

**Environmental Impacts of Hydroelectricity Projects
in the Modi Khola
(Commitments and Findings)**



Submitted to:
Nepal Forum of Environmental Journalists
Lalitpur, Nepal

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August 2019

Acknowledgement

We would like to express our sincere gratitude to Nepal Forum of Environmental Journalists for entrusting us to carry out this study. We express our appreciation to Mr. Subodh Gautam, Executive Director and Ms. Durga Karki, Programme Coordinator for providing guidance and facilitating the work of this study. We also appreciate Mr. Laxman Sapkota, Journalist for supporting us during the field work.

We would like to thank project officials, construction contractors, project-affected families and local people for sharing their field-based experiences and concerns on HEPs during the field study. We equally appreciate Messrs Manohar Bishwakarma Poudel, Chief, District Coordination Office, Parbat and Prem Sharma Poudel, Chair, Modi Rural Municipality for sharing their concerns and providing updated information on HEPs generated issues, local concerns, conflicts and experiences in resolving issues.

We thank Messrs Chandra Majhi and Puskar Bahadur Khadka for capturing issues and concerns in camera and for professionally driving during the whole period of field study.

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13 August 2019
Kathmandu

Acronyms

BS	Bikram Sambat
Co	Company
CSR	Corporate Social Responsibility
DDC	District Coordination Committee
DoED	Department of Electricity Development
EIA	Environmental Impact Assessment
EPA	Environment Protection Act
EPR	Environment Protection Rules
GoN	Government of Nepal
HEP	Hydroelectricity Project
IEE	Initial Environmental Examination
Ltd	Limited
MTL	Manang Trade Link
MoF	Ministry of Finance
MW	Mega Watt
NEA	Nepal Electricity Authority
NEFEJ	Nepal Forum of Environmental Journalists
NRs	Nepali Rupees
PRO	Public Relation Officer
Pvt	Private
SRCL	Soil, Rocks and Concrete Laboratory

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Executive Summary

The Government of Nepal has accorded high priority to hydroelectricity generation. Over 90 percent of the country's total energy (1,142 MW) is provided from hydropower. Nearly 78 percent of the total population has access to electricity by mid-March 2019. The Government has announced to generate 10,000 MW by BS 2082 (AD 2025). Nepal is observing BS 2075-'85 as 'energy and water resources decade'. However, there is an urgent need to make the hydroelectricity project (HEP) environment-friendly and sustainable.

Realising the urgency of resolving issues in HEPs, NEFEJ conducted this study to understand the environmental impacts of HEPs in the Modi Khola and know the level of implementation of mitigation measures as included in the IEE/EIA report of the concerned HEPs. In order to meet the objectives, the study team extensively reviewed literatures, observed sites from intake to powerhouse of each HEP from 30 June to 3 July 2019, including project-induced damages and interacted with elected representatives, district and municipality officials, local people, project officials, and contractors.

This study includes 4 HEPs – Modi and Lower Modi 1 HEPs in operational stage, and Middle Modi and Lower Modi in construction stage. The study area is from Birethanti, intake of Middle Modi to Chuwa, powerhouse of Lower Modie 1 HEP. These projects have carried out IEE or EIA study to identify environmental impacts and propose mitigation measures, including environmental monitoring and auditing.

In general, state of implementation of the mitigation measures in projects is not encouraging. None of the projects has complied with the Hydropower Development Policy (2001) of releasing at least 10 percent of the water flow to maintain aquatic life and its habitat. Fish ladder constructed in the Modi Khola HEP to ensure upstream-downstream movement of fish species is not functional. Local people informed that fish production has declined to 10 percent as compared to the pre-project condition.

Projects are implementing people's demand-based measures rather than as included in the IEE/EIA report. Projects have responded on local people raised environmental issues or conflicts occurred and project construction delayed. For example, Lower Modi HEP has agreed to construct two cemeteries just above its intake site and wall structures to protect Gadtara village from water discharge from tailrace. However, private sector projects have invested in road construction, school and health sector. The study documents the following findings:

1. Inadequate technical or geological studies and low implementation of environmental protection measures has generated additional environmental issues and has resulted to delay in project construction with cost increase.
2. None of the projects have complied with the Hydropower Development Policy related to the release of 10 percent of total water to maintain aquatic environment. This has direct impact on fish production. In cascade HEPs in between Birethanti and Chuwa, such release might not be effective to maintain aquatic lives and their habitat.

3. Local contractors are unaware of mitigation measures and recommendations of the environmental assessment reports.
4. HEPs in the Modi Khola offers learning on construction and operation-related challenges and ways to resolve project-people conflicts, and urge to develop human resources in installing major equipment in the powerhouse.
5. Location and design of the fish ladder is reported inappropriate and ineffective in the NEA-operated Modi Khola HEP.
6. Non-implementation of prior-commitments has raised 'mistrust' and project-people or project-worker conflicts have emerged repeatedly which has delayed construction.
7. Local government has made efforts to resolve 'conflicts', and encouraged private sector for HEPs development.

This study recommends to:

- a. institutionalize environmental monitoring as an integral part of the project construction and operation;
- b. conduct sectoral, or cumulative or strategic environmental assessment to evaluate environmental impacts of cascade projects (to minimize environmental assessment for each project);
- c. encourage local governments to cooperate, coordinate and facilitate resolving environmental issues;
- d. prepare IEE/EIA report by following its key principles and by using scientific methods with active participation of the local people;
- e. encourage local governments to spend certain portion of revenues from HEPs for watershed management activities to reduce damage of turbines from silt load; and
- f. conduct environmental auditing to know 'what worked and what did not' so as not to repeat the mistakes in similar projects.

INTRODUCTION

1.1 Meeting the clean energy demand

The major resources of energy in Nepal are biomass, petroleum products, coal and hydro-electricity. Many people in rural Nepal use biomass as a major source of energy due to lack of or inadequate supply of clean energy at affordable price. Nepal is rich in clean energy sources such as hydropower, solar and wind energy. Lack of technologies and weak financial condition has limited their use. Nepal has expanded its activities in utilizing hydropower in the recent years.

