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*Report*

**Present energy use by urban poor and challenges for  
adoption of Renewable Energy in Bangladesh**

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**June 2024**

## **Report-**

# **Present energy use by urban poor and challenges for adoption of Renewable Energy in Bangladesh**

This report is prepared as part of project titled “Advocacy on Urban Poor Peoples’ Access to Green Energy in Bangladesh” funded by Tara Climate Foundation.

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## **1. Introduction:**

Energy is an essential ingredient, which all people need. Energy is at the heart of climate change-related threats around the world. The use of fossil fuels has heated the Earth's atmosphere. As a result, global warming has reached dangerous levels. Stopping the use of fossil fuels is now imperative to keep global warming at a tolerable level. Since energy is needed to keep civilization running, alternatives to fossil fuels need to be explored. Renewable energy has already proven to be a sustainable and alternative source of energy to fossil fuels, a major driver of climate change.

The International Energy Agency (IEA) defines energy access as households having reliable and affordable access to both clean cooking facilities and electricity, measured against a benchmark that aligns with SDG 7.1<sup>i</sup>. This benchmark serves as a vital tool for evaluating progress toward universal energy access. The adoption of the SDGs in 2015, particularly SDG 7, reflects a global commitment to achieving universal access to affordable, reliable, sustainable, and modern energy. However, recent challenges, such as the energy crisis and the Covid-19 pandemic, have led to an increase in the number of people without access to electricity globally, contrasting with Bangladesh's significant progress in this regard, as indicated by the IEA's data. There has been impressive growth in the percentage of the population with access to electricity in Bangladesh from 2000 to 2022, showcasing a substantial increase from 20.40% in 2000 to 99.50% in 2022<sup>ii</sup>. This progress aligns with international goals and demonstrates Bangladesh's commitment to expanding electricity access. Bangladesh has made progress in clean cooking as well, the percentage of the population with access to clean cooking increased from 7.80% in 2000 to 25.00% in 2022<sup>iii</sup>.

### **1.1. Background:**

Urbanization has been a defining global trend, with an increasing number of people moving to urban areas in search of economic opportunities and improved living conditions. Bangladesh, like many other developing nations, is witnessing rapid urbanization, leading to a surge in energy demand within urban communities. However, amid this growth, a significant proportion of the urban population, particularly the poor, faces challenges in accessing reliable and sustainable energy sources.

The urban poor in Bangladesh encounter multifaceted issues, including economic constraints, infrastructural limitations, and environmental vulnerabilities. As the demand for energy rises, ensuring equitable access becomes imperative to mitigate social disparities and promote sustainable urban development.

Renewable energy, characterized by its environmental sustainability and low carbon footprint, emerges as a potential solution to address the energy needs of the urban poor in Bangladesh. The concept involves leveraging renewable resources such as solar, wind, and biogas to provide clean and affordable energy alternatives. By integrating renewable energy initiatives into urban planning, policymakers can not only enhance energy access but also contribute to environmental conservation and climate resilience.

Despite the potential benefits of renewable energy, there exists a critical gap in understanding the specific challenges faced by the urban poor in adopting and accessing these technologies. This research seeks to bridge this gap by conducting a comprehensive investigation into the dynamics of renewable energy adoption among the urban poor in Bangladesh.

The study aims to explore the socio-economic factors influencing access to renewable energy, analyze the effectiveness of existing policies and initiatives, and identify barriers hindering the widespread adoption of sustainable energy solutions. By shedding light on the unique challenges faced by the urban poor, the research aspires to inform targeted interventions, contribute to sustainable urban development strategies, and pave the way for inclusive energy access in the context of Bangladesh's urban landscape. Ultimately, the findings of this research endeavor to offer valuable insights that can guide policymakers, urban planners, and development practitioners toward creating more resilient, equitable, and environmentally sustainable urban energy ecosystems in Bangladesh.

## **1.2. Rationale**

The study is driven by a comprehensive rationale that encompasses social equity, environmental sustainability, and the imperative of achieving global development goals. Through this research, a nuanced understanding of the barriers and opportunities for renewable energy adoption among the urban poor in Bangladesh will be gained, informing targeted interventions and contributing to a more inclusive and sustainable urban energy landscape.

The urban poor in Bangladesh face persistent challenges in accessing reliable and clean energy sources, contributing to energy poverty. The study aims to understand the specific dynamics of this energy poverty within urban settings and explore how renewable energy solutions can be instrumental in alleviating the energy disparities experienced by the urban poor.

Sustainable urban development is contingent on equitable access to energy. As Bangladesh undergoes rapid urbanization, there is a growing need to ensure that the benefits of development are shared inclusively. Investigating the access of urban poor to renewable energy aligns with the broader goal of fostering sustainable urbanization and mitigating the environmental impact of urban growth.

The adoption of renewable energy by the urban poor not only addresses energy access challenges but also contributes to environmental conservation. By reducing reliance on conventional, polluting energy sources, the study seeks to highlight the potential positive impact on air quality, public health, and overall environmental sustainability in urban areas.

Energy access is intricately linked with socio-economic development. Understanding how the urban poor engage with and can benefit from renewable energy solutions is essential for developing policies that bridge socio-economic gaps. This study aims to identify barriers hindering renewable energy adoption and propose targeted interventions to promote inclusivity.

The findings of the research will provide valuable insights for policymakers and urban planners. By uncovering the challenges faced by the urban poor in adopting renewable energy, the study

aims to inform the development of effective and context-specific policies that facilitate the integration of sustainable energy solutions into urban planning frameworks.

The research aligns with global initiatives such as the United Nations Sustainable Development Goals (SDGs), particularly SDG 7, which calls for ensuring access to affordable, reliable, sustainable, and modern energy for all. By focusing on the urban poor, the study contributes to the achievement of SDGs, recognizing the interconnectedness of poverty alleviation, environmental sustainability, and energy access.

Understanding the socio-economic factors influencing renewable energy adoption among the urban poor is crucial for empowering these communities. The study seeks to identify community-specific needs and preferences, paving the way for community-led initiatives and increasing the likelihood of successful and sustainable renewable energy integration.

In light of global concerns about climate change, sustainable development, and the imperative to transition to cleaner energy sources, the study is timely and relevant. It addresses a critical gap in knowledge regarding the specific challenges faced by the urban poor in Bangladesh in accessing renewable energy, offering insights that can guide immediate and future interventions.

### **1.3. Objectives of the Study**

The objectives of the study on "Present energy use by urban poor and challenges for adoption of Renewable Energy in Bangladesh" are designed to comprehensively investigate and address the challenges and opportunities associated with renewable energy adoption within the context of urban poverty. The study aims to achieve the following objectives –

1. Examine the existing energy access landscape for the urban poor in Bangladesh
2. Investigate the socio-economic, cultural, and infrastructural barriers that hinder the adoption of renewable energy solutions among urban poor communities in Bangladesh.
3. Identify community-specific needs, preferences, and cultural considerations that play a role in shaping the acceptance and utilization of renewable energy solutions within urban poor communities.
4. Develop evidence-based policy recommendations aimed at overcoming identified barriers and promoting the inclusive integration of renewable energy solutions in urban development policies and strategies.

### **1.4. Scope and Limitations**

The research focuses on urban areas across Bangladesh, covering the capital city Dhaka, divisional city Rajshahi and a regional town Satkhira where urban poor communities are prevalent. The study primarily investigates the present energy use pattern and the socio-economic dimensions influencing the urban poor's access to renewable energy, including income levels, employment status, and education. The scope includes an examination of existing policies and regulatory frameworks related to renewable energy adoption in urban areas, with a focus on their impact on the urban poor. The study explores community-specific aspects, such as cultural preferences, awareness levels, and community engagement in renewable energy initiatives. The research assesses potential interventions and strategies to enhance renewable energy access for

the urban poor, considering both governmental and non-governmental initiatives. Limitations of the study include limited time period and limited resources.

## 2. Literature Review

Providing access to affordable modern energy services represents a key requirement for eradicating poverty and reducing inequalities. This is the reason why the United Nations (2015) included the achievement of universal access to affordable, reliable, sustainable, and modern energy among the Sustainable Development Goals at the core of its 2030 Agenda for Sustainable Development. The concept of energy access does not have a unique, widely agreed definition (International Energy Agency 2017<sup>iv</sup>). Generally, it is referred to as household access to minimum levels of modern energy, for both electric appliances and clean cooking needs. However, a heated debate over the quantification of those minimum levels and their measurement is ongoing (Bhatia and Angelou 2015<sup>v</sup>; Nussbaumer et al. 2012<sup>vi</sup>; Pachauri 2011<sup>vii</sup>).

Elias and Victor (2005)<sup>viii</sup> highlights the multifaceted nature of energy transitions in developing countries, emphasizing the need to consider various influential factors beyond income. The energy ladder theory, often used to describe the transition from traditional to modern energy sources as income levels rise, is challenged by empirical evidence suggesting a more complex reality. While high-income households indeed consume more modern fuels than low-income ones, characterizing wood energy as solely for the poor oversimplifies the issue.

Research by Hiemstra-van der Horst and Hovorka (2008)<sup>ix</sup> question the conventional energy ladder concept, showcasing household energy use variations in different contexts like Maun, Botswana. Sathaye and Tyler (1991)<sup>x</sup> reveal that poor households may actually pay more for fuels in terms of energy content due to relative fuel prices. Additionally, Leach (1992)<sup>xi</sup> notes the financial constraint faced by low-income households, who prefer small, frequent purchases of fuel wood and kerosene over lump sum payments for electricity and bottled gas, despite potential higher overall costs. These findings collectively suggest that the energy ladder theory requires nuanced consideration and may not fully capture the complexities of energy use patterns among different socioeconomic groups.

Barnes (1995)<sup>xii</sup> findings from a World Bank survey conducted in the early 1990s across 45 cities and 20,000 households, reveals that poor urban households allocate a significant portion (15 to 22%) of their cash incomes to energy expenses. ESMAP (1999)<sup>xiii</sup> further underscores this disparity, noting that the poor often spend a higher proportion of their income on fuels compared to higher-income households. This discrepancy is attributed to factors such as the heat content of fuels used and the efficiency of energy conversion technologies. Moreover, the purchasing behavior of the poor, which entails acquiring small amounts of fuel on a daily basis, influences their choice of energy sources, leading to higher unit costs compared to bulk purchases. These insights shed light on the intricate relationship between energy access and urban poverty, emphasizing the need for tailored policy interventions to address the energy needs of marginalized communities.

The literature review on urban energy systems, led by Arnulf Grubler<sup>xiv</sup>, explores the complex dynamics of energy access and affordability in urban settings, particularly focusing on low- and

middle-income nations. Grubler highlights the economic pressures faced by slum dwellers in developing countries, who often spend a significant portion of their income on energy, as evidenced by studies from Thailand, Ethiopia, Yemen, and other nations. Lack of access to electricity and clean fuels is a common challenge, exacerbated by political and institutional obstacles, especially in informal settlements. While the shift to clean energy sources and electricity offers numerous benefits, including improved health and convenience, affordability remains a significant barrier for many low-income urban dwellers. Innovations such as pay-as-you-use meters and lifeline electricity tariffs have helped mitigate these costs to some extent. Additionally, while climate change poses challenges for energy access, transitioning to cleaner fuels can reduce the overall environmental impact. Ultimately, successful energy provision to urban poor communities requires collaborative efforts between local governments and inhabitants of informal settlements, with strong public support for slum upgrading initiatives facilitating access to clean energy and electricity.

In a study conducted by Barnes, Krutilla, and Hyde (2004)<sup>xv</sup>, the intricate relationship between energy, poverty, and the environment in urban settings of the developing world is explored. Investigating 34 cities across countries such as Bolivia, India, and the Philippines, the research reveals that the urban poor, predominantly migrants, encounter significant hurdles in meeting their basic energy needs. Relying on traditional fuels collected from the outskirts of urban areas, these individuals face higher prices for usable energy due to the inefficiency of stoves and lamps. The findings underscore the urgent need for targeted interventions to address the energy challenges faced by marginalized urban communities.

Jones (2021)<sup>xvi</sup> delves into the realm of energy justice within the context of Dhaka's slums, offering valuable insights into the intricate socio-technical infrastructures that shape energy access in challenging environments. The study contributes to a deeper understanding of the complexities and inequities inherent in energy provision, particularly in informal settlements. Despite the nascent nature of the energy justice discourse, Jones (2021) highlights a significant gap in research, particularly in the global South and at the household scale. The findings underscore the prevalence of energy injustices in informal settlements, stemming not only from governance and poverty issues but also from factors such as insecure tenure and inadequate housing. This research sheds light on the urgent need to address energy inequalities in marginalized urban communities, offering a crucial contribution to the evolving field of energy justice.

Research paper by Molla Shahadat Hossain Lipu et al. (2013)<sup>xvii</sup> published in the International Journal of Energy Economics and Policy investigates the barriers to energy access in the urban poor areas of Dhaka, Bangladesh. The research concluded that, despite the introduction of various energy policies since 1996, including the National Energy Policy (NEP), Private Power Generation Policy, Draft National Energy Policy, and Renewable Energy Policy, none of these policies specifically addressed the energy needs of the urban poor as a fundamental service. Moreover, there is a lack of comprehensive policy addressing urban poverty, cleaner energy, or energy efficiency. The study also highlights the absence of coordination among sub-sectors within the energy sector, leading to policy confusion and weakening of the regulatory

environment. Additionally, the research sheds light on the issue of price discrimination, where urban poor households are charged significantly higher prices for energy appliances compared to regular prices, exacerbating their financial burden.

Another study by Molla Shahadat Hossain Lipu et al. (2016)<sup>xviii</sup> titled "Energy poverty and access to modern energy of urban poor: a case of Dhaka, Bangladesh," published in the *International Journal of Energy Technology and Policy*. The research examines the energy access status of the urban poor in Dhaka, Bangladesh, despite the prevalent physical availability of modern energy sources like electricity and natural gas. Using a demand-based approach, the study reveals that over one third of the population in Dhaka slums are energy poor, requiring a monthly minimum of 2.38 kgOE of useful energy per person to meet basic needs. However, the distribution of income and energy poverty indicates that not all energy poor individuals are income poor, and vice versa, with more income poor than energy poor individuals in the community. Analysis of energy consumption patterns reveals heavy reliance on traditional energy sources among both energy and income poor households, with minimal usage of modern energy. The study underscores the importance of adequate access to modern energy in addressing both energy poverty and income poverty.

The study by the Institute for Energy Economics and Financial Analysis (IEEFA)<sup>xix</sup> in 2023 examines the transition towards rooftop solar energy in Bangladesh, initiated by the government's directive in 2010 to increase solar energy capacity amidst significant electricity supply-demand deficits. Mandates were issued for new buildings, industries, and households in urban areas to install rooftop solar systems, with specific capacity requirements based on sanctioned loads. The study highlights several key findings, emphasizing the need for risk-mitigation mechanisms, utility business models, import duty waivers on solar accessories, and simplified processes for letter of credit opening to scale up the rooftop solar sector. Despite clear economic benefits, progress in rooftop solar adoption is hindered by factors such as lack of awareness, low confidence, perceived risks, high import duties, and fiscal constraints. The study estimates potential savings for the Bangladesh Power Development Board through new rooftop solar capacity and recommends strategies for awareness-raising, stakeholder capacity development, and quality assurance to foster trust in rooftop solar technology.

The paper by Tahia Fahrin Karim et al. (2017)<sup>xx</sup> explores the challenges and potential solutions for improving electricity access in the Korail slum of Dhaka city, Bangladesh. It highlights issues such as the absence of strong governance, unplanned settlement of slum dwellers, lack of inspection and evaluation systems, and poor urban policies contributing to higher electricity charges in slum areas. Additionally, factors like poor governance, unlawful activities, absence of regulatory frameworks, and political influence pose obstacles to cost-effective and legal electricity supply in urban poor areas. The study emphasizes the importance of introducing suitable plans, policies, and strategies to address these challenges. It identifies solar power and solid waste as potential sources for reliable and affordable electricity supply in the Korail slum, with rooftop solar PV presenting a promising approach. The study estimates that rooftop solar PV could generate 17.2 MW of electricity from the bright rooftop area of 182,108 m<sup>2</sup> in the Korail slum, surpassing the area's demand of 2.6 MW. The surplus electricity could be stored or

transferred to the national grid, thereby contributing to reducing power blackouts. The paper underscores the need for effective management and government support to disseminate solar energy programs in urban poor areas, given their acceptance among the population due to innovative financing mechanisms.

Kabir, Md. Humayun, Wilfried Endlicher, and Jonas Jägermeyr (2010)<sup>xxi</sup> conducted a study titled "Calculation of bright roof-tops for solar PV applications in Dhaka Megacity, Bangladesh" published in *Renewable Energy*. The study addresses the power crisis in Dhaka Megacity, Bangladesh, and explores the potential of stand-alone or grid-connected photovoltaic (PV) systems as pragmatic solutions. By analyzing Quickbird Scene 2006 data, the researchers estimated that Dhaka city has 10.554 km<sup>2</sup> of bright roof-tops within the Dhaka City Corporation (DCC) ward area (134.282 km<sup>2</sup>). They found that stand-alone PV systems using 75 Wp solar modules could generate approximately 1000 MW of electrical power, which could significantly contribute to meeting the city's power demand.

In the study by Phoram Shah et al. (2023), titled "Low-carbon Slum Upgrading,"<sup>xxii</sup> the authors highlight the disproportionate energy burden faced by households in informal settlements compared to other urban residents. These households often allocate a significant portion of their income to meet basic energy needs for cooking, lighting, and heating, yet struggle with limited access to legal, reliable, and affordable energy sources. The prevalence of electricity theft further exacerbates the issue, leading to revenue losses for utility providers. The study also explores various mitigation strategies to enhance clean energy access in slum areas, including the implementation of micro-grids powered by renewable energy sources (RE), energy-efficient (EE) street lighting, and the adoption of household RE/EE appliances. The integration of small Electric Vehicles (EVs) for service delivery within informal settlements emerges as a promising solution, particularly for navigating irregular street layouts that hinder larger vehicle passage. Solar power emerges as a sustainable off-grid solution capable of meeting significant electricity demands in these areas, facilitated by solar photovoltaic (PV) panels and innovative battery storage systems. It acknowledged that the deployment of solar home systems not only extends productive hours for low-income families but also yields health benefits by reducing exposure to indoor air pollution from traditional fuels. Moreover, the utilization of electric two-wheelers for last-mile delivery services offers cost-saving advantages, contributing to overall supply chain efficiency in informal settlements.

