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Clean Technology Adoption for Textile SMEs in Bangladesh

FINAL REPORT
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This report has been prepared based on available documents, communication with the factory staff and management, relevant stakeholders including brands, financial service providers, policy making/implementing authorities, technology service providers, educational institutions, etc. The information is time-dependent, and the relevance of data and observations may change.

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ABOUT ENGINEERING RESOURCES INTERNATIONAL (ERI) LTD.

ENGINEERING RESOURCES INTERNATIONAL (ERI) Ltd. is an international engineering and consulting firm engaged in Water, Energy, and Environment technologies with a particular specialization in technical, environmental, and social compliance in the textile and RMG sector.

ERI has a core group of professionals from industry, business, and academia with world-class expertise in process engineering and project management. ERI experts are trained in Resource Efficient Production, Energy Audit and Energy Efficiency, Water and Carbon Footprint Assessments, Chemical Management, Wastewater Treatment, Environment and Pollution Control, Process Engineering and Safety, Higg FEM, EIA/ESIA/EMS/EMP, OHSAS, WASH & Gender. We have high-level accomplishments in energy, water, chemical and environment management, and data automation.

ERI has worked with 300+ textiles and RMG factories at different levels of engagements under WB/IFC's PaCT: Partnership for Cleaner Textile Program, PaCT II Program, Sweden Textile Water Initiative (STWI)'s Sustainable Water Management Program, Impact Economy's Apparel Innovation Consortium (AIC) Program, NCCI's Energy Efficiency Engagement (3e) Program, Pyoe Pin, Strategic Alliance, and GIZ financed programs as well as its own NEST: Need for Environmentally Sustainable Textile Program in Bangladesh and three international destinations- India, Myanmar, and Ethiopia. We were also the local training provider for Sustainable Chemicals & Environmental Management in Textile Sector-STA: GIZ, Tchibo, REWE, Made-By, STS, ZDHC, to name a few.

With in-depth knowledge of the textile and RMG industry ERI is providing top-notch awareness, performance and productivity enhancement, and overall project supervision trainings in this sector of the economy.

ABOUT INSTITUTE FOR SUSTAINABLE COMMUNITIES

Institute for Sustainable Communities (ISC) is a USA based nonprofit organization that helps unleash the existing power of local people and institutions to address immediate social, economic, and environmental challenges and opportunities – all while building those on-the-ground solutions into national and international best practices and policy. By sharing international best practices and experience, providing technical expertise and training, and building the capacity of local organizations, ISC is sparking creative solutions and lasting change. At the heart of the organization's approach is the results-focused, authentic, and pragmatic engagement with all stakeholders, which unearths locally-driven and equitable solutions to the biggest challenge the earth is facing – global climate change.

Since 1991, ISC has led more than 115 transformative community-driven sustainability projects in 30 countries including the United States, China, India, and Bangladesh. ISC has led more than 110 projects in 30 countries and currently works in Asia and the United States.

In Bangladesh, ISC is working with factory owners, brands, and community members to ensure the country's largest economic engine – factories – make efficient use of limited natural resources, and are safe for both residents and the environment. Partnering with a local university, local training institutes, and industry associations, ISC sustainable manufacturing initiatives have increased resource efficiency, enhanced gender equity and empowerment, and reduced factory GHG emissions.

ABOUT ENVIRONMENT, HEALTH, & SAFETY CLEAN ENERGY ACCELERATOR PROGRAM

With USAID's support, ISC has achieved significant impact in advancing clean technology adoption in India through its EHS+ Center program and its Clean Energy Accelerator component. The goal of the Clean Energy Accelerator (CEA) is to accelerate the deployment of energy efficiency and renewable energy measures among textile Small and Medium Enterprises (SMEs) in India. The project is designed to reduce emissions through the demonstration, dissemination and adoption of SME-relevant clean energy technologies.

In Bangladesh, the program aims to identify opportunities for accelerating clean technology, by conducting a clean technology opportunity assessment in Bangladesh, generating results that can inform the subsequent advancement of clean technology deployment by the textile industry. The program also aims to share its learnings with Bangladesh, from its work on cleantech adoption in textile SMEs in India.

Executive Summary

A study was conducted to identify the barriers to and opportunities for adoption of energy-efficient and renewable energy technologies by textile SMEs in Bangladesh. The approach followed in carrying out the assessment includes landscaping analysis/desk review and stakeholder consultations to collect qualitative data through structured questionnaire, email communications, over the phone interviews, and factory visits. Along with the factories, the study considered four other stakeholders namely policy and/or regulatory bodies, funding institutions/financial service providers, technology providers, and brands that shape the adoption of technologies under considerations.

Desk review and prior knowledge of working with the textile sector revealed a number of barriers and challenges at each level, which are summarized under five major categories, and presented below along with the possible remedies:

Barrier In	Major Contributing Factors	Possible remedies
Awareness and knowledge	• Not knowing factory benchmark • Communication gap • Not make a holistic assessment or understanding business cases • Limited market overview or setting different priorities • Fear or perception of high risk • Absence of qualified assessor at lower or mid-level or resource assessment tools • Limited knowledge of low-interest financing and requirements	Arranging regular sessions to • Raise awareness of factories about resource pricing, policy, and compliance regulations that could significantly affect their business • Demonstrate factories the benefits of knowing its position (KPI) in the industry, continuous monitoring of performance using RTIS tools, business cases, benefits of joining sustainability programs • Provide sources of low-interest financing, qualified service, technology, and service providers • Help developing a knowledge base and qualified energy assessor especially at mid-level
Policies and enforcement of regulatory measures	• Non-enforcement of regulatory measures especially for energy and water utilization, and pollution due to lack of enforcing or monitoring capacities • Subsidized resource pricing • Need for proper policy or review of the policy to address current needs • Need for stimulating economic or non-economic incentives or duty-structure	• Review or formulating and/or strengthening policy, regulatory and legal frameworks as well as enforcing and implementing capabilities • A detailed plan for enforcing regulatory measures especially for energy and water utilization • A comprehensive plan that includes preferential tax incentives and gradual elimination of subsidies • Stimulating economic or non-economic incentives or duty-structure
Financing	• Complex application process and loan processing • Stringent requirements or conditional loan	• Elimination of complexity in application and loan processing through developing clear guidelines and training of lenders

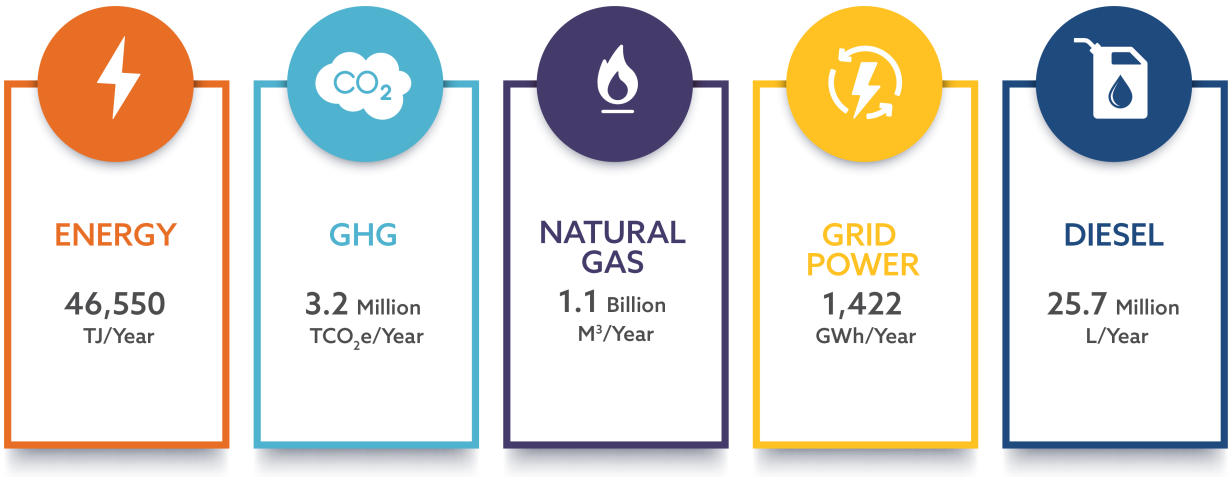
	• Preference for borrowers with strong financial strength only • Not many qualified equipment for financing • Not-so-clear guidelines or instructions about loan processing	• Setting rational requirements or conditions for loan that is achievable and attractive to borrowers • Inclusion of more qualified equipment in the list for financing through reviewing of business cases • Inclusion of organizations like BGMEA, BKMEA, or BTMA to support getting loans for financially not-so-strong business units
Institution	• Non-existent or not-so-strong knowledge hub for awareness-raising, knowledge enhancing, and information sharing mechanism • Need for support especially for not-so-strong business entities • Need for one-stop service • Need for showcasing and implementing business models e.g. demand aggregation model	• Strengthening existing organization or develop a new one that eventually leads to one-stop service for awareness-raising, knowledge enhancing, information sharing, showcasing, financing, and implementing business models e.g. demand aggregation model • Support financially not-so-strong business entities in getting financing by acting as a partial guarantor
Sustainability Programs	• Inadequate engagement of decision makers • No ownership, considers added responsibility. • No dedicated person • Non-convincing recommendations • Duration too short for capital investment • Requires hand-holding; lose focus without monitoring	• Engagement of decision makers during buy-in meetings, might be with the help of the program administrator and the brands • Higher share of participation fees and awareness raising to build ownership • Program duration for at least two years with subsequent follow-up services • Recommendations with convincing case studies • Develop mid-level qualified and dedicated sustainability personnel • Continuous on-line monitoring and comparison of performance against national benchmark

Information from 25 different factories that consist of 37 production units namely 17 RMG, 3 Spinning, 14 WDF, and 3 Weaving units from nearly all clusters in Bangladesh were collected to identify the opportunities; which were extrapolated to estimate the total demand for the entire textile sector in Bangladesh. The 32 identified opportunities establish the feasibility of a demand aggregation model; 12 most promising opportunities in terms of energy savings and financials have been selected for the model. These are presented in the table below along with the savings opportunities through the implementation of these measures.

Sl #	Opportunity	Remarks			Total Energy Saving (TJ/Yr)	Total GHG Reduction (TCO2e/Yr)
		Savings	Investment	Applicable units*		
1	EGB or other cogeneration systems	High	Medium	A (762)	21,000	1,446,640
2	Heat recovery from generator jacket water	High	Medium	A (1524)	10,320	710,920
3	Solar thermal water heaters	High	Medium	A (4763)	5,770	397,480
4	Condensate and flash steam recovery system	High	Low	A (2858)	2,040	140,530
5	Economizer at boiler exhaust	High	Medium	A (2286)	1,965	135,365
6	Solar PV plant with net metering system	High	High	A (3239)	1,600	110,220
7	Servo motors in sewing machines	Medium	Medium	R (1390)	1,530	105,400
8	VFDs for motors (other than boiler fans)	High	Medium	A (3239)	930	64,050
9	G-Trap for steam irons	Medium	Medium	R (1985)	660	45,500
10	Energy-efficient motors	Medium	Medium	A (4191)	535	36,850
11	Bio-Scouring or enzyme-based scouring	High	Low	W (281)	165	11,350
12	Servo motor in 'carding' machines	Medium	Medium	S (300)	35	2,410

**A: All, R: RMG, S: Spinning, W: WDF. Parenthesis indicates the number of units for the total textile sector in Bangladesh scaled from the survey sample, where that particular opportunity is applicable.*

Total possible savings from these 12 measures are as follows:



TJ: Terajoules | TCO_2e: Tons of CO_2 Equivalent | GWh: Gigawatt Hours

Comparison with the opportunities identified in the previous sustainability program clearly identified the trend in awareness and adoption of clean technology in the textile sector. Two major regulatory bodies- DoE and Titas Gas/Petrobangla, two major low-interest financial program- EECPF of SREDA and SREUP of GIZ, two major brand- H&M and Bestseller, and multiple technology service providers

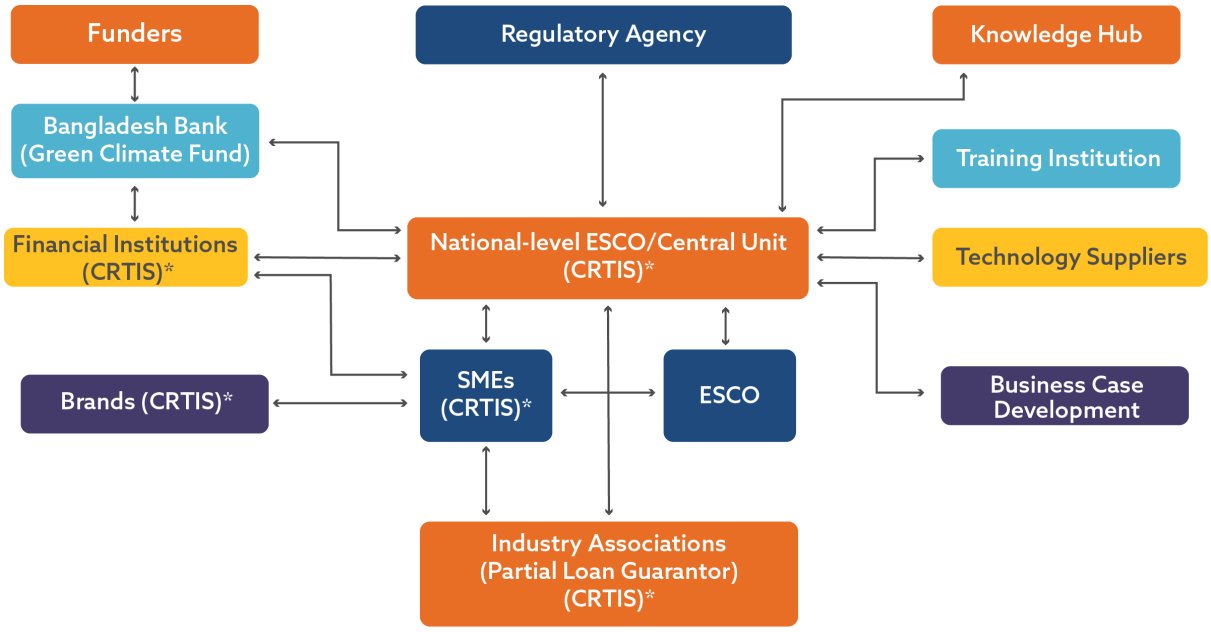
including Forbes Marshal, ABB, Omera Solar, etc., were consulted to assess the opportunities and barriers in financing and adoption of clean or new technologies.

It was also found that significant progress could be made in the adoption of clean technology by getting appropriate institutional level support from the BGMEA, BKMEA or BTMA in terms of finding technology service or equipment providers, information on new technologies and available financing, knowledge sharing, training, etc. as well as help in getting low-interest funding easily. Helping in the deployment of a Resource Tracking Information System (RTIS) on a large scale thereby at a significantly reduced cost to track the resource consumption and performance i.e. KPIs of a production unit monitored by the factory itself as well as by the stakeholders and PFIs authorized by the factory while showing the national benchmark KPIs and best performer's KPIs might bring ground-breaking achievement in the overall performance of the factories while accelerating the adoption of clean technology.

Currently, all stakeholders namely textile SMES, financial institutions, technology suppliers, regulatory bodies, industry associations, and brands are more or less operating independently. However, bringing all the stakeholders to operate collectively under a framework could synergically achieve significant benefits for all.

Accordingly, based on the barriers and opportunities identified through desk research and stakeholder consultations, and incorporating the experience achieved in India from its work on cleantech adoption in the textile SMEs, a comprehensive implementation framework has been proposed to accelerate and streamline the clean technology adoption process.

FIGURE 1: Proposed model for accelerating adoption of clean technology



Central Resource Tracking Information System

The framework requires a Central Unit which could be an existing organization or could be a new entity formed by the GoB, who as a knowledge hub would collect and share all the relevant information, as a non-banking financial institution gets low-interest funding from donors through Bangladesh Bank, gets and aggregates demands from SMEs, procures equipment in bulk from

manufactures through an open tender at the lowest possible cost, makes financing easier for the SMEs by incorporating organizations like BGMEA, BKMEA or BTMA as a partial loan guarantor, and monitor the overall process using RTIS.

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Acronyms

3e	Energy Efficiency Enhancement
AI	Impact Economy
AIC	Apparel Innovation Consortium
AFD	Agence Française de Développement
BB	Bangladesh Bank
BDT	Bangladeshi Taka
BIFFL	Bangladesh Infrastructure Financing Fund Limited
BGMEA	Bangladesh Garment Manufacturers and Exporters Association
BKMEA	Bangladesh Knitwear Manufacturers and Exporters Association
BTMA	Bangladesh Textile Mills Association
CP	Cleaner Production
COP	Cooperation of Parties
DANIDA	Danish International Development Agency
DoE	Department of Environment
E&S	Environmental and Social
ECA	Environmental Conservation Act
EGB	Exhaust Gas Boiler
EIA	Environmental Impact Assessment
ERI	Engineering Resources International Ltd.
ESCO	Energy Service Company
EU	European Union
EVC	Electronic Volume Corrector
GCF	Green Climate Fund
GIZ	German Development Corporation
GoB	Government of Bangladesh
IDCOL	Infrastructure Development Company Limited
IFC	International Finance Corporation
INDC	Intended Nationally Determined Contributions
ISC	Institute for Sustainable Communities
JICA	Japan International Cooperation Agency
KfW	Kreditanstalt für Wiederaufbau
KPI	Key Performance Indicator
LSP	Local Service Provider
NCCI	Nordic Chamber of Commerce and Industry
NFI	Non-banking Financial Institution
PaCT	Partnership for Cleaner Production
PFI	Participating Financial Institution
RMG	Readymade Garments
RTIS	Resource Tracking Information System
SDG	Sustainable Development Goals
SIDA	Swedish International Development Agency
SIWI	Stockholm International Water Institute

SME	Small and Medium Enterprises
SREDA	Sustainable and Renewable Energy Development Authority
SSREU/SREUP	Program to Support Safety Retrofits and Environmental Upgrades in the Bangladesh Ready-made Garments Sector Project
STWI	Sweden Textile Water Initiative
USAID	United States Agency for International Development
ZDL	Zero Discharge of Liquid

Chapter 1: Clean Technology

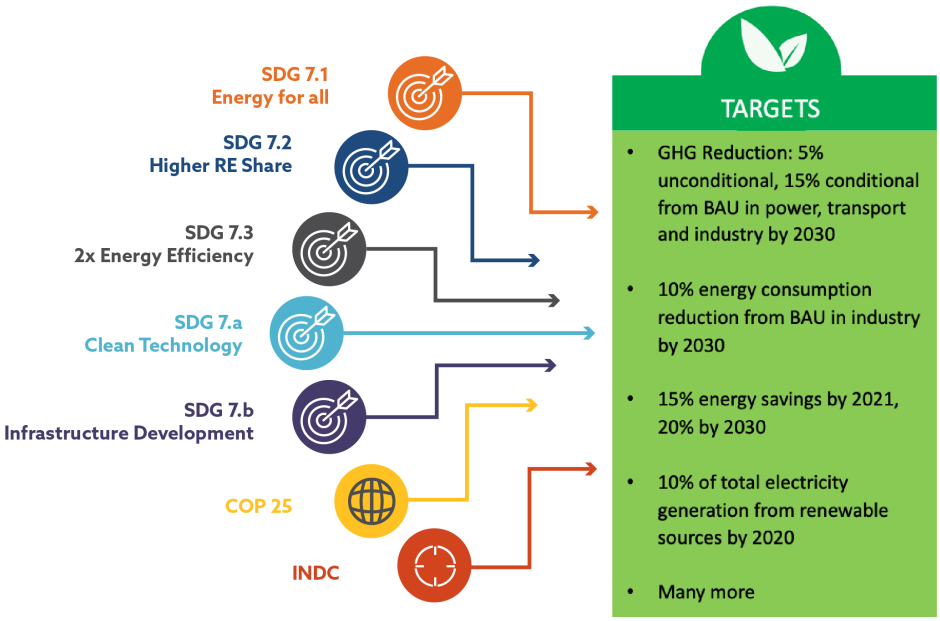
1.1 INTRODUCTION

1.1.1 Energy Scenario and the Textile Sector of Bangladesh

To close the gap between the national energy production and the primary energy use based on the projected economic growth of the industrial sector while working for the fulfillment of the Sustainable Development Goal (SDG) 7, especially 7A and 7B, Intended Nationally Determined Contribution (INDC) commitment under Paris agreement, Bangladesh is committed to an unconditional contribution to reduce GHG emissions by 5% from Business As Usual (BAU) levels by 2030 based on existing resources; and a conditional 15% reduction in GHG emissions from BAU levels by 2030 in the power, transport and industry sectors, subject to appropriate international support in the form of finance, investment, technology development, and transfer, and capacity building.

