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DEUTSCHE ZUSAMMENARBEIT

Implemented by:
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

In cooperation with:

Efficient Utilisation of Natural Lighting in Industries

Background

Bangladesh is a rapidly growing economy and moving forward with the aim of transforming into a middle income country by 2021. Energy security is an important prerequisite for achieving this status, as it leads to industrialization and therefore higher economic growth. Traditionally, the solution for solving an energy crisis is perceived as an increased energy production, which is not always the most sustainable path. Exploring alternative solutions, the Bangladesh Government has formulated the Energy Efficiency & Conservation Master Plan 2015 which aims for 20% energy efficiency improvement by 2030 compared with the 2013 level.

Renewable Energy and Energy Efficiency are one of the three priority areas of German Development Cooperation in Bangladesh. The Renewable Energy and Energy Efficiency Programme, a joint undertaking between the Power Division of Ministry of Power, Energy and Mineral Resources (MPEMR), Government of Bangladesh, and the German Federal Ministry for Economic Cooperation and Development (BMZ), has been promoting renewable energy and energy efficiency in Bangladesh. The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH is implementing the programme in collaboration with Sustainable and Renewable Energy Development Authority (SREDA) of Bangladesh Government.

Industrial sector consumes around 50% of the total primary energy, and 35% of the electricity while emitting around 14.7% greenhouse gas (GHG). Around 14.7% of electricity consumption is for residential lighting, while in industries it ranges from 20 to 30% depending on the type of business. Most of the manufacturing industries, especially the micro, small and medium industries (MSMIs) in Bangladesh are not efficient in lighting load use pattern because of inefficient incandescent beamer (tube) lighting. Moreover the MSMIs are often financially incapable for adopting hi-tech machineries, rather preferring low-tech solutions.

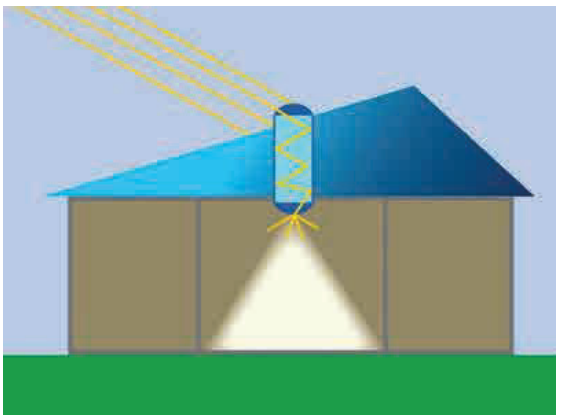
Therefore, finding an alternative and efficient lighting solution can act as a significant countermeasure for minimizing fossil fuel usage in Bangladesh, leading to lower GHG emissions.

Our Approach

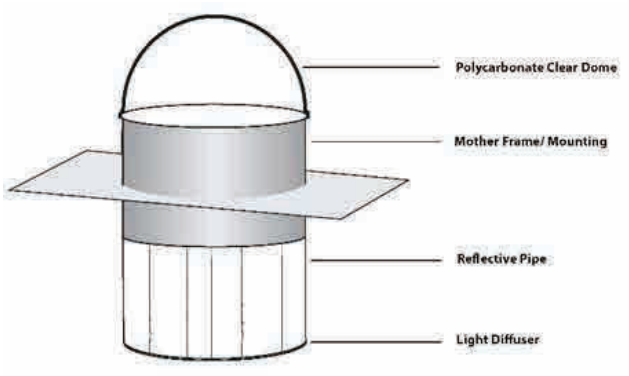
A preliminary estimate has indicated that out of Bangladesh's existing average electricity load of 7,300 MW, there is potential to save about 2,640 MW. Bangladesh needs to increase the share of energy generated from renewable energy sources as well as address various areas in which energy can be saved. Promotion and dissemination of energy efficient technologies can be a sustainable solution to save electricity. A study by Bangladesh University of Engineering and Technology (BUET) identified that 30% of the energy used in the industry sector is used for indoor lighting. Most industrial buildings are very compact, so only a little sunlight can get in. Industries tend to use artificial lighting systems even during the day, resulting in a high rate of electricity consumption.

GIZ has initiated a pilot project titled “R&D of the Industrial Solar Pipe Light (SPL)” to develop a simple, customized and innovative lighting solution by using natural daylight in industries. The aim is to develop a low cost customized skylight with locally available materials to make efficient use of natural lighting in industrial buildings and thus contribute towards addressing the energy crisis. Prototypes have been piloted in two settings - a small cottage factory and an ice cream factory. These factories are using free natural lighting during daytime for 10-12 hours, covering approximately 750-800 sq. ft. of factory area, illuminating light equivalent to CFL bulbs, but with zero carbon emission.

Locally available reflectors and industrial sheets have been used which act as light reflector and diffuser. The SPL utilises sun light without the use of any wire, switches and electricity connection. It is installed on the rooftop and facilitates sunlight access during the daytime. The sunlight is channeled through a hollow pipe and illuminates the inside of the building.



How a Solar Pipe Light works



Technical drawing of a Solar Pipe Light

Clear dome *Polycarbonate/acrylic sheets or glaze*	The transparent dome captures sunlight
Tubular reflector *Print film*	The tubular reflector is made from reflective sheets with a diameter of 22" and height of 32"
Mother frame *Industrial tin*	The dimension of the frame is 3' x3'. The tubular reflector is inserted through the mother frame and installed on the rooftop to hold the dome
Diffuser *Poly-carbonate sheet*	The diffuser filters the sunlight and evenly spreads the soft light inside the room

For an SPL with 22 inch diameter following figures have been found through performance tests with BUET,

Indoor light illumination
- Covers up to 500 sq. ft.
- Equivalent of up to 150 watts

Electricity and bill savings
- Yearly electricity savings up to 450 KWh
- Yearly electricity bill savings up to 4500 BDT

It is estimated that the diameter can vary from 10 to 22 inch based on the room size and lighting requirement.

Technical quality test has been conducted to assess the technical and material quality on water leakage, rust vulnerability, light output and thermal conductivity. Considering the results from these tests, the Solar Pipe Light is a viable alternative solution for electricity saving.

GIZ is currently conducting performance monitoring and evaluation to identify the areas of improvements in the existing design, along with market assesment to develop a business model for this technology.

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