Nepal has economically viable potential of generating over 40,000 megawatts (MW) hydropower. Over 90% (1,029.58 MW) of the country's total electricity (1,142 MW) is generated from hydropower and 27 MW from solar. Nearly 78 percent of the total population has access to electricity by mid-March 2019 (MoF, 2019). Annual consumption of electricity in Nepal is about 100 kWh/person and US has more than 12,000 kWh/person. As electricity demand is higher than supply, 1,834.87 GWh have been imported from India.

During the last decade, the Government of Nepal (GoN) has formed several task forces on energy. The 2009 (BS 2065) task force has proposed to generate 10,000 MW in 10 years while 2010 (BS 2066) task force proposed to produce 25,000 MW in its 20 years Hydropower Development Work Plan. The 2011 'Energy Emergency Action Plan' proposed to generate 2,500 MW in 5 years. In 2017, the then Minister for Energy declared to generate 10,000 MW by BS 2082 under '*Nepalko Pani, Janatoko Lagani*'. In BS 2074, the then Minister for Energy published a white paper on 'Present Situation of Energy Sector and Immediate Work Plan' and proposed to produce 12,000 MW for domestic consumption in 5 to 10 years (Kandel, 2018). The GoN has also declared BS 2075-'85 the 'energy and water resources decade' to make 'Nepal prosperous and Nepali happy'. It clearly indicates the commitment of the governments in generating hydro-electricity but its development should be environment-friendly and sustainable.

With this in understanding, Nepal Forum of Environmental Journalists (NEFEJ) undertook this study.

1.2 Objective of the study

The broad objective of this study is to understand the environmental impacts of hydropower projects (HEPs) in the Modi Khola. The specific objectives are to:

- examine the impact of HEPs on physical, biological, social, economic and cultural aspects of the environment; and
- know the level of implementation of mitigation measures as included in IEE/EIA reports of the concerned HEPs.

1.3 Methodology

Environmental impacts of HEPs on Modi Khola were studied on the basis of primary and secondary information. Before the field visit, EIA reports of HEPs under construction and implementation stages in the Modi Khola, including other publications and news were collected from the Department of Electricity Development (DoED), Nepal Electricity Authority (NEA), project websites and online Medias. These documents provided a basis to understand general environmental issues and streamline the field study.

The study team, composed of Programme Coordinator at NEFEJ, researchers, local journalist (facilitator) and 'audio-visual crew' visited the field (HEPs in Modi Khola) from BS 2076.03.15 to 2076.03.18 (30 June to 3 July 2019). The team visited 4 HEPs from Birethanti, intake of Middle Modi HEP to Chuwa of United Modi HEP (also called Lower Modi 1 HEP), near Kusma, Parbat. Project sites from intake to powerhouse of each HEP were observed. The study team interacted and discussed with the stakeholders, including project officials such as engineers, public relation officers, supervisors and local people. In the next step, project affected families were identified, and discussed with to understand the project-induced damage and their concerns. For information verification and collection of additional issues, local administrations (Modi Rural Municipality and Parbat District Coordination Office) were contacted and discussed at length to collect reflections and their contribution to resolve issues, if any, from both elected and administrative personnel. Information collected in the field has been analysed and presented in this draft report.

Local facilitator was instrumental in organizing interaction/discussion meetings with the multi-stakeholders, contacting the key personalities related with the projects and also assisting to discuss with the project-affected local people.

1.4 Limitation of the study

This study has attempted to explore pertinent environmental impacts of HEPs on the aquatic ecosystem at length and highly based on field visit. Major impact, i.e., dryness of Modi Khola due to non-release of 10 percent of the total water by the projects was not observed due to rainy season. The field visit was limited to one season in Parbat district from Birethanti to Chuwa, powerhouse of Lower Modi 1 HEP. People, directly affected by the project activities, and projects under construction, were primarily consulted and given adequate focus to documents issues and concerns and measures undertaken to resolve them.

PROJECT HIGHLIGHTS

2.1 HEPs in the Modi Khola

The Modi Khola is a perennial river and a major tributary of the Kali Gandaki River in the Gandaki basin. The Khola originates from the high mountain (Himalayas) of Kaski district and joins with the Kali Gandaki at Modi-Beni of the Parbat District. The total length of the Modi Khola is approximately 50 km. The total catchment area of the Khola is 675 km² and main tributaries are Bhurangdi Khola, Rati khola, Pati khola, Malyandi khola, Ghandruk khola and Ambote khola.

Modi khola is highly potential for generating hydroelectricity. Number of licenses has been issued to generate electricity. During the field visit, four HEPs were observed. Two hydropower projects, namely Modi khola developed in Demuwa by NEA and Lower Modi- 1 developed by the United Modi Hydropower (Pvt) Ltd in Chuwa are in operation. Two hydropower projects – Middle Modi, promoted by Middle Modi Hydropower Limited and Lower Modi, promoted by Modi Energy (Pvt) Ltd were in construction stage during the field visit. Latter two projects will soon start electricity generation (Table 2.1).

Table 2.1 Installed Capacity of HEPs in the Modi Khola

SN	Hydropower Project	Promoter	Capacity (MW)	Status
1	Modi Khola	Nepal Electricity Authority	14.8	In operation since 2000
2	Lower Modi 1	United Modi Hydropower Development Co. Pvt. Ltd.	10.0	In operation since 2012
3	Lower Modi Khola	Manang Trade Links Pvt. Ltd.	20.0	Under construction
4	Middle Modi	Middle Modi Hydropower Ltd.	15.1	Under construction
5	Lower modi-II Cascade HEP	United Modi HP Pvt. Ltd.	10.5	Survey license issued

Source: SRCL, 1996; and MTL, 2008.

2.2 Environmental impacts and mitigation measures

Environmental Impact Assessment (EIA) is one of the proven tools to make the project environmentally-sound and sustainable. Nepal has established a legal system on environmental assessment with the enactment of Environmental Protection Act and its Rules in 1996 and 1997 respectively. HEPs of the Modi Khola have prepared IEE or EIA report. Most of the physical, biological and socio-economic impacts of hydropower projects in the Modi Khola are similar. All projects are run-of-the river type and are constructed and operated, as cascade projects, on the same river within a short distance.

