NEPAL RENEWABLE ENERGY PROGRAMME

POLITICAL ECONOMY OF MAINSTREAMING RENEWABLE ENERGY IN NEPAL

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I. DEFINING THE MAINSTREAMING "PROBLEM"

1.1 The Context of the PEA

This report by the Policy Entrepreneurs Inc. (PEI) is part of the submission for the task contracted out by the Nepal Renewable Energy Project (NREP) to conduct a political economy analysis (PEA) of mainstreaming renewable energy (RE) in Nepal. Because of the complex nature of the work being attempted[1] and managing the expectations of the readers with differing backgrounds, we believe we need to be clear from the very outset on a number of things.

First, it is important to clarify the term *political economy analysis* and establish what to expect from this exercise. For this, we rely on *The Beginner's Guide to PEA*, a guidebook commissioned by the UK Government and prepared by the National School of Government International. In this *guidebook,* PEA is defined as "the attempt to find out what is really `going on' in a situation, what lies behind the surface of the immediate problem, for example, whether competing interests exist (sic)." It adds: "PEA is something that can be a natural part of the way in which we all work, much of it hinges on how we inquire into the issues on which we are working, i.e. asking who wants what, why and how?."

The *guidebook* further notes: "the important point is that if we work in development, we are inevitably already involved in political processes and may unintentionally be shaping those processes. PEA, therefore, helps us to peel back the layers of our `political' context." In essence, many analysts often point to the "lack of political will" as the biggest challenge to desired policy reforms. It notes further: "PEA, therefore, helps us to unpack all the issues previously lumped into the `political will' box, so that we can consider the factors to which we must adapt and those that we can try to influence and change." And most relevant to NREP's engagement in policy reform and covered in the final section of this report is the fact that: "PEA can help us to identify entry-points for politically smart interventions… and to outline potential `pathways for reform.'

Second, given the many possible interpretations of some of the concepts used in this discourse, we first establish some definitions. Please note that here we limit to definitions only; the choice of these definitions will be much clearer as we discuss them in more detail later in the report. We begin by defining *renewable energy*. In the global discourse, this refers primarily to energy sourced from hydropower, solar, or wind.[2] But given its immense potential, hydropower dominates Nepal's electricity sector. Meanwhile, other renewable energy sources have been largely considered as a means to increase access to electricity for Nepalis living in extremely rural areas. Hence, when we refer to renewable energy, we will be referring to *other-than-hydro-renewables*. Furthermore, given that the discourse of solar is relatively at a more advanced stage among these *other than hydro-renewables* in Nepal, we will be referring to this particular technology.

Third, we need to define *mainstreaming*. We are aware that there may be differing opinions on what to consider whether or not the mainstreaming of renewable energy has been truly achieved. But based on the scope of work given, how we define the public problem[3] (see section 1.2), our need to come up with a very specific definition for the political economy, and our discussions with various stakeholders of the sector for the purpose of this engagement, we are defining the "mainstreaming of renewable energy" to mean that the policy conditions are established by the Government for full integration of the *other-than-hydro renewables* into the national grid. This

[1] The complexity of this task is defined later in the report.
[2] Biomass and nuclear are also consider renewable, but we do not include them here given the first is not efficient and nuclear is not an option for Nepal.
[3] We use the term “problem” here in the public policy sense, where a policy is a government’s response to a public problem.

definition is in no way is meant to negate all of the important work that is being done in other areas of RE in Nepal and elsewhere.

And finally, we need to emphasize that this document should not be read as a single final report but rather a *living document*. Politics evolve, and it must always be factored in. Other times, new information becomes available that may change the understanding of political settlements. The goal is for the PEI research team and the NREP project team to use this as the basis for ongoing conversations. In that sense, the ideas presented here should be considered as discussion points that will be updated iteratively as the project progresses. In this collaboration, the NREP project team's expertise will be complemented by the political economy analysis of PEI to seek the possible strategies to achieve the stated objective of mainstreaming renewable energy in Nepal.

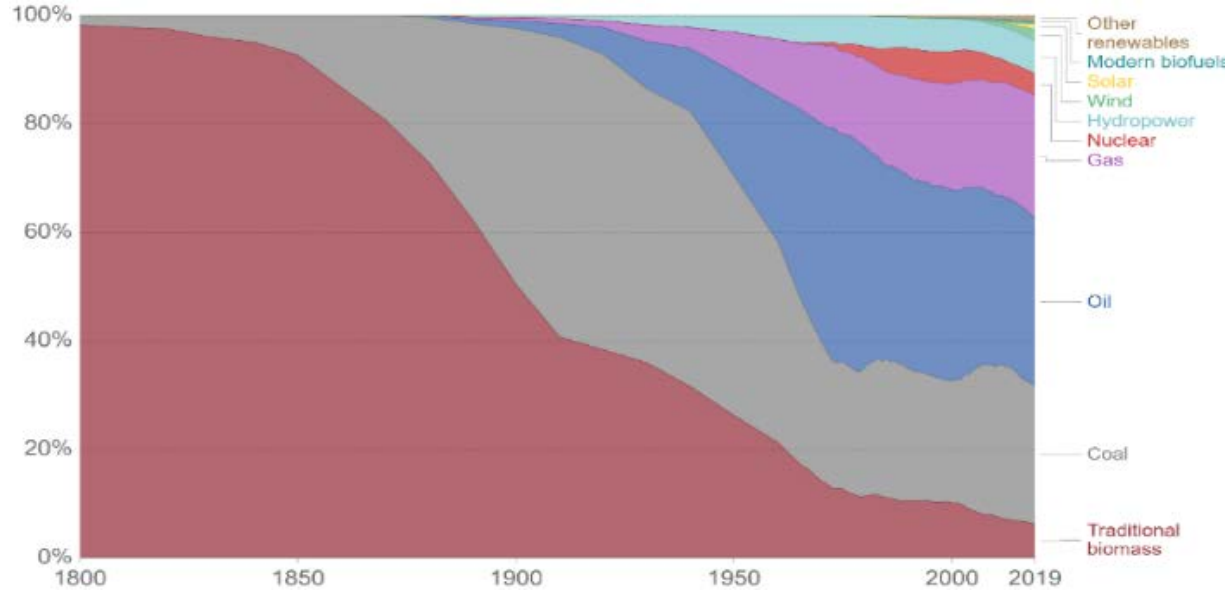
1.2 The "Public Problem"

In policymaking, oftentimes, the framing of a public problem is as important as having a solution. In a battle of ideas, where multiple constituencies have divergent viewpoints, how an issue gets framed usually determines which idea gets elevated over another.[4] Also, convincing policymakers to empathize with a problem can mean the difference between whether or not they are willing to consider policy alternatives. Furthermore, it helps clarify among the multiple constituencies who might be lobbying for the same reform, albeit with very different sets of interest, and indicate possible strategies to collaborate for the same end goal. And so, before we get into the political economy analysis of mainstreaming renewable energy in Nepal, we begin by defining our understanding of "the problem."

For this, we begin with a quick note on humankind's need for energy and the evolution of sources of energy. For most of history (see Figure 1 below), up until the early 1800s, this energy need was largely limited to heat, which was met primarily by traditional biomass such as firewood. But as humans figured out how to transform heat into mechanical energy, there was a gradual shift to coal. By the mid-1950s, coal propelled the industrial revolution, exemplified by the technology such as the steam engine, resulting in the rapid economic growth of many western countries. The use of oil and gas also increased from the 1900s, with the rise of the internal combustion engine that became the driving force of modern transportation.

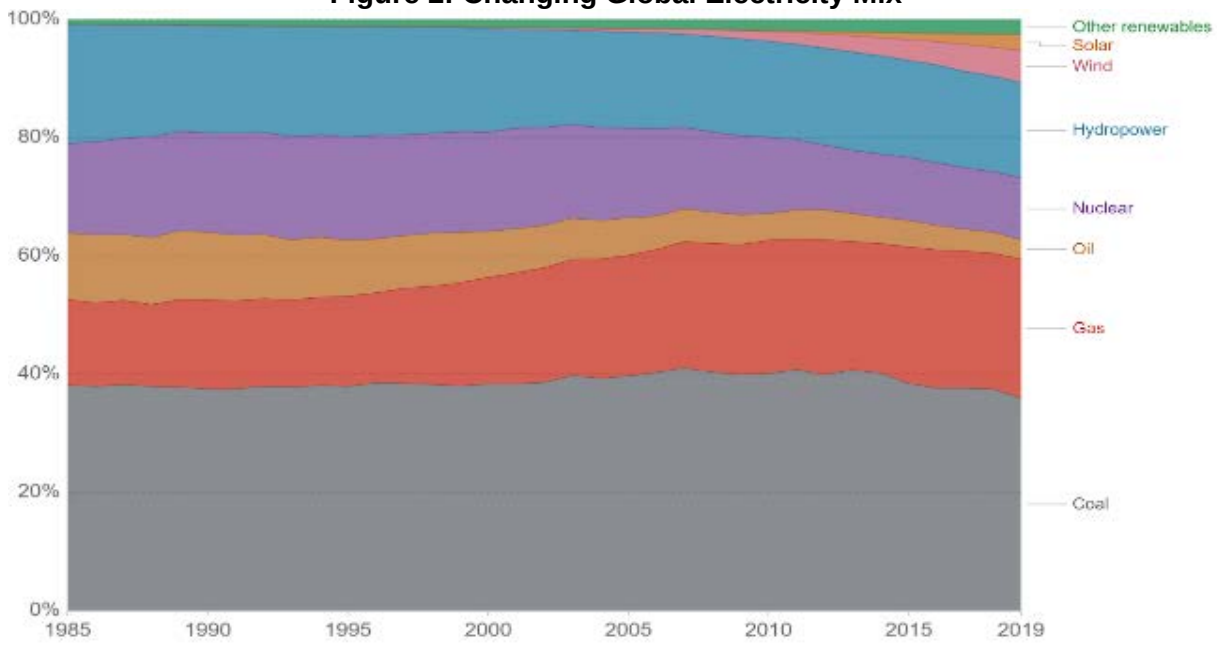
[4] Deborah Stone. Policy Paradox.

Figure 1: Changing Global Energy Mix[5]



Source: https://ourworldindata.org/energy-mix#

Figure 2: Changing Global Electricity Mix



Source: https://ourworldindata.org/energy-mix#

By the 1900s, as electricity was being made more functional, it began displacing the dominance of mechanical energy. Given its versatility, electricity became ubiquitous in modern society, from lighting to heating/cooling homes to powering computers and industrial machineries. It powered the information revolution that helped increase human productivity in today's modern age. This electricity was generated mainly using coal, gas, and oil, which today accounts for close to eighty percent of all generated electricity. The rest is sourced to renewable sources such as nuclear, hydropower, solar, and wind.

[5] https://ourworldindata.org/energy-mix

In these 200 years, energy sourced from coal, gas, oil, nuclear, water, solar, and wind played a crucial role in the development of society. But with the fossil-based fuel sources linked to the growing crisis of climate change, there is a strong push to replace them with renewable sources. Currently, around 80 percent of electricity still comes from fossil-based fuels (see Figure 2). *The sector is the largest source of anthropogenic emissions and accounts for nearly 73 percent of the total GHG emissions. Of this, the generation of electricity and heat alone account for 30 percent of total GHG emissions.*[6] Only around ten percent is from renewable sources. But changing technology, government policy for adoption, and availability of financing is showing signs of the possibility of this eventual change.

Nepal energy transition, however, has not followed the global trend. While the overall demand for energy has risen by around 145 percent in the last three decades,[7] the failure to adequately industrialize and realize the intended development goals has meant that approximately 85 percent of the country's energy need, in 2020, is still being met by biomass. This is consumed mostly by the residential sector, which constitutes about 83 percent of the total energy consumed in the country. The second-largest energy-consuming sector, accounting for 7 percent of total consumption, is transportation, which is sourced primarily to oil products (4 percent of primary energy supply). Industries consume about 5 percent of the total energy. Only four percent of the total energy consumed in Nepal is sourced from hydro.

The consumption trend shows a decrease of over 10 percent in the use of biomass, from 95 percent to 83 percent, from 1990 to 2014. In the same period, the use of coal increased from less than 1 percent to 4 percent and oil products from 4 percent to 12 percent. Hydropower increased its share from about 1 percent to 3 percent. This shows that despite a late start, Nepal is gradually looking to transition away from the traditional biomass and into the new era.