Improved energy efficiency in production and consumption of energy is one of the key mitigation programs envisaged in the country's INDC. In this regard, GoB aimed to achieve 10% of energy consumption reduction in the industry sector by 2030 compared to the BAU. GoB expects to achieve its target of 20% improved energy intensity (national primary energy consumption per gross domestic product/GDP) by 2030 compared to the 2013 level. These are summarized in the figure below:

FIGURE 2: SDG Targets

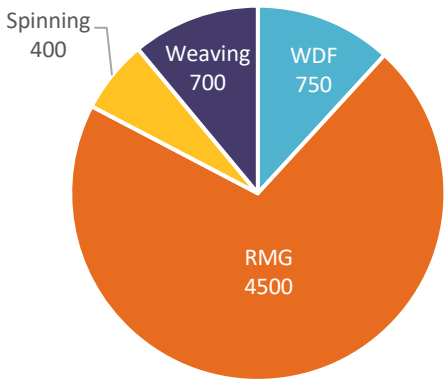


In addition to ensure reliable and quality energy supply, and to meet the extremely high need for boosting the energy-intensive industrial sector towards adopting the energy-efficient technologies, thereby improving the total energy efficiency factor of the country; the Government of Bangladesh (GoB) is taking a number of measures as stated in the Energy Efficiency and Conservation (EE&C) Master Plan up to 2030. The plan would promote the Energy Management Program, EE Labeling Program, and EE Buildings Program, which will be targeted at large energy-consuming entities and equipment in the industrial, residential, and commercial sectors. It is envisaged that during the period

between 2015 and 2030, a total of 5.3 Mtoe/year or the energy savings of approx. BDT 100 billion/year could be achieved through the adoption and implementation of the three EE&C Programs [1].

Bangladesh textile sector with over 6300 business units including nearly 4500 Ready-Made Garments (RMG) units have been the driving force of the Bangladeshi economy for decades. The sector contributed USD 30.4 billion to the economy in the recent fiscal year and employs around 4.5 million workers, most of whom are women. The target set by the Bangladesh Garments Manufacturers Association (BGMEA) in the pre-pandemic situation was to reach USD 50 billion by 2021.

FIGURE 3: Production units in Bangladesh Textile sector (approximate numbers)



Source: Approved PPF Application from GCF (5 November 2018) [2], BGMEA, BKMEA website

The textile sector alone consumes, predominantly in the form of natural gas and electricity, about 30% of the energy consumed in the industrial sector in Bangladesh that accounts for about 47.8% of the commercial energy consumption. Primary energy supply is dominated by Natural gas (75%) followed by crude oil & petroleum products (17%) and coal (8%). A significant proportion of this commercial energy is inefficiently consumed and utilized for economic and production activities since the impetus towards efficient end-use of energy in the industrial sector is lagging largely because of the subsidized energy prices. In addition to the inefficient utilization, the economic growth outlook in the medium to long term will further put tremendous pressure on the government to manage the rising energy, the economic demand, associated GHG emissions and achieve its commitments (INDC) under the UN Paris climate accord.

The following figures show the industrial sector including textile and RMG sector's 2015 and 2030 scenarios:

FIGURE 4: Energy Consumption (2015)

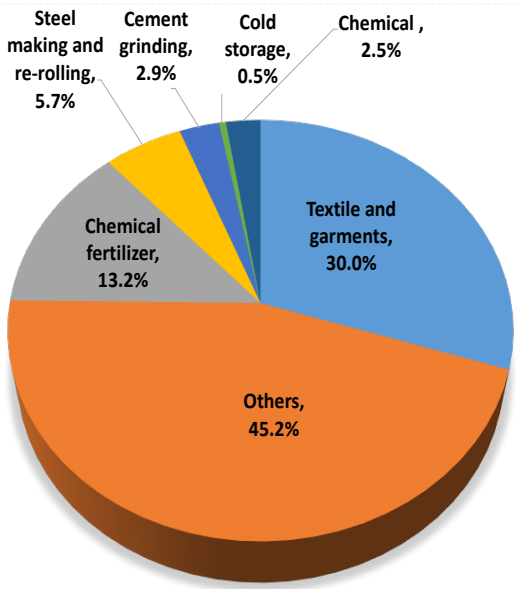
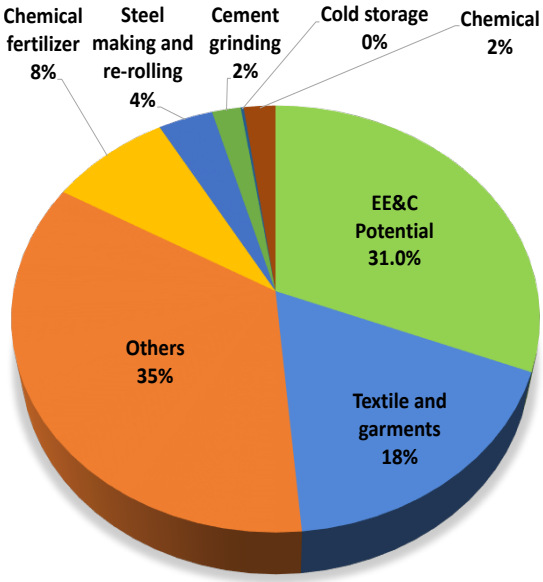


FIGURE 5: EE&C Case Energy Consumption



Source: Energy Efficiency and Conservation Master Plan up to 2030 [3] [4]

The breakdown of electrical and thermal energy consumption is the different types of production units are given below:

FIGURE 6: Electrical Energy Usage Pattern

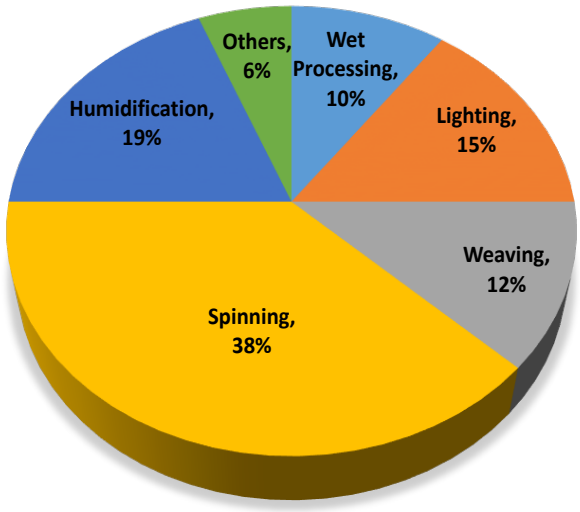
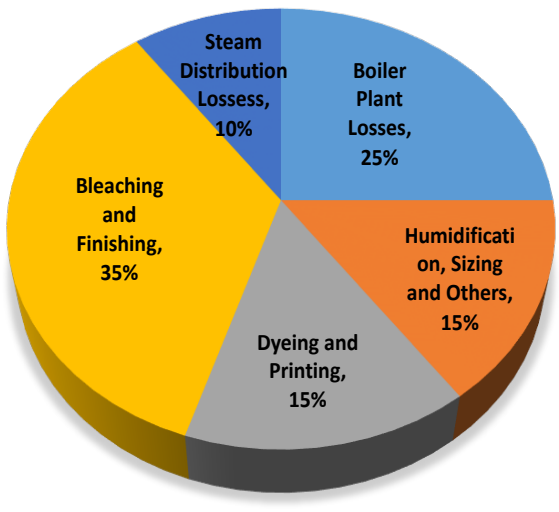


FIGURE 7: Thermal Energy Usage Pattern



Source: Approved PPF Application from GCF (5 November 2018) [2]

The above figures indicate that a significant improvement in energy efficiency is possible in the textile sector. The government, therefore, considers it important to provide EE Finance Program to raise EE awareness among the power end users and boost their investments in EE products. Low-interest loans are one of the key financial incentives envisaged to lessen the financial burden (initial costs) of end-

users who will purchase high energy efficient electric appliances and industrial equipment. Besides, subsidies and preferential tax will also be provided to further reduce the burden.

In the textile sector, the success of any such initiatives, however, depends on identifying the opportunities for and barriers to in terms of technology, policy, financing mechanism, and brands involvement along with the business unit's internal management process and capability that shapes their decision-making process in implementing energy-efficient equipment. In the past, success in implementation of mostly low hanging fruits has been observed as a result of several initiatives. However, large scale adoption of selected energy efficient technologies requires intervention in the form of innovative business models involving all key stakeholders. As a result, an opportunity assessment is essential in this regard to streamline the process for achieving energy efficiency that is practical, profitable, and sustainable.

1.2 PROGRAM DESCRIPTION

ISC with support from USAID has implemented a project "Clean Energy Accelerator" to improve energy efficiency performance of Tirupur textile cluster in India. The project is designed to reduce emissions through the demonstration, dissemination, and adoption of SME-relevant clean energy technologies. The project through its different program activities designed to address the key barriers and challenges for energy efficiency adoption, has been able to see initial successes. As Bangladesh is a major hub for textile industries in south Asia region, it was decided to extend the learning made with the textile industries in India to Bangladesh and explore feasibility of using demand aggregation-based models for large scale clean technology adoption in Textile Industries in Bangladesh. In this regard, a study was conducted in Bangladesh to identify the barriers and opportunities to adoption of energy efficiency and renewable energy technologies by the textile sector. The findings from the proposed work may be helpful in subsequent advancement of clean technology deployment by the textile industry.

1.2.1 Objective

The main objective of this study is to conduct a baseline assessment through a combination of desk research, stakeholder consultations that includes global brands and suppliers, financing institutions, government bodies, SMEs, technology providers, and energy service companies, and analysis to identify barriers to and opportunities for adoption of energy-efficient, renewable energy and pollution abatement technologies by the textile SMEs in Bangladesh. The following are the key points to be addressed in this study:

- Technical considerations for adoption of cleantech and any innovations in this space
- Existing potential for adoption of specific clean technology
- Market opportunities and challenges for adoption
- Challenges existing and opportunities in financial support mechanisms
- Policy and regulatory landscape for industrial cleantech adoption including provisions, pre-requisites, and constraints
- Understanding the feasibility of the demand aggregation model in cleantech adoption and identifying the list of technologies suited for such a model

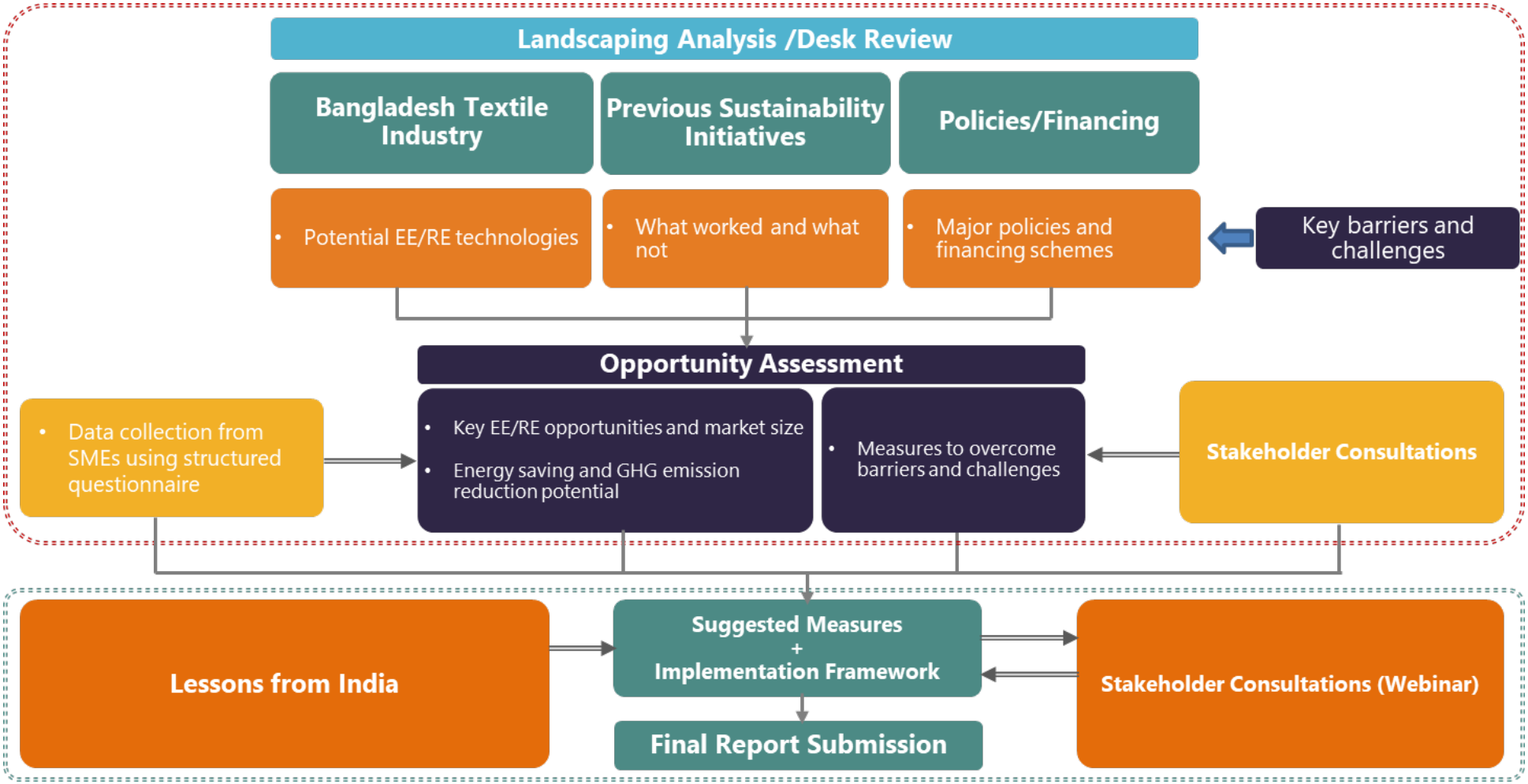
- Suggestion on potential ways to address the existing barriers and challenges for wider replication
- Mapping of all relevant stakeholder to be engaged for effective dissemination of the opportunity assessment results and advancement of cleantech adoption in Bangladesh textile SMEs
- Convening session with the key stakeholders identified and engaged above, for dissemination of the opportunity assessment results and advancement of cleantech
- Adoption in Bangladesh textile SMEs

1.2.2 Methodology

An exploratory research approach has been chosen for this study since no comprehensive studies that include all components of the current assignment namely barriers to and opportunities for implementing clean technology, renewable energy, and pollution abatement technology have been conducted for the textile SMEs in Bangladesh.

The approach followed in carrying out the assessment includes literature review and stakeholder consultations to collect qualitative data through structured questionnaire, email communications, over the phone interviews, and factory visits. The details of the methodology are described below:

FIGURE 8: Overall approach adopted in the present work



1.2.2.1 Landscape Analysis/Desk Review

1.2.2.1.1 Bangladesh Textile Industry

A literature review was done to assess the energy consumption in the textile sector, its share in the industrial sector in terms of commercial energy consumption, types of energy consumed, its EE/RE potentials, and key barriers and challenges faced in the adoption of these potential measures.

1.2.2.1.2 Previous initiatives

All major sustainability initiatives addressing EE and RE improvements in the Bangladesh textile sector namely PaCT, STWI, AIC, 3e, and NEST were reviewed to assess the success and shortcomings, what worked and/or what was missing for the success of these programs, opportunities identified, and the barriers and challenges faced especially for the adoption of clean technology in those initiatives.

1.2.2.1.3 Ecosystem

The study considers the four stakeholders namely policy and/or regulatory institutions e.g. relevant regulatory organizations of the Government of Bangladesh, funding institutions/financial service providers, brands, and technology providers that shape the adoption of clean technologies. Key stakeholders in each category were identified, major policies and regulations that have a profound impact on the adoption of clean technologies were reviewed to understand the policy implications, along with their shortcomings, barriers, and challenges in implementations. Financing opportunities and hurdles at funding institutions/financing service providers as well as services and financing models available from technology providers especially in the face of drastic change in the business landscape due to the COVID 19 pandemic were also studied.

1.2.2.2 Opportunity Assessment

1.2.2.2.1 Factory consultation

Based on the desk research and the experience of commonly identified opportunities in the factories, sets of specific and structured web-based questionnaire for each factory type were developed that consist of about 10 pinpointed questions for each factory type focusing on existing potentials and opportunities, technical issues, and challenges, financial needs, and barriers, etc. The questionnaires were sent to the 25 representative factories of different types, sizes, and clusters in advance. The factories were then visited or contacted over the phone and the relevant information were collected, verified, and analyzed (see Annex 1 and Annex 6 for details).

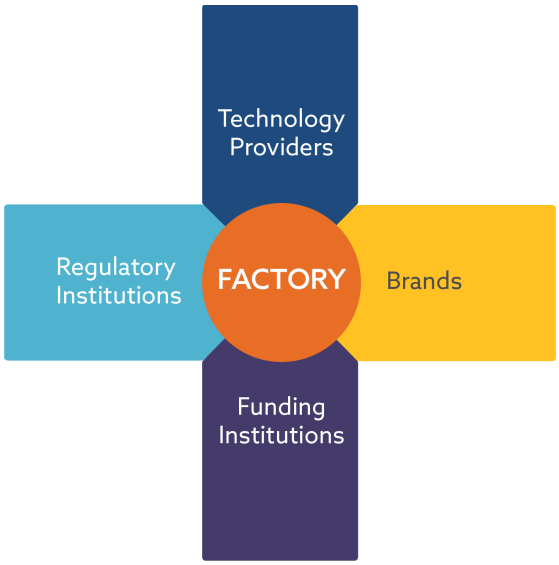
1.2.2.2.2 Stakeholder consultation

Findings from the landscaping analysis were further validated by primary stakeholder consultation conducted using structured questionnaires, email communications, over the phone interviews, and on-site visits (factories only). A set of pre-selected questions were asked to get the information as well as their suggestions or opinion. For regulatory bodies, the question was focused on existing policies, their implications, and hurdles for implementations, if any. Financial service providers' question was focused on the barriers and challenges faced by them and the factories in loan processing. For brands, the questions focused on how their past and post-pandemic activities and targets could encourage the factories in the adoption of clean technology measures while supporting the factories to continue business and become sustainable. Technology providers were asked about their product pricing and services in a COVID 19 pandemic situation as well as when a demand aggregation model is in place (see Annex 4 for list of stakeholders and partners).

1.2.2.2.3 Identification of opportunities, barriers, and challenges

The adoption of clean technology in a factory is often shaped by the influence and interactions of the other stakeholders as indicated by the following figure.

FIGURE 9: Interaction of factory with stakeholders



Based on the desk research, and the factory and the stakeholder consultations; key EE/RE technologies having replication and energy saving potentials were identified. The total demand for such technologies were then extrapolated for the entire textile and RMG sector for Bangladesh. The top 12 opportunities in terms of quantity, savings, and investment were identified; and their total energy saving, GHG emission reductions, and the total market size were estimated. Barriers and challenges that need to be addressed to tap these opportunities were also assessed.