The major identified physical impact in HEPs is related to dryness of river in the dry season due to diversion of water for power generation and non-release of 10 percent of water flow to maintain aquatic ecosystem. The predicted physical impact is an increase in temperature due to decrease in water flow. The evaluated impacts are damages of houses due to blasting at time of tunnel construction (Table 2.2).

The identified biological impact is the loss of aquatic life, mainly fish species and their habitat in the Modi Khola. Local people are concerned with their income activities through fishing and naturally they think of loss of fish species and aquatic life is affected by HEPs. Loss of aquatic life in the Modi Khola is also predicted in case of non-release of minimum required amount of water by HEPs, which reduces diversity and productivity of fish species as well as other aquatic life such as crab.

Identified socio-economic impacts are also related to local hotels and families depending on fishing for income. According to the owner of local hotels, people from different places come to enjoy with varieties of local fishes. At present income from fish sell is badly affected due to low flow of visitors or high flow of budget tourists. Families who are dependent on fishing as main occupation have changed their occupation (Table 2.2). The predicted economic impact is also related to closure of local hotels in future. Direct social and cultural impact of hydropower projects in the Modi Khola has not been noticed.

Table 2.2 Potential Environmental Impacts of HEPs in the Modi Khola

SN	Hydropower projects	Physical Impact	Biological impact	Social and cultural Impact	Economic Impact
1	ModiKhola (14.8 MW)	<ul style="list-style-type: none"> Drying of Modi Khola during dry season due to non-release of 10% water 	<ul style="list-style-type: none"> Fish species are decreasing 	<ul style="list-style-type: none"> Affected families depend on fishing as their main occupation 	<ul style="list-style-type: none"> Income of local hotels from fish selling is decreasing
2	Lower Modi 1 (10 MW)	<ul style="list-style-type: none"> Drying of Modi Khola due to non-release of 10% water Possible fall of livestock and human beings in open canal 	<ul style="list-style-type: none"> Fish species are decreasing Hearing capacity of project staff decreasing. 	<ul style="list-style-type: none"> Families dependent on fishing are adversely affected 	<ul style="list-style-type: none"> Income of local hotels is negatively affected
3	Lower Modi Khola (20 MW)	<ul style="list-style-type: none"> Drying of streams and drinking water sources due to diversion of water into tunnel 	<ul style="list-style-type: none"> Fish species and its production will be decreased to a large extent 	<ul style="list-style-type: none"> Families depended on fishing are affected Two local cemeteries need to be displaced 	<ul style="list-style-type: none"> Income of locals and fishermen adversely affected.

4	Middle Modi (15.1 MW)	<ul style="list-style-type: none"> • Drying of water sources due to tunnel construction • Damage and crack of houses due to blasting in the tunnel 	<ul style="list-style-type: none"> • Species of fishes and its quantity will be decreased 	<ul style="list-style-type: none"> • Families of damaged houses need to be displaced which will affect their social life as well 	<ul style="list-style-type: none"> • Income of locals and fisherman will be adversely affected
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Source: EIA reports of Middle Modi, Modi, Lower Modi and Lower Modi 1 HEPs

As mentioned above (Table 2.2), project-induced impacts are similar from Birethanti to Doubilla and Chuwa areas. Three projects have adopted tunnel technology while Lower Modi I has open canal (covered in geologically weak areas). EIA reports of the respective HEPs also provide mitigation measures.

Mitigation measures which are mentioned in the EIA reports are not implemented even to a minimum level. One of the major mitigation measures that need to be implemented by all HEPs is the release of minimum 10% of water to maintain aquatic life and its habitat. Both HEPs which are in operation have not complied with this measure. The EIA reports have included impact-based mitigation measures (Table 2.3). However, most of the mitigation measures related to construction period were not implemented.



Table 2.3: State of Implementation of Mitigation Measures

SN	Hydropower Projects	Mitigation measures and Field Visit-based Remarks
1	Modi Khola (14.8 MW)	<ul style="list-style-type: none"> • Release of 10% minimum flow of water in dry season has not been complied with. • For migration of fish species, project has constructed fish ladder. The environmental auditing report has confirmed inappropriate location and ineffective fish ladder (SRCL/NEA, 2002). However, the proponent has complied with this measure.
2	Lower Modi 1 (10 MW)	<ul style="list-style-type: none"> • Release of 10% minimum flow of water in dry season. It is under construction and should be monitored during its operational stage about its compliance and effectiveness. • Construction of fish ladder has not been mentioned in EIA report. Tailrace and Modi Khola-bed are at same level, and backwater to tailrace is repeatedly experienced during the rainy season. • Possible fall of people and livestock in the open canal. Such events occurred initially. Project has fenced or covered with slabs in geologically weak (landslide-prone) areas. No falling repeated now.

3	Lower Modi Khola (20 MW)	<ul style="list-style-type: none"> • Two cemeteries should be constructed just above the intake (water diversion) to ensure religious/cultural activities. Project has made commitment to construct it, according to local demand, once the site is identified or selected. • Project is ready to construct stream-bank protection structure to protect Gadtara village, opposite to its tailrace. • Project will provide priority in job opportunities to local people as agreed upon.
4	Middle Modi (15.1 MW)	<ul style="list-style-type: none"> • Compensation has been provided to the damaged houses due to blasting in tunnel. • For greenery maintenance, project will construct park and plant appropriate species on public land. • Project will also construct fish ladder to ensure upstream/downstream movement of fish species



Intake of Lower Modi HEP



High rate of silt (east side of intake of Lower Modi HEP)



Tunnel blasting-induced house damage in Middle Modi HEP

2.3 State of implementation of mitigation measures

Impacts-based mitigation measures must be implemented to make the development sustainable and environmental-friendly. The Environmental Assessment [Initial Environmental Examination (IEE) or Environmental Impact Assessment (EIA) in Nepalese context] report provides impacts-based mitigation measures for both construction and operational phases. Projects have implemented and have made commitments to implement the mitigation measures (Table 2.3). However, compliance is not related to effectiveness as clearly seen in construction of fish ladder both in 14 MW HEP and 10 MW Lower Modi I HEP. Similarly, impact related to drying-up of water source and diversion of water through tunnel was not predicted during the assessment and hence no mitigation measures are implemented to reduce impacts (Table 2.3). Similarly, blasting in tunnel-induced house damage was not predicted in Middle Modi HEP. This Project compensated the affected families (those houses were cracked to damaged) after confirmation from geological study.

