Policy Paper Series

Promoting Zero Liquid Discharge Mandate for the Bangladesh Textile Industry

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Key Messages

The textile sector is the backbone of Bangladesh's economy and provides employment to millions. The industry however is faced with many challenges due to high resource (energy, water and chemical) footprint and its consequent environmental impact, threatening its survival in the long run.

Realising the scale of these issues and the urgent need for addressing them, Bangladesh Government has issued the Zero Liquid Discharge (ZLD) Regulation for the textile sector. This poses a huge challenge for the industry, particularly for the small and medium sized units. The key to its successful implementation would be a cautious and practical approach and view this as an opportunity to deal with the pressing environmental challenges in a sustainable manner. India is one of the first countries to successfully implement ZLD provisions in the textile industry and has many useful experiences and learnings to share with country like Bangladesh embarking on a similar mandate.

This policy brief highlights the benefits as well as challenges in implementing a successful ZLD program in Bangladesh, the guiding principles for framing of meaningful policies, learning's drawing upon the Indian experience and policy measures for promoting ZLD in the textile sector and a possible approach that Bangladesh can follow for rolling out a successful ZLD program.

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1. Background

The textile sector is the backbone of Bangladesh's economy. However, the industry is faced with many challenges due to high resource (energy, water and chemical) footprint and its consequent environmental impact. Water usage by the textile industry in Bangladesh is estimated to be 1,500 million cubic meters, which is principally made of groundwater. Around 70% of this water consumption takes place in the wet processing of textiles, which involves washing, dyeing, and finishing of textiles. Besides high water footprint, the textile industry also faces the challenge of dealing with the problem of effluent discharge and the use of coagulants and chemicals for its treatment.

Realising the scale of these issues and the urgent need for addressing them, Bangladesh Government has issued the Zero Liquid Discharge (ZLD) Regulation for the textile sector. This poses a huge challenge for the industry, particularly for the small and medium sized units. The key to its successful implementation would be a cautious and practical approach and view this as an opportunity to deal with the pressing environmental challenges in a sustainable manner.

This policy brief highlights the benefits as well as challenges in implementing a successful ZLD program in Bangladesh, the guiding principles for framing of meaningful policies, learning's drawing upon the Indian experience and policy measures for promoting ZLD in the textile sector and a possible approach that Bangladesh can follow for rolling out a successful ZLD program.

2. Benefits and Challenges facing the ZLD mandate in Bangladesh textile sector

While successful implementation of ZLD in the textile sector in Bangladesh would have significant environmental, economic and social benefits, it is also thwart with many challenges like; (1) Technical-commercial viability of various options, (2) practical implementation issues like lack of space in existing units to install effluent treatment plants, (3) disposal issues of solid waste/ sludge that would be generated as a result etc. It is important that before the ZLD mandate is rolled out in Bangladesh, the regulatory authorities and the industry are fully aware of the pros and cons of such a program in terms of the possible benefits and the challenges or roadblocks that can come in the way of its successful implementation. The benefit streams and the challenges as highlighted in this paper are compiled based on practical experience of implementing the ZLD mandate in the Tirupur textile industry cluster in India.

2.1 Benefits of ZLD

i. Implementation of ZLD had encouraged the industry to closely monitor water usage, avoiding of wastages and to promote recycling. For example, the textile dyeing industry moved from conventional Winches which used more water (1:16 Liquor of Fabric weight to Water volume) to less water consuming Soft Flow Machines with 1:8 Liquor ratio and many are increasingly moving towards even lower water consuming "Air flow Machines" with 1:3.5 Liquor ratios to increase their production while generating lower volumes of effluent.

ii. The high recovery of water (>90-95%) and the recovery of salt has mitigated the higher cost of operation of a ZLD system.

iii. The implementation of ZLD paved the way for a more sustainable growth of the industry while meeting most stringent environmental norms.

iv. Reduction in water demand from the Industry by implementation of ZLD enabled in freeing up water for Agriculture and Domestic demands.

v. The environmental problems created earlier has been arrested and the degraded land and water bodies are slowly recovering back

vi. Sustainable growth of the industry also implies growth in economy and sustainable livelihood for many people who are dependent on the textile dyeing cluster either directly or indirectly.

