

Designers Lighting Forum

Specifying Sustainable Luminaires

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3.19.24

 **Acuity**Brands®

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.

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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.

Learning Objectives

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

1. Recognize the key elements of sustainability & their impacts including Embodied & Operational Carbon, Materials Responsibility & Workplace Social Responsibility
2. Understand the various methods of assessing sustainability including Circular Design, Embodied Carbon, Life Cycle Assessments & Materials Transparency
3. Gain a working knowledge of the luminaire related sustainability requirements of WELL, LEED and The Living Building Challenge
4. Apply the principals discussed to specify the most environmentally responsible lighting equipment for your project



Pre-Covid



Post-Covid

sustainability

noun [U]

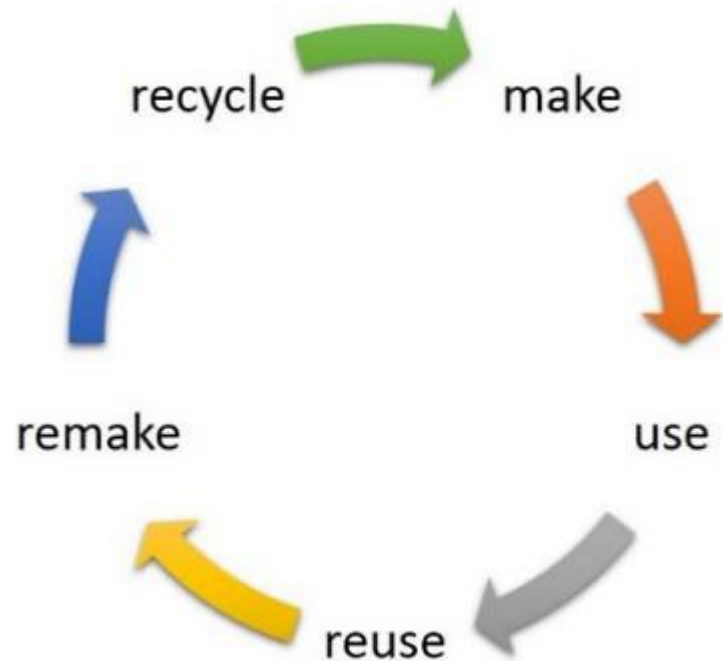
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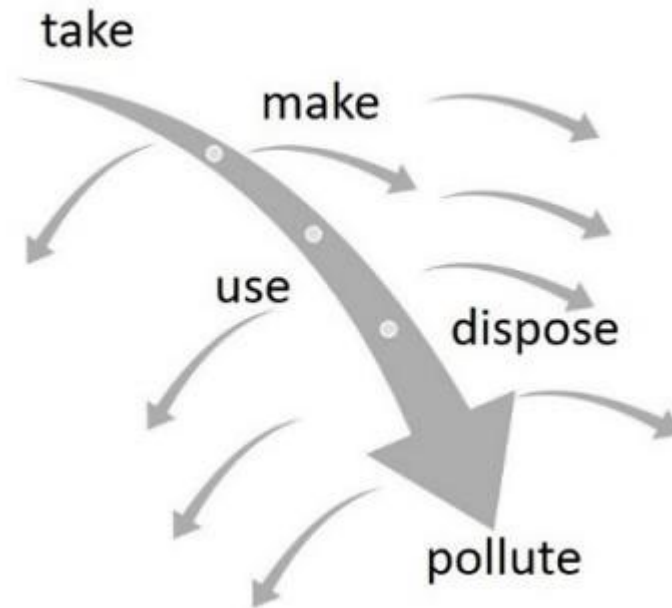
Circular Economy

Economic Model Centered on Regeneration & Reuse

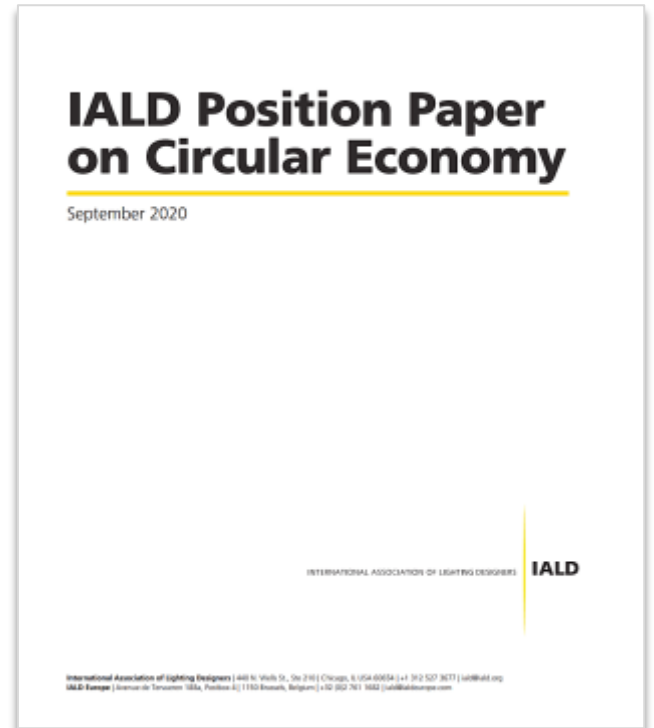
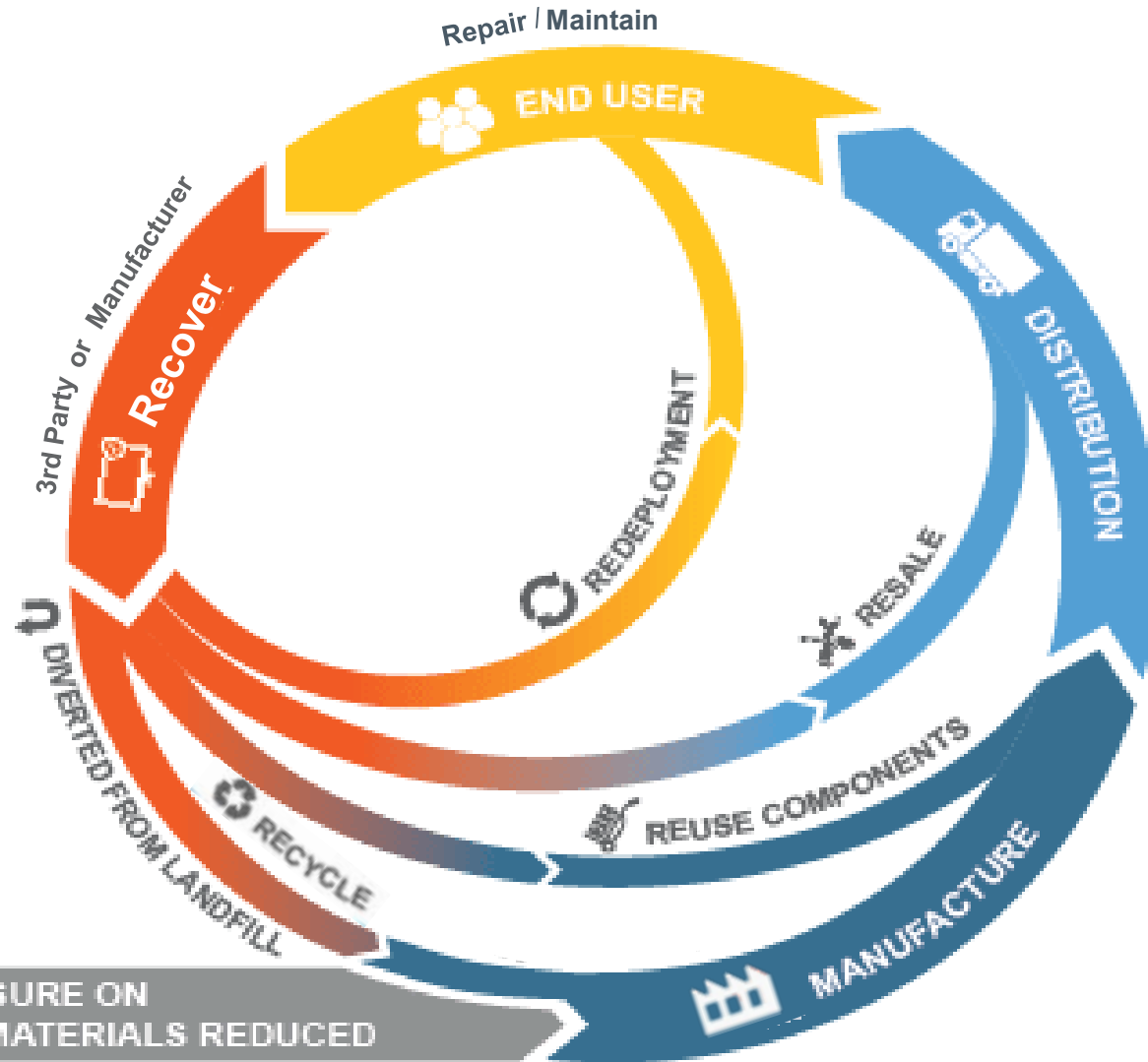
Circular Model



Linear Model



Circular Economy

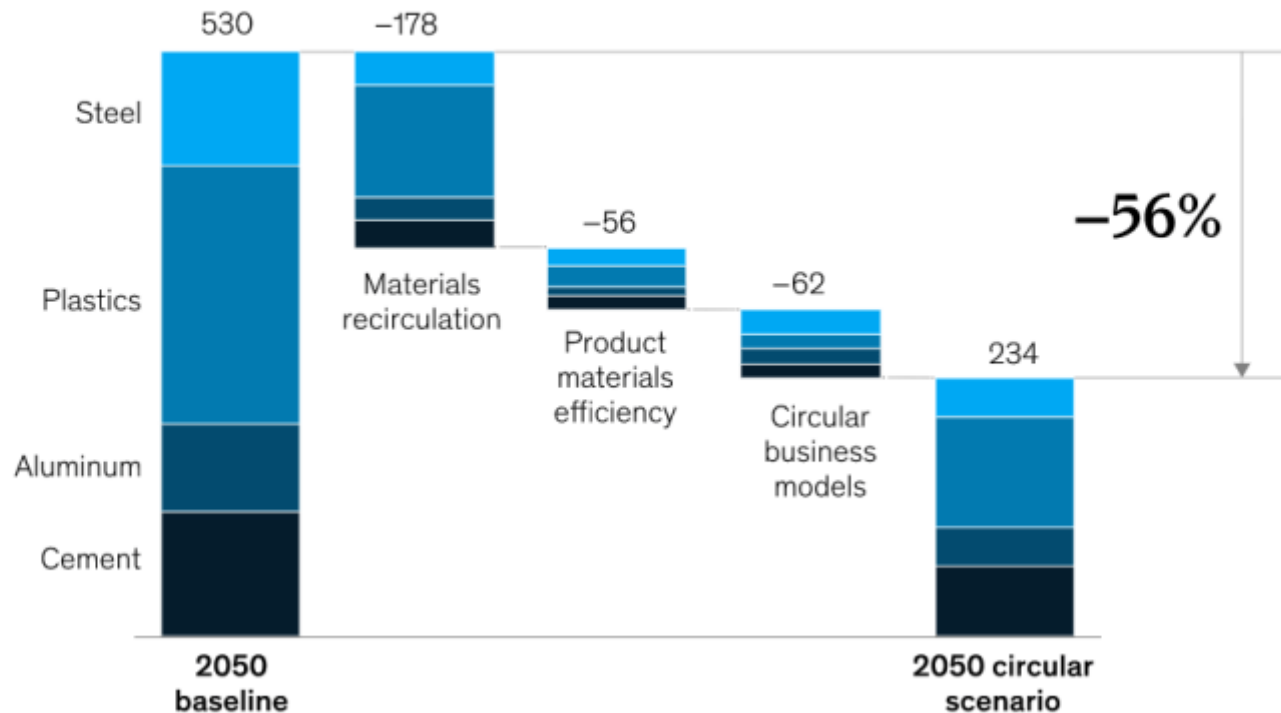


[IALD Position Paper on Circular Economy](#)

Circular opportunities in Europe

Can reduce 2050 emissions from steel, plastics, aluminum and cement by 56%

EU emissions reductions potential from a more circular economy by 2050, million metric tons of CO₂ per year



*“The **revision of the Construction Products Regulation** ...will create a harmonized framework to assess and communicate the environmental and climate performance of construction products...and **ensure that their design and manufacture is...more durable, repairable, recyclable & easier to re-manufacture.**”*

Source: [Material Economics](#)

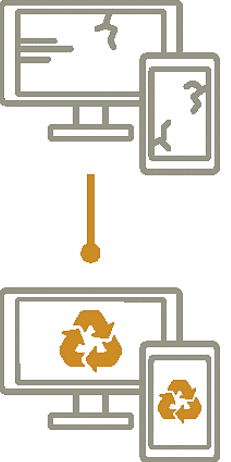
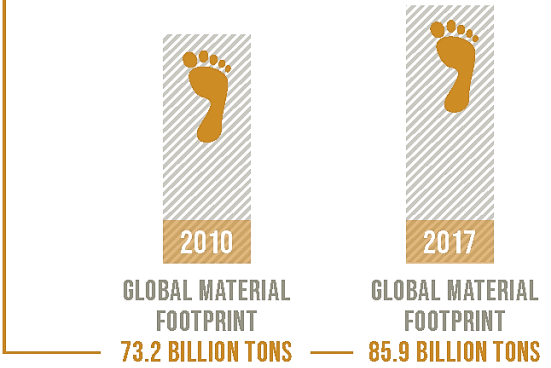
Catalyst for the sustainability movement



Catalyst for the sustainability movement

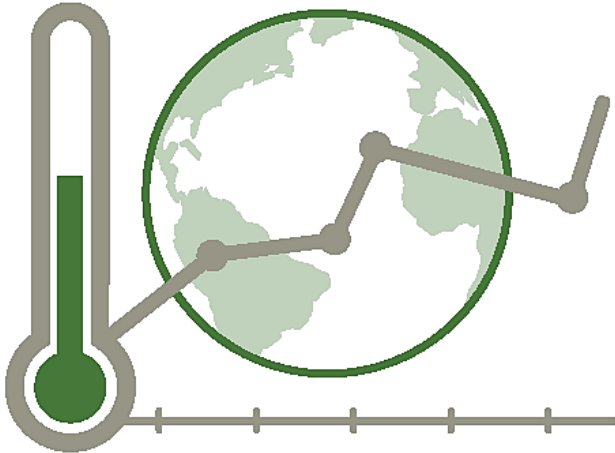


THE WORLD CONTINUES TO USE NATURAL RESOURCES **UNSUSTAINABLY**



ELECTRONIC WASTE GREW BY 38%
BUT LESS THAN 20% IS RECYCLED
[2010-2019]

