

Energy and Livelihood: Exploring the Linkage between Micro Hydro Power and Marginalized People in Rural Nepal

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By
BUDDHI BAHADUR NEPALI

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TU Regd. No. 22891-91

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LETTER OF RECOMMENDATION

We certify that the dissertation entitled '**Energy and Livelihood: Exploring the Linkage between Micro Hydro Power and Marginalized People in Rural Nepal**' submitted by **Buddhi Bahadur Nepali** to the Faculty of Humanities and Social Sciences Tribhuvan University for the degree of **Doctor of Philosophy** was completed under our supervision and guidance.

The dissertation is the candidate's original work. We have carefully read the substance of his dissertation. We, therefore, recommend that this dissertation be accepted by the research committee for the final examination in the fulfilment of requirement for the **Degree of Doctor of Philosophy** in Rural Development.

Dissertation Committee

.....

Supervisor

Prof. Dr. Mangala Shrestha
Central Department of Rural
Development
Tribhuvan University, Kathmandu

.....

Co-Supervisor

Dr. Jagan Nath Shrestha
Visiting Professor
Center for Energy Studies
Institute of Engineering, TU

August 4, 2014

APPROVAL LETTER

DECLARATION

I hereby declare that this Dissertation is my own work and that it contains no materials previously published. I have not used its materials for the award of any kind and any other degree. Where other authors' sources of information have been used, they have been acknowledged.

.....

Buddhi Bahadur Nepali

Date: 5 July, 2015

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ABSTRACT

The micro hydropower has been one of the most promising and commonly adopted decentralized technologies among the renewable energy in the global scenario and in Nepal too as it provides a renewable, sustainable and clean source of energy to its users. The existing literatures have argued that Micro Hydro Power (MHP) has contributed to the assets of livelihood of rural and disadvantaged people. With the intensive review of literatures related to renewable energy and livelihood, MHP and livelihood; the study identifies the gaps in the state of existing knowledge towards the rural marginalized peoples and guided to formulate appropriate research problem, research objectives and hypothesis. In this context, this study explores the linkage whether the assets of livelihood of rural marginalized people have been changed or not after the establishment of MHP from the livelihood perspective. It examines the practices of governance of MHP in the whole process of construction, power distribution, sustainable management and benefit sharing mechanism for the focused rural marginalized peoples i.e. poor, disadvantaged, Dalits, women, ethnic groups etc. from the good governance perspective. Further the study evaluates the policy of government on the MHP development in Nepal.

Three MHP projects of three districts were selected on the basis of geographical differentiation employing the purposive sampling technique i.e. Phak Phok MHP of Ilam from the Eastern part, Kumpur MHP of Dhading from the Central part and Pachuwa Khola MHP of Baglung from the Western part of Nepal. The study has adopted the theoretical framework of ‘Theory of Practice’ and ‘Sustainable Livelihood’ which assert the dialectical relationship between structure and agency. According to the research problem, the conceptual framework and the nature the study has designed guided to adopt mix research approach as it gives the detail information of stipulated research questions substantially.

For the quantitative approach, the household survey was randomly collected from sample size of 181 HHs covering 61 of Phak Phok MHP, 60 of Kumpur MHP and 60 of Pachuwa Khola MHP. The structured and semi-structured interviews questionnaire was used to collect survey data. The in-depth interview, focus group discussions with check list (FGDs), and personal observation tools of the qualitative approach were employed i.e. 42 in-depth interviews, 14 from each MHP; and 15 Focus Group

Discussions, 5 from each MHP; and personal observation in the whole study. To employ the research tools in the field site, Dalits, women, economically backward, indigenous people and others have been balanced. The people having no or less access to and control over in the livelihood assets and political power are defined as marginalized people. Those marginalized people are categorized on the basis of caste, ethnicity, class (economic aspects), gender, disability, single women (widow), spatial remoteness including political power. Out of total 181 respondents, 109 respondents are marginalized i.e. 24 from Dalits, 54 from Janajatis, 15 from Brahmins and 16 from Chhetri communities. Similarly, of the total 42 in-depth interviewee, 27 respondents are marginalized i.e. 5 from Dalits, 10 from Janajatis, 2 from single women, 5 from Brahmin and 5 from Chhetri communities. In FGDs, Dalits, Janajatis and mothers' groups are taken as marginalized people.

