



NEPAL
ECONOMIC
FORUM

nefsearch

December 2011 Issue 1



A SPECIAL REPORT ON HYDRO POWER & HYDRO PROJECTS IN NEPAL

UNLEASHING **NEPAL'S** **HYDROPOWER** POTENTIAL

NEPAL'S ENERGY SCENARIO | HOURS OF DARKNESS | HYDROPOWER POLICY QUAGMIRE

NEPAL'S ENERGY SCENARIO

Never before has humanity faced such a challenging outlook for energy and the planet. This can be summed up in five words: **“more energy, less carbon dioxide”**¹

That Nepal has significant hydropower potential is a well known fact. According to Dr. Hari Man Shrestha's study there is 83,290MW of electricity generating capacity in Nepal's major river basins (*Table 1*), of which, 42,133MW is deemed economically feasible to harness.² However, total installed hydroelectricity capacity in Nepal today stands at only 698MW.³ Clearly there is a large gap between electricity that *is* and *could be* supplied. Of more concern is Nepal's inability to meet present electricity demand. An urgent need exists for bridging this gap to meet the goals of sustainable development for which it is a prerequisite that “[...] energy must be available at all times, in sufficient quantities and at affordable prices”.⁴

This analysis provides a fresh look at Nepal's electricity demand from various angles to gauge just how inadequate supply really is. It then tries to uncover the reasons underpinning inertia in the hydropower sector and provides policy implications.

Due to its comparative advantage, hydropower is inevitably going to be an important source of energy for Nepal. Currently hydropower occupies just 1% of Nepal's total energy portfolio whereas agricultural waste, fuel wood and animal dung occupy around 91%.⁵ These traditional energy sources have significant negative consequences that include enforcing gender inequality, causing health problems, providing poor lighting, and negatively impacting the environment in terms of pollution and deforestation. The remaining 8% of energy in Nepal comes from Indian imports of fossil fuels.⁶ These imports perpetuate economic dependency and exacerbate the trade deficit. They also increase anthropogenic emissions and subject Nepali consumers to the high price volatility. Many such negative side effects of energy consumption could be significantly reduced by turning to clean energy sources like hydropower.

Table 1: Theoretical hydropower generating capacity in Nepal

River basin	Major river courses with catchment areas >1,000 sq. km	Small river courses with catchment areas of 300 to 1,000 sq. km	Total theoretical hydropower potential (MW)
Saptakosi	18,750	3,600	22,350
Sapta Gandaki	17,950	2,700	20,650
Karnali-Mahakali	32,680	3,500	36,180
Southern Rivers	3,070	1,040	4,110
Total	72,450	10,840	83,290

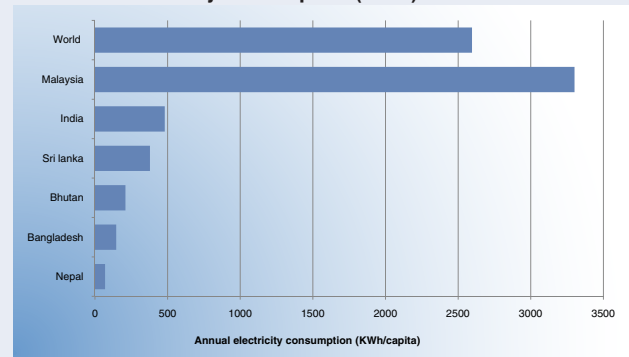
Adapted from Shrestha, 1966

DEMAND COMPARISONS

The electricity deficit in Nepal is perpetuated by myopic projections of future demand. The state utility predicts peak load demand to cross 2,000MW only by the year 2020.⁷ However, if per capita electricity consumption in Nepal was taken at the global average,⁸ Nepal would need an additional 17,000MW of capacity.