Catalyst for the sustainability movement



2019 WAS THE SECOND WARMEST YEAR ON RECORD

GLOBAL TEMPERATURES ARE PROJECTED TO RISE BY UP TO 3.2°C BY 2100

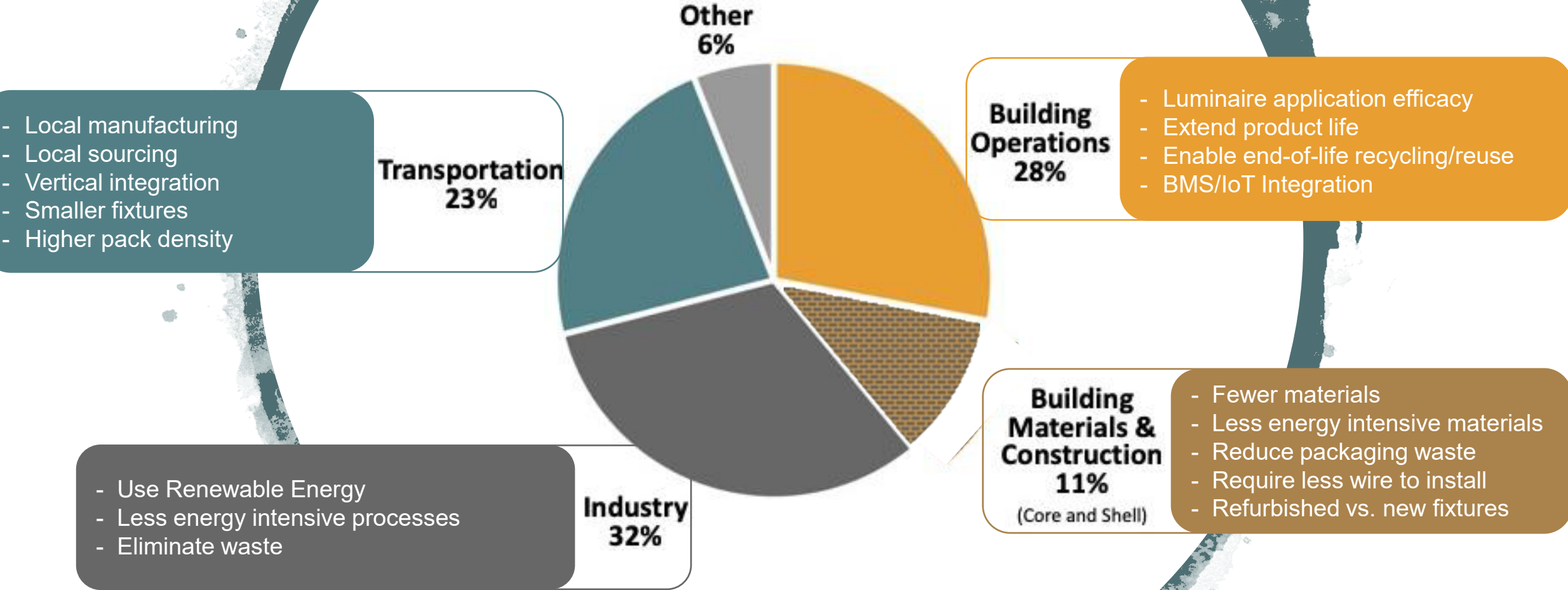


CLIMATE CHANGE CONTINUES TO EXAGGERBATE THE FREQUENCY AND SEVERITY OF NATURAL DISASTERS



AFFECTING MORE THAN 39 MILLION PEOPLE IN 2018

Global CO₂ Emissions by Sector



Source:
Global Alliance for Buildings and Construction.
2018 GLOBAL STATUS REPORT.

CO2 Emissions = Embodied + Operational Carbon

97%+
of Luminaire
Lifecycle
Emissions*

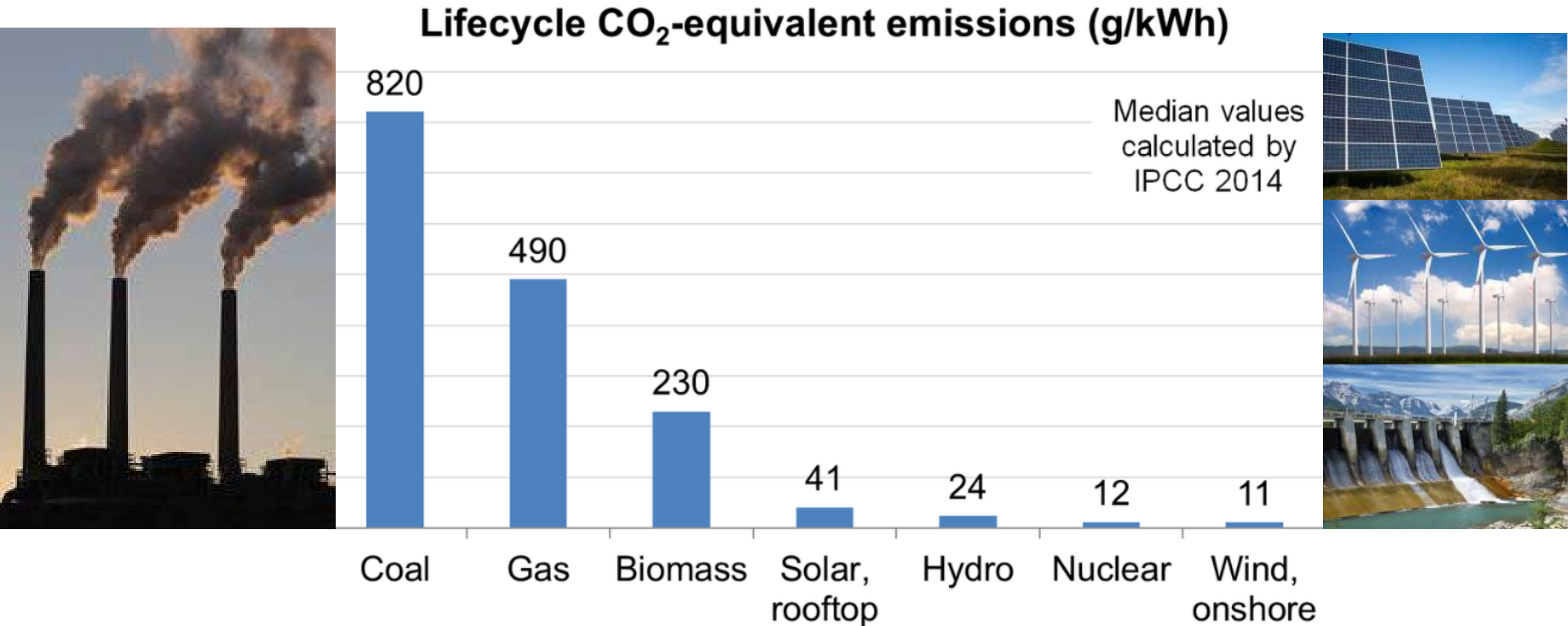
Heavily influenced by the local energy grid/source, fixture efficacy, application efficacy & controls integration



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* Based on results of 2023 Green Light Alliance Life Cycle Assessment Incubator

As we shift to renewables, % CO2 contribution from embodied carbon will increase



Key Elements of Sustainability

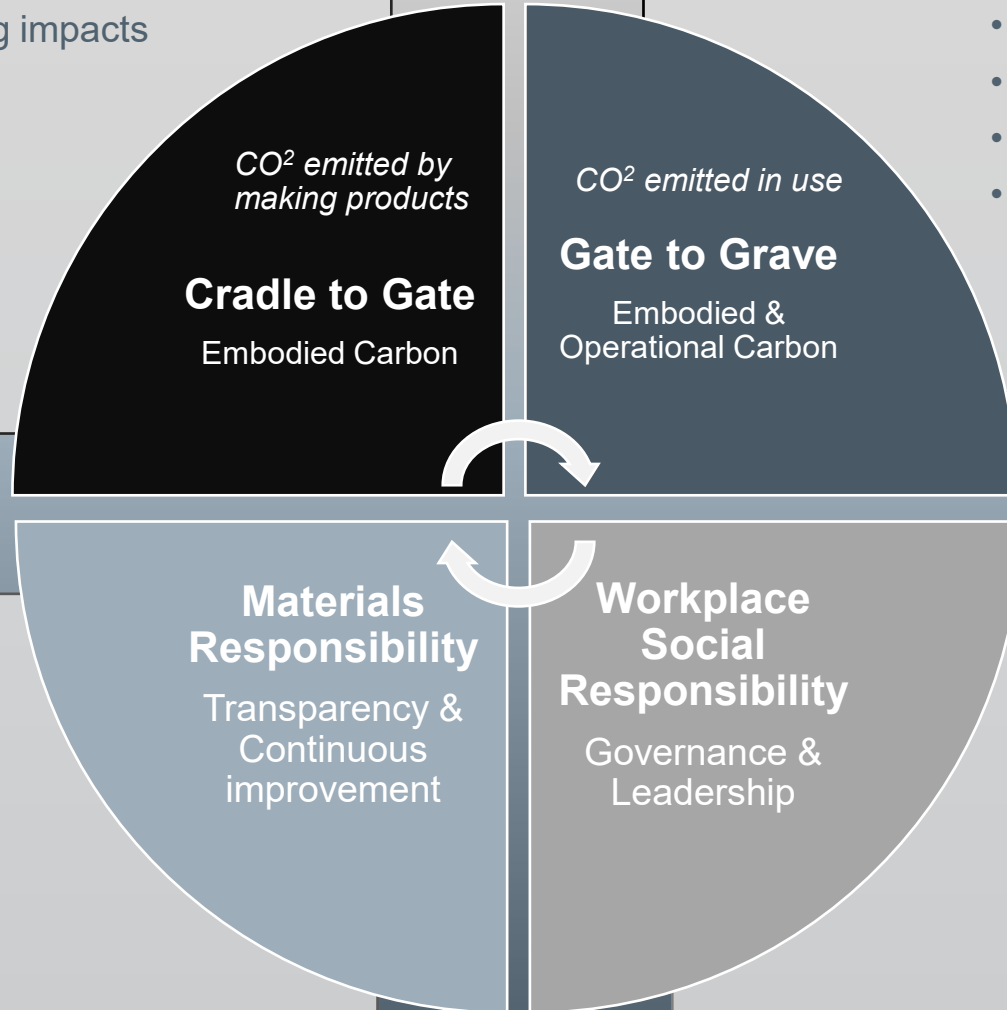
- **Supply Chain** (Scope 3 emissions)

- Reduce Material Extraction & Processing impacts
- Reduce Inbound Transportation

- **Manufacturing** (Scope 1 & 2 emissions)

- Reduce Material Inputs
- Reduce Energy Use & Grid Energy
- Reduce Emissions
- Reduce Waste
- Reduce Transportation to job Site

- Responsible Materials & Sourcing
- Elimination of hazardous content
- Maximize reused & recycled content



Cradle to Gate

Embodied Carbon

CO² emitted by making products

Gate to Grave

Embodied & Operational Carbon

CO² emitted in use

Materials Responsibility

Transparency & Continuous improvement

Workplace Social Responsibility

Governance & Leadership

- Reduce Energy use during operation
- Extend Life: Service/Repair
- Refurbish/Reuse in second life
- Recycle at end of life

- Diversity, Equity & Inclusion
- Ethics, Code of Conduct
- Worksite Beauty/Ecology
- Health & Wellness
- Safety
- Employee Benefits & Growth
- Community involvement
- Philanthropy

Assessing a Manufacturer's Commitment Embodied Carbon & Workplace Social Responsibility

Corporate Sustainability Report (CSR) measurable goals and results following SASB* guidelines

Goal	Metric	FY19 Baseline	FY21 Target	FY21 Actual	FY22 Target	Status
Carbon Intensity	g CO ₂ / \$	25.92	20.73	24.02	19.44	Continuing
	%	-	-20%	-11.01%	-25%	
Energy Efficiency	Mt CO ₂	83,698	66,958	73,888	62,774	Continuing
	%	-	-20%	-11.72%	-25%	
Raw Materials	%	-	-20%	27%	25%	Achieved and Completed
Customer Energy Reduction	Billions of kWh	9.6	18.0	28.77	27.0 (cumulative FY19-22, Goal met, goal retired)	Achieved and Completed
Associate Engagement	%	71	81	84*	85	FY21 Target Achieved
Ethics	%	100% of salaried associates	100% of salaried associates and 60% of hourly associates	100% of salaried associates and 80% of hourly associates	100% of salaried associates and hourly associates	FY21 Target Achieved
Supplier Ethics	%	n/a	70% of total spend	80% of total spend	90% of total spend	FY21 Target Achieved

*Our survey partner changed to Willis Towers Watson in FY21. The metric measures sustainable engagement.

2021 EarthRight REPORT

Acuity Brands, Inc. | 18

CO₂ emitted by making products

Cradle to Gate
Embodied Carbon

Goal: Energy Management

SASB Metrics:

- (1) Total Energy Consumed
- (2) % of grid electricity
- (3) % of renewable electricity

Goal: Recruiting & Managing a Global, Diverse & Skilled Workforce

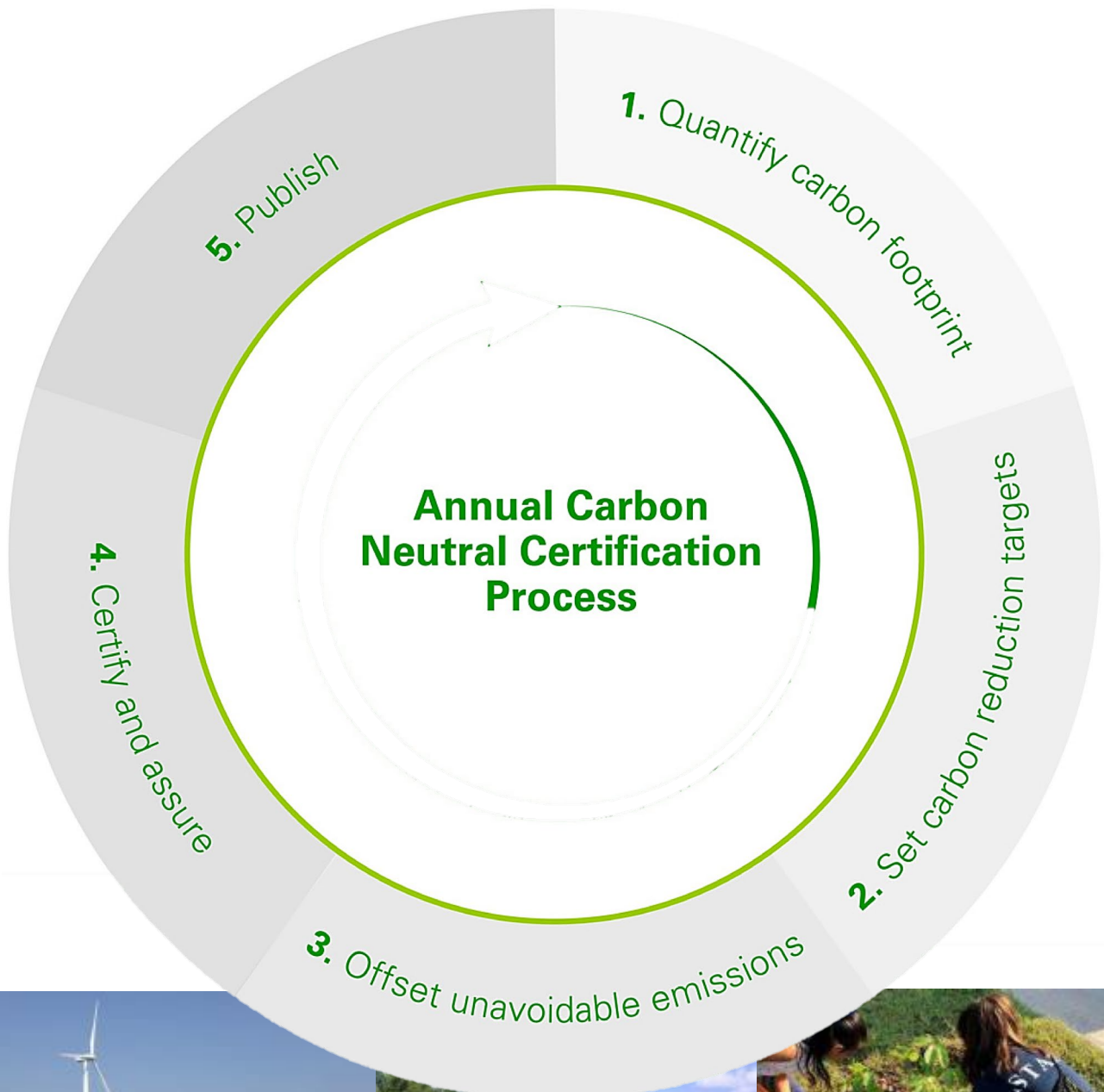
SASB Metrics:

