Renewable Energy for Rural Livelihood (RERL)




Annual Report 2023

PROJECT PROFIL E

About the Project	Geographic coverage of the project
Project Title: Renewable Energy for Rural Livelihood Award ID: 00117173/00076958 Web link: www.aepc.gov.np/rerl/public	National level coverage (Yes/No): No Number of Provinces covered: 5 Number of Districts Covered: 9 Number of Rural Municipalities Covered: 18

Strategic Results
UNSDCF OUTCOME 3: By 2027, more people, especially women, youth, and the most marginalized and poor, increasingly benefit from and contribute to building an inclusive, sustainable, climate-resilient, and green society and reduced impacts of disasters at federal, provincial, and local levels.
UNDP Strategic Plan Output: Number and proportion of households benefitting from clean, affordable and sustainable energy access
Country Programme Outcome 1: By 2022, impoverished, especially economically vulnerable, unemployed and under-employed and vulnerable people, have increased access to sustainable livelihood, safe and decent employment and income opportunities
CP Output 3.2: Reliable, affordable and efficient clean energy solutions promoted Country Programme Indicators: 3.3.1. Number of men and women with access to clean, affordable and sustainable energy (IRRF5.1.1) 3.3.2. Number of renewable energy-based businesses operational, including women-owned (IRRF5.1.2) 3.3.3. Increase (kilowatt) in installed renewable energy capacity per technology (IRFF-5.2.1)

Project Duration (day/month/year)	Implementing Partner(s)	Implementation Modality
Start Date: 1 April 2020 End Date: 31 June 2024	1. Ministry of Energy Water Resource and Irrigation (MoEWRI)/ Alternative Energy Promotion Centre (AEPC)	National Implementation Modality (NIM)

Project Budget (US$)	
Budget 2023:	US$ 1,973,824
Expenditure 2023:	US$ 1,966,798
Budget Utilization % (2023)	**100%**

Signature:_____
Name: Satish Gautam
Programme Manager
Date:

Signature:_____
Name: Nawa Raj Dhakal
Chair, Project Executive Board
Date:

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ABBREVIATION

ADB	:	Asian Development Bank
AEPC	:	Alternative Energy Promotion Centre
ACEF	:	Asia Pacific Clean Energy Forum
BFI	:	Banking and Financing Institutions
BoA	:	Business Opportunity Assessment
CAA	:	Country Action A
CREF	:	Central Renewable Energy Fund
DFS	:	Detailed Feasibility Study
DED	:	Detailed Engineering Design
GoN	:	Government of Nepal
IEEE	:	Institute of Electrical and Electronics Engineers
MEP	:	Municipal Energy Plan
MHP	:	Mini Hydro Plant
NGO	:	Non-Governmental Organization
SGP	:	Small Grants Project
PEU	:	Productive Energy Use
RERL	:	Renewable Energy for Rural Livelihood
SASEC	:	South Asia Sub-regional Economic Cooperation
SGP	:	Small Grant Project
SMG	:	Solar Mini Grid
SWHMG	:	Solar/Solar Wind Hybrid Mini Grid
SPV	:	Special Purpose Vehicle
TA	:	Technical Assistance
UNDP	:	United Nations Development Programme
WECAN	:	Water and Energy Consultants' Association, Nepal

LIST OF TABLES

1. EXECUTIVE SUMMARY

RERL continued providing technical assistance to AEPC to implement ADB funded South Asia Sub-regional Economic Cooperation (SASEC) Power System Expansion Project Off grid Component, which includes development of 8 Mini Hydro Subprojects (MHP) and 9 Solar and Solar Wind Hybrid Mini Grids (SMG). All 9 SMGs under SASEC are completed and operational. In 2023, RERL focused on the construction of i) Chukeni Khola and ii) Khatyad Khola MHPs and mobilized resources from JSB and UNDP TRAC II fund to repair, replace and rehabilitate components of i) Simrutu Khola, ii) Giri Khola and iii) Bom Khola MHPs. Construction of Ankhe and Saniveri MHPs are not eligible for the new subsidy as they were both initiated before the new policy came into effect.

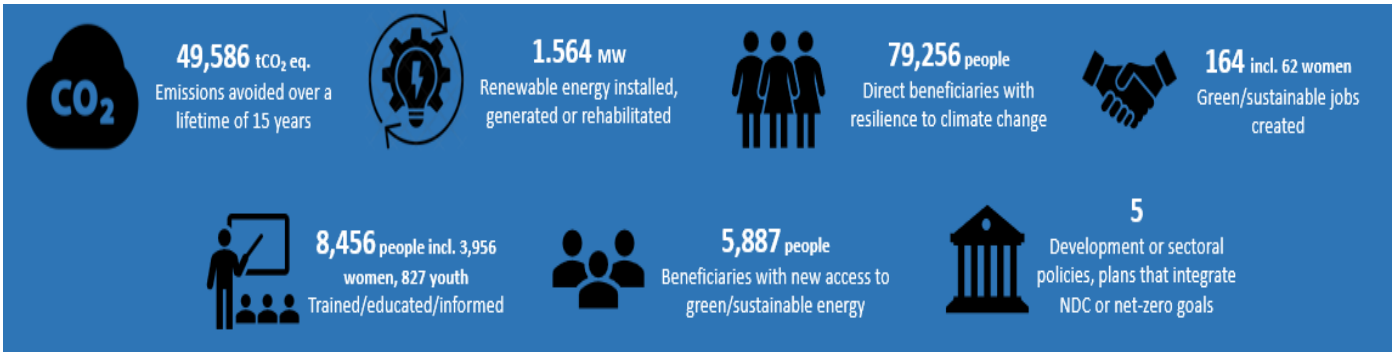
RERL is also supporting communities to establish institutions – users' groups, cooperatives, company - to sustainably manage their renewable energy systems. Further, for meaningful participation of women in management of energy projects and optimization of benefits from access to electricity, they are encouraged to engage in Saving & Credit activities. As of December 2023, 257 Saving and Credit Groups are in operation with 4,831 members, out of which 4,470 or 93% are women and 1,612 or 33% are from DAG community.

In 2023, RERL organized 12 different trainings for 88 people including 40 women from mini hydro and solar mini grid catchment areas. The training includes accounting, mobile phone repair, advance tailoring, etc. Moreover, women entrepreneurs are supported to establish electricity powered enterprises and maximize benefit. Women were encouraged to own and manage business and be involved in all stages of production and marketing by supporting them to access additional subsidy from AEPC.

In 2023, RERL in close coordination with UNDP, to achieve NDCs net-zero emissions and climate-resilient development in response to the climate emergency. The project was funded by the Japan Supplementary Budget and completed by June 2023. The project supported to install solar solutions in Madhesh and rehabilitation of MHPs Karnali, and Sudur Paschim Provinces of Nepal benefiting 74,000 people with clean energy services.

Key Achievements (January - December 2023)

- Reliable and quality electricity services through MHPs to over 74,000 people in Bajura and Jumla
- 1.564 MW renewable energy generated/rehabilitated
- Sustainability of 7 Solar Drinking Water and Irrigation and 1 Agro-voltaic projects
- Established 174 enterprises providing employment to 238 people including 82 women



2. BACKGROUND AND RATIONALE

In recent decades, Nepal has made remarkable achievement in providing electricity access to its people. So far, 98% of the population has access to electricity from national grid or stand-alone renewable energy systems. However, most of the households have only Tier 1 or Tire 2 level access and about 54% of the households still depend on traditional biomass energy for cooking. Electricity is mainly used for lighting and operating low power appliances. While progress has been made in dissemination of off-grid renewable energy systems, affordability of up-front costs (due to both high costs and lack of capital), financial sustainability (due partly to low utilization), and lack of technical capacity constrain progress. On the other hand, Nepal despite huge hydropower and solar energy potential, is importing over half of its electricity requirement during the dry season. In this context, Renewable Energy for Rural Livelihood (RERL) project is focusing on both community-scale off-grid renewable energy technologies to promote income generating opportunities in rural areas, and larger renewable energy systems for grid connection to contribute to distributed generation.

The Alternative Energy Promotion Centre (AEPC) under the Ministry of Energy, Water Resources and Irrigation (MoEWRI) has been implementing the off-grid component of the Asian Development Bank (ADB) funded South Asia Subregional Economic Cooperation (SASEC) project since 2015. UNDP, ADB and AEPC agreed to support RERL to provide technical assistance for implementation of SASEC project in March 2020. The RERL TA primarily focuses on achieving financial closure, community mobilization, institution establishment and strengthening, construction supervision, productive energy use (PEU) promotion and capacity development for smooth operation and management of 4.8MW of mini hydropower projects (MHP) and solar/solar wind hybrid mini grids (SMG).

In March 2022, the Government of Japan provided USD 2.956 million to UNDP Nepal to implement a one-year "Japan-UNDP Support for Transition Effort to Decarbonization (JUSTED)" project with the main aim of 'leveraging Nationally Determined Contributions (NDCs) to achieve net-zero emissions and climate-resilient development in response to climate emergency' under the Japan Supplementary Budget. The aim of the project was to provide electricity and other clean energy services to over 50,000 people in Madhesh, Karnali and Sudur Paschim Provinces of Nepal. The project had 4 components; i) development of solar PV solutions in Sarlahi and Siraha districts, ii) rehabilitation of micro hydropower plants in Bajura and Jumla districts both of which were implemented by AEPC/RERL and 2 other components on agroforestry and waste management directly implemented by UNDP.

3. PROJECT SUMMARY AND OBJECTIVES

The main objective of UNDP/RERL technical assistance is to help AEPC to meet SASEC target of 4.3MW MHP and 0.5MW SMG for electricity access to 30,500 households, 20% capacity utilization in productive uses and mainstreaming gender equality and social inclusion (GESI) throughout the project cycle and JUSTED target of providing energy solutions to 50,000 people.

The RERL activities directly contributes to SDG7 and SDG13 by ensuring access to affordable, reliable sustainable and modern energy for all through the development of mini hydro and solar PV solutions in remote off-grid areas not served by the national electricity grid. Likewise, the project also directly contributes to Nepal's Nationally Determined Contribution (NDC) target to increase the share of renewable energy in the national energy mix. In the same context, the project aims to contribute to other SDGs with energy as the entry point i.e. promotion of productive energy uses of electricity generated that with direct linkages with SDG1, SDG8 and SDG12 while the gender component of the project contributes to SDG5.

Theory of Change

The Alternative Energy Promotion Centre (AEPC) has supported rural communities to install over 1800 micro hydropower projects (MHP) benefiting over 300,000 households since its establishment in 1996. When AEPC started promoting off-grid MHPs less than 20% of Nepal's population had access to grid electricity. Studies undertaken by AEPC show that about 90% of the MHPs are either fully or partially operational and the ones that are not operating are abandoned due to arrival of the grid in their service areas or suffered major damages by natural calamities. A deeper investigation shows that less than 5% of these plants are operating 'highly' satisfactorily with other facing challenges as a result of i). climate induced disaster i.e. flood, landslides that damages the infrastructures; ii). low revenue generation due low utilization of electricity and frequent outages, iii) lack of capacity of operators and iv) unaccountable management and untransparent governance.

In this context, SASEC aims to increase access to electricity by developing 4.8MW of mini hydro and solar mini grids whereas the main objective of JUSTED was to rehabilitate about a dozen MHP and help strengthen the governance and management and enhance electricity utilization for sustainable operation and resilient infrastructures. To overcome a crucial policy barrier for promotion of these larger technologies, RERL provided technical support to AEPC to make policy adjustments in its Renewable Energy Subsidy Policy. Promotion of renewable energy solutions is a key work that is helping communities to access water for drinking and irrigation. Technical and managerial capacity building interventions have ensured that women and members of marginalized communities are capable to maximize benefits from access to electricity and clean energy services by engaging them in decision making processes, income generating activities and establishing enterprises.

Thus, the Project directly contributes to UNSCDF 3 and UNDP's CPD Outcome 3 Output 3.1. through increased access to electricity as well as contributing to SDG 7 and SDG 13 by ensuring access to affordable, reliable and sustainable energy and achievement of national commitments by increasing share of renewable energy mix.

4. PROGRAMMATIC REVISIONS

Project Duration: GoN and ADB agreed on the 'No Cost Extension' of the SASEC project with the current resources until June 2024. MoEWRI, AEPC and UNDP signed project document in January 2023 for RERL support to AEPC up to December 2024.

