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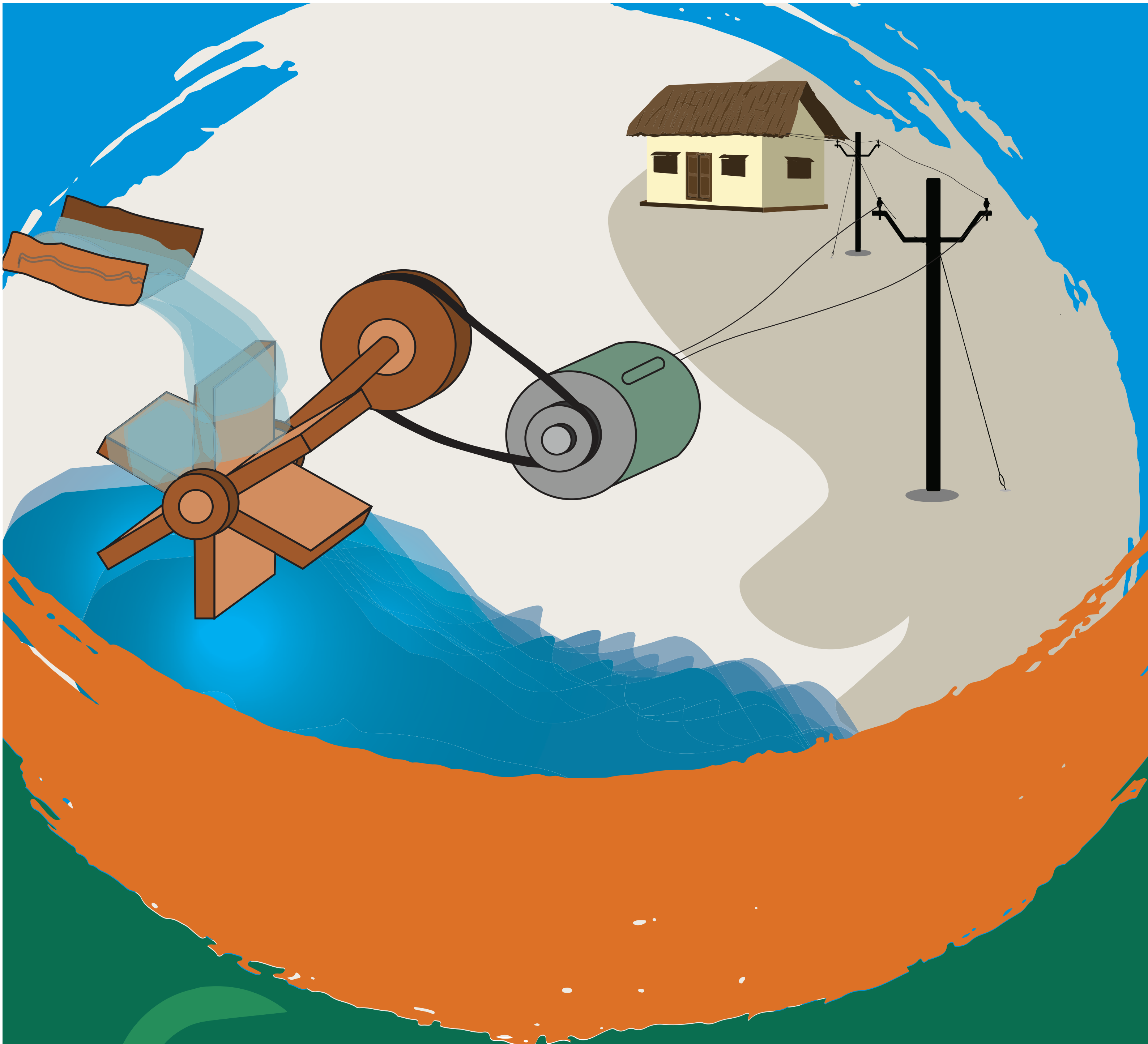

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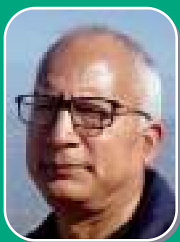

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Editorial

Small Hydropower:

Backbone of Clean Energy or a Forgotten Tale?

Hydropower development in Nepal has now been firmly established as a backbone of the national economy, energy security, and sustainable development. Despite being a country endowed with abundant water resources, Nepal was compelled for a long time to rely on imported energy to meet domestic demand. The most decisive policy intervention adopted by the state to break this dependency was the institutionalization of private sector participation in the hydropower sector.

Although the Nepal Electricity Act, 1963 (2020 BS) first introduced the concept of private sector involvement, practical implementation became possible only after the Hydropower Development Policy and the Electricity Act of 1992 (2049 BS). These policy and legal frameworks initially prioritized projects up to 5 MW, and later up to 10 MW, laying the foundation for domestic investment, technological development, job creation, and rural economic transformation.

It was through this policy opening that the private sector entered hydropower development, beginning its journey with small-scale projects. Projects such as Piluwa Khola, Lower Indrawati, and Sunkoshi (small) demonstrated the capacity, potential, and confidence of private developers. As experience accumulated over time, the scale of investment, access to technology, and the ability to bear risk gradually expanded. According to the Department of Electricity Development (DoED), projects ranging from 1 kW to 10 MW are 124, accounting for 60.49 percent of all hydropower projects. Together, they contribute 576 MW to the country's total installed hydropower capacity. Today, projects totaling thousands of megawatts are at various stages of the study, construction, and planning, financed entirely by domestic investment. As a result of these efforts, electricity generation has increased, enabling Nepal to export surplus power to India during the monsoon season after meeting internal demand.

Behind these achievements, however, there lies a critical reality: the small hydropower projects that laid the groundwork for the sector are now facing a serious crisis. Government bodies, line agencies, and regulatory institutions that once played a decisive role in promoting these projects appear increasingly neglectful toward them. Policy instability, inadequate transmission infrastructure, unviable power purchase agreement (PPA) rates, sharp increases in construction material costs, and high bank interest rates have placed small projects under severe financial pressure. Added climate change–induced risks have confined many of them to a struggle for mere survival.

In reality, small hydropower projects are the "training grounds" of hydropower development. It was through these projects that domestic investors learned to take risks, engineers and technicians gained practical experience in design, construction, and operation, and banks and financial institutions developed hydropower financing models. These projects also played a decisive role in expanding roads, bridges, communications, education, health services, employment, and social infrastructure in rural areas. Through local investment, royalty distribution, and corporate social responsibility programs, they became deeply integrated with local development.

Today, climate change has made river flows increasingly uncertain. Winter generation has declined sharply, while monsoon flows often deviate from expectations. The risks of floods, landslides, inundation, and riverbank erosion have increased. Yet the risk-sharing structure remains outdated—risk is borne by the private sector, while control rests with the state. The failure to update compensation, penalty, and PPA-related provisions in line with changing realities reflects policy insensitivity.

Incentives, exemptions, and facilities that initially appeared attractive failed to maintain continuity over time. Commitments made during periods of energy crisis were forgotten as conditions improved. Repeated policy revisions, inconsistencies between acts and regulations, and the absence of clear implementation guidelines have pushed small projects into an “existential battle.”

An increase in distressed projects inevitably leads to a contraction in future investment. This also adds risk to the banking system, as a growing share of non-performing loans is hardly a positive signal for financial stability. When generation declines, revenues fall, but loan and interest obligations remain unchanged. This directly affects new investment and long-term energy goals. More seriously, it weakens the message that “hydropower investment in Nepal is safe.”

Although the government has announced numerous incentives in recent years in the name of addressing the energy crisis, a large share has failed to materialize in practice. Inability to evacuate generated power, delays in constructing transmission lines and substations, and PPA structures that are disconnected from actual costs and risks are clear indicators of managerial failure. These problems can no longer be postponed. Policy clarity, legal stability, effective implementation, prioritization of transmission infrastructure, PPA review, and financial restructuring have become imperative.

The private sector must be recognized not as a culprit, but as a partner in achieving national energy goals.

Today’s small projects were yesterday’s major initiatives. Protecting projects that serve as the foundation, history, and pathfinders of hydropower development is a shared responsibility of the government and all stakeholders. Without the sustainability of small projects, the future of large projects cannot be secure. Now, small hydropower has become a thing of the past -- almost like a forgotten tale. It should not be treated this way. The government must recognize its importance and adopt appropriate policies to ensure its sustainable operation. Only then can large projects also be safeguarded, and the multidimensional benefits this sector has delivered to the nation and society continue to be realized.

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INSIDE

Legislative Provisions, Implementation Concerns & Sustainable Solution

Power without Protection: Tragic and Traumatic Electrical Accidents of Nepal

Balancing Financial Gains with Sustainability

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Main Story

Rajesh Khanal

Focusing on remote, grid-isolated areas, adopting the build-own-operate-transfer (BOOT) model, and effective utilizations of guidelines for design, construction, and maintenance at various levels could be helpful to ensure sustainability.

Opportunities Amid Constraints

Access to energy is fundamental to fulfilling basic needs, driving economic growth and advancing human development. Growing concerns for mitigating the challenges of climate change has called for maximizing uses of sustainable energy sources, along with ensuring economic benefits.

As a cheap, renewable source of energy with negligible environmental impacts, small hydropower (SHP) has an important role to play in Nepal's future energy supply, according Hydropower Development in Nepal—an economic review of Nepal Rastra Bank (NRB) 2021. This means of energy supply is an attractive alternative to conventional power systems in rural and remote areas through achieving rural electrification.

SHPs contribute to reducing greenhouse gas emissions by providing a cleaner energy source. They also help decrease reliance on fossil fuels, leading to significant reductions in carbon emissions. It provides access to reliable electric lighting enhances daily life, making activities such as studying, working, and household tasks easier and more efficient.

Global scenario

According to International Hydropower Association, SHP refers to hydropower facilities with a capacity of up to 10 MW, encompassing pico, micro, mini, and small classifications, each adapted to suit local conditions and requirements. SHPs play crucial roles in providing remote and rural communities with access to renewable and reliable electricity.

Hydropower contributes about 17 percent of worldwide annual energy generation and 90 percent of national energy generation. Out of this, 25 percent of its generation is contributed by SHPs. More than 65 percent of installed SHPs lie in the Asian region.

Among the various countries, Canada ranks first in the production of hydropower as it has abundant water resources and a geography that provides many opportunities to produce low-cost energy. Canada is reported to have more than 200 active SHPs (between 1-50 MW) contributing an approximately 3,300 MW, with new capacity growing at 100-150 MW annually. Increasing access to the energy from flowing water has played an important role in the economic and social development of Canada for the past three centuries.

Nepal's context

The 16th Five-Year- Plan of Nepal emphasized the transition from fossil fuel energy to an increment in the share of renewable energy such as solar, wind and hydropower. Along with domestic targets, there are international commitments like

Sustainable Development Goal (SDG) 7, under which Nepal has set indicators for affordable and clean energy. These emphasize for the country's priority towards the different sized hydropower projects.

SHPs are crucial for rural electrification in Nepal, with over 1,000 projects, including micro-hydro projects (under 1 MW), established across 52 districts.

Despite its critical importance in the national economy, the definition of Nepal's SHP is still not clear at the government level. In quantitative terms, considering the threshold of 10 MW, approximately 70 percent of hydropower plants in Nepal are SHPs.

At present, there are 17 micro-hydroelectric plants and 80 small hydroelectric power plants connected to the national grid. As of 2023, out of the total installed hydroelectric power plants of Nepal nearly 20 percent of the energy generation is contributed by SHPs, shows research conducted by Institute of Engineering, Tribhuvan University.

Extending the national power grid to remote and scattered settlement in Nepal's rugged terrain is challenging and costly. By the mid-1990s, only 15 percent of the population had grid electricity, with a few villages along trekking routes powered by micro hydropower plants. Though, the number of hydropower plants along with their capacities have enhanced over the period, the SHPs are still of high relevance in remote areas. The sector used to be fully under control of the government until three decades ago. Citing the cost overrun of the small hydropower plants, the government later on decided to lease the SHPs to the private sector.

In 1977, the government established Small Hydropower Development Board aiming to end the related problems like accelerating deforestation process that produces chain reaction affecting ecological balance, environment, rainfall pattern, flood frequency. Institutional restructuring took place again in 1985, when the merging of the Electricity Department, Nepal Electricity Corporation and all the development boards (except the Marsyangdi Hydropower Development Board) resulted in the creation of Nepal Electricity Authority (NEA). Since this arrangement, the NEA has been responsible for the generation, transmission and distribution of electricity from overall sizes of power production plants. In addition, the Alternative Energy Promotion Center has mandate to support hydropower projects ranging from 100 KW to 10 MW.

SHPs have broad-based impacts on the rural economy of Nepal, including the promotion of economic activities related to local mills, tourism, agriculture including livestock farming and irrigation, food processing, cottage industries apart from minimizing environmental impacts by replacing the conventional means of energy supply including fire woods.

Challenges

Despite having lot of potential and suitable energy projects, SHPs have failed to gain momentum. Unfortunately, there are several bottlenecks to the smooth operation of these plants, viz. run-off-river hydropower with low water flow in dry season, insufficiency of proper guidance monitoring, regularization and inadequate and unfriendly policies. Every one in three SHPs has issues with smooth operation in terms of generation capacity, and overall, 50 percent of SHPs have mechanical issues as the major problem.

Many small and micro-hydro projects face sustainability issues due to the expansion of the national grid, high cost, damage from natural disasters (landslides, floods), and lack of maintenance.

As Nepal's power generation capacity has grown to around 4,000 MW, the energy sector contributes around 15 percent to the country's GDP. However, the lack of transmission lines has been hindering the evacuation of electricity generated by many SHPs. The sector's experts have warned if most of them are forced to shut down, it will create serious problems in electricity supply across the country. The low per-capita consumption of energy in Nepal is not just due to lack of demand but to the supply bottleneck resulting from financial constraints and inherent delay in hydropower project development.

The critical reality is the SHPs that laid the groundwork for the sector are now facing a serious crisis. Government bodies, line agencies, and regulatory institutions that once played a decisive role in promoting these projects appear increasingly neglectful toward them. Policy instability, inadequate transmission infrastructure, unviable power purchase agreement (PPA) rates, sharp increases in construction material costs, and high bank interest rates have placed small projects under severe financial pressure.

As per the government estimates, 93.7 percent of the rural households have access to electricity from on-grid and off-grid sources. However, there exists an unequal geographical distribution of electricity access in Nepal. The western part of the country lags behind the rest of the nation in electricity infrastructure. The access to electricity in Karnali and Sudurpashchim provinces stands at 49.63 percent and 81.82 percent respectively, whereas the figures for other provinces exceed 90 percent.

Impacts of climate change have severely challenged mainly the SHPs. An instance of the 3 MW Bhairav Kund project, which was shut permanently with sustaining seven incidents of natural disasters in seven years between 2014 and 2021, after just one and a half months of its operation, produces a gloomy situation. However, the concerned government authority like the Department of Electricity Development (DoED) seems unwary to verify project design to align with impacts of natural disaster.

In most of the SHPs, there lacks mechanism for synchronization. Many small hydel projects operational in the past have now been shut as most of the small hydropower projects' failure seems to be due to poor planning and design, absence of promotional activities, lack of maintenance and operational facility and reliability of supply.

According to research published in Journal of the Institute of Engineering in October 2019, small hydropower technology is robust and can have life of almost 50 years with low maintenance cost. However, it is not in the case of Nepal, which is blamed mainly to the off-grid policy of the government.

The returns from SHPs are too low to attract large-scale investment at the prevailing cost levels and options for debt financing. A project with estimated 18 percent internal rate of return (IRR) gives little premium for investors when the debt rate is around 15 percent. Likewise, the leniency in licensing regulation is causing many project sites to be caught up by speculators without anything happening for years.

Way forward

On February 7, 2024, the NEA decided to open PPA with small hydropower companies tasked with producing up to 10 MW of electricity, to facilitate domestic investors who had been looking to inject capital in SHPs. Subsequently, the NEA on February 27 of the same year announced PPAs for the small hydropower by abolishing the quota system, citing the prevalent quota system as one of the main hurdles to carry out the Power Purchase Agreements (PPAs). The scrapping of quota allows the NEA with freedom to sign PPAs for any production range.

The NEA is actively promoting SHPs, specifically encouraging PPAs for run-of-the-river (ROR) projects up to 10 MW. As of February 2024, the NEA adopted a "take-and-pay" policy for these projects to enhance local, sustainable energy, offering rates of NPR 8.40 per unit (dry season) and NPR 4.80 per unit (wet season). The modality was later changed into 'take-or-pay.' The state-owned power utility will purchase electricity produced by the small hydroelectricity projects under the take-or-pay scheme. Under this clause, the NEA will take responsibility to evacuate electricity generated by the projects or it will be liable to pay a certain amount in penalty for failing to purchase the produce.

At present, 89 projects with production capacity of up to 10 MW have been waiting for the NEA's nod to sign the power purchase agreements (PPA). These projects have earmarked to produce a total of 251 MW of electricity. Out of these, 44 projects of 195 MW have already signed an agreement with the NEA for grid connectivity.

In March 2021, the NRB amended the working procedure for refinancing and categorised hydropower projects with a capacity of less than 10 megawatts as beneficiaries under the special refinance facility, making them eligible to borrow funds at a maximum of 3 percent interest. Renewable Energy Subsidy Policy 2078 has a provision to provide subsidy to community/ cooperative owned off-grid hydro projects from 100kW to 1MW projects to be connected to grid.

Overall, to solve various issues related to the sector, a detailed study of the plants is necessary for the performance analysis of mechanical components, which seem to be the main cause of annual loss in generation and major problematic shutdown. Each plant needs a real-time monitoring system for further investigation to have more information on the cause and consequences. Innovation and digitalization in the modern world have made much improvement in preventive measures and the effective operation of SHP.

The report of Institute of Engineering dated October 2022 has recommended for the artificial intelligence-based monitoring system, automatic flaw detection, remote operation and cyber security in the system are some of the examples applied in modern SHP. These types of systems induce effective operation and automation in SHPs as existing in developed countries. Even the rehabilitation of old plants with such mechanization and innovative systems in developed countries could be a learning lesson and future recommendation for developing countries like ours.

Focusing on remote, grid-isolated areas, adopting the build-own-operate-transfer (BOOT) model, and effective utilizations of guidelines for design, construction, and maintenance at various levels could be helpful to ensure sustainability.

Small/Micro hydropower technology is robust and can have life of almost 50 years with low maintenance cost [8], but small/micro hydropower plants in Nepal do not last long. This shows that there is a problem in off-grid policy of Nepal.

Surya Prasad Adhikari

Statistics show that small projects have made a significant contribution not only to the local but also to the national economy. It seems that the small hydropower contributed Rs 115 billion to the state treasury through VAT during the construction of civil structures alone.

Looking at the challenging situation of the past and the present, the question has arisen as to how meaningful it is to build projects smaller than 10 MW.

Laxman Biyogi

Legislative Provisions, Implementation Concerns & Sustainable Solution

Investigative

The point at which Nepal's hydropower development has reached its present status is based primally on the legal and policy framework prepared half a century ago. Though Nepal Electricity Act, 2020 BS envisioned to involve private sector in electricity development, due to the absence of dynamic leadership and know how, only in 2049 BS the private sector started its initial steps in this sector. After the issuance of the Hydropower Development Policy, 2049 and 2058 BS and the Electricity Act, 2049 BS, the door to private investment in this sector was not only opened, but the basis for the development of domestic capital, technical capacity and entrepreneurship through small hydropower projects was also created. This paper attempts to discuss the issues of the development of such projects, the problems they have faced and the non-cooperation of the government, among others, based on policies, laws, regulations and guidelines, and to come up with more effective legal solutions in this sector.

1 Background and Contribution to Revenue

Existing Nepalese policies, acts, rules and guidelines have no clear definition on the size of 'small scale hydropower projects' in terms of capacity (megawatts). Therefore, various Non-Government Organizations (NGOs) working in Nepal in collaboration with various government agencies, private sector and development partners have their own definition of 'small hydropower projects".

From the government side, all concessions and facilities announced by the government, are specifically focused on Small Hydro Power Projects (SHPs) up to 10 megawatts.

Worldwide, the promotion of SHPs is considered as a major step in a sustainable development. According to the United Nations Industrial Development Organization (UNIDO), the SHPs considered as projects above 10 to 50 megawatts.

According to UNIDO's World Small Hydropower Development Report, 2022, the total installed capacity of 'small' projects of up to 10 MW in the world is more than 78,000 MW. South Asian countries have considered projects of various capacities as 'small' based on their economic, technical and financial investment opportunities. According to the report, Europe has utilized 80 percent of its total potential capacity. More than 54 percent of the world's total installed capacity from SHPs is already exploited in China alone; which is four times the total installed capacity of Japan, Italy, Norway and the US together. It is stated that China occupies 28 percent of the world's total potential capacity. While analyzing China, the countries including the US, Japan, Italy, Norway and Turkey occupy 67 percent of the total installed capacity.

Table 1: Small Hydropower Projects in South Asia (Capacity, MW)

Nations	Small projects	Installed Capacity	Potentials
Afghanistan	Up to 25 MW	-	-
Bangladesh	-	-	-
Bhutan	Up to 25 MW	32.4	23,296.0
India	Up to 25 MW	4,787.0	21,134.0
Iran	Up to 10 MW	19.5	90.8
Nepal	Up to 25 MW	662.5	4,000.0
Pakistan	Up to 50 MW	445.0	3,190.0
Sri Lanka	Up to 10 MW	424.6	873.0

Source: UNIDO

The SHPs sector development plays an important and effective role in Nepal's rural economy; however, it doesn't seem gaining momentum in Nepal. In the nearly three decades since the entry of the private sector into hydropower development, majority of projects smaller than 10 MW, which were considered as pioneers of Nepal's hydropower development, are presently struggling for existence and in the verge of shutting down. Various factors as policy imbalances, implementation weaknesses, provisions related to power purchase-sale agreements (PPAs) climate change, weak transmission lines and lack of internal consumption considerably affecting the operation of these plants.

The contribution of small projects to Nepal's security and rural development is highly commendable. These projects have not only generated electricity, but also introduces radical changes in the physical and social structure of remote areas. In average, each project has built in average 5 kilometers of new access roads and repaired 10 to 15 kilometers of existing tract roads, providing access to easy transfer of various goods to villages. In addition, construction of more than 30 rural bridges across geographical remoteness has added convenience to the lifestyle of local residents. Its role in the field of electrification under corporate social responsibility is unparalleled. Due to this, more than 40,000 kilometers of distribution lines have been built in rural areas, transforming the entire rural life.

From an economic and social perspectives, the estimate shows that about NRs. 750 million for education, health and community welfare has been spent by small projects in operation under social responsibility requirement. This sector also plays a major role in job creation. During the construction process, more than 100,000 people were employed temporary, where as 2,500 people are permanently employed. This has clearly opened the doors to comfortable living at the local level.

