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Six Products, Six Carbon Footprints

Everybody's talking about it. But what exactly is a carbon footprint? And how is it calculated?

By JEFFREY BALL

A new concept is entering the consumer lexicon: the carbon footprint.

First came organic. Then came fair trade. Now makers of everything from milk to jackets to cars are starting to tally up the carbon footprints of their products. That's the amount of carbon dioxide and other greenhouse gases that get coughed into the air when the goods are made, shipped and stored, and then used by consumers.

So far, these efforts raise as many questions as they answer. Different companies are counting their products' carbon footprints differently, making it all but impossible for shoppers to compare goods. And even if consumers come to understand the numbers, they might not like what they find out.

For instance, many products' global-warming impact depends less on how they're made than on how they're used. That means the easiest way to cut carbon emissions may be to buy less of a product or use it in a way that's less convenient.

So, what are the carbon footprints of some of the common products we use? How are they calculated? And what surprises do they hold? What follows is a look at six everyday items -- cars, shoes, laundry detergent, clothing, milk and beer -- and the numbers that go with them.

But first, here's a number that will help you put all those carbon footprints in perspective. The U.S. emits the equivalent of about 118 pounds of carbon dioxide per resident every day, a figure that includes emissions from industry. Annually, that's nearly 20 metric tons per American -- about five times the number per citizen of the world at large, according to the International Energy Agency.

Now, let's take a closer look at those six products.

CARS

The simplest statistic in the carbon-footprinting game may be this: For every mile it travels, the average car in the U.S. emits about one pound of carbon dioxide. Given typical driving distances and fuel-economy numbers, that

translates into about five tons of carbon dioxide per car per year.

A study by the University of Michigan's Center for Sustainable Systems found that, over its expected 120,000-mile life, an American-made midsize sedan emits the equivalent of about 63 tons of carbon dioxide. That number includes all emissions, from the making of the car's raw materials, such as steel and plastic, through the shredding of the car once it's junked.

The vast majority of those emissions -- 86% -- came from the car's fuel use, the study found. Just 4% of emissions came from making and assembling the car. That means consumers can lower their footprint by buying a car with better fuel economy.

Sometimes, the differences between models can be substantial. For one overview of how cars stack up, consider a new computer model paid for by Toyota Motor Corp. that computes the lifetime carbon footprints of about 400 auto models from multiple manufacturers.

To narrow things down, consider a handful of Toyota's own models. The Prius, a hybrid gasoline-and-electric car that averages 42 miles per gallon, has a lifetime carbon footprint of 44 metric tons, according to the updated computer model done for Toyota by Kreider & Associates, a consultant based in Boulder, Colo. The Corolla, a small sedan with a conventional gasoline engine rated at 29 miles per gallon, has a footprint of 64 tons. The Camry, a larger car rated at 23 miles per gallon, has a footprint of 95 tons. And the 4Runner, an SUV rated at 16 miles per gallon, has a footprint of 118 tons.

Gregory Keoleian, co-director of the Michigan center, says he used to advise people that the best way to minimize the carbon footprint of their driving was to keep their car as long as possible, since junking a car and manufacturing a new one produces pollution. But that was before hybrids hit the market and offered markedly better fuel economy. Now, he says, scrapping an old car in favor of a new model makes lots of sense.

The introduction of the hybrid "changes the whole dynamic," Mr. Keoleian says. "Then, you replace."

SHOES

You may think you're at one with nature going for a walk in the woods in your sturdy hiking boots. But those boots pack a lot of carbon. The big reason: the leather.

Timberland Co., a Stratham, N.H., shoe company with an outdoorsy image, has assessed the carbon footprint of about 40 of the shoe models it currently sells. The results range from about 22 pounds to 220 pounds per pair. Each of the shoes that has been carbon-footprinted comes with a label assessing its greenhouse-gas score on a scale of zero, which is best, to 10, which is worst.

Flip-flops tend to have footprints of 22 pounds to 44 pounds, says Pete Girard,

senior analyst for environmental stewardship at Timberland. Shoes typically range from 66 pounds to 132 pounds. Hiking boots typically pack between 154 and 198 pounds, Mr. Girard says.