- % of gender & racial/ethnic group representation for:
- (1) Management
 - (2) Technical staff
 - (3) All other employees

Workplace Social Responsibility

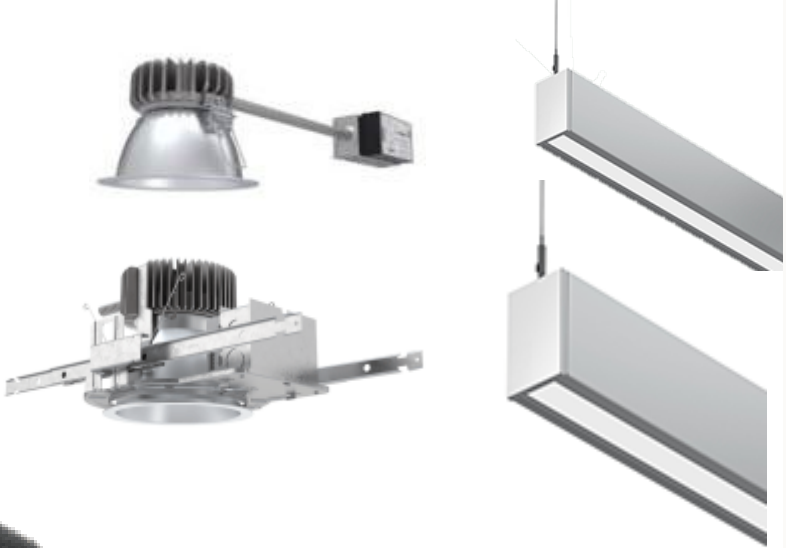
Governance & Leadership

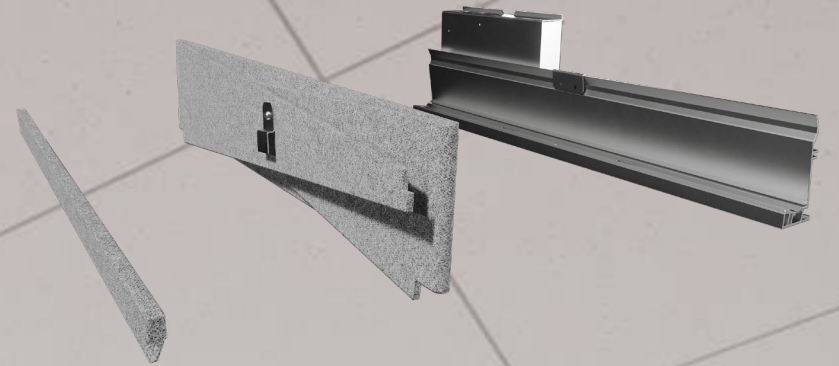
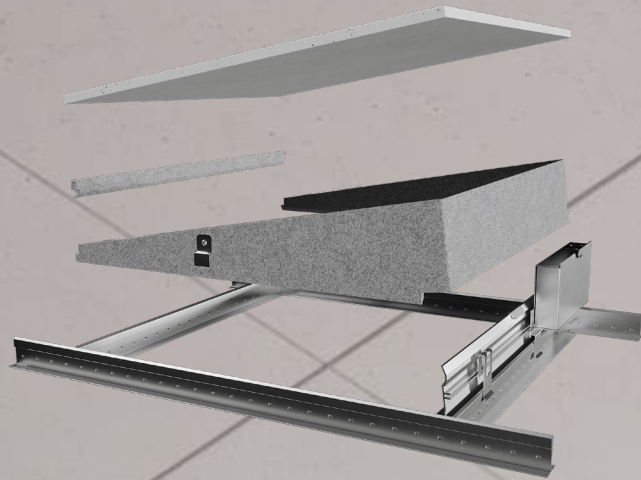
Carbon Neutrality



Embodied Carbon Product Impacts

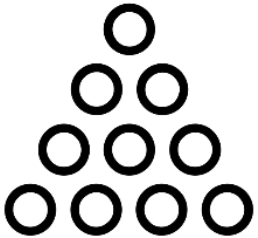
Smaller/lighter/less packaging generally equates to less CO2





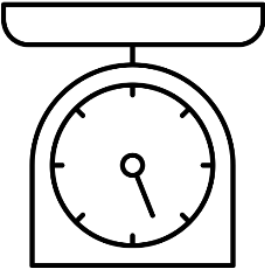
Calculating Embodied Carbon

Quantity of Components



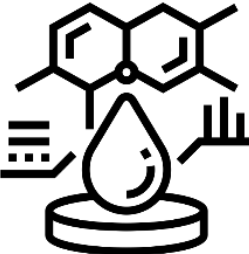
X

Weight of Components



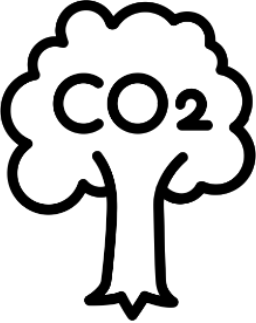
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Embodied Carbon Coefficients



=

Embodied Carbon



Embodied Carbon of common luminaire materials

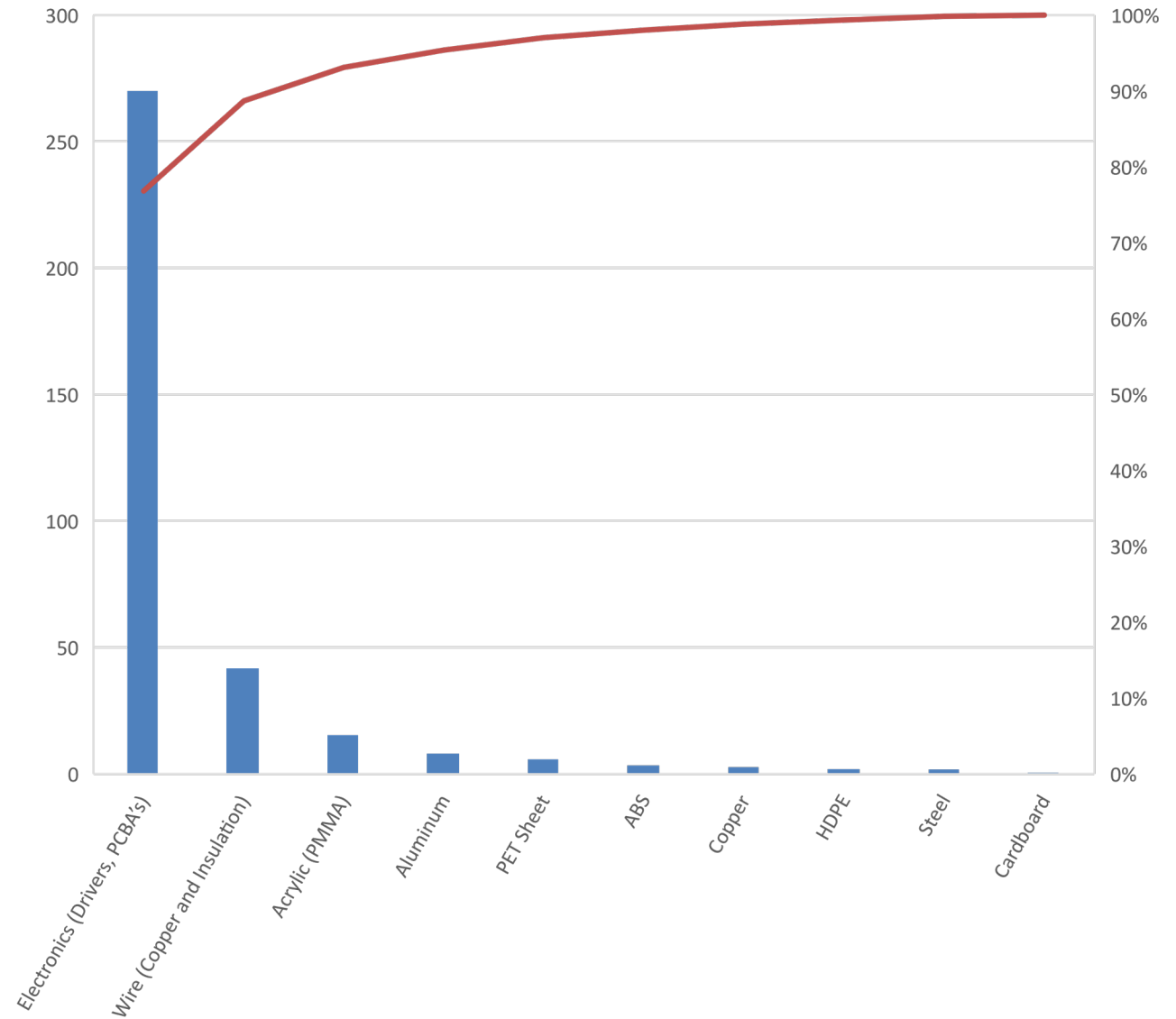
Embodied Greenhouse Gas Emissions (lbCO₂e/lb) coefficients for given materials.



Material	Embodied Greenhouse Gas Emissions (lbCO ₂ e/lb)
Steel	1.77 _a
Aluminum	8.14 _a
Copper	2.77 _a
PET Sheet	5.76 _a
HDPE	1.9 _a
ABS	3.46 _a
Wire (Copper and Insulation)	41.8 _b
Acrylic (PMMA)	15.4 _b
Polypropylene (non-woven)	0.048 _c
Cardboard	0.532 _d
Electronics (Drivers, PCBA's)	270.0 _e

^a Source: Winnipeg.ca. 2021. [online] Available at: <https://www.winnipeg.ca/finance/findata/matmgf/documents/2012/682-2012/682-2012_Appendix_H-WSTP_South_End_Plant_Process_Selection_Report/Appendix%207.pdf> [Accessed 18 May 2021].
^b Source: Crawford, R. (2021, March 5). *EPIC Database*. Figshare. https://melbourne.figshare.com/articles/book/EPIC_Database/10257728
^c Source: Raja, J., Assinder, P., Dixon, N., Fowmes, G., & Frost, M. (2015). *Obtaining reliable embodied carbon values for geosynthetics*. Geosynthetics International, 1–9. <https://doi.org/10.1680/gein.15.00020>
^d Source: Carbon Footprint Calculator | *Corrugated Packaging - because boxes are so much more than ordinary*. (n.d.). <https://www.Corrugated.Org/>. <https://www.corrugated.org/carbon-footprint-calculator/>
^e Source: Teehan, P., & Kandlikar, M. (2013). Comparing Embodied Greenhouse Gas Emissions of Modern Computing and Electronics Products. *Environmental Science & Technology*, 47(9), 3997–4003. <https://doi.org/10.1021/es303012r>

Embodied Greenhouse Gas Emissions (lbCO₂e/lb)



Embodied Carbon of Virgin vs. Recycled Metals

Material	Carbon Coefficient (lbCO₂e/lb)	
	Virgin	100% Recycled
Steel	1.8	0.4
Aluminum	12	2.1

What is the recycled metal content of a luminaire?

- Use of recycled content is embedded in steel and aluminum manufacturing
- Specific percent of recycled content varies with fluctuating supply

Material	Aggregate Recycled Content %
Sheet Steel	25-30% *
Die-Cast Aluminum	80% ^
Extruded Aluminum	54.2% `

[* Steel Recycling Institute](#)

[^ The Environmental Footprint of Semi-Fabricated Aluminum Products in North America](#)

[` Aluminum Extruders Council EPD](#)

2x2 Embodied Carbon Comparison...a 50% reduction!



	Material	Coefficients CO2e [lbs]	Typical 2x2 CO2e [lbs]	Sustainable 2x2 CO2e [lbs]
Structural	Steel	1.8	24.8	1.3
	Aluminum	8.1	11.1	9.0
	Driver Steel	1.8	0.8	0.8
	ABS	3.5	0.5	0.0
Optical	Acrylic (PMMA)	15.4	37.3	0.0
	PET	5.8	0.0	7.9
Electrical	Wire	41.8	7.1	1.2
	PCBA	270.0	119.8	24.0
	Driver Electronics	270.0	108.0	108.0
	Control	270.0	11.8	11.8
	Cardboard	0.5	1.7	0.5
Totals			322.7	164.3

TM65 Embodied Carbon Calculation Methodology



- To create global consistency on how the embodied carbon of building services equipment, to include luminaires, can be assessed
- Includes several publications, digital tools, and free-to-all data-gathering forms
- Currently available for UK, Australia & New Zealand, North American version expected July 2024

[Upcoming Guides \(ashrae.org\)](https://www.ashrae.org)