Taking into consideration the mitigation measures as included in the EIA reports, project officials or contractors or local people have provided following updates regarding compliance of mitigation measures. However, their effectiveness is yet to know.

Box 1

Non-functioning of Fish Ladder and Water Release in the Modi Khola HEP

Mr. Aprim Bajracharya, Mechanical engineer in Modi Khola HEP informed that the Project constructed fish ladder as mentioned in the EIA report but it is not properly working. Old design of the HEP has weakness at intake. In the past, Project released minimum flow in the dry season as well. As time passed, demand of electricity increased and Project failed to release required minimum flow in dry season. He added that release of some amount of water may not meet the requirement of aquatic life. He said, Project has fulfilled all demands of the project-affected families and supported in road construction, and site protection structure. The Project also compensated for land.

Mr Nabaraj Poudel, Vice-Chair of Miteri Youth Club complained that Modi Khola HEP does not release water in the dry season. The Khola gets dry and fish species is disappearing and the flow of tourists who come to enjoy recipe of local fish is also decreasing. This has affected income of the local people.

Mr. Prem Sharma Poudel, Chair of Modi Rural Municipality is aware of the provision of release of 10% flow of water in dry season, and informed that Modi Khola HEP has not released that amount of water. We have requested to the Project for the release of water for several times. The Project commits to release but in reality it does not. This has created several environmental effects such as disappearance of fish species from the Modi. Consequently, families dependent on fishing and local hotel are adversely affected.

Mr. Manohar Bishowkarma Poudel, Chair of District Coordination Committee (DDC) expressed similar opinion that Modi Khola is center of Asala fish species. Non-compliance on release of water in dry season has greatly affected aquatic life and has also made the surrounding environment hot.

Box 2

Mitigation measures in Lower Modi 1 HEP and its implementation

Mr. Prakash Adhikari, Electrical Overseer informed that the Project has constructed fish ladder although it was not mentioned as a mitigation measure in the EIA report. The Project has not released 10% minimum flow of water in the dry season as nearby streams (Rati and Jarrey) have maintained water in the Modi Khola for fishes. There is no negative impact on fish species. The Project is concerned about environmental impacts but it has not released the minimum flow due to high demand of electricity in the dry season.

Mr. Bipin Sharma Poudel, Electrical Engineer informed that continuous noise of turbine has created the hearing problem among the staffs. This problem needs proper attention. He added open canal of the Project may be harmful to livestock and human beings.

Messrs Prem Sharma Poudel, Chair of Modi Rural municipality and Mahohar Bishowkarma Poudel, DDC Chair have similar opinion about non-compliance of release of 10% minimum water flow. This has created loss of fish species and decline in production as well.

Box 3

Waiting for Construction of Cemeteries and Village Protection Structures

Mr. Surendra Belbase, Public Relation Officer (PRO) in the Lower Modi HEP explained key constructional activities which are almost completed. Hydropower will be operated soon. The Project has implemented almost all mitigation measures of construction stage. The Project has invested NRs. 5 crore amounts in developmental activities such as road, drinking water supply, and temple and school construction. Workers' problem stopped Project work for about a month. Now, it has been solved as Project has agreed to offer job priority to the local people in the operational phase.

Mr. Belbase confirmed that design of cemeteries has been completed and they will be constructed soon after local people selects location. People of Gadtara village have demanded for the construction of protection wall on the left bank of Modi khola feeling insecure of water discharge from tailrace of the Project. He confirmed that the project is ready to construct protection structure as per the demand of Gadtara village.

Mr. Prem Sharma Poudel confirmed stop of work demanding job security. The problem was solved with the support of Parbat DCC, Modi Rural municipality and Ward Committees. Mr. Poudel also confirmed that the Project will construct cemeteries after fixing of location, and protection wall on the bank of Modi Khola to protect bank cutting at Gadtara side from water flow from tailrace (Photo).



Box 4

Implementation of Mitigation Measure in the Middle Modi HEP

Mr. Sijan Pahari, Engineer at Fewa Construction (Pvt) Ltd. said that they were not informed about environmental impacts of the Project and have no idea about the EIA report. He mentioned, Project has invested in physical structures such as river protection works and road construction. Geology of the Project site is weak due to Lumle fault. Earthquake has further weakened geology of the area. At time of blasting in the tunnel many houses get cracked and damaged too. The Project has tested the geology of the area and provided compensation to the affected families. He added about 80 local people got employment in project construction.

The Project has also constructed fish ladder. He expressed dissatisfaction about protection structure in residential area across the intake. Protection structures need to be constructed in many places and Project will construct as per need. All hydropower projects have to release 10% water in dry season to maintain aquatic life but this is not implemented.

Mr. Lal Bahadur Thapa, Engineer at Himal Hydro, responsible for Engineering Procurement and Construction, informed that Project has implemented most of the mitigation measures. At the time of construction of office building only limited trees were cut down and saved more trees. The Project is planning to construct park and will plant more trees.

Mr. Sudarshan Sherchan, Public Relation Officer in Himal Hydro confirmed project-induced house crack due to blasting in tunnel, and Project has provided financial support for 31 houses as per the geological study report. The Project has provided about NRs. 3 crore and 80 lacs to construct village road, school, health post and club as per the recommendation of the Parbat and Kaski Concern Committees.

According to Prem Sharma Poudel, lots of problems were created in the Middle Modi HEP. The Project failed to make required geological study before the construction activities. During blasting inside tunnel, nearby houses were cracked and two houses were damaged. Local people asked for compensation. Dr. Arjun Bhattarai studied geology of the project area, and reported house damage linked with blasting activities. The Project compensated to the affected households. Mr. Poudel added, development is important but human life is more important. Development is done for the people and by the people. So, all mitigation measures must be implemented at appropriate time to make the development sustainable.

Above information sufficiently confirms project activities responsible in creating adverse environmental impacts. Although mitigation measures are proposed for identified impacts in IEE/EIA reports, some of them such as release of 10 percent of water are neither implemented nor effective in maintaining and/or improving aquatic environment.

