Life Cycle Assessment:
What is it and how is it used?

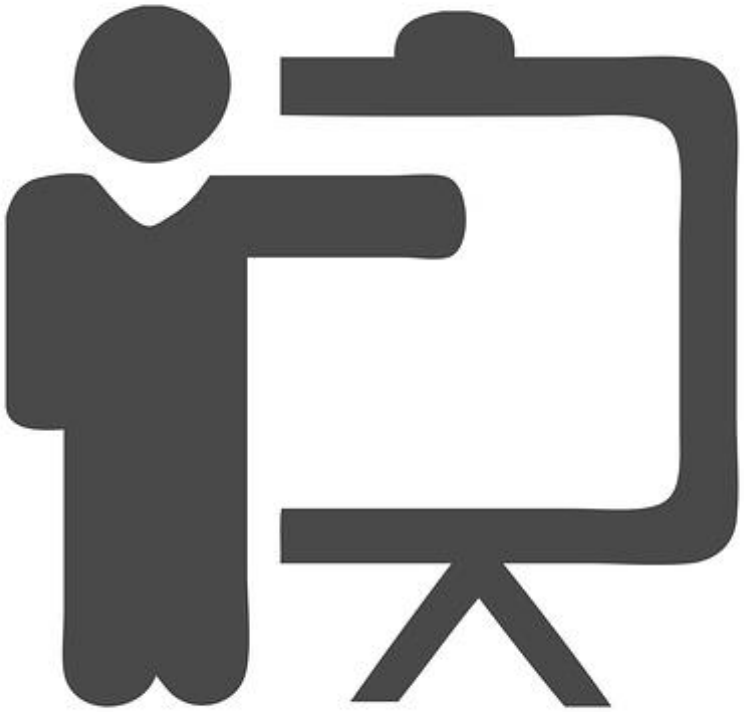
One Government's use of LCA

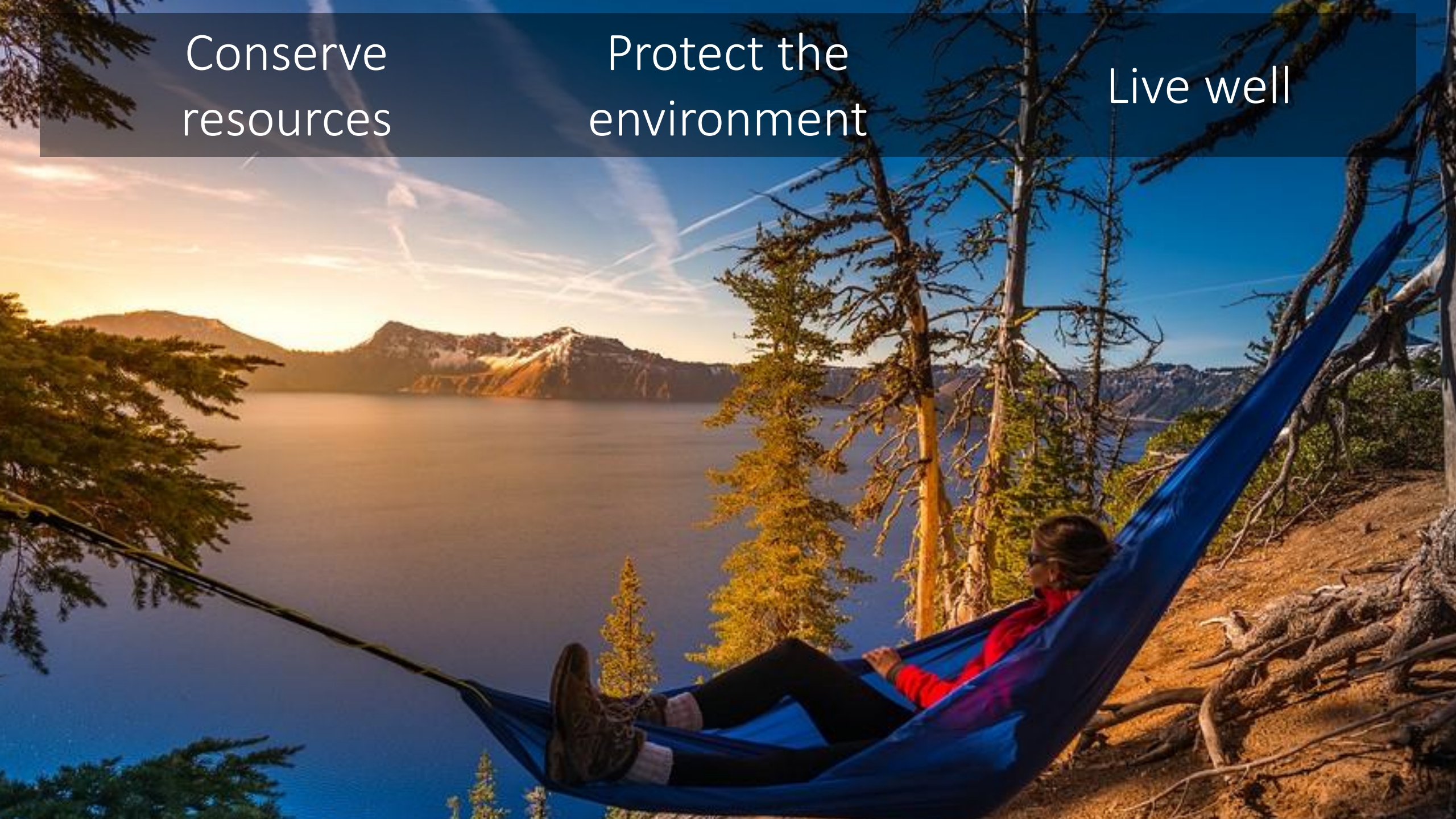
Washington Country GRAC
October 19, 2023

Peter Canepa | Oregon Department of Environmental Quality

Today's Agenda

- Brief Introduction to Materials Management (2 mins)
- LCA Theory (8 mins)
- LCA Practice (30 mins)
- Discussion (remainder)




Conserve resources
Protect the environment
Live well

Introduction to Life Cycle Assessment

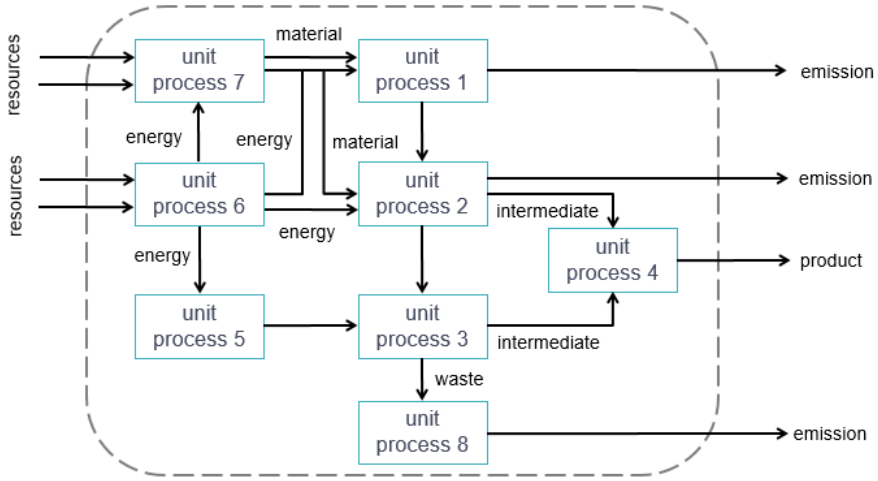
Peter Canepa | Oregon Department of Environmental Quality

Life Cycle Assessment is

*"the compilation and evaluation of the **inputs**, **outputs** and the **potential environmental impacts** of a product system throughout its life cycle."*