The research hypothesis regarding to the change in assets of livelihood and practices of good governance after establishing MHP has been tested by the Chi-Square Test at 5% level of significance with respective degree of freedom, and the validity of positive association is confirmed by the Binomial Test. The research books, journal, dissertations, Acts, Regulations, Policies, National Plans, Budgets, Economic Survey of Nepal government, etc. have been reviewed as a secondary source of data. Similarly, for the analysis of policy related to micro hydropower, the reports of NPC, AEPC, UNDP, World Bank, other policy related documents were concisely reviewed. The growth trend of Micro Hydro from the fiscal year 1986/87 to 2010/11 and its impact on electricity, gas and water GDP has been tested by the Chow Test.

The quantitative data and qualitative data collected from the field study and review of secondary data have been triangulated during the process of analysis. Household survey data has been analysed using tabulation, cross-tabulation, pie chart and bar diagram of SPSS and MS Excel software during the process of interpretation of data.

Out of the total respondents, only 8.3% have revealed extra benefits to the local people by MHP and 91.7 percentages of respondents have rejected it. Of the total respondents 15, 40% have revealed the extra benefits to the local people by participation in management committee following the 13.3% of getting concession in tariff and job opportunities. Only 44% of total respondents have accepted increase in the family income generation after the MHP establishment but 55.2% has rejected it.

At 5% level of significance and $df = 2$, $\chi^2_{cal} (= 3.596) < \chi^2_{crit} (= 5.99)$ accepts the null hypothesis and indicates no association between MHP and income generation. This concludes that the MHP has no significant positive impact on income generation of rural people.

24.3% have diversified their livelihood by vegetable farming, poultry farming, cow/buffalo farming and fruit farming through the MHP following 23.2% of cow/buffalo farming and fruit farming, and 2.8% by poultry farming. This numeric figure indicates that the MHP has contributed significantly to the livelihood diversification in farming through access to electricity.

21.4% have revealed that the MHP has supported them to electronics selling and maintenance following 8.2% of electronics and hotel operation, 0.6% as computer services. Remaining 12.2% respondents of total 181 stay silent who were mostly from Dalits and Janajatis. This indicates that the MHP has not supported them to operate new enterprises.

64.6% have revealed that the MHP has increased the land valuation, 17.2% have revealed that the MHP has contributed in decreasing the migration to some extent but 79% of them expressed as usual condition, 23.2% have revealed that the MHP has contributed in road extension and drinking water, school/college development equally. It indicates the positive impact of MHP on land valuation, decreasing migration and infrastructure development.

The MHP has contributed to the rural people by creating business such as poultry farming, electric shops, photo studio; operation of mills, computer training, and extra facilities including the employment viz., operator, manager and tariff collector. But, the marginalized poor and disadvantaged people like women, Dalits are engaged in the sewing, weaving, and other traditional occupations instead of modern business up to the late evening and early morning. Though some of the management committee of MHP under study has provided loans and other certain incentives to poor Dalits and disadvantaged people at cheap rate to operate small enterprises apart from electricity facilities has supported to build up their social agency to struggle the structure. But out of the total respondents, 50.3% have accepted the contribution of MHP to the poor and disadvantaged people and 49.7% have rejected it. At 5% level of significance and $df = 2$, $\chi^2_{cal} (= 4.466) < \chi^2_{crit} (= 5.99)$ accepts the null hypothesis and strongly

indicates the MHP is not contributing properly to the life poor and disadvantaged people as per their need.

86.8% have benefited to read late night following the 13.2% are benefited by reading late night and other household activities. The electricity harnessed by the MHP has eased children reading habits. They enjoy reading at the late night and early morning with the help of electric light. Access in electricity has brought the drastic change in the result of the students.

36.7% have revealed the cause of good health is access to communication and minimizing the use of kerosene following 20% expressed the causes of decreasing the drudgery of women, easiness to farming, and access to communication and minimizing the use of kerosene; only 2.8% of respondents have used the electricity for cooking purpose. It affirms that the MHP is health friendly though insufficient in cooking purpose.

27.8% have revealed the ways of positive impact of MHP on environment are minimizing the use of fossils fuels and mitigating the CO₂ following the 18.3% of ways of positive impacts are decreasing usage of firewood, mitigating the deforestation, minimizing the use of fossils fuels and mitigating the CO₂. But, the trees have been cutting down every year for the replacement of wooden electric poles has created a serious problem of deforestation and landslides in the project area.

