A Synthesis Report on

Water Reuse: Scope and Potential in Bangladesh

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Water Reuse in Bangladesh

The textile industry in Bangladesh is a significant consumer of water, particularly in the wet processing stages such as dyeing, printing, and finishing. Current practices involve the use of large volumes of groundwater, which is often treated to remove hardness before use. However, this leads to substantial wastewater generation. Developing nations lack resources to adequately monitor the thousands of mills within their borders, or to enforce existing standards.

Governments cannot solve the problem alone—the private sector needs to step up and play a key role in resolving the problem of pollution generated by textile production. Some factories have started implementing wastewater treatment plants (WWTPs) to treat and reuse water. These plants use biological, physico-chemical, and chemical treatment methods.

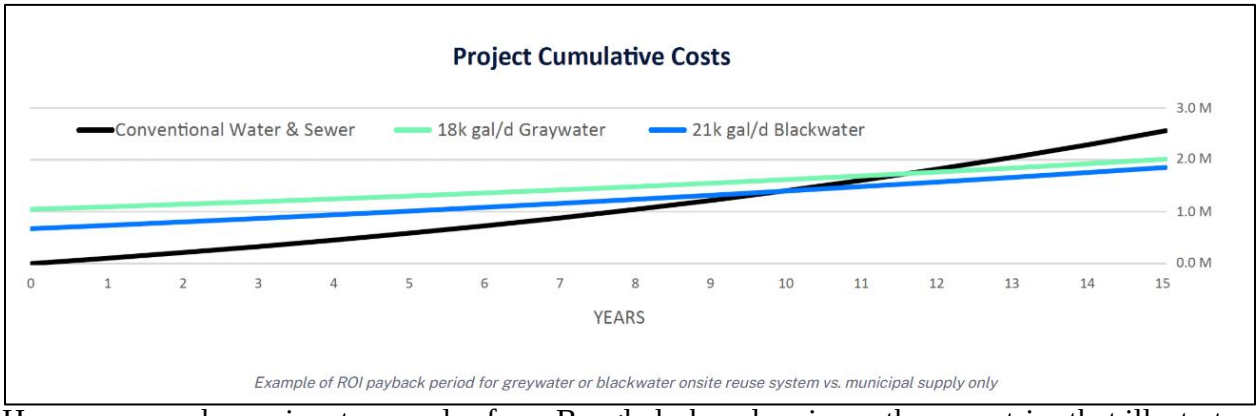
The average specific groundwater consumption to process 1 Kg of textile materials was found to be 164 L/Kg, dyehouse water was136 L/Kg, while corresponding wastewater was 119 L/Kg, in a study conducted with 18 textile factories of Bangladesh. The most comprehensive project that can be considered reliable from the International Finance Corporation (IFC) Partnership of Cleaner Textile (PaCT) estimates that average water consumption in Bangladesh's washing, dyeing, and finishing (WDF) factories is 100 to 150 liter/kg of fabric production, and water and effluent costs account for as much as 5 percent of production costs. According to a study conducted by SIWI, only 61% of wet-processing facilities are equipped with effluent treatment plants (ETPs), of which 29% were found to be compliant, and some 11 to 51% were either poorly designed or operated (Restiani, 2017). IFC PaCT did a water footprint assessment in the Konabari cluster of the Gazipur region, which houses 33 Washing, Dyeing, and Finishing (WDF) units and consumes approximately 13 billion liters of fresh water per year.

A reduction in water use of 10 to 30 percent can usually be accomplished by taking simple measures–water leaks, broken or missing valves, running water, defective toilets, and water coolers (Natural Resources Defense Council, 2012). The practice of overflow washing/rinsing was common when the water consumption is high in textile processing, which could be replaced by batch-wise washing/rinsing (drop fill method) or counter washing and could result in savings of 45% to 75% of water use. PaCT identified that with every $1 invested in Bangladesh, savings of 26 m3 water/year, 2 MWh/year of energy, 0.2 ton/year of GHG emissions and 23 m3/year wastewater can be achieved.

