



# **LCA related issues & Calculation of carbon footprint**

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Thailand Greenhouse Gas Management Organization (Public Organization)

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# Contents

- What is Life Cycle Assessment (LCA) ?
- Examples of LCA
- What is the relationship between LCA and Carbon Foot Print (CFP) ?
- Examples of CFP



# What is LCA ? (1)

## Life cycle analysis in automotive industry

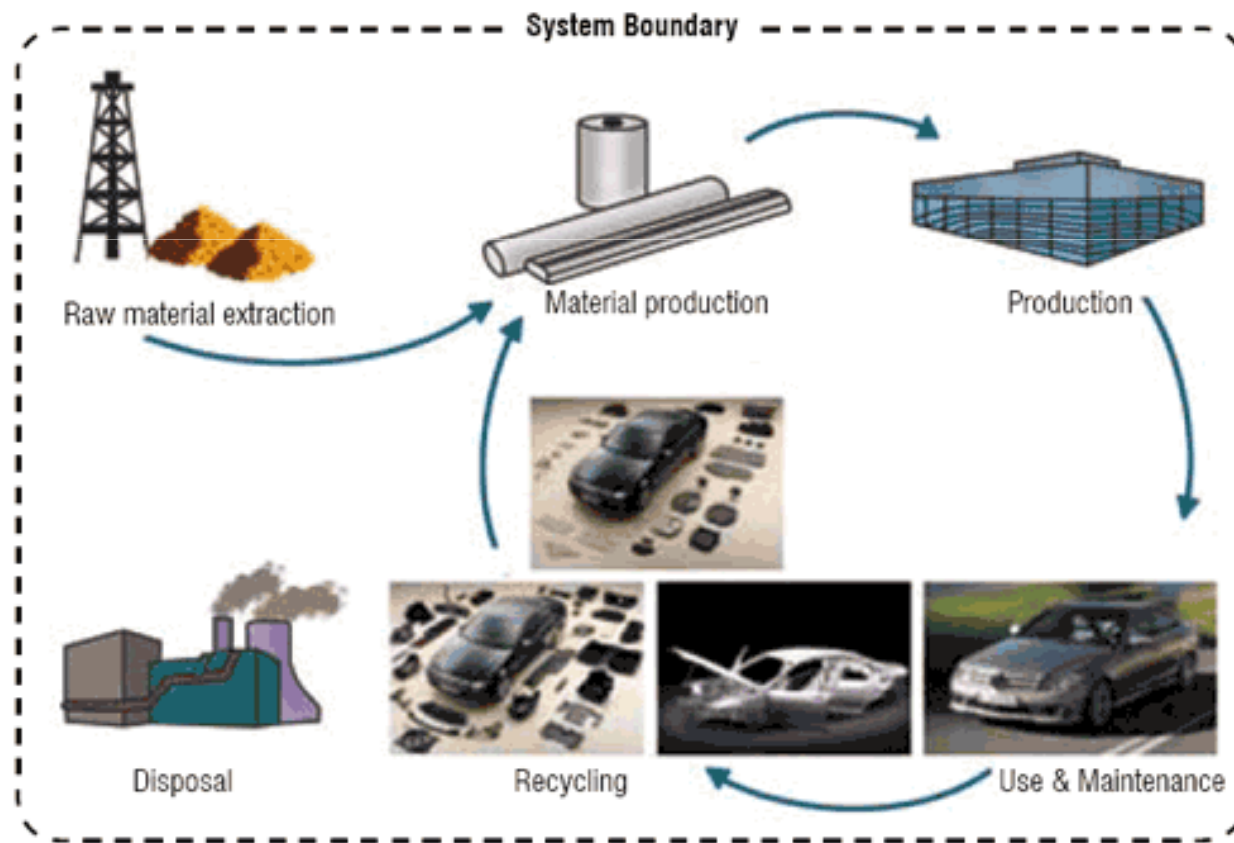


Figure 1

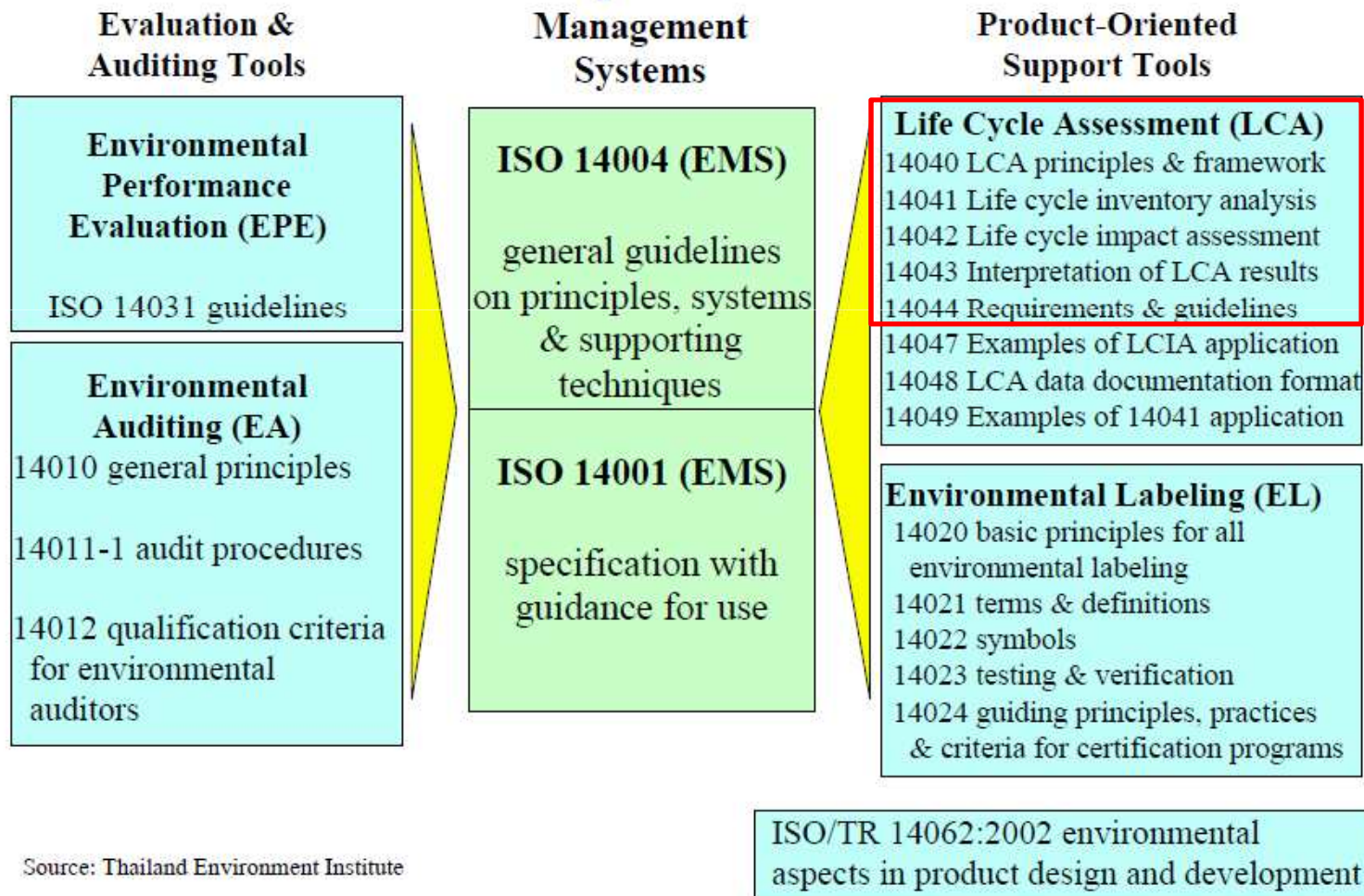
## What is LCA ? (2)

- Life Cycle Assessment (LCA) is method to compare **environmental impacts** of products/ technologies or services with a view to their whole life cycle;