Out of the total 139 respondents who accepted the contribution of MHP to the social awareness, 64% have revealed the means of communication equipment has contributed to social awareness against social evils and stigma following the 20.1% revealed means of communication equipment and organizing the awareness programme. Of the total 167 respondents who accepted the decrease of social discrimination by MHP, 22.8% have revealed the forms of decreased social discrimination are caste, gender and ethnic following the 20.4 % of caste, gender, ethnic, disables and poor categories. Of the total 154 respondents who accepted the decrease of caste discrimination, 97.4% have revealed the decreasing trend of caste based discrimination is better than before following the 1.9% revealed the caste based discrimination is totally decreased than before. These facts and figure indicate the substantial contribution of MHP to the social assets of rural people in the study area. Further, the level of social mobilization has been significantly increased in the MHP areas organizing the women, Dalits, and poor people of the village in cooperatives,

mothers' groups, consumers group and political parties. This has accessed them to the means of livelihood options.

Out of the total 23 respondents of management committee, 34.8% have perceived qualification as a major governing factor for the participation in management committee following the 30.4% of qualification and leading position. Even though the poor, Dalits, single women and other marginalized people contributed either involving in physical labour or providing cash donation equally along with the privileged people, very few of them have been able to participate in the management committee and most of them were just consumers. The major causes of negligible participation of Dalits, women and other marginalized under the MC of surveyed MHP were their poor economic status, lack of educational qualification, lack of leadership in leading position. The members from Dalit community and single widow women attended every meeting of MC just to listen and do signature.

61.4% have revealed no benefit sharing from the MC following 18.2% of investment in public services. The ratio of benefit sharing mechanism is different among various MHPs as the well managed MHPs have been able to provide the benefits to their consumers and precariously managed MHPs on the way are going to close soon. The large amount of income generated from the MHP is invested for maintenance and saving for risk management. This has caused some of poor Dalits' exclusion as they have compelled to pay the tariff. The major problems faced by the MHP are the irregular usage of electric power violating the rules and regulation of MC. The account system of MHP was not systematic and transparent in some of the cases. In this context, lack of substantial technical knowledge to handle and manage the MHP, outgoing skilled man power and some cultural habits have been appeared as a hindering factor for the well operation of the MHP in the rural areas.

The impact of the Growth trend of MHP (1986/87 to 2010/11) on EGW GDP measured using regression slope coefficient 0.9498920 in the first period (1986/87 to 2000/01) is found drastically decreased to 0.3256 in the second period (2001/02 to 2010/11) has been supported by the Chow Test as $F_{cal} (=80.56) > F_{crit} (=3.468)$ at 5% level of significance at $df=2$ and $df=21$. The slope coefficient before introducing hydropower development policy-2001 is found to be higher than that after introducing policy. The result is amazing to say that the Hydropower Development Policy-2001 is

the reason behind this decrease in slope coefficient. This indicates that the policy maker of the government must review the Hydropower Development Policy-2001.

The 60 years long planned initiatives of hydropower development could not get progress as politically consistent policies get priority from the ruling party and pro-people policies are either not implemented or poorly funded. Particularly the Rural Energy Policy, 2006, has opened the door of the micro hydropower to contribute the issues of rural poverty reduction and environmental conservation by ensuring access to clean, reliable and appropriate energy. Nepal's hydropower policy is confusing and the institutional framework is not available in an integrated approach. Lack of technical manpower and financial resources, unaffordable technology, lack of effective and regular monitoring and evaluation mechanisms are some of the underlining problems for MHP; the State alone is not in position to construct many small hydropower plants and to establish local grids in remote hilly areas. Therefore, the State must create conducive environment to invest for national stakeholders rather than foreign assistance under the clean development mechanism.

As Dalits, women, ethnic groups, poor and backward people access to the MHP overcoming the structural barriers, they get access to five livelihood capitals such as i) social capital i.e. social network, access to management committee, political parties, social relations etc. ii) financial capital i.e. cash, income, employment, entrepreneurship, business etc. iii) physical capital i.e. electricity, electronic equipment, computer, mobile, vehicle, infrastructure etc. iv) human capital i.e. education, health, training, leadership development etc. and v) natural capital i.e. land, water, forest etc. This is possible through the good governance (participation, transparency, leadership development, responsiveness, benefit sharing process etc.) in MHP institution to state level policy and practices. This study indicates the agency of poor, disadvantaged, marginalized Dalits, women and ethnic people is gradually but very poorly developing as per the social structure. As a result, they are getting weak access to the benefits of MHP in the latest situation in the studied areas. Therefore, the study affirms that the marginalized and disadvantaged people are still not properly benefited from micro hydropower as they are excluded from the policy making level to benefit sharing process and micro level institutions of MHP.