1.2.2.3 Suggested Measures

With opportunity assessment in the Bangladesh textile and RMG sector, and the lesson learnt from India in terms of capacity building, potential technologies, and demand aggregation/ESCO model; a mechanism with suggested measures and proposed implementation framework that suits the Bangladesh context for the accelerated adoption of clean technologies was proposed. The findings and the proposed mechanism were shared with the relevant stakeholders using a virtual meeting; and the inputs received from them are incorporated in the proposed framework presented in this report. The detailed agenda of the webinar and summary are provided in Annex 7.

1.3 ORGANIZATION OF THE REPORT

The report has been organized as follows:

Chapter 1: Incorporates the background of energy scenario and the textile sector of Bangladesh, program description and objectives, and the approach and methodology

Chapter 2: Provides landscaping analysis that includes regulatory policies, existing financing schemes, and the summary of previous initiatives

Chapter 3: Shows findings from stakeholder consultations that includes consultations with business units, regulatory bodies, funding institutions/financial service providers, brands, and technology suppliers

Chapter 4: Reflects the results and discusses the findings of the opportunity assessment, and the barriers and challenges identified in the study

Chapter 5: Provides suggestions, proposes an implementation framework that is modified by incorporating the suggestions from the stakeholder consultations on the proposed framework; and way forward

Reference: Provides the references and sources of all the important information

Annexures: Provides the relevant information and underlying principles used for the analysis of the information

Chapter 2: Landscaping Analysis

2.1 REGULATORY POLICIES

Bangladesh played a proactive and important role at Paris Agreement and COP25, and was one of the first countries to submit its Intended Nationally Determined Contribution (INDC), thereby proving its commitments towards climate change. In fulfillment of the Sustainable Development Goal 7 i.e. SDG 7: Ensure Access to Affordable, Reliable, Sustainable and Modern Energy for All, and particularly Target 7.2: By 2030, increase substantially the share of renewable energy in the global energy mix; and the Target 7.3: By 2030, double the global rate of improvement in energy efficiency; the Government of Bangladesh has taken multiple steps. Few such steps are described below:

TABLE 1: Summary of major policies/regulations

Policy/Regulation	Major Components
SREDA Act-2012	• Energy Efficiency and Conservation Master Plan up to 2030 & Action Plan for Energy Efficiency and Conservation • Renewable energy power generation to 10% of total generation by 2020 • 15% energy savings by 2021 and 20% by 2030 • Energy Audit Regulations 2018
Bangladesh Climate Change Strategy and Action Plan (BCCSAP)	• Reduce energy intensity (per GDP) by 20% by 2030 compared to 2013 levels (EE & C Master Plan up to 2030) • Energy Management Program, including the establishment of Energy Management Systems and energy audits for the industry by accredited energy auditors • Energy Efficiency Labeling Program to promote sales of high-efficiency
Bangladesh Oil, Gas and Mineral Corporation (Petrobangla)/Titas Gas Circular	• Achieve at least 60% thermal efficiency for captive power and at least 85% thermal efficiency for boiler with economizer
Department of Environment (DoE) of the MoEFCC)	• All environmental and climate change regulations • Action Plan for Energy Conservation 2013 • Water Act 2013 • Renewable Energy Policy 2008 • Initiated ZLD activities

Policies and regulations are described below with some details.

2.1.1 Enacting the 'Sustainable and Renewable Energy Development Authority' (SREDA) Act-2012

Established in 2012 and started operation in 2014, SREDA is working to reduce global warming, environmental hazard risk and to ensure energy security by reducing dependency on fossil fuel through the use and expansion of Renewable Energy, preventing energy waste in residential, commercial & industrial sectors by saving and conserving energy as well as ensuring its efficient use, and assess continuously for new potential sustainable solutions. SREDA's target for 2020 to promote

RE power generation to 10% of total generation; and 15% energy savings by 2021 and 20% by 2030 of total energy consumption in comparison with fiscal year 2013/14. SREDA is relentlessly working for the advancement in the Renewable Energy sector and has made some significant progress in installation of solar power plants, solar home systems, replacing diesel pumps by solar pumps, to name a few. Some of the activities in the energy efficiency and conservation sector include[1]:

- Preparation of Energy Efficiency and Conservation Master Plan up to 2030 & Action Plan for Energy Efficiency and Conservation
- Formulation of Energy Audit Regulation 2018
- Preparation of Energy Efficiency & Conservation rules 2016
- Policymaking for financing environment-friendly & green industry through Bangladesh Bank
- Inspiring to install waste heat recovery and cogeneration systems amongst the entrepreneurs who have captive power generation in their industries
- Low-interest financing for using energy-efficient equipment/machineries in industrial, building & commercial sectors under Energy Efficiency & Conservation Promotion Financing Project

To achieve the goal set by SREDA's Energy Efficiency & Conservation Master Plan, it identifies five major interventions namely (i) energy audit, (ii) EE&C building (iii) EE&C labeling (iv) EE&C finance, and (v) awareness-raising.

In addition, the Government considers it important to provide EE Finance Program to raise EE awareness among the power end users and boost their investments in EE products. Low-interest loan is one of the key financial incentives envisaged to lessen the financial burden (initial costs) of end-users who will purchase high energy efficient electric appliances and industrial equipment. Besides, subsidies and preferential tax will also be provided to further reduce the burden.

2.1.2 Bangladesh Climate Change Strategy and Action Plan (BCCSAP)

Bangladesh Climate Change Strategy and Action Plan (BCCSAP) is a knowledge strategy built upon the National Adaptation Programme of Action (2005). It sets out 44 programs to be taken by Bangladesh over the short, medium, and long-term within six strategic areas – food security, social protection and health; comprehensive disaster management; infrastructure; research and knowledge management; mitigation and low carbon development; and capacity building and institutional strengthening.

As part of the BCCSAP, Bangladesh's strategy on mitigation sets out the program on improved energy efficiency in production and consumption of energy to ensure energy security and low carbon development of the economy. A number of activities and targets to reduce GHG emissions that also helps meeting INDC, and are overlapping with some of the Energy Efficiency & Conservation Master Plan up to 2030 are:

- A target to reduce energy intensity (per GDP) by 20% by 2030 compared to 2013 levels (EE & C Master Plan up to 2030)

[1] For details, please visit www.sreda.gov.bd

- An Energy Management Program, including the establishment of Energy Management Systems and energy audits for the industry by accredited energy auditors
- An Energy Efficiency Labeling Program to promote sales of high-efficiency products in the market
- Energy Efficiency measures for buildings, such as heat insulation and cooling measures, and a revised code on the energy efficiency of new buildings

Therefore, improved energy efficiency in production and consumption of energy is one of the key mitigation programs envisaged in the country's INDC. It has been repeatedly emphasized that GoB expects to achieve its target of 20% improved energy intensity (national primary energy consumption per gross domestic product/GDP) by 2030 compared to the 2013 level.

2.1.3 Bangladesh Oil, Gas and Mineral Corporation (Petrobangla) Circular

Petrobangla under the Ministry of Power, Energy and Mineral Resources, GoB recommended the following guidelines in early 2016 to follow in determining the energy-efficient units while installing gas meters with EVC:

A. For considering a boiler as energy-efficient when the followings should be present in the boiler and the boiler plant:
    1. Ensured combustion efficiency by keeping proper air/fuel ratio, and regularly performing and monitoring the flue-gas analysis
    2. Steam lines, fittings, and valves, and blow-down lines are properly insulated
    3. Blow-down is based on measured TDS or presence of an automatic blow-down system
    4. Condensate recovery from process plant to use it as boiler feed water
    5. Economizer for boilers with capacity 1TPH or above
    6. Effective feed water treatment plant and softening plant

A boiler could be considered as energy-efficient if the thermal efficiency of the boiler alone is at least 82%, and the above-mentioned items (1- 6) are installed and giving a thermal efficiency of at least 85%.

B. For considering a generator/captive power plant as energy-efficient, the followings should be present:
    i. Ensured combustion efficiency by keeping proper air/fuel ratio, and regularly performing and monitoring the flue-gas analysis
    ii. Waste Heat Recovery System such as Exhaust Gas Boiler (EGB), Hot Water Generators, Chillers, etc. are installed to recover the waste heat from generators
C. A generator/captive power plant could be considered as energy-efficient if the electrical efficiency of the generator alone is at least 35%, and the above-mentioned items (I - ii) are installed and giving a cogeneration efficiency of at least 60%.
D. For considering a furnace as energy-efficient, the followings should be present:
    iii. Automated burner control with ensured combustion efficiency by keeping proper air/fuel ratio, and regularly performing and monitoring the flue-gas analysis
    iv. Burner is properly sealed

v. Properly insulated
vi. Recuperator is installed to recover lost heat

A furnace could be considered as energy-efficient if the above-mentioned items (i- iv) are installed and giving a thermal efficiency of at least 70%.

Gas utilizing businesses or industries could be considered as energy-efficient if, to eliminate the wastage of energy and ensuring future energy security, they get Efficiency Level Audit (Energy Auditing) by a registered Energy Auditing Firm or Government Certified Institution having Certified Energy Auditor to determine the installation's current and projected thermal efficiency, reasons for thermal losses and detailed descriptions of adopted or recommended actions to prevent losses along with the saved and estimates of probable gas savings; submit the audit report to the gas distribution company and gets verified, meet the efficiency requirements mentioned in (a) - (c), and get approval by the gas supplying company.

Titas Gas Transmission and Distribution Company Limited accordingly published a circular in July 2016 stating:

> *This is to inform all captive power plant owners and users that, according to government decision to ensure the proper use of the valuable natural gas, order has been given to increase the thermal efficiency of all the captive power plants to 60% within the next six months. To meet this target, it is requested to take all the necessary actions. This matter has already been informed by mail to all customers.*

According to the above directions and guidelines, the gas supply companies could disconnect any gas supply if the gas is being utilized at an efficiency less than what is set by the government/commission/Petrobangla/Company2. The gas supply companies, however, did not execute this power yet as this can't be done overnight, would have serious consequences on the businesses, and most of the units would fail to comply. As the gas shortage and the gas price is on the rise, the gas companies might make a detailed plan for achieving it gradually, and take the necessary steps for formulating and/or strengthening policy, regulatory and legal frameworks as well as enforcing and implementing capabilities.

2.1.4 Department of Environment

The Department of Environment (DOE), under the Ministry of Environment and Forests and Climate change (MoEFCC) is the main environmental regulation and enforcement agency for industrial licensing and pollution monitoring. It is responsible for awarding factories with environmental clearance certificates, undertaking factory inspections, and monitoring compliance and enforcement of environmental standards (through fines and factory closures). The most relevant national laws pertaining to the industrial sector are as follows:

i. National Environmental Policy 1992
ii. National Energy Policy 1995

[2] Bangladesh Gazette, additional, August 18, 2014; section 8.3 (5)

iii. Environment Conservation Act 1995
iv. National Environment Management Action Plan (1995-2005)
v. Environment Conservation Rules 1997 (Amended Feb and Aug 2002)
vi. National Industrial Policy 2005
vii. Environment Court Act 2000
viii. Environment Conservation Act (Amended 2000 and 2002)
ix. Environment Conservation Rules 1997 (Amended 2005)
x. Environmental Conservation Rules 1997
xi. Renewable Energy Policy 2008
xii. BEZA Act 2010
xiii. Bangladesh Climate Change Trust Act 2010
xiv. Balumahal & Soil Management Act 2010
xv. Speedy Increase of Electricity & Fuel (Special Provision) 2010
xvi. National 3R Strategy 2010
xvii. Environment Court Act 2010
xviii. Environment Conservation Rules 1997 (Amended Feb 2010)
xix. Environment Conservation Act (Amended 2010)
xx. Bangladesh Electricity & Energy Research Council Act 2015
xxi. Bangladesh Standards and Guidelines for Sludge Management 2015
xxii. National Industrial Policy 2016
xxiii. Energy Audit Rules 2016
xxiv. Petroleum Act 2016
xxv. Bangladesh Biodiversity Act 2017
xxvi. Environment Conservation Rules 1997 (Amended Feb 2017)
xxvii. SREDA Act 2012
xxviii. Action Plan for Energy Conservation 2013
xxix. Energy Efficiency & Conservation Master Plan 2014
xxx. National Environment Policy 2013
xxxi. Brick Manufacturing and Brick Kiln Establishment (Control) Act 2013
xxxii. Bangladesh Water Act 2013
xxxiii. National River Conservation Act 2013

2.2 EXISTING FINANCING SCHEMES

Bangladesh Bank has been at the forefront in encouraging green economic growth through a combination of policy and institutional initiatives, which directly and indirectly encourage green investments by high polluting industrial sectors, such as leather and textiles. In 2009, Bangladesh Bank established a revolving refinance scheme of BDT 2,000 million from its own fund for lending to borrowers through commercial banks and non-banking financial institutions (NFIs) who are interested to invest in “Renewable Energy and Environmentally Friendly Financeable Sectors” namely solar energy technology, bio-gas plants, and ETPs. The product line has grown since then and now covers 52 items in 8 categories. Out of the 52 products that are allowed, the relevant segments to the RMG industry are:

- Green Industry
- Conversion from Chemical ETP to Biochemical ETP
- Installation of new Biochemical ETP
- Installation of new Biological ETP
- Ensuring work environment and safety for the RMG sector
- Waste Heat Recovery System
- Energy-efficient measures based on energy audit report
- Rooftop Solar micro/ mini-grid

In the course of time, Bangladesh Bank issued Green Banking Policy Guidelines for the commercial banks in 2011 and Green Lending Policy Guidelines for NFIs in 2013.

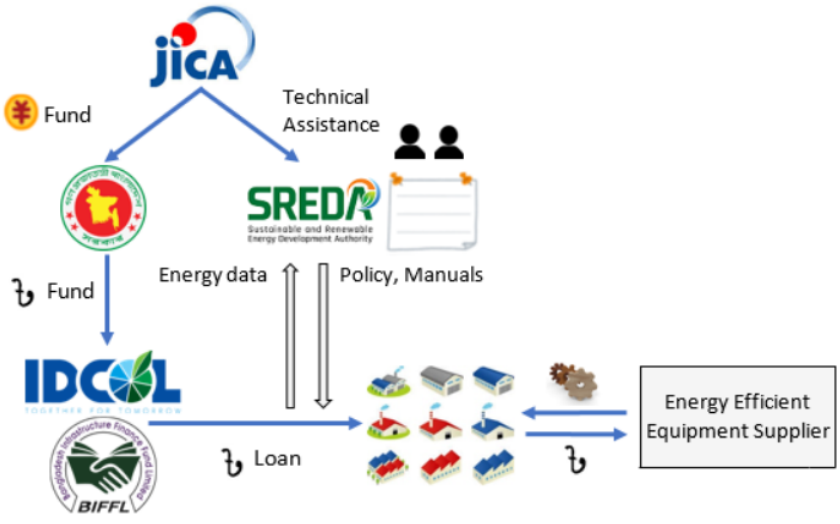
In January 2016, a new longer-term refinancing window named Green Transformation Fund (GTF), with USD 200 million was launched to facilitate access to financing in foreign exchange by the export-oriented textile and leather sectors to import capital machinery and accessories for the implementing environment-friendly initiatives. The categories relevant for the RMG industry are: water use efficiency in wet processing; water conservation and management; waste management; resource efficiency and recycling; renewable energy; energy efficiency; heat and temperature management; air ventilation and circulation efficiency; work environment improvement initiatives; and other fields as identified by Bangladesh Bank from time to time.

Among the number of initiatives taken by the Bangladesh Bank, currently, there are two major financing mechanisms available that offer low-interest funding for energy efficiency and renewable energy projects.

2.2.1 Energy Efficiency & Conservation Promotion Financing (EECPF) Project

This project comprises the fourth pillar among the necessary interventions of the Energy Efficiency & Conservation Master Plan up to 2030. The significance of implementing this EECPF Project is also outlined in the 7th Five Year Plan and EE&C Regulations of the Government of Bangladesh. The project fund was created with support from JICA. The financing process is schematically shown below:

FIGURE 10: Schematic of the financing process of the EECPF project



The three executing agencies that are implementing EECPF Project are SREDA, Infrastructure Development Company Limited (IDCOL), and Bangladesh Infrastructure Financing Fund Limited (BIFFL). SREDA is the administrative authority of the project who is managing the overall implementation arrangements, as well as a technical node for the project who is responsible for identifying the eligibility of the energy-efficient equipment and calculating the energy-saving effect from the project activities. To these ends, SREDA issues the business process manuals for project implementation, and provides the MIS for data collection and calculation. IDCOL and BIFFL are the implementing financial institutions that extend low-interest loans in line with the policies and procedures stipulated in SREDA's business process manuals. Both implementing financial institutions are provided the loan fund through the Finance Division of the Government of Bangladesh.

The terms of loans are as follows:

TABLE 2: Terms of loans under the EECPF project

Loan Category	Maximum Loan Amount (BDT)	Interest Rate	Term (yr)	Remarks
Rooftop Solar System	Up to 80% of the project cost (up to BDT 1 billion)	6%	Up to 10 years including up to 2 years grace period	Minimum capacity 200kW
Energy Efficiency Project	Up to 100% of the equipment/machinery cost (up to BDT 1.5 billion)	5-6%	Up to 10 years including up to 2 years grace period	5% with 100% security, 6% with 75% security. Minimum security 75%

EECPF Project utilizes a two-step loan or financial intermediate lending instrument. SREDA extends low-interest loans using this fund for those who are introducing energy-efficient equipment thereby encouraging the investors to select such equipment.

Once the borrower introduces energy-efficient equipment that was acquired utilizing this low-interest loan, the borrower reports to SREDA energy consumption data throughout the loan period through a designated management information system (MIS) for SREDA to monitor and calculate energy conservation effect through the implementation of the EECPF Project.

