

A close-up photograph of cotton bolls on a branch, with some bolls in sharp focus and others blurred in the background. The cotton is white and fluffy, and the leaves are brown and dried.

COTTON UNIVERSITY™ PRESENTS

# Life Cycle Assessment *of Cotton*

WEBINAR



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Cotton LEADS™ is a  
program committed to  
responsibly-produced cotton.

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[www.cottonleads.org](http://www.cottonleads.org)

# Today's Webinar

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## Q&A

Type your questions in the Q&A window at any time during the webinar.



## Twitter

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Ask questions.  
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## Website

Link to webinar slides, Q&A, and other resources.

Please **turn off your pop-up blocker** to participate in this webinar.

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# Life Cycle Assessment *of Cotton*

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# Life Cycle Assessment Process





# Study Goals

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1. Support users of cotton and cotton-derived products with current and accurate life cycle inventory (LCI) data for cotton fiber production, textile processing, and consumer use.
2. Monitor progress and measure changes for continuous improvement.
3. Guide decisions about current research priorities and new research initiatives.

# Cotton LCA Phases

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## Agricultural Production



## Textile Manufacturing



## Consumer Use & Disposal



# Data Quality and Integrity

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- Data reviewed by:
  - Cotton Incorporated Staff
  - thinkstep
- Reported data was also examined for parity with 2010 LCA data collection
- ISO Compliant Process - ISO 14044
- Critically Reviewed – Panel led by Dekra



# LCA Impact Definitions

Technical Term	Example Impact
Acidification Potential (AP)	Acid rain
Abiotic Resource Depletion (ADP)	Mineral consumption
Eutrophication Potential (EP)	Nutrient loading to stream
Global Warming Potential (GWP)	Green house gas emitted
Primary Energy Demand (PED)	Fossil fuel use
Photochemical Ozone Creation Potential (POCP)	Smog
Blue Water Use (BWU)	Water removed to generate power
Blue Water Consumed (BWC) (Net Volume)	Water evaporated in dryer
Ecotoxicity Potential (ETP)	Plant and animal health
Human Toxicity (non-cancer) Potential (HTPnc)	Human health
Human Toxicity (cancer) Potential (HTPc)	Human health
Human Health Particulate Air (PM2.5)	Lung diseases





# Agricultural Phase

# Cotton Production Data Collected

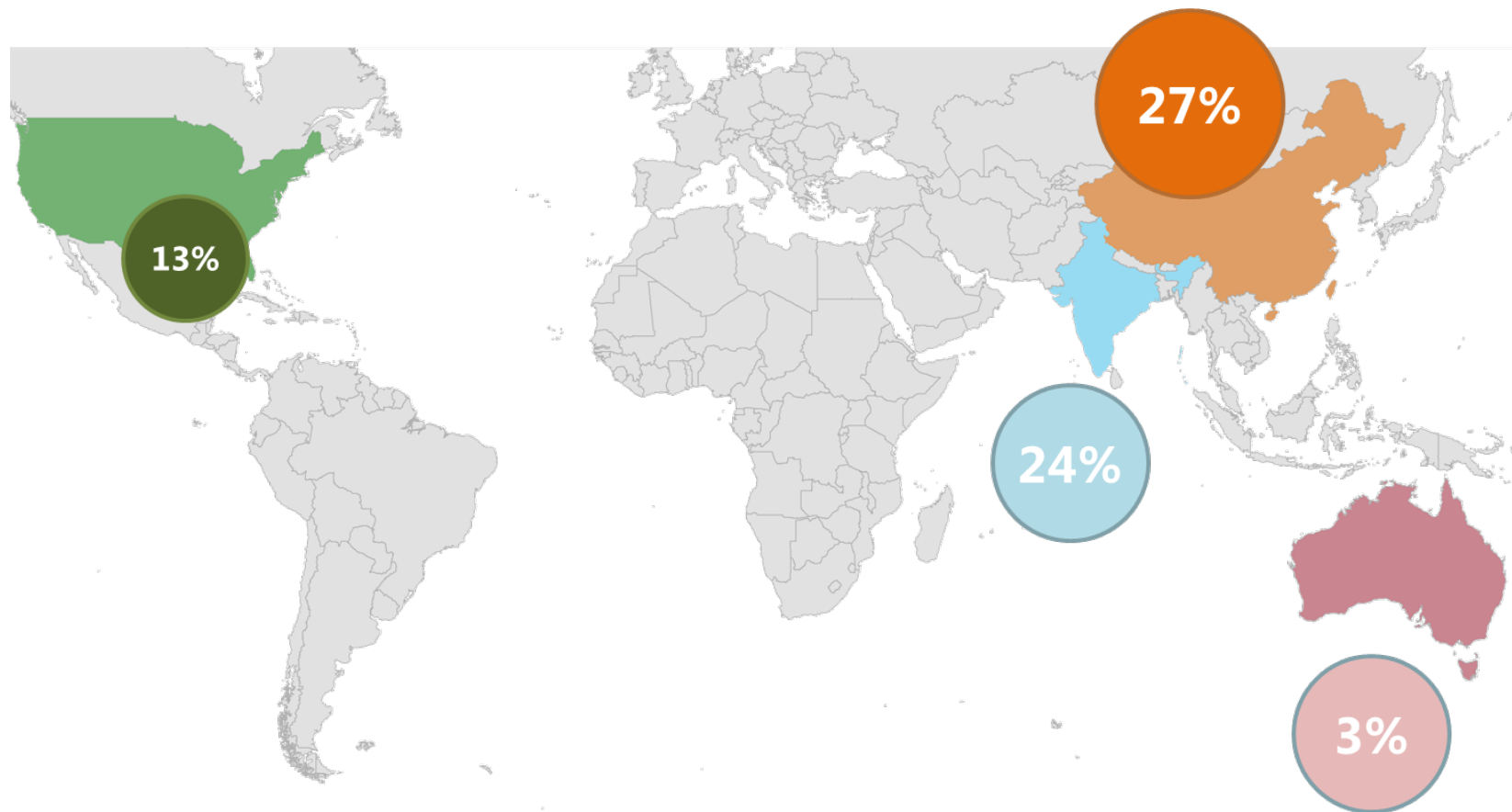
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- Soil Data
- Climatic Data
- In-season Field Practices
  - Fertilizer Rates (N, P, K)
  - Tillage Practices
  - Pumping Energy – ASABE
  - Water Use
  - Fuel Use - ASABE
- Ginning Data
  - Energy (electric and gas)
  - Packaging Materials



