



CASE STUDY

How IDCOL Addressed the Affordability Gap: Lessons from Bangladesh’s Solar Home System Program

Background and Rationale for the Program

In 2003 Bangladesh was in the midst of a huge electricity access challenge - the national access rate was 37%, with over fifteen million rural households lacking access to electricity¹. It was estimated that achieving universal electricity access would take 30 years, owing to slow grid expansion and severe power shortages².

The Government had already recognised the value of SHS and had eliminated import duty on solar home systems (SHS) in 2000. In 2003, they launched the Infrastructure Development Company Ltd (IDCOL) SHS program to further support the uptake of SHS. IDCOL is a government-owned financial intermediary with a mandate to provide long-term financing for

private infrastructure projects. Together, these government actions created strong demand for off-grid solar among the population, which contributed to the program’s success (Figure 1). The IDCOL SHS program became one of the most successful off-grid electrification programs ever, leading to the sale of over four million solar home systems over 15 years³.

Design Overview

The IDCOL SHS Program is the largest national off-grid electrification program in the world, and one of the longest running⁴. From 2003-2018 it provided electricity services to about 20 million people, with a total investment of USD 1.1 billion (current dollar value), at an average of USD 266 per household. In total, development partners provided USD 683 million in grants and loans. The World Bank provided USD 416 million in IDA

credit, and grants totaling USD 81 million. This funding was used to leverage private investment from users, partner organizations, distributors, and manufacturers. Payments from SHS customers, equity investments from partner organizations, and upstream investments by manufacturers and distributors are estimated to have contributed a further USD 412 million⁵.

1 “Living in the Light: The Bangladesh Solar Home Systems Story.” A World Bank Book Publication.

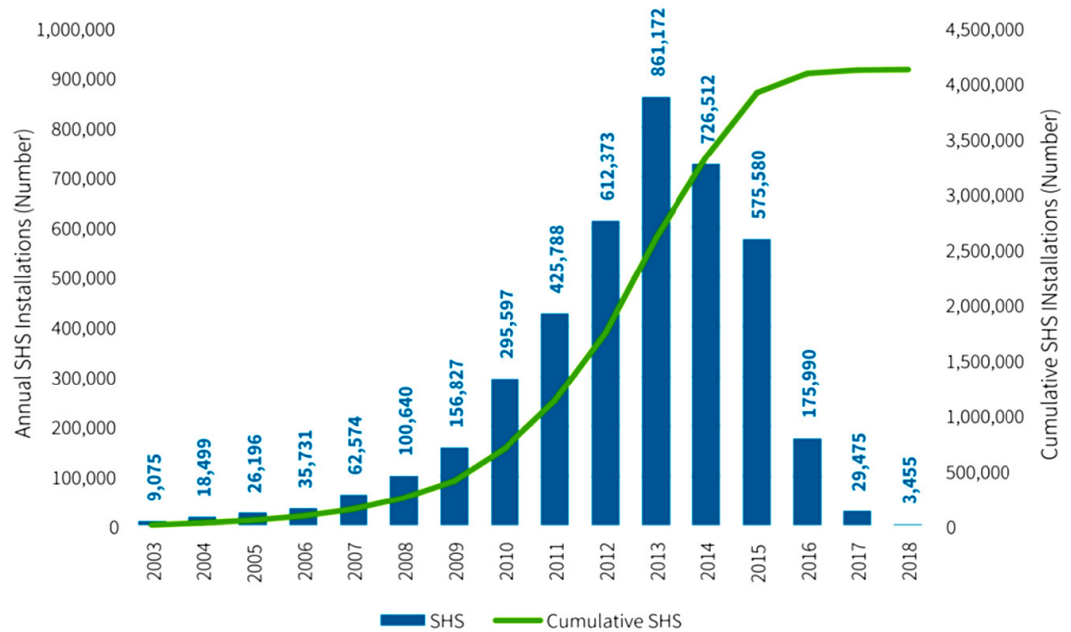
2 Power Point Presentation. December 2020. “Living in the Light: The Bangladesh Solar Home Systems Story.”

