ADBI Working Paper Series

GREEN FINANCE IN BANGLADESH: POLICIES, INSTITUTIONS, AND CHALLENGES

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No. 892
November 2018

Asian Development Bank Institute

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Suggested citation:

Hossain, M. 2018. Green Finance in Bangladesh: Policies, Institutions, and Challenges. ADBI Working Paper 892. Tokyo: Asian Development Bank Institute. Available: https://www.adb.org/publications/green-finance-bangladesh-policies-institutions-challenges

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The author wishes to thank the IDCOL for allowing him to use its data. The author also thanks Marjan Hossain for her excellent research assistance.

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Abstract

This paper provides an overview of Bangladesh's green financing status, with a particular focus on the renewable energy (RE) sector. Despite having great potential of renewable energy sources, the sector currently consists of a meager 1% share of the energy portfolio. The poor performance of the renewable energy sector is attributable to factors such as the lack of the required technology, a regulatory and institutional framework, and proper policies and incentives. This paper discusses both the potential for and the impediments to expanding renewable energy projects. Though the Bangladesh Bank has formulated green banking guidelines, the lack of capacities of banks and financial institutions, the lack of a proper understanding of the risks and returns of green projects, and the underdeveloped equity and bond markets hamper the expected growth of green projects in Bangladesh. As a case study, the paper analyzes various aspects of a successful Solar Home System program, which the Infrastructure Development Company Limited (IDCOL) implemented, to understand the risks and potential of a renewable energy project. The IDCOL's solar homes program in Bangladesh, which has installed 4.13 million solar home systems so far, almost 90% of the total, is a good example of a public–private partnership in green financing. However, this successful program is now on the brink of abandonment due to huge amount remaining default with the customers which is attributed to several reasons such as uncoordinated grid electricity expansion, a lack of coordination among the respective agencies, the failure of the program's commercialization, poor financial governance, and the absence of a national policy oversight body. Therefore, the capacity building of banks and financial institutions, the development of bond and equity markets, a well-coordinated policy oversight body, and mainstreaming green finance are some of the key policy issues that Bangladesh needs to address to promote green financing and achieve sustainable development.

Keywords: green finance, energy security, renewable energy technology, subsidy, Bangladesh

JEL Classification: Q41, Q42, Q43, Q47, Q48

Contents

1. INTRODUCTION

Bangladesh, a low-lying country located on the Ganges–Brahmaputra Delta, is highly susceptible to climate change outcomes, such as floods, draught, salinity, cyclones, sea-level rises, and so on. Almost 75% of its territory lies less than 10 meters above sea level, and more than 700 rivers run through its territory, making it highly vulnerable to climate change risks. The adverse consequences of climate change outcomes would be enormous for a densely populated country of over 160 million inhabitants with 1,252 people per square kilometer. The geographical location, climate vulnerability, dense population, and riverine landscape are the characteristics that make a strong case for green investments in Bangladesh to support its sustainable development. Mainstreaming green finance in climate-resilient and renewable energy projects is thus an important policy challenge for the country.

The impressive economic growth of over 6% in the last decade has accelerated the demand for energy in the country. Since 2000, the per capita energy consumption in Bangladesh has almost doubled to 222.22 kg (oil equivalent) due to the rapid increase in the population, the expansion of production in agriculture and industry, fast urbanization, and the development of roads and transportation (Table A1). At present, the primary source of energy is natural gas (56%), followed by biofuels (24%), oil products and crude oil (13%), coal (6%), and renewable energy (1%) (IEA 2015). As of 2016, about 76% of the population has access to electricity, with 12.5% receiving electricity generated mainly from solar home systems (World Bank 2016). However, a substantial unmet demand for electricity remains. The inadequate supply of electricity badly affects the industry sector. The current electricity generation capacity stands at 15,351 MW with about 3% share from renewable energy sources. The government has set a target to achieve electricity generation of 23,000 MW by 2020, with 10% of the total power demand coming from renewable energy sources. That would require huge investments in the sector. One potential risk is that the country uses about 57% (inclusive of captive power generation) of the country's natural gas production in power generation, and this has become depleted over time, as there is little or no prospect of new extraction of natural gases. The government is thus exploring other sources of energy, such as nuclear power and renewable energy technology. Having strong potential for green energy, including solar, hydro, and other types, the country is yet to reap its full benefit. It is thus important to identify the policy barriers and find a solution for green financing to ensure sustainable and reliable green energy.

The Solar Home System (SHS) program in Bangladesh is one of the most successful solar (green) energy programs, providing about 20 million people with access to solar electricity. The program, which a public non-bank financial institution, the IDCOL, has been implementing, has so far distributed 4.13 million SHSs through mainly NGOs at subsidized prices. This is a good example of a public–private partnership in green financing in Bangladesh. Though people consider the program to be a very successful one, it is now on the brink of abandonment due to huge default amount owed to the customers, which is attributed to some problems like a lack of coordination among various government agencies, weak financial governance, difficulties in commercializing the program, the emergence of a private unregulated market, and so on. Therefore, this paper takes the IDCOL's Solar Home System program as an important case study for an analysis that might unlock various empirical challenges of green energy projects.

It is notable that, like the cases of other developing countries, the IDCOL's SHS program involves a wide variety of support measures, including subsidies, grants, and refinancing facilities for distributing agencies to promote SHSs to people in off-grid areas at an affordable price (Mir-Artigues and Del Río 2016). However, an assessment of the efficiency of subsidies is necessary from the point of view of welfare concerns as well as commercialization perspectives (Yamamoto 2017). At the outset of the current dwindling situation of the SHS market in Bangladesh, we attempt to conduct an in-depth analysis of the subsidies that the SHS program provides, following the approach of Barnes and Halpern (2000), which is based on three factors, efficacy, sector efficiency, and the cost-effectiveness of subsidies. We investigate these aspects through an economic analysis of the demand for SHSs, willingness to pay and subsequent consumer surplus, and the benefit–cost ratio of subsidies.

Apart from the case study of the IDCOL's SHS program, this paper highlights the current status of green financing, including its operational aspects, barriers, and possible solutions. Bangladesh has already adopted various green financing strategies on its own and has remained very vocal in international forums on climate risks and remedies. The Bangladesh Bank (the central bank) has formulated a modus operandi of green financing for banks and financial institutions, which financial institutions now follow. The success of the commercialization of green projects depends on appropriate incentives designed for the private/partner institutions and the way in which the institutions address the operational risks. Given the inadequate supply of green finance, there is a need for the development of green financial instruments, such as green loans, green bonds, and green investment trusts and funds.

This paper thus aims to reflect on green financing in the energy sector, its impact, and its future direction. With this aim, Section 2 discusses the context, Section 3 highlights various aspects of green finance, and Section 4 discusses the case study of the IDCOL's Solar Home System program, in which the analysis attempts to justify the program's subsidy mechanism. Section 5 concludes the paper.

2. THE CONTEXT

2.1 Access to Electricity

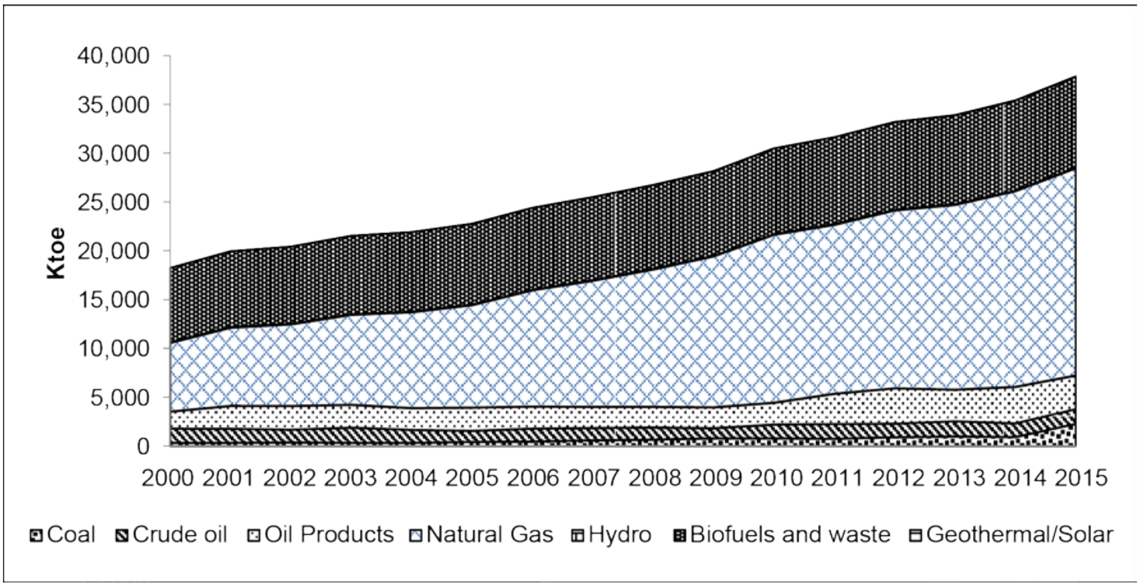
Both the number of electricity consumers and the amount of electricity consumption have increased substantially over time, commensurate with the faster pace of economic growth in Bangladesh. In 2016, the total number of electricity consumers reached 21.8 million. The total electricity consumption has grown by 9.61% per annum. There has been a large increase in the number of electricity customers over the past 24 years, with the electrification rate increasing from 10% to 76% (World Bank 2016). Overall, about 76% of the population now has access to electricity in Bangladesh, about 94% in urban areas and 69% in rural areas (World Bank 2016). Though the access (connections) has increased quantitatively, due to a supply shortage, most people who have connections cannot enjoy the full benefits of access to electricity. Power outages due to an inadequate supply (production) of electricity are still a big concern, and it is necessary to reduce the gap between distribution and generation.