Reusing water offers several benefits, which ultimately leads to more sustainable water management practices-

- Cost Savings: Reducing water consumption lowers the costs associated with water procurement and treatment. A study conducted by GIZ on 21 textile factories of Bangladesh revealed that, the reuse of cooling water can translate into approximate direct annual savings of BDT 1.68 lakh to BDT 15.15 lakh. As investment costs are usually below BDT 2.52 lakhs (for pipes, valves, a pump, holding tanks and a control) the payback period is expected to be between 1 to 7 months.
- Environmental Benefits: Treated and reused water minimizes wastewater discharge, reducing pollution and improving water quality in surrounding ecosystems.
- Sustainability Compliance: Meeting global standards (e.g., LEED certification, ZDHC roadmap) enhances brand reputation and ensures sustained business with eco-conscious buyers.
- Improved Resilience: Factories that rely on water reuse are less vulnerable to water scarcity and regulatory crackdowns.
- LEED and Green Building certifications: Incorporating water reuse systems into building designs can contribute to achieving Leadership in Energy and Environmental Design (LEED) or other green building certifications.
- Reduced fossil fuel consumption: Cooling water has a typical discharge temperature of 45°C, which can be utilized during various processes that require hot water thereby reducing the need for heating makeup water for these processes. Calculations show that reusing hot cooling water can save up to 0.3% of the overall fuel consumption which translates into savings of up to BDT 6.20 lakh per month in monetary terms (GIZ, 2020).

There are many factors that will make a difference in the payback period of water saving reusing schemes. One study conducted in USA indicates that these investments have a payback period of 10 years on an average. The graph below shows the cumulative cost of any factory over the year in three scenarios – BAU, and incremental investments in water reusing.



Example of ROI payback period for greywater or blackwater onsite reuse system vs. municipal supply only

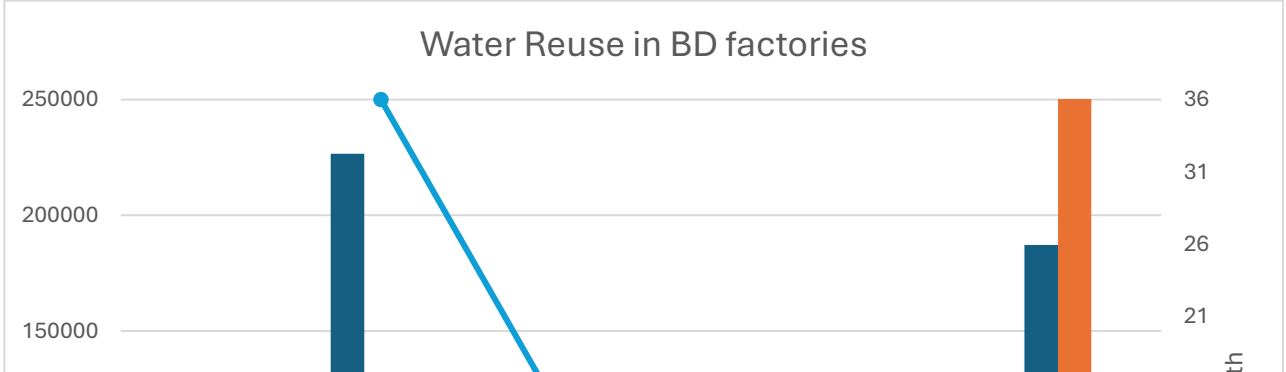
Here are several prominent examples from Bangladesh and various other countries that illustrate the advantages and practicality of implementing water reuse practices within the textile industry-

1. National

- DBL Group, a prominent textile and garment manufacturer in Bangladesh, has installed advanced water recycling technologies, including Effluent Treatment Plants (ETPs) and

Reverse Osmosis (RO) systems, along with rainwater harvesting to treat and reuse wastewater within their facilities. They recycle 40% of wastewater back into the production cycle, and reduced groundwater extraction by 54 million liters annually. DBL reports that the investment paid itself back within a few months.