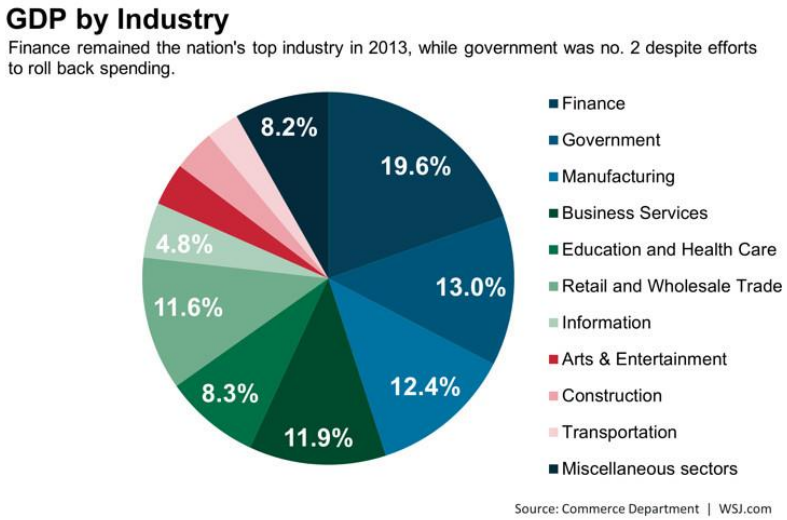
Types of LCA

- Process-based

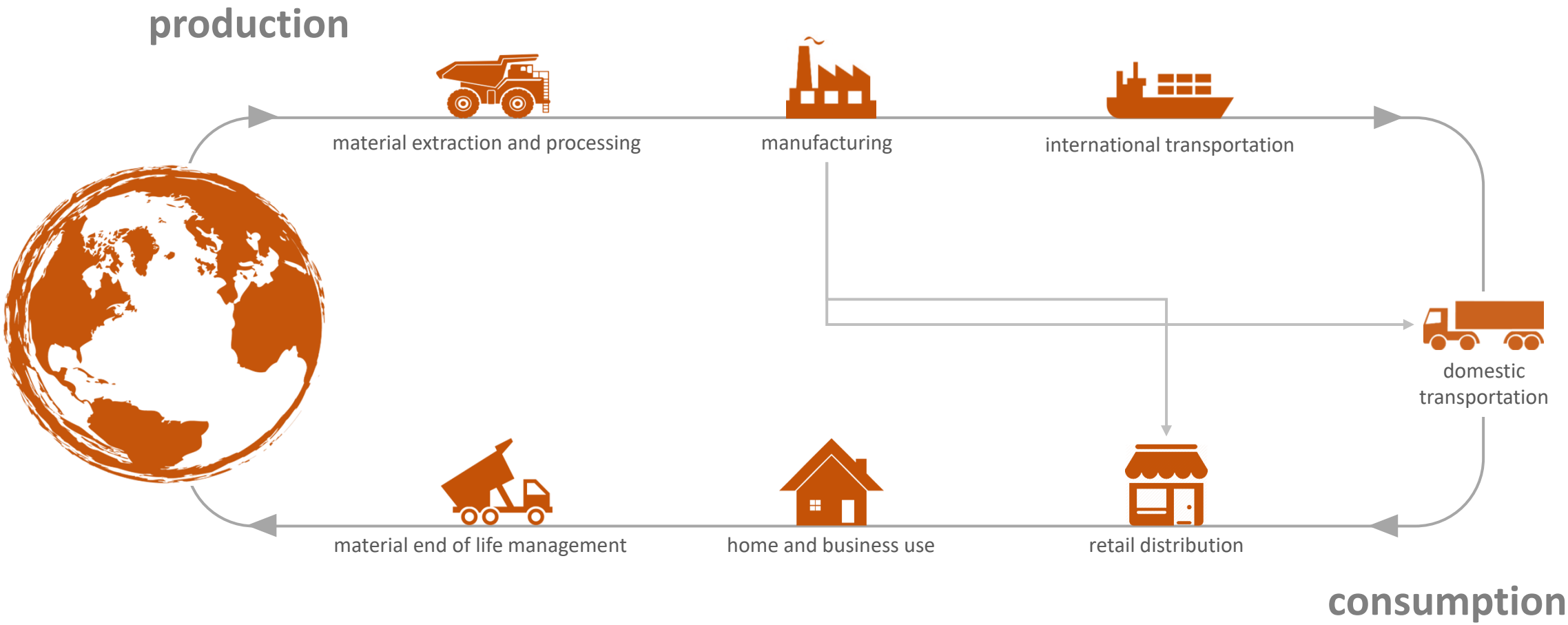


Example of a "cradle-to-gate" product system and boundary

- Economic Input/Output-based

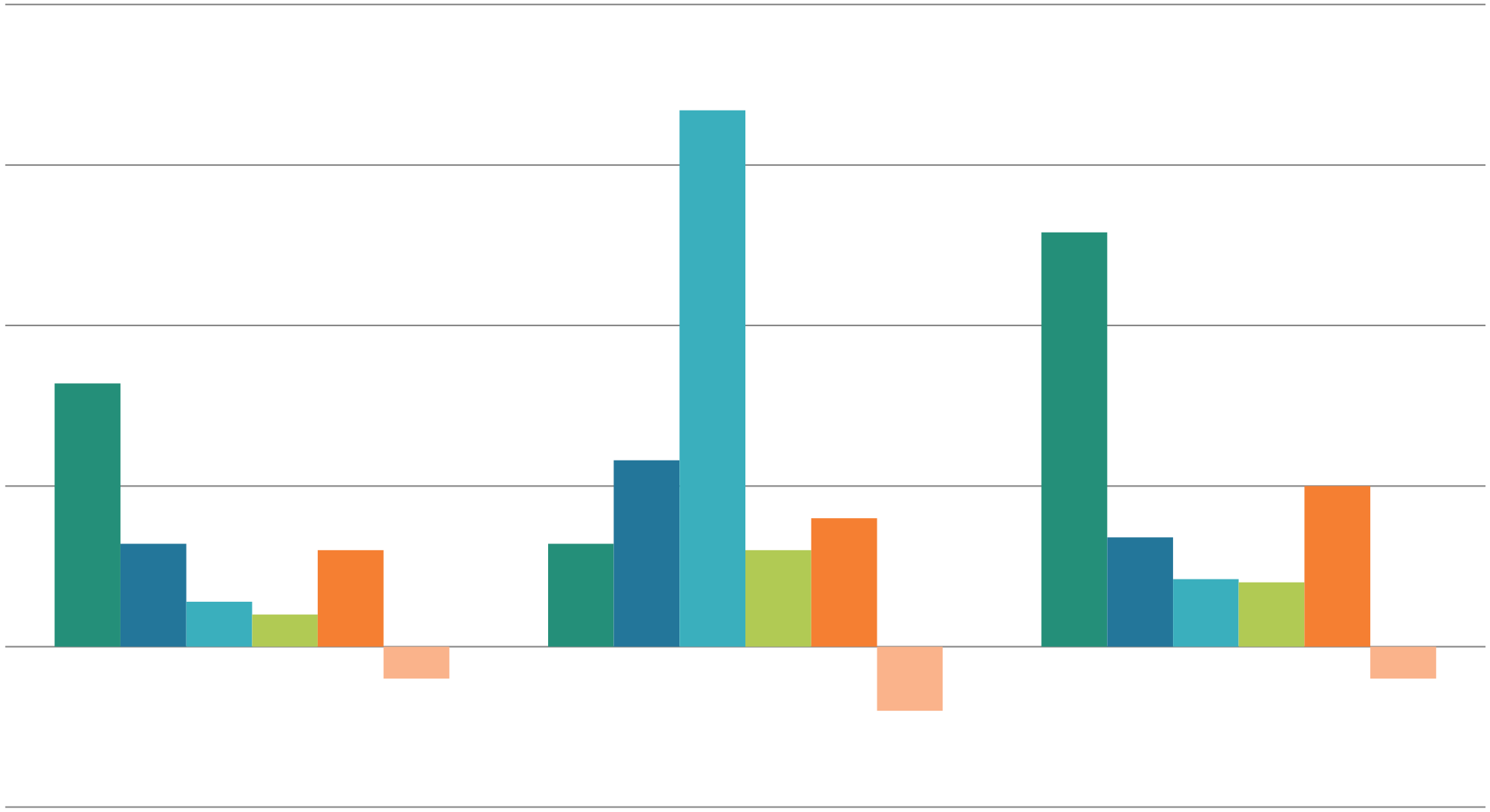


material life cycle



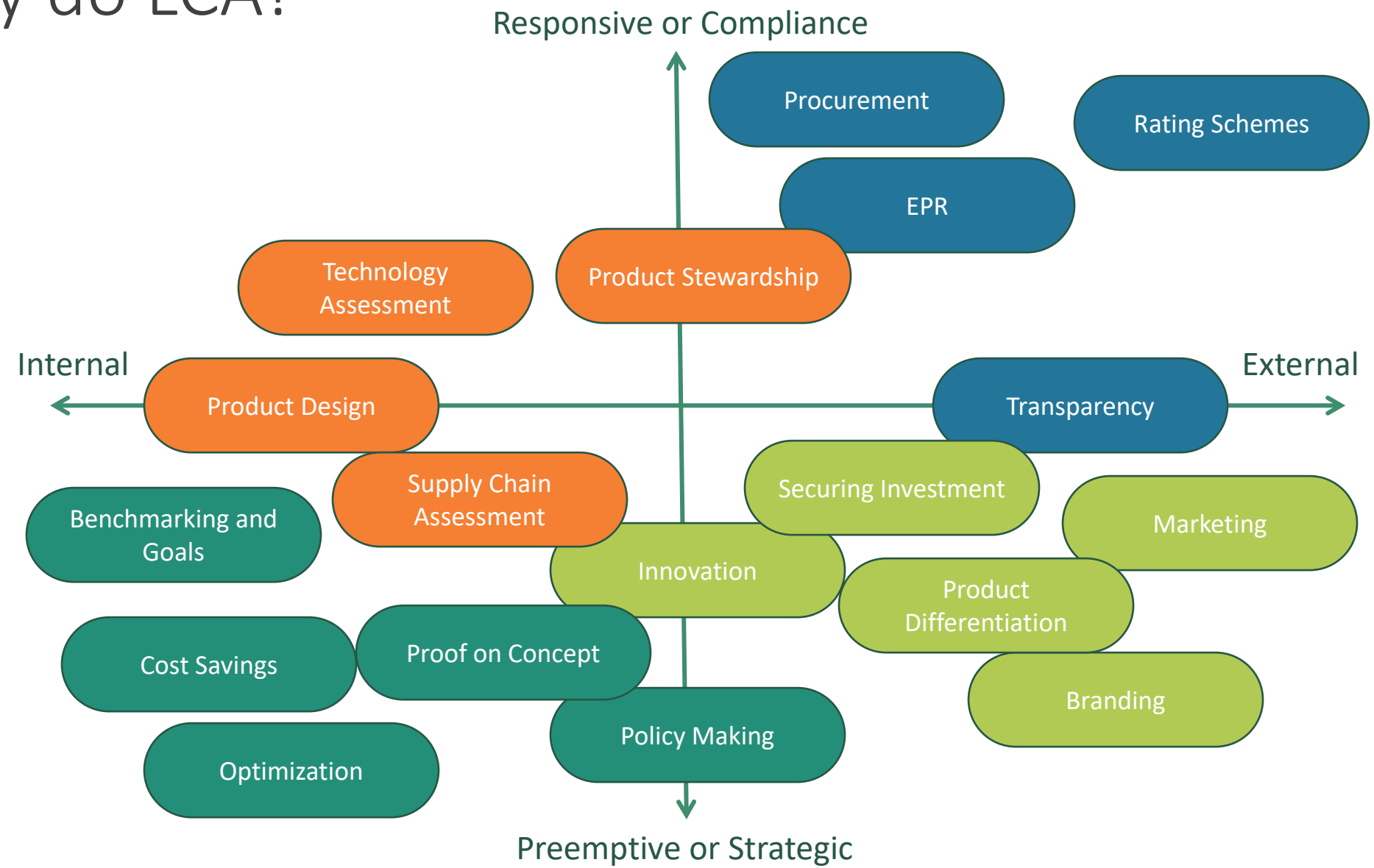
Holistic

quantitative



comparative

why do LCA?


Responsive or Compliance
Procurement
Rating Schemes