In alignment with the higher demand, the government has set a target to generate 23,000 MW by 2020 (BPDB 2017). Bangladesh's current total installed electricity generation capacity (including captive power) stands at 15,351 MW as of January 2017, of which only about 75% is realized. Problems in distribution, an inconsistent power supply, electricity theft, and fund shortage are some of the difficulties that the power sector has been facing for years. In addition, as gas-powered thermal process now produces the majority of electricity, the gradual depletion of natural gas poses an additional risk to the power generation. That calls for the adoption of long-term sustainable approaches to electricity generation and exploring renewable energy as an alternative energy option.

2.2 Bangladesh's Energy Mix

Bangladesh's total primary energy supply comprises natural gas, coal, oil, solar energy, biofuels, and so on, of which natural gas dominates (Figure 1). In the primary energy mix, the contributions of biofuels and waste have remained almost the same since the country's independence in 1971, while the contribution of natural gas has increased substantially from less than 1% in 1971 to 56% of the source mix. Another important source is oil products, the share of which has increased substantially in recent years. Biofuels still dominate the residential energy consumption, despite a fall in their usage (80 to 67%) since 2000, while a subsequent increase in electricity consumption (6 to 10%) as well as natural gas consumption (7 to 20%) occurred during this time period (IEA 2015). If the power demand continues to grow at the projected rate, the installation of an average of 829 MW per year is necessary over the next 15 years to meet the peak demand in 2030 (SREDA 2015).

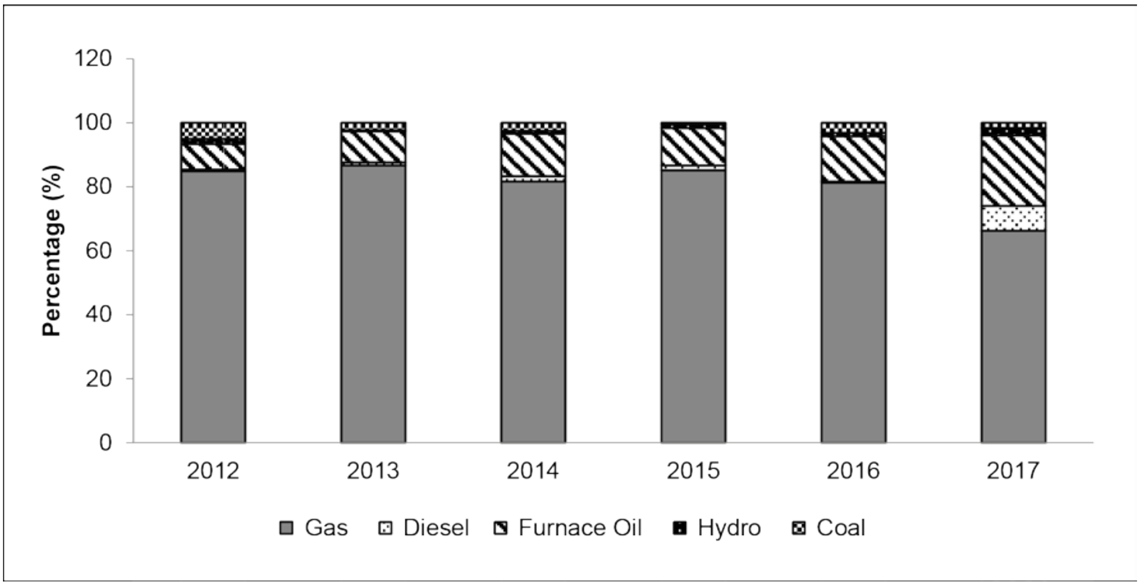
Figure 1: Trends of Primary Energy Sources, 1971–2015



Note: The figure excludes electricity trade. * This graph aggregates peat and oil shale with coal when relevant.
** ktoe stands for thousand tonnes in oil equivalent on a net calorific value basis.
Source: International Energy Agency (IEA) (2015).

Gas-powered thermal generation supplies the majority of electricity (66.3% of the total grid connected capacity in 2017), followed by furnace oil (22%), diesel (8%), and others (3.7%). In recent times, the share of oil-fired and coal-based electricity has increased significantly due to the declining dependency on gas-based production (Figure 2).

Figure 2: Share of Energy Sources in Electricity Generation (of the Total Net Generation), 2012–2017 (September)



Source: BPDB 2017.

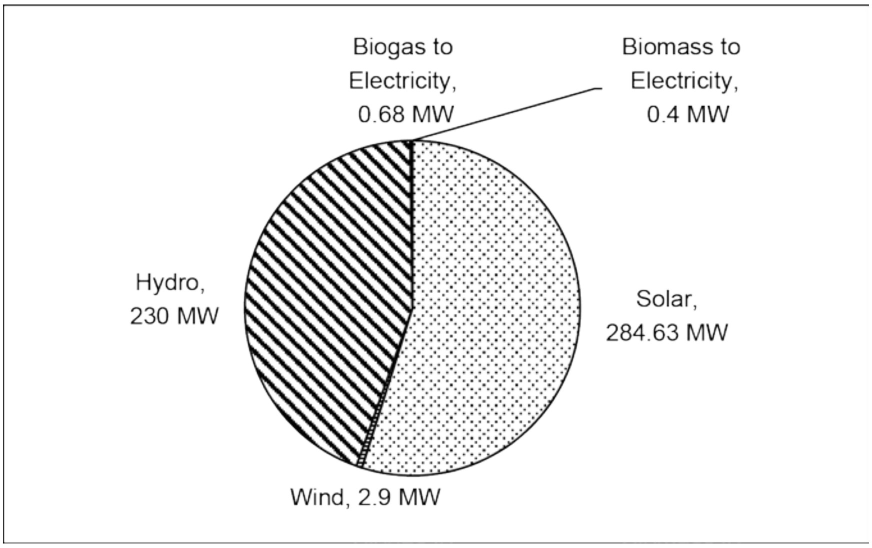
Facing a high probability of natural gas depletion, the government has imposed restrictions on gas-based power-generating projects. In the context of declining indigenous resources, Bangladesh has been exploring various alternative energy options, including renewable energy.

2.3 Green (Renewable) Energy

The key green energy projects in Bangladesh include the Solar Home System (SHS), solar mini grids, solar irrigation pumping systems, biogas plants, and hydropower plants. Currently, about 518.6 MW electricity in Bangladesh comes from renewable energy sources, which is about 3% of the total electricity generation (Figure 3). Bangladesh has acquired about 284.63 MW equivalent solar electricity capacity, which is expected to increase to 10% of the total energy by 2020. The renewable energy mix for generating electricity consists of 55% from solar projects, 44% from the Kaptai Hydropower Plant (230 MW), and a meager 1% from wind, biogas, and biomass.

The government has set a target to generate 500 MW of solar electricity annually, which includes 150 MW from solar irrigation, 190 MW from solar rooftops (public: 160 MW; industrial: 20 MW; and residential and commercial: 10 MW), 25 MW from solar mini-grids and 135 MW from solar parks; this distribution is consistent with the long-term plans of the government (Power Division, 2013). Of course, success of such an ambitious target largely depends on clear and implementable strategies, investments, and proper institutions.

Figure 3: Installed RE Capacity by Type (2018)



Source: Sustainable and Renewable Energy Development Authority (2018).