In 2023, UNDP launched the Renewable Energy for Resilient Agri-Food Systems (RERAS) Project with the financial support of the Norwegian Government. RERL is supporting the Central Renewable Energy Fund of AEPC to implement energy component of RERAS project.

5. NARRATIVE ON KEY RESULTS ACHIEVED IN JANUARY– DECEMBER 2023

Reliable and quality electricity for 74,000 people in Bajura and Jumla: The RERL project supported rural communities to rehabilitate 14 MHPs in Jumla and Bajura districts in 2023. Most of these MHPs were neither generating electricity as per installed capacity nor supplying regularly. Some MHPs were shut down for extended periods of more than six months while others were severely damaged by floods and landslides. The rehabilitation works have taken into consideration climate-induced waterborne disasters both in design and implementation thus supporting climate change adaptation as well. It is expected that the intakes of MHPs will be able to withstand more severe floods. Similarly, rehabilitation of weak sections and bio-

engineering along the canal has made it sturdier. The immediate impact of rehabilitation of MHPs is increase in power generation. Before the project interventions in the 11 MHPs in Bajura district, the power generation was estimated to be around 650 kW and the figure has gone up to 905 kW after completion of the rehabilitation works which is a significant increase of 40%. These rehabilitation and upgradation efforts have resulted in generating 1,378 kW directly benefitting 15,127 households providing reliable and quality electricity services to over 74,000 people. The implementation of the civil works through the communities has resulted in substantial savings, about 15% in overhead costs and 13% applicable Value Added Tax (VAT), while also negating construction delays when working with contractors which has been crucial in completing all JSB funded activities within time.

Sustainability of Solar Drinking Water projects: Traditionally in Nepal, drinking water and irrigation projects have been developed separately as they fall under jurisdiction of two different ministries. RERL has been promoting solar drinking water projects with surplus water availability for irrigation. The concept was further expanded in Tinghare Solar Drinking Water Project, Sarlahi by introducing the agrovoltaic system, which integrates energy generation with agriculture by increasing the height of mounting structure of solar modules to over 3 meters ensuring convenient farming activities underneath. People in rural areas are generally reluctant to pay for drinking water and thus integrating drinking water with irrigation and agriculture will help generate revenue to ensure sustainable operation of these multi-purpose projects.

Resource Mobilization from Norwegian Government: In 2023, UNDP launched the Renewable Energy for Resilient Agri-Food Systems (RERAS) Project with the financial support of the Norwegian Government. RERL is supporting the Central Renewable Energy Fund of AEPC to implement energy component of RERAS project whereas the agriculture component is directly implemented by UNDP.

Introduction

Alternative Energy Promotion Centre (AEPC) has received loan and grant from Asian Development Bank (ADB) to implement the South Asia Subregional Economic Cooperation (SASEC), Power System Expansion Project after Government of Nepal (GoN) signed an agreement with ADB on 11 July 2014. The executing agency (EA) for the SASEC off-grid component is the Ministry of Energy, Water Resources and Irrigation (MoEWRI) whilst the implementing agency is the AEPC. The off-grid component of SASEC intends to increase access to renewable energy for improving the livelihoods of people and create employment opportunities especially in rural areas. RERL has been supporting SASEC since 2014 and the support was extended beyond 2019 upon completion of UNDP and GEF funded activities in 2019 by an agreement between UNDP and AEPC.

The main objective of UNDP/RERL technical assistance to AEPC is to meet SASEC target of 4.3MW MHP and 0.5MW SMG for electricity access to 30,500 households, 20% capacity utilization in productive uses and mainstreaming gender equality and social inclusion (GESI) throughout the project cycle.

Following table shows the linkage of outcome and output statements of the project:

Table 1: SASEC Outcome and Output Statements

Outcome Statement	Output Statement
Country Programme Outcome 2.4.1: By 2022, impoverished, especially economically vulnerable, unemployed and under-employed and vulnerable people, have increased access to sustainable livelihood, safe and decent employment and income opportunities	Country Programme Output 3.2: Reliable, affordable and efficient clean energy solutions promoted. Country Programme Output Indicator 3.3.1 Number of men and women with access to clean, affordable and sustainable energy (IRRF5.1.1) 3.3.2. Number of renewable energy-based businesses operational, including women-owned (IRRF5.1.2) 3.3.3. Increase (kilowatt) in installed renewable energy capacity per technology (IRFF-5.2.1)
Project Output 1: Improved access to clean, affordable and reliable energy solutions.	**Activity 1:** TA for commissioning and sustainable operation of mini hydro and solar mini grid projects under SASEC off-grid component
	Activity 2: Increase utilization of energy from micro hydro systems in remote rural off-grid areas
	Activity 3: Improve access to universal modern energy services for vulnerable groups through solar energy solution
	Activity 4: TA to AEPC for implementation of its project and programme
Project Output 2: Strengthened policy and institutional capacity to create a conducive environment for RE promotion in Nepal	**Activity 1.** Strengthening of CREF
	Activity 2. Capacity development of LGs/PGs
	Activity 3. Capacity development of AEPC
Project Output 3: Enhanced partnership for renewable energy development in Nepal	**Activity 1:** Collaboration with partners
	Activity 2: Resource mobilization

5.1 Progress towards the UNSDCF Outcomes

Table 2: Progress on Outcome Indicators

Outcome statement	Outcome indicator	Baseline	Cumulative Target for 2018- 2022	Total target achieved till 2023	Milestone for 2023, if any	Achievement 2023	Source of data
Country Programme Output 1. By 2022, impoverished, especially economically vulnerable, unemployed and under employed and vulnerable people have increased access to sustainable livelihood, safe and decent employment and income opportunities	Number of households with energy access with UNDP supported interventions (SDG 7.1.1)	107,827 HHs	25,000 HHs connected to energy services.	141,436 HHs	4,650 additional households have access to electricity. (1200 Giri+3450 Chukeni)	143,572 (cumulative households with electricity access) (Giri = 1200 HHs)	RERL CPD Report

Progress towards Output 1: Improved access to clean, affordable, and reliable energy solution

Under this output technical support will be provided to AEPC, Provincial and Local Governments, rural communities and the private sector to develop larger RE projects for improved access to clean, affordable and reliable energy solution to energy deprived communities of the country.

Activity 1.1: Technical Assistance for promotion of mini hydro and solar mini grid systems.

RERL has been providing TA in developing 8 MHPs and 9 SMGs under SASEC/ADB with the total installed capacity of 4.3MW and 0.5MW, respectively. Under SASEC, AEPC distributed 1500 solar home systems to earthquake affected households. Likewise in 2023, RERL supported in rehabilitation of 14 MHP of 100kW capacity or less in Bajura and Jumla districts. Thus, the total households served by these two projects is 18,960 households.

Regarding SASEC MHPs, RERL support starts from project identification to feasibility study and engineering design, financial closure, construction supervision and monitoring and capacity development and institution establishment and strengthening and promotion of PEU. As of December 2023, 9 SMGs with a total capacity of 565kW, providing electricity access to 1632 households, have been installed. Further, 4 MHPs with total capacity of 1100kW are providing electricity to 3,833 households, in total 10,053 households against the target of 30,500 or 33% got electricity access under SASEC.

Similarly, as of December 2023, 4 out of 7 MHPs of 1.1MW total capacity or 26% of the targeted 4.3MW capacity has been completed. Further, 3 MHPs with total capacity of 2.46MW are under construction. In 2023, RERL focused on the construction of i) Chukeni Khola and ii) Khatyad Khola MHPs and mobilized resources from JSB and UNDP TRAC II fund to repair, replace and rehabilitate components of i) Simrutu Khola, ii) Giri Khola and iii) Bom Khola MHPs. Construction of Saniveri MHP halted since December 2022 could not be resumed in 2023. The status of MHPs under SASEC is detailed below in the Table 4.

Table 3 : SASEC MHP Targets and Achievement

RE Projects	Installed Capacity (MW)				Beneficiary Households (No.)		
	Target	Completed	Under const.	Under Bidding *	Target	HH connected to SASEC Subprojects	Under Const.
Mini Hydro Subprojects	**4.3**	**1.1**	**2.496**	**0.75**	**28,000**	**3,833**	**15,944**
Percentage	100	26	56.56	17.44	100	13.69	56.54
Simrutu Khola	0.2	0.2	-	-	1,386	1,386	-
Giri Khola	0.2	0.2	-	-	1,840	1,200	-
Lower Bom Khola	0.2	0.2	-	-	617	617	-
Middle Phawa Khola	0.5	0.5	-	-	2,078	630	-
Chukeni Khola	0.998	-	0.998	-	6,253		3,453
Khatyad Khola	0.5	-	0.5	-	2,564	-	2,564
Saniveri	0.998	-	0.998	-	5,039	-	5,039
Solar/Wind Mini Grid Subprojects	0.5	0.565	-	-	2,500	3,132	-
Percentage	**100**	100	**-**	**-**	**100**	**125**	**-**
Total	**4.8**	**1.665**	**2.496**	**0.75**	**30,500**	**6,965**	**15,944**
Percentage	**100**	**34.68**	**52**	**15.62**	**100**	**22.84**	**52.28**

* *includes 1,500 solar home systems supported after the 2015 earthquake.*

Testimonial: *Mr. Amar Shrestha, Chairperson of Middle Phawa Khola Bidhut Cooperative, the owner of Middle Phawa Mini Hydropower Project (*MPKMHP), *Taplejung, expressing his happiness that the plant was not only providing electricity to 630 households regularly but also exporting surplus energy to NEA. He was excited to inform that the plant had* exported 2,472,142 kWh to NEA by November 2023 and earned over NPR 5,178,000. He further added that the cooperative was interested to add at least 2 micro hydropower plants with installed capacity of 160kW to its systems and expand its service area.

Table 4: Status of Mini Hydro Subprojects

SN	Name of Subproject	Location	kW	HHs	Status
1	Simrutu Khola	Rukum (W)	200	1,386	• RERL has been providing technical support to bring back the plant in operating condition. The major activities undertaken in 2023 include replacement of the control panel and protection system which has been completed with TRAC II fund and rehabilitation of hydro mechanical component which is ongoing and is expected to be completed in QTR I 2024.
2	Giri Khola	Jumla	200	1006	• Giri Khola Mini Hydropower Project (GKMHP), Tatopani Jumla was completed in 2020. However, an unseasonable flood of 2021 had destroyed parts of embankments at the intake and powerhouse and sections of canal. JSB fund was mobilized in 2022 to support in rehabilitation of GKMHP and the works were completed in 2023. Besides reconstruction of embankments and repair of canal sections, the fund was also utilized to construct canal covers, extension of spillway and reinforcement of land along the penstock pipe. • There are some problems with the electronics of human and control panel interface, which will be rectified soon. Electronic parts have already been procured with UNDP TRAC II fund and will be installed in QTR I 2024. • A joint mission of representatives of all stakeholders of RERAS projects, Norwegian Embassy, ADB, AEPC and top management of NEA visited Jumla in December 2023. During the mission AEPC and NEA discussed on grid interconnection of Giri Khola Mini Hydropower Project (GKMHP) and it was agreed that NEA would provide poles, cables and accessories to expand coverage of GKMHP. • RERL plans to initiate grid interconnection of Giri Khola MHP in 2024 under RERAS project.
3	Lower Bom Khola	Solukhumbu	200	617	• The project was tested in October 2021. However, the plant is not generating at the designed capacity. RERL is supporting the developer to install 950 meters of 300mm pipe for an additional waterway to increase the flow with UNDP TRAC I fund. Procurement of the pipe was completed in 2023 and pipe laying work is

					expected to be completed by the end of QTR I 2024. The plant is then expected to generate as per the design.
4	Middle Phawa Khola	Taplejung	500	630	• Testing and Commissioning (T&C) completed in September 2022. • Grid interconnected and exporting surplus power to NEA
5	Khatyad Khola	Mugu	500	2,564	• The unseasonal flood of October 2022 had damaged major parts of the Khatyad Khola MHP that were already constructed. The flood also damaged the road along which the headrace pipe alignment was planned. The cost for construction/rehabilitation of civil components has already been approved by AEPC and ADB. However, the cost of electrical works required is still unresolved. • The repair works of civil components are underway. The contractor has also started digging up a trench along the road for headrace pipe. • Installation of surge pipe, penstock pipe, electromechanical equipment including turbine and generator has been completed. The project is expected to completed by June 2024.
6	Patrasi Chukeni	Jumla	998	6,250	• Most of the work to complete Chukeni Khola MHP has been carried out. It was planned to test the plant in December 2023. However, installation of the electromechanical equipment could not be completed as the contractor was not able to transport some minor accessories to the site. Testing of the project is now planned for QTR I 2024.
7	Saniveri Khola	Rukum East	998	5,039	• Construction work of Saniveri Khola Mini Hydropower Project (SKMHP) has been halted since December 2021 as neither the community nor the local government could raise equity and loan of NPR 121.4 million. Given the extent of poverty in the municipality in general, the people of Putha Uttarganga RM will be hard pressed to come up with any additional equity or loans. In this context, AEPC, NEA, ADB are discussing on possibility of developing the project in partnership with the NEA, where the NEA will provide the required funds and will proportionately own & operate the system. If this matter is resolved soon, there is high probability of completing the project by the end of 2025.

