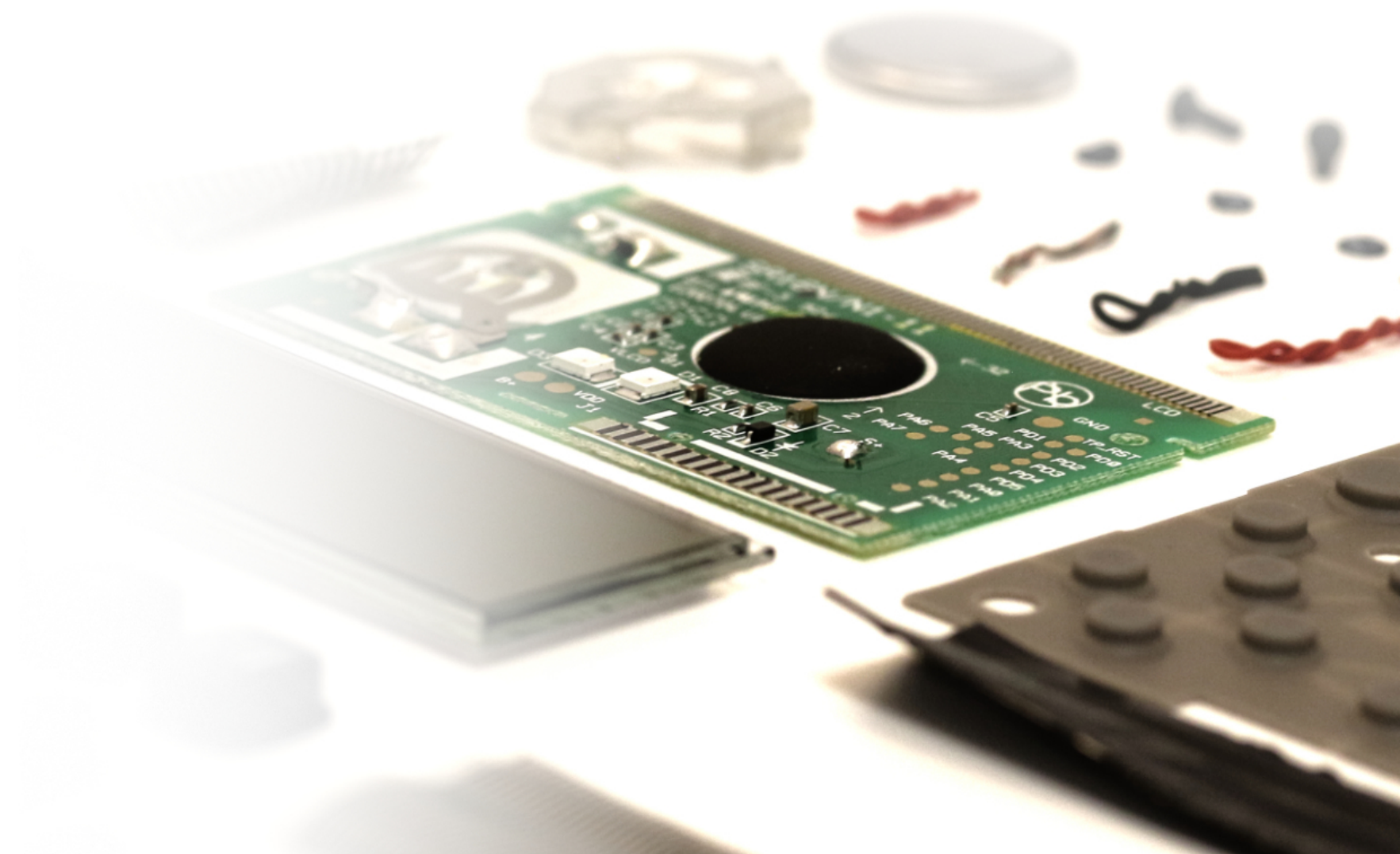


Claigan Webinar

Life Cycle Assessment and SB-253

Presented by:
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VP Consulting

October 8, 2025



Life Cycle Assessment (LCA)

- What is 'Life Cycle Assessment'?
 - Otherwise known as “**LCA**”
- LCA is
 - A method for evaluating the full environmental impact of a product, process, or service from its beginning to end

Life Cycle Assessment (LCA)

Oversimplified

- Simpler
 - The 'Cradle to Grave' Greenhouse Gas (GHG) of product
- Note
 - There are many ways to quantify the cradle to grave contribution of the full lifecycle of a product
 - But the most common is GHG emissions in
 - **Kg of CO₂eq**

Life Cycle Assessment (LCA)

- so far this webinar

- Some information
- But only a 2 out of 10 on the useful information scale



So far....