### **3. Methodology**

The research methodology employed in this study utilizes both quantitative and qualitative approaches to comprehensively investigate the energy usage patterns and challenges faced by urban poor populations in Bangladesh. A household-level survey was conducted across 18 slums in Dhaka city, which hosts the largest concentration of urban poor residents in the country. Additionally, household surveys were conducted in two slums each in Rajshahi, a divisional city, and Satkhira, a district town. These locations were chosen to ensure a representative sample that captures the diversity of urban poor communities across Bangladesh.

The quantitative aspect of the methodology involved surveying a total of 593 households, with 62 households surveyed in each of the selected areas in Rajshahi and Satkhira, and the remaining 469 households surveyed in Dhaka. This approach allows for statistical analysis and quantification of energy usage patterns and expenditures among urban poor households.

Complementing the quantitative data collection, qualitative methods were employed to gain deeper insights into the energy sector and the challenges faced by urban poor communities. This included conducting 22 focus group discussions to explore attitudes, perceptions, and experiences related to energy use. Additionally, observations, media monitoring, and literature reviews were conducted to provide context and enrich the understanding of the broader socio-economic factors influencing energy access and utilization. Together, these mixed-methods approaches provide a comprehensive understanding of the present energy use dynamics and the barriers to the adoption of renewable energy technologies among urban poor populations in Bangladesh.

## **4. Study Results**

### **4.1. Socio-economic condition of Urban poor**

Around 40% of the total population of Bangladesh live in urban areas<sup>xxiii</sup> and about half of them live in slums<sup>xxiv</sup>. The study looked into various socio-economic aspects including urban poor peoples' present energy use pattern in three different urban settings: Dhaka, Rajshahi and Satkhira. These three urban areas are different in size, population and legal status. Dhaka is the capital city of Bangladesh, while Rajshahi is a Divisional City and Satkhira is a District town.

#### **4.1.1. Dhaka**

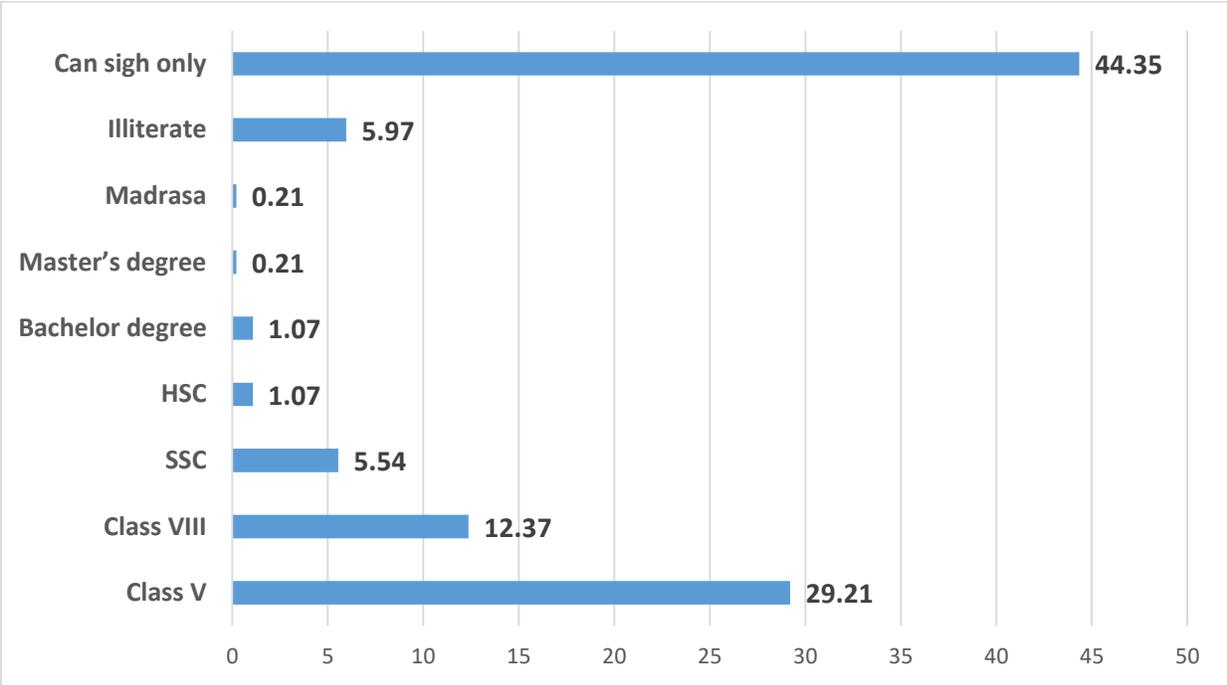
In Dhaka City, the capital of Bangladesh, there are more than 5,000 slums which are densely inhabited by an estimated four million people<sup>xxv</sup>. A total of 18 urban poor areas were studied in both Dhaka South City Corporation and Dhaka North City Corporation.

Upon calculating the composition of male and female members within households, it emerged that females comprise 50.91%, slightly outnumbering males at 49.09%, among the urban poor households surveyed in the study. Furthermore, 30.22% of the population is under 14 years of age.

The most common occupations among urban poor household heads include jobs (15.99%), rickshaw pullers (14.71%), and day laborers (11.94%). Other prevalent occupations include shopkeepers (10.66%), individuals engaged in business (10.66%), and those involved in part-time housework (5.76%). A notable portion of household heads do not work (5.12%), while smaller percentages are employed as drivers, hawkers, shop staff, cleaners, and in various other professions.

It reveals that a substantial portion of the respondents have attained education up to Class V (29.21%) and Class VIII (12.37%). Additionally, smaller percentages have achieved higher levels of education, including SSC (Secondary School Certificate) holders (5.54%), HSC (Higher Secondary Certificate) holders (1.07%), and individuals with Bachelor's degrees (1.07%) and

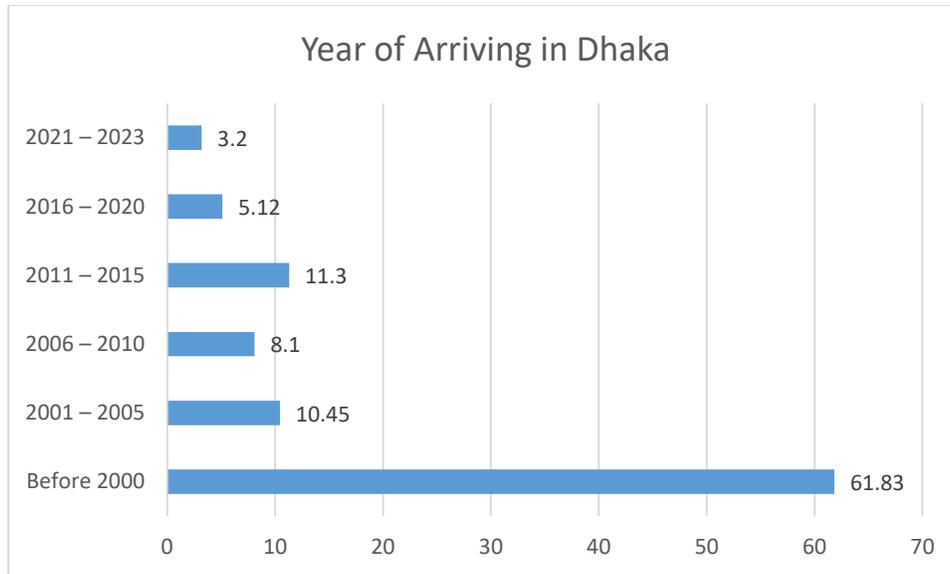
Master's degrees (0.21%). Notably, there are respondents who have received education from Madrasas (Islamic schools) (0.21%). However, a considerable proportion of the respondents are illiterate (5.97%), while a significant majority can only sign their names (44.35%).



It reveals that the majority of respondents are married, comprising 88.70% of the total. Additionally, a considerable number of respondents are widowed (6.82%). There are also respondents who are separated (3.62%). Only a small fraction of respondents are unmarried (0.85%). The average age of the respondents in the surveyed population is reported to be 36 years.

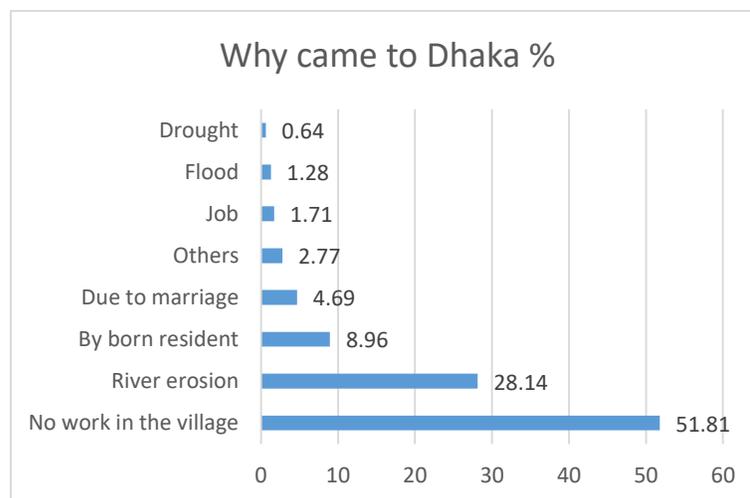
Regarding mobile phone ownership, the majority of respondents (92.54%) reported owning a personal mobile phone.

Majority of households, 61.83% of the total, arrived in Dhaka before the year 2000. Additionally, 10.45% arrived between 2001 and 2005, while 8.10% arrived between 2006 and 2010. Furthermore, 11.30% arrived between 2011 and 2015, 5.12% arrived between 2016 and 2020, and 3.20% arrived between 2021 and 2023.



Information on the origin of urban poor households, the districts from which they migrated to Dhaka reveal that the largest proportion of households, accounting for 23.24% of the total, originated from Bhola district. Following Bhola, Barishal district contributed to 10.02% of the households surveyed, while 8.53% came from Dhaka district itself. Other significant contributors include Comilla (5.54%), Kishoregonj (4.69%), and Mymensingh (4.69%) districts.

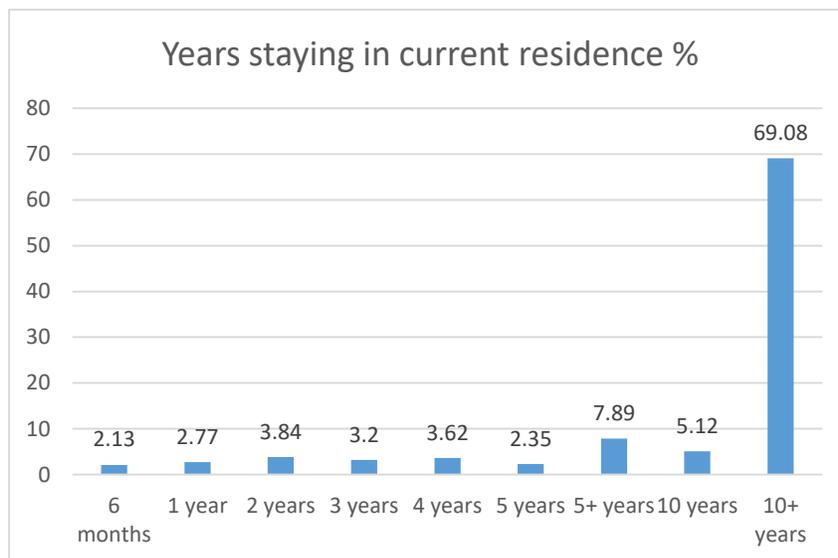
The majority, comprising 51.81% of the households surveyed, came to Dhaka due to the lack of work opportunities in their villages. River erosion emerged as another significant factor, with 28.14% of households indicating it as the reason for their migration. A smaller proportion of households (8.96%) mentioned being born in Dhaka as the reason for their residence in the city, while 4.69% cited marriage as the cause. A few households (1.71%) mentioned coming to Dhaka for job opportunities, while others (2.77%) indicated miscellaneous reasons. Additionally, a small percentage of households attributed their migration to natural disasters such as floods, droughts, and unspecified other reasons.



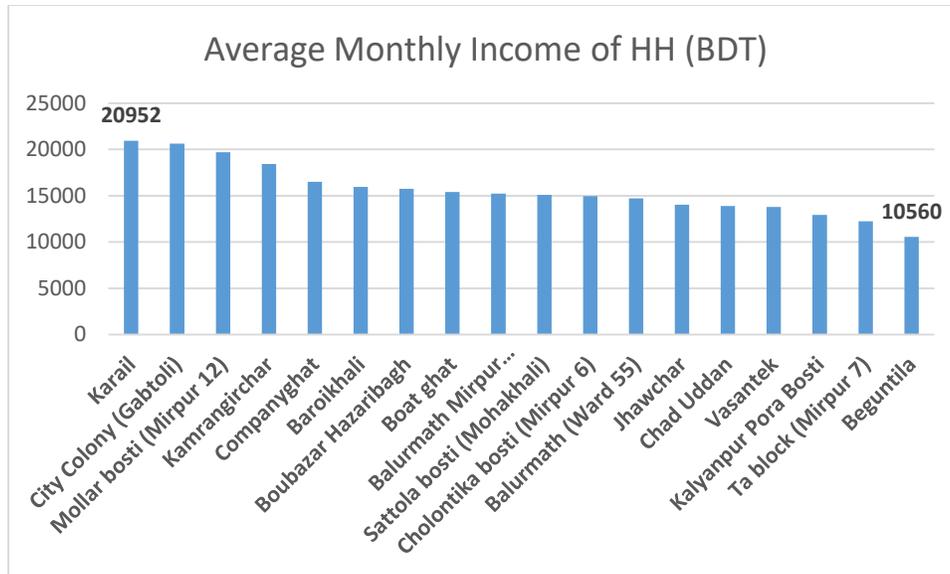
Among the households, 27.29% indicated that they owned a house in their village. Conversely, the majority, comprising 72.71% of the households, reported not owning a house in their village. This data suggests that a significant portion of urban poor households in Dhaka migrated from villages where they did not own residential properties.

Among the surveyed households, 94.46% indicated that they are registered voters, while only 5.54% reported not being registered to vote. Further analysis reveals that approximately 71%, are registered voters in Dhaka. This data suggests that a large majority of the surveyed households have voter registration status, indicating their eligibility to participate in electoral processes in Dhaka.

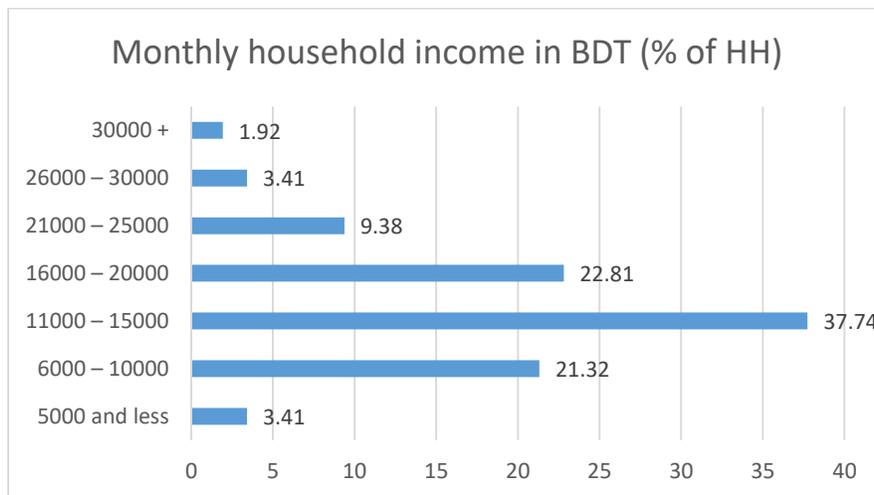
The majority of households, comprising 69.08%, have been living in their current residence for over 10 years. Additionally, 7.89% of households have been residing in their current residence for 5 years or more. Smaller proportions of households have shorter durations of residence, with 2.13% staying for 6 months, and varying percentages for durations ranging from 1 to 10 years.



The average monthly household income of Dhaka urban poor households is 15,585 BDT. Among the various slums in Dhaka, the income levels vary significantly. Karail has the highest average monthly income at 20,952 BDT, followed closely by City Colony (Gabtoli) with an average of 20,640 BDT, and Mollar bosti (Mirpur 12) with 19,720 BDT. Other relatively higher-income slums include Kamrangirchar with an average income of 18,423 BDT, and Companyghat with 16,500 BDT. On the lower end of the spectrum, Beguntilla has the lowest average monthly income at 10,560 BDT.



Among the surveyed households, a small proportion (3.41%) reported monthly incomes of 5000 BDT or less. The majority of households (37.74%) fell into the income bracket of 11000 to 15000 BDT. Additionally, sizable segments reported incomes ranging from 6000 to 10000 BDT (21.32%) and 16000 to 20000 BDT (22.81%), showcasing the distribution across different income ranges. Furthermore, there were smaller groups with higher incomes: 9.38% of households reported incomes between 21000 and 25000 BDT, while 1.92% reported monthly incomes exceeding 30000 BDT.