Statistics show that small projects have made a significant contribution not only to the local but also to the national economy. It is estimated that the small hydropower contributed NRs.11.5 billion to the state treasury through VAT during the construction of civil structures alone. In terms of revenue, the local government receives about NRs. 60 million per year for the first 15 years and up to NRs. 600 million per year thereafter as the capacity royalties. Out of which the provincial government is receiving a royalty of NRs. 350 million per year in the first 15 years and about NRs. 2 billion after that from the sale of electricity. The continuous financial contribution to the state treasury even after construction, confirms that small projects are the cornerstone of the rural economy.

The government, which in the past rigorously promoted these projects for indigenous investment and new know how technological production, presently is paying more attention to relatively huger hydropower projects, neglecting the existing .

By 2067 BS, the country began to face the extreme power outages. As the result, the government has been chaotically changing comprehensive hydropower legislative system one after another. The outcome was a considerable loss to the private sector due to the government's inconsistent policies. Many projects, were not be able to proceed with construction even after entering PPA.

2 Legislative Framework

2.1 Hydropower Development Policy, 2049 BS

For the first time in Nepal, this policy allowed the private sector to enter the hydropower development. According to policy, the goal was to electrify rural areas through small hydropower development, provide access to electricity to industrial areas, and attract domestic and foreign investment. In this, arrangements were made to exempt projects up to 1 MW from obtaining a license and paying royalties for hydropower development, and to provide income tax exemption facility. Electricity generated with private investment was to be delivered to the local level through the transmission and distribution system of the NEA and connected to the central system.

Similarly, promoters developing more than 1 MW projects were required to obtain a license, and its period was set at a maximum of 50 years. In the case of these projects, a standard of NRs. 100 per kilowatt for 15 years and NRs. 1,000 per kilowatt per year were set. Provision also defined to charge 2 percent royalty in the first 15 years and 10 percent on annual electricity sales after 15 years. The policy also included a provision not to nationalize the project during the license period.

In the case of large project developers, an arrangement was made to exempt income tax for 15 years after starting of commercial production of electricity After this period, only 10 percent of corporate tax would be charged. During the construction process, a one percent customs duty was imposed on the import of equipment not manufactured in Nepal. In the context of PPA, the concept of determining the purchase price between the NEA and the developer based on the displaced cost or profit on cost or a certain percentage of the consumer retail rate specified by the authority was adopted. While determining this price, it is mentioned that 25 years of depreciation should be deducted from the project cost.

2.2 Hydropower Development Policy, 2058

The concept of establishing the hydropower sector as an industry was brought forward by revising the 2049 BS policy. The policy has given clear guidelines regarding the maximum utilization of available water resources, development of multipurpose projects, appropriate sharing of benefits, role of the public and private sectors, and utilization of internal and external markets.

Number of the provisions included in the 2049 BS policy, which were unclear, have been further clarified in 2058 BS document:

- To properly manage the risks that may arise in hydropower projects.
- To continuously release at least 10 percent of the minimum monthly average flow of rivers and streams or the amount specified in the environmental report.
- To provide facilities by providing subsidies through the Alternative Energy Promotion Center and including them in priority areas for credit while constructing projects up to 100 kilowatts.
- To make the PPA to purchase electricity generated from projects connected to the national system transparent, by allowing to conduct commercial transactions.
- In case of adverse geological and hydrological conditions or Force Majeure with unforeseen disaster, the nature and impact of the risk will be assessed and the period of the production license will be extended for a maximum of 5 years to minimize the impact.
- In case of requirements for capacity increment of power plants, reconstruction due to emergencies/natural disasters and periodic maintenance, the schemes including customs/VAT facilities will be provided in line of the new projects defined by the policy.
- To distribute the received royalty from the center to the local level.
- To develop projects of less than 10 MW by participating communities/ cooperatives along with an objective of electrification of remote and hilly areas.

2.3 Assessment of the Policies of 2049 and 2058

The differences seen in the two policies are highlighted in below:

Table 2: Changes in Policies (2049 vs 2058)

S.N	Facilities	Hydropower Development Policy,1992	Hydropower Development Policy, 2001
1	Royalties	• No royalties for projects below 1 MW • Projects above 1 MW: o Rs. 100.00 per KW per annum and 2% of the average sale price per unit (KW hour) as royalty up to 15 years o 1,000.00 per KW per annum and ten percent of the average sale price per unit (KW hour) after 15 years	• Projects above 1 MW and below 10 MW: o Annual Capacity Fee up to 15 years NRs. 100 per kW o Annual Capacity Fee after 15 years NRs. 1,000 per kW o Saled Energy Fee up to 15 years 1.75% per kWh o Saled Energy Fee after 15 years 10% per kWh • Projects above 10 MW and below 100 MW: o Annual Capacity Fee up to 15 years NRs. 150 per kW o Annual Capacity Fee after 15 years NRs. 1,200 per kW o Saled Energy Fee up to 15 years 1.85% per kWh o Saled Energy Fee after 15 years 10% per kWh o kWh • Projects above 100 MW: o Annual Capacity Fee up to 15 years NRs. 200 per kW o Annual Capacity Fee after 15 years NRs. 1,500 per kW o Saled Energy Fee up to 15 years 2% per kWh o Saled Energy Fee after 15 years 10% per kWh
2	Licenses	• No licenses for projects below 1 MW • Above 1 MW projects a license should be obtained with the validity of the license of a period of 50 years in maximum.	• Study/survey license for a maximum period of five years. • Hydropower generation license: o Thirty-five years from the date of issuance of the generation license o The export-oriented hydropower project: Thirty years from the date of issuance of the generation license o In the case of the captive plant producing energy of which at least 60% is utilized by any national industrial enterprise on its own up to 30 years o For storage project, a maximum period of five years
3	PPA	• The electric power produced from the hydro power plant of private sector may be sold or purchased by mutual understanding between the private developer and NEA	PPA should be transparent

2.4 Electricity Act, 2049

This act was issued on Poush 2, 2049 and was amended seven times till its final format of Shrawan 14, 2082 BS. It was first amended in 2058 BS when the Electricity Theft Control Act and the Income Tax Act were issued. It has also been amended after the restoration of democracy and in the course of issuing various acts in the related fields.

Main features of the act:

- The study permit will be valid for 5 years, and will be extended for two years in case of force majeure.
- The permit issued for production, transmission/ distribution will be valid for 50 years.
- If issued for a period of less than 50 years, the remaining period will be renewed and will automatically expire if not renewed on time.
- In the case of foreign individuals or organizations that have invested more than 50 percent of the total, after the expiration of the production permit, the structure of the project and the area it occupies will automatically belong to the government or can be operated as per an agreement with the government.
- A royalty of NRs. 100 per kilowatt for 15 years on installed capacity and NRs. 1,000 per kilowatt for the remaining period will be payable.
- An energy royalty of 2 percent of net sales for 15 years on electricity sales and 10 percent for the remaining period will be payable.
- Only 1 percent customs duty will be charged on mechanical equipment and machinery that are not produced in Nepal and have to be imported from abroad.
- Other facilities specified by the prevailing laws will be approved in accordance with this Act without duplication.
- PPA will be prepared through the NEA in accordance with approval given by the Electricity Regulatory Commission and depreciation will be determined in such a way that the entire investment is recovered in 25 years while determining the electricity purchase rate.
- Persons holding permits will be allowed to import and export electricity.
- Land, buildings, equipment or structures related to production, transmission and distribution related to projects larger than 1 MW will not be nationalized; incase otherwise, the government can acquire them with a reasonable compensation price.

Brief Analysis Conclusions

Most of the concepts laid down in the Hydropower Development Policy are included in the Electricity Act, 2049 BS. The 2049 BS policy is considered a milestone in bringing the private sector role into the expanding electricity development. However, instead of relaxing the provisions in the policy and act, the government is found to be toughening them. It has been repeatedly amended to increase payment for license fee along with raising fines and service charges creating difficulties to the promoters. What is even more complicated is that the period of production license was reduced to 35 years through rules and guidelines, although the Act has provision for 50 years. This is posing an adverse effect on small projects. Various conditions have been imposed on production licenses which contradicts policies and laws.

2.5 Electricity Regulations, 2050

The regulations issued on Bhadra 1, 2050 BS have been amended four times till Asoj 10, 2073 BS. In the case of hydropower smaller than 1 MW, there is a provision for technical evaluation by the Department of Electricity Development (DOED) and issuance of licenses by the concerned local bodies. However, this regulation has not simplified issue that is not clear in the policy and act regarding the definition of "small hydropower projects". Generally, when political parties declare their manifestos and talk about promoting small hydropower projects, they do not specify the capacity.

2.6 Directive on Licenses, 2075

The 'Directive on Licenses of Power Projects' issued on Kartik 7, 2075 BS has been amended five times till Mangsir 8, 2081 BS. The directive was based on Section 94 (a) of the Electricity Regulations, 2050 BS. While issuing survey licenses, there is a provision to determine the installed capacity as follows:

- Probability of Accident Q_{45} of Hydrological Time Series Data provided by the promoter.
- In case of any discrepancy between the official hydrological data available in the department and the data submitted by the promoter, the department's data shall prevail.
- Based on the Modified Highest and Medium Hydropower Study Project (MHSP 1997), the water discharge obtained from the calculated data and the total height (gross head) of the proposed project area, up to a maximum of 5 percent head loss and a minimum of 80 percent combined working capacity of the equipment.
- Head loss and overall efficiency of at least 80 percent.
- In the case of projects up to 1 MW for rural electrification where national transmission lines are not available, 'Probability of Accident Q80 of Hydrological Time Series Data'.
- Consent of the Ministry of Forest and Environment in the case of projects falling within national parks, wildlife reserves and conservation areas.

- Generally, it requires two years to complete the PPA and financial management and a specific time frame is set for submitting the Industry Registration Certificate, Foreign Investment Approval, Preliminary Environmental Test Approval and Environmental Impact Assessment (IEEE/EIA) report and issue a conditional generation license. If these works cannot be completed within the time frame, it can be extended based on necessity and justification, not exceeding 3 years.
- If work is not completed within 3 years, the generation license will remain valid after paying the capacity royalty fee (NRs. 100 per kilowatt per year) for the given installed capacity.

2.7 Proposed Bill, 2081

The bill, which was initially endorsed in 2062/63 BS, has been amended and revised dozen times. In the past two decades, it moved back and forth at various stages of parliamentary process, without receiving final approval on the pretext of not going through in-depth discussion with the relevant parties and stakeholders.

The bill mainly aims to establish a legal basis for domestic and cross-border electricity trade, establish a power exchange market and manage licenses, open access for consumers to the electricity system, and develop/operate projects in a competitive manner. It has stated that the government will establish an independent body to operate/manage the national grid within a year of the implementation of the act.

After the bill gets its legitimacy, the promoters will have to pay NRs. 1,200 per kilowatt per year of installed capacity and 12 percent of the energy royalty sale price after 15 years of project operation. The rate is 20 percent more than those of the provisions in the Electricity Act, 2049 BS. The royalty for up to 15 years is proposed as per the Act of 2049 BS.

Currently, there is a provision to provide share investment facilities to locals as per the Hydropower Development Policy, Project Development Agreement (PDA) and the directives of the Securities Board of Nepal (SEBON). The bill attempts to address this issue through the words 'if the locals want to invest in shares,' while Clause (f) of Section 12 and Clause (j) of Section 14 of the Electricity Regulatory Commission Act, 2074 BS have been repeated. These included issues like developing a minimum cost action plan to meet domestic demand and supply and expanding open access to the electronic system.

Arrangements for issuing licenses are proposed as:

- The concerned local level for up to 5 MW.
- The concerned provincial government in the case of provincial-level electricity generation plans for up to 5-25 MW and the necessary electricity transmission lines for it.
- The Government of Nepal in the case of large central-level projects exceeding 25 MW.
- The concerned province in the case of projects falling at the boundaries of the local level. In the case projects situated at the provincial boundaries and except those mentioned above, they will be in scope of The Government of Nepal.
- PPA rates are competitive but not below the following:
    - o Projects selected on the basis of electricity tariff rates.
    - o Projects that have obtained production licenses before the commencement of the Act, but only if the promoter desires.

After the enactment of the Act, the government has a provision to demand a separate performance guarantee, including license fees, while developing projects. The following provisions are made regarding production, transmission, distribution and trade licenses:

- 45 years for reservoir projects and 40 years for others.
- 35 years for transmission/distribution projects.
- 40 years for dams or reservoirs exporting electricity abroad and 35 years for other projects.
- 5 years for electricity trading; however, to be consistent with the same period of the production license issued for exporting electricity abroad.

The proposed bill has placed the line ministry, the Department of Electricity Development, and the ERC as the main regulatory bodies of the energy sector. The NEA and the licensee are depicted as the main stakeholders. The independent system operator and the Nepal Energy Exchange proposed to be established, bringing electricity purchase, sale, and trade within the regulatory framework.

2.8 License and Related Fees

Comparison Tables are presented below, highlighting changes in annual fees for various activities during SHPs implementing process.

Table 3: Survey License: Annual Fees (NPR)

S.N.	Installed capacity	Implemented since Bhadra 24, 2064		Implemented since Ashwin 15, 2069	
		Initial	Renewed	Initial	Renewed
1	1≤MW≤5	50,000	50,000	1 million	1 million
2	5<MW≤10	10,000 per MW	10,000 per MW	2 million	2 million
3	10<MW≤25			3 million	3 million
4	25<MW≤100			4 million	4 million
5	100<MW≤500	1 million	1 million	5 million	5 million
6	500<MW	2 million	2 million	6 million	6 million

Table 4: Transmission and Distribution License: Annual Fees (NPR)

S.No.	Installed capacity	Implemented since Bhadra 24, 2064		Implemented since Ashwin 15, 2069	
		Initial	Renewed	Initial	Renewed
1	1≤MW≤5	10,000	5,000	Lump sum 10,000	Lump sum 10,000
2	5<MW≤10	50,000 per MW	25,000 per MW	Lump sum 20,000	Lump sum 20,000
3	10<MW≤25			Lump sum 30,000	Lump sum 30,000
4	25<MW≤100			Lump sum 40,000	Lump sum 40,000
5	100<MW≤500	500,000	250,000	Lump sum 50,000	Lump sum 50,000
6	500<MW	1 million	500,000	Lump sum 100,000	Lump sum 100,000

Table 5: Generation & Distribution License: Annual Fee (NPR)

S. No.	Installed capacity	Implemented since Bhadra 24, 2064		Implemented since Ashwin 15, 2069
		Initial (Lump sum)	Renewed (Lump sum)	Production/ Transmission/ Distribution (Lump sum)
1	1≤MW≤5	100,000	100,000	500,000
2	5<MW≤10	500,000	500,000	700,000
3	10<MW≤25			1 million
4	25<MW≤100			3 million
5	100<MW≤500	1 million	1 million	4 million
6	500<MW≤1000	2.5 million	2.5 million	5 million
7	1000<MW	5 million	5 million	

Table 6: Royalties: Annual Fees in Nepali Rupees

S. No.	Electricity Capacity (MW)	Annual Capacity (Fee per KW)		Energy Fee per KWh (%)	
		Up to 15 yrs	After 15 yrs		
1	< 1	-	-	-	-
2	1-10	NRs. 100	NRs. 1,000	1.75	10
3	10-100	NRs. 150	NRs. 1,200	1.85	10
4	>100	NRs. 200	NRs. 1,500	2	10

Source: Hydroelectricity Development Policy, 2058

2.9 Tax and VAT

As of now, there is no provision to levy VAT on electricity tariff in Nepa. VAT and other tax facilities have been provided only on machinery, equipment and spare parts imported during operation. There is no clear provision in the policy for hydro-mechanical, transmission lines and civil structures, which account for 40-60 percent of the project cost. Therefore, the taxes on these structures are automatically incorporated in the project cost.

There is a provision to levy zero VAT and only one percent customs duty on machinery, equipment, machinery and related spare parts imported after receiving approval during the construction process. There is a provision that the value of materials imported in this way should not exceed 20 percent of the total. The income tax levied on the operation of hydropower generation, transmission and distribution systems is as per the prevailing Income Tax Act.

3 Small Hydro Development Initiatives

After the issuance of the Hydropower Development Policy, Electricity Act, and Regulations, the private sector was liberalized and moved forward in hydropower development. Initially, PPAs were fixed for projects up to 5 MW and studies and construction were underway. The first project started by the domestic private sector was the 3 MW Piluwa Khola, which was developed by the Arun Valley Hydropower Development Company Limited.

Gradually, political parties started including plans for the development of 'small projects' in their respective manifestos. For the first time, the Nepali Congress adopted a strategy to boost the rural economy through the development of 'small projects' in its manifesto of 2051 BS. Similarly, the CPN-UML adopted the same strategy as Nepali Congress, but only in 2064 BS. The line ministry prepared its periodic plan outlines and included hydropower development in the national priority areas. After the Electricity Act and Regulations were issued, by 2056 BS end, the private sector was increasingly interested in developing projects larger than 5 MW.

4 Impacts of Frequent Legislative Ammendments

In hydropower, once an investment is made, legislative guarantee is required until the license period. The government, however, increased the license fee more than 10 times in 2064 BS without studying the impact on the stakeholders. Due to this move, more than 600 study licenses were listed for cancellation. At the same time, hundreds of projects reserved by the private sector were put in the government's basket.

4.1 Contradictions In Generation License Timeline

After the Electricity Act 2049 BS came into force, it was found that the government approached contradictory while awarding the generation licenses issued between 2051-2059 BS. The license for the 60 MW Khimti project with foreign investment was fixed for 50 years and for the 45 MW Upper Bhotekoshi project of the same nature, for 40 years.

The first domestic private sector license for Piluwa Khola was issued on Bhadra 5, 2057 BS with approved 40 year of generation, whereas the 2.6 MW Sunkoshi (Small) license issued on Asoj 22, 2059 BS was approved for 35 years generation.

The 22.1 MW Chilime, a subsidiary company that has been providing share investment facilities to its employees (2054 BS Shrawan 26), also has a term of 50 years.

After 2059 BS, the license term was fixed at 35 years for the domestic sales and 30 years for projects built with the aim of exporting electricity.

After 2075 BS, several amendments were introduced. The terms of the license conditions were increased by ten folds. Enforcing the payment of capacity royalty even when PPA is not signed is one of the major concerns in the private sector. As a practice, the royalties are paid after the achievement of Commercial Operation Date (COD).

4.2 PPA Rate Determination

Asad 14, 2055 BS was a historic date for the domestic private developers. On the very day, the purchase rate of electricity supplied to grid was fixed at NRs. 4.03 per unit in winter and NRs. 2.95 in the rainy season, though the offer was of least attraction for private sector. It was the then Minister for Water Resources, Mrs. Shailaja Acharya who was the first to determine the PPA rate for domestic investment projects. Mrs. Acharya, who was influenced by the philosophy of world-renowned statistician Ernst Friedrich Schumacher (E.F. Schumacher) that 'Small is beautiful,' announced the determination of the PPA rate at the 286th meeting of the NEA's Board of Directors held on Mangsir 7,2055 BS. The step is considered a milestone in the development of Nepal's hydropower sector. Till now, this is popularly known as 'Shailaja Rate' in PPA.

Following dissatisfaction and further discussions with the private sector the rate of NRs. 3 per unit was fixed then for the rainy season (Baishakh-Mangsir) and NRs. 4.25 per unit for winter (Push-Chaitra) for projects between 100 kW and 1 MW. These rates were subject to increase by 6 percent per year for 5 years and thereafter, to be fixed mutually between NEA and developer, as per the price escalation index of Nepal Rastra Bank.

For projects ranging between 1 MW and 5 MW, the above rates and provision were approved, with condition to be implemented only after FY 2059/60. For projects of 5 -10 MW, the concept of determining the PPA rates through negotiation was introduced. There was a provision that the NEA would ensure the necessary transmission facilities to be connected to the grid. Inspired, the private sector came forward and obtained sufficient number of licenses and conducted related studies. Unfortunately , after granting the licenses, NEA and the government almost remained out of its responsibilities and led the private sector struggle on their own.

The prolonged Maoist conflict from 2052 to 2062/63 BS, among other destructions, hit hard Nepal's electricity sector. As a result of nearly 10 years instability in the country, the economy shrank and the market price increased uncontrollably. During the period, related government bodies and line ministries even tried to discourage the private sector.

On the other hand, the private sector, even after obtaining the license, were not interested in the project development, due to non-attractive PPA rates. As a result, the country entered the energy crisis in 2065 BS.

The then Minister of Water Resources, Mr. Bishnu Prasad Poudel presented the 'National Electricity Crisis Resolution Action Plan' at parliament in 2065 BS. In the same year, the Council of Ministers amended the PPA rates to attract the private sector in project development.

The government fixed the new posted rates in 2068 BS (NRs. 8.40 per unit for winter and NRs. 4.80 for monsoon). In addition, with an aim of mitigating the energy crisis, it was also announced that for projects - which have PPA rates less than new posted rate - if they achieve the commercial production by Chaitra in 2071 BS, the same rate would be provided for 7 years. Under this provision 19 small projects under construction were approved for this rate.

Subsequently, the government brought the 'Concept Paper and Action Plan on National Energy Crisis and Electricity Development Decade' in 2072 BS uplifted the private sector.

Table 7 below presents timeline of the amendments if PPA rates.

Table 7: Timeline of PPA Rates Amendments

S.N	Announced year	Dry season (NRs.)	Rainy season (NRs.)	Price Escalation terms	Remarks
	Initial Proposed Rates	4.03	2.95		
1	Kartik 2055-Mangsir 2065	4.25	3	6% annually for 5 years	<5 MW capacity; Ratio of winter/rainy-4/8 months, Design: Q-65
2	First hike: Poush 2065-Jestha 2068	7	4	3% annually for 9 years	Up to 25 MW capacity; Ratio of winter/ rainy-4/8 months, Design: Changed from Q-65 to Q-40; (505th BoD meeting dated Poush 5, 2065)
3	Second hike: Asadh 2068-2074	8.40	4.80	3 % annually for 5 years	Up to 25 MW capacity; Ratio of winter/ rainy-4/8 months, Design: Q-40; (568th BoD meeting dated Jestha 15, 2068)
4	Third amendment	8.40	4.80	3% annually for 8 years	Up to 100 MW capacity; Ratio of winter/ rainy-4/8 months, Design: Q-40
5	Fourth amendment: Baisakh 14, 2074	8.40	4.80	3% annually for 8 years	Ratio of winter/ rainy-6/6 months, Design: Semi-reservoir and reservoir projects above Q-40 (Separate electricity supply to address daily and seasonal peak demands)
	Mutual understanding	A separate rate for large projects; Price hike: 3% for 14 times (for period of first five constructions); 9 times after commercial production starts			

5 Issues of Existing Small Project in Nepal

5.1 Power Evacuation

Due to the poor condition/operation and limited capacity of substations, transmission and distribution lines, most of the small projects suffers power outages. This, in general, is the techno-commercial issue (alternative arrangement) with NEA, which leads developers to reduce production from their available capacity. Non possibility to operate in available capacity adversely affects income of private producers. PPA provisions in this case states NEA is responsible for such reduction and poor performance of transmission line facilities and pay the losses as 'forced outage' condition

After studying and analyzing these provisions, the Auditor General's Performance Audit Report of 2076 made public the fact that around 100 projects smaller than 10 MW have in total electricity worth of NRs. 380 million annually wasted. The report also mentions that about NRs. 1.09 billion had to be paid when purchasing the same amount of electricity from India.