Item	1990	1995	2000	2005	2010	2014
Total Primary Energy Supply	**5,789**	**6,712**	**8,108**	**9.132**	**10,211**	**11,690**
Coal	49	74	258	248	303	484
Oil products	244	501	713	724	983	1,359
Natural gas	0	0	0	0	0	0
Hydro	75	100	140	216	276	326
Biomass	5,425	6,039	6,988	7.928	8.592	9,403
Total Final Energy Consumption	**5,761**	**6,667**	**8,041**	**9,050**	**10,107**	**11,534**
Industry	106	161	379	388	449	665
Transport	111	203	270	275	637	858
Residential	5,465	6,170	7,199	8,128	8,718	9,624
Commercial and public services	43	60	97	165	171	219
Agriculture/Forestry	33	60	75	72	118	151
Non-energy use	4	7	11	20	10	8

ktoe = kilotons of oil equivalent.
Source: International Energy Agency (IEA). http://www.iea.org/statistics

Part of this trend can be attributed to a progression resulting from the natural development pattern of the Nepali society. With increased migration, urbanization, globalization, Nepalis are shifting to a more modern lifestyle. The Government also pursued a policy to promote energy transition. While the first hydropower plant developed in Nepal over a century ago may have been to serve the opulence of the Rana rulers, the post-Rana governments have consistently considered

[6] Mengpin Ge and Johannes Friedrich, 2020. https://bit.ly/2Q5Qhfv
[7] International Energy Agency (IEA); MoF (2020).

electricity both as a means to development and as development itself. This was stated even back in the nineties when the Government was already thinking about the use of electricity to make "the minimum utilization of fuel wood and to render necessary assistance in the conservation of forest and environment" and "the development of transport system to be run by hydroelectric power in order to substitute the petroleum products."[8]

This electrification it envisioned would be done by exploiting what it considered to be its abundant natural resource, water. As a result, Nepal's electricity mix does not resemble the global scenario, as around 90 percent of its installed electricity capacity is hydropower. The rest of the electricity demand is supplied through thermal[9] sources (5 percent) and solar (5 percent). The government entity with the task to oversee this electrification of the country is the Nepal Electricity Authority (NEA). According to NEA, NEA has connected about 86 percent of the population to the national grid in 2018.[10] The Government and NEA have set an ambitious goal of fully electrifying the country "within the next few years", which is well ahead of the 2030 target set by the UN Sustainable Development Goals[11]. Backed by increased import, electricity consumption per capita has risen from 150 kWh in 2015 to 267 kWh in 2020;[12] among the lowest across the world. It is also looking to increase the electricity consumption of Nepalis from 10,138 GWh to 31,196 GWh by 2030[13].

Concurrently, the government has had another set of initiatives, implemented as various donor-funded projects and pursued through the Alternative Energy Promotion Center (AEPC), to help with the energy transition. AEPC's first task was to replace traditional energy sources such as firewood and dung cakes with more efficient ones, promoted through technologies such as biogas, improved cook stoves, and solar water heaters. AEPC's second task was to increase access to electricity of populations living in remote areas via off-grid solutions, which it promoted through isolated micro-hydro and solar home systems. But with the demographic shift towards urban areas and the government's interest to ensure full electrification, this mandate of AEPC is in a fast decline.

1.3 The Case for the Mainstreaming RE in Nepal

Here we provide a brief overview of the various arguments that are being made for mainstreaming renewable energy in Nepal.

1.3.1 Rethinking Nepal's Renewable Energy Narrative

As stated earlier, renewable energy has been, for the most part, considered a fringe technology in Nepal. This is because of the high cost associated with RE technology and the perception that it is sub-optimal in terms of what it can deliver to meet the desired energy needs of consumers. This is evident because even rural populations seem to prefer grid-connected systems to their off-grid counterparts. Consequently, RE has been limited to providing access to electricity and to transition towards a more modern and efficient energy source to rural populations through off-grid technology.

[8] Hydropower Development Policy, 1992
[9] Nepal Electricity Authority (2020). Generation Directorate 2077
[10] MyRepublica. 2020. Over 86 percent households have now access to electricity through national grid. https://bit.ly/3g2kvsS
[11] Rijal, P. 2019. 95.5 percent of Nepalis have an electricity connection, report says. https://bit.ly/3vAYk3D
[12] Himalayan News Service (2020).
[13] Gunatilake, Herath, Priyantha Wijayatunga, and David Roland-Holst. "Hydropower development and economic growth in Nepal." (2020).

For example, the price of solar PV modules has fallen by around 90 percent since the end of 2009.[14] This has helped change perceptions on the cost competitiveness of RE technology and thus facilitated its wider adoption.[15] Similarly, recent years have seen a rapid and sustained rise in electricity storage innovations, with batteries accounting for nearly 90 percent of all new patents in the area of electricity storage.[16]

However, a new discourse on renewable energy is beginning to gain traction in Nepal. This is due to, first and foremost, the accelerated improvements in technology design and efficiency coupled with improvement in manufacturing efficiency, which have led to a drastic reduction of costs of RE technology.[17] For example, the price of solar PV modules has fallen by around 90 percent since the end of 2009, and wind turbine prices have fallen by close to 60 percent since 2010.[18] This has supported changing perceptions on the cost competitiveness of RE technology and thus facilitated its wider adoption.[19] Similarly, there has been a rapid improvement in electricity storage innovations, with batteries accounting for nearly 90 percent of all patenting activity in the area of electricity storage.[20] The advent of large and efficient utility-scale lithium-ion battery technology and its role to address issues of RE intermittency is arguably going to be a game-changer for a wider and accelerated RE transition. With rapidly declining prices, as much as 70 percent between 2015 and 2018, "big-batteries" of up to 400 MW are already being deployed across many parts of the world.[21]

Second is the climate change narrative that is pushing governments to replace fossil fuel with renewable energy. Countries are committing to massive transition. With demand for electricity and heat expected to grow exponentially, the need to progressively reduce global dependency on non-renewable sources of energy is vital to avoid climate change. The role of renewable and clean energy sources such as hydropower, solar, and wind in this transition is prominent. Global commitments for net-zero GHG emissions by 2050 under the Paris Agreement have further provided the policy impetus for the global RE transition.[22] As a result, the last decade has seen a widespread development and deployment of RE, especially solar and wind. This has supported a growing share of RE in the global energy mix - though still very small, it is slowly increasing (Figure 1). In comparison, the achievements of RE transition in electricity generation are both noticeable and highly encouraging (Figure 2). As of 2019, solar and wind together account for eight percent of the global generation mix and are forecasted to reach 30 percent by 2030.[23] Due to these push and pull factors, utilities are figuring out a way, despite the issue of intermittency, to incorporate renewable energy into their system.

This new discourse is also beginning to take shape in Nepal, as studies reveal [see the SWOT analysis from the ESMAP study] the benefits and challenges associated with investing in RE technology. The Nepali government has, as part of its Nationally Determined Contributions under the framework of the Paris Agreement has set up a target "to expand clean energy generation from approximately 1,400 MW to 15,000 MW, of which 5-10 percent will be generated from mini

[14] International Renewable Energy Agency, https://www.irena.org/costs
[15] Ibid.
[16] International Energy Agency. 2020. A rapid rise in battery innovation is playing a key role in clean energy transitions. https://bit.ly/31u5CIZ
[17] Murray, B. 2019. The Paradox of Declining Renewable Costs and Rising Electricity Prices. https://bit.ly/3qMSJUw
[18] International Renewable Energy Agency, https://www.irena.org/costs
[19] Ibid
[20] IEA. 2020. https://bit.ly/31u5CIZ
[21] Katz. C. 2020. The batteries that could make fossil fuels obsolete. https://bbc.in/3rz64A8
[22] Baruch-Mordo, S., J. M. Kiesecker, C. M. Kennedy, J. R. Oakleaf, and J. J. Opperman. "From Paris to practice: sustainable implementation of renewable energy goals." *Environmental Research Letters* 14, no. 2 (2019): 024013.
[23] World Energy Outlook, 2020

and micro-hydro power, solar, wind and bio-energy." This commitment shows that the Government intends to have the RE generation into the national grid, meaning that the Government is rethinking RE not just for the rural population but also for the country's overall energy sector. In line with this target, NEA has already signed PPA with 22 grid-connected solar projects for a total capacity of 90.2 MW and are in various stages of development. Similarly, the Government has also issued 110 MW of generation licenses and 600 MW of survey licenses for solar.

More interestingly, Nepali Independent Power Producers (IPP) who have traditionally invested in hydropower are also beginning to consider adding solar to their portfolio. For example, Api Power Private Limited, which has two completed hydropower projects with a total capacity of 16.5 MW, has four solar projects with signed PPAs totaling 32 MW. In addition to the decreasing cost of the technology, IPPs state that the shorter period of time it takes to build a solar plant, especially in relation to hydropower projects, is a major factor for them.

Table 4.12: SWOT analysis relative to the solar resource and photovoltaic potential in Nepal

Strengths	**Weaknesses**
• Good solar resource and PV power potential • Flat terrain (or low slopes) is available and existing electricity infrastructure give prospects for development of medium to large scale PV power plants • Existing off-grid and minigrids technology for remote communities	• Large areas of dispersed small settlements • High costs of grid connection, in remote areas is not feasible • Terrain constrains: high elevation and slope, shading, accessibility • Air pollution in urbanized areas • Relative short history of solar PV and only for rural electrification [28]
Opportunities	**Threats**
• Dependency on fuel imports • Growing demand for electricity • International support programs • Positive attitude to renewable energy • Reduced cost of PV • Combination with other renewable energy sources (mainly hydro) helps dealing with variability of solar resource • Approx. 220 MW of solar electricity can be produced in Kathmandu that would substantially cover current demand and reduce environmental pollution [39]	• Geographical risks (e.g. extreme terrain, landslides, avalanches, floods, snow, extreme weather events) • Short term variability of resource has to be analyzed for more effective PV integration

But investments in the RE sector is not limited to just the more prominent developers. A handful of smaller companies are also investing in roof-top solar systems. For example, Saral Urja Nepal invested in a 50kW system and signed a 15-year PPA with NMB Bank to provide electricity at a unit price lower than from NEA.[24] Larger private companies are also beginning to invest in solar roof-top systems as a way to lower their electricity cost. For example, Yak and Yeti, one of Nepal's premier five-star hotels, recently installed a 413 kW solar system on its premises. There are discussions around connecting these isolated systems to the grid through net metering provisions, which would be an added incentive for these companies.

[24] Saral Urja Nepal. http://www.saralurja.com/about.php

But renewable energy technologies come with their own set of challenges. For solar, the two most critical challenges are the intermittency of the energy source and the general requirement for land to build solar projects.

1.3.2 Rethinking Nepal's Hydropower Narrative

The reality of Nepal's hydropower is a paradox of high potential and low achievement. On the one hand, the narrative of Nepal's immense hydropower potential runs deep into the Nepali psyche. On the other hand, the failure to adequately exploit this resource has constrained the country's development while deepening its reliance on energy import from the very country it expects to sell excess capacity. The Government, however, has been—and continues to be—committed to pursuing its hydropower vision. These have been popularized by political slogans such as *10,000 MW in 10 years* and also stated through policy documents going back to the periodic plans of the 1960s to recent documents such as the White Paper on the Current Status and Future Roadmap of Energy, Water resource and Irrigation made public in 2018.

This commitment makes absolute sense given that not only is hydropower a renewable source, it is also the product of one of the primary natural resource that Nepal has been endowed with. As the water runs through the high Himalayas, the steep terrain provides the ideal locations for Nepal to build its hydropower projects. Also, despite its high initial cost of developing projects, the lifetime cost per unit of electricity from hydropower is relatively cheaper than other sources. And finally, these hydropower projects are generally built in rural areas, as a result of which, these localities benefit in a number of ways: from the roads that are developed to the project sites, additional employment during the time of construction, other benefit-sharing programs implemented by the projects such as rural electrification, and lastly, a portion of the royalty from the projects are reallocated back to the affected communities.

But there are a number of challenges in developing hydropower, some of which are factored into the hydropower narrative, while others are not. The first challenge is the long gestation period for hydropower projects development, especially when compared to RE projects. For example, a project of about 10 MW capacity generally takes about, in an ideal scenario, four to five years to develop. To compare, a recent construction of a 10 MW solar power plant in Dhanusa took seven months to complete. Furthermore, the preparatory stages of project development of hydropower take relatively more than for the other renewable energy. The second challenge is the large social and environmental footprint of hydropower development. The demography of the country has changed in such a manner that many of the projects that were once thought of as ideal projects now have to be reconsidered. For example, a JICA-study in 2014 identified Sunkoshi-2 and Sunkoshi-3 hydropower projects in the list of top 10 reservoir projects for Nepal.[25] By 2015, however, building these two projects meant having to submerge significant large settlements such as Dolalghat and almost 40 kilometers of the BP Highway. Similarly, the development of the 1200 MW Budhigandaki Storage hydropower project will require the resettlement of thousands of households, including the entire town of Arughat. These type of resettlements come not only with a huge financial cost to the projects but also the social costs that are entirely borne by the citizens for whom this means the loss of their traditional homes.

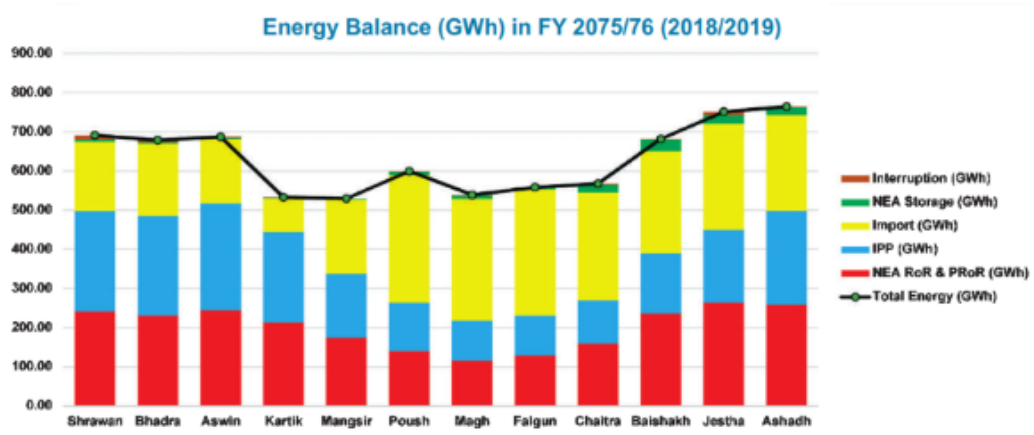
Finally, the issue of climate change and the contributions of energy is at the heart of the current push to transition the sector towards more sustainable sources. While the global discourse, as discussed earlier, is about transitioning away from fossil-based fuels to renewable sources of energy, this is not applicable in a country like Nepal, where hydropower, a renewable energy source, powers over 90 percent of the electricity system. But this does not mean that hydropower

[25] JICA. “Nationwide Master Plan Study on Storage-type Hydroelectric Power Development in Nepal.” (2014).

is isolated from the impacts of climate change. On the contrary, cryospheric changes from climate change-related activities are now a scientifically established phenomenon,[26] which will increasingly expose hydropower to risks such as extreme seasonal precipitation intensity, uncertain hydrology, and the prospects of glacial lake outbursts.[27]

1.3.3 Exploiting Possible Hydro/Solar Complementarities

While Nepal is, in theory, abundantly rich in water, it is quite seasonal, with most of it flowing during the monsoon. During the winter season, the water in the Himalayan rivers drops drastically to about a third of its full potential. This, coupled with the fact that most of Nepal's hydropower projects, both current and future, are run-of-rivers (RoR) schemes, means that the supply in the Nepali electricity system maximizes in summer and decreases to about a third during winter. Nepal has a limited number of reservoir type projects in the works, which will not be able to handle the increased demand. In the coming years, seasonality will result in a surplus in the wet season and a deficit in the dry season, during which Nepal will continue to rely on imports from India to meet its domestic demand.