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LIST OF ABBREVIATIONS/ ACCRONYMS

ACAP	:	Annapurna Conservation Area Project
ADB	:	Asian Development Bank
ADB/N	:	Agriculture Development Bank/Nepal
AEPC	:	Alternate Energy Promotion Centre
AIDS	:	Acquired Immune Deficiency Syndrome
AKRSP	:	Aga Khan Rural Support Programme
AREDP	:	Assessment of Rural Energy Development Programme
BOOT	:	Build Own Operate and Transfer
CBS	:	Central Bureau of Statistics
CDM	:	Clean Development Mechanism (Kyoto Protocol)
CDP	:	Committee on Development Policy
CMF	:	Community Mobilization Fund
CO ₂	:	carbon dioxide
Cos	:	Community Organizations
DANIDA	:	Danish International Development Agency
DDC	:	District Development Committee
DoE	:	Department of Energy
DoED	:	Department of Electricity Development
DR	:	Development Region
ECS	:	Electricity Consumer Society
EDB	:	Electricity Development Board
EGW GDP	:	Electricity, Gas and Water Gross Domestic Product
EIA	:	Environmental Impact Assessment
EREC	:	Energy Efficiency and Renewable Energy Clearinghouse
FECS	:	Federation of Electricity Consumer Society
FGDs	:	Focus Group Discussions
FM	:	Frequency Modulation
FY	:	Fiscal Year
GDP	:	Gross Domestic Product
GHGs	:	Green House Gases
GJ	:	gigajoule
GoN	:	Government of Nepal

GW	:	gigawatts
Hz	:	hertz
IDC	:	International Development Committee
IEA	:	International Energy Agency
IEG	:	Independent Evaluation Group
IMF	:	International Monetary Fund
INPS	:	Integrated Nepal Power System
IPCC	:	Intergovernmental Panel on Climate Change
IPP	:	Independent Power Producers
ITDG	:	Intermediate Technology Development Group
ITSL	:	Intermediate Technology Sri Lanka
kg OE/month	:	kilogram oil equivalent per month
kg/ m ³	:	kilogram per cubicmeter
KLDP	:	Karnali Development Project
kWh	:	kilowatts-hour
LPG	:	Liquid Pressure Gas
m/s ²	:	meter per second square
m ³ /s	:	cubicmeter per second
MANTRA	:	Movement and Action Network for Transformation of Rural Area
MC	:	Management Committee
MDGs	:	Millennium Development Goals
MHP	:	Micro Hydro Power
MHSs	:	Micro Hydro Schemes
MHVE	:	Micro Hydro Village Electrification
MoE	:	Ministry of Energy
MoEST	:	Ministry of Environment, Science and Technology
MoF	:	Ministry of Finance
MW	:	megawatts
n.d	:	not dated
NEA	:	Nepal Electricity Authority
NGOs	:	Non Government Organizations
NIDC	:	Nepal Industrial Development Corporation
NLSS	:	National Living Standard Survey
NPC	:	National Planning Commission

NTC	:	Nepal Telecommunication Corporation
NTFP	:	Non Timber Forest Product
OECD	:	Organization for Economic Cooperation and Development
PPA	:	Power Purchase Agreement
PV	:	Photo Voltaics
REDP	:	Renewable Energy Development Programme
REN21	:	Renewable Energy Policy Network ²¹
RETs	:	Renewable Energy Technologies
SAARC	:	South Asian Association for Regional Co-operation
SCMHDO	:	Sengor Community Micro Hydro Demonstration Organization
SNV	:	The Netherlands Development Organization
SWOT	:	Strength, Weakness, Opportunity and Threat
TWh	:	terawatt-hours
TYIP	:	Three Year Interim Plan
UN	:	United Nations
UNCSD	:	United Nations Conference on Sustainable Development
UNDP	:	United Nations Development Programme
UNEP	:	United Nations Energy Programme
USA	:	United States of America
USAID	:	United States Agency for International Development
VAT	:	Value Added Tax
VDC	:	Village Development Committee
WECS	:	Water and Energy commission Secretariat
WHO	:	World Health Organization
WRSF	:	Water Resources Strategy Formulation

Ph.D.

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Micro Hydro Power and Marginalized People in Rural Nepal**

BUDDHI BAHADUR NEPALI

2015