PROGRAMME DESIGN DOCUMENT FORM FOR SMALL-SCALE CDM PROGRAMMES OF ACTIVITIES (F-CDM-SSC-PoA-DD) Version 02.0

PROGRAMME OF ACTIVITIES DESIGN DOCUMENT (PoA-DD)

PART I. Programme of activities (PoA)

SECTION A. General description of PoA

A.1. Title of the PoA

Energy and Water Saving Promotion Programme for Textile Dyeing Process of Bangladesh Textile and Garment Industries

Version: 7.0
Date: 21/04/2014

A.2. Purpose and general description of the PoA

The purpose of the PoA promotes energy and water saving through optimizing the textile dyeing process from yarn to fabric that is the most water and energy consuming process in textile and garment factories.

The textile and garments industry has been leading Bangladesh economy since early 1990s. RMG (ready made garment) is the country's biggest export products which account for about three quarters of total exports, and the industry is a symbol of the country's dynamism in the world economy. The number of textile and garment factories has increased steadily and the textile and garment industry also has been increasingly becoming the most energy and water consuming sector. Bangladesh is facing water and energy scarcity; in the capital, the people are suffering from serious water crises due to frequent load shedding, drastic fall in ground water level and deep tube wells. Therefore, promoting water and energy saving measures in the textile and garment industry is recognized to be important and urgent.

The PoA will reduce energy and water consumption in textile dyeing process through optimizing dyeing process from yarn to fabric, such as promoting high quality yarns and introducing direct dyeing, new generation reactive dyeing and other new dyes according to requirements of factories and buyers. The technologies and know-how will be introduced and promoted by Green Project W.S.T® Limited (Hereinafter called Green Project W.S.T®) voluntarily as the Green Project W.S.T® was established with a vision of promoting the water and energy saving technologies in Bangladesh Textile and Garment industry.

The PoA is a voluntary action promoted by the Green Project W.S.T®. The Green Project W.S.T® is the coordinating/managing entity (CME) of the PoA and responsible for overall supervising and managing the PoA. PEAR is the PoA developer and CER buyer. The PEAR also supports the Green Project W.S.T® on CDM related management.

The PoA aims to contribute to environment and resources conservation significantly through energy, water saving and CO_2 emission reductions.

The first CPA of the PoA targets the Textile and Garment factory of the Grameen Knitwear Ltd., which supports and closely works with the CME.

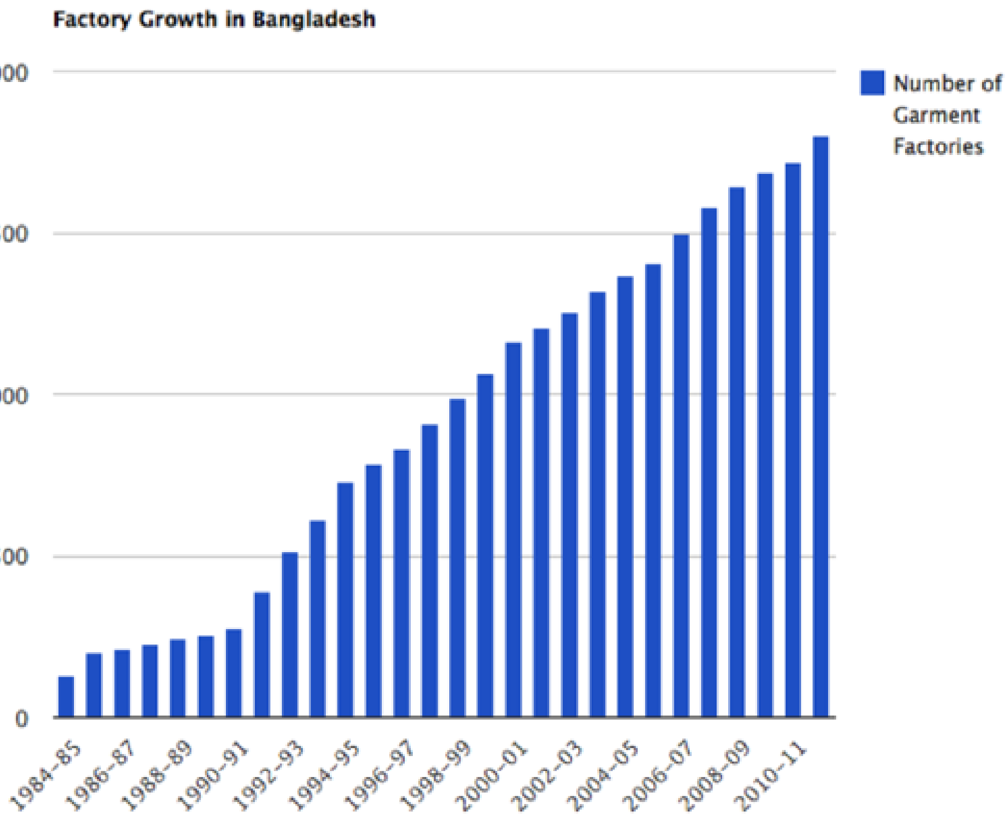

Figure 1. Increasing trend of the garment factories in Bangladesh[1]

A.3. CMEs and participants of PoA

Green Project W.S.T® is the CME of the PoA, which communicates with the CDM Executive Board.

The operators and implementers of CPAs under the PoA are textile and Garment factories in Bangladesh. However, they are not required to be project participants (as per Annex 29 of EB47 Report, paragraph 6, "the operators of individual CPAs are not required to be project participants").

PEAR also is a participant of the PoA as being the CER buyer and the PoA developer.

A.4. Party (ies)

Name of Party involved (host) indicates a host Party	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Bangladesh (host)	Green Project W.S.T® Limited	No
Japan	PEAR Carbon Offset Initiative, Ltd.	No

[1] http://www.bgmea.com.bd/chart/factory_growth_in_bangladesh

A.5. Physical/ Geographical boundary of the PoA

The PoA covers nationwide Textile and Garment industries and targets all Textile and Garment factories in Bangladesh. Therefore, the geographical boundary of the PoA is the whole Bangladesh shown in Figure 2.

Figure 2. Boundary of the PoA (The whole Bangladesh)

A.6. Technologies/measures

The CPAs under the PoA promote energy efficiency improvement in the dyeing process of Textile and Garment industry. The energy efficiency improvement will be realized through the optimization of dyeing process including dyeing machines in Textile and Garment factories. Thus, type II: Energy efficiency improvement project activities that reduce energy consumption, on the demand side, with a maximum output of 60 GWh per year (or an appropriate equivalent) in any year of the crediting period is applicable for CPAs under the PoA. Specifically, the AMS-II.D (Energy efficiency and fuel switching measures for industrial facilities, version 12) will be applied for CPAs under the PoA.

The general dyeing process flow chart is shown in Figure 3.

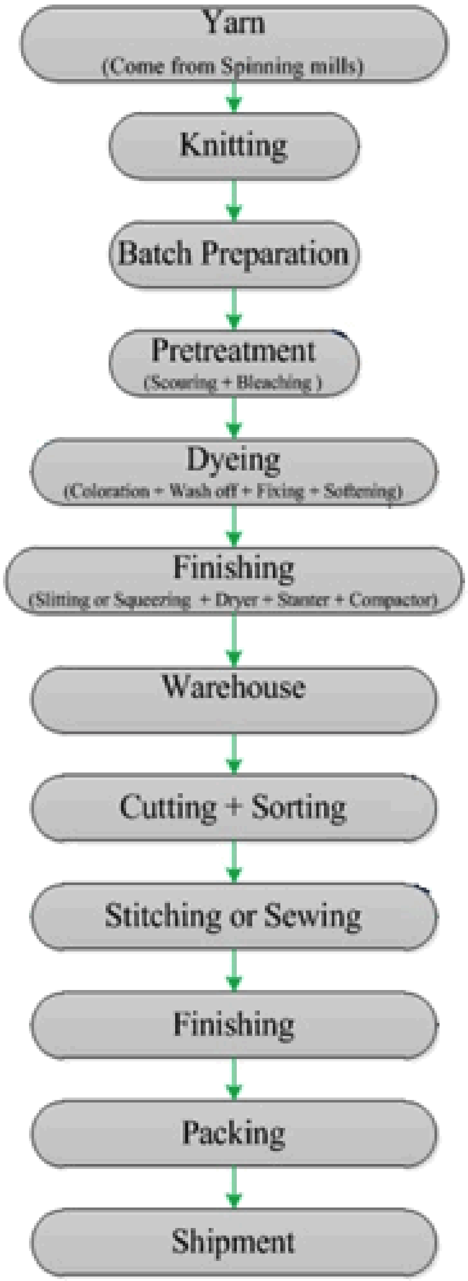

Figure 3. Process flow chart of dyeing process

The CPAs under the PoA target the pretreatment and dyeing process implemented in a dyeing machine (Figure 4).

Figure 4. Dyeing machine

The process adopted in textile dyeing depends upon types of fabrics to be dyed. The dyeing process varies with different materials (cellulose (such as cotton, viscose and modal[2]), Polyester and CVC (Blended fabrics)), different shades and different dyeing machines.

The process optimization includes three ways: The first is yarn optimization such as using compact yarn with low TPI (twist per inch), super combed spun yarn of long staple fiber that avoid bio-polishing[3] and also save dyes and chemicals that contribute to less water consumption. As a result, this way leads to less energy consumption.

The second is switching from hot brand scouring to cold brand scouring in the pretreatment process that contributes to less energy consumption.

The third is the optimization of dyeing process such as promoting direct dyes, noncarcinogenic GOTS (Global Organic Textile Standard) certified Sulphur Dyes, new generation reactive dyes, Vat dyes, etc.

[2] Modal is a semi-synthetic cellulose fiber made by spinning reconstituted cellulose.

[3] Bio-polishing as a finishing process that enhances fabric quality by decreasing the pilling tendency and fuzziness of cellulose fabrics. Enzymes are use for bio polishing. Among the various enzymes, cellulase is extensively used on cellulosic material. There are two types of cellulase, namely, acid cellulase and neutral cellulase. Acid cellulase used in biopolishing, which is very popular finishing treatment given to cellulose fabric.

Bearing in mind here is that "yarn optimization", "hot brand scouring to cold brand scouring" and "dying optimization" are independent measures. Although "dying optimization" and "hot brand scouring to cold brand scouring" will be introduced to every CPA, "yarn optimization" will be optional.

Generally, a dyeing recipe (dyestuff and chemical proportions to produce the required shade and conditions required for application of dyes and chemicals such as temperature, time, rate of rise, rate of fall, dye and chemical addition sequence, liquor conditions) is prepared based on an order and modified iteratively to gain Right-First-Time (RFT). Once the RFT is fixed, dyeing machines are set to perform the RFT dyeing throughout the batches for the order.

Specific processes for dyeing, such as when a specific dyes and chemicals are added to the dye bath, when temperature raises and when each step is completed, is shown as a dyeing chart which can be obtained from dyeing machine's memories (if machines have such function) or can be depicted based on the dyeing recipes and dyeing books.

In Bangladesh, the most dominant dyeing practice (technology) for cellulose (such as cotton, viscose and modal) is classic reactive dyes and the scouring practice (technology) for cellulose (such as cotton, viscose and modal) is hot brand scouring chemical.

Reactive dye is a dye that can react directly with the fabric. A reactive dye is able to create a bond with cellulose through chemical reactions. Scouring is the process by which all natural and additive impurities such as oil, wax, fat, hand dust etc. are removed to produce hydrophilic and clean textile material.

The following are typical dyeing charts for cellulose.

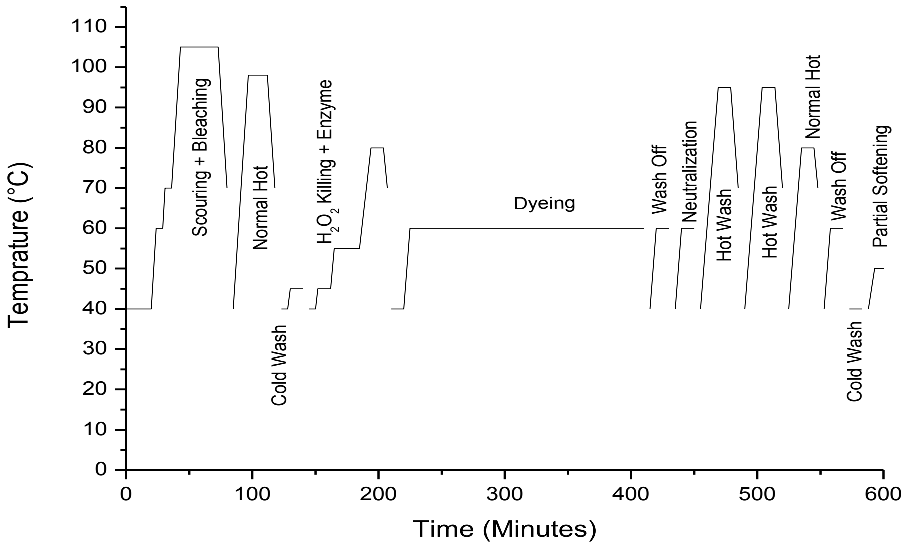

Figure 5. A Dyeing Chart for cellulose with Classic Reactive Dyes

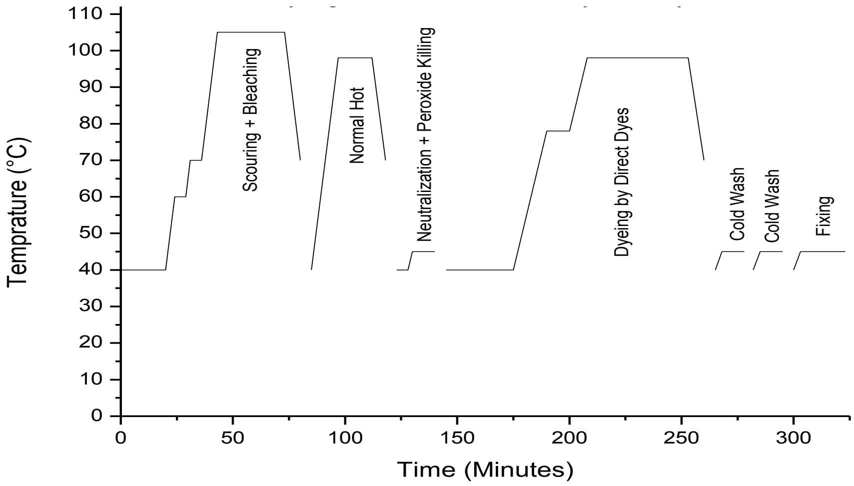

Figure 6. A Dyeing Chart for cellulose with Direct Dyes (Option-1)

