Lighting the Way: Strategies for Achieving Life Cycle Goals

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Kate Hickcox (Pacific Northwest National Laboratory)
Melissa Mattes (Sladen Feinstein Integrated Lighting)

Curated by Fred Davis (Fred Davis Corporation)

Northeast Sustainable Energy Association (NESEA)
March 1, 2022
Introductions

Melissa Mattes
Senior Lighting Designer
Sladen Feinstein Integrated Lighting
Specializes in residential, multi-family, and hospitality design; with special interest in sustainable lighting design solutions and advocating for luminaire material transparency

Alexandra Gadawski
Associate
HMFH Architects
Architect and Sustainability Leader, focus on material health, embodied carbon, lighting and daylighting and education environments

Kate Hickcox
Lighting Research Scientist
Pacific Northwest National Laboratory
Focus areas include lighting design, lighting and sustainability, energy equity and justice, nighttime outdoor lighting and visual research including discomfort glare
Discuss the difference between embodied carbon and operational carbon and explain to colleagues and clients why both should be considered when making sustainable lighting choices.

Analyze design decisions and quantify potential environmental impacts.

Identify pathways and levers to improve sustainable design choices.

Define sustainability policies or goals and implement them on a personal or company level.
Global Temperature Rise by 2100

Paris Agreement Goal

+0°C  +1°C  +2°C  +3°C  +4°C
Global Temperature Rise by 2100
Global Temperature Rise by 2100
Global Temperature Rise by 2100
Why Commitments Matter: Industry Evolution

A+D Letters
- Series of letters to manufacturers asking for transparency of building products

April 2018

AIA Materials Pledge Public Launch

July 2021

Declare.
Now (Early 2022)

- Many, many more labeled luminaires available on the market than 1 year ago

2012

April 2019

LP50 Formed
- Group of manufacturers collaborating to transform the materials economy through transparency, green chemistry, supply chain innovation & awareness.

April 2019

Lighting Advocacy Letter Public Launch (Inspired by the LP50 Letter)

mid 2024

Whole Building Life Cycle Assessments—lighting included
Why Goal Setting Matters

Goals

Iterate

Metrics

Measure

Approach
Human Health

Support human health by preferring products that support and foster life throughout their life cycles and seek to eliminate the use of hazardous substances

AIA Materials Pledge

Climate Health

Support climate health by preferring products that reduce carbon emissions and ultimately sequester more carbon than emitted

AIA Material Pledge

Ecosystem Health

support ecosystem health by preferring products that support and regenerate the natural air, water, and biological cycles of life through thoughtful supply chain management and restorative company practices

AIA Materials Pledge

Social Health and Equity

Support *social health & equity* by preferring products from manufacturers that secure human rights in their own operations and in their supply chains, positively impacting their workers and the communities where they operate.

AIA Materials Pledge

Circular Economy

Support a **circular economy** by reusing and improving buildings and by designing for resiliency, adaptability, disassembly, and reuse, aspiring to a zero-waste goal for global construction activities

AIA Materials Pledge

3 Design Professionals: 3 Projects

**Lighting Designer**
- Budget office fit-out project without specific sustainability goals

**Manufacturer**
- Designing a linear direct/indirect pendant for offices/schools, etc.

**Architect**
- New 400,00 sq ft public high school in Massachusetts
Project:  Budget Office Fit-out without Sustainability Goals

Meet **Liona**, the Lighting Designer!

- Still working from home
- Passionate about growing family
- Loves trail walks with her dog
- Interest in teaching daughters to protect and care for the earth
Project:  Budget Office Fit-out without Sustainability Goals

Firm's Standard Project Targets:

- Leased Lighting Design Services
- Preference for RoHS compliant fixtures
- Transparency labels for high quantity fixtures
- LPD w/sf target
- Code Compliance
- Climate Health
- Human Health
- Ecosystem Health
- Social Health + Equity
- Human Health
- Prefer manufacturers local to project site
- Circulariry

Lighting Designer
Project: Budget Office Fit-out without Sustainability Goals

Meet Richard, the Client!

