

Assessment on current use and needs of energy and potential for community-based renewable and low-carbon energy solutions for Indigenous Tharu women and their communities in Gulariya and Madhuwan municipalities in Bardiya district in southwestern Nepal

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1. INTRODUCTION

This assessment aims to provide an overview of the current situation of use and needs of energy for Indigenous Tharu women and their communities as well as the potential for local sources for community-based renewable energy and low-carbon energy solutions for them in Gulariya and Madhuwan municipalities in Bardiya district in southwestern Nepal. It has been produced under the project titled “Enabling indigenous Tharu women and their communities for access to low-carbon renewable energy and sustainable agriculture practices in Bardiya” implemented by Tharu Women Upliftment Center (TWUC) in technical partnership with Community Empowerment and Social Justice Network (CEMSOJ) with financial assistance from International Indigenous Women Forum (IIWF or Foro Internacional de Mujeres Indígenas (FIMI)) through its AYNi Fund: The Indigenous Women’s Fund Strategic Program, and the Global Environment Facility/Small Grants Programme (GEF SGP) implemented by the United Nations Development Programme (UNDP).

The assessment is based on consultations of CEMSOJ and TWUC representatives with women’s or community groups as well as stakeholders such as the local governments and other authorities in Gulariya and Madhuwan municipalities organized on 14-16 November 2024. In Madhuwan municipality, consultations were held with women’s groups at Dhanaura village in ward no. 3 (formerly Dhodhari Village Development Committee ward no. 4) and at Sundarpur village in ward no. 2. There were 19 women and 2 men at Dhanaura and 11 women and 3 men at Sundarpur. At the Dhanaura consultation, the Ward Chair was also present. In Gulariya, meeting was held with the municipality representatives as well as officials from other local authorities and media personnel at the municipality office, and a consultation was organized with Pragati Samudayik Surakchhya Jaalo Samuha at Bagahi, ward no. 4 of the municipality. There were 7 women and 11 men at the meeting in the municipality and 23 women and 2 men at the consultation in Bagahi. In all the village consultations, overwhelming majority of participants were women. In all consultations and meeting, traditional Tharu village leaders known as Badhgar and Sahayak Badhgar (Assistant Badhgar) were also in attendance along with other local leaders.

The consultations were undertaken using an open-ended questionnaire prepared by CEMSOJ, including follow up questions to probe or elaborate as needed. Further, the meeting at Gulariya municipality led by the TWUC sought to inform not only the assessment but also garner comments on the overall project. Since the project was designed, as per the pre-identified needs, to provide support for improved cooking stoves and solar irrigation pumps, among other things, to Tharu women and their communities, extensive discussions were held if those renewable and low-carbon energy solutions were needed. At the same time, other needs of the women and their communities were also deliberated. Besides, field observations of the villages and informal follow up conversations with villagers also provided supplemental information for the assessment.

TWUC organized additional meetings for needs assessment on 8 January 2025 at Chhotki Taruwa village in ward no. 1 (with 24 women) and at Dhanaura village in ward no. 3 (with 13 women) of Madhuwan municipality in follow up to the consultation in November. Those meetings also adopted decisions on the needs of the communities in line with the renewable or low-carbon energy solutions being supported under the project. Similarly, on 16 January, two consultations were organized at Bagahi in ward no 4 of Gulariya municipality total 47 participants 1 male 46 female, to adopt decisions on the needs of the communities.

This needs assessment has been followed by gradual implementation of the project to provide assistance for improved cooking stoves while the solar irrigation pumps are still being procured at the time of finalization of this assessment. Accordingly, this assessment has been adapted and

updated as per the additional information gathered during the project implementation. For example, in the course of project implementation, it has been noted that the specifications of the solar pumps earlier budgeted under the project fell below the needed capacities for the communities as determined during the consultations. Accordingly, the solar irrigation pumps sought by the communities are costlier than what was budgeted under the project, and there has been inadequacy of budget to procure the planned number of pumps. Thus, the project partners are trying to resolve the issue by exploring new procurement and subsidy options.

At the same time, it is being considered to prioritize other needs for renewable and low-carbon energy solutions (such as solar dryer) identified by the communities during the consultations. Likewise, the Tharu women also pointed out various productive end use of energy during the consultations for needs assessment as well as in the discussions that took place when other project activities were executed. So, such information has also been included.

Besides implementation of the current project, TWUC and CEMSOJ, in follow up to this needs assessment, will collaborate to develop new project proposals and plans for mobilizing necessary funds for the other needs confirmed during the needs assessment but not included in the project. Upon mobilization of funds from national and international sources, TWUC, with technical assistance from CEMSOJ, will implement together with the target women's and community groups to address their aspirations for socio-economic development as informed during assessment. Tharu women and their groups will also be encouraged to mobilize necessary funds by using the local resources.

2. BACKGROUND

Founded in 1992, Tharu Women Upliftment Center (TWUC) is an indigenous Tharu women-led non-profit non-governmental organization headquartered in Gulariya, Bardiya with a general membership of 200 women. TWUC, as the name carries, was born out of conscious efforts of Tharu women to empower Tharu women on social, economic, cultural and political aspects for the improvement of human rights, social justice and environmental conservation.