3 “Living in the Light: The Bangladesh Solar Home Systems Story.”

4 “Living in the Light: The Bangladesh Solar Home Systems Story.” A World Bank Book Publication.

5 Ibid.

Figure 1. IDCOL SHS Program: Annual and Cumulative SHS Sales



Source: "Living in the Light: The Bangladesh Solar Home Systems Story." A World Bank Book Publication.

Detailed Technical Design

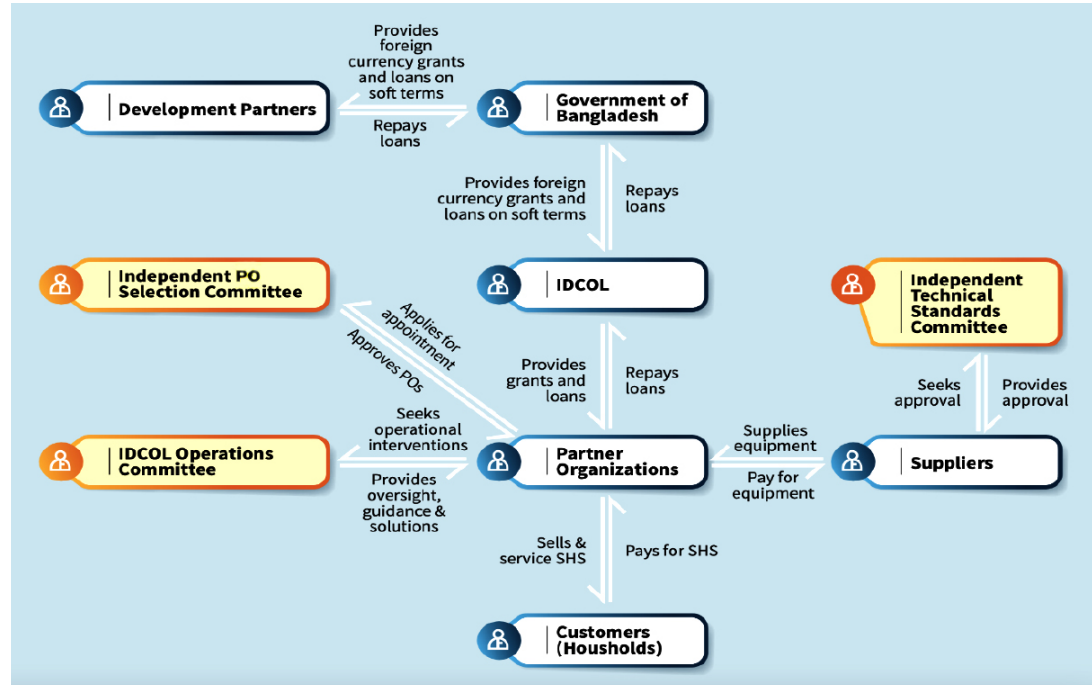
Implementation

IDCOL led, managed, and supervised the program, and their effective leadership was crucial to the program's success. IDCOL mobilized partner organizations (POs) - nongovernmental organizations and microfinance institutions with rural networks, selected by an independent PO selection committee (Figure 2). Multiple rounds of vetting were required to recruit suitable POs, and training support was provided to build their capacity. The POs competitively marketed, sold, financed, installed, and serviced quality verified SHS to rural customers. The number of POs grew from five in 2003, to fifty-seven by 2015. An independent Technology Standards Committee was established to set and enforce quality standards.

Standards, Warranties and E-Waste Management

The POs sourced SHS and components from domestic and international suppliers that met quality and performance standards. An Operations Committee met with POs monthly to monitor progress, resolve problems, and share experiences and lessons. Warranties were set in line with the lifespan of the batteries, and adherence to warranty commitments was carefully monitored, with penalties for POs that did not honour commitments. The larger SHS (>30Wp) had a required 5-year warranty on batteries, whilst smaller SHS (<30Wp) had a 3-year warranty. Under a recycling program, customers were able to sell batteries back to POs, and the POs were given a small incentive from IDCOL for returning the batteries to recycling centres, which subsequently were paid to recycle them.

