Consumer Environmental Index (CEI) Background Information

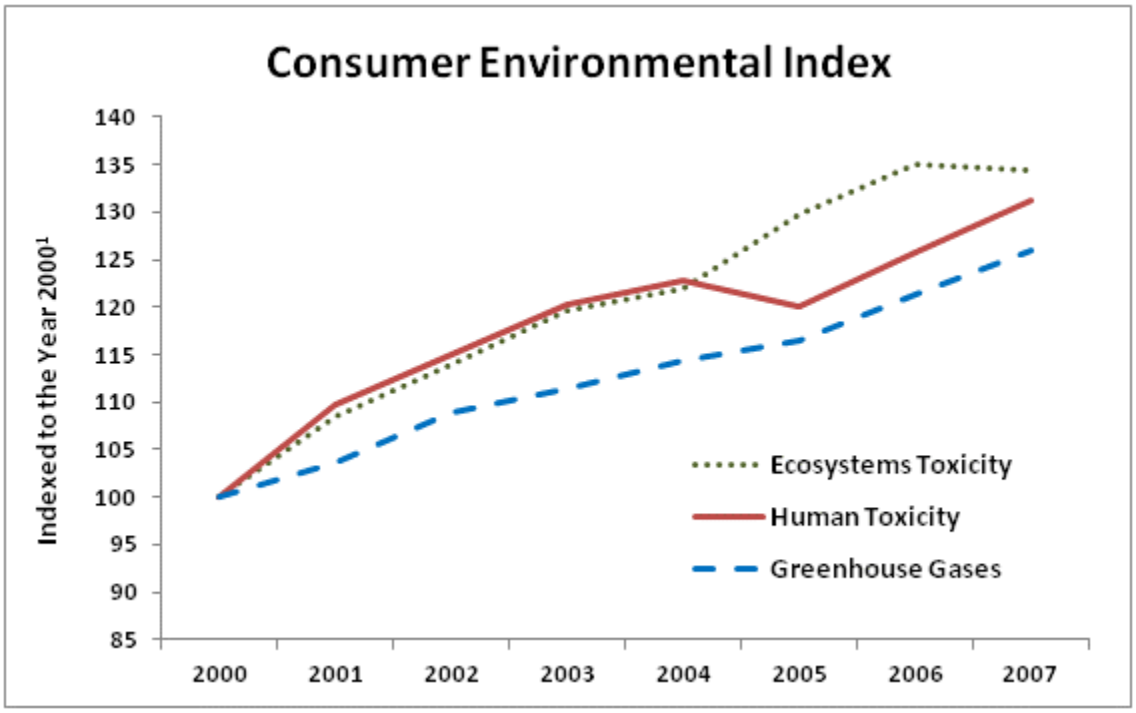
As we consume products or services during our life, we are ultimately responsible for our own contribution to society's "pollution footprint". However, we often don't know the environmental impacts of our purchasing habits. To get a better idea of these impacts, the Washington State Department of Ecology (Ecology) hired a consulting firm to develop the Consumer Environmental Index (CEI).

What is a Consumer Environmental Index?

Ecology is currently using the Consumer Environmental Index (CEI) as a tool 1) to track how consumption patterns influence the pollution releases we observe, and 2) to measure the extent to which we are successful in reducing the amount of pollution associated with our purchases. The CEI uses actual expenditure patterns and calculates the cumulative environmental impacts from consumer choices. The CEI focuses on the potential to cause:

- Climate change (by measuring greenhouse gas emissions).
- Harm to human health (by measuring environmental pollutants that are harmful to humans).
- Ecosystems toxicity (by measuring pollutants that could impact the environment and wildlife).

The index in these three impact areas is shown in this graph for 2000 through 2007:



1. Data series is scaled to make the initial value 100. A value below 100 indicates lower emissions or a positive outcome.

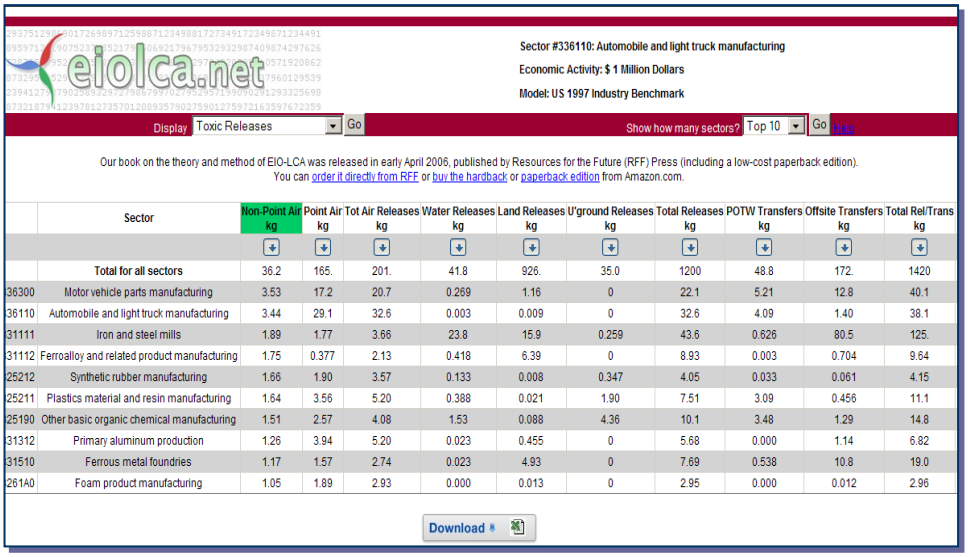
Pollution can be released during the extraction of raw materials. More pollution may occur during production and transportation of products to consumers. Yet more pollution may be released when we use those products and more when we decide how we are going to discard them. That is why each stage of a product's life cycle must be evaluated to show the total impact we are having on climate, our own health, and the environment. The CEI looks at the manufacturing, use, and end of life phase. Each phase is discussed below.