Some of the challenges faced by both lenders and borrowers are:

i. The loan is for equipment only. For setting up a new factory the equipment cost is usually not more than 20-30%. As a result, the borrower often unwilling to take the hassle of dealing and preparing documentation for two different financial institutions.
ii. The borrower can get financing for the JICA listed equipment only (SREDA and few brands are working with JICA to incorporate additional item to the list. An updated list is expected shortly)
iii. Lender prefers reputed businesses with stronger financial capabilities only
iv. Relatively weaker businesses often struggle with submitting required documentation

v. Once taken the loan and installed the equipment, the business needs to input selected data every month to a web portal for SREDA to estimate and monitor the performance throughout the loan period, which is often considered as a hassle for the factories
vi. High employee turnover in the factory made it difficult for SREDA to monitor the progress as SREDA has to train a new employee to enter the data
vii. Failure due to business's inability to meet the target would change the interest rate to the commercial rate

2.2.2 Loan fund for pre-finance under "Program to Support Safety Retrofits and Environmental Upgrades in the Bangladeshi Ready-Made Garments (RMG) Sector Project (SSREU)"

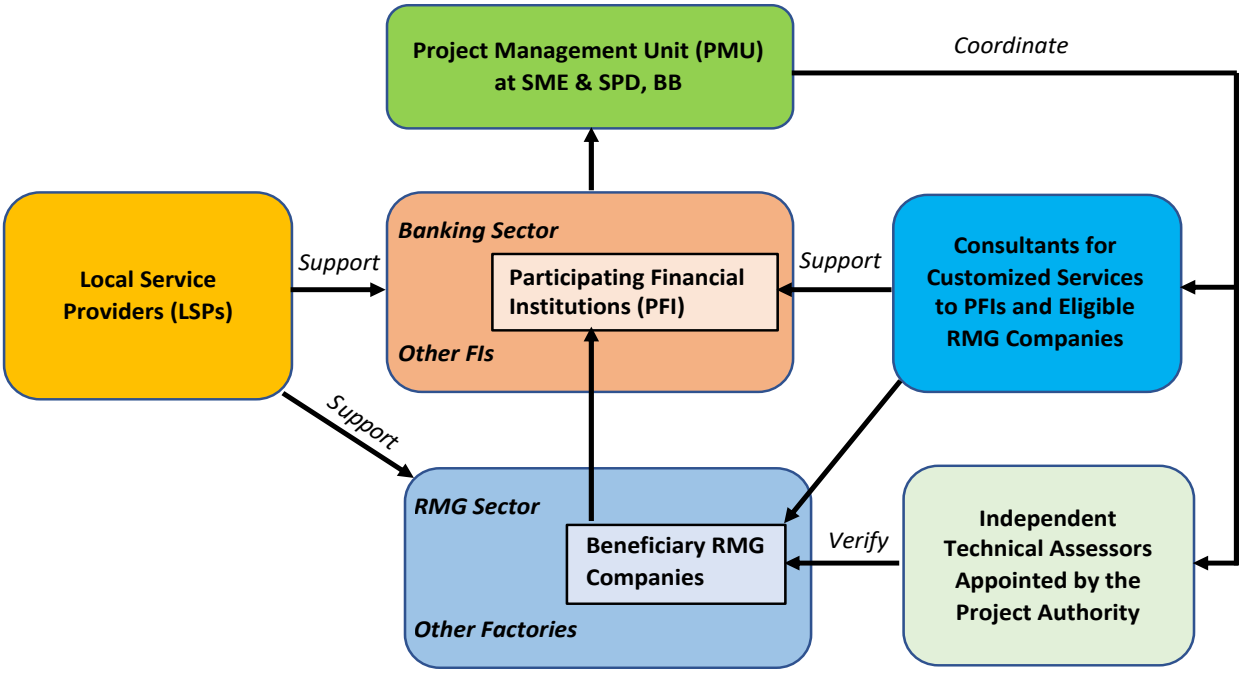
To strengthen the economic sustainability of the RMG sector and make it safer, greener, and a decent place to work, the government of Bangladesh has created this loan fund in Bangladesh Bank to support the RMG factories through medium to long-term finance under this project. The project, implemented by Bangladesh Bank, aims at providing financial and technical support for Safety Retrofits and Environmental and Social upgradation, providing incentives to undertake such investments, and assisting export-oriented RMG factories in implementing them. In October 2019, Bangladesh Bank (BB) along with Agence Française de Développement (AFD), the European Union (EU), Kreditanstalt für Wiederaufbau (KfW) Development Bank, and the GIZ launched the SSREU project. The details of the fund are as follows:

TABLE 3: Details of the fund under the SSREU project

Contributor	Amount (million EUR)	Fund Type	Purpose
AFD	50	Credit	EUR 34 million for safety retrofits/remediation, EUR 16 million for upgradation of E&S standards.
EU	6.3	Grant	Technical Assistance
KfW	4.0	Grant	
GIZ	3.0	Grant	
BB	0.99	Grant	

The project was set to be implemented over a 5-year period from 2018-2022, however, because of the late start as well as COVID 19 situation, it would be extended further. The financing process is schematically shown below:

FIGURE 11: Schematic of the financing process of the SSREU project



The terms of the loan are as follows:

TABLE 4: Terms of loans under the SSREU project

Item	Description
Loan Purpose	Safety remediation, environmental and social up-gradation of RMG factories
Loan Amount	BDT equivalent of EUR 1 million; may be extended up to BDT equivalent of EUR 3 million in case of (i) major environmental up-gradation or (ii) any other duly justified and documented case
Interest Rate	Maximum 7% per year
Maturity	3-5 years, maybe extended up to 7 years in the case of (i) major environmental up-gradation or (ii) any other duly justified and documented case
Incentive	Performance-based investment grant as a deduction from the loan account: 10% of the total loan related to safety remediation investment, 20% of the total loan related to environmental and/or social investments. The breakdown of investment grants among eligible RMG companies and PFIs would be 90:10

Agreements have been already signed between Bangladesh Bank and eleven financial institutions marking an important step for the project's implementation and paving the way for the next phases of remediation investment proposals and loans to RMG end borrowers.

Some of the barriers and/or hurdles for getting the loan are as follows:

i. Only the registered export-oriented factories could get the loan
ii. The loan is tied with safety remediation i.e. no loan is available for environmental and/or social investments only. To get the loan the factories must provide evidence of full compliance to the CAP with positive review by the Independent Technical Assessors or must design their

investment plans as recommended by the Corrective Action Plans (CAPs) prepared by Accord, Alliance, or the National Tripartite Plan of Action (NTPA before going for the E&S activities

iii. Factories may avail both facilities if they are eligible for investments, but at first, the safety retrofits have to be done, and then environment & social up-gradation

iv. Most PFIs are still not very familiar with such loans for the RMG sector hence the processing of loan might be too cumbersome for both parties that could end up in frustrations

v. Contacting the potential factories in a coordinated way and make them interested especially in the COVID 19 situation yet to be developed

2.3 PREVIOUS INITIATIVES

Scores of initiatives especially since 2013 were taken for sustainable cleaner production in the textile sector of Bangladesh. The table below summarizes the major programs.

TABLE 5: Summary of the major sustainability programs in Bangladesh textile sector

Program Name	Features	Remarks
PaCT: Partnership for Cleaner Textile by IFC (2013-continuing)	For WDF factories to reduce water, energy, and chemical consumptions. Basic program to work on low-hanging fruits and increase awareness and knowledge, in-depth CP for larger savings in water, chemicals, and energy in wet processing units, ETPs, etc.	• Phase 1 was a 1-year program • Hardly any capital-intensive investment could be implemented during the project period • Factories often set different priorities when not followed up • Phase 2 is a 2-year program, which might see such implementations and measure actual investments, savings and payback periods.
Sweden Textile Water Initiative Program by SIWI (2015-continuing)	Similar to PaCT but covers RMG and textile units. Targeted both low-hanging and larger resource savings.	• 1-year program • Hardly any capital-intensive investment could be implemented during the project period. However, a factory had the chance to keep enrollment for 2 years.
Apparel Innovation Consortium (AIC) Project by IC (2016-2018)	For composite factories. Collected actual resource consumption data after installing water and energy meters. Targeted both low-hanging and larger resource savings. Provided a significant amount of financing as grant, equipment selection, and vendor support as well as training of 4500+ workers in 3 pilot factories on resource-efficient production, productivity, EHS, social areas, to name a few.	• 2-year program • Worked with measured data • All low and capital-intensive items were implemented, and actual investments, savings, and payback periods were determined • Clearly demonstrated the importance of measurements, longer implementation time, financing, and awareness-raising
3e Program by NCCI (2015-2017)	Only focused on reducing energy consumption and GHG emission in RMG and textile units.	• Only identified energy efficiency measures, and debriefed to factory • No follow-up

NEST Program by ERI (2019-continuing)	Similar to PaCT and STWI programs but covers all factory types.	• 1-year program customized for each factory type and need, with an option for 2nd-year follow-up support • 2-yr or longer program with customized level of engagement is possible • Higher factory engagement as the program is fully customer financed and customized

It was evident from the desk reviews that 1-year programs were too short for implementing the capital-intensive measures to realize the long-term benefits of any such sustainability program, which AIC program has demonstrated very clearly. This program also very strongly demonstrated that how important are financing/financial support as well as awareness raising and training in bringing great success in implementation of saving measures and financial benefits. Other than NEST program, all other sustainability programs operated and are operating under a fixed framework i.e. one-size-fits-all concept, which might not unleash or identify some of the potential benefits for particular factories. Moreover, most programs overlap with each other making it difficult for the factories to select which program they should get enrolled in. The common challenges with all programs could be summarized as:

- Inadequate engagement of decision makers
- Factory does not take ownership of the program i.e. considers it as an added responsibility or responsibility of the consultant or the program administrator
- No dedicated or qualified person at the factory level
- Non-convincing or too general recommendations without case studies or business cases provided by the consultants
- Short duration of the program as the factory lost focus without monitoring
- Factories sometimes need hand-holding especially in case of slightly complex or capital-intensive implementations
- Brand's engagement was often required to engage the factories especially during the implementation phase of the donor/brand sponsored programs

Annex 2 shows some details of each program mentioned above. A comparison of the typical energy saving measures found in the previous sustainability programs with those of the current study is also presented in Section 0.

Chapter 3: Stakeholder Consultation

Along with the factories, multiple other stakeholders, namely, policy and/or regulatory bodies (2), funding institutions/financial service providers (2), technology providers (4), and brands (2), that shape the adoption of technologies under considerations were consulted (detailed list is in Annex 4). This was needed to validate the findings of the desk research as well as collecting additional information. For factories, the consultation was essential to get the idea about their current status and needs in terms of clean technology adoption, how the need for such technology is evolving in general in the textile industry, as well as a sense of their direction during the post-COVID 19 situation.

3.1 CONSULTATION WITH INDUSTRIES

25 textile factories of different types and sizes that included 37 production units (17 RMG, 3 Spinning, 14 WDF and 3 Weaving) covering all textile clusters in Bangladesh were consulted using structured questionnaires (see Annex 6), email communications, over the phone interviews, and on-site visits. Sets of specific and structured web-based questionnaire for each factory type were developed that consist of about 10 pinpointed questions for each factory type focusing on existing potentials and opportunities, technical issues, and challenges, financial needs, and barriers, etc. In addition, qualitative inputs were also sought from unit owners to compile information on barriers and challenges in operation, compliance and financing prevailing at ground level.

3.2 CONSULTATION WITH BRANDS

Brands play one of the most important roles in adoption of clean technology by the factories. It was often the case that the factories enrolled in the sustainability program because of the brand's requirements even though there were significant opportunities for improvements. Most major brands are now having their targets that must be achieved by their suppliers to continue as a supplier. As the textile sector has been hit hard by the pandemic, the brands are aligning their requirements according to the changed situation of the factories.

Two major brands namely H&M and Bestseller who have altogether 500+ sourcing factories in Bangladesh were contacted to get their experience in sustainability programs, and how their corporate goals and business relationship motivates their supply chain in adoption of clean technology. The responses are described below:

3.2.1 Response from H&M

H&M has a public commitment to become climate neutral by 2030 and climate positive by 2040. H&M's factories were and still are involved in many different sustainability programs including PaCT, STWI, 3e, and NEST to work on resource efficiency, which supported the factories to improved energy intensity and reduce GHG emissions over the years. In addition, H&M also have a high priority to develop renewable energy infrastructure within the factories. When it comes to clean technology opportunities those programs focused on boiler efficiency, Exhaust Gas Boiler, energy-efficient machineries liker servo motor, energy efficiency lighting, etc.; low liquor ratio in dyeing and washing machine, cold pad batch dyeing, etc. H&M tracks the factory progress on energy based on annual performance considering the recommendation factory received. Considering its energy objectives, H&M facilitated one seminar involving relevant stakeholders including supplier management, GoB,

Power Division, bank, financial institutions, development organizations, brands, IDCOL, and technology service providers in May 2019. One of the challenges identified during the discussion that the factories didn't have easy access to the green fund since the process of due diligence in connection with sustainable investment was lengthy and complicated, many small and medium-size facilities didn't meet the due diligence criteria as well. Two recommended were suggested to increase the easy intake of green fund:

- Easy access to green financing with rational due diligence requirements
- Enable greater international collaboration for access to low-cost financing

In 2015, H&M's also made an observation [5] that is still valid:

> *There are substantial challenges around monitoring on the ground and major opportunities for improved monitoring of groundwater extraction and ETP functionality through decentralized monitoring approaches and, if possible, increased staff resources. Penalties for non-compliance are too low to be effective, and the mechanisms for pursuing penalties have opportunity for improvement. There is significant potential in the delegation of monitoring powers to local public representatives to improve implementation.*

3.2.2 Response from Bestseller

BESTSELLER is dedicated to accelerating fashion's journey towards a sustainable reality by countering climate change, using resources efficiently, and promoting human rights; with a commitment to become climate positive, fair for all, and circular by design. BESTSELLER, with its ambition strategy-Fashion FWD, has designed a program to strengthen the business unit's long-term sustainability and profitability by reducing its effect on the environment, while keeping in mind the four pillars of creating FWD by designing responsively, working better, producing leaner and consuming better. BESTSELLER is in the process of developing a robust environmental management program customized for the Bangladesh textile sector, and in the meantime, they are continuously working with its suppliers in Bangladesh in making the units sustainable. Prioritizing and selecting suppliers based on sustainability parameters is a core part of BESTSELLER's strategy, and the brand have encouraged factories to go for improved energy efficiency and reduced GHG emissions, through adopting energy-efficient equipment, recovering waste heat by installing economizers, WHRB, dynamic washing/dyeing units, adding solar power and efficient lighting. This has saved significant amounts of resources and money for the participating factories. If less engagement of owners or management is observed, BESTSELLER promotes events for awareness-raising and improving the competence of technical teams and vendors. BESTSELLER is also encouraging its suppliers to explore GCF and other low-interest funds.

3.3 CONSULTATION WITH TECHNOLOGY PROVIDERS

Several technology service providers including Forbes Marshall, Omera Solar, UCC Solar, ABB, Puma Engineering, etc. were contacted to understand the business model that could be developed based on the demand of the factories as well as what additional services the technology service providers could offer because of the drastically changed landscape in the textile sector due to the pandemic.

Most of the technology providers, in addition to other measures, offered 10- 15% additional discount and/or extended service or other services due to the pandemic situations. Forbes Marshall, for

example, took initiatives to help the industries to reduce their energy consumption by arranging webinars/online training for the concerned person, engineers, managers, etc., on how to reduce energy consumption for different industries including textiles. In addition, they are giving the credit facility, i.e. deferred payment for the L/C (90-120 days deferred from the date of shipment/BL) to help the industries to go for the investments comfortably in this crisis. They have also started providing technical support to the industries nearly free of cost, for the detailed engineering or energy assessments for the steam system for any expansion or improvement project. If there is a large number of requirements generated from an aggregated demand, Forbes Marshall would provide special pricing and extended service support, on a case-by-case basis.

One of the lucrative models for rooftop solar power plant for the factories is the OpEx model. Two providers namely Omera Solar and UCC Solar provided the following responses:

- CapEx model may be considered on a case-by-case basis if the generation capacity is over 100kW
- 1 to 5-yr additional free service warranty
- Arrange financing
- Special discounted price
- Help textile clients in opening direct LC to manufacturer to get them lower price due to duty exemption

Jeanologia's response was to assess the factory first and would work on a case-by-case basis in terms of price and services.

Chapter 4: Results and Discussion

4.1 OPPORTUNITIES

During the desk research, 50 representative factories of different types with 60 production units namely 22 RMG, 2 Spinning, and 36 WDF factories from different clusters and covering nearly the entire spectrum of the Bangladesh textile sector were selected to review their savings opportunities identified during the sustainability programs they participated in. For the current study, opportunities of clean technology adoption for 25 different factories that consist of 37 production units i.e. 17 RMG, 3 Spinning, 14 WDF, and 3 Weaving units from nearly all clusters in Bangladesh were determined by collecting information using a structures questionnaire. The factory locations are shown in Annex 1, and the opportunities are shown below. In the graph, the letter next to the opportunity description indicates the unit type where that particular opportunity is applicable while the number represents the number of units where that particular opportunity was identified. “A” represents the opportunity that is applicable to all factories. All opportunities identified for the utility section fall into this category. For this type, the percentage was determined from the indicated number divided by the total number of factories i.e. 25. Similarly, for production units, R represents RMG units, S represents Spinning units, W represents WDF units, and WV represents Weaving units. The percentage for these units was determined from the indicated number divided by the total number of corresponding units. For example, R10 in the current study indicates the opportunity is applicable for RMG units and was identified in 10 units, hence the percentage is 10/17*100 i.e. about 59%, where 17 is the total number of RMG units in the sample. These percentages were multiplied by the total number of applicable factories or production units e.g. 4500 for RMG units to estimate the total opportunities in the Bangladesh textile sector. A margin of error of 25% was applied to these initial estimates to accounts for uncertainty and make the estimates conservative.

