



Toxics Use Reduction Case Study

Brittany Dyeing and Printing Implements Innovative Textile Finishing Process that Saves Energy, Increases Productivity, and Reduces Waste

Summary

With assistance from a \$425,000 grant from the U.S. Department of Energy's NICE³ program, Brittany Dyeing and Printing Corporation implemented a new technology for finishing fabric that is more efficient, cost effective, and generates less waste than traditional methods. The project was completed in December 1998, and is expected to provide the following benefits:

- reduce energy consumption by over 60% per unit weight of fabric;
- reduce air emissions by over 60%;
- increase production capability by over 100% through higher production speeds;
- reduce wastewater discharge almost 80%; and
- cut water use by over 65%.

The company estimates that the new process will reduce annual operating costs (primarily energy, water and wastewater costs) by approximately \$150,000, a 36% savings.

Background

Brittany Dyeing and Printing Corporation is a leader in fabric printing, dyeing, finishing, and rotary screen engraving. The company employs over 300 people at its two plants in New Bedford, MA. In order to improve the company's competitive position and provide better service to its customers, Brittany made plans to upgrade one of its fabric finishing lines to increase production capabilities.

The company decided to seek funding for the new finishing line through the U.S. Department of Energy's (DOE) National Industrial Competitiveness through Energy, Environment and Economics Program (NICE³). The NICE³ Program, which constitutes one of the near-term components of DOE's comprehensive technology development strategy, is a competitive grant program solicited annually to all states. It requires state agencies to team with local companies on projects that demonstrate the merits of first-of-a-kind energy and waste reduction technologies. The Office of Technical Assistance (OTA) encouraged Brittany to submit a proposal for a NICE³ grant since the project involved the use of equipment that would improve

the efficiency of its plant, conserve resources and reduce emissions while maintaining the high quality products its customers demand. OTA provided assistance to Brittany in preparing their proposal, which was submitted in the 1996 solicitation. DOE awarded \$425,000 for the Brittany project based on an evaluation of the potential energy, waste and cost savings. Commonwealth Electric Company also provided \$20,000 in funding for the project.

Project Description

Fabric finishing, the final step in fabric production, is a process to impart shrinkage control, softness, or repellency to textile fabrics. In a conventional finishing process, large amounts of water and energy are consumed to apply finishing chemicals and dry the fabric. The fabric is first immersed in a solution of finishing chemicals (e.g., resins, softeners, stabilizers and catalysts) diluted in water. The saturated fabric is then removed from the solution, excess moisture is squeezed out of the fabric mechanically and then by a vacuum system. The fabric is then dried in a “tenter frame,” which applies hot air to the fabric to remove any remaining moisture. The water-diluted finishing solution generates large volumes of wastewater, and the relatively high moisture content makes the drying steps of the process very energy intensive. Figure 1 shows this process up to the point where the fabric enters the tenter frame (the equipment downstream of the tenter frame is the same for both a conventional finishing line and the new finishing line).

In the new finishing line installed at Brittany, the finishing chemicals are diluted with air instead of water, and applied to the fabric as a foam. Figure 2 shows this process (again, up to the point of entering the tenter frame). No additional mechanical or vacuum moisture removal is necessary. The fabric is able to go directly from the foam applicator to the tenter frame with only 20-25% moisture content, compared to the 40-60% remaining moisture of the conventional process. There is not a corresponding reduction in the quantity of finishing chemicals used, since the foam application uses the same amount in order to achieve the same performance. However, because less water must be evaporated, the system requires less energy to operate. The reduced evaporative requirements of the tenter frame also allow the production speed to be increased.

The new line replaces the previous tenter frame with a high-speed tenter frame design from Marshall and Williams Company that incorporates high-efficiency natural gas burners, a more efficient air distribution system, and smaller high-efficiency electric motors. A unique chain-and-rail design that grips the fabric more tightly and operates with less frictional drag than other designs allows significantly increased production speeds. This new design, coupled with the reduced evaporative requirements, results in a production speed of 275 yards per minute for typical fabrics as opposed to the 120 yards per minute speed of conventional finishing processes, a 129% increase in productivity. Some heavier or delicate fabrics are run at lower speeds, but still faster than conventional technology would allow. While foam finishing of fabric is not a new technology, it has never been used at such high production speeds.

Results

The new finishing line offers a number of energy, waste, water consumption and cost savings, as described below. Calculations are based on processing 34.56 million yards of fabric per year (65% cottons and 35% blends) on the new finishing line.

Energy Savings: To precisely measure the natural gas and electricity savings achieved using the new finishing system, a gas meter was installed on the main gas line supply, and two electricity meters were installed on the main feed to the tenter frame and fans, and the main feed for all other drive motors in the finishing line.

The reduced evaporative requirements of the new finishing line results in decreased natural gas consumption to fire the burners in the tenter frame. Based on data collected over a one-month period, Brittany estimates natural gas consumption to be reduced by 1.33×10^{10} Btu/year (about 13.3 million cubic feet of gas), a savings of 65%.

The increased production speed results in reduced operating hours to process a given amount of fabric, thereby reducing electricity usage by 9.47×10^9 Btu/year (approximately 902,000 kwh), a savings of 61%.

Waste Savings: The new finishing line offers reductions in air emissions both from decreased natural gas consumption and decreased electricity consumption. Using the precise metering of natural gas and electrical consumption, Brittany estimates that annual emissions reductions will be 1,384 tons of CO₂ (63% savings), 3.8 tons of NO_x (62% savings), 6.4 tons of SO_x (62% savings), and 1.9 tons of particulates (61% savings).

Since less water is used in the new finishing line, there is a corresponding decrease in the amount of wastewater discharged. This wastewater consists of finishing chemicals diluted in water. Brittany estimates that total annual wastewater savings will be approximately 27,300 gallons per year, a savings of 76%. The discharge from the new finishing line contains approximately 1,200 gallons per year less chemical than the discharge produced by the conventional line.

Water Savings: As described above, the conversion from a water-based application of finishing chemicals to a foam-based method produces significant savings in water usage. This reduction is estimated to be about 433,700 gallons per year, a savings of 66% over the conventional technology.

Cost Savings: The cost savings associated with the new finishing line include the energy, water, and wastewater savings outlined above, as well as the increase in productivity. Brittany estimates that the energy, water and wastewater savings alone will save the company about \$150,000 a year compared with the conventional technology.

Brittany originally anticipated that the high production capacity of the new finishing line would generate labor cost savings, since it was expected that the number of operators would be reduced from six (two per shift) to four. Instead, Brittany has retained third shift employees and expanded the overall production capacity of the entire company by moving other finishing processes to the new line and increasing production on other finishing lines at the facility.

Comparison of Fabric Finishing Technologies

Conventional Technology

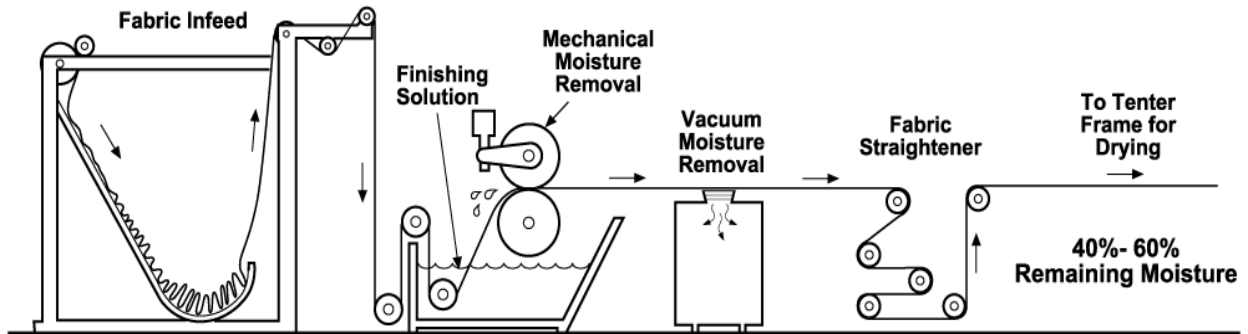


Figure 1

Diagram courtesy U.S. DOE Pacific Northwest Laboratory

Nice³ Technology

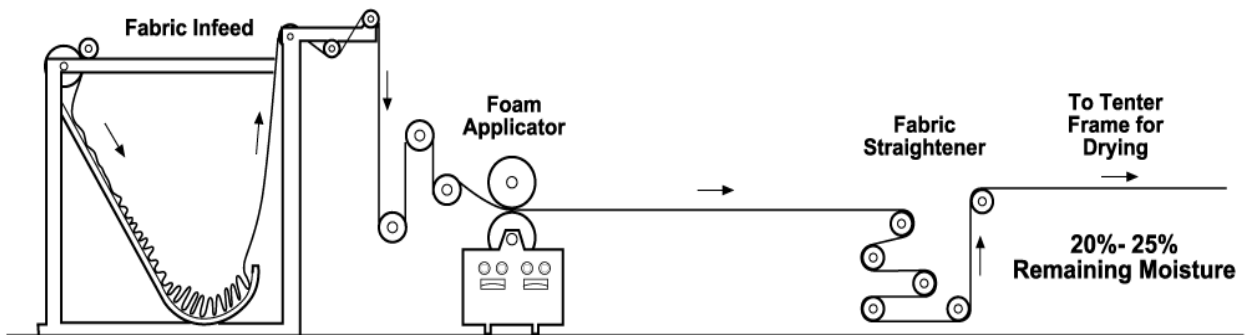


Figure 2

Diagram courtesy U.S. DOE Pacific Northwest Laboratory

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Office of Technical Assistance, 251 Causeway Street, Suite 900, Boston, MA 02114-2136
Phone: (617) 626-1060 Fax: (617) 626-1095 Website: <http://www.state.ma.us/ota>