- Evince Textiles Limited (ETL) uses countercurrent flow in continuous washing range along with recovery-reuse of blanket cooling water. By adopting these two recommendations from PaCT, it has reduced 14% water consumption and 226,560 m3/yr of ETP load with an investment of $4374. An investment of $2,835 in countercurrent flow technology in continuous washing machine generates $2,860 of annual savings, whereas $14,238 of investment in recovery and reuse of blanket cooling water in Sanforizer results in annual savings of $2,870, and payback period of 5 years.
- Viyellatex Ltd. (VTL) installed the condensate recovery system in their factory to recover the total condensate it produces in dyeing and washing section. The recovered condensate is used as make-up water and to increase the temperature of the boiler feed water. The initial investment was $49,814 which has generated annual savings of approximately $39,000, with just about 15 months payback period, and 49,536 m3/year of water savings.
- Envoy Textiles, a LEED Platinum-certified denim manufacturer, has pioneered sustainable water practices through closed-loop water systems to recycle treated water, and reduced freshwater consumption by 35%. They have achieved ZDHC (Zero Discharge of Hazardous Chemicals) compliance, gaining a competitive edge in the global market, and demonstrated profitability through reduced operational costs and enhanced buyer trust.
- Fakir Fashion recycles over 30% of water used in production and thus reduced operational costs and improved environmental compliance.
- JM Fabrics Ltd. invested a total of BDT 3 lakh to plan a customized Cooling Water Reuse System and installing it in the factory premises. This resulted in saving of 45m3 of makeup water, approximately BDT 6.2 lakh per month with payback period of less than a month.
- Jeans Cultue Ltd., a sister concern of Armana Group, invested $2265 to recycle the water used in potassium permanganate spray section, which had a potential to save $30,421 annually.
- Epyllion Group invested in state-of-the-art technology and estimates annual water savings of 37,800 tons a year ($3,700).
- Snowtex Outerwear Ltd. Installed an STP in 2021with an investment of $0.7 million. Approximately 187,200 m3 of STP treated water is available for reuse annually which reduced the factory's groundwater consumption. The facility now reuses the water for irrigation and toilet flushing purposes.



2. International

- Arvind Limited, a major textile company in India has established a Zero Liquid Discharge (ZLD) plant, recycling 100% of wastewater. It installed ultrafiltration (UF) and reverse osmosis (RO) technologies to recover high-quality water and saves over 2 billion liters of freshwater annually (Textile Magazine, 2024).
- TAL Apparel, a global textile leader in China, implemented closed-loop water recycling systems. The factory partnered with WWF and IFC to pilot advanced water management projects, and now recycles treated water for dyeing, washing, and other processes. It helped them reduce water use by 58%, lower operational costs and achieve ZDHC compliance, meeting buyer expectations (TAL Apparel, n.d.).
- Danish polyester yarn dyehouse Trevira Neckelmann implemented direct reuse of water streams in wet treatment operations that do not necessarily require water of freshwater quality. An overall 45% water saving has been achieved with payback period of less than a year (Wenzel & Knudsen, 2005).
- Envirogen Group helped a leading textile manufacturer in UK to establish a water recycling system with payback period of 18 months and annual savings of $10,00,000 on water bill. (Higgins, n.d.).

Applications of Reused Water

Recycled or treated water can be reused across several non-critical processes within textile factories:

- Dyeing and Pre-washing: Treated water can replace freshwater for pre-washing and certain dyeing processes.
- Boiler Feedwater: Recycled water can be used in boilers after proper treatment to remove minerals.

- Cooling Towers: Factories can use treated water for cooling systems.
- Cleaning and Floor Washing: Recycled water is suitable for cleaning factory floors and equipment.
- Gardening and Sanitation: Treated water can be used for factory landscaping and flushing toilets.
- Non-Contact Applications: Water reuse for processes where direct product contact is not required, such as machine cooling or air humidification.

Requirement for Investment

Investing in water reuse systems involves costs related to the installation and maintenance of wastewater treatment plants. The investment varies depending on the scale and technology used. For example, implementing Zero Liquid Discharge (ZLD) systems, which aim to eliminate liquid waste, can be more costly but offer significant long-term savings and environmental benefits.

