



Scan here for handy
acronyms, definitions,
links and resources

Designers Lighting Forum

Life Cycle Assessment (LCA) of Luminaires and Lighting Design Strategies - Tales from the Front

Speakers: Russell Greenberg, Founder, Rux Studio
Kate Hickcox, Lighting Research Scientist, Pacific Northwest National Laboratory
Leela Shanker, Borealis Lighting Studio, Greenlight Alliance LCA Incubator

March 8, 2023



Credit(s) earned on completion of this course will be reported to **AIA CES** for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with **AIA CES** for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

Questions related to specific materials, methods, and services will be addressed at the conclusion of this presentation.



Scan here for handy
acronyms, definitions,
links and resources



Scan here for handy
acronyms, definitions,
links and resources

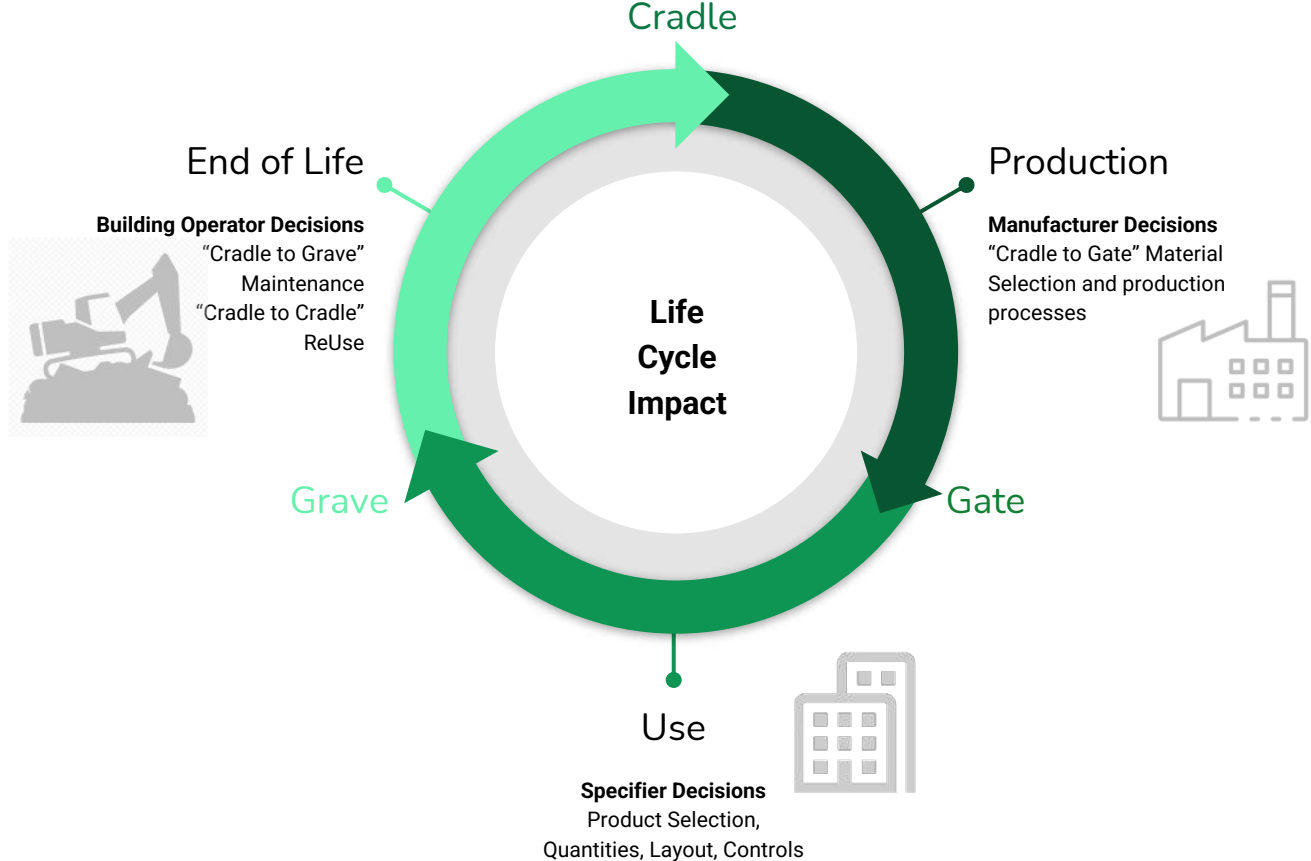
Learning Objectives

At the end of this course, participants will be able to:

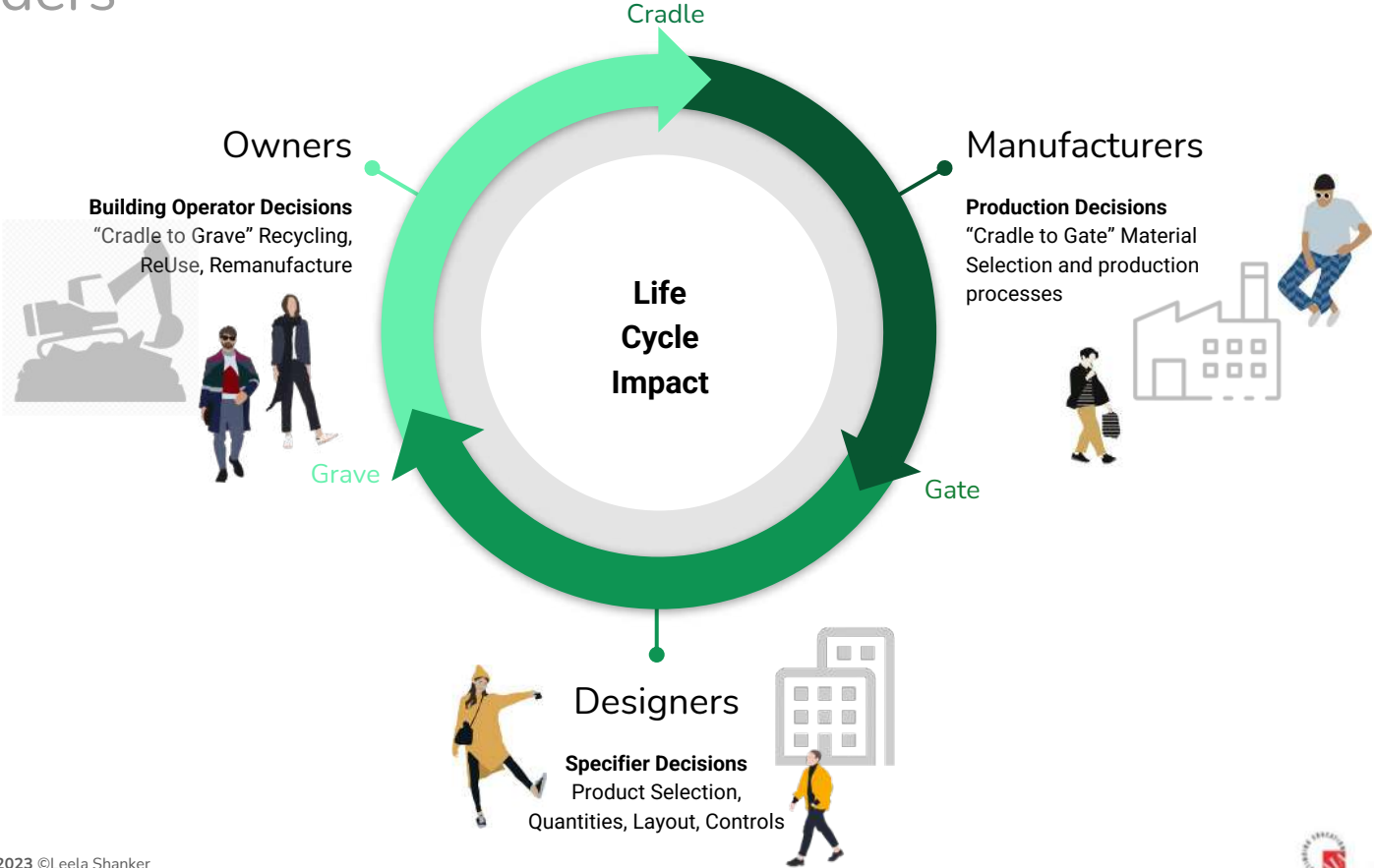
1. Outline current status of metrics and reporting schemes on the life cycle impact of luminaires and lighting strategies
2. Understand practical issues in the LCA data collection and analysis process from the manufacturer's lens
3. Define and identify key impact criteria from LCA reports
4. Evaluate impact dimensions in comparison of luminaires and lighting design strategies using LCA data



