Concrete Progress Toward Improving the Sustainability Performance of Textile Wet Processing in the Fashion Supply Chain in China
# Executive Summary

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Mills and dyehouses across China are struggling to balance economic realities with increasing pressure from consumers, brands, campaign groups, and the government to produce apparel in a more socially and environmentally respectful way. However, these goals do not need to be seen as competing; in reality, economic benefits within textile wet processing can be achieved hand-in-hand with sustainability improvements. In fact, the transition towards more sustainable production and a greener supply chain is an imperative if the industry is to stay competitive.

This brief report summarises results from the first phase of the Better Mill Initiative (BMI) launched in China. These show that saving money and resources are complementary goals.

The BMI programme empowers mills and factories engaged in wet processing to reduce their resource use, increase their efficiency, and ultimately save money while improving the sustainability profile of the industry.

The key areas tackled within the programme include resource efficiency, waste, emissions to water and air, chemical management, workplace health and safety, and social awareness.

Tailored support provided by Solidaridad and a team of technical experts ensures that each mill is able to identify and properly address its own most pressing challenges. Simultaneously, group learning and peer support provides a sense of community, as well as a forum to discuss challenges, share knowledge, and celebrate successes. A defined six-step approach enables participants to build a clear roadmap, and to see where they are on their journey throughout the programme.

About BMI

The Better Mill Initiative, launched in 2013, was initially a collaboration between Solidaridad and H&M. Other brands have since associated with our effort, including C&A, Primark, New Look, Bestseller and Tommy Hilfiger. The programme focuses on improving the textile wet processing industry in China, with particular emphasis on the Yangtze and Pearl River Deltas.

We do so by teaming up with experts to address challenges related to the conservation of water and energy, improved chemical management, and better control of pollution. We evaluate best and better practices and encourage implementation to improve business-as-usual. While this directly benefits the environment and local communities, it also offers an enormous opportunity for the participating mills - nominated by associated brands - to gain new insight into how to measurably improve their performance.

The mill support in the programme is implemented in three phases reaching a total of 43 mills.

Participating mills learned that changes do not need to be expensive or difficult to be impactful, and within the first 15 months of this two-and-a-half year programme, they collectively achieved savings in resources equalling:

- 2,600,000 tons of water
- 28,000 tons of coal
- 5,400,000 Kwh of energy
- 4,000 tons of chemicals
- 40,000,000 RMB (over 5.5 m Euro)
2 PROGRAMME DESCRIPTION

2.1 BACKGROUND & CONTEXT

China now leads the world in apparel manufacturing, but the rapid growth of the industry hasn't come without a price. In 2013, China's apparel industry was reported to be responsible for 2.15 billion tons of wastewater a year — with as much as 85% of that stemming from dyeing and printing processes. Energy consumption from these processes is also alarming, with rates approaching three to five times the energy requirements of mills in more developed countries. China's apparel industry is responsible for a considerable part of industrial air pollution nationwide.

Over recent years, public demand and governmental action has added to the growing momentum to address these issues, contributing to the sense of urgency felt by all parties throughout the value chain. Campaign organizations are continuing to highlight both the environmental and social impacts related to water consumption, air emissions, hazardous chemical use, and unsafe working conditions.

The Chinese government has begun taking aggressive steps to curb both water and air emissions from the textile industry, and many small to medium-sized businesses in China are struggling to stay on top of new legal requirements.

Pioneering brands are realizing the role they can play to turn these statistics around, and they are looking for ways to support their supply chain partners in addressing these concerns while maintaining China's competitive position in the global marketplace. However, they are struggling to identify and influence their partners further down in the supply chain where the need for this action is often the greatest.

Against this backdrop, BMI was developed by Solidaridad in partnership with H&M as a result-oriented programme aiming to improve the sustainability performance of textile wet processing in the fashion supply chain in China. The programme empowers participants to achieve measurable improvements from a sustainability perspective, while analyzing the return on investment.