Until 2078 BS, 35 small projects have been transmitting electricity according to the alternative arrangement of evacuation. Recently, with the completion of new transmission line and substations, this problem has decreased to some extent.

Table 8 below presents few examples of projects which were significantly impacted by weak or non-availability of adequate Transmission line and substation.

Table 8: Projects Affected by Weak Transmission

S. N.	Projects	Capacity (MW)	Remarks
1	Upper Syange	2.4	Incomplete Khudi Hub Substation
2	Chepe Khola	9.63	220 kV Marsyangdi Corridor Transmission Line not completed
3	Dordi-1	12	
4	Upper Dordi	25	
5	Super Dordi	54	
6	Super Chepe	9.05	
7	Nyadi Khola	30	Incomplete Khudi Hub Substation
8	Upper Chhyangdi Khola	4	Need to upgrade 33 kV Udipur Mid-Marsyangdi Line and Transformer
9	Lower Modi	20	Private sector is left to connect New Modi Switching Substation
10	Theule Khola	1.5	ERC directed to connect to 33/11 kV Kusmi Shera Substation, NEA cancelled it on pretext of technical reason
11	Down Piluwa	10.3	Private sector is left to install 33/220 kV transformer at Baneshwor Substation
12	Upper Khorunga	7.5	Private sector is left to construct 33 kV common way. Need for legal provision to allow electricity consume through common line
13	Upper Hewa Small	8.5	Process in progress to end alternative provision
14	Middle Tamor	73	Necessary to complete construction of Dhunge-Sanghu Substation
15	Sanjen Khola	78	New Bharatpur-Marsyangdi line must be constructed as per connection agreement
16	Upper Rawa Khola	3	Construction of 33/11 kV Baksila Substation completed
17	Gelun Khola Small	3.2	Private sector needs to connect to Chautara Substation
18	Thulo Khola	21.3	NEA need to construct Rahughat Substation

Source: Nepal Electricity Authority

5.1.1 System Tripping

Based on the available data, the average tripping of 33 kV transmission facilities is about 20 to 23 percent in monsoon and 5 to 6.3 percent in winter seasons respectively. The amount of wasted energy is 17 to 19 percent in monsoon and 3 to 5.5 percent in winter. At the high voltage level (above 66 kV), the interruption in electricity supply is about 2 percent, while at the low voltage level (33 kV and 11 kV), it is between16 to 23 percent.

In the distribution systems, this situation is even more alarming. In urban areas, the cut of power supply (tripping) of 11 kV and 400-volt distribution lines with distribution substations is around 11 to 17 percent, while in hilly and other rural areas (33 kV, 11 kV and 400 volts), the rate is up to 30 percent.

Such an alarming situation affects both: the private produces in terms of profit and the NEA in term of decreased the per capita consumption and overall performance .

5.2 Role of Private Sector and Government

As small projects were facing financial crisis, the Ministry of Energy, Water Resources and Irrigation formed a study committee led by a joint-secretary of the ministry on Kartik 4, 2076. The committee formed to solve the 'problems of financially distressed hydropower projects run by the private sector' was given the responsibility of studying their electricity generation status, PPA issues, bank loans and Interest, financial status and other aspects. The committee studied the financial and technical data of 66 projects having a cumulative capacity of 281.59 MW operated since 2061 and submitted the report to the ministry on Asadh 31, 2077.

Problems identified by the team were reported as:

- More outages on low-voltage lines and the unable to operate at full capacity, even after the project is constructed, due to lack of transmission lines/substations.
- Compulsion to pay penalty, due to decline in water flow as AD Penalty
- High Interest rates in the case of 'small'.
- Non-implementation of concession/exemption programs announced by the government.

6 Exemption/Concessional Initiatives

Due to the prolong load shedding period starting from 2065 BS, the government announced various exemptions/ concessions to accelerate electricity production. At that time, the 'National Electricity Crisis Resolution Action Plan' was issued. On Chaitra 9, 2067 BS, parliament declared an energy crisis for the first time in the country. In 2068 BS, another 'Load Shedding Reduction Action Plan' came out. Similarly in 2072 BS, a 99-point 'Concept Paper on National Energy Crisis Resolution and Electricity Development Decade' was announced. Along with many other topics, these documents included exemption/concessional programs to be given to private projects to overcome the energy crisis. Not only this, regular facilities were also announced in the budget, policies and programs almost every year.

However, as of date, not all proposed facilities are in place, thus, the private sector still waiting for their full implementation. The following section will present examples of such program/ initiatives which were halted.

6.1 Hold Back Initiatives

Of the 27 announced exemption/concession initiatives approved by the Council of Ministers and endorsed by the parliament, only 3 initiatives (11 percent) have been fully implemented, 6 initiatives (22 percent) have been partially implemented and remaining 59 percent have not been implemented yet. 8 percent (2 initiatives) of the programs announced in the FY 2078/79 and 2079/80 were expected to be implemented in the future.

6.2 Piled up of Unimplemented Facilities

In 14 years, from 2065 BS to 2078 BS, the government announced 27 concession programs for private energy producers under various announcements. Out of these, the government expressed its commitments to implement National Electricity Crisis Resolution Action Plan 2065 BS announced 2, the Load Shedding Reduction Action Plan 2068 BS announced 8, and the 99-point Concept Paper 2072 BS announced 11 exemption/concession programs.

Apart from these, the then Finance Minister, Mr. Baburam Bhattarai, through the budget for the FY 2065/66 announced two additional initiatives. Later on, Former Finance Minister, Mr. Ram Sharan Mahat also announced equal number of programs in the budget for 2071/72 and 2072/73, while Mr. Bishnu Prasad Poudel and Mr. Janardan Sharma each also announced one of the programs in budget during their tenures.

6.3 Additional Subsidy Provisions

Point 19 of the National Electricity Crisis Resolution Action Plan 2065 BS highlights increasing the limit of small hydropower projects up to 1 MW and providing a subsidy of up to 80 percent to projects within that range. Although this program was said to be launched within Chaitra of the same year, it has not been implemented yet.

6.4 New Purchase Rate

According to the decision of the Council of Ministers, out of the 10 points of Load Shedding Reduction Action Plan announced on Magh 17, 2068 BS, the private sector has been included in the first point. In case of projects under construction with low PPA rates, it was said that if the construction is completed by Chaitra 2071 BS, a new purchase rate will be given for 7 years. Under this, 19 private sector projects received the facility but have not yet received payments assigned for some years.

6.5 Concessional Loans Provision

In point 1 (b) of the Loadshedding Reduction Action Plan 2068, it has been decided to adopt four measures to complete the construction of private sector-run projects that are subject to financial crisis. The first was the decision to provide concessional loans through the Ministry of Finance. The ministry has not yet provided such facilities at that time. This issue was raised again in the Monetary Policy of the FY 2077/78. Although some have received such facilities , some declared as 'sick' have failed to have allocated benefits.

6.6 VAT Exemption/Subsidy

The Load Shedding Reduction Action Plan, 2068 BS announced to provide value added tax (VAT) exemption on construction materials and construction work, but it has not been implemented yet.

In the budget for the fiscal year 2070/71, it was announced to provide subsidy of NRs. 5 million per MW and an additional 10 percent for projects to be completed by the fiscal year 2074/75. Due to the lack of coordination between the Ministry of Energy and the Ministry of Finance and the tendency of the private sector to engage in extortion, the amount allocated for VAT subsidies has been transferred to payments to projects that went into commercial production by Chaitra 2071 BS.

6.7 No Penalty Provision

The government announced that the penalty for delay in electricity generation will be waived, but this has not been implemented so far.

6.8 Posted Rates

The new posted rates announced for old small projects as well in the ‘Concept Paper and Action Plan on Energy Crisis Alleviation and Electricity Development Decade’ has also not been implemented.

6.9 Subsidies for Unstarted Projects

It is mentioned that projects that have signed PPA but have not started construction will be encouraged to immediately start construction so that commercial operation can be achieved by Chaitra 2071 BS. For this, the government allocated concessional loans, but related energy producers did not get the facility.

6.10 Delay Penalty

In the case of projects that signed PPA before 2071, but have not started construction, a decision was made to exempt penalties. However, this was not implemented so far by NEA.

6.11 Price Escalation Provision

Although it was said that the number of annual escalations given in the posted rate specified before 2072 BS to be increased from 5 to 8 times in the prevailing PPA, that has not implemented yet.

6.12 Low Generation Penalty Exemption

Through the concept paper, the government announced that if the water flow (discharge) in the river/ stream decreases in any month of the year for projects up to 10 MW and the supply to NEA system as per the PPA is not possible, compensation will not be taken from the concerned developer. The implementation of this point was initiated since Ashwin 3, 2078 BS only after the recommendation of Project on Financial Crisis Study Committee.

This facility was fully implemented for projects that achieved commercial electricity by Chaitra 7, 2077 BS. But for those that produced after this, a 10 percent penalty was imposed as Declaration Deviation Penalty. The ERC has issued in the 'Regulations on the Purchase and Sale of Electricity and Conditions to be Followed by Licensees, 2076 BS' that no hydrological penalty will be imposed on any project of any kind smaller than 10 MW irrespective to the COD. The conditions are:

- The electricity seller should inform the buyer about the forecast of electricity produced by his project (Availability Declaration).
- The buyer should not impose any compensation claim on the seller based on the forecast of generation.
- In case of damage to the transmission line/substation due to floods, landslides and earthquakes, the buyer would not compensate the seller and the buyer should restore the system and inform the ERC as soon as possible.
- While providing compensation for the ‘undelivered energy’ to the seller for the loss of power as per the PPA, the same formula has to be used for 132 kV, 56 kV, 33 kV and 11 kV.
- There will be no provision of spinning reserve in the PPA
- The above conditions will also be applied to the operating projects.

6.13 RCOD Extension

As per point 28 of the concept paper, it had been decided to consider the earthquake, flood and landslides of FY 2071/72 as an uncontrollable situation (Force Majeure) and provide necessary facilities and to extend the Required Commercial Operation Date (RCOD) for the projects under construction damaged by the earthquake by a maximum of one year. Although the budget for FY 2079/80 mentioned extending the Generation License period for those affected by COVID-19 by two years, it was not implemented.

6.14 License Expiration

It was decided to extend the RCOD period of the PPA for a maximum of one year as per the requirement if any project in operation was also damaged by the 2072 earthquake. This provision, so far was not implemented.

Similarly, there was a recommendation to extend the generation license period as per the commencement date of commercial production and the extension of the PPA period too. For this, it was mentioned that this announcement would be implemented after the extension of PPA , but the line ministry did not seem responsible.

6.15 Natural Disaster Compensation

It has been stated that appropriate compensations will be made for the projects affected due to floods and landslides, However, the ministry neither brought any such compensation program nor any procedure.

6.16 Industrial Revival Fund

Point 58 of the concept paper states that the Industrial Revival Fund amount will be made available to the hydropower sector. The Ministry of Industry is focal organization for the immediate work, while the Ministry of Finance and Ministry of Energy are delegated as the supporting bodies. However, no private producer has received financial benefit from the fund as of now. Although such amount is said to be provided for 'sick projects', hydropower is not included in the classification of sick projects.

6.17 Exemption in EIA

During budget announcement for FY 2065/66 by the then Finance Minister Dr. Baburam Bhattarai announcement of exemption limit for EIA from 10

MW to 50 MW was made. The forest sector permit and approval process were expected to be simplified after the budget.

Although this system was implemented for a few years, the IEE requirement in this category has been made more complicated due to amendments in environment regulations and directives.

6.18 Reimbursement In Infrastructure

Finance Minister Bishnu Prasad Paudel introduced ordinance budget in FY 2078/79 and the regular budget in FY 2079/80 budget announced to provide 75 percent reimbursement if the promoter builds an access road and transmission line to the project site. This was not materialized.

6.19 Covid-19 Facilities

The ministry formed a study committee at the joint-secretary level to recommend exemptions and facilities for projects adversely affected by the Covid-19 pandemic. This included extending the period of production licenses and gave an 80 percent fee waiver for renewal of survey licenses, but the Ministry of Finance did not implement it.

7 Developers' Concerns

7.1 Interconnection Issues

On Magh 1, 2052 BS, the PPAs were initiated based on the principle of 'take or pay.' According to this clause, the NEA will have to bear the financial liability if there is a loss in electricity generation of a hydropower company due to the disturbance in the system or any other factors.

Except for Khimti, Bhotekoshi, Chilime and Upper Marsyangdi 'A', the NEA did not pay compensation to any other projects. Moreover, the concerned authorities of NEA reluctant to approve the amount of electricity lost due to the disturbance in the system. Similarly, there is no practice of providing written instructions to reduce production or completely shut down when there is low demand in the system.

Since 2065 BS, the connection agreement had maintained a provision that private sector electricity could not be purchased on a 'take or pay' basis until the 'Dhalkebar-Muzaffarpur Line (DM Card)' was built and its limited capacity.

Despite going into 'take or pay', the NEA has been reluctant to purchase electricity using the 'PD Card (Project Delay-Delay in Project Development)' while the delays in installation of transmission lines become the major problems in evacuating the produced electricity. As a result, there is a practice of forcibly extending the RCOD of projects that are about to be completed.

Contrary, if the COD is delayed due to the promoter, a number of penalties are imposed.

Similarly, in the case of projects that have completed construction and are waiting for the COD, the limited capacity of the transmission line is claimed. As the result, the promoters are forced to either go for a contingency plan (CP Card) or close the power plant and face a 5 percent penalty from the NEA as per the PPA 4-D provisions.

Even though the Dhalkebar-Muzaffarpur transmission line '(DM Card)' is now operational, 500-600 MW of energy is still being wasted during the monsoon season. Until the other four proposed 400 kV cross-border lines are built, projects under construction are forced to flow electricity under the 'CP Card' after signing PPA. While making the connection agreement for each project, a plan for the flow of electricity is made by specifying the time limit for the construction of the cross-border line. In addition, NEA also specifies the time limit for RCOD too.

NEA and the government itself are not confident that the cross-border lines will be completed on time. With the problem in place, the authorities used the skeptical tool of 'take and pay' through the budget for the FY 2082/83. Since the projects are not developed according to the electricity demand in the system, the socialist governments have been playing tricks on the private sector using the CBTL-MCC Card.

Until the cross-border lines are built, the policy of purchasing electricity on the basis of the verbal 'DI Card' (Dispatch Instruction) issued by the load dispatching center remains in place. This situation will continue until an independent system operator will be introduced. For this, it is necessary to take NEA to a fair unbundling.

NEA has been putting forth the conditions of the DI Card an integral part of the PPA in the electricity connection agreement. After the project is tested, the 'CP card' is used for commercial operation. This provision is another lethal weapon. Here, the promoters are in such a dilemma because as per Section 4-D of the PPA, if the conditions are not met, five percent of the electricity that can be generated must be compensated. Otherwise, they have to accept the mandatory provision of 'take and pay' from 'take or pay'. This is the reason why the income received by the promoters from the project has declined by an average of 18 (12-55%) percent.

7.2 Other Challenges

The main challenges by private sector in constructing, managing and operating SHPs can be analyzed from both technical and financial aspects. The technical aspects, especially in machinery and parts, are very much dependable on international suppliers (since not available in the Nepal) and therefore expensive. Likewise, the is no adequate technical manpower in Nepal. Majority of SHPs seek support from other countries. For simple maintenance and repairing works, with rate of about $5 per kW, annually around NRs. 350 million is spent in foreign currencies.

Although the government laws provide facilities of zero VAT and one percent customs duty on spare parts, such expenses have increased by more than 50 percent as the Financial Act does not address this issue.

The complex legal and administrative works while importing heavy machinery and longtime duration to reach Nepal, additionally create difficulties. On other hand, there are socially based conflicts since in general, the local level does not actively participate in the project's ownership, and in majority backed by political interference.

Sections below summarize some issues faced by SHPs based on various studies:

7.2.1 Increase in Cost

An analysis of the impact of the then Maoist Insurgency, earthquake and blockade on the investment of around 36 project shows that the cost per MW has gone up from NRs. 120 million to NRs. 366 million. Seven projects were built with a cost between NRs. 120 million and NRS 170 million; eleven projects with a cost of NRs. 170-200 million, seven projects with a cost of NRs. 200-230 million and ten projects with a cost of more than NRs. 230 million per MW. The cost of one of the hydropower projects has even escalated to NRs. 366 million.

The cost increment of the projects that suffered the above problems based on the major project's components are presented in Table 9 below:

Table 9: Increment in Actual vs Design Cost

S.N.	Details	Increase in Cost by	Reasons for Increase
1	Pre-operation cost	≈0	:
2	Civil construction	34.9%	Armed conflict, blockade/ energy crisis, delay in loan disbursement by banks
3	Steel work	22.8%	Inflation
4	Electromechanical	7.8%	Inflation
5	Transmission line and Switch yard	6.9% (130% to -36%)	Armed conflict, blockade/ energy crisis, delay in loan disbursement by banks, increase in time and cost, and weak capacity of transmission lines
6	Land	105.0%	Policy Issues
7	Site office building	0	
8	Office equipment	76.1%	Weak monitoring
9	Transport cost/rent	0.0%	
10	Short term financial cost	≈0	
11	Infrastructure development cost	≈0	
12	Environment/social impact minimization cost	41%	Policy Issues
13	Project supervision/ management and engineering	38.1%	Armed conflict, blockade/ energy crisis, delay in loan disbursement by banks, increase in time and cost
14	Insurance and miscellaneous		
15	Interest of construction period	30.6%	Policy Issues

Source: Received data from various companies

7.2.2 Low Generation

According to the MoEWRI's report of Ashad 11, 2077 BS regarding the 'problems of financially distressed projects', generation from operating small projects is very low compared to the contract energy. The report shows that: 13 projects are producing less than 50 percent of the contracted energy, 40 projects are producing less than 70 percent of the total energy, and 50 projects are producing around 80 percent. Only 10 projects are seen producing 80 percent of the contracted energy. No project is seen to be able to produce more than 80 percent of the design energy.

7.2.3 PPA Rates

The general power producers' consensus states that the existing PPA rates cannot cover financial and operational expenses. Likewise, the projects with old PPA rates, the income could not cover the operational expenses and financial parameters are well below the profit line. For example, five projects operating since 2057 BS, have been facing difficulties with the machinery and spare parts , since almost all of them are obsolete requiring total replacement. Likewise, other 35 projects require capital repairing and requires testing and commissioning procedures.

Eleven projects operated from 2066/67 BS to 2074/75 BS with old PPA rates with an total installed capacity of 24.89 MW are considered as severely sick projects. Their base PPA rates are NRs. 3 and NRs. 4 per unit in the rainy season and NRs. 4.25 and NRs. 7 in the winter.

7.2.4 Sick Transmission/Hydrology

The study of 35 (refer to section 10.2) projects shows that 12 projects have produced at least 13.5 to 40 percent less energy due to outages and non-dispatch in NEA's transmission lines. Likewise, as the water flow in the rivers decreases, the production of almost all of them further declined. This is the main reason behind 9.3 to 56 percent less generation of contracted energy.

7.2.5 Compensation/Penalties

Before the elimination of hydrological penalties, projects of less than 10 MW were paying damage compensations ranging from 1.07 to 40 percent of their annual income to NEA. Out of them, 18 were paying compensations of more than 10 percent.

7.2.6 Impact of System Tripping

There are 5 projects (capital cost NRs.130 million to NRs. 232.5 million per MW) with very severe low generation outputs due to excessive transmission system tripping and hydrology issues. Eleven projects (NRs.146 million to NRs. 366 million per MW) whose annual energy production is less than 50 percent due to the excessive transmission system tripping and hydrology issues.

8 projects (NRs.150 million to NRs. 230 million) facing the same issues but with lower impact and having annual energy generation in the range between 50 to 60 percent of the contract energy. Those projects which have satisfactory operation transmission system, good management practices and energy generation averaging 50 to 70 percent. Five projects (NRs. 117 million to NRs.190 million million per MW), with relatively low frequency of tripping, have achieved 70% of energy generation.

The above analysis shows that they are relatively low-cost project but their sales is poor due to low PPA rate, excessive tripping and hydrological issues.

On this basis, a further analysis of the financial position of the promoter companies is provide in Table 10 below:

Table 10: Financial Status of Small Project

Status of promoter companies	Total capacity (MW)	Limit (MW)	Project number
Interest/ Installment regular	49.99	2.5-9.98	11
Interest regular & installment irregular	8.52	3-5	2
Interest and installment irregular	81.95	0.5-13.6	23
At watchlist of banks	179.35	1.5-9.98	31
Less than 10 MW, not included in data collection	191	--	40

Source: Statistics financially distressed hydropower projects operated by IPP, Asadh 31, 2077

7.2.7 Corporate Taxes and Other Service Fees

The Hydropower Development Policy and Electricity Act, has placed hydropower sector within a framework of Corporate Tax and Royalty only. However, after the promulgation of Federal Constitution, 2072, the Financial Acts issued by the government keep on adding tax and service fees of local and regulatory bodies.

The expenditure on tax / service charges based on the financial statements of small hydropower projects upto 5 MW is presented in the Table 11 below.

Table 11: Taxes and Service Fees to be paid by IPPs upto5 MW Projects

Offices to collect tax/ service fees	Up to 15 years	After 15 years	Basis of taxes	Remarks
Inland Revenue Department/MoF	0.05% of income	27% of income	Tax, service fees and penalty	
Office of Company Registrar/Ministry of Industry	0.025% of income	0.5% of income	Service fees and penalty	
NEA	5% of income	11% of income	Financial loss, electricity generation payment, compensation for shortfall of produced energy than forecast, unmeasured income for energy production above contract	Include financial loss with price hike on not making commercial production under RCOD and payment delayed for up to 45 days from the billing date
NEPSE/SEBON/CDSC	About 1% of income		Service fees	
ERC	About 1% of income		Service fees	
Banks and Financial Institutions	3% of income	8.5% of income	Service fee, financial loss and compensation	Financial loss incurred for depositing company's income in interest non-earning accounts
DoED	2.5% of income	16% of income	Royalty, service fee and compensation	
Others	1.5% of income			Royalty on leasing forest and land, organization registration etc.

Source: Data received from various hydropower companies

7.2.8 Operational Burden

Various studies confirm that the cost per megawatt of small (up to 10 MW) projects is 25 to 30 percent higher than that of lager ones. Most of the small projects are not able even to pay the bank interest and principal. Due to this some hydropower companies have reached the bankruptcy.

The cost per MW of the projects under study is varies from NRs. 130 million to NRs. 230 million. In addition to the income received from the sale of electricity, the promoters have raised Rs. 20 to 60 million to meet the operational expenses through initial public offering and right call.

