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Implementing Industrial Energy Efficiency (IEE) in Bangladesh: Lessons Learned from the Textile and Garment Industry

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Abstract

Manufacturing sectors in developing countries such as Bangladesh offer the greatest potential in achieving climate benefits through adopting energy efficient practices. While it is commonly termed as the "low hanging fruit", implementing such practices in Bangladesh faces a wide range of challenges. Considering the national energy supply shortfall, it is only rational to adopt industrial energy efficiency measures. This paper identifies new policy goals and implementation barriers in widespread adoption of industrial energy efficiency, and offers some recommendations in overcoming barriers. The paper also documents innovative practices in the textile and garment industry of Bangladesh, which can be further explored to achieve synergistic benefits. It is suggested that soft & targeted support for addressing high-quality competency gap, harnessing the competitive nature of the sector, easing the process for accessing finance, and developing a national strategy for the sector can go a long way for widespread adoption.

Key words: *small and medium enterprises (SME), financial institutes, green factory buildings, waste heat recovery, energy audit.*

I. INTRODUCTION

Economic growth has always been positively correlated with energy consumption. Bangladesh is yet to reap full benefits of industrialization, but the growth potential in this sector is very high and it is expected that a lot of industrial infrastructure will be built in the next two decades. A major problem encountered in maintaining this growth rate is the high inefficiency in using energy. Manufacturing sectors in Bangladesh mainly consume electricity and natural gas as sources of energy. Outdated technology, ignorance and carelessness cause a tremendous waste of energy in industries. Since increase in energy consumption due to industrialization and associated greenhouse gas emission in developing countries are unavoidable, it is important to minimize these increases as far as possible by increasing these countries' energy efficiency.

Energy efficiency (EE) is by far one of the most effective and economically advantageous ways to provide services desired by energy users. Energy efficiency measures in the end use, whether in manufacturing or direct consumption, produces a net economic benefit simply because less input is used to produce the same amount of output. It is also happens to be one of the largest and cheapest source of emission reductions in Bangladesh. This paper will highlight the overall situation regarding Industrial Energy Efficiency (IEE) in Bangladesh with specific reference to the textile and Ready-Made Garment (RMG) industry.

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II. POLICY FRAMEWORK FOR INDUSTRIAL ENERGY EFFICIENCY IN BANGLADESH

In Bangladesh progress with industrial energy efficiency measures have been very slow. This was and continues to be due to - transactions delays that characterize investment decisions in Bangladesh; to the nature of the technology & diffusion process of best practices; and also due to late development of policy framework. The most energy intensive industries in Bangladesh are scrap steel processing, pulp and paper production, clinker grinding, glass manufacturing, bricks and steel re-rolling mills. These industries mostly serve domestic markets. In the export sector, Textiles, Food Processing, Ceramics, Footwear and Tea could benefit most from energy efficient retrofitting and practices [1]. According to United Nations Industrial Development Organization (UNIDO), the 2008 industrial energy intensity of Bangladesh economy is 0.35, which means it takes 0.35 tons of oil-equivalent for manufacturing value addition worth $1000 [2].

The National Energy Policy (NEP) of 1996, together with the Renewable Energy Policy of 2008, has primarily focused on increasing renewable energy contribution to 10% of total energy usage. This has minimized the importance given to the "third fuel" of energy efficiency as recognized by NEP. The government of Bangladesh had some success in initiating energy conservation in the eighties by creating the Energy Audit Cell (EAC). The EAC successfully conducted energy audits in several industries. However, their activities were soon rendered ineffective because of lack of government support and policy framework that required energy assessment & compliance. Adding to the loss of this momentum is the decline in world oil prices during that period [3].