The long-term plan for increasing renewable energy is to supply 10% of the total electricity, equivalent to about 3100 MW, by increasing the RE capacity by 2021. According to the plan, the government has set investment targets for grid-connected renewable energy technologies, which include utility-scale solar, wind, and waste-to-energy. Using the implementation model, projections have indicated that the solar park and wind farm capacity for Bangladesh for the years 2015–2021 is 1,211 MW and 1,370 MW, respectively (Table 1).

Table 1: New Solar Park and Wind Farm Capacity (in MW)
by Implementation Model

		2015	2016	2017	2018	2019	2020	2021	Total
GoB on government land	Solar park		68	40	50	30	40	45	273
	Wind farm			100	150	150	100	100	600
IPP on government land	Solar park	3	85	50	50	50	50	50	338
	Wind farm			50	100	100	50	50	350
Private on private land	Solar park		100	100	100	100	100	100	600
	Wind farm		20	100	100	100	50	50	420
Total		3	273	440	550	530	390	395	2,581

Source: Sustainable and Renewable Energy Development Authority (2015).

An evaluation of the renewable energy technical potential showed the cumulative annual generation from renewable energy sources to be an estimated 7,010 GWh and the cumulative capacity to be 3,666 MW (Table 2). However, the estimated technical potentials appear to be somewhat unrealistic. It has not made clear in the report what methods and techniques are applied while evaluating technical potentials.

Table 2: Renewable Energy Technical Potential

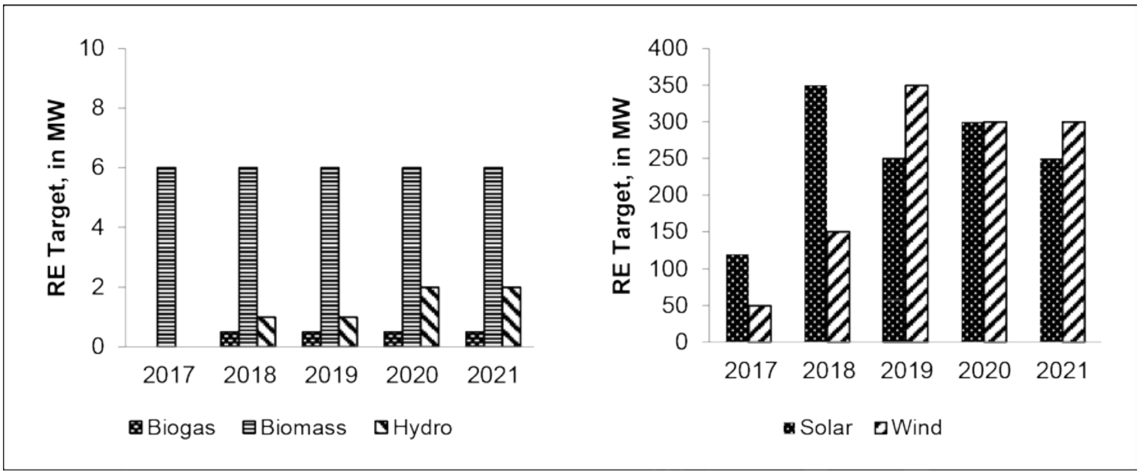
Technology	Resource	Capacity (MW)	Annual Generation (GWh)
Solar Parks	Solar	1,400*	2,000
Solar Rooftops	Solar	635	860
Solar Home Systems	Solar	100	115
Solar Irrigation	Solar	545	735
Wind Parks	Wind	637**	1,250
Biomass	Rice husk	275	1,800
Biogas	Animal waste	10	40
Waste-to-Energy	Municipal Waste	1	6
Small Hydropower Plants	Hydropower	60	200
Mini and Micro Grids***	Hybrid	3***	4
Total		**3,666**	**7,010**

Notes: * Case 1 (agricultural land excluded) estimate; ** Case 1 (flood-prone land excluded) estimate; *** based on planned projects only, not the theoretical maximum potential, because there is a potential overlap with off-grid solar systems. Either could serve the off-grid demand.

Source: Sustainable and Renewable Energy Development Authority (2015).

The RE development targets for the period 2017 to 2021 show that solar (1,270 MW) and wind (1,150 MW) are the major contributors (Figure 4). The government has also set targets to generate 40 MW from waste-to-energy, 30 MW from biomass, 2 MW from biogas, and 6 MW from hydro during the period 2017–2021 (SREDA 2017). However, the progress of implementation appears to be very slow.

Figure 4: RE Development Targets, 2017–2021



Source: Sustainable and Renewable Energy Development Authority (2017).

Ongoing RE Projects

At present, a 900 KW plant at the Muhuri Dam and two 1000 kW plants at Kutubdia are the only grid-connected *wind farms* in operation (SREDA 2018). Two IDCOL-funded biogas plants with 400 KW and 50 KW capacities are in operation, with four more plants ranging from 25 to 100 KW capacities under construction. Because of hydropower having limited potential in Bangladesh due to less sharp land slopes and problems with reservoirs due to frequent flooding concerns, only two *hydropower plants*, namely the 230 MW Kaptai Hydropower Plant and the 10 kW micro-hydropower plant in Bamerchara are in operation. The government has determined the Sangu, Bakkhali, and Matamuhuri rivers along with the Banshkhali Eco-park stream as prospective hydropower locations, which will require a substantial amount of investments for successful implementation. *Solar mini-grid* plants emerged in Bangladesh in 2010. The IDCOL has approved the financing for 25 mini-grid projects, of which 17 are already in operation, and the rest will become operational shortly (IDCOL 2016). Another RE technology is *solar pumps*, which use solar energy to pump water; their primary use is for irrigation. Until now, the IDCOL has approved 629 *solar irrigation pumps*, with 602 pumps being in operation and 27 pumps being under construction (IDCOL 2016).

In off-grid areas, the IDCOL has already installed about 4.13 million *solar home systems*, contributing about 2% of the total power generation and benefiting about 20 million people. It is estimated that there is scope for installing about 7 million SHSs in rural off-grid regions (Khandker et al. 2014). Apart from the IDCOL, the private market is supplying a substantial number of SHSs, along with the government's social safety net programs, which are undertaking free distribution of SHSs.

The abundant availability of biomass makes it a viable option as an energy source for cooking fuel for domestic consumers. One abundant source of biomass in Bangladesh is *rice husks*; the country produces and utilizes an estimated amount of 10 million tonnes annually for power generation (Das and Hoque 2014). To utilize rice husks further, there is a proposal to establish two *rice husk plants* with capacities of 250 KW and 400 KW in Kapasia and Thakurgaon Upazilas, respectively (IDCOL 2016).

The IDCOL's biomass-based improved cooking stoves (ICSs) arrived in the market in 2013. The IDCOL claimed that the ICSs developed so far have the benefits of using fuel up to 50% more efficiently and emitting less smoke than traditional cooking stoves. Another alternative to traditional cooking stoves is to deliver biogas to residential homes for cooking purposes. As of December 2016, the IDCOL has installed more than 44,000 domestic biogas plants, with a target to install about 60,000 domestic biogas plants by 2018 (IDCOL 2016). All these RE projects that the IDCOL has implemented involve a certain amount of grants and subsidies to promote these RE technologies.

Another source of renewable energy is municipal waste. Not only for generating power, municipal waste is a source of gas. The government intends to commission plants with a combined capacity to process 1,000 tonnes of waste to produce 10 MW of power and then to increase the capacity to process 5,000 tonnes of waste to generate 50 MW of power within the next 3 years. The two semi-aerobic sanitary landfills established in Matuail and Amin Bazar are now in operation and are managing 2,700 to 3,000 tonnes of waste per day (CCAP 2013).