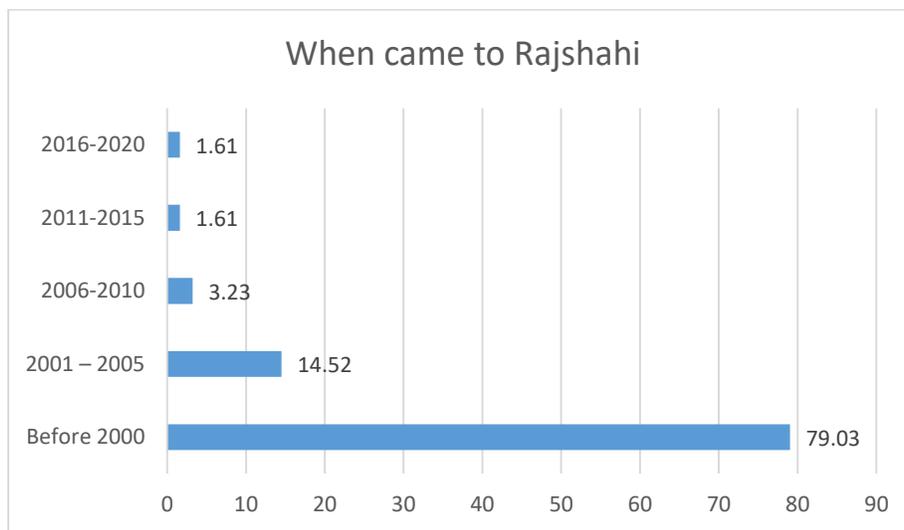
Among the surveyed households, the majority (52.45%) reported having only one earning member. Additionally, a substantial portion (41.36%) indicated that there were two earning members within the household, highlighting a significant reliance on dual-income sources. A smaller proportion of households reported having three (4.69%), four (0.85%), or five (0.64%) earning members, indicating less common but still existent scenarios where multiple individuals contribute to the household income.

#### 4.1.2. Rajshahi

The study was confined to two specific urban poor areas falling under the jurisdiction of the Rajshahi City Corporation. The first area investigated was Namavadra Para, located in Ward Number 19, near Padma Residential Area. The second area examined was Horijon Polli, situated in the Hetem Kha locality within Ward Number 11. It's important to highlight that these two urban poor areas exhibit notable differences in terms of household income, access to electricity, and patterns of cooking fuel consumption.

Urban poor population in Rajshahi is dominated by female comprising 51.52%. A significant proportion of population (21.59%) are children under the age of 14.

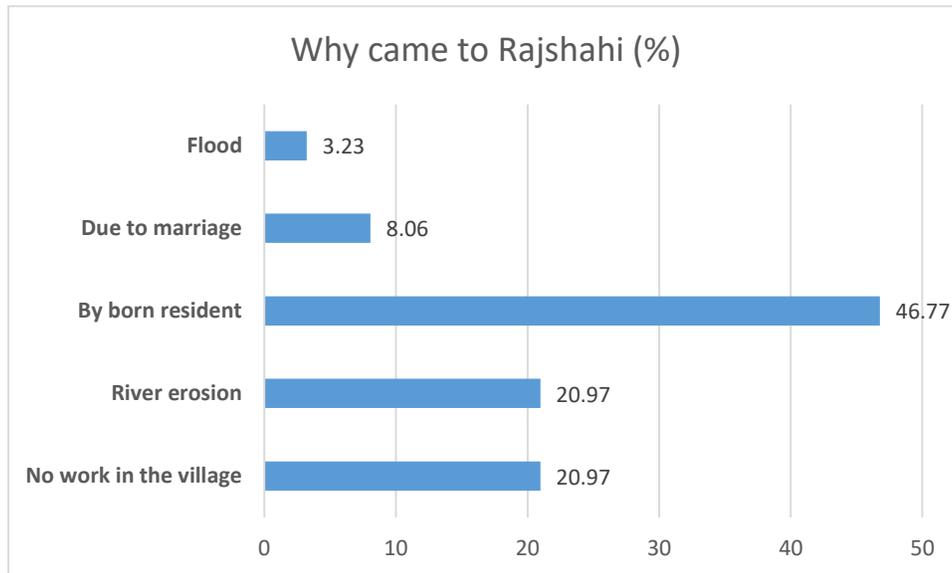
The majority of this population, comprising 79.03%, arrived Rajshahi from their villages before the year 2000, indicating a long-standing presence in the city. A smaller proportion, representing 14.52%, migrated during the period from 2001 to 2005, followed by even fewer individuals who arrived between 2006 and 2010, constituting 3.23%. The data also indicate minor migrations in subsequent years, with 1.61% of the population arriving in each of the periods from 2011 to 2015 and from 2016 to 2020, respectively.



Among the surveyed population, the majority, constituting 51.61%, originated from the Rajshahi district itself, indicating a significant local presence. Nilphamari emerges as another notable district of origin, with 24.19% of the urban poor originating from there. Naogaon and Gaibandha also contribute to the urban poor population in Rajshahi, representing 6.45% and 4.84%, respectively. Other districts such as Dinajpur, Faridpur, Kurigram, Pabna, and Rangpur contribute smaller proportions to the urban poor demographic in Rajshahi.

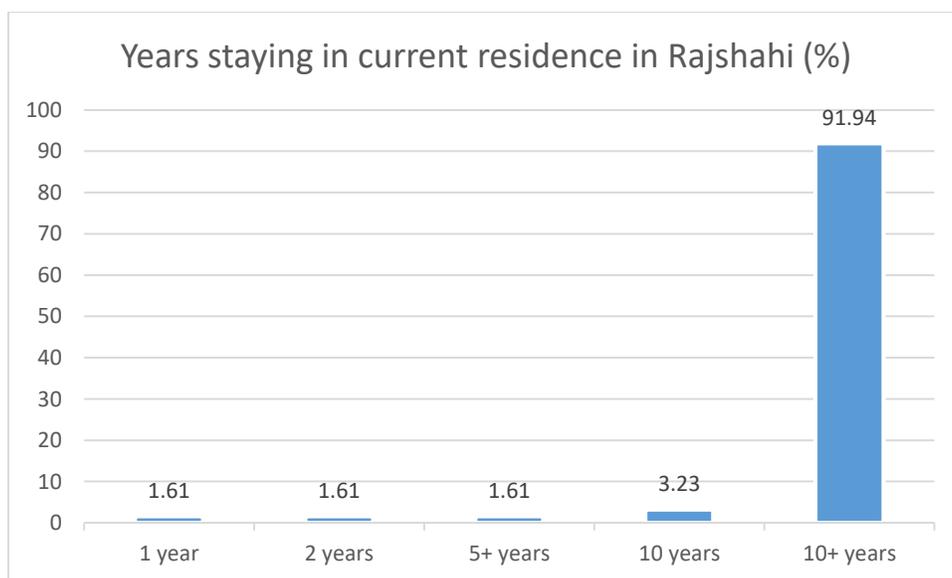
A significant proportion, accounting for 46.77% of households surveyed, reported being born residents of Rajshahi, indicating that migration may have occurred for reasons unrelated to economic or environmental factors. However, for others, economic challenges appear to be a driving force, with 20.97% citing the lack of work opportunities in their villages as a reason for migration. Similarly, an equal percentage attributed their migration to river erosion.

Additionally, 8.06% of households reported migration due to marriage. A smaller proportion, representing 3.23%, cited flood-related displacement as a reason for migration.



A significant majority, comprising 83.87% of households surveyed, reported not owning a house in their villages, indicating that a large portion of the migrating population lacked property ownership in their place of origin. Conversely, 16.13% of households indicated that they did own a house in their villages.

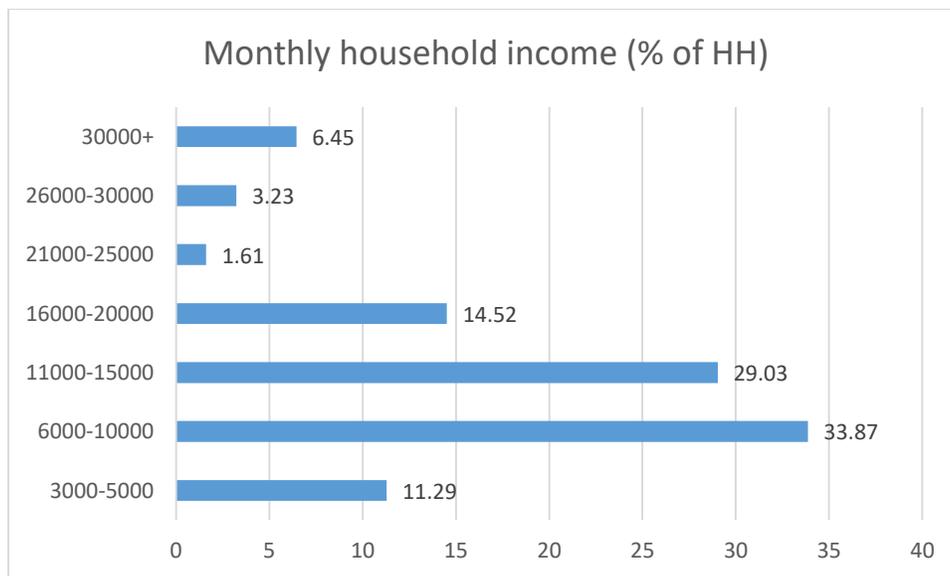
A significant majority, comprising 91.94% of households, reported staying in their current residence for over ten years, indicating a long-standing presence in the city. A smaller proportion of households, representing 3.23%, reported residing in their current residence for precisely ten years, while even fewer households reported shorter durations, with 1.61% each indicating one year, two years, and five or more years of residency.



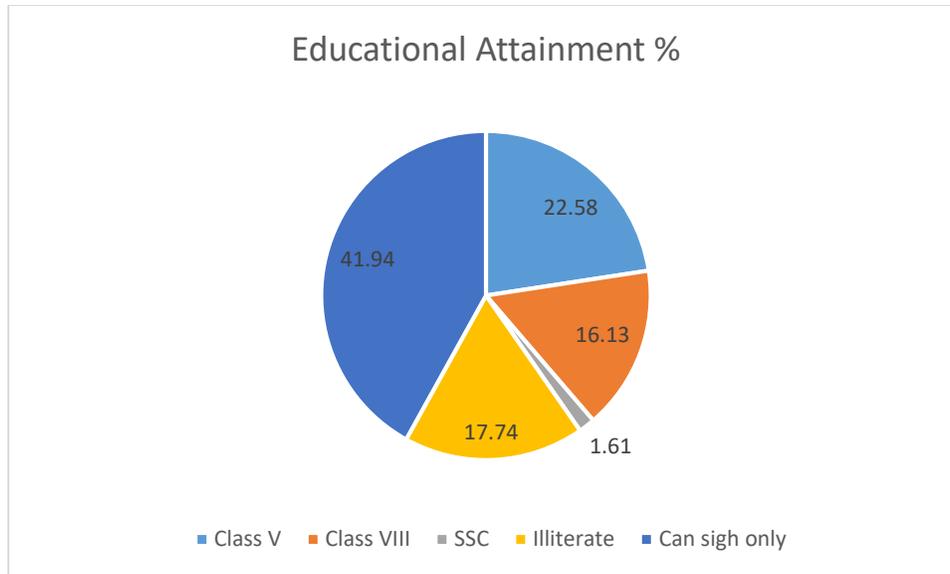
Among urban poor households surveyed in Rajshahi. 90.32% are registered voters. Majority, representing 79.03% of registered voters, are registered in Rajshahi itself. Smaller proportions of registered voters are from other areas, including Nilphamari (8.06%), Gaibandha (1.61%), and Naogaon (1.61%).

Among the urban poor household surveyed in Rajshahi, 41.94% of households, only one person contributes to the family income. Two members contribute to the family income in 46.77% households. However, there are also households where three members contribute to the family income, representing 11.29% of the total surveyed households.

Average monthly household income of urban poor households in Rajshahi is BDT 13,258. Average household income is much higher in Horijon Polli (BDT 17916) compared to Namavadra para (BDT 8890). Overall, monthly household income of the urban poor of Rajshahi 33.87% falling into the bracket of BDT 6,000 to BDT 10,000, and 29.03% falling into the bracket of BDT 11,000 to BDT 15,000. 11.29% of households have a monthly income ranging from BDT 3,000 to BDT 5,000. Additionally, 14.52% of households have a monthly income ranging from BDT 16,000 to BDT 20,000. There are smaller proportions of households with higher income brackets, such as 3.23% with incomes between BDT 26,000 and BDT 30,000, and 6.45% with incomes exceeding BDT 30,000 per month.



Among the respondents, a significant portion, comprising 41.94%, reported having only basic literacy skills, as they can only sign. 22.58% have completed education up to Class V, while 16.13% have reached Class VIII. A small percentage, representing 1.61%, have achieved the level of Secondary School Certificate (SSC). A notable proportion of individuals, constituting 17.74%, reported being illiterate.



A significant majority, comprising 85.48% of respondents, reported owning their own mobile phones. Conversely, a smaller proportion of respondents, representing 14.52%, reported not owning a mobile phone.

A diverse range of occupations among household heads revealed. The majority, constituting 41.94% of households, are employed in various institutions as low-paid service holders, indicating a reliance on formal employment for livelihoods. Day labor is also prevalent, with 16.13% of household heads engaged in this occupation. Other occupations include scrap collectors (9.68%), beggars (8.06%), cleaners (4.84%), and individuals who do not work (4.84%). Additionally, there are smaller proportions of household heads engaged in part-time housework (3.23%), shop keeping (3.23%). Auto-rickshaw driving, retired individuals, farmers, transport helpers, and masons each represent 1.61% of household heads.

### **4.1.3. Satkhira**

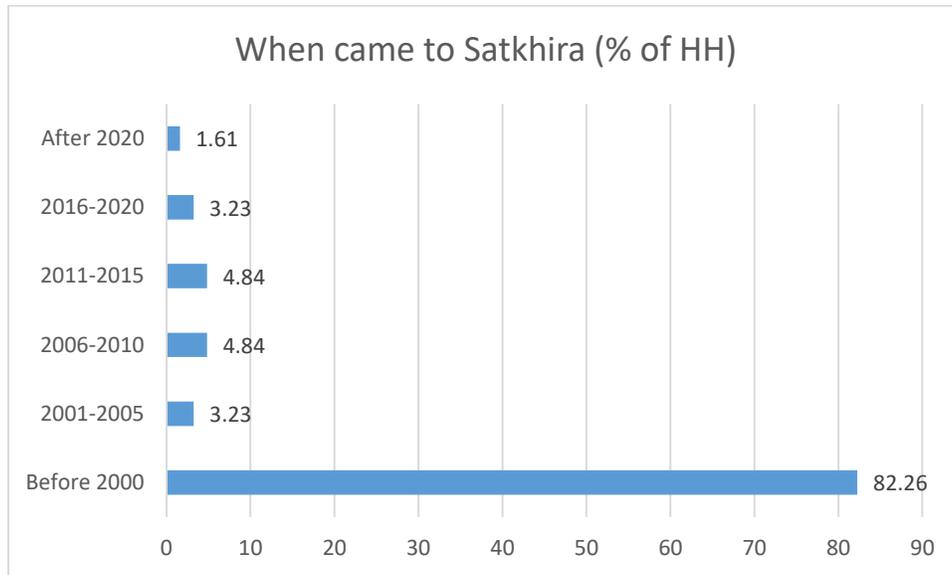
In Satkhira, the study was confined in two urban poor areas namely Boddipur Colony and Bakal Islampur (Islampur 1 & 2). Boddipur Colony was established with Muslim refugees from India during the riots in 1964. Bakal Islampur was established In the subsequent years of 1975, this area was known as Bakal River, after the establishment of the settlement, its name became 'Bakal Islampur'.

The urban poor household heads in Satkhira are engaged in a wide array of occupations, with significant percentages in certain professions. Notably, 35.48% of household heads work as day laborers, while 14.52% are employed as rickshaw van drivers. Additionally, 6.45% are involved in businesses, including auto rickshaw driving and garbage collection.

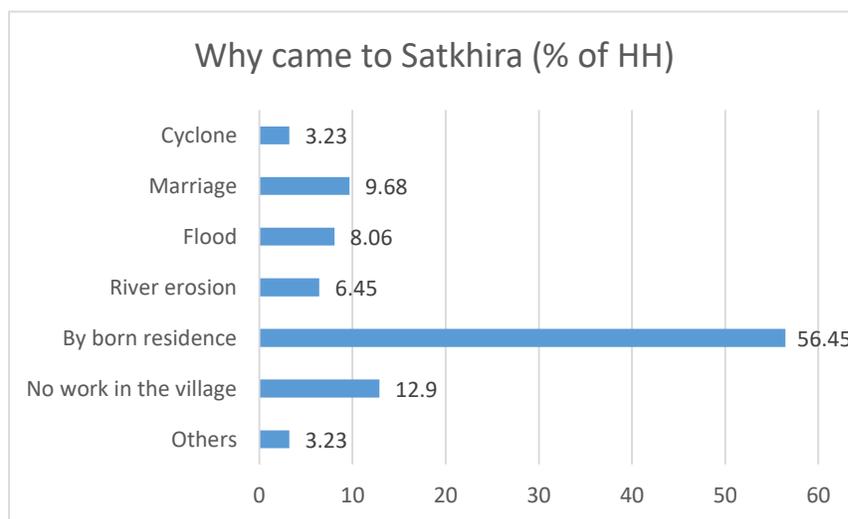
In Satkhira, the demographic composition of urban poor households reveals a slightly higher female population compared to males, with females constituting 51.68% and males 48.32% of

the total population. Moreover, a significant proportion of the population, accounting for 24.83%, comprises children under the age of 14.

The survey found that majority of respondents (82.26%) had settled in the area before the year 2000. This suggests a longstanding presence of a significant portion of the community in the locality. A smaller percentages arrived during subsequent years, with 3.23% migrating between 2001 and 2005, 4.84% each between 2006 and 2015, and a further 3.23% between 2016 and 2020. A marginal percentage of 1.61% arrived after the year 2020.