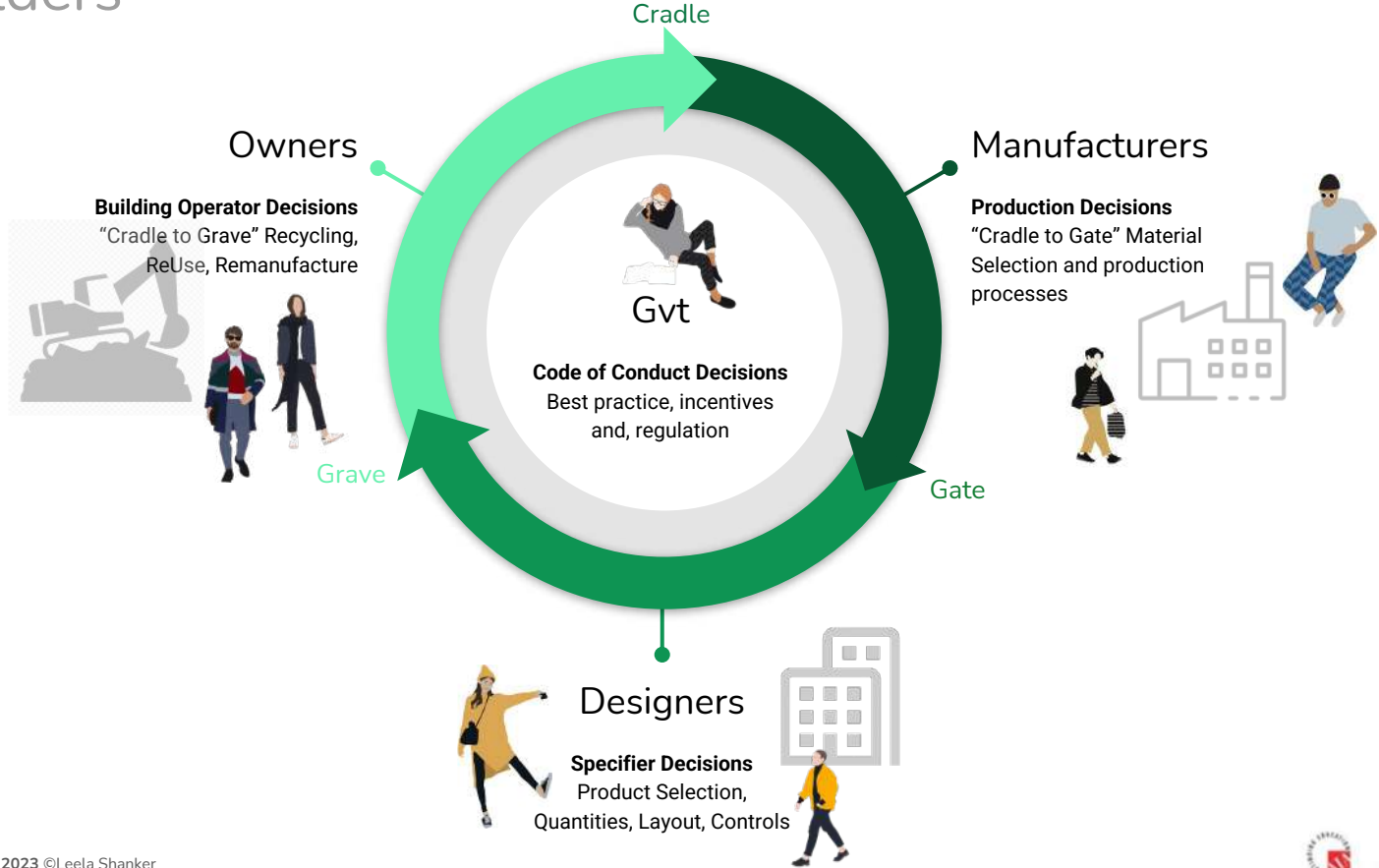
Life Cycle Impact Scope



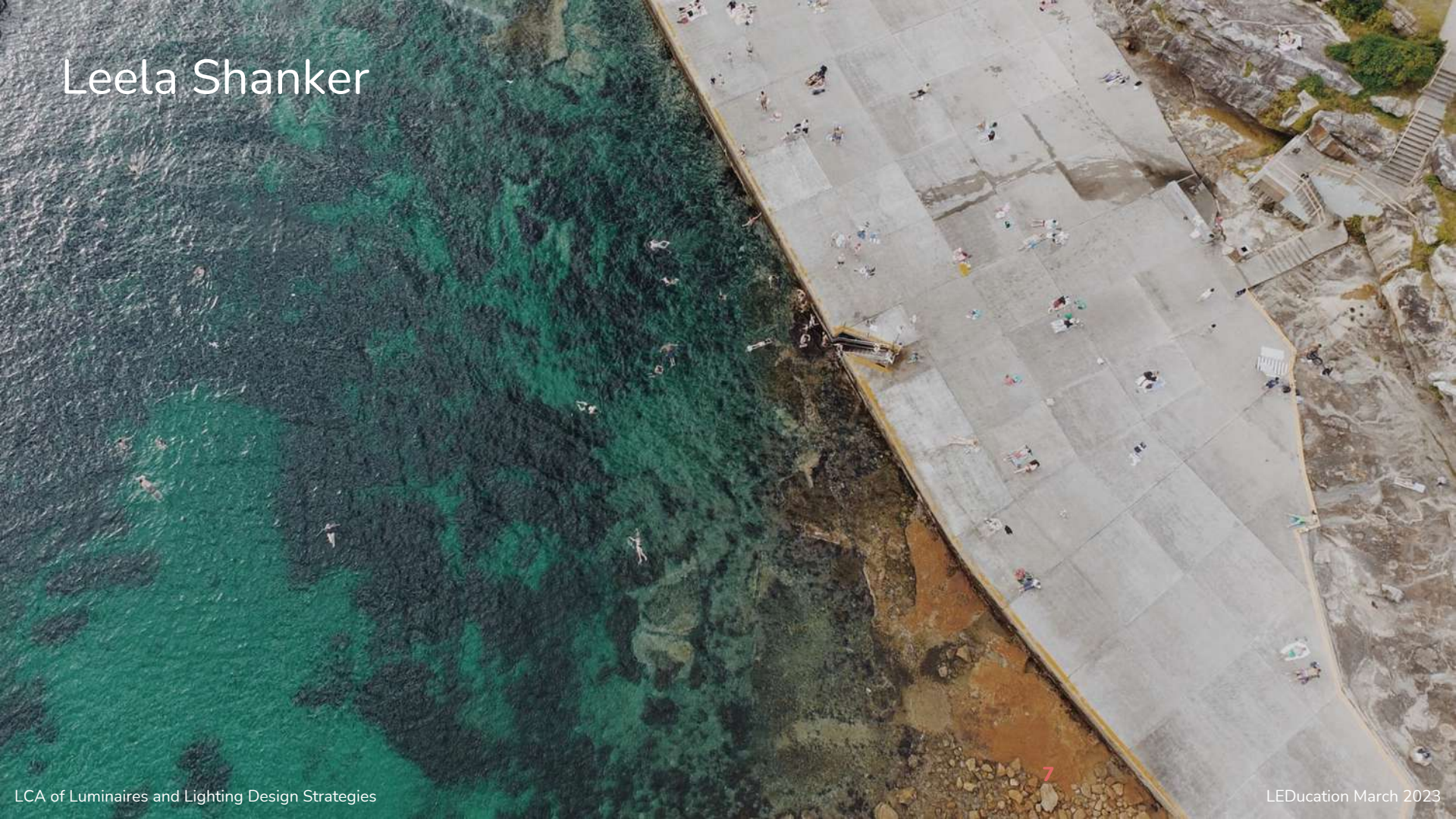
Life Cycle Impact Stakeholders



Life Cycle Impact Stakeholders



Leela Shanker



Russell Greenberg

I am an architect turned product designer + entrepreneur. I am the co-founder and creative director of STICKBULB, a NYC-based lighting manufacturer that makes fixtures from locally salvaged wood.

I went from knowing nothing about LCA a few years ago to using it as an active tool in day-to-day operations and decision-making.

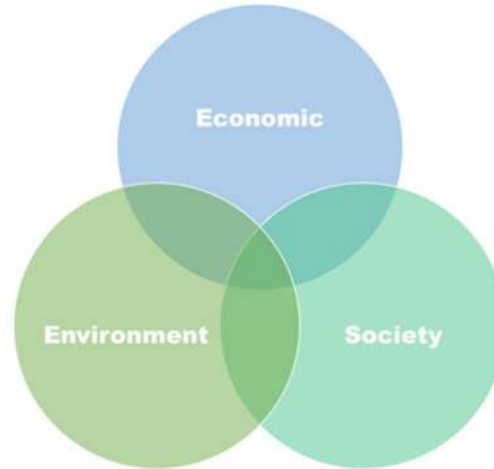
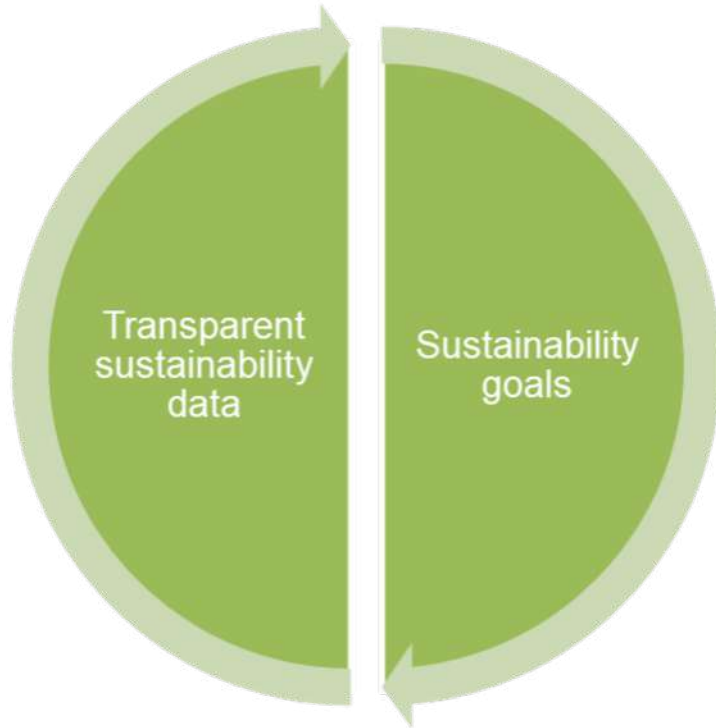


Kate Sweater Hickcox



Energy +
Environment
Research Scientist
PNNL

Lighting LCA - Tales from the Front



**The Three Pillars of Sustainability:
Environment, Society, & Economy**

Also known as the triple-bottom-line of sustainability: people, planet, and profit

Improving sustainability approaches will impact the climate



Image by Midjourney

Approximately 30% of all global carbon emissions are attributed to the building sector

An additional percentage of global emissions can be attributed to embodied carbon from the industry and waste sectors. *

CO₂ emissions from buildings operations have reached an all-time high of around 10 GtCO₂

Around a 5% increase from 2020 and 2% higher than the previous peak in 2019. **

Increased global demand for construction materials to accommodate population growth, particularly in cities



Many industry drivers for sustainability transparency information

Building Ratings & Certifications

- LEED
- WELL
- BREEAM
- Green Globes
- Living Building Challenge

Regulations

- BuyClean (state and federal)
- Other State-level regulations

Corporate Pledges / Challenges

- AIA Materials Pledge
- Mindful Materials Lighting Advocacy Letter
- Living Product 50
- Carbon Leadership Forum MEP 2040
- AIA 2030
- GreenLight Alliance LCA Incubator

Many organizations are asking,
“Is there a quick and easy way to get embodied carbon data? We need this data now.”

A: The best way to accurately quantify impact is with LCAs, but industry needs help to streamline that process and decrease costs and effort.



Alphabet Soup of Sustainability



Summary Report (e.g., EPD)

Report / summarize LCA findings and using transparency documentation such as:

- Environmental Product Declaration (EPD)
- Product Environmental Footprint (PEF)

Life Cycle Assessment (LCA)

Analysis to quantify impacts of the full life cycle - results in a very long report (~500 pages)

Product Category Rule (PCR)

Framework and method for identifying and evaluating environmental impact

Tenets of Life Cycle Sustainability

Functional Unit



e.g. LCA of a car of typology X, assuming a use for Y years, produced in country Z, ect.

Life Cycle Phases



Impact Categories



CLIMATE CHANGE



EUTROPHICATION



LAND USE



RESOURCE DEPLETION



ACIDIFICATION



OZONE DEPLETION



ECOTOXICITY



IONISING RADIATION



PHOTOCHEMICAL OZONE FORMATION



WATER DEPLETION



HUMAN TOXICITY

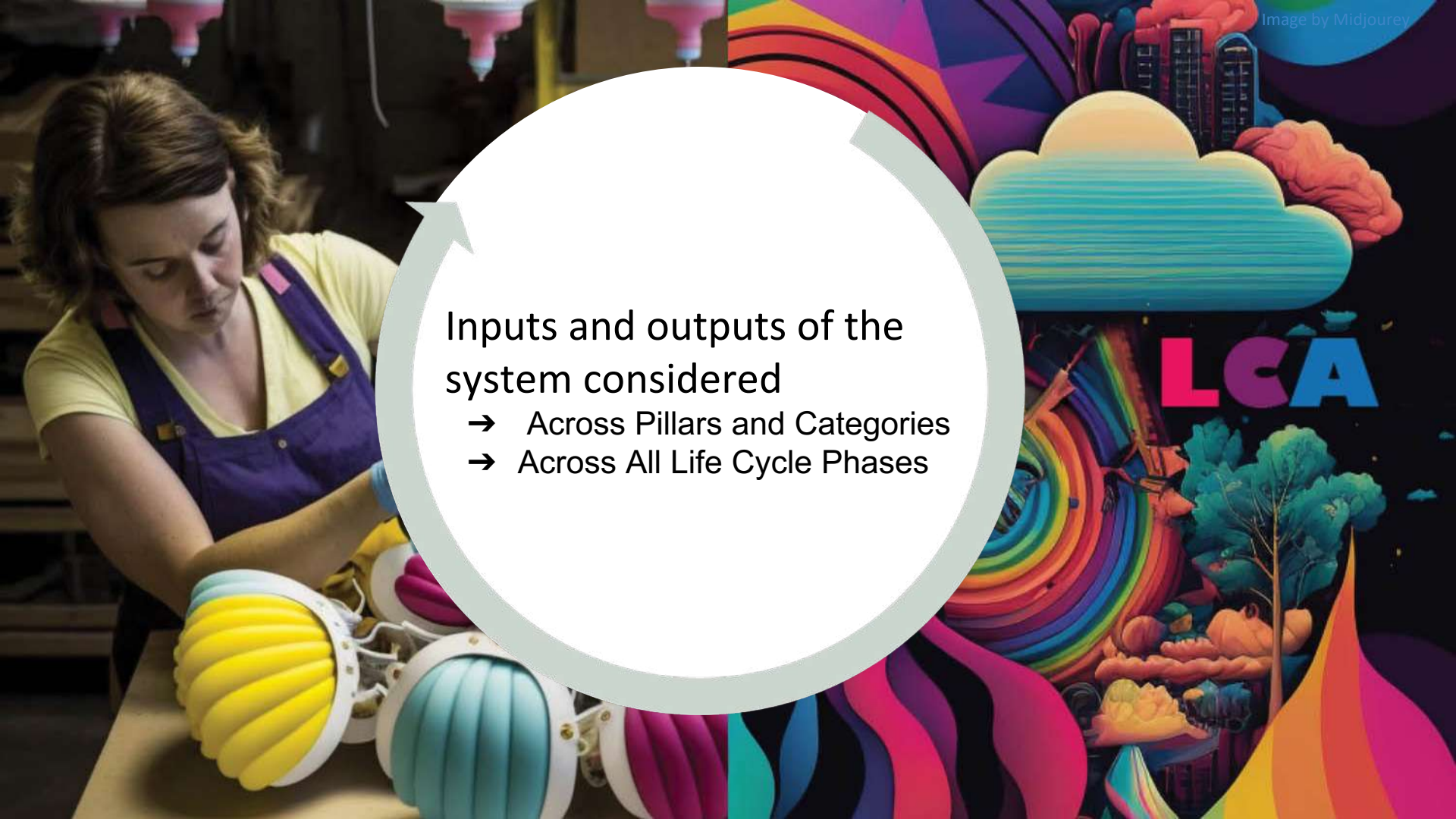
Embodied Carbon metrics and reporting schemes on the life cycle impact of luminaires and lighting strategies