On the other hand, the SASEC target of developing 0.5MW of solar/solar wind hybrid mini grids (SMG) has already been achieved. Nine SMGs with total capacity 565kWp ranging from 25kWp to 150kWp have been installed and are operational. These 9 SMGs provide electricity not only to 1,632 households but also 364 enterprises and other public services.

In 2023, RERL initiated an impact study of solar mini grids to assess quality and quantity of electricity services with Solar and Solar-Wind Hybrid Mini Grid (SMG) under different institutional structures and propose suitable measures for ensuring economic viability of these options.

In spite of the efforts of NEA and AEPC to coordinate their activities and avoid duplication, the national grid is gradually encroaching the catchment areas of SASEC SMGs and as the NEA lifeline tariff is much lower than similar SMG tariff, beneficiaries are tempted to migrate to the grid. If the issue is not resolved soon, SMGs might be abandoned by the people. NEA and AEPC have agreed to grid connect MHPs if their service area is encroached by the grid and 5 Net Metering Agreements have been signed, similar mechanism for SMGs have not been agreed yet. The mechanism is urgently required as the grid has already approached the vicinity of all 9 SMGs developed with SASEC fund.

Arrival of the grid to SMG catchment areas has resulted in different decisions of the beneficiary communities, Ramite Khola SMG has decided to not connect to the grid whereas all the beneficiaries of Hariharpur Chisapani SMG have opted for grid electricity and shut down their SMG. Similarly, Saptame SMG has decided to use both the grid and SMG.

The list of the SMGs, respective capacities and categories of households benefiting are given in table below.

Table 5: List of SMGs and Beneficiaries

SN	Name of Sub-projects	Location	Capacity (kWp)	HHs	FHH	BPL	DAG
1	Chisapani SMG	Harkapur Chisapani, Sindhuli	35	90	7	9	83
2	Ramitekhola SMG	Ramite, Morang	30	75	6	8	57
3	Olane SMG	Olane, Panchthar	25	70	9		19
4	Saptame SMG	Saptame, Panchthar	70	110	16		91
5	Gutu SMG	Gutu, Surkhet	100	344	14		80
6	Sugarkhal SMG	Sugarkhal, Kailali	75	216	21	22	76
7	Dandapur Malladehi SMG	Dandapur, Baitadi	30	110	10	8	
8	Hilepani SMG	Manebhanjyang, Okhaldhunga	50	235	24	8	200
9	Thabang SMG	Thabang, Rolpa	150	382	20	30	365
Total			**565**	**1632**	**127**	**85**	**971**

Activity 1.1.1: Post Installation Support

RERL mobilized fund from UNDP to support to solve problems in the control and protection systems of Giri Khola and Simrutu Khola MHPs. The human and machine interface for automatic operation of Giri Khola MHP and the circuit board of Simrutu Khola MHP were replaced. Further, a sluice gate and a coarse trash rack were installed in Simrutu Khola MHP. Smooth operation of these 2 projects will contribute to install identified micro hydro operated lift irrigation systems in future. Moreover, headrace canal of Simrutu Khola MHP was extended by 26 m to irrigate 0.3 ha vegetable gardens which were using modern polyhouses but did not have enough water to grow vegetables throughout the year. The project also supported to install water tanks, distribution pipes and accessories.

Besides, RERL has been supporting operation and management of Giri, Simrutu and Phawa Khola MHPs.

Women's time burden on household tasks: RERL carried out an assessment of household appliances in use among solar mini grid beneficiaries. The assessment found that 2,194 different electrical appliances such as induction cooker, kettle, rice cooker, grinder/mixer, iron, television, refrigerator, etc. are in use. It is estimated that use of these appliances has reduced women's time spent on daily household chores has been reduced by 2 to 3 hours. According to beneficiary women, the saved time is mostly utilized for leisure, entertainment and income generating activities.

The total capacity of all appliances is 351kW and consume 2135kWh every day. The details of the household appliances in use are given in the table below.

S.N.	Appliances Name	No of Appliances	Total Capacity (watt)	Total Daily Operating Hour	kWh
1	Induction Cooker	1	1600	0.50	0.80
2	Rice Cooker	18	12700	13.03	165.45
3	Kettle	86	85250	120.25	10251.31
4	Grinder/Mixer	119	59500	23.58	1403.21
5	Iron	24	23300	32.83	765.02
6	Space Heating (Heater)	9	7200	30.42	219.00
7	Fan	1135	72020	3591.67	258671.83
8	Television	445	11020	1276.67	14068.87
9	Refrigerator	262	8970	1840.00	16504.80
10	Water Pump	34	38950	16.67	649.17
11	Computer	61	30500	70.00	2135.00
Total		**2194**	**351,010**		**304,834.46**

Activity 1.1.2: Capacity Development

Technical Training: The project supported to enhance capacity of beneficiary communities to operate their plant smoothly. Further, women were also encouraged to participate in technical trainings so that they would be able to engage in gainful employment during project construction, operation and management. Some of the capacity development activities with significant participation of women included training/orientation on electricity hazard and safety, house wiring, linesman, masonry, cooperative/institutions management, computerized financial management and operation and management of mini grids. Participation of women in technical capacity development activities undertaken so far is presented in Chart 2. As of now, 857 community members have received different types of training and capacity development support, 32% of the participants were women against the SASEC target of at least 30%. The trainings include house wiring, masonry and operation of RE systems and management of both RE systems and institutions and electricity hazard and safety. Although the target of 30% women participants in technical training has exceeded, it has been very difficult to find women to participate in core technical training such as operation of mini grid projects. In this reporting period, RERL organized a 12 days' long operator training from 27 September to 6

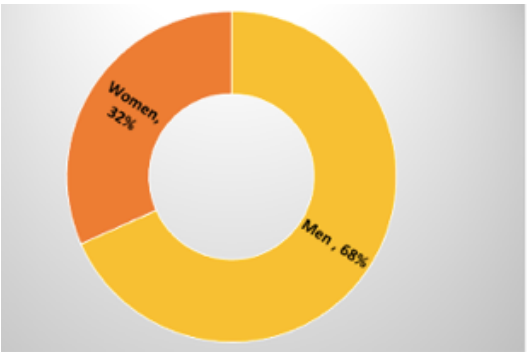


Chart 2: Women's representation in Technical Training

October 2023 for 27 participants including 2 from SASEC supported MHP. After the training it is expected that the operators will be able to better handle their plants.

Management Training: Experience shows that lack of proper management of RE projects after installation is a big problem and needs to be taken care of for systems to be sustainable. RERL has been supporting communities not only to establish formal institutions but also provided training and other capacity development support for incentive-based management. Further, high priority is given to women's participation in all capacity development activities. So far, RERL has provided cooperative management, financial literacy, social mobilization, basic accounting and enterprise development trainings with GESI sensitization in 67 training/orientation for 2,226 members of cooperatives of whom 1356 were women which is 61% of the total participants.

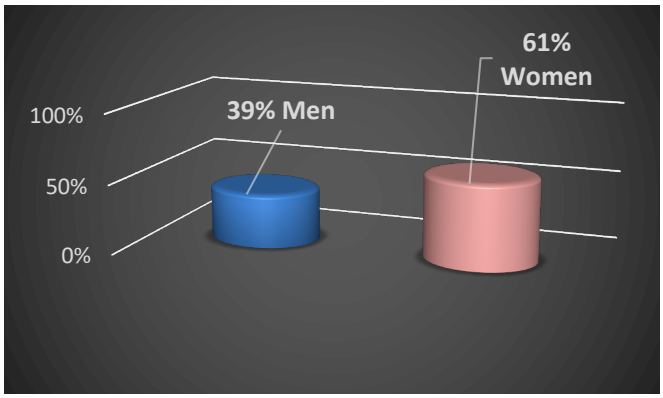


Chart 5: Women's participation in capacity development

In 2023, RERL organized 12 different trainings for 88 people including 40 women from mini hydro and solar mini grid catchment areas. The training includes accounting, mobile phone repair, advance tailoring, etc. The details of trainings are presented in the table below.

S.N.	Name of Training	Participants		People participated from
		Men	Women	
1.	Enterprise Development	25	17	Jumla, Mugu
2.	Computerized Account Management	3	2	Jumla, Mugu, Surkhet, Rolpa
3.	Mobile Phone Repair	16	4	Jumla, Mugu, Rukum, Surkhet,
4.	Advance Tailoring	-	10	Jumla, Rolpa, Surkhet
5.	Electric Home Appliance Repair	4	-	Jumla, Mugu, Surkhet,
6.	Basic Beautician	-	7	Jumla, Mugu, Surkhet,
Total		**48**	**40**	

Technology Promoters: One of the major targets of the SASEC project is to support selected individuals to work as technology promoters, as technical employee of RE projects themselves or entrepreneurs or activists for productive, safe and sustainable use of energy. In this regard, 58 men and 32 women who could be 'technology promoters' in areas such as electricity safety, e-cooking, repair mobile phone and electrical appliances, agro-processing, advance tailoring and other productive end uses have been identified.

Activity 1.1.3: Social Mobilization and Institution Strengthening

The main aim of SASEC is to provide electricity to households in off grid areas mainly to those; i) headed by women, ii) falling below the poverty line and iii) other disadvantage groups as defined by GoN. The target is at least 30% of beneficiary households have to be from these 3 marginalized groups. So far, the target has been exceeded as 83% of the beneficiary households belong to these 3 categories as illustrated in the Chart 1. As the energy projects built under SASEC are located at remote off-grid areas, most of the households fall within the aforementioned three categories. Out of 1632 households served by the 9 completed SMGs, 8% are women headed, almost 60% belong to DAG and 8% are BPL. On the other hand, among the beneficiary households of the 7 MHPs, 13% are women headed, 53% belong to DAG and 19% belong to BPL.

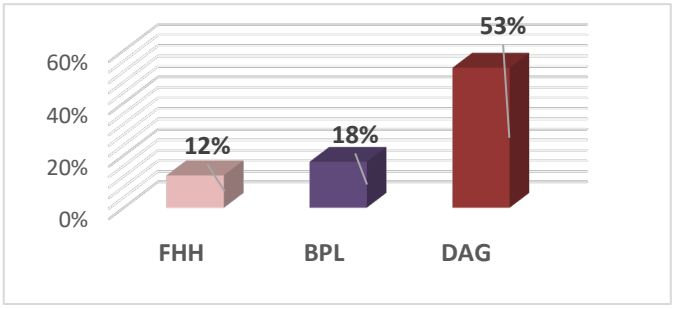


Chart 1: Percentage of FHH, BPL & DAG in MHPs & SMGs

Women representation in Decision Making: SASEC target requires at least 30% women and/or members of disadvantage/marginalized groups in the Executive Committee of each RE project. RERL supported to establish institutions in 7 MHPs and all 9 SMGs. Regarding the institutional arrangement for development and operation of these projects the community have opted to register as cooperative, company or users' groups.