- Former real estate agent turned commercial development entrepreneur
- Known for is billowy laugh and good sense of humor
- 3rd property development
- First time working with a Lighting Designer

Client

Lighting Designer

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Project: Budget Office Fit-out without Sustainability Goals

Richard's Project Parameters:
- Task lighting for Open Office
- Low-glare Fixtures
- Market-ability
- Reconfigurable lighting
- Offer Premium Lease Packages
- Low cost
- Fast timeline

Client

Lighting Designer

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How does Liona achieve client deliverables and her firm’s project targets?

1. Tease out parallels between lighting firm values and client values

2. Pitch to client as solutions to meet their needs while also meeting firm’s standard sustainability targets
Project: Budget Office Fit-out without Sustainability Goals

Richard's Highest Priorities:
- Task lighting for Open Office
- Low-glare Fixtures
- Offer Premium Lease Packages
- Reconfigurable lighting
- Marketability
- Low cost
- Fast timeline

Client

Lighting Designer

Leased Lighting Design Services
- Climate Health
- Social Health + Equity
- Code Compliance
- Human Health
- Ecosystem Health
- Preference for RoHS compliant fixtures
- Transparency labels for high quantity fixtures
- LPD w/sf target
- Circularity

Richard's Highest Priorities:
- Code Compliance
- Leased Lighting Design Services
- Prefer manufacturers local to project site
- Transparency labels for high quantity fixtures
- Low glare Fixtures
- Offer Premium Lease Packages
- Reconfigurable lighting
- Low cost
- Fast timeline

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Project: Budget Office Fit-out without Sustainability Goals

Client

- Task lighting for Open Office
- Low-glare Fixtures
- Leasing
- Low cost
- Fast timeline

Lighting Designer

- Reconfigurable lighting
- Offer Premium Lease Packages

Firm's Sustainable Values:

- Climate Health
- Code Compliance
- Social Health + Equity
- Human Health
- Ecosystem Health
- Preference for RoHS compliant fixtures
- Transparency labels for high quantity fixtures
- Prefer manufacturers local to project site
- LPD w/sf target

Project: Budget Office Fit-out without Sustainability Goals

- Market-ability
- Low-glare Fixtures
- Leased Lighting Design Services
- Transparency labels for high quantity fixtures
- LPD w/sf target

Preference for RoHS compliant fixtures

Transparency labels for high quantity fixtures
Project: Budget Office Fit-out without Sustainability Goals

- Configurable
- Kit-of-Parts
- Direct / Indirect
- 2, 3, & 4 way Connectors
- Accent Light Modules
- Low Glare Optics
Project: Budget Office Fit-out without Sustainability Goals

- Goal Development: Focal Areas
- Budget Conversations
- Design Concepts

- Determine overlap between client and design firm goals
- Choose transparency label or equivalent commitment on lrg qty light fixture(s)

- Ensure specification language is included in final document set

- Provide necessary documentation required for Transparency labels, etc.
Project: Budget Office Fit-out without Sustainability Goals

Client

Low Cost

Fast Timeline

Marketability

Lighting Designer

Lighting Designer

Human Health

Climate Health

Ecosystem Health

Social Health & Equity
Project: Budget Office Fit-out without Sustainability Goals

Healthy Materials

1. Protects ecosystems & fence-line communities harmed by toxic material production

Client

Lighting Designer

Low Cost

Fast Timeline

Marketability

Human Health

Climate Health

Ecosystem Health

Social Health & Equity
Project: Budget Office Fit-out without Sustainability Goals

Healthy Materials

1. Protects ecosystems & fence-line communities harmed by toxic material production

2. Marketing Advantage by Advertising Opportunity promoting Healthy Material

Client

Lighting Designer

Low Cost
Fast Timeline
Marketability

Human Health
Climate Health
Ecosystem Health
Social Health & Equity

Budget Office Fit-out without Sustainability Goals

Low Cost
Fast Timeline
Marketability

Client

Lighting Designer

Human Health
Climate Health
Ecosystem Health
Social Health & Equity

We demand to know what you are forcing us to breathe?
Exigimos saber lo que están obligando a respirar.
Project: Budget Office Fit-out without Sustainability Goals

1. Quickship + Low Travel Distance = Reduced Cost

Client

Lighting Designer

Local Manufacturers

Low Cost

Fast Timeline

Marketability

Budget Office Fit-out without Sustainability Goals

Human Health

Climate Health

Ecosystem Health

Social Health & Equity
**Project:** Budget Office Fit-out without Sustainability Goals