# Cotton Growing Countries Characterized

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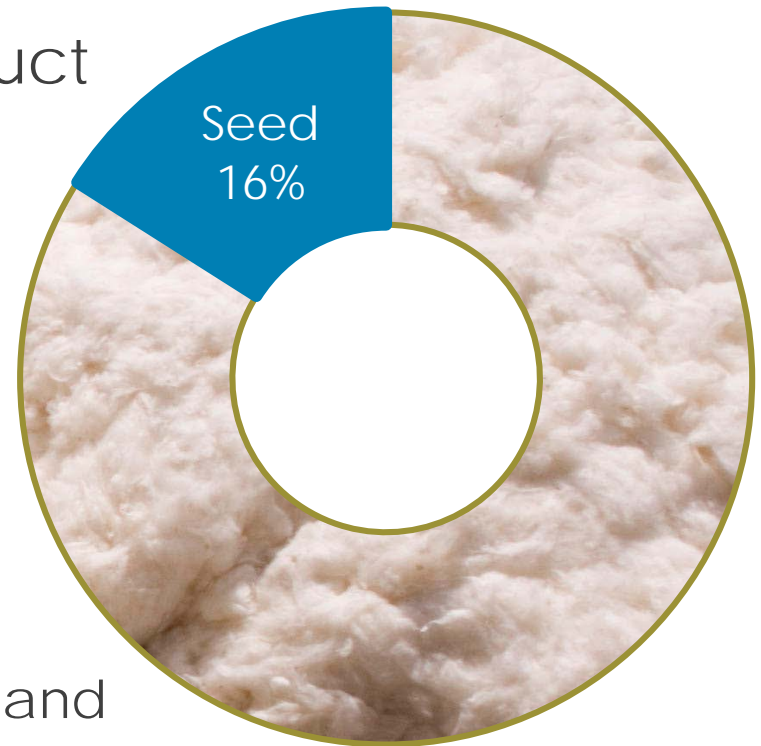


- Represents 67% of World Cotton Production for Study Period of **2010 to 2014**.
- Source: USDA, FAS, Production, Supply and Distribution Online

# Allocation of “Burden”

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- The LCI only considers cotton fiber
- Cottonseed valuable co-product
  - 1.4 kg seed per kg of fiber
- Use “economic” allocation (value of product used to assign environmental burden)
- Based on U.S. value 2010 to 2014
  - Constant applied across regions and countries







# Textile Manufacturing

# Textile Data Collection

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# Textile Data Collection

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- Representative sample of 13 mills
- Regions
  - Turkey
  - Latin America
  - Indian subcontinent
  - Southeast Asia
  - China
- 7 wovens and 6 knits

# Textile Unit Processes

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## Knit Product Processes



```
graph LR; A[Yarn Production] --> B[Knitting]; B --> C[Preparation]; C --> D[Batch Dyeing]; D --> E[Finishing]; E --> F[Compacting];
```

Yarn Production → Knitting → Preparation → Batch Dyeing → Finishing → Compacting

## Woven Product Processes



```
graph LR; A[Yarn Production] --> B[Beam / Slashing / Drying (Warp)]; B --> C[Weaving]; C --> D[Preparation]; D --> E[Continuous Dyeing]; E --> F[Finishing]; F --> G[Sanforizing];
```

Yarn Production → Beam / Slashing / Drying (Warp) → Weaving → Preparation → Continuous Dyeing → Finishing → Sanforizing



# Cut and Sew Methodology

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- Energy usage factors for cut-and-sew of casual pant and knit shirt provided by [TC]<sup>2</sup>
- High- and low-end garments were deconstructed to determine average weight