The average annual income of the project is NRs. 20 million and the average interest on the loan is 11%. Financial expenses account for more than 70% of annual income. The operating period of the project is 30 years based on the generation license and PPA. There is a legal provision to keep 3.33 percent depreciation which is approximately 36% of annual income. The hydropower development policy has a provision to keep the depreciation calculation limit for 25 years. Royalties, taxes, service charges, and penalties are 14.13 per cent for the first 15 years and 66.5 percent thereafter. The average annual cost insurance is 3% of annual income. The administrative cost of operation is approximately 33 percent.

The net worth of listed companies operating small hydropower in the secondary market is less than 100, there is no balance between income and expenditure. Some have a net worth of less than 50. A net worth of less than 100 means that investors are not getting returns. This has discouraged small investors who normally face financial pressure.

In summary: Small hydropower companies are forced to spend 153.12 percent of annual income in the first 15 years and 195.5 percent thereafter. A large part of the deficit (53.12%-95.5%) consists of depreciation and financial expenses.

8 Ways Forward to Sustainable Operation

If the balance between income and expenditure is not achieved, it is seen from the financial projections that the net worth of the promoter companies will decrease and reach almost zero within the next 10 years. In such a situation, either the promoter should liquidate the company, or the government should take ownership of it as per the terms of generation license. It is difficult to define whether the bank, promoters or the government should assume to take the risk and the responsibility of the project.

In such a system, the amount that comes after deducting depreciation and operating expenses from the income generated should at least set at a price that can pay the principal and interest on the loan. For small projects upto 3 MW, the provisions as stipulated for below 1 MW is to be implemented. These are: no limitation on license period, no corporate taxes and royalties. Similarly, PPA rates are to be reviewed based on the generation statistics.

The government should adopt a policy of bearing the risks of financial loss by taking over the 'take or pay' provision. The operating period should not be specified for projects smaller than 3 MW, and for those between 3 and 10 MW, a 50-year license period should be issued as per the Electricity Act, 2049. 'Small Projects' should be exempted from all type of royalties and taxes.

For sustainable operation, it is essential to review the PPA rate to of NRs. 9.30 per unit in winter and NRs. 5.60 in monsoon. The ratio of winter and monsoon should be 6:6.

Finance Bill has made provision for depreciation only up to 12 years, policy arrangements for depreciation should be made based on the operating period. This will prevent further increase in the losses of these projects.

Special loan facilities should be provided with a loan repayment period of 12 years and fixed interest rate not exceeding 5 percent. It is necessary to have a separate policy arrangement for hydropower insurance so that it does not exceed 1 percent of annual income.

Based on above, royalty, service fee, financial loss and damage compensations will be 7.26 percent, depreciation will be 10.75 percent (considering minimum 50 years operating period) and financial expenses will be 37 percent, which will significantly improve the financial indicators of projects up to 3 MW. Since 88.01 percent of the annual income will be spent on operational activities, the financial indicators will be positive and investors can get a maximum dividend of 5 percent. Similarly, in the case of 3 to 10 MW, up to 77 percent of the annual income will be spent on operational activities and investors will earn a profit of up to 10 percent.

To dynamically take forward the development of the energy sector, the government must bring such arrangements through the budget and annual financial bill. The NEA should build transmission and substations for small projects at its own cost.

9 Conclusion

The private sector has entered the nation's hydropower sector owing to Hydropower Development Policy, Electricity Act and Regulations. In particular, those smaller than 3 MW have created a foundation for a domestic investors, technical expertise and project development culture, while those up to 10 MW have prepared a development blueprint. However, due to the imbalance between stable policies, laws, rules, guidelines and the delay in implementation, these projects are facing serious financial crisis.

Looking at the challenging situation of the past and the present, the question has arisen as to how meaningful it is to build projects smaller than 10 MW.

The situation of small than 3 MW projects seem even more critical.

Since SHPs create local employment, stimulate the rural economy and provide energy security in areas not reached by the national transmission line, their importance will never fade from a social and technical perspective. For these projects to operate sustainably, PPA rates must be adjusted according to inflation and transmission lines must be ensured. Moreover, operating period should not be specified for projects smaller than 3 MW, and for those between 3 and 10 MW, a 50-year license period should be issued as per the Electricity Act, 2049. SHPs should be exempted from all type of royalties and taxes.

The currently implemented laws and the proposed Electricity Bill aim at market competition, trade and institutional restructuring. The specific challenges of 'small' have not been adequately addressed. In the face of a large share of income being lost and financial expenses, it seems that the Financial Act should address them at the policy level.

Without ascertaining project operation period, increase in PPA rate, assurance of transmission infrastructure and regulatory facilitation, sustainable operation of these projects is not possible. Delays or hassles in obtaining committed facilities, tax exemptions, and concessional loans have created a deep gap between the policy objectives and practice.

Only by ensuring financial and technical sustainability will these projects strengthen the national economy while maintaining energy security in rural and remote areas.

The fact that currently operating small projects have contributed to the electrification of 35 districts of the country and the energy security of that region cannot remain concealed. If electricity production from these projects stops, sooner or later 50 percent of the country's geography is certain to go into darkness. Big cannot alternatives to 'small'. Protecting them is the prime responsibility of the nation. Therefore, it is inevitable to reduce the gap between policy formulation and implementation. Only by ensuring financial and technical sustainability will these projects will strengthen the national economy while maintaining energy security in rural and remote areas.

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Opinion

Santa Bahadur Pun

The government must as early as possible hive-off Electricity Inspection from DoED to its Ministry itself as was the previous practice. The Inspectorate must be given full autonomy and the necessary. power to inspect and punish the agencies defaulting on Electrical Safety.

Power without Protection:

Tragic and Traumatic Electrical Accidents of Nepal

Background

In early 2025, this writer had the opportunity to visit the children's Disabled Rehabilitation Center (DRC) Nepal at Gokarna in Kathmandu. The Center provides food, shelter, education and even assistance in procuring the necessary equipment for the differently disabled children. Having worked and retired from Nepal's electricity sector, the writer's attention was immediately drawn to DRC's following two children[1] who tragically were victims of Electricity Accidents:

Nirman Puri – birth Chaitra 27, 2071: Aathbiskot, Rukum West district; father Bharat Puri a labourer working in India and mother Jani Puri a Health Assistant in village Health Post; electrocuted on 23th Jestha 2078 at age 7 years; treated at Nepal Cleft & Burn Center at Kirtipur Hospital; right arm amputed at shoulder; admitted to DRC Nepal on 9th Baisakh 2081; now 11 years old, he is in Class 6 at Gokarneshwar Mahadev English Boarding School.

Nirman's Tragic Electrical Accident: Seven year old Nirman was looking after his goats about 200 meters away from his house. A dozer had dug up a drain for the road and piled up the earth dump that was very close to the high tension wires. Thinking that his goats may get too close to the high tension wires, Nirman picked up a kancho/green stick and tried to drive away his goats from the earth dump. Nirman's kancho/green stick, unfortunately, touched the high tension wires and he was electrocuted. Nirman's shirt caught fire and he fell on his face, unconscious. A nearby 13/14 year old boy saw the accident and raised alarm. Nirman's mother rushed to her son and tore away the burning shirt. A villager drove Nirman and his mother on his motorcycle to the Radi Nagar Palika hospital where his badly burnt body was dressed, given some medicines and referred to the Bheri Hospital in Nepalgunj.

As Nirman's father was a mere labourer working in India, his mother took a loan of Rs two Lakhs from a relative, hired a jeep and drove to Bheri Hospital Nepalgunj where the doctors referred the badly burnt Nirman to Kathmandu's Cleft & Burn Center at Kirtipur Hospital. An oxygen laden ambulance charged Rs 40,000 and Nirman was brought to Kirtipur Hospital on Jestha 23, 2078. As Nepal Electricity Authority (NEA) agreed to pay the Hospital's bed and medicine charges, it appears that the high tension wires belonged to NEA. However, Nirman's mother had to bear all other expenses. So she had to take loans of Rs 300,000 from Global IME Laghubitta Bittiya Sanstha and another Rs 300,000 from Sana Kisan Sahakari to pay for Nirman's right arm amputation at shoulder. An organization BVS – Nepal (Burn Violence Survivors) did assist Nirman's mother with Rs 45,000 and some useful materials for Nirman. It was BVS-Nepal that recommended Nirman's mother to send her son to DRC Nepal and he arrived at Gokarna's DRC on Baisakh 9, 2081 and is studying at a local school in Class VI.

At Nepal Cleft and Burn Center of Kirtipur Hospital: The grisly photos of 7 year old Nirman's burnt out back and the burnt left hand that fortunately got saved. His burnt out right hand, however, had to be amputed at the shoulder.

A smiling Nirman though minus his right arm and left arm still with badly burnt marks !

Tekendra Lowar – birth Ashwin 25, 2069: Budhinanda, Bajura district; father Karnabir Lowar and mother Dhansa Lowar, local peasants; electrocuted on 2ndShrawan 2081 at age 12 years; treated at Nepal Cleft and Burn Center at Kirtipur Hospital; left arm amputed at shoulder; admitted to DRC Nepal on Baisakh 17, 2082;

1 The writer thanks Ms Tshering Sherpa, General Secretary of DRC Nepal, for kindly availing all the information regarding the two children Nirman Puri of Rukum West and Tekendra Lowar of Bajura as well as about the DRC organization itself. Thanks go to the journalist, Mr. Prakash Singh, for providing more information about Tekendra and also, of course, to the DRC Chairman Uday Bahadur Limbu.

now 13 years old he is in Class 3 at Kathmandu's Khagendra New Life Special Education Secondary School.

Tekendra's Tragic Electrical Accident: Tekendra was a good student and in his Class IV, he used to come first or second. On Shrawan 2, 2081, 12 year old Tekendra took his goru/ ox for grazing in the jungle. The Budhinanda Municipality operated a small hydroelectric plant which used to remain shut during the day time and operated only during the night time. On that particular day of Shrawan 2, 2081 because of some functions, the municipality authorities had the hydroelectric plant operating during the daytime also. Unfortunately, the badly strung high tension wires touched Tekendra's head and got electrocuted. Those who saw him took him to the nearby Kolti Hospital from where he was taken to the Nepalgunj Hospital with badly burnt head and body. Tekendra was then referred to the Nepal Cleft and Burn Center at Kirtipur Hospital where his left arm had to be amputed. His hospital expenses came to about Rs 9 lakh which his family paid through loans and donations like those of Rs 40,000/- provided by their villagers working in India.

At Nepal Cleft and Burn Center in Kirtipur Hospital: 12 year old Tekendra with his severely burnt head with the grisly hole just above his left ear and after his left arm was amputed.

A smiling Tekendra- minus his left arm!

The writer had difficulty seeing the above grisly traumatic photos of 7 year old Nirman and 12 year old Tekendra being treated at the Kirtipur Hospital. Traumatic and grisly not only to the victims but also their parents who, being from the remote districts of West Rukum and Bajura, had to undergo another trauma of searching for finances to pay the hospital charges. The writer, hence, determined that the photos, though grisly, be retained in the article with the hope that the Government and the concerned Institutions will do something about Electrical Safety and not resort to mere lip services.

"Safety for the NEA personnel while operating and maintaining the electrical supply as well as safety to the consumers will be accorded a high priority."

If that above 'high priority' for electrical safety had been given timely recognition by the concerned authorities and institutions, the tragic electrical accidents of Nirman and Tekendra would probably have been prevented.

Chief Electrical Inspector and Electrical Inspectorate: When this writer joined the then Nepal Electricity Corporation (NEC) as an Assistant Engineer in 2024 BS (1967 AD), he still remembers the then Ministry of Water and Power having an Electrical Inspectorate. The then Chief Electrical Inspector was Gyan Mani Dixit, former General Manager of Nepal Electricity Corporation, who enjoyed an aura of power and autonomy. NEC's system peak load then was only 8.2 MW and the number of domestic consumers as 19,986. Electricity in 2024 BS was definitely a Luxury that only a few urban elites enjoyed. Six decades down the road, while the 8.2 MW peak load jumped over 26 times to 2,212 MW, the number of domestic consumers made a remarkable jump of over 2,500 times from 19,986 to 4,997,612. According to the World Bank Nepal has achieved an electrification ratio of 94% which means 94% of the Nepalese have access to electricity. In six decades, electricity for the Nepalese turned into a Necessity from Luxury – not unlike the developed western world.

Electricity is an extremely versatile servant – a necessity in all the everyday activities of Nepalese. However, this versatile servant demands a very high Safety Standard which if neglected can result in dire consequences. As many as 29 farmers have died in drought-hit Madesh over the past one year from electrocution. According to the data provided by the Madhesh Province Police Office, a total of 449 people have died of electric shock in Madhesh Province over the past five years – most of them from electric shocks while working on water pumps for irrigating fields. In the event of death due to electrocution, NEA forms a probe committee, comprising local representatives and administration officials, to determine whether there was negligence on its part. If NEA's negligence is established, the authority pays Rs 5,00,000 in compensation. Between 2018 and 2023, thirty-eight families across eight Madhesh districts received compensation. Families also get compensation from NEA for animals killed by electric shock – Rs 15,000 per ox and Rs 20,000 per buffalo.

Implementation of Electricity Act 2049 BS (1991 AD): But unfortunately somewhere along that six decades' road from Luxury to Necessity, the Electrical Inspectorate in the Ministry to oversee Electrical Safety lost its way. The Electricity Act formulated in 2049 BS (1991 AD) did envision Electrical Safety and Electrical Inspectorate. Clauses 37 and 38 of the Electricity Act categorically stipulated:

37-Appointment of Inspector: In order to carry out inspection and supervision of generation, transmission and distribution of electricity, Government of Nepal may appoint Chief Electricity Inspector and Electricity Inspector as may be necessary. (2) The qualification required for the Chief Electricity Inspector and Electricity Inspector shall be as prescribed. (3) Other functions, rights and duties of the Chief Electricity Inspector and Electricity Inspector shall be as prescribed.

38-Penalties: The prescribed officer may impose a fine up to five thousand rupees to any person who acts in contravention of this Act or Rules made under this Act. If the damage is caused to anybody due to such act, compensation for such damage shall also be realized from such person by the prescribed officer

Conclusion

Hive off the Electricity Inspection from Department of Electricity Development (DoED) to Ministry –Sadly, the Ministry off-loaded its Inspectorate job to the DoED whose priority, as its very name implies, is to develop electricity. The DoED does have an Inspection Division headed by a Deputy Director General of Class I officer level. This Inspection Division has two Sections, one a Project Inspection and the other Electricity Inspection. While the glamorous Project Inspection is manned by three Class II and two Class III level officers, the mundane Electricity Inspection has only one Class II and one Class III level officers.

This, in short, explains the travesty of the state of Nepal's electrical safety. In order to mitigate the growing number of tragic electrical accidents, like those in Madhesh Province and those of 7 year old Nirman and 12 year old Tekendra in far-away Rukum West and Bajura, this travesty must be addressed immediately. The government must as early as possible hive-off Electricity Inspection from DoED to its Ministry itself as was the previous practice. The Inspectorate must be given full autonomy and the necessary power to inspect and punish the agencies defaulting on Electrical Safety. Top priority and due recognition must be accorded to Electrical Safety that is so urgently required as 94% of Nepalese have access to electricity. Is it fair for the children, Nirman and Tekendra, to lose one of their arms for no fault of theirs? Similarly, is it fair at all for the parents of the children to bear all the huge expenses in treating their children all because of someone else's negligence? These hopefully are some of the difficult questions the government should address.

The writer is the foremer Managing Director of Nepal Electricity Authority.


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Fact Analysis

Prabal Adhikari

As the country progressed in its installed capacity and nationwide electricity access reaches around 98 percent, small hydropower projects do not appear to be of high priority in policy practices.

Status, Practices, and Risks

Background

Considering the global acceptance of small hydropower projects, its contribution to strengthening local economies, social stability and inclusion, environment-friendly sustainable development and ensuring energy security has been immense and indescribable. In particular, the relevance of 'Small is Beautiful' is clear from various angles including the phase-wise development of hydropower projects and the ease of human life. While studying it in depth, we find diversity in the definition and use of small hydropower adopted by different countries.

The International Center for Small Hydropower and the European Small Hydropower Association (ESHA) has defined hydropower plants with an installed capacity of up to 10 MW as small hydropower. Taking the example of other countries in the world, hydropower projects of up to 25 MW in India have been kept under this classification. India has taken this forward by placing it under the 'Ministry of New and Renewable Energy'. Similarly, in neighboring China, hydropower projects with an installed capacity of up to 50 MW are considered small hydropower. In both these neighboring countries, projects smaller than 100 kW are called micro hydropower and those between 101 kW and 2 MW are called mini hydropower. Likewise, projects smaller than 15 MW in the United States and the Philippines, smaller than 10 MW in Japan, and between 1 MW and 10 MW in Nigeria are considered small.

China is the leading country in the development of small hydropower. There are exemplary cases of rural electrification and the development of small hydropower in the China playing a significant role in poverty alleviation and rural economy. However, in recent years, mainly in 2017, China changed its previous policy path, according to which it issued the Thirteenth Five-Year Plan for Renewable Energy. This was followed by a policy to control small hydropower. As a result, the construction of small hydropower in many Chinese provinces were stopped. In addition, between 2018 and 2020, more than 3,500 small hydropower plants being operated in the Yangtze River basin, were completely shutdown.

In the early stages of Nepal's hydropower development, small hydropower had been given much more priority. As the country progressed in its installed capacity and nationwide electricity access has reached around 98 percent, small hydropower projects do not seem to be of high priority in policy practices. Based on the practice and statistics of the Nepal Electricity Authority (NEA), excluding electricity generated by the private sector, the authority has classified its hydropower plants into two categories: those

connected to the national grid and those not. The others are classified a major hydropower projects.

Looking at the status of small hydropower plants connected and not connected to the national grid, there are 4.536 MW from 32 kW to 500 kW and 14.574 MW from 100 kW to 3.2 MW of installed capacity. Some of these projects have been leased to the private sector and are not operational. NEA has not made any specific classification of 'small' in terms of installed capacity. It is seen that in the context of the Power Purchase Agreement (PPA) for projects built/developed by the private sector, up to 25 MW are treated as small. Nepal has also considered 25 MW as 'small project' in its 'Nationally Determined Contribution (NDC)' related document forwarded to the 'United Nations Framework Convention on Climate Change (UNFCCC).

It is also appropriate to recall the situation in which the private sector is openly praising the contribution of

Former Minister for Water Resources Shailaja Acharya in the development of small hydropower projects in Nepal. Acharya, who was also the then Deputy Prime Minister, chaired the 286th meeting of the NEA's Board of Directors held on 2055/8/7 and took decision for the first time to sign a PPA as follows to encourage private sector small hydropower developers:

-From 100 kW to 1 MW: During the rainy season (from April to November) rate to be fixed at Rs 3 per unit and during the dry season (from Poush to Chaitra), the rate will be fixed at Rs 4.25 per unit. This price was supposed to be increased at a rate of 6% annually for 5 years.

-From 1 MW to 5 MW: The above rate will be fixed after the fiscal year (FY) 2059/60.

-From 5 MW to 10 MW: PPA will be determined by fixing an appropriate rate on the basis of competition.

With this arrangement, Nepali promoters started the journey of hydropower development through small projects by combining domestic investment, domestic skills and domestic contractors.

It is worth remembering that in the background of this historic step, during the review of the fiscal year 2050/51, the National Planning Commission (NPC) found it necessary to establish small hydropower and thermal power plants through the private sector. Prithvi Raj Ligal, the then member of the NPC, underlined the situation where industries could not be established due to lack of electricity despite obtaining licenses. He had also expressed the view that industrial development would not occur unless the private sector came and that investment would not come unless the state provided additional facilities. However, until Shailaja Acharya became the Minister for Water Resources in 2054 BS, few people believed that the private sector in Nepal would develop hydropower. The government itself was not confident in it.

Lately, the NEA has fixed the PPA fee in various ways in the context of hydropower development:

(1) The NEA board on 2071/9/20 decided to take the application fee of Rs 600,000 for the agreement in the PPA process for projects with an installed capacity of more than 25 MW.

(2) For projects of up to 25 MW capacity, the following arrangements are in practice regarding the PPA application fee:

(a) Up to 1 MW: Rs 75,000

(b) 1 to 5 MW: Rs 150,000

(c) 5 to 10 MW: Rs 300,000

(d) 10 to 25 MW: Rs 450,000

The 695th meeting of the NEA board held on 2071/9/20 made arrangements to charge PPA application fee of Rs 600,000 for hydropower projects higher than 25 MW. The same meeting decided to fix the initial PPA rate for projects with an installed capacity from 25 MW to 100 MW at Rs. 4.80 (rainy season) and 8.40 (winter or dry season) and to increase the initial purchase rate by 3 percent annually for up to 8 times while making general adjustment to price rise. Before that, NEA did not make any provision for a fixed electricity purchase rate (posted rate) for projects higher than 25 MW.

In BS 2068 (June 2011), NEA raised the PPA rate of hydropower projects of up to 25 MW by 20 percent, making it at Rs 4.80, an increase from Rs 4 (rainy season) and to Rs 8.40 from Rs 7 (dry season).

The Government of Nepal (Council of Ministers) on 2065/9/9, issued a 38-point program and fixed a lump sum (flat) purchase rate for projects of up to 25 MW, revealing that the government treated hydropower projects up to 25 MW as 'small'. Accordingly, NEA while signing PPA for projects up to 25 MW, charged Rs 4.80 per unit during the rainy season (8 months) and Rs. 8.40 per unit during the dry season (4 months). A provision was introduced to provide general price rise compensation for up to five times a year.

Concept Paper and Action Plan on National Energy Crisis Mitigation and Electricity Development Decade, 2072

Based on this action plan, NEA decided to sign PPA for private sector-promoted projects of up to 25 MW within the following framework:

While NEA purchases electricity generated from private sector projects, the number of annual escalations given to the posted rate for projects with an installed capacity of up to 25 MW invested in Nepali currency, is 5 only in the prevailing PPA whereas 8 annual escalations are given to the same posted rate for projects with an installed capacity of up to 100 MW higher than 25 MW. Considering the electricity shortage situation, in the case of projects with an installed capacity of up to 25 MW invested in Nepali currency that produce commercial electricity within the specified commercial production date for the 'Electricity Development Decade, 2082/83', the NEA will provide the same price escalation facility as that given to projects above 25 MW and up to 100 MW as an incentive.

The NEA board has also made decision over this provision and taken it for implementation. So far, NEA has been signing PPA with the approval of the Electricity Regulatory Commission, with the provision of negative price adjustment. in case the return on equity exceeds 17 percent in run-of-river projects larger than 100 MW, with the provision of profit up to 17 percent return on equity. The government has already decided to remove the provision of return on equity while conducting PPA for hydropower under its action plan by issuing the 'Energy Development Roadmap, 2081' for easing financial management process. However, The Authority is yet to implement the provision.

Small Hydropower in Data

Although there is no clear definition of small projects in the context of Nepal, considering some policy bases and the decisions taken by the Authority in the past for the hydropower, projects of 1-25 MW can be considered as 'small'. The draft of the new Electricity Act forwarded to Parliament also defines those above 25 MW as 'large'. According to the draft, projects up to 5 MW are under the local government and projects above 5 MW upto 25 MW are under the provincial government. In this context, projects up to 25 MW can be considered as 'small' hydropower projects.