In recognition of the need to promote sustainable energy in the country, the government instituted the Sustainable & Renewable Energy Development Authority (SREDA) in 2014 to be the national agency for promoting such activities in the country. The Energy Conservation Rules embodied in the SREDA Act will prescribe energy consumption norms and standards for the most energy intensive industries. In 2015 SREDA published the Energy Efficiency and Conservation Master Plan (EECMP) stating the government ambition to improve energy intensity (national primary energy consumption per unit of Gross Domestic Product or GDP) by 20% in 2030 from the baseline level of year 2013 [4]. In September 2015, Bangladesh officially submitted to the United Nations Framework Convention on Climate Change (UNFCCC) the Intended Nationally Determined Contribution (INDC). The INDC reported that 2011 baseline emission from the industrial sector is 26MtCO_2e and the growth under business-as-usual scenario will result in 106 MtCO_2e emissions by 2030. A 4% reduction from 2030 level in the industrial sector has been pledged by the Government of Bangladesh in Conference of Parties (COP) 21 [5].

A. Policy Goals Implementation Challenges

Continuous institutional support will be required to overcome barriers and reach the desired targets envisioned in these Action Plans. A 2011 study shows that approximately $12.5 billion will be required by Bangladesh over the next two decades to cover the incremental costs and risks of energy efficiency and renewable energy [6]. The study also points out that the failure for energy efficiency interventions to materialize is fundamentally due to market failure in the form of low cost of energy which acts as a disincentive to reform. Policy tools and financing mechanisms that exist now are too generic for such transformations. These need to be tailored to the national context and be sector specific. Implementing these will require strong political will and unprecedented international cooperation. If the right policy and regulatory frameworks are in place, cost of energy efficiency measures can be met from domestic investments.

III. TEXTILE AND RMG INDUSTRY IN BANGLADESH

Bangladeshi garments and textile industry is second largest in the world, and includes knitwear and woven garments along with specialized textile products. The country now has more than 5,500 woven garment factories, 1,700 knitwear factories and 1,300 spinning, finishing and dyeing factories [7]. Although the industry is extremely sensitive to costs, abundant labour force, low cost of energy & natural gas, and sound policy decisions on private sector development contributed to the boom in this sector. However, this trend is seriously affected by the energy crisis of the last few years. Frequent power cuts and low gas pressure is adding to production time, forcing exporters to air-freight goods at their own cost.

According to the 2015 Energy Efficiency and Conservation Master Plan (EECMP), 47.8% of primary energy is consumed by the industrial sector in Bangladesh. The garments and textile industry makes up 27.8% of that share among all industrial sub-sectors which amounts to 3740000 ton of oil equivalent per year. The plan estimated that for the textile and garments sector, energy efficiency & conservation potential could be 1159000 ton of oil equivalent per year [4].

There are various energy efficiency opportunities in textile plants & RMG factories, many of which are cost-effective. However, even cost-effective options often are not implemented due mainly to limited information on how to implement energy-efficiency measures, especially given the fact that the sector is made up of units categorized as Small & Medium Enterprises (SMEs) i.e. their production capacity is less than 1000000 pieces per month. Majority of the industrial enterprises in Bangladesh are in the SME size-class [8]. These SMEs in particular have limited resources to acquire IEE information. SMEs require the most help in identifying and implementing energy efficient measures and the resulting improvement in competitiveness will help grow this important industrial sector.

A. Best-Practices and Proven Technologies

Almost all of IEE literature on Bangladesh includes textiles and garment industry not because they are the most energy intensive but because of their size and scale. Some of the prescriptions are generic – for example changing lighting systems, switching to efficient boilers and industrial motors etc. This case-study will not make prescriptions as the interventions only tend to be feasible following investment grade audit at the factory level. However, best practices in IEE experienced so far in the context of Bangladesh textile and garment sector are listed below [9] –

- Mitigating compressed air leakages
- Installing Heat Recovery in Cloth Driers
- Using Servo Motors for Sewing machines instead of Clutch Plate motor in RMG factories
- Steam Management using Steam Traps and Condensate Recovery
- Combined Heat and Power Generation
- Using flue gas economizer to preheat feed-water before entering boiler
- Changing Lighting systems in RMG factories to Light-Emitting Diodes (LEDs).
- Insulation of Pipes, Valves and Flanges.
- Correcting Power Factor in RMG factories [10].

