Product Information Cards: Cups (1 of 4)

Paper Cups

Paper cups are made from trees, a renewable resource. While some paper cups have a small amount of recycled content, most are created from virgin tree fiber, which is harvested from forests using machines that typically run on fossil fuels. Trees are harvested and transported to a paper company that manufactures wood pulp. The pulp is then processed through machinery to make the paper. Paper cups are coated with a thin lining, typically made from polyethylene, which is a type of plastic made from ethane found in natural gas (Packer, 2009). It takes approximately 0.55 megajoules (MJ)* to manufacture a paper cup (Hocking, 1994). They are designed to be disposable and are typically used one time.

The plastic lining keeps the paper from absorbing the liquid, but it also makes the cups nonrecyclable. Therefore, paper cups usually go with trash to a landfill. Landfills have different decomposition rates, depending on sunlight, moisture, and air exposure. In some cases, paper cups can spend more than one hundred years in a landfill due to the lack of water and oxygen needed to breakdown the product. (U.S. EPA, 2011). Though it isn't recommended to drink out of paper cups multiple times (the polyethylene can break down after the first use), used paper cups can have other household uses. For example, they can function as scoops for pet food or containers for sprouting plants for the garden.

Drinking Glasses

Glass is a mixture of sand, gypsum, soda ash, limestone, and dolomite; all are acquired through mining. The raw materials are brought to the manufacturing facility by train, where they are mixed together and melted down to form glass at around 1,649 degrees Celsius (° C) or 3,000 degrees Fahrenheit (° F) (Hess, 2006). The energy to create one glass is approximately 5.5 megajoules (MJ).

Drinking glasses are reusable, and many are used daily for many years. Each time a glass is used, it must be washed, which requires energy and water. Assuming a dishwasher uses 0.18 MJ to wash each glass and that it took 5.5 MJ to manufacture the glass cup, a glass cup must be used 15 times before it becomes as energy efficient as a paper cup (Hocking, 1994). When a person is finished owning a glass it can be donated or sold at a garage sale. Drinking glasses are not accepted at many recycling facilities because of the type of glass used to make them. Therefore, when glasses are broken or thrown away, they often end up in a landfill.

****A megajoule (MJ) is a unit of energy that is equal to one million joules. One megajoule is equivalent to the kinetic energy of a one-ton vehicle moving at 160 km/h (mph).***

Product Information Cards: Books (2 of 4)

Paperback Books

A traditional paperback book is made from paper, cardboard, ink, and glue. Paper is made from trees, a renewable resource. Most of the wood used by paper companies in the United States comes from privately owned tree farms, where trees are grown, harvested, and replanted. Paper can be made from harvesting whole trees, from wood chips and sawdust that are the byproduct of harvesting trees for lumber or other purposes, or from recycled paper products. The energy used at paper-making facilities usually comes from using the facility's own wood waste, such as sawdust. The paper used to make one book is estimated at two kilowatt hours* of energy (Goleman & Norris, 2010). A papermaking facility produces wastewater that can be a pollutant to local waterways. All water pollution and air emissions are monitored to ensure the facility adheres to current environmental regulations.

Every year, Americans use an average of 700 pounds of paper products, including books, magazines, and newspapers (TAPPI, 2013). The amount of paper that can be produced from one tree depends on many factors. In general, it takes 12 trees to produce one ton, or 2000 pounds, of paper, assuming that none of that paper contains recycled fibers (Conservatree, 2012). This means that one tree makes about 167 paperback books, assuming each weighs about one pound.

An advantage of paper books is that they can be given or sold to others, allowing for a postconsumer market. Some people find value in a book that they can hold, as opposed to a digital book. Depending on how owners treat them, books can last for many years. Books can also be recycled once people are done with them. In 2010, paper and paperboard materials made up 29 percent of the 250 million tons of total municipal solid waste generated in the United States. Approximately 62.5 percent of these materials were recovered through recycling—leaving almost 27 million tons in landfills (U.S. EPA, 2011).

E-book Readers

Electronic books, or e-book readers, are gaining popularity. Depending on the device's memory space, e-book readers can store more than 1,000 books, saving both physical space and paper resources.

Heavy metals used to make e-book readers, such as gold, silver, cadmium, lead, mercury and chromium, must be mined and processed. One e-book reader requires the extraction of 33 pounds of minerals. The facilities that manufacture e-book readers use primarily fossil fuels to power their machines. It takes 100 kilowatt hours* to manufacture an e-reader, which results in the emission of 66 pounds of carbon dioxide (Goleman & Norris, 2010). During the use of the product, consumers can download books automatically, which does not require transportation to a bookstore or library. The device must be charged, which requires household energy.

Used electronics can be passed on to other people. When e-book readers break, they are likely to be thrown away by consumers, leading to toxic metals in landfills. Used electronics are also sent to other countries where workers, including children, dismantle them by hand. In the process, workers are exposed to a wide range of toxic substances (Goleman & Norris, 2010).

A kilowatt hour is a unit of energy equal to 1000 watt-hours, which is 3.6 megajoules. This is the amount of energy equal to a 40 watt bulb operating for 25 hours, and 100 kilowatt hours of energy could power an average home for three days.