BMI partner brands include H&M, C&A, Primark, New Look, Tommy Hilfiger, and Bestseller. Technical experts were provided by Huntsman, STS, and Zhejiang University.

BMI was designed as a 2.5 year programme, starting in mid-2013. Results of the first 16 partner mills include the implementation of 268 improvement measures, contributing to substantial progress in areas such as resource efficiency, chemical management and workplace, health and safety, and indicating that the approach of the programme is effective, impactful, and scalable.

2.2 PROGRAMME OBJECTIVES

The overall objective of the programme is to improve the sustainability performance of textile wet processing in the fashion supply chain in China. Through a combination of training workshops and on-site technical support for
participating mills, the programme aims to:

- Introduce effective approaches and methods for achieving measurable improvement in energy saving, water saving, resource conservation, reduced pollution, chemical management, and related production process optimization. In addition, participating mills are supported in addressing specific problems encountered in these thematic areas.
- Align the support offered with major global sustainability initiatives, such as the Sustainable Apparel Coalition’s Higg Index and the Joint Roadmap towards Zero Discharge of Hazardous Chemicals coalition.
- Share international and national good and best practices from the textile dyeing and finishing sector.

Additionally, in line with Solidaridad’s commitment to fostering a mind-set of continuous improvement, participating mills are empowered to build their internal capacity as well as to implement an effective internal management system that supports progress toward sustainability.

Through communication and stakeholder engagement, best practices and case studies are collected and shared to encourage replication in China’s textile sector.

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**2.3 PROGRAMME DESIGN**

**2.3.1 Roles**

The BMI programme is designed to capitalize on the different skills, knowledge, and leverage of the various parties involved.

Partner brands are responsible for engaging suitable mills, supporting the evaluation process, and analysing opportunities for social improvement.

Solidaridad leads the development and delivery of training workshops and meetings, supports baseline assessments, engages subject matter experts, coordinates technical support on site, and manages monitoring and evaluation of actions that are implemented. Partner mills commit to participating in the trainings and meetings by sending the right representatives, delegating the proper human and financial resources, selecting and implementing appropriate improvement measures, and communicating progress.

**2.3.2 Approach**

Keeping in mind the skillsets involved through the various partners, a standard 15 month approach was developed by Solidaridad China, which encompassed the following steps:

1. Baseline assessment: In an onsite baseline assessment, following a self-assessment, the status quo with regards to the internal management system, performance and areas for improvement in relation to the BMI thematic areas was identified.

2. Potential recommendations: BMI experts identify potential improvement options together with factory personnel, taking into account social, environmental, and economic returns.

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**“The joint expertise of businesses and NGOs is the main requirement for improvement of the supply chain, from field to fashion.”**

Janet Mensink, Int. Programme Coordinator Cotton & Textiles at Solidaridad

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**MILL 4** is a private textile mill established in October 2003 that dyes knitted fabrics. It is a large-sized mill with 600 employees. In BMI, 18 improvements were implemented mostly focused on electricity and steam savings and wastewater and flue gas treatment. These improvements reduced annual electricity consumption of 360,000 kWh and 362 tons of standard coal. The mill also reduced 679 tons of carbon dioxide emission, 289 tons of COD emission as well as 4 tons of sulfur dioxide emission.
3. Action plan development: Partner mills prioritize recommendations and develop their action plan for implementation.

4. Resource allocation: Within the partner mills, resources including people, equipment, facilities, timelines and budgets are aligned.

5. Implementation: The internal team in each mill takes the lead in implementing the action plan. Solidaridad’s BMI team is available for support when challenges are encountered.

6. Tracking: Progress is monitored and evaluated, with an eye toward capturing lessons learned to enable others to succeed.

In parallel, the partner mills and brands are offered training and knowledge exchange through workshops on all thematic areas, providing concrete advice and good practice examples which support them in enhancing internal capacity and successfully implementing the action plans.