IV. DRIVERS OF IEE IN THE SECTOR

The textile and RMG sector has developed most since industrialization began in Bangladesh, and a key driver for adopting energy efficient practices is due to the sector being mature & export oriented. Some prominent retailers/buyers order specialized products and yield their suppliers higher profits. They tend to have local offices and place direct orders thus having more active governance structure. Selim (2011) distinguishes such buyers in having a deeper collaboration with suppliers in working out factory improvement projects. This collaboration also includes provision for technology assistance to improve productivity & sustainability. In

one rare case, a renowned buyer followed an Energy Service Company (ESCO) model to purchase a waste heat recovery boiler for its supplier, so that benefits from it can later be adjusted in the form of lower product price. However, shallow collaboration is mostly prevalent where there is only provision of basic upgrading guidelines and cursory attention is paid to auditing [11].

There are other external local factors that spurred adoption of IEE in this sector. Energy costs and uninterrupted supply are increasingly becoming a decision factor for industrial enterprises to stay sustainable or to expand its business activities. In the textile & RMG, it is one of the main cost factors. Suffering from the high power costs & interrupted power supply, RMG and textile factories are not only open minded about programs reducing power consumption by increasing energy efficiency but they are also looking at renewable energy sources. Many industrial and commercial establishments depend on expensive and inefficient captive generation during power interruptions. Since power generation is often done on-site, it makes sense in engaging in demand side management to reduce cost of captive generation. With the current uncertainty in accessing power from utilities, improving energy efficiency is a major avenue for textile plants to expand by utilizing the rebound effect benefits.

There are exceptions too where direct involvement of top management in greening process led those factories to become pioneers. Exporters are increasingly rushing towards green building initiatives in order to impress retailers in the global supply chain. According to the United States Green Building Council (USGBC), 14 garment factories in Bangladesh have already achieved Leadership in Energy & Environmental Design (LEED) certification. At least another 75 factories have registered and are also in the process of obtaining LEED certification [12]. Further analysis of records show that most factories are applying to get new construction units certified, and only 12 factories are applying to get existing factories certified following recommended retrofits.

Recognitions are now being given to factories for best practices and green innovations, although the winners of such awards tend to be larger enterprises that are more capable of adopting IEE than SMEs. In 2014, Jinnat Knitwears Ltd. received international recognition by winning Carbon Performance Improvement Initiative (CPI_2) award for their efforts in energy efficiency competing against 500 textile & shoe manufacturers in 17 countries [13]. Some factories stand out within the sector by involving in activities such as maximum usage of daylight in factory premises, rain-water harvesting, reusing water, and also participating in Clean Development Mechanism (CDM) Program of Activities (PoA) that aims to lower energy and water consumption in textile dyeing and finishing process [14].

V. Barriers to IEE Adoption

It is a known fact that there is a huge potential to reduce energy consumption but there is also lack of skills and data on how to tap it. Only a small number of RMG and textile have adopted energy management systems and energy efficiency practices. The common barrier to energy efficiency cited in all literature is the low price of energy in Bangladesh. As experienced in other developing countries, low energy prices tend to serve as a disincentive for adopting energy efficiency. Other generic and sector specific barriers are summarized below –

- Myopic investment decisions from management side – investors in Bangladesh are generally risk averse and hence investment decisions with payback period of five years or more have low probability of approval. Similar to the Indian SME scenario, a top-down leadership approach in mostly family business settings along with limited bottom-up information flow leads to suboptimal energy efficiency investment decisions [15].
- In line with myopic investment decision, purchasing policy is often geared to lowest first-cost option. Hossain (2013) have attributed this reason to his observation of proliferation of cheap gas turbines which in many cases have efficiencies that are 8-10 percent lower than those of the state-of-the-art [16]. Even if technology upgrade is approved, performance guarantee is often sought which is difficult to provide by many suppliers and service providers [8].
- Access to finance – The traditional view of lenders is that SMEs are ‘non-financeable’ emanates from the way the vast majority of SMEs are organized without professional organization thus creating a sense of risk and financial weakness. Moreover, individual energy efficiency projects are considered to be too small to be commercially ‘interesting’ for mainstream private-sector Financial Institutions (FIs).

  By and large, banks in Bangladesh are not interested in funding energy efficiency projects especially because these are difficult to monitor and in many cases their profitability is considered to be marginal. Cash-flow from energy savings is not a familiar form of revenue or collateral that FIs considers to lend. Even with capital availability, transaction cost are also important factors to consider, as investors procuring equipment from developed countries may have to bear foreign exchange risk during loan repayment period [17]. Results from a global survey on IEE investment conducted by UNIDO in 2011 are also applicable to Bangladesh which found that 90% of investment in IEE in developing countries used simple payback rules to assess financial viability. A more complex analysis of internal rate of return will highlight real accurate costs & benefits that can be compared with alternatives [18].
- Implementation of IEE measures often temporarily halt production, and in an industry that often sees change of orders and short lead time, such disruption in production is generally avoided.
- Energy audit at the factory level in Bangladesh is absent due to lack of awareness about the benefits and lack of technical personnel. Moreover, the cost of energy for industry in general is very low and insignificant compared to other inputs. Given the

current energy price, factory management presumes that no significant amount of energy & cost savings could be attained through EE. In this regard, SMEs are even less enthusiastic than larger enterprises.

VI. Recommendations to Overcome Barriers

Despite the late start in formulating a guiding vision for such transformation, IEE is imperative to stay competitive and gain access to a greater market share. The present situation is encouraging as many multilateral and donor agencies are coming on-board to provide support for adoption of IEE by developing human resources in energy management for service providers, providing institutional support, piloting interventions through public-private partnerships, and raising awareness. Coordination is required among these supporting actors to achieve synergistic results in this sector. Interventions to promote IEE in the textile sector must consider a long-term time horizon of decades to expect results from SMEs [19]. The textile sector should have a special focus from policymakers not only because of its size and structure, but also for its openness in receiving foreign technology, investment & trade.

A. Addressing Awareness & Competency Gaps

Among the major barriers discussed in literature, lack of awareness among all stakeholders comes up frequently. While large scale information dissemination and awareness creation programs could result in increased interest for implementing EE improvement projects, it can only go that far unless other capacity constraints are addressed. To sensitize SMEs about EE and to make them adopt more efficient energy interventions, it is essential to demonstrate positive impacts of reduced energy use to the entrepreneurs in terms of increased productivity and higher profitability. It has been seen that government agencies often fail in keeping industrial units they regulate up-to-date about technology and regulations. This strategy needs to reverse and government must be taking an active role in engaging multiple stakeholders to formulate action plans for industrial energy efficiency. Buyers can also be informed externally about potential EE opportunities within their supplier factories [20]. Not only will it open up new small-scale investment opportunities in existing factories, it will also ensure robust monitoring of energy performance by building up internal management capacity.

An effective strategy could be to promote energy efficiency in a cluster based approach wherein energy efficient technologies and practices can be demonstrated to a group of companies located in close geographic proximity. The government is already implementing such activities for the brick sector under the Clean Air and Sustainable Environment (CASE) project, where pilot projects are placed in all seven divisions in Bangladesh for demonstration purposes. Since RMG and textile units are also concentrated in few regions of Bangladesh, the cluster based model can work effectively as it has worked in India.

B. Developing a National Strategy for the sector

An effective way to spearhead IEE adoption in the textile and garment sector will be to devise a national strategy for it. A Nationally Appropriate Mitigation Actions (NAMA) can be developed for the sector consisting of diverse range of mitigation activities. The exercise of developing a NAMA in itself will pool together resources and stakeholders for a common goal as it did in the case of Cambodia which has recently developed a NAMA for its RMG sector with an aim to increase sector-wide energy efficiency by 28% in six years. The proposed interventions mentioned in the Cambodian NAMA include installation of efficient biomass boiler, sewing machines, washing & drying machines, compressor machines and efficient lighting units. Based on installation target, they have deduced a total cost of $29 million for implementation out of which at least $22 million is expected to be financed locally. If in the future, NAMAs are able to earn credits similar to CDM it will yield economy-wide benefits for Cambodia [21]. While Cambodia only considered the RMG sector, there are ample opportunities for further inclusion of interventions in the case of Bangladesh considering the backward linkages of the industry that has developed.

