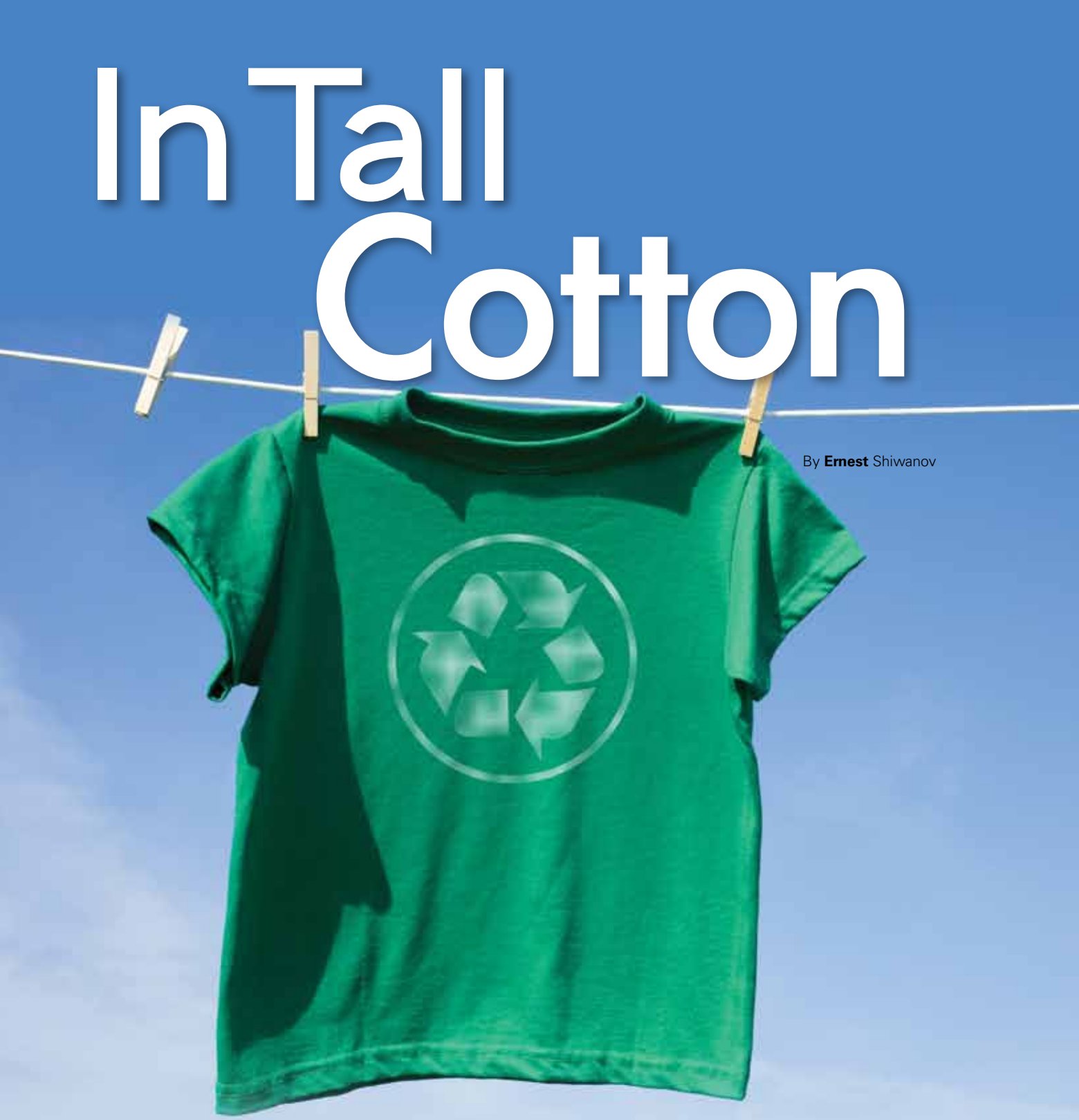
In Tall Cotton

By **Ernest** Shiwanov



New methods increase the potential of recycling nature's own

Before contacting Stefanie Zeldin, co-founder of in2green, the only way I knew for cotton to be completely recycled was to repurpose it as building insulation. In 2006, while looking for a more green than pink solution to augment my new home's insulation, I discovered Bonded Logic's Ultratouch. JBM Fibers and Bonded Logic had teamed up with Cotton Incorporated's Blue Jeans Go Green (formerly Cotton from Blue to Green) to make this new denim-based building insulation. With a bit of smart marketing, a small army of enthusiastic students, Hollywood celebrities and big retailers such as the Gap, Blue Jeans Go Green

took on a life of its own. As of 2014, 600 tons of denim has dodged the landfill bullet and almost 250,000 square feet of Ultratouch insulation has been donated to various Habitats for Humanity projects and other Blue Jeans Go Green grants.