As per the statistics published by the Department of Electricity Development (DoED) on November 28, 2025, the total number of projects with a capacity of more than 1 MW except operational ones that have received construction licenses is 263 (11,097.518 MW). Including the 183 projects (3,673.124 MW) that are operational after obtaining the license and completing the construction, the number of projects for which construction licenses have been issued by the DoED is 446 (14,770.642 MW). Out of them, excluding the operational ones, the number of projects with an installed capacity of 1-25 MW that have received construction licenses is 169 (1,746.414 MW) or 11.82 percent. Similarly, the statistics of hydropower projects with a capacity of 1-25 MW based on the PPA concluded by NEA is as follows:

Status of projects	Number	Installed capacity (MW)	1-25 MW			
			Number	%	Installed capacity	%
Operational	192	3,116	140	72.92	1,188.55	38.14
Under construction	154	5,172	92	59.74	1,000.70	19.35
Without for financial closure	108	2,601	82	75.93	1,024.05	39.37
Total	454	10,889	314	69.16	3,213.30	29.51

Source: Nepal Electricity Authority, December 1, 2025

PPA Rate for Projects up to 25 MW Promoted by the IPP

NEA, in Kartik 2055 BS (November 1998 AD), adopted a policy to purchase electricity from projects up to 5 MW at a fixed rate. The base purchase tariff was fixed at NRs 3.00 per unit during the wet season and NRs 4.25 per unit during the dry season, with an annual escalation of 6 percent for five years, resulting in a maximum purchase tariff of NRs 3.90 per unit in the wet season and NRs 5.52 per unit in the dry season.

In line with the government's target of producing 10,000 MW of electricity within a decade, and in order to further attract the private sector, the need was felt to review the existing power purchase policy for "small" projects. Accordingly, the authority's Board of Directors, through its 501st meeting held on Mangsir 2, 2065 BS (November 18, 2008 AD), formed the following committee to determine the purchase tariff for electricity generated from projects up to 25 MW:

Committee Formed

Name	Designation	Role
Dr Govinda Nepal	Member, Board of Directors, NEA	Coordinator
Bala Ram Pradhan	Member, Board of Directors, NEA	Member
Uttar Kumar Shrestha	Managing Director, NEA	Member
Shiva Chandra Jha	Deputy Managing Director, NEA	Member
Diwakar Paudel	Acting Deputy Managing Director, NEA	Member
Rajeshwar Man Sulpya	Director, NEA	Member
Jayendra Shrestha	Joint Director, NEA	Member

The sub-committee adopted the following bases while determining the PPA rate:

- The total project cost shall be NRs. 150 million per MW.
- The return on equity investment for hydropower entrepreneurs shall not be less than 16%.
- Electricity shall be purchased under take-or-pay terms up to Q40, instead of the hydrological design at Q65.
- System leakage shall be reduced from 26% and shall not exceed 20%.
- The purchase agreement period shall be 30 years from the Commercial Operation Date (COD).
- Tax and Value Added Tax (VAT) shall be as provided under prevailing laws.
- Based on the proposed tariff for the Commercial Operation Date, the base price shall be escalated annually by 3% for nine times.

Tariff Determined by the NEA Board

Based on the above criteria and as recommended by the sub-committee, the NEA's Board, through its 505th meeting held on Poush 5, 2065 BS (December 20, 2008 AD), determined the PPA rate for electricity generated from private sector projects up to 25 MW, applicable to the fiscal year in which the COD falls (Base Year), as follows:

(a) Base PPA Rate

F/Y (Base Year)	Dry (NRs/unit)	Wet (NRs/unit)
Commercial Operation Begins	7.00	4.00

(b) Escalation

Based on the purchase tariff of the base year, an annual escalation of 3% for up to nine times shall be provided for each subsequent fiscal year as follows:

F/Y	Dry (Poush–Chaitra) (NRs/unit)	Wet (Baishakh – Mangsir) (NRs/unit)
After COD	7.00	4.00
1st Year	7.21	4.12
2nd Year	7.42	4.24
3rd Year	7.63	4.36
4th Year	7.84	4.48
5th Year	8.05	4.60
6th Year	8.26	4.72
7th Year	8.47	4.84
8th Year	8.68	4.96
9th Year	8.89	5.08

Considering the severe energy crisis in the country, the then Deputy Prime Minister Bharat Mohan Adhikari issued a public statement in the Legislature-Parliament on Chaitra 9, 2067 BS (March 23, 2011 AD), regarding the government's position and future programs.

In Clause 12 (ga) of that statement, it was mentioned that the purchase tariff determined for projects up to 25 MW would be increased by an average of 20 percent.

In this regard, the Authority's Board of Directors, through its 568th meeting held on Jestha 15, 2068 BS (May 29, 2011 AD), made the following decision concerning the increase in the power purchase tariff for projects up to 25 MW:

- For all PPAs signed henceforth for projects up to 25 MW, the purchase tariff applicable from the COD shall be increased by 20 percent over the previous rate.
- Accordingly, the revised PPA rate shall be:
    - Dry: NRs 8.40 per unit
    - Wet: NRs 4.80 per unit
- After commencement of commercial operation, a simple annual escalation of 3% shall be provided for five times.
- However, if the actual COD is delayed compared to the Required Commercial Operation Date (RCOD), the escalation shall be limited as follows:

Delay Compared to RCOD and No. of Escalations

- More than 6 months up to 18 months: 4 times only
- More than 18 months up to 30 months: 3 times only
- More than 30 months up to 42 months: 2 times only
- More than 42 months up to 54 months: 1 time only
- More than 54 months: No escalation

International Practices

Peru's electricity sector was taken to reform in 1991 and was restructured in 1993. After that, the privatization process escalated. In Peru, projects with an installed capacity of less than 20 MW are classified as 'small'. Peru is considered a successful and exemplary country in the development of small projects. Most of the hydropower projects here are 'run-of-river', which means that they do not cause environmental damage like large reservoir projects, have minimal resettlement problems, and are built at a low cost. The development of such small projects is viewed with pride. When the water level in the river decreases during the dry season, 'small' is combined with photovoltaic solar power and battery storage to form a 'hybrid' system.

Looking at international practices, many countries do not offer rooms for hydrological penalties like in Nepal. As an example, Peru does not require to make advance declaration of electricity availability in the PPAs of small projects as in Nepal. The PPA stipulates that all projects larger than 10 MW will be subject to a penalty to the promoter due to hydrological risks in Nepal.

In Peru, projects with a capacity of less than 20 MW do not have a fixed energy obligation, while their PPAs are also guaranteed. Nepal can learn and adopt many exemplary aspects in this area from the "Design Manual" prepared for 'small' hydropower projects by the International Energy Agency (IEA) and the 'European Small Hydropower Association (ESHA)' and the policy document and master plan prepared by Nigeria for such projects.

Brazil's 'PROINFA' program (Programa de Incentivos a Fontes Alternativas) has specified the following conditions in the definition of small hydropower projects. The 'National Bank for Economic and Social Development' of Brazil provides 80 percent investment to small projects that meet these conditions. The regulatory body also decides to give 'premium electricity purchase rate (premium tariff)' to those projects.

PROINFA conditions: Installed capacity = 1-30 MW, maximum flood area = 3 sq km, generation unit = maximum 5 MW, maximum flow rate = 2 cubic meters, etc.

Major Risks

From the perspective of Nepal, the following major risks appear to exist for small projects (1-25 MW):

(1) Price Risk:

Many projects that had PPAs before NEA implemented 'posted rates' for projects up to 25 MW and some PPAs that were in place before the Authority increased the electricity purchase rate by 20 percent to Rs. 4.80 per unit in the rainy season and Rs. 8.40 per unit in the dry season have rates lower than the current posted rates. Similarly, the government in 2072 BS issued the 'Concept Paper and Action Plan on National Energy Crisis Mitigation and Electricity Development Decade.' According to the Action Plan, the NEA's Board of Directors decided to increase the base price by 3 percent up to 8 times annually for projects of 1-25 MW, similar to those higher than 25 MW.

The provision was implemented only for projects with PPA after this decision date and, therefore, projects up to 25 MW with their PPAs before the date of such decision had to rely on the prevailing purchase rate, which was subject to five price escalations. For a long time, NEA has not been able to adjust the PPA rate of hydropower projects.

(2) Increase in Construction Period:

Due to various reasons, projects cannot be completed by the date required for commercial production (RCOD). On the one hand, the electricity generator has to pay a penalty for the energy for the period that has exceeding RCOD. On the other hand, the cost of the project increases and the income for the delayed period of electricity is lost. Since the project has to be handed over to the government after the period specified in the electricity generation license, in such a situation, the period for generation and sale is shortened. In addition, if the requried date for commercial operation is not extended, the annual price escalations mentioned in the PPA will also be reduced accordingly. This will expose the promoter and investors to a great risk.

(3) Climate Risk:

If the water flow in the river decreases and the contract energy cannot be supplied to the electricity buyer during the dry season, the promoter will be fined as per the terms and conditions of the PPA. On the one hand, there is a risk of less electricity production and loss of income. On the other hand, the fine creates additional risk for the promoter company. Currently, after the decision of the Electricity Regulatory Commission, NEA has reduced this risk in the case of projects of 1-10 MW. Although the government has decided not to impose fines on the promoters in the situation of decreased water flow due to climate change for all installed capacity projects through the Energy Development Roadmap, 2081, it is yet to be implemented by NEA.

The decision made by the government has not been implemented properly even by the fully Goverment-owned NEA, and the regulatory body, Electricity Regulatory Commission. A comprehensive study is required to mitigate the impact of climate change and to minimize its risks in the hydropower sector. The issue must be included as per requirement since the inception of the project design.

(4) Operational Risk:

Integrated hydropower development based on river basins has not been practised in Nepal. While operating small projects, upstream peaking projects may caused a negative impacts on downstream projects as they control the water flow. For this, a 'joint operational guideline' can be prepared. After the small projects come into operation, the river water may be partially diverted by constructing diversions or canals in the name of an irrigation project on the upstream area. It also creates difficulties in operation of small hydropower projects. To remove this problem, the hydropower projects must be ensured water rights through the propar legislation.

(5) Grid Connectivity/ Availability:

Before PPA is signed, a Grid Impact Study (GIS) is conducted using appropriate software to connect the electricity generated from hydropower projects to the national grid and ensure electricity flow, after finalizing the 'Energy Table'. Based on this, if any work like grid expansion/strengthening is required for the electricity flow of the project, a Grid Connection Agreement is concluded between the promoter and the grid owner by incorporating such requriments.

Since the country should give priority to small projects, they must not be given the responsibility of adding or upgrading transformers at the delivery point. What is more noteworthy is that when the project-generated electricity has to be transmitted at voltage levels like 33 kV and 11 kV, there occurs frequent interruptions in those transmission lines. In such a situation, when the line is not available or the transmission capacity of the line is insufficient, some small projects have had to lose significant electricity sales income due to not being able to transmit the generated electricity. This concern is equally relevant for higher voltage transmission lines.

(6) Guarantee of Electricity Purchase:

In Nepal, Government issues electricity survey and generation licenses, and the only body that purchases electricity in bulk is also a Government-owned entity. In this context, a problem arises when the Government issues generation licenses for a fixed time period unless including a mandatory condition that PPAs must be completed within a time frame. After paying a huge fee for the license and spending millions of rupees on studies by developers, it will be the defect on the government side to decline from buying electricity or to put a clause in PPA to purchase electricity only when necessary, with the 'take and pay' provision. The country will have to bear the cost for this in the future.

In addition, without keeping projects up to 25 MW under the practice of 'PPA quota' based on the generation mix, NEA should guarantee the mandatory purchase of all electricity produced in the PPA, in the same way as NEA has been practing for up to 10 MW, with the provision of 'take or pay' like solar projects. As the situation of small hydropower projects is different, the damage it causes to the 'river ecosystem' and the entire environment is very low compared to large projects. It also plays a major role in enhancing the local economy, employment and living standards of the local people.

Since the investment required for small projects is also low, financial management can be done quickly, so until the electricity trade is opened through other options beyond NEA, ensuring domestic and crossborder markets and properly developing the transmission system, and prioritizing projects up to 25 MW with guaranteed electricity purchase should not be delayed. The Government should positively intervene without becoming an obstacle to achieve the national target of generating 28,500 MW of hydropower by 2035 and fulfill Nepal's international commitment to achieve 'net zero emissions' within next 10 years (by 2045 AD).

Similarly, NEA has so far been concluding PPA for projects up to 25 MW according to the 'Fixed Energy Contract' principle. It is necessary to adopt a policy of purchasing all the 'metered energy' generated within the installed capacity of the project. In addition, the practice of requiring the developer to self-declare generation and buying excess energy at half price if the energy of more than the declared quantum is taken from the project, is not justified at all.

Therefore, while preparing the standard PPA model, the practice of defining projects ranging from 1-25 MW as "small" and paying half the amount to the developer if the 'excess energy' is taken by the buyer should be ended. The Electricity Regulatory Commission should make a provision in this regard that the full amount will be paid. After all, when selling electricity from the same project to India or Bangladesh, there are examples of receiving the full amount of exported energy based on the installed capacity. Just as the rules of the game do not differ for each player, even if the participants in the electricity market transaction differ, equitable treatment cannot be avoided.

Conclusion

The situation of 'small projects' is not as satisfactory as it could be, as Government policies including power procurement, cannot allow developers to anticipate future risks and prepare for the implementation of plans to address them. The Government must make appropriate policy interventions and give a clear definition of 'small' to 1-25 MW and prioritize them. The 'sick hydropower' must be taken towards immediate remedies under a special program.

It is not possible to draw a picture of bright future by completely forgetting the past. If Shailaja Acharya had not encouraged the private sector by giving a fixed electricity purchase rate for small projects in 2055 BS, Nepal's hydropower sector would not have come this far today. Further, it would not have been possible to see today's situation where large projects are being built through the domestic private sector with domestic investment and domestic manpower. The private sector has made a commendable contribution to Nepal's presnet installed capacity, which has a significant share of projects up to 25 MW.

In this context, Government's failure to appreciate the role played by the private sector in strengthening the local and national economy through hydropower development and ignoring the lessons of international practice are like the Nepali proverb 'The river is crossed and the stick is forgotten.' Small projects must be prioritized by the Government and regulatory bodies. On one hand, the impact of global climate change on Nepal's overall hydropower development is seen to be escalating, and on the other hand, in the absence of forward-looking plans and program along with the unwavering determination of the Government, this sector will continue to face the risk of gradually losing its potential and opportunities day by day.

The author is a former Deputy Managing Director of Nepal Electricity Authority. The text is an unofficial translation from Nepali version

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Scenario

Sher Singh Bhat

The Constitution 2072 BS has considered small hydropower under the jurisdiction of the local level, the medium-size projects under provinces and central level large hydropower under the federal government.

Journey from Past to Future

Era of Public Investment

In 1968 BS (1911 AD), Nepal started 500 KW Pharping Hydropower as its first hydroelectric project, which was then progressed to 640 KW Sundarijal in 1991 BS (1934 AD) and 1600 KW Letang under Morang Hydro in 1996 BS (1939 AD). At the time, those projects were considered big, not small. Over time, as hydropower sector entered megawatt capacity, these projects have appeared smaller.

Nepal began its planned development through implementation of the First Periodic Development Plan (2013-2018 BS). Under the First, Second, Third and Fourth Plans, hydropower projects such as Trishuli (18 MW), Panauti (2.4 MW), Sunkoshi (10.05 MW) and Seti (1MW) and several diesel generation centers were built in the country under the public sector with the grant contribution of friendly countries.

Under the Fifth Plan (2033-2038 BS), the goal was set for to electrify all the district headquarters of the country albeit through construction of off-grid generation projects. Accordingly, the 'Small Hydropower Development Board' was formed in 2034 BS.

This onwards, small hydropower entered the lexicon of Nepal's electricity sector. From the Fifth to the Ninth Periodic Plan (2055-2060 BS), small hydropower projects including Tinau (950 KW), Gajuri (25KW), Thansing (20 KW), Baglung (200 KW), Dhading (32 KW), Gorkhe (64 KW), Jumla (200 KW), Achham (240KW) and Tatopani (2MW) were developed with the public investment through the same "board". Nevertheless, licenses were also being issued for development of hydropower projects (initially smaller in size) through private investment under the Electricity Act 2049 BS.

Private Investment and Small Hydropower

With the Electricity Act 2049 opening the gateway for private sector investment in electricity generation, large projects such as Khimti and Bhotekoshi were installed with foreign direct investment (FDI). The country had no experience in the appropriate procedures, associated risks and certainty of benefits of private investment in electricity development. The financial capacity of domestic financial institutions was also limited. Therefore, in the beginning, small projects were the priority of domestic financial institutions in terms of debt investment. As a result, projects such as Indrawati III (7.5 MW), Piluwa Khola (3 MW), Sunkoshi Sana (2.5 MW), Chakukhola (1.5 MW), Baramchi (0.98 MW), Rairang (0.5 MW), Khudi (3.45 MW), Syange (0.183 MW), Thoppal Khola (1.4 MW), Sisne Khola (0.75 MW), Feme Khola (0.995 MW), Pati Khola (0.996 MW) and Ridi Khola (2.4 MW) were built with domestic private investment. These projects helped improve the capacity and confidence of domestic investors and lending institutions in electricity generation. As a result, large projects like the 456 MW Upper Tamakoshi could be completed with domestic investment.

Criteria and Classification

The history of hydropower development has shown that projects once considered large became smaller over time. However, according to international classification based on capacity, a project up to 5 KW is considered pico-hydro, 5-100 KW as micro-hydro, 100 KW-1 MW as mini-hydro and 1-25 MW as small hydropower. Constitution of Nepal 2072 BS has classified small hydropower under the jurisdiction of the local level, medium-size projects under provincial jurisdiction and large hydropower under federal jurisdiction.

In the Electricity Bill presented in the parliament last time, projects up to 5 MW were allocated to jurisdiction of locals considering as small.

Currently small hydropower projects in this country are operating with public investment and ownership (most of them under Nepal Electricity Authority), private investment and ownership as well as community investment and ownership. Among these, those connected to the national system are known as grid-connected and those not integrated in the national grid are known as off-grid small projects.

Current situation

With expansion of the national electricity distribution system, the existence of small off-grid projects has started to fall at risk as local communities gain access to electricity supplied by the central system. Some potential projects have also been connected to the grid, while projects that do not have this potential, currently struggle for their existence. Many projects that were once operated with the aim of providing electricity to the people at the expense of the state have been finding it difficult to balance between their operating expenses and the income from the sale of electricity. For this reason, some of the small projects of the Nepal Electricity Authority (NEA) that are not in operation have been dilapidated. Some small hydropower projects of community and private investment have been connected to the national electricity distribution system directly or through mini grid with the support from Alternative Energy Promotion Center. There is a further program to connect additional few of them. Thus, three types of small projects and related issues have come forth:

(a) Small hydropower plants connected to the grid with public and community investment are currently in operation. Although there are no major problems seen in their operation at present, major repairs and operations may not be financially feasible in the future. Projects that are not economically viable will automatically be closed. There is currently no legal clarity on the management of fixed assets, including land, machinery and equipment, of closed public and community-based hydropower plants. The new electricity bill must address this issue too.

(b) Few of the off-grid projects that were built and operated in the past with public, community or private investment are not in operation due to the high cost of repairs and higher operating costs compared to production. In the case of such hydropower plants, a policy decision should be made to connect them to the grid if technically and economically feasible, or to close them permanently after proper management of the fixed assets. If there is a possibility that the dams and canals of such projects will be used for alternative uses such as irrigation or drinking water, it is appropriate to draft and implement a policy specifying the method of transfer to local governments for alternative use.

(c) Community or private investment hydropower projects connected to the grid, constructed and operated by obtaining a license from the Government of Nepal and entering into a Power Purchase Agreement (PPA) with the NEA, are in commercial operation. At present, such projects are facing some problems related to licenses, PPA, and property rights on water mass. The promoters of these projects have been individually and collectively demanding the government to address such issues.

Problems of private grid-connected projects in operation

1. Although in the past, projects were constructed with approval from the government-designated body, frequent intervention from subnational governments have been observed due to the current three tier state structure regarding the issues related to water use right. This has led the promoters in discomfort in their business.

2. The PPAs of small projects are also complicated like the PPAs of mega projects. These projects are based on the water resources of local streams with low discharge. Due to this, the flow of the river and accordingly the electricity production changes widely due to seasonality. Therefore, the PPAs should not have "give or take" provisions for hydrological reasons and should be paid for electricity recorded by the energy meter of the project at the end of the month. Implementing a simple one-page PPA of that nature and amending the previous PPAs accordingly would seem to be convenient for both the NEA and the promoters.

3. Small projects are mostly connected to the grid through 11 kV or 33 kV distribution systems that are prone to frequent interruptions. Such interruptions in the associated distribution system reduce the monthly electricity generation of the project to a considerable level. By installing a data logger at the interconnection point of the project and the grid, the interruptions and production losses in the NEA's system can be calculated throughout the month. If the Power Purchase Agreement is amended to include a provision in the PPA compelling NEA to pay for all the under-dispatched energy due to interruption in the distribution system, promoters would get some relief.

4. Since small hydropower does not have economies of scale, they are comparatively more vulnerable to climate change. In this case, it seems appropriate to make the small hydropower license tenure for 50 years and the PPA for 45 years.

5. The purchase rate of some small projects that signed long ago is very low. After the construction of the project, the interest rate of the loan is found to have changed widely. This has led to a situation where the undergoing loan cannot be repaid even after a long operating period. In this way, for the upliftment of financially distressed projects, the promoter would get some relief if the previous purchase rate were increased by at least 50 percent until the remaining loan is repaid.

Future of Small Projects

A section of economists believe that the country can develop rapidly by operating mega projects related to infrastructure. Others are of the opinion that sustainable development can only be achieved if all local levels become self-reliance by operating local-level infrastructure and industrial projects based on local resources. It seems that physical development has taken a leap forward from mega projects for the time being, but it is becoming expensive through foreign financial resources, imported raw materials and skills.

In Nepal too, when operating mega hydropower projects using foreign loans, raw materials and skills, the state has to bear the long-term burden as well as forex risk. Sustainable development can only be meaningful if each local level is self-sufficient in terms of food, shelter and cloth. In the same context, if local levels are self-sufficient in energy through local resources, the nation will gradually become stronger. If a mega project built with foreign loans, raw materials and skills is affected by natural disasters, the state will have to bear huge losses, and the people will have to suffer accordingly. However, such risks are reduced in a system based on small scale projects.

Therefore, mega projects must be built to meet the energy needs of big cities and industries. But to ensure local self-reliance, control capital flight, and reduce the risk of natural disasters, small hydropower should be built at the local level and a certain proportion of them should be maintained in the system. In this regard, it is not appropriate to argue on the relevance and future of small hydropower in Nepal.