Though Timberland produces many of its shoes in Asia and sells them in the U.S., it has found that transportation typically accounts for less than 5% of the carbon footprint. By far the biggest contributor is the shoe's raw material. "For most Timberland shoes," says Betsy Blaisdell, Timberland's manager for environmental stewardship, "leather really drives the score."

The average dairy cow produces, every year, an amount of greenhouse gas equivalent to four tons of carbon dioxide, according to U.S. government figures. Most of that comes not from carbon dioxide, in fact, but from a more-potent greenhouse gas: methane.

The cow's impact on the atmosphere is due largely to a process known scientifically as "enteric fermentation" -- and colloquially as burping. A cow's multiple stomachs make it particularly efficient at transforming feed into bovine products: meat, milk and hide. But all that churning also produces lots of methane -- a greenhouse gas that, pound for pound, is 25 times as damaging to the atmosphere as carbon dioxide, according to the United Nations. Converting those methane emissions into a carbon-dioxide-equivalent number is one step in calculating the cow's carbon footprint.

Take Timberland's Winter Park Slip On Boot. They're casual boots -- not as heavy as hiking boots -- but their uppers are all leather. Their footprint sits in the middle of the Timberland range, at 121 pounds per pair. Of that total, 8.5 pounds comes from the electricity used to make the boots at Timberland's factory in China's Guangdong Province. The remaining 112.5 pounds comes from the raw materials used to make the shoe: rubber for the outsole; ethyl vinyl acetate, or EVA, for the midsole; and, most of all, leather for the upper.

To come up with these numbers, Timberland first gets data from the factory on the amount of electricity the factory uses in a given period. Dividing that by the number of shoes the factory produces in that period yields a per-shoe energy-consumption figure.

Timberland then checks those figures against tables that list average carbon-dioxide emissions per unit of energy produced. The tables are tailored to the specific power-plant fuel mix in the area where the factory sits. In China, which makes much of its power by burning coal, the carbon hit is greater than in, say, France, which makes most of its electricity with nuclear power.

The harder part for Timberland is figuring out the emissions that come from the part of the process it doesn't control: the production of the raw materials before they get to the Timberland factory. Timberland gets that information from the databases of "life-cycle analysis" consultants, who put together tables showing the environmental impacts of producing given amounts of various materials, from rubber to polyester to leather.

Timberland's carbon-footprint calculations have prompted spats with some of Timberland's leather suppliers, Ms. Blaisdell says. They argue the carbon hit from a cow should fall not on their ledger, but on the ledger of beef producers. The leather producers reason that cows are grown mainly for meat, with leather as a byproduct, so that growing leather doesn't yield any emissions beyond those that would have occurred anyway.

But Timberland has determined that 7% of the financial value of a cow lies in its leather. And life-cycle-analysis guidelines used by Timberland say the company should apply that percentage to compute the share of a cow's total emissions attributable to the leather. "We've had a lot of battles with our leather suppliers over this," Ms. Blaisdell says. Timberland officials, she says, "just follow the guidelines."

Timberland officials concede shortcomings with their method. By using an average energy-consumption number for all pairs of shoes, the calculations fail to recognize that some shoes require more electricity to assemble in the factory than do others. And Timberland's calculations omit the carbon impact of the leather and other materials that fall to the cutting-room floor.

"No question, it's crude in some ways," Mr. Girard says. "But it's a step more information than our designers were making a decision on before."

LAUNDRY DETERGENT

The recipe for a low-carbon load of laundry: Use liquid detergent instead of powder, wash your clothes in cool water and hang them out to dry.

That's the message shoppers get when they walk down the detergent aisles at Tesco PLC stores in the U.K. Starting this spring, the retailer began slapping footprint-shaped carbon labels on Tesco-brand laundry detergent. Along with the carbon-footprint number, the label offers tips about lowering the score.

The carbon footprint of a load of laundry done with Tesco detergent varies from 1.3 pounds to 1.9 pounds, depending on what form of detergent is used, the labels report. According to Procter & Gamble Co., the average American family does about 300 loads of laundry per year, or about six loads per week. That suggests a per-family carbon footprint from doing laundry of about 480 pounds per year, or about 10 pounds per week. And that doesn't include running the dryer.