Figure 2. IDCOL SHS Program: Implementation Model



Source: "Living in the Light: The Bangladesh Solar Home Systems Story." A World Bank Book Publication.

Addressing Affordability

Consumer Financing

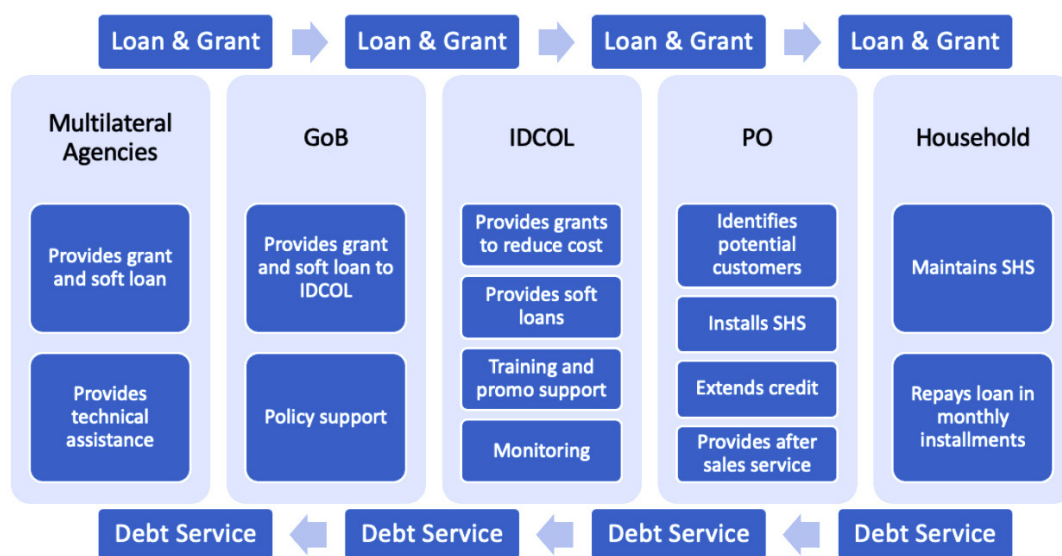


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Access to consumer financing was the main tool used to overcome high upfront costs and address affordability barriers. The POs sold SHS on credit with payments spread out over up to three years. A portion of the PO loans was refinanced by IDCOL, using loan funds from the government. The government obtained loan funds from concessional credits provided by development partners (Figure 3). The customers repaid the loans to the POs, which repaid their loans to IDCOL. IDCOL repaid its loans from the government, which in turn repaid its development partners. This business model permitted hundreds of millions of dollars in loans to flow from international sources to end-users, in the form of microloans to millions of rural customers living in remote areas.

IDCOL addressed affordability by ensuring monthly payments for SHS were the same as, or less than, previous expenditure on kerosene for lighting (Figure 4), based on data provided through household surveys. As the graph indicates, some larger SHS cost more than fuel expenses in some instances, but this catered to the possibility that some customers would want access to expanded services. POs charged below-market interest rates of between 12-16%. These rates were viable because IDCOL provided soft loans to POs at favourable rates, as well as technical support in areas such as marketing and training which helped to reduce costs. In addition, SHS loans were larger than normal MFI loans, and collection was monthly rather than weekly, helping to lower transaction costs. Transaction cost savings could be passed on to end-users through lower rates.

Figure 3. Fund Flow and Role of Partners



Technology Cost Reductions

Reductions in the cost of SHS, and improvements in efficiency, also helped to improve affordability. Cost reductions were driven by improved efficiency of lights and appliances, which allowed a higher level of service to be delivered with a smaller solar panel and battery, and by the global decline in solar panel cost. The installed unit cost averaged USD 12 per Wp in 2003, but by 2017 it had dropped to about USD 5 per Wp (2018 US dollar value). With the influx of LED lighting, and smaller SHS being approved by the committee, demand for 10-25Wp SHS surged. The average size of SHS sold decreased from 50Wp to about 30Wp beginning in 2013-14.