Based on its decades of works with Tharu women and their communities in Bardiya, TWUC recognized that the women and their communities were still heavily dependent on traditional sources of energy for cooking, irrigation and other purposes. This is in line with the data of Nepal's 2021 census, whereby majority of households (51%) of households across the country still rely on wood for cooking followed by imported Liquefied Petroleum Gas (LPG) (44.3%), cow dung (2.9%), biogas (1.2%), electricity (0.5%) and kerosene (0.05%).¹ The use of wood for cooking in rural areas such as in the target areas of the project is even higher than the national average as discussed below.

¹ Energy Sector Synopsis Report 2024, Government of Nepal, Water and Energy Commission Secretariat, http://weecs.gov.np/source/ESR_2024.pdf, pp 8



Similarly, for lighting, 92.2% households use (hydro)electricity followed by solar (6.6%), kerosene (0.6%), biogas (0.03%) and other sources (0.6%).² According to the 16th five-year plan (2024/25-2028/29), 98% of the population has access to electricity, whereby 96.7% has access through the national grid and 1.3% through other isolated off-grid system (solar, wind and microhydro).³ However, despite such high proportion of households and population using electricity through the national grid, agriculture (including irrigation) remains the sector that consumes the least energy in Nepal at just 0.95% of total electricity consumption in the fiscal year of 2022/23. There too, imported diesel is the predominant energy source for agriculture accounting for 75.77% of the total consumption, followed by electricity (22.5%) and petrol (1.22%) while solar energy accounts for meagre 0.51% of the consumption.⁴ Thus, data shows that use of solar energy for agriculture still leaves for much wanting, including in the target areas of the project.

Worse, while renewables such as biogas, wind, solar and micro/pico hydro, account for only 3.10% of the total energy consumption of Nepal, traditional fuels (wood, animal residues and dung) still make up for the largest share at 63.87%, whereby only wood account for 57.22% of energy consumption. Grid electricity account for only 7.23% of total energy consumption.⁵ Above national statistics, which are even starker for rural areas towards the use of fuelwood for cooking

² Ibid.

³ Ibid. pp i

⁴ Ibid. pp 69

⁵ Ibid. pp 64

and diesel for irrigation, supports the project objectives to promote renewable and low-carbon energy solutions, particularly improved cooking stoves and solar irrigation pumps, among Indigenous Tharu women and their communities.

The use of fuelwood and other biomass for cooking has serious repercussions, as it generates a significant amount of smoke causing indoor smoke/air pollution. This smoke contaminates the environment and poses severe risks to respiratory health. Women primarily take on the roles of cooking and gathering biomass, particularly fuelwood from the forest. Women and children, in particular, face exposure to the emissions from this smoke. Greenhouse Gases (GHG) are released into the atmosphere due to poor combustion of biomass fuels in rudimentary stoves, releasing incomplete carbon gas and other dangerous particles. At the same time, inefficient use of fuelwood in those stoves provides placing a tremendous strain on its forest resources and detrimental to the ecosystem.

The concept of Improved Cooking Stoves (ICS) was first proposed in Nepal in the early 1950s with the goals of lowering indoor air pollution and smoke, increasing fuel efficiency, and safeguarding the environment and forest resources. Since the 1980s, when firewood consumption became a critical issue, Nepal's government authorities, UN agencies and Non-Governmental Organizations (NGOs) have been encouraging the use of ICS in rural regions.⁶ Beginning with mud ICS, Alternative Energy Promotion Center (AEPC) has been promoting metallic ICS since 2009 to address dual purpose of simultaneous cooking as well as space heating need of people living in remote hills of Nepal.⁷ As per the Energy Synopsis Report 2023, more than 18,000 metallic ICS and 1.42 million mud ICS have been installed across Nepal.

At the same time, solar-powered irrigation pumps have emerged as viable alternative to diesel pumps in Nepal. Farmers who use groundwater rely on diesel pumps because grid electricity is not available everywhere. Irrigation using diesel pumps is both expensive and harmful to the environment while electric pumps are also cost-intensive. As per the AEPC annual report 2023, solar irrigation has revolutionized agriculture by providing reliable and sustainable water supply solutions, especially in remote and off-grid areas, and 253.2 kW of solar irrigation capacity has been installed across the seven provinces in the country, particularly in the southern Terai/plain region.⁸

Despite increasing uptake of improved cooking stoves and solar irrigation across Nepal, it is still, as noted above, very far from enough. Accordingly, as confirmed in this assessment, firewood and other biomass are still the primary source of energy of cooking in Bardiya district and the two Gulariya and Madhuwan municipalities targeted there in under the project. Similarly, while there were some irrigation facilities, use of solar energy for irrigation and other agricultural purposes is still almost non-existent. Bardiya district and the two municipalities are predominantly populated by Indigenous Tharus. Reliance on fuelwood contributes to deforestation and significant carbon emissions as well as grave health impacts, particularly on Tharu women who experience respiratory illnesses and cataract. Cooking and cleaning also take up a significant amount of time for the women, who are mostly responsible for collecting firewood and fetching water to clean the utensils.

⁶ Improved Cook Stove (ICS) Development: A Case from Nepal, https://www.inforse.org/asia/pdf/Nepal_ICS.pdf

⁷ Improved Cooking Stove, AEPC, <https://old.aepc.gov.np/improved-cooking-stoves>

⁸ Ibid. pp 60 and 150, Also see, Shrestha, S.; Uprety, L. 2021. *Solar irrigation in Nepal: a situation analysis report*. Colombo, Sri Lanka: International Water Management Institute (IWMI). 43p.doi: <https://doi.org/10.5337/2021.218>

Not only that, use of fuelwood also contributes to environmental challenges in Bardiya, which is a highly flood affected area. The silt deposit in the rivers due to floods has also added to the water crisis. So, irrigation for agriculture has also become a challenge. Thus, the Tharus, who are predominantly farmers, have been facing significant challenges with farming and even food security. That again disproportionately burden Tharu women with additional roles for irrigation. On the other hand, use of chemical fertilizers to increase agricultural yield has been increasing among the farmers. Thus, in order to address the social and environmental challenges and promote women's empowerment, TWUC and CEMSOJ designed the project with the aim to enable Tharu women to install ICS in their households as well as support the women/farmers groups with solar irrigation pumps. Moreover, in line with the earlier works of TWUC, the project also seeks to promote organic fertilizer production and use among the women and afforestation activities in their communities to contribute to sustainable agriculture and environmental conservation in the district.

3. HISTORY AND PRESENT OF THARU PEOPLE

Tharus are probably the oldest and original inhabitants of the southern Terai/plain region of Nepal. They are spread from the east to the west of the country as well as in the inner Terai/Madhes areas such as Dang, Surkhet, Udaypur and Chitwan. Further, they extend westward into the Kumaon foothills in India, and thus are also found in northern India, mainly in the states of Bihar, Uttarakhand and Uttar Pradesh.

Considered to belong to Mongloid race, Tharus have dark-brown complexion. They have their own language but depending on where they live, their language seems to have been influenced by Indo-Aryan languages such as Awadhi in the western, Bhojpuri in the central and Maithili in the eastern Terai. They have diverse cultures, sub-tribes and languages/dialects across the southern Nepal different from hill peoples. Officially recognized as one of the 60 Indigenous Nationalities (Adivasi Janajati) of Nepal, Tharu is classified as a marginalized group by the National Foundation for Development of Indigenous Nationalities.⁹ They are the second most populous Indigenous group of Nepal numbering around 1.8 million people i.e. 6.2% of the national population as per the 2021 census.¹⁰ They constitute the largest ethnic group of the Terai.

Tharus typically reside in compact villages in the midst of a clearing in the forest. Tharu people traditionally worship spirits, especially of the forest. They also worship family and ancestral deities as well as village shrines. Tharu priests are known as Guruwa, whose tradition that still holds strong in inner Terai and western Terai villages. A common feature of the Tharu community is the joint family system of living in long houses. Tharu marriages are patrilocal within the tribe. Tenant farmers make up the vast majority of the Tharu population, however few are wealthy landlords. They fish in the streams and are well acquainted with forest life. They have created sophisticated irrigation systems for farming.¹¹

Tharu customary leaders/governance system known as Badhgar (also known as Bhalmansa or Mahatawa) still in practice in many villages lead community management and mobilization, including for maintenance of irrigation canals, cultural preservation and organization of rituals, festivals, and other social affairs, as well as resolution of local disputes, among other things.¹²

⁹ See <https://nfdin.gov.np/nfdin/default/engjatiharul>

¹⁰ National Population and Housing Census 2021: National Report on caste/ethnicity, language and religion, https://censusnepal.cbs.gov.np/results/files/result-folder/Caste%20Ethnicity_report_NPHC_2021.pdf

¹¹ Tharu culture, <https://ntb.gov.np/tharu-culture>

¹² Indigenous Voice. "Who is Tharu?" <https://english.indigenousvoice.com/tharu>

Badhgar system has been legally recognized in Barbardiya municipality in Bardiya district for necessary coordination by local government with them in the governmental affairs.¹³ Similarly, Tharu has been legally recognized as first people/citizen in Itahari sub-metropolitan city in Sunsari district in eastern Nepal to preserve and promote their culture, shrines and practices.¹⁴

Historically, following the formation of modern Nepal in the late 18th century, members of the ruling families received land grants in the Terai. They were entitled to collect revenue from those who cultivated the land. In the 1960s, the eradication of malaria, which Tharus got less often and with less severe consequences than hill people and people from the plains, dramatically changed Tharu lives. For example, in 1955, the Tharu (and related groups such as the Bote and Darai) formed almost 100% of the population of 25,000 of the Chitwan region. By 1970, they had dropped to 14% of the population as 125,000 migrants moved in during those years.¹⁵ Consequently, with lack of awareness, fraudulent money-lending practices, corruption, lack of access to justice and discrimination by State authorities, many Tharus lost their lands to the large influx of hill migrants, mainly from Hindu “high” caste groups who became zamindars (landlords), into the Terai and were eventually even forced to work as bonded laborers (Kamaiya/Kamlari), tenants or wage laborers.¹⁶ While the Government of Nepal abolished the Kamaiya system in July 2000, it has been unable to rehabilitate many Kamaiya families effectively.

A lack of representation in government and politics, language barriers, and a lack of access to State protection and services, including education, perpetuated the marginalization of Tharus. Accordingly, Tharu constitutes one of the several Indigenous groups that are historically discriminated against in Nepal. Thus, Tharus have been involved in many political movements of Nepal from the Maoist conflict, whereby they made up more than 85% of the persons disappeared by the State authorities, to their own movement for abolishment of Kamaiya and Kamlari system and the Tharuhat movement calling for autonomous province in Tharu ancestral domain. Tharu women have played a key role in these movements. Researchers have even called Tharu society matriarchal as Tharu women are perceived to be freer and more empowered without having to face gender restrictions prevalent among Nepal’s other ethnic groups.¹⁷

¹³ See बारबर्दिया नगरपालिकामा रहेका बरघर प्रणाली संरक्षण, प्रवर्द्धन र विकास गर्न बनेको ऐन, २०७७, <https://www.lahurnip.org/uploads/resource/file/barghar-aen.pdf>

¹⁴ See प्रथम नागरिक थारु समुदायको संरक्षण, सम्बर्द्धन र विकास, सम्बन्धि ऐन २०८०, <https://www.lahurnip.org/uploads/resource/file/%E0%A4%AA%E0%A5%8D%E0%A4%B0%E0%A4%A5%E0%A4%A8%E0%A4%BE%E0%A4%97%E0%A4%BF%E0%A4%B0%E0%A4%95-%E0%A4%A5%E0%A4%BE%E0%A4%B0%E0%A5%82-%E0%A4%B8%E0%A4%AE%E0%A5%81%E0%A4%A6%E0%A4%BE%E0%A4%AF%E0%A4%95%E0%A5%87%E0%A4%BE-%E0%A4%B8%E0%A4%82%E0%A4%95%E0%A5%8D%E0%A4%B7%E0%A4%B0%E0%A4%A3-%E0%A4%B8%E0%A4%AE%E0%A5%8D%E0%A4%AC%E0%A4%B0%E0%A5%8D%E0%A4%A7%E0%A4%A8-%E0%A4%B0-%E0%A4%B5%E0%A4%BF%E0%A4%95%E0%A4%BE%E0%A4%B8,---%E0%A4%B8%E0%A4%AE%E0%A5%8D%E0%A4%AC%E0%A4%A8%E0%A5%8D%E0%A4%A7%E0%A4%BF-%E0%A4%8F%E0%A5%88%E0%A4%A8-%E0%A5%A8%E0%A5%A6%E0%A5%AE%E0%A5%A6.pdf>

¹⁵ 5 Myths about the Tharu, Nepali Times, 13 January 2021, <https://nepalitimes.com/here-now/5-myths-about-the-tharu>

¹⁶ World Organization Against Torture (2006). “The Kamaiya System of Bonded Labour in Nepal”. A study prepared by the World Organization Against Torture for the International Conference Poverty, Inequality and Violence: is there a human rights response? Geneva, 4–6 October 2005. Also, OHCHR (2008). “Conflict-related disappearances in Bardiya district”.

https://nepal.ohchr.org/en/resources/Documents/English/reports/HCR/2008_12_19_Bardiya_Report_Final_E.pdf

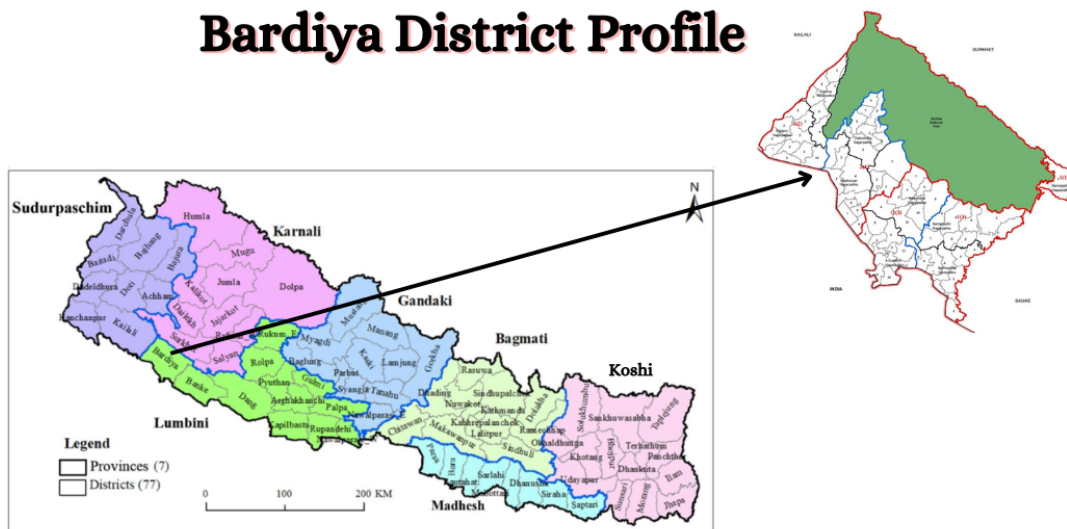
¹⁷ The Tharu story by the Tharu, Nepali Times, 27 March 2024, <https://nepalitimes.com/review/the-tharu-story-by-the-tharu>

4. ENERGY SYNOPSIS IN THE PROJECT AREA

Bardiya in Lumbini province in southwestern Nepal is a thinly populated predominantly forested district with Bardiya National Park covering most of its northern half, which extends to Churiya hills. The district is separated from Banke district in the east by the Man Khola (stream) while the westernmost branch of the Karnali, one of the largest rivers of Nepal, forms its boundary with Kailali district. The district headquarter Gulariya lies on the western bank of the Babai River. There are currently six municipalities and two rural municipalities in the district. As per the 2021 census, the district has a population of 459,900 in 106,285 households. More than 92% of them lived in municipalities. About 53% of the population are female. The district has a literacy rate of 76.85%.¹⁸

Tharus make up the majority (51%) of the population in Bardiya. Other major ethnic groups are Chhetri (12.77%), Bahun (7.13%) and Kami (6.28%), among others. Accordingly, more than 50% of the population speak Tharu, 36.36% speak Nepali and 9.84% as their first language. As per the 2011 census, Tharus made up more than 53% of the population of the district and 35% spoke Nepali as their first language, which indicates some decline in the population of Tharu or their proportion in the district over the ten years.

Bardiya District Profile



Historically, Bardiya district is among the areas that Nepal lost to the East India Company after the Anglo-Nepalese war (1814-16) but was later returned to Nepal, along with Banke, Kailali and Kanchanpur districts. In the early 20th century, Bardiya was still covered with forest and sparsely populated with Indigenous Tharus. Additional Tharus immigrated west from Dang and Deukhuri valleys to Bardiya.

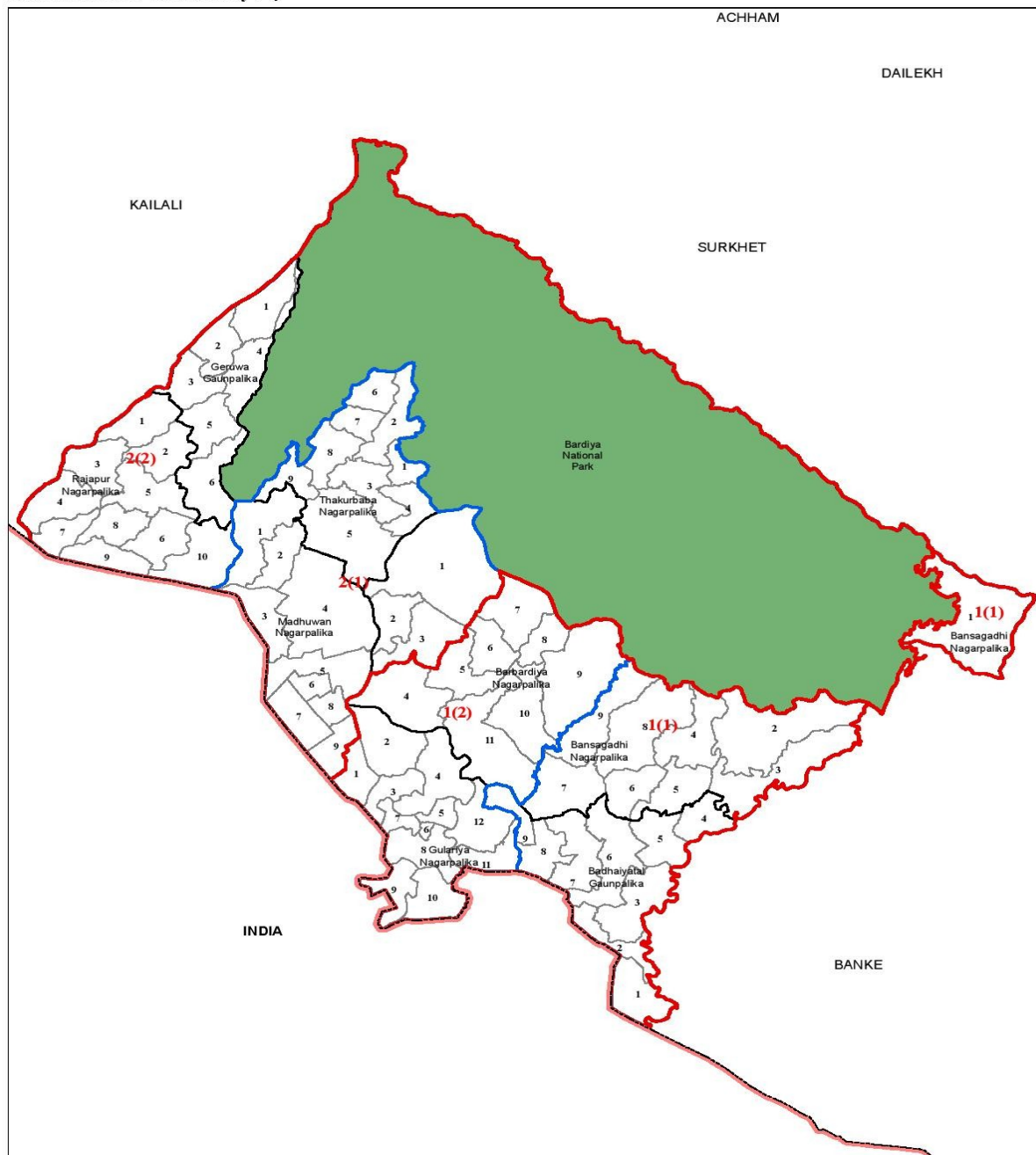
In Bardiya district, the project is implemented in Gulariya and Madhuwan municipalities, which are in south central part of the district bordering India.