F Mark
Influencing the way we build

TM65 Calculation

Luminaire: **DSX0.1.LA084.FW.C9.LRD**

CIBSE TM65 Embodied Carbon 'Basic' Calculation

Date: 24/04/2023
Assessor / Organisation: F Mark Ltd
Contact: studio@fmark.co.uk

Embodied Carbon Results with 'Basic' TM65 Calculation Method Total

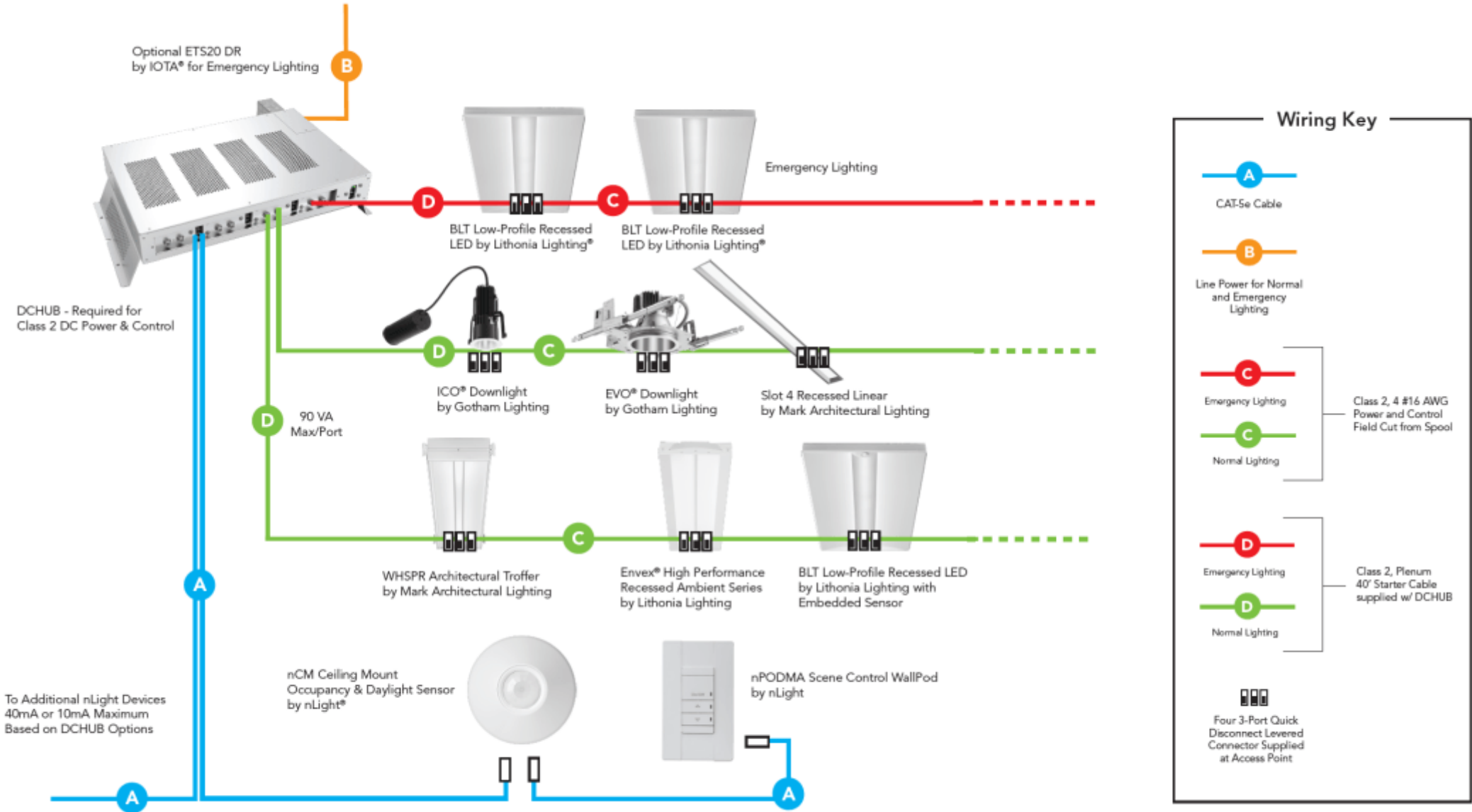
220.02 kg CO₂e

Product information

Type of product:	Luminaire
Capacity of equipment:	0.064 kW
Product weight:	8.27 kg
Material breakdown at least 95% of product weight:	Yes
B3: Materials replaced as part of repair/maintenance	0 kg CO ₂ e
Location of Manufacture:	Milton Keynes United Kingdom

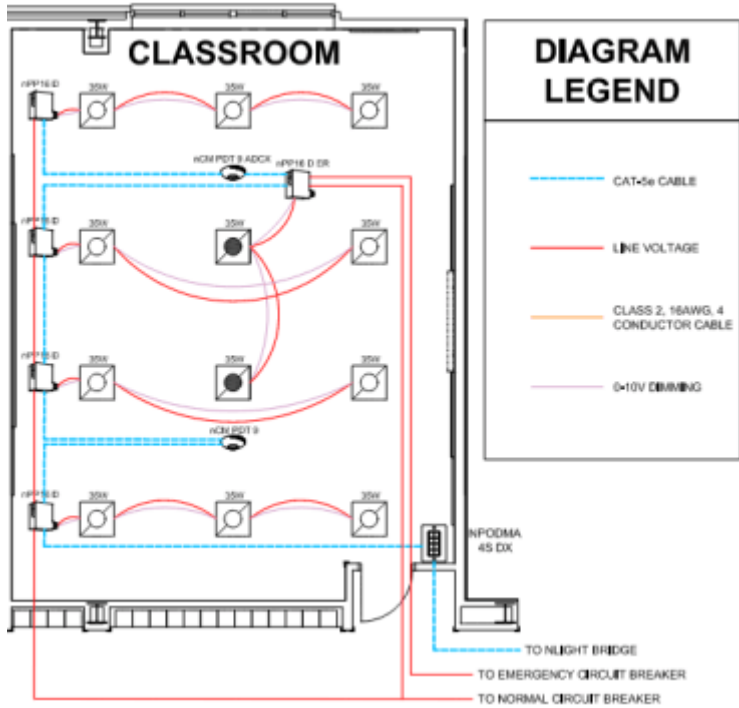
Material	Percentage
Aluminium (Cast)	80.64%
Stainless Steel	8.03%
Electronics	7.06%
PCB	2.104%
Copper	0.60%
PVC	0.60%
Nylon	0.02%
Silicone Rubber	0.93%

DC2DC Embodied Carbon Reduction Potential



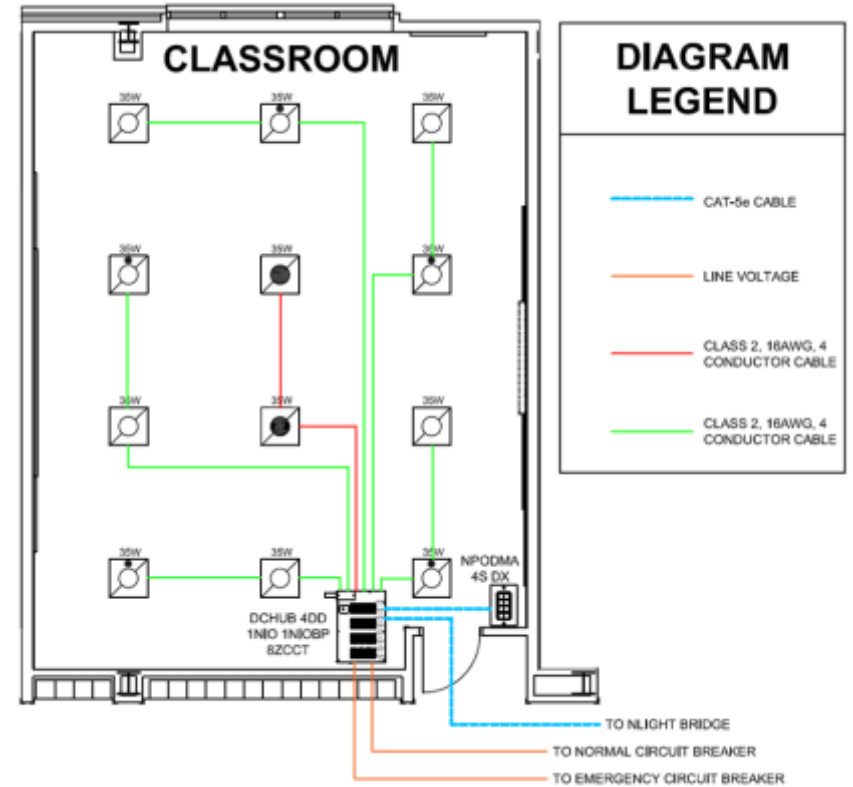
Note: All luminaires require 57VDC DCHUB option

Line Voltage Class 1



16% Embodied CO2 Reduction

DC2DC Class 2



Power Packs

X 5



Line Voltage Connections

X 90

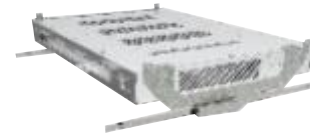


Junction boxes

X10

Conduit

100's ft



DCHUB Install

X 1



Line Voltage Connections

X 6

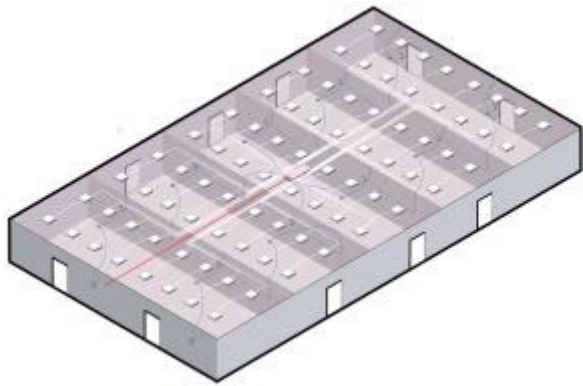


Low Voltage Connections

X 48

DC2DC + Sustainable 2x2 Luminaire

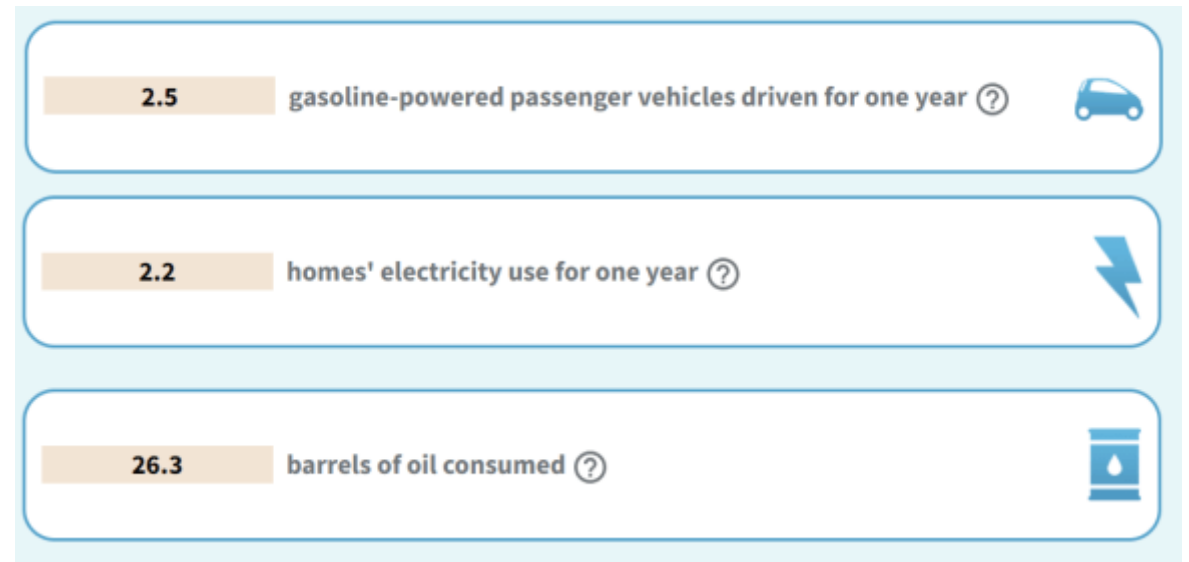
36% Embodied Carbon Savings for a 5800 sq/ft space

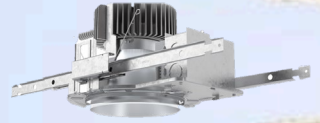
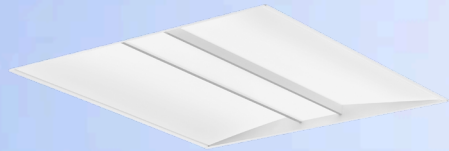
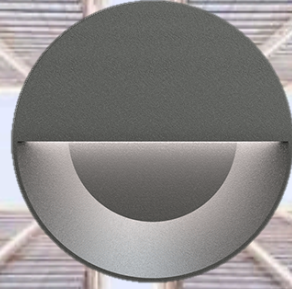
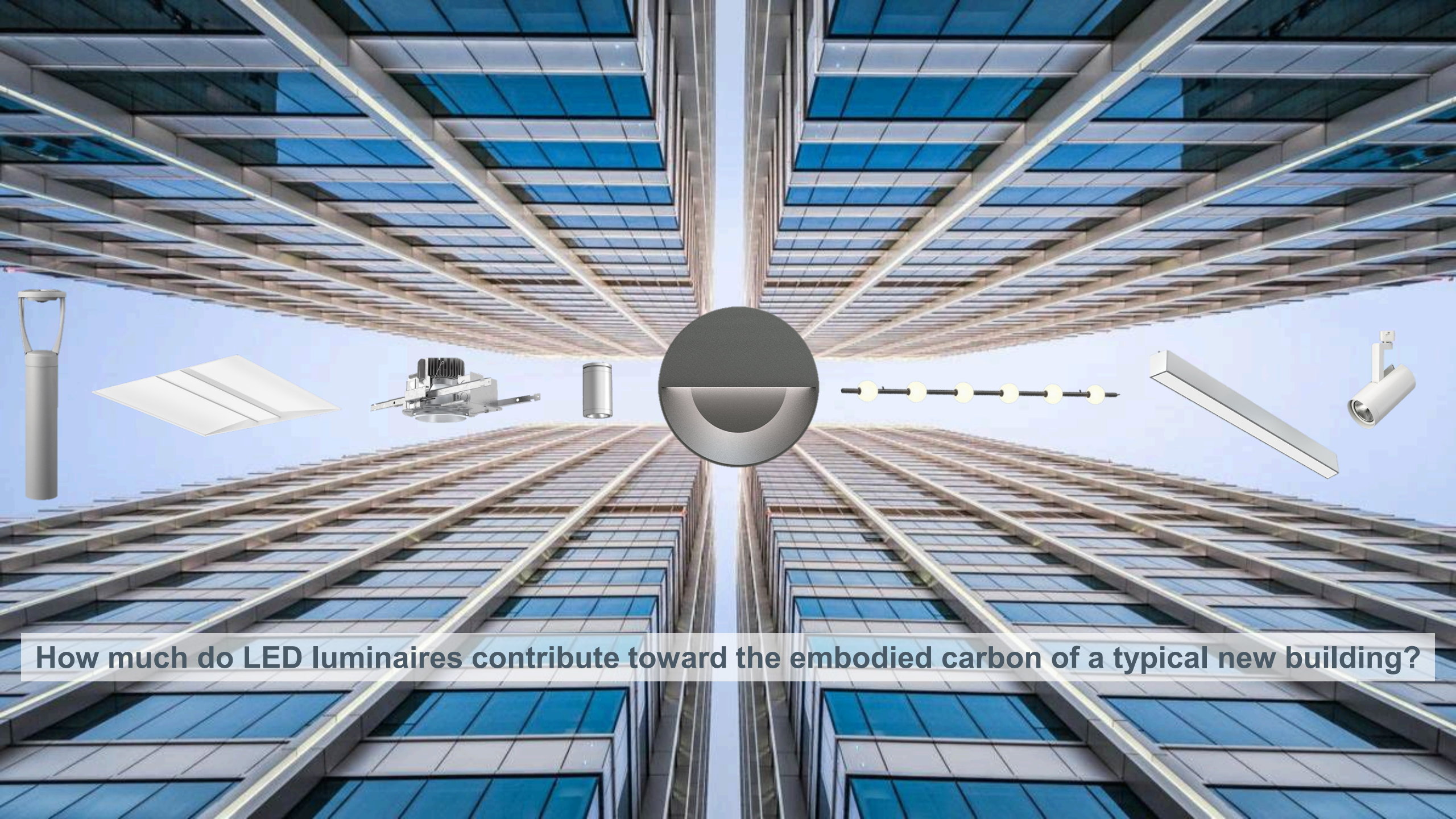


Embodied CO2 Savings (lbs.)