In MHPs, all communities except the 200 kW Lower Bom Khola MHP, Solukhumbu, have opted to establish

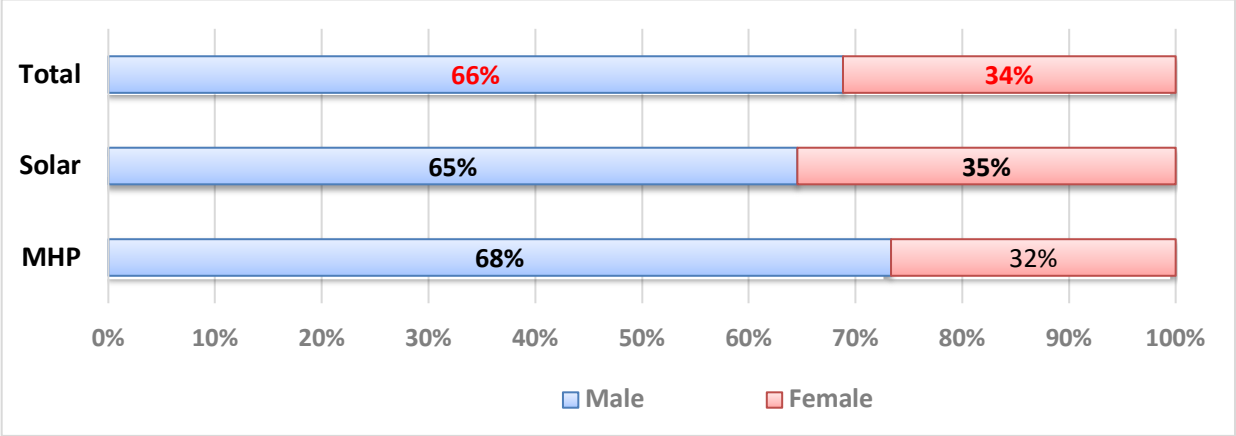


Chart 3: Percentage of Women Representation in Executive Committee

cooperatives while the Lower Bom Khola MHP has been registered as a company owned by the beneficiaries. Out of 81 Executive Members of these organizations, 26 (32%) are women. To increase women's representation in these Executive Committees, RERL provided orientation to the communities and respective municipalities. RERL plans to provide more such orientations to increase women's participation in decision making.

On the other hand, communities have opted to register their SMGs as cooperatives or users' groups, whereas, Thabang Rural Municipality, Rolpa decided to directly manage its system. Saptame and Olane SMGs, Panchthar and Dandpur Malladehi SMG, Baitadi have formed Users' Groups and the rest are managed by cooperatives. Out of 79 Executive Members involved in managing SMGs, 29 (35%) are women.

Likewise, to ensure continued engagement and support of municipalities in operation and management of SMGs, AEPC/RERL has initiated formalizing the relationship between SMGs and respective municipalities. In this regard, Olane, Gutu, Sugarkhal and Dandapur Malldehi SMGs were handed over to their respective

muncipalities. The Ramite Khola, SMG was handed over to Miklajung Rural Municipality, Morang in 2021. This formalization process will be replicated in remaining 3 SMGs too.

Saving and Credit Activity: For meaningful participation of women in management of energy projects and optimization of benefits from access to electricity, encouraged Saving & Credit activities. Communities from 3 MHPs and 3 SMGs - Gutu, Sugarkhal and Hillepani SMGs and Simrutu, Chukeni and Khatayad MHPs are actively participating in Saving & Credit activities.

As of December 2023, 257 Saving and Credit Groups are in operation with 4,831 members, out of which 4,470 or 93% are women and 1,612 or 33% are from DAG community. These groups have so far saved NPR 26 million which is provided to members for income generating activities and the total credit flow including rollover is NPR 30 million. Over 90% of the borrowers are women and have invested mainly in vegetable farming, poultry, goat/pig rearing, etc. The representation of women in Saving & Credit groups is shown in Chart 4.

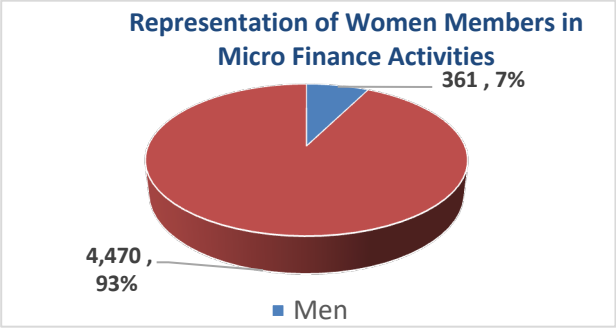


Chart 4: Percentage of Women in Micro Finance Activity

Activity 1.1.4 Productive Energy Use

SASEC project requires installation of productive end uses totalling 0.96 MW capacity (20% of 4.8 MW). To meet this ambitious target, RERL has been supporting both developers and interested community members by providing them orientation on productive energy uses, business opportunity assessment, business scheme and entrepreneurship development, accessing credit and establishment and operation of enterprises.

RERL has comprehensively assessed business opportunities in 7 subprojects that includes 2 MHPs and 6 SMGs. As of now, business plans of 32 potential enterprises in Gutu, Sugarkhal and Hilepani SMGs have been prepared and entrepreneurs were supported to establish and operationalize them. The Gutu SMG along with Sugarkhal SMG and Ramite Khola SMG have potential to become good demonstration sites for financially viable solar mini grids in the country. These three SMGs have been successful as they are servicing bustling markets that cater to surrounding areas. So far, RERL supported to establish 364 enterprises in SMGs that consume 78kW which is 14% of the total capacity. Similarly, 16 enterprises powered by 2 MHPs that consume 86kW which is 8% of total installed capacity have been established.

Women led micro-enterprise development: To achieve the SASEC target of 30% increase in women led micro-enterprises, need assessment mapping existing and potential women led enterprises are carried out in each project site. Support is provided both to establish new enterprises and upgrade existing ones. Women are supported to access additional fund based on AEPC subsidy policy and delivery mechanism. Further, women are also supported on skill development, book-keeping and financial management, access to finance and other services necessary to establish and operate businesses. So far, RERL has supported to establish 380 enterprises mainly in SASEC SMGs, out of which 155 or 43% are women led and provide employment to 561 people of whom 258 or 46% are women. As more MHPs are completed, more productive end uses will be established and operated. RERL will continue emphasizing on promotion of women led enterprises to meet the target of 30%.

In addition, 48 enterprises have come to operation in Giri Khola MHP alone, of which 16 are upgraded, 32 new and 26 women led. Thus, in total 424 electricity operated MSME are established in SASEC subprojects. Further, 127 or 40% of these enterprises are women led and provide employment to 647 people, 294 or 45% women. As more MHPs are completed, more productive end uses will be established and operated. RERL will continue emphasizing on promotion of women led enterprises to ensure that they maximize benefits from access to electricity.

Activity 1.2: Increase utilization of energy from micro hydro systems in remote rural off-grid areas

Nepal has long experience of developing micro hydropower projects less than 100kW capacity and there are over 1800 such systems spread throughout the country. However, electricity in rural areas is mainly used for lighting for few hours in the evening and plants do not generate enough revenue for sustainable operation. To help rural communities for upgradation/rehabilitation of existing MHPs make them climate resilient, promotion of productive energy uses for income generation, utilization of electricity for cooking and space heating and grid interconnection, UNDP mobilized about USD 2 million from the Government of Japan under Japan Supplementary Budget (JSB).

Activity 1.2.1 Micro Hydro Rehabilitation

The JSB fund was utilized to rehabilitated 14 Micro Hydropower Plants (MHPs) in Jumla, Karnali Province and Bajura, Sudur Paschim Province as most of these plants were neither generating electricity per installed capacity nor supplying regularly to their customers. Some MHPs were severely damaged by floods and landslides and shut down for more than six months. The rehabilitation work took into consideration possibilities of climate-induced waterborne disasters both in design and implementation ensuring climate resilience and contributing to SDG 9 with resilient infrastructure. It is now expected that the intakes of MHPs will be able to withstand more severe floods and weaker sections of canal are sturdier with rehabilitation and bioengineering.

The immediate impact of rehabilitation of MHPs was increased power generation, before the project interventions in the 11 MHPs in Bajura district, the total power generated was estimated to be around 650 kW and the figure has gone up to 905kW which is a significant increase of 40%. These rehabilitation and upgradation efforts have resulted in generating 1,378kW directly benefitting 15,127 households or about 74,000 people with reliable and quality electricity services, as expected by SDG 7, through MHPs. Out of which, two MHPs are even exporting reliable and quality electricity to nearby settlements with more than a thousand households.

Activity 1.2.2: Community Mobilization and Institution Strengthening

One of the primary reasons for the suboptimal performance of MHPs in Nepal is their ineffective management in place. Currently, the responsibility for operation and management of plants solely entrusted to users who often lack the necessary skills and knowledge, leading to various challenges in their smooth functioning. To ameliorate the situation, the project supported rural communities to strengthen their institutions. To ensure transparency and accountability, the beneficiary communities were encouraged to restructure their governance and management systems.

Regarding, JSB project comprehensive mass meetings were organized across all MHPs, prior to the commencement of project activities, to provide essential information about the project and the need for restructuring. A total of 123 such mass meetings were organized with participation of 3,293 beneficiaries, including 962 women, 287 youth and 578 individuals from marginalized communities contributing towards effective accountable and inclusive institutions as envisaged by SDG 16.

The project played a pivotal role in empowering women and men from marginalized communities by encouraging them to participate in regular saving and credit schemes. As of now, 1360 men and 1,779 women are actively involved in saving and credit schemes, which covers 13 MHPs. This financial empowerment has enabled them to engage in other income generating activities and improve their overall economic situation.

As a result, all 16 cooperatives have been successfully registered, with a total of 149 executive members, including 62 women and 15 from marginalized communities. The Executive Committee of the cooperative serves as the highest decision-making body, and with extensive advocacy by the project, 43% of the

representatives are now women. Similarly, 5 user groups have been formed to manage micro hydro operated lift irrigation schemes.

As a direct consequence of the institutional strengthening and capacity development efforts, there has been notable increase in people's trust and confidence in their respective institutions. The positive shift in perception has prompted beneficiaries to willingly pay their due electricity bills. In Baddi Gad MHP alone, NPR 800,000 in overdue amounts was collected within 4 months of reconstitution of the Executive Committee. Similarly, Barjugad I and Kasegad III also been success to collect NPR 726,000.

Activity 1.2.3: Productive Energy Use

The promotion of productive uses of MHP aims to enhance livelihoods in rural communities and foster sustainable operations of MHPs by generating additional revenue. In this regard, the project conducted comprehensive business opportunity assessment across all MHP sites to identify existing and potential enterprises and entrepreneurs. The project also provided support in preparing business plans and acquiring necessary equipment for new business establishments or upgradation of existing ones. Carefully selected prospective entrepreneurs were provided specialized trainings in entrepreneurship, management and skill development, such as repairing mobile phones and home appliances, advanced tailoring and beautician services. As a result, 174 new and upgraded enterprises were successfully registered providing employment opportunities to 238 people including 82 women and 103 existing ones were ungraded to be more efficient contributing to SDG 8. Operating these enterprises not only helped in creating 238 green jobs but also supported MHPs in generating additional revenue.

Micro Hydro Operated Lift Irrigation: Likewise, 5 MHP-operated lift irrigation systems with a daily water storage capacity of 339,000 liters have been established benefiting 255 households to irrigate 26 hectares of land during dry season while also bringing more fallow land under cultivation, contributing towards food security and enhanced livelihoods of 1,212 people as envisaged by SDG 1 and 2. While the 3 MHOLIs in Bajura district are used for growing vegetables, the 2 in Jumla serve apple orchards. One notable impact of Sarpala MHOLI in Bajura is the newfound access to clean drinking water in the settlement for 23 households.

Electric Cooking: Furthermore, the project has on cost sharing basis provided 483 electric cooking appliances -406 electric pressure cookers, 35 induction cookers and 42 electric kettles - which helps decrease the use of fossil fuel and biomass energy, reducing both indoor air pollution and related health hazards while also avoiding CO2 emission and contributing towards SDG 13. This activity supports in reducing firewood consumption and alleviating women's time and burden on firewood collection, cooking and cleaning. It is widely believed that until women are weaned away from cooking with firewood by modern energy systems their true empowerment will not be possible as envisaged by SDG 6.

Although the project made significant strides in introducing electric cooking to rural areas, certain challenges such as power limitations and unfamiliarity with modern technologies, hindered complete achievement of targets. To address the issue of limited power generation by MHPs, the project redesigned, fabricated and tested a low wattage water boiler (Bijuli Dekchi) prototype, which had been popular in specific remote locations in 1990s. After successful testing of the 300W prototype, 65 Bijuli Dekchi units were distributed in Jumla as a demonstration. While most users found them useful, some complained about the slow heating process as it took 5 to 6 hours to heat 23 liters of water to 800C.

An important lesson learnt is that promoting high-powered appliances/equipment must be accompanied by the installation of smart meters with time-of-day tariff features to ensure that peak loads are managed below the plant capacity. Further, promoting e-cooking in rural communities unaccustomed to modern technologies requires extensive orientation and demonstrations. Moreover, establishing local service centers to provide minimum repair and maintenance services is also essential. To ensure that such services are available locally, the project trained 11 individuals who either already ran electric shops or were interested in providing similar services, 3 of them were involved to distribute appliances and will also offer fee-based repair services later on.