3. CURRENT STATE OF GREEN FINANCING IN BANGLADESH

3.1 Sources of Green Finance

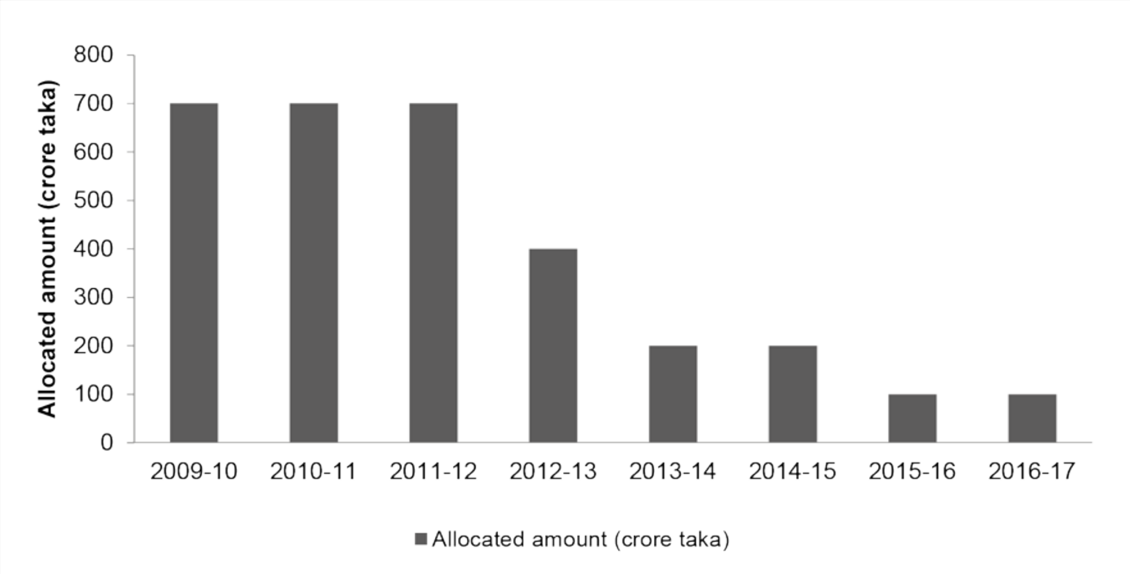
Given the supply–demand gap in electricity generation, investment in the renewable energy sector offers an appealing opportunity. However, the implementation of these grid-connected renewable energy technologies has been slow, despite the significant technical potential. The key challenges for the successful implementation of RE projects include the lack of a comprehensive legal and regulatory framework, the availability as well as the high price of land, technical potential data, and accessible commercial financing from financial institutions. Financial institutions appear to be reluctant to finance RE projects, because they generate a lower rate of return and involve a higher investment risk than fossil fuel projects (Yoshino and Taghizadeh-Hesary 2018).

Hence, it is important to look for various financing tools and methods (banking and non-banking solutions) to secure the flow of funds and growth in the RE sector. Therefore, to encourage RE investment, improving regulations, such as establishing a formal feed-in tariff in addition to providing mini-grid investors with appropriate compensation after transmission expansion, are some of the key measures that Bangladesh can undertake to facilitate the scaling up of RE in the country. Grants as well as low-interest funding could make both grid and off-grid projects more viable.

As financial institutions are reluctant to invest in green projects due to risk–return concerns, the government has established two flagship green funds, namely the Bangladesh Climate Change Trust Fund (BCCTF) and the Bangladesh Climate Change Resilience Fund (BCCRF), which, as of now, are the main sources of green finance in Bangladesh. The Climate Change Trust Act of 2010 established the BCCTF with the country's own budget. The creation of this fund had two initial goals: to fund adaptation projects and to reduce the development time for adaptation projects. With an initial allocation of Tk700 crore in 2010, the accumulated resources of the fund stood at Tk3,100 crore (approximately $400 million) in 2017, with a declining trend of yearly allocations (Figure 5). Over the period, the fund disbursed several hundred million US dollars to several hundred projects of different government ministries as well as to NGOs. However, journalists and NGOs brought to light a number of instances of misallocation and corruption, which may be the causes of the declining allocation in the fund (Huq 2016).

On the other hand, the Bangladesh Climate Change Resilience Fund (BCCRF) is a donor-aided fund established in May 2010 that received donations of $188.2 million from various donors, including the United Kingdom ($96.9 million), the United States ($13.0 million), Switzerland ($12.5 million), Sweden ($19.3 million), Australia ($7.1 million), Denmark ($1.8 million), and the EU ($37.6 million), between 2010 and 2015. Bangladesh has also received total grants worth $143.59 million to implement 41 projects from the Global Environment Facility (GEF), which was established in 1991 (Khan et al. 2017). The World Bank set up a Climate Investment Fund (CIF) in 2008 with funding from 14 developed nations, the UK being the leader. It is composed of 4 programs, of which Bangladesh accesses funds from 3: the Pilot Program for Climate Resilience, the Scaling Up Renewable Energy in Low Income Countries Program, and the Forest Investment Program. Bangladesh received $110 million (45% as grants and 55% as highly concessional loans) in 2010. The SREP has approved Bangladesh an amount of $75 million, of which $35.75 million were grants. Bangladesh also accesses funds worth $40 million from the Climate Resilient Infrastructure Mainstreaming (Khan et al. 2017).

Figure 5: Amount Allocated by the GoB to the BCCTF



Source: Bangladesh Climate Change Trust Fund, Ministry of Environment and Forests (MoEF) (2017).

In addition to public green funds, the policy guidelines for green banking that the Bangladesh Bank prepared instructed banks and financial institutions (FIs) to form a "Climate Risk Fund." They directed the banks and financial institutions to allocate at least 10% of their corporate social responsibility (CSR) budget to the Climate Risk Fund, either by providing direct grants or by providing finance at a reduced rate of interest. In addition, they instructed banks and FIs to provide financing for solid waste management systems, rainwater harvesting plants, and solar power panel projects. In 2016, 56 banks and 33 FIs allocated a total amount of Tk376,078.12 million, of which borrowers have utilized Tk112,583 million (about 30%) (Table A2).

Though Bangladesh has not yet incorporated any inclusive green financing strategies, the Bangladesh Bank has been promoting green financing through concessional refinancing schemes and credit quotas for FIs as well as formulating guidelines for green banking and donor-supported sector-specific transformational projects. In January 2016, the Bangladesh Bank set a mandatory 5% credit quota for direct green finance out of the total loan disbursement of all banks and FIs. The total green finance as of 2016 was Tk503.2 billion, which 38 banks and 9 FIs disbursed, with private commercial banks (PCBs) contributing the major portion, 80.4% (Table 3). The amount of indirect green finance (Tk469.9 billion) exceeded the total amount of direct green finance (Tk33.4 billion) in 2016.

Table 3: Direct and Indirect Green Finance in FY 2016
(Tk Million)

Type of Banks/NBFIs	Direct Green Finance	Indirect Green Finance	Total Green Finance	Sector-Wise Contribution (%)
SCBs	2,013.7	1,234.5	3,248.2	0.6
DFIs	30.1	0.0	30.1	0.01
PCBs	24,597.4	379,887.5	404,485.0	80.4
FCBs	768.8	77,547.3	78,316.1	15.6
NBFIs	5,948.2	11,193.8	17,142.0	3.4
Total	33,358.2	469,863.1	503,221.3	100

SCB: state commercial bank, DFI: development finance institution, PCB: private commercial bank, FCB: foreign commercial bank, NBFI: non-bank financial institution.

Source: Bangladesh Bank 2016.

Private commercial banks and NBFIs were the dominant players in financing most of the categories, such as renewable energy (16%), fire burnt bricks (21%), recycling and recyclable products (15%), setting up green industries (15%), and liquid waste management (14%) (Table 4). However, the IDCOL continues to be the main non-bank financial institution (NBFI) contributor and promoter of renewable energy technologies.

Table 4: Green Finance in Different Products (Tk Million)**, 2016**

Category of Green Finance	SCBs	DFIs	PCBs	FCBs	NBFIs	Total
Renewable energy	44.4	4.2	1,605.0	182.0	3,660.2	5,495.7
Energy efficiency	10.1	0.0	2,394.3	0.6	125.3	2,530.3
Solid waste management	0.0	0.0	12.2	0.0	0.0	12.2
Liquid waste management	26.3	0.0	4,326.5	36.2	449.0	4,838.0
Alternative energy	160.0	0.0	164.8	0.0	9.2	334.0
Fire burnt bricks	1,003.8	25.3	5,353.9	0.0	775.0	7,157.9
Non-fire block bricks	0.0	0.0	169.8	0.0	40.0	209.8
Recycling and recyclable products	99.1	0.0	4,179.6	80.0	518.8	4,877.4
Green industry	380.0	0.0	4,106.2	283.6	256.0	5,025.8
Safety and security of factory	0.0	0.0	1,817.1	34.8	95.5	1,947.4
Others	290.1	0.6	467.9	151.7	19.3	929.6
Total	2,013.7	30.1	24,597.4	768.8	5,948.2	33,358.2

SCB: state commercial bank, DFI: development finance institution, PCB: private commercial bank, FCB: foreign commercial bank, NBFI: non-bank financial institution.

Source: Bangladesh Bank 2016.