The writer is an energy expert and former Deputy Managing Director of the Nepal Electricity Authority. The text is an unofficial translation from Nepali version

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Kumar Pandey

It can be predicted that there were definitely some weaknesses in design of the project, river flow projection, engineering, and selection of machines. In many projects, even the investors or promoters were found making errors, while the problems identified are of different nature in different projects.

Balancing Financial Gains with Sustainability

As per international practices, the International Commission on Large Dams (ICOLD) has defined hydropower plants with a capacity of less than 25 MW as small projects. In Nepal, the government has also included hydropower plants smaller than 25 MW within the official definition of 'small hydropower'. However, in practice, with a capacity of less than 10 MW are currently considered small.

The development of hydropower in Nepal has gone through stages of pico, micro and mini projects with finally transitioned to small and medium-scale. Such projects were used to be targeted for electrification in the government and administrative sectors. Accordingly, the then Prime Minister Chandra Shamsher JBR built the 500 kW Pharping Hydropower Plant in 1967 BS. This is a milestone in the country's hydropower development, is considered a good blend of legitimate use of technology, human resources and financial resources for the first time in Nepal.

During the Rana regime, following the development at Pharping, the 640 kW Sundarijal plant (built in 1991 BS, now upgraded to 900 kW) and the 2 MW Chisangkhola Morang plant (built in 2000 BS) were constructed and brought online.

In 2007 BS, after the end of the Rana regime, 2.4 MW Panauti (Khopasi) (1965 AD) and 1 MW Fewa (1972 AD) were brought into operation.

Following this development, electricity was started to be distributed also to the general public along with the government and administrative areas.

After 2017 BS, the government also started building projects above 10 MW in assistance of various countries.

After enactment of the Nepal Electricity Authority Act, 2041 BS, the work of electricity generation, transmission and distribution have been started through the Nepal Electricity Authority (NEA). Eventually, a 'Small Hydropower Department' was established within NEA and a policy was adopted to build 'mini' and small hydropower projects targeting district headquarters and commercial centers. Consequently, an environment was created for the speedy construction of small and medium-sized projects with foreign grants and investments.

After the people's movement of 2046 BS and the promulgation of the Constitution 2047, the government adopted a policy of attracting private investment in hydropower. The Electricity Act, 2049 and the Electricity Regulations 2050 formally opened the door to hydropower development for the private sector. Initially, the 'power purchase' for entering into a power purchase agreement (PPA) was also fixed, allowing the private sector to develop projects up to 5 MW.

There were many challenges related to human resources, technology and financial management in the sector's development. At that time, apart from government agencies, Butwal Power Company (BPC) and its sister organizations—including ITDG (Intermediate Technology Development Group), GTZ (now GIZ), Clean Energy Development Bank, and others -- were actively engaged in human resource development within the country. In coordination of these organizations, the private sector started moving forward in hydropower development. Finally, the construction of small hydropower projects has gained momentum.

NEA started conducting PPA for small projects of less than 5 MW in around 2055 BS as per the prevailing law. When the private sector entered hydropower sector, the Maoist conflict was at its peak. Amidst the conflict (2055/56-2062/63), two dozen of small projects were built. At that time, the necessary knowledge, skills, capacity and efficiency required for the country's hydropower development, however, were weak.

Most of the small projects built and operated at that time are currently in a financially pathetic state. It can be predicted that there were definitely some weaknesses in design of the project, river flow projection, engineering, and selection of machines. In many projects, even the investors or promoters were found making errors, while the problems identified are of different nature in different projects.

Many of the sick or ROR (Run-of-River) projects have suffered water shortages. Because neither the government had the data related to the water flow required before construction, nor could the data studied by the private sector in a short time period could confirm anything related to the issue. The policy for projecting water flow at the government can be considered the main factor behind this error.

The government announced 27 various facilities for small projects in the past 15 years. Accordingly, promoters started hydropower development, but not even a quarter of the announced facilities were utilized. The vivid examples of which are the subsidy of Rs 5 million per megawatt, infrastructure development and hydrology penalty, among others. The cost of VAT is about 10 percent of the project. For an example, a project worth Rs 1 billion costs about Rs 100 million in VAT.

The government should have collected VAT from the end users of electricity, but this could not have done. When the VAT paid by the promoters is included in the project cost, that price should be adjusted in the purchase and sale of electricity. Companies like Nepal Telecom have been collecting VAT from the end users. This is also a global trend. The impact of not receiving VAT subsidy on small projects is profound, show the financial statements of the projects concerned. After the private sector raised its voice to solve this problem, the government announced a VAT refund of Rs 5 million per megawatt in the fiscal year 2071/72, however, it was not materialized.

On the other hand, the PPA rates of projects built in the past were determined in a haphazard manner. It was set at Rs 3 in the wet season and Rs 4.25 in the dry. The rate was supposed to be increased in every 5 to 6 years. In addition, PPA defined to raise the annual increment rate through agreement between both the promoter and NEA by adjusting it to price index of Nepal Rastra Bank. However, NEA was never ready to provide that facility to small projects that entered into the PPAs. Later on, the clause point was removed in subsequent PPAs.

The damage caused during the Maoist conflict and the delay in construction, on top of the one created by lack of experience, knowledge, skills and efficiency were also added to small projects. Due to these reasons, most of the projects built at that time are now in a situation that they cannot even pay the interest of the bank loans. Some projects have generated good income and profits such that they have even built 8-10 other subsidiary projects.

The pioneer projects, despite being suffered, delivered knowledge, skills, experience, capacity and efficiency to move forward in the sector. Their outcomes as promoters, construction entrepreneurs, loan investors, banks-financial institutions, experts, engineers, technicians and consultants, have now been able to build large projects of up to 500 MW. In almost 3 decades, relying on the same acts, regulations and dilapidated systems, those same entrepreneurs, experts and investors have brought the country to a state where it can achieve cent percent electrification and even export electricity.

Today's hydropower development has been achieved by learning from the success or failure of those projects in the past. In that case, it is necessary to bring relief packages to the sick or martyred 'pioneer' projects and bring them to a state where they can survive and operate. There is now a call to save the pioneer projects that have taken the country to dream of exporting 15,000 MW of electricity by considering various options while implementing the appropriate ones.

Option-1: Merger

A viable approach could be to facilitate the merger of underperforming hydropower companies with successful ones, drawing on the precedent of the successful consolidation of commercial banks in Nepal. For this, various financial and policy incentives can be given to the merged entity. If the merged company is able to bring the project into operation, the project's license, PPA timeline, and PPA rate could be extended or revised accordingly. Successful companies that are already operating projects and want to merge with struggling ones can be allowed to produce solar power in the areas of the sick projects using their own infrastructure. To make this possible, a clear and effective mechanism needs to be established.

Option-2: Fund Creation

Projects often become financially unviable; to make them profitable, interest rates should be balanced, and PPA rates should be set based on actual costs. Since all projects are not of the same nature, it seems that special incentives should be provided to small ones. A **special revolving fund** can be created to bring sick small projects back into operation as it does not require a large amount of money. The fund can provide long-term concessional loans (with interest rate of less than one percent) to the sick small hydropower, while the principal amount can be refunded once the project is operational and starts making a profit. Similarly, arrangements can be made to pay only the principal by waiving the interest on the loans that they cannot repay.

Investment-worthy

The issue of what size of project to build depends on the topography or potential of the project construction site. In that case, small ones do not provide benefits at the existing PPA rate. A study carried out by NEA shows that it is still impossible to connect about 200,000 people in about 20,000 settlements to the national transmission system in a location with topography like Nepal. In addition, many studies have shown that the construction of small hydropower projects plays an important role in the rural economy. Therefore, it might not be appropriate to enforce the idea that only large ones should be built. Rather the projects must be built by looking at its potential, that ensures maximizing benefits.

When building projects, economic benefits (economies of scale) can be obtained, depending on the size of the projects. For example, building a 7.5 MW project is more profitable than building a 5 MW project. Even though the costs such as study, design, engineering, site visit, land purchase, revenue payment, and operation are the same, larger projects generate more income. In this regard, smaller projects should be given higher rates in terms of income and cost.

When building a hydropower, the selection of the construction site and identification of project along with a number of factors like feasibility study, design, engineering, hydrology, and social and environmental studies must be done properly. Attention must be paid to the selection of contractors and procurement of machines, and equipment for the project. So far, as many small projects that were possible in easy places have been identified and built as much as possible. Now, only those that are in difficult and remote areas and are prone to social problems have remained.

Therefore, it will be difficult to build small projects at the current PPA rate. Since the economic benefits are not revealed due to the PPA rate, banks and financial institutions are also reluctant to invest in such small projects. This has to be reconsidered.

The writer is an energy entrepreneur. This text is an unofficial translation of the Nepali version.

UPPER TAMAKOSHI
HYDROPOWER LIMITED

Salient Features	Upper Tamakoshi Hydropower Plant	Rolwaling Khola Hydroelectric Project
Type of Development	Peaking Run-of-River (PRoR)	Run-of-River including Diversion
Location	Dolakha District, Bigu Rural Municipality- 1	Dolakha District, Bigu Rural Municipality-1 & Gaurishankar Rural Municipality-9
Headwork's Location	Bigu Rural Municipality-1, Lamabagar	Gaurishankar Rural Municipality-9
Powerhouse Location	Bigu Rural Municipality-1, Gongar	Bigu Rural Municipality-1, Lamabagar
Installed Capacity	456 MW	22 MW
Annual Energy	2,281 GWh	317 GWh including diversion
Gross Head	822m	207.18m
Design Discharge	66.0 m3/sec	13.4m3/sec
Settling Basins	2 Nos. L=225m	110mx9.0mx9.7m
Headrace Tunnel	8.4km (Cross Sectional Area =32.14m2)	6.2km
Power House (Underground)	142.0m x13.0 mx25.0m (LxBxH)	35x11.85x22m
Number of units	6	2
Tailrace Tunnel	2.9km (Cross Sectional Area =35.0m2)	740m
Access Road from Charikot of Dolakha District	68.0km	68.0km
Transmission Line	220Kv Double circuit, 47.0km (Gongar to Khimti Substation)	8.35km Length, 33kV

Legal Discourse

Semanta Dahal

Likewise, the small projects have been facing strict regulatory provisions and procedures for forest-related permits, which can be simplified to expedite projects related works.

Legal Arrangements and Solutions

First of all, what kind of hydropower projects should be defined as 'small'? Projects up to what capacity are considered small; 50, 100, 200 MW? This is confusing because the law does not provide clear guidance in case Nepal. Looking at the approach taken by the government, it seems that projects above 200 MW are considered large. This is because the Investment Board Nepal (IBN) has been given the jurisdiction to proceed with projects larger than this capacity.

Another indicator to define the criteria of small projects could be the Environment Act. This act has not made mandatory to carry out an Environmental Impact Assessment (EIA) for projects up to 50 MW, while only an Initial Environmental Examination (IEE) is sufficient. In this case, can a project up to 50 MW be considered small? Or, can a project with a capacity of less than 200 MW be considered small? When further generalized, up to 50 MW can be considered small. The same situation is seen according to the Environment Act.

If a project is considered small up to a certain limit, the process of obtaining a license for larger projects must be distinctively different. Currently, the process of obtaining a license for a hydropower project is in two stages; first a survey and then a generation license. Now, the process can be shortened by issuing licenses to small projects that have already been identified under this category at a point. Small projects, in this regard, should be issued license for 30-35 years, setting a proper date to enter the construction phase. If construction does not begin within the specified time, the concerned authority can revoke the generation license. This will reduce the procedural hassles on having to obtain permits repeatedly for small projects.

If the proposed area does not have much impact on the river flow and environment, a provision can also be made in the new electricity bill to proceed with the project with a single license.

Nepal has experienced now for a long period to analyze on how to proceed with the development of hydropower projects.

Currently, Power Purchase Agreement (PPA) for projects up to 25 MW can be carried out at the level of the deputy managing director of Nepal Electricity Authority (NEA). NEA does not have to reach the level of the board of directors and the managing director to decide on the PPA of projects up to this limit. This limit can be extended to 50 MW. The PPA for up to 50 MW can be made at the level of the deputy managing director. This will make the PPA of 'small' faster and faster.

Likewise, the small projects have been facing strict regulatory provisions and procedures for forest-related permits, which can be simplified to expedite projects related works. With few exceptions, most projects up to 50 MW are run-of-river (ROR). It may not be necessary to cut a large number of trees in construction period. In that case, the forest will not be affected much. Therefore, it is appropriate to simplify the complex process of cutting trees.

Similarly, there is a complexity in raising investment (loans) in small projects. To take a bank loan, collateral is compulsory for these types of projects. If a promoter who has already developed a project wishes to take a loan for another project up to 50 MW, the constructed project can be considered as collateral as an arrangement for a loan from a bank and financial institution. Initial public offerings (IPO) can also be issued to raise equity in hydropower projects. There are various criteria set to obtain permission for the primary share issuance from the regulator. Some flexibility can be adopted in such criteria for projects up to 50 MW. This can solve the problem of raising capital faced by small projects to a large extent.

Institutional reform

If any provincial government has the capacity to implement 50 MW projects, then the jurisdiction can be handed over to the sub-national government for this purpose. If otherwise, the authority must be kept within the federal government. The electricity purchase and sale rate is also creating complications in the construction of these projects. In such a case, NEA can adopt the method of determining the rate through competition for projects that are in the process of raising loans. For example, earlier, the rate was determined for 960 MW solar power through competition. NEA itself can fix the per unit rate for projects up to a certain capacity. Some of the currently operating small hydropower stations have not been able to generate income sufficient to cover operating expenses. Some of these hydropower stations have not been able to produce the declared amount of energy (contract energy) as per the PPA. The main reason for this is the receding water level in the river. This may be due to natural factors (uncontrollable circumstances) including climate change. The hydropower stations have lost income due to not being able to provide the declared energy to NEA. In addition, an obligatory situation has been created to pay penalties. The system should be revised to make it balanced.

To overcome the situation, the Electricity Regulatory Commission should play a fair and judicial role. There is an investment from both the promoters and the public in small projects that have come into operation. To protect that, neither the promoters nor NEA can bear the risk of 'hydrology' seen in such projects. In that case, small projects should be exempted from the case. Moreover, the flexibility must always be maintained to allow small projects to review their PPA rate.

New Provision

The then government tabled 'Electricity Bill 2080' at lower parliament (House of Representatives) for the formulation of a new Electricity Act. After extensive discussions in the parliamentary Infrastructure Development Committee under the House of Representatives, the bill progressed for endorsement with necessary amendments. Unfortunately, the House of Representatives was dissolved after the Gen-Z movement of September 8-9, while the bill has reached the death bed. A new draft bill may have to be prepared and presented in the new panel of House of Representatives to be elected from March 5 elections.

The bill in progress has also not clearly classified hydropower projects as small, medium, or large. It however considers large projects to be of capacity above 200 MW. Nevertheless, the Environment Act considers those with a capacity of less than 50 MW as 'small'. In that case, if the bill reaches parliament again in the coming days and is taken for discussion, the issue of project classification may be included.

Secondly, the privious act has a provision that small projects should also obtain both survey and generation licenses or two-stage licenses, which is not necessary. If the proposed area does not have much impact on the river flow and environment, a provision can also be made in the new electricity bill to proceed with the project with a single license. If this can be done, it can be expected that many problems seen in the sustainable construction and operation of small hydropower projects in Nepal will be resolved.

The writer is an associated with Abhinawa Law Chambers. This text is an unofficial translation from Nepali version

Assessment

Nava Raj Pokharel

It has made mandatory the development projects to incorporate the environmental management and to be environment friendly through environmental assessment processes.

Impacts of Environmental Assessment

Importance of Environmental Conservation

Environmental conservation means protecting natural resources such as air, water, land, forests, wildlife, and biodiversity. Environmental conservation not only improves the quality of human life but also ensures the sustainable use of resources for future generations. Nepal is a rich country if it is to consider the ratio of area and its biodiversity. Its natural and biological assets—Himalayas, hills, Terai, rivers, lakes, forests, national parks, and conservation areas—reflect prosperous aspects of environmental diversity.

However, in recent years, the factors like rapid population growth, urbanization, industrial development, deforestation, and excessive use of plastics have caused significant environmental degradation.

Although discussions on environmental conservation began earlier, a formal legal foundation was established with the enactment of the Environment Protection Act, 2053 (1997). This act integrated environmental concerns into economic development for the first time. It has made mandatory the development projects to incorporate the environmental management and to be environment friendly through environmental assessment processes. The Constitution of Nepal 2072 (2015) further recognized the right of every citizen to live in a clean and healthy environment as a fundamental right.

During this period, the environmental assessment process was not legally binding, but this project laid the foundation for the process of formulating the Environmental Protection Act and Regulations in the future.

Sustainable Development and Environmental Health

Sustainable development refers to a development process that meets present needs without compromising the ability of future generations to meet their own needs. It emphasizes a balanced integration of environmental, social, and economic aspects.

Environmental health deals with how environmental quality affects human health. Polluted air, contaminated water, and chemical pollution can cause diseases such as respiratory illness, waterborne diseases, skin diseases, and others. Therefore, environmental cleanliness, human health, sustainable development, and environmental protection are deeply interconnected. If a production unit provides some economic benefit, it cannot be denied to pose risk to the public health if they contribute in air and water pollutions.

In developing countries like Nepal, achieving harmony between sustainable development and environmental health remains even more challenging due to unmanaged urbanization, weak waste management, overexploitation of natural resources, and ineffective implementation of environmental policies, among others. Addressing these challenges requires environmental planning, public awareness promotion, use of green technologies, and strong environmental policies, along with their proper implementation.

Ultimately, only by integrating sustainable development with environmental health, a prosperous, safe and long-term human society can be ensured.

Definition and Objectives of Environmental Assessment

According to the Environment Protection Act, 2053, Environmental Assessment (EIA) is the study, analysis, and evaluation of potential environmental impacts that may arise during the implementation of a development project, along with measures to mitigate adverse effects.

More than a legal obligation, the EIA serves as a mean to integrate environmental concerns into mainstream of economic development. Based on the nature and scale of projects, environmental assessment is categorized into three types:

1. Environmental Impact Assessment (EIA)
2. Initial Environmental Examination (IEE)
3. Brief Environmental Study (BES)

Objectives of Environmental Assessment

1. To study potential adverse impacts on the environment, health, society, and biodiversity.
2. To develop mechanisms for mitigation, compensation, rehabilitation, and monitoring systems.
3. To ensure long-term environmental sustainability of development projects.

Environmental assessment supports environmentally friendly development, helps policymakers make scientific decisions, and ensures public participation. In Nepal, this system has been legally implemented and executed by relevant ministries and departments, maintaining balance between development and environmental protection.

Legal and Historical Background

The EIA and IEE process in Nepal have evolved gradually. Its formal initiation can be traced back to the 1980s, when the environmental aspects were started to align with the government periodic plans. Particularly the Sixth Five-Year Plan (1980–1985) and the Environmental Impact Study Project 1982 were considered milestones in Nepal's EIA/IEE progression.

The Sixth Five Year Plan was an important document prepared by the Planning Commission of Nepal, in which the relationship between environmental protection and sustainable development was presented for the first time in an institutionalized manner. It began to formally consider the potential environmental impacts of development activities (irrigation, hydropower, road construction, and other physical infrastructure) taken place at that time. The main reason for including environmental aspects in the plan was to identify the studies in this area that were necessary to make these projects successful and popular in the long term. The relationship between development and environmental balance motivated the government to adopt related studies during the course of the project.

Another major milestone was the **Environmental Impact Study Project (EISP)** launched in 1982 with support from the Government of Nepal and USAID. The project aimed to develop institutional capacity, produce skilled manpower, and support policy formulation related to environmental assessment. It introduced EIA concepts formally in Nepal and laid the foundation for later environmental laws and regulations. The project provided an opportunity to various professionals like government officials, engineers, planners and environmentalists making them familiar to the concept frameworks of the environment assessments.

The EISP formally introduced the concept of EIA in Nepal. During this period, the environmental assessment process was not legally binding, but this project laid the foundation for the process of formulating the Environmental Protection Act and Regulations in the future. Various study reports, guidance materials, and preliminary environmental baselines were prepared under the EISP, which made it easier to prepare policy and legal documents related to environmental assessment later.

Both the Sixth Five Year Plan and the EISP formed the basis for the initial phase of the development of the EIA/IEE process in Nepal. These efforts made a significant contribution to developing the mindset of including environmental aspects in the plan as a matter of course. This journey, which was started with the aim of maintaining a balance between development and environmental protection, is gradually transforming into a formal, legal, and implementation-oriented process. Therefore, the history of Nepal's environmental assessment system remains incomplete without these two elements (the Sixth Plan and the EISP).

National Environmental Impact Assessment Guidelines (1993)

The National Environmental Impact Assessment Guidelines (1993) provided procedural standards for environmental assessment in development projects. Although not legally binding at the time, they offered a structured framework and strengthened institutional awareness of environmental protection.

The objective of developing these guidelines was to make environmental assessment mandatory before construction of development projects and to provide a basis for formally incorporating environmental issues into the project approval process. It helped planners, engineers, policymakers and project managers understand the need for EIA, the process, scope, report structure and the rationale for public consultation.

The guidelines also clarified the differences between IEE and EIA and provided criteria for determining which process is required for which projects. In addition, it clearly outlined the stages of preparing the report — scoping, data collection, evaluation of alternatives, impact assessment, mitigation measures, monitoring plan. It contributes to make the project planning and assessment process more scientific and transparent.

These guidelines played a crucial role in the formulation of the **Environment Protection Act 1996** and **Environment Protection Regulations 1997**, transforming environmental assessment into a legally enforceable system. Therefore, this guideline is considered a historically important document in the segment.

Strengthening of IEE/EIA: Environment Protection Act 2019 and Regulations 2020

With the implementation of federalism, it was almost essential to update environment related laws. Nepal introduced a new **Environment Protection Act 2019** and **Environment Protection**

Regulations 2020. Along with restructuring the IEE and EIA, these clarified the responsibilities of federal, provincial, and local governments in environmental approval processes and promoted decentralization.

The new system emphasizes a "single-door" environmental approval mechanism and encourages digital submission and monitoring of EIA reports. It has also strengthened provisions related to climate impact assessment, social impact analysis, and sensitive ecological areas.

These act and regulations have tried to clearly define time limits for approval process, maintain transparency and strengthen accountability level through compliance reporting and monitoring mechanisms. New approach has been established in environment related administration to institutionalize entire cycle of development projects—starting from pre-feasibility to implementation and monitoring.

EIA/IEE Process

The EIA process involves systematic and stepwise approaches, which ensures assessment, mitigation and monitoring of environmental impact of development projects.

The starting phase of EIA is **Screening and Categorization**. This stage determines whether a project requires Brief Environmental Study (BES), IEE or EIA.

For this, a decision is made based on the list of action plan included in the Environmental Protection Regulations (Schedule- 1 and 2, and sensitive areas; biodiversity, national parks, community forests). While screening is an initial assessment of the level at which the project falls, classification determines the depth of the required study.