Life Cycle Assessment Overview

- Overview

Green House Gas Equivalents (CO₂eq) generated from



Manufacturing and
transportation of components



The energy used during
assembly of the final product



The energy used in shipping the
final product to the customer

Life Cycle Assessment Overview

- Plus

Green House Gas Equivalents (CO₂eq) generated from



The energy consumed during use of
the product



The energy consumed and gases
generated during end of life of the
product

General Process

- Each contributor has a kg CO₂eq value
- Metal or plastic (per kg) = some level of kg CO₂eq
- Transportation (per km) = some level of kg CO₂eq
- Energy (per kW) = some level of kg CO₂eq
- Each type of metal or plastic, or transportation, or energy source has different coefficients
 - Coefficients can be calculated from first principles
 - But normally annually updated standard coefficients are used

Life Cycle Assessment (LCA)

- *useful information check*

- Better. But I could have googled this
 - Mostly.
- So only a 3 out of 10 on the useful information scale



Fine....

Contribution from Components and Materials



Manufacturing and
transportation of components

- GHG from
 - Manufacturing
 - Transportation Of
 - Materials
 - Components
- To final assembly

Components and Materials

Biggest GHG Contributors

- Biggest contributors to GHG
 - Metals
 - Dense electronics



Manufacturing and
transportation of components

Final Assembly Contribution



The energy used during assembly of the final product

- GHG from
 - Energy consumed during final assembly
 - Escaping refrigerant during assembly

Contribution from Final Product Transportation



The energy used in shipping the
final product to the customer

- GHG from
 - Transportation to final customer
 - By truck
 - By rail
 - By air
 - By ship

Transportation

Biggest GHG Contributors



The energy used in shipping the final product to the customer

- Biggest contributors to GHG
 - Air travel
 - Truck travel
- Average customer
 - Chosen as part of establishing initial 'goal' of LCA

Life Cycle Assessment (LCA)

Target or 'Goal'

- Very important part of LCA
 - What is the target or goal?
- **Goal questions**
 - Lifetime of the product
 - Is it 'x' number years?
 - Or number executions?
 - Pages printed or tests run
 - Typical customer
 - In EU?
 - Or California?
 - Or globally?
 - Output
 - To have an output?
 - Or to be able to improve?
 - Or both :-)



Life Cycle Assessment (LCA)

Target or 'Goal'

- Very important part of LCA
 - What is the target or goal?

- **Goal questions**

- Lifetime of the product

All are valid



But need to be stated in the final output

- Typical customer
 - In EU?
 - Or California
 - Or globally?
- Output
 - To have an output?
 - Or to be able to improve?

Contribution from Energy Used during Lifetime



The energy consumed during use of
the product

- GHG from
 - Power consumption of product
- Note
 - Average active vs standby is critical
 - And average # of active hours per week

Contribution from End of Life of Product



The energy consumed and gases generated during end of life of the product

- GHG from
 - End of life of product
- Note
 - Recycling creates some GHG
 - Landfill creates very little for most products

Life Cycle Assessment (LCA)

- *useful information check*

- Ok. That is better
 - The pictures helped
- Maybe - 6 out of 10 on the useful information scale



Better?

Life Cycle Assessment (LCA)

How to do it?

- How to do it?
- Notes
 - LCAs are no longer custom academic knitting
- They are regularized processes



Life Cycle Assessment (LCA) Standards

- Standards
 - ISO 14040 - Principles and Framework
 - ISO 14044 - Requirements and guidelines for conducting LCAs
- Overview
 - The standards are very general
 - LCA processes have become much more regularized
 - With GHG factors from regularized sources updated each year