EPR
Technology Assessment
Product Stewardship
Internal
External
Product Design
Transparency
Supply Chain Assessment
Securing Investment
Benchmarking and Goals
Marketing
Innovation
Product Differentiation
Cost Savings
Proof on Concept
Branding
Policy Making
Optimization
Preemptive or Strategic

For Example


vs.


vs.


vs.



vs.


vs.


vs.



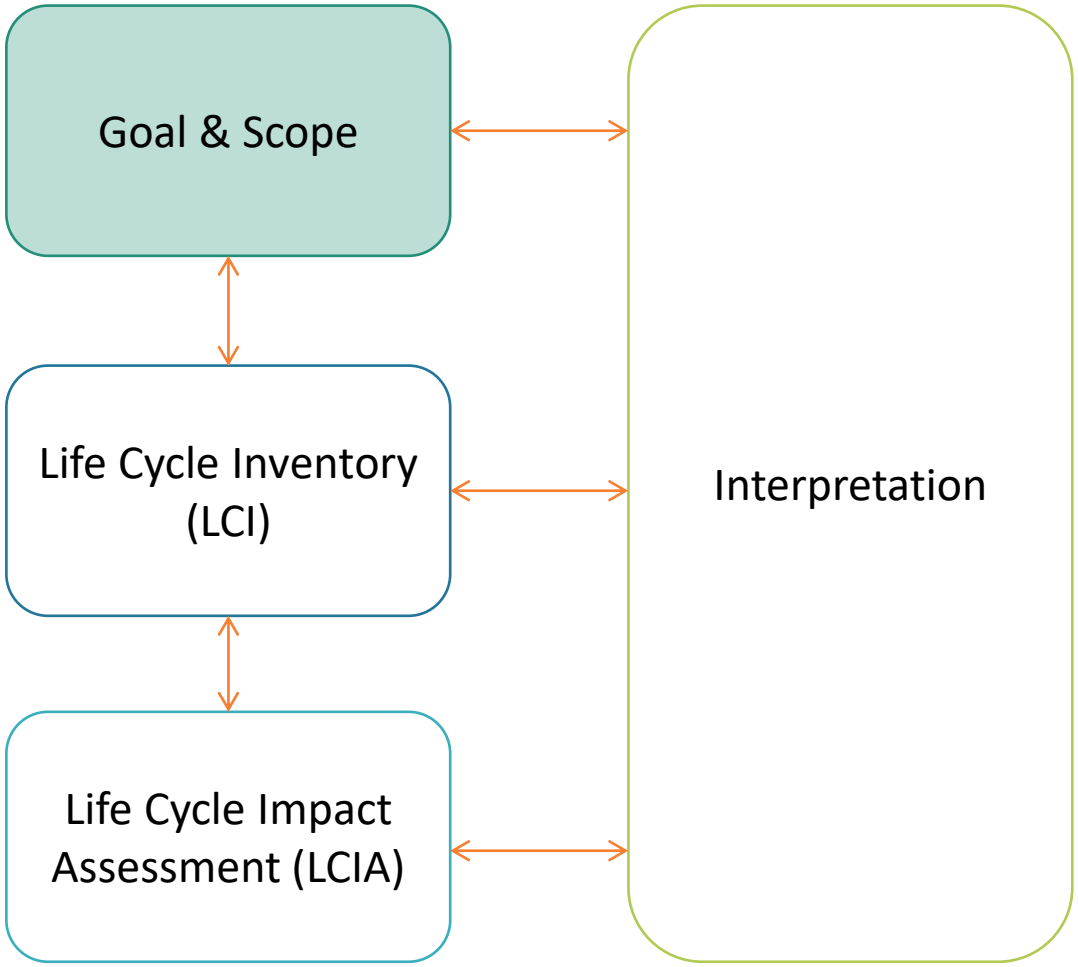
vs.

vs.

vs.

vs.