	Tool	Compare?	Benefits?	Multiple Impact Categories? *	Includes all phases? *
Complete assessment	LCA	Only when following rules outlined in PCR	Hot spot analysis, design process iteration	✓	✓
	EPD ✓ Product Specific, Facility Specific EPD ✓ Product Specific EPD ✓ Industry Average EPD	Only when following rules outlined in PCR	Meeting LEED credits	✓	✓
Embodied carbon only	<u>CIBSE TM65</u>	No (not third-party verified)	Improve understanding of market, determine which product to get EPD for	✗	✗
	EC3 / OneClick / other Embodied Carbon Tools	Only when following rules outlined in PCR		✗	✗

→ May miss materials-related impacts e.g., use of PVC free wire

* Possible to include but may not depending on PCR and product category



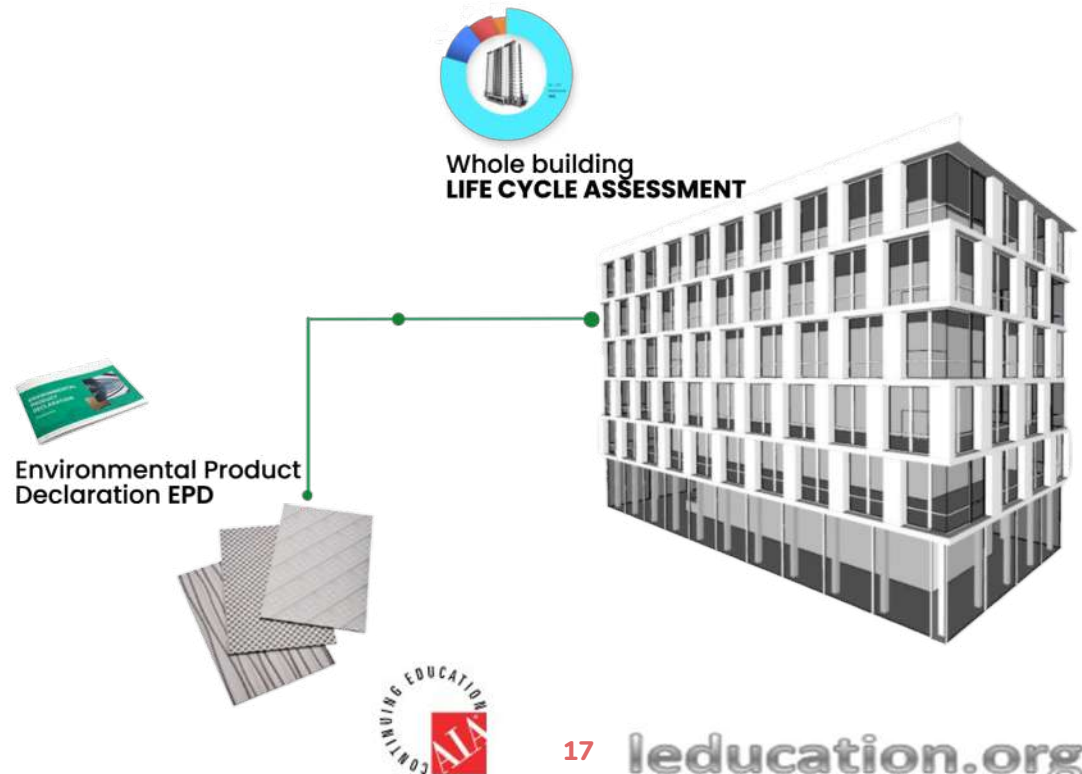
A woman with brown hair, wearing a yellow t-shirt and purple overalls, is focused on working on a large, ribbed, yellow and white light fixture. She is in a workshop setting with other similar fixtures on the table. The background is a vibrant, colorful illustration featuring a rainbow, a city skyline, a large blue cloud, a tree, and the letters 'LCA' in large, bold, multi-colored font. A large white circle with a grey arrow pointing clockwise is overlaid on the image, containing the text.

Inputs and outputs of the system considered

- Across Pillars and Categories
- Across All Life Cycle Phases

Lighting practitioners need LCA to evaluate dimensions

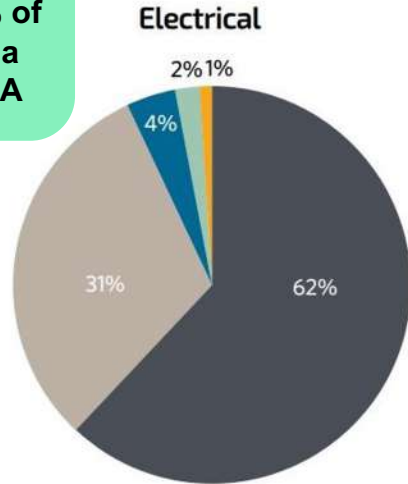
Case studies show: when EPDs are used to conduct Whole Building LCAs, buildings can reduce their environmental footprints, diverting CO₂ from being emitted.



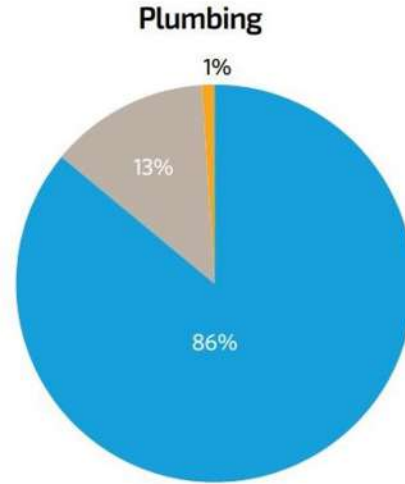
Lighting practitioners need LCA to evaluate dimensions

GAP in EPDs in lighting and MEP products that could affect 15-50% of the EPD inputs in a whole building LCA

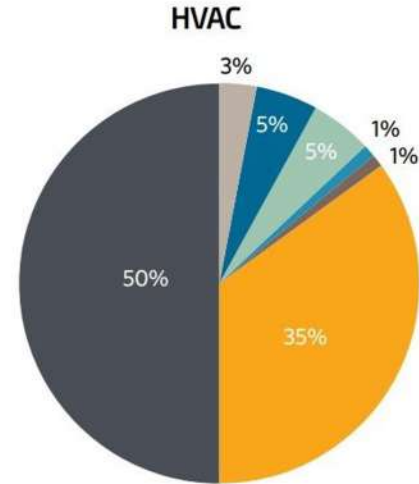
Building services embodied carbon breakdown - medium scenario



- Lighting
- Power
- Sensors, detectors, camera
- Sockets, isolators, junction, floorbox
- Panel



- Water tanks
- Drainage
- Water pipe



- AHU
- Fan coil
- VFR
- Solar thermal collector
- Refrigerant piping
- Refrigerant leaking
- Ventilation (duct, hangars etc)





Lowering barriers to achieving LCAs

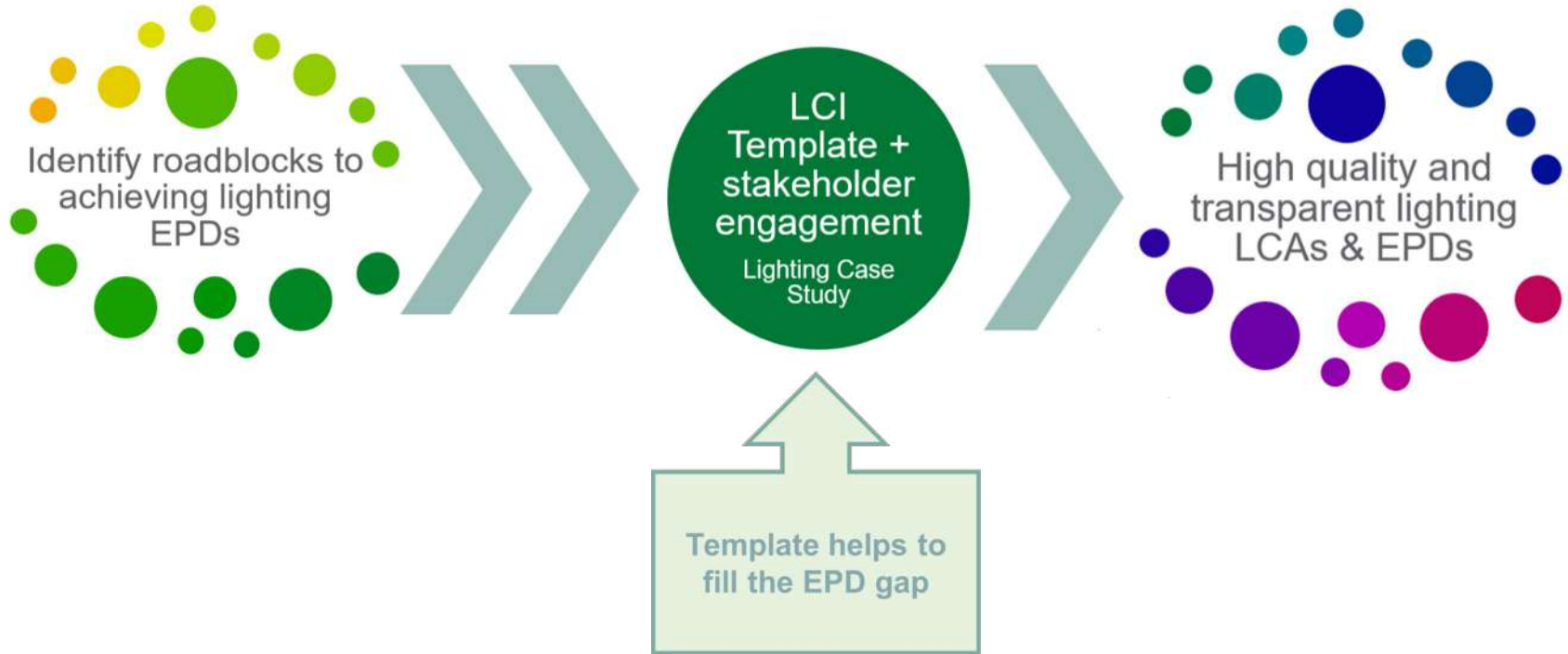
PNNL worked with lighting industry stakeholders and LCA team to gather data on luminaires and the LCA process / barriers

- Identify barriers to the LCA process
- Assess and address the challenges and opportunities for the whole Life Cycle Assessment process for lighting products

PNNL Created innovative LCA template that aligns with updated North American PCR guidelines / BuyClean requirements



Challenges and barriers for lighting LCAs in North America



PNNL study to lower barriers to achieving LCAs in the lighting / MEP industries



Lighting LCA template features

ACLCA Open Standard

Checklist from the ACLCA for PCRs

- Improves EPD transparency, comparability, accessibility
- Supports alignment with new federal BuyClean regulations

Toggle Feature

Easy to modify/scale data inputs

- Toggle between: Tiers of use, Regions, Impact Categories

Connect Open-Source Data

Open access digitization of LCA/EPD data and results

- Maintains confidentiality of proprietary process information

Streamlines and Simplifies

Inventory data entry process is simplified

- Template walks user through required value entries and dropdown menus

Linked to openLCA

User inputs modify and generate LCA results

- Allows for easy automation of LCA results

PNNL study to lower barriers to achieving LCAs in the lighting / MEP industries



Who is it for? Lighting manufacturers who want to get an LCA or an EPD

How does it work?

