Government of Nepal

Ministry of Energy, Water Resources and Irrigation

Alternative Energy Promotion Centre

Progress at a Glance: Year in Review
FY 2078/79 (2021/22)

Hon. Pampha Bhusal
MINISTER
Energy, Water Resources and Irrigation

Government of Nepal
Ministry of Energy, Water Resources and Irrigation

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MESSAGE FROM THE CHAIRPERSON

On the auspicious occasion of the annual day of establishment of Alternative Energy Promotion Centre (AEPC), it gives me immense pleasure to extend felicitations both on my personal behalf and on behalf of the Ministry of Energy, Water Resources and Irrigation (MoEWRI) for its' 26 years of glorious services in renewable energy development and promotion in the country. I congratulate the entire team of AEPC for their meticulous efforts and continuous devotion towards improving access to clean energy through rural and renewable energy technologies mainly mini and micro hydropower, solar energy, and biomass energy (biogas and improved cook stoves) thereby reducing dependency over traditional and imported energy sources. The efforts are especially noteworthy as AEPC has ensured improved access to modern energy services to more than 18% of rural remote households of the country that were then beyond grid connectivity. Even with the rapid expansion of the national grid to most parts of the country, the promotion of off-grid renewable energy systems still holds much significance for increasing modern energy services to the 'last mile' population of highly scattered settlements of Nepal.

Government of Nepal continues to accord high priority for sectoral development of the renewable energy sector in the country. With the abundance of renewable energy resources available in the country, the government has prioritized harnessing renewable energy for providing reliable and uninterrupted energy supply to meet the growing domestic energy demand thereby being a key input to fulfill its aspirations both for economic growth and energy security of the country. During fiscal year, i.e., FY 2078/79, AEPC has achieved a good result in the renewable energy sector with an overturn of more than 80% in terms of both financial and physical progress, though field level disturbances caused by Covid-19. It has also revised the Renewable Energy Subsidy Policy to make renewable energy solutions more affordable in remote and very remote areas of the country. Government of Nepal as per the current status of electricity access and un-electrified areas and number of households to be electrified aims to achieve 100% electrification within the next two years. AEPC has important role to play mainly for promoting the off-grid renewable energy solutions to achieve this target.

The wide-ranging support of stakeholders including the External Development Partners, Local and Provincial Governments to the government's endeavors for further promotion and expansion of renewable energy solutions have been significant. On the occasion of the 26th years of establishment of AEPC, I would like to thank the external development partners, private sector, civil societies and all stakeholders for their continuous support in the government's endeavors which has invigorated the sector to attain new heights. Finally, I like to thank AEPC team for publishing the annual progress report, which provides valuable information on its' targets and achievement of FY 2078/79.

Pampha Bhusal
Hon'ble Minister for Energy, Water Resources and Irrigation
and Chairperson, Alternative Energy Development Board

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MESSAGE FROM THE SECRETARY

Alternative Energy Promotion Centre (AEPC) as the government nodal agency has the principal role for the promotion of renewable energy to achieve universal access to clean, reliable and affordable energy solutions in the country. AEPC has supported to generate electricity through mini grids and off-grid electrification solutions, clean cooking solutions and providing clean energy services to rural people since last 26 years reaching out to more than three million households with a blend of renewable energy technologies. The promotion and expansion of clean lighting and cooking solutions have a significant impact in improving the quality of lives of the local communities in rural remote areas of Nepal. Decentralized and small-scale renewable energy is still the most locally available and affordable source of energy in remote areas which can contribute in reducing carbon emission, ensuring reliable power supply and diversification, enhancing energy security and reducing dependency on fossil fuels.

During the fiscal year 2078/79, AEPC has achieved a steady progress with more than 80% progress both financially and physically. This has enabled it to provide more than 35,000 households with electricity and around 20,000 households with clean cooking solutions in remote areas of the country. The progress achieved on the overall renewable energy systems has been contributing to the target set in the 15th Plan of the Government of Nepal which aspires for a 12% contribution of renewable energy in the total energy consumption by FY 2080/81. Furthermore, it remains a challenge to reach to the poorest of poor households in the extremely remote areas of the country.

As renewable energy is a key component in the White Paper of the Ministry, special initiatives and programmes have been conceived such as the 'Every Home Energy Home' on energy efficiency, Solar Mini Grid program targeting mountainous and upper hilly regions, drive for Clean Cooking Solutions, Grid Connected Solar Roof Top with net metering and net payment system and 'Every Locality Energy Locality' where the government has established Sustainable Energy Challenge Fund to develop renewable energy technologies at each local level of the country. AEPC has an important role in assisting provincial and local governments in designing policies, regulations and procedures on renewable energy development and promotion.

Finally, I am extremely delighted on the achievements of AEPC and would like to congratulate the entire team of AEPC, External Development Partners and other stakeholders for their continued supports in this sector and achievements made during the last fiscal year; and wish for continued effort and profound spirit in the forthcoming years. I hope that the publication of this report will disseminate information to all stakeholders and people regarding the initiatives and achievements of renewable energy technologies in Nepal.

Sushil Chandra Tiwari
Secretary (Energy)
Ministry for Energy, Water Resources and Irrigation

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ALTERNATIVE ENERGY PROMOTION DEVELOPMENT BOARD

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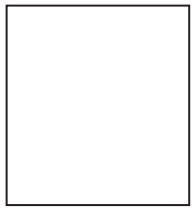

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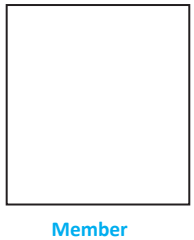
Managing Director, Nepal Electricity Authority



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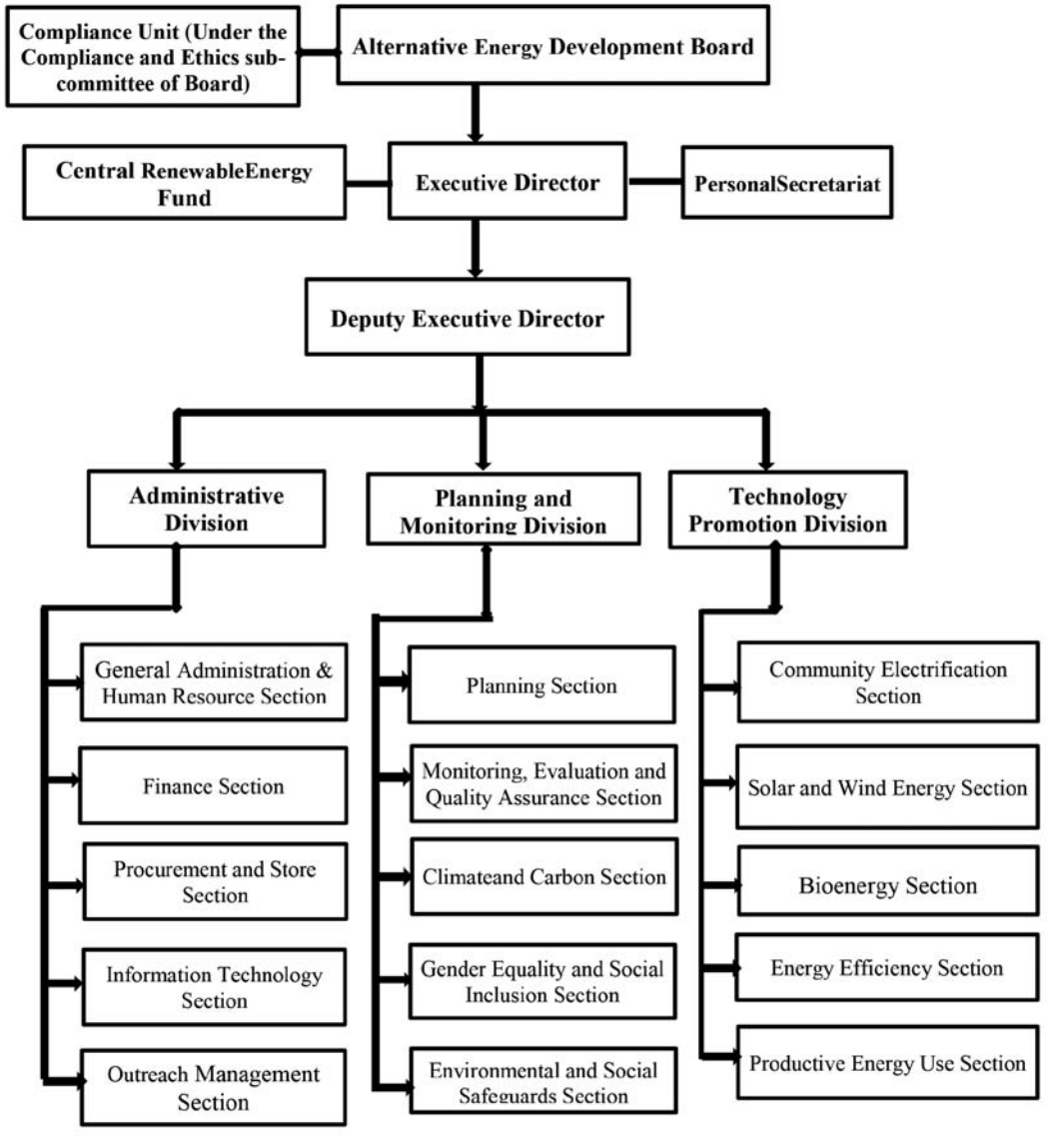
Dr. Madhusudhan Adhikari
Member Secretary
Executive Director, AEPC

ORGANIZATIONAL STRUCTURE OF AEPC



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MESSAGE FROM THE EXECUTIVE DIRECTOR

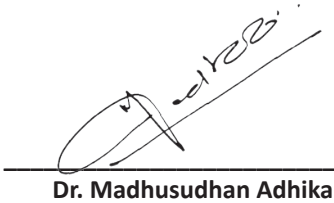
Alternative Energy Promotion Centre (AEPC), established on 3rd November 1996 (18 Kartik 2053 B.S.) with the mandate of developing, promoting and expanding renewable energy technologies with focus in rural areas of Nepal, has rapidly evolved into a nationally and internationally recognized organization. Energy efficiency is a new mandate given to AEPC by the Government of Nepal. It seeks to adopt the measures to addressthe predominant energy poverty and provide viable renewable energy options primarily in rural remote areas by replacing traditional and imported fossil fuels.

The Constitution of Nepal has clearly defined the right to reliable and affordable energy. The 15thplan has also set the target of 12% contribution of electricity access via renewable energy in the total energy consumption by the FY 2080/81. In addition, the plan aims to provide electricity access to additional 5% of the total populationthrough micro and mini hydropower, solar and wind energy and also implement climate change adaptation plans at the local levels. The plan further envisages to install 0.2 million household biogas plants and 0.5 million improved cooking stoves and thermal gasifiers, 20 thousand metric ton annual production of bio briquette and pellets, 2 more carbon projects and annual replacement of 40 thousand metric ton of liquefied petroleum gas through installation of 500 large biogas plant. The Ministry's White Paper 2018 adopts a policy to establish a challenge fund to develop 100-500 kW solar energy at each local level. Similarly, it focuses on Mountainous and Upper Hills targeted Solar Mini Grid program, Clean Cooking Solutions at designated 22 districts of the Terai region and develop AEPC as "Center of Excellence" in renewable energy.

As we are in our 26th anniversary, we reflect on our many accomplishmentsthrough the continuous financial and technical support from the Government of Nepal and external development partners, dedication of our staff and the engagement of the private sector and local communities that have contributed tremendously to the achievement of increasing access to electricity and clean cooking solutions to majority of the population. Over the years, AEPC has supported more than 14 million people across country realizing their energy needs through deployment of appropriate renewable energy solutions, subsidy and credit financing. More than 500 private service providers and numerous local communities are leading service delivery while creating direct and indirect employment opportunities to well over 30,000 people. Despite the Covid-19, AEPC has achieved a remarkable progress during the fiscal year 2078/79 with 83% and 84% of physical and financial progress respectively. During the year, AEPC installed 2,615 kW micro and mini hydropower projects with varying capacities, supported 12,076 and 13,303 households with solar PV home system for electricity and improved cook stoves (metallic stoves and electric stoves) respectively. We constructed 6,374 domestic biogas plants, 683 solar drinking water and irrigation projects and 1009 remote health care and community schools solar PV systems. In addition, there have been various activities related to research and development, user surveys, impact studies, capacity building of provincial and local governments staff. AEPC has also supported the Government for formulating

the Subsidy Policy for Renewable Energy, Renewable Energy Bill and Energy Conservation and Efficiency Bill. This year AEPC achieved the milestone to have land to construct its own office building. Similarly AEPC prepared last mile electrification plan to electrify remaining households and country action plan for transforming the cook stoves and fuel market in Nepal.

The role of AEPC is critical for the sectoral growth of RETs and for providing electricity access and clean cooking solutions to all the people of Nepal. As the foundation of the organization has remained a key challenge, the need of a stronger AEPC is vital in the present context. Finally, AEPC greatly appreciates the role of the Ministry in taking ownership of AEPC's agenda and the role of development partners for their continued support, assistance and cooperation.



Dr. Madhusudhan Adhikari
Executive Director, AEPC

ABBREVIATION AND ACRONYMS

AEPC	Alternative Energy Promotion Center
AEDB	Alternative Energy Development Board
BAT	Best Available Technology
BAU	Business as Usual
BDS	Business Development Services
BMZ	German Federal Ministry for Economic Cooperation and Development
CCU	Climate and Carbon Unit
CDM	Clean Development Mechanism
CER	Certified Emission Reductions
CPA	CDM Program of Activity
CREF	Central Renewable Energy Fund
DAE	Direct Access Entity
DAGs	Disadvantaged Groups
DBG	Domestic Biogas
DOE	Designated Operational Entity
DoED	Department of Electricity Development
DP	Development Partners
EDP	External Development Partners
EE	Energy Efficiency
EJ	Exajoule
ESCOs	Energy Service Companies
ESS	Environmental and Social Safeguards
FY	Fiscal Year
GCF	Green Climate Fund
GDP	Gross Domestic Product
GEF	Global Environment Facility
GESI	Gender and Social Inclusion
GHG	Greenhouse Gas
GoN	Government of Nepal
ICS	Improved Cooking Stoves
IEA	International Energy Agency
ISPS	Institutional Solar Photovoltaic System
IWM	Improved Water Mills
KfW	German Development Bank
kW	Kilowatt
kWh	Kilowatt Hour
LBG	Large Biogas
LFI	Local Financial Institutions
LPG	Liquefied Petroleum Gas
MEP	Municipal Energy Plan
MGEAP	Nepal Private Sector-Led Mini Grid Energy Access Project
MHDF	Micro Hydro Debt Fund
MHP	Micro Hydro Projects
MICS	Metallic Improved Cooking Stoves
MoEWRI	Ministry of Energy, Water Resources and Irrigation

MoF	Ministry of Finance
MSME	Micro, Small and Medium Enterprises
MSW	Municipal Solid Waste
MuAN	Municipal Association of Nepal
MW	Megawatt
NAMA	Nationally Appropriate Mitigation Action
NARMIN	National Association of Rural Municipality in Nepal
NDA	National Designated Authority
NDC	Nationally Determined Contribution
NEA	Nepal Electricity Authority
NGO	Non-Government Organizations
NPC	National Planning Commission
NPR	Nepalese Rupees
NREF	National Renewable Energy Framework
NREP	Nepal Renewable Energy Program
NRREP	National Rural and Renewable Energy Program
PEU	Productive Energy Use
PoAs	Program of Activities
PPP	Public Private Partnership
PVPS	Photovoltaic Pumping Systems
RA	Reverse Auctioning
RE	Renewable Energy
RERA	Renewable Energy for Rural Areas
RERL	Renewable Energy for Rural Livelihood
RETs	Renewable Energy Technologies
RSC	Regional Service Center
RTSP	Regional Technical Service Provider
SAMS	Subsidy Administration Management System
SASEC	South Asia Sub-regional Economic Cooperation
SDG	Sustainable Development Goals
SDW	Solar Drinking Water
SHS	Solar Home System
SIS	Solar Irrigation System
SOP	Standard Operating Procedure
SREP	Scaling Up Renewable Energy Program
TPD	Tons Per Day
TWh	Terra Watt Hour
UNDP	United Nations Development Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United State Dollars
WECS	Water and Energy Commission Secretariat

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Rt. Hon Prime Minister Sher Bahadur Deuba inaugurating the Waste to Energy Plant (30 TPD), Dharan Sub-metropolitan City

CHAPTER 1

ENERGY SECTOR OVERVIEW

1.1 THE CONTEXT

Energy plays a leading role as a global commodity and as a cornerstone of socio-economic development. Considering the contribution of energy in the economy and the overall wellbeing of society, access to clean and affordable energy has remained to be of prime importance. "Between 1973 and 2019, world total energy supply (TES) increased 2.4 times (from 254 EJ to 606 EJ) and its structure changed. Oil fell from 46% to 31% of TES between 1973 and 2019 but still is the dominant fuel followed byCoal which increased from 24.7% in 1973 to 26.8% in 2019. Natural gas consolidated its third rank, growing from 16% in 1971 to 23% in 2019. Hydro increased from 1.8% to 2.5% supplying 15.15 EJ. Solar, Geothermal, Wind and other source has seen significant growth and contributing 2.2% of the total energy supply.[1]

Hydro significantly increased in 2018 (+3.5%), providing 2.5% of global energy production in 2018. Solar photovoltaic, wind and solar thermal productions kept increasing in 2018 but at a slower pace (+24.7%, +12.4% and +3.2% compared to +34.9%, +17.6% and +3.2% in 2017 respectively). As for geothermal, its production grew at the same rate in 2018 and 2017 (+7.2%). Nonetheless, they still accounted for hardly 2% of global primary energy production together."[2] This suggests that there are still avenues to decouple energy production from conventional sources.