However, the effects of seasonality in the Nepali power system do offer unique opportunities for complementary RE integration. A wider strategic deployment of RE systems, in conjunction with a phased and strategic realization of hydro capacity, can help overcome current and future supply deficits. This combination of hydro-solar generation profile can contribute towards effective load management: RE systems can support daytime load while allowing existing and future RoR projects to discover their peaking capabilities. The inevitable advent of RE storage, which today serves as the most significant limitation of the technology, and its successive adoption will further add to this complementarity. These complementarities, if realized, can help reduce electricity imports. More importantly, a hydro-solar generation profile well compliments Nepal's aspiration for exporting electricity. The availability of peaking power in the Nepali system can be dispatched for cross-border electricity trade - the demand and price of peaking power is generally higher in all segments of the Indian electricity market.

[26] Poloczanska, Elvira, Katja Mintenbeck, Hans O. Portner, Debra Roberts, and Lisa A. Levin. "The IPCC special report on the ocean and cryosphere in a changing climate." In *2018 Ocean Sciences Meeting*. AGU, 2018.
[27] Bhatt, Ramesh Prasad. "Hydropower development in Nepal-climate change, impacts and implications." *Renewable hydropower technologies* (2017).

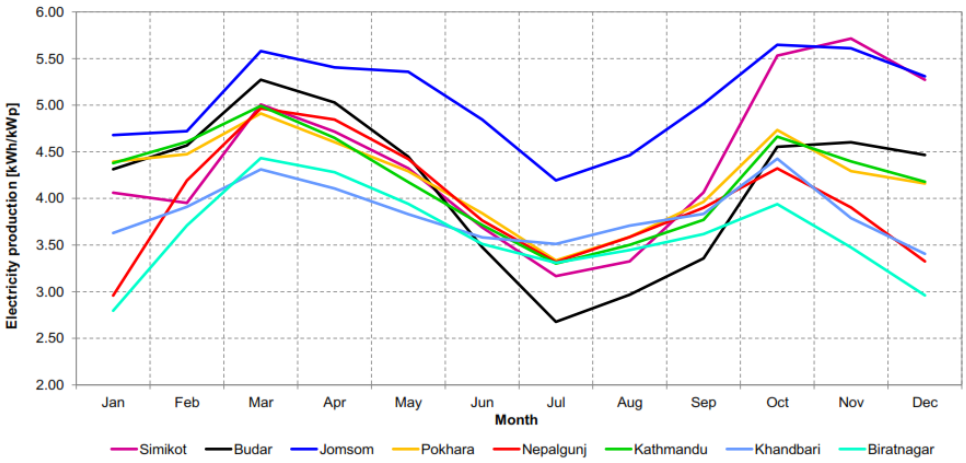


Figure 4.11: Monthly averages of daily totals of power production from the fixed tilted PV systems with a nominal peak power of 1 kW at eight sites [kWh/kWp]

1.3.4 Ensuring Equitable and Efficient Energy Access through Distributed Generation

Nepal's mountainous terrain and its sparse settlements are major challenges to ensuring universal grid-based access to affordable and reliable energy. Not only do these challenges make it expensive to build the necessary transmission and distribution network to far-flung settlements, the resulting system is also prone to a greater degree of technical loss. The Government has thus far relied on isolated RE systems such as solar home systems and micro-hydro power plants to cater to people living in these rural areas, who currently account for about 15 percent of the total population.[28] But these systems are limited in their reliability and lack the robustness to support endeavors that can boost economic activity. Many of these systems, especially micro-hydro, have not been able to prove themselves as being economically viable solutions.[29] Finally, due to the lack of a coordinated approach between the government agencies, the sustainability of these infrastructure remains an area of concern with the prospect of eventual grid extension. As a result, even rural populations seem to prefer grid-connected systems to their off-grid counterparts

Therefore, in exploring solutions to provide grid-based universal access to electricity, one option recently studied by the Government[30]—commissioned by the National Planning Commission and conducted by the NEA Engineering Company—is the concept of distributed generation. This approach, which seeks to use Sustainable Distributed Generation and Grid Access to All (SUDIGAA) as the guiding principle, employs small-scale modular RE technologies to produce electricity closer to the demand sites. The stated benefits of this are the low cost of extending the grid, increased reliability and security of electricity, and low social and environmental impact. The study analyzed the possible optimum path to extend the national grid across all 753 municipalities and the associated infrastructure to connect the distributed generation systems. It also examined the possible systems in each of these municipalities and the financing mechanisms to develop them. The study clearly positions itself in favor of this "bottom-up approach for identifying the best source of energy available locally considering the population distribution and means of production" and "provide local means of income… and comparatively reducing demand on the central grid to completely supply all areas."

[28] UNDP. Renewable Energy for Rural Livelihood https://www.np.undp.org/content/nepal/en/home/projects/rerl.html
[29] NEA Company. Universalizing Clean Energy
[30] Commissioned by the National Planning Commission and researched by NEA Engineering Company

We should note that there is significant interest among the local bodies to develop power projects in their jurisdiction. The share of alternative sources in the mix also includes a distributed solar generation target of 200 MW across the 753 local government units under the '*Every Settlement, Energy Settlement*' policy.

II. CURRENT MAINSTREAMING INITIATIVES AND THEIR POLITICAL ECONOMY

In this chapter, we will look at the various policies of the government to mainstream RE in Nepal. We will then examine the challenges in the implementation of these initiatives.

2.1 Mainstreaming RE in International Practice

As a result of scientific innovations, government support, and market forces, RE technologies—especially those based on solar and wind—that were once considered fringe have moved into the global mainstream energy discourse. This transformation is being abetted largely by the growing concerns around climate change and the push to eliminate the use of fossil fuel that are major emitters of greenhouse gas. Also critical is the issue of energy security, where import-dependent countries who feel vulnerable to price and supply-related shocks see the diversification of their energy sources are inextricably related to the resilience of their power systems.[31] Across countries, the mainstreaming efforts often seen in the formulation of time-bound policy goals to integrate RE in the national energy mix expressed either as a percentage of the total energy mix or through specific generation targets. These goals are supported by the rollout of policies that incentivize and promote the development, use, and uptake of RE-based energy.

Take, for example, India, a country considered to have done exceptionally well in mainstreaming RE. This is made evident by the fact that when the country increased its total installed generation capacity from 105 GW to 370 GW from 2001 to 2021, it did so by incorporating RE-sourced electricity in its generation mix. While thermal generation still dominates the Indian power system, currently supplying about 63 percent of the total generation, India increased the share of RE from a mere 1.5 percent to 23 percent.[32] This increase can be attributed to the commitment made by the Indian Government in 2015 to develop 175 GW of RE capacity by 2022, which includes 100 GW of solar, 60 GW of wind, 10 GW from bio-power, and 5 GW from small hydro.[33] Additionally, India has, as part of its Nationally Determined Contributions under the Paris Climate Agreement, set to increase the share of RE in its electricity supply mix to more than 40 percent and to further increase the RE capacity by 450 GW.[34]

Many other countries have also made similar commitments. For example, the UK has a target to generate a third of its electricity from off-shore wind farms by 2030; Germany plans to realize 65 percent of its energy from clean sources by 2030; China has pledged for carbon neutrality by 2060 and aims to boost the share of non-fossil fuels in primary energy consumption to 25 percent by 2030 on account of 1,200 GW of combined wind and solar power installation target.[35] These countries have adopted a range of policy interventions to support the mainstreaming of RE. These include, but are not limited to, preferential tariffs, purchase obligations, and financial incentives.

> *Preferential Tariff*: Governments have promoted RE by providing potential generators—ranging from household, farms, and industries to commercial producers—with an attractive feed-in-tariff (FIT) rate. FIT, broadly speaking, is a mechanism by which the Government guarantees RE generators a specified payment for feeding electricity into the national grid. These tariffs are generally above the market rate and are contracted for the

[31] Hache, Emmanuel. "Do renewable energies improve energy security in the long run?." *International Economics* 156 (2018): 127-135.
[32] Government of India. Ministry of Power. 2020. Growth of Electricity Sector in India from 1947-2020 https://bit.ly/3vCheGO
[33] Government of India. Ministry of Power. https://powermin.gov.in/en/content/power-sector-glance-all-india
[34] Shrimali, G. 2020. Achieving the 2030 target of 450 GW of renewable energy - A prescription for India. https://bit.ly/3ueENVU
[35] Xu, M. and Stanway, D. 2021. China plans to raise minimum renewable power purchase to 40% by 2030: government document. https://reut.rs/3ugFaiI

long-term that could range from 15-25 years. Another major factor in the calculation of FIT is the cost of generation, which is largely dependent on the choice of RE technology. For example, wind generators may get a lower rate than their solar counterpart should they have a lower cost associated in the procurement of land. Some countries offer net metering as well. This is similar to FIT in that the Government sets a rate for feeding electricity into the grid, but differs in that it entails the use of bi-directional meters that allow consumers to offset their electricity consumption from the grid directly. Overall, consumers can generate revenue should they become a net supplier of electricity.

In recent years, with the rapid growth of RE markets across the globe, these price-support mechanisms such as FIT are being replaced by a competitive bidding process as a means to discover a market-determined tariff. For example, India has adopted the reverse auction mechanism, through which the utility now has the opportunity to select the lowest price bid by eligible companies. This has helped bring down the unit cost of solar tariff in India from NRs. 19.69 in 2010[36] to roughly NRs. 3.19 in 2020[37].

Purchase Obligations: Another popular strategy to promote RE is for governments to require offtakers to include RE sources in their supply mix, a policy tool commonly referred to as, among other things, renewable portfolio obligation (RPO).[38] Unlike FIT, the Government plays no part in tariff setting under RPO but lets the price of such purchase be determined by the market. These requirements often begin small but with gradual increases to meet any RE integration goals set by the country.[39] For example, India has in place the RPO mechanism, determined at the state-level by the State Electricity Regulatory Commission that ranges from about 1 percent in Madhya Pradesh to 10 percent in Tamil Nadu. This is part of a long-term strategy of getting to 21 percent of RE mix in the national supply by 2022, of which 10.5 percent is to be from solar sources.[40] RPOs has given rise to a Renewable Energy Certificate (REC) market that allows the buying and selling of certificates to meet the required standard.

Financial Incentives: Besides preferential tariffs and purchase obligations, subsidies remain popular globally as a tool for mainstreaming RE. These include, but are not limited to, direct financial transfers in the form of grants to producers and consumers, and low-interest or preferential loans, measures of preferential tax treatment such as rebates or exemptions on royalties, sales taxes, investment, and production tax credits, and accelerated depreciation. All of these measures help to lower the cost of generation and subsequently leading to lowering the price for the end consumers.[41] RE subsidies in 2017 were estimated to be around USD 167 billion, with solar and wind combined accounting for 78 percent of the total share.[42] For example, RE subsidies in India as of 2019 totaled USD 1.5 billion, a three-fold increase from an estimated USD 533 million in 2014. Over 90 percent of RE subsidies in India are targeted for production.[43] India has several subsidy

[36] Balasubramanyam, K.R. 2012. Solar energy business looks up in India as tariffs fall. https://bit.ly/3vI9qUr
[37] The Hindu. 2020. Solar power tariff sees a new low of ₹1.99/kWh. https://bit.ly/3vHcP64
[38] Different countries use different terminologies, including renewable purchase obligation (RPO)
[39] Gielen, D., Boshell, F., Saygin, D., Bazilian, M. D., Wagner, N., & Gorini, R. (2019). The role of renewable energy in the global energy transformation. *Energy Strategy Reviews*, *24*, 38-50.
[40] https://rpo.gov.in/Home/Objective
[41] Taylor, Michael. "Energy subsidies: Evolution in the global energy transformation to 2050." *International Renewable Energy Agency, Abu Dhabi* (2020).
[42] Ibid
[43] Garg, Vibhuti, Balasubramanian Viswanathan, Danwant Narayanaswamy, Christopher Beaton, Karthik Ganesan, Shruti Sharma, and Richard Bridle. *Mapping India's Energy Subsidies 2020: Fossil Fuels, Renewables, and Electric Vehicles*. International Institute for Sustainable Development, 2020.

schemes for grid-connected and off-grid RE interventions. Key grid-connected schemes include, among others, accelerated depreciation for wind and solar; financial assistance package for developing grid-connected solar rooftop program; viability gap funding (VGF) for grid-connected solar PV power projects.[44]

2.2 Efforts to Mainstream RE in Nepal

As stated earlier, for most of its history in Nepal, RE was viewed as a fringe technology designed to serve the rural populations to increase their access to electricity and to help transform the country into cleaner energy sources. One early impetus to bring RE into the mainstream policy discourse in Nepal took shape as a result of the acute power shortages that began towards the middle of the 2000s and an acknowledgement of the need for Nepal to bolster its domestic electricity supply. And while various Government plans formulated to end the electricity crisis recognized the role that solar and wind energy could play,[45] the lack of concerted effort to promote them failed to incentivize a holistic growth of the RE sector.