1. Lighting manufacturer could use this template to gather all the data required for an LCA aligned with PCR and additional NA requirements
2. Work with an LCA practitioner to get the full LCA report and resulting EPD
3. Reduces time and effort required to gather the needed information
4. Standardizes background data and data shape for improved comparability



[Beta template launch planned for Spring]

Please reach out if you'd like to be involved in the Beta Launch Focus Group

kathryn.hickcox@pnnl.gov



Image: Edited from Midjourney

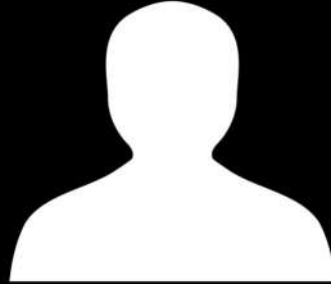
What does a good decision look like
(for a lighting manufacturer)
in the 21st century?

And how do we measure it?

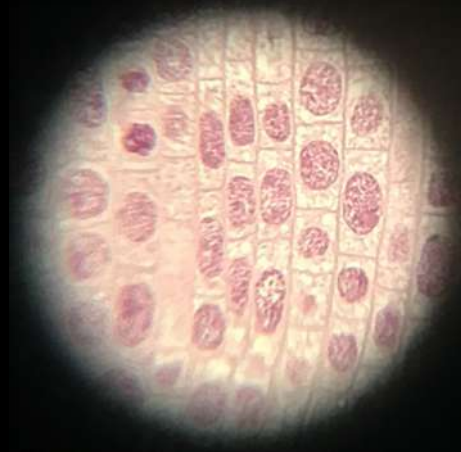
Think bigger



The sum of all of our
decisions and impacts



Think smaller



Tiny decisions
that add up

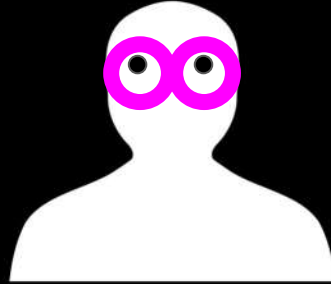


Think bigger

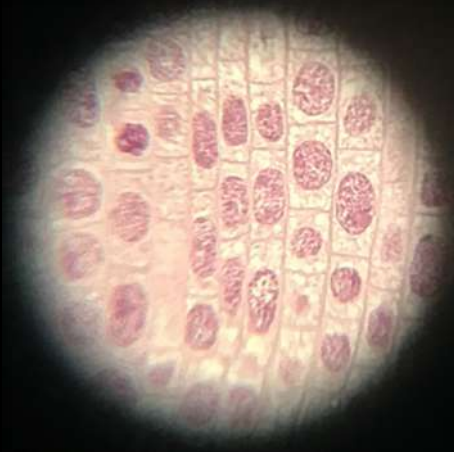


The sum of all of our
decisions and impacts

**LCA
GOGGLES**



Think smaller



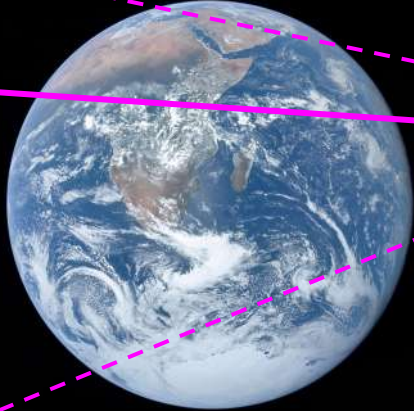
Tiny decisions
that add up



Think bigger

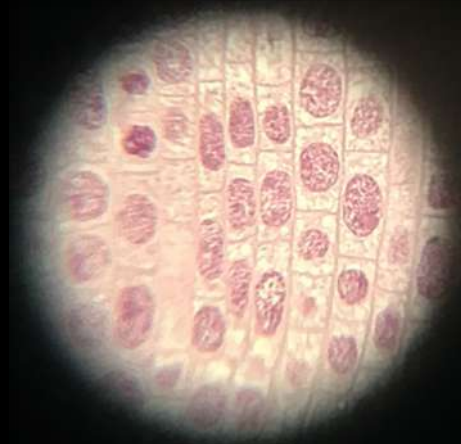


CLIMATE
NEUTRAL
CERTIFIED

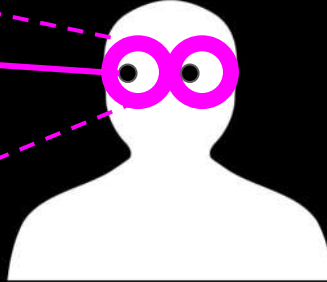


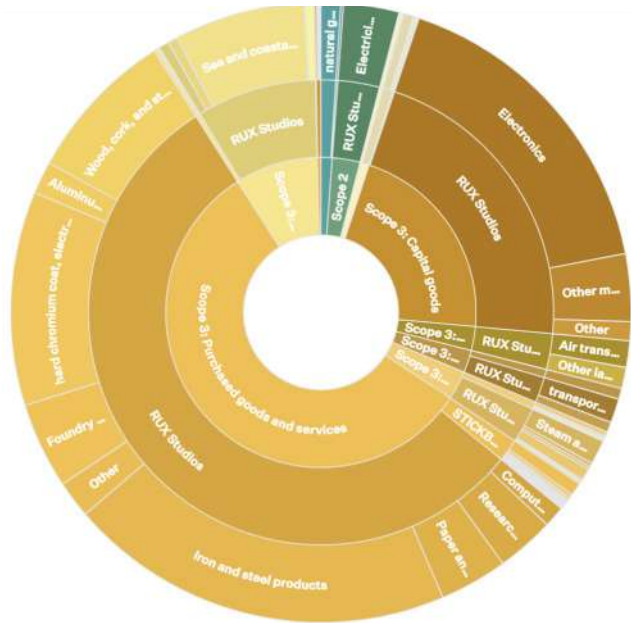
The sum of all of our
decisions and impacts

Think smaller

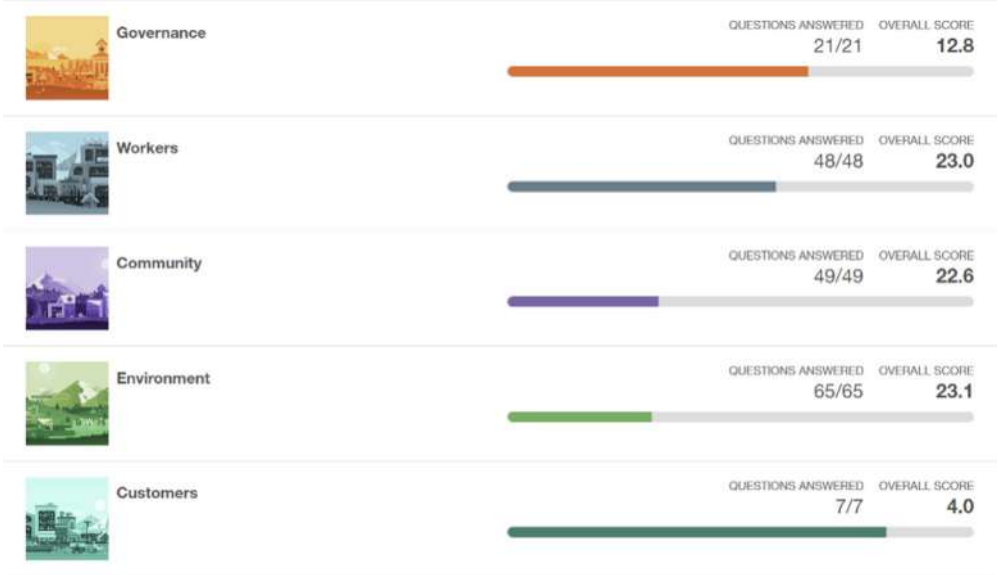


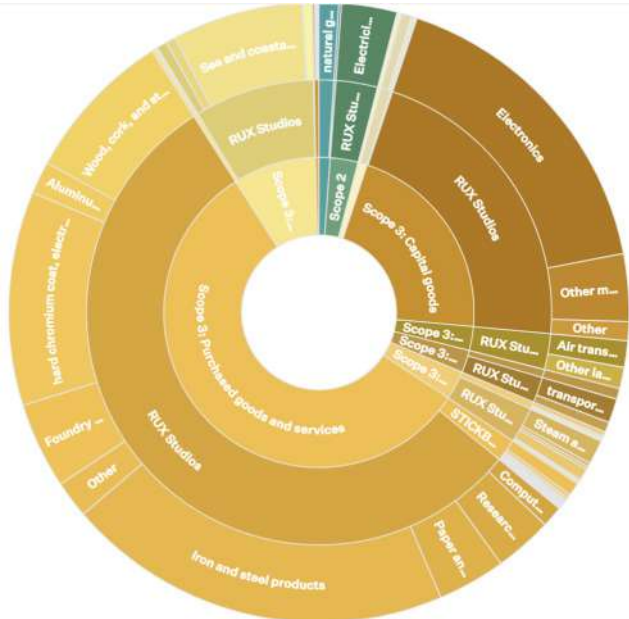
Tiny decisions
that add up





Local. Natural. Circular.





Local. Natural. Circular.

Governance

QUESTIONS ANSWERED: 21/21

OVERALL SCORE: 12.8

OVERALL SCORE: 23.0

OVERALL SCORE: 22.6

OVERALL SCORE: 23.1

OVERALL SCORE: 4.0

Tracking Chemicals in the Supply Chain
★ □

LEARN MORE
FEEDBACK

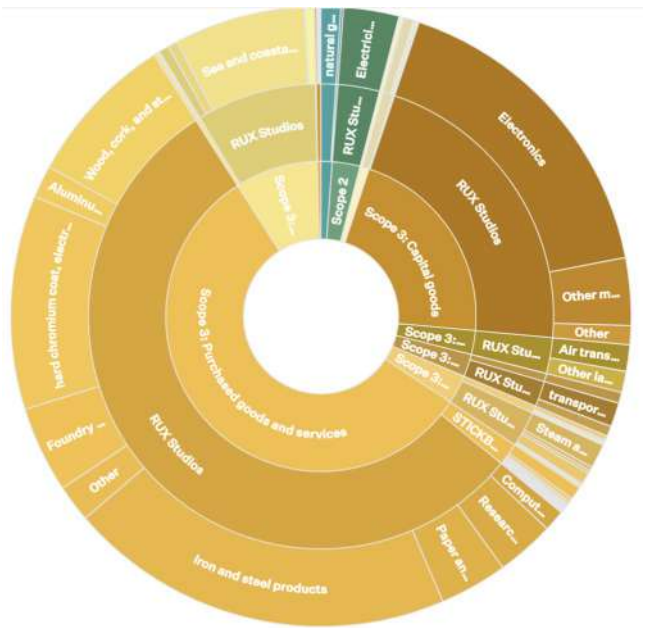
Does your company do any of the following to track chemicals in the supply chain for the majority of materials?

Please check all that apply.

- Do not track chemicals in the supply chain
- Require suppliers to disclose specified chemicals of concern
- Ask suppliers if they know all the chemical ingredients intentionally added to their product and all residuals of high concern present in the product (asking if they know only, not to provide the data to you)
- Require suppliers to provide chemical information to a third party
- Disclose all by-products, contaminants or trace materials to the public

Points Earned: 0.00 of 0.63
NEXT





Local. Natural. Circular.