T-SHIRT  
225 G



KNIT  
POLO SHIRT  
305 G



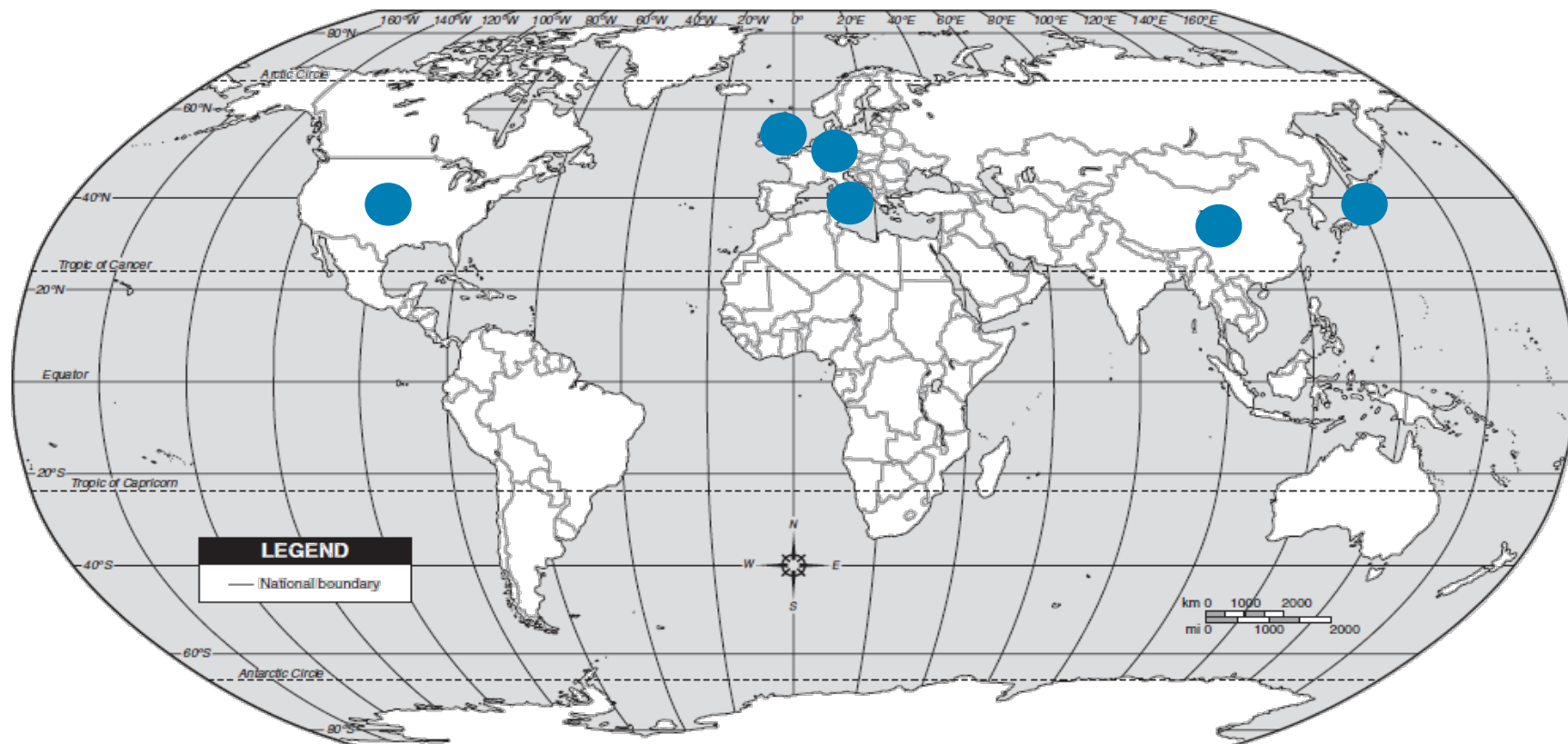
WOVEN  
CASUAL  
PANTS  
513 G



Consumer Use

# Consumer Use Methodology

A total of 6,041 interviews were conducted.  
~1,000 per country