DC-DC	12,243
80 Fixtures material	12,668
Transportation 500mi	183
<hr/>	
Total carbon saving	25,094 lbs

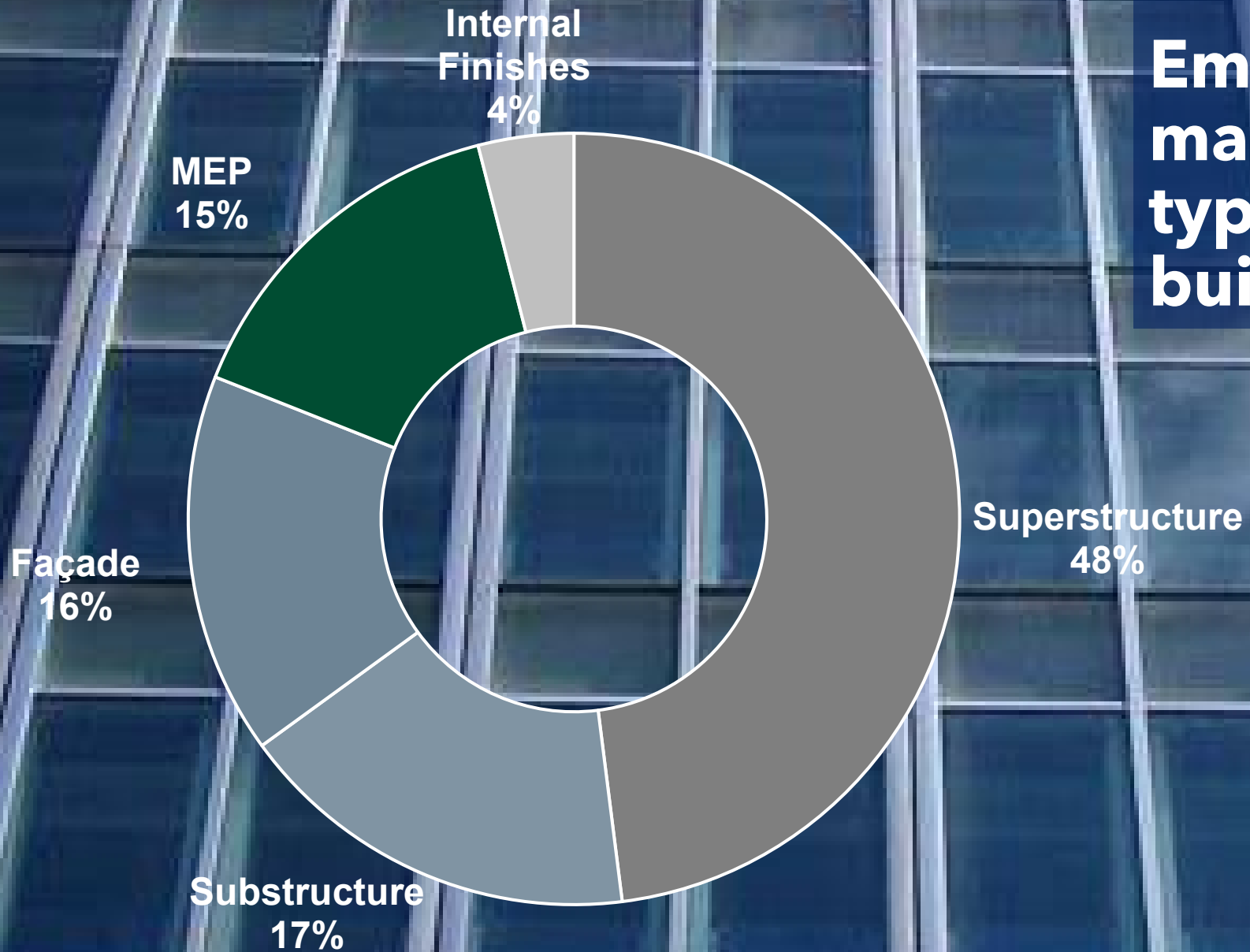
EPA Greenhouse Gas Equivalents



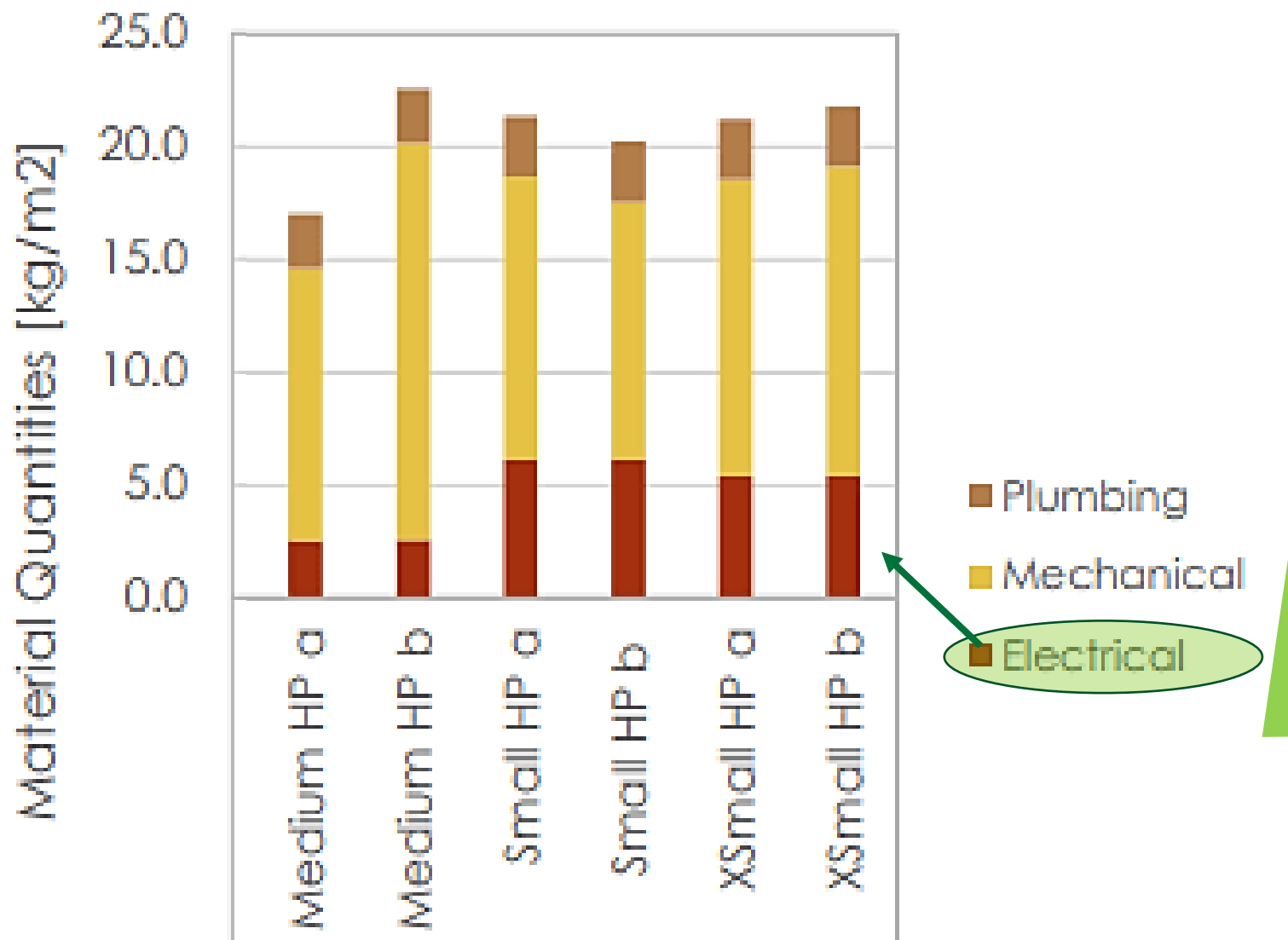


How much do LED luminaires contribute toward the embodied carbon of a typical new building?

Embodied Carbon make-up of a typical new office building

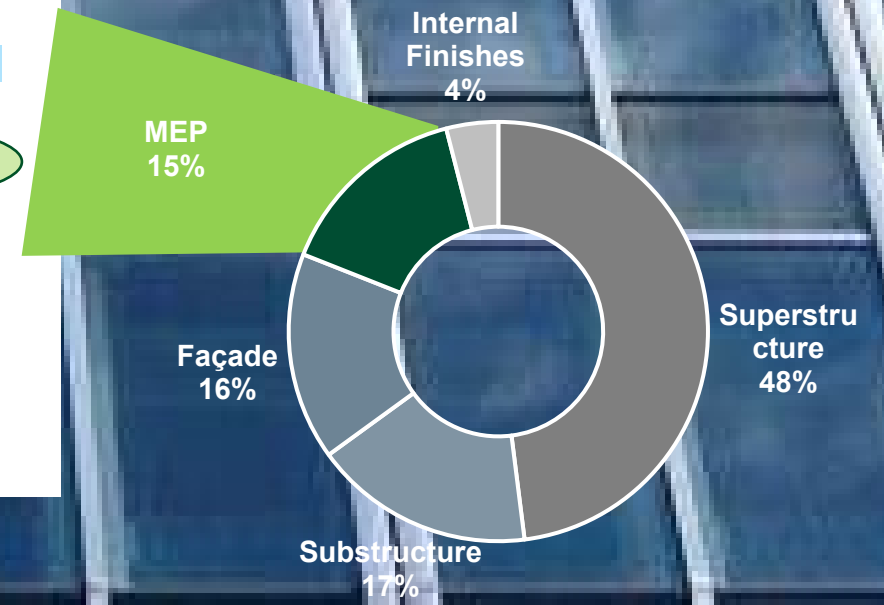


Proportion of embodied carbon in a typical office building's lifecycle excluding operational energy. (ref. LETI Climate Emergency Design Guide)



Electrical = 10-28% of MEP
 <5% of building total embodied carbon

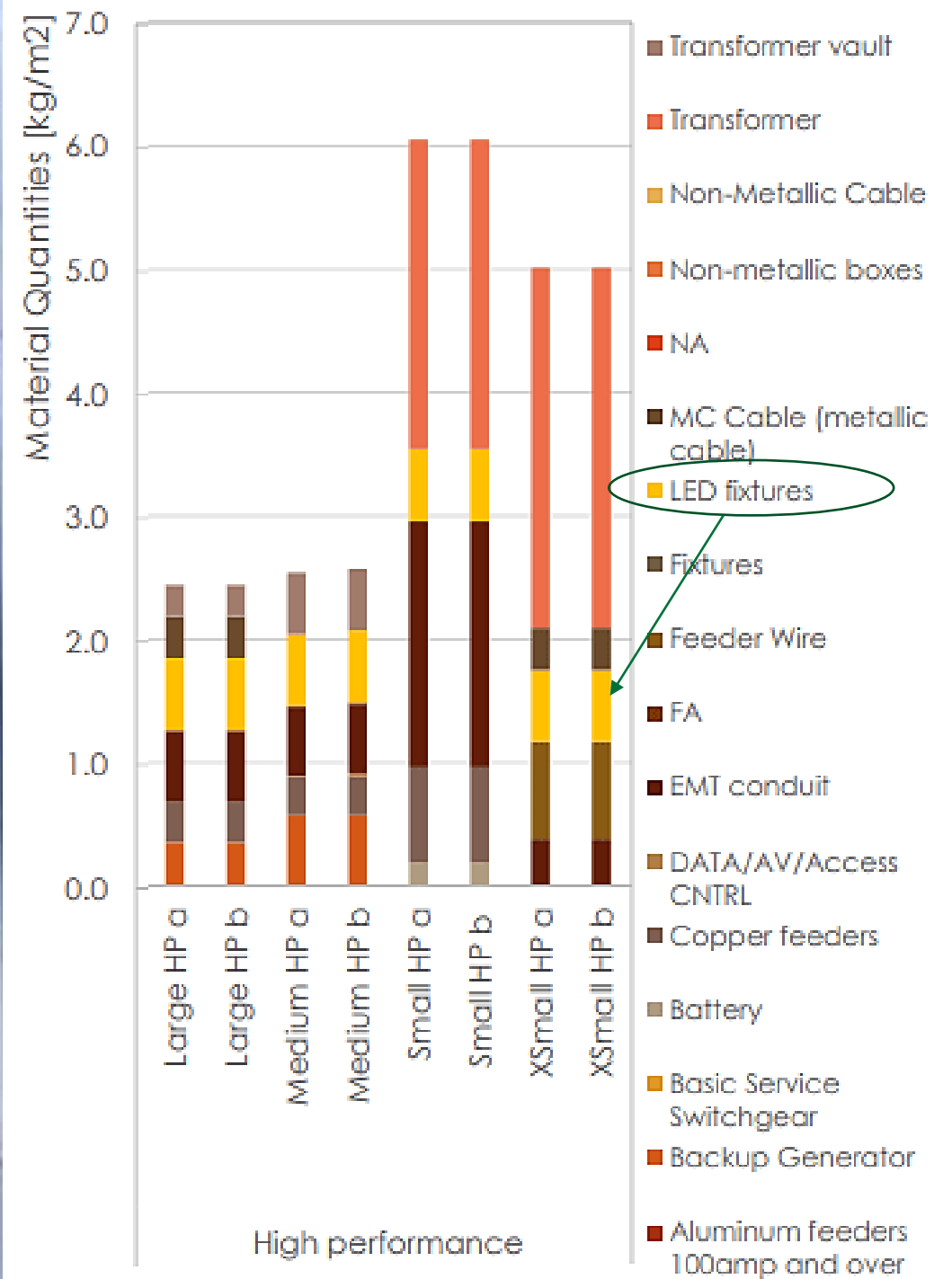
- Plumbing
- Mechanical
- Electrical



LED Luminaires = 10-28% of Electrical

~.5 - 1.5% of the total embodied carbon of a new high performance office building