2.2 Challenges of ZLD

i. ZLD results in generation of hazardous solid wastes (particularly waste mixed salt) causing disposal challenges, which is being stored in storage yards within the CETPs.

ii. For the chemical sludge, the best way to dispose it off is its gainful utilization for cement co-processing but it needs tie up with a willing/recipient cement company.

iii. The high cost of operation of a ZLD is also a major challenge. The recovery of water and salt (Sodium sulphate and brine) offsets this costs significantly, but it would apply only to water scarce areas where the cost of water is high.

iv. High Carbon foot print of a ZLD facility is another major concern. The typical power consumption ranges from 8 to 10 kW/m3. The thermal evaporators alone consume about 20-40 Kw/m3 in addition to several tons of firewood for the boilers.

v. Non uniform application of ZLD standards across the country for similar industries has serious impact on the competitiveness of the local industry.

vi. Implementation of ZLD requires a host of advanced wastewater treatment technologies. Implementation of ZLD in Tamilnadu has highlighted several Technology shortcomings such as in Thermal evaporation & brine concentration, Salt separation and Crystallization, Colour removal etc.

3. Factors to be considered for framing policies for ZLD

There are three important criteria to be considered in framing of a policy for ZLD in textile industry. These are;

- Environmental consideration
- Technical and commercial viability
- Sustainability of the intervention in terms of energy requirement and skilled manpower for operation and maintenance.

There may not be a blanket rule in this regard uniformly applicable to all the textile units in the country because environmental setting and size of operation determine the need and economic viability for ZLD.

The present policy paper presupposes that the textile units other than those for which ZLD is prescribed will comply with other statutory requirements in terms of biochemical Oxygen demand (BOD), AOX, Chemical Oxygen demand (COD), pH, colour, total dissolved solids, chloride, sulphate, location and mode of discharge. The units will also comply with prescribed waste minimization options such as adoption of lower material liquor ratio, type of dyes etc.

A brief description of the three criteria is provided below.

3.1 Environmental consideration

The first question to be asked is where the industrial unit is discharging its treated wastewater into a water body or land and what are its impacts. The next question to be examined is whether the impact is acceptable or not. It may be underscored that the discharge is already treated to levels laid down under law and prescribed to it. If, and only if, the impact is unacceptable based on scientific data, then the next option is to examine relocation of the industrial unit and/or the discharge to an acceptable receiving body. If the options are not available for any reason – technical, economic or social – then ZLD remains the possible option.

By the same token there could be a valid case for ZLD if the sweet water resource of the location is under stress owing to high uptake by the unit(s) and there is a case for restricting the uptake. This could be the case where a large of number units are located in a cluster and/or the units are extracting huge amounts of water, seriously affecting other users.

3.2 Technical and commercial viability

3.2.1 Unit Size

ZLD is economically feasible only at above treatment volumes of 1,00,000 liters per day. Therefore, for units with smaller discharges, a possible option is to form a common effluent treatment plant (CETP) to achieve ZLD. Location of the units will dictate the practicability of such a configuration. In units at less than 1,00,000 litres per day, up to reverse osmosis to recover permeate is viable but reject management which requires high energy input is not viable.

3.2.2 Typical Project Cost

The following table summarizes the various cost components for a 10MLD textile CETP. The cost figures are based on present estimates for a typical facility in India.