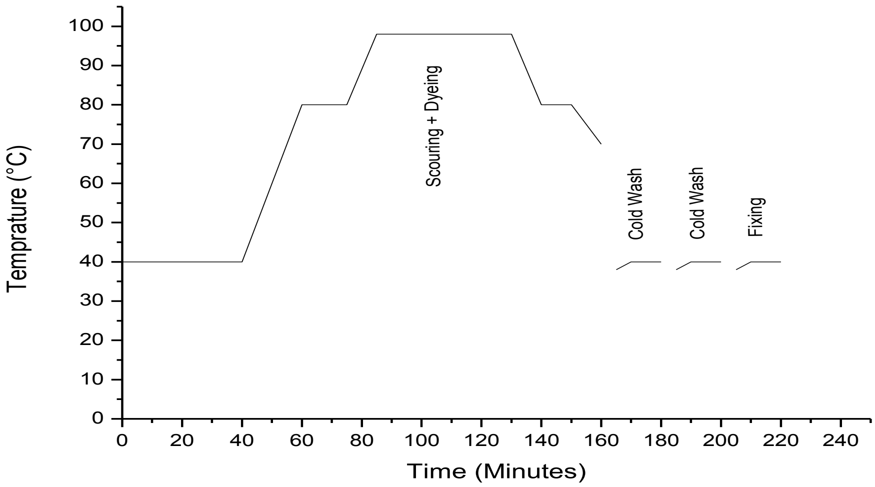

Figure 7. A Dyeing Chart for cellulose with Direct Dyes (Option-2)

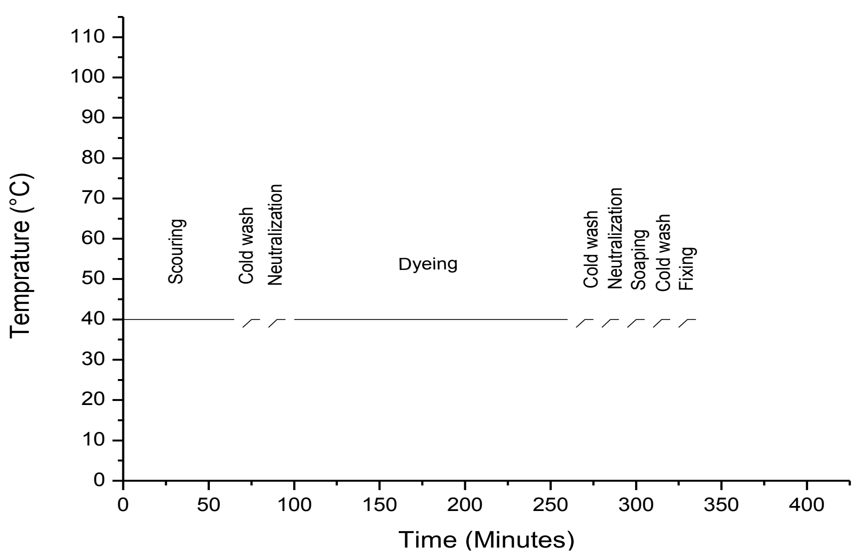

Figure 8. A Dyeing Chart for cellulose with New Generation Reactive Dyes (option-3)

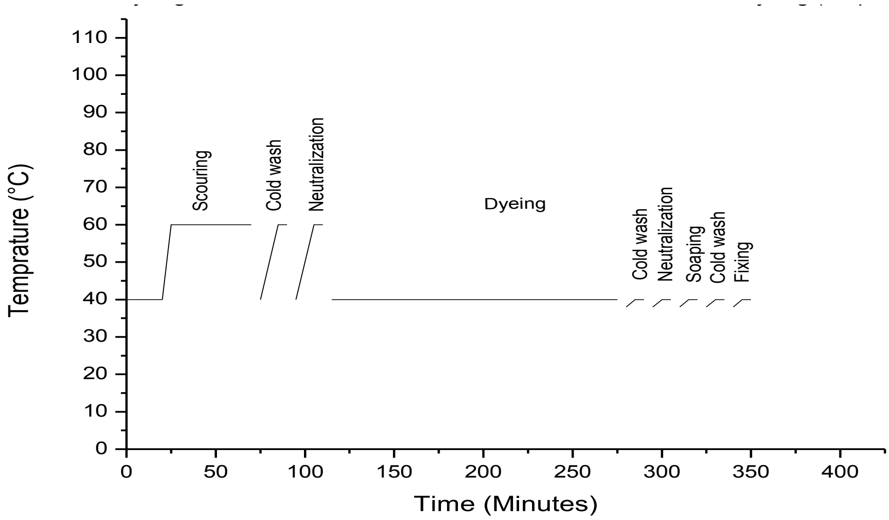

Figure 9. A Dyeing Chart for cellulose with New Generation Reactive Dyes (option-4)

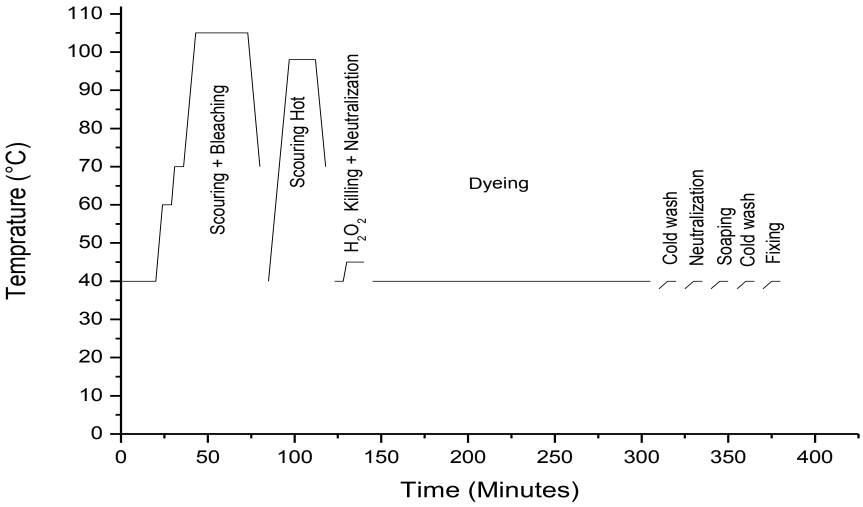

Figure 10. A Dyeing Chart for cellulose with New Generation Reactive Dyes (option-5)

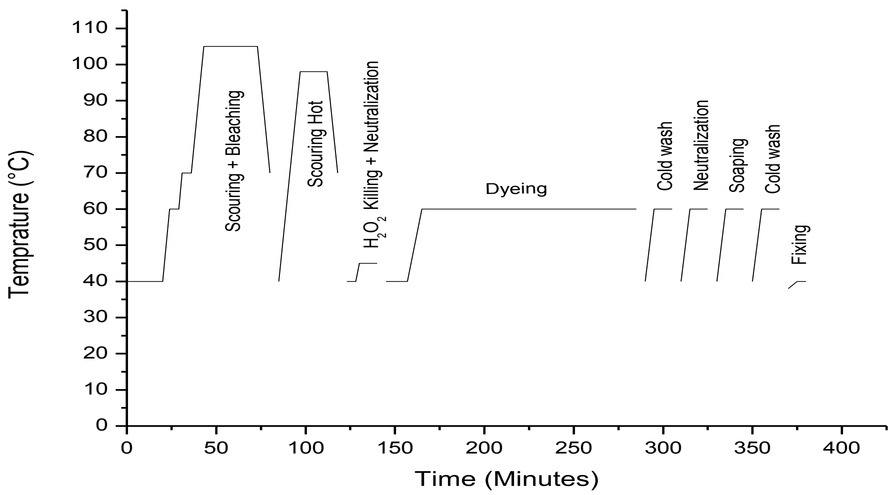

Figure 11. A Dyeing Chart for cellulose with New Generation Reactive Dyes (option-6)

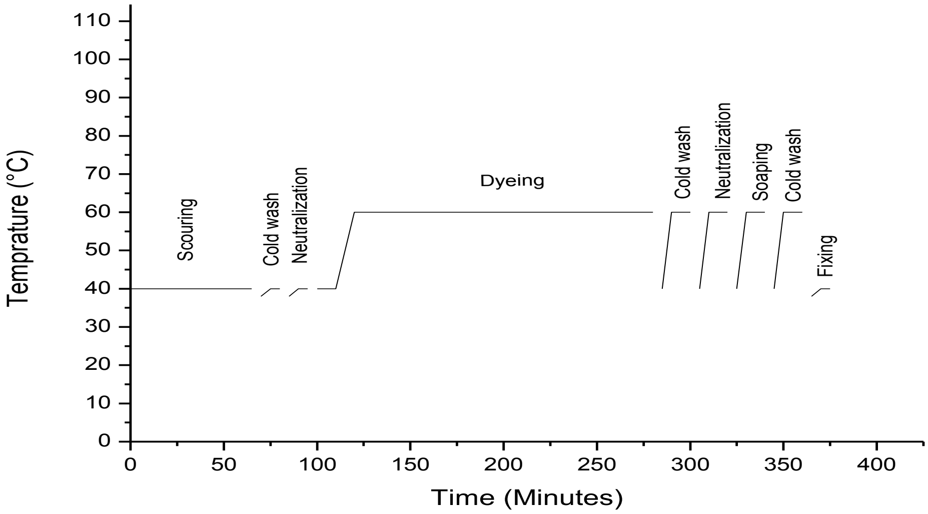

Figure 12. A Dyeing Chart for cellulose with New Generation Reactive Dyes (option-7)

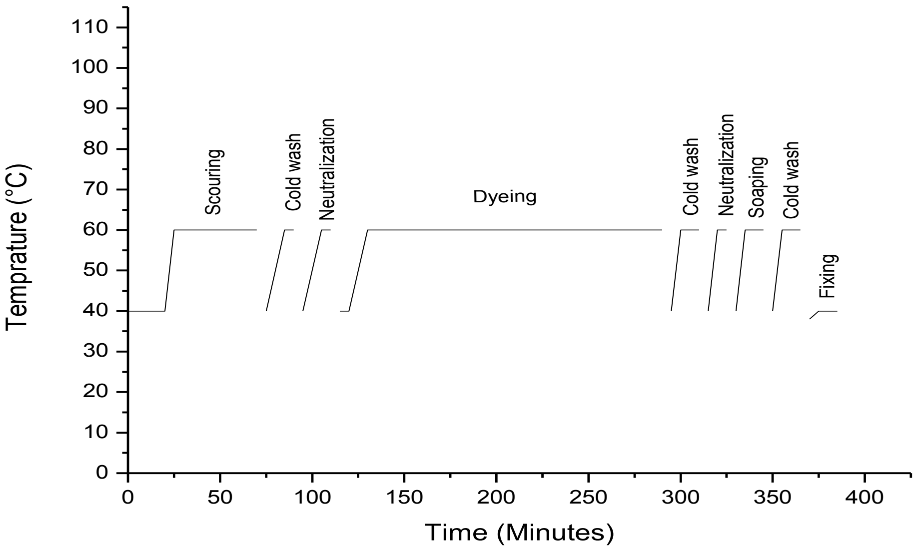

Figure 13. A Dyeing Chart for cellulose with New Generation Reactive Dyes (option-8)

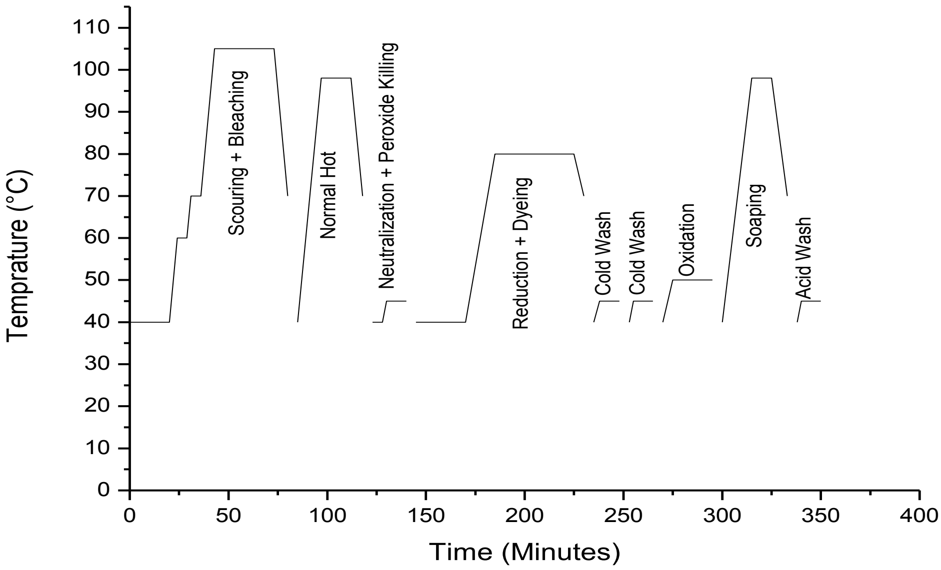

Figure 14. A Dyeing Chart for cellulose Vat Dyes (Option-9)

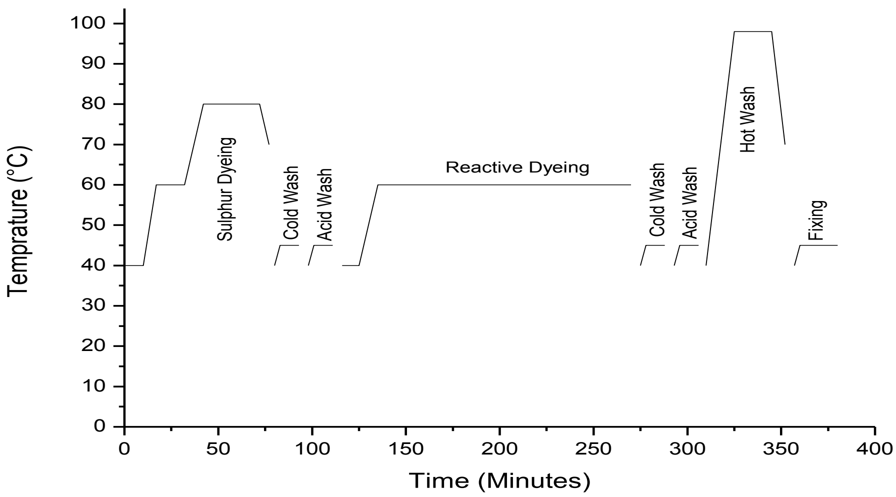

Figure 15. A Dyeing Chart for cellulose with Sulphur + Reactive Dyes (Option-10)

Table 1 Comparison of proposed technologies with current Technology for cellulose[4]

Item	Existing Reactive dyeing	New Generation Reactive dyeing	Direct dyeing	Vat dyeing	Sulphur + New Generation Reactive Dyeing
Number of bathes	13-18	7-9	4-7	7-9	7-8
Time consumption (hours)	8-10	5-6	3-6	5-6	6-7
Water consumption (L/Kg)	100-140	50-70	30-50	50-70	50-60
Steam consumption (Kg/Kg)	6-10	0.5-2	2-4	4-5	3-5
Power consumption (Kwh/kg)	0.4-0.5	0.25-0.3	0.15-0.3	0.25-0.3	0.3-0.35

The classic reactive dye needs 8~10 hours and depends on the colours of fabrics; dark colour generally needs more time. The CPAs under the PoA propose Direct dyes, new generation Reactive dyes, Vat dyes and Sulfur +Reactive Dyes based on conditions and requirements of factories. The comparison of dyeing time, water and energy consumption of different dyeing methods for cellulose is given in Table 1.

When a dye is applied directly to the fabric without the aid of fixing agent, it is called direct dyeing. In this method, the dyestuff is either fermented (for natural dye) or chemically reduced (for synthetic vat and sulphur dyes) before being applied.

High quality yarns are required to avoid bio-polishing or enzyme wash. Note that the proposed technologies will be applied when they are possible to avoid deterioration of the quality of fabrics. In other words, it does not mean that one technology can be applicable for all colours.

