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Energy for Off-grid Villages in Nepal and The Role of Minigrids

Background Paper for

Smart Villages Workshop

Held in

Kathmandu on 10th April 2015

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Issue date: 07/04/2015

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Energy for Off-Grid Villages in Nepal and The Role of Minigrids

Nepal's energy situation reflects its challenging terrain (over 75% mountainous) and very low income levels (UNDP, 2013). About 25% of Nepal's 26.5 million people live below the poverty line, which varies by region but averaged 19,261 NPR per year (or about USD 0.75 per day) in FY 2010/2011 (Central Bureau of Satistics, 2012). The nation is among the poorest countries in the world, with per capita annual income of USD 742 in Fiscal Year 2011/2012 (Ministry of Finance, 2012).

The share of traditional biomass in Nepal's primary energy consumption is about 83.7% (FY 2010/11), of which firewood accounts for the major part. Petroleum products provide 10.4% of primary energy use, coal 2.9%, and grid-connected power generation (almost all from large hydropower) 2.2%. The share of off-grid renewable energy resources is only 0.7% (Ministry of Energy, 2012). If biomass, the largest share of primary energy consumption, is broken down by consuming sector, 90% is used by the residential sector followed by transport 3.9%, industrial sector 3.6%, commercial 1.3% and agriculture 0.6% (Water and Energy Commission Secretariat, 2010).

Despite the availability of extensive hydropower potential - of the order of 42,000 MW - Nepal has one of the world's lowest per capita electricity consumptions, averaging 146 kWh/person annually for FY2010/2011[1]. It is widely accepted that the shortage of power and frequent power outages have severely constrained economic growth in the nation.

Power outages bring down incomes in Nepal

Gagan's grocery shop sells food and other small items such as bread, sweets, and cold drinks. The grocer says, ***'We use energy for lighting, charging cell phones, and operating the refrigerator. We sell lots of cold drinks and make lots of money from this.'*** The electric powered refrigerator is at the mercy of load shedding, the prolonged daily power cuts that grid-connected Nepal is experience during the dry season when the hydro-generation is less effective. During this period, which is also the hottest time of year, the refrigerator mainly remains turned off due to the lengthy power cuts. However, for general-purpose lighting, his house and the shop, different types of lighting devices such as cell-based torchlight, candles and water-based battery, and CFL bulbs are in use. The income from the shop has been severely affected due to the ongoing energy crisis. The gradual decrease is both due to shorter operation hours and due to lack of power for refrigeration. He says, ***'I close down the grocery shop early evening and cannot sell cold drinks as per the demand of customers because of no supply of electricity from the national grid.'*** Subash runs a small carpentry workshop from his house in the same rural village. He uses electricity for lighting, running a fan, watching television, and to power carpentry tools. He says, ***'My profession needs electricity. However, power cuts due to load shedding disturb my regular working hours and capabilities and bring down my income. I cannot earn enough for my family: my wife and children have to rear cattle and find firewood to support the family.'***

(Practical Action , 2012)

[1] (For comparison, averages in 2009 were 517 kWh/person in South Asia, 571 kWh/person in India, 2,631 kWh/person in China, and 2,807 kWh/person in the world (Ministry of Finance, 2012).)

In 2011, about 67% of households used electricity as their main source of lighting - 94% for urban households and 60% for rural households (Nepal Electricity Authority, 2011). With 83% of the population living in rural areas (Central Bureau of Statistics, 2012), this means that some 8.8million lack even the most basic level of electricity access. Of the 60% of the rural population that does have access to electricity, roughly a quarter get that power from off-grid sources, while the other three-quarters obtain access from the grid (Shoko Noda, 2013). While progress has been made in dissemination of off-grid renewable energy systems, issues of affordability of up-front costs of systems (due both to high costs and lack of capital), financial sustainability (due partly to low utilization), and technical capacity constrains progress (UNDP, 2013). Where access is available, low system capacity often limits electricity use to lighting and other low power applications. The issues of power-cut (for grid-connected users) and limited capacity (off-grid users) may limit both the times of day at which they have access as well as the type of electricity consuming activities in which they may take part (Ministry of Finance, 2012).

Overall, around 15% of the rural population and 12% of the total Nepali population has access to electricity through off-grid renewable energy sources, mainly village micro-hydropower plants and solar home systems (Shoko Noda, 2013) as well as village-scale solar PV systems, institutional solar PV systems (such as those used in schools and health clinics), and solar PV agricultural pumping technologies.

Off-grid renewable energy in Nepal has proven its ability to play a significant role in the country's overall power provision. It is making substantial contribution and has the potential to make more, particularly in remote areas where grid extension does not make sense. Further, unexploited potential in most renewable energy segments is vast, particularly hydropower and solar PV with potential of wind being still unexplored for the lack of wind data (UNDP, 2013).