10%+ for a renovation project

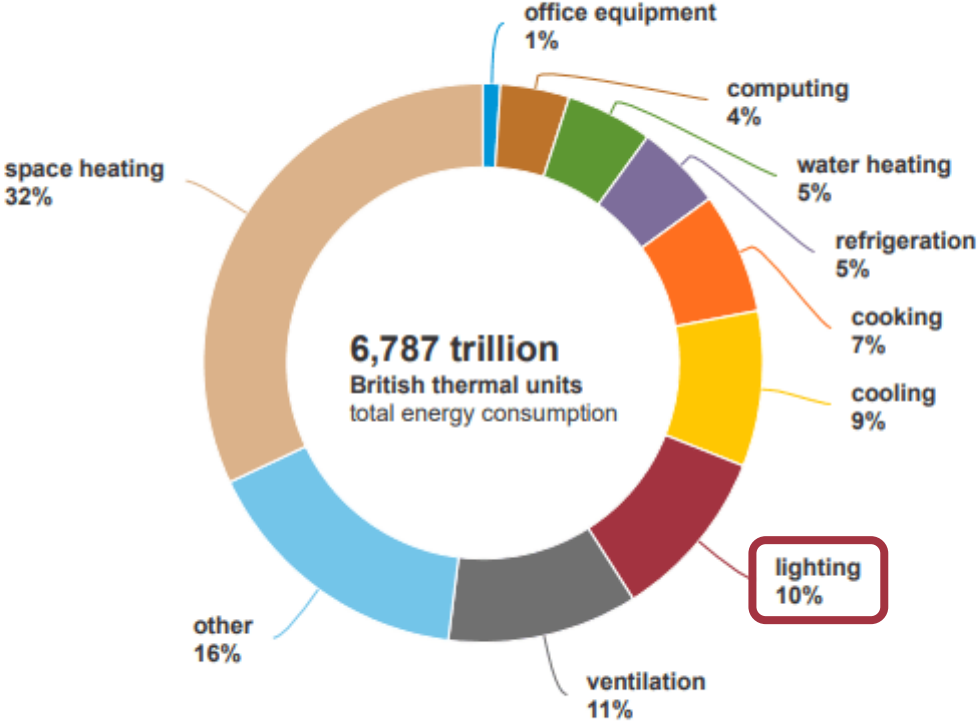


Gate to Grave **Operational Carbon**



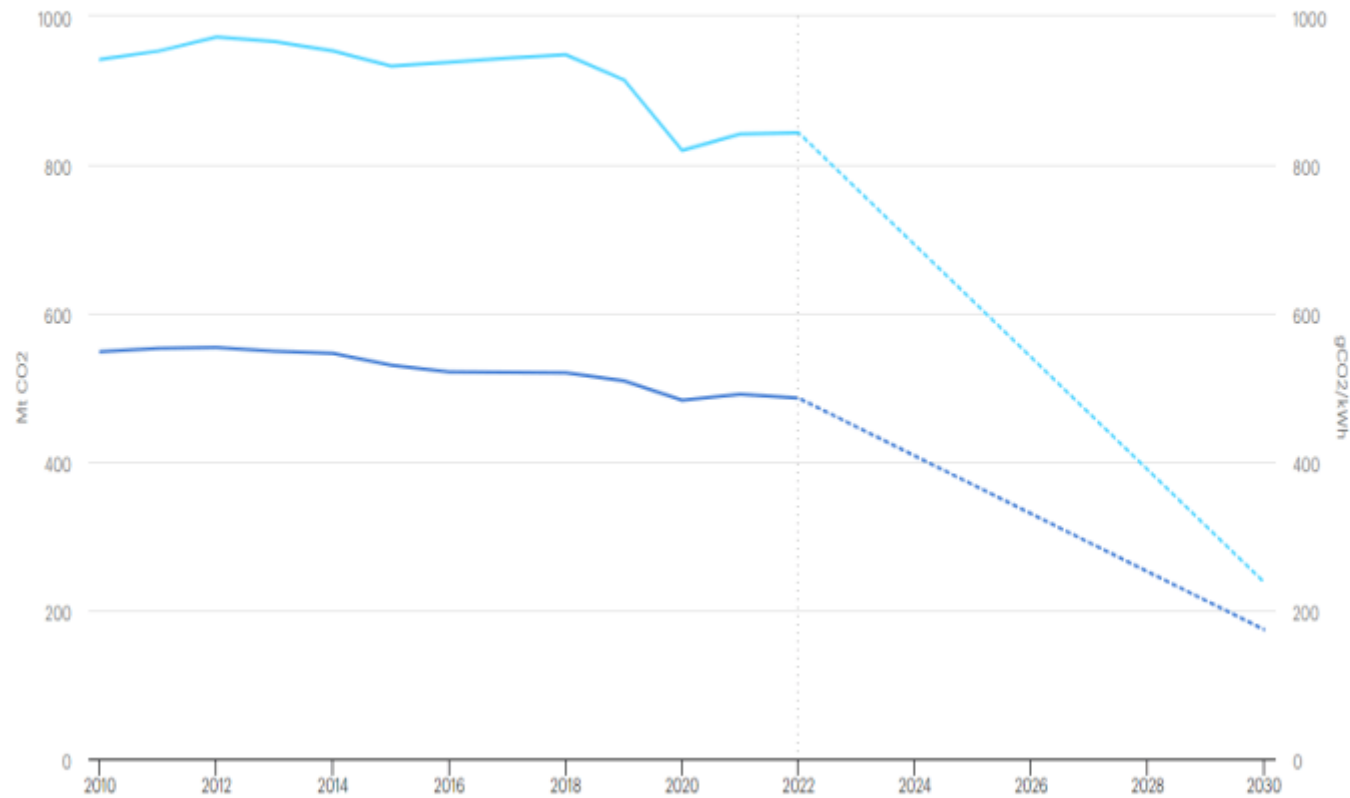
Energy consumption during use stage has the highest lifecycle environmental impact for luminaires

Major fuels consumption by end use in U.S. commercial buildings, 2018
share of total



Data source: U.S. Energy Information Administration, 2018 Commercial Buildings Energy Consumption Survey, December 2022

Lighting CO2 Emissions Reduction to Hit Net Zero by 2030



**Need to reduce by two-thirds...
while demand for lighting is growing!**

- Decarbonize electricity generation
- Phase out older technologies in existing buildings
- Improve efficacy

● Emissions ● Emissions intensity factor

Notes

CO2 emissions from lighting occur indirectly from electricity generation. The emissions intensity factor is the average CO2 emissions intensity across all lighting used.

Gate to Grave **Operational Carbon**



Energy Efficiency

- Diminishing returns from LED transformation
- More work to optimize “Application Efficacy”

how well we deliver light to useful zones in combination with thoughtful lighting and controls design in support of a functional, healthy and inspiring space.

Luminaire vs. Application Efficacy



Luminaire vs. Application Efficacy



Luminaire vs. Application Efficacy

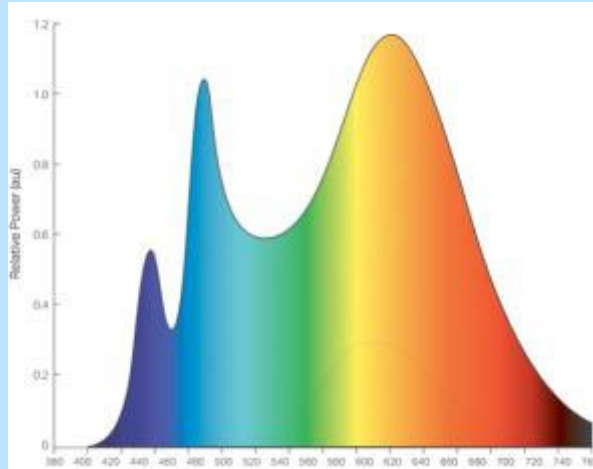
Lighting for Optimized Health & Wellness

Timing/Duration (#1) + Intensity (#2) + Spatial Distribution (#2A) + Spectrum (#3)

DAY



Circadian impactful luminance is measured at the eye



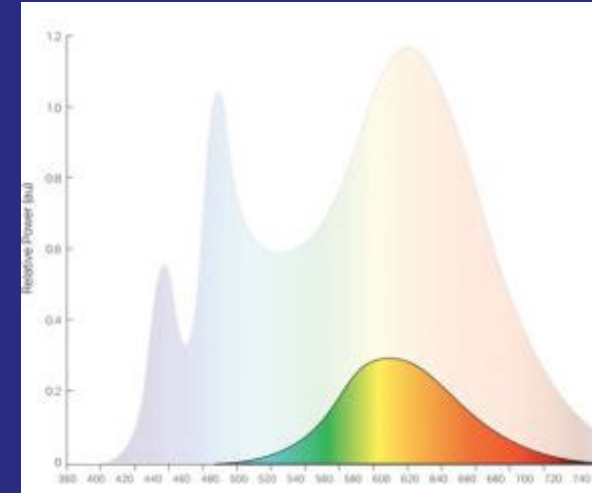
Higher levels of High-Melanopic Cyan-rich light sources



Emphasis on luminous surfaces at eye level through the ceiling plane i.e., “Sky”

SPD illustration source: Bios Lighting

NIGHT



Lower levels of warmer cyan-deficient light



Emphasis on lighting horizontal surfaces below eye-level i.e., “Fire Pit”

Gate To Grave **Embodied Carbon**



Maximize life of LEDs & Electronics

- Quality Components
- Reliable/repeatable Manufacturing Processes
- Robust Circuit Design
- High Efficiency/Lower heat generation & Good Thermal Management
 - 10⁰ C drop doubles life

Mfg. Warranty

L70



Gate To Grave **Embodied Carbon**



Maximize life of LEDs & Electronics

Modularity & Field Serviceability

- Easily replaceable light engine
- Easily replaceable, field programmable drivers
- Other components easily replaceable & serviceable
- Readily available replacements parts
- Readily available technical and warranty information
 - QR Codes, in BIM models, etc.
- Remote Monitoring/preventative maintenance



Gate To Grave **Embodied Carbon**



Maximize life of LEDs & Electronics
Modularity & Field Serviceability

Design for Disassembly (DfD)

- Easy to separate & identify reusable, recyclable or bio-degradable components



- **Good News** Up to 60% of Steel & 75% of Aluminum in products get recycled...and they are infinitely recyclable
- **Bad News** According to EPA only 6% of Electronics & less than 10% of plastics get recycled

Gate To Grave **Embodied Carbon**



Maximize life of LEDs & Electronics
Modularity & Field Serviceability
Design for Disassembly (DfD)

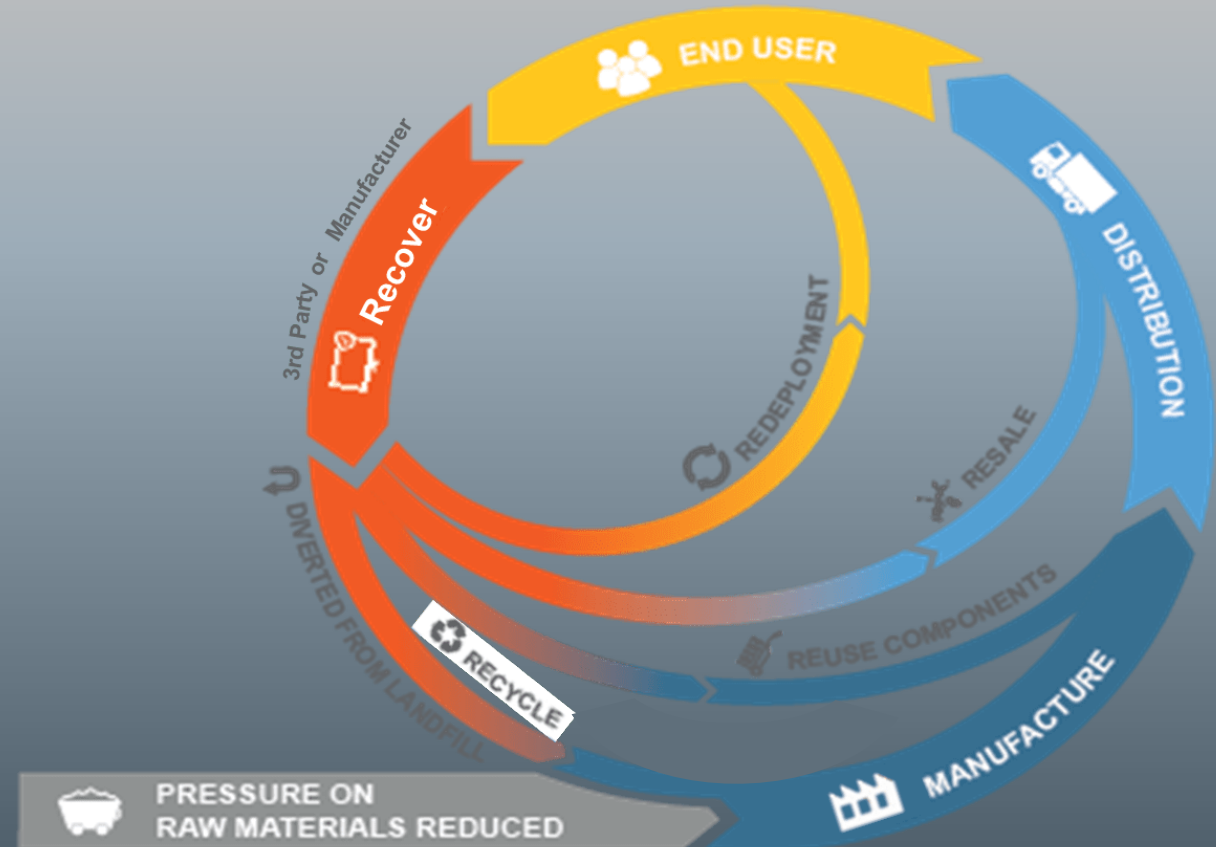
Alternative Business Models

- Lighting as a Service (LaaS)
- Take Back Refurbish/Reuse & Recycle Programs
- Marketplaces for secondhand luminaires

Gate To Grave **Embodied Carbon**



Maximize life of LEDs & Electronics
Modularity & Field Serviceability
Design for Disassembly (DfD)
Alternative Business Models



TM66 Circular Economy Digital Assessment Tool



- Assesses circularity attainment in 4 categories:
 - Product Design
 - Manufacturing
 - Materials
 - Ecosystem
- Manufacturer “Make” survey: 78 attributes
- Specifier “Specify” survey: 26 attributes
 - when “Make” assessment not available

Result			
Category	Points Scored	Maximum possible points	Assessment
Product design	21.0	35.0	2.4
Manufacturing	10.9	11.0	3.9
Materials	5.0	16.0	1.3
Ecosystem	15.0	22.0	2.7
Overall performance	51.9	84.0	2.6

How to analyse the score	
0 to 0.5	Very poor circular economy performance
0.5 to 1.5	Some circular economy functionality
1.5 to 2.5	Definite/substantial progress to circularity
2.5 to 4.0	Excellent circularity

This digital tool is designed to be used in conjunction with CIBSE TM66 *Creating a circular economy in the lighting industry*, available from www.cibse.org/knowledge.