¹⁸ National Population and Housing Census 2021: Provincial Report – Lumbini Province, https://censusnepal.cbs.gov.np/results/files/result-folder/province/Lumbini_Province_census_report.pdf

BARDIYA

No. of House of Representative Constituency: 2

No. of Provincial Constituency : 4



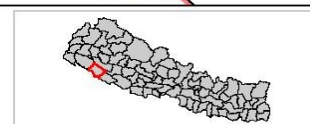
Legend

- International Boundary
- Province Boundary
- District Boundary
- House of Representative Boundary
- Provincial Constituency Boundary

- Palka Boundary
- Ward Boundary
- Sanskritik Area
- National Park/Wildlife Reserve/Hunting Area/Watershed Area

0 3.25 6.5 13 19.5 26 Km

Note:
1 in 1(1) indicates House of Representative Constituency Number and (1) indicates Province
Constituency Number within the House of Representative Constituency Number and likewise.



Prepared By : Electoral Constituency Delineation Commission (ECDC), 2074

Gulariya Municipality was formed in 2073 BS by merging the then Gulariya Mathurahardwar, the former Mohammadpur VDC and Khairapur VDC. As per the 2021 census, Gulariya has a total population of 74,505 in 16,002 households. More than 50% of the population are female. About 27% of the population are Indigenous Tharu, followed by Muslim (16.6%), Yadav (12.1%) and Chhetri (8.8%) and Lodh (8%), among others. 70% of the population are literate – 76.6% among males and 63.7% among females. Most of the population (58%) are engaged in agriculture, followed by trade (12.1%) and construction (11.7%). Overwhelming majority (91.7%) of the households in Gulariya use electricity as the main source lighting followed by kerosene (4.3%), solar (2.2%), biogas (0.1%) and other (1.8%). Most of the households (68.4%) use wood for cooking, followed by LPG (29%), biogas (1.7%) and electricity (0.8%), among others. 71.4% of the households have tubewell/handpump as their main source of drinking water and about 26.5% get tap/piped water. In terms of wealth quintile, 29.6% of the households are in the poorest quintile, 23.4% in average and 22% in poorer quintile.¹⁹

Similarly, as per the 2021 census, Madhuwan municipality has a total population of 50,739 persons in 12,444 households. 54% of the population are female. Indigenous Tharus make up 44.5% of the population, followed by Chhetri (21%), Bishwokarma (11.1%) and Bahun (7.2%), among others. 76.5% of the population are literate – 82.9% among males and 71.2% among females while Tarai Janajatis (including Tharu) have among the lowest literacy rate at 70%. Most population (66.7%) are engaged in agriculture, followed by construction (13.2%) and trade (8.9%), among other occupation. 96.5% of the households use electricity for their main source of lighting, followed by solar (1.8%) while others use kerosene, biogas or other sources. Most households (61.3%) use wood for cooking, followed by LPG (35.3%), biogas (2.6%), electricity (0.6%), cow dung (0.2%) and kerosene (0.01%). Majority (57.5%) of the households have tap/piped water within or outside their compound as their main source of drinking water while 40.5% have tubewell/handpump – others get their drinking water from uncovered well (0.5%), covered well (0.3%), spout water (0.1%), jar/bottle (0.1%) and river/stream (0.02%). 29.4% of the households are in average quintile in terms of wealth index while 21.6% are in the poorer quintile and 16% in the poorest quintile.

5. MAJOR FINDINGS OF THE NEEDS ASSESSMENT

¹⁹ See <https://censusnepal.cbs.gov.np/results/local-level?province=5&district=58&municipality=7>

The needs assessment for the project was carried out, as stated in the first section above, through consultations and meetings with women's groups at Bagahi village in ward no. 4 in Gulariya municipality as well as with the Gulariya municipality representatives, and with women's groups at Chhotki Taruwa village in ward no. 1, at Sundarpur village in ward no. 2, and at Dhanaura village in ward no. 3 of Madhuwan municipality. The major findings from and discussions during the needs assessment are provided below.

As per the information gathered during the consultations with the women's group (Pragati Samudayik Surakchhya Jaalo Samuha) at Bagahi of Gulariya, around 177 households live in the village – all Tharus, except 12 households. Majority of the population (below the age of 40 years) in the village are literate while the highest education attainment among the women is the higher secondary level.



Electricity is the main source of lighting in the village. However, the participants in the consultation expressed concern of high electricity bill when they use water pumps, which can be as high as up to NPR 1,500 per month. Most households use firewood for cooking. But with the traditional stoves, one load of firewood last only two days and cost NPR 500-600 while the women at the consultation complained of waste of fire going everywhere and too much smoke release from the stove and the impacts thereof, particularly on vision and breathing. While two households in the village have biogas plant, such plants of four other households were not operational anymore. The participants at the consultation said that they had not heard about ICS while one of the women had reportedly seen such ICS in another village. They expressed willingness to get training about constructing metallic ICS and installing in their households.

The villagers use tubewell and pumps for groundwater irrigation with water found at around 30 feet deep. However, diesel-powered pumps are also expensive. Thus, the consultation participants highly favored receiving support for solar irrigation pumps while some local NGO had also reportedly called for applications for installing solar pumps but that was yet to materialize.