Waste Reduction Programs

LEARN MORE FEEDBACK

Does your company have a formal program to evaluate how to reduce its generation of hazardous, universal, and/or non-hazardous waste?

Yes

No

Already maximized - we have achieved Zero Waste

Points Earned: 0.00 of 0.63

NEXT

Require suppliers to provide chemical information to a third party

Disclose all by-products, contaminants or trace materials to the public

Points Earned: 0.00 of 0.63

NEXT

OVERALL SCORE 12.8

BALL SCORE 23.0

BALL SCORE 22.6

BALL SCORE 23.1

BALL SCORE 4.0



Think bigger



CLIMATE
NEUTRAL
CERTIFIED

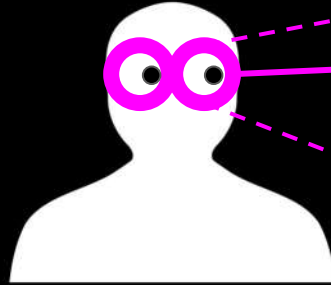
Certified



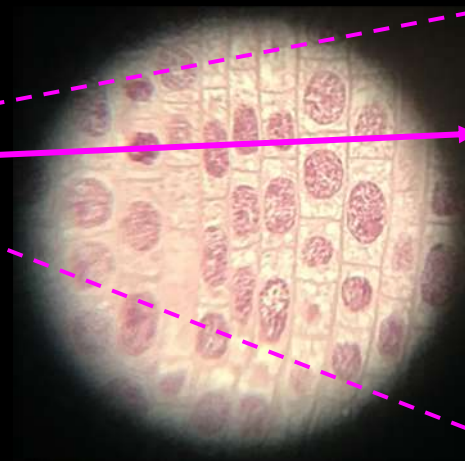
Corporation



The sum of all of our
decisions and impacts



Think smaller



EPD

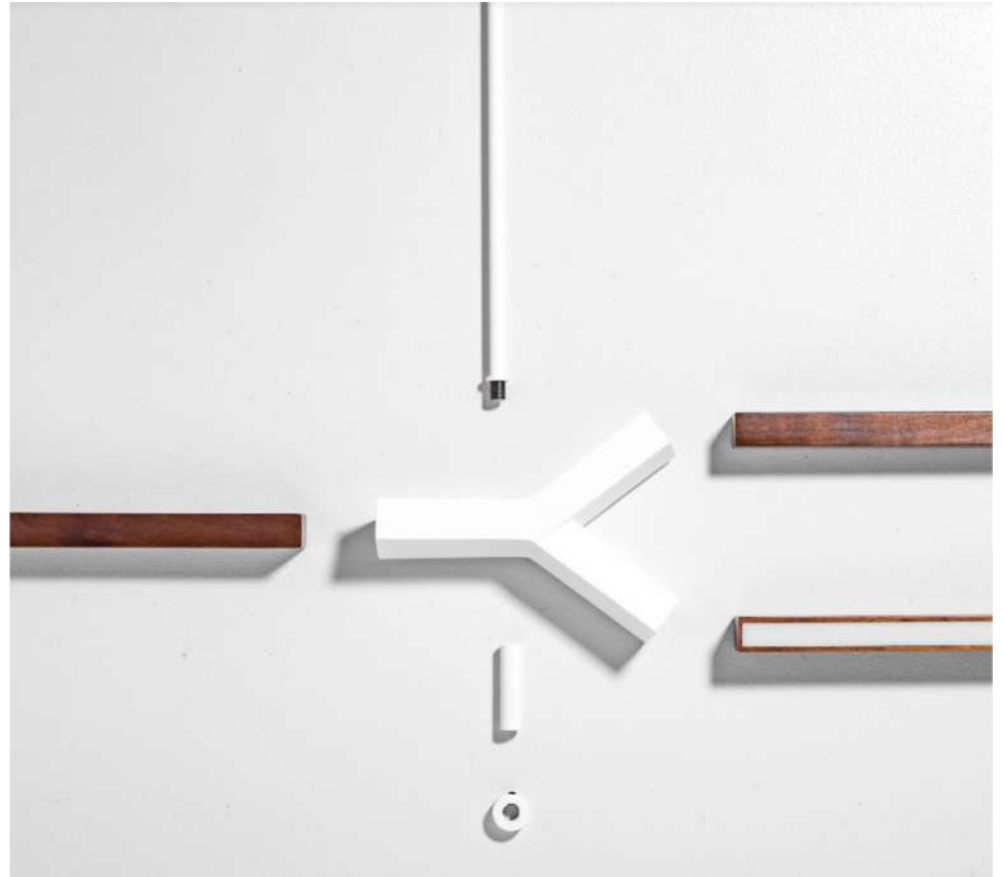
HPD

Tiny decisions
that add up



Classify each part according to:

- material type
- weight of material
- manufacturing processes
- location(s) of part fabrication



Classify each part according to:

- material type
- weight of material
- manufacturing processes
- location(s) of part fabrication



- **STEEL**
 - 0.42 lbs
 - 1018 Hot Rolled
 - Laser Cut + MIG Welded
 - China
- **COATING**
 - 15 inch²
 - Powder Coating
 - USA

BOM Level	Part Number	Part Name	Material (Specify - i.e. aluminum, polyethylene, wood, etc.)	Process 1 (Specify - extrusion, injection mold, cutting, etc.)	Process 2 (Specify - i.e. drilling, etc.)	Process 3 (Specify - i.e. coating, gluing, etc.)	Weight	Unit	Post-Consumer Recycled Content	% Pre-Consumer Recycled Content	% that is lost to waste during assembly	Returned to Supplier, Externally Recycled, etc.)	Truck	Rail	Ocean	Air
Product 1:			Part Description (powder coating, finishes, etc.)				Transportation Distance from Supplier to Manufacturing Facility									
BOM Level	Part Number	Part Name	Material (Specify - i.e. aluminum, polyethylene, wood, etc.)	Process 1 (Specify - extrusion, injection mold, cutting, etc.)	Process 2 (Specify - i.e. drilling, etc.)	Process 3 (Specify - i.e. coating, gluing, etc.)	Weight	Weight in lbs	Post Consumer% Recycled Content	% Pre-Consumer Recycled Content	% Waste (Percent of component that is lost to waste during assembly)	Fate of Waste (Specify Landfill, Returned to Supplier, Externally Recycled, etc.)	Truck	Rail	Ocean	Air
1	W-1	Wood Enclosure	Hyper-locally-sourced	Moulding	Sanding		2.08	lbs	100%	100%	0%		2	0	0	0
1	W-F	Wood Finish	TBD				TBD	lbs	0%	0%	0%					
2	C	C Channel	Aluminum	Extrusion	Cutting / Drilling		2.48	lbs	8-12	8-12	0%		2700		6500	
2	C-S	C Channel (Screws)	Zinc-plated Steel	Machining	plating		0.009	lbs	0%	0%	0%					
3	L	L Channel	Aluminum	Extrusion	Cutting / Drilling		0.86	lbs	8-12	8-12	0%		2700		6500	
3	L-S	L Channel (Screws)	Zinc-plated Steel	machining	plating		0.009	lbs	0%	0%	0%					
4	L-H	L Hook	Aluminum	Extrusion	Cutting		0.0165	lbs	8-12	8-12	0%		2700		6500	
4	L-H-S	L Hook Set Screw	Stainless Steel				0.003	lbs	0%	0%	0%					
5	H	Header	Aluminum	Milling	Anodizing		0.14	lbs	0%	0%	0%		2700		6500	
5	H-S	Header Screws	Stainless Steel				0.012	lbs	0%	0%	0%					
5	H-E	Header Endcap	Aluminum	Milling	Anodizing / Powdercoat		0.06	lbs	0%	0%	0%		2700		6500	
8	LA	Lanyard	Steel Cable				0.028	lbs	0%	0%	0%					
8	LA-S	Lanyard Screws	Stainless Steel				0.005	lbs	0%	0%	0%					
9	CG	Adjustable Cable Gripper	Plated XXX				0.032	lbs	0%	0%	0%					
10	LED-U	LED (up)	Ridgid LED Board				0.19	lbs	0%	0%	0%					
10	LED-U-S	LED Board (up) Screws	Ridgid LED Board				0.032	lbs	0%	0%	0%					
10	LED-D	LED Board (down)	Ridgid LED Board				0.2	lbs	0%	0%	0%					
10	LED-D-S	LED Board (down) Screws	Ridgid LED Board				0.032	lbs	0%	0%	0%					
11	DR-40W	2 Drivers (Signify) 40W each					1.16	lbs	0%	0%	0%					
11	DR-40W-S	Driver (Signify) 40W Screws					0.004	lbs	0%	0%	0%					
12	LENS-U	Lens (up)	Acrylic	Extrusion			0.304	lbs	0%	0%	0%		790			
12	LENS-D	Lens (down)	Acrylic	Extrusion			0.32	lbs	0%	0%	0%		790			
13	W-LV	Wire (Low Voltage)	PVC-Free coating + Copper				0.168	lbs	0%	0%	1%	Landfill	220	0	0	0
13	W	Wire (Line Voltage)	PVC-Free coating + Copper					lbs	0%	0%	1%	Landfill	220			
14	WC-2	Wire Clip (2)	link	injection molded			0.012	lbs	0%	0%	0%					
14	WC-3	Wire Clip (3)	link	injection molded			0.0275	lbs	0%	0%	0%					
15		Canopy Part A														
15		Canopy Part B														
15		Canopy Part C														
15		Canopy Part D														



Think bigger

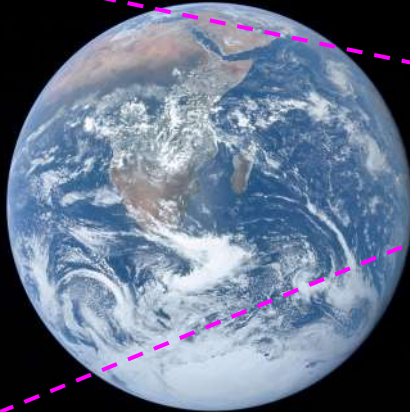


CLIMATE
NEUTRAL
CERTIFIED

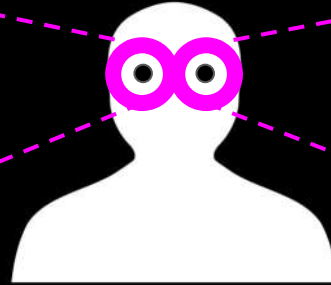
Certified



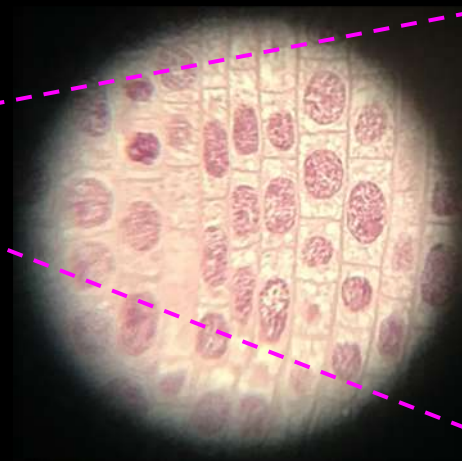
Corporation



The sum of all of our
decisions and impacts



Think smaller



EPD

HPD

Molecules matter.
Tiny decisions add up.



Where do I source my packaging?

Think bigger

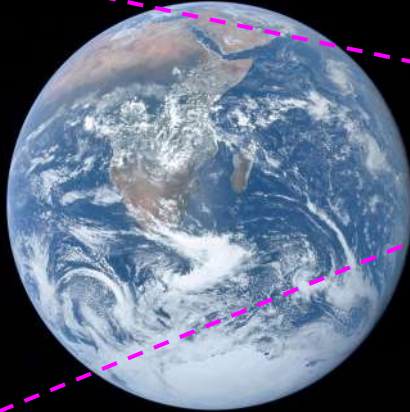


CLIMATE
NEUTRAL
CERTIFIED

Certified

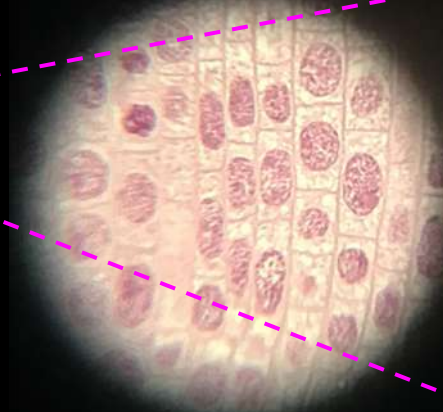


Corporation



The sum of all of our
decisions and impacts

Think smaller



EPD

HPD

Molecules matter.
Tiny decisions add up.