- The emissions to all components of environment such as **SO<sub>2</sub>, COD, hazardous wastes,** and **CO<sub>2</sub>** during product production, use and disposal are considered;
- Processes of raw material mining, **material** and **energy** production, additional processes or sub processes are also involved.

## What is LCA ? (3)

- First LCA was implemented by Coca Cola in the USA, as a comparison of returnable bottle with PET-bottle.
- LCA method has fixed structure and is practiced according to international standards **ISO 14040 and 14044** from 2006.
- The LCA method is one of the most important information tools of environmentally sound product policy.

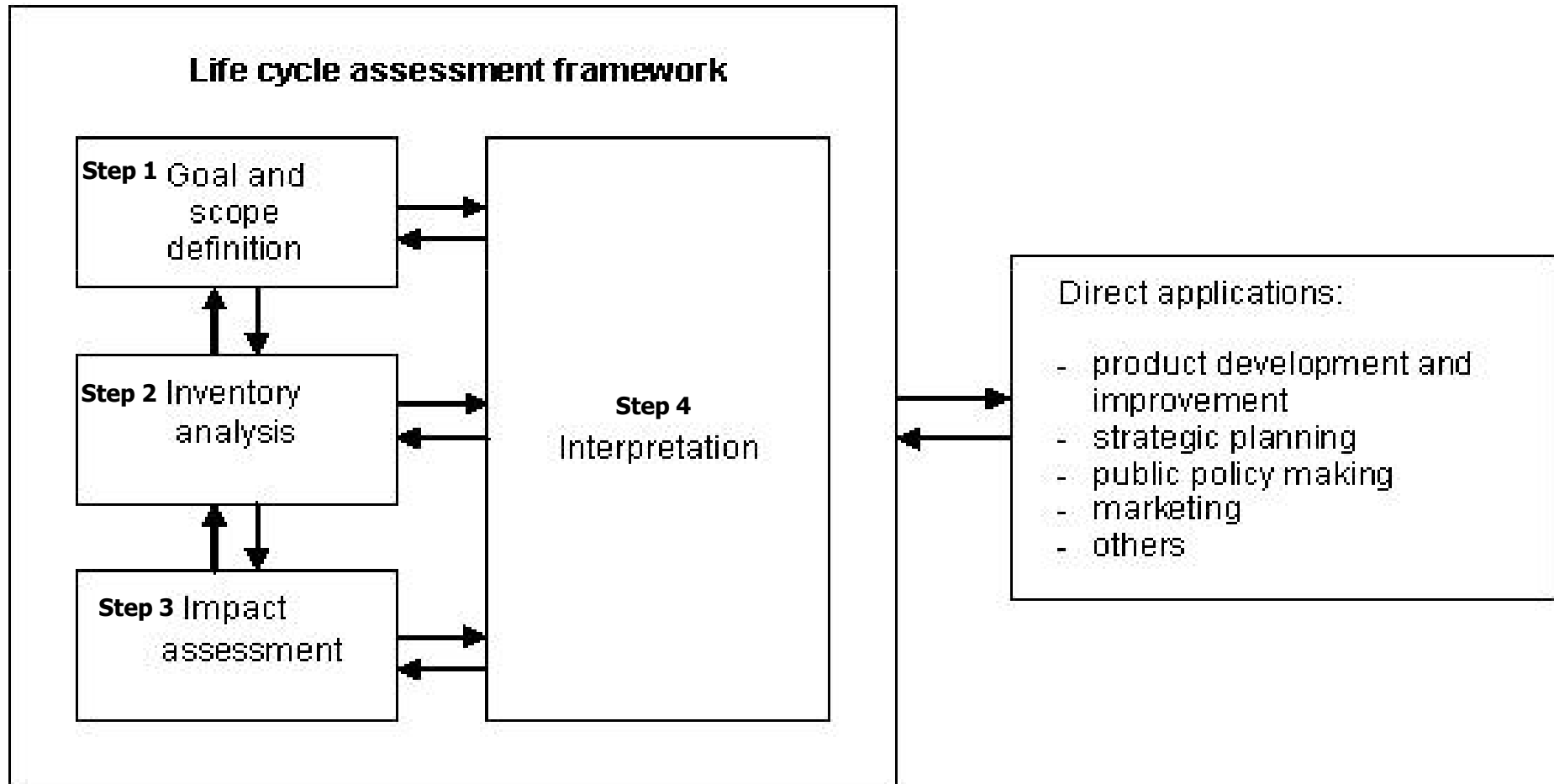
# What is LCA ? (4)