Additionally, as informed during the consultation and learnt during field observations around the village, many households have been engaged in riverbank (or riverbed or bagar) farming (known in Nepali as baluwa kheti). Thereby, they have been farming watermelon. Around 5 quintals of

watermelon are produced in one katha of land²⁰ while hundreds of households in the village are engaged in such farming in between 1 and 6 kathas of land. Thus, while there is good production of watermelon, they do not have collection center and storage facilities. As a result, they have to sell watermelon for cheap or throw away as waste if they cannot sell immediately. So, at the consultation, solar-powered cold storage facilities as well as other value-added products of watermelon (such as juice, jam, etc.) were also discussed as ideas for productive end use of energy. Likewise, many households are also engaged in farming mushroom, peanuts and vegetables such as tomato, cauliflower and pumpkin. However, for those too, they lack market.



In the second meeting at Bagahi, the participants also determined the need for training on modern techniques of vegetable farming and producing value added products. Also, they decided on the need for solar dryer to prevent waste of vegetables produced in lack of market.

The participants during the consultation had also identified challenge to market access for their other products as well. For example, many families are also engaged in animal husbandry (buffalo and goat) as their other source of income, but they cannot scale that up. The women also produce masyaura (fermented sun-dried vegetable balls are made with a combination of various or single minced vegetables with black lentils) and fermented radish root dish (sinki) and fermented leafy green vegetables (gundruk). They also make traditional Tharu handicrafts such as dhakiya (baskets), which they would like to produce commercially.

²⁰ 1 bigha = 20 katha = 6,772.41 sq. meters

During the Gulariya municipality meeting, after the municipality representatives were briefed on the objectives and outputs of the project that were generally approved, a representative indicated the need for waste management of animal dung and agricultural residue for potential source of energy as well as for use during production of organic fertilizer (jhol mal) under the project. He also pointed to the need for raising the awareness of farmers on various low-carbon and renewable energy solutions that can be useful and relevant to them.



As per the consultation at Dhanaura in ward no. 3 of Madhuwan, more than 200 Tharu households live in the village. 8 out of 10 households are engaged in farming. Besides farming, daily wage work is another source of income, which is seasonal. Majority of the villagers are literate while the highest level of attainment of education is only up to high school. Among the 22 females in the consultation, all were engaged in farming except four of them.

Electricity from the national grid is the main source of energy for lighting in the project area, which the villagers find affordable. For cooking, majority still use firewood from the community forest. Few use LPG gas stoves but those are not always used. However, there are challenges with firewood collection, including due to risks from animals. One load of firewood lasts two to three days for cooking and even less in winter. Thus, they were very interested to learn about ICS to cook with less firewood and in shorter time.

The villagers have tubewell in each household, but the water is not good for drinking. So, they use water purifier. While they get water from the Babai River for irrigation through canals, they also have to rent diesel-powered pump to distribute the water in the farm, which is costly (around NPR 500 per hour). Only four households have deep boring to supply water for irrigation. The consultation participants stated that if better irrigation was possible, they could increase their produce to three harvests of paddy in a year. Similarly, they use tractor for farming and power tiller for harvesting that run on diesel. Rental tractor costs between NPR 2,500 and 3,000 per hour.



The consultation participants identified lack of market for the vegetables they produce as their major challenge. For example, even though the village have potato farming pocket area in 15 bighas of land, which they sell for as low as 18 rupees per kilo. Also, they grow cauliflower, cabbage, tomato, gourd, garlic, onion, bitter gourd, which they sell for meagre price – for example, they sell garlic at NPR 7,000 for a quintal (100 kgs). They also grow banana, mango, and lychee albeit in small scale. So, lack of vegetable collection center and cold storage facilities was also deliberated during the consultation. Besides, the participants informed about problems with animals from India spoiling produce as a unique challenge in the village. At the later meeting held to determine their needs, the villagers also decided on the need for solar dryer that could help in preserving their produce in lack of market.

Moreover, women during the consultation also discussed the idea of producing leaf plates and bowls from Sal (*Shorea robusta*) leaf as a strategy for their economic empowerment and inquired

of possible financial assistance for a machine for the purpose. However, the idea requires more market research and analysis on availability of Sal leaf in the village.

Earlier during the consultation, the Chairperson of ward no. 3 had also highly stressed on the need for support for livelihood enhancement and economic empowerment in the village, including through setting up a rice mill. While welcoming the project objectives to promote solar irrigation pumps and afforestation, he also cautioned that mud ICS project was previously implemented in the ward but not effective as most stopped using the ICS after the ICS broke.



In another consultation held in Madhuwan at ward no. 2 with the women's group (Sundarpur Samudayik Surakchhya Samuha), representatives of 22 households in the women's group participated as well as Badhgar and Assistant Badhgar. Around 65 households live in Sundarpur – 95% of them Tharu. Farming is their main source of income followed by daily wage work. Almost all the villagers are literate while the highest education level is only up to the higher secondary school.

As per the consultation participants, the villagers use electricity as the main source for lighting, which is quite affordable. However, since LPG is costly, majority of the villagers use firewood for cooking in traditional stoves with wood from their community forest (Sagun community forest). However, they shared concerns of health challenges with the use of wood for cooking in traditional stoves. So, they showed interest in installing ICS in their households. Moreover, since they have good access to the community forest, they also indicated that they could produce leaf plates for their economic empowerment using abundant Sal leaf in the community forest.

75% of the households in the village have electric motor pumps for drinking water although the electricity bill gets high due to the use of the pump. Like in Dhanaura, they also faced the challenge of human-animal conflict with monkeys destroying the vegetables they farm.