1.) United States  
4.) Italy

2.) United Kingdom  
5.) China

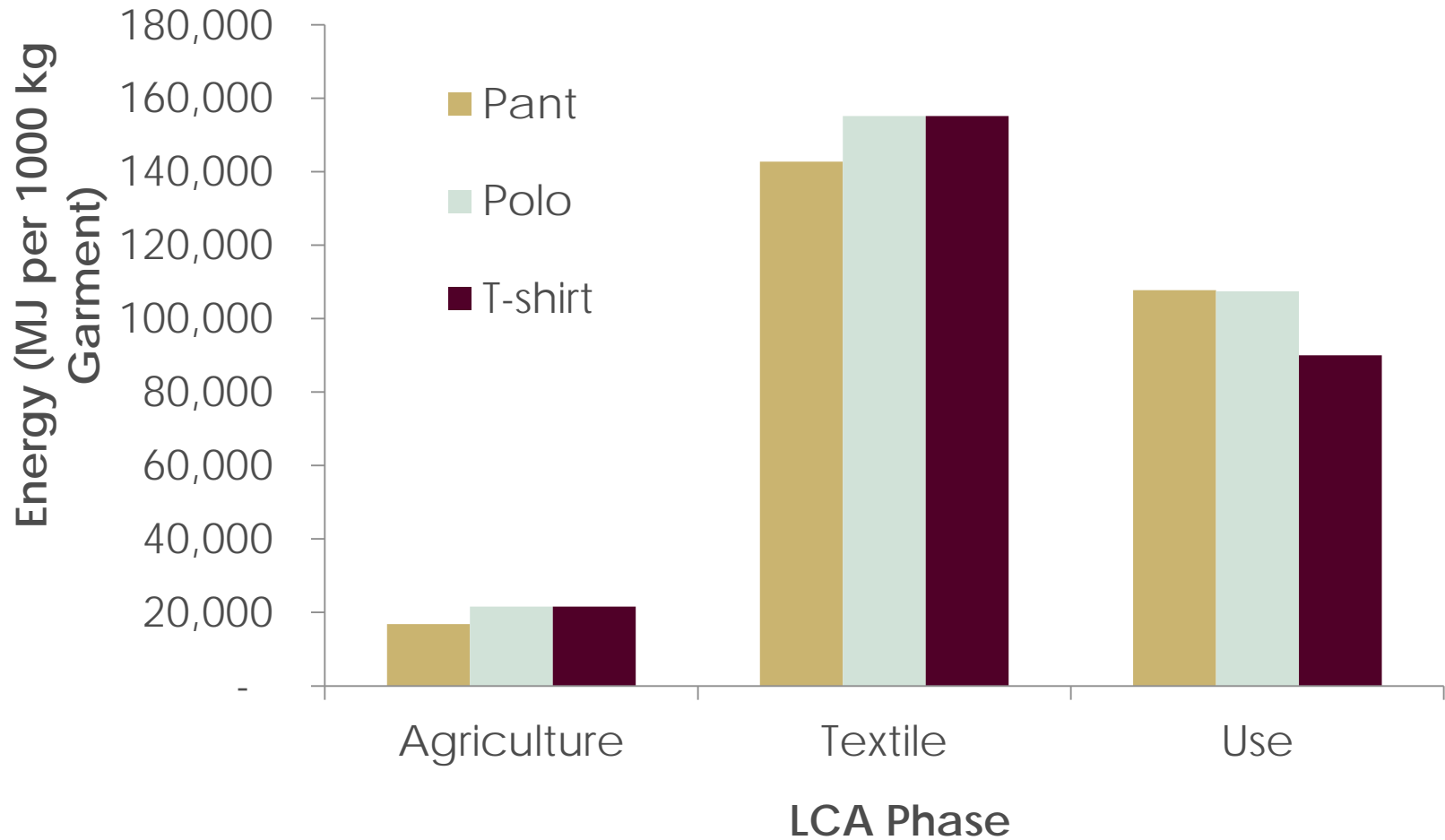
3.) Germany  
6.) Japan

# RESULTS

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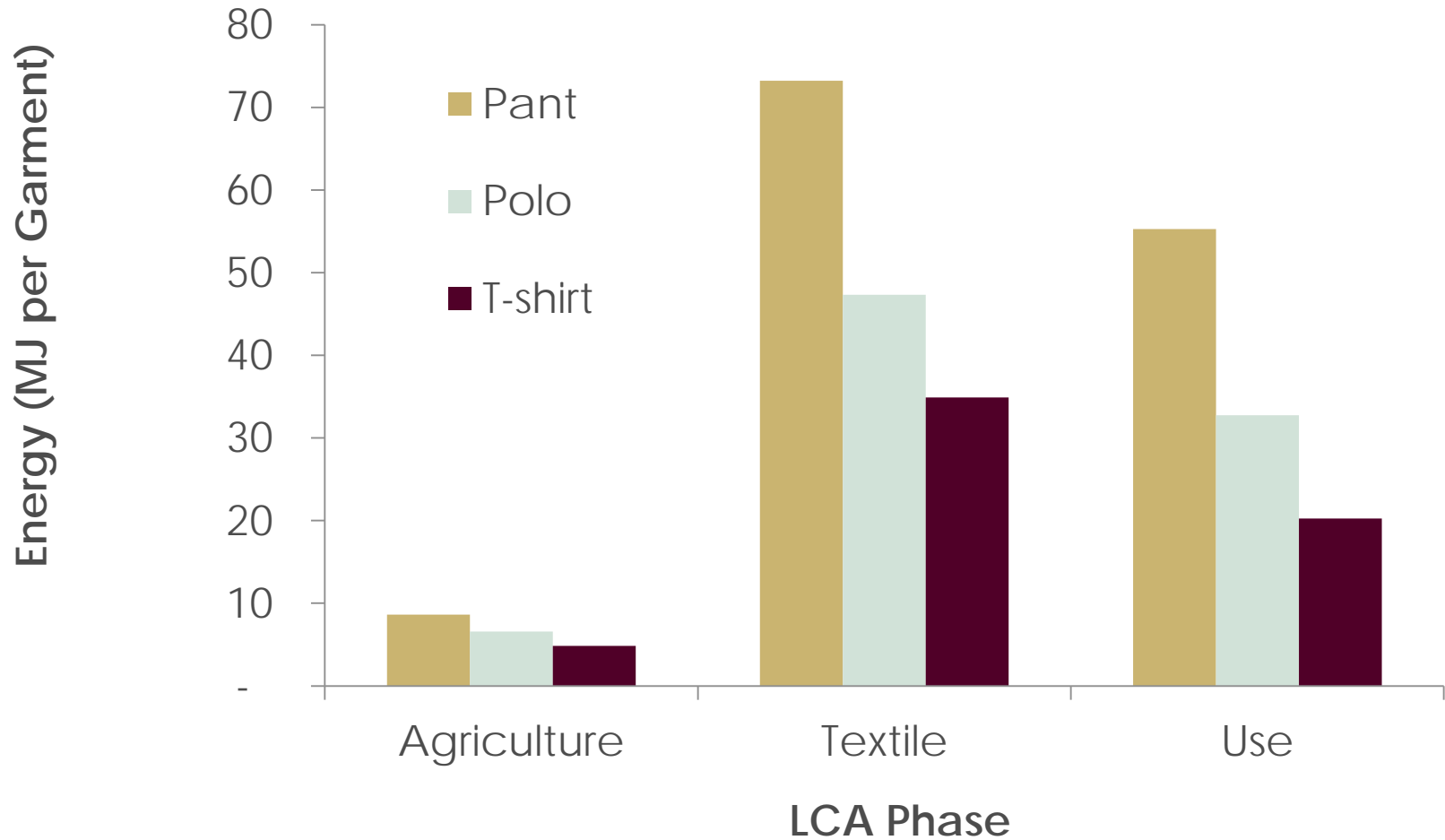