TM66

Example Questions



Third party verification scheme now available to manufacturers in the UK

		Select evidence per action towards circular economy					Score	Evidence in support of choice	
		0	1	2	3	4			
Circular economy effect	Feature	No evidence	Some positive evidence	Positive evidence	Excellent positive evidence	Outstanding evidence			
Upgradability	Allows products to be upgraded, keeping existing products in use rather than requiring new products with high percentages of virgin feedstock to be procured	Ease of upgrading light source	Impossible <input type="radio"/>	Risk of damage <input type="radio"/>	Possible <input type="radio"/>	Easy/ Zhaga Style <input type="radio"/>		-1	
		Effect of light source upgrade on thermal performance	Degraded <input type="radio"/>	High risk of reduction <input type="radio"/>	Maintained but difficult <input type="radio"/>	Maintained and easy <input type="radio"/>		-1	
		Ease of configuring upgrade, including plug sockets, driver settings	Impossible <input type="radio"/>	Termination & configure <input type="radio"/>	Plug & configure <input type="radio"/>	Plug & play <input type="radio"/>		-1	
		Availability of upgrade light sources	Not available <input type="radio"/>	Available, but product specific <input type="radio"/>	Available, covers multiple products <input type="radio"/>	Commonly available <input type="radio"/>		-1	

Materials Responsibility



CO² emitted by making products

Cradle to Gate
Embodied Carbon

CO² emitted in use

Gate to Grave
Embodied & Operational Carbon

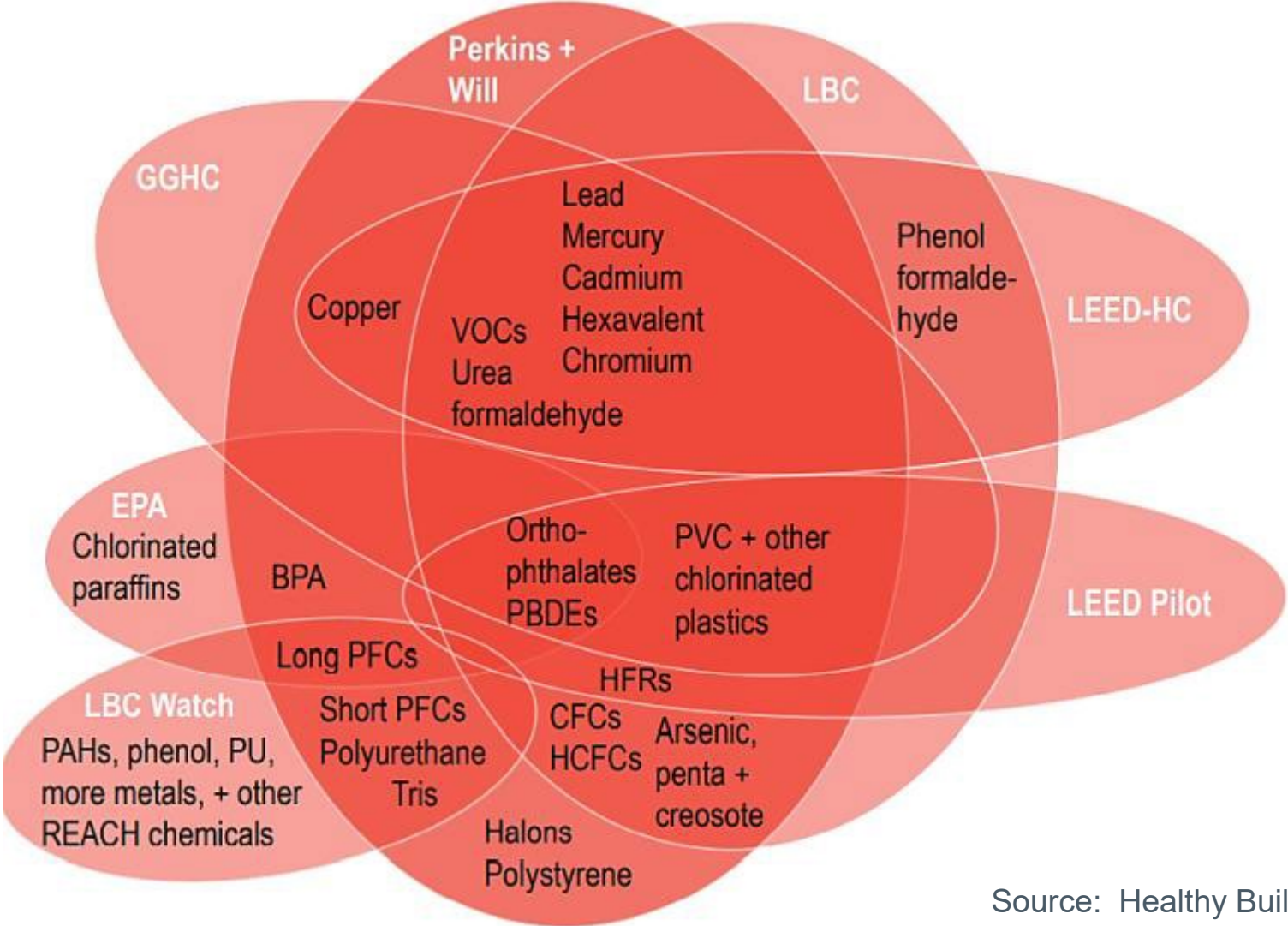
Materials Responsibility
Transparency & Continuous improvement

Workplace Social Responsibility
Governance & Leadership

Government Regulations and Directives

- **US mandatory regulations**
 - EPA Toxic Substances & Control Act (TSCA)
 - Reporting, record-keeping, testing & restrictions specific “forever” chemicals including PCBs, asbestos, radon, & lead
 - State and local regulations
 - i.e., California Prop 65 requires warnings on about exposures to chemicals known to cause cancer, birth defects or other reproductive harm
- **European directives that global suppliers generally comply with**
 - Restriction of Hazardous Substances (RoHS)
 - Restricts use of hazardous substances in electrical/electronic products
 - Registration, Evaluation, Authorization & Restriction of Chemicals (Reach)
 - Identify and manage risks of all chemical substances

Hazardous substances commonly found in building products



Source: Healthy Building Network

Red List

Worst in Class materials found in building products that area known to pose serious risks to human health & greater ecosystems

Additives

- Antimicrobials (many are harmful)
- Alkylphenols and related compounds
- Asbestos compounds

Harmful & worthless!

Additives

- Bisphenol A (BPA) and structural analogues
- California-banned solvents
- Chlorinated Polymers, including:
 - Chlorinated polyethylene (CPE)
 - Chlorinated polyvinyl chloride (CPVC)

Additives

- Chloroprene (neoprene monomer)
- Chlorosulfonated polyethylene (CSPE)
- Polyvinylidene chloride (PVDC)

Wire Insulation

Eco-friendly alternatives available...but (PVC)

- Chlorobenzenes
- Chlorofluorocarbons (CFC) and hydrochlorofluorocarbons (HCFC)
- Formaldehyde (added)
- Monomeric, polymeric and organophosphate halogenated flame retardants (HFRs)
- Organotin Compounds

Additives

- Perfluorinated compounds (PFCs)

Additives

- Phthalates (orthophthalates)
- Polychlorinated biphenyls (PCBs)

- Polycyclic aromatic hydrocarbons (PAHs)
- Short-chain and medium-chain chlorinated paraffins

LED Drivers

- Toxic heavy metals
 - Arsenic

Small Electronics Exemption for Declare "Red List Approved" products

- Lead (added)
- Mercury
- Volatile organic compounds (VOC) (wet-applied products)
- Wood Treatments containing creosote or pentachlorophenol

HPDs & Declare Labels

- Both Credible
- Both an enormous commitment of manufacturer & supply chain partner time & resource to obtain and maintain

Product Name by Product Manufacturer
 CLASSIFICATION: PRODUCT DESCRIPTION:
 Health Product Declaration v2.1
 created via: HPDC Online Builder

Section 1: Summary Nested Method/Product Threshold

CONTENT INVENTORY

Inventory Reporting Format	Threshold Level	Residuals/Impurities	Are All Substances Above the Threshold Indicated:
<input type="radio"/> Nested Materials Method	<input type="radio"/> 100 ppm	Residuals/Impurities Considered in ___ of ___ Materials	Characterized <input type="radio"/> Yes <input type="radio"/> No Percent Weight and Role Provided?
<input type="radio"/> Basic Method	<input type="radio"/> 1,000 ppm		Screened <input type="radio"/> Yes <input type="radio"/> No Using Priority Hazard Lists with Results Disclosed?
Threshold Disclosed Per	<input type="radio"/> Per GHS SDS	Explanation(s) provided for Residuals/Impurities?	Identified <input type="radio"/> Yes <input type="radio"/> No Name and Identifier Provided?
<input type="radio"/> Material	<input type="radio"/> Per OSHA MSDS		
<input type="radio"/> Product	<input type="radio"/> Other		

CONTENT IN DESCENDING ORDER OF QUANTITY
 Summary of product contents and results from screening individual chemical substances against HPD Priority Hazard Lists and the GreenScreen for Safer Chemicals. The HPD does not assess whether using or handling this product will expose individuals to its chemical substances or any health risk. Refer to Section 2 for further details.

MATERIAL | SUBSTANCE | RESIDUAL OR IMPURITY
 GREENSCREEN SCORE | HAZARD TYPE

Number of GreenScreen BM-4/BM-3 contents:
 Contents highest concern GreenScreen Benchmark or List translator Score:
 Nanomaterial:

INVENTORY AND SCREENING NOTES:

VOLATILE ORGANIC COMPOUND (VOC) CONTENT
 Material (g/l): Regulatory (g/l):
 Does the product contain exempt VOCs?
 Are ultra-low VOC tints available?

CERTIFICATIONS AND COMPLIANCE See Section 3 for additional listings.
 VOC Emissions:
CONSISTENCY WITH OTHER PROGRAMS

Third Party Verified? Yes No
 PREPARED BY: VERIFIER: VERIFICATION ID:
 SCREENING DATE: PUBLISHED DATE: EXPIRY DATE:

Product Name: www.productid.com HPDC v2.1 created via HPDC Builder Page X of Y

Declare.

Product Name Manufacturer

Final Assembly: First City, State, Country;
 Second City, State, Country; Third City, State, Country
Life Expectancy: 50 Years
Embodied Carbon: # kg CO₂-eq ■
Declared Unit: # m²
End of Life Options: Recyclable (95%), Landfill (5%),
 Take Back Program (Program Name/Location)

Ingredients:

Your First Component: Sustainably Sourced Ingredient;
LBC Red List Ingredient; **Your Second Component:**
LBC Watch List Priority for Inclusion; Non-Toxic Ingredient;
 Undisclosed (<0.1%)²

¹LBC Temp Exception RL-009 Formaldehyde
²LBC Temp Exception RL-004var.a Proprietary Ingredients

Living Building Challenge Criteria: Compliant

I-13 Red List:
 LBC Red List Free % Disclosed: 99.9% at 100ppm
 LBC Red List Approved **VOC Content:** # g/L
 Declared

I-10 Interior Performance: CDPH Standard Method v1.2-2017
I-14 Responsible Sourcing: Product Available with FSC Chain of Custody

XXX-XXXX
 EXP. 01 OCT 2021
 Original Issue Date: 20XX

Third Party Verified

MANUFACTURER CLAIMS VERIFIED BY THIRD PARTY VERIFIED ASSESSOR
 INTERNATIONAL LIVING FUTURE INSTITUTE™ living-future.org/declare

Manufacturer's Letter

- Most not credible or compliant with building certification program requirements
- Not possible to really know what is in your product if you don't do the investigative work!

[REDACTED]

06/15/2018

To Whom It Concern:

As the [REDACTED] Product Manager, I am writing this letter to confirm that our [REDACTED] Product Lines do not contain any Red Listed Materials or Chemicals including:

- Alkylphenol
- Asbestos
- Bisphenol A (BPA)
- Cadmium
- Chlorinated Polyethylene & Chlorosulfonated Polyethylene
- Chlorobenzenes
- Chlorofluorocarbons (CFCs) & Hydrochlorofluorocarbons (HCFCs)
- Chloroprene (Neoprene)
- Chromium VI
- Chlorinated PolyvinylChloride (CPVC)
- Formaldehyde (all types - added)
- HalogenatedFlameRetardants (HFRs)
- Lead (added)
- Mercury
- Perfluorinated Compounds (PFCs)
- Phthalates
- PolychlorinatedBiphenyls (PCBs)
- Polytetrafluoroethylene (PTFE)
- Polyvinyl Chloride (PVC)
- Polyvinylidene Chloride (PVDC)
- Short Chain Chlorinated Paraffins
- Wood treatments containing Creosote, Arsenic or Pentachlorophenol and
- Volatile organic compounds (VOCs) in wet-applied products

Sincerely,

[REDACTED]
Product Manager
[REDACTED]



May check the box...but viewed wholistically luminaires are not without Red List ingredients




- **Incandescent socketed pendant...excludes LED lamp**
- **Remote driver fixture...still requires a driver like other fixtures**
- **A fixture component i.e., aluminum extrusion or felt panel...Whooptie do!**

LBC, LEED & WELL "Materials" Program Requirements



Standard	Category	Section	Credit	Required or Optional	# of Points	Luminaire Related Requirements Summary
LBC v4.0	Material Petal	I-12 (Core) or I-13/14/15 (Energy Petal or full Living Certification)	Responsible Materials	Required	N/A	-One Declare labeled product per 200 square meters -All non-Declare manufactures requested to provide letter disclosing ingredients & identifying Red List content -20% of const. materials sourced w/in 500 KM of site I-13= 90% by cost Red List Free I-14 = I-12 + Use Living Product Challenge certified products I-15 = Local sourcing:20%-500KM/ 30%-1000KM/ 20%-5000KM
LEED v4.1	Building Product Disclosure & Optimization	MI Option 1	Material Ingredient Reporting	Optional	1	-Min 20 products disclose chemical inventory to at least .1% (1000 ppm) using one of several approved formats including HPD, Declare Label or publicly available inventory provided by manufacturer identifying hazardous ingredients. -Products w/ third party verified data count as 1.5 products -Products sourced w/in 100 miles of site count as 2 products
		MI Option 2	Material Ingredient Optimization	Optional	1	-Min 5 products with compliant material ingredient optimization report or action plan
WELL v2	Materials	X07 Part 1	Material Transparency	Optional	1	-Min 25 (or 50%) of products disclose chemical inventory to at least .1% (1000 ppm) using one of several approved formats including HPD, Declare Label or publicly available inventory provided by manufacturer identifying hazardous ingredients.
		X07 Part 2		Optional	1	-Min 15 products disclose chemical inventory to a more granular .01% (100ppm) using HPD, Declare Label or manufacturer's inventory
		X07 Part 3		Optional	1	-Min 15 products have chemical inventory verified by third party
		X08 Part 1	Material Optimization	Optional	1	-Min 25 products disclose chemical inventory to .01% (100ppm) <u>and</u> have no hazardous contents (i.e. Red List, etc.).
		X08 Part 2		Optional	1	-Min 15 products Cradle to Cradle or Living Product Challenge Certified

LBC, LEED & WELL "Materials" Program Requirements

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 LEED v4.1	Building Product Disclosure & Optimization	MI Option 1	Material Ingredient Reporting	Optional	1	-Mi (10 HP ma -Pr -Pr -Mi rep -Mi lea incl pro -Mi .01 inve -Mi and -Mi 15 products Cradle to Cradle or Living Product Challenge Certified
		MI Option 2	Material Ingredient Optimization	Optional	1	
 WELL v2	Materials	X07 Part 1	Material Transparency	Optional	1	
		X07 Part 2		Optional	1	
		X07 Part 3		Optional	1	
		X08 Part 1	Material Optimization	Optional	1	
		X08 Part 2		Optional	1	

Only a limited number of all products used in a project require material transparency to meet program requirements