The Bangladesh Bank established a refinancing scheme worth Tk2 billion for "Renewable Energy and Environment Friendly Financeable Sectors" in 2009 to facilitate financing possibilities for green products, such as solar energy, biogas plants, and effluent treatment plants (ETPs). As of September 2016, four banks and one financial institution have signed participation agreements with the Bangladesh Bank to access the fund. From 2012 to 2016, the aggregate refinanced amount under the scheme stood at Tk2678.9 million. However, the total disbursement under the refinancing scheme for green products has been very slow though it has geared up in recent years–increased from Tk393.5 million in 2015 to Tk919.7 million in 2016 (Table 5).

Table 5: Disbursement Trend of the Bangladesh Bank's Refinance Scheme for Green Products (Tk Million)

Green Product Category	FY12	FY13	FY14	FY15	FY16
Biogas	133.2	113.6	212.8	83.3	84.8
Solar home system	10.5	40.2	32.2	87.5	114.7
Solar irrigation pump	8.4	0.0	17.9	26.5	0.6
Solar assembly plant	248.8	122.7	49.6	148.1	16.3
Solar mini-grid	0.0	0.0	0.0	0.0	10.0
Effluent treatment plant	22.2	57.4	10.0	0.0	58.0
HHK technology in brick kiln	55.0	172.2	59.0	47.0	177.8
Vermicomposting	0.0	0.0	0.0	1.1	1.6
Green industry	0.0	0.0	0.0	0.0	400.0
Safe working environment for textile and garment industry workers	0.0	0.0	0.0	0.0	35.7
Organic manure from slurry	0.0	0.0	0.0	0.0	0.2
Paper waste recycling	0.0	0.0	0.0	0.0	20.0
Total	478.1	506.1	381.5	393.5	919.7

Source: Bangladesh Bank 2016.

Overall, in 2016, Bangladesh's green financing (spending on climate-sensitive activities) consisted of about 5-6% of the country's GDP and 22% of the total government budget. Over the years, Bangladesh's climate expenditures have risen. Despite a small decrease during 2012, 2013 saw a significant increase (over 50%) in climate expenditures (UNDP 2016). The government mainly funds Bangladesh's climate expenditures, disbursing up to 80% of the total climate expenditures.

3.2 Institutions and Policies

Bangladesh Bank: As the central bank, the Bangladesh Bank remains the primary enabler and source of green finance in Bangladesh. It has devised green banking guidelines for banks and financial institutions to promote green financing. It devised the guidelines in 2011 for implementation in two phases. Phase one includes (1) policy formulation and governance; (2) the incorporation of environmental risk into credit risk management (CRM); (3) the initiation of in-house environment management; (4) the introduction of green finance; (5) the creation of the Climate Risk Fund; (6) the introduction of green marketing; (7) online banking; (8) supporting employee training, consumer awareness, and green events; and (9) the disclosure and reporting of green banking activities. In phase two, banks and FIs are required to formulate: (1) sector-specific environmental policies; (2) green strategic planning; (3) setting up green branches; (4) improved in-house environment management; (5) the formulation of bank-specific environmental risk management plan and guidelines; (6) rigorous programs to educate clients; and (7) the disclosure and reporting of green banking activities. Despite the directives of the Bangladesh Bank (BB), it is apparent that the SCBs and SDBs are far behind in implementing green banking policies, though only a handful of PCBs and FCBs have initiated some activities towards green banking (Shakil, Azam, and Raju 2014). Despite the steep growth in the disbursement of bank loans to green projects, some banks have yet to disburse funds, while others are in the initial phase of following the BB's policy rules. Considering the slow progress of SCBs and SDBs in becoming involved in green financing, the government might take measures to incentivize its adoption by granting financial aid and technical assistance to these public banks.

Moreover, the Bangladesh Bank insists on a uniform reporting format for banks to report green banking activities, a mandatory credit quota of 5% of the total loan disbursement for banks, and greening banking infrastructures that include solid-waste management, rain water harvesting, and the installation of solar roof-top panels. Moreover, it has prepared environment risk management (ERM) guidelines for banks and FIs for assessing environmental impacts before financing any projects. The Bangladesh Bank has also provided banks and FIs with directives to establish a sustainable finance unit (SFU) in their head offices by merging all types of green banking units and CSR units. As already discussed, it has also created a refinancing scheme window for providing a smooth flow of funds for promoting green projects in Bangladesh.

Sustainable and Renewable Energy Development Authority

The government established the Sustainable and Renewable Energy Development Authority (SREDA) in 2012 as a nodal agency to encourage, facilitate, and propagate sustainable energy, which includes both renewable energy and energy efficiency sectors, to guarantee the energy security of the country. One of the principal mandates of this institute is to maintain coordination among the various organizations working on renewable energy technologies. The SREDA is now operating under the Power Division in the Ministry of Power, Energy, and Mineral Resources of the Government of Bangladesh as a coordination body for the expansion of renewable energy in the country. The SREDA has been functioning to construct and supervise the execution of the renewable energy policy of the government. It has also developed an "Energy Efficiency and Conservation Master Plan" up to 2030. One of the criticisms is that the SREDA does not have sufficient capacity in terms of manpower and logistics as well as funds to deliver its mandated activities and prove itself to be a top policy-making body in the area of renewable energy.

3.3 Challenges of Green Financing in Bangladesh

Although not sufficient, Bangladesh has accessed a certain amount of international green finance, and the domestic banking sector and financial institutions are investing a certain amount of their investment portfolio in green projects. The Bangladesh Bank has encouraged financing for green projects through the establishment of green banking policy guidelines, donor-aided sector-specific transformational projects, an on-lending scheme, credit quotas for financial institutions, and concessional refinancing schemes. In addition to bank finance, Bangladesh has created scope, albeit limited, for green equity finance. Fifteen venture capital firms are currently working on green projects. The first venture capital firm, BD Venture, was established in 2012 and made its initial green investment in a venture called "Sustainable Power Limited," which specializes in products like solar-powered fans and lights. Green projects in Bangladesh are attracting attention from both local and foreign equity investors. Foreign venture companies, such as DEFTA Partners, a US-based venture capital firm, and a number of Nordic companies, are interested in investing in green energy and clean technology-related projects in Bangladesh. On the other hand, underdeveloped bond markets and an immature capital market impede the possibility of green bond facilities in the country.

Though the green banking policy guidelines are in place, the poor capacity of banks and financial institutions to manage green projects has resulted in slow growth of green finance promotion. Among the 50 sectors that the government identified as eligible for direct green finance until 2017, most do not have a well-established investment demand, and the few that are eligible do not usually require investment of more than 5 crore taka. In most cases, small-scale local green entrepreneurs find it difficult to prove their creditworthiness and thus to secure funding in the form of either equity or liability. Banks and financial institutions often receive applications for green funds from small-scale enterprises that do not have proper documents. Moreover, high transaction costs cast a shadow on the benefits of green projects (Khan et al. 2017). Therefore, despite having a policy guideline to disburse a minimum of 5% of the total loan portfolio to green projects, banks and FIs are unable to find enough green project proposals.

Notably, a significant amount of operational and market risks are associated with green projects. While the projects often involve new technology that has not been used much before, generating some risks, the underdeveloped market for green products also poses risks. Moreover, green projects that are reliant on financing through the current guidelines of the Bangladesh Bank are vulnerable to any change in policy. A small change in policy may render them unprofitable. This is applicable to other green projects too. The IDCOL's SHS program is a good example.