An important shift, however, took place in 2015, as an unintended consequence of the six-month economic blockade imposed by India on Nepal. The resulting energy crisis provided policymakers with a cause to think through the country's energy strategy, which resulted in the formulation of the *National Energy Crisis Reduction and Electricity Development Decade Plan, 2016*. This Plan, commonly referred to as the *99-Point Action Plan*, outlined 99 actionable items for the Government to exploit Nepal's water resource and achieve energy security within a decade. While the Action Plan naturally assumed hydropower to be the preferred source of electricity, it introduced the idea of a generation mix and called for the adoption of other sources of electricity such as solar, wind, biomass, and geothermal.

While the Action Plan was, for the most part, a laundry list of reforms needed in Nepal's electricity sector, the recognition of RE as a viable source of grid-connected electricity can be considered a turning point for the RE mainstreaming discourse in Nepal. As a result of this development, the Government, in subsequent years, formulated a number of policies such as the *Procedure for the Development of Grid Connected Alternative Energy,* 2018 to help connect RE into the national grid. These policies have been implemented to varying degree of effectiveness. In the next section, we will discuss in greater detail these specific policies, with special focus on the key issues at play and the challenges that it faces. Once we build an understanding of these policies, we will then attempt to break down the political economy of the relevant actors and institutions.

2.2.1 Establishing the RE Target

The overarching goal of the 99-Action Plan was to create an enabling environment for Nepal to generate 10,000 MW in 10 years.[46] The Government was also specific in the Plan of its intent to ensure a generation mix: 40-50 percent from storage and pumped-storage hydropower, 15-20 percent from peaking-RoR hydropower; 25-30 percent from RoR hydropower; and 5-10 percent from alternative sources. It did, however, set a ceiling of 10 percent of the total installed capacity for the amount of integration of RE at any moment.

The generation mix of the 99-Action Plan was revised in 2018 after a new government took over. In its *White Paper on the Current Status and Future Roadmap of Energy, Water Resource and*

[44] Government of India. Ministry of New and Renewable Energy. Solar Schemes. https://mnre.gov.in/solar/schemes
[45] National Electricity Crisis Mitigation Plan, 2008; Loadshedding Reduction Plan, 2012; Loadshedding Reduction Plan, 2013
[46] This type of claim is not a new phenomenon as prior governments had expressed even more ambitious targets such as 25,000 MW in 20 years. What was somewhat different this time was that the government had provided (relatively) detail on how the government intended to get there.

Irrigation (henceforth, White Paper), it launched a new mix that decreased the target for storage and pumped storage by 15 percent and increased the peaking-RoR by 10 percent and RoR by 5 percent. It did, however, maintain the proportion of RE at 5-10 percent.

Beyond these two official policy documents, Nepal has also committed to RE as part of its NDC under the Paris Agreement. In it, it has set a conditional clean energy generation target of 15,000 MW and an unconditional target of 5000 MW by 2030,[47] of which 5-10 percent is to be generated from mini and micro-hydropower, solar, wind, and bio-energy.

2.2.2 Offering Attractive Tariff

There were a number of provisions in the 99-Action Plan that sought to incentivize increased investment in RE. The first the benchmarking of a FIT at NRs 9.61 kWh,[48] a fairly attractive rate, especially when the posted rate for hydropower stood at NRs 12.40 per KWh during the dry season (December to May) and NRs 7.10 per KWh for the wet season (June to November)[49] at that time. Another important provision was that the Government would guarantee a take-or-pay Power Purchase Agreement (PPA) for 25 years, providing a guaranteed long-term assurance for potential investors. The third provision called for the development of a separate policy for the promotion and development of grid-connected alternative energy.

The Action Plan also called for NEA to work with the private sector to set up grid-connected solar plants, with the capacity of over 1 MW, at various locations across the country. Subsequently, NEA, in 2016, put out a Request for Proposal inviting interested developers to supply power as per the terms and conditions of the tariff set by the Plan. The response to the RFP was highly encouraging as 19 developers, for a combined capacity of 61 MW, responded to the call. However, further progress was stalled in the absence of a dedicated policy envisaged by the Plan, especially that would bring clarity around issues of licensing.

This policy gap was eventually resolved in 2018 when MoEWRI formulated the *Procedure for the Development of Grid Connected Alternative Energy.*[50] In addition to provisions on licensing, the Procedure detailed the key issues around tariff: it lowered the rate to NRs 7.30 per unit; it maintained the take-or-pay provision; and offered the new rate only for projects signing PPAs within three years, i.e., February 2021.[51] But despite this reduction in rate, NEA was able to negotiate PPAs with 10 of the developers from the earlier RFP procedure for a combined capacity of little over 50 MW. Of these, two projects have completed their construction.

Recently, in April 2021, MOEWRI updated the *Procedure*, where it recognizes the establishment of the Electricity Regulatory Commission (ERC) and its role in the electricity sector. The Procedure now offers ERC the responsibility to set the new tariff. Interestingly, the provision for the *take-or-pay* arrangement has been fully eliminated.

Besides FIT, keeping in line with the vision of the 99-Action Plan, the Government also provisioned for net metering. In 2018, the Procedure provisions for the installation of a "net energy meter" in interested household and institutions[52] with solar roof top systems and that these

[47] *Condition and unconditional refers to the availability of international funds. //check, update, and verify//*
[48] The document states that this calculation was done using the principle of avoided cost, although it does not provide any details
[49] Kathmandu Post. 2017. Energy Ministry fixes power purchase rates. https://bit.ly/3c4j4cn
[50] This replaced the short-lived *Procedure for the Development of Grid Connected Solar Energy, 2018*
[51] The Procedure also state that since the tariff has been derived by taking the average RoR rate and factoring in 8 time 3% increment, it is not subject to further escalation
[52] The Procedure defines households from 500W to 10 KW

consumers that have uploaded net surplus electricity to the grid can receive to payments at the established rate. But NEA as the offtaker also made it clear that it did not have interest in not pay for any surplus electricity fed by the consumer onto the grid. It states that if a consumer power supplied to the grid exceeds power withdrawal, NEA is liable to compensate the energy difference per the ERC's purchase tariff. If power withdrawal from the grid exceeds power supplied, NEA levies energy charges for the difference as per the retail consumer tariff set by ERC. Finally, it is unclear how much actual demand there would be from consumers to opt for investing net metering.

2.2.3 Providing Financial Incentives

The development of Nepal's RE sector has traditionally been through a "projectified" approach that primarily involved the supplying of subsidies. With a relatively underdeveloped national grid, these subsidies were instrumental in facilitating the promotion of RE to increase access to electricity for rural households in Nepal. This has benefited an estimated 18 percent of the country's population and continues to be the dominant national strategy to extend electricity to remote populations that live outside the national grid.[53] However, this subsidy regime is being increasingly scrutinized for creating dependence and crowding out competitive market-based innovations and investments to support the development of a vibrant RE market in Nepal.[54]

Responding to this criticism, some of the donors that have supported the development of RE in Nepal are offering subsidies intended to promote private sector participation in larger utility-scale solar power projects. For example, the Asian Development Bank administered in 2018 a Viability Gap Funding program, with USD 18.5 million,[55] through NEA to support the commercial viability of privately developed solar projects. Five projects with a combined capacity of 24 MW, were selected to receive a FIT of NRs 16.60 per unit up to June 2022, which would drop to NRs 6.60 per unit for the remainder of the PPA period.

2.2.4 Setting Purchase Obligation

While there is no clear policy provision on purchase obligation, it is however, stated in the new Procedure that the NEA will undertake PPAs up to 10 percent of the total installed capacity in the national grid.[56] The interpretation of the language on this provision suggests that this is more of a flexible target outlining the limits of maximum RE integration rather than a firm policy target. In fact, the policy does not even reference the word obligation.

2.3 Challenges to Mainstreaming RE in Nepal

In the section above, we discussed the various policy initiatives that have been taken up by the Government to mainstream RE in Nepal. We next discuss some of the key challenges despite all these initiatives.

2.3.1 The Hydro-Dominant Nepali Narrative

The global movement towards the adoption of clean energy is dominated by the mainstreaming of solar and wind energy. The Nepal government is also fully committed to this clean energy transformation, but it considers hydropower to be its primary renewable source. Additionally, the exploitation of its bountiful hydropower potential is also at the heart of Nepal's aspiration to achieve long-term energy security and the eventual realization of its economic prosperity. As a

[53] Bhusal, R. 2019. Subsidies killing renewable energy investments in Nepal. https://bit.ly/3sC2C9g
[54] Ibid.
[55] This was part of the financial grant support of USD 20 million from the Climate Investment Facility for Scaling up Renewable Energy Project
[56] The earlier Procedure has this at 15 percent.

result, other RE sources are relegated to the policy fringes and considered to be complementary alternates for clean energy development. A good example of this is the discussion related to this is generation mix and energy security. A high concentration of a single source in the generation mix is widely seen as an indicator of system vulnerability and a threat to energy security,[57] But Nepal's 90-95 percent of Nepal's generation mix target is sourced to hydropower, albeit with attempts to offset the risks with a mix comprising of storage, peaking RoR, and RoR projects.

Furthermore, a closer examination of the evolution of the generation mix since it was announced in the 99-Action Plan suggests that the Government's approach is driven less by the technical robustness of the strategy but rather sectoral interests and, perhaps, a degree of wishful thinking. For example, having signed PPAs for capacity exceeding the 35 percent target for RoR, there is pressure on MoEWRI and NEA to sign even more PPAs in this category. MoEWRI admits that it is in the process of revising the RoR threshold to 40-45 percent to facilitate additional PPAs. The rationale for this revision, it argues, is on account of the country likely failing to the set target on the share of storage in the mix. For those familiar with the workings of Nepal's non-transparent, non-competitive, and highly politicized PPA regime, it is evident that the only loser of this likely adaptive increment is the concern of energy security.

While the 5-10 percent been set aside for RE in the generation mix is a noteworthy achievement, there seems to be no institutional memory at the Ministry on how that figure was derived. It simply holds the position that this commitment reflects the Government's interest to diversify its energy source, which is influenced by the changing global outlook of solar and wind technology. One possible explanation that the study team was given by government officials was that, through a series of conversations, it was established that the threshold of 5-10 percent was the limit of system integration and grid stability. The study team could not locate any technical analysis to validate the concerns around system integration. Clearly, there is no actual on its meaningful contribution towards energy security

2.3.2 Uncertainty Over Tariff

The provision of an attractive FIT has played an enabling role in the development of nascent RE markets around the world. In Nepal, the Government's decision to offer FIT at NPR 7.30 per unit and its guaranteed offtake through the *take-or-pay* provision were instrumental in incentivizing a number of private developers to invest in utility-scale solar projects. However, with the earlier FIT offer now no longer valid, there is some uncertainty around how attractive the next round of tariff will be and whether or not the new tariff will be able to incentivize future investors. Also, with ERC now responsible for setting the tariff, which needs time to develop an understanding of the issue and the necessary procedures, it is unsure when it might be able to take this task up.

One thing is quite clear, though: there is significant downward pressure on any future tariff. This is due to a number of things. First is the continuing decrease in the price of RE technologies. As stated earlier, the levelized cost of energy (LCOE) of solar technology fell by 82% from USD 0.068 per kWh to USD 0.378 per kWh within a span of nine years and is further projected to reach USD 0.06 per kWh by 2050[58]. This decrease in the cost of input will surely be reflected in the new tariff. Second is the expectation established by the successes of countries such as India where the price of solar has reached as low as NRs. 3.19 per unit. India was able to achieve this partly

[57] Kruyt, Bert, Detlef P. van Vuuren, Han JM de Vries, and Heleen Groenenberg. "Indicators for energy security." *Energy policy* 37, no. 6 (2009): 2166-2181.
[58] Taylor, M., P. Ralon, H. Anuta, and S. Al-Zoghoul. "IRENA Renewable Power Generation Costs in 2019." *International Renewable Energy Agency: Abu Dhabi, UAE* (2020).

because of the lowered cost of RE technology and through the adoption of the reverse auction mechanism, where the competition between the private investors helped bring down the price.

But what cannot be discounted is the Government's investments in developing designated solar parks with ready-made evacuation infrastructure that help in lowering the transactional costs for the private investor.[59] Given Nepal's unique challenge of having limited land and the inability of the Government to develop transmission infrastructure, there may be some significant challenges to replicating the success that India has shown. Finally, the recommendation by the Ministry to only include land lease rates for computing the new tariff suggests that the Government does not have the interest to provide any price support to promote utility-scale solar projects in Nepal.