Contrasting consumption in Nepal with proximate countries shows the poor state of the current situation (see figure 1). The average person in Bangladesh, Bhutan, Sri Lanka and India respectively consume around two, three, five and seven times as much as their Nepali counterpart. Even more startling is that Malaysia, a country with approximately the same population as Nepal, consumes nearly 50 times more electricity!⁹

Figure 1: Country comparison of per capita electricity consumption (2005)

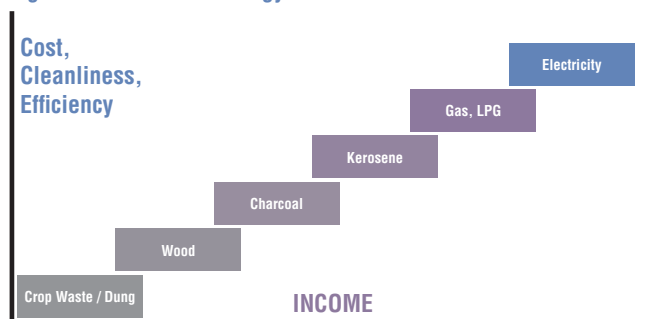


NEPAL'S LATENT ELECTRICITY DEMAND

Calculating more accurate statistics for future electricity demand requires us to think in terms of latent demand, i.e., demand capable of emerging but which is not yet active. This should, for example, take into account the possible uptake of electrical goods such as air-conditioners, microwave ovens and other household appliances. Cur-

rently demand for these goods is restrained because electricity shortages compromises the utility of these goods.

Figure 2: The classic energy ladder



Adapted from Duflo et al, 2008

If Nepal's middle class grows by 20% in the coming two decades as is expected¹⁰ so will the demand for electricity. People with more disposable income demand cleaner, more efficient sources of energy (see figure 2). To give an idea of the extra demand, substituting half of today's annual LPG consumption with electricity would require an additional 1000MW of electricity generating capacity. An absence of these types of considerations from top-level decision makers stops the electricity crisis from being properly addressed.

Even if a precise prediction of latent demand is not possible there is little harm in over supplying. Being located adjacent to India's energy starved states of Bihar and Uttar Pradesh presents the opportunity to export electricity. However, the immediate priority should be to use electricity for domestic value addition.¹¹

Transport, Industry and Commerce

ELECTRIFICATION of sectors like transport will significantly lower dependence on expensive petroleum imports and generate carbon offset benefits. The recent public announcement that transportation fares would be increased by over 9% for the second time this year¹² indicates that a long term strategy for

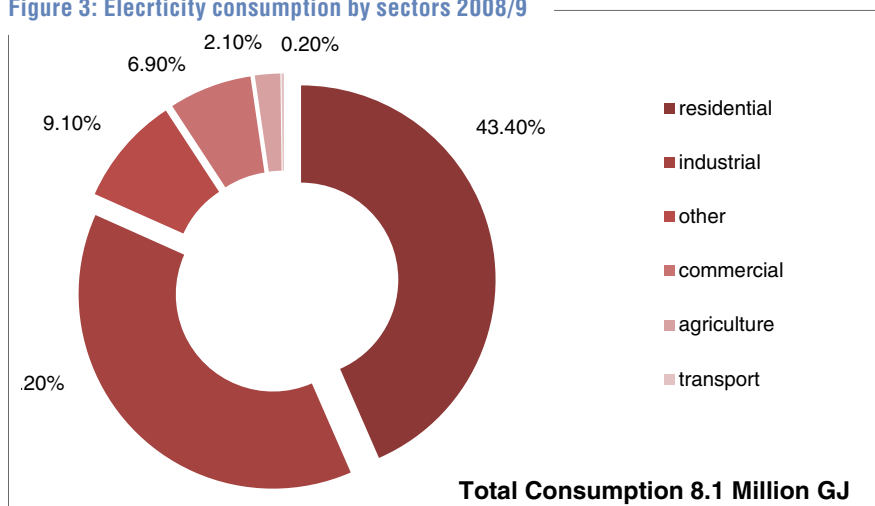
increasing electric transportation is needed sooner rather than later. China has been exemplary in rolling out an electrified public transport system in a relatively short period of time. Mentioning the uptake of electric trains, buses, cars and two-wheeler in China a few decades ago was laughable and the same is true for Nepal today. Nev-

ertheless, the possibility is there and experts suggest an additional 800MW is sufficient to make it happen.¹³

Growth of the industrial and commercial sector needs to be complemented with increased electricity output. Currently these two sectors consume less than half of total electricity and are being held back by shortages in supply (See figure 3).¹⁴ Looking ahead, the planned construction of a new international airport will need around 120MW to operate. One large scale aluminum or cement plant would consume nearly half of our current peak demand.