Source: Thailand Environment Institute



# What is LCA ? (5)



# Example of LCA



SOURCE: UNEP LCA Training Kit Module b – Overview of LCA

Which one is better for less GHGs ?



# LCA Step 1

## LCA Step 1 - Goal definition

**Goal:** To compare the two products in terms of their impacts to the environment.

### Definition:



Product property	Incandescent lamp	Fluorescent lamp
power consumption	60 W	18 W
life span	1000 hr	5000 hr
mass	30 g	540 g
mercury content	0 mg	2 mg

SOURCE: UNEP LCA Training Kit Module b – Overview of LCA



# LCA Step 2

## LCA Step 2 - Inventory Analysis

### Inventory table:



Elementary flow	Incandescent lamp	Fluorescent lamp
CO <sub>2</sub> to air	800000 kg	50000 kg
SO <sub>2</sub> to air	1000 kg	80 kg
Copper to water	3 g	20 g
Crude oil from earth	37000 kg	22000 kg

SOURCE: UNEP LCA Training Kit Module b – Overview of LCA

# LCA Step 3

## LCA Step 3 - Impact Assessment

### Equation

$$\text{Emissions}_i = \sum (\text{activity}_i \times \text{emission factor}_i)$$

where "i" type for a impact



Impact category	Incandescent lamp	Fluorescent lamp
Climate change	120000 kg CO2-eq	40000 kg CO2-eq
Ecotoxicity	320 kg DCB-eq	440 kg DCB-eq
Acidification	45 kg SO2-eq	21 kg SO2-eq
Depletion of resources	0.8 kg antimony-eq	0.3 kg antimony-eq