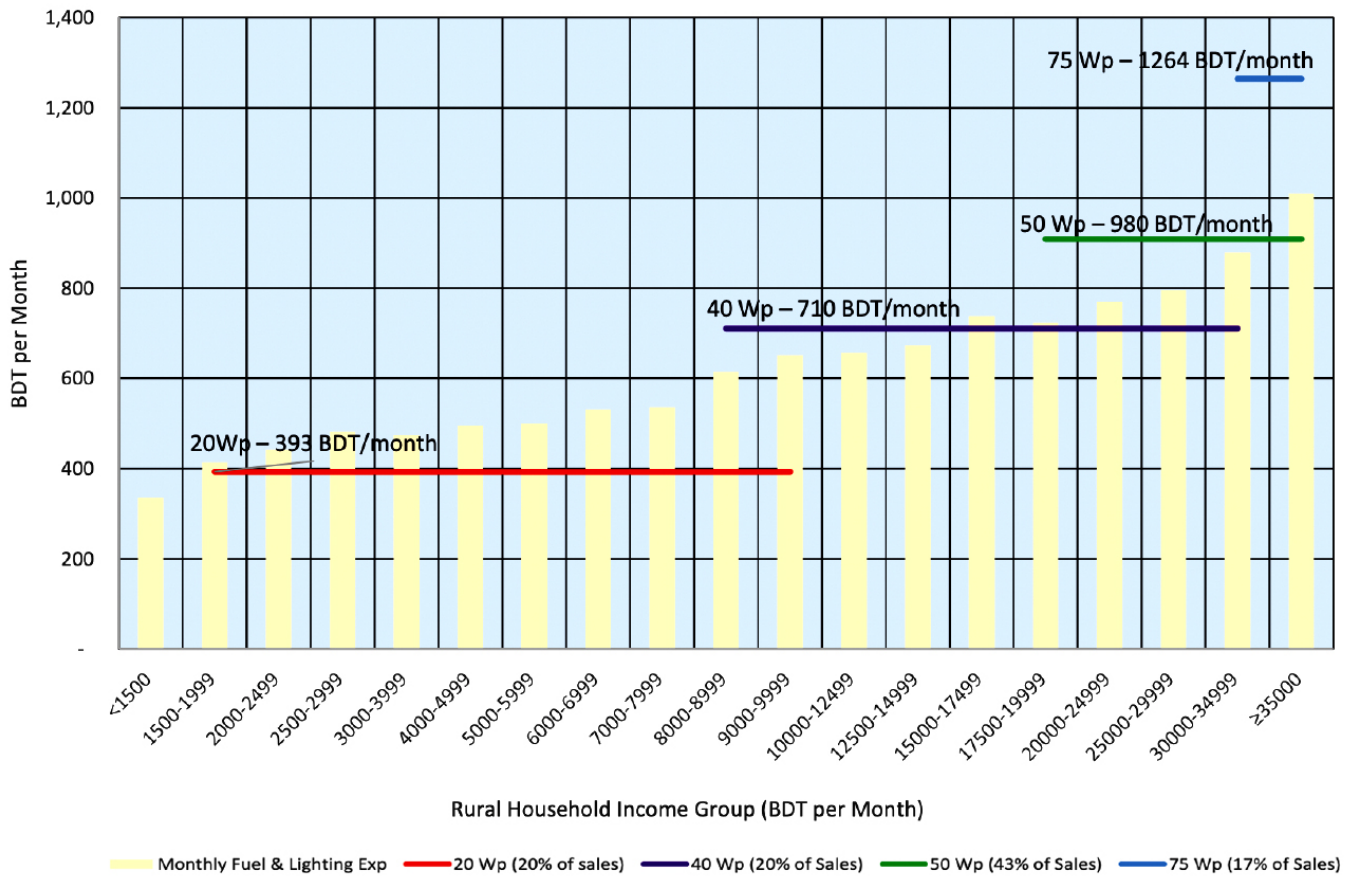
End-User Subsidies

IDCOL also used grants to buy down the cost of SHS, but as SHS became more affordable there was less need for end-user price subsidies. The grant amount was the same for all sizes of SHS, making the end user subsidy progressive and