2.3.3 Half-hearted Commitment from the Offtaker

Whether or not mainstreaming RE in Nepal is successful will ultimately depend on the willingness of NEA to offtake the generated power. NEA's public position on this matter is that it is working to meet the 5-10 percent RE target as first stated in the 99-Action Plan. How this is actually playing out, in reality, for a number of reasons, is a bit more complicated. To begin with, given NEA's dual role as generator and offtaker of electricity, it has been investing in solar projects of its own as well as buying power from solar projects owned and operated by IPPs. NEA already has around 30 MW of solar power in its system, with about 10 MW from its plants and 20 MW from IPPs. Furthermore, NEA has already signed PPAs with half a dozen projects, with a combined capacity of around 50 MW, which are expected to come online in the next several years. Given that Nepal's total installed capacity is only around a 1,000 MW, this 80 MW of solar projects, going strictly by the numbers, already falls within the intended target range.

Moving forward, however, is another story. There are over a dozen companies, including NEA, with around 100 MW of capacity that have applied for construction licenses. Another three dozen companies, also including NEA, with a total capacity of 500 MW that have applied for survey licenses. While a number of these projects may not, for various reasons, pan out in the long run, one reason being NEA's lack of commitment to add more RE capacity into its system. This is for two particular reasons. The first is that there is a strong likelihood that the Nepali power system will witness wet season surplus in the next several years. In the meantime, an additional 215 construction licensed projects with a combined capacity of 7400 MW remain in the queue for offtake (PPA) commitment from the NEA. As a result, NEA does not want to commit to any more non-peaking power. Nepal is also expected to import power even when it is projected to be running a surplus. Neither the RoR nor the RE projects are able to cater to this particular demand. There is significant innovation happening around battery storage, and if and when that technological breakthrough occurs, NEA should not have a problem incorporating that into the mix.

NEA's hesitation to sign additional PPAs is not just with solar but also with RoR hydropower. But with powerful interests, NEA may have to add more RoR hydropower projects given that developers have made significant investments on these projects and they remain mobilized to draw positive support from the Government on the future of their projects. It is further estimated that NRs 600 billion has already been invested in these projects. But beyond PPAs, NEA's positions on two issues lowers the incentive for future investors in RE. The first is its interest to lower the tariff from NPR 7.30 to NPR 6.60. The scope of this study does not allow us to look into the feasibility of solar projects at the new rate, but IPPs that we discussed with flagged this as an area of concern for them in their decision to continue investing in RE. This is exacerbated by the

[59] Parira, A. S. 2016. Solar Parks: Accelerating the Growth of Solar Power in India. https://mnre.gov.in/img/documents/uploads/bcf7e95e88ae4f8dbfa8bd25d21e5e12.pdf

omission of the *take-or-pay* provision in the updated Procedure, which adds uncertainty of the offtake guarantee, thus reducing the bankability of these projects.

NEA also seems to be reluctant to fully implementing net metering. In 2018, it made public its decision stipulating that solar energy not exceeding 90 percent of the annual energy consumed by the producer through the national grid should be fed into the grid. No net payment will be provided to the producers by the NEA should energy more than the consumed amount be fed into the grid.

2.3.4 Limited Availability of Land

In comparison to other RE technologies, utility-scale solar projects require large tracts of clear, stable, and flat terrain that is both accessible and close to the grid – an estimated 3-5 acre for a single MW. However, given Nepal's predominantly steep topography, such type of land is in short supply and is mostly concentrated in the Terai. With the policy requiring all license holders to self-provision land for their projects, the preference for most solar developers in Nepal has been to look for land in the Terai. However, as most developers are quick to point out, there is a tradeoff between the benefits of accessibility and relative ease of connecting to the grid and the cost of acquiring land in the Terai. While there have been continuing concerns over whether this trend of developing utility-scale projects in the Terai is if, at all, sustainable, the newly formulated special licensing provisions add to the current uncertainty.

The Procedure states that all projects above 1 MW will not be issued licenses for survey and generation if the projects are located within "irrigable areas," national parks, and protected areas. The Procedure goes on to define "Irrigable area" as "all land having irrigation potential from already completed or under-development irrigation projects of the federal and the provincial government." The Procedure makes it mandatory for all the developer to include in its license application the recommendation confirming that the projects are not located in "irrigable areas," national parks and protected areas; from the Department of Water Resources and Irrigation or the Ministry of Physical Infrastructure Development under the provincial Government for irrigable areas, and the Ministry of Forest and Environment for national parks and protected areas.

III. THE POLITICAL ECONOMY OF THE MAINSTREAMING RE AGENDA

We have, thus far, detailed the factors that influenced the Government to mainstream RE in Nepal, the initiatives that it has subsequently taken, and the key challenges it faces to achieving its stated objectives. But underlying all these are the interests of the various individuals and institutions and the power they hold over the sector. In this section, we dig deeper into these factors to paint the current settlement of this particular agenda. We will use this analysis to develop a set of programmatic recommendations for NREP in the final chapter of this report.

We should also note that our analysis here is based largely on the two dozen interviews that the study team conducted for this research. Beyond that, we rely on the years of experience of the PEI's research team in Nepal's energy and water sector. Using information from these, and working within the limitations of the time and resources made available to us, we have tried to draw out a narrative that we believe best represents the interests of each set of the institutional actors.[60] But we understand any political economy paper to be a living document that should is updated regularly through an iterative process reflecting both the dynamic nature of politics and policies as well as the ability to collect more information. We hope that our readers will take this into consideration while reading this.

3.1 Ministry of Energy, Water Resources, and Irrigation

Mandate

MoEWRI holds the overall responsibility of the country's energy and water resources sectors. It is led by a minister with support from two secretaries, one of whom oversees the *energy* portfolio and the other, the *water resources and irrigation* portfolio. Through its authority derived from the law, the control over most of the funds allocated to the sector, and the technical expertise of its leadership, the Ministry, in theory, holds significant influence over the institutions that fall under its jurisdiction. In the energy portfolio, these institutions being the Nepal Electricity Authority (NEA), the Department of Electricity Development (DoED), the Water and Energy Secretariat (WECS), and the Alternative Energy Promotion Center (AEPC)—all of which are discussed in greater detail in this section. The Ministry also has an Alternative Energy Promotion and Energy Efficiency Unit, a two-person section led by a Senior Divisional Engineer, to anchor all its RE-related engagements.

Interest and Position

Views on RE mainstreaming: The dominant position of the senior leadership in the Ministry is that hydropower is Nepal's key resource and, therefore, its first priority is to exploit that to the fullest. This is meant to help realize the country's economic potential and to ensure its energy security. The corollary to this position is that other non-hydro RE are alternative technologies that are best suited, at the moment, to take electricity to rural populations that are difficult to reach through the national grid. The ministry states that Nepal is fully committed to developing a clean energy system but holds the opinion that hydropower is a renewable energy source and Nepal's primary means to achieve that. Furthermore, it does not find the adoption of other non-hydro renewables, as is being done with solar and wind in many parts of the world, to be contextually relevant to Nepal. To them, the rationale for including the 5-10 percent RE target from non-hydro sources in the generation mix is disconnected from the climate change agenda. This commitment, they expressed, is merely an expression of interest to explore possible sources of generation diversity, given the recent advancements in solar and wind technology, and so avoids placing this as any firm offtake obligation on NEA.

[60] When we say institutional interest, we understand that institutions do not have an interest, but rather it is that of the individuals who drive these institutions. It is the amalgamation of their interest that we identify as institutional interest.

The senior leadership in the ministry also has a degree of awareness with regard to some of the sustainability challenges around hydropower development, albeit with limited acknowledgement of how critical they could be or how to respond to them through policies. They are also aware of the broader opportunities, the complementarities, and the tradeoffs offered by RE sources. For example, the senior staff interviewed for this study referenced the deployment of RE as being complementary and strategic for the viability of Nepal's cross-border electricity trade aspirations.[61] Unfortunately, beyond casual conversations, there is very little institutional interest or appetite for such systems-based policy thinking.

The ministry is aware of NEA's unwillingness to take on the price support. For example, when the ministry made public its offer of NPR 9.30 as FIT for hydro, it stated that it would offset NEA the extra price over its hydro tariff. This policy, however, was never implemented, and it is unsure how the ministry would have executed this in reality.

With such an engrained hydropower-centric aspiration of the bureaucracy in the ministry, achieving the RE mainstreaming targets could be seen as requiring policy tradeoffs, i.e., the push for developing any additional capacity of non-hydro RE will be at the cost of not developing the same amount of hydro-capacity.

Changing policy priority: When the 99-Action Plan included RE into Nepal's generation mix target, it was a reflection of those times when Nepal was reeling from the chronic shortages of electricity, Nepali citizens (including the bureaucracy) had experienced loadshedding that reached up to 18 hours in a day, all of which has been exacerbated by the energy crisis resulting from the Indian economic embargo. Clearly, the Government was desperate and was wanting to be seen as doing something to ameliorate the situation, even if it meant being open to including RE in the generation mix.

Fast forward to 2021, and things look very different, and the most recent policy update impacting RE reflects the new scenario. Between then and now, a number of things have changed in Nepal's situation. First and foremost, India transformed into a net exporter of electricity, and Nepal was able to complete its first major cross-border electricity transmission infrastructure. As a result, Nepal has access to the Indian electricity market to source electricity at highly competitive prices. Second, there has been a gradual increase in the hydro capacity that is strengthening Nepal's domestic supply position towards self-sufficiency. There is even a projection that Nepal will have to spill some of its excess electricity during the peak wet season. Additionally, it is also concerned that a favorable regime will lead to an oversupply of RE in the system, given that an estimated 1,200 MW of grid-connected solar projects currently in various stages of licensing at the DoED and the Investment Board of Nepal. MoEWRI believes that this capacity could be realized in 5-7 months if the Government were to continue the tariff and the PPA regime outlined in the 2018 Procedure. Even if only a small fraction of this were to materialize in the next several years, the Ministry feels that the Nepali power system has neither the demand for this amount of supply nor is not ready for integration at this scale.

Given this context, the Ministry no longer feels the need to aggressively promote grid-connected RE with guaranteed offtake and price support mechanisms. This is made evident by its decision to omit the provision for take-or-pay PPA and the recommendations it has made to ERC on the factors to be considered in the new procedures for approving the new RE tariff

[61] In reference to role of solar to help realize peaking response from Nepal's hydropower to sell for higher rates in the Indian electricity market.

Concerns over land use: MoEWRI sees land as a major constraint for the scale-up of grid-connected solar energy in Nepal. It is specifically concerned with the current trend of projects being built in the southern plains. Two key factors underscore this concern. First, it views this trend to be conflicting with the priority of the Ministry and the Government on irrigation development and food security. It is firmly against the conversion of productive lands into solar farms, especially in considering the efforts being undertaken by the Ministry to develop and expand irrigation networks in the Terai and the hills for increased agricultural productivity and food security. It has identified the development of multipurpose projects and inter-basin water diversion schemes as key priority areas. In fact, a large portion of the Ministry's annual budget today is being allocated to schemes such as the Budhigandaki Multipurpose Project and the Bheri-Babai Inter-basin Transfer (IBT) Project. And it is further preparing to implement other schemes such as the Sunkoshi-Kamala IBT, Sunkoshi-Marin IBT, and the Kaligandaki-Tinau IBT. The interest in the implementation of these schemes is more than just irrigation development and food security. Given the strategic nature of these schemes, the Ministry has full and direct control over the implementation of these schemes. Implying, they also have control over all opportunities for patronage or rent extraction. These projects, however, can only be rationalized if there is still a demand for irrigation.

Second, MoEWRI is also concerned that solar projects are increasingly becoming a new tool for the private sector to grab and hold land above the stipulated landholding ceiling. As per the Land (Eighth Amendment) Act, 2020, the land ceiling for an individual landowner (person or company) has been at ten *bigha* (17 Acre) in the Tarai. However, the Act provisions for companies to acquire excess land above the set ceiling through approval from the Federal Ministry of Land Management, Co-operatives, and Poverty Alleviation. The Ministry thinks that individuals are using this provision to purchase and hold excess land in the name of solar projects for purely future capital gains. While it is impossible to validate this opinion, it nevertheless has resulted in MoEWRI taking strong action on the issues of land and licensing in the new Procedure. For example, there is now a new provision that requires projects above one MW to demonstrate that it is not situated in an existing or proposed irrigable area. Similarly, the Ministry has resorted to tariffs to disincentivize land grabbing. Accordingly, it has now provisioned that in calculating the overall project cost, the heading of land is to only include applicable lease rates for the area occupied by the project. Given that land accounts for the largest share of the project costs, this provision is expected to considerably bring down PPA tariffs.

3.2 Department of Electricity Development

Mandate

DoED is one of the line agencies of MoEWRI with a specific mandate to promote the development of Nepal's electricity sector. DoED's responsibility, among other things, is to award licenses for tasks related to generation, transmission, and distribution of electricity and to monitor the projects on behalf of the Government. The Electricity Regulation (1993) specifies DoED's jurisdiction to be for projects over 1 MW, regardless of the "means of electricity production."[62]

Interest and Position

Views on mainstreaming RE: As a functional arm of MoEWRI, and the fact that all DoED staff are from the same hydro-bureaucracy, DoED's views on mainstreaming RE are similar to that of the ministry. Some of the staff interviewed for this study expressed, from a licensing point of view,

[62] We should note that when the Electricity Act and Regulations were being drafted in the early 1990s, the non-hydro RE sector was still in its infancy and was probably not seriously considered by the policymakers. But it is quite clear that the document refers to other sources than water as “means to produce electricity. See the various schedules at the end to see examples of this reference.

their skepticism about the intention of the license holders,[63] who they see as being more interested in evading the landholding ceiling or as long-term investments for windfall capital gains after the end of the license period. This is abetted by the fact that, for example, the cost of holding a non-hydro survey license is quite cheap. For example, a survey license costs a developer NPR 10,000 per MW per year. Compare this to hydro, where developers pay a fixed fee based on the size of their project that starts from NRs 1 million for 1-5 MW; NRs 2 million for 5-10 MW; NRs 3 million for 5-10 MW; NRs 6 million for above 50 MW.[64] They also did not seem to be confident about the current trend of investments in grid-connected solar projects, which they see as being primarily due to financial incentives such as the VGF.

