OVERVIEW

When performing a Scope 3 GHG assessment two types of data are required: activity data and environmental data.

Activity data defines the quantity of an activity your business engages in: the dollars or physical amounts (pounds, gallons, and cubic meters) you sell or purchase. Environmental data (called emission factors in the GHG protocol) define the environmental flows (natural resources and emissions) that relate to the quantity of activity your company engages in. There are two types of emission data: primary and secondary. Primary environmental data come directly from your suppliers or customers. Secondary environmental data comes from public databases. This paper describes the two types of secondary emission factor data available: environmental extended input-output (EEIO) and process data.

EEIO is based off a macroeconomic flow analysis of the transfer of money between sectors of an economy where the environmental impacts of each sector required to produce a good or services are added up to determine the complete supply chain impact. EEIO is cradle-to-gate; it does not evaluate your downstream impacts. Process data is based off a material flow analysis that adds up the environmental impacts of all the individual processes required to produce, use, dispose a good or service. Process data can evaluate both your upstream and downstream value chain. Both are valid methods for calculating scope 3 GHG emissions. Each method has its strengths and weaknesses.

“Companies may combine the top down EEIO approach with the bottom-up, process-based approach to leverage the benefits of both approaches. For example, the upstream emissions of purchased goods could be calculated using an EEIO approach, whereas downstream emissions from use and end-of-life could be calculated using a process-based approach.” (GHG Protocol, 2013)

The GHG Protocol also states that calculating your scope 3 GHG emissions requires the use of multiple calculation methods that are selected based on:

- The relative size of the emissions from the scope 3 activity
- The company’s business goals (see chapter 2 of the Scope 3 Standard)
- Data availability
- Data quality
- The cost and effort required to apply each method
- Other criteria identified by the company.
ENVIRONMENTAL EXTENDED INPUT-OUTPUT (EEIO)

Input-output analysis (IOA) is a macro-economic method that describes the money transactions between sectors of the economy. An input-output analysis relies on national input-output tables that document the flow of money to and from the various industry sectors\(^\text{1}\). Input-output tables show how a dollar purchased or sold by one industry leads to a chain of other transactions in the economy.

**Example\(^\text{2}\) (Murray, 2010):**

From an input-output table you see that to produce $100m worth of insurance the insurance industry purchases $1m of paper. That is the same as saying that they need penny worth of paper input for every dollar’s worth of insurance output. Now you go to the paper industry. Let’s say that you find that the paper industry needs $.25 worth of wood to produce a dollar’s worth of paper. Now to the wood industry. Let’s say they need $.10 worth of machinery to produce a dollar’s worth of timber. Now the machinery industry. Say they need $.20 worth of steel to make a dollar’s worth of forestry machines. Next the steel industry. Say they need $.40 worth of iron ore to make a dollar’s worth of steel.

Now for the million dollar question. How much iron ore does it take to make a $2,000 insurance policy from this one single path through the supply chain: iron ore for steel for machine for wood for paper for insurance policy? And the answer is:

\[
\begin{align*}
2000 \text{ insurance} & \times 1\text{¢ paper} \times 25\text{¢ wood} \times 10\text{¢ machine} \times 40\text{¢ iron ore} = \\
& \times 1\$ insurance \times 1\$ paper \times 1\$ wood \times 1\$ machine \times 1\$ steel
\end{align*}
\]

\[
\begin{align*}
2000 & \times 0.01 \times 0.25 \times 0.1 \times 0.2 \times 0.4 = 4\text{¢ iron ore}
\end{align*}
\]

Environmental input-output analysis (EIOA) adds the physical flows of natural resource (minerals, energy, water) and emissions to the economic input-output tables. With this additional environmental information, an EEIOA can not only tell you that selling a $1’s worth or insurance requires $.04 of iron ore, but it may also emit 2kg of CO2e and require 10MJ of energy and 10 gals of water. Using your purchase ledgers (dollar activity data) an EEIOA can show you both total emissions by supplier and where the emissions are buried in your supply chain.

**PROCESS FLOW ANALYSIS**

A process flow analysis does not use dollar based activity data, but rather relies on physical activity data to develop a process tree from which GHG emissions are added up. Process based data is derived from assessing all

\[1\] More than 100 countries worldwide regularly publish input-output tables according to guidelines governed by the UN Department of Economic and Social Affairs Statistics Division.

the known energy and environmental inputs of a particular process (say polystyrene) and calculating the direct emissions associated with the outputs of the process.

**Example**³ (Schenck, 2014)

![Diagram of process flows required for PET resin production](image)

In this example, you input the quantity of PET you buy which then links the quantities of all the other materials and processes required to produce that amount of PET.

**PROS AND CONS**

The GHG Protocol defines the advantages and disadvantages of each type of secondary data as:

The advantages of EEIO data include:

- Comprehensive coverage of the entire economy (i.e., no emissions sources are excluded from the system boundary)
- Simplicity of method and application
- Time and cost savings as data requirements are less onerous than in a process-based approach.

The disadvantages of EEIO data include:

- Broad sector averages may not represent nuances of unique processes and products, especially for nonhomogeneous sectors
- Assumption of linear attribution between monetary and environmental flows provides only indicative results (i.e., EEIO models cannot distinguish between products of different monetary value within a single sector)

³ This example comes from the book “Environmental Life Cycle Assessment” Available for $70 through the American Center for Life Cycle Assessment : http://aclca-shop.lcacent.org/t/books
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Systems for Sustained Performance

- Lacks specificity and accuracy of process-based approaches
- Difficult to measure and demonstrate results of reduction efforts
- EEIO databases are generally limited to a specific geographic region, (e.g., United States) and are not available in some world regions.

The advantages of process-based data include:

- High level of specificity and focus
- Detailed analysis and possibility of unique insights to particular processes
- Straightforward concept.

The disadvantages of process based data include:

- Collection of data may be time, cost, and labor intensive
- Lack of comparability as the system boundary and the data are selected by the practitioner
- Data requirements may render large-scale, multi-product analysis impractical.

REFERENCES: