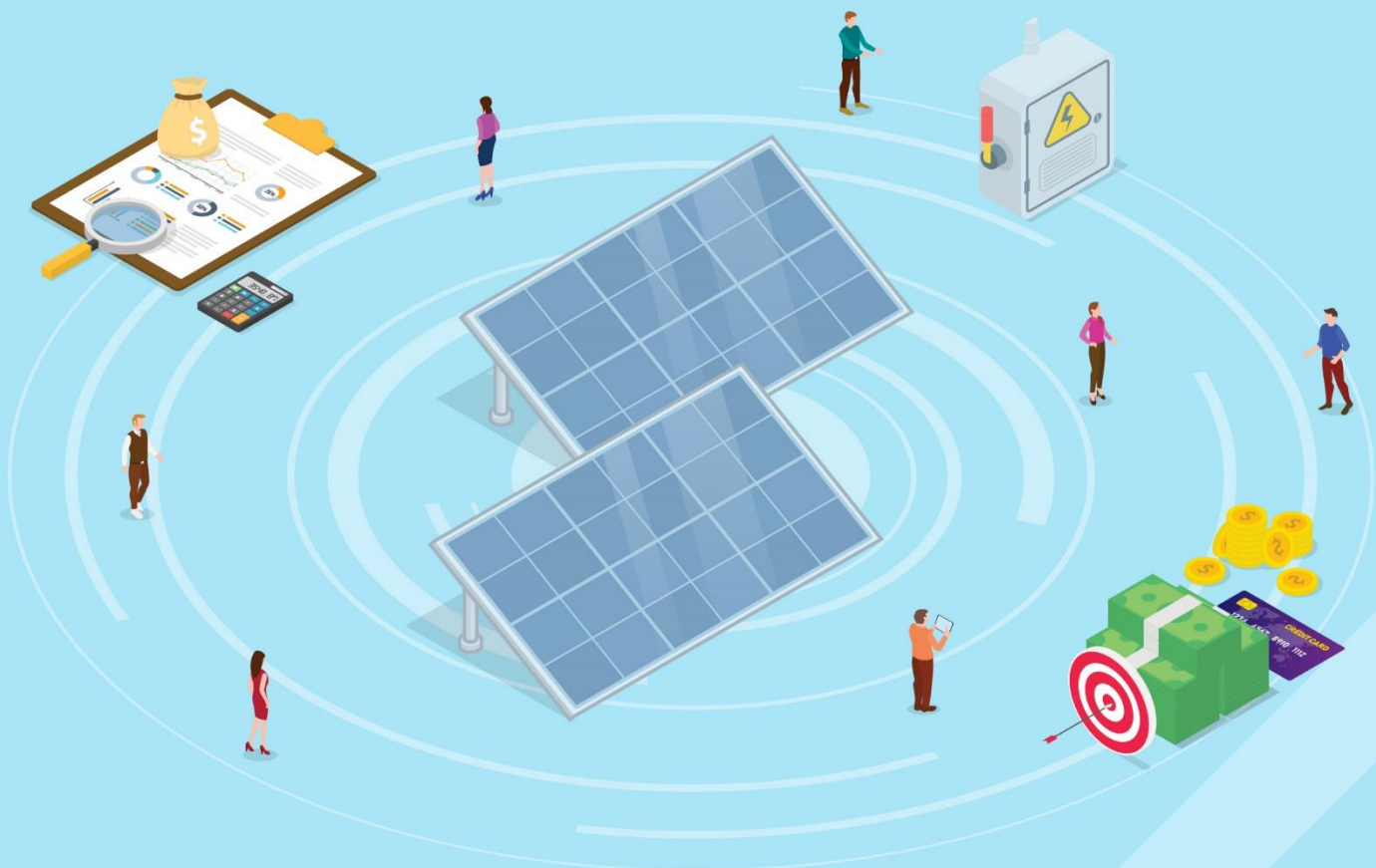




SDPI
Sustainable Development Policy Institute

Democratizing Clean Energy Access: The Role of Microfinance in Pakistan's Solarization

Author: Nabiya Imran



Abstract

There is a strong momentum worldwide towards decarbonization, and Pakistan is no stranger to it. With significant potential for renewable energy, the country has been experiencing a solar boom as rising electricity prices and decreasing solar panel costs have incentivized households and businesses to solarize. However, this growth excludes certain segments for whom the upfront costs are still high. This paper explores how microfinance institutions (MFIs) can support the adoption of solar power among low-income households and small businesses in Pakistan, bridging gaps in clean energy access, affordability and reliability. Research reveals that by helping overcome financial barriers, MFIs are well-positioned to facilitate solar adoption in low-income off-grid rural communities and urban areas (such as slums), hence supporting national targets and improving energy equity¹. Evidence from studies reveals that there is a strong interest in solar solutions if financial support is available. The paper also identifies key barriers - from regulatory uncertainty and limited collaboration across the financial sector to low digital adoption within MFIs - and offers actionable policy recommendations. The paper's focus on MFIs as catalysts for solar expansion provides a unique contribution to the research on Pakistan's energy transition, highlighting how financial inclusion can be leveraged to accelerate renewable energy adoption and promote an inclusive energy future.

¹ In this paper, the term “underserved communities” is used to refer to these low-income households and businesses, especially in off-grid rural areas and urban slum areas.

