Business Case: Reuse of Cooling Water

Support to Safety Retrofits and Environmental Upgrades in the Bangladeshi Ready-Made Garment (RMG) Sector

It is Worth to Recover and Reuse Cooling Water

The textile and leather industry in Bangladesh growths rapidly and requires a lot of water for its processes. In 2014 the estimated daily water demand of the textile and leather industry was4,027 Mega Litres per day (MLD) and it is expected that the demand will go beyond 6,788 MLD in 2030 – an amount equivalent to the annual water need of a population of approximately 60 million people in Bangladesh. The projected increased water demand combined with falling groundwater tables is likely to threaten industrial production[1].

An easy to achieve practice to save valuable water resources is the reuse of cooling water used in large amounts by textile factories to cool down hot machines. Usually, cooling water does not directly get in contact with dyes or other chemicals, which means that after its initial use it is still clean and high in temperature. This so-called "non-contact" cooling water potentially offers great economic savings since it can be reused beneficially in various processes, such as in de-sizing, scouring, washing, or rinsing, saving significant amounts of makeup water.

Advantages of cooling water recovery at a glance:

- Reduced fuel demand
- Reduced water demand
- Reduced water treatment cost
- Reduced environmental damage

Common sources of large volumes of cooling water in textile/RGM factories are singeing machines, preshrink machines, circulating pumps or batch jet dyeing machines. Reusing cooling water from dyeing baths before they are drained out is a promising option. The typical discharge temperature of cooling water is about 45°C.

By separating cooling water from other effluent streams with the help of a water reuse systems, factories can reduce their water demand by 2% to 9%. Additional savings can be realised through a reduction of fuel consumption, otherwise required for heating up cold makeup water. Overall, the reuse of cooling water can translate into approximate direct annual savings of BDT 1.68 lakh to BDT 15.15 lakh[1]. As investment costs are usually below BDT2.52 lakhs (for pipes, valves, a pump, holding tanks and a control) the payback period is expected to be between 1 to 7 months[2].

Approximate Investment Cost and Monthly Savings (BDT)

Detailed information about the cost and benefits of cooling water reuse systems can be found on the next page, followed by a case study on page 3. Technical details on the installation and implementation process as well as legal requirements and possible means of financing can be found on pages 4 to 5.

An operator running a Dyeing machine (cap: 500kg) JM Fabrics

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[1]*Data from 21 textile factories with an annual production volume between 506 to 33,229 tons*

[2]*Greer, L. et al. (2013). NRDC's 10 Best Practices for Textile Mills to Save Money and Reduce Pollution*

Saving Water, Reducing Fuel Consumption

Recovering and reusing cooling water bears significant water and fossil fuel saving potentials. Potential direct and indirect benefits of reusing cooling water are shown in the table below:

Direct Benefits:

Reduced water demand	Recovering and reusing cooling water from processes can significantly reduce a factories' water requirement Especially non-contact cooling water from sources such as singeing machines, preshrink machines, circulating pumps and batch jet dying machines can easily be captured and reused. Installing a cooling water reuse system typically leads to a reduced annual water demand of 2% to 9%. In some cases, a reduction of over 18% can be achieved. Lowered water demand translates into an approximate monetary savings of BDT 1.68 lakh to BDT 15.15 lakh per year[3]depending on the source and price for water.
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. In a factory with 21 dyeing machines operating in a range of 14t/8h to 18t/8h capacity this translates into savings of up to BDT 6.20 lakh[4]per month in monetary terms.[5]
Reduced water treatment costs	As per environmental norms, wastewater cannot be disposed at high temperatures. Furthermore, the discharge of large amounts of hot water stresses the wastewater treatment system, lowering its efficiency, making the reuse of hot cooling water even more beneficial. Case study results from Bangladesh show that reducing the amount of water can result in savings of up to BDT 2,250 per month.[6]

Indirect Benefits

Reduced Greenhouse Gas Emissions	As cooling water reuse systems reduce the demand of fossil fuels, the amount of GHG emissions is also reduced. A reduction in fuel demand of1m^3 natural gas, otherwise used for heating water, would translate into reduced total emissions of 1,9 – 2.2 kg CO_2eq (ref. 2014 IPCC Guidelines).
Reduced environmental stress	Avoiding hot effluent disposal to nearby water bodies reduces the environmental stress in the respective areas.

Calculating the Cost of a Cooling Water Reuse System

The cost of cooling water reuse systems depends on the type of technology, the quality, quantity and chemical composition of the available cooling water within the factory. Experiences show that the average investment needed is usually in the range of BDT 1.5 to 2.5 lakh.