As shown in Table 1, the direct dyeing reduces dyeing time significantly, which leads to the savings of energy and water.

For the CVC, the dominant practice is disperse and classic reactive dyes in Bangladesh.

The current disperse and reactive dyes need 12~15 hours while it depends on the colour of fabric; dark colour generally needs more time.

Against this current dominant practice, the PoA proposes one bath dyes and Scour dyes.

The followings are the dyeing charts of CVCs for the proposed technologies. The comparison of dyeing time, water and energy consumption of different dyeing methods for CVC is given in Table 2.

[4] This is a simple comparison. All data given above are not constant; it depends upon liquor ratios of dyeing machines, depths and types of shades, fabric compositions and fabrications etc.

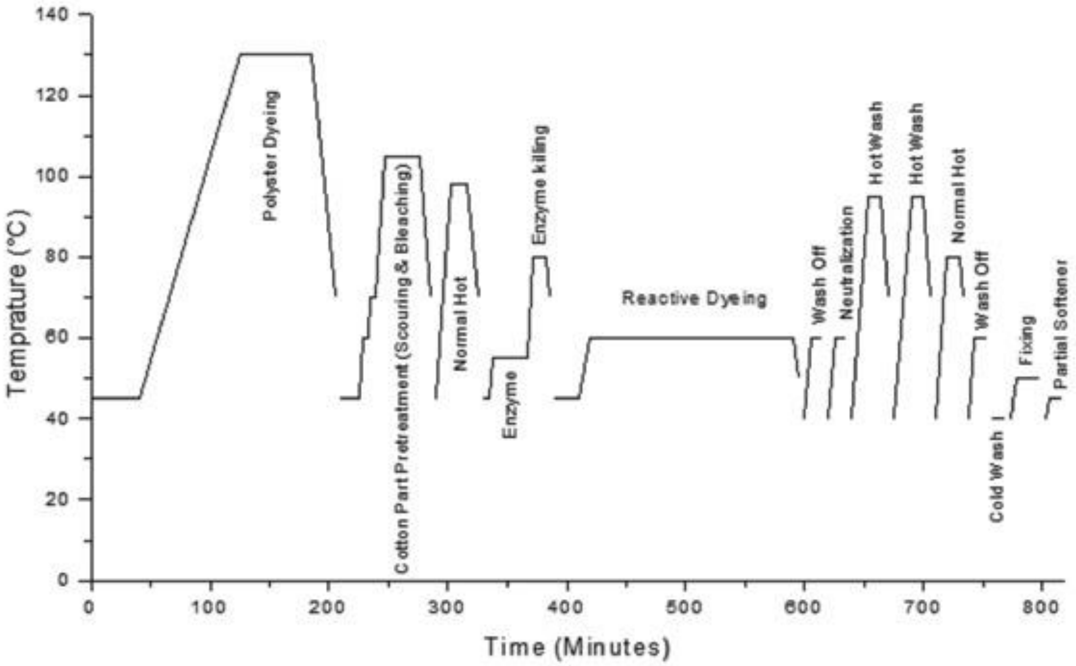

Figure 16. A Dyeing Chart for Current for CVC with disperse and classic Reactive Dyes

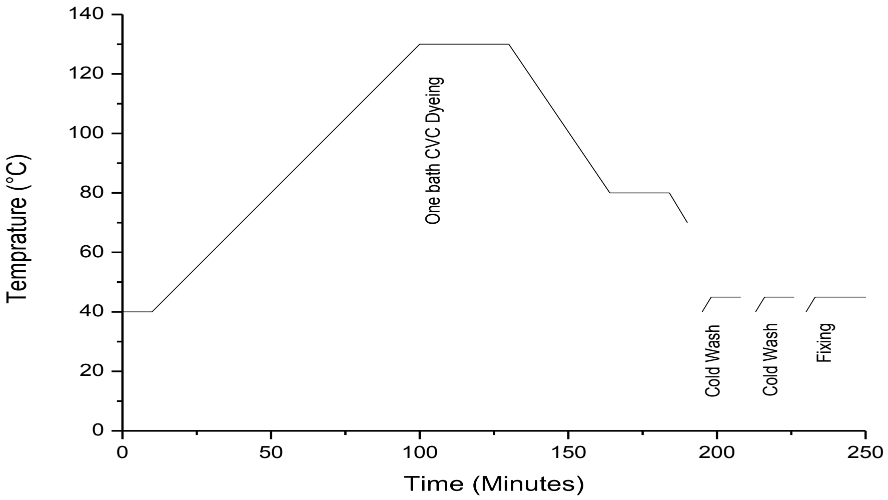

Figure 17. A Dyeing Chart for CVC with Disperse and direct dyes in One-Bath (option-1)

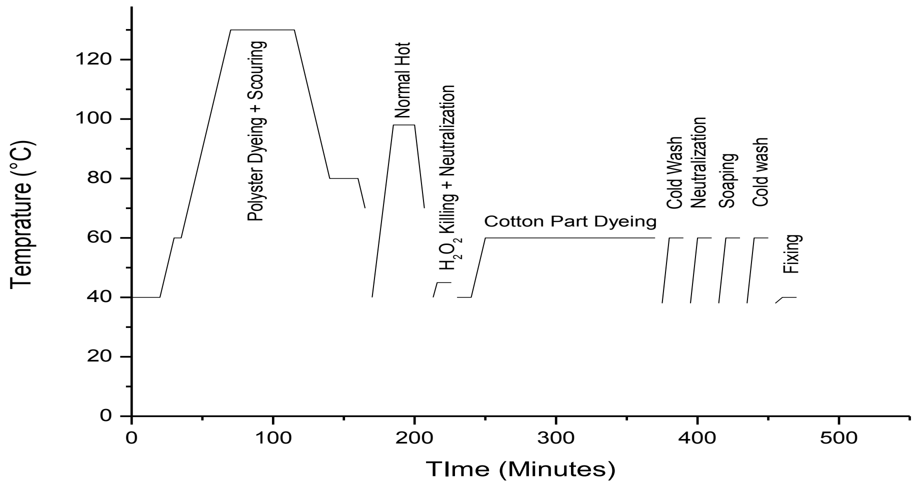

Figure 18. A Dyeing Chart for CVC with disperse + scouring in one bath and New Generation reactive dyes (Option-2)

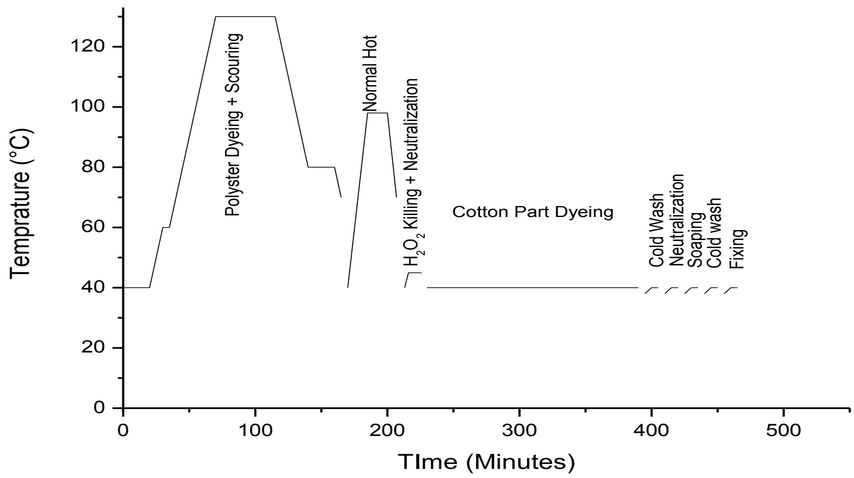

Figure 19. A Dyeing Chart for CVC with disperse + scouring in one bath and New Generation reactive dyes (Option-3)

Table 2 Comparisons of Proposed Technologies with Current Technology for CVC[5]

Item	Existing Disperse + Reactive dyeing	Disperse + New Generation Reactive dyeing	Disperse + Direct dyeing (One bath)
Number of bathes	14-18	8-9	4-5
Time consumption (hours)	12-15	7-8	4-4.5
Water consumption (L/Kg)	110-150	70-80	30-40
Steam consumption (Kg/Kg)	10-12	4-6	2-3
Power consumption (Kwh/kg)	0.6-0.75	0.35-0.4	0.2-0.25

For the case of polyester, current dyeing practice is disperse dyes. The proposed technology for the polyester is cationic dyeable polyester that is polyester with different characteristic from conventional polyester that is dyeable at a temperature (100° C) lower than the conventional temperature of 130° C.

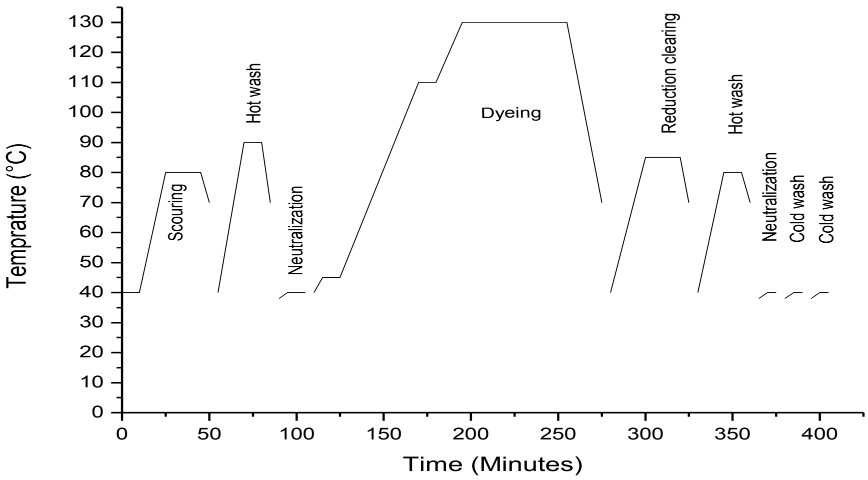

Figure 20. A Dyeing Chart for Polyester with Disperse Dyes

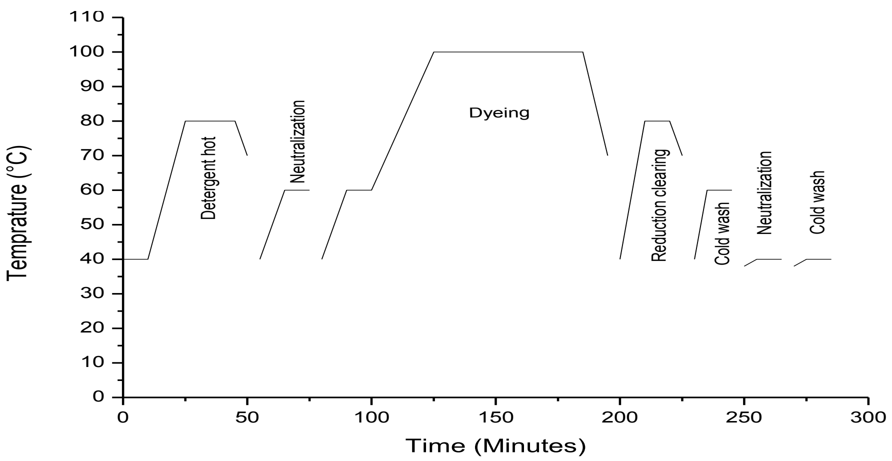

Figure 21. A Dyeing Chart for Cationic dye able Polyester with cationic dyes (Option-1).

[5] This is a simple comparison. All data given above are not constant; it depends upon liquor ratios of dyeing machines, depth and type of shades, fabric composition and fabrications etc.

The comparison of dyeing time, water and energy consumption of different dyeing methods for polyester is given in Table 3.

Table 3 Comparisons of Proposed Technologies with Current Technology for polyester[6]

Item	Existing Disperse dyeing	Cationic dyeing
Number of bathes	9-10	6-7
Time consumption (hours)	6-7	4-4.5
Water consumption (L/Kg)	70-80	50-60
Steam consumption (Kg/Kg)	5-6	3.5-4.5
Power consumption (Kwh/kg)	0.25-0.3	0.2-0.25

The technologies explained above are promoted as a package and tailored to factories by the Green Project W.S.T®.

A.7. Public funding of PoA

The PoA does not depend on any public funding. All of the CPAs will be implemented by private companies. In case any CPA under the PoA avails of any public funding, it will be required to provide in its CPA-DD that no official development assistance is diverted to that public funding.

SECTION B. Demonstration of additionality and development of eligibility criteria
B.1. Demonstration of additionality for PoA

The proposed PoA is a voluntary coordinated action by the CME as mentioned before. The Green Project W.S.T® was established for promoting the water and energy saving technologies in Bangladesh Textile and Garment industry. The implementation of the PoA and associated CPAs needs technologies initiated/led by Green Project W.S.T® and commercial incentives to encourage coordinated voluntary participation by each Textile and Garment factory. In general, the commercial incentives for the CPA are expected to be in the forms of energy and water use cost savings. The commercial incentives from technologies under the PoA is instructed and demonstrated by CME to convince factories participating the PoA.

The PoA started with a vision of developing a CDM PoA and any individual CPA under the PoA would never be implemented in the absence of the initiative and incentives mentioned above.

In the absence of the PoA, the current dyeing practices would be continued and avoidance of anthropogenic GHG emissions would not occurred.

The demonstration of additionality of the PoA is provided as per "Guidelines for demonstrating additionality of microscale project activities" (Version 05.0) as only microscale CPAs are to be included in the PoA.

According to paragraph 9 of the "Guideline", *9. Energy efficiency project activities that aim to achieve energy savings at a scale of no more than 20 gigawatt hours per year are additional if any one of the conditions below is satisfied:*

[6] This is a simple comparison. All data given above are not constant; it depends upon liquor ratios of dyeing machines, depth and type of shades, fabric composition and fabrications etc.

(a) The geographic location of the project activity is in an LDC/SIDS or SUZ of the host country identified by the government.

As Bangladesh is one of the LDC countries and any CPA included in the PoA aims to achieve energy saving at a scale of no more than 60 GWh_{th} per year, the PoA is deemed to be additional.