### 2.3.3 Contents

BMI focuses on the seven key sustainability areas related to textile wet processing:

1. Water management
2. Energy management
3. Waste water
4. Air emissions
5. Solid waste
6. Chemical management
7. Occupational health and safety

From a broader perspective, the programme also engages key industry stakeholders to improve access to resources and support positive changes at a policy level.

### 2.3.4 Delivery

Delivery of the BMI programme begins with the individual baseline assessments, followed by training workshops to address identified needs, then individual on- and off-site support, and finally, network meetings to allow for discussion and evaluation.

During the baseline assessments, several consistent challenges emerged that shaped the direction of the
programme delivery. Examples of some of these findings include the following:

- **Certification does not always equal effective implementation, particularly relating to chemical management.** Many participating mills have certifications in place for their management systems, but implementation on a day-to-day level can often be improved, particularly in the area of chemical management.

- **Social performance within the second tier requires more attention.** Examples of areas for improvement relate to occupational health and safety, working hours, contracts, and health checks for juvenile workers.

- **Access to the Higg Index Facility Module tool was restricted** due to technical challenges in China in 2013/early 2014. Online use of the Higg Index was a challenge which made the tool difficult to use in baselining.

- **Mills needed support on both information disclosure and crisis management;** Knowing what to communicate and when to communicate it remains a challenge, particularly when under pressure.

### 2.3.5 Monitoring

Monitoring is key to understanding and maximizing impact. Data was gathered twice during the programme, both before and after implementation of improvement measures. Data gathering methodology included observation, informal monitoring, site visits, and off-site follow ups by technical experts as well as the Solidaridad China team.

**Mill 7**

M07 is a private textile mill established in December 2002 that mainly manufactures middle and high grade knitted fabrics. It is a large-sized mill with 600 employees. In BMI, the mill implemented 19 improvements including water and energy savings, wastewater and flue gas treatment, carbon dioxide emission reduction, and better chemicals management. These improvements resulted in a total saving of 60.15 tons of standard coal and 3 tons of chemicals. It also reduced 99.6 tons of carbon dioxide emission, 723 tons of COD emission and 25.6 tons of sulfur dioxide emission.

**Snapshot of key achievements in the first 15 months**

- 16 mills engaged
- 7 topics addressed
- 268 improvement measures completed
- 70% of improvements cost around 7k Euro or less
- 80% of improvements have payback times of less than 2 years
- 2.6m tons of water saved
The first phase of the programme spurred 16 mills to implement 268 improvement measures across the seven targeted topics of water and energy consumption, waste water, air emissions, solid waste, chemical management and occupational health and safety.

Overall, within the first 15 months the programme, the first batch of 16 mills achieved the following savings:

Looking in aggregate, the average improvement in water consumption was 7.63%. The largest savings achieved was a 42% reduction in water consumption by a mill that upgraded its effluent treatment plant and installed more efficient low liquor-ratio dyeing machinery.

The average improvement in energy consumption was 4.41%. One top-performing mill achieved a reduction of 11.83%, largely due to installing high efficiency steam traps and insulating pipes and machinery. Payback time was less than half a year.

1 In the calculation of the averages, the 2 mills that were in the process of relocation have not been taken into account.
Additionally, there were some powerful findings that emerged throughout the first phase of the programme, such as those included below:

1 **Mills don’t need to invest a lot to achieve impact**

Nearly 70% of the improvement measures required an investment of less than RMB 50,000, or about 7,300 Euro.

2 **Mills don’t need to wait a long time to see the return on their investment**

Nearly 80% of the investments have a payback period of less than two years.

3 **Plenty of low hanging fruits to pick**

Improvement opportunities were overwhelmingly found at the management level (45%) and facility level (23%) as illustrated in the graph. Particularly in the initial stages engagement, BMI focuses on supporting partner mills to ensure good housekeeping practices and effective internal systems as a basis for continuous improvement. This is reflected by the type of improvements implemented.