SOURCE: UNEP LCA Training Kit Module b – Overview of LCA



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# LCA Step 4

## LCA Step 4 - Interpretation

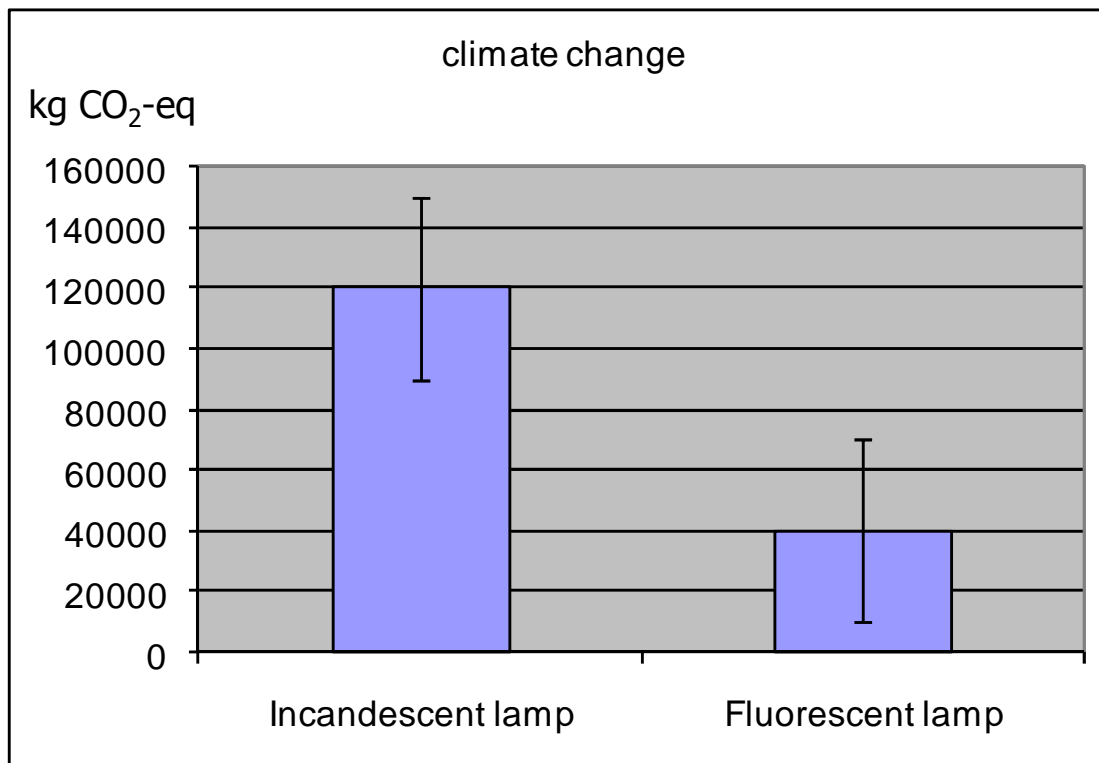


Process	Incandescent lamp	Fluorescent lamp
Electricity production	88%	60%
Copper production	5%	15%
Waste disposal	2%	10%
Other	5%	15%
<b>Total climate change</b>	<b>120000 kg CO2-eq</b>	<b>40000 kg CO2-eq</b>

SOURCE: UNEP LCA Training Kit Module b – Overview of LCA

# LCA Step 4.1

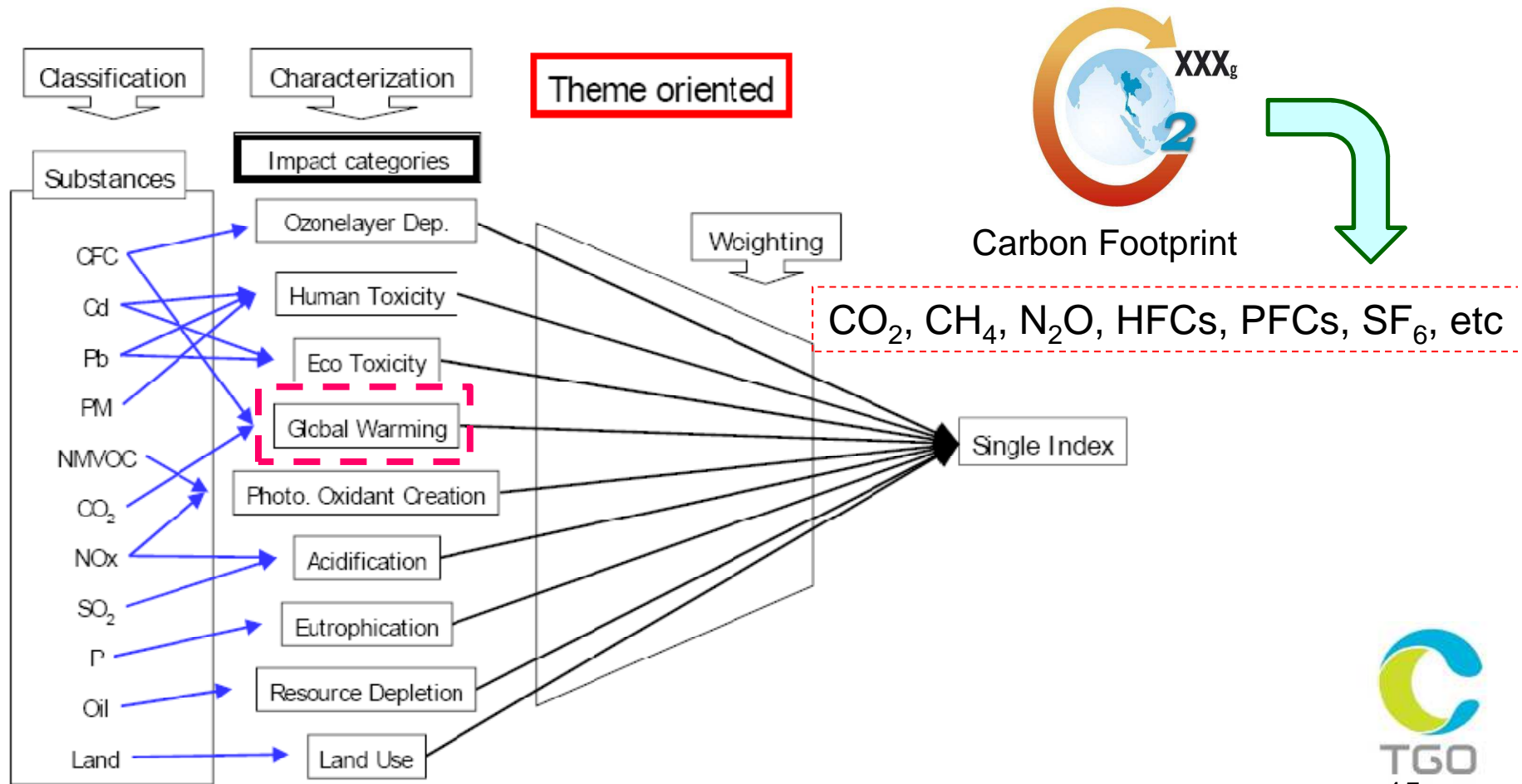
## LCA Step 4.1 - Interpretation



# The LCA method can be applied in next applications:

- strategic planning and decision making,
- product development (eco design),
- alternative comparison for purpose of decision making in investment,
- eco labeling,
- policy and regulations.