After construction for all 66 approved hydropower projects is finished they will be able to supply a total of 1471.5MW of electricity,¹⁵ which is simply not enough to satisfy Nepal's economic aspirations. We therefore need to not only expedite implementation but also to plan for more projects.

Figure 3: Electricity consumption by sectors 2008/9



Hours of Darkness

Electric transport and 24-hour lighting, appliances and machinery may sound like a fantastical dream but the current situation is a true economic nightmare. Diesel generators are used to compensate for power outages at great additional expense. The cost of generating one KWh of electricity from diesel is three times while furnace oil is twice the cost of generating electricity from hydropower. Purchasing the machinery is not cheap either.

The cost of heating using LPG is almost equal to the cost of generating heat using electricity. With the additional benefits that come with having a domestically supplied renewable

energy source, it is imperative to facilitate the transition. If a year's worth of government expenditure on LPG subsidies was channeled into hydropower, an extra 25MW of capacity could be built each year.¹⁶

The entire population continues to be affected by scheduled load shedding that has lasted for up to 18 hours a day to curtail electricity demand. In 2009 the cost to economy stood around USD one billion (NPR 7,290 crores), which was an eighth of GDP.¹⁷ Another study found that the opportunity cost of planned and unplanned electricity outages for industry in Kathmandu was USD 0.21/KWh (NPR 15.31/KWh) for an oxygen plant, USD 0.23/KWh (NPR 16.77/KWh) for a spinning mill, and USD 0.98/KWh (NPR 71.45/KWh) for a steel mill.¹⁸ Additional costs such as these inhibit Nepali industries from being globally competitive.

THE “NO” ELECTRICITY AUTHORITY

THE NEPAL ELECTRICITY AUTHORITY (NEA) was established in 1984 as a monolithic state-owned entity responsible for the generation, transmission and distribution of electricity. Today it has almost 10,000 employees making it one of the most inefficient electricity utilities worldwide. It has over 14 permanent staff per MW of installed capacity! A long history of political involvement in NEAs management has given rise to high levels of bureaucratization, inefficiency and corruption.¹⁹

The energy market was opened up to Independent Power Producers (IPPs) in 1992 but the NEA is still the only licensed distributor of electricity.²⁰ This monopsony situation (multiple sellers and one buyer) hinders distributive optimization. The problem is exacerbated in Nepal as the NEA is not only the sole buyer of electricity from commercial sub-stations but is also involved in power generation. It is justified then that IPPs are weary of an uneven playing field.

In 2010/11 fiscal year, NEA incurred a loss of NPR 2.39 (USD 0.03) per KWh and as a result had a net loss of NPR 6,511.65 million (USD 82.74 million).²¹ To escape financial turmoil, the NEA has lobbied for the electricity tariffs to be raised from the current levels (See figure 4), which have stayed the same for

the past decade.²² This wouldn't be needed if the NEA managed to reduce its operational inefficiencies, like leakages in transmission and distribution networks that amount to a loss of nearly 30% of total electricity.²³ These inefficiencies also results in unattractive Purchasing Price Agreements (PPAs) for IPPs.

The Ministry of Finance recently endorsed a proposal to write off the NEA's cumulative losses of NPR 28 billion (USD 384.09 million) and provide it with reduced interest rates.²⁴ The objective of this is to help strengthen and, supposedly, reform the state utility. But rather than strengthening, it would be worth scaling down the NEA to give room for more private sector dynamism and growth in the power sector.

Table 2: Electricity tariffs
(exchange rate NPR:USD = 72.9:1; average from Nov '10 – '11)

	up to 20 KWh	21 – 250 KWh	Above 250 KWh	Average
Price (per KWh) in Nepal	NPR 4.00 (USD 0.05)	NPR 7.30 (USD 0.09)	NPR 9.90 (USD 0.13)	NPR 6.58 (USD 0.08)

Source: NEA, 2011

ANALYSIS OF NEPA'S HYDROPOWER POLICY QUAGMIRE

UNLEASHING HYDROPOWER in Nepal requires the concerted efforts of multiple stakeholders. There is no silver bullet solution for this complex task. However, identifying issues facing the main actors will help draw out some relevant policy implications. In particular the role of the private sector, international donors, government and local communities needs to be constructively scrutinized to better understand the causes of Nepal's hydropower policy quagmire (See Table 3).