But regardless of its views on the drivers of the current market enthusiasm, DoED, given its core mandate on licensing and monitoring, is institutionally indifferent on how it engages with hydro and solar projects. Its primary interest is revenue collection and project facilitation, and it serves this interest regardless of the eventual outcome of the licensed projects. Grid-connected solar projects have opened up a new revenue stream for the DoED, and unlike hydro projects, the institutional burden for project facilitation remains nominal for solar projects.

Maintaining control: Bureaucracies like to maintain control over their turf, and this is no different to DoED. For example, the Constitution of Nepal makes the local bodies the licensing authority for projects under 1 MW. But DoED is seeking to exert its control of the sector by requiring projects of all sizes, including those under 1 MW, to get technical clearance from them. Where this is more problematic is with regard to AEPC's interest to define *alternative energy* broadly as solar energy, wind energy, biomass energy, biogenic gas, and hydropower under 10 MW, in order to increase its own turf.[65] Of interest here is the inclusion of hydropower *under 10 MW*, which is an increase from the earlier limitation of *under 1 MW*. But given that DoED already has the jurisdiction of hydropower projects of over 1 MW[66], it is unsure how this overlap is to play out with regard to licensing and monitoring. While AEPC refers to this particular definition to move out of its off-grid space, DoED is of the opinion that given AEPC's existential crisis, this lobbying for increasing its hydro space is simply to ensure its institutional sustenance.

3.3 Water and Energy Commission Secretariat

Mandate

The Water and Energy Commission was established in 1975 with "the objective of developing the water and energy resources in an integrated and accelerated manner."[67] A permanent secretariat (a.k.a. WECS) was established, under the then Ministry of Water Resources (the predecessor to today's MoEWRI), to assist the various government agencies working in the formulation of policies and planning of projects in the water and energy sectors. While many retired governments lament that the glory days of WECS are in the past and that it is merely a shell of its former self, WECS has produced a number of documents that are frequently mentioned in current policy discourse. For example, the Electricity Demand Forecast Report (2015-2040) that it produced in 2017 serves as the Government's official demand forecast.

[63] This perception, i.e., of there being a lack of genuine developers, is not much different to that against hydro developers who are criticized for squatting on licenses.
[64] The cost of generation license is the same for hydro and non-hydro projects: a fixed fee of NRs 0.5 million for 1-5 MW; NRs 0.7 million for 5-10 MW; NRs 1 million for 10-25 MW.
[65] The fifth amendment to AEPC's formation order defines *alternative energy* to include solar energy, wind energy, biomass energy, biogenic gas, and hydropower under 10 MW.
[66] DoED was initially responsible for hydropower projects up to 500 MW, over which was the responsibility of IBN. Most recently, this was decreased down to 200 MW. The Constitution places large hydropower project under the jurisdiction of federal government, medium of provincial, and small of local governments. The Local Government Operations Act places all hydropower under 1 MW within the jurisdiction of local bodies.
[67] Government of Nepal. Water and Energy Commission Secretariat. https://wecs.gov.np/

Interest and Position

Views on RE mainstreaming: WECS has been curating policy ideas that promote universal access to clean and sustainable energy and has pushed for a policy of energy mix that emphasizes the need to include RE. However, given that WECS, like DoED, is also staffed by the members of the same hydro-bureaucracy, its overall views and priorities on RE match that of MoEWRI. However, unlike the Ministry, because WECS has a more comprehensive institutional mandate for research, it has relatively more space to examine ongoing practices and explore newer ideas on issues of energy and water and not just focus on the development of electricity. As a result, there is a greater degree of interest in clean energy transition, energy security, and long-term sustainable energy.

Senior staff at WECS also seem to be more accommodating to discuss the role and relevance of RE. In our discussion for this paper, they expressed their belief in a complementary coexistence of hydropower and other forms of RE as a core component of long-term energy security and the integrity of the national power system. Moreover, they also stated their priority is to increase the per capita energy consumption, thereby creating a stronger market for clean energy domestically to support the growth of both hydro and non-hydro resources.

3.4 Alternative Energy Promotion Center

Mandate

The Government established AEPC[68] as a dedicated institution (albeit with a weak legal foundation) to promote and develop the country's RE sector. Established primarily to support the replacement of traditional inefficient energy sources and to increase decentralized access of electricity to populations living outside the national grid, the future of AEPC now stands uncertain due to the changing RE scene in Nepal. On the one hand, its mandate of working in off-grid RE is rapidly shrinking due to the extension of the national grid where an estimated 86 percent of the population are now connected and the Government has a goal of full electrification by 2030.[69] On the other hand, there has been a gradual mainstreaming of Nepal's RE sector with the initiation of utility-scale projects, all being done without any significant contribution from AEPC.

AEPC's integration into MoEWRI was viewed to be potentially transformational for both AEPC and the RE sector. However, this has failed to alter the status quo on APEC's mandate and role in the sector. Despite several institutional reform conversations, including those related to transforming AEPC into a center of excellence, its mandate and primary business remain unchanged.

Interest and Position

Views on RE mainstreaming: As an institution that positions itself as the biggest champion of RE in Nepal, AEPC's views on the rationale and the need to mainstream RE aligns with that of the established narratives of hydro complementarities, system optimization, energy security, and reducing Nepal's dependency on dirty electricity imports from India. Interestingly, there is a clear institutional preference to anchor the discourse on mainstreaming RE within the idea of energy mix rather than the generation mix. There are several reasons why AEPC opts to engage in this conversation through the language of the energy mix: partly because it views the generation mix

[68] PEI has conducted a more comprehensive political economy of AEPC for NREP already. For a more detailed examination of AEPC's role in Nepal's RE sector, please refer to that document.

[69] MyRepublica. Over 86 percent households have now access to electricity through national grid https://bit.ly/3vrvh2A

discourse in Nepal to be focused on hydro-mix; and partly it feels this to be an effective way to safeguard its institutional interest to remain relevant in the RE sector.

Given its *off-grid* mandate and branding, AEPC has limited influence and is more or less absent from the current utility-centric RE generation discourse in Nepal. In contrast, anchoring the mainstreaming conversation on energy mix enables AEPC to leverage its *off-grid* generation assets and achievements to continue having a voice in the RE sector. A major related interest in this regard is the integration of the existing DRE assets, especially micro-hydro, into the national grid. However, given NEA's weak reception and inaction on the issue, from AEPC's perspective, this is a more critical concern for RE mainstreaming as there is a genuine risk of a sizable block of generation assets turning dysfunctional.

3.5 Electricity Regulatory Commission

Mandate

The ERC was established in 2018 as an autonomous institution to regulate the country's electricity sector. It holds the legal authority to, among other things, approve PPAs, establish grid codes, and secure the rights of consumers. But given that in its infancy, the current institutional standing of the ERC is relatively weak, and it is yet to cement its position in energy sector operations.[70]

There are two primary areas where ERC will have a relevant role for the RE sector: the approval of PPA rates and the development of grid codes, and the quality of electricity that need to be ensured by RE generators. ERC is making an official entry into the RE sector with its upcoming role to revise PPA tariffs for grid-connected alternative energy.[71] There is great interest and expectation surrounding how ERC will deliberate and decide on the issue, especially given that one of its key members, namely, Dr. Ram Prasad Dhital, holds significant RE expertise and has previously led AEPC and played an important role to facilitate its integration into MoEWRI.

Interest and Position

Views of RE mainstreaming: The ERC views mainstreaming essentially as an endeavor to upscale grid-connected RE in terms of choice of technology, the scale of interventions, and coverage. However, it is the position that this upscaling should be contextually viewed to accommodate the full scope of RE sector operations in the country, including its past achievements; current trends and challenges; and future opportunities. While this view of the ERC generally implies a RE movement towards the grid, at the same time, it also conveys a policy imperative to accommodate differing mainstreaming priorities of the Nepali RE context – building utility-scale RE installations, and strengthening compatibility and facilitating the integration of existing DRE assets into the national grid. This, the ERC believes, is crucial for the diversification and the strengthening of the national energy mix and security. It does, however, recognize that these mainstreaming goals are constrained by unique policy and institutional constraints, some of which are already pushing the RE sector towards observing similar risks and challenges currently observed in the hydropower sector. For example, the absence of a coherent policy position on RE mainstreaming and the disconnect between licensing and offtake, and the differing interests and priorities of AEPC and NEA.

[70] Key institutional and individual sector actors, including those in the government see the ERC as an outsider primarily created in the interest of the development partners. Even those in the sector in Nepal that advocated for its establishment see that its purpose and performance remain underachieved. Though legally autonomous, there is widespread speculation regarding its ability to be impartial and independent of political and bureaucratic interest. The ERC is currently being completely supported by the technical assistance of the development partners.

[71] The ERC was yet to be established at the time of formulation of the previous tariff in 2018.

Role in tariff setting and sector promotion: In line with the aforementioned views and positions, ERC has the interest to play a facilitating role in mainstreaming RE. Given its mandate and jurisdiction, it identifies the scope of this facilitation to be possibly related to tariff rationalization and non-tariff measures such as developing a technical regulation for net metering and formulating a policy on reverse-auction bidding. Cognizant of the interest and sensitivities surrounding the issue of tariff, especially that related to PPA for grid-connected RE, the ERC's position on the subject is extremely measured. It vaguely maintains that its goal will be to facilitate the best agreement. As much as this position reflects the difficult institutional political economy surrounding tariffs for grid-connected RE, it is also a fact that the ERC, yet, does not have a framework for PPA setting to rationally engage with the NEA. It does, however, more openly express its interests and willingness to provide tariff impetus for fostering small-scale grid-connected RE innovations such as the installation of solar panels above irrigation canals and on lakes or generating electricity from municipal waste. These innovations, the ERC argues, are non-competitive to mainstream institutional interests and concerns regarding large-scale RE projects.

3.6 Private Sector

There is a wide range of private sector actors that are directly or indirectly engaged in Nepal's RE sector. Based on their type of engagement, we categorize them into two groups: the traditional RE private sector and the large scale developers.

3.6.1 Traditional RE Private Sector

This set of actors are those that have been associated with the traditional approach of RE in Nepal. Their primary role has been in supplying small-scale RE technology.

Views on RE mainstreaming: Actors in this subset view RE mainstreaming as a natural evolution of the sector that started with kW-scale DRE for rural energy access and is now entering a new phase of MW-scale RE assets for utility-level consumption. But they state that despite the successes—and importantly, the potential—that RE has shown, the sector remains in the fringes of government policies and priorities. They believe that this is primarily due to the dominant perception about RE that it is just an "alternative" technology—a branding that helps undermine the role and contributions of the overall RE sector to Nepal's current and future energy sector achievements.

However, the actors remain positive on the prospects of RE mainstreaming. Some even believe that the national grid has the potential to integrate up to 20 percent of RE, and the decision to cap the generation mix at under 10 percent is an interest of the government to play safe. And that, there is an opportunity to realistically examine the rationale for the current threshold based on stronger scientific and policy evidence on issues of intermittency, grid frequency, reactive power, and system forecasting. Regardless, there is a common consensus that the country will not be able to meet the stated long-term targets on RE integration in the generation mix. The issues informing this perception being: lack of policy coherence of the government to strengthen domestic demand and consumption of electricity; land availability limiting the growth of grid-connected solar energy; weak interest towards incentivizing RE generation and grid integration.

Operational challenges: Given that most of these actors are mostly engaged in projects at the kW-scale operations, their interests in the mainstreaming agenda are primarily concerned with the challenges related to net metering or the integration of DRE assets into the national grid. While there is no common perception of policy sufficiency on the two issues, most generally agree that the challenge is primarily operation and related to the NEA, who they believe has little interest in changing the current status quo drastically. For example, its hesitancy to incorporate DRE

projects (most of which are below 100 KW) into the national grid over concerns of staffing responsibilities and high operating and maintenance costs; complacency on net metering, including its reluctance to compensate for the excess supply into the grid due to concerns over losing revenue from medium to large commercial consumers in urban areas.

The private sector and the NEA have continued to differ on the principles of net metering. While there is a clear interest for the provision to include compensation for excess supply into the grid, even in the current setup, there are outstanding differences between the two. The private sector interest is for "net" on energy, and the NEA stands firm on "net" on price - producers want to have applicable buying or selling rates applied on the net difference of electricity, whereas NEA's interest is for applying applicable rates on the total units supplied or drawn from the grid to charge the "prosumer" the net on price. The latter is the standing policy on net metering in Nepal. Moving forward, the policy standing, the primary concern of the private sector, relates to the implication of reduced tariffs for the future growth of net metering. In the context of the current preparation for tariff revision, which the private sector is expecting to be a concerning reduction, it could result in on-grid DRE no longer being sensible or commercially viable as it would be cheaper to rely on the grid than invest in a DRE asset. The implications of this probable scenario will impact the business and profitability of the private sector.

Subsidies: The private sector actors have a common position on subsidies: it is no longer required for urban areas but is still relevant for the rural populations that are still outside the grid. In fact, several private sector actors stress that RE subsidies, especially for urban areas, are creating market distortions and thus remain a threat to the natural evolution of the RE sector in Nepal. Relatedly, they also do not see the relevance of subsidies such as the VGF for MW scale grid-connected RE, especially considering that many developers are already committed or willing to develop projects within the existing tariff structure (NRs. 7.30 per unit). They, however, do note that a significant reduction to the current tariff may limit the viability of the large projects.