As the system can be maintained by skilled internal staff, maintenance cost can be considered as insignificant.

The following table shows possible investments for the installation of cooling water reuse system on the example of a medium sized RGM factory in Bangladesh:

Possible investments for cooling water reuse systems:

Type of Investment	Quantity	Average Cost (BDT)
Pipes (1"-1.5" GI)	100m	16,000
Water pump (1.5 kW, Operate <80°C)	2	44,550
Tank (100m3, Sump)	1	31,500
Tank (10m3, Day Tank)	1	18,000
Motorised Valves	1	11,700
Valves (1"-1.5", Operate <180°C, <1000 psi)	7	32,130
Other Accessories	1	9,900
Installation	n. a.	36,000
Total Costs	**BDT 199,780**	
Average payback period	**1 – 7 Months**	

An operator running a Dyeing machine of cap 750kg used for gray fabrics dyeing

[3]*Greer, L. et al.(2013). NRDC's 10 Best Practices for Textile Mills to Save Money and Reduce Pollution*

[4] *Case Study Sport light: JM Fabrics LTD, Dhaka, Bangladesh*

[5]*Ebd.*

[6]*Ebd.*

Case Study Spotlight: JM Fabrics LTD, Dhaka, Bangladesh

Description of the Factory

JM Fabrics Ltd. (JFML) is an export-oriented textile and garment manufacturer, specialised in producing ladies' knit and intimate garments. The company started exporting in 2007 and ever since has built long-standing business relationships with reputed brands from North America, the European Union and some South Asian countries.

As a composite apparel manufacturer, JMFL's production processes stretch from knitting, dyeing, finishing to garments manufacturing. By developing and implementing a long-term expansion strategy, JMFL can handle high volumes and offers a broad range of products including higher and lower value-added goods.

Underground water reserved tank (capacity-90,000 Ltr) and water transferring pump (capacity-15Kw) with water vessel. All these are important for water storage and supplying

Implemented Measures

In the face of rising utility costs and increased competition, efficient utility management provides a good opportunity to build a competitive advantage in the industry. One easy and effective way to save costs is to recover waste heat from cooling water and reuse it in production processes where it is needed.

At JMFL, the average temperature of the water used to cool the 21 dyeing machines operated by the factory (capacity 14t/8h to 18t/8h), was about 70 °C. Having served its purpose of cooling the machines the water was usually discharged into the Effluent Treatment Plant (ETP), resulting in regular system overloads. Moreover, hot water causes the death of micro-organisms in biological treatment plant leading to a slower settlement of sludge in the flocculation process.

To reduce the ETP stress and to recover heat from the cooling water JMFL's management team decided to invest in pipes dedicated to circulate the cooling water, pumps as well as a hot water tank. The used cooling water is collected and redirected to other production steps where hot water is required.

Challenges during Implementation

One major challenge JMFL experienced after installing the Cooling Water Reuse System was that the pumps redirecting the hot water to the production steps where it was required were regularly operating at elevated temperatures and therefore had to be stopped from time to time to avoid overheating. Furthermore, JMFL initially struggled to reuse the cooling water for the dyeing section as it did not meet the temperature requirements.

Investments and Savings

JFML invested a total of BDT 3lakh to plan a customised Cooling Water Reuse Systemand installing it in the factory premises. However, installing the system proved to be a worthwhile investment as the increase in resource efficiency lowered the factory's utility costs dramatically. Taking into consideration the savings from reduced water and fuel consumption in combination with decreasing demand for power, total savings sum up to approximately 6.2 lakh per month. Consequently, the payback period for the Cooling Water Reuse System at JMFL was less than a month.

Key Performance Measures

Since the system was installed in 2014, JMFL has been saving approximately 700 m^3 of CNG per month by reusing hot cooling water instead of heating cold water. The savings in fuel amounts to about BDT 6.2 lakh per month

In addition, the factory is saving 45$m^3$of makeup water per month. When assuming an average price of BDT 1.3 per m^3 this translates into monthly savings of BDT 59. Although, the financial impact seems negligible, the savings need to be assessed against the background of the rapid depletion of Bangladesh's groundwater resources that could jeopardize food and water security for millions throughout the country.

Last but not least, by significantly reducing the amount of wastewater being discharged through the Effluent Treatment Plant (ETP), JMFL was able to additionally save around BDT 2,250 per month as fewer chemicals were needed to treat the water.

Cooling water pipeline interconnected to main header line. After this, pipeline is connected in to the main reserve tank. JM Fabrics Ltd.