S No.	Items	Value
1	Capacity of the CETP (cu.m/day)	10,000
2	Water consumption for dyeing (Litres/Kg)	50
3	Total Production capacity (Tons/Day)	200
4	Processing cost of dyed fabric (INR/Kg)	90
5	Processing Cost (INR.Mn/day)	18
	O&M Cost of ZLD system – INR/Cu.m)	227
6	Cost of ZLD system for 10 MLD W/o recoveries (INR Mn/day)	2.27
7	Cost of ZLD for dyed fabric – INR/kg (W/o recovery)	11.35
8	**% of ZLD cost on processing cost of dyed fabric (W/o recovery)**	**13%**
	Recoveries:	
	Cost of Water – INR/KL	78
	Cost of Sodium Sulphate salt – INR 12/Kg	12
9	Water @ INR. 78/KL with 98% recovery)	76.44
10	Salt (with 80% recovery)	67.20
11	Total Recovery	143.64
12	Cost of ZLD system @ Rs. 83/cu.m net for 10 MLD (INR.Mn/day)	0.83
13	Cost of ZLD for dyed fabric INR/Kg	4.17
14	**% of ZLD cost on Processing cost of dyed fabric (After recovery)**	**5%**

It may be noted that the cost calculations are subject to two important conditions, both pertain to the values attributed to the recovered water and the salt, sodium sulphate. If sodium chloride is used instead of sodium sulphate and water is available in plenty at low cost, then the calculations will be very different and would weigh heavily against the ZLD option.

3.3 Sustainability

Energy requirement and skilled manpower are the two main factors that determine the sustainability of a ZLD plant. Cogeneration plant incorporated in the ZLD plant will ensure energy demand is met. But cogeneration plant may not be feasible in every case.

It is unrealistic to expect the technical personnel in the production process to run the ZLD plant also. Operation and maintenance of ZLD facility should form part of the turn key contractor setting up the facility.

3. Indian policy experience for promoting ZLD in the textile sector

In India, the policies with regard to ZLD in the textile industry were essentially driven by the Court's intervention. It started with the textile industry cluster in Tirupur based on petition filed by the farmers in 2003, the judgment for which was pronounced in 2010. Recently, MOEF&CC issued a draft notification regarding effluent standard for textile industry that includes ZLD. CPCB also issued guidelines that makes ZLD mandatory in all 9 Ganga river basin states as part of Ganga action plan. In this section, some highlights of these policy initiatives are presented along with the financial incentive scheme that the India government provides for implementation of ZLD facilities.

3.1. The ZLD mandate for the Tirupur textile industry cluster

Tirupur is situated the near the city of Coimbatore in the State of Tamil Nadu. Cotton is grown in the area and Coimbatore over a period of time, grew into a large cotton textile industry hub. Hosiery industry, as an off shoot, took roots in Tirupur owing to the availability of good surface and ground water. About 700 hosiery bleaching and dyeing units came up in this area. The river Noyyal, which flows through the town of Tirupur slowly started getting impacted and the river flow dwindled owing to poor catchment area management, vagaries of monsoon and increasing extraction of ground and surface water. This reduced flow resulted in losing the benefit of dilution to the high TDS bearing effluent and in the year 1992, a small dam was constructed in the river downstream of Tirupur, to store the high TDS water. Evaporation concentrated the salts and with the passage of time, it became a perennial source of ground water pollution. The farmers depending on the water source got agitated and filed a petition in 2003, the judgement for which was pronounced in 2010, mandating the industry to implement ZLD. However, due to rampant non-compliance of the Court orders, the farmers filed a contempt application forcing the Court to order closure of all dyeing units in 2011. The regulatory agency clamped the condition of Zero Liquid Discharge (ZLD) on the industries under the orders of the Courts and thus started the concept of ZLD in the textile cluster in tirupur-the first such textile cluster in the world.

A comprehensive life cycle analysis or strategic environmental impact analysis, however, needs to be carried out to quantify the benefits accruing from such a sweeping policy.