The level of investment required depends on the technology and scale of operations:

1. Effluent Treatment Plant (ETP): Costs for setting up an ETP can range between USD 300,000 to 1 million, depending on the factory size and treatment capacity.
2. Zero Liquid Discharge (ZLD): ZLD systems are more expensive, with investments exceeding USD 2-3 million for medium to large factories.
3. Water Recycling Systems: Installation of modern water recycling systems, such as Reverse Osmosis (RO) and Membrane Bioreactor (MBR) technologies, costs around USD 500,000 to 1 million.
4. Maintenance Costs: Regular operation and maintenance of these systems require 5-10% of the initial investment annually.

Investors in the Sector

Investments in water reuse technologies in the textile sector come from various sources:

1. International Organizations: Organizations like the Foreign, Commonwealth, and Development Office (FCDO), the United Nations Conference on Trade and Development (UNCTAD), UNIDO, IFC, GIZ, and the World Bank are involved in funding projects aimed at improving water management in the textile sector
2. Private Sector: Companies within the textile industry, such as Kingsley Engineering Service Corporation and QStone Capital, are investing in advanced water treatment technologies. Companies supplying advanced water treatment solutions often provide financial plans, including Build-Own-Operate-Transfer (BOOT) models.

3. International Buyers: Brands such as H&M, Levi's, and Zara are driving water reuse initiatives through partnerships, incentives, and technical support for their suppliers.
4. Financial Institutions: Commercial banks and international agencies offer low-interest green financing schemes to support sustainable water practices.

Scope and Potential

1. Sustainable Certifications: Growing demand for certifications like LEED, OEKO-TEX, and GOTS opens up opportunities for factories to invest in water reuse.
2. Public-Private Partnerships (PPP): Collaborative initiatives between government, industry, and NGOs can promote widespread implementation of water reuse.

Drivers behind the success of other countries

- India: Acute water scarcity in India, particularly in textile hubs like Gujarat and Tamil Nadu encouraged the government to enforce stringent environmental regulations mandating Zero Liquid Discharge (ZLD) policies for industries. Tamil Nadu made ZLD mandatory for textile factories (Tamil Nadu Pollution Control Board, 2019). Effluent Treatment Plants (ETPs) and Reverse Osmosis (RO) systems were installed to recycle wastewater. Collaborations with NGOs and global organizations provided technical and financial assistance. Tamil Nadu's policy resulted in over 90% compliance among textile manufacturers, significantly reducing water pollution (Preetha, 2024).
- China: Severe pollution of water bodies due to industrial discharge acted as the major drive for enforcement of stringent water reuse standards and financial penalties for non-compliance. Factories were given strict water consumption limits, pushing them to adopt water reuse systems. Tax reductions and subsidies were provided for installing wastewater treatment systems. Municipalities invested in centralized treatment plants, enabling industries to reuse treated water. Textile hubs like Dongguan achieved water reuse rates of over 60%. The introduction of a nationwide water tax, levied based on the volume of water extracted and effective December 1, 2024, replaces the previous water fee system, increasing the fee for high water-consuming industries and specific areas, thereby penalizing excessive water use. Tax reductions are granted to taxpayers whose water use efficiency meets the national advanced standards.
- Singapore: Singapore had a strategic national vision to achieve water self-sufficiency, due to its limited natural water resources and dependence on imports. "NEWater" initiative educated the public and industries on the benefits of reclaimed water (PUB, n.d.). Industries were mandated to use recycled water for non-potable purposes, such as cooling and washing. Massive government funding ($200 million) for state-of-the-art water recycling plants using advanced membrane and UV disinfection technology resulted in 30-50% savings on water costs due to lower tariffs on recycled water (Aquatech, 2022).
- California: Chronic droughts and water scarcity in key industrial regions encouraged federal and state-level incentives for water conservation (USEPA, 2017). California's Recycled Water Policy required industries to use reclaimed water for specific processes.

The Water Recycling Funding Program (WRFP) provides technical and financial support to local agencies for water recycling projects (California Water Boards, 2019). Government grants and low-interest loans (1% interest rate) helped industries install water reuse systems. Large-scale water recycling projects in industries reduced water usage by 35-40%. Successful public-private partnerships have improved the scalability of water reuse technologies.

