METHODOLOGY
for Environmental Cost Calculations

The Footprint Chronicles reports on the results of Patagonia's efforts to track key environmental issues across the supply chains of our products. For the first round of products in the Footprint Chronicles, we chose five styles representing a wide range of products that we expect will continue to be offered for years to come: the PBL Wool 2 Crew, Synchilla® Vest, Men's Polo Shirt, Eco Rain Shell Jacket (men's and women's), and Honey Dew Shoe. Numerous components make up each garment. Our focus is on the primary material used in each garment. We chose not to include secondary materials (e.g., linings) or trims (e.g., buttons and zippers), except for the Eco Rain Shell jacket, where the outer shell and the mesh lining make up equally significant portions of the garment.

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
- CO_2 emissions
- Waste generation

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 goes through each step in the production of a garment from fiber to yarn to fabric to finished garment and ends when the garment reaches the Patagonia Distribution Center in Reno.

Energy Consumption

The energy consumption metric includes energy consumed through out 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 mega joules (MJ). Energy consumption does not include the feedstock energy value of the primary material (e.g., the energy content of polyester).

CO_2 Emissions

This metric includes the CO_2 emissions (and related greenhouse gas emissions) that result from the transportation and facility energy use in the product supply chain. The CO_2 emissions were calculated using the GHG (Greenhouse Gas) Protocol calculation tools. All emissions are reported in pounds/kilograms (kg) of CO_2 equivalent.

Waste Generated

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

Reporting Unit

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

Data Collection

We queried the Patagonia vendors that manufacture the fabrics and garments for the five Patagonia products about annual energy use, the type of energy used, the quantity produced by the facility in one year and the waste generated 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 as well as additional LCA (life-cycle analysis) studies. In nearly all cases, vendors were able to provide annual energy use and waste data for their production processes.

Calculation Methodology

The production information provided by the vendors along with Patagonia's production data (units produced, yield, and efficiency) were used to calculate energy consumption for the vendors' portion of the life cycle. We calculated the proportion of the annual factory energy use that reflect the number of units of the specific garment against the total number of units produced in that factory for Fall 2007 and Spring 2008. The GHG Protocol calculation tools were used with the calculated energy to determine CO_2 emissions. The vendor information was also used to calculate the waste generated during the cutting and sewing operations for each specific garments. 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 port to Los Angeles port by boat and then from the Port of Los Angeles to Reno by truck. Shipping weights were determined from fabric quantities for each style calculated using Patagonia style-specific production data for Fall 2007 and Spring 2008, minus the calculated waste generated in each step of the supply chain. The GHG Protocol calculators and conversions were used to determine transportation-related CO_2 emissions.

Transportation Calculations

Units/Conversions. All energy values are reported in Mega Joules (MJ) and all carbon dioxide emissions are measured in metric tons. All other weight measurements are also measured in pounds/kilograms (kg). Distances are reported in miles.

Geographic Distances. The distances between international locations were obtained from the following sources: www.indo.com/distance/index.html; www.mapcrow.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. Distances were rounded up to the nearest increment of 10 or 100.

Transportation Energy and CO_2 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 CO_2 emissions from mobile combustion. Within this worksheet, the following conversions were found:

Table 1. Fuel Efficiency and CO_2 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 most automobiles cannot carry one metric ton.

Table 2. Energy and CO_2 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 CO_2 emissions from these charts are converted from kilograms (kg) to metric tons by dividing by 1000.