The Alternative Energy Promotion Centre (AEPC), under the Ministry of Environment, Science, and Technology is the key government organization for the nation's off-grid renewable energy efforts. AEPC has been implementing renewable energy projects with support from bilateral and multilateral development partners, including ADB, Danida, DFID, the EU, KfW, Norwegian Ministry of Foreign Affairs, SNV, UNDP and the World Bank. Similarly, the Ministry of Finance, Ministry of Local Development, Nepal Electricity Authority (NEA), Ministry of Energy, National Planning Commission (NPC), Ministry of Federal Affairs and Local Development (MFALD) and the Department of Cottage and Small Industries (DCSI). The Renewable Energy Test Station (RETS), the Council for Technical Education and Vocational Training (CTEVT), national and international NGOs, Nepal Micro Hydro Development Association (NMHDA) and qualified RET, Solar Manufacturers' Association of Nepal (SEMAN), Independent Power Producers Association (IPPA) and financial and insurance institutions are some stakeholder's of energy sector.

To date, most off-grid renewable power systems in Nepal have been developed with subsidy from the government and/or development partners. Currently, the Government of Nepal's Alternative Energy Promotion Centre (AEPC) with support from various donors provide subsidy to these projects accounting for about 40% of the costs. The other 60% of the financing is typically provided by the developer (via debt and equity financing) and community/rural electric cooperatives, which generally provide part of their equity contribution in-kind through labour. Yet, even this level of subsidy has so far not been adequate to spur development to the pace AEPC now targets for the sector.

Prospects for Minigrid Development

According to the recently completed RISE (Readiness for Investment in Sustainable Energy) pilot study undertaken by the World Bank as part of the SE4All Initiative, Nepal generally provides an inviting environment for energy investments. Of the twelve countries reviewed, Nepal ranks second (behind India) in terms of its readiness for energy access investment (World Bank, 2014) (see fig 1 below).

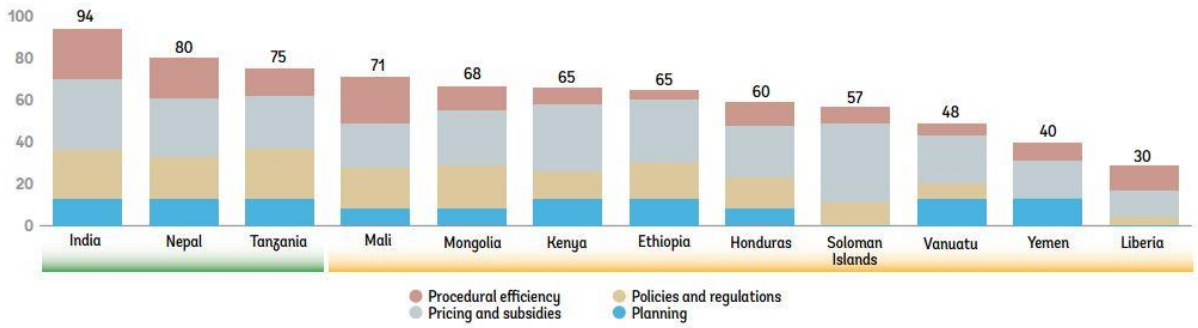

Figure 1 RISE energy access scores (World Bank, 2014)

Despite this, political instability has stalled progress on many large energy infrastructure projects. Many projects are still at the feasibility study stage or have been put on hold. In contrast, small-scale off-grid hydropower stations (totalling about 37 MW) and other renewable energy power producing technologies should provide much more potential for progress as they are not stymied by larger political and institutional issues (Alternative Energy Promotion Centre, 2011).

As the RISE pilot study notes, Nepal has regulations explicitly allowing operation of minigrids, though they are not yet comprehensive[2]. With some 2500 micro-hydro based minigrids, Nepal is, however, one of only a handful of countries with operational privately owned mini-grids and experience of the minigrid licensing and permitting process.

In Nepal, mini-grid development linked to small hydro schemes has been relatively successful and rural entrepreneurs have driven it. This has been attributed to (Martinot et al., 2002):

- The availability of credit from a public sector agricultural development bank.
- Simplified licensing procedures to reduce transaction costs.
- Unrestricted power tariffs, private financing from commercial banks.
- Capital cost subsidies from the government.
- Technical assistance by bilateral donors and NGOs leading to technology development and manufacturing within Nepal's industrial base.

(The history of mini-grid development in developing countries – (GVEP, 2011)

[2] This compares with countries such as Mali and Tanzania which have set up innovative mechanisms to support mini-grid development including: regulations outlining rights and mandates of developers, a right to charge a higher tariff than the national level to recover the incremental cost of mini-grids, no requirement of prior regulatory approval before sales, mini-grid standards, protection against expropriation, and duty exemptions or subsidies.

The RISE study also notes that the cost of permitting a minigrid has been kept minimal at $37 and the government provides subsidies to mini-grid promoters. Still, the process to obtain all the necessary approvals is quite long and burdensome, as it requires approvals from six agencies and takes more than seven months. (See Fig 2 below). The report also suggests that Nepal could improve its mandates for mini-grids by including provisions for reliability and safety, and laws against expropriation, and that it could also usefully seek to adopt financing for rural and new household connections.