FINDINGS

The Modi Khola will be diverted to the tunnel just below Birethanti to generate electricity from the Middle Modi HEP. Water released from its tailrace will be diverted from about 100 m downstream to the NEA-operated Modi Khola HEP. In Patichaur, distance between tailrace of Modi Khola and intake of Lower Modi HEP is about 200 m. Furthermore, water released from tailrace of the Lower Modi at Gadtara area flows in the Modi Khola for about 400-500 m and then has been diverted to open canal of the Lower Modi 1 HEP to generate 10 MW electricity. It means, Modi Khola will be almost devoid of water during the dry season in between Birethanti and Chuwa, tailrace of Lower Modi 1 HEP. The following findings are based on the field visit of this portion of the Modi Khola and four HEPs.

3.1 Effectiveness of the Mitigation Measures

3.1.1. Modi Khola HEP

The feasibility study of Modi Khola HEP was conducted by NEA in 1993 and EIA report was prepared in 1995. This HEP is in operation since 2000. Mitigation measures as proposed in the EIA report are:

- Minimum release ($0.5\text{m}^3/\text{s}$) of water during dry season during the dry season to save aquatic ecosystem; and
- Construction of fish ladder, fish hatchery and fish trapping operation.



The field visit in July 2019 (rainy season) revealed water release from weir. According to the local people, local government officials and project staff, Project does not release minimum required amount of water to maintain or improve aquatic ecosystem in the dry season, and it clearly indicates non-implementation of mitigation measures. However, fish ladder is constructed but it has no use as water is not released in dry season. Fish hatchery has not been developed and fish trapping operation as mentioned in EIA report has not been performed. Overall, required mitigation measures are either not implemented or not effective.

High rate of siltation in the desander is repeatedly reported. Damage of turbine from silt and sand is a permanent problem in many HEPs in Nepal. Each year, Modi Khola HEP also invests significant amount for turbine maintenance. HEPs operated in the Modi Khola experience it.



3.1.2 Lower Modi 1 HEP

The IEE report of Lower Modi 1 was conducted in 2009. This HEP was in operation since 2012. One of the mitigation measures proposed in IEE report is minimum release ($0.95\text{m}^3/\text{s}$) of water during the dry season.

The July 2019 field visit confirmed the flow of water in the river during the rainy season. Local people informed that, in dry season, the project does not release minimum quantity of water and this indicates non-compliance. The Project has constructed fish ladder but it has no use due to lack of water flow in dry season. Hearing ability of staff is reduced in powerhouse due to high noise generated by turbines. The Project has yet to address it.

3.1.3 Lower Modi HEP

The EIA report of Lower Modi Khola HEP was prepared in February 2008. This Project is at the final stage of construction. There is also provision for the release of minimum flow of water. It means conservation of aquatic ecosystem and life form has not received due attention in this Project. The cemeteries will be constructed soon on the bank of Patti or Modi Khola. Overall constructional mitigation measures are implemented by the project. Stream protections works are more focused and greenery part is comparatively weak.



3.1.4 Middle Modi HEP

The IEE study of Middle Modi HEP was carried out in 2012. The Project is in construction phase. Conservation of aquatic environment has not received priority. The Project has supported local people for social service or infrastructure development activities rather than implementation of project-induced environmental impacts. Release of minimum water flow is for operational stage of the project.

During the construction phase, some houses located above the tunnel were observed cracked and damaged due to blasting in the tunnel. The geological study confirmed blasting-induced house damage and Project provided compensation to the affected households. In a nutshell, contractor is unaware of mitigation measures and Himal Hydro has approached to minimise loss of plants during the Project construction stage. However, the Project is facing technical difficulties in constructing the powerhouse.



3.2 Projects contributions

HEPs have contributed to generate clean energy to meet domestic needs and promote local economies. About 25 MW of electricity is generated and transmitted to Pokhara station. This will contribute to minimize load shedding and advance socio-economic opportunities.

Projects have provided employment opportunities to the local people in construction and operational phases. Projects have invested in developmental works such as road, temple and school construction. The Middle Modi HEP has provided NRs. thirty eight million for road and school construction and health sector as its corporate social responsibility (CSR). Similarly Lower Modi has invested NRs thirty million for developmental works as per the demand of local people. The new legislation has provisioned for providing 25% royalty of the project to the local government. After implementation of this provision, annual income of Modi Rural Municipality is expected to reach forty million. In a nutshell, Projects have provided agreed amount as support for social service and infrastructure development in the project's adjoining areas.

3.3 Project Construction Issues

The prescribed HEPs in EPR, 1997 are constructed after the approval of EIA or IEE report. Environmental impacts are either identified or predicted and then evaluated for both construction and operational stages. Mitigation measures are included in the IEE/EIA report to reduce adverse impacts. Sometimes, unpredicted impact might also occur.

In case of Middle Modi Hydropower, 30 houses were cracked and 2 damaged at the time of blasting inside the tunnel. Local people protested, stopped work, and demanded for compensation. The Project was closed for about 6 months. After geological test of the affected area, the Project provided compensation and started its work. It made delay in project work. Still, the Project has faced challenge to construct the powerhouse.

In Lower Modi HEP, local people complained that stream water sources are drying-up due to tunnel construction and water diversion in the tunnel. In dry season, people are facing drinking water problem due to drying-up of springs. Furthermore, agriculture production is also declining due to shortage of water for irrigation.

In Lower Modi HEP, workers protested for job security in operation and Project was closed for about a month. The project agreed to give priority in job to local people based on their experience and duration of their work in the project to resolve the issue.

3.4 Project Operational Issues

Impact-based mitigation measures are also identified and included in the IEE/EIA report for operational stage. However, unpredicted impacts may emerge and new issues may come-up during implementation. In number of cases, issues and challenges may be created due to non-implementation of mitigation measures as well. Reviewing the approved environmental assessment reports, major common issue of operating projects - Modi Khola HEP and Lower Modi 1 - is non-release of 10% of minimum flow of water in the dry season. Both projects have

mentioned to release minimum flow. This non-compliance matters a lot to the survival and productivity of Asala fishes in the Modi Khola.