Commendable effort to be sure, but in terms of textile recycling, this is just the tip of the iceberg. The U.S. Environmental Protect Agency's 2012 Municipal Solid Waste generation estimate for textiles (including nylon, wool, polyester, etc.) was 14.3 million tons. Of that amount, 2.3 million tons or 16 percent was exported or reprocessed – the equivalent impact of recycling aluminum or removing one million cars from the road. So where does cotton fit in this textile recycling scheme, how is it recycled and is it really better than conventionally produced cotton or organic cotton on the carbon footprint scale?

To start, recycled cotton figures prominently in the textile recovery stream, in part due to used clothing. The massive used apparel business places recovered clothing into very well-established channels of distribution.

"Over 70 percent of the world population has a need for second-hand clothing. The demand for used textiles is large, especially in third world countries," states The Boer Group, a Dutch-based textile recycling consortium. With a worldwide network, The Boer Group has been providing used textiles with a second life for more than 40 years.

Much but not all of this business is done as exports to third world countries. Thrift shop chic, environmental concerns and rappers Macklemore's and Ryan Lewis' *Thrift Shop* have helped grow the secondhand apparel couture within developed countries. Goods not sold as recycled clothing are processed into cleaning rags, shredded into batting for sound-proofing and upholstery or reprocessed into new yarns or fibers, cotton being among them.

The process of converting these recycled textiles into new components is similar to virgin materials, except that the birthing process starts at the recycling center rather than cotton fields or synthetic fiber mills. Labor-intensive sorting by skilled workers separates textiles by type, color and condition. This waste stream can include cradle-to-gate waste (post-industrial, pre-consumer), and the waste comes from any number of steps in the textile or apparel manufacturing process. For instance, in a cut-and-sew operation, waste comes off the cutting room floors, selvage, mistakes (re-cuts) or as excess or unsold inventory.

To no surprise, technology recently has entered the sorting domain. Textiles for Textiles (T4T), originally a project under the European Commission's Eco-Innovation, has turned to near infrared (NIR) spectrometry to bring sorting into the 21st century. The spectrometer works by projecting a beam of light through an extremely fine grating, thus separating it into its component colors. NIR is found just outside of the red part of the color spectrum, not visible to the human eye. This light is then projected on the recycled clothing or other textiles moving along on a conveyor belt at two meters or 6.6 feet per second.

Engineers operate the newest textile sorting NIR spectrometer in the center of the image. Courtesy: Wieland Textiles B.V., Wormerveer, The Netherlands

There is no other special preparation needed. The light non-invasively penetrates the materials in the same way a campfire's near infrared light warms you through your clothing. In this case, the recycled materials do not heat up but the reflected light energy coming off the textiles are identified by their characteristic light absorptions. These light absorptions are then matched against a comprehensive database containing absorption characteristics for polyester, nylon, silk, cotton, poly-cotton, rayon, wool, acrylic, etc. plus millions of colors. So after passing through the NIR light, the sorting machinery quickly separates the textiles by content and color, thereby saving time and skilled workers from repetitive tasks.

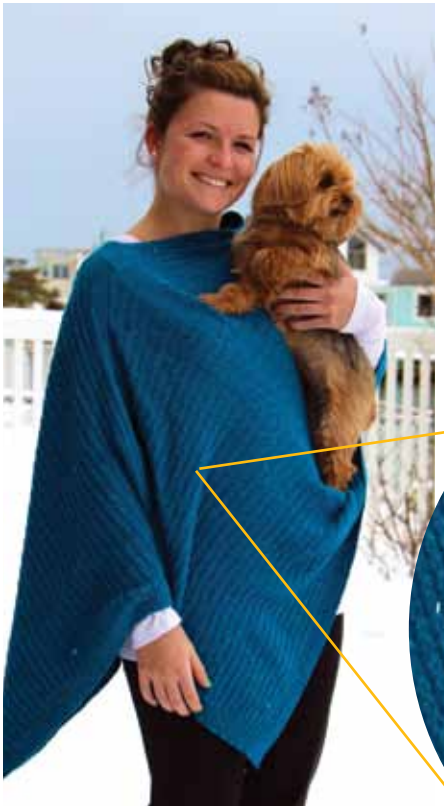
At this time, the automatic sorting machine recognizes four monostreams: polyester, cotton, wool and acryl, says Noor van Steden, of KICI, an innovative Dutch recycling company with a sustainable development mindset. "So, the output is pure fractions, which can be used for making new clothes," she continues. "Our next step is to optimize the machine so it will recognize blends of textiles, too."