3.2. The ZLD mandate as per MoEF&CC

The Ministry of Environment and Forests and Climate Change issued a draft notification dated 22nd October 2015 regarding the standards for effluents from textile industry. The clauses 6(B) and 6(c) of the notification specifically covers provisions for ZLD as highlighted below;

Textiles unit (having dyeing process/ Cotton or woolen processing units and all integrated textile units) where wastewater discharge is greater than 25KLD

i. Textile units having wastewater discharge greater than 25KLD shall establish Zero Liquid Discharge (ZLD) – Effluent Treatment Plant (ETP).

ii. The recovered water from the Zero Liquid Discharge (ZLD) – Effluent Treatment Plant (ETP) through Reverse Osmosis (R.O)/ Multi Effect Evaporators (MEE) shall be re-used in the process by the units and no ground water abstraction is allowed except for makeup water and drinking purpose as assessed by respective State Pollution Control Board (SPCBs)/ Pollution Control Committee (PCCs).

iii. For construction/ augmentation of Zero Liquid Discharge (ZLD) – Effluent Treatment Plant (ETP) by the unit, time limit of 30 months is allowed and will be linked with Consent to Operate after the approval of action plan by the respective State Pollution control Board (SPCBs)/ Pollution Control Committee (PCCs). Effluent discharge standards as specified shall be followed by the units until ZLD is implemented.

Textiles units (having dyeing process/ cotton or woollen processing units and all integrated textile units) in clusters irrespective of waste water discharge quantity

i. Units in textile clusters shall establish Zero Liquid Discharge (ZLD) – Common Effluent treatment Plant (CETP) and augment all existing CETPs into Zero Liquid Discharge (ZLD) – Common Effluent treatment Plant (CETP).

ii. In all the new CETPs and those to be upgraded, provision has to be kept for the member units to utilize the recovered water from the Zero Liquid Discharge (ZLD) – Common Effluent treatment Plant (CETP) through (Reverse Osmosis (RO)/Multi Effect Evaporators (MEE) etc.), through piped network connection. The recovered water from the Zero Liquid Discharge (ZLD) – Common Effluent treatment Plant (CETP) through (Reverse Osmosis (RO)/Multi Effect Evaporators (MEE) etc.), shall be re-used in the process by the member units and no ground water abstraction is allowed except for makeup water and drinking purpose as assessed by respective State Pollution Control Board (SPCBs)/ Pollution Control Committee (PCCs).

iii. For construction/ augmentation of Zero Liquid Discharge (ZLD) – Common Effluent treatment Plant (CETP) in the textile cluster, time limit of 30 months is allowed and will be linked with Consent to Operate after the approval of Detailed Project Report (DPR) by the respective State Pollution Control Board (SPCBs)/ Pollution control Committee (PCCs). Effluent discharge standards as specified in Schedule-I at Serial No. 55 in the Environment (Protection) Rules, 1986, shall be followed by the CETPs until ZLD is implemented.

In addition, the Central Pollution Control Board in February 2015, issued direction under section 18 (1) (b) of the Water (Prevention & Control of Pollution) Act, 1974 to Textile Units & clusters', located in 9 Ganga basin states of Uttar Pradesh, Bihar, West Bengal, Jharkhand & Uttarakhand, Haryana, Chhattisgarh, Madhya Pradesh and UT of Delhi to implement Zero Liquid Discharge (ZLD) based CETP in composite textile plants and implement ZLD based ETPs in all Textile industries and clusters in the state. a revised modified direction is issued regarding abstraction of water to be

read with the directions issued on February 2015 to implement and to ensure Zero Liquid Discharge and Water Management practices, in Textile sector, as under:

i. In Textile Units (included all Composite/woolen Textile Mills, integrated textile mills, all individual Textile units having dyeing process) & Textile clusters (CETPs), it is to clarify that every industry which is member of CETP or standalone can be allowed to abstract water to make up for process losses as assessed by SPCBs. The other points in the directions dated 22-04-2015 shall remain unchanged.

ii. CBCP/ SPCBs/ PCCs may draw guidelines regarding extent of abstraction of water which may be allowed within a period of two months.

iii. Action taken report regarding implementation of ZLD may be submitted industry/ cluster wise within two weeks.