While preparing the report, the organizer must first prepare a Terms of Reference (ToR) and obtain approval from the concerned government authority. The ToR mentions the details of the proposed project, study area, potential impact, technical areas involved, and study methodology. After the ToR approval, a public hearing with the residents of the project-affected area must of conducted, for which a public notice is published 7 days in advance through local newspapers, FM, or notice boards. The suggestions collected during that period should be included in the report. To ensure the quality of the report, the concerned ministry or body forms a technical committee, which assists in reviewing and evaluating the report.

Once the EIA/IEA report is prepared, the review and approval phase begins, in which all three tiers of government—the federal, provincial, and local levels—play a role as per their jurisdiction. The federal government (Ministry of Environment) approves the report of large projects of national importance, such as large electricity, water resources, mining, or transnational projects. The provincial government looks after provincial-level projects, while the local government can review and approve small, local-impact projects. In accordance with the principle of decentralization, it provides an opportunity to take environmental decisions closely.

In the review process, a timeline of 21 days has been set for the IEE report, while it is 45 days for the EIA. During this period, suggestions and feedback are collected from the stakeholders, technical committees, and the concerned community. If errors, incomplete information, or weaknesses are traced in the report, the facility to make amendments is provided. It is reviewed after resubmission. This stage aims at making the process transparent and participatory.

After the report is approved, a project is issued with Environmental Clearance Certificate (ECC). This certificate clearly states the conditions for environmental protection - minimizing deforestation, minimizing social impacts, measures to control water, air, and noise pollution, and a monitoring plan. The conditions of the ECC are monitored by the concerned agencies during project implementation. The project developer is required to submit regular compliance reports. Violations of the conditions may result in fines, cancellation of permits, or suspension of the project. Thus, the ECC acts as an important legal instrument for sustainable development and environmental protection.

Need and Justification of Environmental Assessment

The core objective of environmental assessment is to identify potential negative impacts in advance and minimize risks before project implementation. It is very essential to identify any projects before they are taken for construction. It helps modify project design, location, or technology to reduce harm and supports long-term sustainability.

This process involves evaluating alternative options, including biological, physical, social and economic aspects, which contribute to long-term sustainable development. The role of this stage in making the right decision at the right time cannot be undermined.

Public participation and transparency are another key pillar of the environmental assessment. Early engagement of affected communities increases social acceptance and project success. Inclusive participation of women, indigenous groups, and marginalized communities is mandatory. As the environment is created to hear citizens' voice along with ensuring inclusiveness, the project moves forward with support of local people.

The main element of environmental assessment is to control narrow environmental impacts, which include deforestation, biodiversity, natural habitats, and protection of water resources. Many projects, such as roads, dams, mines, or industrial areas, have the potential to reduce forest coverage area, pollute water, and affect wildlife habitats. The identification and mitigation measures for such impacts should be clearly included in the EIA process. Alternative locations, restoration plans, or compensation programs are prepared to conserve biodiversity. This helps in the long-term conservation of natural resources.

Similarly, socio-economic aspects are also given due consideration in environmental assessment. A project may affect public health, housing, education, agricultural land, air, dust, noise, and climate. When a project is operated in a tourist destination, its ecological beauty may be negatively affected. In such cases, the study identifies these impacts and presents a mitigation and improvement plan. Issues such as compensation, rehabilitation, alternative livelihoods, and health protection measures for the affected communities are mentioned in the report. This makes the project sustainable, equitable and socially acceptable.

Finally, the EIA/IEE system also plays an important role in preventing abuses and improving policy. Adequate legal frameworks, implementation monitoring and public awareness are necessary to control the impacts when the project is implemented. Report approval is not the final step; subsequent compliance monitoring and corrective measures are also important. In addition, environmental protection culture should be disseminated at the public level through awareness programs such as environmental education, mass communication and government capacity building. Further institutionalizing the trend of including environmental concerns in policymaking is the basis for sustainable development.

Background of Small Hydropower Projects

Small and micro hydropower projects (below 10 MW) have played a vital role in rural electrification, economic development, social transformation, and environmental conservation in Nepal. In remote and mountainous areas where large projects are difficult, small hydropower serves as a reliable renewable energy alternative.

Although termed "small," these projects still generate environmental and social impacts. Proper planning, management, community participation, and sustainability measures are essential to maximize benefits and minimize adverse effects of such projects.

Nepal has been developing micro (1 KW-100 KW), mini (100 KW-1 MW), and small (1 MW-10 MW) hydropower projects since the 1970s. Such projects have played a major role in rural electrification, agricultural modernization, drinking water, irrigation, and the development of local industries and businesses. Small and micro hydropower systems supply electricity to thousands of households in more than 50 districts of Nepal. Most projects are operated under a community-management model, which has increased social ownership and local participation.

Positive Environmental Impacts of Small Hydropower

Small hydropower projects are generally considered environmentally friendly. Most are run-of-river projects that do not require large reservoirs, resulting in minimal land submergence and low greenhouse gas emissions.

They reduce dependence on firewood, kerosene, and fossil fuels, thereby decreasing deforestation, carbon emissions, and indoor air pollution. Electrification improves living standards, supports agriculture, irrigation, agro-processing, and promotes environmentally friendly lifestyles.

Although the impact is minimal, small hydropower projects can also pose some negative environmental challenges and negative effects in social life. Due to the high sedimentation rate due to the hilly terrain, there are also problems such as damage to intakes, headworks and pipe systems, frequent repairs and changes in the natural course of the river.

Negative Environmental Impacts

Despite their benefits, small hydropower projects can cause negative impacts such as reduced downstream water flow, obstruction to fish migration, biodiversity loss, riverbed alteration, and sedimentation problems.

Multiple projects within the same river system can lead to cumulative impacts, disrupting river continuity and aquatic ecosystems. This can lead to disruption of the natural continuity of the river, disruption of the ecological balance of aquatic life, and direct impacts on the livelihoods of communities living in the lower river belt areas. In addition, temporary but sensitive environmental impacts such as stone, sand, and gravel extraction, construction of temporary roads, noise and dust pollution, and deforestation will also occur during the construction phase of the project.

Effective mitigation measures, environmental flow maintenance, fish ladders, proper waste management, and strong monitoring systems are essential to minimize these impacts.

Positive Social Impacts

Small-scale hydropower projects have had multifaceted positive impacts on rural society. First, there has been a significant improvement in rural electrification and living standards. With the arrival of electricity, access to mobile and internet has expanded, houses have lighting facilities, and it has become easier to use electrical appliances such as fans, refrigerators, and TVs. This has not only made daily life easier, but has also contributed to educational improvement by increasing opportunities for reading and writing in the evenings.

Second, there have been significant improvements in the field of health and sanitation. Air pollution inside homes has decreased due to smoke-free lighting, the use of refrigerators and freezers has made it possible to keep food safe, and it has become easier to operate necessary equipment in public health centers. The storage of medicines, vaccines, and food has also become safe and effective.

Third, small hydropower projects have played a major role in the development of the local economy. Electricity has supported the operation of small industries such as agro-based industries such as mills and oil mills, modern cutting, welding, wood and iron industries, hotels, shops, and other businesses. Its contribution to agricultural irrigation and processing is also significant.

Fourth, employment and skill development opportunities have been created. From project construction to operation, the use of local labor, technical skill development, turbine and maintenance skill acquisition, and participation in the management of community organizations have increased. Finally, the empowerment of women and disadvantaged groups is also an important social achievement of small hydropower projects. Women's participation in user committees, financial management, and decision-making processes has strengthened gender equality and social inclusion.

Negative social impacts

Although small-scale hydropower projects contribute to rural development, the social challenges associated with them cannot be ignored. First, inequality in the distribution of benefits is a major problem. In some cases, access to electricity is limited to a countable number of households, with financially capable and wealthy households benefiting more, and local vulnerable and marginalized groups staying away from the decision-making process. This can increase social inequality and create negative perceptions of the project.

Second, land use and property disputes can create social tensions. Damage to farmland during the construction of intakes, penstocks, and transmission lines, the need to acquire private land, and the lack of proper management of compensation can lead to conflicts between local communities and the project party. Third, problems with the sustainability of the project have a direct social impact. Weaknesses in maintenance and management can lead to project failure, disruption of power supply, discontinuity in industry and business operations, and increased consumer dissatisfaction.

Fourth, natural disaster risks are also deeply linked to small hydropower projects. Especially in hilly areas, if projects are exposed to risks such as landslides, floods, heavy rains and earthquakes, not only the infrastructure but also local life, livelihoods and social stability are affected. Therefore, timely identification and management of such social risks is essential for the successful and sustainable operation of small hydropower projects.

Technical and Economic Challenges

Although small-scale hydropower projects have high prospects, there are some serious challenges in practice. The first challenge is the high initial cost. Even though they are small projects, they require large investments in infrastructure such as turbines, generators, physical structures, and transmission lines, which increases the financial burden on investors and weakens the economic viability of the project. Second, the lack of maintenance and technical manpower is another important problem. The lack of skilled technicians at the local level, absence of easy availability of quality materials, and the inability to carry out regular maintenance on time, pose a risk of equipment breakdown and project shut down for a long time. This reduces production and increases costs further.

Third, the problem of low load factor is also obvious in small hydropower projects. Since the electricity supplied by such projects is usually limited to agricultural and domestic purposes, the load is very low at night, demand is limited during the day, and the production capacity cannot be fully utilized. This increases the cost per unit and affects the sustainability of the project. Financial facilitation, local technical capacity development, and measures to balance production and consumption are necessary to address these challenges.

Reforms for Sustainable Development

Small-scale hydropower is an important basis for sustainable energy development for a mountainous and river-rich country like Nepal. As it helps in generating environmentally friendly and decentralized electricity using local resources, some reform measures are essential for its long-term sustainability. First, maintenance of environmental balance is very important.

If the policy of maintaining minimum river flow is not strictly followed, it may have negative impacts on aquatic life, ecosystems, river systems and downstream communities, therefore, effective implementation of legal provisions is necessary. Second, increasing community participation is the main basis for sustainability. Meaningful participation of local communities in the planning, construction, operation and decision-making processes of the project increases the sense of ownership, reduces conflict and ensures the longevity of the project.

Third, the use of modern technology and quality infrastructure is indispensable. The sedimentation flushing system helps in the management of sand and soil. The fish ladder facilitates the movement of fish and aquatic life. The robust intake structures reduce the risk of floods and landslides. The disaster-related design enables projects to cope with climate change-related risks. Fourth, strengthening women's participation is critical for sustainable social change. Enabling women through training, leadership development, and committee membership increases inclusion in decision-making processes and ensures equitable distribution of project benefits. In this way, if environmental protection, social inclusion, and technical strengthening are promoted simultaneously, small-scale hydropower projects can be an effective means of achieving sustainable development goals.

Conclusion

Environmental assessment is a critical tool for balancing development and environmental protection, at a time the country is facing challenges due to increased population, urbanization, industrialization, deforestation and unplanned development.

In Nepal, EIA, IEE and BES have evolved into structured, legally binding processes that support sustainable development. This system, which started in the 1980s, has become more robust, transparent and decentralized through the Sixth Five Year Plan, the EISP (1982), the National EIA Guidelines (1993), the Act of 2019 and the Regulations of 2020. It has mainstreamed environmental aspects from project planning, approval, implementation and monitoring.

In Nepal, small hydropower projects (less than 10 MW) have made significant contributions to rural electrification, local economy, health, education, employment and social empowerment. Due to the river-flow based model, their environmental impact is relatively low and helps reduce deforestation and carbon emissions. However, problems such as minimum flow reduction, sedimentation, cumulative effects, construction phase impacts, social inequality, land disputes, techno-economic challenges and natural disaster risk are also seen.

Small hydropower projects, when properly planned and managed, can significantly contribute to clean energy production, rural development, and environmental conservation. However, neglecting environmental assessment and management can lead to long-term ecological and social harm.

Therefore, strengthening environmental governance, public participation, monitoring, and environmental education remains essential for achieving sustainable and equitable development.

This text is an unofficial translation from Nepali version.

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Domestic Market

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Mining is an energy-intensive computing process, but unlike most industrial loads, it is highly flexible. Operations can be located close to generation, can run only during periods of excess supply, and can shut down almost instantly when electricity is needed elsewhere.

A cautious case for piloting Bitcoin mining in Nepal

Nepal's hydropower sector is entering a new phase, shifting from a narrative of scarcity to one of structural energy surplus. Installed capacity now stands at roughly 4,000 megawatts, export arrangements with India are improving, and additional generation capacity of about 5,500 MW is expected to be added in the next five years.

Yet alongside this progress sits a less visible challenge. During the monsoon months, Nepal frequently produces more electricity than it can use domestically or export efficiently. Within five years, Nepal is projected to generate over 24,000 GWh of surplus electricity annually—more than twice the country's current total annual demand. At present, Nepal's only large-scale outlet for surplus electricity is export to India and transmission constraints, seasonal demand patterns, and pricing pressure means that some power is sold below cost or curtailed altogether. Furthermore, cross-border power trade operates within a geopolitical context that introduces significant policy, regulatory, and market risks beyond Nepal's control. The structural asymmetry is stark: for India, electricity import from Nepal is a rounding error in a massive and diversified power system; for Nepal, the inability to export or productively absorb surplus electricity domestically can be economically destabilizing.

This is not a failure of planning. It is a structural issue faced by many hydropower-rich countries. The policy question, therefore, is not simply how to generate more electricity, but how to extract greater economic value from the electricity Nepal has already produced or will produce. One option worth examining, cautiously and without ideological framing, is Bitcoin mining.

This is not an argument for Nepal to adopt Bitcoin as legal tender, nor a call to embrace cryptocurrency speculation. It is a narrower question. Can Nepal pilot a tightly controlled form of Bitcoin mining as a buyer of last resort for surplus hydropower that currently has limited alternatives.

To assess this, it is important to understand Bitcoin mining in operational rather than financial terms. Mining is an energy-intensive computing process, but unlike most industrial loads, it is highly flexible. Operations can be located close to generation, can run only during periods of excess supply, and can shut down almost instantly when electricity is needed elsewhere. In effect, mining functions as an interruptible and price-sensitive energy consumer.

This flexibility aligns with Nepal's energy profile. Surplus generation during the monsoon coincides with relatively unchanged domestic demand. Traditional industries require stable, year-round power and long-term certainty. Bitcoin mining does not. It can absorb electricity when it is cheapest and step aside when conditions change.

The appropriate way to explore this potential is through a limited pilot rather than sweeping policy declarations. A pilot mining of 20 to 30 megawatts, located near existing hydropower facilities or at transmission-constrained nodes, would be sufficient to test the concept. At current network conditions, industry's estimates suggest that mining one Bitcoin requires on the order of 800,000 to 900,000 kilowatt-hours of electricity. A 20-megawatt facility operating during surplus periods could therefore produce roughly 120 to 180 Bitcoin per year, depending on uptime and difficulty.

A controlled mining pilot could also drive meaningful local infrastructure and capacity building. Installing and operating even a 20–30 megawatt facility requires reliable grid connections, cooling and data center systems, and secure on-site facilities. These investments create construction and maintenance jobs, train a technically skilled workforce, and strengthen local electrical and IT infrastructure and benefits that endure well beyond the pilot. In effect, the project can seed a cluster of expertise and facilities that could support other industries or future energy-intensive ventures.

At recent Bitcoin prices, this value would translate into tens of millions of dollars in gross annual output, before costs. These figures are illustrative, not predictive, but they provide a sense of scale. More importantly, such a pilot could be evaluated directly against export alternatives on a revenue-per-kilowatt-hour basis.

Any pilot should be time-bound, perhaps 18 to 24 months, and subject to explicit performance criteria. These should include tariff neutrality for households, full interruptibility during peak domestic demand, transparent onshore accounting and taxation, and revenue performance relative to export prices. Crucially, the pilot should include a clear exit clause. If these benchmarks are not met, it should be shut down.

Such an approach helps address the most common concerns.

The first is electricity pricing. Nepal's history of load shedding means any perception that electricity is being diverted from households carries political risk. A mining pilot must therefore operate only on surplus or off-peak power, with automated shutdowns during periods of domestic scarcity and regulatory safeguards that explicitly prioritize residential and productive use.

The second concern is volatility. Bitcoin prices fluctuate, and mining revenues are not fixed. However, export electricity prices are also subject to market and geopolitical risks. A pilot should not be judged on short-term price movements, but on issue whether or not, over its duration, it delivers competitive or complementary returns compared to existing monetization options.

The third concern is governance and capital flight. These risks arise primarily in unregulated environments. They are significantly reduced when operations are licensed, domestically incorporated, audited, and taxed at source. Transparency, in this context, is not an add-on but a prerequisite.

Other hydropower-rich countries have begun cautious experiments. Bhutan offers a particularly relevant example. While cryptocurrency trading and private use remain restricted under Bhutanese law, the state has permitted Bitcoin mining in a tightly controlled, sovereign context, using surplus hydropower. Public reporting suggests Bhutan has accumulated over 12,000 Bitcoin, valued at roughly $1.3 billion at recent prices. The distinction matters. Bhutan's experience demonstrates that mining can be treated as an energy and industrial policy tool, without liberalizing cryptocurrency use more broadly.

Bitcoin mining is not a solution to Nepal's energy challenges. It will not replace exports, resolve transmission bottlenecks, or substitute for industrial development. At best, it may prove to be a modest additional tool. At worst, a well-designed pilot would fail quickly and generate valuable data at limited cost.

Looking further ahead, even modest scaling illustrates why the question deserves examination. If Nepal were, by the end of the decade, to allocate on the order of 200 megawatts of surplus hydropower to tightly regulated mining operations, gross annual output could plausibly reach hundreds of millions of dollars, depending on market conditions. This is neither a forecast, nor a recommendation, but an indication of magnitude relative to current export revenues.

Beyond immediate revenue, Bitcoin mining could be Nepal's first stride into a new digital frontier. By cultivating expertise in high-performance computing, network security, and energy-intensive IT operations, Nepal can position itself as a recognized player in the global digital economy. The knowledge, infrastructure, and regulatory experience built through a careful pilot could spark innovation across fintech, cloud computing, and other knowledge-driven industries, turning surplus hydropower into a launchpad for future exports of talent and technology. In this light, mining is more than a pilot, it is the opening move in Nepal's journey toward a value-added, digitally empowered economy.

The next step needs not be dramatic. Any decision to proceed should rest on evidence rather than assumption. Nepal does not need to bet on Bitcoin. It does, however, have an opportunity to test whether surplus electricity that currently goes undervalued or unused can be put to more productive use. That is a question of energy economics, not ideology.

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Energy & Climate

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In contrast to large, scale dams, these projects are usually less invasive as they create a smaller reservoir, use natural streamflow, and can be financed and carried out quickly by domestic developers.

Policy, Performance, and Prospects of ROR Schemes for Energy and Climate Resilience

Small hydropower (~10 MW) has been a critical source of energy in Nepal since 2025, largely due to its extensive contribution to the national grid. Additionally, it has facilitated electricity access to remote areas, promoted the involvement of the private sector, and supported the development of local communities. It is worth mentioning that Nepal has a theoretical hydropower potential of ~83 000 MW. Up to now (~2025), the total capacity of the plants that have been commissioned is only around 3,388 MW, which is just a fraction of the country's potential. The article delineates an in, depth examination of policy and the regulatory framework, and strategic recommendations for the small hydropower sector.

1. Background

Hydropower is the backbone of Nepal's energy system and is expected to contribute about 90% of electricity generation till 2025. Small hydropower projects (~10 MW Run, of, River) have become a trustworthy and economical type of technology to maintain the stability of the grid, supply electricity to the rural areas, grow the private sector, and support decentralized economic development. In contrast to large, scale dams, these projects are usually less invasive as they create a smaller reservoir, use natural streamflow, and can be financed and carried out quickly by domestic developers.

2. Policy and Regulatory Framework

Nepal's hydropower policy details clear and comprehensive regulations for the establishment of projects at different levels. It covers the smallest hydropower projects such as 10 MW ones. Developers carrying out the projects must first create a company under the Companies Act.

This step establishes the legal entity that will be responsible for the project execution. The licensing process by the Department of Electricity Development (DoED) has two stages. At first, a Survey License, typically valid for five years, allows developers to perform detailed field studies, feasibility assessments, and baseline data gathering. Upon successful completion of the survey and meeting of technical and environmental criteria, a Generation License is issued. This license under a Build, Own, Operate, Transfer (BOOT) model for 35 to 50 years is the right to construct and operate the hydropower plant.

Small hydropower projects need to comply with environmental standards, which is generally verified by an Initial Environmental Examination (IEE) along with public consultation; a comprehensive Environmental Impact Assessment (EIA) is only required for ecologically sensitive areas.

Moreover, land acquisition and forest clearances have to be secured, with the forested areas needing permission from the Ministry of Forest and Soil Conservation. At the end of the day, the Nepal Electricity Authority (NEA) is instrumental in power commercialization through the provision of "take, and, pay" Power Purchase Agreements (PPAs) for small hydropower projects, thus, guaranteeing a source of income once the plant turns into operation.

3. 10 MW Hydropower Projects in Nepal: Status Overview

These tables offer a comprehensive overview of all the approximately 10 MW hydropower projects that have been licensed (have power purchase agreements), are under construction, and are operational as of late 2025. The list serves as a reality check of the momentum of small hydropower at different stages of development.

a) Operational Projects (~10 MW)

Project Name	Capacity (MW)	Location (District)	Promoter / Owner	Commissioned
Sunkoshi Hydropower Station	10.05	Sindhupalchowk	Nepal Electricity Authority (NEA)	1972
Lower Modi I	10.00	Parbat	United Modi Hydropower Pvt. Ltd.	2012
Sipring Khola	10.00	Dolakha	Synergy Power Development P. Ltd.	2013
Super Mai-A	9.60	Ilam	Sagarmatha Jalbidhyut Co. Ltd.	2020
Rairang Iwa Khola	9.90	Taplejung	Rairang Hydropower Dev. Co. Ltd.	2019
Andhi Khola	9.40	Syangja	Butwal Power Company	(Operational)
Mai Beni	9.51	Ilam	Urja Developers	(Operational)

* Notable for receiving the **Blue Planet Prize 2025** for sustainability.

Total Operational: 7 projects (~10 MW range) generating electricity, feeding the **national grid**, and supporting local load demands.

b) Projects Receiving PPA / Licensed (~10 MW)

Project Name	Capacity (MW)	Promoter	Status
Supreme Kabeli Khola	9.90	Best Hydropower Co.Pvt.Ltd.	Licensed (2025)
Baglung Kali Gandaki	10.00	Tara Energy Pvt. Ltd.	Licensed (2025)
Kabeli-3	9.85	Kabeli Hydropower Co. Ltd.	Licensed (2022, PPA)

Total Licensed/PPA: 3 projects granted generation rights and PPAs, now progressing toward construction.

c) Under Construction (~10 MW)

Project Name	Capacity (MW)	Location	Promoter
Siddhi Khola	10.00	Ilam	Siddhi Hydropower Co. Pvt. Ltd.
Upper Daraudi-1	10.00	Gorkha	Diamond Hydropower Pvt. Ltd.
Sabha Khola A	9.99	Sankhuwasabha	Deepsabha Hydropower Pvt. Ltd.
Lungri Khola	9.60	Pyuthan	Tripura Sundari Hydro Energy Pvt. Ltd.
Daram Khola	9.60	Baglung/Gulmi	Daram Khola Hydro Energy Ltd.
Rudrawati Badigad	9.60	Myagdi/Gulmi	Hanumante Power and Energy Pvt. Ltd.
Isuwa Cascade-3	9.95	Sankhuwasabha	Magic Arun Hydropower P. Ltd.