FIGURE 12: Opportunities identified in previous sustainability programs

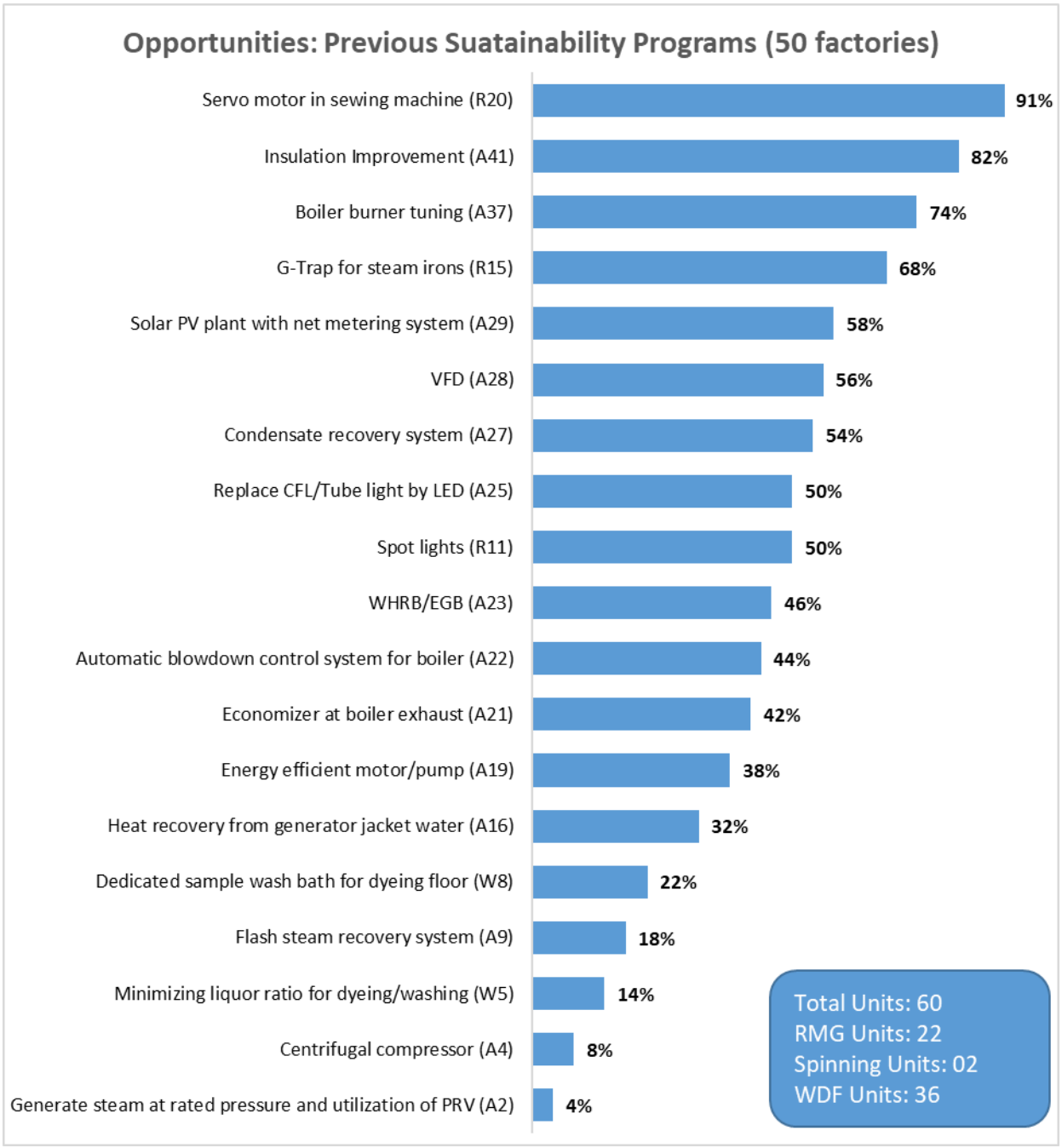
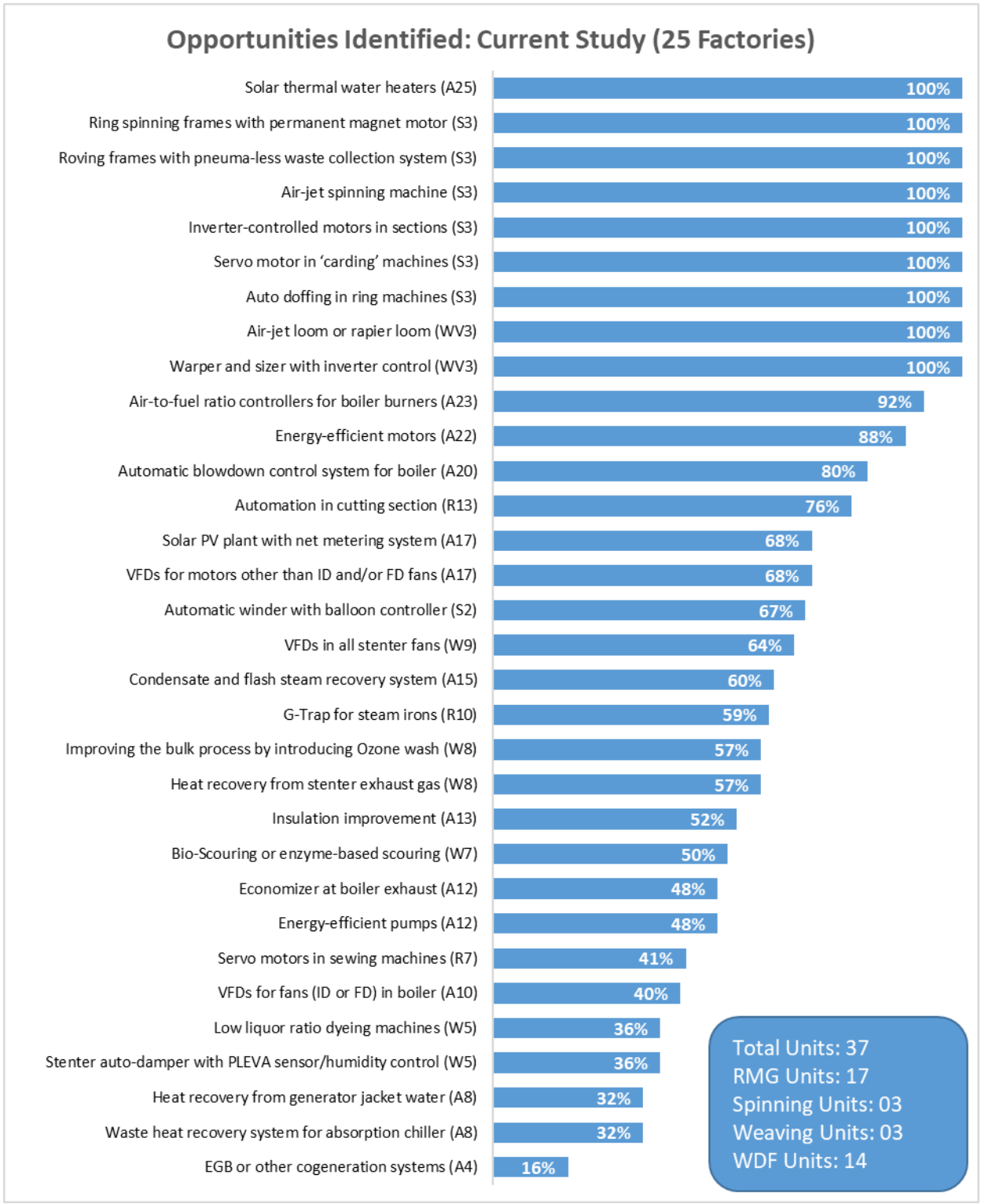
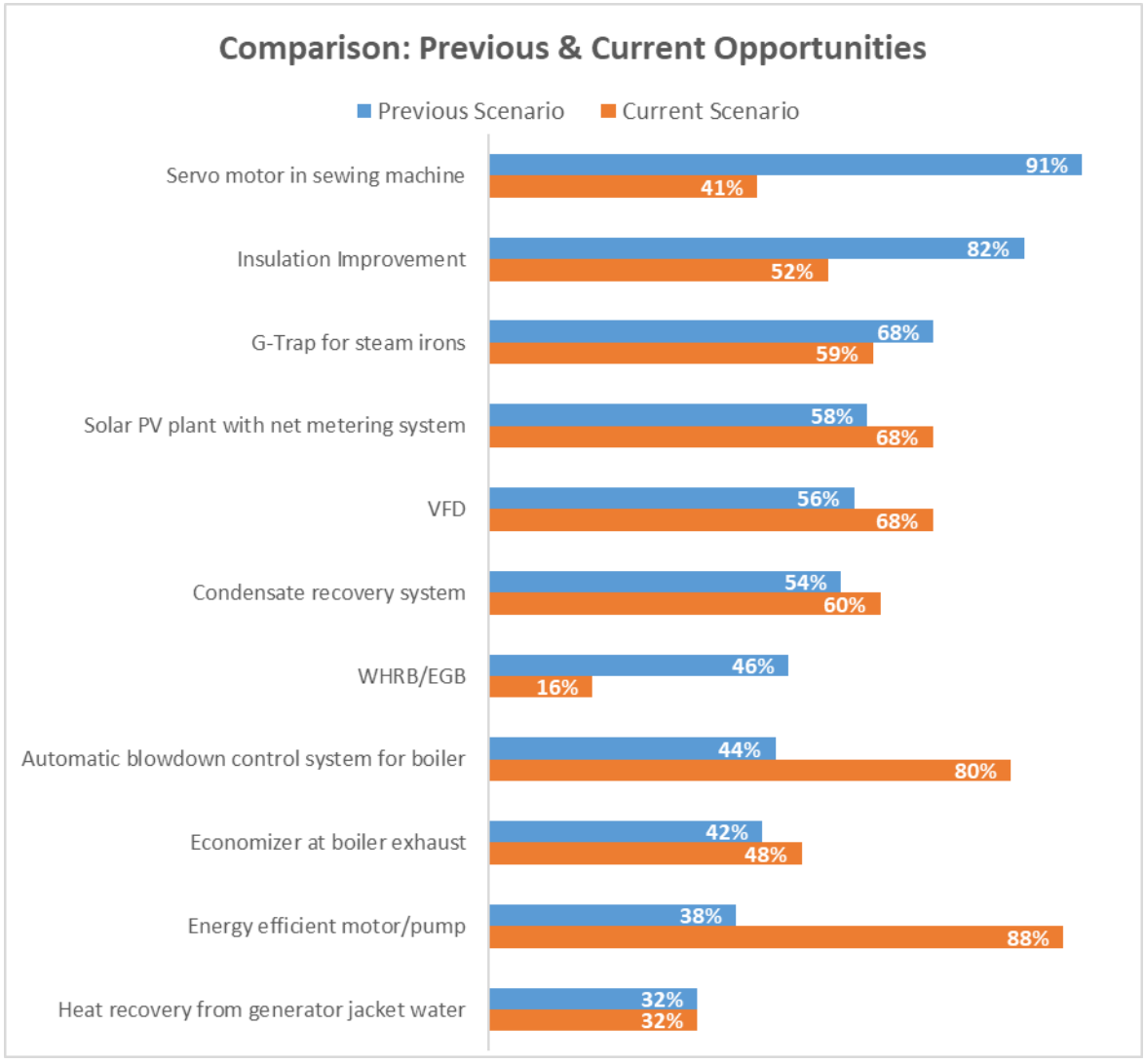


FIGURE 13: Opportunities identified in the current study



A comparison of some of the opportunities identified in the previous sustainability programs to those in the current study is presented below, which nicely indicates the trend of awareness and adoption of clean technology developed in the textile industry.

FIGURE 14: Comparison between previous and current opportunities for a few major energy-efficient technologies



For example, a sharp drop in the requirements for servo motor or insulation indicates the factories are well aware of the benefits of these improvement measures and adopting these technologies. For G-traps, the demand slightly dropped. The factories used to install G-traps but often incorrectly, therefore, faced the condensate leakage at the iron, and consequently stopped using the traps. With proper technical support from the vendors, the factories are now well informed about the correct way of installation and the benefits. Current emphasis on installation of solar panel from policymakers, brands, etc. as well as reduced price and net metering options increased the demand. Similarly, the benefits of automatic blowdown control systems and energy-efficient motors or pumps are now well established, hence their demands have sharply increased. Although the factories are well aware of the benefits of EGB/WHRB, and a number of factories have already installed it, lots of factories could not install it due to space limitations, inability to use the additional steam produced by the EGB e.g. only RMG units, or where the captive power generators are only used as standby, or for high investment

cost. The reduction of demand might be due to the combination of all these factors. The installation for economizer and condensate recovery system often requires a complicated piping system, change of some of the existing setups e.g. feedwater tank, additional measures, addressing space constraints, higher investment, and can only be installed when the boiler is shut-down for an extended period of time, which is usually two times a year (Eid vacation), their demands have not changed much probably because of these constraints.

Bangladesh textile and RMG sector is comprises of the following major production units. The total demand for any particular opportunity was scaled using the figures listed below:

TABLE 6: Production units in Bangladesh textile sector

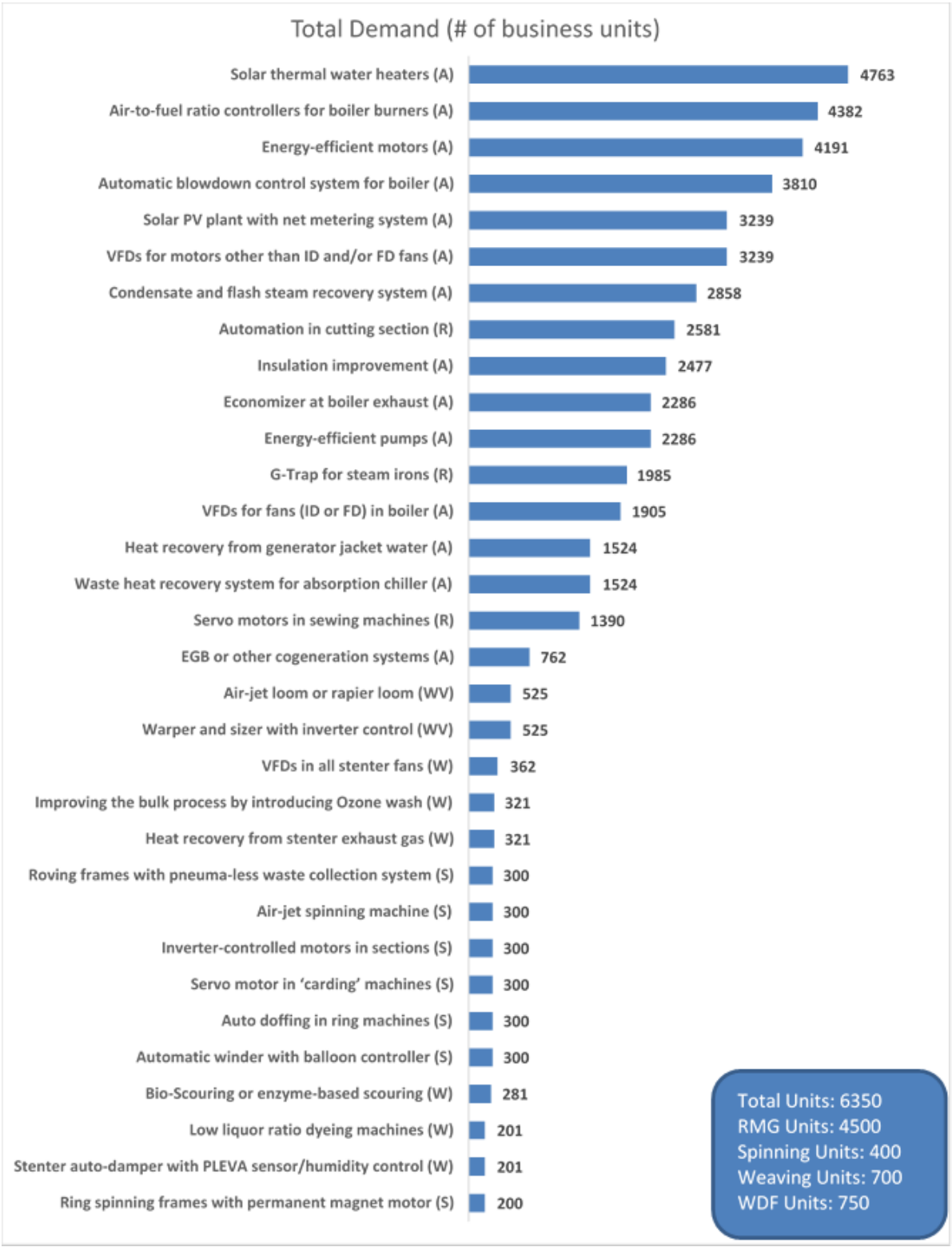
Unit	Number*	Energy Intensity	Major Energy Incentive Equipment/Process
WDF	750	High	Compressor, submersible pump, ETP blower, dyeing and finishing machines
RMG	4500	Low	Compressor, sewing machine
Spinning	400	High	Compressor, motor
Weaving	700	Medium	Compressor, loom

**Approximate figures*

Source: Approved PPF Application from GCF (5 November 2018) [2], BGMEA, BKMEA website

The total demand for the Bangladesh textile sector scaled from the study sample is shown below:

FIGURE 15: Estimated total demand for major energy-efficient technologies



The above figure indicated the total estimated opportunities in each category in the Bangladesh textile sector. As mentioned earlier, the letter next to the description of opportunity indicates the type of production unit where it is applicable; the number next to the bar graph indicates the number of units where that particular opportunity exists. It should be noted that the above figure only indicated the number of business units, not the number of equipment. For example, a mid-size factory usually has 8-10 pumps and about 30 motors of different capacities; an RMG unit might have a demand for 500 servo motors. To estimate the actual number of each equipment, which was outside the scope of this project, a comprehensive survey of a representative sample of textile industry in Bangladesh could be undertaken to have a robust demand aggregate model.

For the current study, the feasibility of a demand aggregation model seems well established as indicated by the opportunities shown in the above figures. Based on the experience of textile industry, the number of equipment in each category a factory might need, energy savings potential, investment need, rate of return, etc., the following equipment shows great promises and could be initially taken for case study to establish the potential and for demand aggregation model:

TABLE 7: Summary of the most promising opportunities

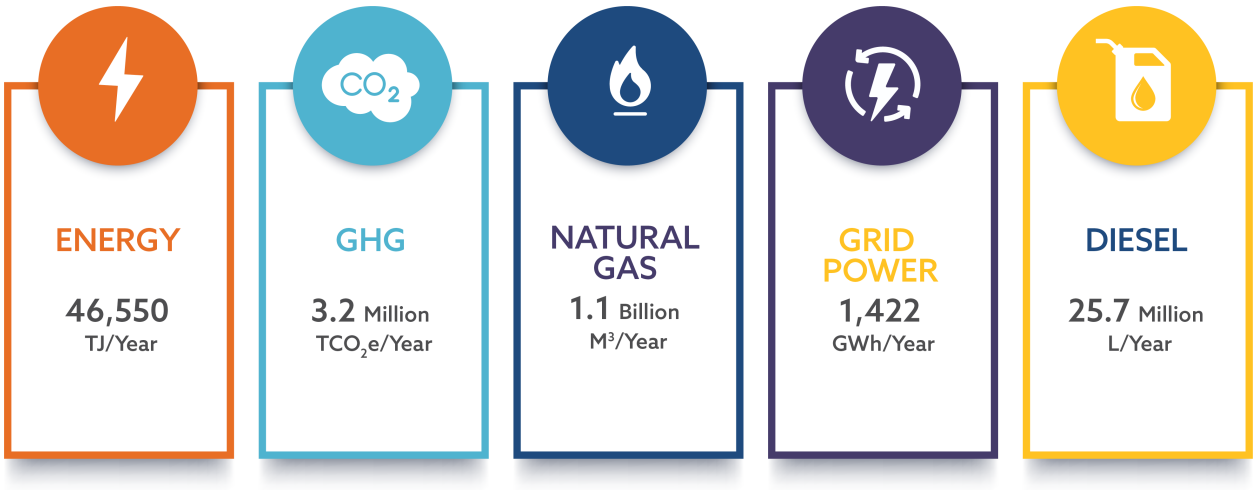
Sl #	Opportunity	Remarks			Total Energy Saving (TJ/Yr)	Total GHG Reduction (TCO2e/Yr)
		Savings	Investment	Applicable units*		
1	EGB or other cogeneration systems	High	Medium	A (762)	21,000	1,446,640
2	Heat recovery from generator jacket water	High	Medium	A (1524)	10,320	710,920
3	Solar thermal water heaters	High	Medium	A (4763)	5,770	397,480
4	Condensate and flash steam recovery system	High	Low	A (2858)	2,040	140,530
5	Economizer at boiler exhaust	High	Medium	A (2286)	1,965	135,365
6	Solar PV plant with net metering system	High	High	A (3239)	1,600	110,220
7	Servo motors in sewing machines	Medium	Medium	R (1390)	1,530	105,400
8	VFDs for motors (other than boiler fans)	High	Medium	A (3239)	930	64,050
9	G-Trap for steam irons	Medium	Medium	R (1985)	660	45,500
10	Energy-efficient motors	Medium	Medium	A (4191)	535	36,850
11	Bio-Scouring or enzyme-based scouring	High	Low	W (281)	165	11,350
12	Servo motor in 'carding' machines	Medium	Medium	S (300)	35	2,410

** A: All, R: RMG, S: Spinning, W: WDF. Parenthesis indicates the number of units for the total textile sector in Bangladesh scaled from the survey sample, where that particular opportunity is applicable.*

Again, in addition to the previous one, a margin of error of 25% was also applied in the energy savings and GHG reduction estimates to accounts for uncertainty and make the estimates conservative.

The figure below shows the total energy and GHG emission reduction as well as the equivalent natural gas (NG), grid power, and diesel savings that could be possible through the implementation of the twelve most promising opportunities. Details of the assumptions and calculations are given in Annex 5.

FIGURE 16: Summary of savings opportunities from twelve most promising measures



4.2 BARRIERS AND CHALLENGES IDENTIFIED

As discussed in the executive summary, some of the most significant barriers and challenges in adoption in clean technology in the textile factory are not knowing the factory's performance compared to others or to the national benchmark for its type, lack of communications to the top management to convince for investing in improvement measures, non-holistic assessment with short-term planning focus and limited understanding of the long-term benefits, non-understanding of the business cases, limited market overview, lack of energy management, high upfront cost of investment with higher payback period, not sure about projected benefit or perception of high risk, lack of fund or different priority, which are often shaped or intensified by the subsidized resource price, lack of policy or policy enforcement, lack of knowledge or easy access to financing, lack of price or tax incentives, to name a few. For example, energy-saving technology upgrades typically bear higher upfront/initial costs. This combined with subsidized energy prices provides limited business cases for the textile sector to opt for energy-efficient technologies. Similarly, water is considered "free" i.e. there is no or hardly any regulation to extract groundwater outside the EPZ, which creates less enthusiasm or urgency to invest in water-efficient technology that not only saves water and energy but also reduces production time, ETP cost, and pollution. Similarly, while Petrobangla/Titas Gas circular of 2016 clearly notified the industries with generator/captive power plant to increase the thermal efficiency of all the captive power plants to at least 60% within six months, and increase boiler efficiency to at least 85%, however, never enforced pursued to create the urgency or motivation adoption of energy-efficient technologies.

Financing, which is another most important motivating factor for adoption of clean technology did not or could not play the role it is capable of in the textile sector. As the financial institutions are relatively new in processing the low-interest funds for energy-efficient retrofits, the loan processing mechanism is often complicated and not streamlined. This, along with other restrictions, limited list of qualified machinery for financing, not reaching to bulk factories, or letting them know what financing is available became another contributing factor for less than possible adoption of clean technology.