Claigan Specific Process

- Two (2) different questionnaires

Project Questionnaire						
#	Question #	Category	Question Text	Response Type	Required?	Completed
	1	Product Information	What is the full product name?	Text	☒	☐
	2	Product Information	What is the model number of the product?	Text	☒	☐
	3	Product Information	What is the primary function of the product?	Text	☒	☐
	4	Product Information	Please provide a datasheet or specification	Document	☒	☐
	5	Product Information	Does the product use consumables? If yes what are they?	Text	☒	☐
	6	LCA Target	What is the target lifetime or number of cycles for the LCA?	Text	☒	☐
	7	Manufacturing	Where is the product manufactured? (Country/Region)	Text	☒	☐
	8	Manufacturing	What is the average energy consumption (kWh) by the manufacturing floor per unit produced?	Number	☒	☐
	9	Energy Consumption	What is the daily typical energy consumption (kWh) of the product?	Number	☒	☐
	10	Energy Consumption	How many days of operations (on average) is required to meet the LCA target?	Number	☒	☐
	11	Transportation	Average distance transported by rail to customer (km)	Number	☒	☐
	12	Transportation	Average distance transported by air to customer (km)	Number	☒	☐
	13	Transportation	Average distance transported by ship to customer (km)	Number	☒	☐
	14	Transportation	Average distance transported by truck to customer (km)	Number	☒	☐
	15	End-of-Life	What is the expected lifespan of the product (years)?	Number	☒	☐
	16	End-of-Life	Do you offer a recycling program for the product at the end of life?	Text	☒	☐

Project Questionnaire

Includes assembly, transportation, use, and end of life



LCA Questionnaire (Detailed)				
Product Name:				
Company Name:				
Total Product Weight (g):				

Large Components	Material Type	Mass (g)	Comments
Large Component 1			
Large Component 2			
Large Component 3			
Large Component 4			
Large Component 5			
Large Component 6			
Large Component 7			
Large Component 8			
Large Component 9			
Large Component 10			
Large Component 11			
Large Component 12			
Large Component 13			
Large Component 14			
Large Component 15			

If multiple materials cannot be separated insert those comp the next section.
Examples: Glass casing, Large Flasks.

Assemblies					
Assembly Type	Quantity of Saws:			OR	Mass (g)
	Small (<2")	Medium (4-6")	Large (>6")		
Fans					
Internal Pumps					

PREFERRED

Motors	Quantity of Rigid Circuit Boards:			OR	Mass (g)
	Small (<1")	Medium (1-2")	Large (>2")		
Quantities					

PREFERRED

Circuit Boards	Total Mass (g)	OR	Quantity of Rigid Circuit Boards Size:		
			Small (<10 sq. in.)	Med. (10 to 75 sq. in.)	Large (75 to 500 sq. in.)

Product Approach

Includes manufacturing and transportation of components used to make the product



Life Cycle Assessment (LCA) For Claigan Customers

- Two approaches
 1. Stand alone service
 2. Add on to any testing project
- Add-on specifics
 - Just a variation in process from other projects
 - Compared to the 250 REACH SVHC, LCA is straight forward
- If you would like LCA added to any project
 - Just ask :-)
 - [It might surprise you](#)

Output Data portion

Output version also included references, goals, and assumptions.

Product:	Lenovo Tab M9
Company:	Lenovo
Weight (kg):	0.55
Product Life Time:	3 years
Date Processed	

Materials

Item	Weight %
Large metals	8.85%
Aluminum	8.32%
Copper	0.46%
Other	0.05%
Large Plastics	10.39%
ABS	7.83%
Thermoplastic	2.56%
Other	0.00%
Electronics	53.04%
Display Screen	28.06%
Battery	12.66%
Other	12.29%
Miscellaneous Materials	1.10%
Packaging	26.62%

Product Transportation

Method of transportation	Average Distance (Km)
Air	7,960
Rail	
Ship	
Truck	9,000

End of Life

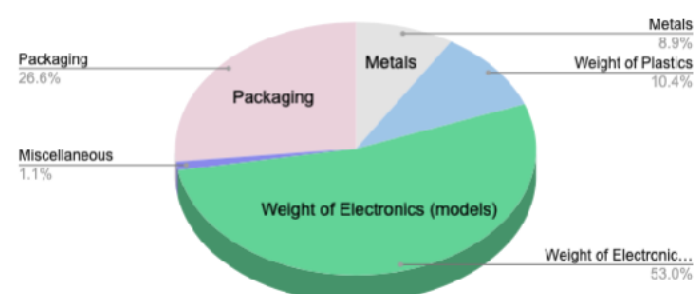
Disposal Method:	Recycled
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CO2 Breakdowns

Item	CO2 Emmissions %
Large metals	0.67%
Aluminum	0.63%
Copper	0.04%
Other	0.00%
Large Plastics	0.50%
ABS	0.44%
Thermoplastic	0.06%
Other	0.00%
Electronics	68.85%
Display Screen	36.46%
PCB Assembly	28.87%
Other	3.52%
Packaging	1.69%
Paper	1.34%
Cardboard	0.33%
Other	0.02%
Miscellaneous Materials	0.07%