# Product Comparison: Energy Use per 1000 kg

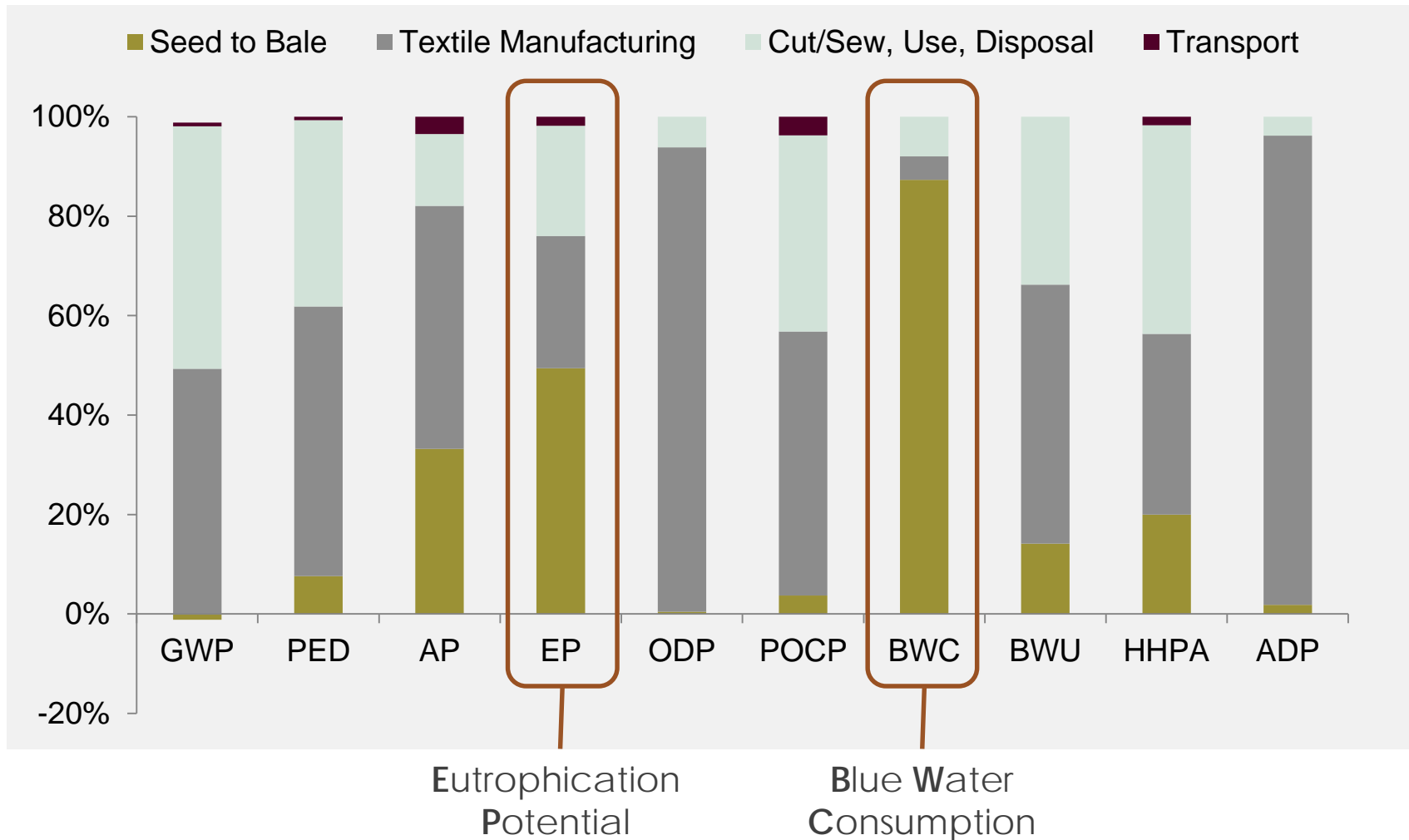




# Product Comparison: Energy Use per Garment



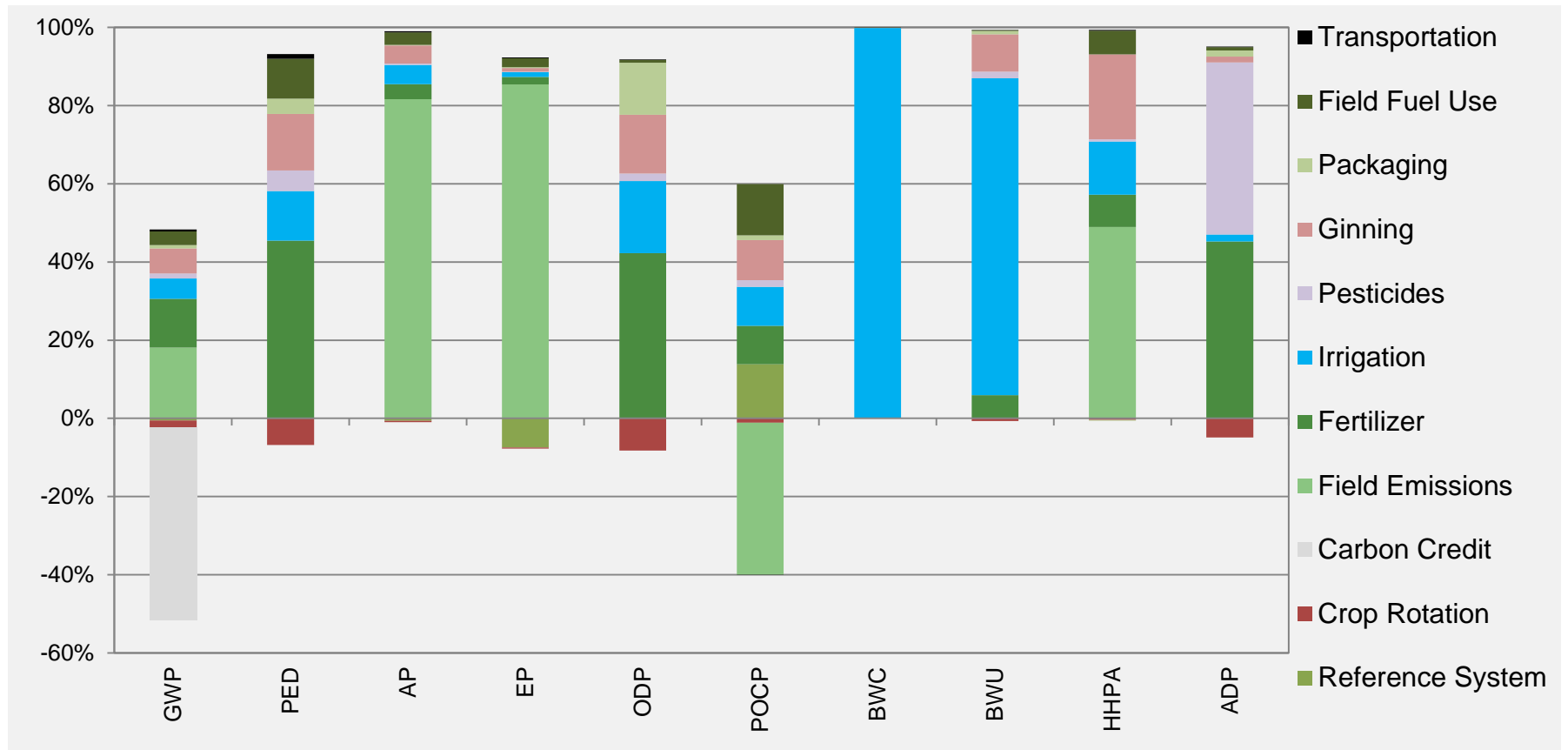
# Overall Results for a Knit Collared Shirt