Not getting the incentives from the policy authorities or even slightly higher price from the buyer were also contribute to the barrier in adoption.

On the institutional level, inadequate support for capacity development for both factory management and the local service providers in energy assessment, making loan processing comparatively easier by taking additional responsibility as well as not working as a knowledge hub to their capacity is also contributing to the slower adoption of clean technology.

Working with 300+ textile factories in Bangladesh as well as learning from different studies, a number of factors that impose barriers to the implementation of energy-efficient technologies have been identified. These barriers are summarized in the following five categories:

TABLE 8: Barriers in the adoption of clean technology

Barrier In	Major Contributing Factors
Awareness and knowledge	• Not knowing factory benchmark • Communication gap • Not make a holistic assessment or understanding business cases • Limited market overview or setting different priorities • Fear or perception of high risk • Absence of qualified assessor at lower or mid-level or resource assessment tools • Limited knowledge of low-interest financing and requirements
Policies and enforcement of regulatory measures	• Non-enforcement of regulatory measures especially for energy and water utilization, and pollution due to lack of enforcing or monitoring capacities • Subsidized resource pricing • Need for proper policy or review of the policy to address current needs • Need for stimulating economic or non-economic incentives or duty-structure
Financing	• Complex application process and loan processing • Stringent requirements or conditional loan • Preference for borrowers with strong financial strength only • Not many qualified equipment for financing • Not-so-clear guidelines or instructions about loan processing
Institution	• Non-existent or not-so-strong knowledge hub for awareness-raising, knowledge enhancing, and information sharing mechanism • Need for support especially for not-so-strong business entities • Need for one-stop service • Need for showcasing and implementing business models e.g. demand aggregation model
Sustainability Programs	• Inadequate engagement of decision makers • No ownership, considers added responsibility.

	• No dedicated person • Non-convincing recommendations • Duration too short for capital investment • Requires hand-holding; lose focus without monitoring

To tap the potentials or have large scale adoption of clean technologies, these barriers and challenges need to be addressed.

Details of the barriers and challenges could be seen in Annex 3.

Chapter 5: Suggestions

The main objective of this study was to understand the barriers and opportunities in the Bangladesh textile sector, adopting the knowledge acquired by the ISC in improving the energy efficiency performance in India, and come up with an implementation framework that is applicable and functional in the Bangladesh context.

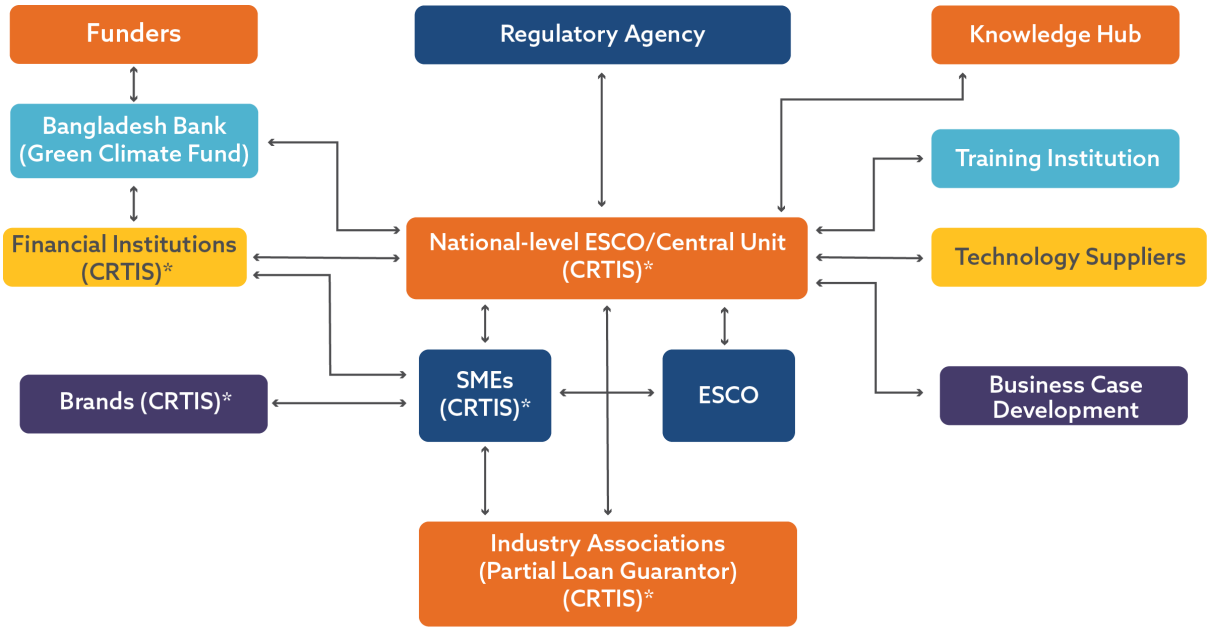
ISC with support from USAID has implemented a project to improve energy efficiency performance of Tirupur textile cluster in India. With the goal of accelerating the adoption of IE3 class (Premium) motors by addressing higher/upfront cost barrier, and implementation of the best operating practices, the program with the help of the government established the Energy Efficiency Services Ltd. (EESL) that made the demand aggregation model in to a reality. EESL collects the demands for the EE motors from the factories procures them with its own money through open tender that secures lowest possible cost, standardized technology, higher quality, extended warranty, to name a few; and pass these benefits to factories who can chose to pay upfront or in installments. In addition, the program created Clean Energy Forum for knowledge sharing, capacity building and awareness raising through workshops and trainings. The program also created pilot demonstration for business case development, energy technician training and certification program to develop qualified energy assessor at the mid-level, ESCO financing, and many more activities to accelerate the adoption of clean technology.

5.1 PROPOSED FRAMEWORK

Currently, in Bangladesh all stakeholders namely textile SMES, funding/financial institutions, technology suppliers, regulatory bodies, industry associations, and brands are more or less operating independently. However, bringing all the stakeholders to operate collectively under a framework could synergically achieve significant benefits for all.

Based on the barriers and opportunities identified through desk research and stakeholder consultations, and incorporating the very positive experience achieved in India from its work on cleantech adoption in the textile SMEs, the following comprehensive model is proposed to accelerate and streamlined the clean technology adoption process:

FIGURE 17: Proposed model for accelerating adoption of clean technology



Central Resource Tracking Information System

The model requires a central organization who deals with the factories through national or independent Energy Service Companies (ESCO), make the business cases, receives low-interest funds e.g. GCF from donors/BB following proper financing regulations, and communicates and negotiates with the manufactures to buy clean technology equipment in bulk at the lowest price through open tenders. BGMEA/BKMEA or similar organizations whose members are the factories acts as partial loan guarantors and receives a fee for their service. In a nutshell, the national Central Unit (CU) under the proposed framework will act as a conduit for transfer of technology and financing, standardizing technologies, developing business cases, knowledge sharing, capacity development, demand aggregation, online performance monitoring, and much more.

The central organization could be an existing entity or it could be collectively formed by the GoB or BGMEA/BKMEA of similar organizations. Since per Bangladesh law, the central organization should a non-banking financial institution (NFI) to receive the said funds, the new organization would need to be formed with the required regulations and capacity to perform the tasks.

Before investing for the clean technology measures by the factories, there must be proven business cases to make them convinced. The selected opportunities shown in TABLE 7 could be considered for this purpose. The funding for the project might come from the donors or directly from the manufacturers with a repayment guarantee once approached by the CU. The CU could then select a factory and perform an in-depth assessment through ESCO to establish the baseline and find the savings opportunities and financials for a particular piece of energy-efficient equipment. The manufacturer installs the equipment at the factory site with no cost to the factory, and keeps tracking the energy savings. CU/manufacturer quarterly collects a portion of the savings e.g. 50% until the total cost of installation is paid back per contract. Several business cases for different pieces of equipment at different factories thus could be developed and widely showcased to build factory confidence and enthusiasm toward adoption of clean technology.

To help the factories in finding the right and qualified ESCOs, the CU might have a list of ESCOs registered with them after fulfilling some set criteria. These ESCOs would work with the factories in finding the demands. The factories would then feed their demands to the CU along with the financial choices of upfront or low-interest payments. After processing the demand applications, the CU procures the required items in bulk from manufacturers via open tender at the lowest possible cost and have it installed at the factory. The factory would keep on making payments per the contract.

As a partial loan guarantor, CU might involve BGMEA, BKMEA, or similar organizations whose members are the participating factories, by paying a set fee e.g. 0.1% of the total loan. In turn, they would use their organizational capacity to help CU in collecting installments in case of non-payment. Per contract, CU might be able to adjust the non-payment amount only from these organization's total fees.

Deployment of a web-based Resource Tracking Information System (RTIS) on a large scale i.e. similar to demand aggregation model for equipment to track the resource consumption and performance i.e. KPIs of a production unit monitored by the factory itself as well as by the stakeholders authorized by the factory while showing the national benchmark KPIs and best performer's KPIs might bring ground-breaking achievement in the overall performance of the factories while accelerating the adoption of clean technology. The factory would be able to continuously monitor its performance i.e. KPIs against the best performer's or national benchmark, and take appropriate actions immediately; while the stakeholders including PFIs once given access by the factories could see the summary as well as individual factory performance, and notify and support the units struggling for improvements.

To make the improvement sustainable, capacity development of the factory personnel is essential. A continuous certification training program on energy efficiency appropriate for factory floor level people could be introduced by the CU with the help of the BGMEA, BKMEA, SREDA, or similar organizations. As proposed by SREDA to have at least one certified energy auditor at each factory, requirements for these certified energy technicians could also be included. To implement this, development of a robust plan and policy would be necessary.

To achieve these goals and have the implementation framework effective, eliminating or reducing the barriers and challenges at each stage might be considered as the first step toward adoption of clean technology. The following table summarizes the recommendations to overcome these barriers and challenges:

TABLE 9: Possible remedies to overcome barriers and challenges in adoption of clean technology

Barrier In	Major Contributing Factors	Possible Remedies	Major Actor
Awareness and knowledge	• Not knowing factory benchmark • Communication gap • Not make a holistic assessment or understanding business cases • Limited market overview or setting different priority	Arranging regular sessions to • Raise awareness of factories about resource pricing, policy, and compliance regulations that could significantly affect their business • Demonstrate factories the benefits of knowing its position (KPI) in the	• Central Unit (CU)

	• Fear or perception of high risk • Absence of qualified assessor at lower or mid-level or resource assessment tools • Limited knowledge of low-interest financing and requirements	industry, continuous monitoring of performance using RTIS tools, business cases, benefits of joining sustainability programs • Provide sources of low-interest financing, qualified service, technology, and service providers • Help developing a knowledge base and qualified energy assessor especially at mid-level	
Policies and enforcement of regulatory measures	• Non-enforcement of regulatory measures especially for energy and water utilization, and pollution due to lack of enforcing or monitoring capacities • Subsidized resource pricing • Need for proper policy or review of policy to address current needs • Need for stimulating economic or non-economic incentives or duty-structure	• Review or formulating and/or strengthening policy, regulatory and legal frameworks as well as enforcing and implementing capabilities • A detailed plan for enforcing regulatory measures especially for energy and water utilization • A comprehensive plan that includes preferential tax incentives and gradual elimination of subsidies • Stimulating economic or non-economic incentives/duty-structure	• GoB • DoE • SREDA • Petrobangla • CU
Financing	• Complex application process and loan processing • Stringent requirements or conditional loan • Preference for borrowers with strong financial strength only • Not many qualified equipment for financing • Not-so-clear guidelines or instructions about loan processing	• Elimination of complexity in application and loan processing through developing clear guidelines and training of lenders • Setting rational requirements or conditions for loan that is achievable and attractive to borrowers • Inclusion of more qualified equipment in the list for financing through reviewing of business cases • Inclusion of organizations like BGMEA, BKMEA, or BTMA to support getting	• Funding Institutions • Financial Institutions • CU • Industry Associations

		loans for not-so-strong business units	
Institution	• Non-existent or not-so-strong knowledge hub for awareness-raising, knowledge enhancing, and information sharing mechanism • Need for support especially for not-so-strong business entities • Need for one-stop service • Need for showcasing and implementing business models e.g. demand aggregation model	• Strengthening existing organization or develop a new one that eventually leads to one-stop service for awareness-raising, knowledge enhancing, information sharing, showcasing, financing, and implementing business models e.g. demand aggregation model • Support not-so-strong business entities in getting financing by acting as a partial guarantor	• CU • Industry Associations

The above-mentioned barriers, challenges and opportunities are elaborated below.

5.1.1 Factory Level

As discussed earlier, to feel the urgency for becoming energy efficient the factory must know its position compared to the national benchmark. The factory, therefore, should have a proper metering system at the factory level to accurately measure the total resource consumption in establishing its benchmark, as well as at section and sub-section levels to identify the troublesome areas that are running below par.

It is strongly recommended that the factory gets engaged in any sustainability program or perform an in-depth assessment of its resource utilization using in-house capacity or employing qualified 3rd party assessor. The assessment should reveal the factory's current status i.e. establish the baseline, and identifies the improvement opportunities with detailed financials e.g. investment, benefits, rate of return, etc. using a holistic approach considering future resource price hikes, increased productivity, increased compliance, strict regulations, to name a few.

One of the biggest challenges in the factory is conveying the message to the upper management and convince them to invest in energy efficiency measures identified in the assessment, as well as financing for the measures. Providing them with business cases developed from case studies, financing options, relevant information on upcoming regulations, etc. would greatly help the mid-management to overcome this barrier and establish the cases as opportunities rather than a cost to the company. A group of qualified mid-level personnel would be extremely beneficial for the factory to implement the measures and make them sustainable to get the most out of it. As proposed by SREDA, each factory might require to employ at least one certified energy auditor in their facility, however, it would take a while to adopt this measure. As a quick measure, the factory could employ or have their selected mid-management personnel become Certified Energy Technician from any reputed training organization like SREDA.

In short, the factory would need a clear understanding of its standing compared to national benchmark applicable to its type and size, a list of opportunities with financial details, risk factors, and all relevant information for any investment, source of funds, a clear long-term focus, action plan and investment planning, proper monitoring mechanism, and a group of qualified people to carry out the required tasks. Institutions like BGMEA, BKMEA, BTMA, etc. could play significant roles in this area which are discussed below.

5.1.2 Policy Level

Policies or regulations have direct effects that could shape a factory's decision toward adoption of clean technologies. For example, implementation of the Petrobangla/Titas gas regulations since 2016 to have at least 60% thermal efficiency for captive power and at least 85% thermal efficiency for boiler with economizer would automatically impose the conditions for adopting energy-efficient measures. Although it is a necessary condition to increase energy efficiency and reduce GHG emissions throughout the industrial sectors in complying with the COP agreement and achieving SDG goals; however, this can't be done overnight as it would have serious consequences on the businesses especially at this critical pandemic/post-pandemic situation. It is, therefore, recommended that the authority should make a detailed plan for achieving it gradually i.e. in multiple phases within a 3-5-year time span; and take the necessary steps for formulating and/or strengthening policy, regulatory and legal frameworks as well as enforcing and implementing capabilities.

Zero Discharge of Liquid (ZLD) is another policy level intervention that needs much more attention. Although DoE is working on it, detailed regulatory reforms and preparation for implementation could be expedited for immediate benefits. Regulating water usage not only reduces its consumption that translates into reduced pollution, which is killing the water bodies and posing an immense threat on human life and health, and eco-system; it also significantly reduces energy consumption, and encourage factories for looking into low or no water-consuming modern and clean technologies.

To encourage the factories in adopting clean technologies, a comprehensive plan that includes preferential tax incentives and gradual elimination of subsidies could be discussed at the policy level.

5.1.3 Financing Level

Most factories would need or be interested if low-interest financing is made available at a minimal hassle, and the clean technology at an affordable price. Stakeholder consultation reveals that financial institutions, as well as factories, are still struggling with loan application process to a certain extent e.g. in interpreting the guidelines for eligibility or eligible piece of equipment. As a result, the SREUP program for low-interest financing introduced a training component for the financial institutions that would help streamline the loan processing system. It was, however, found that most financial institutions do not want to go outside their client list, only considers factories with strong financial standings, or not very interested in processing small loans as paper works remain the same as big loans, as well as not communicating to the factories to the extent possible. Sometimes the loan conditions require additional commitment e.g. work on safety retrofit first or in parallel with environmental upgradation as in the SREUP program, or there is only a limited list of equipment that could be purchased under the program as in the EECPF program. Too stringent conditions for EIA/ESIA or due diligence also acted as a great barrier for accessing green funds. It is, therefore, recommended that rational due diligence requirements be practiced along with an expanded list of eligible

equipment, and reducing or delaying the additional conditions e.g. safety retrofit to the extent possible so that the factories can see the benefits first from clean technology adoption and gets encouraged for the next steps.

Since the current financing mechanism might not work equally well for all factories and/or lending institutions across the board, institutions like BGMEA, BKMEA, or BTMA could play active roles in getting the low-interest financing for the financially not-so-strong factories.

5.1.4 Institutional Level

Significant progress could be made in adoption of clean technology by getting appropriate support from the BGMEA, BKMEA or BTMA in terms of finding technology service or equipment providers, information on new technologies and available financing, knowledge sharing, training, increase and strengthen the supply of services by LSPs, particularly with regard to cost-benefit analysis and investment planning, etc., as well as help in getting low-interest funding easily. Support in the deployment of a Resource Tracking Information System (RTIS) on a large scale at a reduced cost to track the resource consumption and performance i.e. KPIs of a production unit monitored by the factory itself as well as by the stakeholders authorized by the factory while showing the national benchmark KPIs and best performer's KPIs might bring ground-breaking achievement in the overall performance of the factories while accelerating the adoption of clean technology.

5.2 STAKEHOLDER CONSULTATION ON THE PROPOSED FRAMEWORK

To share the findings of the current study and refine the proposed implementation framework outlining the overall size of the cleantech market, recommendations on technologies, market-based mechanisms, and business models to unlock the full market potential, an interactive webinar was arranged with cleantech stakeholders including textile factories, policy and regulatory bodies, industrial associations, funding/financial institutions, energy service companies, technology companies, buyers as well as other stakeholder that influence the adoption of clean technologies.

The following major points were emerged from the discussions during the webinar:

TABLE 10: Major inputs/suggestions from the stakeholders

Stakeholder	Input/suggestion
SREDA	• Currently, there is no properly developed ESCO or existing model for ESCO implementation; and the GoB has not yet adopted the idea of a national ESCO
IDCOL	• As different energy-efficiency financing options are there, and most of the funding options are not accessible by the small and medium textile units, it is essential and high time that both ESCOs and ESCO-based models are formed • Proper baseline assessment/survey, information sharing and awareness building programs as well as disposal of the replaced inefficient equipment must be addressed properly by the CU

GIZ	• Partial loan guarantor would be vital for widespread implementation of the model since it could bring small and medium enterprises under the financing programs
BGMEA	• The most important component is the financing component for the accelerated adoption of the clean technology • GoB can provide tax concession to the factories for producing a certain fraction of the total energy from renewable sources, and can also offer duty-free purchase of solar panels • Brands may give certain advantages to factories that comply with all the environmental requirements, adopt green technologies and green buildings, and show climate efficiency
Envoy Textiles Ltd. (Factory)	• Disposal of the replaced equipment is going to be a major concern
H&M (Brand)	• Disposal of the replaced equipment must be kept in mind and a proper method should be thought of before going for mass scale replacement
Bestseller (Brand)	• Proper maintenance of the new technologies so factories can get the most out of these technologies • Capacity building program should be more emphasized for long-term outcomes
Others	• In Bangladesh, clean technologies are sometimes difficult to access • RTIS platform can play a huge role in continuous sustainability reporting of the factories

The proposed implementation framework has been refined with the feedback provided by the panelists during the webinar. Details of the webinar could be seen in Annex 7.