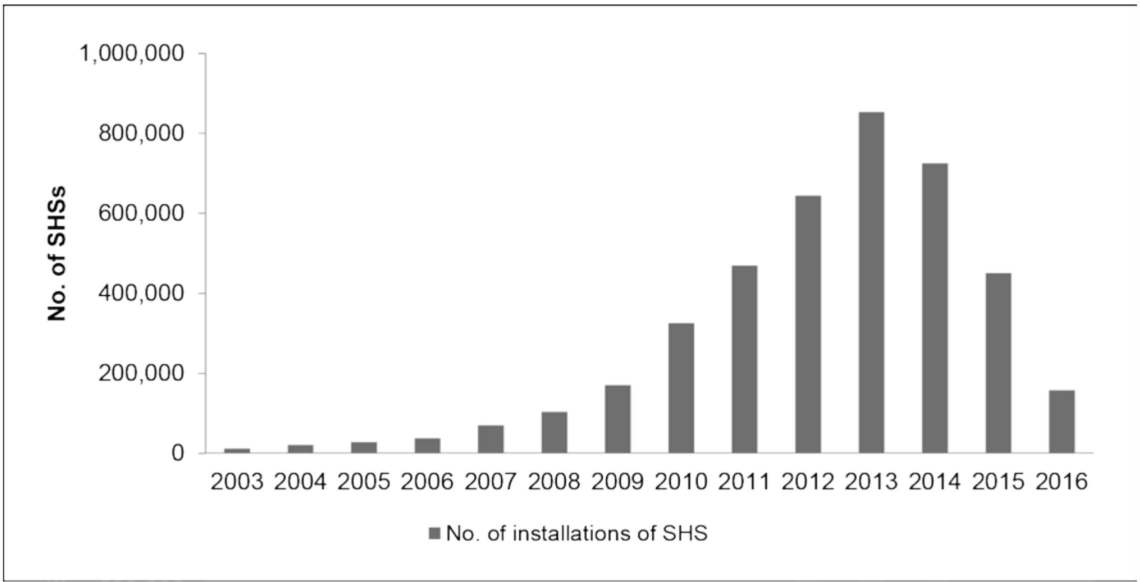
4. CASE STUDY: THE IDCOL'S SOLAR HOME SYSTEM PROGRAM IN BANGLADESH

4.1 Background

The IDCOL's subsidized Solar Home System (SHS) program was arguably one of the fastest-growing off-grid renewable energy programs in the world. Since its introduction in 2003, the SHS program of the IDCOL has distributed about 4.13 million SHSs to ensure a supply of solar electricity to about 20 million people, that is, 12.5% of the country's total population, who had previously used kerosene lamps for lighting. The program reached its peak in 2013, when the average installation of SHSs was about 81,000 units per month (Figure 6). However, the average installation rate started to decline afterwards. In recent months the sales of SHS came down to less than 1000 units per month. This plummeting situation arises not only for decreasing demand for SHS, but also for other reasons, such as the REB's grid expansion, the emergence of a low-cost unregulated private SHS market, and free distribution of SHSs under a social safety net program of the government. To understand the current dwindling situation of the program, it is important to conduct an in-depth analysis of it.

The IDCOL's SHS program provides a good example of a public–private partnership in green energy technologies. The IDCOL involves mainly NGOs for marketing the SHSs in their respective operational areas, which are called partner organizations (POs). POs receive several incentives, such as capital buy-down grants, institutional development grants, and refinancing facilities, from the IDCOL for the credit given to households for selling the SHSs in installments. POs also make a contribution of their own by providing credit, while they receive an institutional development grant. Households make down payments as well as installments. POs receive the credit from the IDCOL at a 6–8% rate and pay it back in 6–8 years. Households pay 12% interest and pay the loan back in 3 years.

Figure 6: Sales Volume of SHSs by POs



Source: Infrastructure Development Company Limited (2016).

However, as the market matured, the IDCOL started phasing out the subsidies and grants. The program started in 2003 with a subsidy of $90 per system, which has fallen to $20 per system since 2015. The capital buy down grant has reduced to $20 applicable to 30 or lower Wp systems since 2015 from $70 for a system irrespective of its capacity (Table 6). The current subsidy structure continues to provide incentives to sellers of smaller systems so that they can keep the price at an affordable level for poor rural households. As a result of the subsidies, the IDCOL is offering a relatively low cost but better quality of photovoltaic panels and batteries than unregulated private market products. Even the price of a typical 50 Wp SHS is relatively lower in Bangladesh (about $408) than in neighboring countries, like India (about $490–500) and Sri Lanka ($480) (Urmee and Harries 2009). However, phasing out of any forms of subsidies entails certain costs, either it be economic or social, that has to be addressed carefully (Hossain et al., 2018).

Table 6: Phasing Out of Subsidies for SHSs

	2003	2004	2006	2008	2010	2012	2013
Capital buy-down grant ($)	70	55	40	40	25	25	20
Institutional capacity development grant ($)	20	15	10	5	3	0	0

Source: Infrastructure Development Company Limited (2016).

From the sustainability perspective of the SHS program, it is necessary to analyze the incentive structure, its efficiency, and the associated derived consumer demand. The study applies several methods of economic analysis of the subsidies and demand here. While the price elasticity determines the sensitivity of a price hike towards the demand, the willingness to pay measures the affordability for consumers in terms of the accrued/perceived benefits from SHSs. That is, while elasticity is the measure of sensitivity across the board, willingness to pay refers to consumers at different levels of income. Furthermore, estimating the internal rate of return (IRR) with/without subsidies helps us to understand the justification for subsidies in terms of the cost–benefit perspectives of households. Thus, the analysis employs several conventional techniques of economic analysis, using data from a primary survey of 462 households, including SHS and non-SHS households, conducted in 7 districts in 2015.

The analysis of the subsidies in the SHS program proceeds following the approaches that Barnes and Halpern (2000) suggested. They proposed to assess the subsidies in a program in terms of their relative *efficacy*, *sector efficiency*, and *cost-effectiveness*. If the subsidy reaches those for whom it is intended, particularly the poor, then it ensures the *efficacy* of the program. If it is structured in such a way that it encourages the provision of the service at the least cost, it indicates the efficiency of the program. However, sector efficiency is an important aspect that it is necessary to address more thoroughly in the energy sector restructuring work, particularly in remote rural off-grid areas. It is possible to measure the *cost-effectiveness* of the program according to whether the subsidies achieve social goals at the lowest program cost while providing incentives to businesses to serve the poor and rural populations. Therefore, in the light of these aspects, this study analyzes the current subsidy structure for SHSs.

The descriptive analysis provides an understanding that subsidies have implications for the changing demand for SHSs amid its effect on prices. In this section, we try to estimate the elasticity of demand for different Wp SHSs and the willingness to pay of the consumers using standard econometric techniques. Moreover, we estimate the justification for subsidies by analyzing the cost–benefit ratios.

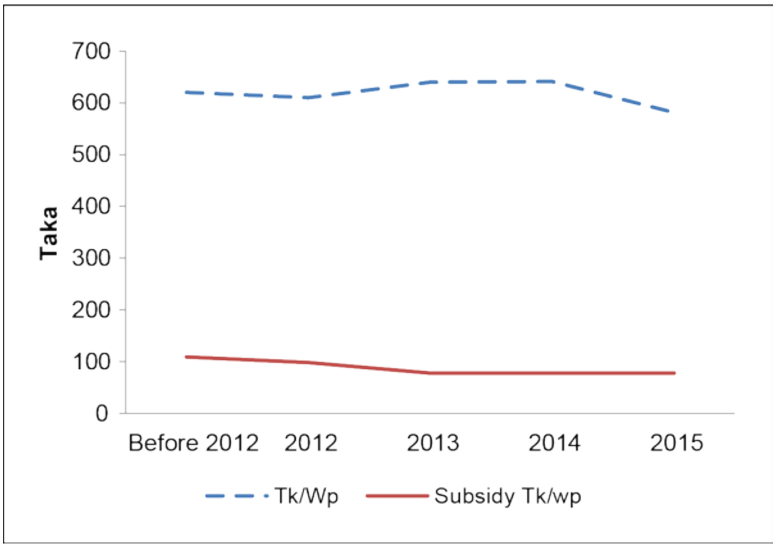
4.2 Characteristics of SHS Beneficiaries

The data come from a primary survey of both adopter (treatment group) and non-adopter (control group) households. We selected a total of 462 households using a multi-stage sampling technique with an equal ratio of adopters and non-adopters (230 vs. 232). Following a systematic random-sampling approach, we selected 22 households from each of the villages. The non-adopter households were from a distant village from the same Upazila (sub-district).

Among the existing current users of smaller SHSs (<=30 Wp), the majority use a 20 watt peak SHS (66.06%), followed by those who use a 30 Wp SHS (25.22%). About 77% of treatment and 83% of control households belong to the poor category. Our estimates suggest that users of the subsidized smaller SHSs are mostly poor and hence the program targets the right segment of the population for the subsidized SHS program.

As Figure 7 shows, the price escalation of SHSs reflects the impact of subsidy reduction. While the price of SHSs per Wp was about Tk620 in 2012 and 2013, it had jumped to Tk640 in 2013 and continued to rise until 2014 due to the reduction of subsidies and grants at a rate of Tk20/Wp (considering a 20 Wp SHS). Thus, the increase in price was just the amount of the subsidy reduction. However, the price of SHSs again declined to about Tk581/Wp without further subsidy reduction, which was partly due to technological advancement for the SHS panel, relaxation of battery specifications, better marketing strategies, and increased competition among the service providers. Thus, further subsidy reduction will affect the price of SHS if POs' do not improve its operational efficiency.

Figure 7: Impact of Subsidy Reduction on the Price of SHSs



Source: IDCOL provided the price data.