ISO 14040/44 Standardization



Applications:

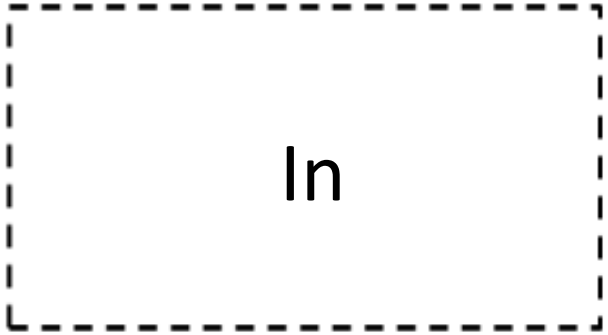
- Strategy
- Public policy
- Product design
- Marketing

goal

- the intended application
- the reasons for carrying out the study
- the intended audience, i.e. to whom the results of the study are intended to be communicated
- whether the results are intended to be used in comparative assertions intended to be disclosed to the public

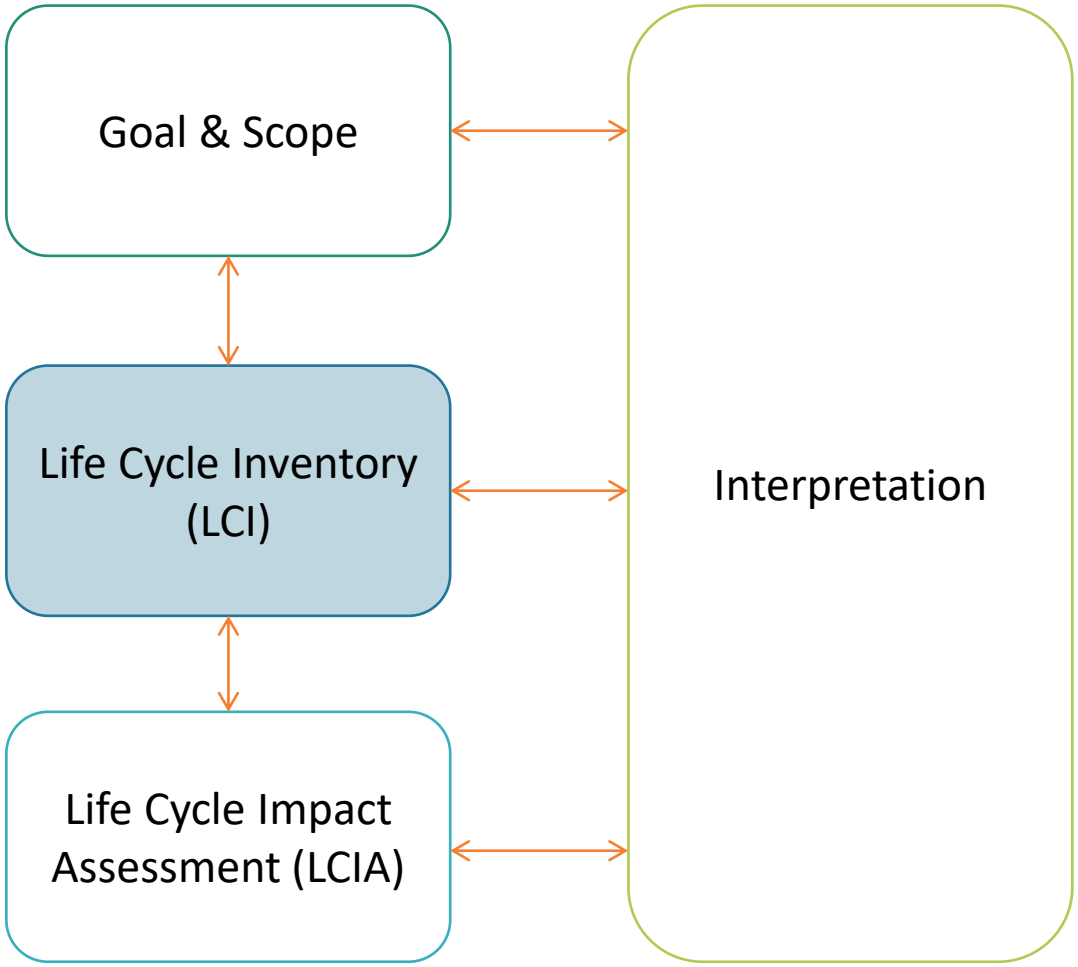
scope

- the product system(s) to be studied
- the function(s) of the product system(s)
- **the functional unit**
- **the system boundary**
- allocation procedures
- LCIA methodology and types of impacts
- interpretation to be used
- data requirements
- assumptions
- value choices and optional elements
- limitations
- data quality requirements
- type of critical review, if any
- type and format of the report required for the study.



Out

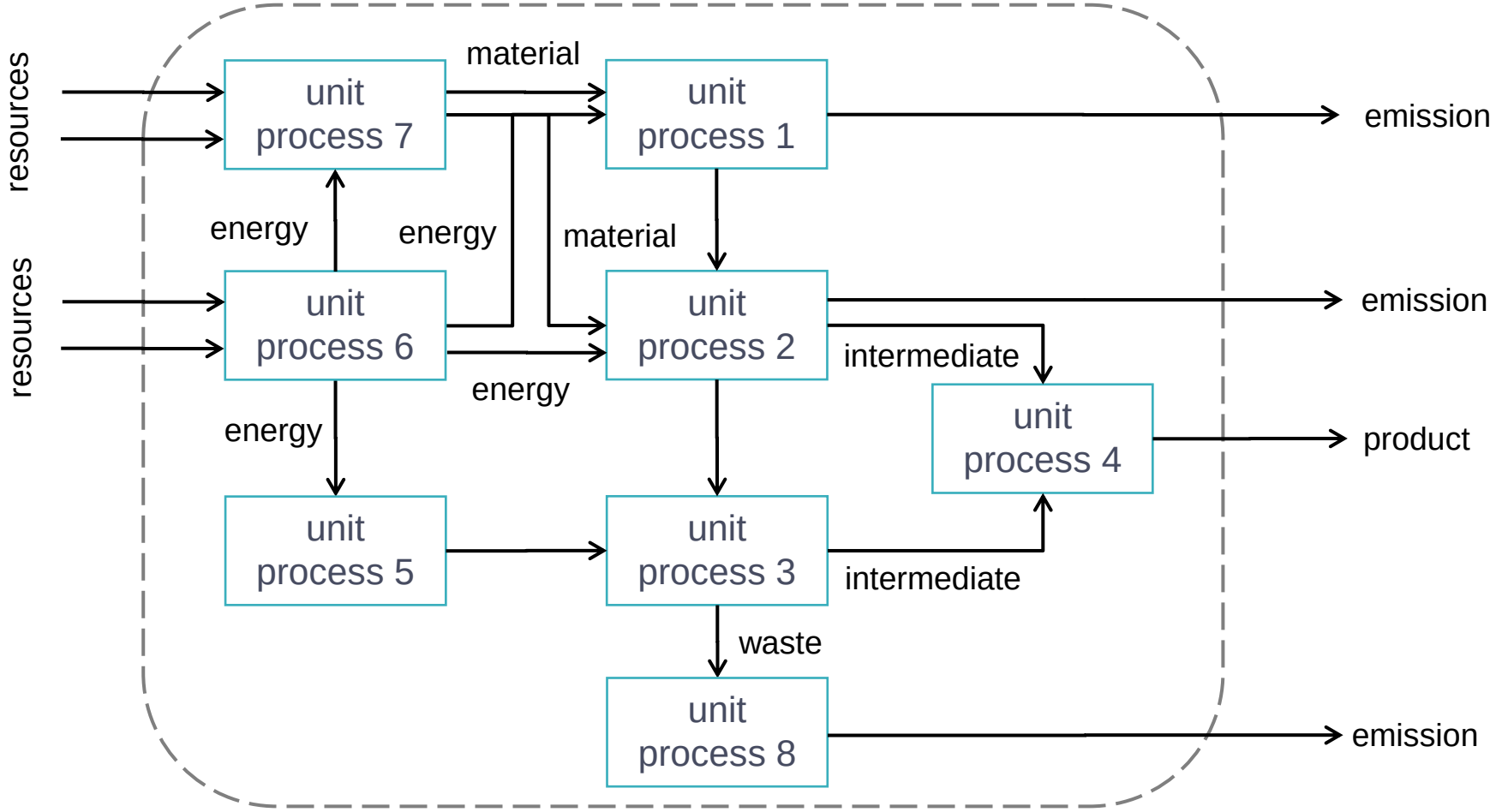
ISO 14040/44 Standardization



Applications:

- Strategy
- Public policy
- Product design
- Marketing

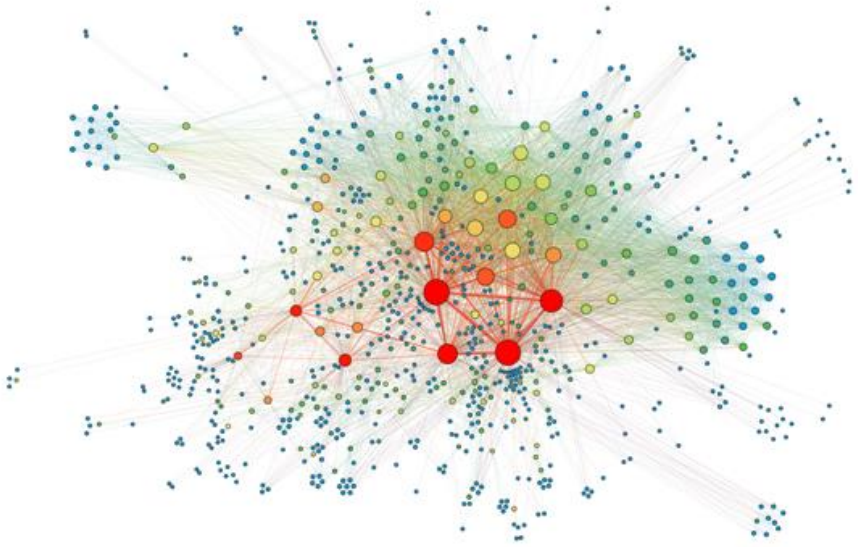
system boundary defines LCI



Example of a "cradle-to-gate" product system and boundary

data sources

Primary data: collected directly from the process operators



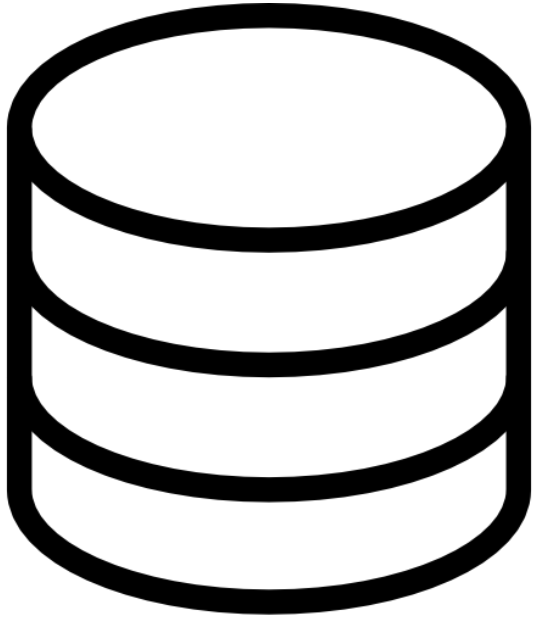
Sources for primary data:

- Energy & raw material accounting
- Process flow diagrams
- Design documents - bills of materials
- Emission reporting
- Financial reporting
- Equipment specs
- Technical experts

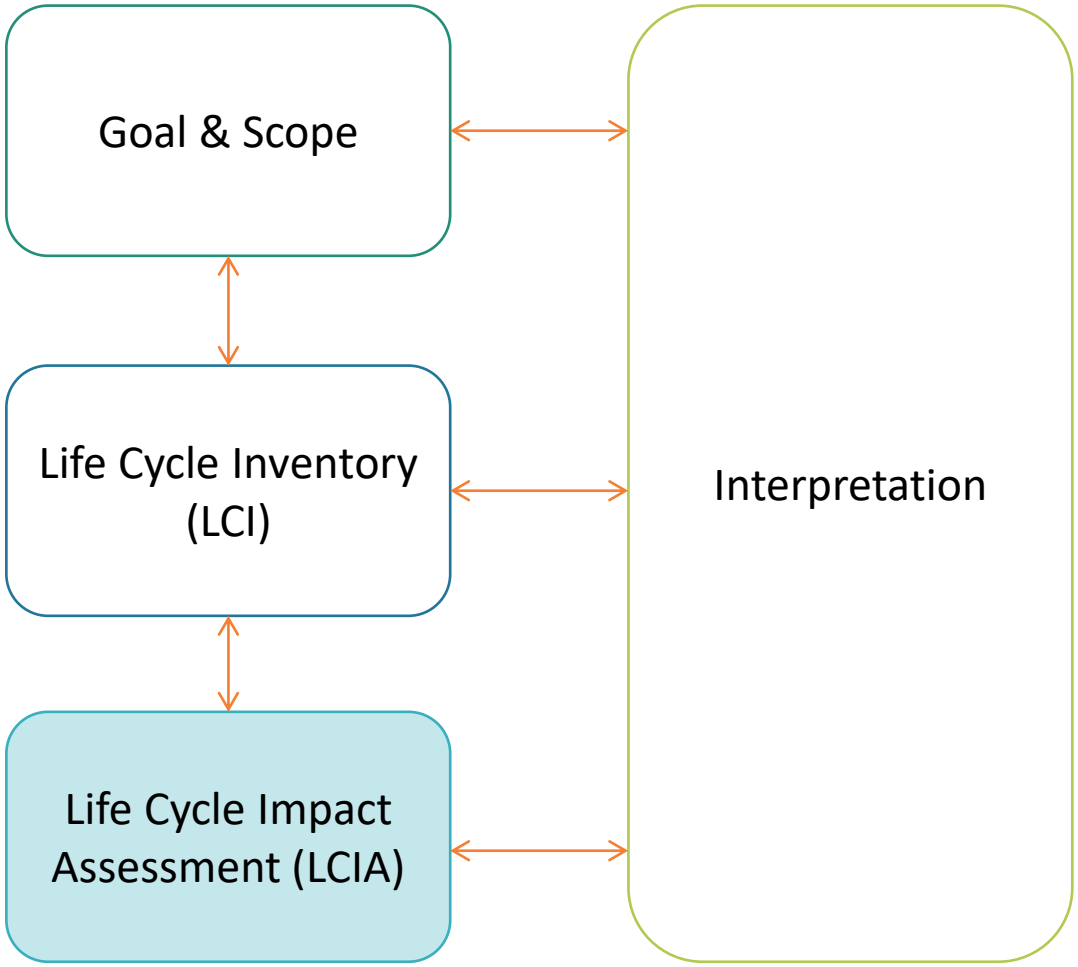
data sources

Secondary data: all publicly available data

- LCI databases / LCA software: Ecoinvent, GaBi, USLCI, ELCD
- Industry associations: WorldSteel, AA, ACC, PlasticsEurope, NAIMA, NRMCA
- Other published LCAs
- Environmental Product Declarations (EPDs)
- Ullmann's Encyclopedia of Industrial Chemistry
- Scientific journals
- BAT/BREF documents
- Patents
- National economic input-output tables



ISO 14040/44 Standardization

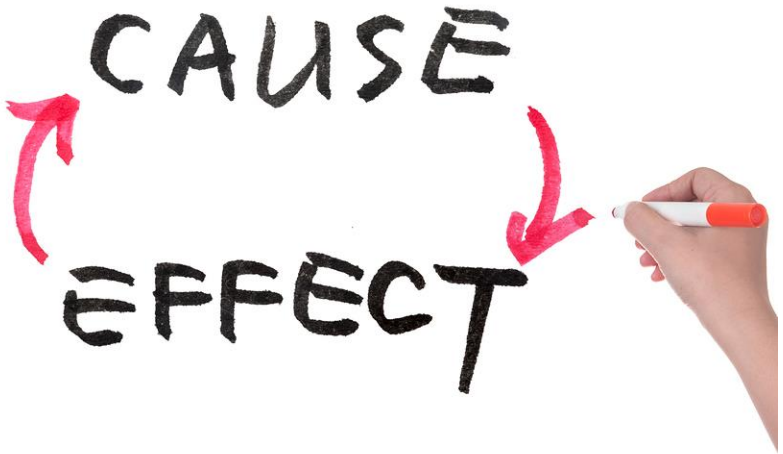


Applications:

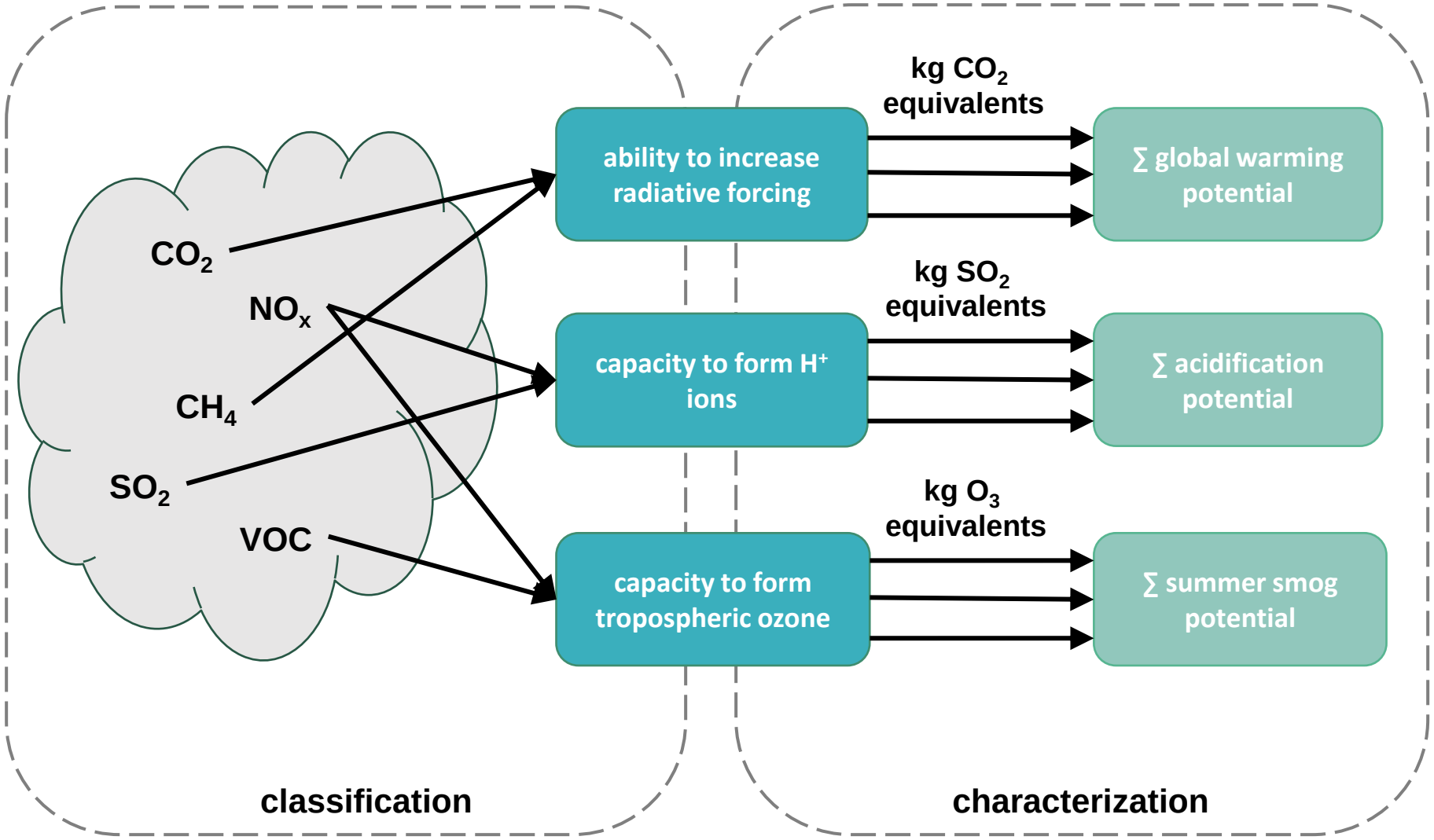
- Strategy
- Public policy
- Product design
- Marketing

life cycle impact assessment (LCIA)

Phase of life cycle assessment aimed at understanding and evaluating the magnitude and significance of the potential environmental impacts for a product system throughout the life cycle of the product (ISO 14044, 3.4).



life cycle impact assessment (LCIA)



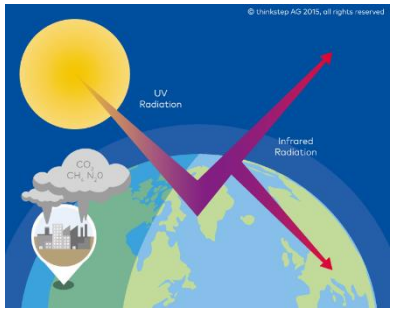
life cycle impact assessment (LCIA)

LCI Values				Characterization Factors		Impact Potential (GWP)	Unit
Outputs	Value	Unit					
Carbon Dioxide	50	kg	*	1	=	50	kg CO2-equiv.
Methane	2	kg	*	30	=	60	kg CO2-equiv.
Nitrous Oxide	1	kg	*	265	=	265	kg CO2-equiv.
Inputs	Value	Unit					
Carbon Dioxide	-60	kg	*	1	=	-60	kg CO2-equiv.

= **315** kg CO2-equiv.

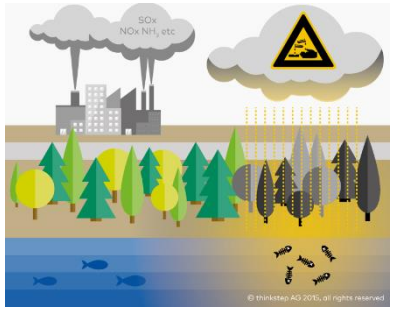
Must be done for each indicator/impact category!

life cycle impact assessment categories



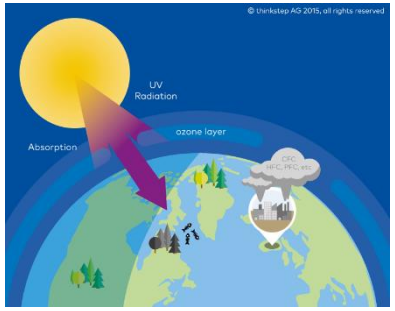
Global Warming Potential (GWP)

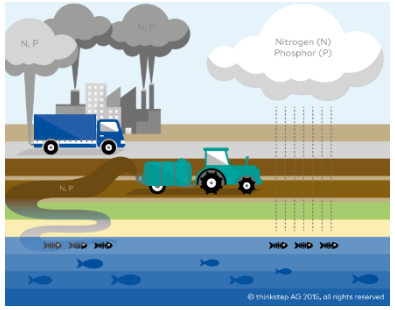
Smog Creation Potential (SFP/POCP)



Acidification Potential (AP)

Ozone Depletion Potential (ODP)



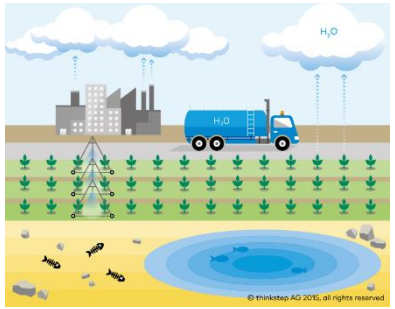


Eutrophication Potential (EP)

+

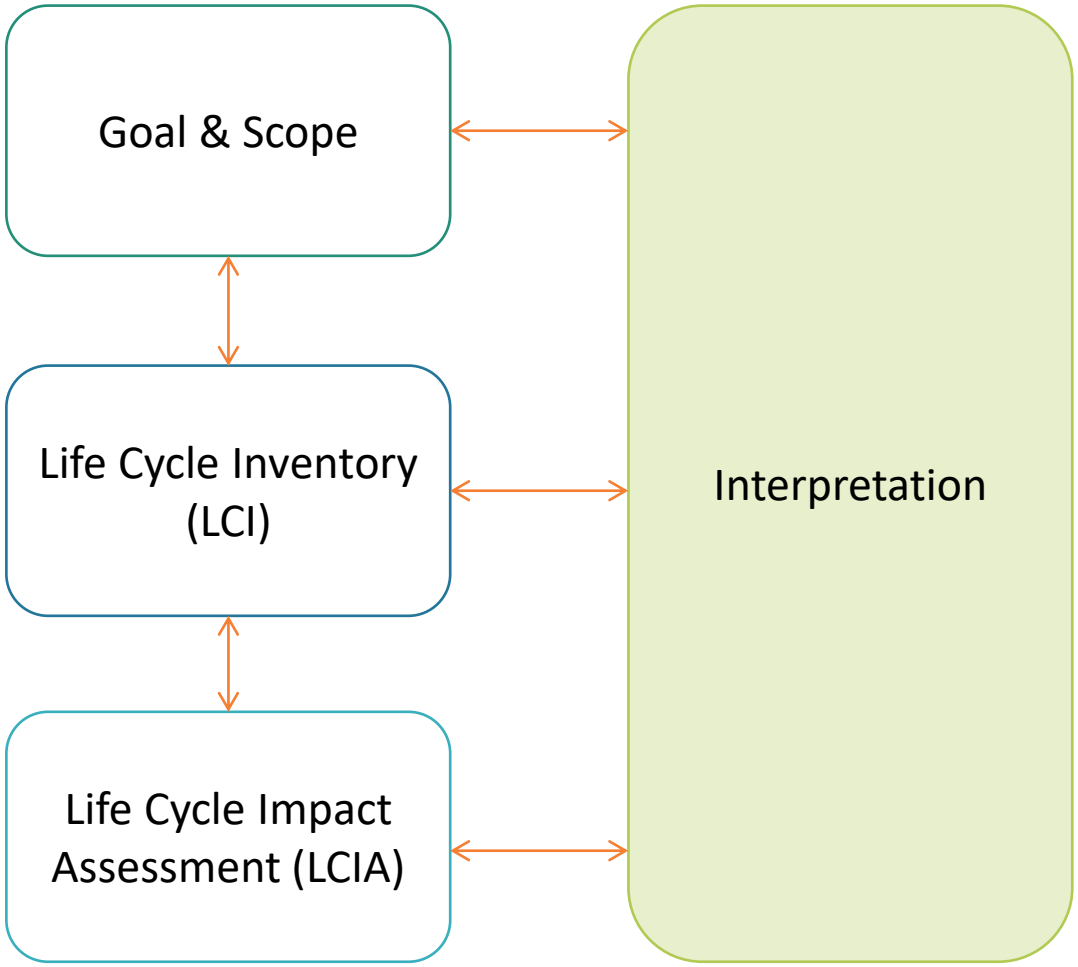
Primary Energy Demand (PED)