Activity 1.2.4: Capacity Development

Technical Training: The project encourages women to engage in construction work and productive uses of electricity, thereby enabling them to optimally benefit from access to reliable and quality electricity and organized various trainings. However, in 2 MHP operation trainings, only 3 participants belonged to marginalized communities and no women participated, mainly due to the perception that technical areas are men's domain. The project put extra effort to attract women to participate in other technical trainings, such as masonry. As a result, more than 52% of the 19 participants in 2 masonry trainings were women with one of these trainings having all women participants.

Cooperative Management Training: To enhance the management capacities of the cooperatives, 39 cooperative leaders, managers and staff members, including 8 women participated in various capacity development activities. The activities included exposure visit to a successfully operating and effectively managed MHP, as well as trainings in accounting, bookkeeping and computerized financial management. Altogether, 96 people including 50 women benefitted from these specialized trainings.

On the other hand, Capacity development support has been a crucial focus of the project with particular emphasis on cooperative formation and strengthening which included cooperative education and cooperative establishment and governance in which 3,389 people including 1,012 women participated. These people have been instrumental in forming MHP cooperatives and MHOLI Users' Groups. After the completion of the rehabilitation works, public audits were organized in all MHPs where financial transactions were publicly endorsed by the general beneficiaries.

Activity 1.3: Improved access to universal modern energy services for vulnerable groups through solar energy

This activity focuses on provisioning solar solutions in areas without national grid. UNDP mobilized resources from Government of Japan under JSB for promotion of solar solution in Sarlahi and Siraha districts of Madhesh Province of southern plains.

Activity 1.3.2: Promotion of Solar Solution

The project supported rural communities to develop 2 new solar drinking water projects benefiting more than 2200 people with access to clean drinking water and irrigation facilities and solarization of 5 existing drinking water projects which regularly supplies clean drinking water to over 8,000 people contributing towards SDG 6. Furthermore, solar PV backup systems were installed in 2 schools enhancing learning process for 950 pupils by enabling the operation of computers, audio-visual aids, and other equipment, promoting a more visual and interactive teaching approach over traditional 'rote' learning contributing towards SDG 4. Likewise, the project equipped 11 health facilities with birthing centres with solar PV backup systems which ensure uninterrupted power supply to operate essential life-saving equipment like oxygen concentrators, vaccine storage, nebulizers, suction machines, etc. ensuring gender and social inclusion per SDG 5. The combined service areas of these 11 health facilities cater to a total population of 41,676 people, including 20,142 women, thereby significantly improving healthcare access in the region as envisaged by SDG 3.

Activity 1.3.3: Capacity Development

To ensure that the technical knowhow is localized, engineers working with Drinking Water Supply Division Offices (DWSDOs) of the Madhesh Province were trained on Solar Pumping System Design and Installation. Likewise, a training on Solar Pumping System Design was organized for engineers working with the private sector and other organizations involved in promotion of solar pumping in the country. Moreover, a specialized training for the local community on masonry and plumbing was organized, empowering local individuals with necessary skills for engagement in construction work. A total of 170 people including 19 women and 9 youth benefited from these technical trainings. In total, 401 people including 79 women and 41 youth have directly benefitted from these comprehensive capacity development programs.

Training on Solar Pumping System Design: With the JSB fund RERL supported to conduct training on Solar Pumping System Design for engineers working with private sector and other organizations involved in promotion of solar pumping in the country. Moreover, a specialized training for the local community on masonry and plumbing was organized, empowering local individuals with necessary skills for engagement in construction work. A total of 170 people including 19 women and 9 youth benefited from these technical trainings. In total, 401 people including 79 women and 41 youth have directly benefitted from these comprehensive capacity development programs.

Orientation on Cooperative Management and Leadership Development: Similarly, RERL organized orientation on cooperative/user group formation, as well as management and leadership development for development and operation of solar drinking water projects. The Tinghare Solar Drinking Water Project is now managed by a cooperative, while the remaining 6 drinking water projects are being overseen by user groups. The executive committees of these projects consist of 109 members, comprising of 58 men and 51women, which is 47% of the total members. An exposure visit to a solar drinking water and irrigation project operated by a private company was organized which provided valuable insights and practical lessons to 49 individuals, including 20 women and 11 youth on water energy and food nexus. In total, 231 men and women participated in different training and orientation programme related to institution formation and strengthening.

Under JSB project, overall capacity development support for both MHP and solar PV systems benefited 6,410 people, of which 2,703 were women, 1,029 were youth and 1,199 belonged to indigenous communities.

Progress towards output 2: Strengthened policy and institutional capacity to create a conducive environment for renewable energy promotion in Nepal.

UNDP's support in the renewable energy sector has resulted in formulation and implementation of many policies such as Rural Energy Development Policy 2006, numerous policy documents, implementation modalities and amendments of RE Subsidy Policy. Similarly, decentralized renewable energy promotion was institutionalize in District Development Committees.

Activity 2.1 Strengthening Central Renewable Energy Fund (CREF)

Since implementation of GEF RERL, the project has been supporting CREF of AEPC to design and operationalize financial instruments to attract private investment in RE projects. The Credit Guarantee Mechanism established at CREF has proven to be the most crucial instrument to support communities to achieve financial closure of mini hydropower projects and provision of working capital for contractors in projects developed with SASEC fund.

UNDP has signed a Letter of Agreement (LoA) with CREF/AEPC to implement the energy component of Renewable Energy for Resilient Agri-Food Systems (RERAS). RERL is supporting CREF to carry out assessment of MHPs for rehabilitation, detailed feasibility studies of lift irrigation schemes, promotion of productive energy uses, institution strengthening, etc.

Activity 2.2 Capacity development of Federal, Provincial and Local Governments

In 2023, RERL supported rural communities to rehabilitate 14 MHPs. In all cases, municipalities provided 10% of the cost of rehabilitation and were closely involved in planning and monitoring rehabilitation activities. This close involvement has helped build up the capacity of elected representatives and municipal officials to plan and implement development projects.

RERL has been supporting municipalities to prepare their municipal energy plans (MEP) in participatory approach, engaging individuals, elected officials, civil society, private sectors, governmental line agencies and donor. In this reporting period, RERL supported 3 municipalities, i) Patarasi, Jumla, ii) Budiganga and iii) Triveni Municipalities, Bajura to prepare their MEPs.

RERL has been supporting AEPC and Nepal Electricity Authority (NEA), the sole grid owner in Nepal, to prepare standards and modalities for grid interconnection of MHPs. RERL also provided financial and

technical support to prepare Interconnection Master Plan of Minigrids (IMPM) which looked into more than 1400 MHPs and identified 100 best ones to interconnect with the grid immediately.

Activity 2.3: Capacity enhancement of AEPC

RERL has been leading the grid interconnection of RE within AEPC and has helped prepare guidelines and standards, draft Simplified Power Purchase Agreement and Net Metering Agreement between NEA and MHPs. Besides the 4 MHPs of less than 100kW capacity that were grid interconnected as demonstration projects, RERL has supported 3 mini hydropower projects of 200kW and 500kW capacities to sign Net Metering Agreement with NEA. One of these projects has been supplying electricity to rural consumers and selling surplus to NEA, which has clearly demonstrated that MHPs need not be abandoned once the grid reaches their service areas but rather interconnect the two systems for win-win solution. This has opened opportunities for scaling up similar interconnections throughout the country.

Likewise, RERL professionals work closely with AEPC counterparts and help develop plans, implementation modalities and implementation management of solar and community electrification subcomponents. As SASEC project is implemented following Public Procurement Act, AEPC's capacity to implement larger RE projects has been enhanced.

RERL has also supported AEPC to draft several policy document including Renewable Energy and Energy Efficiency Bill which has been tabled in the parliament for discussion.

Progress towards output 3: Enhanced partnerships for renewable energy development in Nepal

Cooperation and collaboration among national and international agencies is necessary to plug technical and financial resources gaps that ultimately aims to ensure sustainability of interventions while optimizing the available resources and expertise. In this context, RERL recognizing the national need to mobilize resources and foster partnerships in the RE sector, has been assisting both UNDP and AEPC to develop partnerships and mobilize resources from different sources.

Activity 3.1: Collaboration with partners

a) RERL is providing technical assistance to AEPC to implement ADB funded SASEC project since 2020 to install 4.3 MW of mini hydro and 500 kW of solar mini grids and provide electricity access to 30,500 households. This is a three-way partnership between ADB, AEPC and UNDP where each partner brings its strength on the table to help rural communities; ADB is financing RE projects, AEPC is the implementor and UNDP is providing technical assistance to AEPC through RERL. As this is the first partnership of its kind between ADB and UNDP, it has proved to be pathbreaking initiative and has been replicated in the Asia Pacific Region.

b) RERL supported UNDP to prepare proposal for the Japan-UNDP Support for Transition Effort to Decarbonization (JUSTED) Project, which was approved in 2022 and implemented by RERL in 2022 and 2023. The main goal of the projects was to contributes towards achieving NDCs net-zero emissions and climate-resilient development in response to the climate emergency. The project was funded by the Japan Supplementary Budget and completed by June 2023. The project supported to install solar solutions in Madhesh and rehabilitation of MHPs Karnali, and Sudur Paschim Provinces of Nepal benefiting 74,000 people with clean energy services.

c) RERL supported UNDP to prepare proposal for Royal Norwegian Embassy (RNE) for funding the Renewable Energy for Resilient Agri-Food Systems (RERAS) Project which was signed by UNDP and RNE on 7 September 2023. UNDP is directly implementing the agriculture component and has signed Letter of Agreement (LoA) on 14 December 2023 with Central Renewable Energy Fund of AEPC to implement energy component of RERAS project. Based on which RERL and the Central Renewable Energy Fund of AEPC signed a Memorandum of Understanding (MOU) to implement the same.

TRAC II Progress:

In 2023 RERL received USD 150,000 from UNDP TRAC II fund which was utilized in 5 municipalities mainly to support agriculture related activities. Most of these activities complemented RERL's earlier activities undertaken with financial support of different development partners.

1. Giri Khola MHP, Tatopani RM, Jumla and Simrutu Khola MHP, Tribene RM, West Rukum were developed by beneficiary communities under ADB's SASEC Project Off Grid Component. Both these projects are of 200kW capacity and provide electricity to over 2500 households. Giri Khola MHP was completed on 30 December 2020 and Simrutu Khola MHP on 30 December 2018, respectively. There were some problems in the control and protection systems of both projects and were rectified with TRAC II fund. The human and machine interface for automatic operation of Giri Khola MHP and the circuit board of Simrutu Khola MHP were replaced. Further, a sluice gate and a coarse trash rack were installed in Simrutu Khola MHP. Smooth operation of these 2 projects will contribute to install identified micro hydro operated lift irrigation systems in future.
2. Moreover, headrace canal of Simrutu Khola MHP was extended by 26 m to irrigate 0.3 ha vegetable gardens which were using modern polyhouses but did not have enough water to grow vegetables throughout the year. The project also supported to install water tanks, distribution pipes and accessories.
3. A 5kVA voltage stabilizer was installed at Dolkatti Micro Hydro Operated Lift Irrigation Project, Patarasi RM, Jumla to supply stable voltage to the pump, which irrigates 2 ha. of apple orchard owned by 84 households.
4. Two polyhouses of 500 sq.m size were installed at Guidung, Ishworpur Municipality to demonstrate modern agricultural practices utilizing surplus water from Devidanda Solar Drinking Water Project.
5. Tinghare Solar Drinking Water Project, Lalbandi Municipality, Sarlahi which directly benefits 450 households with access to clean and reliable drinking water supply was completed with TRAC II fund. Further, the novel concept of utilizing land under solar arrays for agriculture, known as agrovoltaic, was introduced in Tinghare Solar Drinking Water Project by increasing the height of the solar modules mounting structure to over 3 meters ensuring convenient farming activities in 0.14 ha land underneath. Moreover, the concept of fertigation is also introduce in the agrovoltaic system by integrating fertilizers with drip irrigation for production of cash crops such as tomato, elephant foot yam, golden lime, etc. If successful, this concept could be replicated under existing 86MWp solar arrays in Nepal.

RERAS Progress:

In 2023, UNDP launched the Renewable Energy for Resilient Agri-Food Systems (RERAS) Project with the financial support of the Norwegian Government. RERL is supporting the Central Renewable Energy Fund of AEPC to implement energy component of RERAS project whereas the agriculture component is directly implemented by UNDP. The RERAS activities build up on the work of JSB–JUSTED project and the following activities were carried out in December 2023.