Product Information Cards: Bottles and Cans (3 of 4)

Plastic Bottles

Plastic bottles are made from petroleum through an energy intensive process that produces carbon dioxide emissions. While some energy is used when the plastic is molded into the bottle shape, the largest amount of energy is used to actually produce the plastic itself (University of Cambridge, 2005). Producing a one-liter bottle, cap, and packaging requires around 3.4 megajoules (MJ)* of energy (Pacific Institute, 2012). Reusing plastic bottles is not recommended, as the plastic can break down over time. Most plastic water, soda, and juice bottles are made from plastic #1, a plastic that is intended for one use, unlike the plastics that are used to create food containers or other reusable plastic items. Plastic #1 is weaker than other plastics and more susceptible to wear and tear, which can cause chemicals to be released from the plastic over time.

Plastic can take hundreds of years to decompose in a landfill. However, many plastic bottles are recyclable. Plastic containers are assigned a number (#1 through #7) based on the type of plastic from which they are made. Most plastic bottles are made from plastic #1, which is recyclable in most areas. In 2010, more than 13 percent of plastic containers—mostly soft drink, milk, and water bottles—were recycled (U.S. EPA, 2011). Recycling uses about 10 percent of the energy that is required to produce one pound of plastic from virgin materials (U.S. EPA, 2002). During the recycling process, the chemical structure of the plastic is altered, so the recycled plastic cannot be remade into plastic bottles. When plastic containers are recycled, they are often made into products such as carpeting, pens, and jackets.

Aluminum Cans

Aluminum is produced by refining bauxite, a mineral ore that contains alumina. It takes four tons of bauxite to produce two tons of alumina. The alumina is then processed into aluminum metal through a smelting process. To produce a 12-ounce aluminum can, 0.81 megajoules (MJ)* of electricity is required. Therefore, it would take approximately 2.82 MJ of electricity to produce enough aluminum cans to hold one liter of liquid. In the United States, most of the aluminum is produced from bauxite imported Japan or Australia (Reynolds Aluminum, 1999).

The entire aluminum can is recyclable—it can be melted down and reused with little loss in quality. In as little as 60 days, aluminum can be recycled and back on the shelf (The Aluminum Association, 2014). In states with can and bottle laws, people pay a small deposit when they purchase a can, which is returned when the can is brought back for recycling. In 2010, the recycling rate of aluminum cans was about 49.6 percent. Recycling one ton of aluminum cans conserves more than 207 million British Thermal Units (BTU), which is the equivalent of 36 barrels of oil or 1,665 gallons of gasoline (U.S. EPA, 2011).

A megajoule (MJ) is a unit of energy that is equal to one million joules. One megajoule is equivalent to the kinetic energy of a one-ton vehicle moving at 160 km/h (mph).

Product Information Cards: Grocery Bags (4 of 4)

Paper Bags

Paper bags are made from cellulose from trees, a renewable resource. Most of the wood used by paper companies in the United States comes from privately owned tree farms, where trees are grown, harvested, and replanted. Paper can be made from harvesting whole trees, from wood chips and sawdust that are the byproduct of harvesting trees for lumber or other purposes. To improve durability and strength, paper bags are typically made from mostly virgin wood fibers, although they can contain various amount of recycled paper materials as well. The energy used at paper-making facilities usually comes from the operation's wood waste, such as sawdust. The facility produces wastewater that can be a pollutant to local waterways. Typically, water and air emissions are monitored to ensure that the facility adheres to current environmental regulations.

Paper bags can be reused by consumers for wrapping packages, as garbage bags, or for holding other items. Paper bags are 100 percent recyclable, and about 10 to 15 percent of paper bags are recycled by consumers (Project GreenBag, 2009). For those bags that end up in a landfill, the length of time it takes for paper to decompose depends on a number of factors, such as temperature, pH, presence of bacteria and nutrients, as well as composition of the paper (Chaffee & Yaros, 2010).

According to a life cycle assessment, the overall energy use to produce 1,000 paper bags that contain 30 percent recycled material is 2,622 megajoules* (MJ) (Chaffee & Yaros, 2010).

Plastic Bags

Plastic bags are made from a material called polyethylene, which is produced from petroleum and natural gas (LaJeunesse, 2004). In 2001, between 500 billion and 1 trillion plastic bags were used worldwide.

Plastic bags can be reused by consumers for a limited number of times. Plastic bags are 100 percent recyclable. In 2010, 12 percent of plastic bags, sacks, and wraps were recycled (U.S. EPA, 2011). The recycled plastic is used to create items such as new plastic shopping bags or outdoor deck material (Progressive Bag Alliance). Many plastic bags (approximately 1 to 3 percent) end up being neither recycled nor put in the trash but become litter that makes its way to rivers, streams, and oceans (Roach, 2003). This litter can impact marine, freshwater, and forest habitats and wildlife.

According to a life cycle assessment, the overall energy use to produce 1,000 plastic bags is 509 megajoules* (MJ) (Chaffee & Yaros, 2010).

A megajoule (MJ) is a unit of energy that is equal to one million joules. One megajoule is equivalent to the kinetic energy of a one-ton vehicle moving at 160 km/h (mph).