# Relationship between LCA and Carbon Footprint (CFP)





# Calculation of carbon footprint



@ Carbon Footprint



# Calculation Step 1

## LCA Step 1 - Goal Scope and definition

- **Business-to-Business**

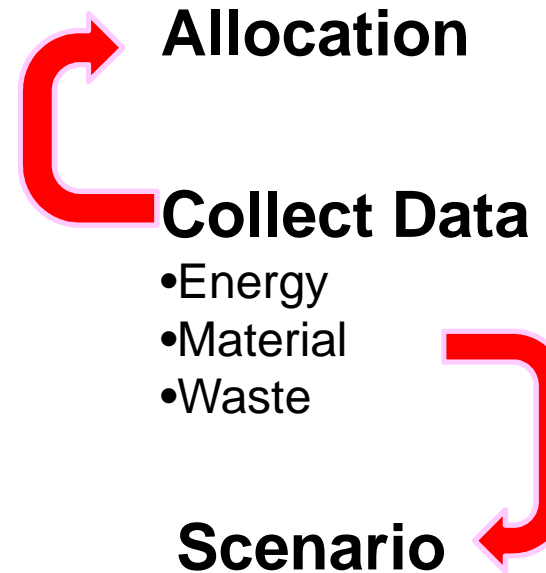


- **Business-Consumer**



# Calculation Step 2

## LCA Step 2 – Inventory Analysis



Source: Guide to PAS 2050

**primary data:** which are collected by organization

**secondary data:** which are referred to the common data, reference data and other LCA studies

# Calculation Step 2.1

## LCA Step 2.1 – Inventory Analysis

### Allocation

line production have two product or more categories are handled in same stages of production should allocate the emission of an individual product from the total emissions in Allocation by mass stage and Allocation by economic.

### Scenario setting

If don't data some processes so assumed activity is in stage, the common scenario can be set up in considering the following points

# Calculation Step 3

## LCA Step 3 – Impact Assessment

Equation

$$\text{GHG emissions} = \sum (\text{activity}_i \times \text{GHG emission factor}_i)$$

where "i" stands for a process

CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>, etc.