3.3. Operating models and Financial support for ZLD

In Tamilnadu, the Textile sector CETPs are functioning based on the Full Private Ownership model. Under this model, group of textile dyeing & bleaching units have formed a company for setting up and operation of the CETP by investing 25% (typically) of the initial project cost, with the balance 75% being received as grant from the state and central governments under various schemes of the MoEF, Ministry of Commerce (ASIDE, ILDP schemes) etc. The industry's contribution of 25% is through equity (15%) from their member units and loan through banks.

The Ministry of Textiles, Government of India have recently come out with a new Scheme titled "Integrated Processing Development Scheme (IPDS)", wherein 75% of the project cost for establishment of CETPs with ZLD is being provided as grants/subsidy by the Central /State Governments. The scheme also provides for installation of common infrastructure such as captive power generation plants and for establishment of common facilities such as testing laboratories/R&D centres. The scheme also requires the CETP Company to appoint a professional technical O&M agency for the entire components of the CETP for a period of 15 years.

4. Way Forward for Bangladesh

This is a need for integration of environmental concerns in the development and growth of textile industry in Bangladesh. This can be made possible by implementation of zero discharge system, which not only takes care of the environmental pollution, but also increases the price competitiveness through effective utilization of natural resources and increases productivity. In this regard the best way for implementing zero discharge is waste minimization by recycle of water, reuse of salt/ chemicals in dyeing and making productive use of waste sludge. Adoption of zero discharge will enable Bangladesh textile sector in getting access to wider international market, enhancing its export and increasing employment and growth opportunities. This would, however, require a practical and phased approach and concerted effort of the textile industry as well as the Government of Bangladesh in addressing the challenges in implementing ZLD in a holistic manner.

In India, the ZLD program was triggered by Court's intervention in response to public interest litigations filed by concerned citizens against polluting industries. The gravity of the environmental problem led the Court to pronounce landmark judgements leading to knee jerk response from the industry. This led to finding solutions in a hurry and not allowing time for addressing the problem in a systematic manner and the Court also ordered closure of factories on account of non-

compliance. All this had massive implications including the loss of livelihood of large number of workers dependent on such industries. While Bangladesh is starting with the right intent to curb water pollution and promote water conservation in the textile dyeing units, the Indian experience can serve as a good learning model. The following approach is suggested, which would help Bangladesh avoid some of the bottlenecks faced by India and the learning's thereof while implementing the ZLD program.

a. Before embarking on a full-fledged ZLD program, there is a need for **systematic piloting** to demonstrate techno-commercial feasibility and viability of ZLD in the context of Bangladesh

b. It must be recognized that not all textile dyeing effluents are same. Which implies that **standard solutions are seldom possible** and depending on the nature of effluents, the system design has to be customized for each individual application

c. As no single EPC company can provide expertise for all the components of ZLD, there is a need for a **specialized entity to provide system integration services** and process performance guarantee

d. For scientific design of the ZLD system, it is important that apart from water balance, the **material balance with regard to critical parameters** are also carried out

e. The following technical issues must be kept in mind while designing ZLD systems. The ZLD guidelines, therefore, must consider incorporating the following;

   i. System design should be based on high **`reliability index'**

   ii. **Internal circulation**, by way of quality and quantity of backwash, regeneration, cleaning of the treatment process etc. must be carefully accounted for

   iii. To handle variations in the effluent quality, the design should have **high process flexibility** to avoid downtime

   iv. The design must aim for the **reduction of brine concentrate** to reduce the energy need for evaporation and crystallization

   v. Try and **avoid evaporator usage** to avoid high energy use and associated technical issues linked to evaporation of mixed salts

f. To achieve `Zero Liquid Discharge', aim for **`Zero Waste Discharge'** by focussing on salt recovery (and reuse) and reduced sludge generation

g. For the program to be successful, there is a need for independent Operation and Maintenance (O&M) service providers

h. Introduce **certified ETP operator courses** to solve the problem of lack of trained and professional manpower for O&M services

i. The Bangladesh Government may consider extending **subsidies and financial assistance** for ZLD systems.