Continuing the trend of decreasing share of fossil fuels and increasing shares of renewables, oil demand in 2020 fell by 8.8% its largest ever decline. Similarly, the demand of coal and natural gas dropped by 4% and 1.9% respectively. Renewable energy demand increased by 3% mainly due to use of renewables in electricity generation.

In regards to the electricity generation, it declined by 1% in 2020. The share of renewables in electricity generation increased by 7% mainly owing to increase in solar PV energy and wind energy which grew at 12% and 23% respectively. Share of non-renewables sources for electricity generation declined by 3% with share of coal, gas fired power plant and oil declining at 4.4%, 1.6% and 4.4% respectively.[3]

Nepal's National energy demand and supply scenario depicts a gap in energy demand and supply. Since energy is fundamental to propel National economy and overall socio-economic development, situation of under supply or a "suppressed demand" leads to a compromise. Therefore, careful planning and

1 Key World Energy Statistics (2021) https://iea.blob.core.windows.net/assets/52f66a88-0b63-4ad2-94a5-29d36e864b82/KeyWorldEnergyStatistics2021.pdf

2 World Energy Balances: Overview (2020 edition), https://iea.blob.core.windows.net/assets/23f096ab-5872-4eb0-91c4-418625c2c9d7/World_Energy_Balances_Overview_2020_edition.pdf

3 https://iea.blob.core.windows.net/assets/d0031107-401d-4a2f-a48b-9eed19457335/GlobalEnergyReview2021.pdf

deployment of efforts and resources are critical to narrow the gap in future. Nepal's electricity demand projection based on total population (39 million) and gross domestic product (GDP) growth rate of 4.5% (the Business-as-Usual Scenario) for 2040 stands at 1536 kWh). The projection of per capita electricity consumption in the business-as-usual (BAU) scenario from 2015 to 2040 is presented in figure 1[4]. This projection demands enhanced generation of electricity through all available means.

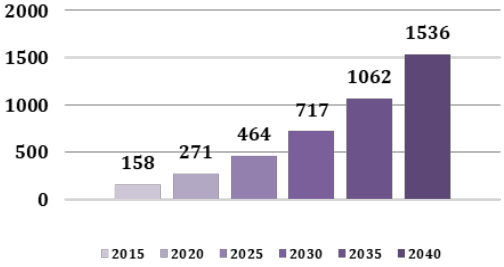


Figure 1: Projection of Electricity Consumption for 2015-2040 in kWh, (adapted from WECS, 2017)

1.2 NATIONAL ENERGY CONSUMPTION SCENARIO

The households in the country have more affinity towards solid fuels (fire woods) as primary fuel for cooking followed by the use of Liquefied Petroleum Gas (LPG). While Traditional Cookstoves (TCS) is predominantly used for cooking in the rural areas, Liquefied Petroleum Gas (LPG) is the most commonly used cooking technology in the urban and peri-urban areas. Moreover, LPG has to be imported and in 2021/22, Nepal imported 536,028 MT of LPG, which is a 195% increase since 2011/12.[5] This over dependence on LPG import has put Nepal in a perilous situation, as it has not only widened the trade deficit, but has also made Nepal very susceptible to risk of energy security. Nepal must curtail its dependency on LPG in order to strengthen its economy and for its sovereignty.

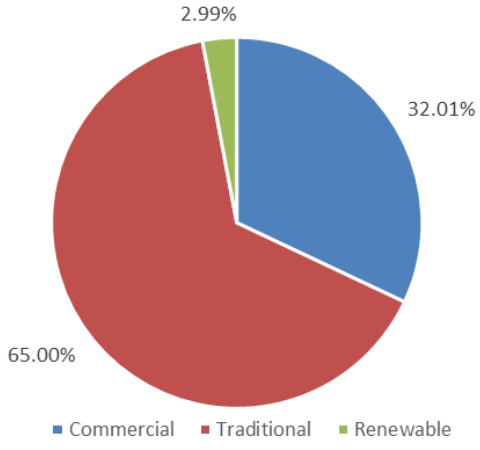


Figure 2: Energy Consumption by Fuel type 2021/22first eight months, (adapted from MoF, Economic Survey, 2078/79)

However, household's heavy reliance on traditional energy sources (solid fuels) remains alarming.The ratio of conventional, commercial and renewable energy consumption to total energy consumption has been 65.00 percent, 32.01 percent and 2.99 percent, respectively. Figure 2 presents the energy consumption scenario by fuel type in first 8 months of FY 2021/22 (Economic Survey 2078/79 B.S., MoF).

1.2.1 National Electrification Status Access

By mid-March 2022, population having access to electricity has reached 94.0 percent. In comparison to the last fiscal year the total electricity generation has increased by 30.9 percent to 2,205 megawatt (MW). Out of the total generated electricity, 2,033megawatts is from hydroelectricity, 49.73 megawatt from solar plant, 53.4

4 Water and Energy Commission Secretariat (WECS), 2017: Electricity Demand Forecast Report (2015-2040).

5 Nepal Oil Corporation (NOC), 2022 http://noc.org.np/import?type=import&offset=0&max=10

megawatt from thermal plant and 80 megawatts from others which include renewables and co-generation (Economic Survey 2078/79 B.S., MoF). As of the mid-March of fiscal year 2021/22, 398 kilowatts (KW) of micro and small hydropower and 200 KW of solar and wind projects have been commissioned.. During the same period, 1,733 biogas plants,11,956 solar household power systems have been installed(Economic Survey 2078/79 B.S., MoF).

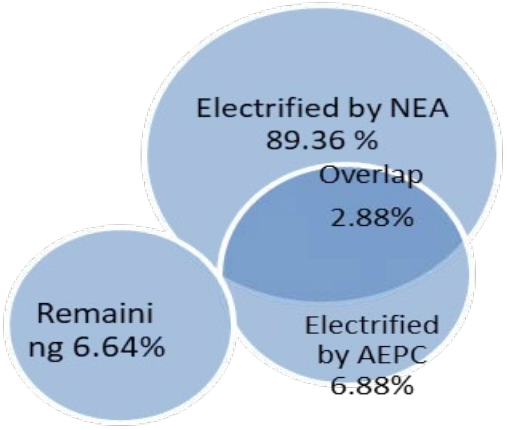


Figure 3: Energy Access Data

1.3 SECTORAL EVOLUTION

The seventh plan (1985-1990) embraced alternative energy in the national planning framework and adopted the policy to encourage alternative sources of energy; especially the biogas, solar and wind. Similarly, the plan also adopted the policy to promote improved cooking stoves (ICS), small water turbines and the improved water mills (IWM). In order to realize the policy targets, the plan adopted working policy of engaging private sector and providing the consumers with grant or loan for effective promotion of such technologies. The plan equally emphasized on the research and studies, and on developing technical manpower. Subsidy was first introduced during this plan for the technology (biogas, ICS, IWM and small turbines) and research/ training.

The eighth plan (1992-1997) marks as the first plan of the democratic government of Nepal after restoration of democracy in 1990. The plan continued with the alternative energy agenda adopted by the previous plan and realized the need to set up an alternative energy agency to implement and coordinate different energy related programs. The plan emphasized rural electrification and electricity from micro-hydro projects as a means to achieve it and institutionalized set up for development of micro-hydro projects, biogas energy, solar energy, wind energy and biomass energy. The plan envisioned that the alternative energy development program be implemented through efforts of the private sector. The program was envisioned for implementation with necessary collaboration between the Agricultural Development Bank, other financial institution, private sector and non-government organizations. The plan continued with the allocation of government budget in alternative energy sector.

By the Ninth Plan (1997-2002), development of rural energy was recognized as a means to increase employment opportunity with the aim to develop economic foundations, enhance rural living standard and maintain environmental sustainability. The plan adopted a policy to engage private sector, national and international non-government organizations in research and development of rural and alternative energy technologies. Similarly, the plan institutionalized Alternative

Energy Promotion Center (AEPC) to collect and update data related to alternative energy technologies. The plan especially emphasized on expansion and promotion of ICS, micro hydro, solar and other isolated renewable energy technologies. In the meantime, the plan also conceptualized the decentralized energy planning and adopted a policy to institutionalize AEPC as the focal agency for promotion of alternative energy in Nepal. The plan also sought to attract private sector and grid interconnection of the rural alternative energy systems.

The tenth plan (2002-2007) came up with the quantitative targets for the deployment of renewable energy technologies and adopted long term vision of accelerating economic development, increasing employment opportunities and maintaining environmental sustainability. Similarly, the plan also envisioned to commercialize alternative energy technologies and replace the traditional forms of energy with modern energy sources. As a strategy to propel the adopted vision and target more effectively, the plan envisioned to create a Rural Energy Fund (REF) which would ultimately be propagated to district and village levels. Separate programs for promotion of biogas, solar energy, micro-hydro, wind energy and bio-energy were planned for effective implementation of the targets set.

By the time the Three Year Interim Plan (2007-2010) was formulated renewable energy sector had attained necessary institutional, organizational and execution framework for its implementation in Nepal. The plan continued setting up sectoral targets for different renewable energy technologies. In addition to the long term vision established by preceding periodic plans, this plan kept the vision to generate financial resources through development of the renewable energy technologies as Clean Development Mechanism (CDM) projects banking on the potential of the renewable energy technologies in reducing greenhouse gas emissions. Similarly, gender and social inclusion through increased participation of women and population of all caste and class in the process of promotion and utilization of renewable energy resources was envisioned. The plan focused on expansion of technologies as a means to improve energy access, livelihood, investment leverage from non-state actors and access to information. More importantly, Central Renewable Energy Fund (CREF) was conceptualized for establishment for effective and sustainable development of rural energy.

The Three Year Plan (2010-2013) adopted a long term vision of ensuring 10% contribution of renewable energy in the energy mix such that 30% penetration is achieved among the population with access to electricity. Technology specific programs adopted by previous plans were continued with the strategy to promote and expand off-grid renewable energy systems. The plan also adopted the strategy to implement integrated programs targeting overall economic and social development and environmental sustainability, sectoral coordination, and research and technology transfer. The plan adopted policies to serve urban population, through promotion of urban solar and waste to energy projects targeted at commercial and municipal scale. Similarly, institutionalization of the CREF, promotion of renewable energy based

enterprise and grid interconnection of the renewable energy projects were among the key policy introductions in the plan.

The Thirteenth Plan (2013-2016) adopted the strategy of research and development, and technology transfer of renewable energy technologies, mobilization of internal and external resources including those from carbon revenue and research, development and management of energy efficiency measures in renewable energy technologies. The plan, among others, aspired capacitating local bodies plan, implement, monitor and evaluate the renewable energy related activities. Similarly, the plan also adopted policy to operationalize CREF, manage the used batteries generated from solar based technologies and use solar and wind technologies for the purpose of water pumping.

The Fourteenth periodic plan (2016-2019) aspired to reach additional 9% of population with electricity from solar, hydro (mini and micro) and wind resources. The 14th plan also aimed to promote 0.2 million units of biogasdigester and 1.065 million units of improved cooking stoves (NPC, 2016)[6].

1.4 PREVAILING POLICY AND LEGAL FRAMEWORK

The Constitution of Nepal (2015) ensures that the government will take the policies relating to protection, promotion and use of natural resources (Part 4 Article 51 g). The constitution directed that the government will take the policy to ensure reliable supply of energy in an affordable and easy manner, and make proper use of energy, for the fulfillment of the basic needs of citizens, by generating and developingrenewable energy[7]. This has mandated the government to develop and implement the policies and strategies related to renewable energy promotion in the country.

Rural Energy Policy (2006)focuses on reducing dependency on traditional energy and conserve environment by increasing access to clean and cost effective energy in the rural area. Increase the living standards of rural people by creating employment and productivity through the development of rural energy resources.

Nationally Determined Contributions (NDC) (2016) of Nepal focuses on the promotion of renewable energy and energy efficiency for the adaptation and mitigation of climate change. The process of revising the NDC 2016 has been completed.

Biomass Energy Strategy (2017) aims to promote the biomass energy as reliable, affordable and sustainable energy resource to address the increasing energy demand of Nepal. Increasing production of sustainable biomass energy by utilizing agriculture, forest residues and organic wastes hence contributing access to clean cooking solutions. Increasing the effectiveness and efficiency of utilization and production of Biomass energy.

National Energy Efficiency Strategy (2018) *approved by the* GoN's cabinet meeting on November 19, 2018 sets its **vision** to assist in the energy security by increasing the energy access through efficient use of available energy, **mission** to promote energy efficiency by effectively implementing energy efficiency programmes through establishing policy, legal and

6 National Planning Commission (NPC), 2016: The Fourteenth Plan (2016/17-2018/19)

7 The Constitution of Nepal (2015)

institutional framework and the **goal** to double the average the improvement rate of energy efficiency in Nepal from 0.84% per year, which existed during the period of 2000-2015 to 1.68% per year in 2030 A.D.

The white paper of Ministry of Energy, Water Resources and Irrigation (2018)[8] presents the scenario of the renewable energy in Nepal. Above 55 MW of the electricity has been produced by the renewable energy serving 3.6 million people. The white paper has provisioned the policy to establish the challenge fund to develop the 100 to 500 kW solar energy in each local level. The white paper also focuses to develop AEPC as "Centre for Excellence" in renewable energy sector. Priority has also be given to establish national carbon market for renewable energy.

National Climate Change Policy (2019) adopts the goal of contributing to socio economic prosperity by developing climate resilient society. Following a theme based approach in eight thematic areas of (i) agriculture and food security (ii) forest, biodiversity and watershed conservation (iii) water resources and energy (iv) rural and urban settlement (v) industry, transport and physical infrastructure (vi) tourism, natural and cultural heritage (vii) health, drinking water and sanitation (viii) disaster risk reduction and management and four cross cutting areas of (i) gender and social inclusion, livelihood and good governance (ii) Increased public awareness and capacity development (iii) Research, technical development and dissemination (iv)climate finance management . It aims at advancing capacity on climate change adaptation, promoting green economy, mobilizing national and international climate finance, formulating strategies, regulations and guidelines at all three tiers of government The current policy released on August 2019 supersedes the Climate Change Policy 2011 of Nepal which had the objective to reduce GHG emissions by promoting the use of clean energy, such as hydro-electricity, renewable and alternative energies, and by increasing energy efficiency and encouraging the use of green technology.

Environment Policy (2019) aims to ascertain the citizens' right to live in clean and healthy environment through pollution control, Waste management and greenery development. The policy strategizes to the mitigation activities through promotion of electric vehicles and the use of renewable energy technologies. Similarly, the policy strategizes the adaptation activities through expansion of "Climate Resilient Village" program, sustainable forest management practices and integrated watershed management practices. The policy also adopts strategy for climate resilient infrastructure in order to minimize the infrastructure related loss and damages from disasters.