Regardless of the sorting method, the next step is to shred the collated textiles or clothes using a stripping machine. Additional fibers might be added at this point depending on the end use of the yarn.

Next, the fibers are carded. This process takes the shredded textile's emerging fibers through fine bent wires, pulling them further apart, cleaning them and straightening them into slivers. The slivers are gathered into loose webs where they undergo a few more processes before being re-spun into yarn.

Due to the recycled nature of the yarn's source, the end product is composed of short staple fibers with random qualities. Therefore, many mills add virgin materials to lengthen the staple, improve the hand (feel) and increase the strength. In2green's Zelden takes what some would consider a shortcoming and matches her products to the repurposed fiber or yarns.

"Recycled cotton blend yarns are mostly offered in the coarser counts, so we tend to make heavier-weight



In2green's recycled cotton Eco Cable Knit Poncho: 75% recycled cotton yarn/20% polyester/5% other; made in the USA

products," she explains. "Lighter, finer weights for apparel and home furnishings are not possible."

For Zeldin and her design team, they have many options on the goods they select for their products. For fiber content, Zeldin states, "The yarn we run typically has above 75 percent post-industrial recycled cotton and of the remaining fiber, mostly polyester. This is a mix of virgin, post-consumer from bottles and post-industrial re-fiberized."

Finishing the yarns completes the process. Since the recycled yarns are dyed from their previous lives, a designer has two choices: either going with the available colors, which saves time, money and the environmental impact of the dying process, or the yarns can be re-dyed. Zelden prefers the recycled look. "We also love the colors that come from blended color, rather than package dyed color; our colors have depth and mélange/heather appearances."

Regardless of the finish, the results are a unique cotton blend which retains most of the benefits of virgin cotton but with a lower environmental cost. The reason being is recycled cotton lowers the carbon footprint by saving additional energy required to plant, irrigate, harvest, transport, process (ginning and spinning) and

dye virgin material. It also eliminates the associated water, air and gin emissions and additional cropland wind erosion.

Spanish textile research firm AITEX quantitatively defends this in a lifecycle assessment (please see *Green Glossary*, page 48) commissioned by Canadian apparel company EcoGear. The study compares recycled cotton verses conventionally grown cotton. AITEX concludes, "to manufacture recycled cotton yarn (80% cotton/20% polyester), not only is there a savings in chemical products, savings in water consumption, savings in the amount of land used for cultivation, which could be put to another agricultural use, but in addition, energy savings is over 17 percent."

AITEX goes further by stating, "it could be said that where recycled cotton yarn is used (80% cotton/20% polyester) as opposed to fully certified organic cotton yarn, there is even less impact on the environment."

There is no doubt switching from conventional cotton to organic cotton production will help in reducing cotton's environmental footprint. However, the EPA's estimates for Municipal Solid Waste for 2012 show recovered textiles make up only 16 percent of total textile waste. Of the 16 percent, it was not clear what portion was actually recycled into new fibers or yarns. Given that, perhaps from a carbon footprint standpoint, we need to take a closer look at recovering cotton for reprocessing to fibers.

With worldwide demand for organic cotton growing, using reclaimed cotton has the potential to ease the demand for a greener alternative to conventionally grown cotton. At the very least, it warrants a role as a complementary solution to the supply chain's environmental challenges.

Recycled vs. Conventionally Grown Cotton

	Conventional Cotton	Recycled Cotton	% Difference
Energy consumption kilowatt-hour/metric ton	2,984.8	2,472.3	17.2%
Fertilizer kilograms/metric ton	194.4	0	-
Pesticide kilograms/metric ton	0.3	0	-
Colorants kilograms/metric ton	5.26	1.05	80%
Additional chemicals kilograms/metric ton	15.39	3.08	79.9%
CO2 emissions kilograms/metric ton	292.27	58.5	79.9%
Water consumed liters/metric ton	6022	1204.4	80%

Source: AITEX; EcoGear