Water Scarcity



Source: thinkstep, used with permission and iStockphoto.com/DrAfter123

ISO 14040/44 Standardization

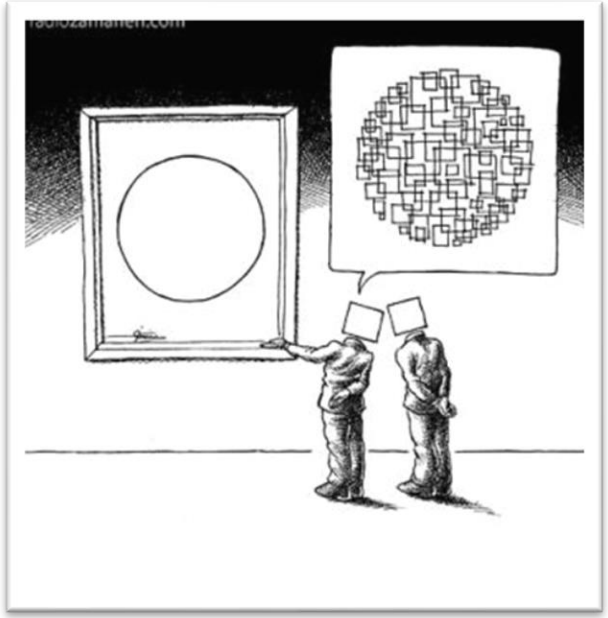


Applications:

- Strategy
- Public policy
- Product design
- Marketing

interpretation

- The key findings of the study
- Assumptions, limitations, or significant issues
- Data quality assessment
- Conclusions and recommendations
- Use and applications of results



Let’s look at an LCA model of….

Source: Toll House

LCA in Practice

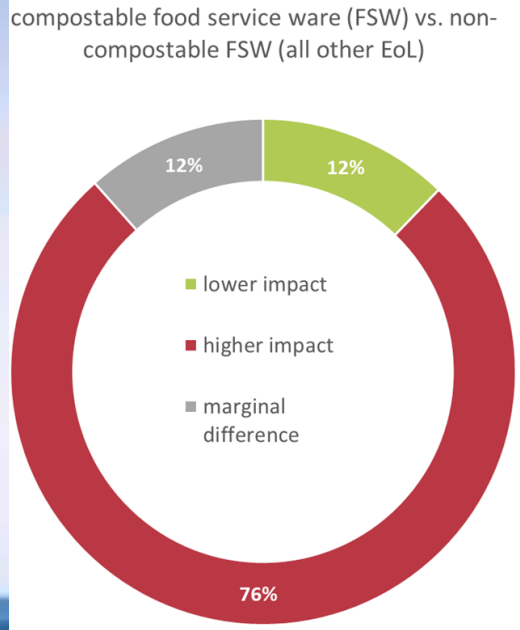
leveraging the potential for environmental impact reduction

Peter Canepa | Oregon Department of Environmental Quality

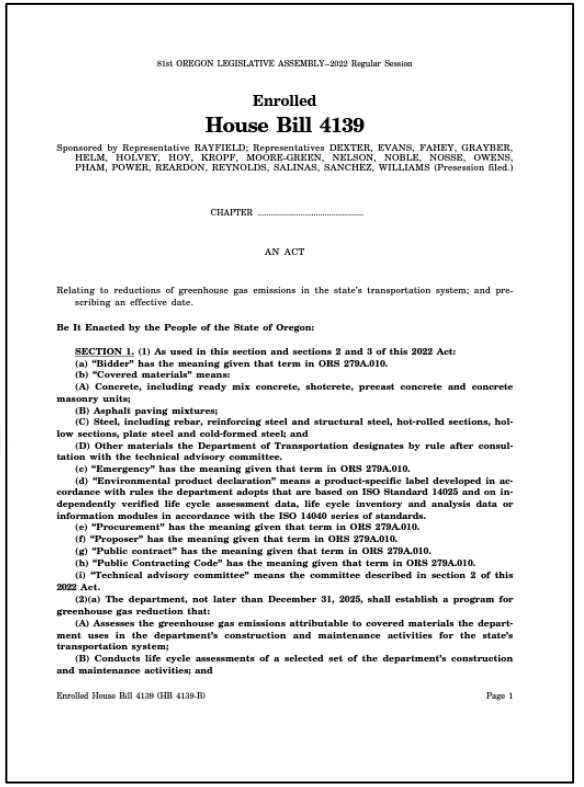
DEQ's applied LCA portfolio

Clackamas County milk dispenser program in schools reduces waste: packaging and waste of milk.

Water bottle study – a Life Cycle Assessment of different drinking water delivery systems.



How well do popular packaging attributes correlate with reduced environmental impact?



81st OREGON LEGISLATIVE ASSEMBLY–2022 Regular Session

Enrolled

House Bill 4139

Sponsored by Representative RAYFIELD; Representatives DEXTER, EVANS, FAHEY, GRAYBER, HELM, HOLVEY, HOY, KROPF, MOORE-GREEN, NELSON, NOBLE, NOSSE, OWENS, PHAM, POWER, REARDON, REYNOLDS, SALINAS, SANCHEZ, WILLIAMS (Presession filed.)

CHAPTER .....

AN ACT

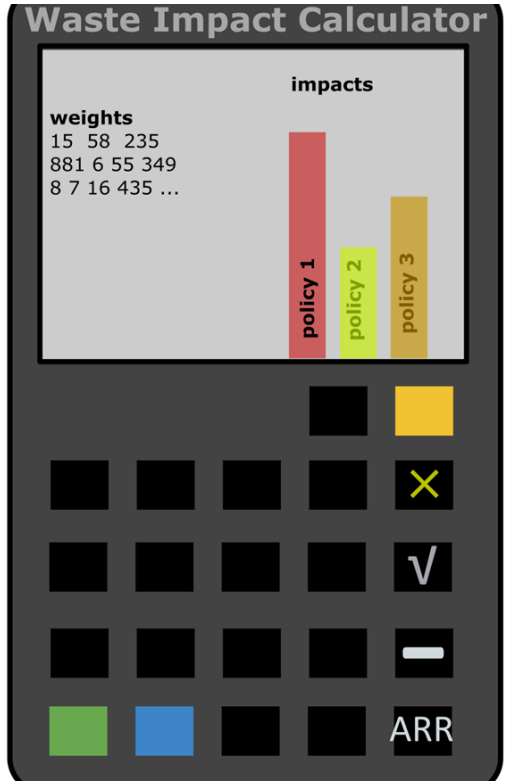
Relating to reductions of greenhouse gas emissions in the state's transportation system; and prescribing an effective date.