C. Taking Advantage of a Competitive Sector

IEE policies for the sector must be designed considering its unique characteristics in the national context. The sector is fiercely competitive and factories want to stand out from peers by showcasing best practices. Such healthy competition among factories should be utilized to promote diffusion and further innovation in energy efficiency. The Top Runner program for energy efficiency in Japan is a good example where competitors chase performance targets set by the government, which also led to a national sector benchmark [22]. Although the program worked for industries with local consumers, it needs to be adapted to the local conditions. Another potential scheme could be Perform, Achieve & Trade (PAT) which is currently being implemented by the Bureau of Energy Efficiency (BEE) in India. Under this scheme, based on an energy consumption threshold limit, 90 textile units have been given targets to reduce their Specific Energy Consumption (SEC) within 2014-2015. If any unit achieves beyond target, they will be issued Energy Savings Certificates which can also be traded among units [10]. Since 1991, BEE also organizes the annual National Energy Conservation Award for enterprises [19].

It is an encouraging sign that SREDA has launched an Energy Management Program similar to PAT where Designated large energy Consumers (DCs) are being asked to improve efficiency by 20%. The criterion for inclusion for the textile and garment industry is also a consumption threshold of 3000 ton of oil equivalent, and in the preliminary stage of the program SREDA plans to include 15 textile factories [4]. Application and reporting system for the Energy Management Program has already been developed within SREDA website, and such data management system will also become an integral part in establishing benchmarks [23].

D. Ensuring Access to Finance

Coordinated efforts will be required to engage bank personnel on financing EE projects, and to increase their understanding of EE investments. Local FIs need to become familiar with the nature, as well as the performance and credit risks of energy savings financed projects in order to be comfortable with providing debt. Government policy needs to play a central role in stimulating investment activity in this area, bringing to the attention of FI boards the seriousness of EE activities as part of the energy landscape. In 2011, Bangladesh Bank formulated policy guidelines for green banking with a view to developing green banking practices in the country. Running in three phases, the policy mandates commercial banks to develop and start offering green services that addresses environmental challenges of the country. While the policy mandate of developing sector specific policies, targets & strategies by the banks seems promising, it is too early to assess the impact of green banking in spurring IEE [8].

There is also scope for innovation in offering financial services for IEE. Even though ESCOs have been credited for widespread adoption of energy efficiency measures by SMEs in India, no such services developed in Bangladesh. Currently some financial institutes may be able to adopt the model of ESCOs which implement efficiency projects proving performance and savings guarantees, and its remuneration will be directly tied to the energy savings achieved.

E. Accreditation to Service Providers

Accreditation of the audit and consultancy services should be promoted to enhance the professionalism and quality of energy services offered to commercial clients. SREDA is expected to carry out certification of Energy Managers & Energy Auditors in order to create a cadre of professionally qualified energy managers with expertise in energy management, project management, financing and implementation of energy efficiency projects [4]. Enhancing capacity is also required at the factory level, so that they are able to implement effective energy management systems. This barrier could take a while to overcome as currently most SME units do not have even financial reports in writing. There is also a strong degree of reluctance to share input and other production data. As the SREDA Act mandates some form of energy audits in high energy intensive industries, the scenario is expected to gradually change.

F. Adjusting Price Structure

The most important factor that can spur industrial energy efficiency intervention would be to correct market failure in the form of low energy tariff. Although it is prerequisite, it is often difficult to implement and sell politically. A gradual phase-out of subsidies can be planned to give recipients time to adjust. The longer a subsidy has been in place, the more difficult it will be to remove and the longer the likely time frame required for reform.

VII. Conclusion

Energy efficiency can be the transition fuel for Bangladesh, until new sources and reserves can be run on a sustainable basis. Being a mature and export oriented industry, the textile and RMG sector of Bangladesh can serve as a role model in industrial energy efficiency for other industrial sector, despite being not very energy intensive. There is considerable uncertainty about Bangladesh's future CO_2 emissions due to highly uncertain changes in Bangladesh's future energy efficiency. To keep up with the competition faced by the apparel sector, companies should strive to adopt newer and innovative approaches to upgrade their technological capabilities. Otherwise, the energy that is locked into inefficient systems and processes may limit the growth potential of Bangladesh.

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