Contents

Abstract.....	2
Contents.....	3
List of Figures	4
List of Abbreviations	5
1. Introduction.....	7
Objectives.....	7
Methodology	8
2. Mapping the State of Renewable Energy Installation and Financing in Pakistan	8
3. Solarization in Pakistan: The Need for Financial Inclusion.....	10
4. Intersection of MFIs and Energy Transition: A Global Overview	12
5. Leveraging Microfinance for Pakistan's Solar Boom	13
6. Policy Recommendations	15
7. Conclusion.....	16
8. Bibliography	17

List of Figures

Figure 1: Installed Renewable Energy Capacity and Investments in Renewable Energy in Pakistan (Source: Renewables First)	9
Figure 2: Perceived Concerns of Banks regarding Green Lending (Source: PRIED)	10
Figure 3: Net-Metering Users in Pakistan as of June 2023 based on Distribution Companies (DISCOs) (Source: Renewables First)	10

List of Abbreviations

AGCR	Annual Compound Growth Rate
COP	Conference of Parties
CSR	Corporate Social Responsibility
CTBCM	Competitive Trading Bilateral Contract Market
DISCOs	Distribution Companies
GDP	Gross Domestic Product
IDCOL	Infrastructure Development Company Limited
IEA	International Energy Agency
IGCEP	Indicative Generation Capacity Expansion Plan
IPPs	Independent Power Producers
KFW	German Development Bank
MFBs	Microfinance Banks
MFIs	Microfinance Institutions
NBMFCs	Non-Bank Microfinance Companies
NDCs	Nationally Determined Contributions
NEPRA	National Electric Power Regulatory Authority
NGOs	Non-Governmental Organizations
NRSP	National Rural Support Program
NSTP	National Science & Technology Park
PAYG	Pay-As-You-Go
PMIC	Pakistan Microfinance Investment Company
PMN	Pakistan Microfinance Network
POs	Partner Organizations
PSX	Pakistan Stock Exchange
PV	Photovoltaic
RBF	Results-Based Financing
SBP	State Bank of Pakistan
SECP	Securities and Exchange Commission of Pakistan
SHS	Solar Home Systems
VRE	Variable Renewable Energy



1. Introduction

The energy sector in Pakistan faces a multi-faceted crisis, combining increasing fossil fuel reliance, high subsidies, and aging transmission and distribution infrastructure. This is closely intertwined with the broader macroeconomic crisis grappling it and the “ad hoc policy solutions” that the government tends to come up with (Rashid 2023). Increased energy demand, coupled with emission reduction goals, and the aim to reduce reliance on energy imports and enhance energy security, necessitates increased investments in renewable energy.

As global momentum for decarbonization grows, solar technology has particularly seen a boom in Pakistan. Driven by rising electricity costs (tariffs have risen by 155%) and declining solar panel costs (from 24 cents to 10 cents per Watt in 2024 (Jillani 2024)) as well as battery prices, residential, industrial and agricultural sectors are increasingly adopting solar power. However, this growth in solar adoption is uneven owing to high initial capital investments as well as delays in approvals from relevant authorities in this regard. This paper explores how microfinance institutions (MFIs) can bridge this financial gap to support a more equitable solar transition.

MFIs are banking or non-banking entities that provide financial services, including but not limited to loans, insurance, savings and money transfers, to individuals or groups who would otherwise have limited access to traditional banking, mainly due to their socioeconomic background, lower creditworthiness or their remote geographic location. MFIs enable democratization in the energy space as they make clean energy setups available and affordable for individuals by spreading the payments over time thus reducing the immediate financial burden.

This paper posits that MFIs hold immense potential to support the solar energy transition in Pakistan by helping low-income households and small businesses, particularly in off-grid areas and urban slum areas, to overcome financial accessibility gaps. However, their success is dependent on an enabling regulatory environment, a strong innovation in financial sectors and institutional capacity building.

Objectives

This study investigates how MFIs are currently engaged in driving the solar transition in Pakistan, the regulatory framework governing them, and what challenges and opportunities they face in this current dynamic. It seeks to understand the extent to which microfinance can be leveraged as a tool for expanding access to solar energy, particularly among low-income and underserved communities in both rural and urban settings. This paper begins with renewable energy finance mapping in the country followed by how the role of MFIs intersects with adoption of clean energy. It also highlights the barriers, including financial, regulatory, institutional, and technological, that hinder the scaling of microfinance for solar products, in addition to providing actionable policy recommendations that can enable a more equitable energy transition. In doing so, the study aspires to contribute to the emerging discourse on

climate finance and energy justice in the Global South, with a focused lens on Pakistan's evolving energy finance landscape.

Methodology

It is a desk study based on secondary research. The data has been collected after a thorough literature review of government documents, research papers, reports of multilateral institutions and website contents. The study contributes to the limited body of literature that currently exists on integration of renewable energy finance and microfinance, especially in the case of Pakistan

2. Mapping the State of Renewable Energy Installation and Financing in Pakistan

Pakistan has abundance of renewable energy potential. According to World Bank projections, solar potential lies at 40,000 MW(Hayat 2023) and wind potential on the coasts of Sindh and Balochistan alone is 50,000 MW(Omar 2024). Despite the 2019 Alternate and Renewable Energy Policy to increase Variable Renewable Energy (VRE) to 30% by 2030, there is only 2,625 MW of installed capacity of solar and wind power which account for 6% of the total power production capacity. An additional 2,890 MW of projects are in the pipeline(Ghauri & Ahmad 2024). Cumulatively, \$4.6 billion has been secured for utility-scale wind and solar installations by Pakistan, more than half of which amount to foreign lending(Ghauri & Ahmad 2024).