Products "Upstream" or Manufacturing Impacts

The Department of Commerce's Bureau of Economic Analysis (BEA) (www.bea.gov) develops economic input-output (EIO) tables to calculate gross domestic product (GDP) among other things. These EIO tables are a long-established view into how the economy works, and were first available for the U.S. economy beginning in the 1940s. They define how much each economic sector buys from all the other economic sectors in dollars.

The CEI uses these economic input-output tables and emissions from the industries used in the sector analysis to calculate the cumulative impacts from manufacturing. Further calculation gives us the pollutant emissions from the total supply chain used in the upstream phase.

An Economic Input-Output Life Cycle Assessment (EIO-LCA) model (http://www.eiolca.net) is available as a software tool providing a wealth of data. The model summarizes the current U.S. economy in 500 sectors with information on energy and materials use, pollution and greenhouse gas discharges, and other attributes like associated occupational deaths and injuries. This model is maintained by the Green Design Institute of Carnegie Mellon University, which partnered with Ecology in the development of Washington's Consumer Environmental Index (2007).



	Sector	Non-Point Air kg	Point Air kg	Tot Air Releases kg	Water Releases kg	Land Releases kg	U'ground Releases kg	Total Releases kg	POTW Transfers kg	Offsite Transfers kg	Total Rel/Trans kg
	Total for all sectors	36.2	165.	201.	41.8	926.	35.0	1200	48.8	172.	1420
36300	Motor vehicle parts manufacturing	3.53	17.2	20.7	0.269	1.16	0	22.1	5.21	12.8	40.1
36110	Automobile and light truck manufacturing	3.44	29.1	32.6	0.003	0.009	0	32.6	4.09	1.40	38.1
31111	Iron and steel mills	1.89	1.77	3.66	23.8	15.9	0.259	43.6	0.626	80.5	125.
31112	Ferroalloy and related product manufacturing	1.75	0.377	2.13	0.418	6.39	0	8.93	0.003	0.704	9.64
25212	Synthetic rubber manufacturing	1.66	1.90	3.57	0.133	0.008	0.347	4.05	0.033	0.061	4.15
25211	Plastics material and resin manufacturing	1.64	3.56	5.20	0.388	0.021	1.90	7.51	3.09	0.456	11.1
25190	Other basic organic chemical manufacturing	1.51	2.57	4.08	1.53	0.088	4.36	10.1	3.48	1.29	14.8
31312	Primary aluminum production	1.26	3.94	5.20	0.023	0.455	0	5.68	0.000	1.14	6.82
31510	Ferrous metal foundries	1.17	1.57	2.74	0.023	4.93	0	7.69	0.538	10.8	19.0
261A0	Foam product manufacturing	1.05	1.89	2.93	0.000	0.013	0	2.95	0.000	0.012	2.96

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Products Consumption or "Use" Phase Impacts

Consumers typically have little control over the manufacturing practices for the specific products that we purchase. But, we influence the level of environmental impacts from the manufacturing phase mainly by which products we choose to buy and how we use them. We make choices that directly affect pollutant emissions levels. For example, we decide how fast to drive cars, how well to maintain vehicle pollution control systems, how warm or cool to keep homes, how much food to throw away, and how carefully or carelessly to use household cleaning, lawn and gardening products.

The development of the CEI starts with examining our actual consumption patterns derived from the annual Consumer Expenditure Survey (CES) from the U.S. Bureau of Labor and Statistics (BLS) (http://www.bls.gov/cex/). The emissions during the use phase are then calculated using the average unit price of each product to convert to quantities purchased. The emissions profiles of products are taken from known literature and other sophisticated models, like BEES (http://www.bfrl.nist.gov/oae/software/bees/) and WARM (http://epa.gov/climatechange/wycd/waste/calculators/Warm_home.html). The emissions during the use phase are mainly from energy and fossil fuels use.