5.3 WAY-FORWARD

The webinar clearly demonstrated the acceptance, validity and potential for operation of the implementation framework in the Bangladesh context, and has been considered as the right thing to do without any delay. However, as pointed out by SREDA that there is no properly developed or existing model for ESCO implementation; and the GoB has not yet adopted the idea of a national ESCO; the first step should be to come up with a proposal with sufficient details that is convincing enough for the policy makers i.e. relevant government institutions. Institutions like BGMEA, BKMEA or BTMA should take the leading roles in this respect, and involve relevant stakeholders to formulate the proposal with possible details. USAID might initiate the process with BGMEA, BKMEA and BTMA.

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Annexures

ANNEX 1: FACTORY INFORMATION

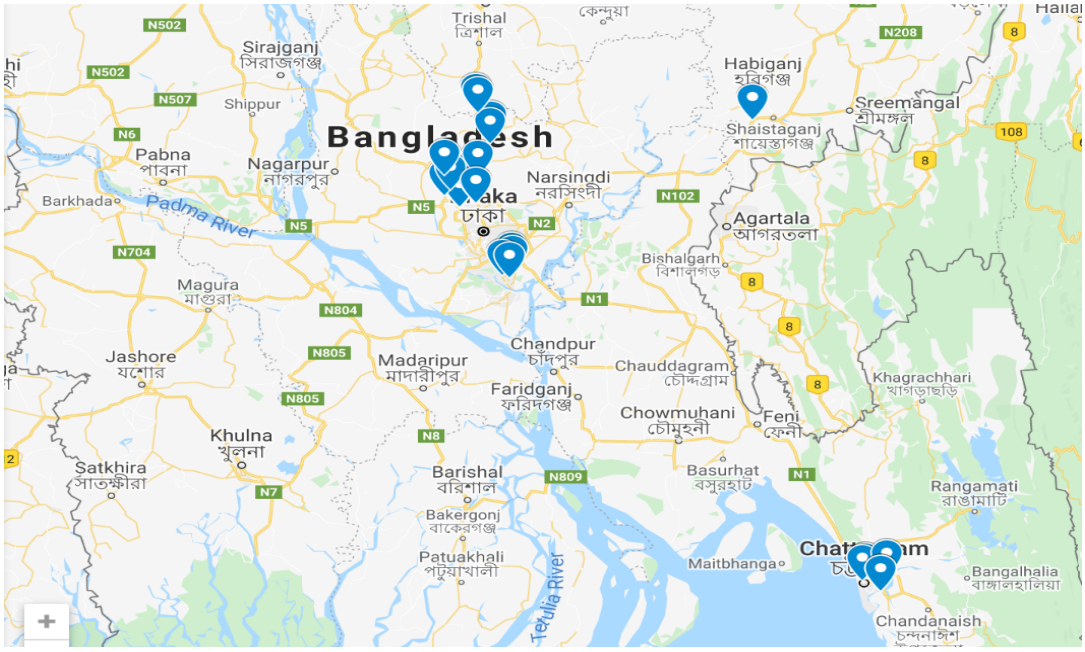
TABLE 11: Factory size

UNIT	Small (S)	Medium (M)
Spinning	Up to 10 ton/day	10-40 ton/day
Weaving	Up to 20,000 yards/day	20000-40000 yards/day
Only Washing	Up to 10000 pieces/day	10000-30000 pieces/day
Only Printing	Up to 10000 yards or pieces/day	10000-30000 yards or pieces/day
RMG	Up to 2000 workers	2000-5000 workers
WDF	Up to 10 ton/day	10 - 20 ton/day
Composite	Up to 10 ton/day	10 - 20 ton/day

TABLE 12: List of factories that participated in the survey

Sl. #	Factory Name	Factory Location
1.	Abanti Colour Tex Ltd.	Narayanganj
2.	Belamy Textile Ltd.	Chittagong
3.	Chittagong Denim Mills Ltd.	Gazipur
4.	Cutting Edge Industries Limited	Gazipur
5.	Divine Design Ltd.	Chittagong
6.	Divine Intimates Ltd.	Chittagong
7.	Envoy Textile Limited	Mymensingh
8.	Evince Textiles Limited	Gazipur
9.	Helicon Limited	Savar
10.	KC Lingerie Ltd.	Narayanganj
11.	Lida Textile & Dyeing Ltd.	Gazipur
12.	MG Niche Flair Limited (2nd Unit)	Narayanganj
13.	Natural Denims Ltd.	Savar
14.	Oasis Fashion Ltd.	Gazipur
15.	Organic Jeans Ltd.	Chittagong
16.	Pahartali Textile & Hosiery Mills Ltd.	Chittagong
17.	Rahim Textile Mills Ltd.	Gazipur
18.	Russel Garments	Narayanganj
19.	Southern Clothings Ltd.	Savar
20.	Square Denim Limited	Sylhet
21.	Square Fashions Limited	Mymensingh
22.	Thanbee Print World Limited	Gazipur
23.	TRZ Garments Industry Ltd.	Gazipur
24.	Utah Fashions Limited	Gazipur
25.	Viyellatex Ltd.	Gazipur

FIGURE 18: Location of the participating factories on Google map



Factory Pictures

Opportunity for
rooftop solar plant

Opportunity for EGB using
generator exhaust

Opportunity for G-trap
in steam iron

Opportunity for servo motor
in sewing machine

ANNEX 2: DETAILS OF PREVIOUS SUSTAINABILITY PROGRAMS

PaCT: Partnership for Cleaner Textile

In 2013, the International Finance Corporation (IFC) in partnership with the NGO Solidaridad, the Embassy of the Kingdom of the Netherlands, 13 leading buyers and two technology suppliers, textile factories, and the Bangladesh Garment Manufacturers and Exporters Association (BGMEA) launched the PaCT: Partnership for Cleaner Textiles project to provide selected RMG companies with advisory services to help them switch to more sustainable production methods. Factories were first enrolled in basic Cleaner production (CP) to work on low-hanging fruits and increase awareness, then in in-depth CP for large savings in water, chemicals, and energy in wet processing units, ETPs, etc. Partner factories received technical and business information on CP measures, B2B linkages with vendors, and demonstration on the possibility of reducing an enormous amount of water, energy, and chemicals per year. The increased resource utilization efficiency and cost savings estimates made during Phase 1 made it clear that the textile factories and the sector could be significantly benefitted both environmentally and financially by implementing the CP measures.

PACT Phase 1, which was a 1-yr program, involved 215 partner factories, and USD 11 million in development assistance. PaCT Phase 2 has been launched in 2018 with about 30 factories with a target of engaging 250 partner factories with USD 7 million in development assistance.

STWI Program

In 2015, Sweden Textile Water Initiative Project, which is a public-private partnership between SIDA, SIWI, Swedish brands, and their suppliers and sub-suppliers, launched the Sustainable Water Management Program for Textile Industries for the improvement of wet processing section and CMT factories in terms of water, energy and chemical usage and management in Bangladesh. The program's vision was to reduce environmental impact of the factories and build their capacity to continue improving their resource efficiency, and catalyze a shift towards sustainable production in major production hubs. The program also operates in India, China, Turkey, and Ethiopia.

The program has worked with nearly 65 wet processing sections and CMT factories during 2015-2018, and currently working with 3 washing, spinning, and CMT factories in Bangladesh.

AIC Program

Impact Economy- an independent and privately held impact investing and strategy firm committed to identifying or designing solutions for companies and professional investors that have substantial financial upside while making a positive impact on society and the environment, launched the Apparel Innovation Consortium (AIC) project in Bangladesh on a pilot basis. The program had the objective of assessment and identification of savings opportunities on current usage resources, evaluating various options and investment plan to reduce resource consumption in the textile processing, and making the factory owners and decision-makers aware of the advantages of investing in technologies that significantly reduce the consumption of resources namely energy, water, and chemical. This 2-year program has many unique features including installation of meters before the assessment to work with actual data instead of estimated data, financing as a grant, financial planning, training in environmental, social, and productivity, to name a few. Because of the financing, duration of the project, and close communications with the top management, the program saw most of the capital

investments and determined the real benefits instead of estimated benefits which most of the similar programs report.

NCCI 3e Program

Funded by DANIDA, the 3e program of NCCI focused on minimizing costs related to energy consumption and increasing profitability while making production more sustainable for business. The overall aim of the program was to reduce CO2 emissions from select industries and minimize costs related to energy consumption by identifying the business case in implementing energy efficiency measures in the production and operations, which is often overlooked in the management decision-making.

The program only looked in the energy efficiency measures and ended after submitting and buy-in meeting with the factory management.

NEST Program

Need for Environmentally Sustainable Textile (NEST) is a sustainability program that is designed and owned by Engineering Resources International (ERI) Ltd. Launched in 2019 with 2 major brands namely H&M and Decathlon with 15 WDF, spinning, printing, and CMT units, this is a 1-year program with monitoring and implementation support looking at promoting resource-efficient production, awareness-raising, and capacity building of the production units.

PaCT phase 1 and STWI programs were 1-year programs with implementation advisory and monitoring support while NCCI 3e program was for energy assessment only. Since capital intensive implementations are time-consuming in terms of decision making, financing, vendor and equipment selection, procurement, etc., such implementations were rarely taking place during the project period. The AIC program, which was a 2-year program, did see the implementation of most of the capital-intensive implementation not only because of the longer time period but also for the significant amount of financing as grant, documentations, intense implementation support in terms of selecting equipment, supplier, installation, training, to name a few. This clearly indicates the factors, in addition to management's willingness and commitments, that what factors play key roles in adoption of clean technologies.

Although the factories are much more aware than before, brand involvement especially in the pre-COVID situation was always a driving force for adopting clean technology measures. PaCT 2 is also a 2-year program; however, its 1st phase might not see much of the capital-intensive measures implemented because of the total change in the business scenario due to pandemic as well as the reduction in brand's voice to expect such changes.

ANNEX 3: BARRIERS TO ADOPTION OF CLEAN TECHNOLOGY

Based on the point of origin, these barriers could be put under 4 major categories namely factory, policy, financing, and institution. Some of the major barriers are summarized below [5]–[7]:

Barriers at Factory Level

1. **Not knowing factory benchmark:** Most factories don't have even basic metering systems that could measure the total or unit-wise consumptions of major utilities namely water, electricity, gas, and steam. As a result, there is no comparison of factory's actual KPIs with national or similar unit's benchmark, therefore, no or low motivation for improvements
2. **Communication gap:** Lack of communication and convincing skills of the lower and mid-management to pursue projects especially capital-intensive ones to upper management. Conversely, commitment or support from top management
3. **Lack of capital:** Lack of capital or other preferences for capital venture i.e. management is more interested in increasing production than become resource-efficient
4. **Lack of adequate knowledge:** Limited knowledge and application of the existing and emerging legal framework in the area of labor, building, fire, electricity as well as the environment
5. **No holistic assessment:** Fail to make a holistic assessment of the investment's payback that needs to consider future resource price hikes, increased productivity, increased compliance, strict regulations, etc. Many factory owners and managers have a short-term planning focus, which contributes to gaps in investment planning and limited understanding of the long-term benefits. As a result, only low-investment and quick return measures are implemented
6. **Understanding business cases:** Lots of factories do not see or fully realize the business case for investments due to lack of information on available remediation measures and environmental production techniques, as well as knowledge about their costs and benefits
7. **Limited market overview:** Have limited market overview over possible suppliers of remediation goods and services as well as available financing options
8. **Low share of energy cost:** Focus on other cost-savings measures e.g. labor or raw material get precedence over energy saving when energy saving is only a small fraction of the total cost e.g. CMT units
9. **Different priority:** Meeting customer's deadlines has precedence over any other activities, therefore limited time is allocated for improvement projects
10. **No dedicated and/or capable person:** Implementing improvement measures is an additional and less priority job for the persons responsible for the project. The person sometimes does not have the right background or technical ability to identify resource savings, costing, and payback, and develop these into profitable actions
11. **Company culture:** Lack of company culture, absence of competent managerial measures, absence of long-term investment in technology commitment, on the job training on resource-efficient production or cross-departmental communication
12. **Perception of high risk:** False perception of high risk or too much worries due to limited knowledge of market and services, low-visibility or uncertainty of demonstrated technology, cost or payback especially for capital intensive investment with high up-front cost and longer payback period
13. **Pioneer:** Unwilling to be a pioneer in implementing a new technology

14. **Pressure from investors:** No Pressure from investors as most of the companies are family owned
15. **Awareness:** Lack of awareness or consciousness especially at the lower level
16. **Water usage:** Water is often considered as a “free” commodity, hence unnecessary water use or extra steps in processing using old technology increases water use, thereby increases energy consumption at each step of WTP, process, and ETP
17. **High employee turnover:** High employee turnover rate in the textile industry causes any improvement program to lose its momentum
18. **Fear:** Fearing that it might be considered as their incompetency, not communicating to their higher management the improvement measures found by the consultants
19. Product price: Unwillingness to spend more while not getting a higher price for the product from the buyer
20. **Brand pressure:** Factories often only react when there is pressure from buyers (Brands)
21. **Consultant:** Unwilling to engage or pay for 3rd party consultancy services only as the expectation is it should be a part of the bigger service that might follow
22. **Enforcement of regulatory laws:** Effective enforcement continues to be a major issue. No incentive or tax break. Subsidies for energy efficiency schemes

Barriers at Policy Level

1. **Regulatory measures:** Strong regulatory signals from the government through a combination of policy review, regulations review, revised target setting, and regulatory measures suited to the medium and low performers
2. **Policy review:** Review of policies and institutional structures around environmental and water quality regulation is needed, and the possible consequences in terms of compliance be conveyed to the factories to encourage them for adoption of resource-efficient and environment-friendly technologies
3. **Resource pricing:** Subsidized energy price combined with higher up-front investment often slows down adoption of clean technology
4. **Water extraction:** Water is often considered a free commodity by the factories. Lack of momentum in the ZDL initiative along with non-implementation of water extraction and pricing policy creating less-urgency in adoption of water and energy-efficient technologies
5. **Monitoring capacity:** Enhancing compliance mapping and regular monitoring involving DOE, municipalities and local government, and capacity building for cleaner production monitoring and implementation
6. **Implementing capacity:** The capacity of supervision to assess adherence and sanction non-compliance is not yet in place
7. **Energy Auditor:** As proposed by SREDA, employ qualified energy auditor at each factory. In addition, make a pool of Certified Energy Technician at the mid-management level
8. **Economic and non-economic incentives and duty structures:** Review of economic and non-economic incentives and duty structure of all stakeholders e.g. simplified access to green financing, recognition of green actions through ease of business, etc., along with incentives for locally procured green tech solutions to promote adoption of clean technology

Barriers at Financing Level

1. **Awareness:** Low awareness of the funding window and associated mechanisms among the majority of smaller and medium-sized RMG companies. Need to take more SMEs aware of the green financing
2. **Guidelines:** Unclear guidelines from lender
3. **Loan Processing:** Complex application and processing procedure, high and complex transactions costs, stringent requirements for qualification often not possible to fulfill, heavy documentation requirements for donor lines of credits, as well as the limited capacity of banks to verify costs and appraise safety retrofits and environmental upgrades; larger RMG factories mostly consider themselves constrained with regard to the available funding envelope and the maturity structure
4. **Lower percentage of EE equipment cost:** For a new factory, the qualified energy-efficient equipment cost often constitutes about 20-30% of the total cost. As a result, the fac
5. **Documentation:** Many of the RMG factories are family owned and do not follow standard accounting and auditing rules, which make loan processing complicated, delayed and often resulted in rejections
6. **Qualified equipment list:** Limited types of equipment are qualified for low-interest financing
7. Condition imposed: Loan for energy-efficient measures sometimes tagged with other pre-conditions such as safety retrofits be implemented first or simultaneously, restriction of machinery that can only be imported, etc.
8. **Training:** More training is needed for lenders to streamline loan processing in energy efficiency, which is a relatively new area for most of them
9. **Knowledge Sharing:** Expert knowledge sharing and public relations management

Barriers at Institutional Level

1. **Knowledge hub:** Establishing and strengthening Central and Regional Cleaner Production Knowledge Hubs that would work as one-stop solution centers, and with additional participation from the DOE or local government on monitoring and compliance assistance
2. **Monitoring KPI:** Institution like BGMEA BKMEA could monitor the resource consumption KPIs of their members and regularly inform their standings compared to national benchmark using an automated system
3. **Consultancy service providers:** Factories often struggle finding qualified consultants who could meet the requirements of the lender/brands/stakeholders. Few local service providers understand the benefits of safety and environmental upgrades, have a market overview over available measures and products, lack overall knowledge about the regulatory framework and international standards, appropriate mechanisms of how to conduct cost/benefit analyses of retrofit investments, and how to carry out investment plans for the retrofits. Institutions like BGMEA, BKMEA could help increase and strengthen the supply of services by Local Service Providers (LSPs), particularly with regard to cost-benefit analysis and investment planning, and keep lists of local experts for different areas e.g. energy audit, social and environmental compliance, technical, etc. for easy access by the factories
4. **Information sharing:** Institution like BGMEA, BKMEA, etc., create momentum in network building, collaboration, and information sharing on best practices, and keep sustained dialogue at the topmost level

5. **Brand:** Brand's support for green financing

Although the situation is slowly improving as more and more factories are getting involved in the sustainability improvement programs, however, there is still a long way to go.

ANNEX 4: STAKEHOLDERS AND PARTNERS LIST

- ISC's institutional partners: EHS^{+} Center of NSU, SREDA
- Regulatory bodies: SREDA, DoE, Petrobangla/Titas Gas
- Industry associations: BGMEA, BKMEA
- International Organizations: GIZ, USAID
- Funding institutions/Financial service provider: IDCOL/GIZ
- SMEs: Representative textile factory's higher management
- Brands and Suppliers: H&M, Bestseller
- Clean Technology equipment providers: ABB, Forbes Marshall, Omera Solar, UCC Solar
- Academic Institutions: BUET

ANNEX 5: ASSUMPTIONS FOR SAVINGS CALCULATION

TABLE 13: Summary and basis of savings calculation

Sl #	Opportunity	Energy Saving Per Unit (MJ/Yr/Unit)	Assumptions	Conversion Factors
1	EGB or other cogeneration systems	27,558,062	Average flue gas flow rate: 13,000 m3/hr	Heating Values NG: 37,335 KJ/m3 Diesel: 36,273 KJ/L Grid Power: 3600 KJ/KWH GHG Emission Factors NG: 0.002154 TCO2e/m3 Diesel: 0.002676 TCO2e/L Grid Power: 0.0005635 TCO2e/KWH
2	Heat recovery from generator jacket water	6,771,600	Average flow rate of jacket water: 20 m3/hr	
3	Solar thermal water heaters	1,210,946	Feasible area: 6,000 sft	
4	Condensate and flash steam recovery system	713,837	Average condensate production: 550 kg/hr	
5	Economizer at boiler exhaust	859,246	Average boiler capacity: 5 TPH Average no.: 01	
6	Solar PV plant with net metering system	494,402	Feasible plant area: 30% of total roof area Average roof area: 40000 sft Average plant size: 100 KWP	
7	Servo motors in sewing machines	1,102,863	Average no.: 300 pcs	
8	VFDs for motors (other than boiler fans)	287,536	Average quantity: 5 motors Average capacity of each motor: 30 KW Average running hour: 1400 hr/yr	
9	G-Trap for steam irons	334,112	Average no. of steam irons: 50	
10	Energy-efficient motors	127,575	Average quantity: 30 motors Average capacity: 15 KW Average running hour: 3000 hr	
11	Bio-Scouring or enzyme-based scouring	588,945	Possible temperature reduction of each bath: 50 K	
12	Servo motor in ‘carding’ machines	110,286	Average no.: 30 pcs	

Note: Average GHG emission has been determined from the energy mix used in the 25 sample factories.