4 **Key impact areas prioritized by partner mills focused on addressing energy consumption and chemical management**

A comparison of types of improvements implemented by partner mills, initially reflects the increasing attention for chemical management in the textile sector combined with the scope for improvement in this area identified in BMI. Chemical management improvements don’t need to be complicated but lay an essential foundation for avoiding hazards. Examples include gathering up-to-date MSDSs, developing a chemical inventory list, and improving chemical storage methods.

Secondly, energy management, an area with often a clear return on investment, is not surprisingly another key area prioritized by our partner mills.
Throughout the programme, key observations and lessons were gathered in order to adjust the programme in real time, and to offer insight on the best way to proceed in future phases of the programme. Some key learnings include the following:

1. **Relocation takes a toll on resource efficiency**
   Some of the BMI partner mills were in the process of relocating to a different geographical area. These mills have shown less than average improvements or sometimes even increases in water and/or energy consumption. Not surprisingly, mill management is reluctant to invest in implementing improvements in the facility that will be soon closed. Those mills that showed an increase in energy and water consumption were in the time prior to the relocation also suffering from very suboptimal production volumes making production less efficient than at the start of BMI.

Whether the learnings from trainings and expert advice have been taken into account in setting up the new facility is something we have not been able to monitor within the programme.

2. **Self-assessment tools need to be easily accessible and identified as adding value**
   Only three of the 16 mills were able to complete the Higg Facility Environmental Module Self-Assessment due to limited access to the tool. This was in part the result of the slow performance of the online tool in China in 2013 due to firewall issues – which were largely resolved in 2014. Mills were also not easily convinced of the added value of completing the self-assessment, which highlighted a challenge to the programme design aiming to use Higg in the baselining process. Technical improvements of the Higg, the introduction of verification, but most importantly, industry adoption and recognition by brands and retailers are likely to strengthen the added value of Higg – particularly for our target group of tier 2 suppliers.

3. **Mill management must be committed to the programme in order to secure financial and human resources**
   Additionally, it is important to involve staff at all levels, and to develop an integrated incentive mechanism to motivate and reward those who work toward positive change.

4. **Mills must have an internal coordinator who is empowered to make decisions and implement changes**
   Without a leader who is authorised to implement improvements inside the mill, progress is slow and difficult.

5. **Mill engagement must include a commitment to send the right people to trainings**
   In some cases, mills sent representatives who were not closely involved with the topics being addressed. This limited discussion and exchange among peers, and reduced the likelihood of follow-up action on the topics discussed.

   “**BMI really accelerates cleaner production in textile manufacturing.**”
   Felix Ockborn, Environmental Sustainability Coordinator - Water

6. **Brands must be engaged in the process to show mills their commitment to sustainability**
   Brands can be a driving force for positive change by linking sustainability performance with sourcing decisions. Mills nominated by brands closely involved in the project made more progress on average.

Going forward, the profile of an “ideal” participant would include the following characteristics:

1. **Mill has direct relationships with brands, not just with intermediaries or at least the brand is closely involved in the selection process.**

2. **Mill has a strong willingness to improve resource efficiency and chemical management.**

3. **Mill is not listed in the relocation plan of any local government.**

   “**Experts have a profound understanding of the production process, equipments and legal requirements. They are able to provide practical solutions and suggestions based on the mills’ specific needs.**”
**5 CONCLUSIONS**

Individual mills face individual challenges, and their success within a programme such as the Better Mill Initiative will vary based on factors such as starting point, willingness and capacity to invest financially, ability to cope with change, quality of relationships with brands, and commitment to the overall goals of the programme. Tailoring the approach to each mill’s particular situation – especially during the on-site support phases – was a key contributor to the success of the programme.

Greater success could have been achieved by selecting mills with more commitment and more operational stability, and these factors will be front-of-mind in the next phases of the programme.

However, this initial phase has achieved significant impact, such as concrete savings in water and energy and improved access to safe environments for workers.