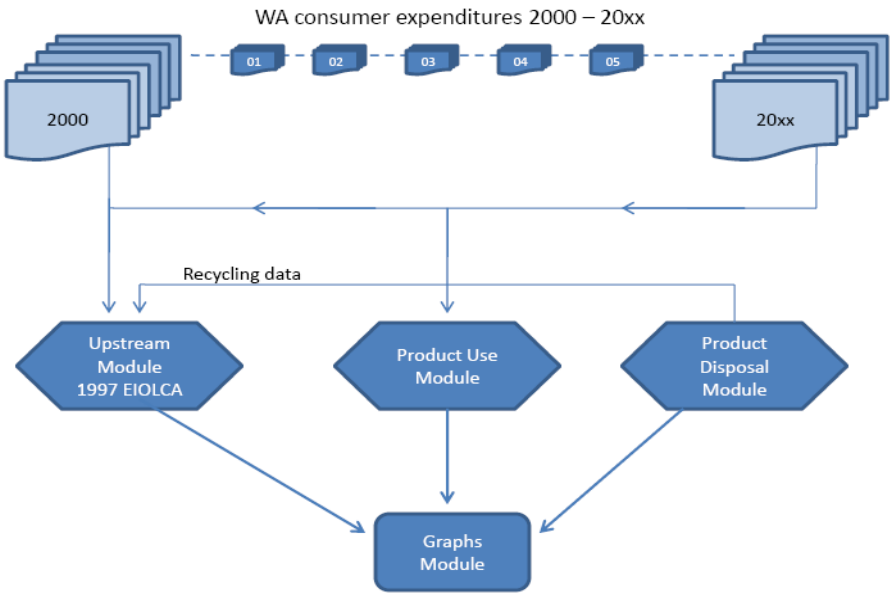
Products Disposal or "End-of-life" Impacts and Credits

We have all bought products and used them up. Many products are thrown in to landfills and others end up down the drain. When a product reaches the end of its useful life, consumers make choices about what to do with the product: reuse, recycle, compost it, or throw it in the garbage. These decisions directly affect pollutant emissions. State and local governments and businesses play a key role in providing opportunities and access to infrastructure and take-back programs, which provide consumers with more end-of-life options. Some options reduce pollutant emissions more than others. Government also plays a crucial role in the management of end-of-life wastes, such as wastewaters, and solid and hazardous wastes.

Most of the emissions calculations that are part of the CEI end-of-life phase are derived from waste management strategies. Recycling and reuse or composting quantities are used to reduce raw material extraction impacts in the 'upstream' module of the CEI and thus are considered credits. Emissions are calculated using the EPA's Greenhouse Gas Emissions (http://epa.gov/climatechange/emissions/index.html) with WARM and Solid Waste Management Decision Support Tool (DST) from RTI International (http://www.rti.org/).

Putting it all together

Using actual consumer expenditure data compiled by the U.S. Bureau of Labor Statistics each year, the impacts from the manufacturing phase of goods and products is calculated using the EIO-LCA model from our partners at Carnegie Mellon University. The use-phase emissions are calculated by converting expenditures into quantities and then using weighted emission impacts. The end-of-life phase calculates emissions from the disposal of the products. If goods and products are recycled, they are credited to the upstream effects.



The CEI examines how changes in expenditure patterns over time impact human health, climate change and ecological harm, just as the Consumer Price Index (CPI) tracks changes in the prices consumers pay for those purchases. The individual life cycle impacts are calculated and summed. The index can be developed in many different ways. It can be used as a single CEI, as a rolled-up index or as several indexes. Additionally, key products such as pesticides can be pulled out and measured separately for such attributes as how much is purchased and/or toxicity.

What does this index tell us?

Over time, the CEI tracks the environmental impacts from:

- What consumers buy and how their purchasing patterns are changing.
- Growth in the number of consumers and their adoption of new technologies.
- Changes in the efficiency with which manufacturers reduce pollution.
- Changes in the pollution footprint of various commodities.
- Changes in how consumers manage products at the end of the product's life.

How can we use the Consumer Environmental Index?

Just as the Consumer Price Index (CPI) is used as a single index of how inflation and costs are increasing over time, the Consumer Environmental Index (CEI) has the potential to show how our behavior is affecting our own health, the environment and climate change. The relative impacts of consumer spending gives a great deal of information about what projects and regulations may be working and where the best "bang for the buck" is in reducing pollution and making the world more sustainable.

As the CEI is derived using economics and spending patterns, the methodology can be applied to any scale by changing the amount spent on products and services. Therefore, we see a use for the CEI in indexing the pollution footprints of agencies, businesses and even individuals based only on their spending. As mentioned earlier, certain products can be analyzed separately. The CEI is specifically designed for Washington State and is based on ***consumer*** spending patterns. Therefore, by definition it does not yet include impacts from government spending, or new housing costs. The Bureau of Economic Analysis manufacturing relational tables are based on manufacturing in the U.S. and there is work being undertaken now to define impacts from overseas manufacturing.

The fact that the index has dramatically increased over the past six years is because people are buying more and disposing more. Until that trend changes, it will be difficult to reach the goal of Beyond Waste.

More information

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- Dr. Jeffrey Morris of Sound Resource Management is the consultant who developed CEI. His website includes some additional information about CEI: http://www.zerowaste.com/default.htm.