4.3 Analysis of Subsidies

Elasticity of Demand and Implications

The reverse "Ramsey pricing" principle calls for subsidies to focus on those products or services with a higher elasticity of demand to achieve the maximum market expansion per invested subsidy amount (Mostert 2001). Therefore, we first estimate the elasticity of demand for adopting an SHS, particularly for both poor and non-poor segments of the population, using a probit regression model (Table 7). We find that the estimated elasticity is very high for the poor (–0.96) compared with the non-poor (–0.36), indicating the justification for subsidies.

Table 7: Estimated Demand Elasticity for SHSs (Probit Estimates)

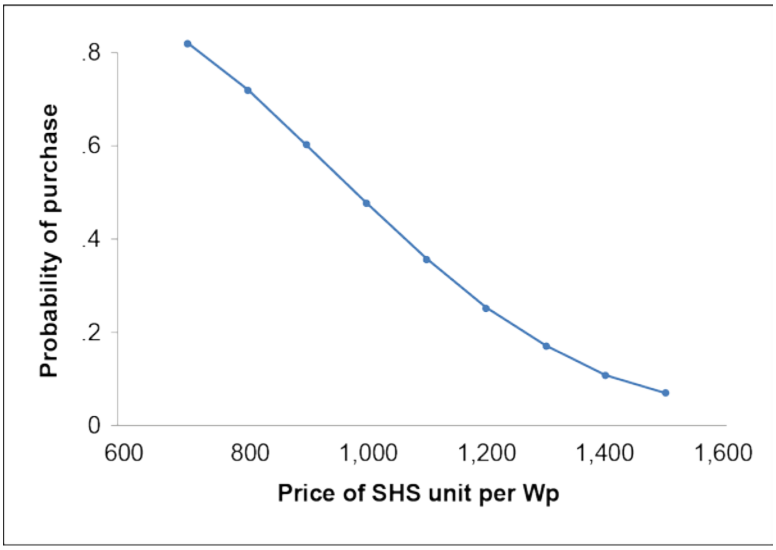
	Non-poor	Poor	All
Price of offered SHS unit per Wp (Tk)	–0.3597	–0.9624	–0.853
Age of household head	–0.0297	–0.0351	–0.040
Household land asset (decimal)	0.0237	0.0231	0.021
Cost incurred (Tk./month) for energy without solar and natural	–0.0498	0.0035	0.001

Note: We estimated the elasticities including both the groups' WTP, which we obtained through the contingent valuation (CV) technique.

Source: IDCOL Survey (2015).

Further, we estimated the probability of purchasing an SHS at different prices by employing the probit model, as Figure 8 shows. It is apparent that, as the price of SHSs rises, the probability of purchase declines.

Figure 8: Probability of SHS Purchase at Different Prices



Source: Author's estimation.

The higher price elasticity of demand for various Wp SHSs indicates that subsidies should matter for making SHSs popular among the people, particularly the rural poor. To substantiate the results, we further estimate the willingness to pay (WTP) and test the sensitivity of subsidy reduction to the prices of SHSs in the following section.

Gradual Subsidy Reduction and its Impact on Willingness to Pay

We estimate the consumer surplus as the difference between the consumers' maximum WTP for an SHS unit and the actual cost of the services. The survey randomly offered the respondents different packages, from which they chose one. The method is well known as the contingency valuation (CV) method. The estimated WTP is higher for relatively higher Wp capacity SHSs, and so is the consumer surplus (Table 8). The net benefit to the households is the highest when they purchase an SHS with Wp 30.

Table 8: Estimated Willingness to Pay and Consumer Surplus

SHS Size Owned (Wp)	**WTP**	**Actual Price Households Paid to Purchase the SHS**	**Consumers' Surplus**	**Probability of Purchase**
Non-SHS user	–	–	–	0.895
10	13,867.89	9,403.20	4,464.69	0.992
20	16,602.58	14,039.50	2,563.08	0.643
30	25,764.75	16,325.00	9,439.75	0.676

Source: IDCOL Survey (2015); author's estimation.

Based on the higher consumer surplus, we then test the sensitivity of subsidy reduction to the prices of SHSs. The survey made offers to the respondents considering various prices with a gradual subsidy reduction at a rate of $20, $10, and $0. The results show that customers are apparently less willing to buy SHSs if the price escalates due to further reduction of subsidies (Table 9). Similar results are evident for non-adopters. The findings suggest that the current level of subsidy, if withdrawn, may affect customers' purchasing decision regarding SHS panels. Subsidies thus play an important role in making SHSs popular among rural people.

Table 9: Current Users' Sensitivity to Price Changes with Gradual Reduction of Subsidies

Option for Subsidies	Watt Peak	Price/Unit (Cash)	Down Payment (15%)	Final Price after Three Years	Adopters' Willingness to Buy (%)	Non-adopters' Willingness to Buy (%)
	[a]	[b]	[c]			
$20	10WP	7,200.00	1,080.00	9,403.20	27.78	61.11
$10	10WP	7,970.00	1,195.50	10,408.82	8.33	50
$0	10WP	8,740.00	1,311.00	11,414.44	33.33	70.59
$20	20WP	10,750.00	1,612.50	14,039.50	68.44	97.37
$10	20WP	11,520.00	1,728.00	15,045.12	72	87.50
$0	20WP	12,290.00	1,843.50	16,050.74	68.75	81.25
$20	30WP	12,500.00	1,875.00	16,325.00	92.31	100
$10	30WP	13,270.00	1,990.50	17,330.62	87.5	90.32
$0	30WP	14,040.00	2,106.00	18,336.24	80.77	80

Source: IDCOL Survey (2015).

Cost–Benefit Analysis of Subsidies

The benefit–cost ratio (BCR) focuses on the distributional aspect of subsidies (Miere 2003). We attempt to perform a cost–benefit analysis of the adoption of an SHS as the avoided costs of the services in unelectrified households that the SHS would replace with a certain amount of subsidies. These services include lighting (largely from kerosene lamps and some candles and torch cells) and television and radio (largely run on dry cells and rechargeable batteries). Such an analysis provides a lower bound for the economic benefits, because it does not account for the fact that SHSs provide a greater level of service. For example, a 20 Wp system is capable of providing 10 times as many lumens of better-quality light as the kerosene lamp(s) that it replaces. In addition to the fuel replacement cost, the analysis includes other costs, such as VAT and interest expenses, in estimating the benefit–cost ratio. The analysis also provides an understanding of the economic and financial benefits with a gradual reduction of subsidies for higher watt peak systems.

Table 10 reports the estimated economic rate of return (EIRR) and financial rate of return (FIRR) for the systems 10 Wp, 20 Wp, and 30 Wp with the existing subsidy structure at $20 per system, assuming that an SHS will last for 20 years. The analysis shows that the FIRR is about 10% higher than the EIRR for the 10 Wp system, while it is about 5% higher for the other 2 systems. Thus, subsidies generate relatively higher benefits for the smaller system adopters, who are mostly poor. Overall, the current subsidies generate a certain level of benefits for the system adopters, and a gradual reduction (a hypothetical scenario with $15 for 20 Wp and $10 for 30 Wp) will decrease the benefit to some extent. The BCRs are greater than 1 in both the cases—purchase by either cash or installation with a 15% down payment—though the benefit is higher if it is purchased in cash.

Table 10: Economic and Financial Analysis of SHSs (FIRR and EIRR)

	No Change in Current Subsidy Structure ($20/System)			Gradual Reduction for 20 Wp and 30 Wp: Subsidy $15	Gradual Reduction for 20 Wp and 30 Wp: Subsidy $10
	10 Wp	20 Wp	30 Wp	20 Wp	30 Wp
Financial Analysis					
FIRR: Cash	37.77	20.22	26.83	20.22	22.42
FIRR: 15% Down Payment	35.51	13.33	22.66	13.33	18.00
BCR: Cash	1.31	1.11	1.23	1.11	1.14
BCR: 15% Down Payment	1.22	0.97	1.13	0.97	1.05
NPV: Cash (Tk)	4,340.11	1816.49	2,687.40	1,816.49	2,886.36
NPV: 15% Down Payment (Tk)	3,305.35	–639.95	1,652.64	-639.95	1,138.61
Economic Analysis					
EIRR: Cash	26.37	16.11	19.51	17.01	20.22
EIRR: 15% Down Payment	22.76	10.59	16.01	11.20	16.10
BCR: Cash	1.19	1.02	1.10	1.04	1.10
BCR: 15% Down Payment	1.12	0.90	1.02	0.92	1.02
NPV: Cash (Tk)	2,983.59	459.97	1,330.88	799.10	2,208.10
NPV: 15% Down Payment (Tk)	1,948.83	–1,996.47	296.12	–1657.34	460.35

Source: IDCOL Survey (2015); author's estimation.