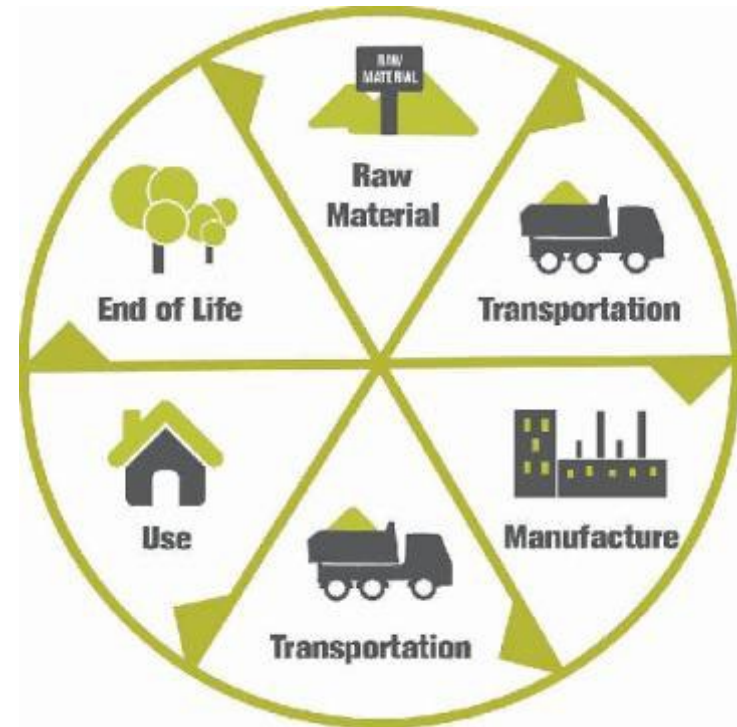
Lighting Related Sustainable Building Certification Elements



			LEED	LBC	WELL
Mfg. Driven	Luminaire Design	Material Sourcing/Ingredient Disclosure	X	X	X
		Life Cycle Assessment	X	x	x
Specifier Driven	Lighting Performance & Application	Energy Performance (lighting + controls)	X	X	
		Visual Lighting Design/Light Quality	X		X
		Occupant Controlled Lighting Scenes	X		X
		Daylighting & Views	X	X	X
		Circadian Lighting Design			X
		Acoustic Performance (luminaire can contribute)	x		x
		Light Pollution	X		

Life Cycle Assessment (LCA)

Analytical Methodology tracking emissions released into air, water & soil over the life of a product










Product Stage			Construction Process Stage		Use Stage							End of Life Stage*			Benefits and Loads Beyond the System Boundaries	
Raw material supply	Transport	Manufacturing	Transport from gate to the site	Construction/ installation process	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	Deconstruction /demolition	Transport	Waste processing	Disposal	Reuse-Recovery- Recycling potential

- Theoretically enables accurate product comparisons
- Can guide manufacturers to identify areas of improvement

LEED
1 Point

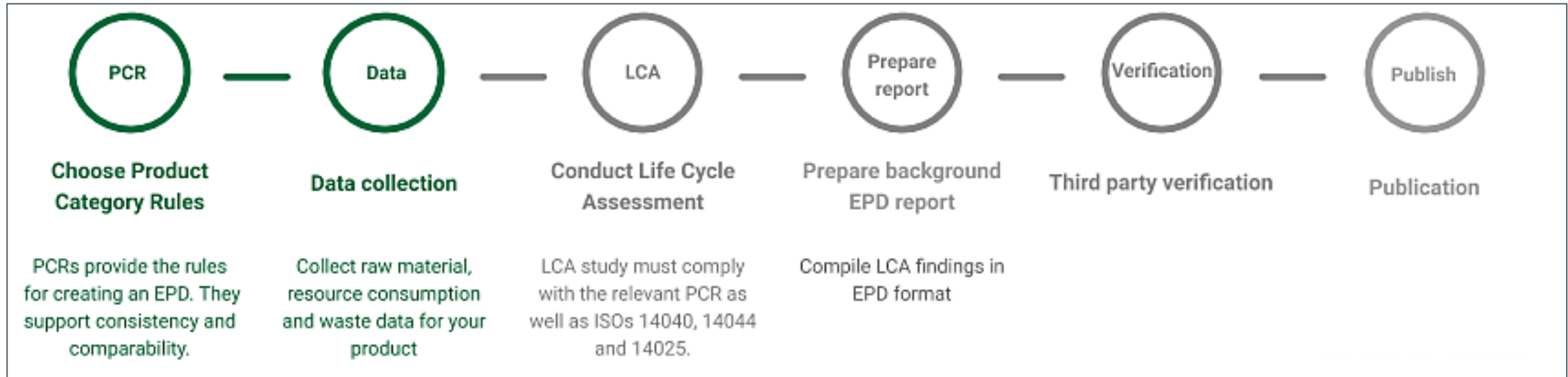
ASHRAE 189.1 Std for High Performance Green Buildings
Requires min of 10 products w/ <125% of industry average GWP

EPD Life Cycle Assessment Impact Categories

ATMOSPHERE			WATER		EARTH	
 <p>Global Warming Potential refers to long-term changes in global weather patterns that are caused by increased concentrations of greenhouse gases in the atmosphere.</p>	 <p>Ozone Depletion Potential is the destruction of the stratospheric ozone layer, which shields the earth from ultraviolet radiation that's harmful to life, caused by human-made air pollution.</p>	 <p>Photochemical Ozone Creation Potential happens when sunlight reacts with hydrocarbons, nitrogen oxides, and volatile organic compounds, to produce air pollution known as smog.</p>	 <p>Acidification Potential is the result of human-made emissions and refers to the decrease in pH and increase in acidity of oceans, lakes, rivers, and streams – polluting groundwater and harming aquatic life.</p>	 <p>Eutrophication Potential occurs when excessive nutrients cause increased algae growth in lakes, blocking the underwater penetration of sunlight needed to produce oxygen and resulting in the loss of aquatic life.</p>	 <p>Depletion of Abiotic Resources (Elements) refers to the reduction of available non-renewable resources, such as metals, that are found on the periodic table of elements, due to human activity.</p>	 <p>Depletion of Abiotic Resources (Fossil Fuels) refers to the decreasing availability of non-renewable carbon-based compounds, such as oil and coal, due to human activity.</p>
<p>10.39 kg CO₂-Equiv.</p>	<p>2.66E-07 kg CFC 11-Equiv.</p>	<p>1.46E+00 kg O₃ -Equiv.</p>	<p>6.30E-02 kg SO₂-Equiv.</p>	<p>2.13E-02 kg N-Equiv.</p>	<p>- kg Sb-Equiv.</p>	<p>- MJ</p>

EPD Life Cycle Assessment Process

Time and Resource intensive...very challenging to scale to a large stable of luminaires



Many industry challenges to scale EPDs in a meaningful and comparable way:

- High per fixture time and cost
- North American luminaire category rules still in development
- Numerous inconsistencies hinder accuracy/comparability
 - Underlying data: Secondary vs. Primary vs. Averages from different Public & Proprietary sources
 - Different analysis software using different methodologies
 - Different interpretations of how to collect/estimate/validate inputs
- Outsized 97%+ lifecycle impact of site-specific energy use vs. the manufacture of the luminaire

EPD Life Cycle Assessments are work in process...



GreenLight
Alliance



LCA-CALC
SMART ECO-LIGHTING METRICS

- **Coming Soon...Industry Wide (IW) EPDs**

- For 2x2s, 4' Linear, Downlights, Cylinders & Post Tops
 - Aggregated data from multiple manufactures
 - Acceptable to apply toward earning 1 Point for EPDs in LEED
 - Will enable lighting system carbon calculations

Simplified “Scoring” Systems are useful proxies to full life cycle assessments



Chartered Institution of Building Services Engineers

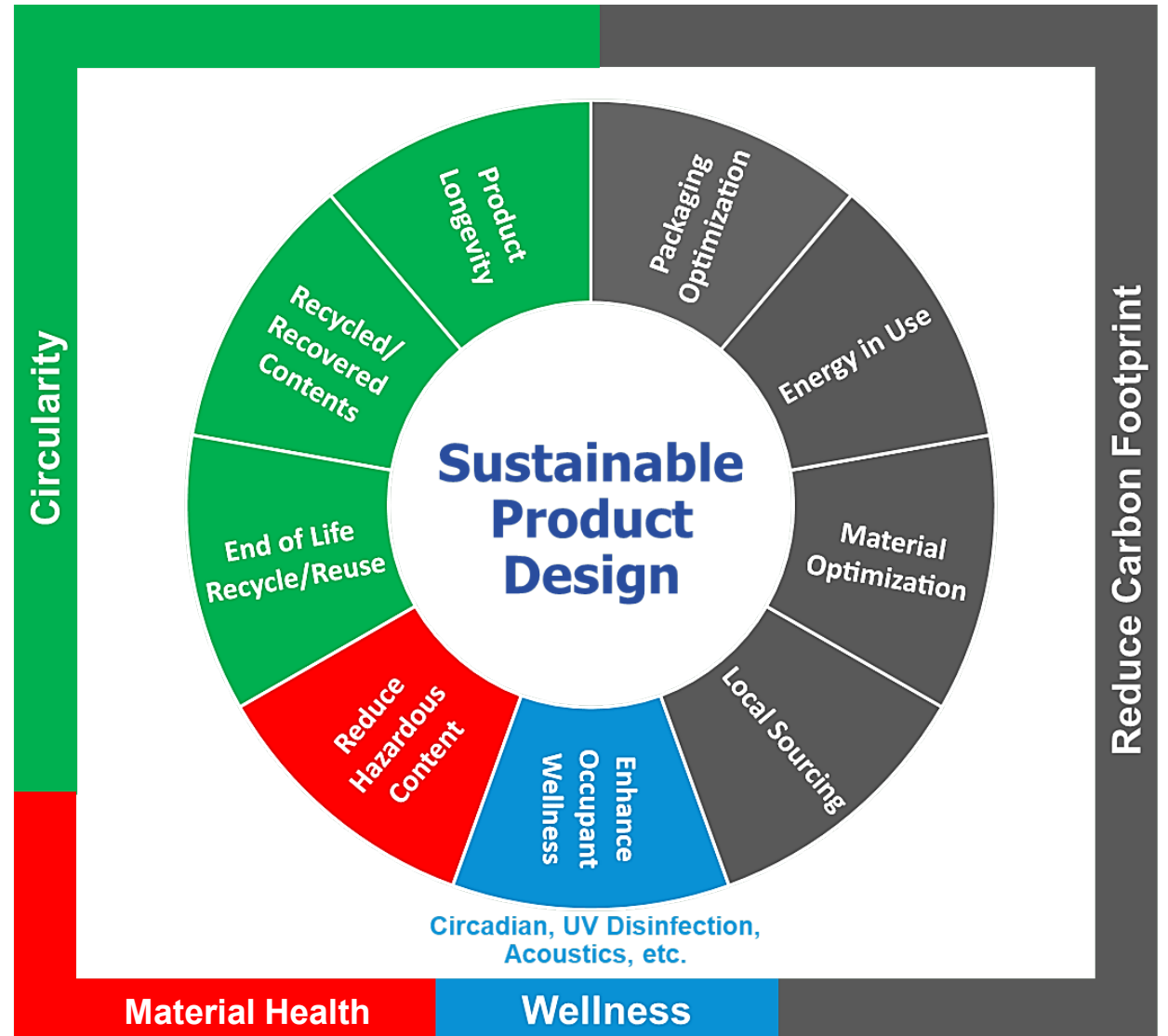
TM65
Embodied
Carbon
Calculation
Methodology

TM66
Circular
Economy
Assessment
Method

Product Development Sustainability Wheel

Framework to guide a manufacturer's sustainable product design efforts

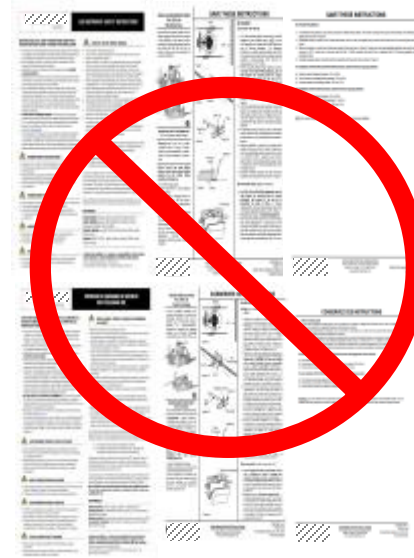
- Establishes key performance metrics and goals for achievement in each area of influence for sustainability
- Integrate as part of the design criteria used to develop a product
- Adopt simple, practical, cost-effective tools to help guide, measure & communicate attainment
 - i.e., TM65 & TM66





Low Hanging Embodied Carbon Fruit

Replace printed instruction sheets with QR codes linked to electronic version



Facts about the environmental impact of paper:

- 45' tall, 8" diameter pine tree produces 10,000 sheets or twenty 500 sheet reams¹
- 40% of commercially cut timber is used to produce paper resulting in an almost 10% decrease in tree cover since 2002...deforestation accounts for 25% of human-caused greenhouse gas emissions³
- The paper industry consumes 4% of the world's energy²
- The paper industry is responsible for 9% of total manufacturing carbon emissions
- Pulp & Paper is the 3rd largest polluter of air, water & soil...chlorine-based bleaches are used during production and when paper rots it emits methane gas which is 25 times more toxic than CO₂.²
- Paper accounts for approximately 26% of total waste at landfills including approximately 45% of all office printed paper³
- One 8-1/2" x 11" sheet of paper requires 10 liters of water to produce²

[1. How much paper comes from one tree? Ribble](#)

[2. The World Counts: A useful but wasteful product](#)

[3. The environmental impact of using paper, Institute of Ecolonomics](#)

[4. Paper in Business, Tonerbuzz.com](#)

The Opportunity

- Eliminate 1.5 Billion sheets of paper printed annually for instruction sheets by North American luminaire manufacturers
 - ~250 Million luminaires shipped per year x average 6 pages each

Eliminating the use of 1.5 Billion sheets of paper could...

- Save 150,000 trees that produce enough oxygen to support 450,000 people¹
- Preserve 15 billion liters of water
- Save 230 billion kilojoules (kJ) of energy² equivalent to 38,000 barrels of oil³
- Eliminate 26 million pounds of CO₂ emissions⁴ , which would offset the annual emissions from 3.5 million passenger vehicles⁵
- Make a small dent in the overall environmental impact of paper production...and set a big precedent for others in the electrical & allied industries to follow

[1. The World Counts: A useful but wasteful product](#)

[2. Energy Use of Print vs. Electronic Media](#)

[3. Kilojoules to Barrels Of Oil Equivalent | Kyle's Converter](#)

[4. HP Carbon Footprint Calculator](#)

[5. Natural Resource Canada Greenhouse gas equivalency calculator](#)

Summary

- Principles of a **Circular Economy**
- **Elements of Sustainability:** Material Responsibility, Embodied Carbon, Operational Carbon & Workplace Social responsibility
- **Corporate Sustainability Reports & Carbon Neutrality/Net Zero Declarations** are good indicators of environmentally responsible companies
- **Embodied Carbon vs. Operational Carbon** and the variables that drive reductions
- **Material Transparency** Health Product Declaration (HPD) or DECLARE Label
- **Life Cycle Assessments** to characterize environmental impacts in a meaningful/comparable/scalable way is challenging & still evolving
- **Simplified scorecards** like TM65 carbon calculator & TM66 Circular economy assessment can be very helpful in assessing and communicating a product's sustainable/circular attributes

This concludes The American Institute of Architects Continuing
Education Systems Course

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