This progress, however, falls short of what is needed. As party to the Paris Agreement and a country very vulnerable to climate change, Pakistan's Nationally Determined Contributions (NDCs) have set the target to reduce emissions by 50% by 2030 with 15% being unconditional and 35% being subject to provision of international climate finance. To support this goal, Pakistan aims to have renewable energy as 60% of its energy mix and ban imported coal ('Updated Nationally Determined Contributions' 2021). However, despite a moratorium on new coal power plants, coal is still being used- its share in electricity generation jumping from less than 1% (2016) to 18% (2023) (Pakistan 2024). Government estimates claim that the money needed by 2030 for the energy transition alone in Pakistan is \$101 billion(Zia et al. 2023). The following figure showcases an overview of installed renewable capacity and investments made so far:

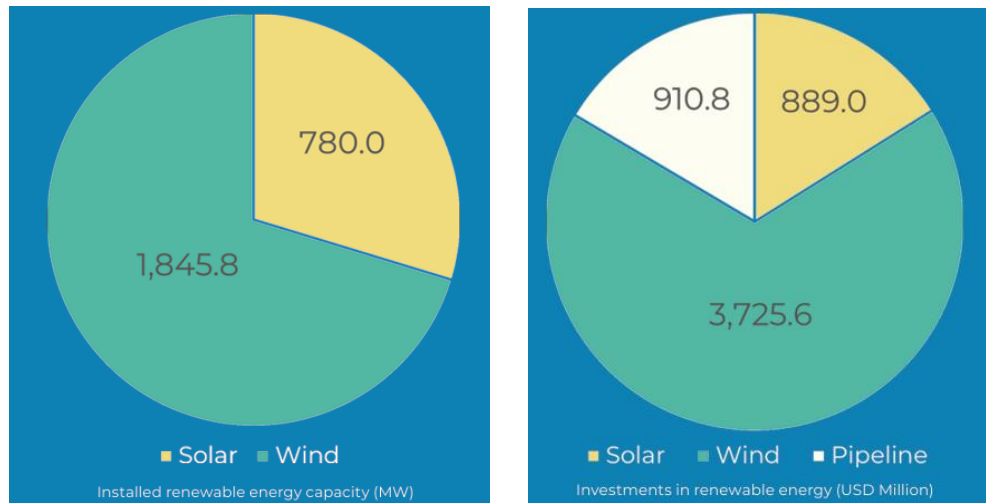


Figure 1: Installed Renewable Energy Capacity and Investments in Renewable Energy in Pakistan (Source: Renewables First)

Over the past decade, policies and budget allocations by key government entities in Pakistan have signaled support for green investments, though broader policy inconsistencies and uncertainty remain. This is evident through recent attempts by the government to reduce buy-back rates of rooftop solar power ('Govt decides to consult all stakeholders on net metering policy after backlash' 2025) and decrease the portion of VRE from 29.6% to 13.3% of total capacity in the draft Indicative Generation Capacity Expansion Plan (IGCEP) 2024-2034 ('Neglected Potential: How the Latest IGCEP Fails Renewable Energy Future in Sindh and Balochistan' 2024). Such inconsistent policies and a lack of awareness among stakeholders further undermines investor confidence.

"Green" finance policies include Securities and Exchange Commission of Pakistan (SECP)'s adoption of voluntary corporate social responsibility (CSR) guidelines in 2013 and introduction of sustainable financing regulations in 2020, as well as the State Bank of Pakistan (SBP)'s introduction of renewable energy financing scheme in 2016 and green banking guidelines in 2018 (Nasir et al. 2024). In 2022, the Pakistan Stock Exchange (PSX) also introduced green financing initiatives. Most recently in February 2025, SBP launched Green Taxonomy Guidelines for public consultation. This draft outlines a proposed definition of "green" and aims to improve transparency in sustainable investments (Public Consultation on Draft Pakistan Green Taxonomy n.d.).

However, green lending landscape in Pakistan seems to be in "infancy". Firstly, there is bureaucratic complexity owing to fragmented regulations, political turmoil and a lack of transparency, which makes the regulatory environment complex. Secondly, green financing options are inequitably accessible. SBP's financing scheme, for instance, was discontinued in June 2024 owing to the economic crisis facing the country and even when it was operational, it was voluntary for commercial banks to participate in it. A study done by Policy Research Institute for Equitable Development highlighted that most banks in Pakistan were "uninterested at best and unaware at worst" about this scheme and perceived them as high-risk investments with low returns, especially with increased transaction costs (Rehan 2024).

The study revealed that financial institutions (11 of whom were interviewed for the study) face certain risks in this regard which the following figure encapsulates: The study revealed that financial institutions (11 of whom were interviewed for the study) face certain risks in this regard which the following figure encapsulates:

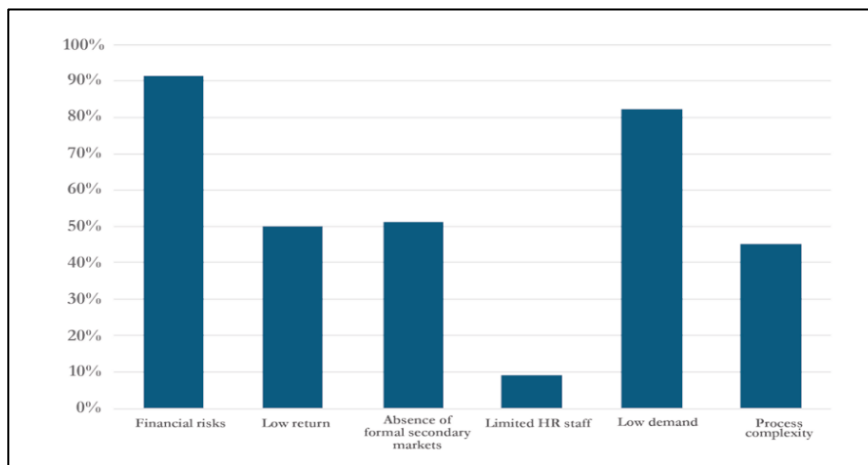


Figure 2: Perceived Concerns of Banks regarding Green Lending (Source: PRIED)

