

METHODOLOGY

for environmental cost calculations

The Footprint Chronicles reports on the results of Patagonia's efforts to track key environmental issues across our products' supply chains. We have chosen to focus our efforts on a wide range of styles that we expect will be offered in our line for years to come. Numerous components and materials are used to make each garment, so our focus is on primary materials. We chose to include secondary materials (e.g. linings) or trims (e.g. buttons and zippers) when these materials make up a significant portion of the product. In our analysis we made an effort to account for 95 percent of a garment's weight. Tracking key environmental metrics for the primary material provides a reasonably complete picture of the product, while keeping the task manageable.

Metrics

The metrics we are tracking in the Footprint Chronicles are:

- Energy consumption
- CO₂ emissions
- Waste generation
- Water use

We began tracking water use in 2009. The products added to the Footprint Chronicles in April include this metric. The product analyses that were completed prior to 2009 do not include water use information.

For this project, the supply chain and the metrics have been defined in the following way:

Supply Chain

The boundaries of the supply chain start at the origin of the primary material (the agricultural field for the fiber source in the case of our cotton, the ranches for our wool and leather products and the polymer for synthetic products) and go through each step in the production of a garment, from fiber to yarn to fabric to finished garment. The supply chain ends when the garment reaches the Patagonia Distribution Center in Reno.

Energy Consumption

The energy consumption metric includes energy consumed

throughout the supply chain. It includes two main components: energy consumed from fuel use during transport and energy consumed at each of the facilities in the supply chain. The energy used in the various facilities involved in this supply chain come from a variety of fuel sources. All energy consumption is converted to megajoules (MJ). Energy consumption does not include the feedstock energy value of the primary material (e.g. the energy content of polyester).

CO₂ Emissions

This metric includes the CO₂ emissions (and related greenhouse gas emissions) that result from transportation and facility energy use in the product supply chain. The CO₂ emissions were calculated using the GHG (Greenhouse Gas) Protocol calculation tools. All emissions are reported in pounds/kilograms (kg) of CO₂ equivalent.

Waste Generated

The waste generated includes the solid waste that results from each step in the production processes. The waste does not include liquid, hazardous or packaging waste. Waste is reported in ounces/grams.

Water Use

Water use information includes the total water consumed in each step of the production process. The water use metric does not account for water recycled or discharged in the manufacturing process. Water use is reported in liters.

Reporting Unit

All metrics are reported as the amount per garment of each style (e.g. MJ/garment).

Data Collection

We queried vendors who manufacture Patagonia's fabrics and garments about annual energy use, the type of energy used, the quantity of product produced by the facility in one year, the waste generated and the water used during production. We requested

that vendors provide actual production information specific to their facility. Where vendor data could not be obtained, we used life-cycle data provided by Bluesign Technologies AG, as well as additional LCA (life-cycle analysis) studies. In most cases, vendors were able to provide annual energy and water use and waste generation data for their production processes.

Calculation Methodology

We calculated the energy consumption of our vendors' portion of the life cycle with production information from vendors and our own production department (units produced, yield and efficiency). The energy use per unit of production was calculated using annual energy use and annual production data for all facilities involved in the garment production process. GHG Protocol calculation tools were used with the calculated energy to determine CO₂ emissions. The vendor information was also used to calculate the waste generated during cutting and sewing operations for each specific garment. All calculations were normalized to one garment per style. Transportation impacts were calculated by estimating the ton-miles traveled by the primary materials and garments, through the individual supply chains from the point of origin, until the product reaches the Patagonia Distributing Center in Reno (normalized to one garment per style). The distance-traveled calculations include all transport modes used across the entire supply chain (see Transportation Appendix). For example if a garment is shipped from the manufacturer in Japan to Reno, the distance traveled includes the transport via truck from the sewing facility to the port in Japan, from Japan to San Francisco by boat and then from San Francisco to Reno by truck. Shipping weights were determined from fabric quantities for each style (calculated using Patagonia style-specific production data) minus the calculated waste generated in each step of the supply chain. The GHG Protocol calculators and conversions were used to determine transportation-related CO₂ emissions.

Transportation Calculations

Units/Conversions. All energy values are reported in megajoules (MJ) and all carbon dioxide emissions are measured in pounds/kilograms (kg) of CO₂ equivalent. Distances are reported in miles.

Geographic Distances. The distances between international

locations were obtained from the following source: www.map-crow.info/. These distances are calculated based on straight-line regression between two points of latitude and longitude, and therefore represent the shortest possible distance between them. The distances within the United States were calculated using www.google.com and www.mapquest.com. These distances are calculated using major highway routes and should be representative of actual driving distances.

Transportation Energy and CO₂ Emissions

Calculations. The energy and emissions calculations were based on information from the Greenhouse Gas Protocol Initiative's website: www.ghgprotocol.org. This website provides a calculation tool for CO₂ emissions from mobile combustion. Within this worksheet, the following conversions were found:

Table 1. Fuel Efficiency and CO₂ Emissions by distance

Mode of Transport	Metric ton-miles per gallon	CO ₂ Emissions per metric ton-mile
Automobile	(19 mpg average)*	0.4746 kg
Truck	91	0.1139 kg
Train	320	0.0316 kg
Local Ship	184	0.0563 kg
Marine Ship	640	0.0161 kg

*The efficiency of the automobile is given in vehicle miles per gallon, not metric ton-miles per gallon, because in this case automobiles are not carrying one metric ton.

Table 2. Energy and CO₂ Emissions by fuel energy

Fuel Type	Energy Content (mega joules) per gallon	CO ₂ Emissions per MJ
Gasoline	130 MJ	0.069 kg
Diesel	140 MJ	0.074 kg

The CO₂ emissions from these charts are converted from kilograms (kg) to metric tons by dividing by 1000.