Where do I source my packaging?

Think bigger



CLIMATE
NEUTRAL
CERTIFIED

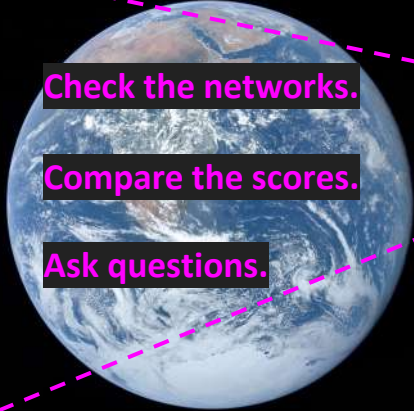


Certified
B
Corporation

Check the networks.

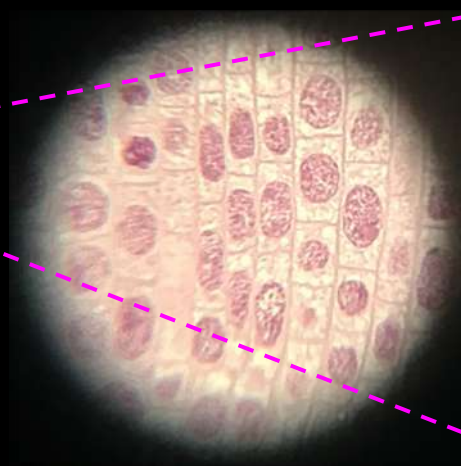
Compare the scores.

Ask questions.



The sum of all of our decisions and impacts

Think smaller

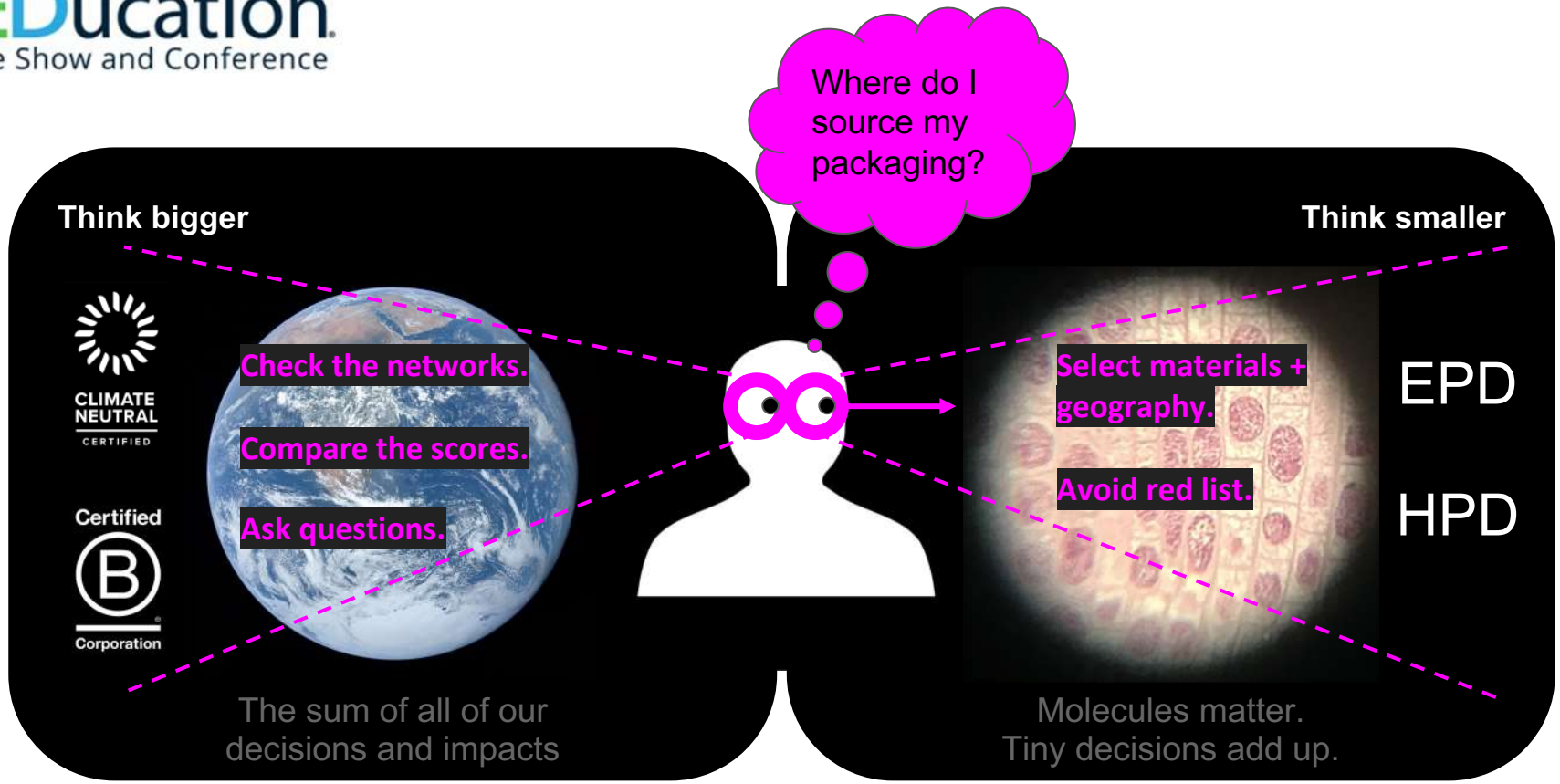


EPD

HPD

Molecules matter.
Tiny decisions add up.





Think bigger

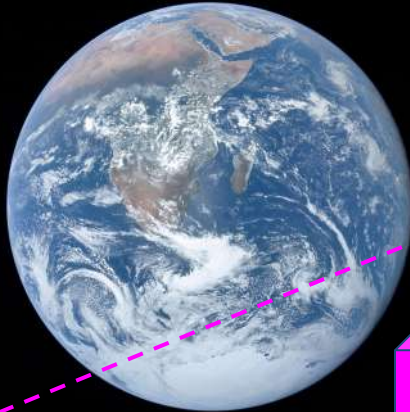


CLIMATE
NEUTRAL
CERTIFIED

Certified



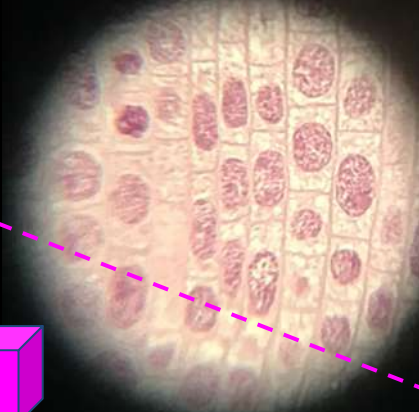
Corporation



The sum of all of our
decisions and impacts

Choose
from all
good
options.

Think smaller



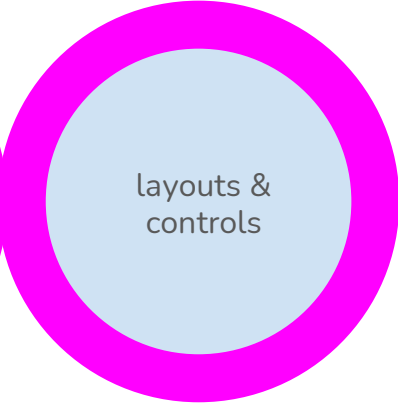
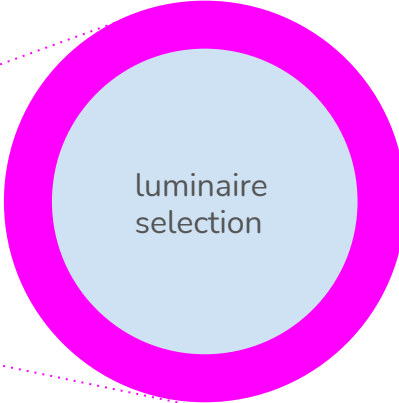
EPD

HPD

Molecules matter.
Tiny decisions add up.



Designer Decisions Enables



Is it hard?



Designer Decisions

Incentives V Regulation



Vs



Designer Decisions

Incentives V Regulation



Vs



Designer Decisions Incentives V Regulation



**MEP
2040**
Committing to Zero



Environmental Product
Declarations [2]

Material Ingredients [2]

V4.1 New Building and
Construction

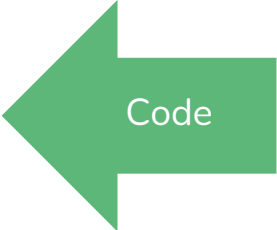


Designer Decisions

Incentives V Regulation

GWP < 125%
of industry
average

Standard for the Design of High
Performance Green Buildings
Standard 189.1-2017



Designer Decisions

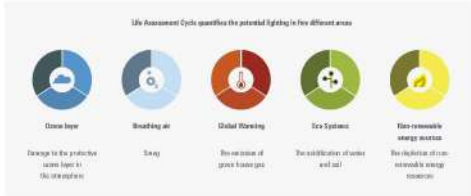
Finding the data

EPD
(Environmental Product Declaration)



GWP
(Global Warming Potential (kgCO2e))

Greenhouse Gases that affect the environment



Designer Decisions

Reports + metrics

EPD
(Environmental Product Declaration)



GWP
(Global Warming Potential (kgCO₂e))

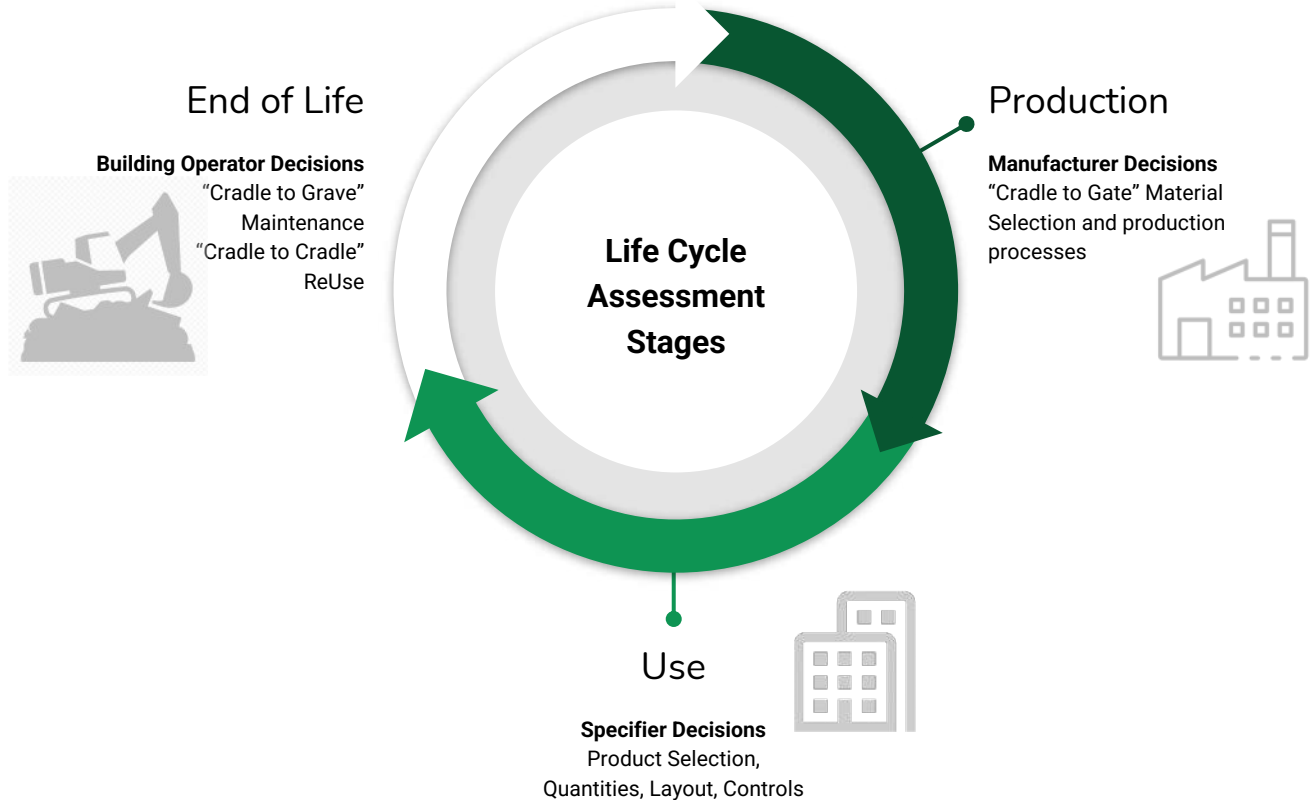


“How do I find the Global Warming Potential (GWP) for my luminaire?”