Fifteenth Periodic Plan has been adopted by the GoN in FY 2019/20 and up until 2023/24. The plan has a vision to uplift society from the impacts of climate change, aiming to enhance capacity of resilience and minimize the adverse consequences on the development of sustainable society. The plan has set the strategy and working policy to utilize the resources from carbon financing and other climate financing including Green Climate Fund for the promotion of renewable energy in Nepal. The plan aspires to for a 12% contribution of

8 White Paper of Ministry of Energy, Water Resource and Irrigation

renewable energy in the total energy and envisages to install 0.2 million household biogas plants and 0.5 million improved cooking stoves and thermal gasifiers, 20 thousand metric ton annual production of bio briquette and pellets, 2 more carbon projects under its belt and annual replacement of 40 thousand metric ton of liquefied petroleum gas through installation of 500 large biogas plant.

Second Nationally Determined Contribution (NDC), 2020 By 2030, ensure 15% of the total energy demand is supplied from renewable energy sources; In transport, 25% electric vehicles in 2025 and by 2030, increase to cover 90%; In Residential cooking by 2030, ensure 25% of households use electric stoves by 2025, install 500,000 improved cook stoves, specifically in rural areas and by 2025, install an additional 200,000 household biogas plants and 500 large scale biogas plants.

Long Term Strategy for Net Zero Emissions (2021) envisions bold policymaking, social transformation and technological innovations that will lead to a carbon neutral, inclusive and climate resilient path. The strategy was developed with the intentions of developing pathways for reducing emissions and hence achieve net zero carbon emission by 2045 by increasing the use of clean energy, improve energy efficiency, increase carbon sinks, expand circular economy and invest in carbon neutral and circular economy compatible technologies etc.

National Adaptation Plan (2021) aims to help the country achieve the objectives of the NAP process that have been agreed under the UNFCCC. These objectives are to reduce vulnerability to the impacts of climate change by building adaptive capacity and resilience and to facilitate the integration of climate change adaptation, in a coherent manner, into relevant new and existing policies, programmes and activities, in particular development planning, processes and strategies, within all relevant sectors at different levels as appropriate. The NAP has been formulated to help the country adapt to the effects of climate change over short term (until 2025), medium term (until 2030) and long term (until 2050).

RE Subsidy Policy (2022) focuses on providing universal access to clean, reliable and affordable renewable energy by 2030 by expanding access to renewable energy while reducing reliance on traditional and commercial energy sources. Reduction and re-adjustment of the subsidy amount to increase access to RE technology. Empowerment of women and indigenous people by creating employment opportunities through the use of Renewable Energy Technology. Encourage private and financial sectors to invest in renewable energy by reducing risk and hence assist in developing market for renewable energy.

National Renewable Energy Framework (2022) is an umbrella mechanism to coalesce and coordinate policies and programmes in the RE sector behind a set of strategic objectives. It is jointly owned by the GoN and DPs, and aims to converge initiatives of GoN, DPs and other organisations behind a common over-arching vision delivered through an integrated results framework. The RE Framework will serve to jointly coordinate and track results of various RE initiatives, engage stakeholders and help mobilise finance.

Hon. Minister Ms. Pampha Bhushal on the occasion of the silver jubilee of AEPC along with and Hon. British Ambassador to Nepal Nicola Pollitt

CHAPTER 2

ALTERNATIVE ENERGY PROMOTION CENTRE

2.1 INTRODUCTION

The positive role of RETs for the fulfillment of energy needs of rural people was recognized by the Government of Nepal as early as 1980's in the Seventh Five Year Plan. Since then, the promotion and development of RETs has gained momentum by integrating them in development plans and programmes. Alternative Energy Promotion Centre (AEPC) was established on November 3, 1996 by the Government of Nepal with the objective of developing and promoting renewable energy technologies in the country. Currently under the Ministry of Energy, Water Resources and Irrigation, AEPC is a semi-autonomous government body governed by the Alternative Energy Development Board (AEDB) represented by members from the government, private sector, non-governmental organizations and financial institutions. AEPC's Board is the supreme body for the overall management of activities planned and implemented by AEPC.

2.1.1 Mandate

The mandate of AEPC includes the promotion of micro/mini hydro up to 10 MW, solar energy, wind energy, biomass energy, biogenetic gas, sulfur spring including biogas. The Seventh Amendment of the AEPC Formation Order 2053 (1996) has broaden the functions of AEPC. AEPC has been mandated for energy efficiency, implementing carbon related projects and working with provincial and local governments for their capacity building in implementing renewable energy and energy efficiency projects.

2.1.2 Vision Statement

An institution recognized as a regional/ international example of promoting large-scale use of renewable energy sustainable and a national focal point for resource mobilization. The focus is to make AEPC recognized as an active institution promoting RETs in the region.

2.1.3 Mission Statement

To make renewable energy mainstream resource through increased access, knowledge and adaptability contributing for the improved living conditions of people in Nepal.

2.1.4 Strategic Objectives

The main objectives of the AEPC are as follows:

- To popularize and promote the use of alternative/renewable energy technology.
- To raise the living standard of the rural people.
- To protect the environment.
- To develop the commercially viable alternative energy industries in the country.

2.2 AEPC's WORKING APPROACH

2.2.1 Working Modality

AEPC follows the Public Private Partnership (PPP) Model and Demand Based Approach. The public sector works for the capacity building, technical and financial assistance, coordination, quality assurance etc. and the private sector works for manufacturing, supply and installation, and after-sales services. AEPC supported to institutionalize renewable energy and climate change agenda at decentralized level through establishing District Environment, Energy and Climate Change Sections. Similarly, AEPC executed programs have been succeeding in service delivery through partnership with the national/regional level Non-Government Organizations (NGOs). AEPC engages with private sector for manufacturing, supply, installation and after sales services of different renewable energy technologies.

AEPC APPROACH FOR PROGRAM IMPLEMENTATION

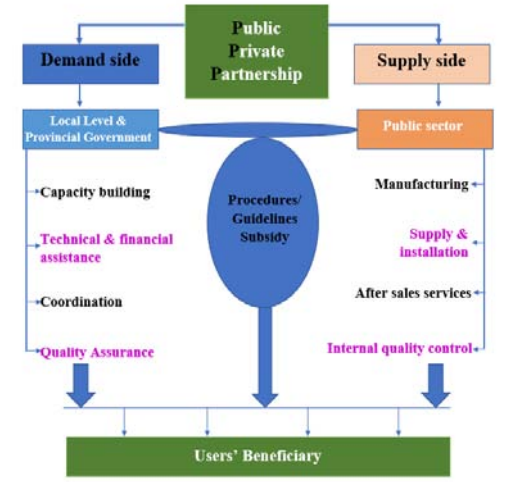


Figure 4: PPP Model of Renewable Energy Service Delivery

After the promulgation of the new constitution and state restructuring into the federal system, AEPC has been concentrating its efforts to establish provincial setups (7 provinces) and local setups (753 local governments).

At national level AEPC works closely with related ministries, their departments, non-governmental organizations, private sector, civil society, national banking institutions, academic institutions and community/users groups for the development and promotion of RETs in the country. With 26 years of its successful operation, AEPC has maintained working relations with a range of External Development Partners (EDPs), Intergovernmental organizations, multilateral banks etc. AEPC is also involved in accessing different international climate and environment funds. AEPC has been accredited as the Direct Access Entity of the Green Climate Fund (GCF) with a signed funded activity agreement for the project "Mitigating GHG emissions through modern, efficient and climate friendly clean cooking solutions". AEPC is also the delivery partner of the Green Climate Fund to implement the GCF Readiness and Preparatory Support Program on behalf of the Ministry of Finance. Further AEPC has been regularly involved in developing project concepts and proposals to increase the access to the available international climate finance resources.

2.2.2 Promotion of Renewable Energy

Presently, AEPC is implementing different programs and projects to promote the following renewable energy systems in the country:

- Mini and Micro Hydropower,
- Improved Water Mill;
- Solar Photovoltaic and Solar Thermal;

- Biogas;
- Biomass and Bio-fuels;
- Wind Energy,

In addition, AEPC has promoted RETs under carbon project (basically Clean Development Mechanisms). Biogas, Micro-hydro, Improved Water Mills and Improved Cook-stoves are already under the portfolio of CDM. AEPC is gradually planning to develop more RETs aligning with the Paris Agreement.

2.2.3 Outreach

The role of outreach in the current federal context is pivotal. The outreach function at AEPC has aptly assisted in signing Memorandum of Understanding (MoU) with all the seven provincial levels, concentrates it efforts of capacity building and orientation on RE at the provincial and local level and ultimately providing technical assistance to the provincial and local level in designing, developing, implementing and monitoring Renewable Energy Programs.

In order to assist the local governments, AEPC has prepared methodology to develop Municipal Energy Plan(MEP), with inputs from municipalities and development partners. The MEP focuses on provision of clean cooking and lighting solutions for all by 2030, energy for community services such as health centers and schools and enterprises. The methodology helps identify the least cost solutions for a set of particular energy service/s considering the life cycle cost of different energy options such as grid extension, mini/micro hydro, solar PV/thermal, biogas and biomass.

2.2.4 Promotion of Productive Energy Use

Productive energy use (PEU) promotion seeks to enable the translation of Renewable Energy (RE) provision into positive economic outcomes for Micro, Small and Medium Enterprises (MSMEs). Those positive outcomes (i.e., increase in product outputs, improved product quality and increased productivity) will result in income generation growth for MSMEs and contribute to poverty reduction in rural areas of Nepal. Hence, AEPC seeks to promote productive energy use of RE in order to generate employment and income of the rural men and women by establishing MSMEs.For the sustainability of any renewable energy project, productive energy use has an important role in increasing the income of local people and generating new jobs in the vicinity of renewable energy project area. This enhances the people's ability to pay and purchase the renewable energy systems whereas the energy systems that provides the energy to the productive component also benefits from the high load factors and hence operating sustainably in the long run. Thus, the energy components and the productive energy use complement each other.

2.2.5 Financing Instruments and Mechanism

The crux of AEPC's operation has been on the subsidy administration of different RETs. The Central Renewable Energy Fund (CREF) was established as financial mechanism of AEPC to finance RETs. Overall guiding

principle for the establishment of CREF was for the gradual phase out of subsidies for promotion of RET and its replacement by credit facilities and that the management of such credit facilities shall be handled by private sector. The main objective of CREF is, as the core financial mechanism, to be responsible for the effective delivery of subsidies and credits to the renewable energy sector.

The CREF Financial Management Mechanism is implemented through private commercial and development banks selected on a transparent and competitive basis in accordance with well-defined eligibility criteria. The Handling Bank is responsible for managing the core functions of CREF i.e., wholesale lending to qualified Partner Banks; Subsidy Fund Management; and Investment Management. A number of qualified Partner Banks, the second-tier financial institutions are responsible for the retailing of CREF funds to eligible projects in the renewable energy sector. In order to enhance the outreach, the banks are required to form strategic alliances with local financial institutions (LFI). The selected banks take the credit risks, which will be reflected in the interest spreads, and as such they are also responsible for loan appraisal and supervision. CREF, through the Secretariat, assist the banks with capacity building in order to increase outreach, efficiency, infrastructure and stability of the financial systems for lending to the renewable energy sector.

In the reporting period with support from the British Embassy Kathmandu-funded, 4.5-year Nepal Renewable Energy Programme (NREP) with the Government of Nepal is implementing a Sustainable Energy Challenge Fund Financial Assistance for Distributed Renewable Energy Projects.

2.2.6 Compliance and Ethics

AEPC has established the Compliance Unit across the entire organization through the decision of the Board dated 04/01/2016 AD (20/09/2072 BS) to serve the oversight function for AEPC and to ensure the adequacy of internal controls at the institutional level. The oversight of the Unit is be done by a five member sub-committee "Compliance and Ethics Sub-committee" headed by one Board member to oversee the internal control, ethics and internal audit of AEPC. Other members of the sub-committee are joint secretary from the legal department and under-secretary from the finance section of the line ministry, independent legal expert and independent finance expert. The Compliance Unit through this sub-committee directly reports to the Board on a periodic basis highlighting the improvement needs to ensure proper functioning of the internal controls.

2.2.7 Environment and Social Safeguards

AEPC has brought in to affect the Environmental and Social Safeguards (ESS) policy adhering to the Nepal's Environment Act and Environment Protection Rules to ensure that the environmental and social impacts are minimized to the extent possible through appropriate mitigation measures. The key principle set out in the policy aims to avoid, reduce and

mitigate any harm to the environment and society by incorporating environmental and social concerns as integral part throughout AEPC's project cycle.

2.2.8 Energy Efficiency

Following the adoption of National Energy Efficiency Strategy 2018, AEPC has been designated as the energy efficiency entity of the GoN. AEPC is tasked to promote energy efficiency (EE) in Nepal and coordinate between national institutions and stakeholders involved in the programs and activities related to EE.

2.3 HUMAN RESOURCE

Currently AEPC has 54 permanent staff positions. Apart from the in-house pool of staffs, it employs a pool of experts in renewable energy, environmental safeguard, social safeguard, gender equality and climate change through different projects/programs it implements.

2.4 SECTORAL POLICIES

Since its establishment, AEPC has emerged as a proactive institution in delivering renewable energy services to targeted beneficiaries. AEPC has remained in the forefront supporting government to formulate necessary plans, policies and strategies required to mainstream renewable energy supply in Nepal and in making climate change mitigation and adaptation a national priority. AEPC has closely contributed in formulating the following key policy and strategic documents:

- Rural Energy Policy, 2006
- Periodic Plans (focusing on RE and Climate Change)
- Renewable Energy Subsidy Policy, 2016
- Renewable Energy Subsidy Delivery Mechanism, 2016
- Biomass Energy Strategy, 2017
- National Renewable Energy Framework, 2017
- White Paper of Ministry of Energy, Water Resources and Irrigation, 2018
- National Energy Efficiency Strategy, 2018
- National Climate Change Policy, 2019
- Renewable Energy Policy (Draft), 2014
- Low Carbon Economic Development Strategy (Draft), 2014
- Second Nationally Determined Contributions (NDC), 2020
- Renewable Energy Subsidy Policy, 2022
- National Renewable Energy Framework (2022)

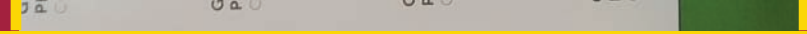
2.5 Cumulative Achievements

AEPC has promoted renewable energy across all available technological measures, both in the rural and urban areas. In 26 years of its establishment AEPC has supported over 14 millionpeople (a single beneficiary may have been counted up to four times based on the number of different RETs provided) across the country realize their renewable energy needs through appropriate deployment of the technical support, subsidy and credit financing. The table below depicts the number of renewable energy technologies promoted by AEPC in the reporting period.

Table 1: Cumulative achievement in technology promotion

Program	Unit	Achievement
		Up to FY 2021/22
Improved Water Mill (IWM)	Nos.	11,104
Institutional Gasifier	Nos.	33
Domestic Biogas	Nos.	439,547
Institutional, Urban and Commercial Biogas Plant	Nos.	355
Mud Improved Cooking Stoves (ICS)	Nos.	1,423,242
Portable Metallic stoves	Nos.	106,287
Metallic ICS	Nos.	18,068
Electric/induction cookstoves	Nos.	22,699
Solar installed at religious place and homestay	Nos.	4,511
Solar street lights	Nos.	3,309
Solar Home System	Nos.	974,001
Institutional Solar PV System	Nos.	3,817
Solar Drinking Water and Irrigation Pump	Nos.	3,129
Solar Dryerand cooker	Nos.	2,464
Roof top solar	kW	10,080
Solar Mini grid Solar/Wind Min-grid System	kW	2,929
Micro/Mini Hydro	kW	37,734

In its quest to deliver renewable energy services to the people, AEPC has maintained its trust with key EDPs. Effort of AEPC has been recognized and it has received several felicitations and awards. The sector has witnessed competitiveness with about 500 private companies creating direct and indirect employment opportunities to over 30,000 people. This has led to creation of renewable energy market and more importantly this market has penetrated the entire country.



Hon. Minister of Finance, Mr. Janardhan Sharma and participating members from Nepal with GCF officials on the GCF Global Programming Conference.

CHAPTER 3

PROGRAMS AND PROJECTS

AEPC has been implementing various programs & projects with the support of development partners while it has also been implementing targeted programs with the sole funding from the GoN's budget. This section highlights various programs/projects and targeted activities implemented by AEPC during the reporting period.

3.1 SPECIAL AND TARGETED RE PROGRAM

AEPC implemented regular RE development and promotion activities with government funds during the reporting period. AEPC successfully implemented activities to provide RE services through micro/ mini hydropower, solar, bioenergy and biogas to the remote rural population with priority to women, marginalized communities and disadvantaged groups. Targeted initiatives such as smoke free homes program, energy for health and education, energy for irrigation and agriculture, energy for tourism, biogas pipeline and bottling and RE service provision at local levels, religious institutions, schools, hospitals and public institutions were implemented. Furthermore, activities related to productive energy use, capacity development, quality assurance, gender and social inclusion, carbon and climate change were also implemented during the reporting period.

3.2 NATIONAL RURAL AND RENEWABLE ENERGY PROGRAM (NRREP)

National Rural and Renewable Energy Program (NRREP) was a national framework program that brought together the efforts of the GoN and development partners to promote renewable energy in Nepal. Through NRREP, five governments, two multilateral banks and three intergovernmental organizations synthesized their resources equivalent to USD 171 Million for the renewable energy promotion for five years (2012- 2017).

The development objective of the NRREP was to improve the living standards of rural women and men, increase employment of women and men as well as productivity, reduce dependency on traditional energy and attain sustainable development throughintegration of alternative energy with the socioeconomic activities of women and men in rural communities. NRREP targeted to reach rural men and women through intervention of an array of renewable energy technologies exploiting the solar, hydro and biomass based resources.

After the conclusion of the NRREP, the GoN continued its efforts for the development of renewable energy sector through introduction of National Renewable Energy Framework (NREF). The framework allows development partners

and other organizations behind a common vision join hands with the government to deliver the renewable energy services through integrated results framework. NREF aims to coordinate and track results of various RE initiatives, engage stakeholders and help mobilize finance. The government has continued NRREP from its own resources and other development partners. CREF, established as the financial intermediation mechanism mobilizing subsidies and credits in renewable energy through a set of banking and financial institutions, has also been continued.

3.3 MAJOR PROGRAMS/ PROJECTS IMPLEMENTED UNDER NRREP

3.3.1 Scaling Up Renewable Energy Program (SREP)

The World Bank under Scaling up Renewable Energy Program (SREP) has been supporting AEPC to develop market for large scale Commercial Biogas and Municipal Solid Waste (MSW) to energy projects in Nepal. The total grant amount of SREP under Extended Biogas Program is 7.9 million USD. SREP is expected to contribute on achieving NRREP targets of large biogas plants especially commercial biogas plants and waste to energy projects in collaboration with MGEAP set out below . SREP funding is provided to reimburse AEPC's contribution after the verified operation of the plant for a designed capacity.

3.3.2 South Asia Sub-regional Economic Cooperation (SASEC)

SASEC Power System Expansion Project, supported by Asian Development Bank (ADB), aims to contribute to Nepal's energy development objectives by mainly scaling up both on-grid and off-grid RE supply. Among the two components of the project, the on-grid component is being implemented by Nepal Electricity Authority (NEA) while the off-grid component is being implemented by AEPC.

The off-grid component is intended to increase the access to renewable energy for improving the livelihoods of people and create employment opportunities especially in rural areas thus improving income and prosperity of rural communities mainly in rural enterprise, education, health and agriculture sectors. The project is consistent with the ADB Country Partnership Strategy which focuses on (i) Improving inclusive electricity access; (ii) RE development; (iii) Regional cooperation; and (iv) Strengthening sector governance.

For the project there is provision of (i) a credit line of $ 5 million from ADB's Special Funds to user communities/ developers for mini-hydro power plants and (ii) $11.2 million grant from the Strategic Climate Fund (SCF) administered by ADB.

The project also provides support to overall enhancement of capacity by implementing the capacity development of programme for AEPC. The physical investments will be reinforced and supplemented by capacity building support to AEPC, including project management support, preparation support for distribution system/rural electrification master plan and feasibility study of utility level wind farm, and parallel livelihood development activities in the project area.

The off-grid component complements NRREP's outputs related to community electrification.The project targets to support 4.3 MW Mini-hydro and 500 kW capacity solar or/ and solar-wind hybrid projects.

3.3.3 Renewable Energy for Rural Livelihood (RERL) Project

The Renewable Energy for Rural Livelihood (RERL) Project has been under implementation since 2014 with the primary objective of removing technological, financial, institutional, regulatory, legal barriers for large scale deployment of renewable energy systems in the country. The initial 5-year project had a total budget of USD 5 million of which Global Environment Facility (GEF) as a part of its Climate Mitigation Portfolio supported USD 3 million and the United Nations Development Programme (UNDP) contributed the remaining USD 2 million.

After the conclusion of GEF-RERL in 2019 as planned, a new phase of RERL was initiated with joint financing of UNDP and ADB. The ADB-RERL seeks to help improve rural livelihood by providing access to clean energy in remote off-grid areas. The project 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 mini grid projects in remote off-grid areas not being currently served by the national electricity grid. Likewise, the project also contributes to increase the share of renewable energy in the national energy mix. Similarly, the project aims to contribute to other SDGs with energy as the entry point. The promotion of productive energy uses of electricity generated has direct linkages with SDG1, SDG8 and SDG12 while the gender component of the project contributes to SDG5.

RERL has supported in the preparation of the Municipal Energy Plans, assisted in the development of various technical and institutional guidelines, establishment of financial instruments such as Vendor Financing Mechanism, Vendor Challenge Fund and Credit Guarantee Mechanism to de-risk private investments, provided construction supervision and development support for mini hydro and solar mini grid projects and conduction of micro financing activities targeting women in RE projects.

RERL through UNDP has mobilized additional resources from the Government of Japan under the Japan Supplementary Budget for implementation of Japan-UNDP Support for Transition Effort to Decarbonization (JUSTED) project with the objective of leveraging Nationally Determined Contributions (NDCs) to achieve net-zero emissions and climate-resilient development in response to climate emergency. The activities are aligned to Nepal's commitments towards achievement of SDGs (Goal7) and will support Nepal to kick off the implementation of its commitments made under NDC and take a trajectory of green recovery of the economy contributing to achieve SDGs by 2030. This support is being implemented through the RERL project with AEPC as the implementing partner.

3.3.4 Promotion of Energy Efficiency and Renewable Energy-Component 2 Promotion of Solar Energy

The German development bank (KfW) committed an amount of 5.7

million euros for the promotion of Institutional Solar Photovoltaic Systems (ISPS) and Photovoltaic Pumping Systems (PVPS) for drinking water in rural areas of Nepal. This aims for implementation of 185 ISPS on schools, 185 ISPS on health posts and 188 PVPS for drinking water. This program is also supporting for used lead acid battery management, and quality assurance mechanism for RETS. This project is carried out by the Alternative Energy Promotion Centre (AEPC) as executing agency under the framework of the National Rural Renewable Energy Programme (NRREP).

3.3.5 Renewable Energy and Energy Efficiency Programme (REEEP)

The Deutsche Gesellschaft für InternationaleZusammenarbeit (GIZ) GmbH supporting the REEEP Programme with a focus on Renewable Energy and Energy Efficiency Programme (REEEP). REEEP is a technical cooperation project agreed between the Government of Nepal (GoN) and the Federal Republic of Germany. With support of the GIZ on behalf of the German Federal Ministry of Economic Cooperation and Development (BMZ), REEEP is executed by the Ministry of Energy, Water Resources and Irrigation and sets out improve the preconditions for planning and implementation of measures for the efficient use of energy in Nepal. The main objective of REEEP is to create the regulatory, institutional and private-sector conditions for disseminating renewable energy and improving energy efficiency in Nepal. REEEP uses a multi-level approach consisting of 4 output areas components, viz. Output 1: Policy- Institutional and Regulatory Framework for Renewable Energy (RE) and Energy Efficiency (EE) at National Level; Output 2: Institutional Frameworks for RE and EE at Subnational Levels; Output 3: Sustainable Market Development for RE and EE; and Output 4: Dissemination of Results in the field of RE and EE.

3.3.6 Micro Hydro Debt Fund

Micro Hydro Debt Fund (MHDF) was established with support from GIZ which is earmarked for lending to MHPs. Initial MHDF of Euro 500,000 was established which was later increased by Euro 42,000. The overall objective of the fund is to improve the access to the rural population to clean energy solution by providing credit for off-grid MHPs. The fund is being channeled by two banks; the Himalayan Bank and the NMB Bank.

3.3.7 Biogas Credit Fund

Biogas Credit Fund was established in 2000 supported by Federal Republic of Germany through KfW to the Government of Nepal with the objective of financing the loan via intermediate wholesale lending organizations and receiving nongovernment organizations, saving and credit cooperative and/or rural development banks (NGO/SCO/RDBs) for granting sub-loans to those farmers, who are not able to cover the cost of the biogas plant by their own fund. Initial seed fund was of 5 million EURO. As of now, more than 300 LFIs/MFIs are involved to channel this credit to the biogas users.

3.3.8 Nepal Renewable Energy Program (NREP)

NREP is a four and half year programme with the total value of £ 9.2 million funded by DFID under the aegis of Climate Smart Development

for Nepal, implemented by DAI Europe and Winrock International in collaboration with AEPC. NREP aims to deliver a series of programmes activities in line with four objectives:

1. Build the capacity of Government of Nepal to lead and manage the NREF. AEPC will be the main entry point but other relevant institutions may also be considered (such as AEPC provincial offices, the Ministry of Energy, Water Resources and Irrigation (MoEWRI), Ministry of Physical Infrastructure and Development (MoPID) at province level, Nepal Electricity Authority (NEA), etc.).
2. Strengthening the capacity of CREF to enable it to manage and spend climate finance.
3. Directly deliver programme activities related to: (i) demand for renewable energy; (ii) supply of renewable energy technologies; and (iii) finance for renewable energy.
4. Generate and share knowledge and research in relation to Nepal's renewable energy sector. Develop networks of partners working in the sector and facilitate knowledge sharing and learning

3.3.9 Nepal Private Sector-Led Mini Grid Energy Access Project (MGEAP)

To improve and sustain the off-grid electricity supply model, it has realized the need to encourage a private sector-led model with private sector management and financing. So, to promote commercial financing and increase private sector participation in the operation and management of mini-grids, the Government of Nepal has signed an agreement with the World Bank to implement "Nepal: Private Sector-Led Mini Grid Energy Access Project (MGEAP)". The main objective of MGEAP is to increase electricity generation from renewable energy mini-grids (Solar, Wind, Solar/Wind Hybrid and Micro/ Mini Hydro) in selected areas by mobilizing Energy Service Companies (ESCOs).Renewable energy mini grid subprojects eligible for participation in Mini Grid Energy Access Project (MGEAP) include:

1. Greenfield mini grid subprojects: subprojects with the cumulative capacity of 2.8 MW
2. Up gradation of mini grid subprojects: subprojects with the cumulative capacity of 0.5 MW
3. Grid interconnection of mini grid subprojects: subprojects with the cumulative capacity of 0.5 MW

Welcoming Mr. Sushil Chandra Tiwari, Secretary (Energy), MoEWRI at AEPC office.

CHAPTER 4

PROGRESS OVERVIEW

In 2021/22, AEPC implemented renewable energy technologies through two separate windows: the targeted renewable energy program solely financed by GoN; and NRREP jointly financed by the GoN along with other EDPs. During to the reporting period 2020/21 programs implemented under targeted RE program achieved 82% physical progress and84% financial progress. Similarly, for NRREP the physical progress stood at 83% and the financial progress stood at86%.

Table 2: Annual progress of AEPC implemented programs

SN	Programs	Progress	%
2021/22			
1.	Targeted RE program (GoN Financed)	Physical	82%
		Financial	84%
2.	NRREP	Physical	83%
		Financial	86%

4.1 ALLOCATION AND DISURSEMENTS

During the review period, AEPC implemented its activities through two routes; special and targeted programs titled AEPC and NRREP.In 2021/22GoN allocated around 71% of the total budget to implement the Program from two windows; the targeted RE Program and the NRREP. The remaining fund was provisioned from foreign investment as a grant (23%) and loan (6%).

The total budget allocated for AEPC in both the routes in FY 2021/22 was NPR 2752Million out of which the expenditure was NPR 2322 Million.

The overall financial progress of AEPC including both the program in the FY 2021/22 stood at 84%. Financial progress of targeted RE program implemented by AEPC during the review period stood at 82% whereas the progress under the NRREP remained around 86%.

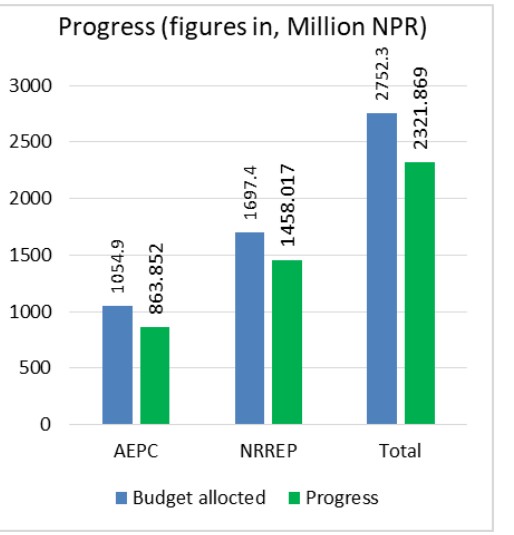


Figure 5: Budget allocated and the progress (in million NPR) (FY 2021/22)

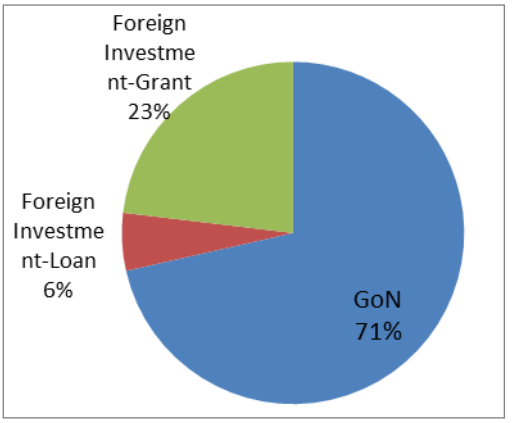


Figure 6: GoN allocation and Foreign Investment (Grant and Loan) in total RE budget in 2022/22

4.2 PHYSICAL PROGRESS

The physical progresses of the given period are given above. The physical progress achieved during the reporting period is detailed in annex 1 and annex 2. The field work were somewhat affected due to COVID 19.

4.2.1 Mini & Micro Hydro and IWM Related Activities

The work plan of the FY 2021/22 targeted to produce 1400 kW of electricity through Pico/Mini/Micro hydro and Micro hydro installation through SASECprogramme. In the review period, 1748kW electricity was produced through the two activities. The Pico/Mini/Micro hydro achieved a staggering 137% achievement with Micro hydro installation through SASECprogramme achieving 120%.

With plan for rehabilitation of incomplete and sick MHPs and IWM, out of 15, only 5 were rehabilitated. Similarly, in terms of the repair maintenance and reconstruction of CDM registered IWM and mini/micro hydro projects, 42% of the target was achieved.

Regarding the grid connection of the MHPs, out of the target to connect the 16 MHPs, targets were not attained during the reporting period.

Under NRREP, Feasibility study, survey, design, supervision, quality assurance, training and capacity development on community electrification stood at 110%.The installation of IWM stood at 82% during the reporting period.

Figure 7: Headworks of 500 kW Middle PhawaKhola MHP, Taplejung

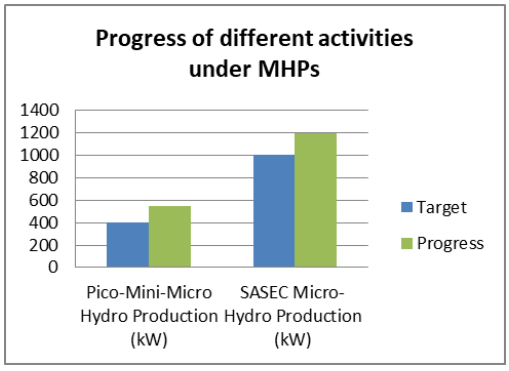


Figure 8: Progress of key micro hydro related activities

Figure 9: Inside view of 380 kW Tara Khola MHP

4.2.2 Solar Energy Related Activities

For the period 2021/2022, in terms of progress on activities related to solar energy, installation of solar pumping system for irrigation supporting commercial agriculture, out of 630 planned, 634 was achieved. The installation of solar home system in religious places, out of 500 planned, 545 was achieved.The multi-year electricity from mini program generated 867 kW out of the targeted 1000 kW.

Under NRREP, solar water pumping for irrigation and drinking water achieved 122% progress. On the installation of institutional solar photovoltaic system for various institutions, out of 1000 institutions targeted , 1009 benefitted through the activity. Feasibility study, survey, design, supervision, quality assurance, training and capacity development on solar achieved 96%

progress. 93% of the target (28 out of 30) was met on Nepal Mini Grid Related activities. Solar home system for un-electrified areas achieved 121% progress reaching 12,076 households compared to 10,000 targeted.

Under NRREP, the solar cooker and dryer installation reached7% achieving 7 out of 100 planned for the year. The Nepal Mini grid related solar/mini and micro hydro development grant and loan is yet to achieve targets with ongoing development works

Figure 10: Hilepani Solar Mini Grid Project

Figure 11: Poly House at the Belhi drinking water and irrigation project

Figure 12: 100 kWp Gutu Solar Mini Grid, Surkhet

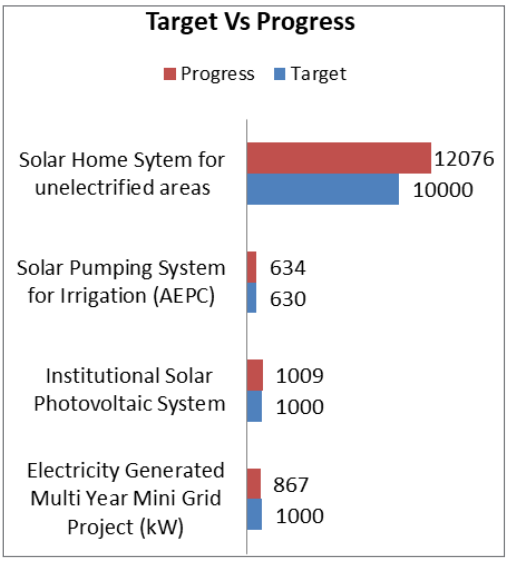


Figure 13: Progress of different activities under solar technology promotion

4.2.3 Bioenergy

In 2021/22, repair, maintenance and reconstruction of CDM registered domestic biogas plants achieved a progress of 127%, i.e., 7617 achieved out of 6000 planned. Clean energy program: replacement of dung cakes and agriculture residue for cooking achieved 48% of their targets (i.e., 8,350 out of 17,500).

Under NRREP, access to clean energy with Household Biogas Installation achieved 58% progress with 6,374 installations out of 11,000 targeted. In terms of the community and institutional biogas plant installation, 11 plants were completed out of the targeted 20 plants during the reporting period. The feasibility study, survey, design, supervision, quality assurance, training and capacity development on bio energy achieved 96% of the total target.

Two/three holes pot MICS installation for heating and cooking in mountainous and high hill districts

achieved a progress of 58% with 2,900 reached out of the planned 5,000 households. Tier 3 improved cook stoves and rocket stove installation at institutional and household level stood at 23% with 2,053 households benefitting out of the planned 9,000 households. In terms of the waste to energy and commercial biogas plant, 15% of the target was met with 9 out of 60 projects.

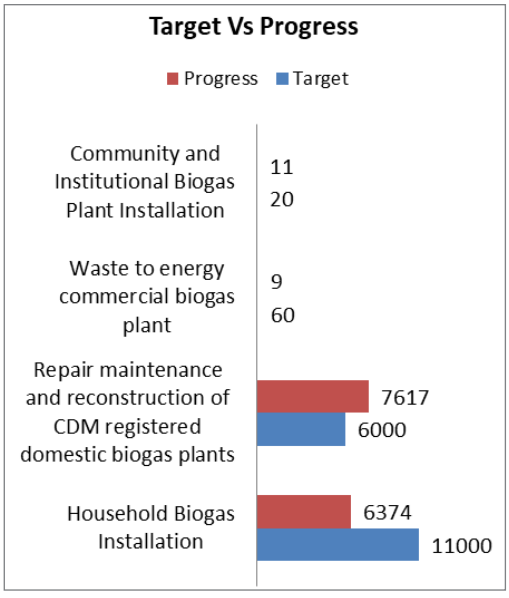


Figure 14: Progress of biogas technology

Figure 15: 40 TPD Biogas plant at Damak Municipality, Damak

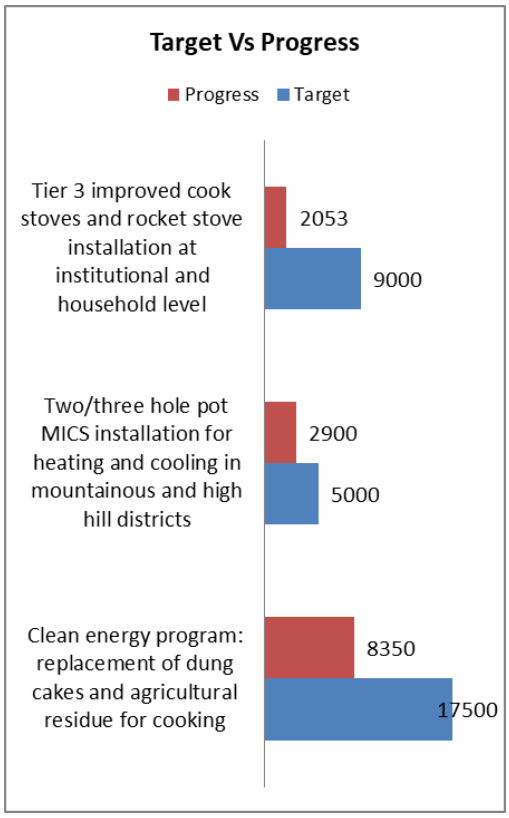


Figure 16: Progress of improved cookstoves

4.2.4 Wind Energy

In the reporting period 2021/22, data is being received from the installed data loggers and plants are under operation.

Figure 17: Mityal, Palpa Solar Wind Mini Grid

Figure 18: Solar Wind Mini Grid at Chisapani, Sindhuli

4.2.5 Productive Energy Use activities

In the FY 2021/22, the target on Productive energy use achieved 66%, reaching 66 beneficiaries out of 100 targeted.

Figure 19: Computer Institute at Tara Khola MHP

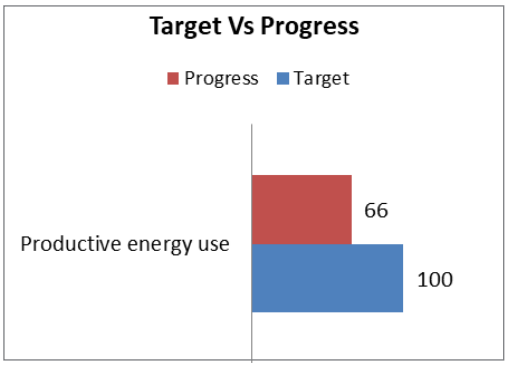
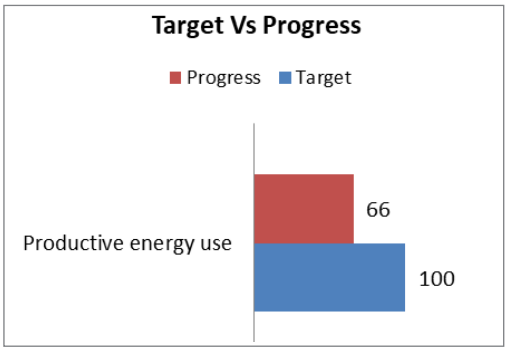


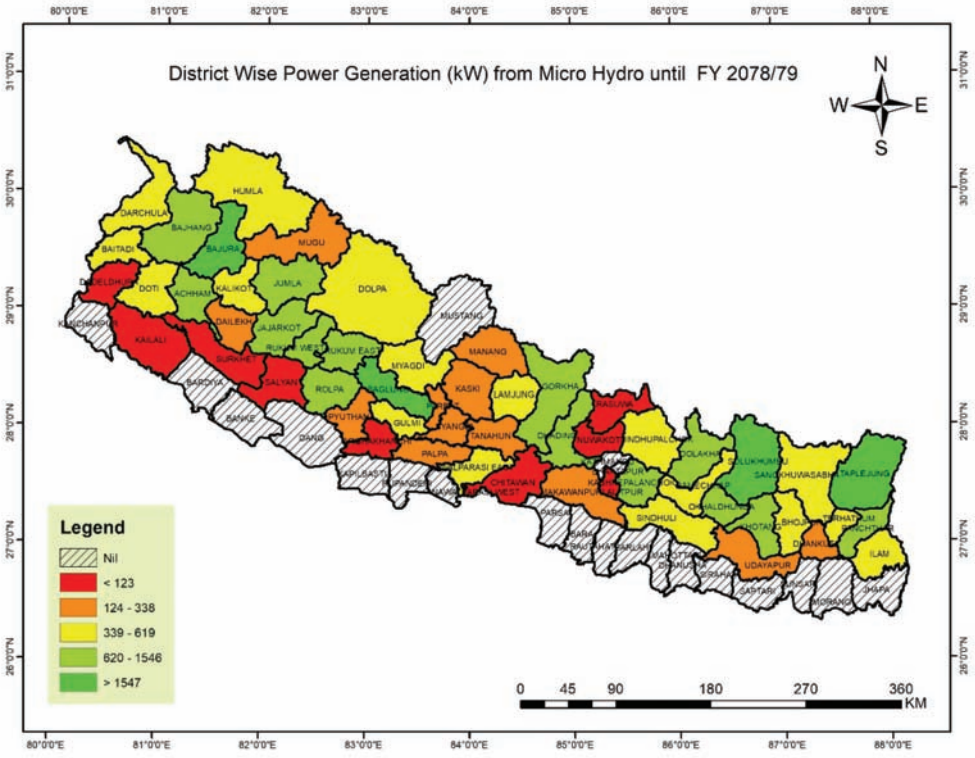
Figure 20: Progress of PEU activities

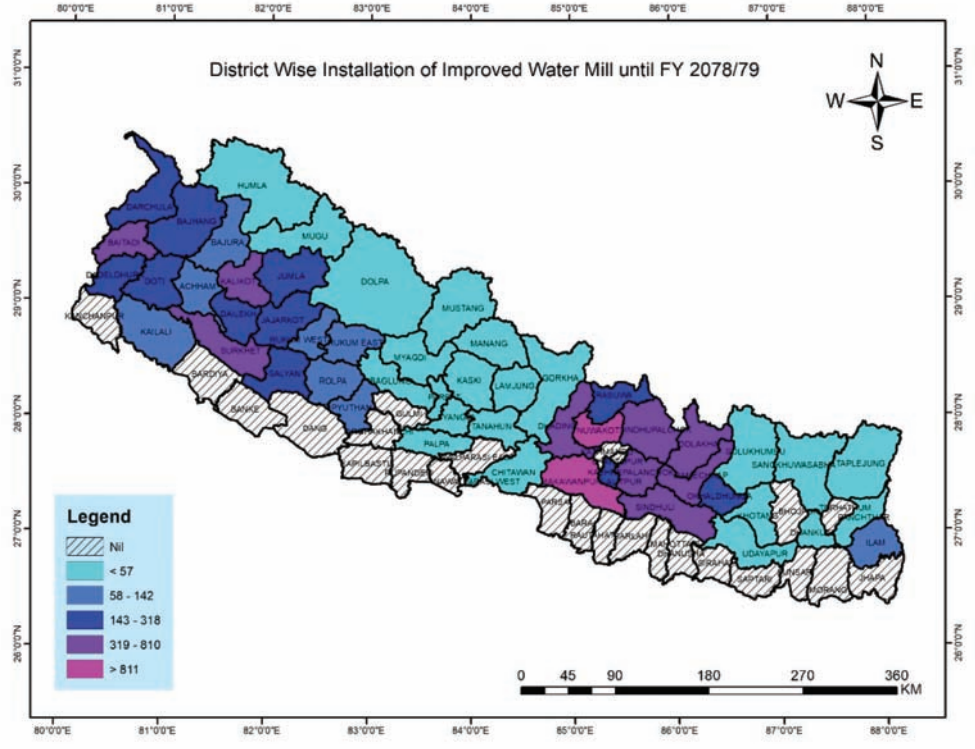
4.2.6 Energy Efficiency

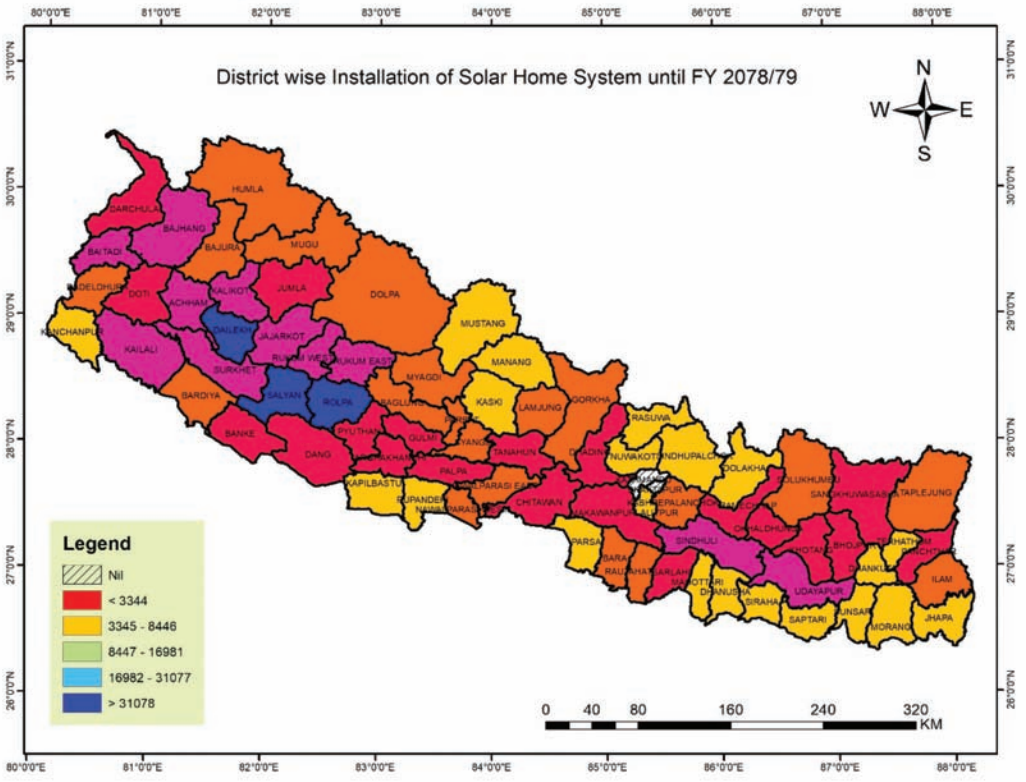
In the reporting period 2021/22,100% of the target was met on implementation of energy efficiency program at federal, provincial and local level and Capacity development of public/private institution on Energy Efficiency.