B.2. Eligibility criteria for inclusion of a CPA in the PoA

The CME has established the eligibility criteria in accordance with EB 74 Annex 5, "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities" for the implementation of the PoA, as follows:

Table 4. Eligibility Criteria

No	Requirements for Eligibility Criteria	Eligibility Criteria	Conformity Yes or No
a	The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA.	1. Each CPA should target an existing textile and garment factory in Bangladesh and the registered name and address of a factory in each CPA should be given clearly.	Each CPA will demonstrate the conformity of the eligibility criteria
b	Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo).	2. Each CPA is a new project that is not a registered CDM or CPA under the other PoA.	Each CPA will demonstrate the conformity of the eligibility criteria
c	The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;	3. Specifications of technologies/measures such as dyeing machines, dyeing methods, yarn types, boiler and pumps for water supply should be available.	Each CPA will demonstrate the conformity of the eligibility criteria
d	Conditions to check the start date of the CPA through documentary evidence.	4. The start date (the date of signing of "Application of Membership of Green Project W.S.T. and Participation of CDM-PoA") of any CPA should not be prior to 01 December 2012 that is the date of publication of the PoA-DD for global stakeholder consultation.	Each CPA will demonstrate the conformity of the eligibility criteria
e	Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs.	5. Each CPA should meet the applicability and other requirements of AMS- II.D (version 12.0). This will be explained in each CPA as a demonstration of applicable condition.	Each CPA will demonstrate the conformity of the eligibility criteria
f	The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality.	6. Each CPA should claim energy saving of no more than 60 GWh_{th} per year and emission reductions comparable to that for every year to meet the requirements of guideline of "Demonstrating additionality of micro scale project activities".	Each CPA will demonstrate the conformity of the eligibility criteria

g	The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis[7].	Not applicable (N/A). The local stakeholder consultation is conducted at the PoA level and CPAs under the PoA will not be required to conduct local stakeholder consultations. Moreover, environmental impact analysis are not required for CPAs under the PoA in Bangladesh.	N/A
h	Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance.	7. Any CPA that uses any public fund from Annex I parties should demonstrate that the public fund is not a diversion of official development assistance.	Each CPA will demonstrate the conformity of the eligibility criteria
i	Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation)[8].	Not applicable (N/A). The CPAs under the PoA target all Textile and Garment factories in Bangladesh and introduce the water and energy saving technologies as per factories condition and requirement. There is no any specific target group among the factories and CPAs do not involved in any distribution mechanism.	N/A
j	Where applicable, the conditions related to sampling requirements for the PoA in accordance with the "Standard for sampling and surveys for CDM project activities and programme of activities".	Not applicable (N/A). CPAs under the PoA do not apply any kind of sampling method for data collection.	N/A
k	Where applicable, the conditions that ensure that every CPA (in aggregate if it comprises of independent sub units) meets the small-scale or microscale threshold[9] and remains within those thresholds throughout the crediting period of the CPA.	Not applicable (N/A). As CPAs under the PoA apply a guideline of "Demonstrating additionality of micro scale project activities" that is taken as one of the eligibility criteria, so there is no need to mention this kind of criteria once again.	N/A
l	Where applicable, the requirements for the de-bundling check, in case the CPAs belong to small-scale or micro scale project categories.	8. Each CPA should be confirmed as a single project, which is not a de-bundled component of another large-scale CPA or CDM project activity as per the latest guidance given in CDM EB.	Each CPA will demonstrate the conformity of the eligibility criteria

B.3. Application of methodologies

The methodology applied for CPA under the PoA is:

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7 See also relevant paragraphs of "Clean Development Mechanism Project Cycle Procedure".

8 This is to re-test the validity of assumptions made at the PoA level. For example, in a lighting efficiency application, lighting usage hours of 3.5 hours per day would be valid if the target group is residences/households. Usage hours would be different in commercial applications and vice versa.

9 Please refer to the latest approved version of the "Guidelines for demonstrating additionality of microscale project activities" and the latest approved version of the "General Guidelines to SSC CDM methodologies".

Scope No: 4
Sectoral scope: Manufacturing industries
Category: AMS-II.D. (Energy efficiency and fuel switching measures for industrial facilities)
Version: 12

This category comprises any energy efficiency and fuel switching measures implemented at a single or several industrial or mining and mineral production facility (ies).

The measures may replace, modify or retrofit existing facilities or be installed in a new facility. The aggregate energy savings of a single project may not exceed the equivalent of 60 GWh_{th} per year for microscale project.

The conformity of PoA in line with applicability conditions in the AMS-II.D is described in Table 5.

Table 5. Baseline and Monitoring Methodology Applicability Demonstration

No	Applicable conditions of the Methodology	Conformity of CPAs
1	This category comprises any energy efficiency and fuel switching measures implemented at a single or several industrial or mining and mineral production facility/ies. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B.[10] Examples include energy efficiency measures (such as efficient motors), fuel switching measures (such as switching from steam or compressed air to electricity) and efficiency measures for specific industrial or mining and mineral production processes (such as steel furnaces, paper drying, tobacco curing, etc.).	Each CPA will target dyeing process in a textile and garment factory to introduce process or/and fiber optimization technologies for reducing energy and water consumption in the dyeing process.
2	The measures may replace, modify or retrofit existing facilities or be installed in a new facility.	The measures in CPAs will replace existing dyeing process/technology with proposed technologies on the existing dyeing machines/facilities.
3	This category is applicable to project activities where it is possible to directly measure and record the energy use within the project boundary (e.g., electricity and/or fossil fuel consumption).	The electricity, water and steam consumption of textile dyeing process can be measured directly through meters installed at dyeing machines or can be gained through energy management systems installed at dyeing machines.
4	This category is applicable to project activities where the impact of the measures implemented (improvements in energy efficiency) by the project activity can be clearly distinguished from changes in energy use due to other variables not influenced by the project activity (signal to noise ratio).	Each CPA will target dyeing process which process and/or fiber optimization technologies are introduced to. Therefore, the target of the measures is clear and the impacts of the measures are controllable, distinguishable from the dyeing machines performance and/or other related meters.

[10] Thus, fuel switching measures that are part of a package of energy efficiency measures at a single location may be part of a project activity included in this project category.

5	The aggregate energy savings of a single project (inclusive of a single facility or several facilities) may not exceed the equivalent of 60 GWh_e per year. A total saving of 60 GWh_e per year is equivalent to a maximal saving of 180 GWh_{th} per year in fuel input.	For microscale energy efficiency project activities, the aggregate energy savings of each CPA under the PoA will not exceed 20 GWh_e or 60 GWh_{th} per year during the crediting period.

SECTION C. Management system

(1) Generic description of the operation and management system:

Green Project W.S.T® is responsible for collection of all necessary information from target factories directly and responsible for defining and inclusion of each CPA with a help of PEAR.

Textile and Garment factories that voluntarily participate in the PoA have responsibilities to provide necessary information to the CME for management of the PoA.

Textile and garment factories who are interested in the PoA will apply to Green Project W.S.T® for participating the PoA. The, Green Project W.S.T® will send water ambassador to the factories to audit the CPA factory and make full report on dyeing machines, utilities and current dyeing practices.
In the factories, some trials of technologies proposed by Green Project W.S.T® will be conducted by water ambassador and team leader will make reports to CDM management team of Green Project W.S.T®. The CDM management team will conduct technical review of the report and pass it to the CEO of Green Project W.S.T® and PEAR. Based on the report and confirmation of CEO of Green Project W.S.T® and PEAR, the inclusion of CPAs will be decided.

Then the factories will sign agreements with the Green Project W.S.T® for implementing CPAs and providing all relevant information and undertaking the monitoring.

CDM technical team of Green Project W.S.T® will provide training on the operation and maintenance of meter to dyeing operator, supervisor and/or CDM responsible staff.

CDM technical team of Green Project W.S.T® will further provide training program on monitoring procedure and data record keeping system to dyeing master, manager, production officer and/or supervisor of CPA textile factories before monitoring of CDM activities and once in a year. Training program details will be kept as hard copies for each CPA.
Personnel trainings of Green Project W.S.T® on the CDM related matters including CPA inclusions are organized once in a year with the help of PEAR or other international organizations such as GIZ.

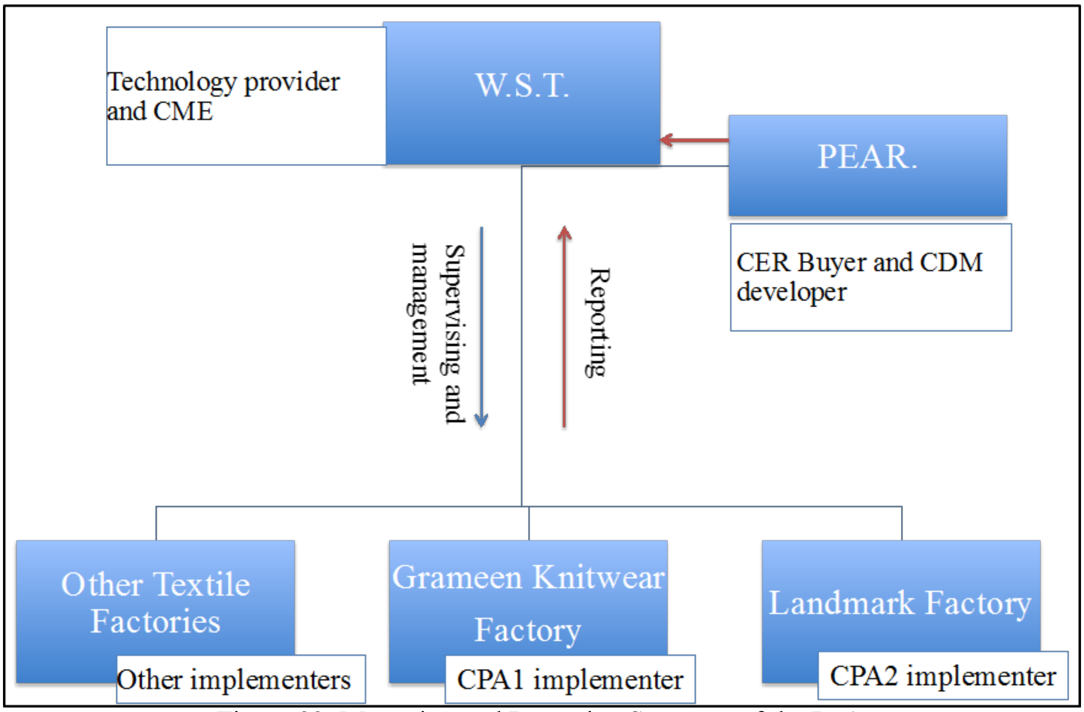

Figure 22. Managing and Reporting Structure of the PoA

(2) A record keeping system for each CPA under the PoA:

The record keeping system includes the method of data collection, the duty and roles of each player, training logs for Green Project W.S.T® staffs and CPA implementers and the database. CPA textile factory will keep record in the dyeing registered book. Water Ambassador of Green Project W.S.T® will periodically report to the team leader and CDM record keeping team accordingly, supported by CDM management team.

A database for each factory in each CPA includes the following information:

-- Names of factories and their addresses
-- ID numbers of the CPAs
-- Starting dates of CPAs
-- Number of dyeing machines and their capacity in each factory
-- Batch-wise baseline electricity consumption for targeted dyeing machines
-- Batch-wise baseline steam consumption for targeted dyeing machines
-- Batch-wise baseline water consumption for targeted dyeing machines
-- Number of batches for machines for different dyeing process in the project
-- Batch-wise project electricity consumption for targeted machines
-- Batch-wise project steam consumption for targeted dyeing machines
-- Batch-wise project water consumption for targeted dyeing machines

Related responsibilities and tasks of participants under the record keeping system are described in Table 6.

Table 6. Responsibilities and tasks of organizations involved in the PoA

	Organization	Processes
Coordination of the PoA including the process of inclusion of CPAs	Green Project W.S.T®	• Coordinate between implementers and PEAR and CDM Executive Board • Develop a PoA management system, select and contract with CPA implementers. • Apply for the registration of the PoA and inclusion of any CPA to CDM Executive Board
	Each CPA implementer	• Apply for participation of the PoA as an implementer. • Provide all relevant data and information regarding inclusion of a CPA.
Ex ante and *ex post* data collection	Green Project W.S.T®	• Specify the required data/ information to be collected before start and/or during implementation of each CPA. • Develop database format for CPAs
	Each CPA implementer	• Conduct data collection from its own factory.
Data storage and management	Green Project W.S.T®	• Develop database for CPAs. • Check the reported data from each CPA implementer. • Calculate emission reductions based on the data reported by implementers. • Compile and store data and information as a database.
	Each CPA implementer	• Store the electronic and hard copy of the data and information. • Provide the electronic or hard copy file to CME.
Communication and reporting	Green Project W.S.T®	• Coordinate between implementers and communicate with DOE and CDM EB
	Each CPA implementer	• Report collected data and information to the CME
Training and capacity building	Green Project W.S.T® (with the help of PEAR)	• Implement training programs for its own staffs and implementers to meet the needs of the monitoring and verification.
Quality assurance and verification	Green Project W.S.T®	• Double check data related to inclusion and monitoring between Green Project W.S.T® and PEAR.

	Each CPA implementer	• Undertake regular maintenance of meters and calibration of meters in accordance with the specifications and requirements. • Keep record for all dyeing books and recipes for the project activities.
PDCA cycle	Green Project W.S.T®	• Review each of CPA, the PoA as a whole annually and assess the performance of the PoA management system with feedbacks from implementers and other factories through audits. • If necessary, revisions are to be done to the management system.

(3) A system/procedure to avoid double accounting e.g., to avoid the case of including a new CPA that has been already registered either as a CDM project activity or as a CPA of another PoA:

Green Project W.S.T® reviews a new proposed CPA at the time of inclusion whether or not any textile and garment factory under the CPA is included in another registered CDM project activity or in a CPA of another small scale PoA.

(4) The SSC-CPA included in the PoA is not a de-bundled component of another CPA or CDM project activity:

Green Project W.S.T® will follow the latest version of "Guidelines on assessment of de-bundling for SSC project activities" provided by the Executive Board to identify whether a proposed CPA is a de- bundled component of a large scale activity.

(5) The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA:

Any CPA under the PoA is recommended and planned by Green Project W.S.T® and PEAR. Moreover, as explained in Table 6, under the record keeping system, CPA implementers are to have a contract to undertake any project activities under the PoA—under the supervision of Green Project W.S.T® —are well aware of and have agreed to their activity under the PoA.

SECTION D. Duration of PoA

D.1. Start date of the PoA

The start date of the PoA is the date in which the PoA-DD is published for global stakeholder consultation, 01 December 2012.

D.2. Length of the PoA

The duration of the PoA is 28 years and 0 month.

SECTION E. Environmental impacts

E.1. Level at which environmental analysis is undertaken

The PoA is believed to have no any negative impacts on the environment.The impact of each CPA under the PoA on the environment is identical in most extension regardless of location; therefore, Environmental Analysis is done at the PoA level. However, environmental impact assessment for the PoA is not required in Bangladesh.

E.2. Analysis of the environmental impacts

As the PoA focuses on process change or process optimization in the existing textile and garment factories that have had environmental clearance certificates and the PoA is seen as no any negative environmental impacts, an additional environmental impact assessment for the PoA is not required.

The impact of the PoA on the environment in the whole process is believed to be positive, which is manifested in the following aspects:

(1) The project will contribute to ensure future water security in Bangladesh.

The groundwater is not only the main source of drinking water, but also the main source of industrial water for textile dyeing and garment industry in Bangladesh. It has been figured out that the continuous and heavy use of groundwater in so many places including Dhaka city causes the groundwater levels to dry up faster than normal. The project promises to reduce groundwater consumption for textile dyeing process significantly.

(2) The project will contribute to ease land subsidence having occurred.

It is reported that there are too many places in the country where the heavy withdrawal of groundwaters have disturbed the soil layers and caused land subsidence. Even in the capital city and other cities of the country that depend disproportionately on the lifting of groundwater for household and other uses, land subsidence is noted to be a serious consequence of the practice. Thus, from the preventing the disfigurement of land and its calamitous effects, a reducing consumption of groundwater is an indispensable way.

SECTION F. Local stakeholder comments

F.1. Solicitation of comments from local stakeholders

The Local stakeholder consultation meeting was conducted at the PoA level as social and environmental impacts of the CPAs are seen to be identical regardless of target factories.

The Local Stakeholder Consultation Meeting at the PoA level was held at Uttara Club (Lotus Hall), Dhaka on 5th of November 2012 to collect comments and opinions from local stakeholder from various sectors.