introducing an indirect targeting mechanism through self-selection. As lower income households are more likely to select a smaller system, they benefitted from a proportionally larger subsidy amount. As system costs dropped over the years and POs began to achieve significant economies of scale, demand for larger systems grew and grant amounts per SHS were reduced. The grant component declined from 18% in 2004 to 3-8% from 2007 onwards, as a proportion of SHS price. From 2012, a grant of US\$9-13 per SHS was available only for SHS smaller than 30Wp, with no grant support for larger SHS. Figure 5 shows the declining trend in SHS cost and therefore the necessary subsidy amount over program duration.

Grants were disbursed to the POs after verification of sales. Since SHS pricing was competitive and IDCOL did not set or control prices, the amount of grant passed on to customers was determined by the market. Companies could choose to pass the whole grant on to end users through lower pricing, or to retain

Figure 4. Comparing Monthly Fuel & Lighting Expenditure in 2010 of Rural Households to Monthly SHS Loan Payment by SHS Size in Bangladesh



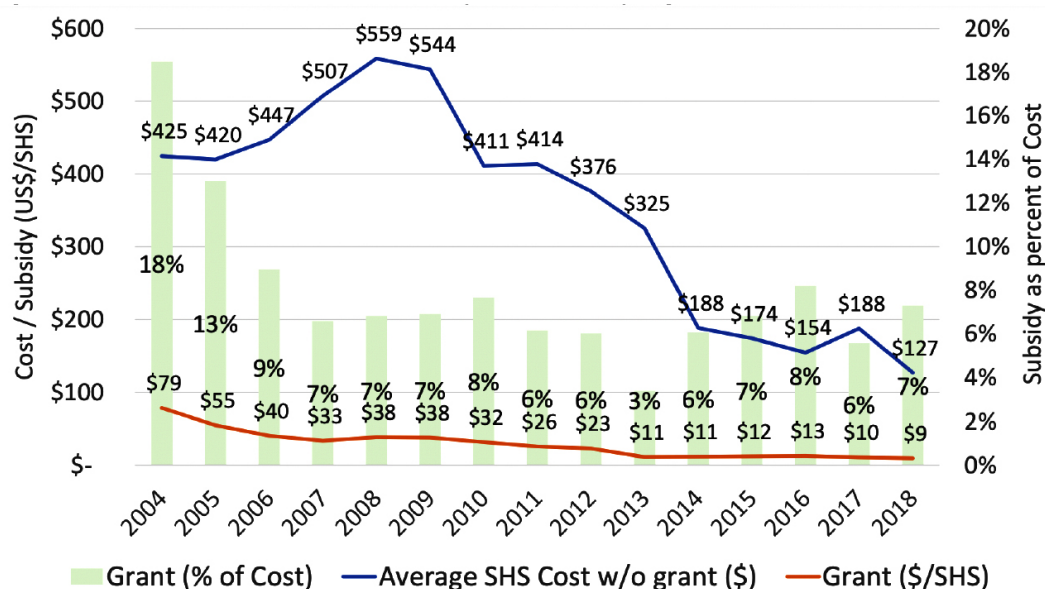
Source: "Living in the Light: The Bangladesh Solar Home Systems Story." A World Bank Book Publication.

a portion of the grant, depending on their pricing strategies and how competitive their products were in the market.

Monitoring and verification was done in-house through IDCOL who built the capacity to manage the process in an effort to reduce program costs. IDCOL established three divisional and 12 regional inspection offices. There were 103 technical inspectors who performed monthly inspections, averaging 350 SHS per inspector.

This resulted in 51% of total financed SHS being inspected in-person. Though this percentage is unusually high, it was determined to be cost effective due to in-house verification operations and it enforced a high level of accountability on behalf of the POs to provide and maintain high quality and well-functioning SHS. This in term resulted in a high level of consumer confidence and subsequently the high level of program success.