A) The Private Sector

Private sector players have dithered in deciding their role and have attempted

to take an all-in-one approach, i.e., as developer, contractor and vendor. A synchronization of specialized efforts will give better results. Developments taking place in the legal framework to ensure that unique functional entities must be separate for legal purposes is likely to help.

Progress in the peace process will strengthen investor confidence. This is particularly important for foreign investors, who can provide the necessarily capital to build up our hydroelectric capacity. Raising the sums of money needed - around USD 2 million (NPR 14.58 million) per MW of hydropower - is not possible for domestic players due to their limited

borrowing capacity. Even the largest Nepali business houses cannot raise the 20-30% of total equity they need to cover large scale projects.

The investment risks are exceptionally high as total scrap value is only 3-5% of original equipment cost. Inactivity during the decade of war resulted in a lack of research in producing sediment and hydrological time series data. This increases the cost of feasibility studies that are needed for financial lending agreements to be signed. In the case of the Bhote Koshi hydroelectric project this expense was around USD 3 million (NPR 21.87 million), highlighting the great amount of financial risk.²⁵

Finally, getting the private sector to perform requires strengthened linkages with supporting industries like finance, telecoms and insurance, which needs to be more actively promoted. This could be facilitated by industry trade bodies.

B) The Government

The government's foremost challenge is creating a stable environment for businesses to operate. To do this, a number of prevailing anti-business issues need addressing, e.g., aggressive and uncompromising labor unions, lack of a national credit rating, exposure to various political and commercial risks, lack of transparency, burdensome and incoherent regulatory framework, and an institutionalized culture of rent seeking. These are by no means straightforward tasks but high-level proactive engagement in these issues will improve prospects for the economy.

Incentives and guarantees similar to the Bilateral Investment Protection and Promotion Agreement (BIPPA) recently signed with India should be extended to more countries to relieve financial bottlenecks. Complementary deals like the USD 250 million (NPR 196.75 million) Line of Credit extended by India can arise. Economic diplomacy of this sort tells investors that Nepal is open for business and it is critical that this message is backed up with clear and consistent policies.

More liberalization of the power sector will result in rapid expansion and more widespread distribution, as exemplified by the telecoms sector. In the mid-nineties Nepal Telecom projected growth of around 2 million connections but with liberalization

Table 3: Nepal's hydroelectric policy quagmire

<p>A) A private sector which cannot perform</p> <ul style="list-style-type: none"> • Unsure of its own role: developer/contractor/supplier/vendor? • Difficulty attaining financial closure • Risks galore • Absence of supporting industries and deficit of information 	<p>B) An impeding public sector</p> <ul style="list-style-type: none"> • Difficult to attract investors to fragile states • A state utility without utility • Promoting business in a people's republic • Culling institutionalized rent seeking
<p>C) Flipping policies of international donors</p> <ul style="list-style-type: none"> • Lack of coordination between donors • Past failures undermine public's confidence in their support • Easily stifled by ideological opposition • Insufficient amount of scientific evidence 	<p>D) Innovative inclusion of local communities</p> <ul style="list-style-type: none"> • Distorted rights versus responsibilities debate • Need to manage inflated expectations • Gaining trust of communities • Innovative inclusion schemes required

Source: Author's own

taking place it is about five times this amount.²⁶ Contrary to what some political factions say, privatization can greatly promote social development. Thus the government should assign itself the role of a fair and efficient regulator instead of trying to be an active participant in this crucial sector of the economy.

Government officials' treatment of the hydropower sector as a means to get travel junkets and to employ their political cadre in Nepal Electricity Authority (NEA) needs to be rethought. The recent resignation of the Managing Director of NEA and the short-lived reforms initiated by the Minister for Water Resources display the gravity of erosion in governance and the difficulty for making reforms in the sector.

C) International Donor Organizations

International donors play an active role in hydroelectricity by providing technical and financial support, helping ensure local people become project beneficiaries, conducting social and environmental assessments, and advising governments on structural reform. But not all of their past involvement has benefited Nepal. The

World Bank pulled out of the 201 MW Arun III hydropower project in 1995 after investing time and resources into it, causing wasted time, resources and great disillusionment.