Around 50 participants including Mr. Faruque Hassan, Vice President, BGMEA, delegates from Textile and Garment Factory and experts from Machinery Manufacturer were present at the meeting.

F.2. Summary of comments received

The comments received during the meeting are summarized in Table 7.

Table 7. Questions and comments received

Stakeholder comments	Was comment taken into account (Yes/No)?	Explanation (Why? How?)
Is this project can reduce the use of chemical & if yes how? (Mr. Mohammad Roqibul Islam from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH)	Clarification was given	This project can reduce the use of chemical for textile wet processing. Because in textile wet processing the chemicals are dozing in g/liter, so according to our proposed technology (in which 30-40 liters of water are used for each kg cotton fabric processing) we are using less amount of water then the existing system (100 liters of

		water for each kg fabric processing) that's how we are saving chemicals.
Does the concentration of chemical increase in ETP (Effluent Treatment Plant) after the implementation of the project? If increase then how you will control this? (Mr. Mohammad Roqibul Islam from Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH)	Clarification was given	No our project does not increase the concentration of chemical in the ETP. So we don't need to control this matter in ETP.
Why you are working only on two-model factories? (Mr. Zaman from Jamuna Group)	Clarification was given	At present, we are actively working with the two factories (Grameen Knitwear Ltd. & Landmark Fabrics) to register the programmatic CDM (PoA) as a CDM project. After registration the entire interested factory can be included to the programme.
How other factories can be a part of this Project and what are the criteria for this? (Mr. Zaman from Jamuna Group)	Clarification was given	Other factories also can be a part of this project as a CPA (Component Project Activity) after the PoA registered to be CDM project. Any textile and garment factory in Bangladesh can apply participation of the PoA through implementing water and energy technologies proposed by Green Project W.S.T®. So please contact with Green Project W.S.T® which will advise you on what kind of technologies will appropriate for your factory.
Does your technology can overcome the fastness problem of red and dark black? (Mr. Zaman from Jamuna Group)	Clarification was given	Our proposed technology can overcome this problem. By choosing the appropriate process of dyeing from our proposed options this problem can easily solved.
If we invite you, are you interested to come to our factory? (Mr. Zaman from Jamuna Group)	Yes	We are interested to work with factories who are believing and willing to apply our idea

May we take back the sustainable development matrix and return it by e-mail with full completion? (Mr. Sohag Miah from NIAGARA TEXTILES LTD)	Yes	You can complete the table after the meeting and send it back us with e-mail. And kind of continues inputs are welcome by e-mail and telephone.

F.3. Report on consideration of comments received

All questions and comments are responded to increase stakeholders understanding of the project. Some factories' requirements of conducting audits on their factories for joining the project are accepted.

Some stakeholder's requests to complete the sustainable development matrix after the meeting are accepted also.

Please refer to Table 7 for detailed responses on corresponding questions and comments.

SECTION G. Approval and authorization

Project participants have obtained the Letters of Approval from both host country (Bangladesh) and Japan.

PART II. Generic component project activity (CPA)

SECTION A. General description of a generic CPA

A.1. Purpose and general description of generic CPAs

The proposed small-scale Component Project Activity (CPA) would consist of introducing energy and water saving technologies toward dyeing process of Textile and Garment factories. The aim of the CPA is to contribute to the sustainable development of Bangladesh. The proposed SSC-CPA will reduce greenhouse gas emissions through the increase in energy efficiency as well as saving water consumption of the targeted garment factories in textile dyeing process.

SECTION B. Application of a baseline and monitoring methodology

B.1. Reference of the approved baseline and monitoring methodology (ies) selected

Table 8. Methodologies, related tools and guidelines for CPAs

Baseline and Monitoring Methodology	Version 12 Sectoral Scope: 04 EB 51	AMS-II.D; Energy efficiency and fuel switching measures for industrial facilities
	Version 17 Sectoral Scope: 01 EB 61	AMS-I.D; Grid connected renewable electricity generation
Tools and Guidelines	EB 74 Report, Annex 5, Version 03.0	Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities
	EB 54 Report, Annex 13, Version 3	Guidelines on assessment of de-bundling for SSC project activities
	EB 74 Report, Annex 8, Version 03.0	GUIDELINES FOR COMPLETING THE PROGRAMME DESIGN DOCUMENT FORM FOR SMALL-SCALE CDM

		PROGRAMMES OF ACTIVITIES
	EB 66 Report, Annex 17, Version 01.0	GUIDELINES FOR COMPLETING THE COMPONENT PROJECT DESIGN DOCUMENT FORM FOR SMALL-SCALE COMPONENT PROJECT ACTIVITIES
	EB 68 Report, Annex 27,Version 09.0	GUIDELINES ON THE DEMONSTRATION OF ADDITIONALITY OF SMALL-SCALE PROJECT ACTIVITIES
	EB 73 Report, Annex 13,Version 05.0	GUIDELINES FOR DEMONSTRATING ADDITIONALITY OF MICROSCALE PROJECT ACTIVITIES

B.2. Application of methodology (ies)

The methodology of AMS-II.D (Energy efficiency and fuel switching measures for industrial facilities, version 12.0) is applied for CPAs under the PoA and a justification of applicability of the methodology is given in Table 9. CPA-specific conformity or compliance with the eligibility criteria will be assessed at the time of its inclusion.

Table 9. Applicability of baseline and monitoring methodology

No	Applicable conditions of the Methodology	Conformity of CPAs
1	This category comprises any energy efficiency and fuel switching measures implemented at a single or several industrial or mining and mineral production facility/ies. This category covers project activities aimed primarily at energy efficiency; a project activity that involves primarily fuel switching falls into category III.B.1 Examples include energy efficiency measures (such as efficient motors), fuel switching measures (such as switching from steam or compressed air to electricity) and efficiency measures for specific industrial or mining and mineral production processes (such as steel furnaces, paper drying, tobacco curing, etc.).	Each CPA will target dyeing process in a textile and garment factory to introduce process or/and fiber optimization technologies for reducing energy and water consumption in the dyeing process.
2	The measures may replace, modify or retrofit existing facilities or be installed in a new facility.	The measures in CPAs will replace existing dyeing process/technology with proposed process/technologies on the existing dyeing machines/facilities.

3	This category is applicable to project activities where it is possible to directly measure and record the energy use within the project boundary (e.g., electricity and/or fossil fuel consumption).	The electricity, water and steam consumption of textile dyeing process can be measured directly through meters installed at dyeing machines or can be gained through energy management systems installed at dyeing machines.
4	This category is applicable to project activities where the impact of the measures implemented (improvements in energy efficiency) by the project activity can be clearly distinguished from changes in energy use due to other variables not influenced by the project activity (signal to noise ratio).	Each CPA will target dyeing process which process and/or fiber optimization technologies are introduced to. Therefore, the target of the measures is clear and the impacts of the measures are controllable, distinguishable from the dyeing machines performance and/or other related meters.
5	The aggregate energy savings of a single project (inclusive of a single facility or several facilities) may not exceed the equivalent of 60 GWh_e per year. A total saving of 60 GWh_e per year is equivalent to a maximal saving of 180 GWh_{th} per year in fuel input.	For microscale energy efficiency project activities, the aggregate energy savings of each CPA under the PoA will not exceed 20 GWh_e or 60 GWh_{th} per year during the crediting period.

B.3. Sources and GHGs

Figure 23 depicts related equipment, systems and flows of mass and energy including GHG sources in each CPA under the PoA. The project boundary of each CPA covers:

- The dyeing machines (dyeing process)
- The water supply system
- Energy sources such as boilers and captive power generators at factories.
- National grid or isolated grids

The electricity power for dyeing processes is provided by a national grid or an isolated grid that supply energy for specific area or captive power generators exclusively for the factories. The steam energy for dyeing processes comes from boilers owned by the factories. On the other hand, water for dyeing process is supplied by water supply stations that provide water for specific area or water pumps owned by the factories.

The parameters needed for monitoring are electricity, steam and water consumptions in dyeing processes.

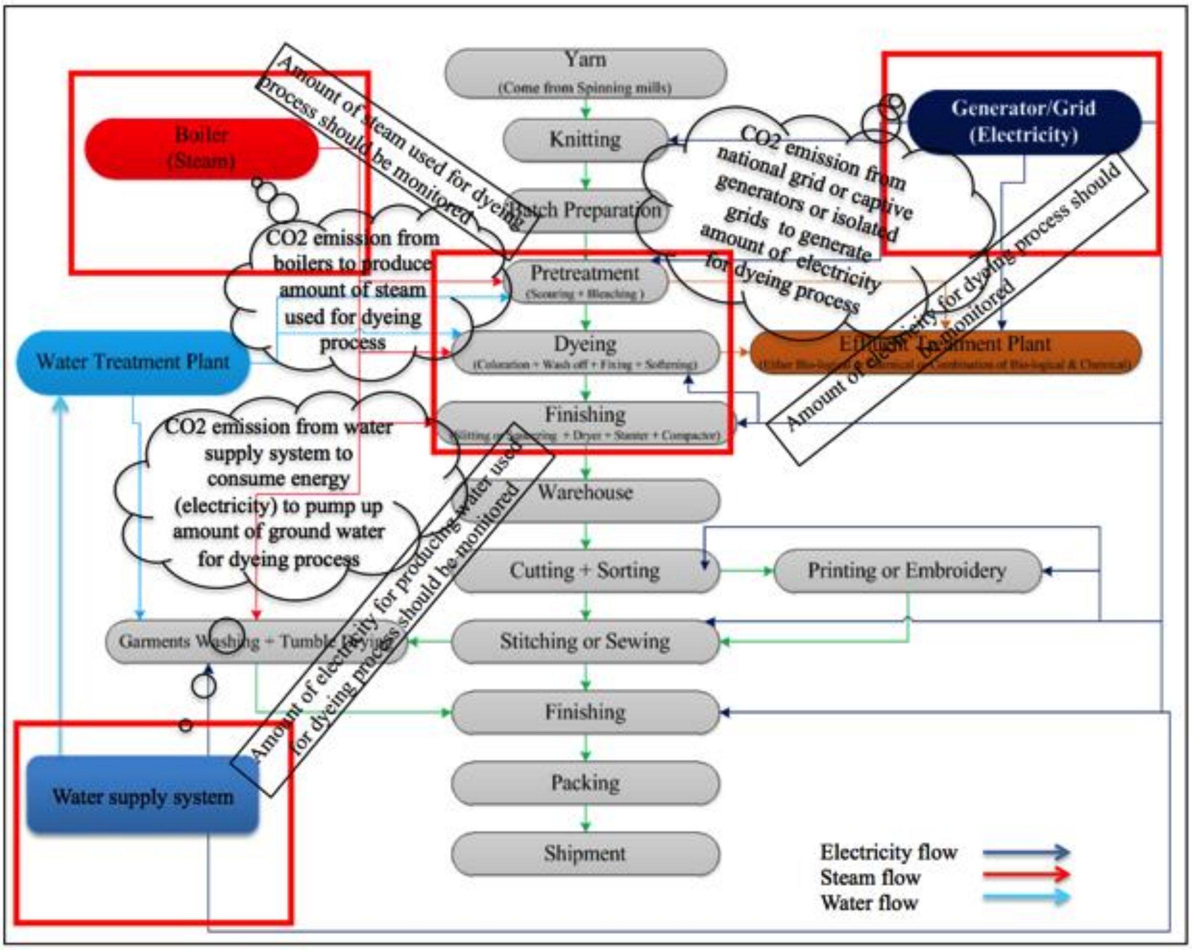

Figure 23. Delineation of each CPA and GHG sources

As per the methodology, the sources of GHGs considered in CPAs under the PoA are explained in the table below.

Source		GHGs	Included?	Justification/Explanation
Baseline	Electricity consumption of dyeing machines for textile dyeing	CO_2	Yes	Major Source of emissions
		CH_4	No	Minor Source and thereby neglected
		N_2O	No	Minor Source and thereby neglected
	Steam consumption of dyeing machines for textile dyeing	CO_2	Yes	Major Source of emissions
		CH_4	No	Minor Source and thereby neglected
		N_2O	No	Minor Source and thereby neglected
	Electricity consumption by pumping of water that is used in dyeing machines for textile dyeing	CO_2	Yes	Major Source of emissions
		CH_4	No	Minor Source and thereby neglected
		N_2O	No	Minor Source and thereby neglected
Project	Electricity consumption of dyeing machines for textile dyeing	CO_2	Yes	Major Source of emissions
		CH_4	No	Minor Source and thereby neglected
		N_2O	No	Minor Source and thereby neglected
	Steam consumption of dyeing machines for textile dyeing	CO_2	Yes	Major Source of emissions
		CH_4	No	Minor Source and thereby neglected
		N_2O	No	Minor Source and thereby neglected
	Electricity consumption by pumping of water that is used in dyeing machines for textile dyeing	CO_2	Yes	Major Source of emissions
		CH_4	No	Minor Source and thereby neglected
		N_2O	No	Minor Source and thereby neglected

B.4. Description of baseline scenario

For the textile and garment industry in Bangladesh, there has been no any mandatory policy or regulation for energy and water saving. As per the methodology AMS II.D./version 12, the baseline scenario for the PoA is demonstrated as follows.

In the absence of the CDM project activity, the factories would continue to apply the current dyeing practices to consume energy at historical average levels, until the time at which the dyeing practices would be likely to be replaced by the proposed technologies. The proposed technologies include fibre optimization (for example replacement of low quality yarn with high quality yarn that avoids enzyme washes), change of hot brand scouring to cold brand scouring and dyeing process optimization (for example, replacement (change) of dyeing methods). Among the proposed technologies, the fibre optimization is optional for application, but others are mandatory. Therefore, the current dyeing practices use enzyme wash, hot brand scouring and application of classical reactive dye for celluloses, reactive and disperse dye for CVCs and disperse dye for Polyesters.

No emission reductions will be claimed from a point of time of the replacement of existing dyeing machines with new dyeing machines onward.

Baseline emissions for electricity are estimated by multiplying the amount of electricity (in kWh/year) by the CO_2 emission factor of isolated grid/national grid/captive power generator (in kg CO_2/kWh or tCO_2/MWh). On the other hand, baseline emissions for thermal (steam) energy are calculated by multiplying the amount of steam consumption (in ton/year) by an emission factor of steam generation (in tCO_2/ton-steam). The emission factor of of steam generation is calculated based on the specification of thermal energy suppliers (boilers) and the IPCC default values for net calorific values and CO_2 emission factors of fossil fuels that are used for thermal energy generation.