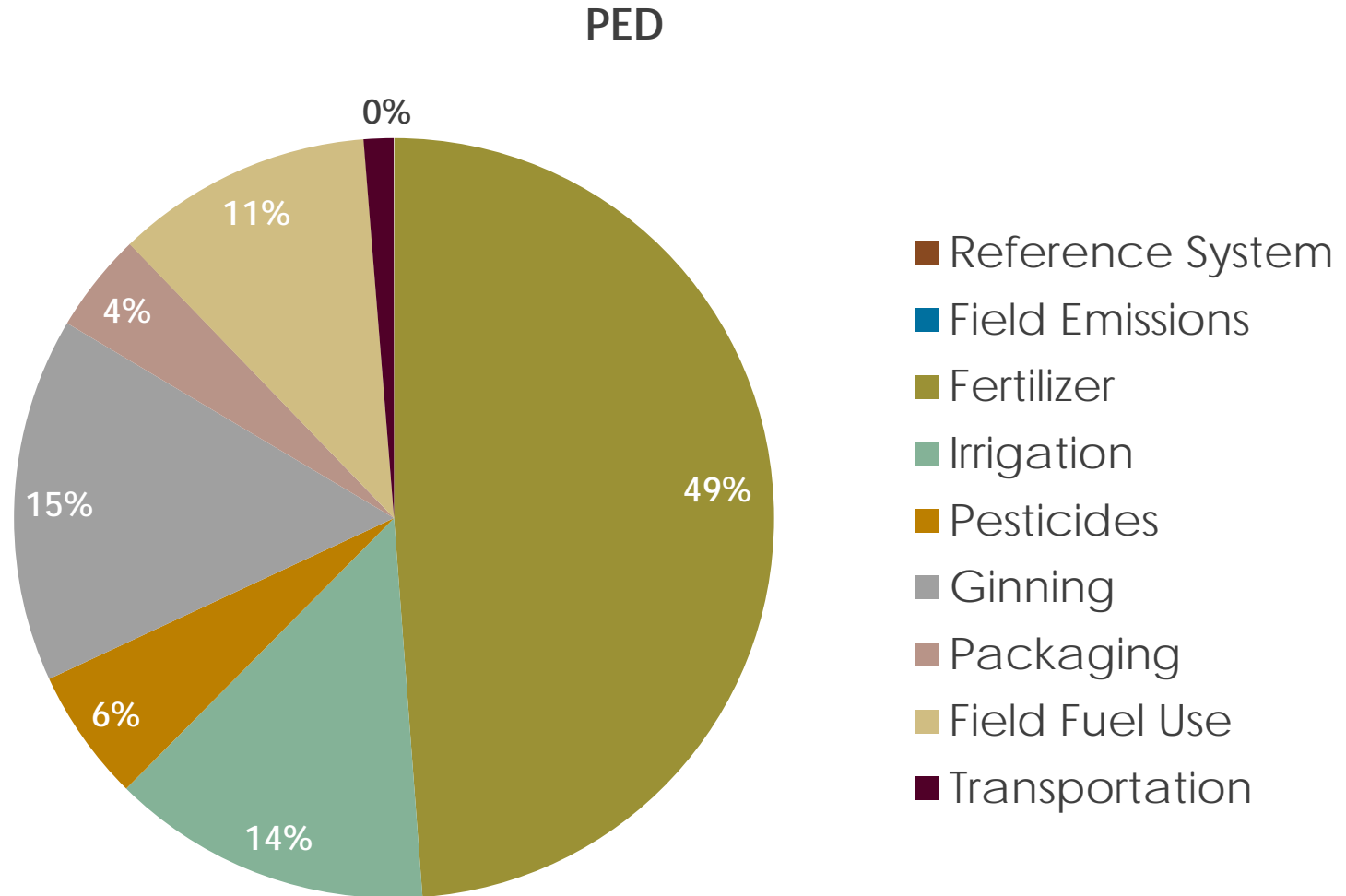
# Agricultural Phase RESULTS

# Agricultural Phase Details



# Energy Details – Agricultural Phase

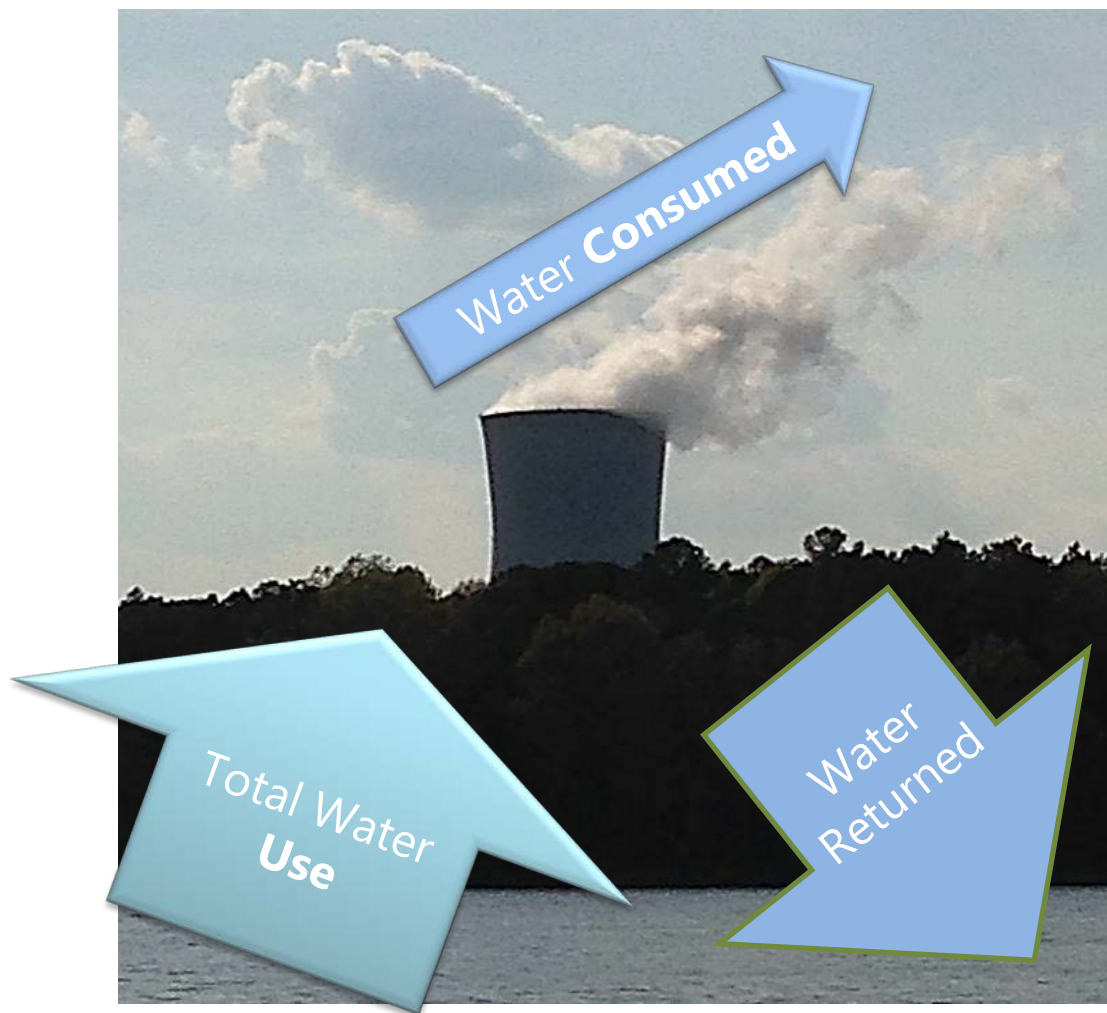
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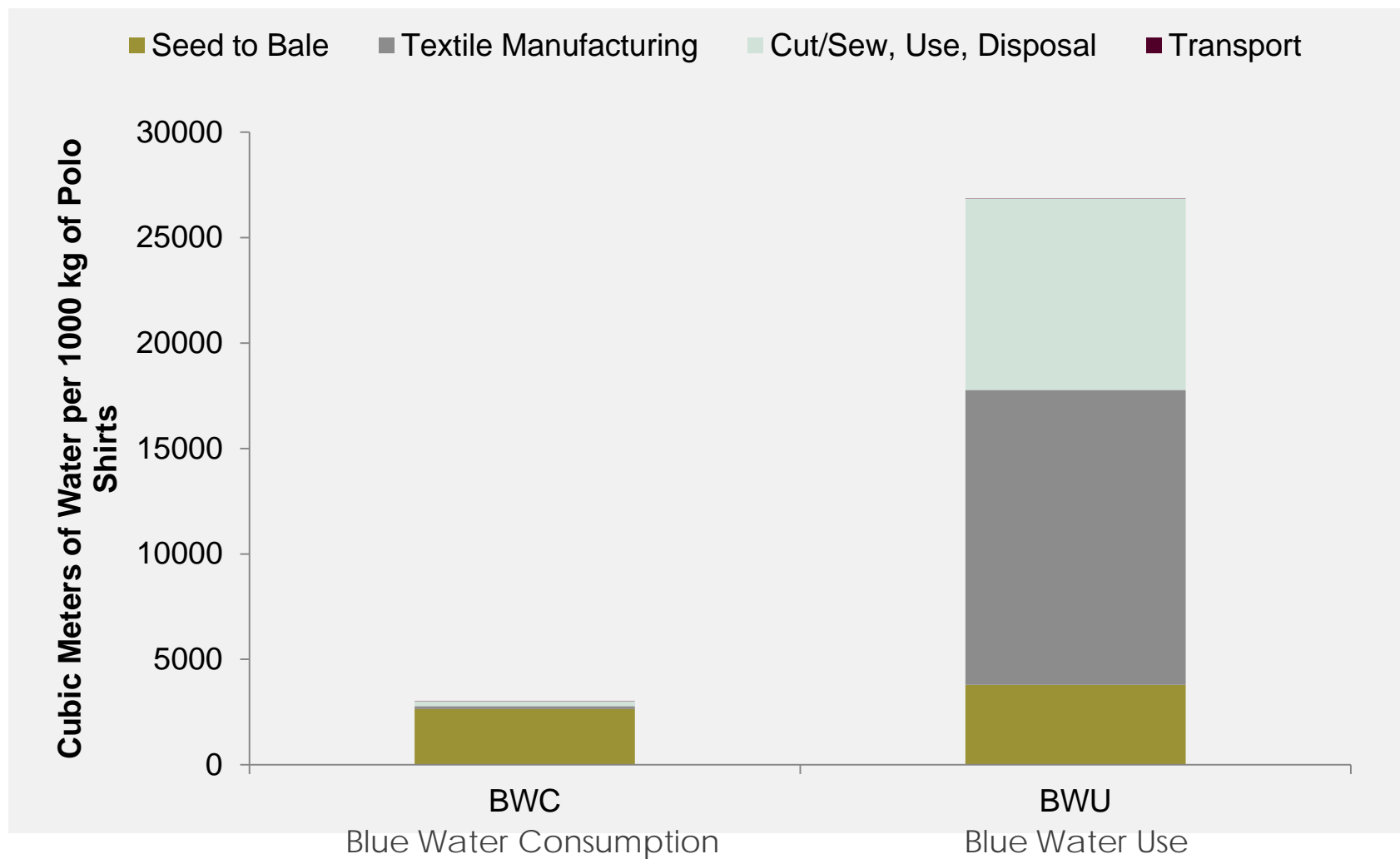


# Water Metrics

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# Water



# Agricultural Research Directives

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- Precision **nitrogen** and **water** management.
- Increase winter cover crop use.