3. Solarization in Pakistan: The Need for Financial Inclusion

Both off-grid and on-grid installations are prevalent across the country. Net-metered solar capacity in Pakistan (on-grid) has reached 5.3 GW as of April 2025 (Jowett 2025). This seems to be highest in the residential sector, which is also reflected in the following figure:

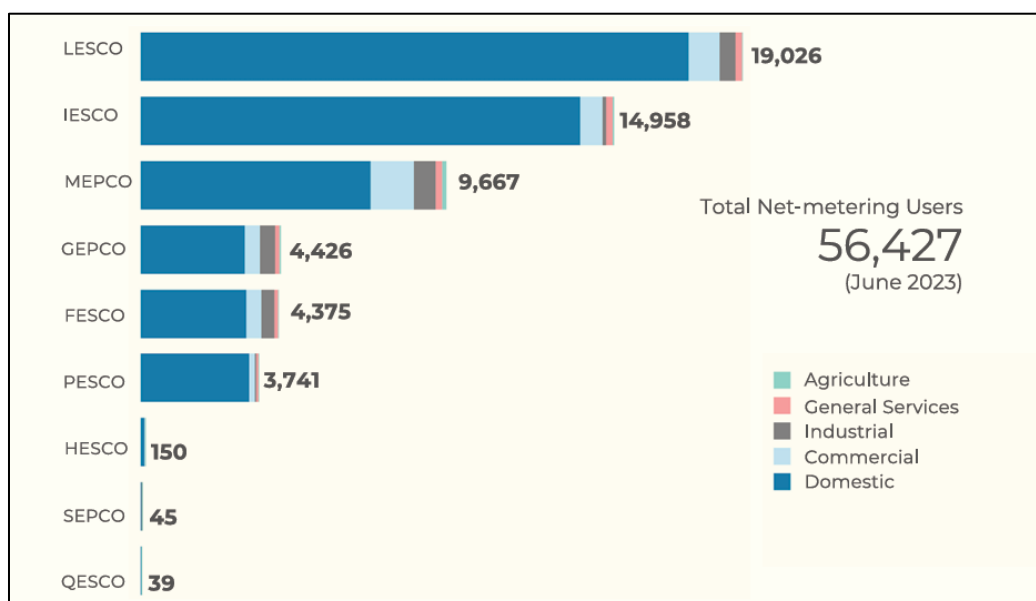


Figure 3: Net-Metering Users in Pakistan as of June 2023 based on Distribution Companies (DISCOs) (Source: Renewables First)

Off-grid solar panel installations are also on the rise, particularly driven by users wanting to reduce dependency on the grid. Experts estimate that these numbers are higher than net-metered installations (possibly 2-3 times more but there is a lack of official data). All in all, there is incredible momentum for solarization in the country. Despite the possibility of reduced buy-back rates for net-metered solar power, investments are still likely to break even within 5 years (currently, it is 2-4 years)- which is still a lucrative proposition (Amjad et al. 2024).

Despite its accelerating pace, the growth in Pakistan's solarization is inequitable, exacerbated by existing inequalities in the energy system, regarding both access and affordability. Over 40 million people still live without electricity (Sprung & Khan 2024). Across the provinces, energy poverty is very pronounced in Balochistan where grid access is at 56.1% (Naeem 2025). Even grid connectivity does not guarantee reliable supply as prolonged outages often take place. The matter of energy affordability further complicates the situation. A 2024 study showed that 71% rural and 19% urban households cannot afford basic energy provisions. This indicates that merely having a grid connection does not guarantee true access, a key marker of energy poverty prevalent in the country. Solar power can be a solution to this poverty, but high upfront costs, liquidity constraints, limited credit access, high interest rates, insufficient awareness and inadequate supportive schemes (Hussain 2024a) make it inaccessible to low income households and businesses. Consequently, these households remain exposed to rising electricity tariffs and declining service quality while those who can afford to have adopted solar power. With delays in implementation of the Competitive Trading Bilateral Contract Market (CTBCM), persistent obligations of capacity payments and reducing demand for the grid, electricity becomes increasingly expensive. In other words, people who cannot afford to invest in solar power are the ones who end up paying more electricity tariffs. Without intervention to support financial inclusion, the imbalance of energy access and affordability would only worsen.

Such discrepancy and inequitable access make it even more important for the government to approach energy planning in a more integrative way instead of trying to curtail this progress on solar power. This integrative approach will not only cover generation, transmission and distribution of power, but also access, affordability and reliability for all populations. As such, while the government works to develop large-scale renewable infrastructure (keeping in mind that the transmission lines cannot handle more than 22,000 MW (Hussain 2024b)) and streamline regulatory frameworks, it is also important to tackle the systematic barriers to green financing for this consumer base, therefore supporting a financial inclusion-driven decentralized energy transition in which MFIs can play a key role. To better understand how microfinance can contribute to this transition, global precedents are analyzed in the next section before shifting the focus back to Pakistan.

4. Intersection of MFIs and Energy Transition: A Global Overview

About 140 million people worldwide are served by the microfinance industry focusing on a wide range of themes including agriculture, business and energy(What is Microfinance? n.d.). MFIs are often well-established in the regions they operate in and have a strong relationship with the communities living there. This gives them an advantage to adapt to clean energy lending, especially as these regions are often more vulnerable to the impacts of climate change and do not necessarily present a lucrative investment opportunity for traditional commercial entities. Despite the high global momentum towards renewable sources of energy, initial capital costs are still relatively high in developing economies, especially low-income segments within these countries('Financing clean energy transitions in Asia and the Pacific- Note by the Secretariat' 2023). MFIs enable democratization in the energy as they make clean energy setups available and affordable for individuals by spreading the payments over time thus reducing the immediate financial burden. These individuals may or may not be connected to the grid and are notably impacted more by the impacts of climate change despite contributing very little to it. Research also shows that more mature MFIs, those operating in poorer countries and those with higher customer retention rates are more likely to offer financial products for clean energy installations(Dorfleitner et al. 2020).