The lack of coherence between different donor agencies needs to be addressed. This problem arises as different donor agencies have conflicting agendas relating to energy sector reform. Whilst some appear to urge Nepal's government to improve incentives for the private sector and roll back the state utility, others provide financial support to the NEA to maintain its existing functions. World Bank's Power Development Fund could not make any difference as it was housed with the most controversial local bank as the manager of the fund. The German government continued to support building power plants when private sector investment had been tested and began working. More coordination of agendas through constructive dialogue will expedite the needed structural changes.

Inevitably such large scale infrastructure projects will incur some ideological conflict. International donor organizations ought to facilitate the arbitration of these disputes in fair

and effective ways rather than allow it to stifle progress. To do this, greater assistance is needed to build a regulatory framework for hydropower that addresses social and environmental concerns. Support is also needed to promote research and evidence based policy for issues where there is scientific uncertainty.

D) Community

In Nepal, the debate about rights and responsibilities has become divorced from reality. Inflated estimations of hydro electricity revenue have stoked unrealistic demands from local communities. Public dialogues need to take place to manage stakeholder expectations and IPPs must also be willing to help communities in various ways. Past cases have shown that lack of local acceptance for hydropower projects can result in project failure.²⁷

Therefore, it is essential that environmental and social information of specific projects needs to be documented and disseminated in an easily understandable way. Local communities can then make an informed contribution towards issues like the site identification, planning, benefit distribution and potential resettlement options. Affected communities also need sufficient lead time to consider the consequences of the negotiated proposals. Knowledge of, and respect for, local communities helps to gain their trust and to devise appropriate settlements in return for access to the required resources.

Endnotes

- 1 Jeroen van der Veer, Chief Executive Officer of Royal Dutch Shell, 2006. "Shell Energy Scenarios to 2050". Accessed November 10, 2011. http://www.shell.com/home/content/aboutshell/our_strategy/shell_global_scenarios/shell_energy_scenarios_2050/.
- 2 Hari Man Shrestha "Cadastre of Potential Hydropower Resources in Nepal" (PhD diss. Moscow Power Institute, 1966).
- 3 Nepal Electricity Authority. "Annual Report, 2011". Accessed 1 November, 2011. <http://www.nea.org.np/>
- 4 Water, Energy, Health, Agriculture and Biodiversity. "A Framework for Action on Energy". Accessed 25 October, 2011. http://www.johannesburgsummit.org/html/documents/summit_docs/wehab_papers/wehab_energy.pdf
- 5 United States Agency for International Development. "South Asia Regional Initiative for Energy". Accessed 3 November, 2011. http://www.sari-energy.org/PageFiles/Countries/Nepal_Energy_Overview.asp
- 6 Ibid
- 7 Nepal Electricity Authority. "Annual Report, 2009". Accessed 1 November, 2011. <http://www.nea.org.np/>
- 8 World Resources Institute. "Earth Trends Environmental Information". Accessed 5 November, 2011. <http://earthtrends.wri.org/>
- 9 Ibid
- 10 Asian Development Bank. "The Rise of Asia's Middle Class". Accessed 2 November, 2011. http://www.adb.org/Documents/books/key_indicators/2010/pdf/KI2010-Special-Chapter.pdf
- 11 Ratna Shrestha. "Hydrocratic Dreams" Nepali Times, May 13, 2011.
- 12 "Transport Fares Up 9.9 Percent" eKantipur.com, November 3, 2011.
- 13 Ram Shrestha. "Sustainable Transport for Low Carbon Society in Nepal: Institutional and Other Challenges". Accessed 1 November, 2011. http://lcs-rnet.org/meetings/2010/11/pdf/D2S10_1_Shrestha.pdf
- 14 Nepal Electricity Authority. "Annual Report, 2009". Accessed 1 November, 2011. <http://www.nea.org.np/>
- 15 Ministry of Energy. "Department of Electricity Development". Accessed 4 November, 2011. <http://www.doed.gov.np/>
- 16 Masami Kojima. Government Responses to Oil Price Volatility. World Bank, 1996. http://siteresources.worldbank.org/INTOGMC/Resources/10-govt_response-hyperlinked.pdf
- 17 Khadga Bisht. Hydropower Nepal. Kathmandu: Independent Power Producers' Association Nepal, 2010.
- 18 Roop Jyoti, Aygul Ozbafli & Glemnn Jenkins. The Opportunity Cost of Electricity Outages and Privatizations of Substations in Nepal. QED, 2007. http://qed.econ.queensu.ca/working_papers/papers/qed_wp_1066.pdf
- 19 Khadga Bisht. Hydropower Nepal. Kathmandu: Independent Power Producers' Association Nepal, 2010.
- 20 United States Agency for International Development. "South Asia Regional Initiative for Energy". Accessed 3 November, 2011. http://www.sari-energy.org/PageFiles/Countries/Nepal_Energy_Overview.asp
- 21 Nepal Electricity Authority. "Annual Report, 2011". Accessed 1 November, 2011. <http://www.nea.org.np/>
- 22 "Government mulls revising power tariff" Accessed 6 November, 2011. <http://www.ekantipur.com/2011/09/06/business/govt-mulls-revising-power-tariff/340333.html>
- 23 Nepal Electricity Authority. "Annual Report, 2011". Accessed 1 November, 2011. <http://www.nea.org.np/>
- 24 "Finance Ministry endorses NEA reforms proposal" Accessed 6 November, 2011. <http://www.ekantipur.com/2011/11/06/business/finance-ministry-endorses-nea-reforms-proposal/343326.html>
- 25 Revealed through discussions with former president of Bhote Khote Power Company Pvt. Ltd.
- 26 "Nepal Telecoms Authority" Accessed 10 November, 2011. <http://www.nta.gov.np/en/index.php>
- 27 Sustainable Hydropower. "Community Engagement and Acceptance" Accessed 10 November, 2011. <http://www.sustainablehydropower.org/site/social/communityengagement/management.html>