ANNEX 6: SURVEY QUESTIONNAIRE

The following questionnaire was used to conduct the opportunity assessment:

CLEAN TECHNOLOGY ADOPTION FOR TEXTILE SMEs IN BANGLADESH

Description of the Survey

Clean Technology Adoption for Textile SMEs in Bangladesh

The survey aims to identify opportunities for and barriers to clean technology adoption in textile sector, and looks for those information at factory, technology, financing and policy levels. The findings would help streamlining the advancement of clean technology adoption by the textile industry.

বাংলাদেশের টেক্সটাইল খাতে ছোট ও মাঝারি আকারের প্রতিষ্ঠানে পরিবেশ-বান্ধব প্রযুক্তির বাস্তবায়ন

এই সমীক্ষার উদ্দেশ্য, টেক্সটাইল খাতে পরিবেশ-বান্ধব প্রযুক্তি বাস্তবায়নের সুযোগ এবং বাধাসমূহ কারখানা, প্রযুক্তি, অর্থায়ন এবং নীতিমালা পর্যায়ে অনুসন্ধান করা। প্রাপ্ত তথ্য টেক্সটাইল খাতে পরিবেশ-বান্ধব প্রযুক্তির বাস্তবায়ন সহজতর করে তুলতে সহায়তা করবে।

General Information

Factory name

_____

_____

_____

_____

_____

Address

_____

_____

_____

_____

_____

Details of the respondent/person in charge

	Please fill out with appropriate response
	Enter text below
Name and designation	
Phone number	
Email address	

Please select the zone that the factory is in:

- Dhaka City
- Chittagong
- Savar
- Gazipur
- Narayanganj
- Narsingdi
- Mymensingh
- Sylhet
- Other _____

Please select the process type(s) that your factory has. (Select multiple if applicable)

- Dyeing
- Washing
- Finishing

Please select the process type(s) that your factory has. (Select multiple if applicable)

- Knitting
- Weaving
- Spinning

Please select the process type(s) that your factory has. (Select multiple if applicable)

- Garments
- Sweater

Energy Profiling

Please select the primary electricity source(s) of the factory (select multiple if applicable)

- Grid electricity (please enter the connected load below)
  _____
- Natural Gas generator (please enter the capacity below)
  _____
- Diesel generator (please enter the capacity below)
  _____
- Other (please describe) _____

Please select the standby electricity source(s) of the factory (select multiple if applicable)

- Grid electricity (please enter the connected load below)
  _____
- Natural Gas generator (please enter the capacity below)
  _____
- Diesel generator (please enter the capacity below)
  _____
- Other (please describe) _____

Does your factory have the following renewable electricity source?

	Yes	No
Solar PV plant		

Display This Question:

Does your factory have the following renewable electricity source? = Solar PV plant [Yes]

If yes, please answer the following

	Enter the value below	Select unit from the dropdown list

	Numeric input only	KW	MW
Capacity of the solar plant			

Display This Question:

Does your factory have the following renewable electricity source? = Solar PV plant [Yes]

Which of the following models did the factory invest in?

- Opex Model
- Capex Model

Please enter the facility's average annual electricity consumption from each source:

_____

_____

_____

_____

_____

Please select the fuel(s) that is/are used in the factory for utility heating purposes (e.g. steam production) and/or process heating purposes (e.g. stenter, singeing, etc.)

- Natural Gas
- CNG
- Diesel
- LPG
- Jhute (waste fabric)
- Biomass
- Other _____

Display This Question:

If Please select the fuel(s) that is/are used in the factory for utility heating purposes (e.g. steam... = Biomass

Please specify the biomass (name of the biomass) that your factory use

_____

Carry Forward Selected Choices from "Please select the fuel(s) that is/are used in the factory for utility heating purposes (e.g. steam production) and/or process heating purposes (e.g. stenter, singeing, etc.)"

Please specify the particular use of the fuels you selected

	What is the fuel used for?		If anything else, please specify briefly
	Steam Production	Process Heating	Other use of the fuel
Natural Gas	•	•	
CNG	•	•	
Diesel	•	•	
LPG	•	•	
Jhute (waste fabric)	•	•	

Biomass	•	•	
Other	•	•	

Please enter the facility's average annual fuel consumption from each source:

_____

_____

_____

_____

_____

Technical Capability and Challenges

Please answer the following questions related to the facility's technical capability:

	Please select 'Yes' or 'No'	
	Yes	No
Have you ever carried out energy audit in your facility by any external agency /consultant?	○	○
Do you carry out internal energy audit in your company?	○	○
Do you have dedicated energy manager/auditor in your company?	○	○

What are the key challenges/constraints in improving energy performance and/or implementing clean technology measures?

- Short of capital
- Challenges related to financing
- Management decision
- Other challenges, both technical and financial (please mention in detail)

  _____

Financing

Did your facility previously avail any financing for implementation of energy-efficient technologies?

- ○ Yes
- ○ No

Does your facility know about the program “Program to Support Safety Retrofits and Environmental Upgrades in the Bangladeshi RMG Sector (SREUP)” for financing energy-efficient technologies?

- ○ Yes
- ○ No

Display This Question:

If Does your facility know about the program “Program to Support Safety Retrofits and Environmental... = Yes

Had/has your facility applied to access the fund under this program?

- ○ Yes
- ○ No

Does your facility know about the financing option titled "Energy Efficiency & Conservation (EE&C) Promotion Finance"?

- ○ Yes
- ○ No

Display This Question:

If Does your facility know about the financing option titled "Energy Efficiency & Conservation (EE&C... = Yes

Had/has your facility applied to access the fund under this program?

- ○ Yes
- ○ No

What are the key challenges you anticipate or have already faced in availing financing schemes for implementation of energy-efficient technologies? (select multiple if applicable)

- ○ Too much paperwork
- ○ Too many constraints
- ○ The program provides funding for certain equipment or upgradations that are not applicable for the factory
- ○ Other (please describe briefly) _____

Would you like to avail any financing for implementation of energy-efficient technologies?

- ○ Yes
- ○ No

Boiler

Please answer the following:

	Put your answer below	Select unit from dropdown list			
	Numerical input only	Ton/hr	kg/hr	Bar	kg/cm2
Boiler capacity (all boilers)		○	○	○	○

Average steam generation pressure		○	○	○	○

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
Exhaust gas boiler (EGB) or other cogeneration systems	○	○	○
Economizer to recover heat from boiler exhaust gas	○	○	○
Automatic blowdown control system for boiler	○	○	○
Air-to-fuel ratio controllers for boiler burners	○	○	○
VFDs in fans (ID or FD) in boiler	○	○	○

Insulation Improvement

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
Insulation improvement technologies, wherever applicable (e.g. boiler surface, boiler rear side, steam lines, steam header, steam header valves, etc.)	○	○	○

Heat Recovery

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
Heat recovery from generator jacket water for hot water application	○	○	○
Condensate and flash steam recovery system	○	○	○
Waste heat recovery system and utilizing the heat content for absorption chiller	○	○	○

Solar Energy

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
Solar thermal water heaters, wherever applicable	○	○	○

Motors and Pumps

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
Energy-efficient motors (e.g. IE3 class) replacing all the old motors	○	○	○
Energy-efficient pumps replacing all the old pumps	○	○	○
VFDs for motors other than ID and/or FD fans	○	○	○

Display This Question:

If Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the... = VFDs for motors other than ID and/or FD fans [Yes]

How many VFDs have your factory installed for motors other than ID and/or FD fans?

_____

Spinning

What is the control type of your dehumidification plant?

- Semi-automatically or manually controlled
- Automatically controlled

Do you have an absorption chiller?

- Yes
- No

Display This Question:

Do you have an absorption chiller? = Yes

Please put your absorption chiller's capacity below:

	Put your response below	
	Value	Unit
Capacity		

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
Automatic winder with balloon controller	○	○	○
Ring spinning frames with permanent magnet motor	○	○	○

Roving frames with pneuma-less waste collection system	○	○	○
Air-jet spinning machine	○	○	○
Inverter-controlled motors in sections where applicable, especially in the 'ring' section	○	○	○
Servo motor in 'carding' machines	○	○	○
Auto doffing in ring machines	○	○	○

RMG

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
G-Trap for steam irons	○	○	○
Servo motors in sewing machines, replacing the clutch motors	○	○	○
Automation in cutting section (spreading, automatic cutting, etc.) to reduce fabric waste	○	○	○

Washing, Dyeing and Finishing

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
Bio-Scouring or enzyme-based scouring			
Low liquor ratio dyeing machines	○	○	○
Improving the bulk process by introducing Ozone wash	○	○	○

Automatic damper for stenter with PLEVA sensor/humidity control system	○	○	○
Heat recovery from stenter exhaust gas	○	○	○
VFDs in all stenter fans	○	○	○

Do you recover heat from hot water effluent from dying or other processes?

- Yes
- No

Display This Question:

If Do you recover heat from hot water effluent from dying or other processes? = No

What is the temperature (degree C) of the hot water effluent?

_____

Weaving

Have you installed/implemented the following energy-efficiency/clean technology measure(s) in the factory?

	Yes	No	Not applicable
Air-jet loom or rapier loom with technology for reducing both air consumption and air pressure			
Warper and sizer with inverter control			

ANNEX 7: WEBINAR DETAILS

Virtual Meeting of Clean Technology Stakeholders of Bangladesh:

Opportunities and Solutions to Addressing Barriers through Innovative Business Models

28 September 2020| 10.00 AM – 12.00 PM BD| ZOOM Webinar

As we emerge out of the pandemic, it's imperative that the economic recovery of Bangladesh is resilient and sustainable. Textile industry is the pillar of Bangladesh's economy and its sustained growth will play an important role in its recovery. For sustained growth of the textile sector, availability of sustainable and affordable energy is critical. Energy efficiency and renewable energy is the most promising way to improve energy security, bring down the cost of production, to remain competitive in the global and local markets.

ISC with support from USAID has implemented a project to improve energy efficiency performance of Tirupur textile cluster in India. To enable knowledge exchange between India and Bangladesh, a study was conducted in Bangladesh to identify the barriers and opportunities to adoption of energy efficiency and renewable energy technologies by the textile sector. Textile factories, policy and regulatory bodies, financial institutions, energy service companies, technology companies and buyers that influence the adoption of clean technologies were consulted to develop an opportunities report outlining overall size of the cleantech market, recommendations on technologies, market-based mechanisms, and business models to unlock the full market potential. During the virtual meet, ISC and ERI will launch the report, and share its findings with cleantech stakeholders from Bangladesh.

AGENDA

10:00 am – 10:05 am	**Welcome Address** Mr. Akber Hakim, MD and CEO, ERI
10:05 am – 10:10 am	**Introductory Remarks** Mr. Vivek Adhia, Country Director, ISC
10:10 am – 10:17 am	**Remarks from USAID – India Mission** Karen Klimwoski, Indo-Pacific Coordinator, USAID
10:17 am – 10:25 am	**Remarks from USAID - Bangladesh Mission** Shayan Shafi, Senior Energy Advisor, USAID/Bangladesh
10:25 am – 10:35 am	**Learnings from the CEA Project in India** Mr. Suresh Kotla/Director, ISC /Mr. Amit Kumar Singh Parihar, Program Coordinator, ISC
10:35 am – 10:50 am	**Clean Tech Adoption Potential in Bangladesh Textile Sector** Dr. Zahid Hassan, Director, ERI

10:50 am – 11:40 am **Panel Discussion: Overcoming Barriers to Clean Tech Adoption in Textile units in Bangladesh**

Session Moderator: Mr. Amit Kumar Singh Parihar, ISC

Panelists:

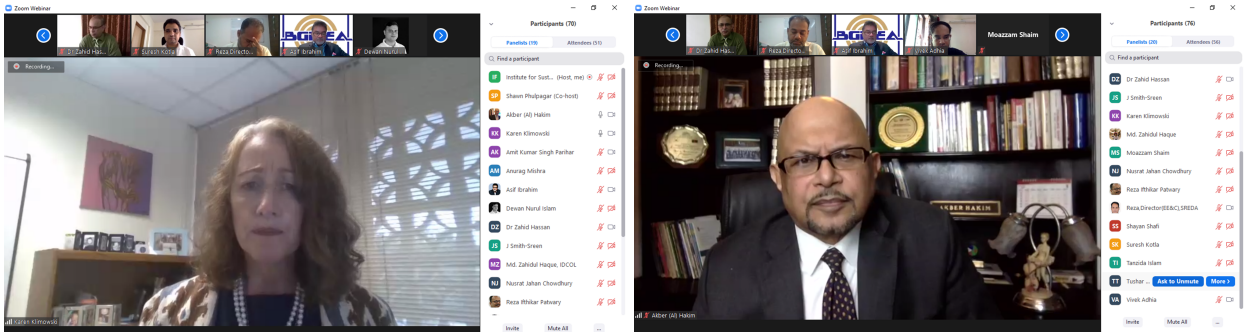
- Md. Rezaul Hoq, Director, EEC, SREDA
- Mohammed Zahidul Haque, Unit Head, IEEF, IDCOL
- Md. Abdul Wahab, GM Planning, Titas Gas TDCL
- Reza Ifthikar Patwary, Sr. Advisor, GIZ
- Asif Ibrahim, Director, BGMEA
- Shamsuz Zaman, Director, BKMEA
- Tushar Tripathi, CEO, Envoy Textiles Ltd.
- Tanzida Islam, Sustainability Program Manager, H&M
- Dewan Nurul Islam, Chemical and Environment Manager, Bestseller

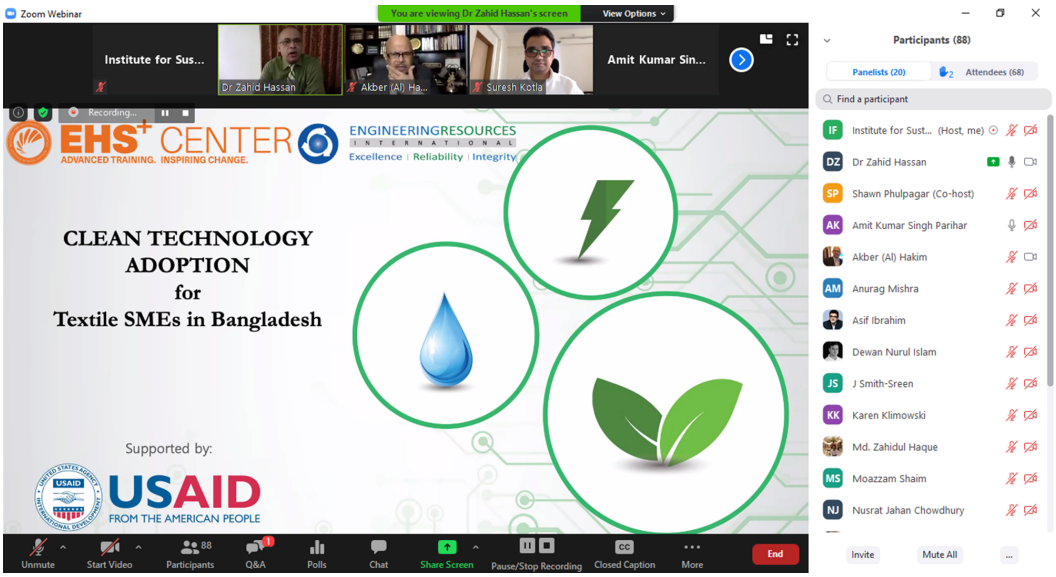
11:40 am – 11:55 am **Q&A**

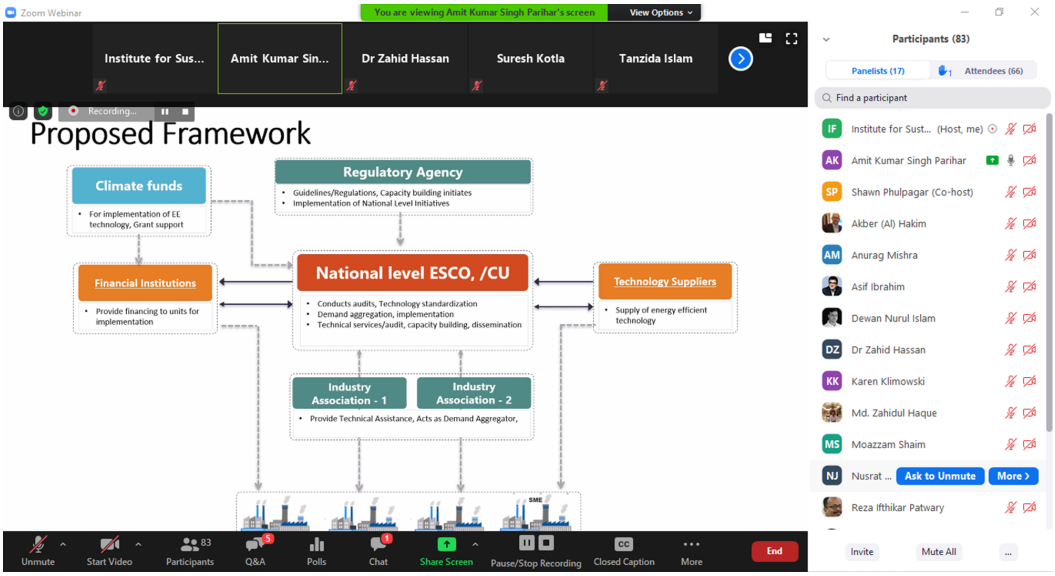
11:55 am – 12:00 pm **Vote of Thanks**

Mr. Moazzam Shaim, ISC

Webinar Pictures



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Climate funds
For implementation of EE technology, Grant support
Regulatory Agency
Guidelines/Regulations, Capacity building initiates
Implementation of National Level Initiatives
Financial Institutions
Provide financing to units for implementation
National level ESCO, /CU
Conducts audits, Technology standardization
Demand aggregation, implementation
Technical services/audit, capacity building, dissemination
Technology Suppliers
Supply of energy efficient technology
Industry Association - 1
Industry Association - 2
Provide Technical Assistance, Acts as Demand Aggregator,
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Karen Klimowski
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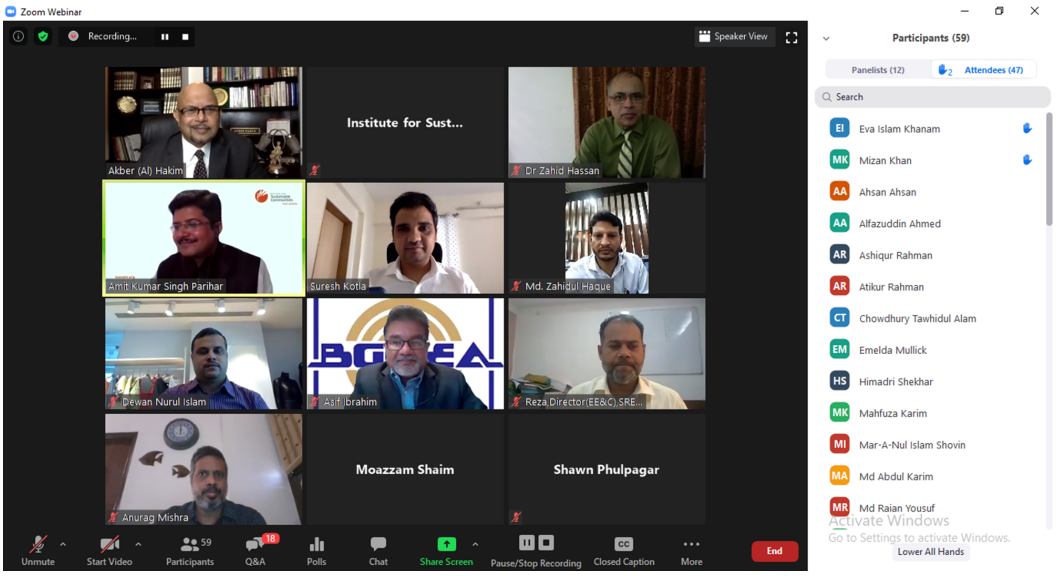
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