Additionally, these early successes have made the case that when getting started with cleaner production, change doesn’t need to be expensive, difficult, or long-term to be impactful, and that achieving sustainable production can lead to economic benefits alongside environmental benefits.

The economic benefits achieved through BMI are key to ensuring the spirit of continuous improvement, creating enthusiasm for sustainable production and allowing the sector to work toward meeting the increasing sustainability expectations of the Chinese government, brands, retailers and the community in which the mills operate.

Solidaridad is encouraged to see that mills are recognizing these benefits already. BMI mills of the first phase continue to identify and implement further improvements even after the direct support of BMI has concluded.

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**Top improvement recommendations:**

1. **Reclaim caustic soda**
2. **Install energy efficient steam traps**
3. **Recycle cooling water and condensate**
4. **Install water efficient dyeing machines.**
APPENDIX 1: BENEFITS OF BEST PRACTICES

This Appendix shows examples of measures implemented by BMI partner mills with a brief explanation and impact.

**Best practice 1**

**Automatic dyestuff storage and weighing system**

An automatic dyestuff storage and weighing system enables controlled storage of different dyestuffs and direct delivery of the dyestuff into dyeing machinery without manual handling. This reduces manual error as well as exposure to hazardous chemicals.

**Facts and figures**

<table>
<thead>
<tr>
<th>Total investment</th>
<th>RMB 308,000</th>
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<tbody>
<tr>
<td>Dyestuff saving</td>
<td>13.57 t/a out of annual dyestuff use of 13.57 t/a (10%)</td>
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<tr>
<td>Annual cost saving</td>
<td>RMB 203,600 Yuan</td>
</tr>
<tr>
<td>Payback period</td>
<td>23 months</td>
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**Best practice 2**

**Installation of water efficient dyeing machines**

In order to improve water efficiency, a total of RMB 4,000,000 Yuan was invested by one mill to install new dyeing machines that require less water for the same amount of fabric. Compared to the old ones (liquor ratio 1:10), the new equipment has a relatively low liquor ratio of 1:5, which results in annual water and steam savings of 64,000 tons and 1,318 tons, respectively.

**Facts and figures**

<table>
<thead>
<tr>
<th>Total investment</th>
<th>RMB 4,000,000 Yuan (~590,000 Euro)</th>
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<tbody>
<tr>
<td>Steam saving</td>
<td>1,318 t/a</td>
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<tr>
<td>Water saving</td>
<td>64,000 t/a</td>
</tr>
<tr>
<td>Annual cost saving</td>
<td>RMB 625,000 Yuan</td>
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<tr>
<td>Payback period</td>
<td>32 months</td>
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</tbody>
</table>
**Best practice 3**

*Electric motor upgrading*

A TYJX250M-4 permanent magnet synchronous motor (55kW, efficiency 95%) is used in heat conducting oil boilers. Compared to the old Y280S-2 (75kW, efficiency 92%) asynchronous motor, its efficiency increased by 3% and the motor rated power decreased by 26.7%, which resulted in electricity saving of 137,900 kWh. At the same time, the occupational health and safety situation improved significantly due to less noise nuisance.

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**Facts and figures**

<table>
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<tr>
<th>Total investment</th>
<th>RMB 22,000 Yuan (~3.250 Euro)</th>
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<tr>
<td>Electricity saving</td>
<td>137,900 kWh/a</td>
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<td>Annual cost saving</td>
<td>RMB 111,700 Yuan (~16.500 Euro)</td>
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<td>Payback period</td>
<td>3 months</td>
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**Best practice 4**

*Installation of energy efficient steam traps*

Old steam traps are known to have high steam leakage (>10%), and require frequent repair and maintenance. A total of RMB 800,000 Yuan (~118,000 Euro) was invested to install energy-efficient steam traps on each drying cylinder in order to minimize steam leakage and to recycle the condensate generated. It is calculated that a total of 16,000 tons per year of steam can be saved, and 80,000 tons of condensate recycled.