OUTLOOK & IMPLICATIONS

Tapping into domestically produced renewable energy will ultimately provide brighter prospects for future generations of Nepalis. It will also significantly help alleviate widespread poverty. Thus, the need for progress in this sector is very urgent. From the available data it is obvious that despite only having rough estimates, there is great potential for generating hydroelectricity in Nepal. The opportunities this affords are limitless but are prohibited by a policy quagmire. For this reason stakeholders and policy makers in government must actively seek to overcome problems by confronting their root causes. This discussion re-frames the debate on hydropower and emphasizes the need to reduce the opportunity cost of power outages by expediting hydropower development. It looks critically at what key actors are (not) doing and suggests that immediate attention needs to be paid to the following tasks:

- Using subsidies in the correct places to make the transition to hydropower more affordable instead of maintaining our dependence on imported petroleum products
- Insisting that Nepal's electricity demand is projected more accurately by taking into account latent demand and economic development
- Attracting IPPs to the energy sector by creating a level playing field and implementing liberalizing reforms
- Mandating the government to take on the role of a fair regulator rather than an obstructive and inefficient player in the hydropower sector
 - o Unbundle the NEA and the government
 - o Make the NEA focus solely on transmission
 - o Give the role of power generation to private firms
 - o Facilitate distribution through public-private-community partnership (PPCP)
- Ensuring a stable business environment and implementing more incentives to attract foreign direct investment for relief of the sector's financial bottleneck.
- Instigating more research for resolving ongoing scientific controversies and providing data relevant for hydroelectric project feasibility
- Redressing the distorted national debate about rights and responsibilities through a set of clear guidelines that ensures reasonable compensation for local communities

The current electricity crisis in Nepal not only withholds development from taking place, it also costs the national economy significantly. The financial burden of having to rely on alternative sub-stations such as diesel generators inflicts excessive costs on productive activity and hampers the efficiency of domestic industry. Additionally, it increases dependence on imported fossil fuels which is an unsustainable burden on government coffers and our environment. Hydropower is an obvious alternative for Nepal although close attention must be paid to the complexities and controversies surrounding it. However, instead of allowing these to derail Nepal's path to energy security certain compromises must be negotiated to deliver the most benefit to the greatest number of people in Nepal.