Nonetheless, unique to this village was that they were in Simsar (wetland) area. So, they could only make one paddy harvest a year while irrigation would also be a challenge for them.

Finally, in the meeting held at Chhotki Taruwa village in ward no. 1 of Madhuwan village, the participants decided on the needs for ICS to avoid heavy use of firewood for cooking. As most villagers are engaged in farming, they also identified the need for solar irrigation. Further, in lack of collection/storage centers for their agricultural produce, they decided on the need for solar dryer to sell their produced in dried form.

6. KEY TAKEAWAYS ON ENERGY NEEDS AND WAYS FORWARD

Below are the key takeaways and ways forward of this needs assessment – many of which have also been confirmed by the decisions adopted during the meetings of the women's group:

1. First and foremost, Indigenous Tharu women and their households in the project area are still mostly reliant on fuelwood and other biomass for cooking and heating in traditional stoves. That impacts their health and that of their family due to excessive smoke while it also takes a lot of time of the women for fetching wood and cleaning and costs them highly. Thus, installation of Improved Cooking Stoves (ICS) needs be promoted as most of households are in poor quintile in terms of wealth index to be able to afford electric cooking stoves. At the same time, to promote the socio-economic empowerment of the women during installation of the ICS, the women's representatives themselves should be trained to install and carry out maintenance of the ICS.
2. Secondly, as most Tharus in the project area are engaged in agriculture as their primary source of occupation and irrigation is their common challenge, solar irrigation pumps are viable alternatives to diesel pumps for them in terms of financial and environmental benefits. However, standalone off-grid solar pumps remain expensive although panel costs have declined globally. Thus significant subsidization or grant support is required for small and marginal farmers. Support for solar pumps should be provided to farmers' groups or to farmers engaged in large-scale commercial rather than individual farmers engaged in subsistence or small scale farming so as to ensure optimal use of the pumps and generate most benefits vis-à-vis the high upfront capital costs. Again, Tharu women and men should also imparted technical knowledge on maintenance of such pumps to avoid costs in terms of minor repairs if needed.
3. In most villages (Bagahi, Dhanaura and Chhotki Taruwa) under this assessment, solar dryer has been identified as another daunting need. That is because there is lack of access to market despite abundant agricultural produce. So, solar dryer can help the Tharu women and men to preserve their produce, particularly fruits and vegetables, and sell even in dried form as appropriate. Such dryer would not incur any cost for operating. However, market research must be undertaken for such dried products. Otherwise, piloting the solar dryer at one village as part of the project could be the way forward if the resources under the project allow.
4. Also, in Bagahi, Dhanaura and Chhotki Taruwa villages, need for collection centers for agricultural produce and storage facilities were discussed to address lack of easy or nearby market. Thus, plans for solar-powered collection and cold storage facilities should be addressed in follow up to the project. For most benefits from such facilities vis-à-vis high costs

that would be incurred to set them up, Tharu women should be encouraged and enabled to set up farmers' groups or cooperatives if not existent yet or strengthen them if already existing. That is because setting up such facilities would also require local contributions in terms of finance as well as labour, which might not be possible at individual level. Such groups or cooperatives then could also be the way forward in addressing the challenge to market access itself. With significant quantity of agricultural produce collected through such group or cooperative, transportation costs to take the produce to even distant markets can be proportionally lessened.

5. In Dhanaura and Sundarpur, Tharu women indicated production of leaf plates and bowls as a potential additional livelihood for them by using Sal (*Shorea robusta*) leaves available locally in their community forests in abundance. Since there is increasing uptake of production of leaf plates and bowls across Nepal and even being undertaken at commercial scale by the private sector, market research is again a must to move ahead with this idea. One way could be that support for the machinery for leaf plates and bowls production as requested by the women's groups in the villages is provided together with solar power plants to run the machinery. That way, the minimal or no operational costs to run the machinery might give the production by the women's group required cost advantage over such leaf plates and bowls already available in the markets.
6. As suggested by a representative at Gulariya municipality, another way forward can be to organize awareness raising of Tharu women and men, who have mainly been engaged in agriculture, on the entire universe of renewable, low carbon and low cost energy solutions that can be helpful for them to increase their agricultural yield and value. For this, Tharu communities and their support groups such as TWUC and CEMSOJ need to learn from other communities, NGOs and private sector in Nepal and beyond that have been innovating on various agricultural and other technologies.



7. In Bagahi, training on modern techniques of vegetable farming and producing value added products has also been identified as a need. Such training could be useful for all villages in the project area as Tharu women in Dhanaura, for example, also pointed to the challenges of not being able to commercialize their vegetable and fruit farming. Here too, for producing value added products, Tharu women should be enabled and supported to use appropriate energy solutions (such as solar energy for running packaging machine, etc.) and produce innovative products (for example, watermelon jam rather than easily available juice) so that they have the costs and other advantage over competitive products.
8. Finally, as floated by the Chairperson of ward no. 3 of Madhuwan municipality, renewable and low-carbon energy solutions should be explored for even major agricultural produce such as for the rice mill. That is so that Indigenous-led energy solutions become the dominant way rather than an alternative towards enabling Indigenous communities using those energy solutions for controlling their lands and resources.

7. ANNEX

1. *Pictures of the needs assessment consultations and meetings*
2. *Pictures of the ICS training and installation under the project*