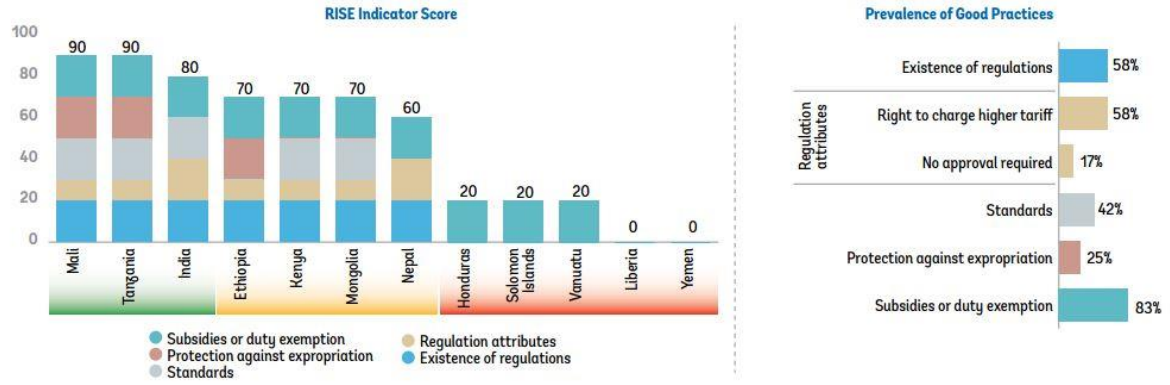

Figure 2 A handful of countries have performed well in creating an enabling environment for mini-grids (World Bank, 2014)

Furthermore, the RISE study notes that for those who are connected to the grid, the cost of electricity is, at ~6.9 US c/kWh, (in the centre of the distribution for the countries reviewed, see Fig 3 below) and is regarded as affordable for most households, with a "standard package" of 30kWh/month costing 0.8% of Gross National Income per household. While this benefits those with grid access it poses a significant challenge for mini-grid developers in seeking to achieve comparable tariff levels.

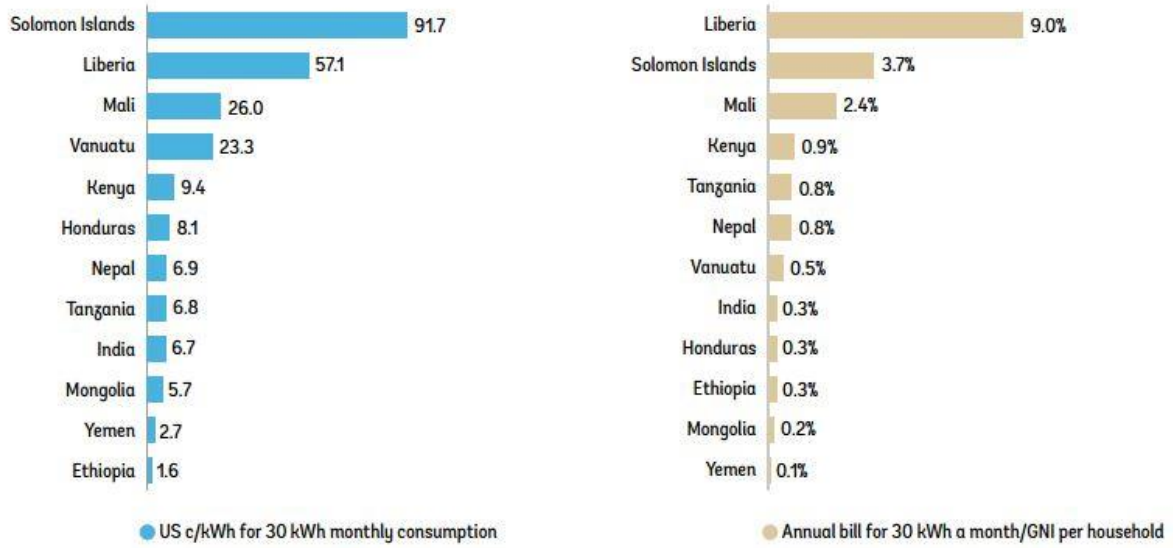

Figure 3 Tariffs and affordability vary widely among countries (World Bank, 2014)

Minigrid developers also face the challenge of low levels of demand, particularly in isolated rural communities. If minigrids are to become an economic prospect for investment, a focus on productive uses and achievement of access to markets for electricity enabled goods and services will be needed.

Conclusions

Both the potential and the need for off-grid and specifically minigrid provision of electricity to many rural communities in Nepal are clear, and Nepal has one of the strongest track records of hydro mini-grid development in the world. Despite this, development to-date has failed to match the potential and it is equally clear that further steps will be needed if these prospects are to be brought to fruition at the required scale.

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