Local people unanimously informed that fish production and fish diversity is decreasing. This has greatly affected livelihoods of the fish-dependent families and local hotels. Furthermore, all water diversion from Modi Khola has increased temperature of the stream as well.

Officials of the operational stage projects raised issues related to high silt load in the Modi Khola and damage to turbines. Each year, significant amount is spent for turbine maintenance. However, such maintenance has been very fast in the recent years.

3.5 Key conflicts and problem solving approaches

Increasing demand of local people and non-implementation of necessary activities has accelerated conflict between local people and projects. In Middle Modi HEP, tunnel blasting has damaged local houses. People demanded for compensation. The problem was not locally solved. Local government and DDC, after geological study, supported to resolve the conflict through compensation.

In case of Lower Modi HEP, conflict between worker and project was experienced. Workers asked for continuity of job in operation phase and organized a month-long strike. Later the problem was solved with the support of Modi Rural Municipality and local stakeholders. Local people and Project staff agreed to construct protection wall along the left bank of the Modi Khola (Gadtara village) and opposite to tailrace of this HEP.

The perennial conflict between stakeholders (local governments, hotels, club and people) and HEPs is related to the release of 10% of water by HEPs in all seasons. Non-compliance has been reported for dry season. During the field visit (rainy season), water flow in the Modi Khola was adequately maintained for aquatic life.

3.6 Key opinions of the stakeholders

Opinions and concerns of the project officials, construction contractors, local people and local governments have been summarized during the field visit and are as follows:

Box 5.

Unaware of the Environmental Impacts

Mr. Sijan Pahari, Engineer of the Phewa Consulting (Pvt.) Ltd, and the contractor of the Middle Modi HEP, informed that contractor is constructing the headwork (intake) and powerhouse as per the design provided by the client. Mr. Pahari has neither seen EIA nor has been informed about the environmental protection measures (benefit enhancement and adverse impacts mitigation measures). He opined that the Project will contribute to promote tourism; Project has constructed access road and protection wall to save few houses of the Birethanti near the Project intake.

Mr. Pahari showed his dissatisfaction for not being able to construct more protection wall to save the settlement, address drying-up of water sources, damage or crack of houses due to 'controlled' blasting in the tunnel, tunnel squeezing associated with geological faults in Lumle area, loose rock mass, and increased landslides. He is equally worried about low water flow in the Modi Khola and possible inadequacy in water even if 10 percent of the water is left in the Khola as per the Hydropower Development Policy.

The Project has neither Environment Section or Unit nor Environment Officer to implement or advice or support for implementation of mitigation measures for project-induced impacts and conduct compliance and impact monitoring. The contractor is unaware about the environmental requirements to make the project environment-friendly and sustainable. S/he assumes that detail design might have considered the findings and recommendations of the EIA study.

Mr. Lal Bahadur Thapa, Engineer of the Himal Hydro which is responsible for Engineering Procurement and Construction (EPC) informed that it conducts monitoring of all activities and has made effort to cut only 'necessary' tree species as a part of site clearance. The Project has planned to plant appropriate species after the construction stage to make the project area green.

Mr. Sudarshan Sherchan, Public Relation Officer informed that project-induced damaged houses received financial support for 31 houses as per the geological study report and agreement between the Project and Public Concern Committee. The Project has provided about NRs. 3 crore and 80 lacs to construct village road, school, health post and club as per the recommendation of the Parbat and Kaski Concern Committees as a part of its Corporate Social Responsibility (CSR).

In a nutshell, local officials of the contractors are unaware of the environmental impacts, EIA report recommendations, implementation of mitigation measures and need for carrying out environmental monitoring to understand effectiveness of mitigation measures in addressing project-induced adverse environmental impacts on physical, chemical, biological, social, economic and cultural domains of the environment.

Box 6

Decline in Fish Production and Drinking Water

Mr. Nawa Raj Poudel, Vice-Chair of Miteri Youth Club and a hotelier in Ambot (a small settlement between Dimuwa and Dobilla) was extremely worried about the drying-up of stream and drinking water source due to tunnel of the Lower Modi HEP. Mr. Poudel informed that people stop at hotels in Ambot for food and local fishes. All water is diverted to generate electricity from the Modi Khola during the dry season. Now, fish production is greatly affected and is declined to only about 10 percent as compared to pre-project fish production. It has greatly affected the local market and livelihood of local people who depend in collecting and selling fishes. In order to meet the increasing demand of fish, hoteliers collect or purchase fishes from Thado Khola and Kali Gandaki, several kilometers downstream of the Modi Khola.

Mr. Poudel informed that 'we urged several times to implement the recommendations of the EIA report and release 10 percent of total water in the Modi Khola but it has not been complied with'. 'In order to address water scarcity in the villages, the Municipality will implement "one house: one tap" project very soon', said Mr. Kuman Singh Gurung, Chief Executive Officer in the Modi Rural Municipality. This was further stressed by Mr. Bikash Timilsina, Ward Chair of Modi Rural Municipality-2. Mr. Timilsina also informed that the Municipality has requested the Provincial Government to develop an integrated settlement in a safe place for 49 Project-affected households so as to resolve Project-people conflict.

The tunnel-induced water scarcity has been greatly experienced in stream, water mill, and drinking water in Ambot hotels, agriculture firm and livestock during the dry season as water flows from the tunnel. In winter and dry season, drinking water is collected from Tarevhir community forest area which is across the tunnel. The Project has made several commitments to relax conflicts and tensions with local people, but it has yet to implement. Local people consider future of Ambot village at 'risk' from water scarcity and fish.

Box 7

People-centered Infrastructure Development

Mr. Prem Sharma Poudel, Chair of the Modi Rural Municipality urged for prioritizing and implementing people-centered electricity and road projects. As development is for the people and by the people, Projects should not harm the people, damage people's property and adversely affect people's livelihood.

The Middle Modi HEP faced geological problem due to weakness in technical studies and provided compensation for damaged houses. The Lower Modi HEP was closed for 31 days due to demand of the workers for job in its operational stage. The Chief District Officer, People's Concern Committee, Project official, and workers discussed issues and resolved with job priority to local workers. Similarly, 26 people of Gadtara, located east to the powerhouse site of the Lower Modi HEP, predicted possible stream-bank cutting due to tailrace water, and demanded for bank protection works. The Project has agreed to invest on bank protection works to protect the Gadtara village. Furthermore, the Project has agreed, in writing, to develop the 'ghat' (cremation site) at two places near the intake of the Lower Modi HEP.