B.5. Demonstration of eligibility for a generic CPA

All CPAs are eligible under the PoA, if the CPA complies with the following criteria:

Table 10. Conformity of eligibility criteria

No	Eligibility Criteria	Conformity Yes or No
1	Each CPA should target an existing textile and garment factory in Bangladesh and the registered name and address of a factory in each CPA should be given clearly.	Each CPA will demonstrate that targeted factory under the CPA is an existing textile and garment factory with its registered name and address.
2	Each CPA is a new project that is not a registered CDM or CPA under the other PoA.	Each CPA will demonstrate that the CPA is a new project and is not a registered CDM or CPA under the other PoA
3	Specifications of technologies/measures such as dyeing machines, dyeing methods, yarn types, boilers and pumps for water supply should be available.	Each CPA will provide specifications of technologies for the CPA such as specifications of dyeing machines, dyeing methods, yarn types, boiler and water pumps
4	The start date (the date of signing of "Application of Membership of Green Project W.S.T® and Participation of CDM-PoA") of any CPA should not be prior to 01 December 2012 that is the date of publication of the PoA-DD for global stakeholder consultation.	Since the start date of the CPA-1 is not prior to the date of commencement of validation of the PoA, the other CPAs also meet the criteria.
5	Each CPA should meet the applicability and other requirements of AMS- II.D (version 12.0). This will be explained in each CPA as a demonstration of applicable condition.	Each CPA will demonstrate the conformity of applicability conditions of the methodology (AMS- II.D (version 12.0)) applied for CPAs. Please refer to Part II section B.2.
6	Each CPA should claim energy saving of no more than 60 GWh_{th} per year and emission reductions comparable to that for every year to meet the requirements of guideline of “Demonstrating additionality of micro scale project activities”.	Each CPA will demonstrate that every year during the crediting period, the aggregate energy savings of each CPA will not exceed 60 GWh_{th} per year.

7	Any CPA that uses any public fund from Annex I parties should demonstrate that the public fund is not a diversion of official development assistance.	Each CPA will demonstrate that any public fund used for the CPA is not a diversion of official development assistance.
8	Each CPA should be confirmed as a single project, which is not a de-bundled component of another large-scale CPA or CDM project activity as per the latest guidance given in CDM EB.	Each CPA will demonstrate that the CPA is not a de-bundled component of another large-scale CPA or CDM project activity

B.6. Estimation of emission reductions of a generic CPA
B.6.1. Explanation of methodological choices

Baseline Emissions

As mentioned before, the baseline scenario for the project is the continuation of the current dyeing processes in textile and garment factories. The CPAs under the PoA will not replace any dyeing machine in the target textile and garment factories. Only existing dyeing machines in a factory before project implementation are targeted throughout the crediting period.

According to the methodology AMS-II.D. (version 12), the baseline emissions can be calculated by the following equation.

$$BE_y = (EC_{Dyeing,y}^{BL} + EC_{Water,y}^{BL})/1{,}000 \times EF_{CO2}^{Elec} + SC_y^{BL} \times EF_{CO2}^{Steam} \quad (1)$$

Where:

BE_y	Baseline emissions in year *y* (tCO_2e/year)
$EC_{Dyeing,y}^{BL}$	Baseline electricity consumption by existing dyeing machines to which new measures are introduced by a CPA in year *y* (kWh/year)
$EC_{Water,y}^{BL}$	Baseline electricity consumption by pumping of water that is used in existing dyeing machines in year *y* (kWh/year)
SC_y^{BL}	Baseline steam consumption by existing dyeing machines to which new measures are introduced by a CPA in year *y* (ton-steam/year)
EF_{CO2}^{Elec}	CO_2 emission factor of the electricity used at the factories for dyeing (a grid emission factor or an emission factor of a captive generator or isolated grid from where electricity is provided) (tCO_2e/MWh)
EF_{CO2}^{Steam}	CO_2 emission factor of steam generation at the factories (tCO_2e/ton-steam).

$$EC_{Dyeing,y}^{BL} = \sum_i \sum_j \sum_k \sum_l EC_{i,j,k,l}^{BL,Batch,dyeing} \times NB_{i,j,k,l,y}^{PJ} \quad (2)$$

Where:

$EC_{Dyeing,y}^{BL}$	Baseline electricity consumption by existing dyeing machines to which new measures are introduced by a CPA in year *y* (kWh/year)
$EC_{i,j,k,l}^{BL,Batch,dyeing}$	Electricity consumption of an existing dyeing machine *i* for a batch in the baseline dyeing process for brightness of colour *j*, material *k* and at a load of *l* (kWh/batch)
$NB_{i,j,k,l,y}^{PJ}$	Number of batches performed on an existing dyeing machine *i* in the project dyeing processes for brightness of color *j*, material *k* and at a load of *l* in year *y*
i	Type of an existing dyeing machine used at the factories
j	Brightness of color of textile being dyed at the factories (*j*: light, medium, dark)

k	Type of textile being dyed at the factories (k: cellulose (such as cotton and viscose), CVC and polyester)
l	Load of fabric for an existing dyeing machine used at the factories

$$EC_{Water,y}^{BL} = \sum_{i}\sum_{j}\sum_{k}\sum_{l} WC_{i,j,k,l}^{BL,Batch} \times NB_{i,j,k,l,y}^{PJ} \times EC_{Water}^{Pump} \quad (3)$$

Where:

$EC_{Water,y}^{BL}$	Baseline electricity consumption by pumping of water that is used in existing dyeing machines in year y (kWh/year)
$WC_{i,j,k,l}^{BL,Batch}$	Water consumption in an existing dyeing machine i for a batch in the baseline dyeing process for brightness of colour j, material k and at a load of l (Litre/batch)
$NB_{i,j,k,l,y}^{PJ}$	Number of batches performed on an existing dyeing machine i in the project dyeing processes for brightness of color j, material k and at a load of l in a year y
EC_{Water}^{Pump}	Electricity consumption for pumping groundwater to the factories (kWh/liter).
i	Type of an existing dyeing machine used at the factories
j	Brightness of color of textile being dyed at the factories (j: light, medium, dark)
k	Type of textile being dyed at the factories (k: cellulose (such as cotton and viscose), CVC and polyester)
l	Load of fabric for an existing dyeing machine used at the factories

It is preferable to calculate emission factor based on the *ex-ante*/*ex-post* monitored records. However, in Bangladesh it is not common practice to monitor the amount of electricity consumed and amount of water pumped by water pumps. Therefore, the emission factor for water pumping is calculated *ex-ante* as per specification and installation condition of water pumps in a conservative way.

$$EC_{Water}^{Pump} = \frac{P_{in}^{Pump}}{Q_{discharge}^{Pump} \times 3.6 \times 10^{6}} \quad (4)$$

Where:

EC_{Water}^{Pump}	Electricity consumption for pumping groundwater to the factories (kWh/liter).
P_{in}^{Pump}	Pump electrical input power (kW)
$Q_{discharge}^{Pump}$	Pump discharge capacity (m^3/s). Use a maximum discharge capacity from the specifications of a pump.

$$P_{in}^{Pump} = \frac{P_{shaft}^{Pump}}{\eta_{motor}} \quad (5)$$

Where:

P_{in}^{Pump}	Pump electrical input power (kW)
P_{shaft}^{Pump}	Pump shaft power (kW)
η_{motor}	Pump motor efficiency (%). 100% is used in a conservative manner

$$P_{shaft}^{Pump} = \frac{P_{hydro}}{\eta_{pump}} \quad (6)$$

Where:

P_{shaft}^{Pump}	Pump shaft power (kW)

P_{hydro}	Pump hydraulic power (kW)
η_{pump}	Pump efficiency (%). 100% is used in a conservative manner

$$P_{hydro} = Q_{discharge}^{Pump} \times H_{total} \times \rho \times g \;/1000 \quad (7)$$

Where:

P_{hydro}	Pump hydraulic power (kW)
$Q_{discharge}^{Pump}$	Pump discharge capacity (m^3/s). Use a maximum discharge capacity from the specifications of a pump.
H_{total}	Total head of a pump (m).
ρ	Density of water (1,000 kg/m^3).
g	Acceleration due to gravity (9.80665 m/s^2)

$$SC_y^{BL} = \sum_i \sum_j \sum_k \sum_l SC_{i,j,k,l}^{BL,Batch} \times NB_{i,j,k,l,y}^{PJ} \quad (8)$$

Where:

SC_y^{BL}	Baseline steam consumption by existing dyeing machines to which new measures are introduced by a CPA in year *y* (ton-steam/year)
$SC_{i,j,k,l}^{BL,Batch}$	Steam consumption of an existing dyeing machine *i* for a batch in the baseline dyeing process for colour j, material k and at a load of *l* (ton-steam/batch)
$NB_{i,j,k,l,y}^{PJ}$	Number of batches performed on an existing dyeing machine *i* in the project dyeing processes for brightness of color *j* material k at a load of l in a year *y*
i	Type of an existing dyeing machine used at the factories
j	Brightness of color of textile being dyed at the factories (*j*: light, medium, dark)
k	Type of textile being dyed at the factories (k: cellulose (such as cotton and viscose), CVC and polyester)
l	Load of fabric for an existing dyeing machine used at the factories

In the case where textile and garment factories use electricity steadily from national grid, the Bangladesh national grid emission factor (combined margin) officially published by DNA (designated national authority) will be applied. That is

$$EF_{CO2}^{Elec} = Bangladesh\, grid\, emission\, factor \quad (9)$$

If the factories use electricity from their own generators or isolated grid that provide electricity to specific region where the factories are located, the emission factor of the power plant is calculated *ex-post* by the following equation based on AMS-I.D (version17) with data on fuel type, fuel input and power output obtained from generators or each plant.

$$or \qquad EF_{CO2}^{Elec} = \frac{FC_{Gen,y} \times \rho_{Gen}^{Fuel} \times NCV_{Gen}^{Fuel} \times EF_{CO2}^{Fuel,gen}}{EG_{Gen,y}} \times 10^{-6} \quad (10)$$

Where:

EF_{CO2}^{Elec}	CO_2 emission factor of the electricity used at the factories for dyeing (a grid emission factor or an emission factor of a captive generator or isolated grid from where electricity is provided) (tCO_2e/MWh)
$EG_{Gen,y}$	Amount of electricity generated by captive generators at the factories or isolated grid in year y (kWh/year).

$FC_{Gen,y}$	Fuel consumption of captive generators or power plants of isolated grid in year y (m^3/year).
NCV_{gen}^{Fuel}	Net calorific value of the fuel used for electricity generation (TJ/Gg)
ρ_{Gen}^{Fuel}	Density of the fuel for used for electricity generation (kg/m^3)
$EF_{CO2}^{Fuel,gen}$	CO_2 emission factor of the fuel used for electricity generation (kg CO_2/TJ)

It is preferable to calculate emission factor of steam generation based on the *ex-ante*/*ex-post* monitored records. However, in Bangladesh it is not common practice to monitor the amount of fuel consumed and amount of steam generated by boilers. Therefore, the emission factor of steam generation is calculated *ex-ante* based on the specification of water boilers in a conservative manner.

$$EF_{CO2}^{Steam} = FC_{boiler}^{Fuel} \times \rho_{boiler}^{Fuel} \times NCV_{boiler}^{Fuel} \times EF_{CO2}^{Fuel,boiler} / SGC_{boiler}^{Fuel} \times 10^{-6} \quad (11)$$

Where:

EF_{CO2}^{Steam}	CO_2 emission factor of steam generation at the factories (tCO_2/ton-steam)
FC_{boiler}^{Fuel}	Boiler fuel consumption (m^3/h). A figure from a boiler specification; in the case of boilers from different makers, the lowest figure will be used in a conservative manner
ρ_{boiler}^{Fuel}	Density of fuel used for steam generation (kg/m^3)
NCV_{boiler}^{Fuel}	Net calorific value of the fuel used for steam generation (TJ/Gg).
$EF_{CO2}^{Fuel,boiler}$	CO_2 emission factor of the fuel used for steam generation (kg-CO_2/TJ)
SGC_{boiler}^{Fuel}	Boiler steam generation capacity (kg-steam/h). A figure from a boiler specification; in the case of boilers from different makers, the highest figure will be used in a conservative manner

<u>Project Emissions</u>

$$PE_y = (EC_{Dyeing,y}^{PJ} + EC_{Water,y}^{PJ})/1{,}000 \times EF_{CO2}^{Elec} + SC_y^{PJ} \times EF_{CO2}^{Steam} \quad (12)$$

Where:

PE_y	Project emissions in year y (tCO_2e/year)
$EC_{Dyeing,y}^{PJ}$	Project electricity consumption by existing dyeing machines to which new measures are introduced by a CPA in year *y* (kWh/year)
$EC_{Water,y}^{PJ}$	Project electricity consumption by pumping of water that is used in existing dyeing machines in year *y* (kWh/year)
SC_y^{PJ}	Project steam consumption by existing dyeing machines to which new measures are introduced by a CPA in year *y* (ton-steam/year)
EF_{CO2}^{Elec}	CO_2 emission factor of the electricity used at the factories for dyeing (a grid emission factor or an emission factor of a captive generator or isolated grid from where electricity is provided) (tCO_2/MWh)
EF_{CO2}^{Steam}	CO_2 emission factor of steam generation at the factories (tCO_2/ton-steam)

$$EC_{Dyeing,y}^{PJ} = \sum_i \sum_j \sum_k \sum_l EC_{i,j,k,l}^{PJ,Batch,dyeing} \times NB_{i,j,k,l,y}^{PJ} \quad (13)$$

Where:

$EC_{Dyeing,y}^{PJ}$	Project electricity consumption by existing dyeing machines to which new measures are introduced by a CPA in year *y* (kWh/year)
$EC_{i,j,k,l}^{PJ,Batch,dyeing}$	Electricity consumption of an existing dyeing machine *i* for a batch in the project

	dyeing process for brightness of colour j, material k and at a load of l (kWh/batch)
$NB^{PJ}_{i,j,k,l,y}$	Number of batches performed on an existing dyeing machine i in the project dyeing processes for brightness of color j, material k and at a load of l in a year y
i	Type of an existing dyeing machine used at the factories
j	Brightness of color of textile being dyed at the factories (j: light, medium, dark)
k	Type of textile being dyed at the factories (k: cellulose (such as cotton and viscose), CVC and polyester)
l	Load of fabric for an existing dyeing machine used at the factories

$$EC^{PJ}_{Water,y} = \sum_{i}\sum_{j}\sum_{k}\sum_{l} WC^{PJ,Batch}_{i,j,k,l} \times NB^{PJ}_{i,j,k,l,y} \times EC^{Pump}_{Water} \quad (14)$$

Where:

$EC^{PJ}_{Water,y}$	Project electricity consumption by pumping of water that used in existing dyeing machines in year y (kWh/year)
$WC^{PJ,Batch}_{i,j,k,l}$	Water consumption of an existing dyeing machine i for a batch in the project dyeing process for colour j, material k and at a load of l (Litre/batch)
$NB^{PJ}_{i,j,k,l,y}$	Number of batches performed on an existing dyeing machine i in the project dyeing processes for brightness of color j, material k and at a load of l in a year y
EC^{Pump}_{Water}	Electricity consumption for pumping groundwater to the factories (kWh/liter). It is determined from specifications of pumps used for water provision such as power capacity, water output capacity and other working conditions such as heads.
i	Type of an existing dyeing machine used at the factories
j	Brightness of color of textile being dyed at the factories (j: light, medium, dark)
k	Type of textile being dyed at the factories (k: cellulose (such as cotton and viscose), CVC and polyester)
l	Load of fabric for an existing dyeing machine used at the factories

$$SC^{PJ}_{y} = \sum_{i}\sum_{j}\sum_{k}\sum_{l} SC^{PJ,Batch}_{i,j,k,l} \times NB^{PJ}_{i,j,k,l,y} \quad (15)$$

Where:

SC^{PJ}_{y}	Project steam consumption by existing dyeing machines to which new measures are introduced by a CPA in year y (ton-steam/year)
$SC^{PJ,Batch}_{i,j,k,l}$	Steam consumption of an existing dyeing machine i for a batch in the project dyeing process for brightness of colour j, material k and at a load of l (ton-steam /batch)
$NB^{PJ}_{i,j,k,l,y}$	Number of batches performed on an existing dyeing machine i in the project dyeing processes for brightness of color j, material k and at a load of l in a year y
i	Type of an existing dyeing machine used at the factories
j	Brightness of color of textile being dyed at the factories (j: light, medium, dark)
k	Type of textile being dyed at the factories (k: cellulose (cotton and viscose), CVC and polyester)
l	Load of fabric for an existing dyeing machine used at the factories

<u>Leakage</u>

The equipment utilized is not transferred from outside of the project boundary and the project activity does not involve the replacement of equipment. Therefore, there are no leakage emissions identified for this type of project as per the methodology.