This synergy between microfinance and energy sectors addresses energy poverty and enhances access to small-scale clean energy simultaneously. There are several case studies available globally where MFIs have played a key role in supporting the diffusion of "green" products among low-income groups, ranging from clean cooking fuels and sustainable agriculture practices to solar home systems (SHS) and efficient cookstoves. Some examples include SELCO in India, Uganda(Levaï et al. 2011), solar rural electrification in Mali(*Green Climate Fund energy strategy accelerates low-carbon transition* 2024), Tanzania(Kasoga & Tegambwage 2022), Nicaragua(*Microfinance and FinTechs are Working Together for Clean Energy Access* 2023), Nepal(*CleanStart Programme launched in Kathmandu* 2012). One of the most remarkable cases is perhaps that of the SHS program in Bangladesh. With support from the World Bank and other donor partners, the government of Bangladesh enabled the provision of SHS among remote and rural areas of the country through partner organizations (POs). These POs, which included MFIs, were responsible for marketing, selling, financing, installing, and providing after-installation services to customers. The program enabled the penetration of about 4.1 million SHS into the market between 2003 and 2018, reaching about 25% of the target population(Cabraal et al. 2021) and thus creating a scalable off-grid model.

From a broader perspective, access to cleaner energy supports livelihoods in the communities where MFIs operate and has environmental and health benefits as well. From the MFIs' point of view, working in the energy access/transition space enhances their recognition, thereby supporting competition in the microfinance industry in a particular country or region. By aligning with environmental and social goals, MFIs become more attractive to impact investors and international donors thus opening doors to new funding sources. It also allows

them to differentiate themselves from competitors and attract new customers (Groh & Taylor 2015). This is not to suggest that the deployment of MFIs to enhance clean energy access is the only option in the pursuit of a just energy transition, it is important to consider all possible avenues and deploy them strategically. The following sections provide an overview of the current landscape of MFIs and solar financing in Pakistan, and how they can be employed to further support clean energy and economic development in the country.

5. Leveraging Microfinance for Pakistan's Solar Boom

MFIs can play a critical role in the energy transition in Pakistan by enabling households and small businesses to overcome financial barriers. Flexible repayment terms make high upfront costs manageable, supporting both off-grid and on-grid solarization (Hussain 2024c). This complements broader energy transition goals by expanding grid access and integrating renewables, while directly enhancing energy access in off-grid regions. The electricity system in Pakistan is based on cross-subsidization whereby wealthier consumers and commercial/industrial sectors pay a higher tariff which indirectly reduces costs for underserved communities. Scaling microfinance to increase access of solar power for these underserved communities can help foster energy independence and reduce reliance on cross-subsidies. Unbundling these categories through microfinance would make the system fair and efficient (Sprung & Khan 2024). Despite the potential, only 21% of the adult population in Pakistan has access to formal financial services.

From a regulatory perspective, there are three major kinds of MFIs that operate in Pakistan. There are 11 Microfinance Banks (MFBs), regulated by the SBP, and about 20 active Non-Bank Microfinance Companies (NBMFCs), regulated by the SECP. A third category consists of several NGOs that offer microfinance products but have not been scaled to an extent to be regulated by the SECP. MFBs rely on deposits while NBMFCs obtain funding through equity, credit from commercial banks or financing from supporting institutions such as the Pakistan Microfinance Network (PMN) and Pakistan Microfinance Investment Company (PMIC). The latter are also more client-centric and operate mainly in rural areas (Javed & Khan 2024).

Research indicates significant potential for scaling microfinance for solar power in both urban and rural solar markets. In rural areas, there is an urgent need for off-grid and decentralized connections as 70 million of the rural population is not grid-connected and even those that are, face blackouts ('Development Advocate Pakistan- Energy Investments: Powering Businesses & Communities' 2024). Region-specific microgrids especially in underserved areas of Sindh, KPK, Gilgit-Baltistan and Balochistan could support reliable and affordable solutions for rural Pakistan. One study conducted for solar electrification in off-grid rural areas across three districts of the country (Chakwal, Khushab and Thatta) showed that 71% of the people surveyed expressed interest in purchasing a SHS, and 72% were receptive to microfinance loans to do so. Acceptance for microfinance loans was higher in areas where MFIs were already operating (Ajaz & Taylor 2015). This suggests that MFIs can play a pivotal role in

scaling decentralized solar solutions while fostering community ownership and long-term maintenance.

While rural areas show clear demand for decentralized solutions, urban environments present their own distinct opportunities for MFIs. Here, MFIs can support solarization, particularly in slum areas (which are 42 in the capital Islamabad alone (Mohsin 2020)) and areas with high losses. Karachi, Pakistan's largest city, is served by K-Electric, the country's only vertically integrated utility (Company Profile- K Electric n.d.). Distribution inefficiencies in the system result in excessive load shedding in high-loss feeders. Solarizing these feeders is not only feasible but also essential for the power sector in the country. A survey of 1,450 households in these high-loss areas revealed high interest in solar adoption. However, most of the surveyed individuals had either self-financed or taken informal loans. Only one household had approached the bank. This shows the low level of awareness about solar financing options, and an opportunity for MFIs to step in as 43% of the households surveyed showed high willingness for solar PV adoption if they had financial support (Ahmad & Zahid 2022).