Considering the Modi Khola as an 'energy hub' and need for Indian and Korean skilled manpower in installing electricity equipment in powerhouse, Mr. Poudel shared his interest to establish an Institute to offer technical education to develop human resources in electricity generation and maintenance. He advocated for the need for coordination, partnership building, and inter-relationship to develop Modi Khola basin for human resource development.

Mr. Poudel urged all concerned to engage local people – both project beneficiaries and to be affected people – while preparing the EIA report to make such report a tool for 'problem solving' rather than creating conflicts. As Modi Khola is not used for irrigation and drinking water purposes and contains high amount of silt/sand, tunnel construction-induced water shortage demands for detail technical studies and implementing appropriate measures to resolve these problem. Mr. Poudel confirmed that none of the projects have adversely

impacted on local drinking water supply, health post medicines, and forest areas, including no major accidents while constructing the project.

The Chair also urged to consider the adverse impacts of the project in the livelihoods of local fishermen and fish-dependent communities in Ambot and Doubilla areas. The Project has supported for the construction of road, school building and generated some employment and will provide one-fourth of the total revenue to the local government. Hence, local government is much concerned to make investment-friendly, attract private sector, facilitate project activities, resolve any issues and challenges amicably and create 'win-win' situation.

Box 8

Environmental Issues in Tunnel and Open Canal

In Lower Modi-1 HEP, water is diverted through 'open canal', covered in geologically weak areas, to generate electricity. Other three projects divert water through a tunnel of different length. Issues and challenges in the tunnel construction are related to house 'damage and crack' due to blasting, water source drying, seepage and channeling of 'underground' water towards the tunnel, and safe disposal of tunnel 'muck'.

The Lower Modi 1 HEP experienced fall of goats and wild animals on the 'uncovered' open canal in its first year of operation, and damage of canal due to landslides. Animals were collected in 'trash rack' in the surge tank. The Project wire-fenced the open canal and 'covered' with concrete slab in geologically unstable and landslide-prone areas.

In a nutshell, non-implementation of prior commitments or mitigation measures, non-sharing of IEE/EIA reports, inadequate technical studies, construction technologies/practices and inadequate response to local people's concerns have created conflicts. Local governments, concern committees, and project officials have jointly resolved issues and challenges.

3.7 Challenges and opportunities

Based on field visit and interactions with project officials, contractors, representatives of the concern committees, local people and local governments, major issues are related to non-compliance of mitigation measures as contained in IEE/EIA, lack of monitoring, and unaware of environmental impacts. Both HEPs in operation have not released 10% minimum flow of water in the dry season and it has greatly affected aquatic lives such as fishes and crab and their habitat.

Local hotels in operation from many years are facing challenges to offer local 'delicious' fishes. About 20 fishing-dependent families live in Modi Rural Municipality. They have changed their occupation due to decline in fish production and fishing in the Modi Khola.

The temperature of the streamside area has changed. Before 5-6 years back, temperature was cold in dry season. Due to low flow of water, temperature is increasing. If the flow of water decreases in the same pattern aquatic life will disappear and other environmental problems may crop-up.

Along with challenges, HEPs provide lots of opportunities. The Projects have provided clean energy and employments during construction and operational stages, and invested significant amount of budget in developmental works such as road construction, school and health sector. Local government will receive 25% of the total revenue and it can be used for social and economic development activities in the area, including watershed conservation to reduce soil erosion and silt load in the Modi Khola.

The HEPs in the Modi Khola offers knowledge and learning in making them environment-friendly and sustainable. This study documents the following findings:

1. Inadequate technical (in particular geological) studies and low implementation of environmental protection measures has generated additional social issues such as difficulty in powerhouse construction, delayed project construction, and increased cost to resolve local conflicts or demands in Middle Modi HEP.
2. None of the projects have complied with the Hydropower Development Policy (2001) related to the release of 10 percent of total water to maintain aquatic environment. This has direct impact on fish production which is said reduced to 10 percent of the pre-project stage. In the cascade HEPs in between Birethanti and Chuwa, such release might not be effective to maintain aquatic lives and their habitat as water is diverted from tailrace of one project to generate electricity in another HEP. It calls for revisiting non-evidence-based policies.
3. Local contractors assume that design of the project structures should have considered mitigation measures and recommendations of the environmental assessment reports. This is not the case as contractors are unaware of such measures.
4. Number of hydroelectricity projects in the Modi Khola offers learning on construction and operation-related challenges and ways to resolve project-people conflicts and urge to develop human resources in installing major equipment, particularly in the powerhouse.
5. As per the EIA report, Modi Khola HEP has constructed fish ladder to ensure upstream-downstream movement of fish species. However, location and design of fish ladder is reported inappropriate.
6. Non-implementation of prior-commitments has raised 'mistrust' and project-people or project-worker conflicts have emerged repeatedly which has delayed project construction.
7. Local government has coordinated to reduce and resolve 'conflicts', and encouraged private sector in HEPs construction and promotion. Local government understands economic benefits from HEPs.

These practical experiences urge to consider during project design, carrying out IEE/EIA reports, conducting environmental monitoring, and implementing similar HEPs in Nepal.

CONCLUSION AND RECOMMENDATIONS

4.1 Conclusion

Four HEPs, two in operation and two in construction phase located between Birethanti and Chuwa areas in the Modi Khola in Parbat district can be considered cascade projects. Additional two projects have been planned in the Modi Khola.

These HEPs are obliged to implement mitigation measures as per the legally approved IEE or EIA reports in both construction and operational phases. Field study has confirmed that project contractors are not aware of IEE/EIA reports and hence there is no chance to implement mitigation measures in construction period. In Middle Modi HEP, blasting inside the tunnel has cracked and damaged the houses. After geological study, the Project has compensated as agreed upon with the project-affected families.