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**Facts and figures**

<table>
<thead>
<tr>
<th>Total investment</th>
<th>RMB 800,000 Yuan</th>
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<tbody>
<tr>
<td>Steam saving</td>
<td>16,000 t/a</td>
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<tr>
<td>Water saving</td>
<td>80,000 t/a</td>
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<tr>
<td>Annual cost saving</td>
<td>RMB 3,000,000 Yuan</td>
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<tr>
<td>Payback period</td>
<td>4 months</td>
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**Best practice 5**

**Caustic soda reclamation**

A total of RMB 1,200,000 Yuan (~Euro 177,000) was invested to install caustic soda reclamation equipment with a more efficient steam-water ratio of 1:4, which resulted in steam savings of 5,000 t/a, and an increase in recycled water of 24,000 t/a. In addition, a total of 7,200 t/a of caustic soda was reclaimed, which not only improves the resource efficiency, but also significantly reduces the pollution load of wastewater going to the treatment plant. The implementation resulted in annual cost saving of RMB 913,000 Yuan, with a payback period of 20 months.

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<th><strong>Facts and figures</strong></th>
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<tbody>
<tr>
<td><strong>Total investment</strong></td>
<td>RMB 1,200,000 Yuan</td>
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<td><strong>Steam saving</strong></td>
<td>5,000 t/a</td>
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<td><strong>Water saving</strong></td>
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<td><strong>Caustic Soda saving</strong></td>
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<tr>
<td><strong>Annual cost saving</strong></td>
<td>RMB 913,000 Yuan</td>
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<tr>
<td><strong>Payback period</strong></td>
<td>20 months</td>
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**Best practice 6**

**Installation of online moisture monitor**

In one of the BMI partner mills, online moisture monitors were installed. These online monitors allow for continuous monitoring of the remaining moisture content in fabric during the drying process and adjusts the steam supply automatically. It not only helps to reduce steam consumption of up to 10%-40%, but also to avoid manual errors caused by operators, thus reducing the reject rate of products. It is calculated that the total investment of RMB 440,000, will result in annual steam savings of 7,920 tons, and a reduction of the annual steam costs of RMB 1,420,000.

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<tr>
<td><strong>Total investment</strong></td>
<td>RMB 440,000 Yuan</td>
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<td><strong>Steam saving</strong></td>
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<td><strong>Annual cost saving</strong></td>
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<td><strong>Payback period</strong></td>
<td>5 months</td>
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**Best practice 7**

**Recycling of cooling water and condensate**

Cooling water and condensate generated from the dyeing process can be collected and stored in a well-insulated storage tank, and then reused in the washing process. Reuse of such water that has a temperature of 60 °C not only reduces freshwater consumption, but also increases the temperature of freshwater and reduces steam consumption. It was calculated that such an installation resulted in an annual reduction of steam consumption up to 2,931 t/a, and water saving of 64,000 t/a. The investment of RMB 500,000 Yuan (~74,000 Euro) translates into a cost saving of RMB 630,500 Yuan per year (~93,000 Euro).

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<td><strong>Water saving</strong></td>
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<td><strong>Cost saving</strong></td>
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<td><strong>Payback period</strong></td>
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**Best practice 8**

**Improving chemical management**

In BMI, special attention is paid to chemical management. Improvements on chemical storage are implemented. For example, standard operationing procedures have been developed; dyestuff are stored in stainless steel containers with clear labels and are placed on wooden pallets to keep away from moisture which will affect the accuracy of chemical weighing. In addition, unauthorized workers are restricted from entering the warehouse. Dyestuff are measured strictly according to the process recipes to avoid unnecessary waste of chemicals.

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<th><strong>Facts and figures</strong></th>
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<tbody>
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<td><strong>Total investment</strong></td>
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<td><strong>Chemical saving</strong></td>
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<td><strong>Cost saving</strong></td>
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<td><strong>Payback period</strong></td>
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Better Mill Initiative, Phase One Results

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