Some MFIs in Pakistan have already made headway in solar financing. For example, Mobilink Microfinance Bank provided PKR 1.7 billion (almost USD 6 million) in financing for solar products as of July 2024 (Hussain 2024c). In another project, PMIC and German Development Bank (KfW) have collaborated to implement a program on financing solar products (specially Pico PV and SHS) in rural and peri-areas of the country. Challenges in this program include installation, post-installation maintenance and transportation over long distances, which can increase costs. This project has reduced electricity costs, created job opportunities for locals, and reduced the carbon footprint of the region. Communities are also trained in solar power, which has created a strong sense of ownership to maintain the installed systems (Voices from the Field: Empowering Rural Pakistan with Solar Energy 2025). Other institutions like Akhuwat Foundation, Khushali Microfinance Bank, Thardeep Foundation, Rural Community Development Programme, HBL Microfinance Bank, National Rural Support Program (NRSP) and the First Microfinance Bank are also exploring solar financing, though adoption remains limited, and MFIs continue to be an under-leveraged tool for solarization. For example, up until at least mid-2021, no MFI had adopted the State Bank's financing scheme for renewables (Saleh 2023) (which was discontinued in 2024).

Globally, traditional SHS are increasingly being complemented by new shifts in the energy industry such as mini-grids and pay-as-you-go (PAYG) models. This requires MFIs to be adaptable in their program designing and implementation. Instead of directly financing SHS for end consumers like households or small businesses, they should collaborate more extensively with entities across the solar supply chain, especially last-mile suppliers, to tailor financial products that are as closely aligned with community preferences as possible (Groh & Taylor 2015).

There is also an increasing role for digital services to support MFIs in loan disbursements and payment recollection. However, despite widespread mobile coverage in Pakistan, many MFIs have limited integration with digital payment networks and prefer to rely more on field agents in addition to using outdated management systems. This hinders their ability to offer customer-

friendly financing options – a key factor for the success of similar programs in East Africa. Moreover, most MFIs present solar financing options as an add-on to their existing services as opposed to a separate innovative tool which results in poorly targeted marketing (Leveraging Digital Finance to Scale the Solar Home Systems Market in Pakistan 2022).

All in all, while MFIs in Pakistan are well-positioned to catalyze solar energy adoption, scaling this opportunity requires an integrated approach through regulatory support, digital innovation, strategic partnerships, and tailored financial products. These efforts can play a crucial role in helping Pakistan meet its decarbonization goals in the energy sector and are discussed in detail in the following section on policy recommendations.

6. Policy Recommendations

Following are the policy recommendations to improve the link between MFIs and solarization in Pakistan.

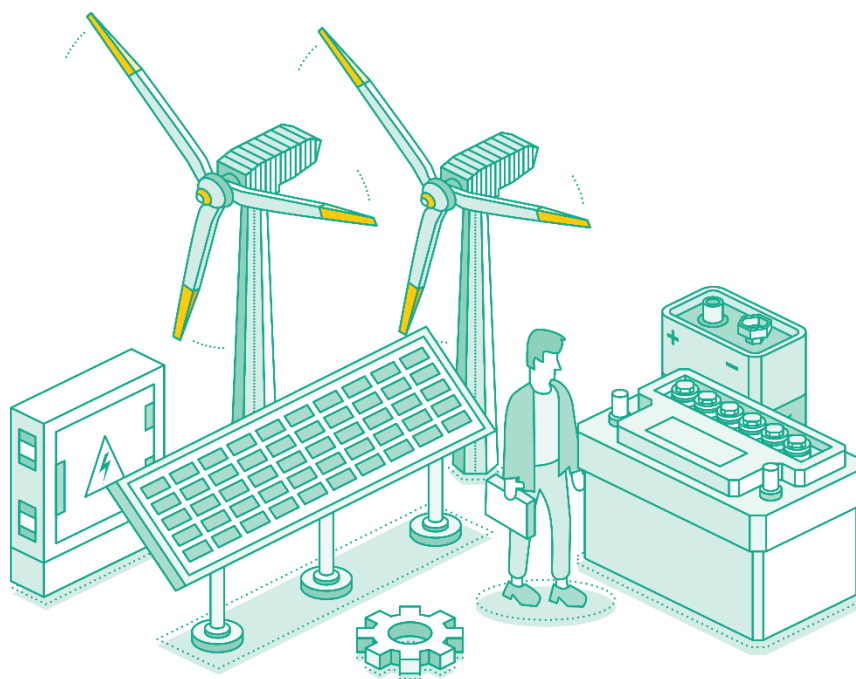
- i. While there are currently consultations taking place regarding establishing green taxonomy, there should also be a clear definition and guidelines for green microfinance.
- ii. Solar products should be granted eligibility under the potential green microfinance guidelines. This would align the work of MFIs with national energy transition goals as opposed to MFIs offering solar products merely as an add-on.
- iii. A national quality certification registry should be established to protect consumers taking microfinance loans from faulty products.
- iv. The SBP and SECP could mandate the MFBs and NBMFCs to commit a certain portion of their loan portfolios for solar projects in line with national goals.
- v. SBP's financing scheme should be reintroduced and restructured to include MFIs, especially for solar loans. The scheme should also involve awareness and engagement with banks/MFIs and consumers both to increase its adoption by these entities.
- vi. Organizations working with MFIs should establish Results-Based Financing (RBF) mechanisms that connect disbursement of funds to verified solar installments.
- vii. A program should be launched to support MFIs in generating revenue from carbon credits (based on emissions avoided by solar installations) which can then be reinvested in the communities and enhance MFIs' credibility to tap in international climate finance mechanisms.
- viii. MFIs should be equipped with technical training modules to develop expertise in solar projects, financial tools and risk management- contextualized for on-grid and off-grid settings along with rural and urban contexts.
- ix. MFIs should leverage digital payment methods such as SadaPay or EasyPaisa to improve repayment methodology. Digital financial services can be especially useful for PAYG solar models.