Figure 5. Trends in SHS cost and subsidy over life of program



Source: "Living in the Light: The Bangladesh Solar Home Systems Story." A World Bank Book Publication.

Impact

SHS sales grew rapidly from 2003 and peaked in 2013, with over 861,000 SHS installed that year. After 2013 sales declined due to rapid grid expansion from 2015, alongside a new 'Kabita' National Social Safety Net Program that started distributing SHS for free to low-income households. Commercial sales of SHS, outside of IDCOL, also picked up, building on the increased credibility in SHS.

The rapid sales decline had a detrimental impact on the program's financial viability and IDCOL took several steps to overcome the challenges. These included restructuring PO and IDCOL debt and integrating Kabita into the SHS program.

About 14% of the Bangladesh population obtained electricity services through the SHS program, with access to electricity climbing steadily during

program years (Figure 6). The SHS program enabled one-quarter of the unelectrified rural population in 2003 to obtain electricity services far sooner than would have been possible with grid electricity. The program led to SHS becoming a credible electricity source in Bangladesh and, more broadly, to the acceptance of off-grid solar as a viable electrification solution around the world.

Economic and financial analysis by the World Bank suggests that the program had significant positive net benefits for households, IDCOL, government, and partner organizations (Figure 7). Net financial benefits exceeded US\$1.5 billion, with half the net benefits flowing to households⁶. The government was the second largest beneficiary. The Treasury's net gain was USD 384 million from taxes on SHS, and USD 90

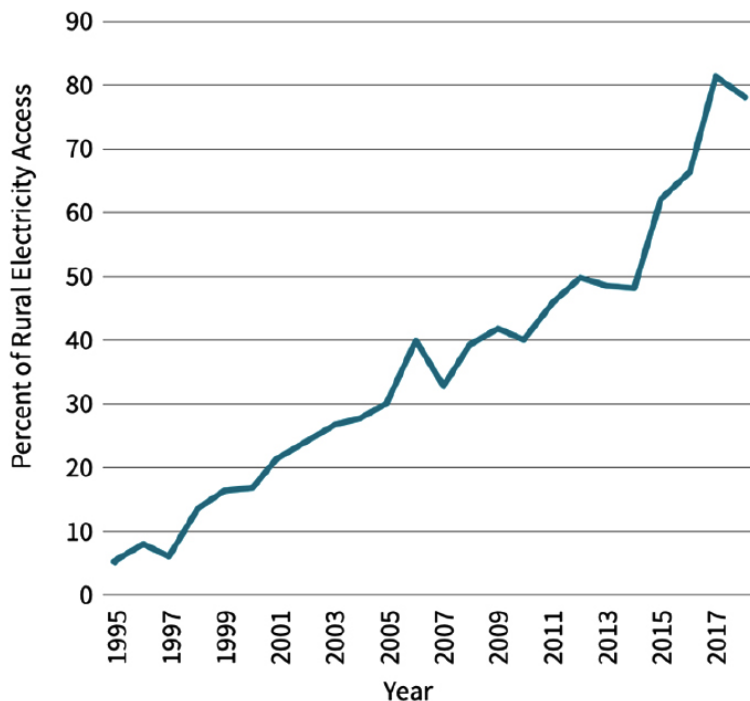
⁶ All in constant 2018 US Dollars, discounted at 10 percent.

million from savings due to avoided kerosene subsidy. In addition, the Treasury received USD 180 million from on-lending funds borrowed from development partners to IDCOL at higher rates. The environmental impact was also significant, with 9.6 million tons of CO2 emissions avoided through reduced use of kerosene for lighting.