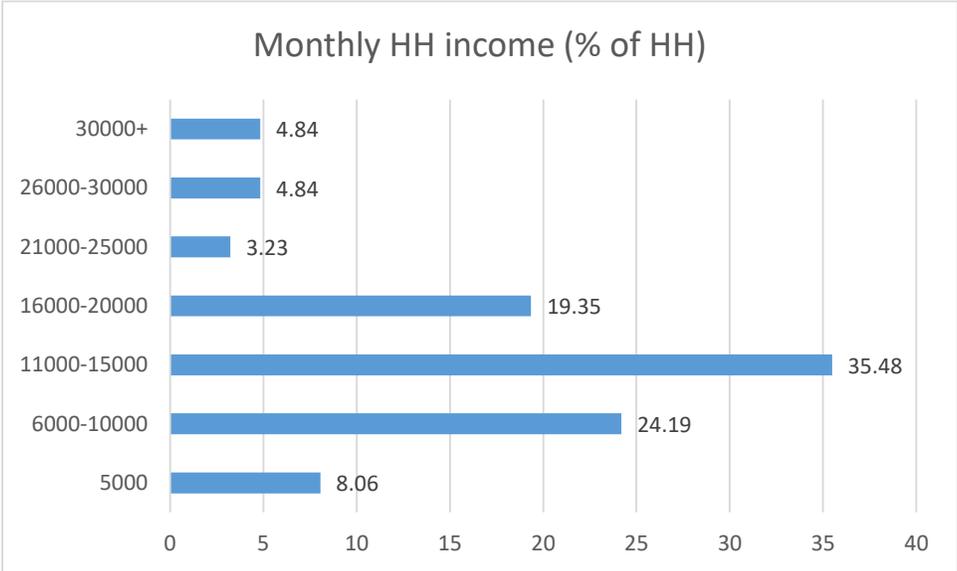


A significant proportion, constituting 56.45% of respondents, were born in this locality, indicating a sense of rootedness or family ties to the area. Additionally, 12.9% of families migrated due to the lack of employment opportunities in their villages. Environmental challenges such as river erosion and floods also prompted migration for 6.45% and 8.06% of respondents, respectively. Furthermore, marriage was a reason for migration for 9.68% of families, while other unspecified reasons accounted for 3.23%.



An overwhelming majority, comprising 90.32% of respondents, have resided in their current dwellings for over a decade, indicating a deep-rooted presence in the locality. Additionally, 4.84% of households have been residing for five or more years, while smaller percentages, each representing 1.61%, have lived in their current residences for one, four, or ten years. All respondents in Satkhira are registered voters. They are all registered voters of Satkhira.

The average monthly income of urban poor households surveyed is BDT14927. Monthly income range among surveyed urban poor households varies significantly, reflecting diverse economic circumstances. The majority of households fall within the income brackets of 6000-15000 BDT, with 24.19% earning between 6000-10000 BDT and 35.48% earning between 11000-15000 BDT. Additionally, 19.35% of households earn between 16000-20000 BDT. Relatively smaller proportions fall into higher income brackets, with 4.84% earning 26000-30000 BDT and another 4.84% earning above 30000 BDT. The majority of households, constituting 58.06%, have one earning member, while 33.87% have two. Smaller percentages of households have three or four earning members, comprising 6.45% and 1.61%, respectively.

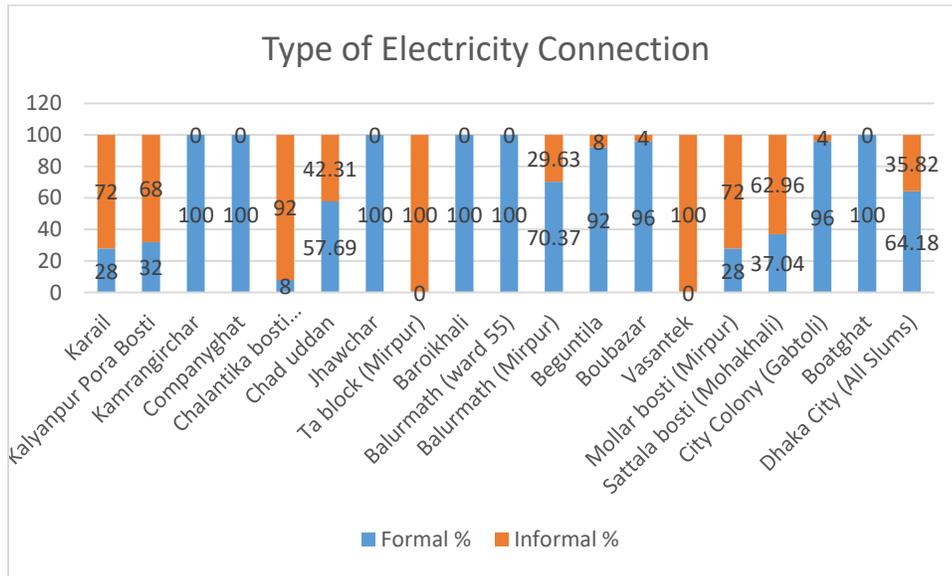


**4.2. Access to Electricity, use and expenses**

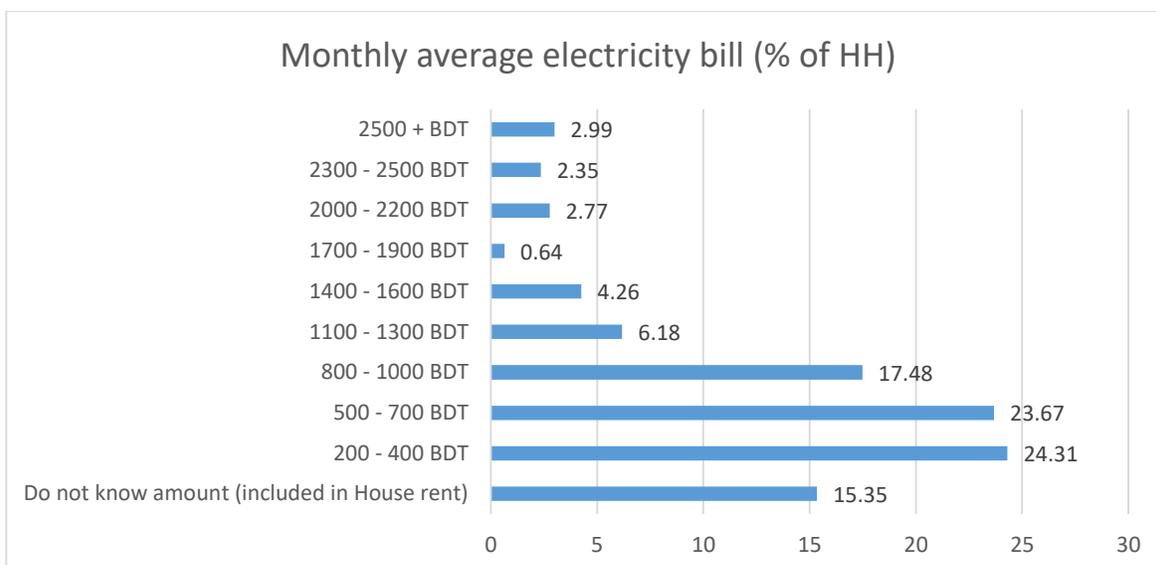
Urban poor households in Dhaka, Rajshahi, and Satkhira experience different levels of access to electricity and variations in related expenses. In Dhaka, while all households have some form of electricity connection, there is a mix of formal and informal connections. Electricity costs vary significantly, with some areas having notably higher bills. Rajshahi presents a contrasting scenario where half of the urban poor lack electricity access entirely. Satkhira, on the other hand, shows widespread access to formal electricity connections, with most households paying their bills directly to the electric company. Despite the differences, all three areas highlight a reliance on basic electrical amenities, with variations in the types and numbers of appliances used across households.

### 4.2.1. Dhaka

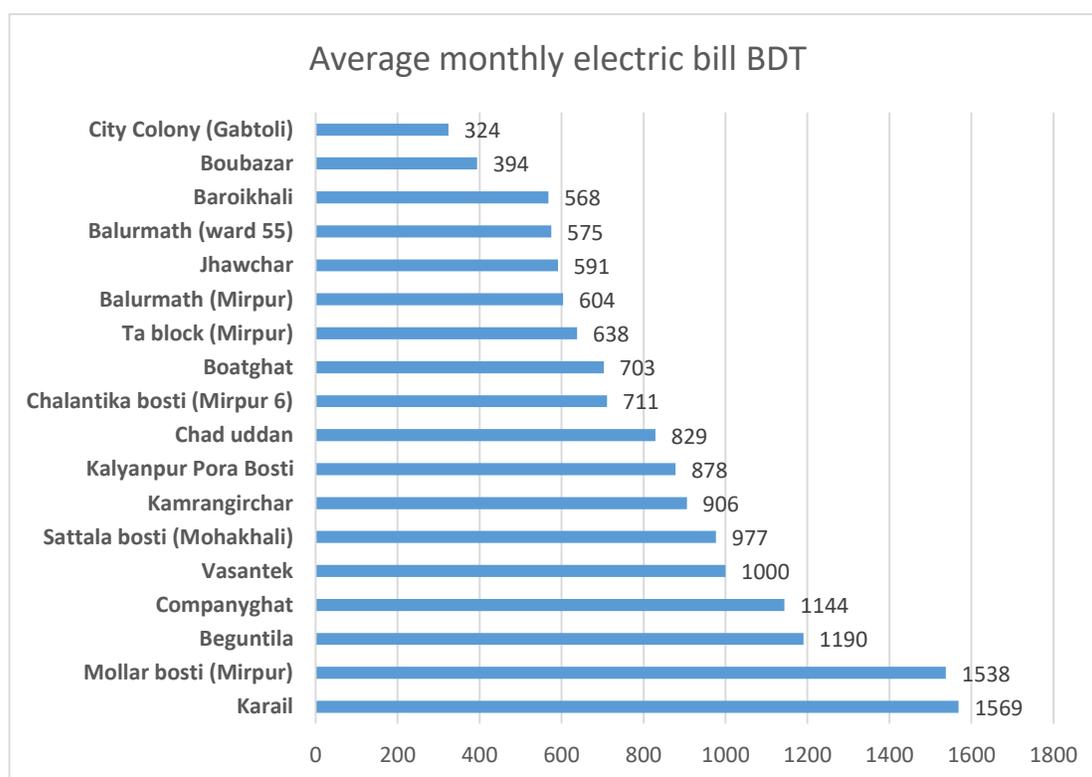
All urban poor households in Dhaka have some form of electricity connection, but the nature of these connections varies across different areas. According to the household survey, 64.18% of households have formal electricity connections, while 35.82% have informal ones. In some areas like Kamrangirchar and Companyghat, all households have formal electric connections, while in places like Ta block (Mirpur) and Vasantek, all households have informal connections. Additionally, there are areas with mixed scenarios, such as Karail and Mollar bosti (Mirpur), where a significant proportion of households have informal connections. These findings highlight the diversity of electricity access among urban poor communities in Dhaka, with variations in the formality of connections based on the specific characteristics of each locality.



Average monthly electricity cost for urban poor households across the city is BDT 875. The majority of respondents fall into the categories of 200-400 BDT (24.31%) and 500-700 BDT (23.67%). About 3% household reported a monthly bill of over 2500 BDT. A significant portion (15.35%) household do not know the amount of electricity bill as it is included with the house rent.

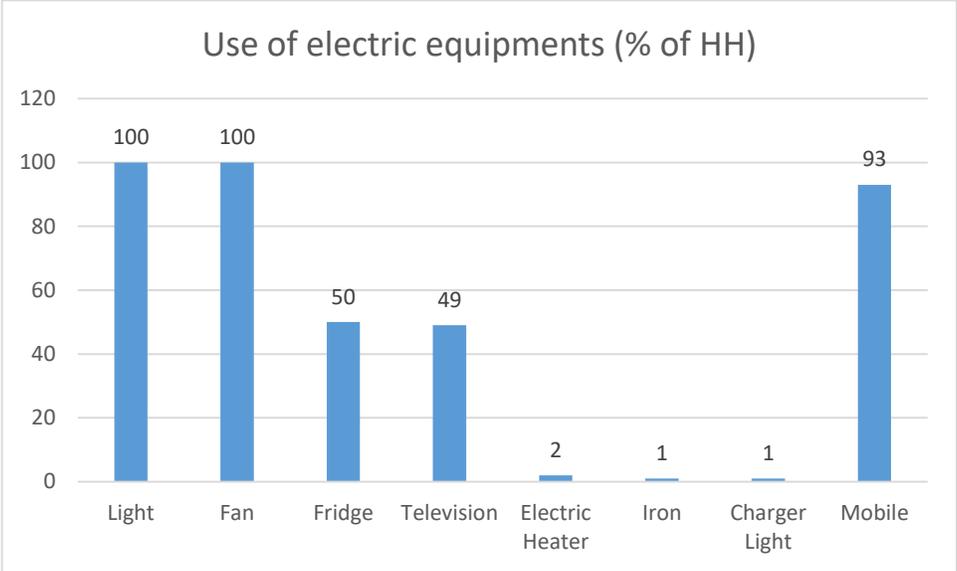


There is diversity in electricity expenses across different urban poor areas within Dhaka. For instance, slums like Karail and Mollar bosti (Mirpur) have notably higher average monthly electricity bills of BDT 1569 and BDT 1538, respectively. Conversely, areas such as City Colony (Gabtoli) and Boubazar exhibit lower average monthly bills, with figures of BDT 324 and BDT 394, respectively.

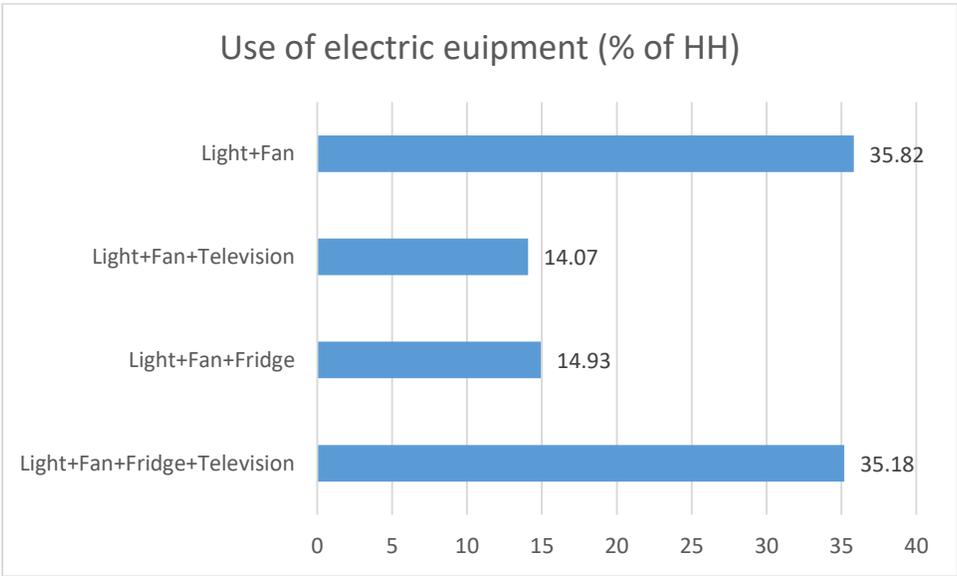


All urban poor households in Dhaka employ electric lighting and fans, indicating widespread access to basic electrical amenities. Approximately half of the households possess refrigerators and televisions, signifying a moderate level of appliance ownership. In contrast, the usage of

electric heaters and electric irons is considerably lower, with only a small fraction of households employing these appliances (1%). Majority of households utilize mobile phones, with an adoption rate of 93%, highlighting the prevalence of this communication device among urban poor communities in the city.

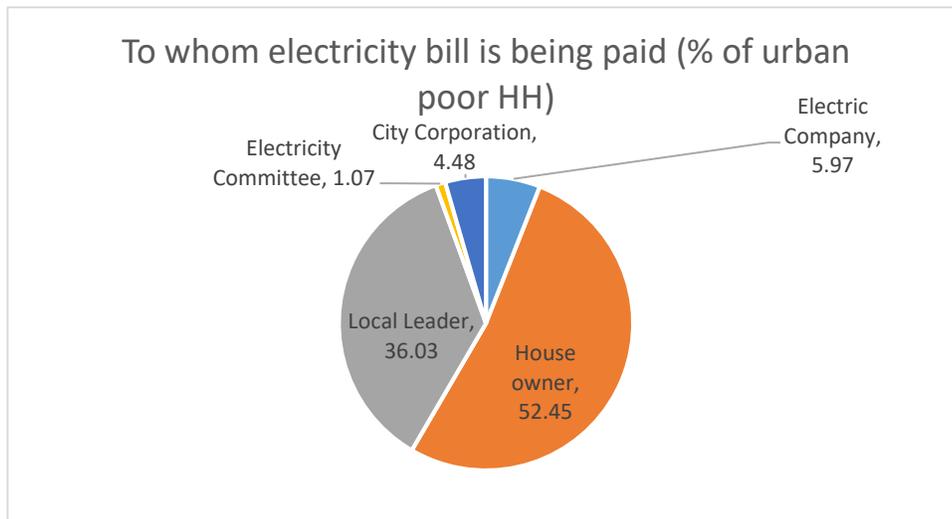


There is variability in the utilization of electric appliances among the urban poor in Dhaka. The most common combination of appliances, accounting for 35.18% of households, includes light, fan, fridge, and television. Another significant portion, comprising 35.82%, utilizes light and fan only, suggesting a preference for basic electrical amenities. Additionally, 14.93% of households use light, fan, and fridge, while 14.07% use light, fan, and television.



Majority of urban poor households in Dhaka, accounting for 52.45%, pay their electric bills to the house owner, indicating a common practice of including electricity expenses within rent payments or through direct billing by landlords. A significant portion, comprising 36.03% of

households, pays their bills to local leaders, suggesting informal arrangements or community-based systems for managing utility payments. A smaller percentage, 5.97%, directs payments to the electric company, indicating direct engagement with utility providers. Additionally, 4.48% of households pay their bills to the city corporation, suggesting municipal involvement in electricity billing processes. A negligible percentage, 1.07%, pays bills to electricity committees, highlighting localized management structures for utility payments within specific neighborhoods or communities.