Be It Enacted by the People of the State of Oregon:

SECTION 1. (1) As used in this section and sections 2 and 3 of this 2022 Act:
(a) "Bidder" has the meaning given that term in ORS 279A.010.
(b) "Covered materials" means:
(A) Concrete, including ready mix concrete, shotcrete, precast concrete and concrete masonry units;
(B) Asphalt paving mixtures;
(C) Steel, including rebar, reinforcing steel and structural steel, hot-rolled sections, hollow sections, plate steel and cold-formed steel; and
(D) Other materials the Department of Transportation designates by rule after consultation with the technical advisory committee.
(c) "Emergency" has the meaning given that term in ORS 279A.010.
(d) "Environmental product declaration" means a product-specific label developed in accordance with rules the department adopts that are based on ISO Standard 14025 and on independently verified life cycle assessment data, life cycle inventory and analysis data or information modules in accordance with the ISO 14040 series of standards.
(e) "Procurement" has the meaning given that term in ORS 279A.010.
(f) "Proposer" has the meaning given that term in ORS 279A.010.
(g) "Public contract" has the meaning given that term in ORS 279A.010.
(h) "Public Contracting Code" has the meaning given that term in ORS 279A.010.
(i) "Technical advisory committee" means the committee described in section 2 of this 2022 Act.
(2)(a) The department, not later than December 31, 2025, shall establish a program for greenhouse gas reduction that:
(A) Assesses the greenhouse gas emissions attributable to covered materials the department uses in the department's construction and maintenance activities for the state's transportation system;
(B) Conducts life cycle assessments of a selected set of the department's construction and maintenance activities; and

Enrolled House Bill 4139 (HB 4139-B) Page 1

Buy Clean Oregon Act – Required LCA impact disclosure for ODOT purchases of concrete, asphalt, and steel



A tool – Waste Impact Calculator – that translates solid waste tons into environmental impacts based on disposition and material type.

DEQ's applied LCA portfolio

The City of Portland has a deconstruction program to reclaim materials from old houses creating new jobs and markets for aged lumber.

Oregon's Concrete EPD program provides tools, technical support, and reimbursement to producers in Oregon.

Increase supply and demand for smaller housing options in Oregon.

Statewide campaign to prevent the wasting of food supported by specific grant funding.

Life Cycle Assessment of edible food rescue systems.

The pieces of the RMA

OVERSIGHT AND INTEGRATION

Materials Management
DEQ
State of Oregon

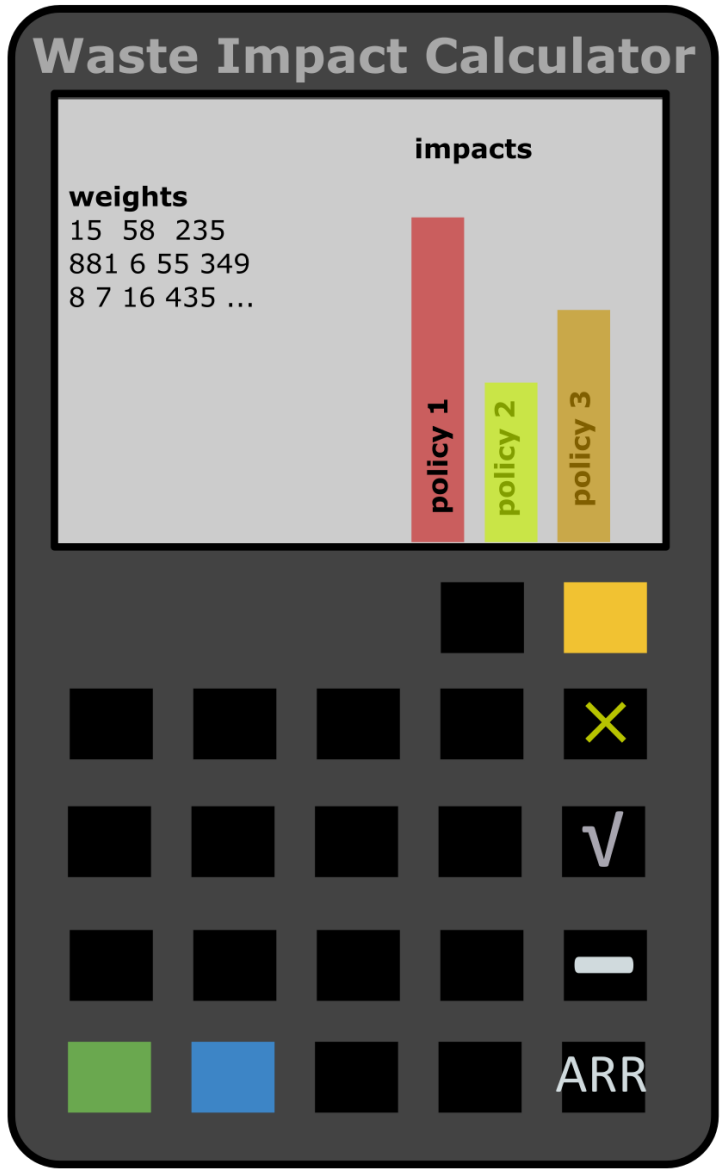
Oregon Recycling System Advisory Council

What the RMA accomplishes

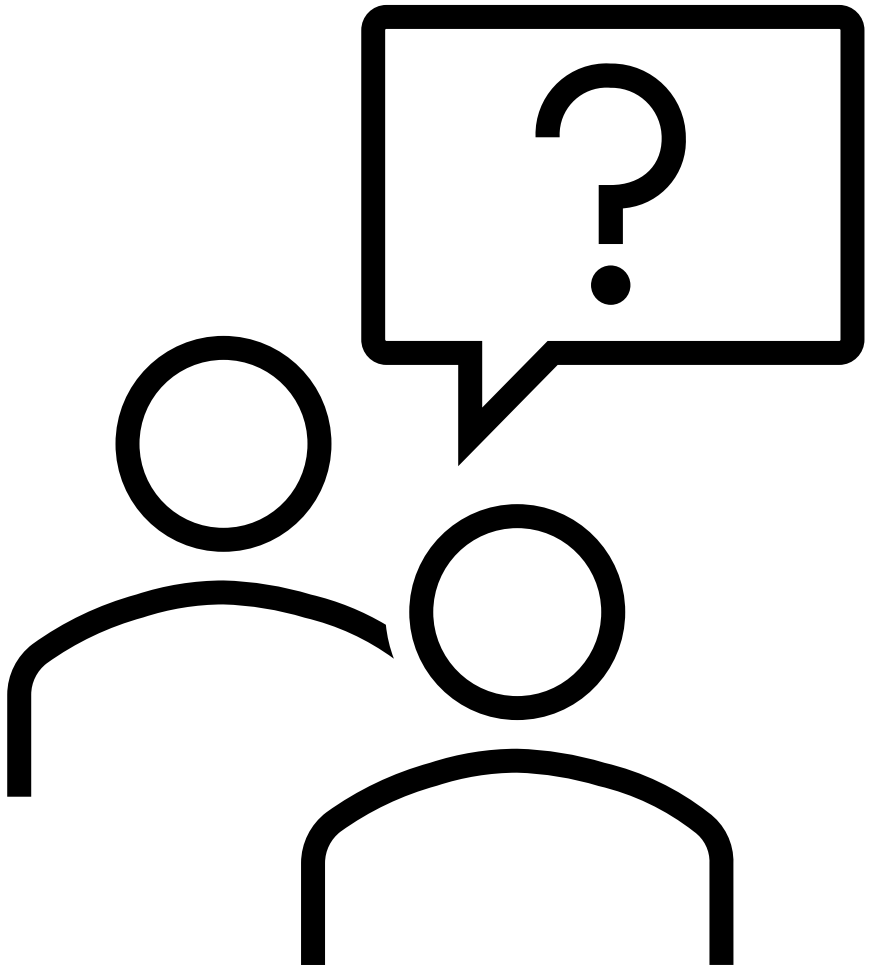
- Expansion of recycling opportunities
- A Uniform Statewide Recycling Collection List
- Improved education
- Responsible end markets
- Stability for businesses in the recycling system and much more

RMA Spotlight on: Life cycle considerations

- Preamble (“Legislative findings”)
- Changes to ORS 459.015 (policy; hierarchy)
- Collection list informed by environmental assessment
  - Explicitly link collection list to end markets
- Eco-modulation of PRO membership fees
  - Incentive for disclosure of life cycle impacts
- Standards in rule for evaluation and disclosure of life cycle impacts
- Mandatory impact disclosure for 25 largest producers
- Funded program to “reduce the environmental impacts of covered products through means other than waste recovery”
- EPR as a life cycle consideration (cost sharing)


Waste Impact Calculator
impacts
weights
15 58 235
881 6 55 349
8 7 16 435 ...
policy 1
policy 2
policy 3
ARR

Discussion and Questions



materials management

conserving resources
protecting the environment
living well

peter.canepa@deq.oregon.gov