1. Energy services mapping of 5 municipalities in Bajura was initiated through UNDP. The study will assess existing energy systems, capacities, functional status, productive usages, potential demand for agricultural activities, their exact locations, etc. The study is expected to be completed in QTR I 2024. Similar assessment for municipalities in Jumla and Mugu will be carried out from March 2024 as Jumla is very cold at the moment and it will be difficult to meet all stakeholders.
2. Detailed Feasibility Study of 2 Lift Irrigation projects in Bajura and 1 in Sindhuli have been completed. Civil components and procurement of pipes will be carried out through community procurement process whereas supply and installation of pumps and accessories through competitive bidding. Procurement of all 3 projects will be started in February 2024.
3. A quick assessment of 5 solar pumping projects in Tatopani RM of Jumla was carried out upon the request of Tatopani RM in December 2023. All 5 projects were financed by the provincial government. The assessment found that all the projects are in very poor condition and non-operational.

4. Detailed assessments of status of electro-mechanical equipment of 5 MHPs for Rehabilitation in Bajura was completed in December 2023. Civil components will be procured through community procurement process whereas supply and installation of electro-mechanical equipment and cables and poles through competitive bidding. The community procurement process has already started, and procurement of electro-mechanical equipment and cables and poles will be initiated in February 2024.

5. A 12 days' training on preparing bakery products using indigenous crops like millet and buckwheat was organized in Surkhet, Karnali Province. It is expected that the trainees – 3 women and 10 men from Bajura and Jumla districts – will be able to produce bakery products for their local consumers including schools.
6. A 7 days' training on basic repair and maintenance of sewing machine and tailoring was organized in Surkhet, Karnali Province. It is expected that the trainees – 18 women and 1 man including 6 from Dalit and 2 from Janajti communities – will be able to carry out minor repair and regular maintenance of their sewing machines and design, cut and stich high value clothes such as coat and trousers and enhance their income.

Activity 3.2: Resource Mobilization:

ADB/SASEC: between AEPC and UNDP signed an agreement on 19 March 2020 to implement SASEC Off Grid Component. The contribution of ADB for TA component of SASEC is USD 1.5 million and UNDP contribution is USD 0.8 million. The project is still ongoing and has been extended by ADB to complete mini hydropower projects of 4.3MW capacity whereas 0.5MWp solar mini grids have already been completed and are operational.

Japan Supplementary Budget: UNDP Nepal received USD 2.9 million from Japan Supplementary Budget (JSB) to implement JUSTED project which contributes towards Nepal's Nationally Determined Contributions (NDCs) to achieve net-zero emissions and climate-resilient development in response to climate emergency. JSB allocation for implementation of micro hydro and solar components under the JUSTED project was USD 2.149 million and implemented through AEPC with RERL's technical support.

RERAS: In 2023, UNDP launched the Renewable Energy for Resilient Agri-Food Systems (RERAS) Project with the financial support of the Norwegian Government. The budget for energy component of RERAS is USD 1,059,620 and is being implemented by Central Renewable Energy Fund of AEPC with RERL's technical support.

5.2 Progress on Project Outputs

Table 6: Progress on Output Indicators

Output statement	Output indicator	Baseline	Cumulative Target for 2018 - 2022	Total target achieved till 2023	Milestone for 2023, if any	Progress in 2023 against	Cumulative progress up to 2023	Means of verification	Remarks
Output 3.1: Provide technical support to operationalize 4.3 MW mini hydro	Installed Capacity	400kW Haluwa Khola Mini Hydro	4.3 MW	1.1MW	1.4MW	-	1.1MW	Testing & Commissioning Report	
Output 3.2: Provide technical support to operationalize 0.5 MW solar/wind mini grid	Installed Capacity	NA	0.5MW	0.565MW			0.565MW	Project Completion Report	Target Achieved in 2020
Output 3.3: Women trained in the construction, O&M of mini grid systems and as customer service providers	% of women trained on technical trainings	NA	30%	32%	15%	17%	32%	Training Report	On track to achieve target
Output 3.4: Formation of user committees for project development and implementation	% of women and proportionate representation of disadvantaged groups in executive committee	NA	30%	Total – 34% SMG -35% MHP -32%		Total – 34% SMG -35% MHP - 32%	Total – 34% SMG -35% MHP -32%	Project MIS	On track to achieve target
Output 3.5: Mobilize community-based organizations for social and environmental	% of women and proportionate representation of disadvantage	NA	30%	Total – 4247members.		223 new women members	- Total 4831 members - Women members 4470 (93%)		Target Achieved in 2020

community development activities	d groups in environment management activities			Women Members – 3886 (91%)					
Output 3.6: The total connected load of productive end uses is 20% (0.96 MW) of installed capacity (4.8 MW)	Minimum 960 kW productive end uses	NA	960kW	Total - 164kW SMG-78kWp MHP-86kW	100kW			Project MIS	More productive uses of electricity will come online as MHPs are completed
Output 4.1: Training in GESI based community participation and management of energy systems	No. of training conducted	NA	5	63	0	8	71	Training Reports	Target already achieved, (one off training/orientation per subproject is not enough) This target already been achieved in till 2020
Output 4.2: Conduct training of trainer to develop 'technology promoters'	No of trainee	NA	17		5	39	44	Training Report	RERL has organized advance training for 10 potential Technology Promoters of whom 12 are women
Output 4.3: Reducing women's time burden spent on household tasks	No of studies (baseline and end line)	NA	17	10	2	2	12	RERL MIS	Baseline data survey already completed and endline survey of Ramite and Hilepani SMGs completed in 2022
Output 4.4: 30 30% increase in women led micro-enterprises	30% increase in women led micro-enterprises	1,289	30%	21%	30%	45%	41%	RERL MIS	
Output 4.5: Draft regulation for implementing renewable energy promotion board act	AEPC Act drafted	Rural Energy Policy 2006	1 AEPC Act drafted	1 AEPC Act drafted and submitted to AEPC					Already achieved

6. BUDGET AND EXPENDITURE

The following table shows the output wise indicative budget and expenditure for 2023 **(January – December 2023)** and the sources of funds budgeted and utilization.

Table 7: Output wise annual budget and corresponding expenditure as per CDR

Output	Annual Budget	Annual Expenditure through project	Annual Expenditure through UNDP	Total Expenditure	Budget Utilization %
Output 1	263,150.00	261,868.00	0	261,868.00	100%
Output 2	34,250.00	30,537.00	0	30,537.00	89%
Output 3	9,200.00	7,489.00	0	7,489.00	81%
Output 4	64,000.00	3,952.00	60,000.00	63,952.00	100%
Output 5	11,800.00	5,625.00	6,000.00	11,625.00	100%
Programme Support Cost	76,240.00	76,143.00	2000.00	78,143.00	100%
JSB	1,363,184.00	1,008,225.00	354,959.00	1,363,184.00	100%
TRAC II	150,000.00	150,000.00	0	150,000.00	100%
Total	**1,973,824.00**	**1,543,839.00**	**422,959.00**	**1,966,798.00**	

Table 8: Source of funds and Budget and Utilization of project period

Donor	Total Budget	Advance	Expenditure	Balance
GON-00180	260,000.00	200,000.00	159,793.00	40,207.00
BGN-13285	640.00	640.00	640.00	-
UNDP-TRAC I	200,000.00	192,000.00	192,000.00	-
UNDP-TRAC II	150,000.00	150,000.00	150,000.00	-
JSB-00141	1,363,184.00	1,055,316.00	1,055,316.00	-
TOTAL	**1,973,824.00**	**1,597,956.00**	**1,557,749.00**	**40,207.00**

Table 9: M&E Expenditure: In 2023, Project spend on M&E activities.

Expenditure for Monitoring	
Costs associated with UNDP/project staff, consultants, project partners, supporting national statistical systems in designing project specific data collection methodologies (qualitative and quantitative), monitoring methods including stakeholder surveys and other qualitative methods, collection of data, analysis and dissemination of the findings to inform a project, either with project partners or to fulfill specific UNDP/project requirements (preferably the former).	
Expenditure in USD	**124,083 (8%)**

Narrative on Progress related to Budget and Expenditure

RERL allocated USD 1,597,956 for 2023 of which RERL utilized USD 1,557,749, which is 97.48% of the annual allocation. Out of the total annual expenditure, USD 159,793 from GoN for ADB/SASEC activities, USD 640 from BGN, USD 192,000 from UNDP TRAC I, and USD 150,000 from UNDP TRAC II and USD 1,055,316 from Government of Japan JSB fund.

7. CROSS CUTTING ISSUES

7.1 Targeting and voice/Participation of Target groups

The main target groups of RERL support are people living in rural off-grid areas. All RERL activities are related to promotion of renewable energy systems for provision of modern energy in such areas through enabling environment for active participation of beneficiaries including women and members of marginalized communities, their representatives in the local government and the private sector.

RERL directly works with beneficiaries to empower them for identification, planning, implementation, management, operation and monitoring of RE projects. RERL supported projects are community owned and managed by either users' groups, cooperatives or public limited companies.

Beneficiaries of RERL supported activities form their community organization and have executive committees that have representation of all marginalized groups and at least 33% women. In addition, to ensure that women and members of marginalized groups maximize benefits from access to electricity, RERL encourages them to engage in saving and credit and income generating activities, which not only helps them in accessing finance but also develop their capacity for meaningful participation by voicing their concerns in other community development activities too.

7.2 Gender Equality, Women's Empowerment, and Social Inclusion

To ensure that women maximize benefit from reliable and quality electricity supply after rehabilitation of MHPs, the project has been actively promoting women's participation in establishing and operating enterprises that use electricity. To accomplish this, the project has identified potential women entrepreneurs and provided them with crucial support, including assistance in preparing business plans, entrepreneurship and skill development trainings.

The two most popular enterprises among women beneficiaries are tailoring and beauty parlor. A total of 23 women participated in these skill development trainings. Notably, out of 16 women who received advanced tailoring training, 9 have successfully established or upgraded their businesses. The impact of the training and access to electric sewing machines has been significant for women entrepreneurs who reported a remarkable 25% growth in income after implementing these improvements.

Furthermore, women and men from marginalized communities were encouraged to participate in regular saving and credit schemes, enabling them to engage in additional income-generating activities. As of December 2023, 257 Saving and Credit Groups are in operation with 4,831 members, out of which 4,470 or 93% are women and 1,612 or 33% are from disadvantage groups. These groups have so far saved NPR 26 million which is provided to members for income generating activities and the total credit flow including rollover is NPR 30 million. Over 90% of the borrowers are women and have invested mainly in vegetable farming, poultry, goat/pig rearing, etc.

Traditionally, women have not been active participants in the decision-making process of development activities although they contribute more than their share of voluntary labor for the same. However, the project has taken substantial strides towards gender empowerment and social inclusion, employing extensive effort and advocacy to engage municipal officials, users' committees and general population. As a result, 43% of the executive committee members of the 14 MHPs, supported for rehabilitation, are women providing them with a vital platform to voice their concerns and opinions in the decision-making process.

Women led MHP Management

An example of women's active participation in the RERL supported activities is the successful management takeover of Ikadigad MHP by a women led cooperative, Shree Badhimalika Sana Kisan Krishi Sahakari Sanstha Limited. The cooperative has 980 shareholders, with 855 (87%) being women and 7 out of 10 executive members also are women. Under the leadership of Ms. Maya Shah, the Chairperson, the cooperative made some bold decisions, including replacing the MHP management team through a competitive hiring process. This change proved highly effective, with the new management succeeding in collecting overdue bills amounting to NPR 250,000 while also generating monthly revenue of NPR. 50,000 from the MHP. Improved regularity in electricity supply and the enhanced quality of services after the successful rehabilitation of the MHP are the main reasons for the customers' willingness to settle their dues on time.

RERL has been encouraging women to maximize benefit from access to electricity by establishing or upgrading existing enterprises. Women are supported to access additional fund based on AEPC subsidy policy and delivery mechanism. Further, women are also supported on skill development, book-keeping and financial management, access to finance and other services necessary to establish and operate businesses. So far, RERL has supported to establish 380 enterprises mainly in SASEC SMGs, out of which 155 or 43% are women led and provide employment to 561 people of whom 258 or 46% are women. As more MHPs are completed, more productive end uses will be established and operated. RERL will continue emphasizing on promotion of women led enterprises to meet the target of 30%. In 2023, 48 enterprises have come to operation in Giri Khola MHP alone, of which 16 are upgraded, 32 new and 26 women led.