“Where do I find an EPD?”

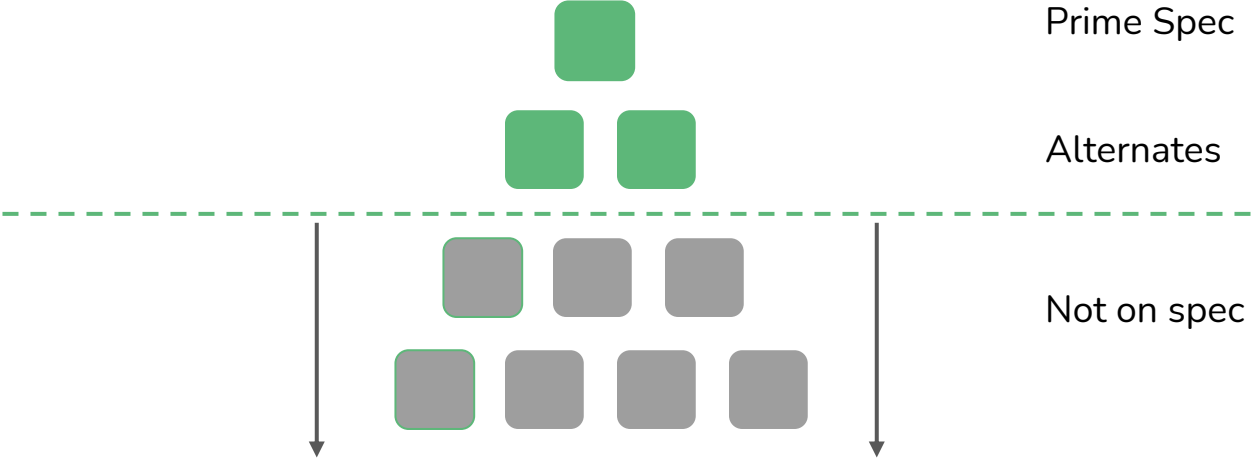
Stakeholders

Key Decisions



Documenting the Spec

Fixture Selection



Selecting Luminaires

Documenting_Spec Section

Definitions

Embodied Carbon Submittals

Material Ingredient Submittals

Hierarchy of Reports

Section 26 50 10 – LIGHTING FIXTURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All of the Contract Documents, as listed on the Table of Contents and including General and Supplementary Conditions and Division 01, General Requirements, shall be included in, and made part of, this Section.

1.2 DESCRIPTION OF WORK

- A. The work of this Section shall include furnishing and installation of all interior and exterior lighting fixtures and necessary supports and devices for a complete functioning lighting system, including final aiming and adjustment as applicable in coordination with the Architect and/or the Lighting Designer.
- B. The work under this Contract shall also include all labor, materials, tools, equipment, transportation, insurance, temporary protection, supervisors and incidental items essential for proper installation and operation, even though not specifically mentioned or indicated on the drawings, but which are usually provided or are essential for proper installation and operation of all systems as indicated on the drawings and specified herein.
- C. The specifications and drawings describe the minimum requirements that must be met by the Contractor for the installation of all work as shown on the drawings and as specified herein under.
- D. The following general systems and equipment shall be provided for the new building and renovated areas of the existing building, as a minimum, but not necessarily limited to the following:
1. Lighting fixtures
 2. Lamps
 3. Drivers

1.3 RELATED WORK

- A. For work to be included as part of this Section, to be furnished and installed by the Electrical Subcontractor, refer to the Related Work section of Specification Section 260310.
- B. Carefully examine all of the Contract Documents, criteria sheets and all other Sections of the specifications for requirements which affect work under this Section, whether or not such work is specifically mentioned in this Section.

1.4 REFERENCES

- A. All lighting fixtures including custom fixtures and modified standard products shall comply with all applicable provisions of the following Codes and Trade Standard Publications, and are hereby incorporated into, and made a part of, the Contract Documents:
1. ANSI: American National Standards Institute
 2. ASTM: American Society for Testing and Materials
 3. ETL: Electrical Testing Labs (US)
 4. IS: Federal Specifications
 5. IEC IP Rating: Ingress Protection Enclosure Ratings and Standards
 6. IEEE: Institute of Electrical and Electronics Engineers
 7. IES: Illuminating Engineering Society
 8. IPCEA: Insulated Power Cable Engineers' Association
 9. MIL-STD-461F: EMI Characteristics Requirements for Equipment
 10. NEC: National Electrical Code
 11. NEMA: National Electrical Manufacturers Association
 12. NFPA 70: National Electrical Code
 13. OSHA: Occupational Safety and Health Administration
 14. ROHS: Restriction of Hazardous Substances in LED Underwriters' Laboratories
 15. UL: Underwriters' Laboratories

Selecting Luminaires

Documenting_Fixture Schedule

Description

GWP and Material Ingredients Reporting

PROJECT NAME - LIGHT FIXTURE SCHEDULE

TYPE	LOCATION	DESCRIPTION	MANUFACTURER	CATALOG NUMBER	FINISH	LED DATA				VOLTS	GWP kgCO ₂ e	MATERIAL INGREDIENTS	NOTES
						CCT & CRI	DELIVERED LUMENS	DRIVER & CONTROLS	INPUT WATTS				
BP-01	Back of House Areas	Recessed 2' x 2' x 4" deep ambient 90CRI LED luminaire with center opal acrylic diffuser, white steel housing, and integral driver. Environmental Product Declaration and Material Ingredients report required.									x kgCO ₂ e being <130% of Industry Average TYPE III PRODUCT SPECIFIC EPD	REPORT REQUIRED	QC to coordinate fixture trim with specified ceiling system Fixture shall be switched
BP-02	Offices	Cable mounted, nominal 4'w x 3-3/2" h x 6' long, 2-circuit, indirect/direct pendant with 90CRI LED. Rating distribution indirect, 55-degree distribution direct. Matte white, powder coat painted cold rolled steel housing with flat aluminum endcap, frosted bottom diffusing lens and integral driver. Environmental Product Declaration preferred and Material Ingredients report required.									x kgCO ₂ e being <125% of Industry Average TYPE III INDUSTRY-WIDE EPD	REPORT REQUIRED	QC to coordinate fixture mounting with specified ceiling system. Mount bottom of fixture at XX A.F.F. Fixture shall be dimmed
BW-03	Lobby	Decorative Sconce. Environmental Product Declaration preferred and Material Ingredients report required.									REPORT PREFERRED	REPORT REQUIRED	QC to coordinate fixture mounting with specified wall system Mount at height and orientation as per Architect's elevations Provide blocking as required

- NOTES:
- Contractor to verify fixture flange conditions with selected ceiling systems.
 - Contractor to coordinate all cables, connectors and accessories for complete installation per manufacturer's recommendations.
 - Contractor to provide continuous blocking as required.
 - Contractor shall be responsible for all final wiring.
 - All lighting products shall be coordinated with central vendor to ensure specified performance.
 - Contractor shall adhere to all fixture, transformer, driver, wire, etc. product requirements.
 - Contractor shall ensure no visible lighting level differences due to voltage drop.
 - All external drivers, transformers, and other maintenance items shall be installed in accessible locations with proper protection from the elements and heat dissipation.
 - All low voltage wiring shall be concealed.
 - Refer to "Section 265010 - Lighting Fixtures" of the specifications manual.
 - The primary base bid lighting fixtures that are specified in the Lighting Fixture Schedule by manufacturer and model numbers represent the standard for photometric performance, energy efficiency, functionality, aesthetics, physical dimensions, finishes, materials and construction integrity for this project. Alternate or equal manufacturers listed in the Lighting Fixture Schedule may closely approximate the attributes of the base bid standard. Alternate manufacturers may need to modify their products, as required to reasonably match the qualifications of the base bid specifications. Final determination of alternate manufacturers/products' compliance with the base bid standard shall be made solely by the Architect.
 - All Lighting Data requires reliable data to support additional information, including data on energy sources, materials, products, and other alternate, comply with the specified standards.
 - Life Cycle Assessment Reports and Environmental Product Declarations will comply with USGBC LEED Environmental Product Declarations Credit. Documentation will be provided at the time of submittals.
 - Material Ingredient reporting will comply with USGBC LEED Material Ingredients credit. Documentation will be provided at the time of submittals.

Notes



Design Approach

Efficiency

Vs

Sufficiency

Design Approach

Metrics



Efficacy
W/sf
Lumens / Watt

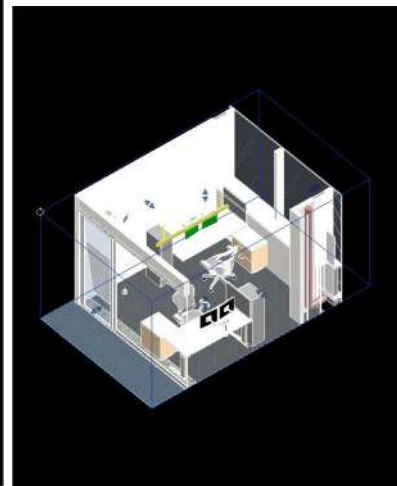
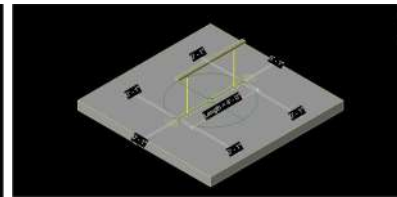
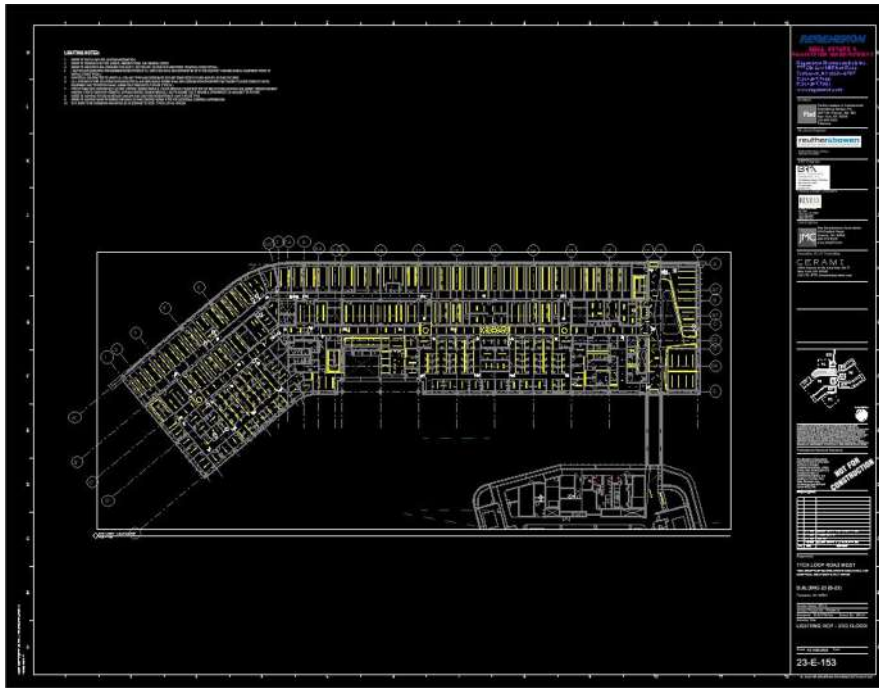