#### 4.2.2. Rajshahi

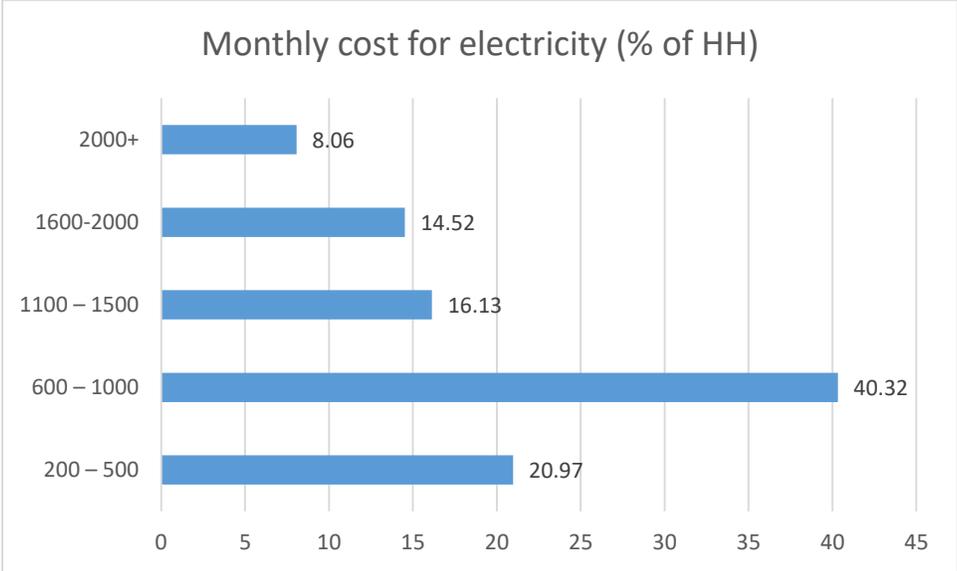
In Rajshahi city, 51% of the urban poor population lacks access to electricity. Specifically, the Namavadra area does not have any electricity connections. On average, a family in this area pays 1417 Taka per month for electricity. However, due to the absence of electricity infrastructure in Namavadra, households there incur zero electricity costs. Overall, in Rajshahi, approximately 22% of the monthly family income is allocated to cover electricity and cooking fuel expenses, with the average monthly expenditure totaling 2829 Taka.

The utilization of electric appliances among urban poor households in Rajshahi City Corporation varies significantly across different areas, as highlighted by the study. Overall, in Rajshahi, 48% of households use electric lights and fans, with 37% owning refrigerators and 47% having televisions. However, when comparing specific areas, the disparities become apparent. In Namavadra, only 10% of households use electric lights, 5% use fans, and none have refrigerators or televisions. Conversely, in Horijon Polli electric lights and fans are used by 100%, along with 77% owning refrigerators and 97% having televisions.

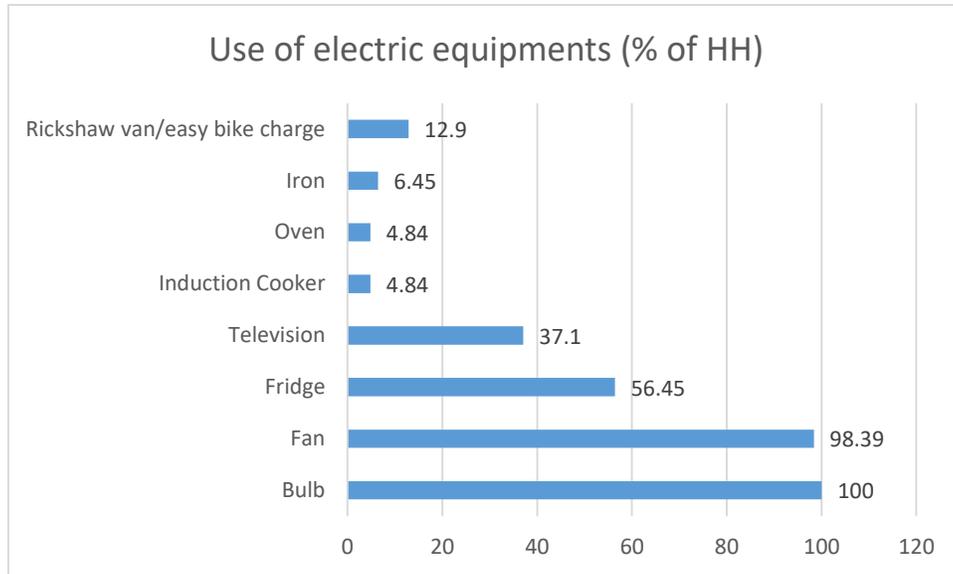
#### 4.2.3. Satkhira

All urban poor households surveyed in Satkhira have formal electricity connections, indicating widespread access to electricity infrastructure. The vast majority, comprising 94%, pay their electric bills directly to the electric company or use prepaid cards, while the remaining 6% settle

their bills through their house owners. The average monthly electric bill across all households stands at 1144 BDT, with varying expenditure ranges observed. The majority of households, 40.32%, pay between 600-1000 BDT per month, followed by 20.97% paying 200-500 BDT, and 16.13% paying 1100-1500 BDT. Additionally, smaller percentages allocate higher amounts for electricity bills, with 14.52% paying 1600-2000 BDT and 8.06% paying over 2000 BDT monthly.



100% of the households surveyed in Satkhira utilize bulbs for lighting, while a slightly lower but substantial percentage, 98.39%, employ fans for cooling purposes. 56.45% own refrigerators, while television ownership stands at 37.1%. However, the use of more specialized electric appliances such as induction cookers and ovens remains relatively limited, with only 4.84% of households employing each. Irons are utilized by 6.45% of households for clothing maintenance. Moreover, a noteworthy proportion, 12.9%, use electric charging services for rickshaw vans or easy bikes.



### **4.3. Cooking fuel use and expenses**

Urban poor households in Dhaka, Rajshahi, and Satkhira face distinct challenges in their use of cooking fuel and related expenses. In Dhaka, many households have gas connections, resulting in diverse fuel usage, including firewood, gas cylinders, and plastic. A significant portion of income is spent on cooking fuels. Rajshahi lacks gas supply, leading to higher dependence on firewood, kerosene, and gas cylinders, with significant variations in fuel costs between areas. In Satkhira, firewood is the predominant fuel, supplemented by gas cylinders, tree leaves, and other materials. Across all three areas, the reliance on traditional fuels like firewood is common. This highlights the need for better access to cleaner, more efficient energy sources.

#### **4.3.1. Dhaka**

Urban poor households in Dhaka spend BDT 2389 per month on an average for electricity and cooking, which is 15% of their average monthly income.

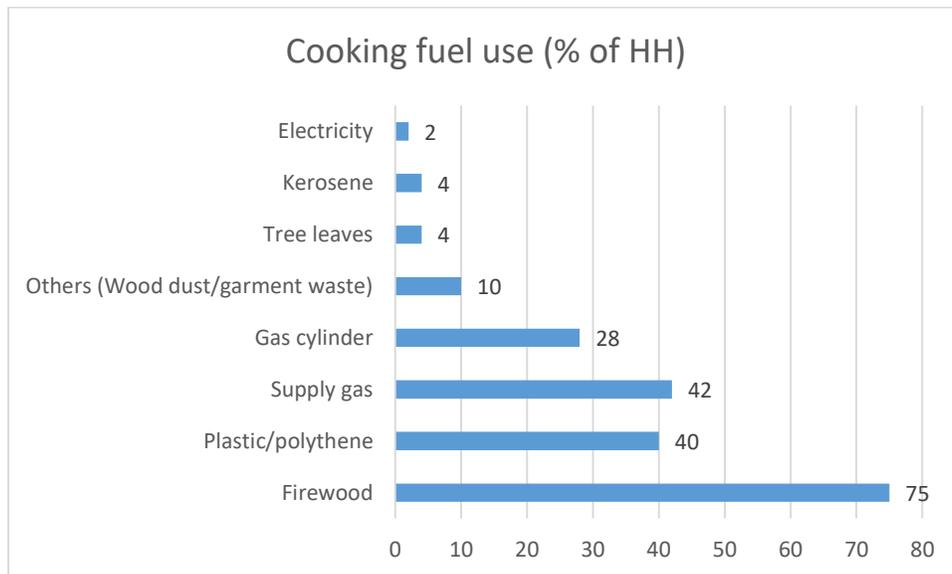
41.79% of the surveyed urban poor households have a gas connection, while 58.21% do not. This suggests that a significant portion of urban poor households in Dhaka lack access to a gas supply. Among the households with gas connections, 52.55% have formal connections, while 47.45% rely on informal connections.

The average monthly gas bill paid by slum dwellers in Dhaka is BDT 589. The range of monthly bills varies, with the lowest being 100 taka and the highest being 1600 taka. This indicates disparities in gas consumption and billing amounts among households. Among households with gas connections, 82.14% pay their gas bills in cash, while 17.86% have the gas bill included with their house rent.



Photo: Gas connection in slums are not consistent. Left: Kamrangirchar, Right: Boubazar

On an average urban poor households in Dhaka spent BDT 1514 per month as expenses for cooking which is 11% of their average household monthly income. Firewood is the predominant cooking fuel, 75% are relying on it. 40% households use plastic/polythene, 42% have access to gas supply, 28% use gas cylinder, 10% use wood dust/garment waste, kerosene and tree leaves are used by 4% households, while 2% rely on electricity.



Cooking fuel usage indicates a diverse mix among urban poor households in Dhaka. 15% of the respondent households use supply gas only for cooking. Use of only firewood was found same (15%). 7% households use only cylinder gas. About 20% of the households use mix of firewood and polythene for cooking. 10% are using mix of supply gas, firewood and polythene. Mix of

cylinder gas and firewood was found among 7% households. 6% are using mix of cylinder gas, firewood and polythene. People also found cooking using mix of supply gas, gas cylinder and firewood (2%). While a significant proportion (28%) use gas cylinders for cooking, a smaller percentage (5%) utilize both supply gas and cylinder gas. Among the surveyed households, the majority employ multiple fuel sources for cooking. Specifically, 21.75% utilize a combination of three different fuels, while 37.74% rely on a mixture of two fuel types.

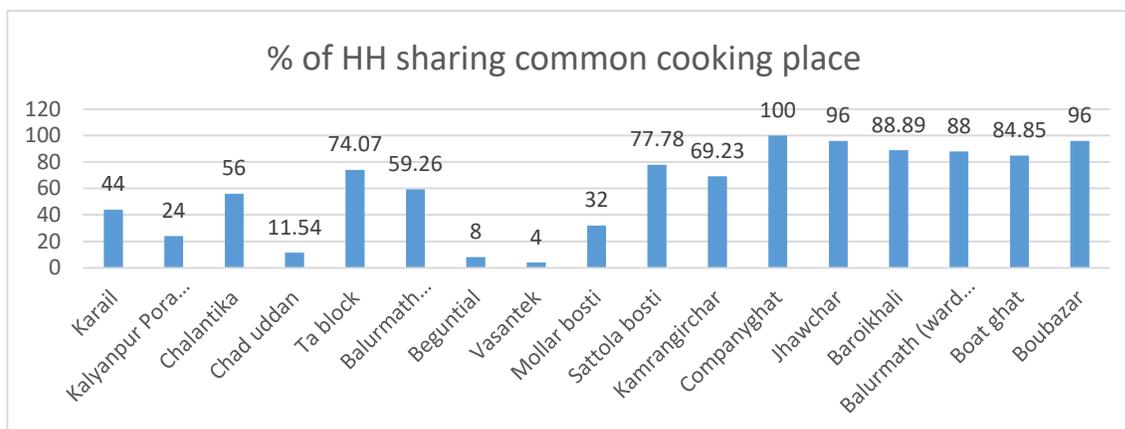
Average monthly cooking fuel costs for various types of cooking fuel in Dhaka were found Kerosene 93 BDT, gas from the gas line 593 BDT, Gas cylinders 1316 BDT, electric heaters 617 BDT, induction heater 450 BDT, firewood 1316 BDT, plastic or polythene 23 BDT, and finally solar energy is 400 BDT.

The households spend on average 1.98 hours daily for cooking. 74% of them spend 2 hours daily, while 15% spend one hour.

Majority of the urban poor in Dhaka (57.14%) use common cooking facility. 30.49%, reported having cooking facilities inside their rooms. 83.16%, reported having cooking facilities outside their rooms. 16.84% reported having cooking facilities only inside the room, 69.30% reported having cooking facilities only outside the room, 27.72% reported having cooking facilities both inside and outside.

Cooking facility only inside the room	16.84
Cooking facility only outside the room	69.30
Cooking facility both inside and outside	27.72
Households using common cooking facility	57.14

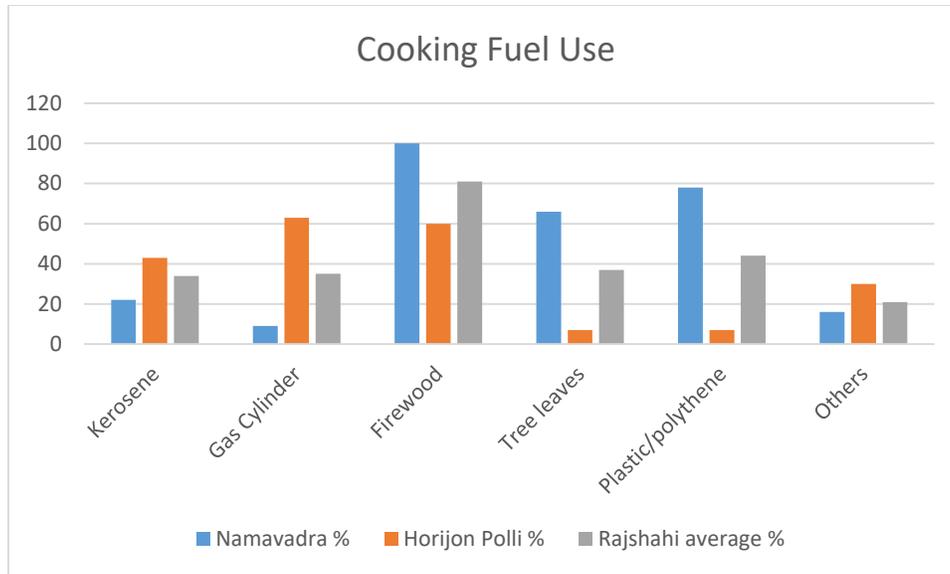
The utilization of common cooking facilities among urban poor households in Dhaka varies significantly across different slums. Companyghat show universal adoption with 100.00% of households sharing cooking spaces, others exhibit lower rates, such as Beguntial with 8.00% and Vasantek with 4.00%. Slums like Chalantika and Sattola bosti have relatively higher participation rates at 56.00% and 77.78%, respectively. Notably, certain communities like Jhawchar and Ta block demonstrate widespread acceptance, with 96.00% and 74.07% of households, respectively, engaging in shared cooking arrangements.



### 4.3.2. Rajshahi

The average monthly spending on cooking fuel totals 1462 Taka. However, significant discrepancies in cooking fuel expenses are evident between the two surveyed areas. In Namavadra, households allocate an average of 860 Taka per month to cooking fuel, while in Horijon Polli, this expenditure more than doubles, averaging 1999 Taka.

In Rajshahi, the cost of cooking fuel varies significantly among urban poor households, impacting their monthly expenses. On average, families spend 425 Taka on kerosene, 1821 Taka on gas cylinders, and 763 Taka on firewood per month. Firewood emerges as the primary choice, with 81% of families opting for this source. Additionally, a considerable proportion of households use supplementary materials such as plastic/polythene and tree leaves (44%), while gas cylinders (35%) and kerosene (32%) also play significant roles in meeting cooking needs. However, there are notable disparities in cooking fuel preferences between the two areas studied, Namavadra and Horijon Polli. In Namavadra, kerosene is the primary fuel for 22% of households, while in Horijon Polli, this figure rises to 43%. Gas cylinders are more prevalent in Horijon Polli, utilized by 63% of households compared to 9% in Namavadra. Similarly, while firewood is universally used in Namavadra, it is employed by 60% of households in Horijon Polli.



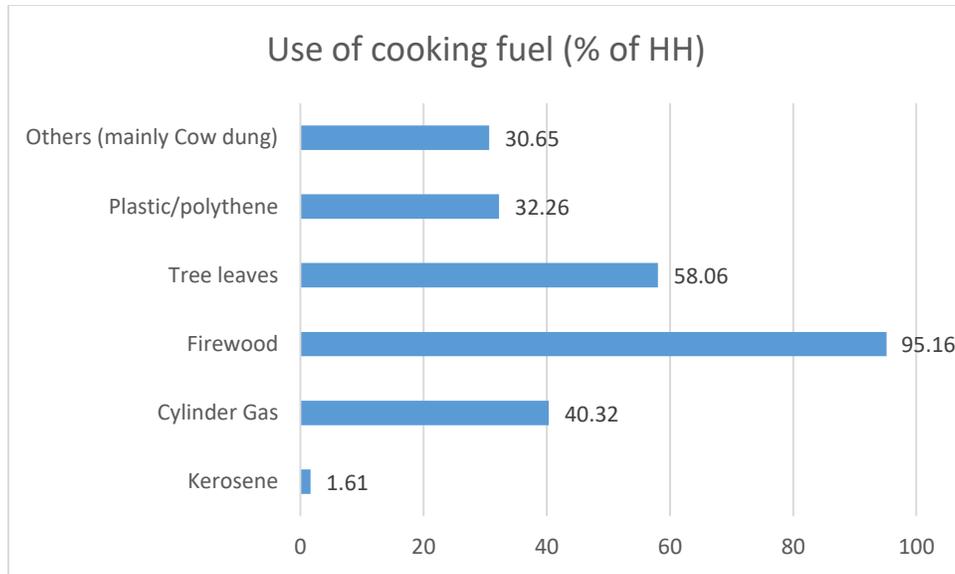
The analysis of the major fuel mix for cooking among urban poor households in Rajshahi reveals a diverse array of combinations. Firewood emerges as the primary component in various mixtures, with combinations such as firewood with tree leaves and plastic, firewood with plastic, and firewood with cylinders being prevalent, accounting for 14.52%, 14.52%, and 11.29% of households, respectively. Additionally, firewood combined with kerosene, tree leaves, and plastic is observed in approximately 6.45% of households. Gas cylinders and kerosene are also seen solely used, each accounting for approximately 8.06% and 6.45% of households, respectively.

A majority, accounting for 62.90% of urban poor households studied in Rajshahi, have cooking facilities located inside their rooms, 45.20% of households possess cooking facilities situated outside their rooms. A smaller percentage, comprising 8.1% of households, benefit from both inside and outside cooking facilities.

The urban poor households in Rajshahi allocate varying durations for cooking each day, with the majority dedicating two hours for cooking, as evidenced by 56.45% of households. A significant portion, comprising 33.87% of households, spend one hour on cooking tasks daily, while a smaller percentage, around 9.68% of households, allocate three hours for this purpose. On average, the cooking time for urban poor households in Rajshahi is approximately 1.76 hours per day.