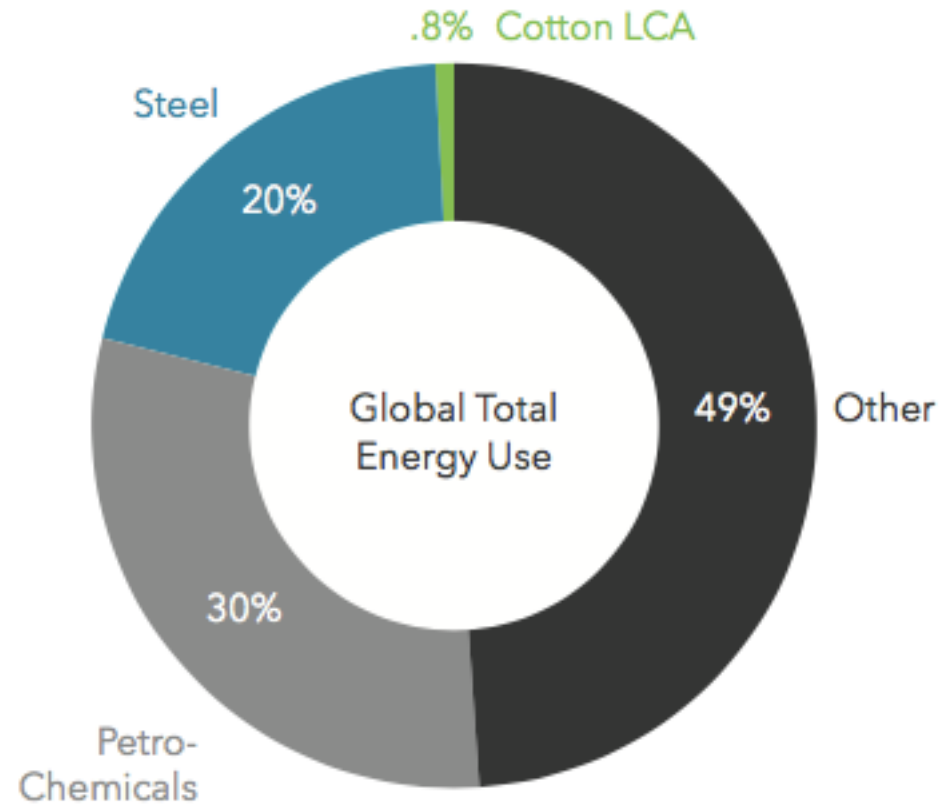




# Results in Context

# Energy Results in Context

- If all of the cotton in the world were manufactured into a knit shirt and laundered 20 times, the energy and green house gas emissions are less than 1% of humanity's annual impact.



Data for global energy use via [www.eia.gov](http://www.eia.gov)





# CORE 5 PRINCIPLES OF COTTON **LEADS**<sup>™</sup>

## **COMMITMENT**

to the social, environmental, economic and regulatory factors required to produce world-class cotton.

## **RECOGNITION**

that sustainable and responsible cotton production requires continual improvement, investment, research and sharing of best practices information among growers and industry.

## **UNDERSTANDING**

that leading change in responsible and sustainable cotton practices will have the most positive impact when implemented in collaboration among farm, regional, national and international programs.

## **BELIEF**

in the benefit of working cooperatively with similar programs that seek to advance responsible and sustainable cotton production in an effort to keep global cotton competitive in world fiber markets.

## **CONFIDENCE**

in cotton identification systems that ensure traceability from farm to manufacturer.

# Submit Your Questions

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**Please submit all final questions now.**

Questions may be submitted through the Q&A box on your screen or by tweeting to **@Cotton\_Univ.**

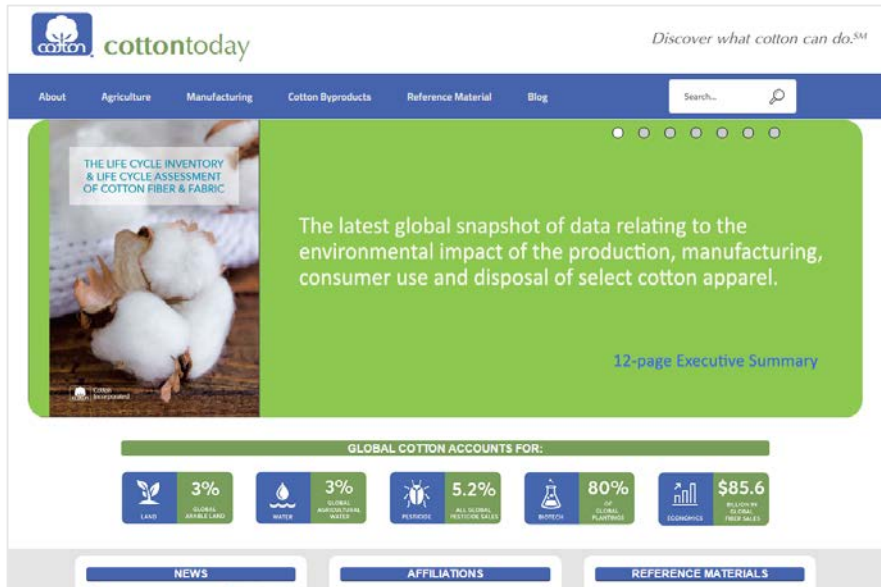
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# Additional Resources



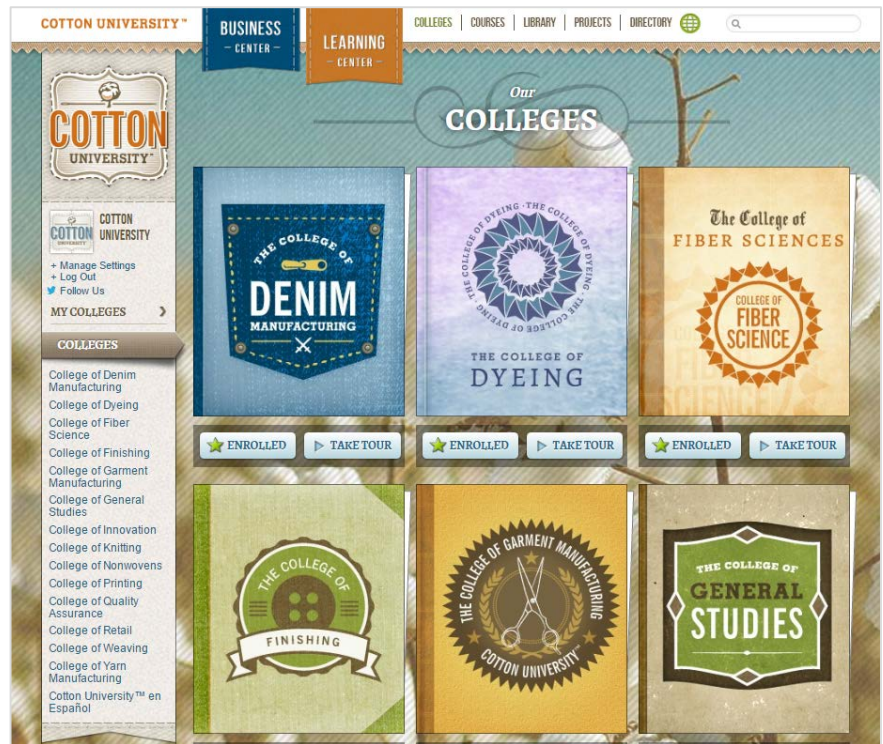
**Cotton Today**  
cottontoday.cottoninc.com



**Cotton Sustainability**  
cottonuniversity.org



# Find this webinar at CottonUniversity.org.



Look for this webinar in the  
College of Fiber Science and the  
Cotton Sustainability resource.

ADDITIONAL WEBINAR RESOURCES  
Webinar slides for download + Additional Q&A



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