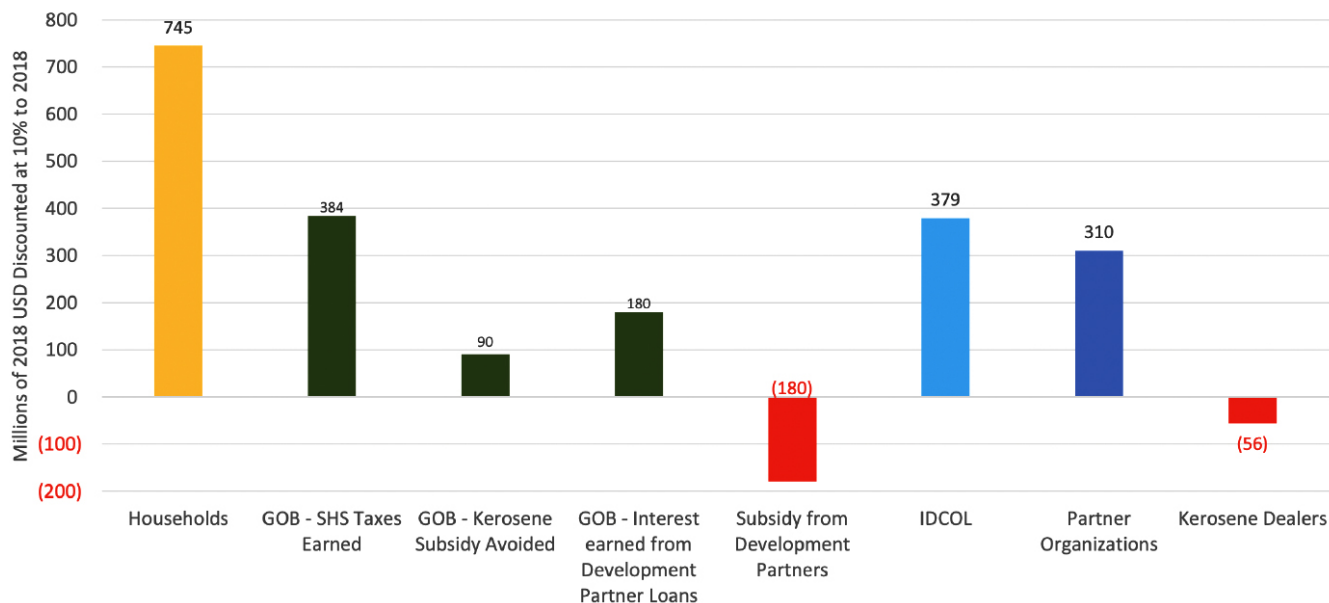
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Figure 6. Trends in Rural Electricity Access 1995-2018



Source: World Bank Database

Figure 7. Present Value of Benefits from SHS Program



Source: Bangladesh Subsidy Lab Webinar, October 2021⁷

⁷ <https://www.gogla.org/off-grid-solar-smart-subsidies/event-recordings>

Lessons and Key Takeaways

Falling technology costs can help to make systems more affordable, especially over longer timeframes. It is important to anticipate falling technology costs, and to adjust program design accordingly.

Lending at favourable interest rates can be passed from DFIs to end-users, ensuring monthly payments are affordable and equivalent to, or less than, previous expenditure on kerosene or other inefficient energy sources. End-user costs can also be brought down by providing implementing partners such as companies or MFIs with other forms of support, in areas such as awareness-raising and capacity building, enabling them to pass savings on to end-users.

Grants can also be used to bring down end-user prices, if needed. In the case of IDCOL, end-user subsidies played an important role at the outset when the market was still nascent. From 2012 onwards, however, only the smallest products benefited from a modest end-user price subsidy. By unlocking economies of scale and

fostering competition amongst POs over time, IDCOL leveraged market dynamics that brought down prices, enabling a gradual reduction and phasing out of end user subsidies.

Making SHS affordable did not lead to a net loss for the Government of Bangladesh – it led to a net gain. Modelling the present value of benefits from an SHS program, as shown in Figure 7, could be useful to inform discussions around program design, to help governments think through the fiscal implications of using end-user subsidies or other public funding mechanisms. In some cases, modelling may find a high likelihood of an overall net benefit to the government finances, as there was in the case of IDCOL.

For more information, the World Bank publication “Living in the Light: The Bangladesh Solar Home Systems Story”, by Anil Cabraal, William A. Ward, Susan Bogach and Amit Jain, can be downloaded from <https://openknowledge.worldbank.org/handle/10986/35311>.