7.3 National Capacity Development

RERL professionals work closely with AEPC counterparts and help develop plans, implementation modalities and implementation management of solar and community electrification subcomponents and Central Renewable Energy Fund (CREF) in areas of project selection, detailed feasibility study, credit financing and achieving financial closure. As SASEC project is implemented following Public Procurement Act, AEPC's capacity to implement larger RE projects has been enhanced.

RERL has been leading the grid interconnection of RE within AEPC and has helped prepare guidelines and standards, draft Simplified Power Purchase Agreement and Net Metering Agreement between NEA and MHPs. Besides the 4 MHPs of less than 100kW capacity that were grid interconnected as demonstration projects, RERL has supported 3 mini hydropower projects of 200kW and 500kW capacities to sign Net Metering Agreement with NEA. One of these projects has been supplying electricity to rural consumers and

selling surplus to NEA, which has clearly demonstrated that MHPs need not be abandoned once the grid reaches their service areas but rather interconnect the two systems for win-win solution. This has opened opportunities for scaling up similar interconnections throughout the country.

7.4 Sustainability

Experience has clearly demonstrated that the rural communities require technical support not only during RE project formulation and implementation but more so after completion of installation works. Post installation support, which includes institutional strengthening and capacity enhancement for smooth operation of the plants and promotion of productive electricity uses for increasing revenue generation.

Studies on functional status of MHPs carried out by AEPC show that beside major calamities, grid encroachment in the catchment area of a MHP is the main reason for its demise/abandonment. In this context, RERL has been able to play a crucial role on behalf of AEPC to bring Nepal Electricity Authority (NEA) onboard to jointly prepare standard and guidelines for grid interconnection of MHPs, technology development, piloting in 4 MHPs and policy inputs for upscaling. Grid interconnection of MHP not only ensures its sustainability but also helps improve reliability of NEA system in rural areas and quality of electricity. Furthermore, post installation support, operation of over 2000 AEPC supported micro/mini hydropower projects are evidence that there is a strong correlation between revenue generation and sustainable operation of the plants.

Involvement of local governments in project development as shareholders and post installation support in case of major damages due to natural calamities is crucial for enhancing robustness of RE systems. In all RERL supported RE projects, municipalities have invested at least 10% of project cost and responsibility for post installation support.

Furthermore, technical capacity of rural people to operate complex engineering technologies such as MHP and solar PV systems is limited. Although AEPC provides operator training, it is not adequate for smooth operation of the plants. RERL is working with AEPC and communities to bring the knowledge, skill and efficiency of the private sector to rural areas to operate and manage mini/micro hydropower projects and solar PV systems. As the private sector is reluctant to work in rural areas in general due to lack of economy of scale and community owned projects in particular due to problems of collective action, a lot of financial incentives and other supports are necessary to convince them to get involved. RERL is supporting the private sector to access finance through CREF, mobilize communities to overcome collective action problems and capacity building of rural technicians and establishment of linkages between them to help ameliorate the risk perception of private companies. As a result, Run Hydro Private Limited is operating 3 mini hydropower projects built with ADB funding.

7.5 South-South and Triangular Cooperation

The COMET App, developed by ENACT Malaysia, was applied for identifying potential e-cooking users in Bajura. The ENACT team visited Nepal on 15 May 2023 to provide orientation on the App to Nepali professionals working in the renewable energy sector, introducing them to the features and functionalities on the COMET App. The COMET has useful features enabling users to select electrical appliances, input their power ratings, capital costs, usage patterns during different times in a day or seasons, as well as tariff information.

Subsequently, the App was successfully piloted among beneficiaries of 11 MHPs in Bajura to collect demand for electric cooking. The App received a positive response from rural communities, particularly women, who found it fascinating and actively participated in the e-cooking demand collection process. ENACT has provided the right to use the COMET App to UNDP's Acceleration Lab, which will significantly contribute to its dissemination and popularization across Nepal.

7.6 Partnerships

RERL has been supporting municipalities to prepare municipal energy plans (MEP) in participatory approach, engaging individuals, elected officials, civil society, private sectors, governmental line agencies and donors. In this reporting period RERL helped Patarsi RM, Jumla and Budiganga and Triveni municipalities of Bajura to prepare their MEPs. Further, respective municipalities have contributed 10% of the cost for rehabilitation of 14 MHPs in Bajura and Jumla districts.

7.7 Promotion of civic engagement

All RERL supported projects are community owned and managed by either users' groups, cooperatives or public limited companies. RERL directly works with beneficiaries to empower them for identification, planning, implementation, management, operation and monitoring of RE projects.

7.8 Expanding opportunities for youth

Young men and women usually are the proponents of RE projects in off-grid areas as they know the benefits of having reliable and adequate electricity supply. Young people have been engaged from the beginning of the project cycle and take advantage of electricity access later on by establishing different productive uses. In almost all RE projects supported by RERL, the operators are young men. There are 15 men working as operators of MHPs and SMGs. On the other hand, both men and women are engaged in establishing and operating productive use enterprises. As of now, 562 people, mostly young men and women, are employed in 380 different businesses. Furthermore, young men and women have taken advantage of training opportunities provided by the project. In this reporting period, 128 men and 17 women and 17 youth have participated in technical training and 53 men and 62 women in leadership.

7.9 Innovation

Agrovoltaic: Tinghare Solar Drinking Water Project, Lalbandi Municipality, Sarlahi which directly benefits 450 households with access to clean and reliable drinking water supply. Further, the novel concept of utilizing land under solar arrays for agriculture, known as agrovoltaic, was introduced in Tinghare Solar Drinking Water Project by increasing the height of the solar modules mounting structure to over 3 meters ensuring convenient farming activities in 0.14 ha land underneath. Moreover, the concept of fertigation is also introduced in the agrovoltaic system by integrating fertilizers with drip irrigation for production of cash crops such as tomato, elephant foot yam, golden lime, etc.

Nepal's solar energy promotion policy has undergone several changes over time, causing uncertainty within the industry. One such recent change discouraged the development of solar power plants on irrigated land. However, the successful demonstration of the Tinghare Agro-voltaic Farm could lead to necessary policy amendments. These changes may include bringing land under existing 86MWp solar power plants for cultivation and removing barriers against developing solar power plants on irrigated land.

Micro Hydro Operated Lift Irrigation (MHOLI): In the past, different organizations have supported rural communities to build MHOLI systems, but unfortunately, most of these systems have become non-operational primarily due to weak institutional arrangement for operation and maintenance. To address this issue, the project focused on a comprehensive approach to ensure sustained success of MHOLI installations. Before implementation, the project placed significant emphasis on community mobilization actively engaging with local communities for the formation of cooperatives/farmers' groups, strengthening their capacities, tariff fixation and collection mechanism, etc. This 'soft' support is expected to well-equip the farmers to operate their systems sustainably.

7.10 Knowledge Management and Products

- https://www.facebook.com/UNDPNepal/posts/pfbid0atxZJkW2xzEQT6hwCM32eiKTc664ZUt78eBmqEMFF2gmHwHnUSPGt5GT73kRVKRjl
- https://undpnepal.exposure.co/2022-a-year-in-review
- https://www.undp.org/nepal/stories/how-energy-transforming-communities-bajura
- https://risingnepaldaily.com/news/28333
- https://myrepublica.nagariknetwork.com/news/over-11-000-residents-in-madhesh-benefit-from-solar-powered-water-projects/
- https://www.peoplesreview.com.np/2023/06/20/11000-residents-in-tarai-gain-access-to-clean-water-irrigation-through-solar-energy/

8. LESSONS LEARNED

Electric Cooking: Nepal is likely to meet universal access to affordable, reliable and modern energy services for lighting – but not cooking, as envisaged by the Agenda 2030 (SDGs). Access to electricity is not considered for cooking in the RE subsidy policy, which provisions only 200 watts per household. In areas where biogas is not feasible, MHP should be promoted for electric cooking and space heating/cooling purposes. Although the project made significant strides in introducing electric cooking in MHP catchment areas, but certain challenges, such as power limitations and unfamiliarity with modern technologies, hindered progress. For this, low wattage cooking appliances and modification of commercially available stoves should be encouraged. New technological solutions and innovative tariff structures should be designed and implemented for demand side management to cut/shift the peak demand. Another crucial lesson learnt is that promoting high-powered appliances/equipment must be accompanied by the installation of smart meters with time-of-day tariff features to ensure that peak loads are managed below the plant capacity.

Community Involvement: The implementation of the civil works through the communities as provisioned in the Public Procurement Act (PPA) and Public Procurement Regulation (PPR) has resulted in substantial cost savings, about 15% in overhead costs and 13% in Value Added Tax (VAT). In addition, community procurement has negated construction delays to a large extent against the experience of working with contractors where timely completion of construction works is seldom achieved.

Local Government Involvement: Though the Constitution of Nepal 2015 gives all rights related to alternative/renewable energy and hydropower projects up to 1MW to local government, their management capabilities are limited. Local government requires much support to be able to prepare energy plans, identify suitable projects, mobilize resources, and to implement, monitor and manage RE systems. Orientation on their roles and responsibilities, guidelines and manuals on the various aspects of RE development, establishment of planning and monitoring systems and training in, for instance, planning, implementation, and monitoring, needs to be provided to local governments until they are able to function independently as envisaged by the Constitution. Municipalities should be supported in preparing energy plans that include an understanding of their energy supply and consumption situation, in identifying potential resources and appropriate technologies, and on choosing sustainable and least cost options.

Central Renewable Energy Fund: Although CREF has been operational for some years, most of its focus has been on approving and channelling subsidies. It has not been able to mobilize credit from BFIs to the fullest extent despite having financial instruments specifically designed to attract private investment in RE projects. The efforts made to mobilize credit for mini hydropower projects need to be continued and other innovative approaches adopted to de-risk financing RE projects.

Grid Interconnection: Although 7 MHPs with the national grid with AEPC support, the policy is still ambiguous and implementation arbitrary. Therefore, lobbying/advocacy needs to be continued for grid interconnection of RE projects to realize the benefits of distributed generation that enhances the reliability of grid and quality electricity supply. The procedure for grid interconnection of MHP is the same as that for

large hydropower projects, which is cumbersome for communities in remote areas and needs to be simplified and standardized. The technology required for grid interconnection also needs further research and development for greater reliability and cost effectiveness.

9. IMPLEMENTATION ISSUES AND CHALLENGES

Financial Closure: Financial closure of mini hydropower projects under SASEC has been a challenge resulting in delays in project implementation and completion. The main reason for delays are the communities' inability to raise required equity and reluctance of commercial banks to lend to them, which has been only partially addressed by financial support and investment of municipalities. Credit Guarantee Mechanism of CREF/AEPC has helped ameliorate the situation to a large extent regarding bank lending to communities. However, even with the ADB fund as loan and credit guarantee by CREF/AEPC, the banks charge high interest rate, which is an additional burden to the communities. Realizing the situation, the GoN approved Renewable Energy Subsidy Policy 2078 with provision of providing subsidy up to 90% of the project cost. However, Saniveri and Ankhe MHPs are not eligible for the new subsidy as they were both initiated before the new policy came into effect.

Extension of the National Grid: One of the main reasons for abandonment of isolated MHPs developed by rural communities in Nepal is the arrival of national grid in their service areas. RERL/AEPC have extensively lobbied with NEA for grid interconnection of renewable energy projects and successfully grid interconnected 7 MHPs. A successful example of grid interconnection is the 500kW Middle Phawa Khole MHP which is providing electricity to 630 households and exporting surplus energy to NEA and earning additional revenue. Similar mechanism for grid interconnection of SMGs needs to be developed and agreed with NEA.

Post Installation Support: RERL subcontracted Run Hydro, a private company with experience in operating and maintaining small hydropower projects developed by Independent Power Producers, to operate Simruru Khola MHP, Middle Phawa Khola MHP and Giri Khola MHP for a year and provide on the job training to local operators in February 2022. The one-year experience has mixed results – the operation of Middle Phawa Khola MHP and Giri Khola MHP were smooth and the operators of Middle Phawa MHP are now able to independently operate their system whereas the other 2 projects still require support for smooth operation. Post installation support is indispensable in case of renewable energy projects in remote areas where trained technicians are not locally available.