- **Low Cost**
- **Fast Timeline**
- **Marketability**

1. Quickship + Low Travel Distance = Reduced Cost

2. Smaller Embodied Carbon Footprint with shorter transit to job site
Project: Budget Office Fit-out without Sustainability Goals

Client

Low Cost
Fast Timeline
Marketability

Lighting Designer

Healthy Materials

Local Manufacturers

Human Health
Climate Health
Ecosystem Health
Social Health & Equity
Project: Budget Office Fit-out without Sustainability Goals

Concept/Schematic
- Goal Development: Focal Areas
- Budget Conversations
- Design Concepts

Design Development
- Determine overlap between client and design firm goals
- Choose transparency label or equivalent commitment on lrg qty light fixture(s)

Construction Documents
- Ensure specification language is included in final document set

Bid/Construction Administration
- Provide necessary documentation required for Transparency labels, etc.
Project: Budget Office Fit-out without Sustainability Goals

Healthy Materials
- RoHS Compliance
- HPD's
- Declare Labels
- Red List Free = No Phthalates, PVC, + Polycarbonates

Impact on Environment
- Local Manufacturers
- LPD Target - 10% reduction from current code
- Ask for EPD's

Available Metrics!
Project: Budget Office Fit-out without Sustainability Goals

- Require transparency label or equivalent for top 1-2 fixture types by quantity
- Require RoHS compliant fixtures for main fixture types
- Prefer manufacturers local to project site
- Future Goal: Require EPD for main fixture types

Impact on Environment

Measurable Action!
Project: Budget Office Fit-out without Sustainability Goals

Capture Language on Schedule

<table>
<thead>
<tr>
<th>LP1 EQ1</th>
<th>BPRO4-LIN-FLSH-LED35-30-400LMEN/FT-LENGTH-CC-SAL-NSG-UNV-CAF-DIM01</th>
<th>3.8W/LF LED 3500K 90 CRI</th>
<th>0-10V</th>
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<td>0-10V</td>
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</table>

Construction Documents
- Ensure specification language is included in final document set

Lighting Designer
Project:  Budget Office Fit-out without Sustainability Goals

Provide Documentation

- Provide necessary documentation required for Transparency labels, etc.

Lighting Designer
Project: Budget Office Fit-out without Sustainability Goals

- Marketable
- Healthy Materials: Red List Approved
- Lighting Fixtures

Client

- Low Cost
- Fast Timeline
- Marketability

Lighting Designer

- Human Health
- Climate Health
- Ecosystem Health
- Social Health & Equity
Project: Budget Office Fit-out without Sustainability Goals

Marketable
Healthy Materials: Red List Approved Lighting Fixtures

Fast Local
Manufacturers: Located within 100-mile radius

Low Cost
Fast Timeline
Marketability

Client

Lighting Fixtures

Marketable
Healthy Materials

Lighting Designer

Human Health
Climate Health
Ecosystem Health
Social Health & Equity
Project: Budget Office Fit-out without Sustainability Goals

- **Marketable Healthy Materials:** Red List Approved Lighting Fixtures
- **Fast Local Manufacturers:** Located within 100-mile radius

**Transparency for High Quantity Fixture Types:** Top 1-2 types with transparency label

**Client:**
- Low Cost
- Fast Timeline
- Marketability

**Lighting Designer:**
- Human Health
- Climate Health
- Ecosystem Health
- Social Health & Equity
Project:

designing a new linear interior direct/indirect pendant for use in interior offices, schools, etc.

Circular Economy
Attract new talent
Improve diversity and inclusion
Worker Productivity
Healthy Materials
Return on Investment
Financial Success
Climate Health
Sustainable and Regenerative
Lower Commuting Times
Project:

designing a new linear interior direct/indirect pendant for use in interior offices, schools, etc.