#### 4.3.3. Satkhira

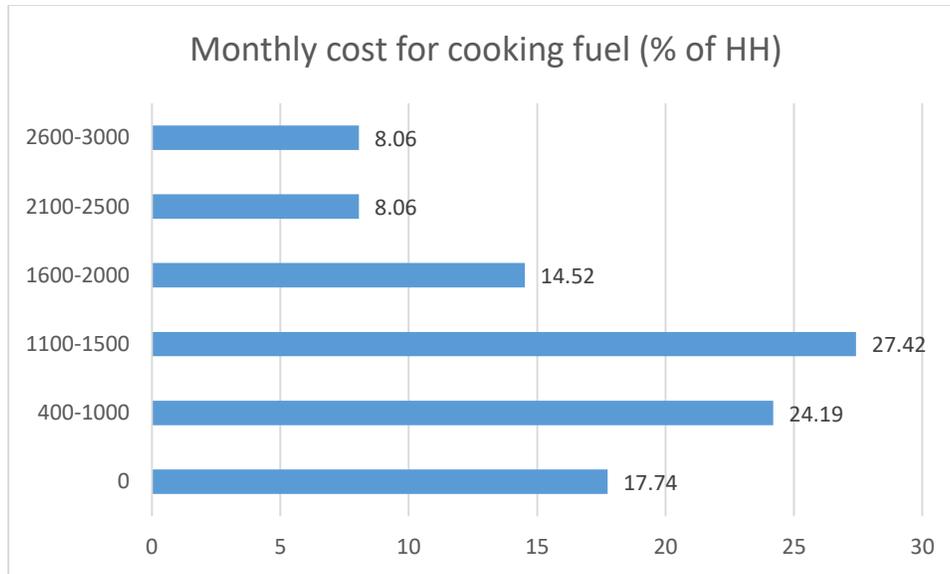
Among the urban poor households surveyed in Satkhira, firewood emerges as the most prevalent cooking fuel, with an overwhelming 95.16% of households utilizing it for culinary purposes. Additionally, a substantial portion of households, approximately 40.32%, rely on cylinder gas for cooking. Kerosene is less commonly used, accounting for only 1.61% of households. Tree leaves and plastic/polythene are also utilized by 58.06% and 32.26% of households. Use of other types of cooking fuel mainly cow dung in different forms are used by 30.65% households.



In terms of fuel mix for cooking purpose, various combinations are observed. The predominant fuel mix includes the use of firewood either alone or in combination with other materials such as tree leaves, plastic, and other organic matter. For instance, combinations like firewood + tree leaf (8.06%), firewood + tree leaf + plastic/polythene (8.06%), and firewood + tree leaf + plastic poly + others (11.29%) are notable. Additionally, the utilization of cylinder gas alongside firewood and other materials is evident in combinations like cylinder gas + firewood (9.68%) and cylinder gas + firewood + tree leaf + plastic/polythene + other (3.23%). This was observed that 24.19% of the households rely on firewood alone as cooking fuel.

Cooking arrangements among urban poor households in Satkhira revealed that 61.29% solely rely on outdoor cooking facilities. Conversely, 25.81% of households have only indoor cooking setups. 12.90% of households have access to both indoor and outdoor cooking facilities. Only 4.83% of the surveyed population, reported sharing outdoor cooking facilities with other families.

The monthly average expenditure on cooking fuel amounts to BDT 1227. Additionally, the average monthly cost for energy consumption, including both electricity and cooking fuel, stands at BDT 2372. Among respondents, the reported lowest cooking cost is zero, accounting for 17.74% households. Cooking fuel expenses represent approximately 8.22% of the monthly household income, whereas the total energy expenditure, combining both electricity and cooking fuel, constitutes 15.89% of the average household's monthly income.



The majority of urban poor households in Satkhira spend about 2 hours (61.29%) cooking each day. Additionally, 22.58% of households allocate 1 hour, while 11.29% spend 3 hours on cooking daily. A smaller percentage, 4.84%, reported spending more than 3 hours each day for cooking.

#### 4.4. Experiences of accidents associated with cooking and health issues

In Dhaka, cooking-related accidents were more frequently reported compared to Rajshahi and Satkhira, with firewood being the most common cause. In Dhaka, accidents also involved electricity and gas, unlike in Rajshahi and Satkhira, where only firewood-related incidents were noted. Severe coughing was a common health issue across all three cities, with Dhaka and Satkhira attributing this primarily to firewood use, while in Rajshahi, a significant number did not see cooking smoke as a health threat. Beliefs about the health impacts of cooking smoke varied; in Dhaka and Satkhira, a notable portion linked smoke to multiple respiratory issues like coughing and asthma. In contrast, a larger percentage of respondents in Rajshahi did not associate cooking smoke with health problems.

##### 4.4.1. Dhaka

In Dhaka, 8.32% of the total households surveyed reported accidents related to cooking during the last two years. The majority of reported accidents, comprising 53.85%, were associated with the use of firewood, for cooking purposes. 10.26% were attributed to electricity, signifying incidents related to electrical appliances or wiring. Gas (line) connections accounted for 23.08% of accidents, while accidents involving gas cylinders represented 12.82%.

21.96% of respondents or their family members experienced severe coughing within the last six months. Among those affected, the cause of the coughing was attributed to firewood used as a cooking fuel.

Urban poor households participated in the survey have varying beliefs regarding the health risks associated with smoke from cooking. A substantial portion, approximately 14.07%, attribute coughing solely to cooking smoke, while a larger segment, accounting for 24.95%, connect cooking smoke with a combination of symptoms including cough, asthma, and a burning sensation in the chest. Additionally, 11.73% associate both asthma and coughing with cooking smoke. Moreover, the majority, comprising 49.25% of respondents, attribute various other health problems to cooking smoke beyond respiratory ailments.

#### **4.4.2. Rajshahi**

Only a small fraction, roughly 3% of respondents, reported fire-related incidents within the past two years in Rajshahi. Fortunately, these incidents were minor in nature. According to their accounts, the source of these accidents was attributed to firewood.

During the last six months, family members of 8% of respondents reported experiencing severe coughing. Regarding their believe of health effects of cooking smoke 30.65% believe it may cause coughing coupled with asthma and chest irritation. Notably, 46% of respondents do not perceive cooking smoke as a health threat.

#### **4.4.3. Satkhira**

Out of the surveyed households, only 5% reported incidents related to cooking over the past two years, all of which were minor. These incidents exclusively occurred as a result of using firewood for cooking.

Around a quarter of the respondents, constituting 25.81%, reported that their family members experienced severe coughing episodes within the past six months. All of these respondents attributed the sickness to the use of firewood. A significant portion holds the belief that smoke generated from cooking is linked to various health issues. Specifically, 25.81% of respondents associate smoke exposure with a combination of coughing, asthma, and chest burning. Additionally, 9.68% attribute coughing and asthma solely to smoke inhalation, while 12.90% report coughing as a direct consequence. Asthma is also cited as a concern by 8.06% of respondents. However, a notable proportion, comprising 43.55% of respondents, does not perceive any health issues arising from cooking smoke exposure.

#### **4.5. How familiar is Renewable Energy**

Only 9% respondents recognized that they have heard the word “green/renewable energy” and have understanding on it. It is highest in Dhaka (10%), followed by Satkhira (6%) and Rajshahi (5%). The survey found zero use of solar energy by urban poor in Dhaka, while it is 5% in Rajshahi and 3% in Satkhira.

### **Solar experience in Bhashantek slum in Dhaka**

SNV Bangladesh installed a grid-tied solar PV in 2021 at Bhashantek slum-1 in Mirpur, Dhaka. Main objective of the project was to promote e-cooking as a source of clean cooking method in urban slum. SNV implemented the project “E-cooker network for Urban Slums: Benefits and Barriers to Implementation”, partnering with the University of Southampton, UK and United International University. The project intended to implement electric cooking using the grid electricity with a solar PV installation to supplement the grid power. The project started with 60 homes with e-cookers provided by SNV. Monthly electricity bill for the users was fixed 450 BDT – to provide an incentive for the local electricity suppliers to engage in the project. This covered their grid costs and time for regular cleaning. Additionally, the slum leaders agreed to take responsibility for the system post project implementation, with the local electricity supplier agreeing to take responsibility for maintenance services to beneficiaries. The project report published in December 2022 claimed that, “At the end of the project, around 75% of the targeted beneficiaries (N= 60 all Female) are using induction cookers for the majority if not all of their daily cooking. However, 25% are not using induction cookers at all due to the issues of food taste, capital cost and, in a small number of participants, moving away from the area”. Main barriers for installation of PV system in informal settlements identified by the project are: lack of policy and infrastructure for formal PV installation in informal settlement, local electric supply line upgrade and lack of storage to support load shedding (*University of Southampton, United Kingdom (2022), E-cooker network for Urban Slums: Benefits and Barriers to Implementation <https://mecs.org.uk/wp-content/uploads/2023/02/MECS-ECO-Report-ECooker-in-Urban-Slums-Dhaka-Formatted.pdf>*).

BARCIK study team visits to the user households revealed that most of the recipients of e-cookers are not currently using the facility. This was confirmed that the system does not work without electricity connection. Users complaints that e-cooker provided by the NGO was not good quality as a result this require frequent repairing. Users claimed that they can only cook rice and lentil (dal) with this cooker that is not enough for their requirement. There is complexity regarding management of the project, which might be the major obstacle to provide benefit to the users observed.

Familiarity and knowledge about green or renewable energy among urban poor households in Dhaka is poor. A small percentage, approximately 9.81%, are aware of renewable energy, while the majority, comprising 90.19%, lack knowledge in this regard. Among those familiar with renewable energy, sunlight is the most recognized source, with 52.17% identifying it as a renewable energy source, followed by sunlight combined with waste at 26.09%. Only a minority of respondents recognize other sources like waste alone (8.70%) or a combination of sunlight and wind (2.17%). When considering the sources of knowledge on green energy, the data indicates that the village environment is the most common, with 39.13% of respondents acquiring their knowledge there. Additionally, NGOs play a significant role, contributing to the knowledge of 28.26% of respondents, followed by textbooks (23.91%) and mobile/internet sources (8.70%). Among those respondents who indicated familiarity with renewable energy, a

significant majority, comprising 89.13%, expressed a keen interest in utilizing renewable energy sources. Conversely, only a small proportion, approximately 10.87%, reported a lack of interest in adopting renewable energy.

In Rajshahi, ninety-five percent of the respondents are unfamiliar with the term "renewable energy", while only 5% mentioned having heard of it and having some understanding. Interestingly, these respondents expressed interest in utilizing green energy to reduce energy costs. They cited their neighbors as the primary source of their knowledge on this subject. On an average it can be estimated that about 5% of urban poor households in Rajshahi use solar panels. There is difference in two areas studied. In the Namavadra area, 9% of families use solar panels. There are no solar panel users in Horijon polli.

There is a significant lack of awareness about renewable energy among urban poor households in Satkhira. 94% of respondents admitted to being unfamiliar with the term "renewable energy" during the data collection process. Conversely, only a mere 6% of respondents claimed to have heard of the term and possessed some understanding of it. Moreover, a minority, approximately 3% of families, acknowledged using solar panels as an alternative energy source.

#### **4.6. Willingness to use green / renewable energy**

Among the respondents know the word 'green/renewable energy' 87% of them (46) are interested to use if it is available. It is only 8% of all the respondents participated in the household level survey. Most of them are willing to use it to reduce energy cost (78%), followed by keep the environment clean (52%) and reduce health risk (30%). However they have mentioned multiple reasons. Among the respondents know about green/renewable energy, 36% opined that the urban poor have not the ability to afford it, 36% have no idea whether it would be possible to afford. 28% of them think they might be capable to afford the cost. However, there is differences of opinion regarding use of renewable energy in different areas and at community level. Willingness to use renewable (solar) is high among the urban poor without having access to grid electricity (Namavadra of Rajshahi).

## **5. The Energy Sector and Bangladesh Government policies on Renewable energy**

Currently, there is a notable absence of policy addressing the provision of affordable and reliable energy services for urban poor communities in Bangladesh. Despite the government's introduction of numerous energy policies since 1996, none have explicitly targeted the energy needs of the urban poor as a fundamental service. Furthermore, there is a lack of comprehensive policy addressing urban poverty and cleaner energy or energy efficiency improvement initiatives. While policies have been established to expand electrification, they often prioritize infrastructure development rather than focusing on end-use applications or energy efficiency. Bangladesh Delta Plan 2100 (BDP2100), Perspective Plan 2021-2041 (PP2041), and 8th Five Year Plan July 2020-June 2025 (8FYP) commonly refer to expansion of renewable energy, though the degree of actual recommendations varies.

### **5.1. National Energy Policy 2004<sup>xxvi</sup>**

The National Energy Policy, initially introduced in 1996 and revised in 2004, aims to foster sustainable development within Bangladesh's energy sector. It delineates several key objectives, including ensuring energy availability for sustained economic growth across various sectors, optimal development of indigenous energy sources, and meeting the energy needs of different regions and socioeconomic groups. The policy emphasizes sustainable operation of energy utilities, rational utilization of total energy sources, and environment friendly energy development programs, with a focus on renewable energy to minimize environmental damage. A significant aspect of the policy involves promoting renewable energy utilization, targeting a share of at least 5% of total demand by 2010 and 10% by 2020. To incentivize renewable energy projects, both public and private sponsors are granted exemptions from corporate income tax for 15 years. Additionally, accelerated depreciation incentives are provided, allowing 100% depreciation in the first year for certain renewable energy projects like solar photovoltaic and solar thermal, and over a period of five years for others such as wind, biomass, geothermal, tidal, and small hydro projects. Moreover, the policy waives all taxes and duties on renewable energy technologies to further encourage their adoption and promotion within the country.

### **5.2. Renewable Energy Policy 2008<sup>xxvii</sup>**

The Renewable Energy Policy of 2008, issued by the Government of Bangladesh, established targets for renewable energy generation capacity, aiming for 10 percent of total demand to be met by renewable sources by 2020. This policy underscores the imperative for Bangladesh to develop renewable energy technology, emphasizing solar, wind, biomass, hydro, geothermal, and tidal wave energy. It outlines objectives, institutional arrangements, resource technology, program development, investments, fiscal incentives, and regulatory policies. Developed by the Power Division of the Government of Bangladesh, the policy aims to proliferate the use of renewable energy technologies nationwide by fostering a conducive technical, financial, and legal environment. The policy lays the groundwork for the Sustainable and Renewable Energy Development Authority (SREDA).

### **5.3. 8th Five Year Plan July 2020-June 2025<sup>xxviii</sup>**

The 8<sup>th</sup> Five Year Plan, spanning from July 2020 to June 2025, outlines Bangladesh's commitment to sustainable development and enhancing the utilization of renewable energy within its power sector. Recognizing the decline in renewable energy share during the previous plan, the government emphasizes a shift towards renewable energy sources to mitigate challenges for the future. A substantial investment of \$70 billion over the next 15 years is planned to meet electricity demand, with a strong emphasis on cost-effective options and renewable energy to reduce electricity costs and carbon pollution. Despite limited progress in the 7th Plan towards increasing the share of renewable energy, the 8th Plan aims to aggressively pursue renewable energy generation, particularly solar and wind power. Policy and regulatory actions have been initiated to facilitate increased production of environment-friendly electricity, including the establishment of the Sustainable and Renewable Energy Development Authority (SREDA) and encouraging private investment in renewable energy projects. During the 8th Plan period, the government aims to generate 10% of total power from renewable sources, targeting approximately 3700 MW of renewable power generation. Various incentives such as tax exemptions and financial support will be provided to encourage investment in renewable energy

ventures and promote the use of renewable energy equipment. Additionally, the plan prioritizes enhancing women's access to renewable energy sources like solar power and bio-gas, alongside improving cook-stoves for increased energy efficiency. Overall, the 8th Five Year Plan strives to establish a financially sustainable, efficient, and least-cost power generation system with a strong emphasis on increasing renewable energy utilization, particularly solar and wind power, to ensure sustainable development and address environmental concerns.

#### **5.4. Integrated Energy and Power Master Plan 2023<sup>xxix</sup>**

The Integrated Energy and Power Master Plan (IEPMP) 2023 for Bangladesh acknowledges the challenges of transitioning to a low-carbon economy due to the country's lack of abundant renewable energy resources like solar radiation, stable wind flow, or geothermal heat, coupled with its high population density and limited land area. The plan emphasizes the importance of considering various clean energy options, including nuclear power, hydrogen, and carbon capture and storage (CCS), alongside renewable energy. Despite efforts to maximize the utilization of renewable energy sources like solar and wind, their contribution is expected to remain below 20% even by 2050 due to land constraints. Therefore, technologies such as nuclear power, hydrogen, and CCS are anticipated to play significant roles in achieving low-carbonization goals, leveraging their high energy density and industrial applicability.

#### **5.5. Mujib Climate Prosperity Plan 2022 - 2041<sup>xxx</sup>**

The Mujib Climate Prosperity Plan (MCP) outlines Bangladesh's ambitious renewable energy goals, aiming to achieve 30% renewable energy by 2030 and at least 40% by 2041, with aspirations to become a net green energy exporter. The plan emphasizes grid resilience and modernization, with flagship projects like the Mujib Bangoposagor Independence Array focusing on large-scale hybrid renewable energy infrastructure, including mangrove green belt revitalization for coastal protection. Additionally, coal plants will be converted into green energy facilities like hydrogen works. The MCP prioritizes equitable growth and aims to create more jobs through renewable energy and energy efficiency initiatives, with a focus on aligning with the Paris Agreement's 1.5°C limit. Accelerated support for modern technologies like solar photovoltaic, wind power, and concentrating solar power (CSP) is crucial, especially for industries requiring thermal power like cement and steel production. The plan also targets clean cooking solutions, aiming for 100% adoption by 2030, alongside efforts to expand access to improved cook-stoves.