- x. MFIs should strategically partner with universities, especially those with incubator setups like the National Science & Technology Park (NSTP) located within National University of Sciences & Technology (NUST).
- xi. Gender-focused donor programs can be a great opportunity for MFIs that focus on female entrepreneurs or women-led households. Policies should mandate female participation targets in solar initiatives, especially in rural settings to achieve the goals of a gender-just energy transition.

All in all, a comprehensive strategy that combines regulatory reforms, financial innovation, capacity building, multi-stakeholder partnerships and inclusivity can support Pakistan's energy transition through solar-based microfinance.

7. Conclusion

Like other developing countries, Pakistan has a fossil-fuel dependent economy across power, transportation and industrial sectors. However, over the past few years rising electricity costs have increased the adoption of renewable energy, particularly solar power, by households and businesses. Unfortunately, the upfront costs remain high for certain segments. This paper has examined the role that can be played by MFIs in accelerating solar adoption by low-income households and small businesses in Pakistan, in both urban and rural settings. Studies show the MFIs are well-positioned to do so, owing to their flexible and tailored financial products and their existing community connections, and that there is consumer interest in solarization if financial support is available. However, certain barriers can curtail this momentum including regulatory uncertainty, inadequate digitization, risk perception about renewable energy products, insufficient awareness among consumers about available financial options, and limited collaborations with the broader financial sector. This paper has recommended a comprehensive strategy based on supportive regulatory framework, enhanced financial products, and institutional capacity programs to enable MFIs to effectively support solar energy adoption in underserved communities along with digital innovation and gender sensitivity in microfinance-led solar initiatives in Pakistan's inclusive energy transition.



8. Bibliography

Ahmad, A 2024, 'Derisking Pakistan's Renewable Energy Future Leveraging Financial Innovation to Catalyze Renewables Investment', <https://uploads.renewablesfirst.org/Derisking_Pakistan_s_Renewable_Energy_Future_4dea3963b2.pdf>.

Ahmad, M & Zahid, H 2022, *Fostering Solar PV in high-loss feeders: Mapping Solutions*, Policy Research Institute for Equitable Development, <<https://www.priedpk.org/wp-content/uploads/2023/01/Research-study-PRIED-Fostering-Solar-PV-in-High-Loss-Feeders-Mapping-Solutions.pdf>>.

Ajaz, W & Taylor, H 2015, 'Demand Assessment of Solar Electrification in Off-Grid Rural Communities of Pakistan Through Microfinancing of Solar Home System', in, *Decentralized Solutions for Developing Economies*, Springer International Publishing, Switzerland, pp.217–231.

Amjad, MM et al. 2024, 'The Great Solar Rush in Pakistan', <https://uploads.renewablesfirst.org/The_Great_Solar_Rush_in_Pakistan_38157451a3.pdf>.

Cabraal, A et al. 2021, *Living in the Light: The Bangladesh Solar Home Systems Story*, World Bank, viewed 11 October 2024, <<https://hdl.handle.net/10986/35311>>.

CleanStart Programme launched in Kathmandu 2012, United Nations Capital Development Fund, <<https://www.uncdf.org/article/1108/cleanstart-programme-launched-in-kathmandu-migration>>.

Company Profile- K Electric n.d., K-Electric, <<https://www.ke.com.pk/corporate/company-profile/#:~:text=KE%20is%20the%20only%20vertically,and%20delivering%20energy%20to%20consumers.>>>.

'Development Advocate Pakistan- Energy Investments: Powering Businesses & Communities' 2024, <<https://www.undp.org/pakistan/publications/energy-investments-powering-business-and-communities>>.

Dorfleitner, G, Forcella, D, & Nguyen, QA 2020, 'Microfinance and Green Energy Lending: First Worldwide Evidence, Credit and Capital Markets', *Kredit und Kapital*, vol. 53, no. 4, pp. 427–460.

'Financing clean energy transitions in Asia and the Pacific- Note by the Secretariat' 2023, <https://www.unescap.org/sites/default/d8files/event-documents/ESCAP_APEF%283%29_4_E_Financing%20clean%20energy%20transitions%20in%20Asia%20and%20the%20Pacific.pdf>.

Ghauri, MB & Ahmad, A 2024, 'Capitalizing on Green: A Stock-take of Renewable Energy Finance for Pakistan', <https://uploads.renewablesfirst.org/Capitalizing_on_Green_A_Stocktake_of_Renewable_Energy_Finance_for_Pakistan_87fdf2b51c.pdf>.

'Govt decides to consult all stakeholders on net metering policy after backlash' 2025, Dawn.

Green Climate Fund energy strategy accelerates low-carbon transition 2024, Green Climate Fund, <<https://www.greenclimate.fund/news/green-climate-fund-energy-strategy-accelerates-low-carbon-transition>>.

Groh, S & Taylor, H 2015, 'The role of microfinance in energy access: changing roles, changing paradigms, and future potential', *Enterprise Development and Microfinance*, vol. 26, no. 4, pp. 307–324.

Hayat, A 2023, 'Can Pakistan capitalise on solar as it becomes popular', *The Express Tribune*, <<https://tribune.com.pk/story/2420254/can-pakistan-capitalise-on-solar-as-it-mes-popular>>.

Hussain, B 2024a, 'Amid funding crunch, solar companies are being offered a door at PSX', *Business Recorder*, <<https://www.brecorder.com/news/40305411/amid-funding-crunch-solar-companies-are-being-offered-a-door-at-psx>>.