Solid capsules of detergent have the highest carbon footprint, according to Tesco. Powder has a slightly lower footprint; liquid has a lower one still; and concentrated liquid has the lowest of all. That's because making solid detergent uses more energy than making the liquid variety.

But consumers who care about their carbon emissions should do more than switch detergent forms, the labels advise. Doing the wash in cooler water -- 86 degrees Fahrenheit instead of 104 degrees -- will shave the carbon footprint of

each load by 0.3 pounds. That's as much of a reduction as you get from switching to liquid from powder.

The biggest way to cut the environmental impact of cleaning clothes, however, is to stop using a clothes dryer. Drying laundry outside on a line, Tesco says, will cut the carbon footprint of every load by a whopping 4.4 pounds.

Along with detergent, Tesco labels store-brand orange juice, light bulbs and potatoes. To trace the carbon footprints, Tesco uses data from its suppliers and information from life-cycle-analysis databases. The retailer is labeling products from its own brands first because those were the ones it could most easily control. But Tesco is considering labeling other brands, as well as expanding the effort to its U.S. stores, which operate under the Fresh & Easy name.

The suppliers that make the labeled products "don't see a risk" in publicizing information about the environmental impacts of their products, says Katherine Symonds, Tesco's sustainability manager. For one thing, all forms of the detergent come from the same suppliers, so those suppliers wouldn't necessarily be hurt if consumers shifted from one form to another.

Ms. Symonds adds that Tesco carefully picked for its initial labels products whose carbon footprints likely wouldn't shock consumers. The retailer purposely avoided labeling the carbon footprint of beef, for instance, because beef's carbon footprint is significantly higher than that of many other foods.

If Tesco had presented consumers "with a message that was so counterintuitive and difficult," Ms. Symonds says, "we might have found it difficult to take carbon labeling forward."

JACKETS

Patagonia Inc.'s Talus jacket looks like a naturalist's dream. In fact, its carbon footprint is 66 pounds. That, Patagonia notes on its Web site, is 48 times the weight of the jacket itself.

Over the past year, the Ventura, Calif., outdoor-equipment maker has computed and posted on its Web site the carbon footprints of 15 of its products. Because most of Patagonia's products are made in Asia or Latin America and sold in the U.S., the company expected that a big chunk of the carbon footprints came from transportation. It was wrong.

The fabric for the Talus is made in China, the zippers come from Japan, and the jacket is sewn in Vietnam. Yet all that transportation adds up to less than 1% of the product's total carbon footprint, Patagonia says. The majority of the footprint -- 71%, or about 47 pounds -- comes in producing the polyester, which originates with oil.

"If we had listened to the rhetoric out there at the time, which was all around miles, we could have spent years rearranging our supply chain to reduce transportation, when really that's not the bulk of our concern," says Jill Dumain,

Patagonia's director for environmental analysis. "There's a lot of reasons to have a tight supply chain, but environmentalism isn't one of them."

One way to slash the Talus jacket's carbon footprint would be to make it with recycled, rather than virgin, polyester. But when the jacket was being developed, the company that makes the fabric, Polartec LLC, of Lawrence, Mass., couldn't find the right kind of recycled yarn in Asia, says Nate Simmons, director of marketing for the fabric maker.

Polyester yarn with recycled content is more widely available in the U.S. than in Asia, he says, and Polartec uses it to make some fabric for Patagonia. But the Talus is a particularly complicated jacket, because its material fuses together a weather-resistent outer layer with a warm inner layer.

At the time the Talus was being developed, using recycled material would have required either making the fabric in the U.S. or shipping U.S.-made recycled-content yarn to Asia to be made into fabric. "It would have been extremely expensive," Mr. Simmons says. "Probably very few people would have bought it. And it wouldn't have had much of a positive

impact because of that."

The bottom line: In making the Talus, Patagonia decided that cost concerns outweighed environmental concerns. "Consumers are starting to put environmental values into their purchasing decisions, but it doesn't always translate into their being willing to pay a higher price," Patagonia's Ms. Dumain says.

