonwealth Secretariat (http://publications.thecommonwealth.org/regional-integration-in-south-asia-1028-p.aspx).

Torvik, R. (2002) 'Natural resources, rent seeking and welfare', *Journal of Development Economics* 67(2): 455–470.

United Nations Development Programme (2007) *Energy and poverty in Nepal: challenges and the way forward*. Bangkok: UNDP Regional Center.

van der Ploeg, F. (2011) 'Natural Resources: Curse or Blessing?', *Journal of Economic Literature* 49(2).

Vidyarthi, H. (2014) 'An econometric study of energy consumption, carbon emissions and economic growth in South Asia: 1972-2009', *World Journal of Science, Technology and Sustainable Development* 11(3).

WECS (2010) *Energy sector synopsis report*. Kathmandu: Water and Energy Commission Secretariat.