2.83/2.183 Life Cycle Analysis Homework 2
Feb 17, 2011

The Smith family wants to understand the impact of this year's (2010) holiday gifts. What are the impacts associated with their presents?

Mrs. Smith received a $300 gold bracelet.
Mr. Smith received a $500 HDTV.
They bought their daughter two tickets to see her favorite hockey team play, for $150.
They bought their son a new wool winter coat, which cost $100.

1. The Smiths live in the US, and the year is 2010. Which EIO-LCA model should you use and why?

   US 2002 Purchaser. We want to use the most recent model, and the Smiths are consumers, and are thus paying "Purchaser" price as opposed to production price.

2. To analyze the impact of their purchases, what EIO-LCA sectors should you use for each member of the household's gifts?
   a. Mrs.: *Other Miscellaneous Manufacturing/Jewelry and silverware manufacturing*
   b. Mr.: *Computers, Audio-Video, and Communications Equipment/Audio and video equipment manufacturing*
   c. Daughter: *Arts, Entertainment, Hotels and Food Services/Spectator sports*
   d. Son: *Textiles, Apparel, and Leather/Men's and boys' cut and sew apparel manufacturing*

3. Assume we are using the US 2002 Purchaser price model. The problem is that we have prices in 2010 dollars! Use the Bureau of Labor Statistics Inflation Calculator (http://www.bls.gov/data/inflation_calculator.htm) to estimate the 2002 prices for each of their gifts

Dollars	Mrs.	Mr.	Daughter	Son
2010	$300	$500	$150	$100
2002	*247.51*	*412.51*	*123.75*	*82.50*

4. The Smiths are interested in the greenhouse gases and carcinogenic toxic releases associated with their gifts. Rather than jump straight into the "per gift" releases, let's look at those industries, on a per million dollar basis. For each gift's sector, use the model to find the total global warming potential in terms of metric tons of carbon dioxide equivalent, and carcinogens in terms of megagrams of vinyl chloride.

Per million $	Jewelry	AV Equipment	Sports	Men's Clothes
GWP – MTCO2E	*532*	*446*	*223*	*381*
Carcinogens Mg C2H3Cl E	*6330*	*611*	*46.1*	*62.8*

5. Now, find the impact for each individual gift, using the industry values given in part 4 and the 2002 price equivalents from part 3.

	Mrs.' Bracelet	Mr.'s TV	Daughter's Tickets	Son's Jacket
GWP – kg CO2E	*132*	*184*	*27.6*	*31.4*
Carcinogens kg C2H3Cl E	*1570*	*252*	*5.70*	*5.18*

Which gifts have the highest global warming potential, and what might cause that? Which gifts have the highest toxic emissions, and what might cause that? (Hint: Look at the contributing sectors.)

Both the bracelet and the TV have high GWP. In part this is because of the higher price of these two items, but also in part because of the intensive material production required in both cases. In particular, the energy use in the jewelry is tied to smelting the metals.

In terms of toxic emissions, the jewelry is by far and away the leader in toxic emissions. The mining of gold, silver, and other ores produces a lot of carcinogenic material. The smelting of these materials also contributes to the toxic emissions releases. The precious metals are also the main contributor toward the carcinogenic releases of the TV. Many of the connectors and conductors in electronics use gold, silver, and other high value metals, which as we see have a high footprint.

6. What are possible drawbacks using EIO-LCA analysis on these gifts?

Price variability is a big concern in EIO-LCA in general, but it is a major drawback in the case of consumer goods, where dollar price to purchased good is highly variable. The cheap seats to a hockey game might cost half as much as the tickets the Smiths bought for their daughter, but do they have half the impact? Another drawback is that the use phase of each product is not profiled. The bracelet and the hockey tickets may not have a large use phase component, but the TV has a plug. If we measured the power used by the TV in the Smith household over a year period, we could use the EIO-LCA model to calculate the impact of the use phase based on electricity cost. What about the coat, will it require "cleaning service" in its lifetime? There are many possible answers here.