References for recycling of cooling Water in Bangladesh

Although there are no explicit regulations regarding the reuse of cooling water, there are guidelines which address the allowed maximum temperature of industrial discharge water.

In accordance with the guide for assessment of effluent treatment plants published by Bangladesh Department of Environment (DEO) and the National standards for waste discharge quality at discharge point for Industrial Units and projects the maximum discharge temperature of water must not exceed 40°C in summer and 45°C in winter.[7]

Besides the national standards in Bangladesh, leading brands in the textile industry have also recognised the need to limit hazardous wastewater discharges from textile manufacturing processes. This has been driven both by heightened public scrutiny and the desire by industry leaders to be good stewards of the planet's resources. As a result, several multi brand consortia such as the American Apparel and Footwear Association(AAFA), the Business for Social Responsibility (BSR) or the Sweden Textile Water Initiative (STWI) as well as most of the major textile brands (e.g. H&M, C&A, Levi Strauss & Co, etc.) have published waste water guidelines. These guidelines have an even stricter temperature limit for wastewater discharge of 35°C to 37°C.[8]

Apart from this, the further development of energy prices (in particular of gas) in Bangladesh is relevant issue to be taken into account in the context of considering energy efficiency measures. In February 2017, the price of domestic gas was already hiked by 22.70%resulting in a price of BDT 7.35 per cubic meter of gas.[9] For 2018 the Government of Bangladesh plans to include LNG in the national Gas Grid by further increasing imports of LNG and developing the LNG import infrastructure. Since LNG is more expensive than domestic gas, the Energy and Mineral Resources Division took the initiative to off-set the cost by raising consumer prices. To cope with this price hike the Bakhrabad Gas Distribution Company (BGDC) recently proposed the Bangladesh Energy Regulatory Commission (BERC) to again hike commercial prices for gas by up to 70%[10]. Given the increasing demand for natural gas, prices are expected to further rise in the future.

[7] Bangladesh Department of Environment (2008). Guide for Assessment of Effluent Treatment Plants

[8]ZDHC (2015). Textile Industry Wastewater Discharge Quality Standards

[9]Mahfuj Risad (2018). Titas, Bakhrabad, Karnaphuli sought Price hike of Gas. Available online at: https://energybangla.com/titas-bakhrabad-karnaphuli-sought-price-hike-of-gas/.Last checked on 08.05.2018

[10]Sanchita Shetu (2018). Commercial gas price might rise by 70%, household gas could cost double. Available Online at: https://www.dhakatribune.com/bangladesh/power-energy/2018/03/22/commercial-gas-price-rise/. Last checked on 08.05.2018

Key Steps Required for Implementation

As per experience, the installation of a cooling water reuse system within a factory will approximately take 3 months[11] to install (including planning and design).

The following steps can help you to decide what measures have to be taken:

- Identification of cooling water sources within the factory (from both plant and process perspective).
- Quantitative and qualitative assessment of the cooling water. Important parameters that must be determined include:
  - → Water temperature
  - → Cooling water quality (Chemical composition)
  - → Availability of cooling water
  - → Spatial availability
  - → Opportunities for cooling water reuse
- Selection of appropriate technology. Using the gathered data non compatible cooling water reuse systems can be excluded and compatible systems can be compared regarding factors such as cost, volume and special requirements
- Planning and installation of the selected system
- Monitoring and maintenance

Availability of Materials in Bangladesh

The required materials can be sourced via local or international traders. You may contact JM Fabrics LTD for their recommendations regarding possible suppliers.

Nature of Services Required to Support the Implementation

- Based on the hot temperatures of the used cooling water the system design requires expert knowledge
- Installation services are usually carried out by external experts
- Maintenance services for the systems can be carried out by skilled internal staff

Photo: Water Flow Meter which is used for cooling water measurement

Possible Sources for Financing

SREUP credit line could be a good source of financing for such an investment.

Main Feature of SREUP Credit Line	
Loan Type	Normally Term Loan
Discount	Provision and possibility of 20% discount from loaned amount
Loan Tenure	3-5 years in general and in special case up to 7 years
Loan Limit	Normally up to 1 Million Euro and can be increased up to 3 Million Euro in special cases
Interest Rate	7% p.a. (maximum)
Grace period. Debt: Equity Ratio. Repayment	All issues are subject to agreement between borrower and lender

Cooling water pipeline interconnected to main header line which is shown in the image. This pipeline then after connected in to the main reserve tank. JM Fabrics Ltd.

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