### Collect Data

- Energy
- Material
- Waste

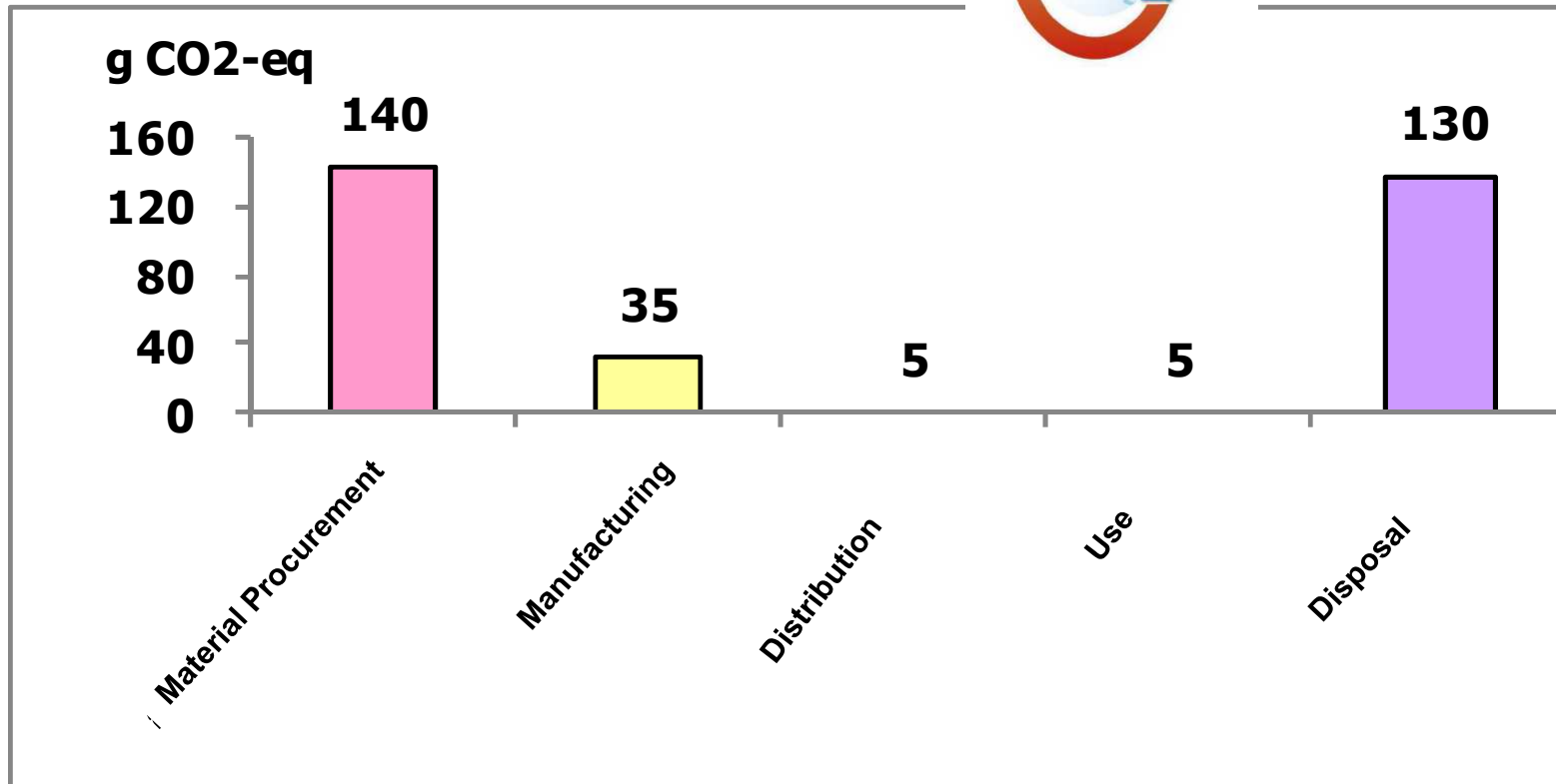


# Priority to selection emission factor

- Thai National LCI Database
- Database of Thesis and Research in Thailand (peer-review publication)
- LCA Software or Database of Group Industrial
- IPCC

# Calculation Step 4

## LCA Step 4 – Interpretation





# Example of carbon footprint

# Example to calculate carbon footprint of Picnic chair







# Goal Scope and Definition

**Goal:** Life Cycle Assessment of Picnic chair.

**Scope:** Business to Consumer

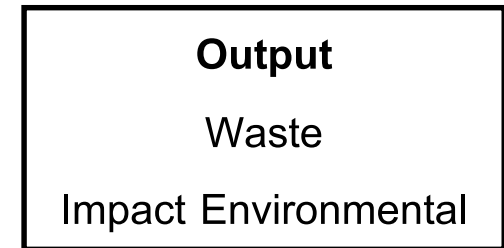
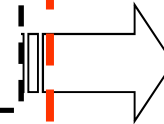
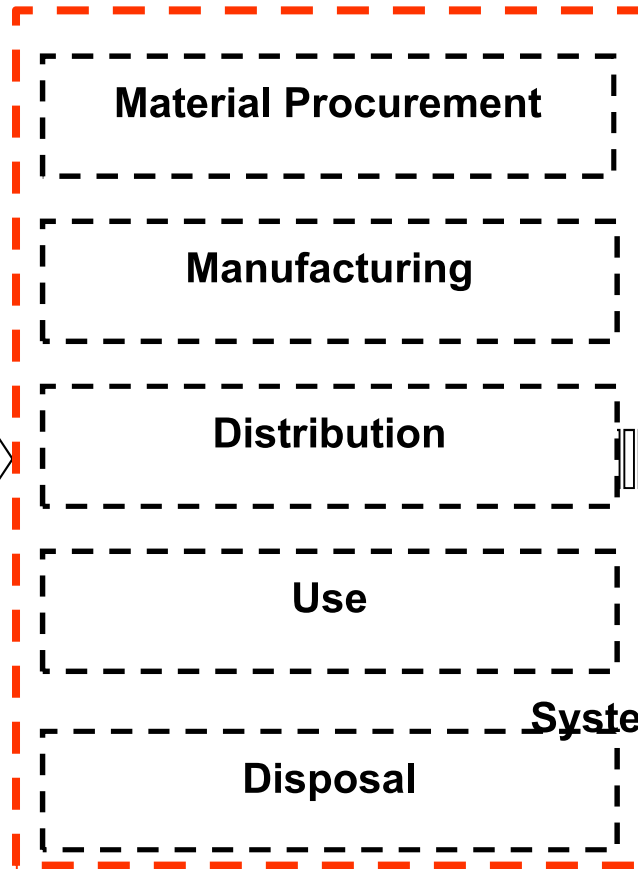
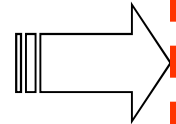
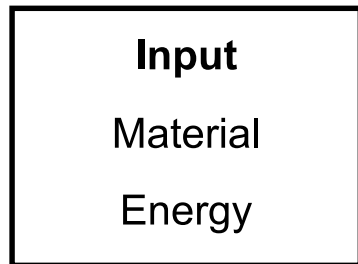
**Functional unit:** Impact/1product