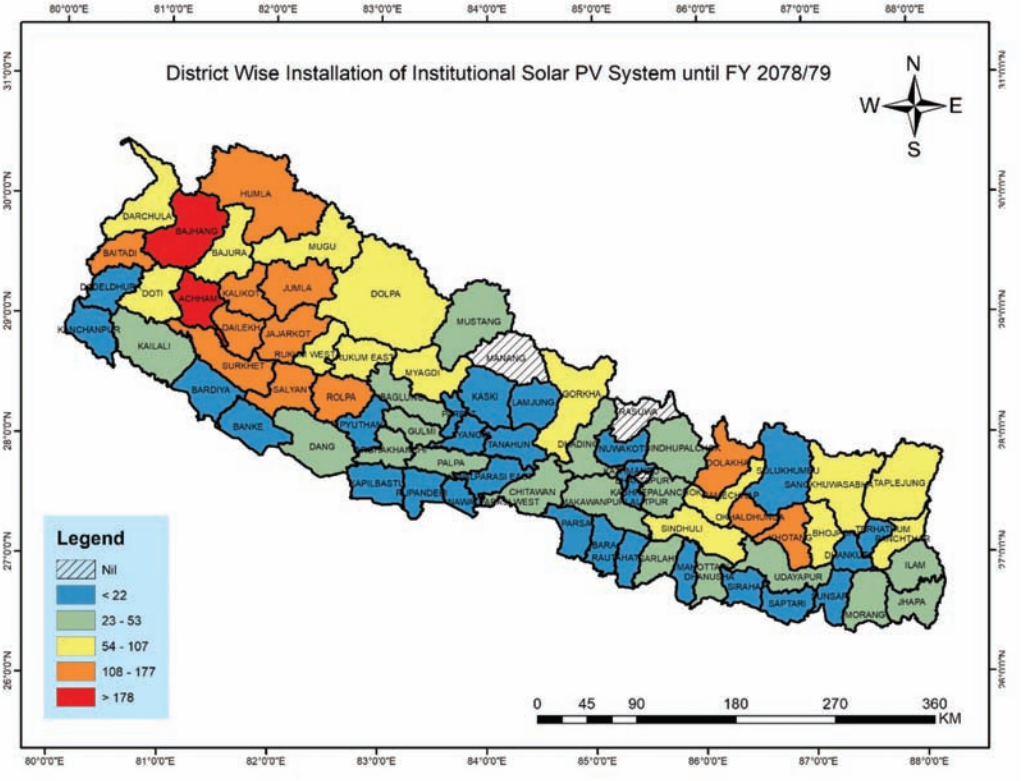


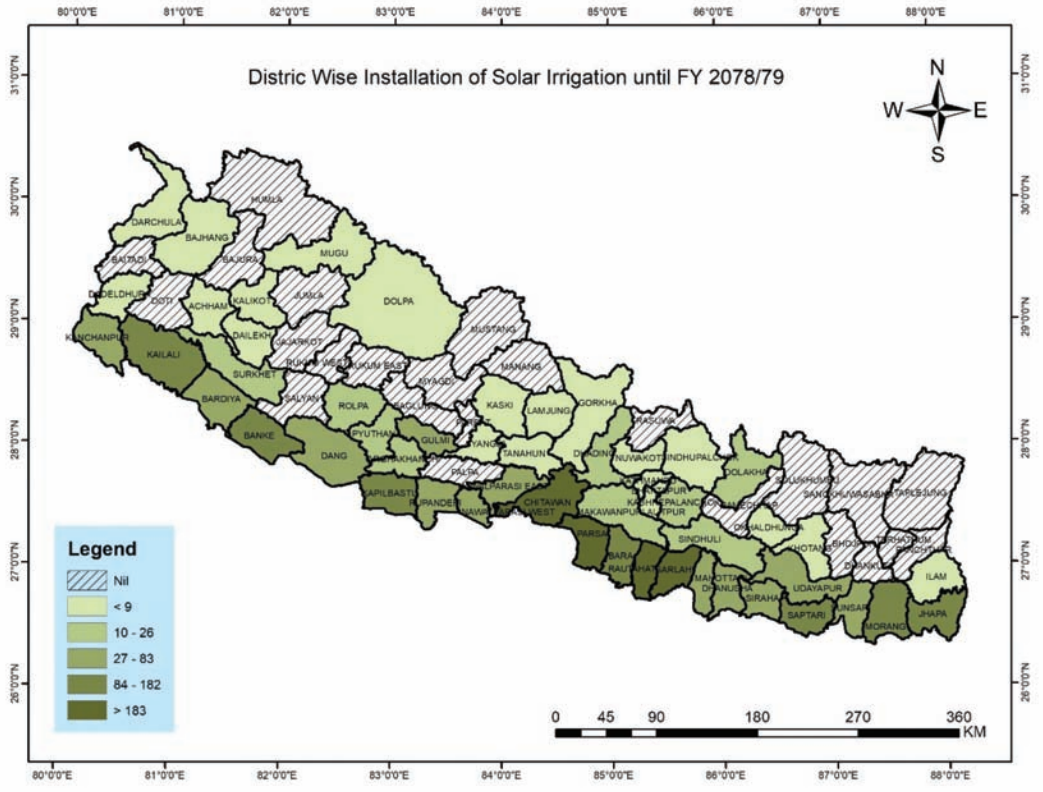
4.3 GIS MAPS RENEWABLE ENERGY TECHNOLOGIES

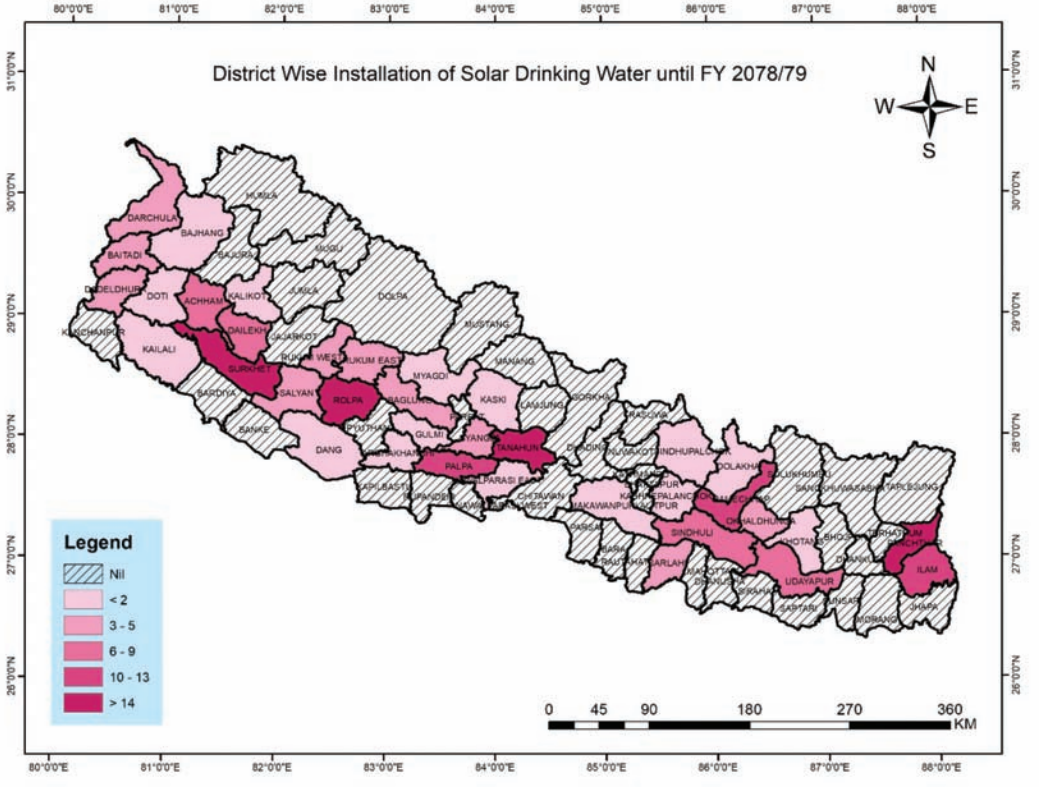


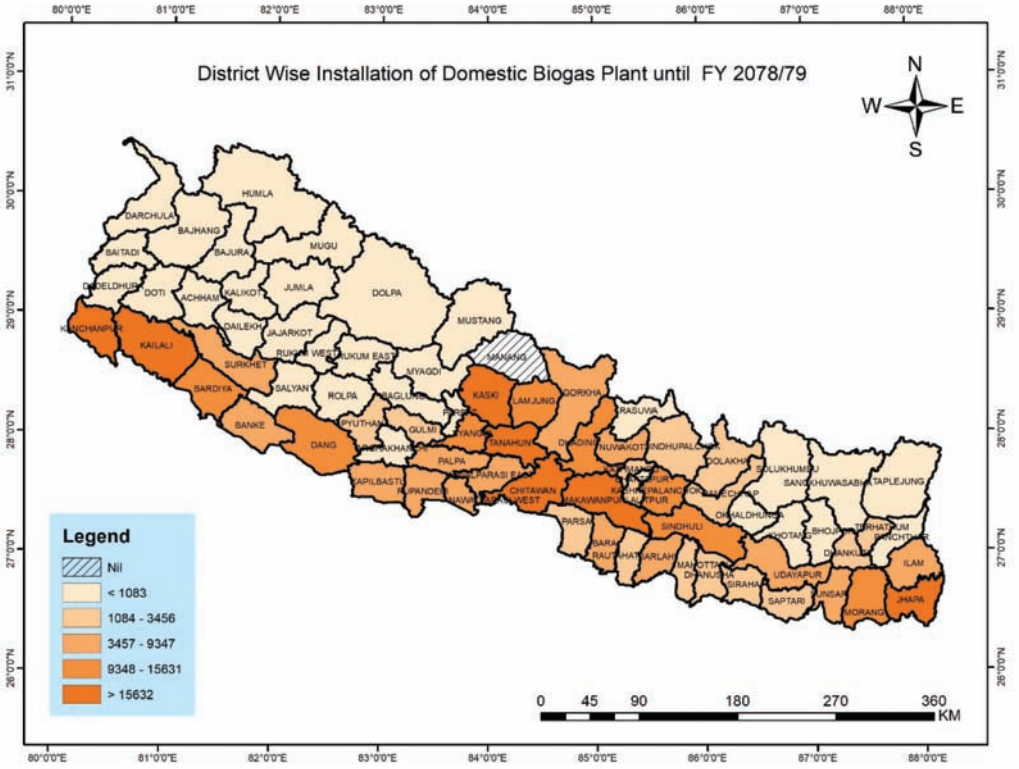


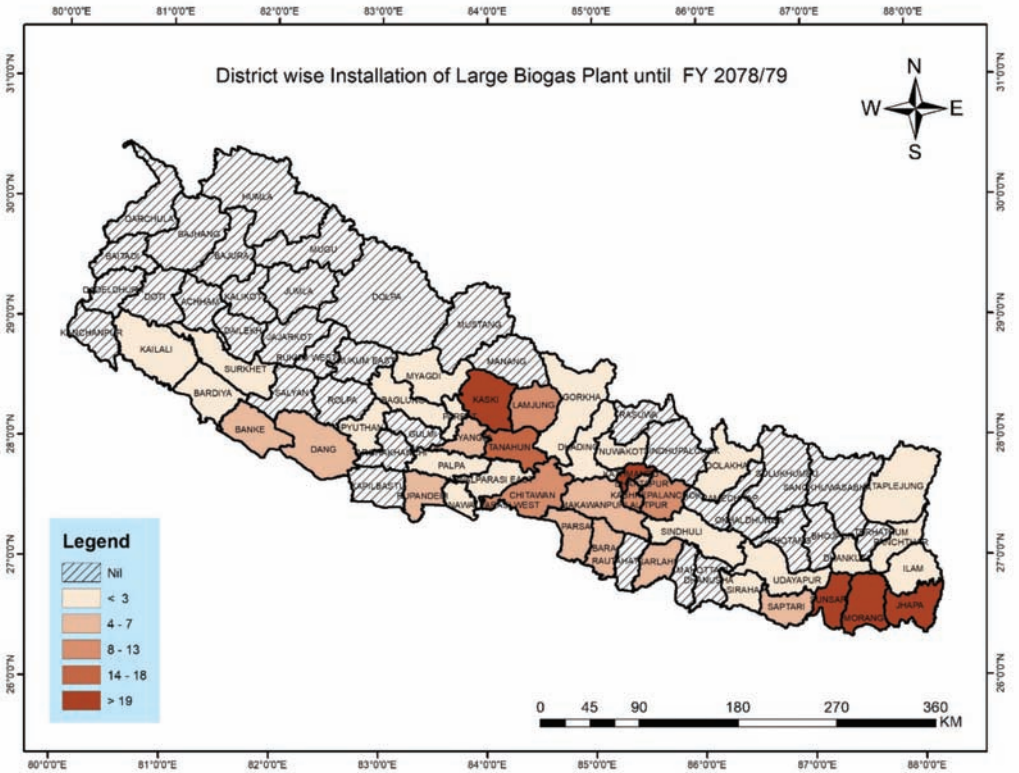

District wise Installation of Solar Home System until FY 2078/79
N
W
E
S
Legend
Nil
< 3344
3345 - 8446
8447 - 16981
16982 - 31077
> 31078
0 40 80 160 240 320
KM


District Wise Installation of Institutional Solar PV System until FY 2078/79
N
W
E
S
Legend
Nil
< 22
23 - 53
54 - 107
108 - 177
> 178
0 45 90 180 270 360
KM


Distric Wise Installation of Solar Irrigation until FY 2078/79
N
W
E
S
Legend
Nil
< 9
10 - 26
27 - 83
84 - 182
> 183
0 45 90 180 270 360
KM


District Wise Installation of Solar Drinking Water until FY 2078/79
N
W
E
S
Legend
Nil
< 2
3 - 5
6 - 9
10 - 13
> 14
0 45 90 180 270 360
KM


District Wise Installation of Domestic Biogas Plant until FY 2078/79
N
W
E
S
Legend
Nil
< 1083
1084 - 3456
3457 - 9347
9348 - 15631
> 15632
0 45 90 180 270 360
KM


District wise Installation of Large Biogas Plant until FY 2078/79
N
W
E
S
Legend
Nil
< 3
4 - 7
8 - 13
14 - 18
> 19
0 45 90 180 270 360
KM

District Wise Installation of Metallic Improved Cookstove until FY 2078/79
N
W
E
S
Legend
Nil
< 1096
1097 - 2600
2601 - 5480
5481 - 10042
> 10043
0 45 90 180 270 360
KM
HUMLA
DARCHULA
BAJHANG
BAITADI
BAJURA
MUGU
DADELDHURA
DOTI
ACHHAM
KALIKOT
JUMLA
DOLPA
KANCHANPUR
KAILALI
DAILEKH
JAJARKOT
MUSTANG
SURKHET
MANANG
BARDIYA
SALYAN
ROLPA
KASKI
LAMJUNG
GORKHA
BANKE
PYUTHAN
GULMI
PARBAT
TANAHUN
DANG
PALPA
CHITAWAN
PARSA
BARA
SINDHULI
RAUTAHAT
BHOJPUR
TAPLEJUNG
ILAM
UDAYAPUR
SAPTARI
JHAPA
MORANG

The Executive Director of AEPC receiving felicitation from Mr. Til Bikram Nembang (BairagiKainla) for providing clean energy to indigenous communities.

CHAPTER 5

PROGRESS OF CROSS CUTTING ACTIVITIES

5.1 CARBON FINANCING ACTIVITIES

AEPC is in forefront when it comes to the climate change related activities in Nepal. Climate and Carbon Unit (CCU) was established in 2010 and transformed into Climate and Carbon Section (CCS) in 2020 AEPC board decision to focus on streamlining the climate change related activities in AEPC.CCS has been instrumental in mobilizing carbon financing, accessing international climate finance and other climate change mitigation and adaptation activities in AEPC.

In response to the call for expression of interest from the Ministry of Finance (MoF), National Designated Authority (NDA) for Nepal, AEPC posted its candidacy for national recommendation to seek the status of Direct Access Entity (DAE) with the Green Climate Fund (GCF). The 22nd GCF Board held from 26th to 28th February 2019 has approved the accreditation.This allows AEPC to directly access the projects having low to medium environmental risks with GCF worth USD 50 Million. The accreditation to the GCF has brought the following opportunity for AEPC as well as for the country.

- Opportunity for accessing climate finance "Directly".
- Ease for executing agencies in accessing climate financing
- Complimentary financial resources to bridge the gap.
- Enhancing the institutional capacity and build trust with international development partners.
- Opportunity for accessing other international financing.
- Building trust amongst donor agencies, private sectors.
- Complementing the country's need for CC adaptation/ mitigation by leveraging financial resources (International/public/ private).

Major achievement is seen in the Green Climate Fund with the accreditation of AEPC as the DAE. For this purpose, AEPC has developed Entity Work Programme (EWP) that constitutes of the potential project pipelines. Out of four concept notes for different projects on (i) Clean Cooking Solutions based on electric cooking, biogas and improved cook stoves, (ii) Equitable Access to Green Agriculture based on solar irrigation, (iii) Energy access in health and education based on solar energy and (iv) Large Size biogas program have been prepared. Funding proposal for the project titled "Mitigating GHG emission through the use of modern climate friendly clean cooking solutions" has been approved by 30th Board of the GCF in October 2021.Furthermore, AEPC has been endorsed by the MoF (National Designated Authority for the GCF) as the delivery partner to implement the GCF Readiness and Preparatory Support Programme. Subsequently,AEPC submitted its readiness proposal to the GCF and was approved in September 2021.

5.1.1 Carbon Projects

AEPC holds eight Clean Development Mechanism (CDM) projects and program of activities (PoA) which

contributes as its regular source of revenue. Till date, about 5.19 million Certified Emission Reduction has been sold equivalent to the 28.45 Million USD from household Biogas, Improved Water Mill projects and Micro-hydro projects.

In terms of issuance of the certified emission reductions (CERs), for this fiscal year,Improved Water Mill PoA: 9970 CER has been issued while Biogas PA: 186,703 CER, Biogas PoA: 582,363 CER is in the process of issuance. In case of Gold Standard, Gold Standard Certified Emission Reduction (GS CER) will generated 186,703 GS CER from Biogas PA and 582,363 GS CER from Biogas PoA.

Similarly, the trading of the CERs during this year reporting period garnered by AEPC and will be sold in coming Fiscal Year. The estimated total amount that will be generated from carbon selling will be about 6.0 Million USD. Development of Large Size Biogas as Carbon Programme in Nepal is proposed for ITMO under article 6.2 of Paris Agreement.

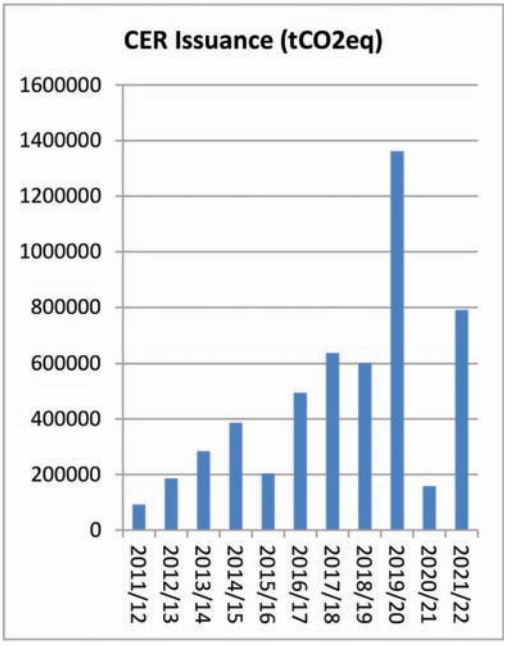


Figure 21: Year wise issuance of CERs (in '000)

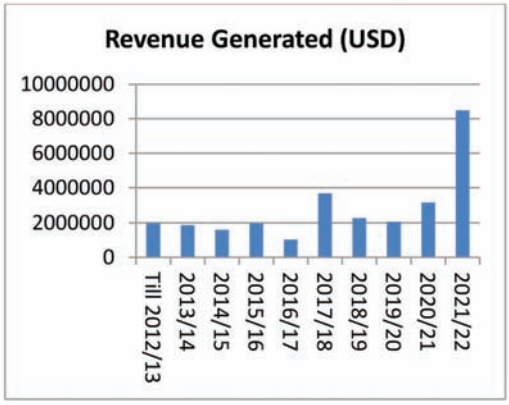


Figure 22: Year wise carbon revenue earning (in USD)

5.1.2 CDM Audits

Verification audit of the Biogas Project Activities and Nepal Biogas Support programme-PoA was initiated in the reporting periods. Field verification was completed in the reporting period by Designated Operational Entity (DOE).Similarly, the verification of the Improved Water Mills PoA generated9,970 CERs.

5.2 GENDER AND SOCIAL INCLUSION

The GESI activities are internalized across all technologies and is led by Gender Equality and Social Inclusion Section. Different activities have been conducted in the area of GESI focusing on the increase of renewable energy systems in off grid areas, these include (i)Women trained in the construction, O&M of mini grid systems and as customer service providers, (ii) Enhanced women and disadvantaged groups participation in project development (iii) Development of women-led micro-enterprises (iv) Trainings in GESI-based community participation and management of energy systems.

5.3 ENVIRONMENT AND SOCIAL SAFEGUARDS

The environment and social safeguard issues are being dealt project by project and the case by case as required by the project documents and Environment protection Act and Environment Protection Rules of Nepal. In order to effectively implement the Environmental and Social Safeguard (ESS) Policy adopted by AEPC, a dedicated Environment and Social Safeguard Sectionhas been established. The staffs are assigned to in order to streamline environment and social safeguard measures across all technologies promoted by the organization.

5.4 COMPLIANCE RELATED ACTIVITIES

To strengthen the internal control, internal audit and the compliance related issues, the compliance unit in has been working effectively since it's establishment.The compliance and ethics sub-committee met a total of seven times during the reporting period. The reporting period oversaw audit of CREF, with ongoing development of procedure on sexual exploitation, abuse and harassment, establishment of internal control committee and compliance report prepared at different period of time.

5.5 MONITORING AND QUALITY ASSURANCE

The monitoring and quality assurance activities are the integral part of the program/project implementation under AEPC's portfolio of work. Various monitoring and quality assurance activities were also undertaken during this reporting period. Basically, monitoring and quality assurance activities were conducted through external firms termed as third party monitorsbased on the subsidy delivery mechanism. Training for power output and household verification inspectorand orientation training programme for third party monitoring consultants were conducted by MQA unit.

5.6 OUTREACH MANAGEMENT

The immediate objective of Outreach is to ensure scaling up of RETs through efficient and collaborative engagement with local and provincial level governments, line agencies, national and provincial/regional service delivery organizations, private sectors, other relevant programmes /projects, organizations and other relevant stakeholders. This involves coordinating and collaborating to provide strategic support for expanding RE access to the target beneficiaries through local and provincial level governments (i.e. based on the existing legal mandate), national and provincial service providers. Outreach utilizes existing institutional linkages to enhance the livelihood of the off-grid communities through intervention of RE services. In this context, ownership, harmonization, synergy, result based monitoring and alignment are most crucial elements of the coordination, while clarity on roles and responsibility of all stakeholders is important for establishing collaborative environment.

1.7 TRAINING AND CAPACITY BUILDING

AEPC continued with the capacity development activities of its partner organizations and other sectoral actors during the reporting period. In the reporting period trainings were conducted various RETs, climate finance, technical support to provincial and local level, among others.

Participants from various Ministries, AEPC and other national stakeholders on climate finance training.

CHAPTER 6

RENEWABLE ENERGY RESULT AREAS

6.1 ACCESS TO CLEAN ENERGY

Renewable energy promotion in Nepal has been instrumental in providing clean energy access to the beneficiaries. Till date about 55 MW of electricity has been produced from Mini/Micro-hydro and Solar energy promoted by AEPC providing the access to 3.6 million households a clean electricity solutions. This has reached to the 18% of the total population and has created 30,000 jobs in this sector.

In the reporting period generation of electricity was achieved from Mini/ Micro-hydro projects.This has ensured enhanced access of electricity to more than and created opportunities for the establishment of local enterprises. In addition to this, by rehabilitating the MHPs equivalent to, access to electricity has been reinstated. More than household benefitted from the electricity generation through solar home system. Similarly, solar mini-grid installation, supported to light around -households.

ICS and biogas remained to be the key technologies providing the households with clean energy for cooking. During the reporting period, more than households realized the benefits of clean cooking energy supplied by these technologies.

IWM technology supported rural households with faster agro-processing services thereby reducing drudgery and avoiding the potential proliferation of the fossil fuel based diesel mills. Installation of IWM during the reporting period is expected to provide efficient milling services to rural households.

6.2 SUSTAINABLE DEVELOPMENT BENEFIT

Promotion of renewable energy under AEPC has a range of sustainable development benefits which are fully attributable to these technologies.

Environmental Benefits: The optimization of RET resources available locally for energy production helps to replace the carbon intensive fossil fuel for energy generation. This will help in reducing the emission of long lived and short lived pollutants.

Health Benefits: The supply of clean energy leads the reduction in indoor air pollution and energy related accidents. It can significantly reduce the respiratory and pulmonary health related illness. Further the proper management of the waste (dung, municipal waste, human excreta) leads to the reduction in incidence of disease caused by disease vectors.

Economic Benefits: The access to clean and green energy reduce the fossil fuel consumption so that dependency over the imported fossil fuel is reduced. The efficiency of the clean cooking solutions is financially

and economically beneficial for the households using them. Further it will create new entrepreneurial opportunities and enhance the income opportunities through sale of products and accessories.

Social Benefits:The renewable energy projects connect the community for managing and implementing the projects. Similarly, for the waste to energy project and Biogas, this will reduce the socio burden to effective waste management.

Technology Transfer:Some of the renewable energy technology such as large biogas and wind offers new technological option for the users to get familiarized with. On broader perspective, the local market will also have opportunity to enhance their technological know-how on new advancements on these technologies.

The technologies implemented during the reporting periods helps in achieving the Sustainable Goal 3, goal 7 and goal 13 directly whereas it also helps significantly in achieving the goal 1, goal 2, goal 4, goal 5, and goal 6 whereas complements to achieve other goals as well.

Figure 23: Key RE related Sustainable Development Goals

6.3 GREEN-HOUSE GAS EMISSION REDUCTION

During the reporting period, the technology implemented by it helped in reducing the significant amount of Green House Gas Emission reduction. The estimated amount of emission reduction achieved by the technology implemented in the reporting period is 39,727 tCO_2eq. The detail technology wise emission reduction achieved is given in figure 24. The amount of emission reduction given above are the estimated amount of emission reduction and does not resemble to the tradable CERs.

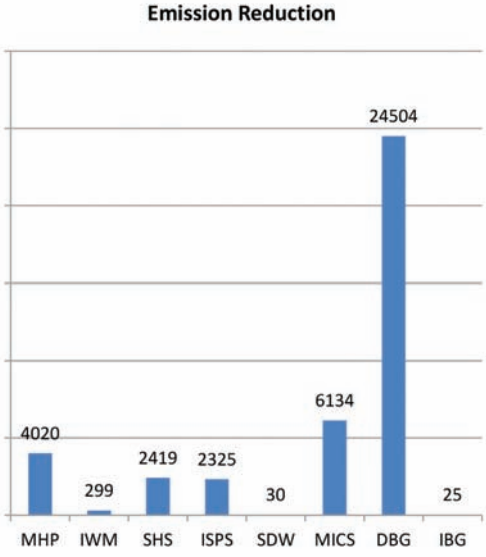


Figure 24: Emission Reduction Achieved by RETs installed during reporting period

6.4 SUCCESSFUL CASE STUDIES

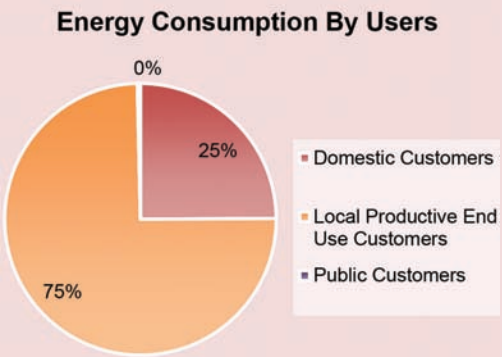
Lower Bom Khola Mini Hydro Project 200 kW, Solukhumbu District Operated as Community Private Partnership (CPP) Model

Lukla, the gate way of Everest, is the small town in Khumbu Pasanglhamu Rural Municipality of the Solukhumbu District in Province No:1 of north-eastern Nepal situated at 2860 meters. It is the popular place for visitors to the Himalayas near Mount Everest to arrive via air flight from Kathmandu to Tenzing-Hilary Airport. Due to high demand of electricity for serving visitors, the community in Luklahas established a new approach of management through energy business modality as public company i.e. Lower Bom Khola Hydro Company Ltd where all the community users have invested the community part as upfront equity. The company was registered under Company Act 2063 with 5 members of Board leading by Mr. Ang Phurwa Sherpa as Chairman.

The total budget of the project is NRs. 141.078 million out of which NRs. 63.01 million & NRs. 30 million is funded through SCF Grant & ADF Loan through Bank from ADB and NRs. 16.20 worth of VAT refund shall be shall be provided by AEPC. The local community provided upfront equity on NRs. 31.38 million for the project. The project has an installed capacity of 200 kW. The project provides electricity for 617 households and existing schools, commercial banks Hotels, Lodges, Motels, Airport terminal building, Rural Municipality Ward office, Restaurant and NCell& NTC telephone towers respectively.

The company has fully taken over 100 kW plant and operating with yearly income of NRs. 3.0 million and after installation of new 200 kW additional plant the company has expected NRs. 15.30 million Yearly income. The company has made 3 segments of consumers' tariff category i.e., domestic, commercial and public.

As the project is in a rural area in an almost isolated location, the main source of revenue is from the sales of electricity. The highest source of revenue is PEU customers who are responsible for 89.1% of revenue whereas the domestic customers generate 10.7% of the revenue.



Damak 40 TPD Municipal Solid Waste based large Biogas plant laid another success milestone producing 1,484 cubic meter Biogas per day

Family sized domestic biogas plant and institutional biogas plant smaller than 100 cubic meter (m3) is a huge success in Nepal with more than 450,000 plants installation. It took more than three decades and is a source of cooking and heating for more than 0.3 million rural households. Presenting household biogas plant success, large sized biogas plants success is also stepping though it took more years. Looking just three years back, large Biogas plants in Nepal that can handle more than 30 ton per day (TPD) was a dream. Support from government of Nepal, World Bank, municipalities, developers and Alternative energy promotion center (AEPC) have made it no wonder. Today, AEPC, a body of Nepal government under Ministry of Energy Water Resources and Irrigation proudly states that now era of large biogas plant in Nepal has entered. This year only, there are more than 11 large biogas plants that are in construction and about to accomplish. Already more than 7 plants are in operation. Following, the Next Era Energy P. Ltd plant also is able to generate biogas plant this month. Construction pace reveals that all under construction plants will be completed this year. There are other many MSW WTE biogas plants in pipeline. Many more developers and municipalities are attracted and reaching to AEPC for this technology that harnesses energy for cooking, heating, electricity, transportation there by caring energy and environment. Meanwhile it has many other products when developed in large sized it can take care of all municipal waste as better and greater resource for a country like Nepal. Accomplished plants have already revealed its better scope and its success is booming day by day. Its main success connects and booms due to its capacity to manage organic waste as a resource that comes from urban, agro industries, food and beverage industries etc.

Damak Municipal Solid Waste (MSW) large Biogas plant developed by Next Era Energy Pvt Ltd setup in Hansedumse Community Forest Area at Damak-3 is a site worth visiting. The project daily utilizes 40 TPD MSW collected from the city and produces 1,484 cubic meter bio methane gas. The digester built is of 22 meters (m) width and 8.5 m height. Gas produced is planned for household gas pipeline distribution and for transportation purpose. In total 10,000 kilograms of organic manure and around 7,500 liters of liquid manure is a byproduct that can be produced daily which is used to replace chemical fertilizer and improve quality of soil and crops grown. Total approved cost of the plant is NRs 147,069,757.00 whereas NRs 58,827,902.80 is being subsidized by government of Nepal and World Bank. This plant has also proven adding another success story. This type of technology is today's need that will grow, glow and help to maintain eco circular economy too of the country like Nepal.

With ever increasing solid waste and its management, this kind of large biogas is best suited. Chairman of CPN-UML and former prime minister KP Sharma Oli visited the plant an area on August. He highlighted its importance and motivated all stakeholders. He especially encouraged AEPC to upscale similar project that has multiple benefits. No wonder, Nepal will have many larger sized biogas plants in upcoming days with better successful inspiring story as of domestic biogas plant

Solar Drinking Water transforming lifestyles of the villagers

LilmayaSaru Magar is the head of her family, she is busy with household chores. Lilmaya used to fetch water in the morning and evening using vessels like Doko and Gagro on her head and hence could not participate in any kind of income generating activities. Like Lilmaya, most of the women ofSunuwar, Mikwakhola Rural Municipality, Taplejung spent their time fetching water from a little pondage.

Under the leadership of Lilmaya, a user's committee was formed for the installation of technologies for water pumping. In this regard, an application for the PVPS system was also submitted to AEPC. Considering the importance of the projects and the problems faced by the women, AEPC prioritized the process for project management and constructed a 2.485 kWp PVPS. Due to the PVPS, the water is easily accessible to every house and has resulted in significant time saving, especially of the women. It has brought joy to their life. 76-year-old senior of the village, Som Bahadur Sunuwar, is forever grateful to be able to have tap water at home in his lifetime.

The project has been successfully completed in partnership with AEPC, Local Level and local residents. The project "ThamdadaSunuwar Tole Solar Lift Water Supply Project" has successfully provided the residents with access to clean and pure drinking water. With the access to water in the residence, LilmayaSaru Magar, with surplus time, has started business of selling surplus vegetables from her own farm. It contributes to support her family in managing household expenses and children needs. That is the case for many women in the Sunuwar Village as they are utilizing the saved time for some form of income generating activities. The lifestyle of the women there, including Lilmaya, has changed with easy access to water.

With the financial and technical support of the Alternative Energy Promotion Center and with the support of the donor agency, the Kreditanstalt für Wiederaufbau (KFW), about 300 such schemes have been successful completed across the country. In the last fiscal year alone around 50 projects have been successfully installed.