GWP + LAE
Lighting
Application
Efficacy

<https://www.frontiersin.org/articles/10.3389/fbuil.2022.986961/full>

Design

Layout comparative impact



Type Properties

Family: LT-BP-02-EM

Type: LT-BP-02-EM

Type Parameters	
Parameter	Value
Watts Per Foot	3.40 W
Global Warming Potential (GWP)	70
kgCO ₂ e	
Log Number	
Color Rendering Index (CRI)	0
Color Temperature (CCT)	0.00 K
Dim/Non-Dim	
Direct Lumen Output (lm)	0.00 lm
Equivalent Manufacturers	
Finish	
Identity Type Mark	
Indirect Lumen Output (lm)	0.00 lm
Lens-Louver	
Location	
Lumen Output	
Mounting	
Notes	
Projected Life	
Schedule Notes	

[What do these properties do?](#)

LCA Incubator Global Participants Representation



Global Participants Representation





Global Harmonisation

designers

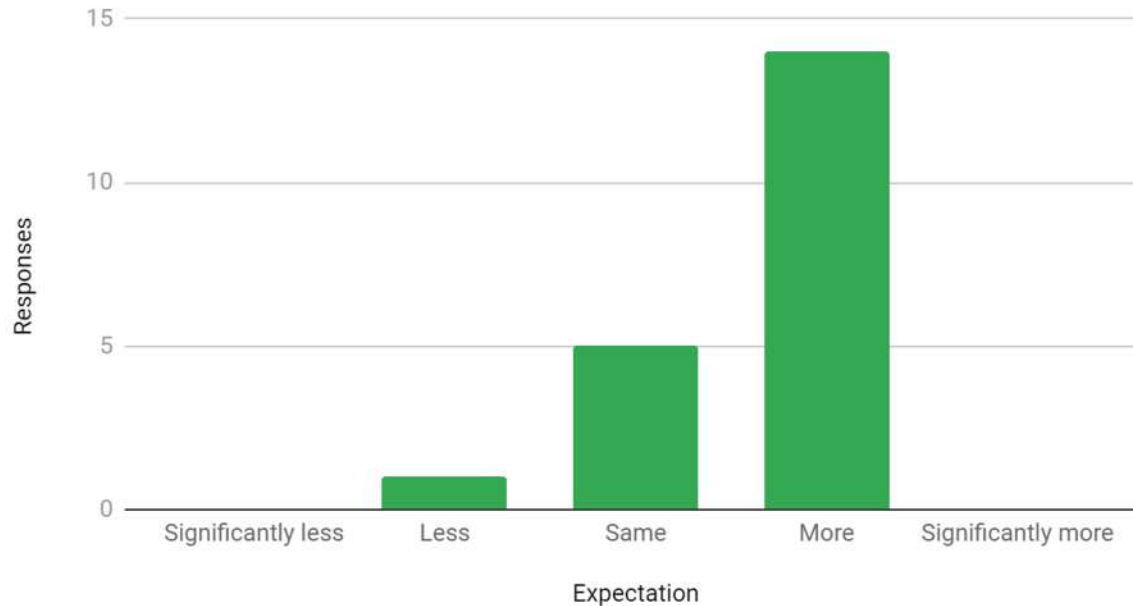
manufacturers

Consistency & Translation

Value for Sustainable Products

Preliminary Findings - Relative Cost

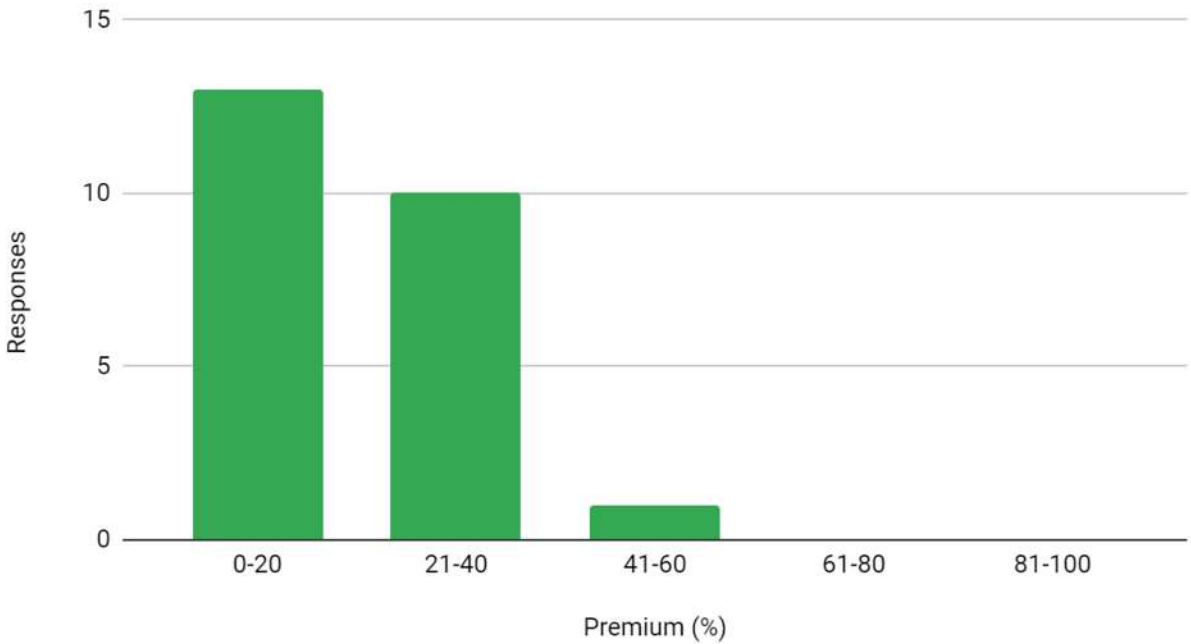
Cost Expectation of Sustainably Designed Products



Value for Sustainable Products

Preliminary Findings - Premium

Expected Premium for Sustainably Designed Products

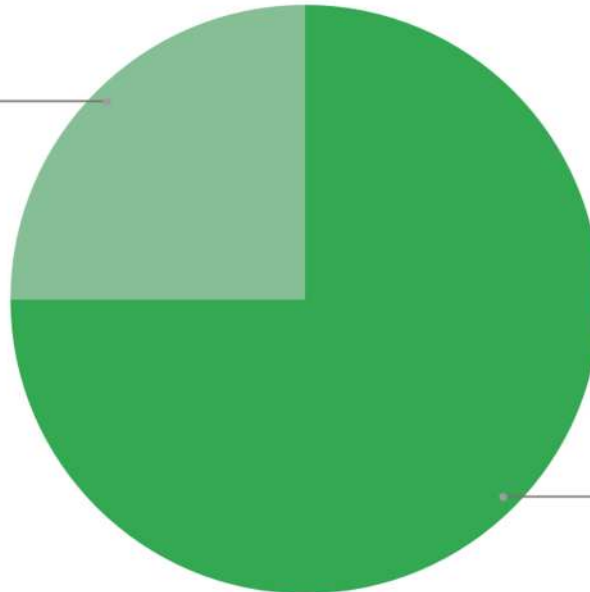


Value For Prime Spec

Preliminary Findings - Defending Sustainability Criteria

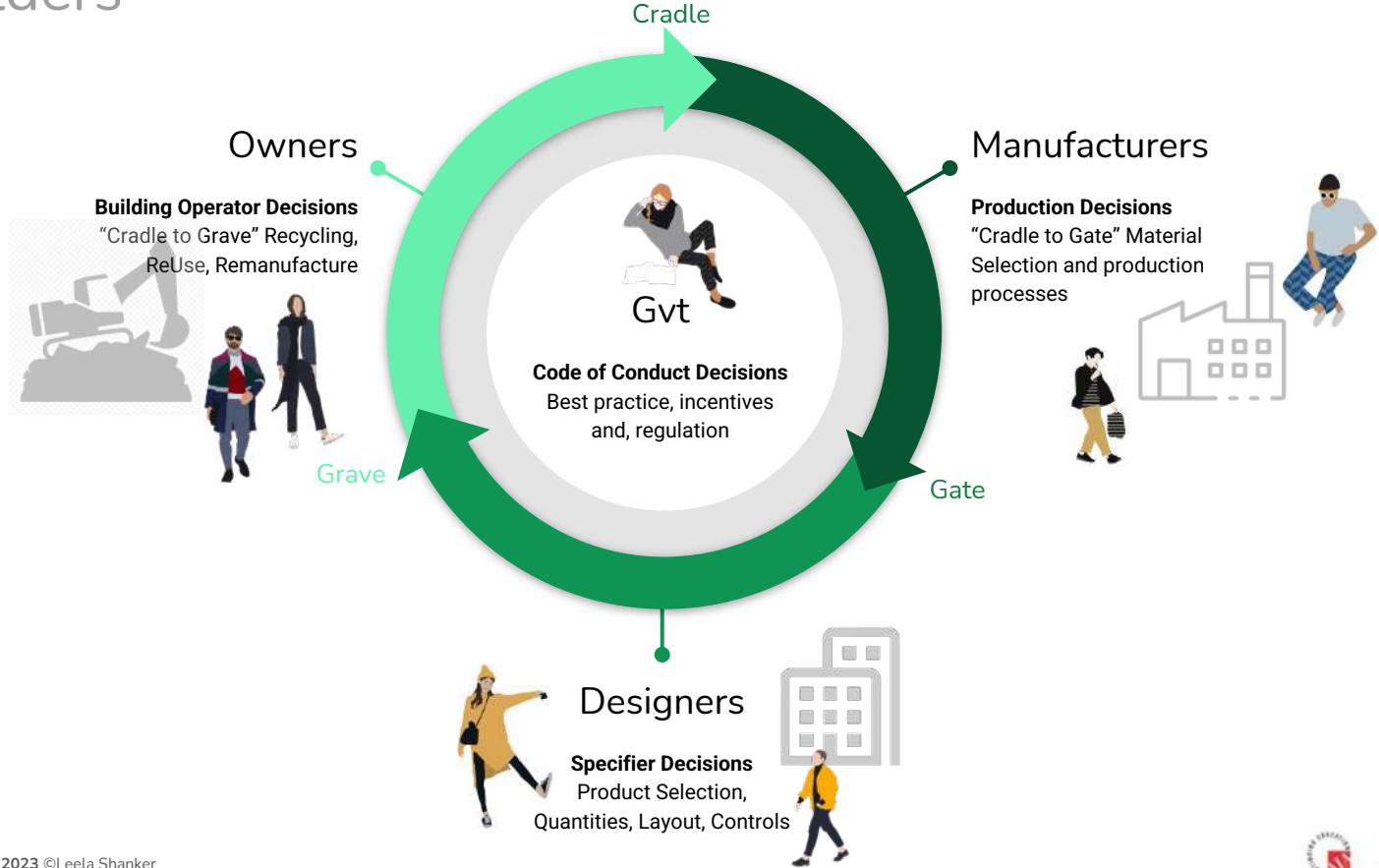
Hold Spec Against Value Engineering?

Maybe
25.0%



Yes
75.0%

Life Cycle Impact Stakeholders



Thank
You

leela@greenlight-alliance.com

russell@ruxdesign.net

kathryn.hickcox@pnnl.gov



Scan here for handy
acronyms, definitions,
links and resources



Scan here for handy
acronyms, definitions,
links and resources

This concludes The American Institute of Architects
Continuing Education Systems Course