**Definition:** Picnic chair use for sit



# Give inventory data in process

B to C



System boundary



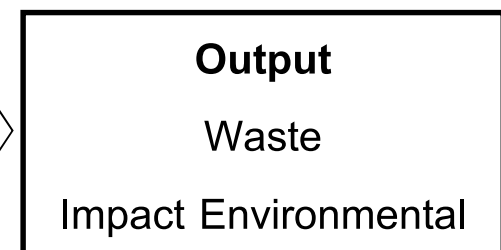
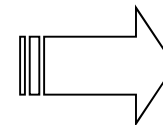
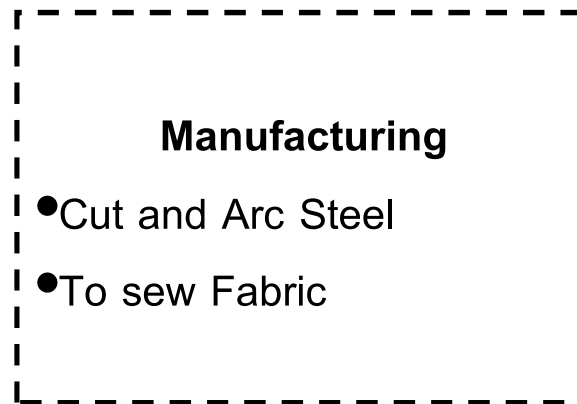
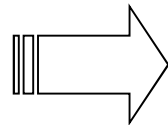
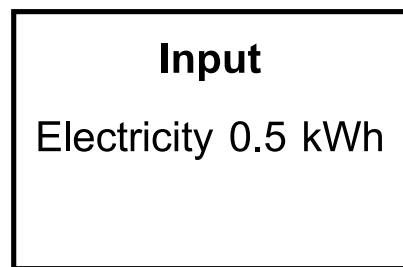
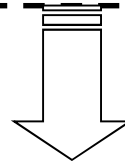
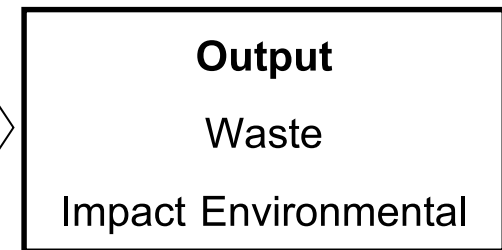
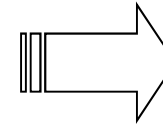
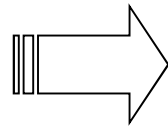
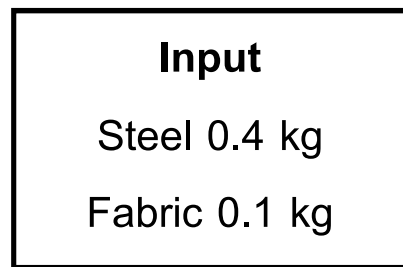
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# Give inventory data in process (1)