Total Under Construction: 7 projects progressing in civil & electrical work and grid preparation.

4. Ground Reality: Challenges and Data Insight

Small hydropower projects of around 10 MW in Nepal, are crucial from a strategic point of view for decentralized energy development, but they struggle with a wide variety of challenges, spanning the operational, financial, infrastructural, and socio, environmental domains.

Hydrological and operational risks are especially significant and can be attributed to the extreme seasonal variability of the Himalayan rivers, where dry, season flows constitute only ~16% of the annual volume while the monsoon accounts for ~84%, thus the dry, season capacity factors are reduced to 4050% and the revenue streams become unstable. Moreover, these risks are compounded by climate extremes such as flash floods and Glacial Lake Outburst Floods (GLOFs) that harm directly the civil structures and operational reliability over the long term. From a financial standpoint, these projects, as the smaller ones of less than large, scale dams, still need a considerable capital investment upfront and have gestation periods of three to five years.

Local banks regularly demand substantial collateral, and foreign investors are wary of currency fluctuations and potential PPA risks, thus a financing gap continues to exist. On top of that, infrastructure limitations make it even more difficult to get projects off the ground: slow extensions of the high, voltage transmission lines may result in newly finished projects being stranded, thus wasting energy, while the rugged terrain increases the cost and time of the construction of access roads and material transportation.

Moreover, the incorporation of social and environmental governance (ESG) aspects necessitates a careful approach. For instance, the generation of electricity may be lowered as a result of environmental flows that are mandated by law to sustain the ecology of the river, while the community's expectation for benefit sharing, if not fulfilled, may lead to a delay in the project's implementation. Hence, these obstacles, in combination, demand integrated planning, engineering designs with resilience, stakeholder engagement that is proactive, and financing mechanisms that are innovative in order to obtain the technical, financial, and social sustainability of small hydropower projects in Nepal.

5. SWOT Analysis

Small hydropower projects of about 10 MW in Nepal reveal a plethora of strategic strengths that position them as a fundamental instrument for decentralized energy development. A chief benefit of these is the relatively short period of commissioning, which is often doable within three to four years. This duration allows developers to see their returns in a much shorter time than large, scale hydropower projects that may take ten years or more.

Moreover, the manageable scale and capital requirements of these projects make them a very feasible option for domestic private investors, thus the emergence of a local hydropower industry and the accumulation of technical expertise in the country. Additionally, the government, imposed provision of equity shares to local communities is a tool for direct social benefit, thus creating a sense of ownership among stakeholders and, consequently, reducing the risk of social resistance, which is a common problem in large hydropower developments.

Nevertheless, 10 MW projects have major weaknesses that need to be handled carefully. Seasonal variability of energy output is, in fact, still the main issue since a Run, of River (RoR) scheme is, basically, a hydropower plant dependent on the flow of a river, which can change significantly between the dry and monsoon seasons

Seasonal imbalance frequently results in lower dry, season capacity factors, which rarely go beyond 40, 50%, thus having a direct impact on the revenue streams. Moreover, transmission delays and lack of expansion of the grid in remote areas may cause stranded capacity and energy losses, thus diminishing the efficiency of even well, performing projects. The projects are additionally at risk of hydrological hazards such as flash floods, landslides, and Glacial Lake Outburst Floods (GLOFs) that may damage the civil works and turbines and mandate regular, expensive maintenance interventions. The arrival of blended financing instruments such as climate funds, green bonds, and concessional loans, can be instrumental in bridging the equity gap and luring both domestic and foreign investors. The application of hybrid renewable energy systems such as solar photovoltaics and energy storage can provide a way to counter seasonal generation variability, thus stabilizing the grid and guaranteeing a continuous supply of electricity during the whole year. Likewise, small hydropower can be a lever for regional energy trade, where the excess generation can be sold to neighboring countries like India and Bangladesh, thus creating new revenue streams and consolidating Nepal's strategic position in the South Asian energy network.

Nevertheless, 10 MW projects are not immune to the difficulties that threaten their very existence and must be addressed in a decisive manner. The consequences of global warming, such as changed precipitation patterns, melting of glaciers, and doubling of the occurrence of extreme weather events, endanger both the capacity for generation and the physical facilities.

The existence of a policy veil, which may comprise sudden changes of licensing procedures, tariffs, and Power Purchase Agreement (PPA) frameworks, has the effect of investment hesitancy and consequent financial instability. Moreover, the overall ecological effects of numerous small hydropower plants in the same river system, e. g., destruction of fish migration, sediment transport, and water availability downstream, represent environmental issues that require solutions through integrated river basin management and the intervention of regulatory bodies.

To prevent these weaknesses and threats from materializing while at the same time exploiting the strengths and opportunities, the best practices and the strategic solutions set have crystallized. Climate, smart infrastructure is an absolute necessity from an engineering point of view, and the list may include well, designed spillways, strengthened headworks, and sediment management systems securing the turbines and uplifting the station's ability to withstand floods and debris flows. On the capital and investment side, various instruments such as blended finance, climate funds, green bonds, and virtual PPAs are at the disposal of developers who can use them to lessen the weight of the initial investment and widen the revenue sources, thus contributing to the overall project bankability.

Operationally, a 10 MW hydropower plant combined with solar or wind power can mitigate a seasonal fluctuation and secure a stable supply. At the same time, the use of standardized civil and electro, mechanical designs reduce the risk of construction overruns and shortens the time to project completion. In terms of policy and governance, simplifying the licensing process through a single window, grid expansion coordination, and creating local benefit, sharing frameworks based on transparency increase the efficiency of the regulatory system, community participation, and social acceptance, respectively.

Together, these measures form a strong plan for the environmentally friendly design, execution, and administration of 10 MW small hydropower scheme in Nepal. This is a key factor in achieving technological efficiency as well as socio, environmental advantages and in supporting the country's broader renewable energy and climate resilience goals.

6. Best Practices & Solutions

Ensuring the long, term sustainability, efficiency, and socio, economic impact of 10 MW small hydropower projects in Nepal demands a holistic and integrated approach that covers the engineering, financial, operational, and policy aspects. In terms of resilient engineering, signing a power project entail among other considerations, climate, smart designs. For instance, it is necessary to install reinforced spillways, robust headworks, and powerhouses that should be located in a place that is less vulnerable to flash floods, landslides, and Glacial Lake Outburst Floods (GLOFs). Moreover, sediment management should be practiced to avoid derangement and/or over, frequent maintenance of the turbines due to polluted rivers.

The rivers in the Himalayan region are highly silted, and when this continues for a long time, turbine abrasion will occur, generation efficiency will go down, and maintenance costs will increase. Hence proper site selection, hydrological assessment, and structural reinforcement turn out to be the basic key points for operationally reliable small hydropower throughout the seasonal and climatic fluctuations.

On the financial side, innovations are what can be used to solve the shortage of equity and the investment gap that developers of small hydropower projects usually face. The use of blended funding sources such as concessional loans, climate funds, and green bonds can tremendously lower the initial equity requirement, thus making a project more attractive to domestic private investors.

Exploring Virtual Power Purchase Agreements (VPPAs) provides a flexible revenue model that allows developers to hedge market risk, obtain long term cash flows, and attract international financing while reducing currency exposure which results from conventional Power Purchase Agreements (PPAs). These financial strategies not only increase project bankability but also make 10 MW schemes more attractive as a source of viable investment in Nepal's renewable energy market, which is getting established.

From an operational integration viewpoint, combining 10 MW hydropower with complementary renewable sources such as solar or wind energy can revive the electricity supply during the dry season when river flows are low, and capacity factors drop significantly. The hybrid solution thus ensures energy continuity, reinforces grid stability, and lowers the risks of dependence on a single resource.

Moreover, by standardizing civil and electro, mechanical designs across projects, construction can be accelerated, costs can be lowered, and the efficiency of both implementation and maintenance processes can be improved. In addition, standardization allows contractors to implement established methods and materials, thus improving quality control and lowering the likelihood of cost overruns that are typically associated with small hydropower construction.

At the policy and governance level, simplifying regulatory procedures and enhancing the coordination of government agencies are vital steps in enabling projects to be carried out on time. It is very important to reduce the delays caused by bureaucrats and to ensure that the technical development is in line with the national energy plan by:

a) making the Department of Electricity Development (DoED) the one, stop shop for all licensing activities,

b) coordinating the grid extension with the Nepal Electricity Authority (NEA), and

c) facilitating the issuance of sector surveys and generation licenses.

On top of that, the benefits sharing schemes with clear rules and regulation is a guarantee for the local community that it will enjoy equal economic returns deriving from the project thus gaining social acceptance, minimizing potential conflicts and reinforcing the social license to operate. Such frameworks can be represented by local equity shares that are compulsory, community infrastructure development, or direct financial participation in project revenues.

Looking at these integrated strategies, which cover technical, financial, operational, and policy dimensions, as different parts of one puzzle, it is evident that they form a comprehensive plan for upgrading the performance, resilience, and socio, environmental impact of Nepal's small hydropower sector. Installed behind the mountain peaks where the climate is harsh and unpredictable, these 10 MW hydropower schemes coupled with climate, resilient infrastructure, innovative financing, hybrid operational models, and participatory governance can be a source of local development, rural electrification, and national renewable energy expansion that goes with the mitigation of financial, technical, and environmental risks.

7. Outcomes and Strategic Impact

Small hydropower projects of 10 MW capacity scattered throughout Nepal have generated significant energy, economic, and social gains, thus, these schemes have become a key energy transition tool in the country's renewable energy mix. At present, seven 10 MW plants are up and running, supplying the national grid with clean power, and as a result, decentralized energy access is getting promoted, and the system's overall stability is being secured.

These projects are instrumental in realizing Nepal's national energy targets of a total capacity of 10, 000 MW by 2026 and are setting the groundwork for the long, term goal of 28, 500 MW by 2035. In addition to contributing to domestic energy security, small hydropower projects become an emerging export resource that can allow excess generation to be sold to neighboring markets like India and Bangladesh. This scenario is win, win as it can create valuable foreign exchange revenues while strengthening regional energy cooperation. Furthermore, 10 MW projects are sources of immense community development in particular remote and off, grid areas, aside from their macroeconomic significance. Small, local enterprises can grow by using clean energy. For example, agro, agro, processing, handicraft, and cottage industries are directly increasing household income and local employment.

Power availability is a game, changer for education as students get the chance to study at night. The health sector is also benefitted since clinics can operate uninterrupted, vaccines can be stored, and modern medical equipment can be used. To sum up, these initiatives not only bring social and economic development but also reduce the migration risk by creating feasible livelihoods in rural areas. Besides, the environmental and social governance (ESG) benefits of small hydropower projects are equally important.

These projects, as clean alternatives to traditional biomass and kerosene, based energy sources, help in reducing indoor air pollution and thereby improving the local air quality, which in turn leads to better health conditions. Besides, the requirement for local equity participation gives the community a feeling of ownership and hence it becomes the social license to operate, ensuring that project benefits are not only shared fairly but also that community involvement is at a high level throughout the project lifecycle. The synergy of dependable energy production, socio, economic upliftment, and ESG benefits puts 10 MW small hydropower projects in a place of strategic instruments to realize Nepal's sustainable development goals, thus proving that decentralized, community, centered renewable energy can be a win, win solution for national energy targets, local economic empowerment, and environmental conservation.

8. Strategic Insights

The 10 MW segment of Nepal's small hydropower has emerged as one of the strategically important bases of the country's renewable energy landscape. The segment has not only played a major role in the realization of Nepal's ambitious national goals but also in the socio-economic development at the grassroots level. These hydropower projects of small scale are a big part of the Nepalese energy target of producing 10,000 MW by 2026 and 28,500 MW by 2035. Furthermore, these projects provide decentralized energy solutions, thereby improving grid stability, making rural electrification easier, and getting the private sector involved.

The short duration of commissioning, low investment requirement, and the availability of take-or-pay Power Purchase Agreements (PPAs) that ensure revenue make 10 MW projects very appealing to local developers and thus, a supportive local entrepreneurial environment and the development of technical skills in the energy sector. Small hydropower projects are subject to seasonal, hydrological, and climatic challenges. These challenges consist of low river flow during dry season, flash floods, sedimentation, and vulnerability to Glacial Lake Outburst Floods (GLOFs). However, the implementation of resilient engineering designs such as robust spillways, sediment management systems, and uniform civil and electro-mechanical configurations significantly reduces the operational risks.

Together with the innovative financing approaches—such as blended finance, green bonds, and virtual power purchase agreements—these strategies boost project bankability, draw in both local and foreign investors, and support financial sustainability in the long run. The operational collaboration with renewable energy sources like solar and wind adds to the reliability of the power supply, as it not only provides a cushion against seasonal fluctuations but also supports the delivery of a steady energy supply to local communities and the national grid. In terms of socio-economic impact, small 10 MW hydropower plants act as a rural development engine, providing job opportunities in the area, supplying electricity to small businesses, and making the healthcare system better and schools more effective.

The local equity participation that is required by law guarantees that the benefits of the project are shared equally, which in turn increases social acceptance and community ownership, something that is very important for the project to be sustainable in remote areas. Furthermore, small hydropowers help in protecting the environment as they lessen the usage of biomass and kerosene, reduce the emission of greenhouse gases, and foster better air quality in the locality.

The ongoing evolution of regulatory structures, efficient licensing procedures, and synchronized grid development are all essential elements for the 10 MW projects to realize their total potential. The incorporation of these projects into a larger renewable energy package, which also includes the storage-based Run-of-River (PRoR) and hybrid systems, will not only secure energy for the summer but also improve the overall power generation and help Nepal in its newly acquired position as an energy trader with India and Bangladesh.

Through the combination of technical durability, financial creative approaches, community participation, and nature protection, the 10 MW small hydropower segment is not only considered as an additional power resource but rather as a larger, climate-resistant, and socially-transforming asset that meets national energy policy and local development priorities. Therefore, Nepal's 10 MW small hydropower projects exemplify a strategic synergy between decentralized energy provision, private sector engagement, and community empowerment. When supported by robust policy, innovative financing, resilient engineering, and proactive social engagement, these projects can serve as a blueprint for sustainable energy development in the Himalayan context, demonstrating how small-scale renewable energy can simultaneously achieve national, regional, and local development objectives while contributing to climate resilience and sustainable socio-economic transformation.

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Success Story

Dr. Narayan Gurung

The amount which is believed to be the largest maintenance fund raised by the community among existing mini / micro-hydro projects in Nepal.

Sirdibas Uhiya Mini Hydro: A Model of Sustainable Success

Sirdibas Uhiya Mini Hydro Electricity Project, a 150 KW power plant built in 2015 by Kadoorie Agricultural Aid Association (KAAA), has been supplying electricity to more than 1200 HHs in Dharche Rural Municipality (Ward 1 to 3) and Chumnubri Rural Municipality (Ward 3 to 6) in North Gorkha. The KAAA is funded by the Kadoorie Charitable Foundation at the MOD's request and with their support, the KAAA works as implementing partner alongside the Gurkha Welfare Trust. The KAAA now does more in the way of infrastructure engineering and training than we used to do in agriculture in the past; but in essence, the KAAA is about "Helping those who help themselves" and "Bringing opportunity in life to the disadvantaged".

Sirdibas Uhiya Mini Hydro Electricity Project is not only the largest hydro-electricity project ever built by the KAAA, but also it has been one of the most successful and exemplary projects managed and run by the local community in Nepal. The powerhouse is located at Jagat, the entry point of Manaslu Conservation Area Project (MCAP). Its transmission line stretches to over 54 KM, connecting two different rural municipalities and thus increasing social harmony between them.

It was built with a total cost of about NRs 140 million, including self-help contribution equivalent to some NRs 6.3 million from the local people.

Owned and managed by the local community via Users' Committee, this plant was initially operated with NRs 2.5 million in their maintenance fund. In addition, with the collection of extra fund for the additional line extension to new villages and good saving from monthly tariffs and compound interest in the bank, the Users' Committee now has NRs 42 million as maintenance fund of this project deposited in Kumari Bank. The amount which is believed to be the largest maintenance fund raised by the community among existing mini / micro-hydro projects in Nepal.

Thanks to the KAAA's technical team, this project has required no major repair or maintenance to date. The regular or routine maintenance of the plant is being carried out by the Users' Committee themselves. They do have three operators who do work in shift schedule system and one operator is stationed at the powerhouse on 24/7 basis. The Users' Committee also recruits a manager who is accountable for the overall management of this project. Further, two site staffs are designated to fix fault in the transmission line and address issues of HHs. It shows that the project has given direct employment to six local people. Locals are using electricity not only for cooking, heating, lighting, TV, or mobiles but are also heavily using it to operate their small production units including bakery, mill (grinder, expeller and saw mill).

With the construction of Arughat - Larke Pass Road, the Nepal Electricity Authority (NEA) is extending national grid line to the project site. But their next step is already decided. The Users' Committee has expressed its readiness to synchronize their 150 KW hydro plant with NEA line after the authority completes extension plan of grid line to the project site. At present, most of its power is being wasted as the peak demand load is only 70 KW. After synchronization, they will have additional income from NEA, which will greatly help uplift livelihoods of local people.

The writer is a Technical Director, Kadoorie Agricultural Aid Association.

Potential of Power Generation from different sources

Source	Capacity (MW)
Hydropower (WECS Study)	72,000 (Technical and Economics)
Hydropower (Dr. Hariman Shretha)	83,000
Micro Hydropower	1000
Solar PV (GIZ)	432,000
Wind Power	3000

Power Generation Scenario

Source	Capacity
Hydropower	3782.48
Hydropower (Isolated)	4.54
Thermal	53.41
Grid Connected Solar	149.94
Co-Generation	6.00
Off Grid (Micro hydro, Solar)	103.00
Total Generation	4099.37

Existing High Voltage Transmission Lines

S.N.	Decription	Length (Circuit km)
1	66 kv Transmission Line	514
2	132 kv Transmission Line	4193
3	220 kv Transmission Line	1266
4	400 kv Transmission Line	787
	Total	**6706**

South Asia Energy Scenario (MW)

S.N.	Country	Installed Power	Potential Power (Hydro)	Installed (Hydro)
1	Afghanistan		23000	
2	Bangladesh	28359	-	230
3	India	513729	150,000	50914
4	Bhutan	3473	36900	3467
5	Nepal	4099.37	100,000	3787.02
6	Sri Lanka	6300	2000	1957
7	Maldives	650	-	-
8	Pakistan	46605	60,000	11519
9	China	3790 (GW)	600 (GW)	445 (GW)

Per Capita Energy Consumption (KWh)

Country	Quantity	Sources
Afghanistan	144.20	Energy Statistics Pocketbook 2025
Bangladesh	608	https://lowcarbonpower.org/region/Bangladesh
India	1460	Ministry of Electricity Annual Report, 2025
Bhutan	9167	Zorig Melong: A Technical Journal of Science, Engineering and Technology Vol. 8 Issue 2 (2025)
Nepal	465	Nepal Electricity Authority, Annual Report (2082, Bhadra)
Sri Lanka	700	Ceylon Electricity Board, August 2025
Maldives	1556	https://www.worlddata.info/asia/maldives/energy-consumption
Pakistan	730	National Electric Power Regulatory Authority
China	7420	National Energy Administration (NEA) and the National Bureau of Statistics (NBS)

Sorces of Power Generation

Institution	Hydropower	Solar	Thermal	Co-generation	Micro Hydro	Total
NEA	**Grid**	**Off Grid**	25	53.41	-	**661**
	578.05	4.54				
NEA Subsidiry	748.4	-	-	-	-	748.4
IPP	2456.03	124.94	-	6	-	**2586.97**
AEPC	-	62.75	-	-	40.25	**103**
Total	**3787.02**	**212.69**	**53.41**	**6**	**40.25**	**4099.37**

Slogan: To become a partner in nation-building by developing and operating hydropower projects to boost the country's renewable energy production.

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Turbine	3 Jet Pelton
Head	237.8 m
Total Capacity	8.5 MW
Project Name	Upper Hewa
Country	Nepal
Year. O. Comp	2022

Turbine	Francis
Head	187.2 m
Total Capacity	19.8 MW
Project Name	Upper Solu
Country	Nepal
Year. O. Comp	2023

Turbine	4 Jet Pelton
Head	632.7m
Total Capacity	54 MW
Project Name	Super Dordi
Country	Nepal
Year. O. Comp	2023

Turbine	Francis
Head	188.9 m
Total Capacity	40 MW
Project Name	Upper Chameliya
Country	Nepal
Year. O. Comp	2023

Turbine	Francis
Head	182.2 m
Total Capacity	9.7 MW
Project Name	Ingwa Khola
Country	Nepal
Year. O. Comp	2024

Turbine	Francis
Head	120 m
Total Capacity	9.9 MW
Project Name	Kuwarsi
Country	India
Year. O. Comp	2024

Turbine	2 Jet Pelton
Head	128 m
Total Capacity	998 KW
Project Name	Chukeni
Country	Nepal
Year. O. Comp	2024

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Turbine	3 Jet Pelton
Head	320.59 m
Total Capacity	6 MW
Project Name	Super Hewa
Country	Nepal
Year. O. Comp	2025

Turbine	Francis
Head	135.9 m
Total Capacity	4.72 MW
Project Name	Upper Piluwa – 2
Country	Nepal
Year of RenV	2025

Turbine	2 Jet Pelton
Head	441.00 m
Total Capacity	5 MW
Project Name	Banu
Country	India
Year. O. Comp	2025

Turbine	2 Jet Pelton
Head	186.00 m
Total Capacity	4.2 MW
Project Name	Upper Lohore
Country	Nepal
Year. O. Comp	2025

Voltage	33 kV
Scope	Interconnection
Sub scope	Bus Bar Extension
Project Name	Upper Hewa
Country	Nepal
Year. O. Comp	2022

Voltage	33 kV
Scope	Interconnection
Sub scope	Substation
Project Name	Balanch
Country	Nepal
Year. O. Comp	2023

OTHER PROJECTS UNDER EXECUTION IN ASIA
Upper Irkhuwa Khola HEP - 14.5 MW
Junbeshi Khola - Interconnection
Khani Khola BOP Equipment - 30 MW
Upper Deumai Khola - 8.3 MW
Phedi Khola SHEP - 4.3 MW
Rellichu - 1 HEP - 28.8 MW
Pareng HEP - 14.55 MW
Madhya Chameliya HPP - 28.3 MW
Super Trishuli HPP - 100 MW - Power & Auxiliary Transformer Supply
Rabom Chu HEP - 5.20 MW
Lower Hewa Khola A HEP - 6.9 MW
Luja Khola Cascade HPP - 9.52 MW
Khimti Ghwang Khola Small HPP - 9.0 MW

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