#### **5.6. Draft National Solar Energy Roadmap, 2021 - 2041<sup>xxxi</sup>**

The Draft National Solar Energy Roadmap, 2021 - 2041, is a comprehensive document developed within the framework of the 'Development of Sustainable Renewable Energy Power Generation (SREPGen)' project. It aims to establish a long-term vision and feasible capacity targets for Bangladesh's solar energy sector, alongside strategies to achieve them. After evaluating various implementation scenarios, the Roadmap endorses a specific selection and outlines both general and time-bound measures necessary to reach the target by 2041. SREDA has spearheaded this initiative to align with SDG, NDC, and other national targets, ensuring synergy with existing policies and plans like REP, PSMP, FYPs, and BCCSAP.

### **5.7. Bangladesh Delta Plan 2100<sup>xxxii</sup>**

It is the maiden initiative by the Government of Bangladesh (GoB) to adopt such a long-term strategy for flood and soil erosion prevention, managing rivers and wastes, and ensuring nationwide water supply. The document is relevant and worthwhile in respect of the renewable energy landscape from multiple viewpoints. In this plan, a renewed target of generating 30 per cent of the total energy from renewable sources by 2041 has been set. This policy document also indicates significant land reclamation potential along the major riverbanks and in the estuary region that can be utilized for setting up stand-alone solar panels. It speculates that the large piece of land available from accelerated natural reclamation process through building cross dams and other infrastructures can be utilized for any suitable purposes like urbanization and industrialization.

### **5.8. Nationally Determined Contributions (NDCs) 2021 Bangladesh (updated)<sup>xxxiii</sup>**

Bangladesh's Nationally Determined Contributions (NDCs) for 2021 outline its targets for reducing greenhouse gas (GHG) emissions. These include an unconditional reduction of 12 million tons (5% reduction) from the Business as Usual (BAU) scenario by 2030, and a further conditional reduction of 24 million tons (10% reduction) with support from the international community. These targets are based on the 2011 baseline year. To achieve the unconditional contribution, Bangladesh plans to implement renewable energy projects with a total capacity of 911.8 MW by 2030. Additionally, to deliver the conditional contribution, the country aims to implement renewable energy projects with a total capacity of 4114.3 MW. These mitigation actions are crucial for Bangladesh to meet its emissions reduction targets and transition towards a more sustainable and low-carbon energy system.

### **5.9. Making Vision 2041 a Reality PERSPECTIVE PLAN OF BANGLADESH 2021-2041<sup>xxxiv</sup>**

The Perspective Plan of Bangladesh 2021-2041 (PP2041) aims to create an urban social structure devoid of absolute poverty and slums, ensuring every household possesses basic minimum housing quality. In its energy strategy, PP2041 targets the elimination of the existing demand gap and meeting new demands, aligning with the 2016 Power Sector Master Plan (PSMP) and updating it every five years. With a planned generation of 62,000 MW capacity buildup over 20 years, focusing on an average annual expansion of 3,100 MW, renewable energy development takes center stage in PP2041. The plan intends to revise and strengthen the 2009 renewable energy policy and Sustainable and Renewable Energy Development Authority (SREDA), emphasizing proper pricing of fossil fuels and incentivizing private investment in renewables. Additionally, PP2041 encourages renewable energy supply by private producers to both the grid and households, exploring various options like offshore wind, tidal energy, and waste-to-energy for increased renewable energy share.

### **5.10. National Adaptation Plan of Bangladesh (2023-2050)<sup>xxxv</sup>**

With an underlying objective of reducing risks and vulnerabilities to climate change impacts, the National Adaptation Plan (NAP) of Bangladesh envisions building a climate-resilient nation through effective adaptation strategies that foster a robust society and ecosystems and stimulate sustainable economic growth. It has set six national adaptation goals to achieve its vision. One of

the goal of NAP is to develop climate-smart cities for improved urban environment and well-being. Through this goal, the NAP aims to develop climate-smart cities reinforced with robust urban drainage networks and water management infrastructure; expand green infrastructure, effective solid waste and renewable energy mechanisms; improve human health and WASH, and so on. It has mentioned development of climate smart solar energy based utilities in the urban areas as adaptation priority for combating adversities of climate change. The policy document mentioned that implementation of NAP will help develop climate-smart, livable, pollution-free, clean and healthy cities through city climate action plans (City-CAP) up to municipality level and considering peri-urban areas, poor urban communities and the potential influx of climate migrants. Youth-led and community-based urban waste and nature management will be prioritized. Development and expansion of climate, gender and disability- responsive WASH, health and disease prevention facilities will give preference to urban slums and marginal communities, leading to smart and resilient city development.

## **6. Barriers to adoption of renewable energy for urban poor**

Barriers to adopting renewable energy vary depending on the location. This study identified differences in willingness and challenges reported by respondents surveyed in Dhaka, Rajshahi, and Satkhira, as well as variations in community-level views within the slums. Urban poor households in Dhaka face the constant risk of eviction, which respondents identified as a significant barrier to adopting renewable energy. In Satkhira, respondents who had experience with solar energy expressed a lack of confidence in its reliability. Conversely, in Rajshahi, where many households lack access to electricity, there is a growing interest in solar energy adoption. However, across all three locations, urban poor communities expressed a willingness to adopt solar energy if financially supported by the government or NGOs, and some were willing to contribute partially to the cost.

Responses gathered from urban poor households in Dhaka on obstacles to access renewable energy solutions, 60.87% of respondents highlighted the lack of information and knowledge regarding green and renewable energy options. 39.13% expressed financial constraints, indicating an inability to afford renewable energy technologies. Coupled with this, 21.74% cited the lack of availability of such technologies as a barrier. Moreover, infrastructure deficits were also noted by 30.43% of respondents. A small percentage (6.52%) indicated that there are restrictions preventing their access to renewable energy solutions.

The responses collected regarding the urban poor's perception of their ability to afford green energy solutions in Dhaka reveal a mixed outlook. 41.30% expressed a negative stance, indicating skepticism or doubt regarding their capacity to afford green energy options. 34.78% admitted to having no clear idea about their financial capability in this regard, a smaller proportion, accounting for 23.91% of respondents, expressed belief in their ability to afford green energy solutions.

Urban poor communities in Dhaka face numerous challenges, with tenure security emerging as a significant barrier. Tenure security refers to the legal or customary rights of individuals or

households to occupy and use land or property. In urban poor settlements in Dhaka, residents lack formal tenure rights, which deter them from investing in renewable energy technologies. Without secure land tenure, residents may be reluctant to make long-term investments in renewable energy infrastructure, such as solar panels or biogas digesters. The uncertainty surrounding land tenure status increases the risk of displacement or eviction, making households hesitant to install renewable energy systems that require significant upfront costs. Moreover, insecure land tenure can impede access to financing for renewable energy projects, as lenders may be unwilling to extend credit to households without clear property rights.

Access to energy for urban poor communities is closely linked to their housing rights. To effectively address energy needs, we must first secure their right to housing. For example, if we want to introduce renewable energy in slum areas, it depends on who controls the settlement. If those in control prioritize profit over serving residents, they may resist such initiatives. Therefore, it's crucial to address power dynamics within these communities. By ensuring legal connections and stable services, even existing fuel sources can become more affordable and reliable for slum dwellers.

The data from Dhaka, Rajshahi, and Satkhira collectively indicates a concerning lack of awareness and understanding among the urban poor regarding renewable energy. 91% of the urban poor found unfamiliar with the word 'Renewable Energy' during the survey. Only 9% demonstrated some level of comprehension regarding renewable energy concepts. Interestingly, among these respondents those who have some level of understanding, sunlight emerged as the most recognized source of renewable energy, cited by 56.60%, followed by a combination of sunlight and waste (22.64%). However, a significant portion (13.21%) admitted to having no knowledge about the source of renewable energy, indicating a gap in basic understanding.

Energy-intensive lifestyle prevalent among the urban poor poses a significant barrier to the adoption of renewable energy solutions. A substantial portion of urban poor households, estimated at least 50%, own energy-consuming appliances such as refrigerators and televisions, while all households have fans and lighting systems. This widespread reliance on electricity-intensive devices raises concerns about the compatibility of renewable energy sources, particularly solar power, with meeting the energy demands of these households. During focus group discussions, many respondents expressed skepticism about the capacity of renewable energy solutions to power appliances like fridges, televisions, and fans.

One of the primary barriers hindering the adoption of renewable energy by the urban poor in Bangladesh is the financial constraint associated with installation costs. The initial investment required for setting up renewable energy systems, especially solar panels, demands a significant financial commitment that may not be feasible for low-income urban households. The substantial upfront costs act as a deterrent for many urban poor families, preventing them from accessing clean and sustainable energy alternatives. As a result, the financial barrier becomes a significant impediment to the widespread adoption of renewable energy solutions among the urban poor population in Bangladesh.

Finally, lack of policy and infrastructure for solar system installation in informal settlement can be identified as the major barrier<sup>xxxvi</sup>. The role of the state in developing an appropriate institutional and policy framework is crucial for achieving Sustainable Development Goal 7. Bangladesh have several policies and plans in place aimed at securing a reliable energy supply for the nation. The country has several policies including National Energy Policy 1996, Renewable Energy Policy 2008, Integrated Energy and Power Master Plan 2023. However, there is a lack of attention to urban poor communities to have legal access to affordable energy. Moreover, the current energy policy prioritizes coal, nuclear power, and import reliance due to the influence of lobbyists seeking profit leads to financial burdens, environmental disasters, and increased dependency.

## **7. Learning from other countries on urban poor peoples' access to renewable energy**

The idea of expanding renewable energy in urban areas, especially for the urban poor, is relatively new. While there are success stories in rural regions where renewable energy has been effectively utilized by communities, such as the widespread adoption of Solar Home Systems in Bangladesh, similar achievements are scarce in urban settings. Challenges faced by the urban poor in accessing affordable, reliable, and safe electricity remain largely unaddressed worldwide, with limited understanding of how cities can ensure clean and affordable energy for informal urban communities amidst ongoing urbanization. Furthermore, there's little precedent for the active involvement of urban poor residents in such initiatives.

In recent years, countries like China, Vietnam, Thailand, India, the Philippines, and Germany have made significant strides in solar energy production, largely due to government incentives. Key factors contributing to their success include offering subsidies for solar panels and batteries, as well as promoting 'net metering' installations at subsidized rates. India, for example, has introduced the 'Prime Minister's Solar Scheme' to encourage citizen participation in solar energy. It is a scheme that aims to provide free electricity to households who opt to install rooftop solar electricity units. The households will be able to get 300 units of electricity free every month. Under this scheme, Indian households can receive a subsidy of 18,000 rupees for installing a three-kilowatt solar panel system, with the remaining cost borne by the installer. India aims to involve ten million families in this initiative<sup>xxxvii</sup>.

In India, where many households in both urban and rural areas lack access to electricity and natural light, innovative solutions are being implemented to address these challenges (solar lighting project). One such solution is the Micro Solar Dome (MSD), specifically designed to alleviate these issues in rural households and urban slums. Since its installation in 2016, PV Integrated Micro Solar Domes (MSD) – Surya Jyoti have been successfully deployed in approximately 1000 units across slums in cities such as Delhi, Kolkata, Agartala, Guwahati, Bhopal, and Bengaluru<sup>xxxviii</sup>.

Models like Pay-As-You-Go (PAYG) solar businesses offer household-scale solar energy solutions with payment plans tailored to the budgets of bottom-of-the-pyramid customers. This approach enables poor households to afford solar products gradually, making solar energy

accessible to those without reliable grid connections and providing a cleaner, safer alternative to kerosene for lighting. Integration with mobile money (MM) infrastructure plays a crucial role in scaling up off-grid solar energy solutions, as it facilitates convenient payment methods. The success of the PAYG model in providing affordable solar power to over 8 million people in sub-Saharan Africa between 2013 and 2018 highlights its effectiveness. Moreover, PAYG models have also been implemented in off-grid locations in South Asia and Latin America<sup>xxxix</sup>.

## **8. Recommendations and Conclusion**

### **8.1. Recommendations**

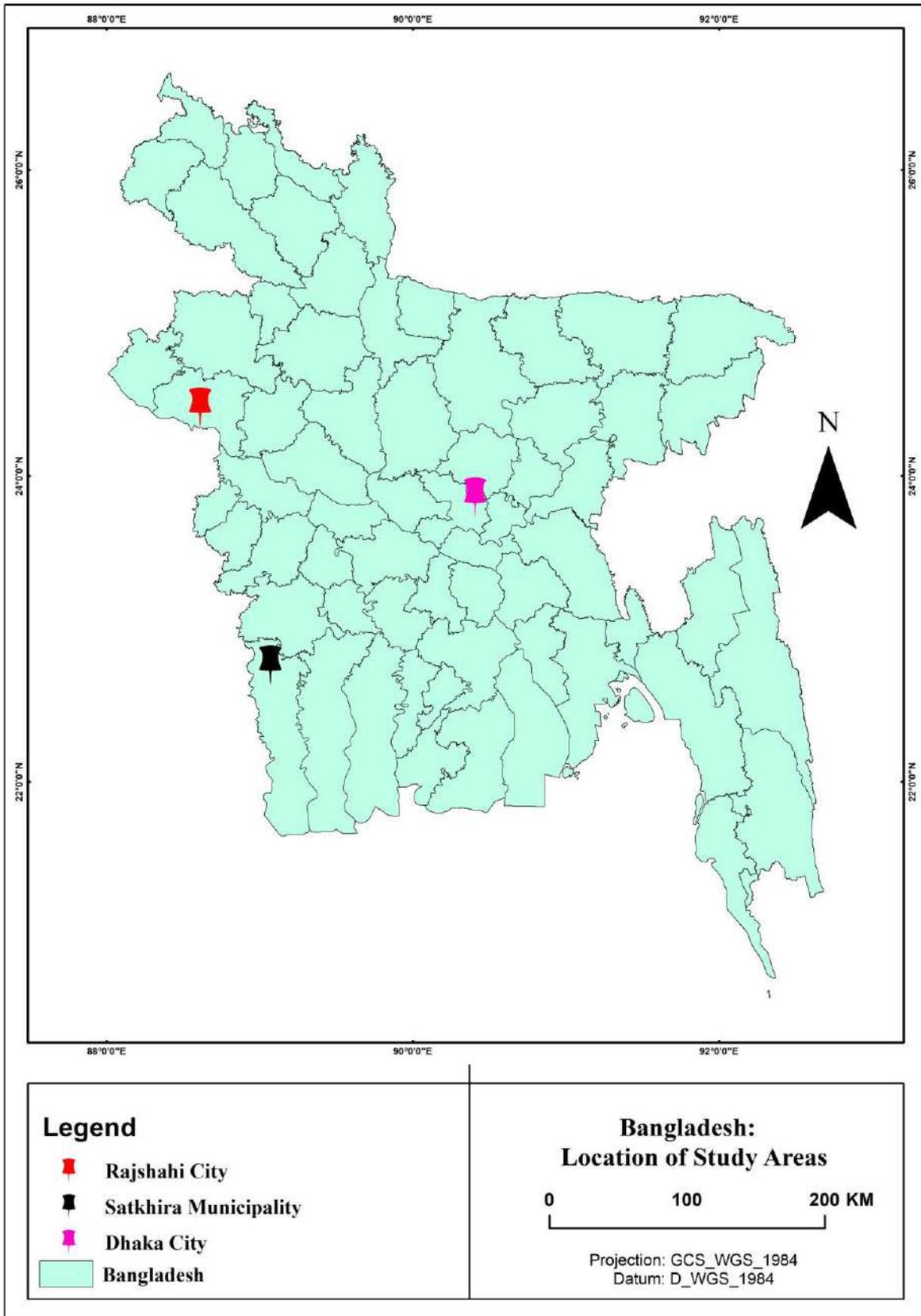
- Transition to broader use of renewable energy among urban poor has no doubt involves a coordinated multi-stakeholder approach and would require recognition of urban poor peoples' rights as a city dweller as well as citizen to enjoy basic services like electricity. There is a need to develop sustained program to provide the necessary technical and financial support to urban poor communities to transition to renewable energy sources such as solar and waste-to-energy. However, there is tenure insecurity exists, which is a major barrier for adopting renewable energy by the urban poor. Therefore, distribution in urban poor areas can be facilitated through solar power generation and net metering in buildings and establishments in the city or community-based micro grids.
- Bangladesh can learn from the experiences of China, India, and Vietnam in leveraging solar power to reduce reliance on fossil fuels. While Bangladesh has ambitious solar energy goals, progress has been slow. The Mujib Climate Prosperity Plan calls for 30 per cent renewable energy use by 2030, and at least 40 per cent by 2041. The government has set a target of 100 per cent clean cook stoves by 2030. This target cannot be achieved by excluding the urban poor. Encouraging the use of renewable energy, taking initiatives, and making policies inclusive in this regard will improve the quality of life of the urban poor, reduce energy costs and improve the environment.
- There exists high level of polluting cooking practice among urban poor causing environmental and health hazards. Government policies should address this through provision of subsidy on clean cooking for the urban poor.
- Local government like city corporations, municipalities have a major role in the promotion of renewable energy. Local governments and other organizations should take initiatives to increase the use of renewable energy/fuel to implement the Mujib Climate Prosperity Plan pledges, address climate change risks and control pollution.
- Renewable energy must need to be sustainable, affordable and accessible for all including the urban poor communities. Developing financial arrangements would be required for the promotion of renewable energy through involving NGOs, foreign assistance and the private sector through public private partnership and locally. In urban poor areas, there should be proper assessment of local need. Various packages tailored to the capacity and demands of urban poor communities can be promoted and sold at subsidized prices, both by the government and non-governmental entities. To accelerate the transition, efforts should focus on making solar panels more affordable and simplifying the process of installing solar energy meters.

- The study revealed there is a lack of adequate information and awareness among people about renewable energy. Therefore, awareness needs to be increased. Both governmental and non-governmental organizations should take various initiatives for promotion and dissemination of knowledge. Latest technological improvement, price and other necessary information related to solar and other renewable energy can be made available.

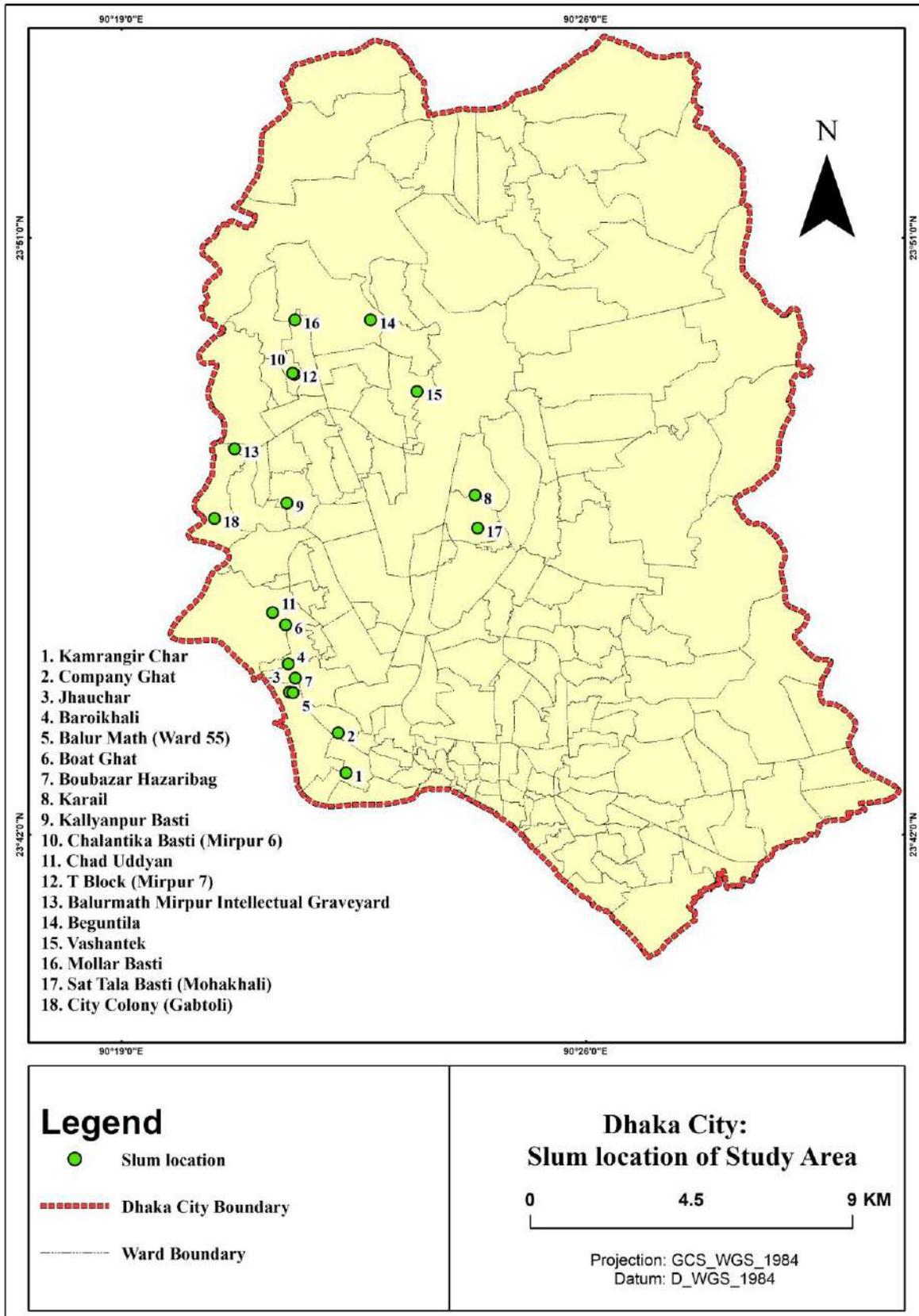
## **8.2. Conclusion**

Renewable energy, unlike fossil fuels, doesn't release harmful CO<sup>2</sup> emissions into the environment. This means it's cleaner and doesn't contribute to climate change like traditional fuels do. Plus, once renewable energy systems are set up, they have low costs for materials and operation. This leads to stable prices for energy and less reliance on imported fuels. Recognizing the urgency to address climate change, the Intergovernmental Panel on Climate Change (IPCC) underscores the potential of renewable energy solutions in informal settlements to help limit global warming to 1.5°C<sup>x1</sup>. Access to reliable and affordable clean energy not only reduces reliance on polluting bio and fossil fuels but also mitigates black carbon emissions. Recent studies from reputable sources show that investing in renewable energy technologies and infrastructure can boost the renewable energy sector, create jobs, and stimulate economic growth in Bangladesh. However, there are challenges with renewable energy, such as the high initial costs, and the fact that solar and wind energy can be inconsistent. There's also a pressing need to develop better ways to store and manage energy efficiently. Despite these challenges, it's important for Bangladesh's energy transition to include everyone, especially the urban poor. The insights from this study can guide policymakers and organizations in Bangladesh to work towards an energy-efficient and self-reliant future.

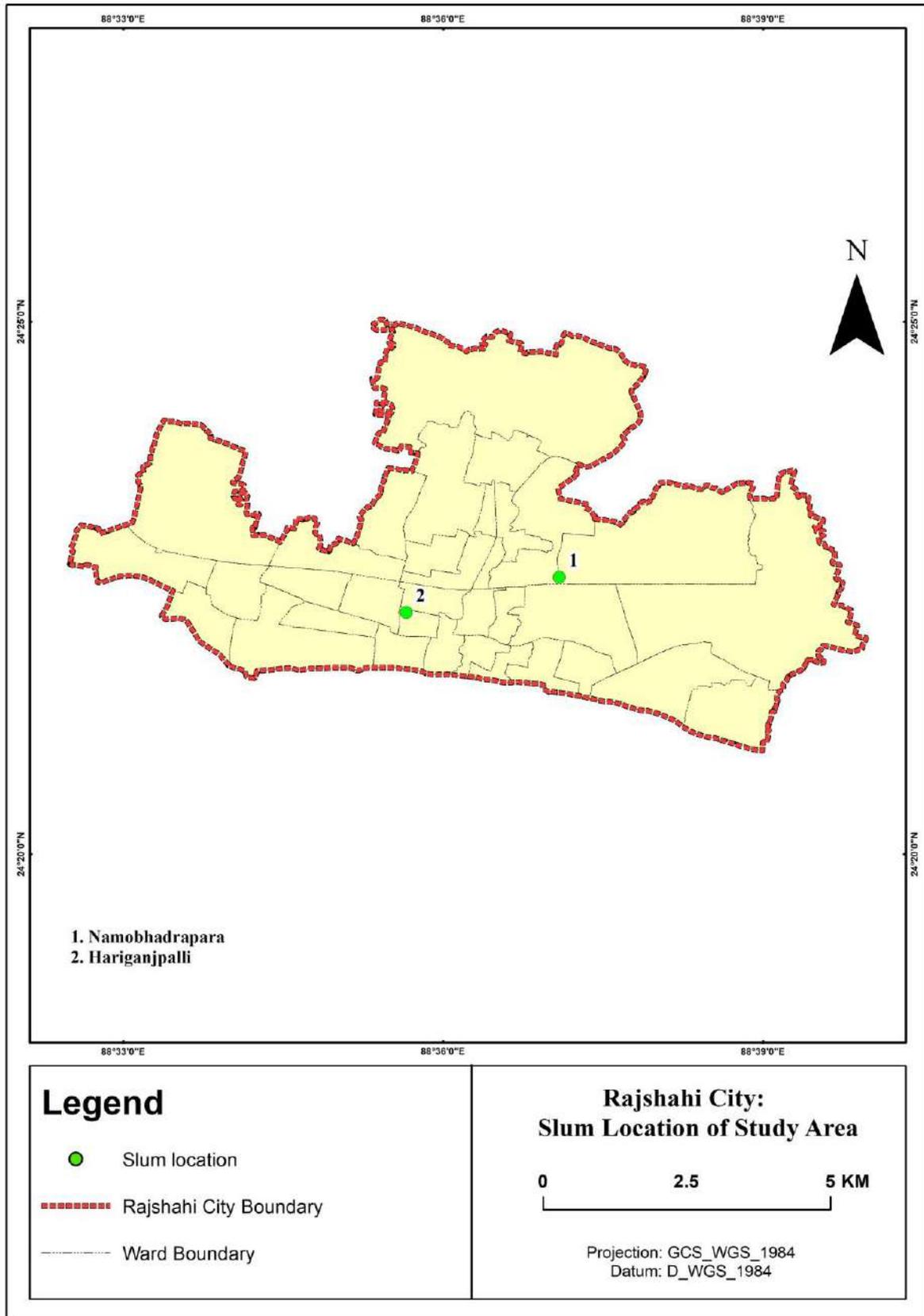
# Annex-1: Map showing location of study areas in Bangladesh



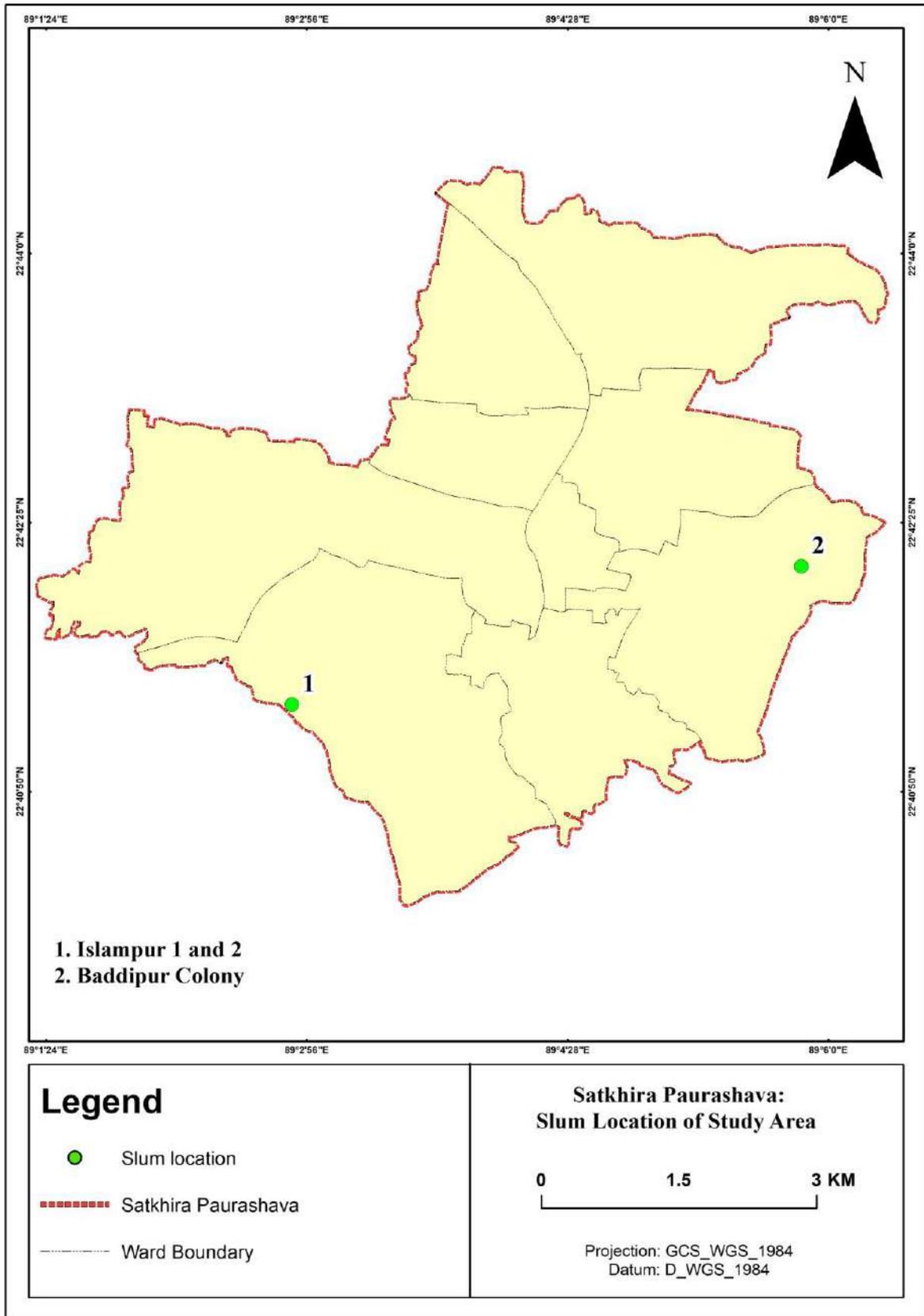
## Annex-2: Map showing study locations of Dhaka City



### Annex-3: Map showing study locations of Rajshahi City



# Annex-4: Map showing study location of Satkhira municipality



## Annex-5: List of FGD conducted

Sl No.	Location	Date
	<b>Dhaka</b>	
01.	Baroikhali (Hazaribagh)	8 November 2023
02.	Chad uddan (Mohammadpur)	14 January 2024
03.	Baroikhali	15 January 2024
04.	Boat ghat	15 January 2024
05.	Balur math (1)	16 January 2024
06.	Balur math (2)	16 January 2024
07.	Jhawchar	17 January 2024
08.	Company ghat	18 January 2024
09.	City Colony (Gabtoli)	21 January 2024
10.	Kalyanpur pora bosti	22 January 2024
11.	Beguntila	23 January 2024
12.	Chalantika bosti	24 January 2024
13.	Ta block (Mirpur 7)	24 January 2024
14.	Mollar bosti (Mirpur 11)	25 January 2024
15.	Balur math (Mirpur buddijibi koborstan)	28 January 2024
16.	Korail	29 January 2024
17.	Sat tola bosti (Mohakhali)	30 January 2024
18.	Vasantek, Dhaka	31 January 2024
	<b>Satkhira</b>	
19.	Boddipur Colony	3 January 2024
	<b>Rajshahi</b>	
20.	Namavodra	26 December 2023
21.	Horijon polli	27 December 2023

## Annex-6: Photographs



*Common cooking facility in Balurmath slum, Dhaka*



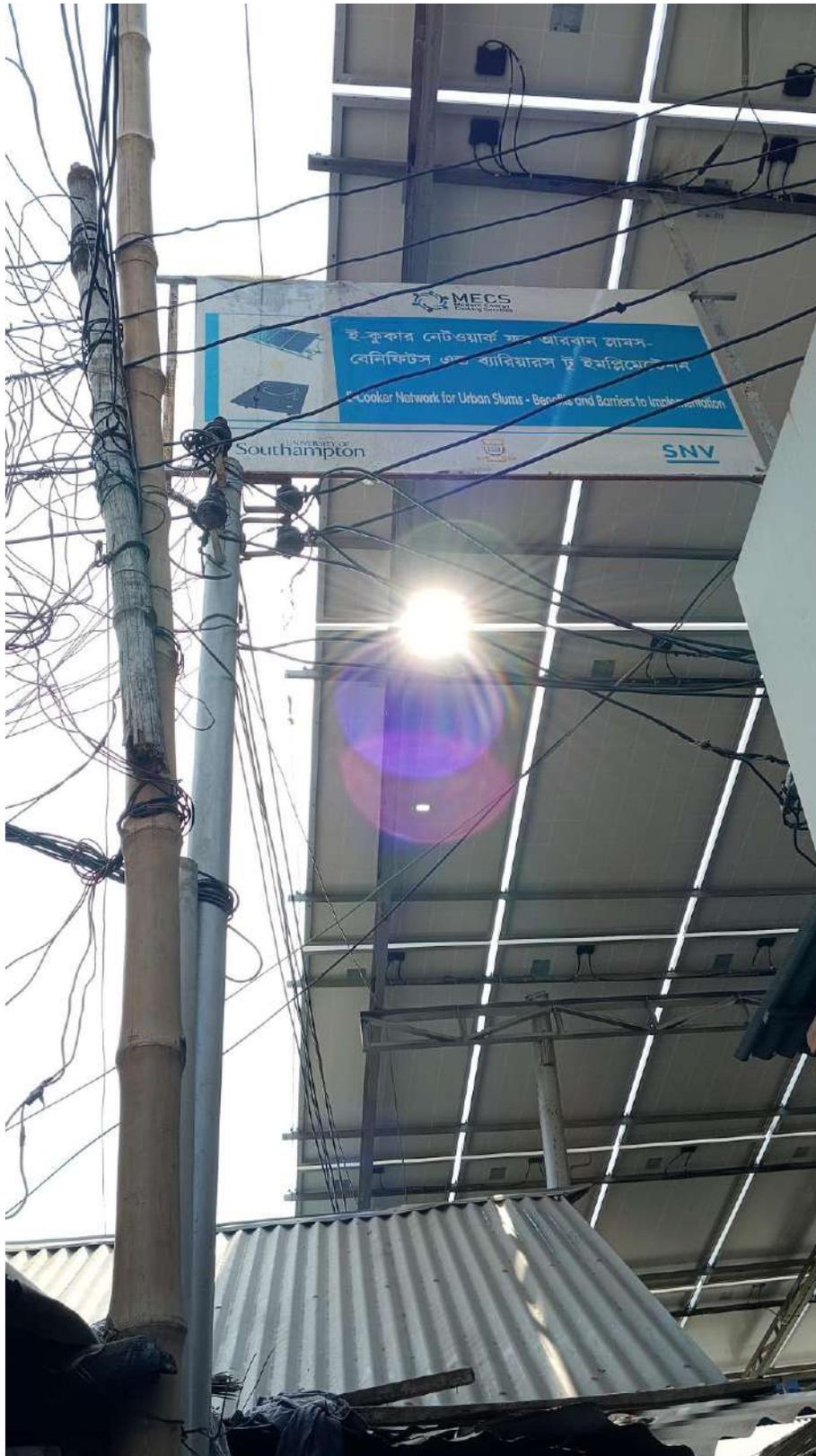
*Common cooking facility at Boatghat slum, Dhaka*



*Slum eviction at Chad Uddan slum, Dhaka, 22 November 2023*



*Use of Electric appliances in Sattala slum, Mohakhali, Dhaka*



*Grid-tied Solar PV at Vasantek slum, Dhaka installed by SNV in 2021*



*A man cooking at Namavadra, Rajshahi using cloth*



*Figure 1: A van selling cow dung stick at Boddipur slum, Satkhira*

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- <sup>ii</sup> IEA (2023), SDG7: Data and Projections, IEA, Paris <https://www.iea.org/reports/sdg7-data-and-projections>, Licence: CC BY 4.0
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