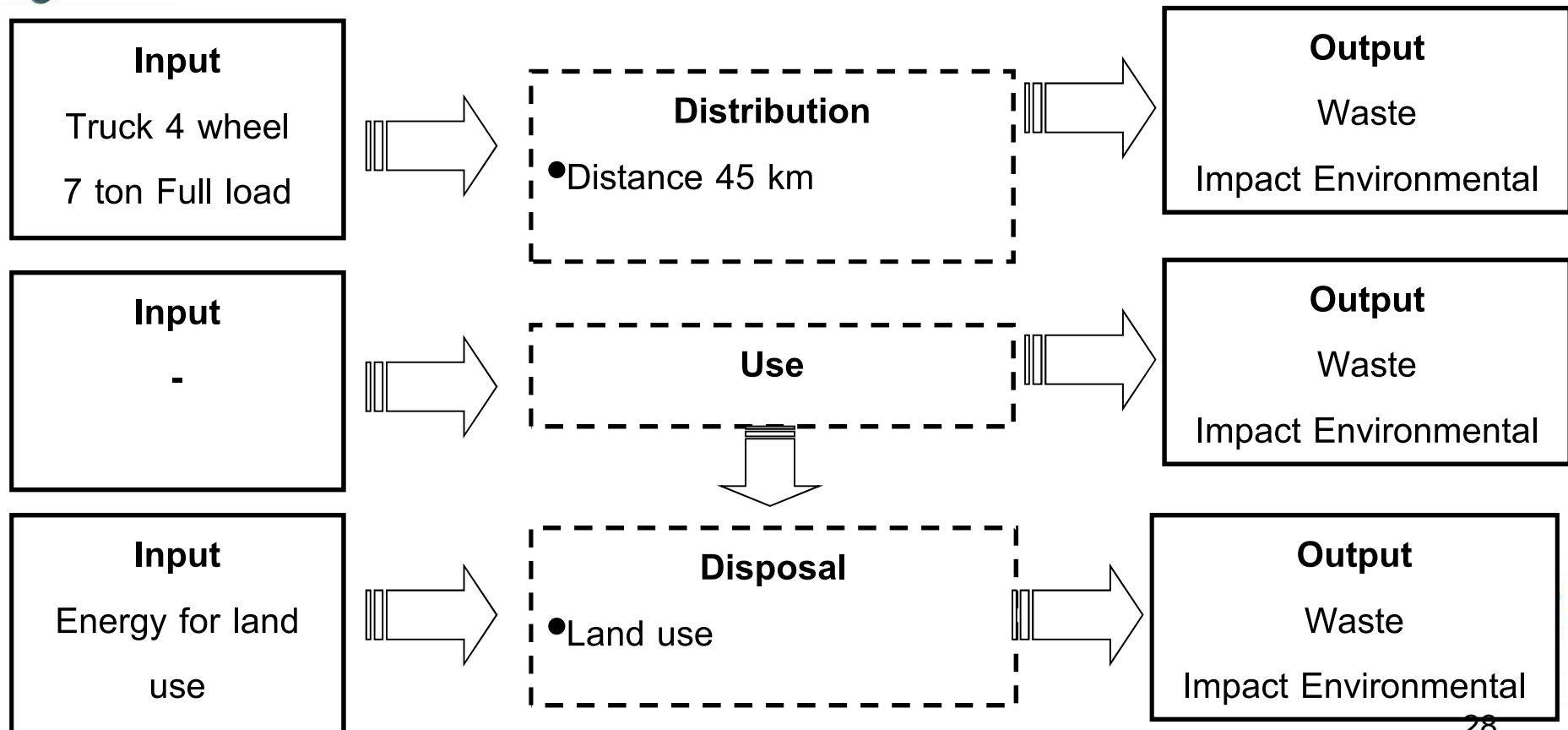
B to C





# Give inventory data in process (2)

B to C



# Summary of Inventory data

Process	Energy	Material	Source
Material Procurement	-	Steel = 0.4 kg Fabric = 0.1 kg	Primary data
Manufacturing	Electricity = 0.5 kWh	-	Primary data
Distribution	Distance = 45 km	-	Secondary data
Use	-	-	-
Disposal	Landfill = 0.5 kg		Secondary data

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# Emission Factor

List	Unit	EF(kgCO <sub>2</sub> e/Unit)	Sources of Data
Steel	kg	1.7600	IPCC 2007
Fabric	kg	2.1100	IPCC 2007
Electricity	kWh	0.5610	Thai National LCI Database
Truck 4 wheel 7 ton Full load	ton km	0.1472	Thai National LCI Database
Landfill	kg	2.32	IPCC ; TGO Study

# Calculation

Equation

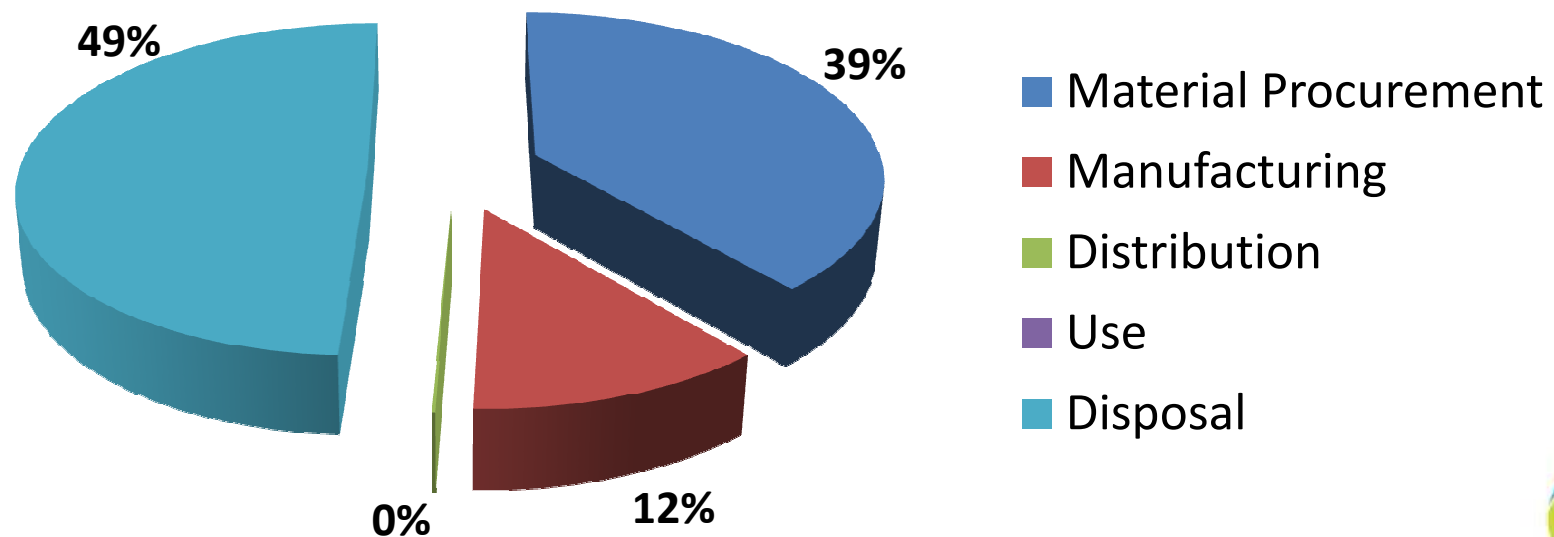
$$\Sigma (\text{activity}_i \times \text{emission factor}_i) = \text{Emissions}_i$$

Process	Name	Volume (Unit)	EF (kgCO <sub>2</sub> e/Unit)	Volume (kgCO <sub>2</sub> e)
Material Procurement	Steel	0.4 kg	1.7600	<b>0.70</b>
	Fabric	0.1 kg	2.1100	<b>0.21</b>
Manufacturing	Electricity	0.5 kWh	0.5610	<b>0.28</b>
Distribution	Truck	0.0225 ton km	0.1472	<b>0.003</b>
Use	-	-	-	-
Disposal	Landfill	0.5 kg	2.32	<b>1.16</b>
		<b>All</b>		<b>2.35</b>



# Calculation result (1)

## Volume (kgCO<sub>2</sub>e)





## Calculation result (2)

1 Picnic chair is emits Greenhouse gases equal to 2.35 kgCO<sub>2</sub>e



# Thank you!

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