3.6.2 Large Scale Developers

This subset includes actors that are currently engaged in the business of developing MW scale grid-connected solar energy projects in Nepal. As noted earlier, hydro developers, including NEA, hold a dominating position in this market share. Hence, under this subset, we take into account the interest of both hydro and non-hydro actors in mainstreaming RE.

Views on RE mainstreaming: There are two positions within this subset of actors on RE mainstreaming. The first, which is also representative of the views of the coalition of Nepali private sector hydropower developers, i.e., Independent Power Producers Association of Nepal (IPPAN), see the opportunities with hydro-solar complementarities for daily and seasonal load management being central to the prospects of RE mainstreaming in Nepal. They do, however, stress the need to work towards a common goal: increasing per-capita electricity consumption to ensure a sizable domestic electricity market for both hydro and non-hydro sources to benefit from the gains of complementarity.

The second position, representative of the views of notable sector influencers from networks such as the Confederation of Nepalese Industries (CNI), questions the need and relevance of RE in Nepal. Contrasting to the first position, actors argue that the generation profile of RE, without the option of storage, does not help to optimize the system and reduce costs. Further adding, grid-connected RE is more suitable for countries like India where there is significant industrial and commercial load during day time. They are, however, more accommodative of the prospects of roof-top solar and net metering in Nepal and argue this to be a viable policy option for commercial entities that have a comparatively higher daytime load. They also refute narratives around climate-

induced hydro-solar complementarities, claiming that there is growing evidence that suggests little to no impact on Nepal's hydropower for the foreseeable future.[72]

Both sets of actors, however, do agree that land is the major constrain for the expansion of large-scale grid-connected RE. Further adding, the need to build generation diversity and promote solar should not compromise the loss of arable land in the Terai, especially when there already exists a viable and mainstream source of electricity generation in the form of hydropower. Responding to the current trend of large projects being developed in the Terai, they attest this to be primarily influenced by the licensing precondition that stipulates projects to be located nearby substations. Given NEA's weak infrastructure (capacity of substation and power evacuation) outside the terai and urban centers, this is currently the only technically feasible option available for the developers. Unfortunately, it is also not the most commercially viable option because of the high land prices in the Terai and the urban centers. The developers believe, ceteris paribus, it is fairly impossible to ensure commercial feasibility of any project located in the Terai unless individuals have sufficient private landholding fairly close to substations and opt to develop their project in that property. This is the dominant trend. Alternatively, a few developers are relying on lease arrangements. Relatedly, developers confirm that there is also a segment with the financial backing and the interest to acquire land to develop projects and that such investments are primarily intended to make long-term property investments. Moving forward, developers view that the future growth of the sector is largely dependent on how the government positions to facilitate access to land. They identify two potential options: (i) some form of an arrangement that enables developers to access (acquire) public lands for the license period; (ii) public investments in developing solar parks in feasible locations.

Concern over tariff uncertainties: The primary concern of these large-scale developers pertains to the uncertainty around tariff. They argue that the existing tariff of NRs 7.30 per kWh is adequate to ensure the commercial viability of most large grid-connected projects. They highlight that the levels of profits are primarily dependent on two things: the arrangement on land and the cost of financing. Though, there are some that hold the view that the NRs 7.30 as insufficient to internalize the high costs of land acquisition. However, given that the policy does not require developers to hand over the land after the license period, most developers refrain from making this argument and understand how the government and other market actors interpret this interest. In the context of the current discussion on tariff revision, most developers are expecting the tariffs to come down to NRs 6.60 or lower. They stress that this scale of revision impacts the commercial viability of new projects and could potentially lead to the exit of many developers.

The private sector believes that two key issues are influencing the current revision: (i) the government's position that the cost of technology (solar panels) is falling in the global market and hence projects should be built cheaper; (ii) the drastic reduction in the price of solar electricity in the Indian electricity market. They reject the relevance of both these issues. On the first issue, they argue that the cost of technology while did drastically reduce over the last decade but now has more or less stabilized, however, at the same time, the cost of other inputs such as steel and transportation has gone up. On the second issue, they argue that the comparison is senseless, as, unlike the Government of Nepal, the government in India has policy and provisions to offset major costs of project development through interventions such as the development of evacuation-ready solar farms. The developers also position that the current discussion on tariff reduction also

[72] This claim coincides with emerging research evidence from leading climate and water scientist that claim that "Contrary to common misconception, accelerated glacial and snow melt owing to global warming, as well as greater anticipated precipitation in the Himalayas, actually strengthens the case for further development of Nepal's significant hydropower potential." See https://bit.ly/3wTl4fF

relates to NEA's weak interest in buying RE. They argue NEA will likely resort to using tariffs to disincentivize and constrain RE generation rather than having to buy power from RE generators.

3.7 Nepal Electricity Authority

Mandate

NEA is a government-owned vertically-integrated electricity utility that holds the mandate to make "appropriate arrangements to supply power by generating, transmitting, and distributing electricity" in an accessible, efficient, and reliable manner. While it has lost some of its original monopoly in the generation business, it maintains full control of the national grid and its allied transmission and distribution businesses. While hydropower constitutes the large majority of its electricity portfolio, since 2018, its electricity portfolio also includes solar PV power sourced either through long-term PPAs or through the provision of net metering.

Interest and Positions

The official position on RE: Given its size of around 8000 employees, there are usually varying perspectives within the NEA hierarchy on issues related to the electricity sector. However, on the subject of RE, these views are relatively uniform and signify limited institutional interest to engage on/with RE. For NEA, RE engagement is mostly a matter of demonstrating compliance to GoN policy/directives on RE. Its official position is that it is fully committed to supporting the integration of 10 percent of RE in the national grid, as required by the government. Partly, NEA's interest also stems from the need to respond to RE interests of the donors, whose financial and technical contributions are integral for other "core" functions of the organization. In fact, most of NEA's engagements in the RE sector have been directed by donors. For example, WB support for the generation of 25 MW from solar PV, ADB-backed VGF support for five grid-connected solar projects, and ADB-supported TA to conduct feasibility studies for a solar park in Mustang.[73]

Offtake commitment and tariffs: As discussed earlier in section 2.3.3, NEA's commitment for the offtake of RE is half-hearted. Its hesitation in signing additional PPAs is not just with RE projects but also with RoR hydropower. NEA's reluctance is entirely commercial. Given that it already has a sizable supply stack of already committed hydroelectric and solar projects in the pipeline, it is no longer concerned about insufficient generation. Also, it now has full access to the Indian electricity market to competitively source power to manage system deficits in the short to medium term. NEA's primary concern, at current, is related to finding a market for the power that is going to be generated in the coming years. With only small incremental changes in domestic demand, NEA is now actively advocating for the need to strengthen in-country demand as well as to make a timely entry into the Indian electricity market. Officially though, NEA states that once RE PPA tariffs are formulated by the ERC, it will be opening up new PPAs within the government-defined threshold of 10 percent of system capacity.

Challenges of managing system intermittency: Beyond the official position, NEA is generally more critical about the suitability of RE in Nepal. First, they argue that the RE generation profile does not complement the system load profile and stress that unless there is a concerted policy effort to create demand there is a low relevance for RE in Nepal. Second, there are concerns related to the impact of RE intermittency on system operations. From NEA's perspective, there is a limited capacity to respond to intermittency gaps due to the absence of adequate PRoR and storage projects in the system. This capacity was noted to be around 10 percent on account of factors such as the availability of automatic generation control mechanisms in projects such as the 144 MW Kali Gandaki and the 70 MW Middle Marshyangdi.

[73] A solar park is one of the several components of the TA that primarily focuses on developing protection coordination for the INPS and trainings on transmission and substation desing. For details see https://bit.ly/3uAP2TQ

It was confirmed to the study team that NEA is yet to conduct any study related to system analysis for RE integration. Given that this is the same threshold referenced for the maximum share of RE in the generation mix helps confirm the threshold was not scientifically established. Also, for the sake of argument, the 10 percent threshold discounts the ability of the current Nepali power system to stopgap intermittency from the Indian grid - now that both grids are interconnected in sync. Irrespective, the general perception at NEA is that given the challenges of intermittency, if the government intends to promote solar, this should go hand in hand with a move towards building more PRoR and storage projects. Some even claiming that the VGF for grid-connected solar projects should be equally complemented with VGF for building reservoirs.

Interest to integrate DRE: Despite the skepticism of many, NEA does seem to have an interest to integrate DRE, especially micro-hydro projects, into the national grid. This is driven by NEA's view that this offers an opportunity to help optimize system operation for efficiency and cost reduction. Additionally, they also see DRE projects being complementary for system loss reduction and Volt-Amperes Reactive (VAR) power support. Given this interest, it is being increasingly vocal about its service mandate[74] and its responsibility to safeguard investments made by the government and communities. The official position being, there is no need to spill power and that the NEA system can manage potential faults that could be created by the DRE projects. As NEA observes, the challenges towards DRE integration are more transactional. The most important being the contractual modality of integration. They outline both PPA-based or net metering type provisions to be viable policy options for interconnection. Still, they stress that the profile of the existing consumer base will need to be central to the actual decision on the opportunity.

In the PPA model, the existing DRE consumers will need to come under the NEA system and pay the set consumer tariff. The implications of this transition will be significant if the DRE system is serving low-income groups which may not be able to afford consuming electricity under NEA tariffs. In the second option, consumers will continue to be governed by their respective micro-grid norms but will have the option to withdraw or inject power into the grid under a net metering-like provision.

Position on net metering

NEA's current position on net metering is fairly straightforward. From its point of view, it does not need the electricity generated by households or commercial consumers. As provisioned under the policy, it is simply facilitating an exclusive service for consumers to offset part of their cost of consumption from the grid. Also, it positions that the current 90 percent threshold for surplus supply into the grid is necessary as the net metering clients hold flexible generation responsibilities and are outside the formal purchase arrangement. Hence, the clients are first consumers, then producers. The NEA has recently initiated an annual energy banking provision under net metering, which allows clients to bank surplus monthly generation to offset grid consumption on an annual basis.

3.8 Other Stakeholders

3.8.1 Development Partners

Development partners (DP) have played an instrumental role in the development of Nepal's RE sector. But due to the evolution of the sector, concerns over the delivery, and the effectiveness of their subsidy-based approach, there is an interest among the DPs to reposition their engagement. While some of the key DPs no longer support the sector, those that remain are concerned over the financial viability and the sustainability of the sector and advocate the transition from subsidies

[74] On account of subsized consumer tariffs at certain threshold.

to an innovative credit-based market system. At the same time, the need and relevance of this transition have found a new purpose with Nepal's transition to federalism and the prospects of grid-connected RE. Several DPs are looking to leverage this window of opportunity to explore and unlock RE sector growth opportunities in Nepal. Some DP engagements in this area include: ADB's VGF for large grid-connected RE and TA to prepare feasibility reports for a solar park; FCDO/NREP's upcoming challenge fund to, among other things, incentivize large-scale RE generation; and USAID/Urja Nepal's in-pipeline TA to support RE sector policies and practices, including the preparation of standard bidding guidelines for solar and wind.

Among other things, the DPs establish the relevance of RE to the need to promote source diversity and enhance system security and its complementary role to hydropower. They view tariffs and off-take commitment to be central to the future direction of the sector. Some even believe that the need for generation subsidies may not be necessary if the current tariff of NRs 7.30 is to stand.[75] In the context of ADB's VGF support, it claims that the VGF was decided before the tariff was benchmarked by the government and that on average, the tariff rounds up to about the same rate provided by the government then. On the issue of off-take, unfortunately, most DPs, including ADB that has significant clout at NEA, view that it has little to no interest in the RE sector.

3.8.2 Commercial Banks

There is an increasing number of commercial banks that are now financing large grid-connected solar projects in Nepal. Though this is a relatively new venture for the banks, and that they lack adequate institutional experience and capacity in the sector, there is growing interest to invest in the sector. From their point of view, the key financing considerations are twofold: licensing and PPA, which is no different to that of hydropower. Consequentially, they are more inclined towards taking up RE projects owned by reputed hydro developers as they believe that these developers already have their skin in the game and are, therefore, better positioned to better navigate the ordeals of licensing and PPA approvals.

Interestingly, we were informed that the banks, for a number of reasons, consider the risk factors of financing RE projects to be generally modest, especially when compared to hydro. For example, the banks are able to lock-in close to 80 percent of the total RE project costs at the time of financial closure, and with a higher certainty of the project completing in the stated time and cost. This level of certainty generally does not exist in the case of hydropower, where there are many exogenous factors at play. Also, unlike hydro, RE projects can start their payback in around one to two years of financial closure. This is a clear advantage, as the banks do not need to worry extensively about what will become of the developer in the next five to seven years and how this might impact project delivery and payback

Similarly, PPA tariffs are integral to the financing decision and the banks state that most RE projects today have a payback period of 13-15 years at the current tariff of NPR 7.30. According to banks, this calculation does not include the cost of land; factoring in this cost would extend the payback by about 5-7 years. They also note that most developers that are currently approaching them are planning to develop projects in property they already own. This arrangement, to them, is reassuring and a plus point for securing financing commitment; as banks perceive land lease arrangements to carry a higher financing risk due to a general weak contractual enforcement environment in Nepal.

[75] ADB implemented the VGF before the tariff was set at NRs 7.30.