JSB Implementation: Several challenges emerged during implementation of JSB activities, especially in Bajura. Both local and national elections in Bajura turned violent, resulting in the district being sealed off for several days hampering project activities. Additionally, floods and landslides during and after the monsoon season in both Jumla and Bajura disrupted transportation of goods and people further complicating the project's progress. On the other hand, unavailability of solar equipment and pumps in Nepal also slowed down the project implementation in Sarlahi and Siraha districts to some extent. Recognizing the potential for delays, UNDP alerted EoJ in December 2022 about these challenges. Subsequently, EoJ agreed to extend the project duration by 3 months until the end of June 2023, within which all project activities were completed. To implement projects with short duration a lot of preparatory works have to be carried out even before the financing is ascertained. Learning from JSB experience, RERL chose only those activities for TRAC II fund that complemented ongoing activities that could be completed within the given timeframe.

10. PRIORITIES FOR 2024

The focus of RERL in 2024 will be.

i) Completion of 2 ongoing SASEC MHPs by June 2024 and continuation of post installation support including promotion of PEU for sustainability,
ii) Support communities to adopt electric cooking and demand side management measures,
iii) Support CREF/AEPC to implement RERAS energy activities.
iv) Preparation of documents, project proposals and concept notes to mobilize resources from ADB, Norwegian Embassy, GCF and other potential development partners.

11. A SPECIFIC STORY

Unlike many married Nepali women, 21-year-old Krishna Pariyar never had to depend on her husband financially. Pariyar, a resident of Pilichaur in Jagannath Rural Municipality-1, Bajura, didn't have to depend on anyone from her maternal home either. Her life took a turn for good—a revolutionary turn, so to speak—when her tailoring business took off. She had invested NPR 20,000 in the business. "Previously, I would sew around eight pairs of clothes with the manual machine," she said. "Now, with an easy supply of electricity, I make up to 18 pairs using electric sewing machine."

Until 2015, the rural municipality was without electricity. Then came the 100kW Badigaad Micro Hydropower Project (MHP) and brightened up the village. Pariyar represents thousands of Nepali Dalit women who have to battle the existing social prejudices to live independently. But even after access to electricity, it hasn't been a smooth sailing for its residents. When a flash flood in Badigaad river swept away the structure of the MHP, they had to live in darkness. Locals were worried as to whether or how the project that was supplying electricity to 1200 households would be rebuilt.

"People would come to me to order clothes walking 4-5 hours but for a lack of power, I couldn't deliver their orders on time," Pariyar said. Electricity has directly helped her business, which subsists her family of eight. Pariyar aims to expand her shop. "If my business runs at this rate, I aim to add more machines and expand the shop," she said, noting that the hydro project is back in operation after maintenance with help from the Japanese government. "My work has increased by 80 percent since the electricity came back," Pariyar said. "My income has risen and so has my savings."

1. RISK AND ISSUE LOGS

Table 10: Risk and Issue Log Matrix

S.N	Description	Category (financial, political, operational, organizational, environmental, regulatory, security, strategic, other)	Likelihood of risk (scale of 1 to 5 with 5 being the most likely) A	Impact (Scale of 1 to 5 with 5 being the highest impact) B	Risk factor (A x B)	Mitigation measures if risk occurs	Date risk is Identified	Last Updated	Potential Effects
1.	Incompletion of 4 MHPs within the project period	Implementation	5	5	25	• ADB has extended SASEC duration up to June 2024 • Capacity building of contractor/vendor/Site Engineers on project construction management	September 2020	December 2023	• Khatyad and Chukeni Khola MHPs are expected to be completed by June 2024 • As the financial closure of Saniveri MHPs has not been completed yet, the project will not be completed before June 2025
2.	Delay in the timely financial closure of MHPs • The beneficiary community is not able to raise equity of over NPR 55 million. • Although the bank has agreed to provide loan worth NPR 65 million, they have declined to release credit as the community has not been able to raise equity	Financial	5	5	25	• The community has approached Ministry of Finance through Puttha Uttarganaga RM for grant support to cover the equity amount	September 2020	December 2023	• As the financial closure of Saniveri MHPs has not been completed yet, the construction work had to be stopped

3.	Lack of financial capacity of contractors to complete mini hydro projects on time	Operational	4	5	20	• Credit facility from CREF to ease cash flow problem of contractors.	March 2019	December 2023	• Project delivery delayed. • Project cost increased
4.	Lack of capacity of community to manage projects	Organizational	4	5	20	• Capacity building for establishment of accountable governance and management system with incentive-based rules and regulations • RERL has been supporting communities for technical backstopping by experienced professionals	December 2020	December 2023	• Irregular electricity supply and services • Weak revenue stream • Lack of proper repair and maintenance
5.	Increase in frequency and severity of natural calamities (flood and landslide)	Environmental	3	5	15	• Additional fund mobilized to rectify damages	September 2019	December 2023	• Project delivery delayed • Reconstruction/rehabilitation required • Project cost increased

ANNUAL WORK PLAN 2023

Project Title: Renewable Energy for Rural Livelihood Programme (RERL)

Award ID: 76958 / 00117173

Duration of this plan: 1 January - 31 December 2023

Country Programme Outcome 1: By 2022, impoverished, especially economically vulnerable, unemployed and under-employed and vulnerable people, have increased access to sustainable livelihood, safe and decent employment and income opportunities

Country Programme Outcome 1.1: Vulnerable groups have improved access to sustainable productive assets and environmental services

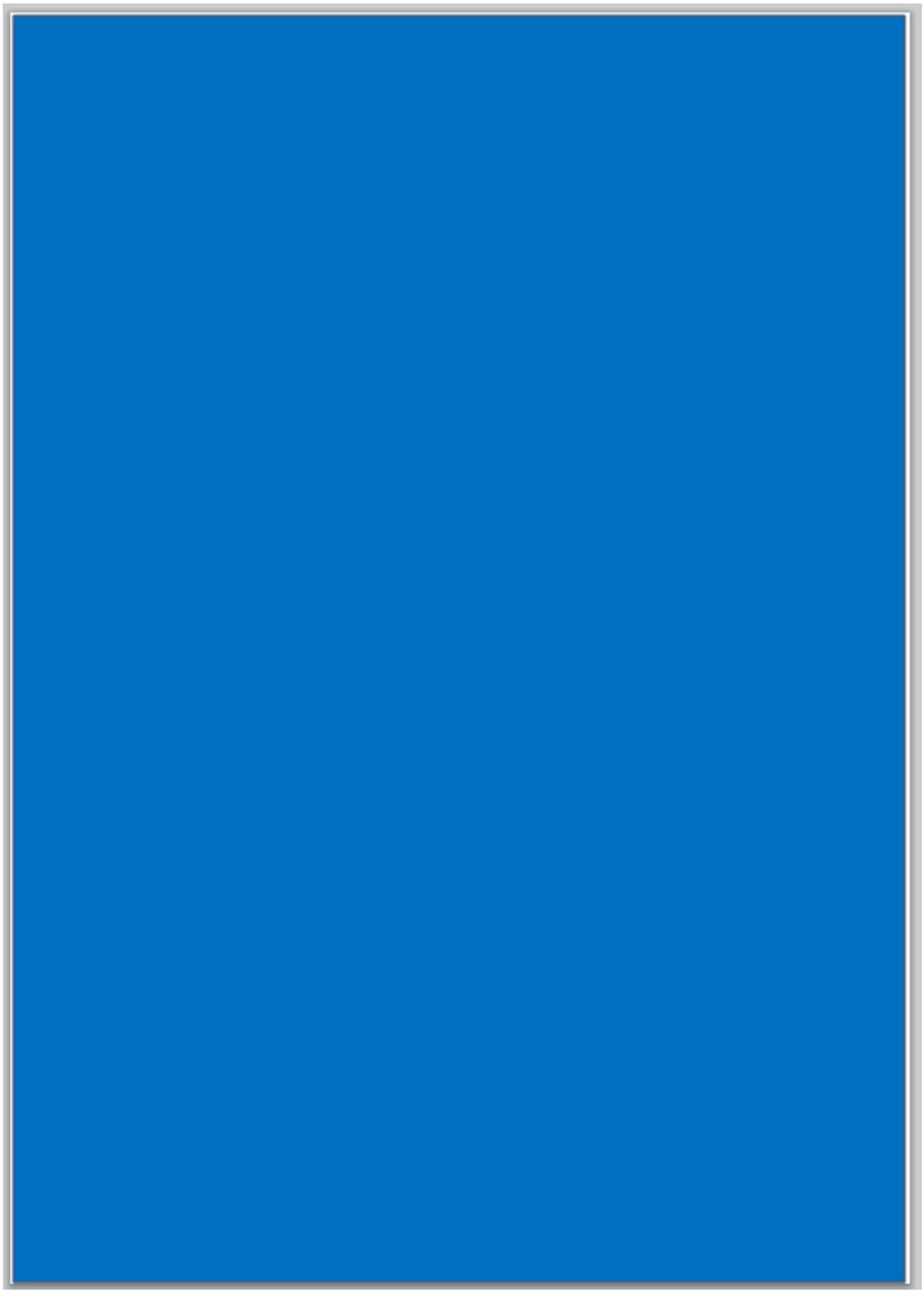
Country Programme Output 1.1.2: Number of households with energy access with UNDP supported interventions (SDG. 1.1)

EXPECTED OUTPUTS	Planned Activities	Targets for Planned Activities	Annual Achievement of Targets	Annual Achievement of Targets in %	Donor Name	Approved Budget	Amount Spent
UNDP/CPAP Output 2.4.1: . Alternative Energy Promotion Centre's capacity enhance for scaling up energy services in rural areas							
Project Output 3: Mini-grid based renewable energy systems in off-grid areas increased	**Output 1:** Provide technical support to operationalize 4.3 MW mini hydro and 0.5 MW solar/wind mini grid	• Construction and Supervision of Mini Hydro Projects • Testing & Commissioning (T&C) Backstopping • O&M Technical Backstopping • Knowledge Products and Publications	• Construction & Supervision of Bom Khola, Middle Phawa Khola, Giri Khola, Patarasi Chukeni Khola, Khatyad Khola MHP • T&C of Chukeni Khola • Published Guideline of Cooperative Management • Documentary on JSB Micro Hydro and Solar	**100%**	ADB	**263,150.00**	**261,868.00**

			Drinking Water Projects				
	Output 2: Strengthened institutions for smooth operation and management of mini hydro and solar/wind mini grid subprojects	• Impact Study SASEC Solar Mini Grid Projects • Gender Equality and Social Inclusion • Institution Establishment and Stengthening	• Impact Study SASEC Solar Mini Grid Projects • Linking between Energy and Gender and Social Inclusion Training • Performance assessment of 5 solar lift irrigation in Jumla	**89%**	UNDP	**34,250.00**	**30,537.50**
Project Output 4: Capacity Development support to NEA and AEPC	**Output 3** Facilitated utilization of at least 20% of installed capacity for productive use	• Social mobilization For promotion of productive energy uses • Business Opportunities Assessment of Enterprises and Business plan preparation • Entrepreneurship training and selection of business/enterprise with emphasis on women, BPL, DAG	• Community mobilization in 5 MHPs in Bajura • Basic Smart Phone Repairing Training – 20 people including 4 women • Advance Tailoring Training – 10 people all women • Electric Home Appliance Repair Training – 4 people • Basic Beautician Training – 7 people all women • Repair and maintenance of induction stove	**81%**	UNDP	9,200.00	7489.00

			and electric pressure cooker for 6 participants from Jumla & Bajura				
	Output 4 Developed capacity of promoters and users for operation and management of subprojects	• House Wiring Training • Electrical Hazards and Safety Awareness training for the consumers of Mini-Hydro Subproject	• Training for 16 Operators in Malagad MHP, Bajura • Enterprise Development Training for 20 participants including 10 women in Giri Khola, Jumla • 3 people including 1 woman participated in Computerized Account Management Training • 2 people including 1 woman participated in Account Training for Cooperative Manager	**100%**	UNDP	**64,000.00**	**63,952.00**

	Output 5: Strengthened policy and planning environment to support RE and other low-carbon technology development and utilization	• RE Policy and Planning in Federal Structure		**100%**	UNDP	**11,800.00**	**11,625.00**
Programme Support Activities				**100%**	UNDP	**76,240.00**	**78,143.00**
JSB				**100%**	UNDP	**1,363,184.00**	**1,363,184.00**
TRAC II				**100%**	UNDP	**150,000.00**	**150,000**
Total Budget & Expenditure						**1,973,824.00**	**1,966,798.00**

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