Hussain, B 2024b, 'Pakistan's economic crisis is largely due to its power sector: experts propose bypassing govt', <<https://www.brecorder.com/news/40312262/pakistans-economic-crisis-is-largely-due-to-its-power-sector-experts-propose-bypassing-govt>>.

Hussain, B 2024c, 'Microfinance solar loans: for Pakistan, this can be a sustainable road ahead', *Business Recorder*, <<https://www.brecorder.com/news/40314900>>.

Javed, A & Khan, F 2024, 'An overview of Microfinance Institutions and Related Developments in Pakistan', *Journal of Development Policy Research & Practice*, vol. 7, pp. 1–30.

Jillani, H 2024, 'Chinese solar panel boom threatens Pakistan's debt-ridden grid', *Financial Times*, <<https://www.ft.com/content/69e4cb33-3615-4424-996d-5aee9d1afe19>>.

Jowett, P 2025, 'Pakistan's net-metering capacity hits 5.3 GW', *PV Magazine*, <<https://www.pv-magazine.com/2025/06/02/pakistans-net-metering-capacity-hits-5-3-gw/>>.

Kasoga, PS & Tegambwage, AG 2022, 'Microfinance, Energy Poverty, and Sustainability: The Case of Tanzania', in, *Handbook of Research on Energy and Environmental Finance 4.0*, IGI Global, Hershey, PA.

Levaï, D et al. 2011, 'Microfinance and Energy Poverty: Findings from the Energy Links Project', <https://www.centerforfinancialinclusion.org/wp-content/uploads/2024/02/110929_cfi_rpt_energy-links-full_final.pdf>.

Leveraging Digital Finance to Scale the Solar Home Systems Market in Pakistan 2022, World Bank, Washington DC, <<https://openknowledge.worldbank.org/server/api/core/bitstreams/263a7482-8f82-59df-978f-f49bf42979e8/content>>.

Microfinance and FinTechs are Working Together for Clean Energy Access 2023, Inclusive Money, <<https://inclusivemoney.com/fintech/microfinance-energy-access>>.

Mohsin, M 2020, *Islamabad: A City for the Rich*, Pakistan Institute of Development Economics, viewed 19 September 2024, <<https://pide.org.pk/research/islamabad-a-city-for-the-rich/>>.

Naeem, A 2025, 'A solution to Balochistan's energy poverty', *The News*, <<https://www.thenews.com.pk/tns/detail/1268650-a-solution-to-balochistans-energy-poverty>>.

Nasir, N, Ahmad, W, & Basharat, MA 2024, 'Emerging Pathways of Green Financing and its Role in Inducing Sustainable Development in Pakistan', *Journal of Finance and Accounting Research (JFAR)*, vol. 6, no. 1, pp. 129-155.

'Neglected Potential: How the Latest IGCEP Fails Renewable Energy Future in Sindh and Balochistan' 2024, <<https://www.priedpk.org/wp-content/uploads/2024/06/How-the-Latest-IGCEP-Fails-Renewable-Energy-Future-in-Sindh-and-Balochistan.indd-R05.pdf>>.

Omar, E 2024, *The Path Forward for Pakistan's Energy Transition*, Stimson Center, <<https://www.stimson.org/2024/the-path-forward-for-pakistans-energy-transition/>>.

Pakistan 2024, Ember, <<https://ember-energy.org/countries-and-regions/pakistan/#:~:text=As%20Pakistan's%20electricity%20demand%20more,to%20almost%2018%25%20in%202023.>>>.

Public Consultation on Draft Pakistan Green Taxonomy n.d., State Bank of Pakistan, viewed 20 February 2025, <<https://www.sbp.org.pk/greentaxonomy/PGT.asp>>.

Rashid, F 2023, *Financing Pakistan's Energy Transition*, Julis-Rabinowitz Center for Public Policy and Finance, <<https://jrc.princeton.edu/news/pakistan-energy-finance-s23>>.

Rehan, R 2024, *Greening Pakistan's Future: Facilitating Loans for Electric Vehicles and Distributed Solar PV*, Policy Research Institute for Equitable Development, <<https://www.priedpk.org/wp-content/uploads/2024/04/Situation-Brief-Greening-Pakistans-Future-2024-R03-1.pdf>>.

Saleh, N 2023, *Unlocking the Economic Potential of Rooftop Solar PV in Pakistan*, Policy Research Institute for Equitable Development and Rural Development Policy Institute, <<https://www.priedpk.org/wp-content/uploads/2023/09/Research-study-Unlocking-the-Economic-Potential-of-Rooftop-Solar-PV-in-Pakistan-R01.pdf>>.

Sprung, CS & Khan, M 2024, *Pakistan is experiencing a solar power boom. Here's what we can learn from it*, *World Economic Forum*, <<https://www.weforum.org/stories/2024/11/pakistan-solar-power-energy-transition/>>.

'Updated Nationally Determined Contributions' 2021, <<https://mocc.gov.pk/SiteImage/Misc/files/PakistanUpdatedNDC2021-compressed.pdf>>.

Voices from the Field: Empowering Rural Pakistan with Solar Energy 2025, GOPA AFC, <<https://gopa-afc.de/news/voices-field-empowering-rural-pakistan-solar-energy>>.

What is Microfinance? n.d., FINCA, viewed 27 February 2025, <<https://finca.org/our-work/microfinance>>.

Zia, U ur R, Aslam, H, & Majeed, Z 2023, 'Financing Pakistan's Low Carbon Development and Climate Resilience through Green Bonds', <https://sdpi.org/financing-pakistans-low-carbon-development-and-climate-resilience-through-green-bonds/publication_detail>.