All HEPs under this study have not complied with the Hydropower Development Policy¹ (2001), which clearly mentions that HEPs should implement measures as per the EIA study report and release at least 10% of the minimum flow of water to maintain aquatic life in the river/stream. Two HEPs under operation have mentioned in mitigation measures of EIA report to release 10% minimum flow of water in dry season. This measure has not been implemented. This has affected aquatic life, and species of fishes are disappearing from the Modi Khola. Local people have complained reduction on fish diversity and production.

HEPs are providing clean energy that mitigates environmental pollution. The Projects have invested large amount in developmental works such as road construction, school and health sectors. Local government gets 25% revenue from each Project. After completion of two constructional projects, local government will collect revenue to about NRs. forty millions from HEPs only. Projects have also provided employment opportunities to the local people.

This study provides additional knowledge, experience and learning in promoting HEPs in Nepal. It calls for carrying out necessary technical studies, implementing mitigation measures as included in the legally approved IEE or EIA reports, complying with the Policy provisions (10 percent water release), circulating the approved IEE or EIA reports widely and to field staff and contractor, developing human resources to install equipment in powerhouse, constructing appropriate and user-friendly fish ladder, avoiding or reducing 'mistrust' and/or appreciating

¹ The Hydropower Development Policy (2001) includes environmental provisions as its working policy which states "provisions to implement the programmes identified under the environmental impacts assessment study report shall be made in the project sites where implementation of infrastructures such as powerhouses, dam sites, tunnels or canals and reservoirs, transmission lines, distribution lines of the hydropower generation project have direct adverse impact. The prevailing laws shall govern the environment-related matters during the construction of the hydropower projects. Provision shall be made to release such quantum of water which is higher of either at least 10 percent of the minimum monthly average discharge of the river/stream or the minimum required quantum as identified in the environmental impact study report. (#6.1.1.)

the efforts of the local governments in resolving 'conflicts'. It calls for rethinking the release of water to maintain or improve aquatic ecosystems in cascade projects.

4.2 Recommendations

Based on extensive field study, consultation with project officials, contractors, project affected people, district and local governments, and review of the existing environmental reports, following recommendations have been made:

- a. Environmental monitoring (at least compliance and impact monitoring) must be an integral part of the project construction and operation. Third party monitoring would contribute for unbiased outcome.
- b. Sectoral Environmental Assessment, or Cumulative impact Assessment or Strategic Environmental Assessment would be useful to evaluate environmental impacts of cascade projects.
- c. Cooperation and coordination between the projects and facilitation from local governments would contribute to resolve environmental (physical, chemical, biological, social, economic and cultural) issues.
- d. IEE/EIA report should be prepared by following key principles and by using scientific methods with active participation of local people. In-depth consultation with project-affected families would be an 'win-win' situation to resolve environmental issues during construction and operational stages.
- e. Local governments should be encouraged to spend certain portion of the revenues from HEPs for watershed management activities to reduce damage of turbines from silt load.
- f. Environmental auditing should be an integral part to project administration to know 'what measures worked and what did not' so as not to repeat mistakes in similar projects.

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United Modi Hydropower Limited – Lower Modi 1 Hydropower Project

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Annex 1

List of Persons Contacted

SN	Name	Designation	Organisation or Address
1	Aprim Bajracharya	Mechanical Engineer	ModiKhola Hydro-electric Project, Dimuwa
2	Bal Bhadra Sharma	Surveyor	Phewa Consulting (Pvt.) Ltd, Middle Modi HEP
3	Bal Govinda Sah	Store keeper	Phewa Consulting (Pvt.) Ltd, Middle Modi HEP
4	Bikash Timilsina	Ward Chair	Modi Rural Municipality – 2, Deopur
5	Bipin Sharma	Electrical Engineer	United Modi Hydropower Limited (Lower Modi HEP-1), Kusma, Parbat
6	Ganesh P. Bhandari	Asst. Mechanical Engineer	ModiKhola Hydro-electric Project, Dimuwa
7	Hem Lal Pokhrel	Farmer	Modi Rural Municipality – 2, Kalyani, Aaite Village
8	Jaya Prasad Gautam	Chief, Education	Modi Rural Municipality, Patichaur
9	Jeevan Malla	Electrician	No Light, Nepal Electricity Authority, Patichaur
10	Kalpana Ghimire Nepal	Chief District Officer	Office of the District Administration, Kusma
11	Khim Bahadur Khatri	Chair	Hydropower Concern Group, Birethanti
12	Kuman Singh Gurung	Chief Executive Officer	Modi Rural Municipality, Patichaur
13	LalBahadurThapa	Engineer	Middle Modi Hydroelectric Project, Himal Hydro and General Construction Ltd., Deopur
14	Manohar Biswakarma Poudel	Chief	District Coordination Committee, Kusma
15	Maya Devi Khatri	Farmer	Modi Rural Municipality – 2, Kalyani, Aaite Village
16	Megh P. Dhungana	Farmer	Modi Rural Municipality – 2, Kalyani, Aaite Village
17	Nawa Raj Poudel	Vice-Chair	Miteri Youth Group, Ambot, Parbat (near Lower Modi HEP powerhouse site)
18	Nirmala Kumari Dhungana	Farmer	Modi Rural Municipality – 2, Kalyani, Aaite Village
19	Prakash Adhikary	Overseer (Electrical)	United Modi Hydropower Limited
20	Prem Sharma Paudel	Chair	Modi Rural Municipality, Patichaur
	Raj BahadurSubedi	Worker	Krishna Integrated Agriculture Farm, Ambot, Parbat
21	Ram Shrestha	Truck Operator	Phewa Consulting (Pvt.) Ltd, Middle Modi HEP
22	Seti Mahat	Vice-Chair	Modi Rural Municipality, Patichaur
23	Sijan Pahari	Engineer	Phewa Consulting (Pvt.) Ltd, Middle Modi HEP
24	Sudarshan Sherchan	Public Relation Officer	Middle Modi Hydroelectric Project, Himal Hydro and General Construction Ltd., Deopur
25	Sumitra Dhungana	Farmer	Modi Rural Municipality – 2, Kalyani, Aaite Village
26	Surendra Belbase	Public Relation Officer	Lower Modi Hydroelectric Project, Site Office

Local Facilitator: Mr. Laxman Sapkota, Journalist