Are Subsidies Worth Continuing?

Our results in the previous sections well justify the allocation of subsidies to SHSs. About 80% of the smaller and subsidized SHS adopters are poor, and there is a high degree of willingness to adopt the system among the poor non-adopter group of people. The withdrawal of subsidies for higher Wp systems (>30 Wp) and the partial reduction of subsidies for smaller SHSs will result in a price hike for the respective SHS, which is likely to affect the purchasing decisions of the poor. In Bangladesh, the IDCOL involves NGOs for marketing SHSs because of their wide rural networks. Though a trivial unregulated private market outside the IDCOL market does exist, the quality of PV panels and accessories available in the market could not be ascertained due to the absence of a regulatory or oversight body. Again, the cost–benefit analysis ensures the cost-effectiveness of subsidies, as subsidies generate relatively greater benefits for the smaller system adopters, who are mostly poor.

While the efficacy and cost-effectiveness concerns confirm that the current subsidy structure applicable to the smaller SHSs is appropriate for the poor, the market efficiency issue raises some doubts regarding whether POs are posing any obstacles to the entry of better-quality PV modules and making supra-normal profits from this incentivized structure by depriving the poor of the right price for the SHSs. The current plummeting situation of the IDCOL's SHS market triggers failure on the part of the IDCOL in commercializing and privatizing the SHS market to a certain extent. With the gradual withdrawal of subsidies, the prices of SHSs remained at a level above that of the private market, decreasing the demand for the IDCOL's SHSs among the poorer households. Not only their financial constraints but also the lower prices of similar-capacity SHSs in the private market have motivated people to default on their due installments for the IDCOL's POs. Thus, the analysis justifies the provision of subsidies to SHSs.

The other issues, such as the uncoordinated expansion of grid electricity, the emergence of an unregulated cheaper private market, and the free distribution of SHSs under two social safety net programs, KABITA and TR, have also contributed to the current dwindling state of the program. Broadly, we have identified the following factors that are responsible for the current sorry state of the IDCOL's SHS market: (i) the lack of policy coordination among the stakeholders; (ii) the IDCOL's financial approach lacking foolproof financial governance; (iii) POs' motive for evading the repayment of loans in the context of weak financial governance; (iv) the absence of a national oversight policy body of renewable energy programs; and (v) the IDCOL's failure to commercialize the program.

The IDCOL's SHS program provides a case for learning regarding the implementation of RE technologies in developing countries from the perspectives of welfarism versus commercialization. It is rather difficult for a profit-motivated institution to run a program from the welfare perspective. Therefore, the IDCOL failed to transform it into a commercially viable program by conducting dynamic assessments over time. This calls for a national RE oversight body with the objective of analyzing the situation and guiding the respective agencies in the right direction. Perhaps the SREDA could have played the role, but in reality this has not happened, as a result of which the once successful SHS program has had to be abandoned abruptly.

5. CONCLUSIONS

It is important for a country like Bangladesh, which is highly vulnerable to climate change risks, to move forward by incorporating green finance into its mainstream finance. However, it is necessary to address some challenges. For example, the country must build the capacity to evaluate the financial implications of the environmental risks as well as internalizing the environmental externalities. For this purpose, it should develop uniform techniques and formats. On the other hand, proper incentives and measures are necessary to improve the entrepreneurial interest in green projects. Local businesses require profit incentives that could encourage investment in green project models. The IDCOL's Solar Home System program in Bangladesh provides the lesson that only incentives are not sufficient; in addition, coordination among all the stakeholders and a gradual move to commercialization of the model with dynamic assessment are essential for making green finance sustainable. Green energy projects, such as solar irrigation, solar mini-grids, and so on, usually have a larger initial investment demand, which might lead to a maturity mismatch, as it involves a longer payback time period.

A positive point is that the Bangladesh Bank is taking the lead in introducing green finance into the local market with a clear vision of internalizing green banking in the financial sector. It has introduced a host of policy decisions for environmental and social safeguards for banks and non-bank financial institutions to follow while disbursing loans to commercial enterprises. However, a host of challenges are holding back the initiatives, including low or insufficient investment demand for green projects, a lack of skills in assessing the financial implications of environmental risks, the high risk associated with funding new green technologies and other untested green ventures, and high transaction costs in disbursing green loans to small-scale entrepreneurs with no or poor prior credit records. Further initiatives to address these challenges are necessary to make the SFU functional. Moreover, the role of the capital market in financing green projects is not favorable considering the underdeveloped bond market and the limited exposure of venture capital firms in Bangladesh. It is notable that only a handful of venture capital and impact investment funds are in operation in the market. Due to the lack of a proper business environment and regulatory framework for attracting impact investments, the potential for generating green equity finance remains limited.

The risk associated with green projects has always been a big challenge for making green projects successful in countries like Bangladesh. Green projects usually involve a certain degree of operational risks because of the adoption of new technology as well as the commercialization perspectives. The IDCOL's SHS program suggests that, in the case of customer defaults, it becomes very difficult to enforce guarantees due to the financial weaknesses of the small entrepreneurs who undertook the risks of marketing or producing green products. Another aspect is the enhancement of the risk profile if green projects are susceptible to policy changes. Considering the consumer demand and the high risks associated with green products, shared equity ownership among stakeholders to some extent could solve the problem of popularizing green projects, which consequently could help to achieve green growth.

Therefore, the capacity building of banks and financial institutions, the development of bond and equity markets, a well-coordinated policy oversight body, and mainstreaming green finance are some of the key policy issues that Bangladesh needs to address to promote green financing for achieving sustainable development.

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APPENDIX: TABLES AND FIGURES

A. Tables

Table A1: Development of the Green Economy in Bangladesh

Indicators	1980	1990	2000	2010	2014
Energy production (kt of oil equivalent)	6,745	10,760	15,156	26,080	29,457
Energy use (kt of oil equivalent)	8,453	12,738	18,262	30,513	35,423
Energy use (kg of oil equivalent per capita)	103.1	119.9	138.8	200.6	222.22
Electric power consumption per capita (kwh)	18.68	48.37	101.5	239.8	310.39
Combustible renewable and waste (% of total energy)	67.26	53.88	41.7	28.83	26.05
Population (million)	81.47	106.19	131.58	152.15	162.95 (2016)
GDP (constant 2010 US billion $)	28.63	42.42	67.01	115.28	167.77 (2016)
Particulate emission damage (% of GNI)		3.77	1.85	1.33	1.19 (2015)
CO_2 emissions (kt)	7,638	15,533	27,869	59,992	68,951 (2013)
CO_2 emissions (kg per 2010 US$ of GDP)	0.27	0.37	0.42	0.52	0.50 (2013)
CO_2 emissions (kg per 2011 PPP $ of GDP)		0.11	0.13	0.16	0.15 (2013)
CO_2 emissions (metric tonnes per capita)	0.09	0.15	0.21	0.39	0.44 (2013)
CO_2 damage (% of GNI)	0.18	0.42	0.73	1.16	1.17 (2015)
Rate of deforestation (average annual %)	0.18 (2000 to 2015)				

Sources: International Labour Organisation (ILO) (2010, 2014); The World Bank; and other sources.

Table A2: Allocation and Utilization of Fund for Green Banking Activities (2016)

Annual Allocation of Fund, 2016 (in Million Taka)				
Type of Bank/FI	**Green Finance**	**Climate Risk Fund**	**Marketing, Training, and Capacity Building**	**Total**
SCBs (6)	13,770.75	146	402.75	14,319.50
SDBs (2)	800	2	1	803
PCBs (39)	267,260.28	386.68	287.09	267,934.04
FCBs (9)	69,309.15	122.45	65.3	69,496.90
FIs (33)	23,450.83	48.95	24.9	23,524.68
Grand Total	374,591.01	706.08	781.03	376,078.12
Utilization of Funds, July–September 2016 (in Million Taka)				
Type of Bank/FI	**Green finance**	**Climate Risk Fund**	**Marketing, Training, and Capacity Building**	**Total**
SCBs (6)	1,018.33	0	0.06	1,018.39
SDBs (2)	5.03	0	0	5.03
PCBs (39)	85,345.03	242.32	8.02	85,595.37
FCBs (9)	22,863.41	13.28	0	22,876.69
FIs (33)	3,086.20	0.5	0.82	3,087.52
Grand Total	112,318.00	256.1	8.9	112,583.00

* Note: The corresponding numbers of institutions are in brackets.

Source: Quarterly Report on Green Banking Activities (Bangladesh Bank 2016).