IV. PROGRAMMATIC RECOMMENDATIONS

The objective of this political economy exercise is to develop a more nuanced understanding of the politics around the mainstreaming RE agenda in Nepal. This is expected to help develop a strategy to further engage in mainstreaming RE in Nepal, in terms of exploring and advancing possible policy positions for NREP and other reform champions in the coming days.

Given the resources available for this engagement, PEI, as agreed with NREP, considers this to be an initial phase where the scope of work is limited to documenting the positions of the stakeholders. In this section, we put forth the principles with which we believe the project can/should engage to further the reform agenda. We should note that PEI has proposed to NREP additional phases to co-create and implement the strategies, and we hope that there will be opportunities to collaborate on this important reform in the coming days.

4.1 Promoting a Narrative

Narratives matter! Policy actors often exercise the power of narratives to frame and interpret policy problems and solutions. A multi-stakeholder policy arena with several and often competing narratives can be an added complexity. In such context, narratives become influential and tractable if they are coherent, evidence-based, and most importantly, grounded to the broader realities of the policy setting. We observe the current narratives around the mainstreaming RE to be uncompelling and lacking a strong evidence base.

Broadly speaking, existing narratives in support of mainstreaming RE in Nepal draw heavily from the global narratives of climate change and RE transition to position RE as a “greener” policy alternative. Some even go further to draw inference to the role of RE in substituting “dirty” imports from India. Both narratives lack traction in the Nepali policy context and the former implying “greener than hydropower” easily draw resistance. An important factor to keep in mind is that hydropower development sits deep in the psyche of Nepali policymakers, and the narrative around mainstreaming *other-than-hydro* RE can often be seen as an attempt to replace Nepal’s central energy narrative of hydroelectricity generation. As most stakeholders agree, hydroelectricity is vital for achieving net-zero emissions and the country needs to sustainably harness its potentials.

In comparison, the narrative on *complementarities* has a wider policy acceptance and, therefore, a more tractable framing on mainstreaming. Very importantly, this framing reaffirms hydropower as the primary source of energy in Nepal and positioning RE as a complementary source aligns neatly with how the policymakers view the sector. Very clearly, there are real limitations beyond weak policy interest that define the true scope of the RE sector in Nepal. While proponents tend to conveniently comment about the underrepresentation of the sector in the generation mix and tend to move the conversation to energy mix to rationalize a potentially larger share, there is a discussion around whether it is physically possible for the sector to meet the target of 1500 MW, i.e., 10 percent of 15,000 MW by 2030.

As it stands, the policy target on RE integration is largely aspirational and framed by the proponents of hydropower. Unfortunately, there has been no effort from the RE proponents to realistically examine this target. Such an examination is imperative for making the narrative on mainstreaming RE more realistic, nuanced, and context-specific. Similarly, RE proponents generally tend to leverage the idea of hydro complementarity to rationalize their narrow interests. There is, however, a lack of a coherent and convincing meaning associated with the idea. There is a need for more evidence and data on how, when, and how much to complement as well as noticeably demonstrate the benefits and gains of this complementarity.

It is also equally important that the new narrative demonstrates a clear intent to internalize innovation and opportunities in sync with global and regional shifts on clean energy. RE technology is rapidly changing with several transformative technological advancements, for example in battery storage, are likely in the coming decades. With such rapid changes in technology, we should expect some serious technological jump in the coming decades. Policies should encourage this progress rather than impede their development.

Finally, the discussion around the energy mix includes that of energy security. Clearly, the availability of a stable, affordable, and uninterrupted supply is a concern shared by all stakeholders that provide opportunities for Nepal to enhance energy security through phased reduction of its dependence on imported fossil fuel. This would also help make it less vulnerable to the impact of global and regional trends on price and quantity of supply.[76] The energy crisis of 2015 was a key impetus in the formulation of the 99-Action Plan and the inclusion of RE in the mainstream energy discourse. Unfortunately, Nepal relies even more so in India today, including for electricity, which contributes to about a third of its total consumption. A stronger push for a narrative that reminds the perils of such dependence and the need to tap into all forms of indigenous energy sources, including RE, should get more acceptance from a bureaucracy that is highly conscious of the integrity of its nationalism.

4.2 Working to Increase Demand for Electricity

The primary reason behind MoEWRI's policy pushback and NEA's reluctance to off-take RE is more circumstantial than an outright dislike for RE technology. The national supply position is expected to be significantly bolstered through the phased realization of around 6,000 MW of PPA-approved power. Of this, 3,157 MW have completed financial closure and are in different stages of development;[77] an estimated 1,629 MW is expected to come online by 2022.[78] In light of this increase in generation capacity, the Nepali power system is expected to witness a surplus in the coming years. Very initial estimates project wet season surplus starting from 2021/2022 and dry season surplus starting from 2023/2024, with an annual net surplus of around 15,693 GWh by 2026/2027.[79] Given this context, the primary concern for both MoEWRI and NEA today is not insufficient generation, but finding and creating a market domestically and through trade in order to manage the projected surplus.

This surplus is particularly concerning to NEA as it is directly linked to its financial viability and the consequences of NEA's inability to find a market for this surplus have catastrophic consequences for the sector. With the prospect and scope of cross-border electricity markets fairly uncertain in the current period, it is now a policy imperative of the GoN to increase electricity consumption and strengthen domestic demand. This demand is equally defining for the growth prospects of both, hydro and non-hydro sources.

As it stands, the electricity market in Nepal is still relatively small. Electricity consumption per capita is just 267 kWh - among the lowest in the world – and there is significant work to be done in terms of electrifying energy end-use in Nepal. More than half the country still relies on traditional fuel sources as its primary source of energy and the reliance on imported fossil fuels (petroleum products) in the transportation sector is also deepening. As Nepali society changes, with more urbanization and economic development, energy consumption will only increase. And a clean

[76] Gielen, D., Boshell, F., Saygin, D., Bazilian, M. D., Wagner, N., & Gorini, R. (2019). The role of renewable energy in the global energy transformation. *Energy Strategy Reviews*, *24*, 38-50.
[77] NEA Annual Report 2020
[78] GoN, Budget Speech for Fiscal Year 2021/2022. https://bit.ly/2TrEtpf
[79] Initial internal estimates made by VROCK and PEI in 2020.

energy transition can be beneficial to Nepal not just in terms of decreasing its carbon footprint but also in terms of its exploiting its natural resource available to it. This is also tied to economic growth (electricity as a means to development and not an end to its self); energy security (decrease in imported fossil fuel, but Nepal needs to generate from its own indigenous source and not be totally reliant on import from India). The narrative on expanding the reach of electricity and increasing consumption thus is today highly tractable in Nepal. Proponents of RE must look to align and add value to this narrative. It through targeted intervention in support of mainstreaming electricity that will ultimately create a favorable environment for mainstreaming RE.

4.3 The Pathways for Reform

As noted in our introductory chapter, a PEA is meant to help outline a potential pathway for reform. In this final section, we will use our analysis from the preceding chapters and relevant past work on political economy[80] to provide a potential pathway that NREP to take for a reform engagement to mainstream RE in Nepal. We should note that given the scope of this current undertaking and the resources made available, we are able to draw out a skeletal structure only. The initial agreement between NREP and PEI was to co-design a full set of activities after having finalized the PE analysis.

Before we get to describing the pathway, we also need to briefly explain the *thinking and working politically* approach that we recommend for any future reform engagement. This approach has been conceptualized and implemented through various frameworks such as the Problem Driven Iterative Adaptation[81] and Development Entrepreneurship.[82] The basic tenet of these approaches is that policymaking is "a complex, multi-directional, fragmented, and unpredictable" process and that the general disregard of the political context in traditional approaches to reform efforts have had limited impact in generating the desired changes.[83] Instead, these approaches espouse the need to i) identify solutions that are technically sound and politically feasible and ii) engage in the reform process through small but smart bets that iteratively advance the primary reform agenda.

- *Build the Evidence*: Before committing to a reform agenda, it is important to have a thorough understanding of the technical case for it. Based on this PEA it is quite evident that there are a number of areas that in the absence of in-depth technical analysis are impeding the reform. Technical undertakings in these areas could help improve the quality of dialogue between the relevant factors that may have differing opinions at the moment. NREP could fund a number of technical studies in the following areas to bring evidence for mainstreaming RE discourse in Nepal: grid integration, energy mix and security,

- *Identify Bureaucratic Interest*: AEPC is a bureaucracy with some institutional interest to push for the mainstreaming RE agenda, which it has been doing so, albeit from its own limited self-interest. But AEPC has very limited capacity to influence the ministry and it needs to build an alliance for this purpose. It is PEI's understanding that, despite all its limitations, WECS can be a strategic agency, at least in the initial phase and a limited purpose, to help advance the mainstreaming RE agenda.

[80] By this, we refer to ealier works that PEI staff members have done for then DFID on policy reform engagements in Nepal. For further info on this document, please contact the authors of this report
[81] Andrews et al. 2013. Building Capability by Delivering Results: Putting Problem-Driven Iterative Adaptation (PDIA) principles into practice.
[82] Faustino, J. 2012. Development Entrepreneurship: A Model for Transformative Institutional Change
[83] Unsworth, S. and Booth, D. 2014. Politically Smart, Locally Led Development. https://odi.org/en/publications/politically-smart-locally-led-development/

- *Locate a Champion*: The objective here is to find within the bureaucracy and other relevant agencies of the government specific individuals with the interest and the influence over the energy sector. It is too early to pinpoint any particular individual that would fit this criteria, but with individuals such as Dr. Dhital who have the experience and the interest as well as already in positions of influence, we already have a headstart on this matter. But we will need more such individuals within the MoEWRI and NEA, which might prove to be more difficult.

- *Find Political Support*: Developing and getting support from influential political actors can be a key factor in the success of any reform engagement. Based on this PEA and the other study conducted by PEI for NREP, namely, *The Implementation of Federalism and its Impact on Nepal's Renewable Energy Sector*, one possible area of engagement could be to work with local political actors, who have the mandate and the interest in generation, to influence mainstreaming of DRE. But this, and other possible engagement with political actors, requires further analysis.

- *Mobilize Interest Groups*: With the evolution of the energy sector and the political context of the country, there is a growing number of interests groups who have an interest to mainstream RE in Nepal. Whether this is the new government agency with the authority to oversee the country's electricity sector, the large scale hydro developers and their interest to invest in RE, or the local governments across the country who have a new mandate in the sector, all of these constituencies can be potential partners to further the mainstreaming agenda. NREP will have to develop a strategy to engage with each of them and mobilize them in a coordinated manner to achieve the overall goal.

- *Coordinate Donor Support*: There is donor support to mainstream RE in Nepal but their efforts often lack the necessary coordination thus limiting their ability to influence the agenda. Given NREP's relatively more rounded support to promoting Nepal's RE sector, it can work to leverage the strengths of each donor towards the overall agenda.

- *Invest in Institutional Capacity*: The ultimate factor in whether or not a reform agenda has been successful or not is in how the new policy is implemented. This requires investments in making sure that there is the necessary institutional capacity of the agencies involved. This too is difficult to state at the moment. But as NREP, or any other agency that is engaged in this reform, gains traction in the agenda, it need to invest early on in identifying the necessary technical capacity requirement and work with the agencies involved.

To sum of this political economy, the factors that influence the mainstreaming RE agenda are all trending towards an eventual mainstreaming of RE in Nepal. However, the current interests of the policymakers, for very valid reasons, are not aligned to make that transition happen yet. Any reform initiative can expedite the process by working politically to achieve mainstreaming agenda.

ANNEX 1: LIST OF KEY INFORMANT INTERVIEWS

	Name	Affiliation
1	Bishal Thapa	Saral Urja Nepal
2	Kushal Gautam	Quasar Energy Consultants
3	Kushal Gurung	Wind Power Nepal
4	Ananda Chaudhary	Treasurer, IPPAN
5	Guru Neupane	Api Power Company Limited
6	Indra Khanal	President, SEMAN
7	Madhu Prasad Bhetwal	Joint Secretary, MOEWRI
8	Sishir Koirala	Joint Secretary, WECS
9	Sagar Rai	Secretary, WECS
10	Sujana Timilsina	Engineer, MOEWRI (Alternative Energy Promotion and Energy Efficiency Unit)
11	Nawa Raj Dhakal	AEPC, Deputy Executive Director
12	Mukti Bikram Chhetri	AEPC, Finance Expert
13	Laxman Pd. Ghimire	AEPC, Assistant Director, Solar & Wind Energy/ Energy Efficiency
14	Krishna Prasad Acharya	President, IPPAN
15	Gyanendra Lal Pradhan	National Council Member, CNI
16	Ram Prasad Dhital	Member, ERC
17	Nabin Singh	DG, DoED
18	Sanjay Dhungel	DDG, DoED (Project Design Division)
19	Pratibha Tuladhar	SDE, DOED (Royalty and Electricity System Management)/Previously SDE MoEWRI (Alternative Energy Promotion and Energy Efficiency Unit)
20	Shyam Kishore Yadav	SDE, DoED (Generation License Unit)
21	Prabal Adhikari	Director, Power Trade Department, NEA
22	Hara Raj Neupane	Deputy Managing Director, Distribution and Consumer Service Directorate, NEA
23	Tek Nath Tiwari	Chief, Provice 1 Regional Distribution Center, NEA
24	Sushen Shrestha	Senior Credit Risk Officer, NMB Bank
25	Pragyan Regmi	Senior Partnership Manager, NMB Bank (Renewable Energy - Solar)
26	Pushkar Manandhar	Senior Project Officer (Energy), ADB