Impact Category	Result	Unit
Total Carbon Footprint:	46.28381063	kg CO2e

Product Material Composition by Weight

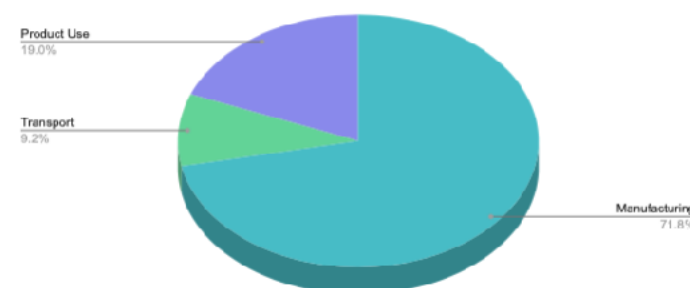


Product Use

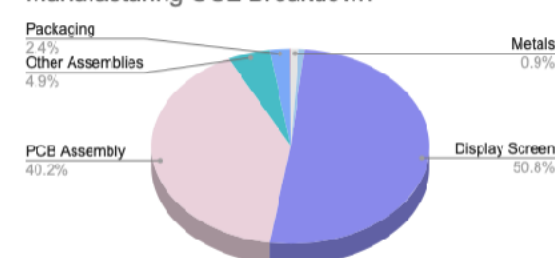
Factor	Value	Unit
Product Life Span:	3	years
Yearly Energy Consumption:	12	Kwh
Life Time CO2 Production:	8.784	kg CO2e

Factor
Energy Consumption
Reagent Consumption
Waste Generation
Days of use for x samples

CO2 Production by Element



Manufacturing CO2 Breakdown



GHG Emission Declarations in California (SB-253)

- **Mandatory for companies over \$1B in revenue**

- **Starting in 2026**

- Scope 1 emissions
 - From energy generated by the company
 - Including company cars
 - + escaping refrigerants
- Scope 2 emissions
 - From energy purchased by the company

EH&S Function



GENERALLY

EH&S Function



GENERALLY

GHG Emission Declarations in California

- **Starting in 2027**
 - Scope 3 emissions
 - GHG from the full life of your products
 - Ie - Lifecycle Assessment (LCA)
 - Including average employee commute and business travel

Product Compliance



EH&S Function



Life Cycle Assessment (LCA)

- *useful information check*

- The whole picture is there
 - But there is still a lot of detail missing
- Let's end with - 8 out of 10 on the useful information scale



If you want more

[Let's talk detail](#)

Life Cycle Assessment (LCA) For Claigan Customers

- Two approaches

1. Stand alone service

2. Add on to any testing project

- Add-on specifics

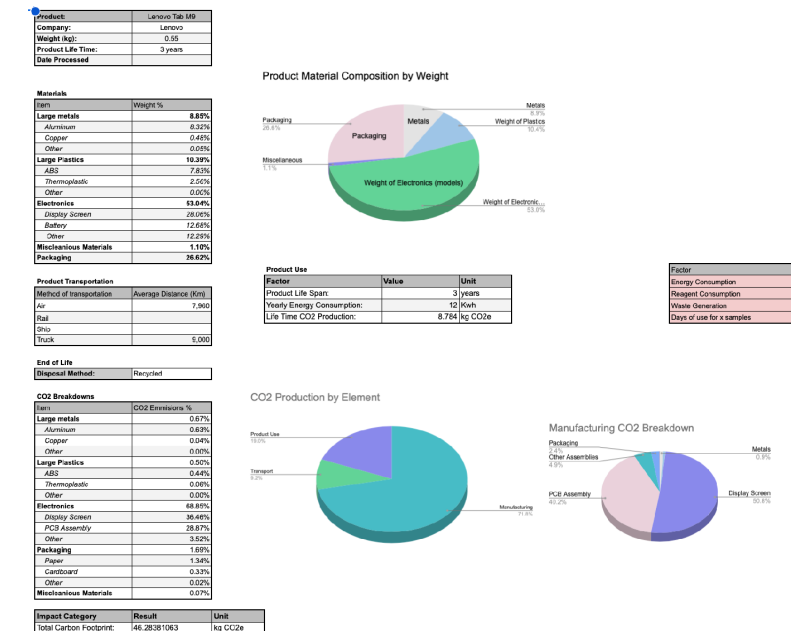
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Q&A