Therefore:

$$L_y = 0 \quad (16)$$

<u>Emission Reduction</u>

$$ER_y = BE_y - PE_y - L_y \quad (17)$$

Where:

ER_y	Emission reductions in year y (tCO_2e/year)
BE_y	Baseline emissions in year y (tCO_2e/year)
PE_y	Project emissions in year y (tCO_2e/year)
L_y	Leakage in year y (tCO_2e/year)

B.6.2. Data and parameters that are to be reported *ex-ante*

Data / Parameter	$EC_{i,j,k,l}^{BL,Batch,dyeing}$
Unit	kWh/batch
Description	Electricity consumption of an existing dyeing machine i for a batch in the baseline dyeing process for brightness of colour j, material k and at a load of l
Source of data	CPA implementer
Value(s) applied	Dependent on each CPA
Choice of data or Measurement methods and procedures	*Ex-ante* measurement through meters or process control and energy management systems installed to dyeing machines if available. The lowest measured value among the data for the most recent three years prior to the implementation of a CPA in the same machine/colour/material/load category is used as the baseline electricity consumption for conservativeness.
Purpose of data	Used to calculate the baseline emissions
Additional comment	If meters or energy management systems are not available prior to project implementation, *ex-post* measurement will be conducted in parallel with the project through meters or process control and energy management system installed.

Data / Parameter	$WC_{i,j,k,l}^{BL,Batch}$
Unit	Litre/batch
Description	Water consumption of an existing dyeing machine i for a batch in the baseline dyeing process for brightness of colour j, material k and at a load of l
Source of data	CPA implementer
Value(s) applied	Dependent on each CPA
Choice of data or Measurement methods and procedures	*Ex-ante* measurement through meters or process control and energy management systems installed to dyeing machines if available. The lowest measured value among the data for the most recent three years prior to the implementation of a CPA in the same machine/colour/material/load category is used as the baseline electricity consumption for conservativeness
Purpose of data	Used to calculate the baseline emissions
Additional comment	If meters or energy management systems are not available prior to project implementation, *ex-post* measurement will be conducted in parallel with the project through meters or process control and energy management system installed.

Data / Parameter	$Q_{discharge}^{Pump}$
Unit	m^3/s
Description	Pump discharge capacity (m^3/s). Use a maximum discharge capacity from the specifications of a pump.
Source of data	Manufacturer's specifications
Value(s) applied	Dependent on each CPA
Choice of data or Measurement methods and procedures	Use a maximum discharge capacity from the specifications of a pump
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	η_{motor}
Unit	%
Description	Pump motor efficiency
Source of data	The highest efficiency theoretically possible
Value(s) applied	100%
Choice of data or Measurement methods and procedures	100% is used in a conservative manner
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	η_{pump}
Unit	%
Description	Pump efficiency
Source of data	The highest efficiency theoretically possible
Value(s) applied	100%
Choice of data or Measurement methods and procedures	100% is used in a conservative manner
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	H_{total}
Unit	m
Description	Total head of a pump
Source of data	CPA implementer or water supplier
Value(s) applied	Dependent on each CPA
Choice of data or Measurement methods and procedures	It is determined based on the conditions of pumps. In the case of several pumps, the shallowest one will be used in a conservative way
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	ρ
Unit	kg/m^3
Description	Density of water
Source of data	U.S. Geological Survey (USGS) Water Science School http://ga.water.usgs.gov/edu/density.html
Value(s) applied	1,000
Choice of data or Measurement methods and procedures	Density of water at 4 degree centigrade
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	g
Unit	m/s^2
Description	Acceleration due to gravity
Source of data	The NIST Reference on Constants, Units and Uncertainty http://physics.nist.gov/cgi-bin/cuu/Value?gn|search_for=gravity
Value(s) applied	9.80665
Choice of data or Measurement methods and procedures	Constant value
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	$SC_{i,j,k,l}^{BL,Batch}$
Unit	ton-steam/batch
Description	Steam consumption of an existing dyeing machine *i* for a batch in the baseline dyeing process for colour *j* material *k* at a load of *l*
Source of data	CPA implementer
Value(s) applied	Dependent on each CPA
Choice of data or Measurement methods and procedures	*Ex-ante* measurement through meters or process control and energy management system installed to dyeing machines if available. The lowest measured value among the data for the most recent three years prior to the implementation of a CPA in the same machine/colour/material/load category is used as the baseline electricity consumption for conservativeness.
Purpose of data	Used to calculate the baseline emissions
Additional comment	If meters or energy management systems are not available prior to project implementation, *ex-post* measurement will be conducted in parallel with the project through meters or process control and energy management system installed.

Data / Parameter	FC_{boiler}^{Fuel}
Unit	m^3/h
Description	Boiler fuel consumption
Source of data	Manufacturer's specification
Value(s) applied	Dependent on each CPA
Choice of data or Measurement methods and procedures	It is determined based on the specifications of boilers used at the factories. In the case of boilers from different makers, the lowest value will be applied in a conservative manner
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	SGC_{boiler}^{Fuel}
Unit	kg/h
Description	Boiler steam generation capacity
Source of data	Manufacturer's specification
Value(s) applied	Dependent on each CPA
Choice of data or Measurement methods and procedures	It is determined based on the specifications of boilers used at the factories. In the case of boilers from different makers, the highest value will be applied in a conservative manner
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	NCV_{Gen}^{Fuel}
Unit	TJ/Gg
Description	Net calorific value of the fuels used for electricity generation
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	46.5 for natural gas 41.4 for diesel
Choice of data or Measurement methods and procedures	Default values
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	NCV_{boiler}^{Fuel}
Unit	TJ/Gg
Description	Net calorific value of the fuels used for steam generation
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	46.5 for natural gas 41.4 for diesel
Choice of data or Measurement methods and procedures	Default values
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	ρ_{Gen}^{Fuel}
Unit	kg/m^3 (natural gas); kg/L (diesel)
Description	Density of the fuel used for electricity generation
Source of data	Natural gas: Page 11, FINAL REPORT ON EMISSION INVENTORY, BANGLADESH COUNTRY STUDY, ASIA LEAST-COST GREENHOUSE GAS ABATEMENT STRATEGY (ALGAS), DEPARTMENT OF ENVIRONMENT MINISTRY OF ENVIRONMENT AND FOREST, GOVERNMENT OF BANGLADESH Diesel: Studies on the Production of Gasoline from Heavy oil (furnace oil) by Thermal Cracking, Bangladesh, MS Jamal, Mohammad Ismail, M Yunnus Miah, M Naimul Haque, Sujit Kumar Banik, J. Sci. Ind. Res. 44(4), 473-478, 2009
Value(s) applied	0.717 for natural gas 0.8445 for diesel
Choice of data or Measurement methods and procedures	The value used for Bangladesh emission inventory.
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	ρ_{boiler}^{Fuel}
Unit	kg/m^3 (natural gas); kg/L (diesel)
Description	Density of the fuel used for steam generation
Source of data	Natural gas: Page 11, FINAL REPORT ON EMISSION INVENTORY, BANGLADESH COUNTRY STUDY, ASIA LEAST-COST GREENHOUSE GAS ABATEMENT STRATEGY (ALGAS), DEPARTMENT OF ENVIRONMENT MINISTRY OF ENVIRONMENT AND FOREST, GOVERNMENT OF BANGLADESH Diesel: Studies on the Production of Gasoline from Heavy oil (furnace oil) by Thermal Cracking, MS Jamal, Mohammad Ismail, M Yunnus Miah, M Naimul Haque, Sujit Kumar Banik, Bangladesh Journal of Scientific and Industrial Research, 44(4), 473-478, 2009
Value(s) applied	0.717 for natural gas 0.8445 for diesel
Choice of data or Measurement methods and procedures	The value used for Bangladesh emission inventory.
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	$EF_{CO2}^{Fuel,gen}$
Unit	kg-CO_2/TJ
Description	CO_2 emission factor of the fuel used for electricity generation
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	54,300 for natural gas 72,600 for diesel
Choice of data or Measurement methods and procedures	Default values
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	$EF_{CO2}^{Fuel,boiler}$
Unit	kg-CO_2/TJ
Description	CO_2 emission factor of the fuel used for steam generation
Source of data	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	54,300 for natural gas 72,600 for diesel
Choice of data or Measurement methods and procedures	Default values
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	-

Data / Parameter	EF_{CO2}^{Elec}
Unit	tCO_2e/MWh
Description	Bangladesh grid emission factor
Source of data	Bangladesh DNA
Value(s) applied	0.67
Choice of data or Measurement methods and procedures	Official data published by Designated National Authority of Bangladesh
Purpose of data	Used to calculate the baseline and project emissions
Additional comment	This emission factor is used only when grid electricity is used at a CPA factory. Determined *ex-ante* and fixed during the crediting period

B.6.3. *Ex-ante* calculations of emission reductions

As per the formulae given in Part II, B 6.1, the *ex-ante* calculations of the energy savings and emission reductions are explained on each CPA.

For *ex-ante* calculation of emission reduction for a CPA, the following calculations are considered.

Baseline Emissions

The baseline emission can be calculated based on the following equations.

$$BE_y = (EC^{BL}_{Dyeing,y} + EC^{BL}_{Water,y})/1{,}000 \times EF^{Elec}_{CO2} + SC^{BL}_y \times EF^{Steam}_{CO2} \quad (18)$$

BE_{20XX} = (XXX+XXX) /1,000*XXX + XXX*XXX = *XXX* tCO_2/year

$$EC^{BL}_{Dyeing,y} = \sum_i \sum_j \sum_k \sum_l EC^{BL,Batch,dyeing}_{i,j,k,l} \times NB^{PJ}_{i,j,k,l,y} \quad (19)$$

$EC^{BL}_{Dyeing,20XX}$
= (XXX*XXX+XXX*XXX+ ………………………….)

=XXX kWh/year.

$$EC^{BL}_{Water,y} = \sum_i \sum_j \sum_k \sum_l WC^{BL,Batch}_{i,j,k,l} \times NB^{PJ}_{i,j,k,l,y} \times EC^{\text{Pumping}}_{Water} \quad (20)$$

$EC^{BL}_{Water,20XX}$
= (XXX*XXX+XXX*XXX+…………………………….)*XXX

=XXX kWh/year.

$$EC^{Pump}_{Water} = \frac{P^{Pump}_{in}}{Q^{Pump}_{discharge} \times 3.6 \times 10^6} \quad (21)$$

= XXX / (XXX × 3.6× 10^6) = XXX kWh/liter

$$P^{Pump}_{in} = \frac{P^{Pump}_{shaft}}{\eta_{motor}} \quad (22)$$

= XXX/1 = XXX kW

$$P^{Pump}_{shaft} = \frac{P_{hydro}}{\eta_{pump}} \quad (23)$$

= XXX/1= XXX kW

$$P_{hydro} = Q^{Pump}_{discharge} \times H_{total} \times \rho \times g\ /1{,}000 \quad (24)$$

= XXX×XXX×1,000×9.80665/1,000 = XXX kW

$$SC^{BL}_y = \sum_i \sum_j \sum_k \sum_l SC^{BL,Batch}_{i,j,k,l} \times NB^{PJ}_{i,j,k,l,y} \quad (25)$$

SC_{20XX}^{BL}
= (XXX*XXX+XXX*XXX+………………………………)

=XXX Ton/year.

$$EF_{CO2}^{Elec} = \frac{FC_{Gen,y} \times \rho_{Gen}^{Fuel} \times NCV_{Gen}^{Fuel} \times EF_{CO2}^{Fuel,gen}}{EG_{Gen,y}} \times 10^{-6} \quad (26)$$

= XXX×XXX×XXX×XXX/ XXX /1,000,000 = XXX tCO_2/MWh

$$EF_{CO2}^{Steam} = FC_{boiler}^{Fuel} \times \rho_{boiler}^{Fuel} \times NCV_{boiler}^{Fuel} \times EF_{CO2}^{Fuel,boiler} / SGC_{boiler}^{Fuel} \times 10^{-6} \quad (27)$$

= XXX×XXX×XXX×XXX/XXX/1,000,000 = XXX tCO_2/ton-steam

Project Emissions

The project emission can be calculated based on the following equations.

$$PE_y = (EC_{Dyeing,y}^{PJ} + EC_{Water,y}^{PJ})/1{,}000 \times EF_{CO2}^{Elec} + SC_y^{PJ} \times EF_{CO2}^{Steam} \quad (28)$$

PE_{20XX} = (XXX + XXX) /1,000*XXX + XXX*XXX = *XXX* tCO_2/year

$$EC_{Dyeing,y}^{PJ} = \sum_i \sum_j \sum_k \sum_l EC_{i,j,k,l}^{PJ,Batch,dyeing} \times NB_{i,j,k,l,y}^{PJ} \quad (29)$$

$EC_{Dyeing,20XX}^{PJ}$
= (XXX*XXX+XXX*XXX+ ………………………….)

= XXX kWh/year.

$$EC_{Water,y}^{PJ} = \sum_i \sum_j \sum_k \sum_l WC_{i,j,k,l}^{PJ,Batch} \times NB_{i,j,k,l,y}^{PJ} \times EC_{clean,water}^{PJ,pumping} \quad (30)$$

$EC_{Water,20XX}^{PJ}$
= (XXX*XXX+XXX*XXX+………………………………..)*XXX

= XXX kWh/year.

$$SC_y^{PJ} = \sum_i \sum_j \sum_k \sum_l SC_{i,j,k,l}^{PJ,Batch} \times NB_{i,j,k,l,y}^{PJ} \quad (31)$$

SC_{20XX}^{PJ}
= (XXX*XXX+XXX*XXX+ …………………………….)

= XXX Ton/year.

Leakage

There are no leakage emissions identified for this type of project.
Therefore:

$$L = 0 \quad (32)$$

Emission Reduction

$$ER_y = BE_y - PE_y - L_y \quad (33)$$

ER_{20XX} = XXX – XXX= XXX tCO2/year

B.7. Application of the monitoring methodology and description of the monitoring plan
B.7.1. Data and parameters to be monitored by each generic CPA

Data / Parameter	$NB_{i,j,k,l,y}^{PJ}$
Unit	Number
Description	Number of batches on an existing dyeing machine *i* in the project dyeing for brightness of color *j*, material *k* and at a load of *l* in year *y*
Source of data	CPA implementer
Value(s) applied	Depend on each CPA
Measurement methods and procedures	Recorded daily in factories
Monitoring frequency	Aggregate daily-recorded data monthly
QA/QC procedures	
Purpose of data	For calculating baseline and project emissions
Additional comments	-

Data / Parameter	$EC_{i,j,k,l}^{BL,Batch,dyeing}$
Unit	kWh/batch
Description	Electricity consumption of an existing dyeing machine i for a batch in the baseline dyeing process for brightness of colour j, material k and at a load of l
Source of data	CPA implementer
Value(s) applied	Depend on each CPA
Measurement methods and procedures	Measured *ex-post* for each batch by meters or process control and energy management system installed to dyeing machines at factories. The lowest measured value among the same machine/colour/material/load category is used as the baseline electricity consumption for conservativeness.
Monitoring frequency	Aggregate daily recorded data monthly
QA/QC procedures	Calibrations of electricity meters will be conducted as per related guidelines and instructions and cross-checked with calculations from dyeing charts
Purpose of data	For calculating baseline emissions
Additional comments	If *ex-ante* direct measurement is possible, there is no need to conduct *ex-post* measurement

Data / Parameter	$EC_{i,j,k,l}^{PJ,Batch,dyeing}$
Unit	kWh/batch
Description	Electricity consumption of an existing dyeing machine i for a batch in the project dyeing process for brightness of color j, material k and at a load of l in year y
Source of data	CPA implementer
Value(s) applied	Depend on each CPA
Measurement methods and procedures	Measured for each batch by power meters or process control and energy management system installed to dyeing machines at factories. The average value among the same machine/colour/material/load category is used as the project electricity consumption for correctness.
Monitoring frequency	Aggregate daily recorded data monthly
QA/QC procedures	Calibrations of electricity meters will be conducted as per related guidelines and instructions and cross-checked with calculations from dyeing charts
Purpose of data	For calculating project emissions
Additional comments	-

Data / Parameter	$WC_{i,j,k,l}^{BL,Batch}$
Unit	Litre/batch
Description	Water consumption of an existing dyeing machine i for a batch in the baseline dyeing process for brightness of colour j, material k and at a load of l
Source of data	CPA implementer
Value(s) applied	Depend on each CPA
Measurement methods and procedures	Measured *ex-post* for each batch by meters or process control and energy management system installed to dyeing machines at factories. The lowest measured value among the same machine/colour/material/load category is used as the baseline water consumption for conservativeness.
Monitoring frequency	Aggregate daily recorded data monthly
QA/QC procedures	Calibrations of flow meters will be conducted as per related guidelines and instructions and cross-checked with calculations from dyeing charts
Purpose of data	For calculating baseline emissions
Additional comments	If *ex-ante* direct measurement is possible, there is no need to conduct *ex-post* measurement

Data / Parameter	$WC_{i,j,k,l}^{PJ,Batch}$
Unit	Litre/batch
Description	Water consumption of an existing dyeing machine i for a batch in the project dyeing process for brightness of colour j, material k and at a load of l in a year y
Source of data	CPA implementer
Value(s) applied	Depend on each CPA
Measurement methods and procedures	Measured for each batch by flow meters or process control and energy management system installed to dyeing machines at factories. The average value among the same machine/colour/material/load category is used as the project water consumption for correctness.
Monitoring frequency	Aggregate daily recorded data monthly
QA/QC procedures	Calibrations of flow meters will be conducted as per related guidelines and instructions and cross-checked with calculations from dyeing charts
Purpose of data	For calculating project emissions
Additional comments	-

Data / Parameter	$SC_{i,j,k,l}^{BL,Batch}$
Unit	ton-steam/batch
Description	Steam consumption of an existing dyeing machine *i* for a batch in the baseline dyeing process for colour *j* material *k* at a load of *l*
Source of data	CPA implementer
Value(s) applied	Depend on each CPA
Measurement methods and procedures	Measured *ex-post* for each batch by meters or process control and energy management system installed to dyeing machines at factories. The lowest measured value among the same machine/colour/material/load category is used as the baseline steam consumption for conservativeness.
Monitoring frequency	Aggregate daily recorded data monthly
QA/QC procedures	Calibrations of steam flow meters will be conducted as per related guidelines and instructions and cross-checked with calculations from dyeing charts
Purpose of data	For calculating baseline emissions
Additional comments	If *ex-ante* direct measurement is possible, there is no need to conduct *ex-post* measurement

Data / Parameter	$SC_{i,j,k,l}^{PJ,Batch}$
Unit	ton-steam/batch
Description	Steam consumption of an existing dyeing machine *i* for a batch in the project dyeing process for colour *j* material *k* at a load of *l* in year *y*
Source of data	CPA implementer
Value(s) applied	Depend on each CPA
Measurement methods and procedures	Measured for each batch by flow meters or process control and energy management system installed to dyeing machines at factories. The average value among the same machine/colour/material/load category is used as the project steam consumption for correctness.
Monitoring frequency	Aggregate daily recorded data monthly
QA/QC procedures	Calibrations of steam flow meters will be conducted as per related guidelines and instructions and cross-checked with calculations from dyeing charts
Purpose of data	For calculating project emissions
Additional comments	-

Data / Parameter	$EG_{Gen,y}$
Unit	kWh/year
Description	Amount of electricity generated from captive generators at the factories or isolated grid in year y
Source of data	CPA implementer or isolated grid operators
Value(s) applied	CPA specific value
Measurement methods and procedures	Collect data from factories or isolated grid operators where the data are measured and recorded.
Monitoring frequency	Collect data once in three months from isolated grids and monthly from factories.
QA/QC procedures	Calibrations of power meters will be conducted as per related guidelines and instructions and cross-checked with electricity bills.
Purpose of data	For calculating baseline and project emissions
Additional comments	-

Data / Parameter	$FC_{Gen,y}$
Unit	m^3/year
Description	Fuel consumption of captive generators or power plants of isolated grid in year y
Source of data	CPA implementer
Value(s) applied	CPA specific value
Measurement methods and procedures	Collect data from factories or isolated grid operators where the data are measured and recorded.
Monitoring frequency	Collect data once in three months from isolated grids and monthly from factories.
QA/QC procedures	Calibrations of flow meters will be conducted as per related guidelines and instructions and cross-checked with fuel bills.
Purpose of data	For calculating baseline and project emissions
Additional comments	In case where diesel is used for electricity generation, generally diesel will be cross-checked with fuel bills and further with the amount of electricity generated and specifications of generators such as fuel efficiency.

B.7.2. Description of the monitoring plan for a generic CPA

(1) Monitoring Framework

The monitoring management system is integrated part of the implementation management system as shown in section C.

CPA factory people will write down water, steam and electricity consumption data in dyeing registered book. Water ambassador of Green Project W.S.T® will collect water, steam and electricity data and necessary data from CPA textile factory. Water ambassador will report to team leader regarding CPA update information. The CDM record keeping team will input information into CPA database format. Monthly and yearly database format will be prepared by CDM record keeping team. The CDM management team will review CPA updated data and send it to DOE. Two types of CPA database format will be used for monthly and yearly emission reductions.

The Green Project W.S.T® will act as the overall supervisor and prepare a monitoring report periodically to the DOE.

(2) The Function of CME and CPA Implementers

Table 11 shows the roles of the CME and implementers for the monitoring.

Table 11. Roles of CME and CPA Implementers on Monitoring

	CME (Supported by PEAR)	Implementers (Textile and Garment Factories)
Monitoring management	- Develop the operation and monitoring manual for the PoA. - Develop and establish data collection and reporting system for parameters monitored in every CPA.	- Implementation and management of monitoring
Data collection	- Establish and maintain data collection systems for parameters monitored. - Check data quality and collection procedures regularly.	- Implement data collection
Data storage and management	- Develop database for CPAs. - Check the reported data from each CPA - Calculate emission reductions based on the data reported by the implementers. - Store and maintain records.	- Prepare electronic or hard copy data. - Store and maintain records.
Communication and reporting	- Coordinate between implementers and communicate with DOE and CDM EB	- Report collected data to the CME
CDM training and capacity building	- Implement training programs for implementers to meet the needs of the monitoring plan.	- Ensure relevant staffs' training organized by CME.
Quality assurance and verification	- Develop operating and management system that ensures double checks for data and information collected. - Prepare, facilitate and coordinate verification process.	- Undertake regular check of data and information collected - Undertake regular maintenance and calibration of monitoring equipment

(3) Monitored Data

The data to be monitored are described in section B.7.1.

(4) Monitoring Equipment

Two types of monitoring measures will be used for monitoring of CPAs as per factories' choice. The installation of monitoring equipment will be determined at CPA level.

1) Fixed mount type meters
a) Water Flow meter
Flow meters will be installed at the inlet of water pipeline to the dyeing machine.

b) Steam Flow meter

Steam flow meters will be installed at the inlet steam pipeline to the dyeing machine.

c) Electricity meter

Electricity meters will be installed at the electricity input connection of the dyeing machine.

2) Process control and energy management system

Process control and energy management system for textile dyeing and finishing industry will provide computer based energy and water management through programming dyeing process, optimizing dyeing process and displaying all step functions of running batches and logging process curves for all events, as shown in Figure 24.

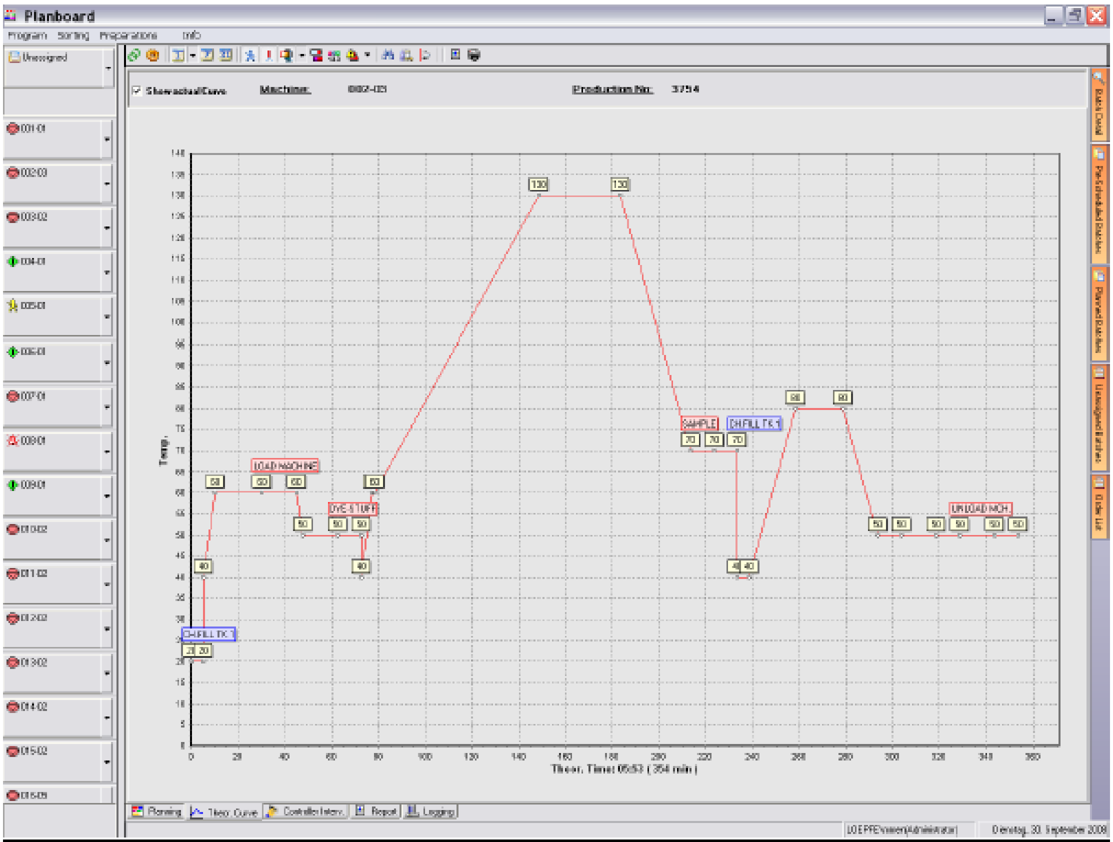

Figure 24. Example of Dyeing Curve (chart) Display

(5) Monitoring Method

The textile and dyeing factories in Bangladesh has rarely conducted direct measurement of electricity, steam and water consumption of dyeing machines so far. Therefore, in order to obtain the data of energy and water consumptions for baseline batches, *ex-post* measurement of baseline batches is implemented as the proposed technologies are to be introduced step-by-step over several years.

If a factory has existing monitoring equipment prior to a project implementation, the baseline emissions are determined *ex-ante* through the direct measurement data of the energy and water consumption of the baseline batches.

If there is no monitoring equipment in a factory before a project implementation, energy and water consumption for baseline batches will be measured after the project implementation until the time at which all baseline batches are replaced by the project technologies. In this case, for *ex-ante* estimation of emission reductions, electricity, steam and water consumption for baseline batches can be calculated

based on the dyeing charts recorded in dyeing machines or depicted as per dyeing recipes and dyeing books. The *ex-ante* calculated baseline data is will be replaced and adjusted by *ex-post* measured baseline data in a conservative manner.

(6) Data Management and Quality Assurance (QA) and Quality Control (QC)

Data management is the most important step in the monitoring process to ensure transparent and credible emission reduction calculations.

Each implementer shall collect data described in section B.7.1 and archive them electronically using the common template developed by the CME. The electronic files and the hard copy shall be sent to CME.

The CME will develop an appropriate electronic template for archiving all data of every activity.

After reporting data from implementers, the CME shall check the data. If there are any errors found, they will be checked against original data.

The CME will calculate emission reductions for each CPA supported by PEAR, and store the outputs in hard disks as well as hard copy printouts.

The water flow meters, steam flow meters (flow meters measure volume flow, but steam systems are generally rated by mass or energy content, so these meters are frequently used in combination with a pressure and/or temperature sensor) and energy meters will be installed in line with relevant standards and calibrated by a qualified organization at least once every two years. The installation and maintenance of monitoring equipment will be implemented in line with the manufacture's specification.

The process management system will also be installed according to system providers' manual and standards.

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Appendix 1: Contact information on entity/individual responsible for the PoA

Organization	Green Project W.S.T® Limited
Street/P.O.Box	Sonargaon Janapath Road
Building	KC Tower
City	Dhaka
State/Region	Uttara
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Telephone	
Fax	
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Website	www.greenproject-wst.com
Contact person	Wolfram Engel
Title	President and CEO
Salutation	Dr.
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Middle name	
First name	Wolfram
Department	
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Direct tel.	
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Department	
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Direct fax	
Direct tel.	
Personal e-mail	n_matsuo@pear-carbon-offset.org

Appendix 2: Affirmation regarding public funding

If any CPA under this PoA avails of public funding, it will be required to provide in its CPA-DD that no official development assistance is diverted to the public funding.

Appendix 3: Application of methodology (ies)

The applicability conditions are demonstrated in section B.2 of this PoA-DD

Appendix 4: Further background information on ex ante calculation of emission reductions

Ex-ante calculation of emission reductions is done separately for each CPA.

Appendix 5: Further background information on the monitoring plan

Please refer to B.7.2 of the PoA-DD.

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the programme design document form for small-scale CDM programmes of activities" (EB 66, Annex 13).
01	EB33, Annex43 27 July 2007	Initial adoption.
Decision Class: Regulatory **Document Type:** Form **Business Function:** Registration		