Possible approaches

To achieve widespread water reuse in the textile sector of Bangladesh, a comprehensive approach involving technology, regulation, financing, and collaboration is essential. Here are the key strategies to adopt water reuse across the sector:

1. Policy and Regulatory Framework

A. Mandatory Regulations:
- Enforce stricter rules requiring factories to install Effluent Treatment Plants (ETPs) and water recycling systems.
- Establish water reuse targets (e.g., factories must reuse 30-50% of water by a specified year).
- Impose penalties for groundwater over-extraction and untreated wastewater discharge.

B. Incentivize Compliance:
- Provide tax rebates, subsidies, or reduced utility costs for factories investing in water reuse technologies.
- Offer certifications or awards for factories achieving high water efficiency (e.g., Green Factory recognition).

C. Monitoring and Enforcement:
- Strengthen regulatory oversight by authorities like the Department of Environment (DoE) to ensure proper operation of ETPs and recycling systems.
- Adopt real-time monitoring systems to track water consumption, treatment efficiency, and reuse rates.

2. Investment and Financing

A. Access to Green Financing:
- Promote funding through programs like the Green Transformation Fund (Bangladesh Bank) to help factories invest in advanced water treatment systems.
- Collaborate with international financial institutions (e.g., IFC, World Bank, ADB) to provide low-interest loans for water reuse projects.

B. Private Sector Investment:
- Encourage Build-Operate-Transfer (BOT) and Public-Private Partnerships (PPPs), where private companies finance, install, and operate water recycling systems for textile factories.

- Develop tailored financing solutions for small and medium enterprises (SMEs), which often lack resources for high-cost technologies.

C. Buyer Participation:
- Global brands and buyers should fund or co-finance water reuse initiatives as part of their supply chain sustainability commitments.
- Introduce buyer-driven financial incentives, such as preferential contracts for water-efficient factories.

3. Adoption of Technology

A. Advanced Water Treatment Systems: Promote the adoption of proven technologies like Reverse Osmosis (RO) and Membrane Bioreactor (MBR) to enable high-quality water recycling.
B. Automation and Smart Water Management: Encourage use of IoT-based water management systems to optimize water use, reduce wastage, and monitor treatment performance in real-time.
C. Demonstration Projects: Establish pilot water reuse projects in key industrial zones (e.g., Gazipur, Narayanganj) to showcase successful adoption and encourage replication.
D. Rainwater Harvesting Integration: Combine water reuse with rainwater harvesting systems to reduce overall freshwater dependency.

4. Capacity Building and Knowledge Sharing

A. Training Programs:
- Conduct training for factory managers, engineers, and workers on the operation and maintenance of water recycling technologies.
- Develop educational programs in collaboration with technical institutions to create a skilled workforce for water management.

B. Industry Awareness Campaigns:
- Launch awareness campaigns highlighting the economic, environmental, and regulatory benefits of water reuse.
- Share success stories and case studies of factories that have achieved significant water savings.

C. Collaboration Platforms:
- Create platforms where industry stakeholders (government, brands, factory owners, and technology providers) can share knowledge and experiences on water reuse.
- Facilitate industry partnerships with research institutions to develop customized water treatment solutions.

5. Support from Global Brands and Buyers

A. Enforce Water Efficiency Standards:
- Global buyers (H&M, Levi's, Zara, etc.) should mandate compliance with international standards like ZDHC (Zero Discharge of Hazardous Chemicals) and LEED certification.

- Require factories to implement water reuse systems as a condition of business contracts.

6. Infrastructure Development in Industrial Zones

A. Common Effluent Treatment Plants (CETPs): Build centralized Common Effluent Treatment Plants in industrial zones, where multiple small and medium factories can treat and reuse water collectively.
B. Shared Water Recycling Facilities: Develop shared water recycling infrastructure in industrial clusters to reduce costs for individual factories.

7. Integration of Circular Economy Principles

A. Promote a shift towards a circular water economy:
   - Treat wastewater as a resource rather than a liability.
   - Develop systems to recover and reuse valuable chemicals (e.g., dyes, salts) from treated wastewater.

8. Industry Collaboration and Leadership

A. Form industry-wide coalitions (e.g., BGMEA, BKMEA) to drive joint water reuse initiatives.
B. Set collective water efficiency targets for the sector and monitor progress.
C. Engage international organizations (e.g., UNIDO, IFC) to provide technical support, funding, and policy guidance.

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