Electric Vehicle Rally organized on the occasion of the 25th years Silver Jubilee of AEPC

CHAPTER 7

PROBLEMS, CHALLENGES AND LESSONS LEARNT

7.1 SECTORAL CHALLENGES

The Government of Nepal has been promoting renewable energy since mid-1970s. The GoN has periodically formulated different policies, strategies and guidelines for RE promotion in the country. After the political transformation of the country, bridging the knowledge and information gap existing at state actors at different levels of governance poses an enormous challenge. With the newly established federal structure, there is huge challenge to integrate and harmonized renewable energy initiatives at all three levels of governance. The local governments have enhanced roles and responsibilities in overall planning and implementation of RE. However, the local and provincial governments have limited technical and managerial capacities to carry out their roles related to RE promotion.

Sustainability of off-grid RE systems poses a big challenge to the sector. The rural communities are not able to sustain operation and maintenance of RE systems after installation. Plants that can generate surplus revenue are doing very well but the rest are operating at subsistence level and do not provide reliable and quality electricity as envisaged and generate revenue that barely covers operating costs. Such systems are considered as a 'community asset' rather than a profit making 'social enterprise' and faced many challenges of collective action.

Scaling up of the renewable energy technology, appropriate promotion of the end use activities and grid interconnection of the electricity produced by renewable energy system needs propulsion for the sector to gain momentum. Awareness on energy and financing options are still not widespread enough, and limited organized effort is being made for demand creation. Significant financial barriers persist, and the transition to a market-enabled or credit-based model has been slow. Furthermore, the renewable energy market is not significantly benefitting from innovative approaches, best available technologies, and global best practices.

Furthermore, the Nepali energy sector is still largely dependent on traditional resources putting pressure on natural resources and environment. Approximately 69% population still rely on traditional energy resources for cooking which is a huge sectoral challenge.

7.2 INHERENT PROBLEMS AND CHALLENGES OF AEPC

AEPC was formed through a formation order. In order to have more firm establishment to strengthen renewable energy agenda, AEPC needs to get established through a separate Act. This agenda has remained the priority of AEPC since very long time. Having change in the line of ministry to the MoEWRI, the ministry has formed a committee

to draft AEPC bill and committee conducted several rounds of interactions with stakeholders and submitted draft bill to the Ministry. Lack of own building and land is also a key challenge for AEPC which is not only affecting institutional stability but is also burdensome to the government incurring expenditure against office rent. Besides these challenges, followings are few operational challenges which needs to be addressed by AEPC.

- Implementing the working modalities with local and provincial governments
- Utilizing carbon revenue for investments in RE sector
- Mitigating the turnover of qualified staffs
- Engaging Development partners and attracting more investments from international climate funds such as GCF and NAMA facility.
- Aligning and harmonizing development partner support within National Renewable Energy Framework
- Scaling-up activities in energy efficiency
- Maintaining quality standards of RETs and adopting new technologies
- Adhering new policies and regulations for system improvements
- Operationalizing the RE Sector MIS system at the federal, provincial and local levels.
- Enhancing capacity and establishing facilities for an effective Battery Management System.
- Re-positioning AEPC and its functions in new federal context
- Transforming AEPC towards national and regional Center of Excellence

7.3 LESSONS LEARNT IN THE REPORTING PERIOD

Based on experience on implementation of programs/ projects, Followings are the key lesson learned:

- Access to electricity has substantial forward linkages for rural livelihood marked by potential for improvements in productivity and income, resulting in further spill-over effects. At the same time, rural development in the form of productive uses helps stimulate demand for more electricity and additional revenue stream for profitability and sustainability of isolated RE systems. Therefore, RE promotion should not be considered strictly from financial profitability perspective but from potential for larger socio-economic impact.
- For the foreseeable future, subsidy/grant will continue to be a major part of the initial capital expenditure given the high upfront cost of decentralized rural energy options. To attract the private sector's efficiency in operation and management of RE systems, the subsidy policy has provisioned not only upfront kilowatt-based capital subsidy but also subsidy for energy consumed to cover part of the operational expenditures. However, the new provision has not been able to draw any

takers as the risk in investing in community owned off-grid projects is perceived to be extremely high. Different innovative incentives need to be further explored for to appeal de-risk private investment.

- Use of electronic tools such as Subsidy Administration Management System (SAMS) for subsidy administration was successfully implemented which helped AEPC go paperless processing of subsidy application forms of the household based technologies. This has potential for replication to community and institutional RE systems. Therefore the RE MIS system superseding all existing systems needs to be in operation to incorporate the provincial and local levels and ultimately supersede

7.4 OPPORTUNITIES AND WAY FORWARD

With every challenge, opportunities prevail; crucial is the ability to bank on the prevailing opportunities. There are opportunities for the implementation of renewable energy technologies but the sector could not attract sufficient financial resources. AEPC is aware of the prevailing opportunities for renewableenergy financing through a climate window and has also taken initiatives to tap most out of it. Moreover, AEPC needs to look ahead on what it can bank on through partnership with one or more global initiatives. AEPC sees the following as the key opportunities for the promotion and deployment of RE in Nepal.

- Global concerns on climate change and its impacts create avenue for renewable energy deployment.
- National commitments on SDG, Sustainable Energy for ALL and NDC targets demands concerted efforts towards promotion of renewables reaching out to the most deprived and help graduate others who already are using its basic form.
- New and additional funding opportunities through international climate financing window such as GCF, Climate Investment Fund (CIF), and NAMA Facility will help leverage national private sector investment as participation of such funds would act as risk guarantee for private investment.
- Leveraging synergy with NEA and other institutions for large scale grid interconnection of RETs.
- Energy Efficiency, the new mandate given opens new avenues for AEPC.
- Large Scale Biogas Plants and Waste to Energy Projects are the current demand where AEPC's experience can be of huge advantage.
- Utility Scale Grid Connected Solar System has huge potential in decreasing the ever dependency in imported energy.

In order to tap these opportunities overcoming the challenges, AEPC envisioned the followings way forward measures which might require further strategic deliberations.

- Establish a strong linkage with the provincial and local level government to support initiatives in the RE sector. AEPC supporting

overall RE development as the "Centre of Excellence" in the changed context.

- Start dialogue with the government to clear transition in renewable energy technology promotion responsibility conferred to the local governments by the constitution. AEPC can support government in institutionalizing renewable energy service infrastructure at the local government level.
- Strengthening compliance unit by making its more resourceful and attending to the compliance related finding on priority basis.
- Streamlining new mandates and responsibilities such as energy efficiency, working modalities with local and provincial governments, utility scale solar PV and grid interconnection of MHPs.
- Accessing international climate finance with timely development of project concepts and pipelines. And prepare a competent team to prepare bankable proposals for climate financing.
- Implement new financial mechanisms such as smart subsidy, challenge fund, result based financing etc. to prepare private sector to leverage more investments in the renewable.
- Engaging private sectors as investors/partners rather than contractors and promote RE based entrepreneurship.
- Special focus for reaching to last mile people.
- Integrated Renewable Energy database and information exchange system within three governments. A hub for national and international knowledge management.
- Aligning DPs support through National Renewable Energy Framework.
- Lead to a rapid paradigm shift in the areas of municipal waste to energy projects and Large scale biogas plant , bottling and pipelines for an overall up-scaling of the RE sector in terms of capacity, investment, size and innovation.
- Implement the challenge fund to ensure an inclusive and wider participation and galvanize innovation.
- Institutional strengthening through enactment of its own act and strengthening coordination between RE sector and other sectors such as agriculture, forestry, health, education and urban development.

ANNEXES

Annex-1:Progress achieved in 2021/22 for the programs/activities (AEPC Core Activities)

SN	Activity/Program	Unit	2021/22		
			Target	Achievement	% Achievement
1	AEPC building design	No.	1	1	100%
2	Repair maintenance and reconstruction of CDM registered domestic biogas plants	No.	6000	7617	127%
3	Repair maintenance and reconstruction of CDM registered IWM and mini/micro hydro projects	No.	12	5	42%
4	Detail feasibility study of solar mini grid projects Publications related to renewable energy	No.	35	44	125%
5	Workshops and Seminar on RETs	No.	5	5	100%
6	Awareness Programme on Renewable Energy	No.	3	3	100%
7	Program implementation units at Province 1 and 7	No.	2	2	100%
8	Technical support to provincial and local level with support on outreach	No.	15	15	100%
9	Implementation of energy efficiency program at federal, provincial and local level	No.	7	7	100%
10	Technical standards of five electrical appliances. Preparation of baseline and benchmark	No.	5	5	100%
11	Feasibility study on for model carbon neutral village	No.	2	2	100%
12	Capacity development of public/private institution on Energy Efficiency	No.	6	6	100%
13	Publication of RE Materials	No.	50	50	100%
14	incomplete and sick micro hydro completed and rehabilitation	No.	15	5	33%
15	Solar Home System installation in community and religious places	No.	500	545	109%
16	Integration of micro/mini hydro projects in national grid	No.	16	0	0%
17	Programme implementation for minimize of fossils fuel used in industrial sector by using of briquette and palate.	No.	6	0	0%
18	Solar pump for irrigation	No.	630	634	101%
19	Clean energy program: replacement of dung cakes and agricultural residue for cooking	No.	17500	8350	48%
20	Electricity generation from mini grid project (Multiyear program)	kW	1000	867	87%

Annex-2: Progress achieved in 2021/22 for the programs/activities (NRREP)

SN	Activity/Program	Unit	2021/22		
			Target	Achievement	% Achievement
1	Access to clean energy with Household Biogas Installation	No.	11000	6374	58%
2	Solar water Pumping for Irrigation and Drinking water	No	40	49	122%
3	Institutional Solar Photovoltaic System for various institutions	No	1000	1009	101%
4	Community and Institutional Biogas Plant Installation	No	20	11	55%
5	Productive Energy Use	No	100	66	66%
6	Feasibility study, survey, design, supervision, quality assurance, training and capacity development on community electrification	No.	10	11	110%
7	Feasibility study, survey, design, supervision, quality assurance, training and capacity development on solar	No.	25	24	96%
8	Feasibility study, survey, design, supervision, quality assurance, training and capacity development on bio energy	No.	25	24	96%
9	GESI related activities	No.	6	8	133%
10	Carbon and climate change related activities	No.	10	10	100%
11	GCF related activities	No.	4	4	100%
12	Electrification (mini hydro installation) through SASEC project	Kw.	1000	1198	120%
13	NRREP Management Expenditure	No.	20	20	100%
14	Nepal Mini-grid related activities	No.	30	28	93%
15	NREP related activities	No.	8	8	100%
16	Two/three hole pot MICS installation for heating and cooling in mountainous and high hill districts	No.	5000	2900	58%
17	Tier 3 improved cook stoves and rocket stove installation at institutional and household level.	No.	9000	2053	23%
18	Solar home system for un-electrified areas	No.	10000	12076	121%
19	Solar cooker and dryer installation	No.	100	7	7%
20	Nepal Mini grid related solar/mini and micro hydro development grant and loan	kW	500	0	0
21	Sustainable Energy Challenge Fund for promotion of RETs	No.	5	4	0

SN	Activity/Program	Unit	2021/22		
			Target	Achievement	% Achievement
22	Pico/Mini/Micro Hydro	kW	400	550	137%
23	Installation of Improved Water Mills	No.	100	82	82%
24	Compliance related activities	No.	6	6	100%
25	Third party monitoring of Household based RETS Power output verification and testing of micro/mini hydro projects	No.	15	13	87%
26	Environment and social safeguard	No.	7	7	100%
27	Support to Establish of battery recycling plant	No.	1	0	0%
28	Management of subsidy application form processing	No.	8	8	100%
29	Formulation of national policy of Renewable Energy	No.	1	0	0%
30	Waste to energy and commercial biogas plant installation	No.	60	9	15%

Annex-3: District wise installed RETs 2078/79

District	MHP	IWM	SHS	LBG	DBG	MICS	ISPS	SDW	SIS
Achham	0	0	1121	0	0	3	124	0	0
Arghakhanchi	0	0	2	0	0	0	14	0	2
Baglung	0	0	0	0	0	138	11	0	0
Baitadi	0	0	360	0	0	0	82	0	0
Bajhang	0	17	1024	0	0	0	114	0	0
Bajura	152	0	32	0	0	79	33	0	0
Banke	0	0	511	0	139	0	0	0	21
Bara	0	0	495	0	316	0	3	0	39
Bardiya	0	0	11	0	299	0	0	0	10
Bhaktapur	0	0	0	0	3	0	0	0	1
Bhojpur	0	0	140	0	67	0	42	0	0
Chitawan	0	0	82	0	16	0	19	0	43
Dadeldhura	0	0	77	0	0	0	9	0	1
Dailekh	0	0	2731	0	95	95	72	0	1
Dang	0	0	186	0	95	0	20	1	19
Darchula	0	15	486	0	0	0	20	0	1
Dhading	0	0	3	0	338	148	3	0	0
Dhankuta	0	0	0	0	13	0	0	0	0
Dhanusha	0	0	0	0	59	0	0	0	18
Dolakha	0	0	85	0	61	432	5	0	3
Dolpa	0	0	108	0	0	139	27	0	6
Doti	0	0	132	0	0	1	15	0	0
Gorkha	0	0	1	0	312	0	13	0	1
Gulmi	0	0	0	0	0	0	1	0	2
Humla	0	0	390	0	0	387	47	0	0
Ilam	0	0	0	0	116	0	1	2	3
Jajarkot	0	23	2715	0	17	319	69	0	0
Jhapa	0	0	0	0	369	0	0	0	23
Jumla	258	0	1031	0	0	27	40	0	0
Kabhrepalanchok	0	0	29	0	402	0	10	0	3
Kailali	0	0	924	0	202	0	12	0	45
Kalikot	38	14	2391	0	0	67	111	1	4
Kanchanpur	0	0	1	0	198	0	0	0	16
Kapilbastu	0	0	0	0	32	0	0	0	29
Kaski	0	0	0	0	321	336	0	1	0
Kathmandu	0	0	0	0	7	0	0	0	2
Khotang	0	0	38	0	3	0	73	0	1
Lalitpur	0	0	0	0	15	0	0	0	1

District	MHP	IWM	SHS	LBG	DBG	MICS	ISPS	SDW	SIS
Lamjung	0	0	0	0	305	0	2	0	3
Mahottari	0	0	0	0	89	0	0	0	24
Makawanpur	0	0	126	0	1153	5	23	0	6
Manang	0	0	0	0	0	0	0	0	0
Morang	0	0	0	0	332	0	0	0	30
Mugu	0	0	164	0	0	228	19	0	0
Mustang	0	0	0	0	0	0	5	0	0
Myagdi	0	0	0	0	5	37	14	0	0
Nawalparasi east	100	0	80.5	0	8	0	5	1	3
Nawalparasi west	0	0	80.5	0	8	0	5	0	2
Nuwakot	0	0	1	0	260	0	0	0	1
Okhaldhunga	0	0	94	0	10	3	16	1	0
Palpa	0	0	148	0	5	0	11	0	0
Panchthar	0	0	1	0	3	0	2	3	0
Parbat	0	0	0	0	9	0	0	0	0
Parsa	0	0	0	0	46	0	0	0	86
Pyuthan	0	0	0	0	5	0	0	1	2
Ramechhap	0	0	32	0	40	83	1	4	0
Rasuwa	0	0	0	0	30	0	0	0	0
Rautahat	0	0	15	0	136	0	0	1	26
Rolpa	0	0	1314	0	19	300	42	3	0
Rukum east	0	0	410	0	4	33	4	0	0
Rukum west	200	0	410	0	3	33	34	2	0
Rupandehi	0	0	0	0	95	0	0	0	37
Salyan	0	0	3265	0	58	0	24	1	0
Sangkhuwasabha	0	0	71	0	14	0	17	1	0
Saptari	0	0	0	0	23	0	1	0	10
Sarlahi	0	0	0	0	220	0	2	5	55
Sindhuli	0	0	813	0	332	29	51	0	5
Sindhupalchok	0	0	0	0	42	547	1	0	1
Siraha	0	0	0	0	43	0	0	0	4
Solukhumbu	200	0	13	0	0	118	9	0	0
Sunsari	0	0	0	0	125	0	0	0	17
Surkhet	16	0	1902	0	351	0	58	2	6
Syangja	0	0	0	0	250	0	0	0	0
Tanahun	0	0	1	0	512	0	6	3	1
Taplejung	500	0	0	0	87	0	19	0	0
Terhathum	0	0	0	0	0	0	6	0	0
Udayapur	0	0	145	0	51	0	17	1	3