Some Patagonia products -- generally ones whose fabric isn't as complex as the Talus's -- are made with recycled-content fabric. Among them is the Eco Rain Shell, which has a carbon footprint of just 15 pounds, Patagonia says. But the Eco Shell has a different environmental problem: A byproduct of manufacturing the material that makes the jacket water-repellent is perfluorooctanic acid, a substance that Patagonia says has been found accumulating in humans and animals and that scientists say could pose health risks.

Patagonia lays out this conundrum on its Web site, saying it "reflects the complexities involved" in balancing concern for the environment with the need for performance.

MILK

Several studies of milk's carbon footprint are under way in the U.S. Each has come up with a different number, largely because each is counting things differently.

A recent study by National Dairy Holdings, a Dallas-based dairy, found that the carbon footprint of a gallon of its milk in a plastic jug is either 6.19 pounds or 7.59 pounds. The difference rests in what kind of cases the jugs are placed in during transport from the milk-processing plant to the distribution center.

Plastic cases, because they take more energy to produce, yield more carbon-dioxide emissions than do cardboard ones.

But National Dairy Holdings' study doesn't count all the emissions created by a gallon of milk. It includes those from the cows themselves (more than half of the total), from the processing of the milk and from the transport of the milk to a distribution center. It doesn't count the emissions earlier in the process: growing the cows' feed. Nor does it count the emissions later in the process: transporting the milk from the distribution center to the store and refrigerating it there.

That's because National Dairy Holdings did its study largely at the request of Wal-Mart Stores Inc., a big customer, which is trying to prod environmental improvements in its supply chain. So, National Dairy Holdings measured only its piece in the supply chain, explains Howard Depoy, the dairy's director of power, refrigeration and sustainability. That's "the CO2 that we can control and manage," Mr. Depoy says.

Aurora Dairy Corp.'s Aurora Organic Dairy, a small organic-milk producer based in Boulder, Colo., is finishing a more-complete study of the carbon footprint of its milk. Its study, done by researchers at the University of Michigan's Center for Sustainable Systems, attempts to include emissions all the way from growing the cattle feed to refrigerating the processed milk in the store. The preliminary findings are that producing a half-gallon of Aurora's milk generates the equivalent of 7.2 pounds of carbon dioxide. That's essentially the same amount as the National Dairy Holdings study concluded is produced by an entire gallon of National Dairy Holdings' milk. But the National Dairy Holdings study left out much of the process that the Aurora study included.

Both studies found that the single biggest chunk of emissions from milk production comes from all that action in the cow's gut. Now, the U.S. dairy industry's main trade group, Dairy Management Inc., is launching yet another study of milk's carbon footprint. It plans a complete measurement akin to Aurora Organic Dairy's.

The dairy industry doesn't plan to put carbon-footprint labels on milk cartons, says Rick Naczi, an executive vice president for Dairy Management. "It's something that would be very, very difficult to make understandable to consumers," he says.

BEER

When New Belgium Brewing Co. set out last year to compute the carbon footprint of a six-pack of its Fat Tire Amber Ale, it figured it would find transportation was the biggest problem. That's the emission source New Belgium thinks about most often. The microbrewer, based in Fort Collins, Colo., has been expanding into more states, necessitating more trucking of its beer.

When the numbers came in this summer, they showed that a six-pack's carbon footprint was about seven pounds. The real surprise was where the bulk of that

number came from: the refrigeration of the beer at stores. Transportation came in fourth, behind manufacturing the glass bottles and producing the barley and malt. "It seems that in every [carbon-footprint study] I've come across, people are surprised," says Jennifer Orgolini, New Belgium's sustainability director.

Now, New Belgium is considering switching to bottles with more recycled glass, because making them consumes less fuel. It's also considering buying barley and malt produced organically, rather than with chemical fertilizers, which are big emitters.

Refrigeration poses a tougher problem. Stores selling Fat Tire aren't owned by New Belgium, so even if the brewer wanted them to stop refrigerating the beer, they might not do so.

There are smaller potential fixes. Many stores could switch from less-efficient, open-front beer chillers to more-efficient models enclosed by clear doors. But that presents its own hurdle, Ms. Orgolini notes: "People don't want to have to open the door."

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