Circular Economy

Attract new talent

Improve diversity and inclusion

Worker Productivity

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Healthy Materials

Return on Investment

Sustainable and Regenerative

Climate Health

Lower Commuting Times

Supply chain issues

Manufacturer

Healthy Materials

Attract new talent

Improve diversity and inclusion

Worker Productivity

Financial Success

Sustainable and Regenerative

Climate Health

Lower Commuting Times

Manufacturer
Project: new linear interior direct/indirect pendant

- Environmental impact of a product is largely determined in the design stage
- Most embodied carbon for lighting products are released in production stage
How we measure can affect our design approach

- Efficacy (lm/W)
- Color Temperature (CCT)
- Payback
- Material Health
- Impact on Environment
- Circularity
Identifying Design Approaches

- **Efficacy (lm/W)**
- **Circularity**
- **Material Health**
- **Impact on Environment**

- Modular Design
  - Low Impact Materials
  - Reduce Embodied Carbon

- Modular Design
  - High Efficacy
  - Reduce Operational Carbon

- Modular Design
  - Take-back program
  - Support Circular Economy

- Modular Design
  - Materials healthy going in
  - Materials healthy at EoL
  - Healthy Materials

- **Efficacy (lm/W)**
- **Circularity**
- **Material Health**
- **Impact on Environment**
Overview about Circular Economy Approaches in Lighting Designs and Projects by Mark Ridler, BDP, UK
https://www.youtube.com/watch?v=kWUAHthW3v0

Example: Fasteners
- Reduce, standardize & eliminate fasteners
- Identify separation points
- Provide a disassembly guide
- Avoid adhesives and composite materials
Alternative Business Models

- Take-back programs
- Lighting as a Service (LaaS)

Measurement and Reporting Frameworks

Figure 4. The circular economy model. TM66 The Chartered Institution of Building Services Engineers (CIBSE) 2021
Measurement and Reporting Frameworks

- Circular Economy
- Human Health / Healthy Materials
- Climate Health

- Product Category Rule (PCR)
- Life Cycle Assessment (LCA)
- Various documents or reporting tools report the LCA findings and provide transparency
  - Environmental Product Declaration (EPD)
  - TM66
  - PEF
  - Other reporting tools

Framework and method for identifying and evaluating environmental impact
Analysis to quantify impacts of the full life cycle
**Project:** new linear interior direct/indirect pendant

**Operational Carbon**
- Efficacy (lm/W)
- Modularity (time and effort of disassembly)

**Circularity**
- Metrics (TM66, LPC, Cradle 2 Cradle)
- Take-back-program

**Material Health**
- Methodologies (LCA/EPD, HPD)
- Labels (Red List, Declare)

**Impact on Environment**
- Methodologies (LCA/EPD, EC3)
- Labels (Declare, etc)

**Modular Design**

- **Goals**
- **Metrics**
- **Approach**
- **Measure**
- **Iterate**

**Manufacturer**

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Project: New Public High School
Meet Archie the Architect

I am committed to...
AIA Materials Pledge
2030 Challenge
Lighting Advocacy Letter
Project: New Public High School

Public high school in Massachusetts
3 Equals for all specified products
Project: New Public High School
Project: New Public High School
Education
Project: New Public High School

Efficient Design
Project: New Public High School

Operational Carbon

Location

Carbon Intensity - Northeast US (gCO2e / kWh)

Project: New Public High School

Embodied Carbon

Project Benchmark

Goal - 40%

Information from:
Project: New Public High School

Material Health
Project: New Public High School

- **Embodied Carbon**
  - EPDs
  - LCA
  - Efficient Design

- **Operational Carbon**
  - EUI Target
  - LPD Target

- **Material Health**
  - Declare Label, Red List Free
  - HPD
  - RoHs
  - PVC Free

- **Education**
  - Daylight
  - Exterior Connection
  - Program

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Summary Actions

- Convey goals and successes to clients and consultants
- Design for holistic sustainability
- Require transparency documentation for most commonly used products
- Set EUI and LPD targets
- Consider warranties, repairs and maintenance
- Changing how we measure and communicate about our designs
We can’t solve this one building at a time!
Identifying measurement and reporting frameworks
### Examples of Sustainability Labels & Declarations

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<th>Label</th>
<th>Human Health</th>
<th>Climate Health</th>
<th>Ecosystem Health</th>
<th>Social Health &amp; Equity</th>
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Join or Follow Organizations Working on This

**Carbon Leadership Forum**
https://carbonleadershipforum.org

**IES Sustainability Committee**
https://ies.org

**Mindful Materials**
https://www.mindfulmaterials.com

**Lytei – Hub for Share Lighting Ideas**
https://www.lytei.com/

**AIA Committee on the Environment**
https://network.aia.org/committeeonthenvironment/

**Built Environments Plus**
Home - Built Environment Plus

**Green Light Alliance**
https://www.greenlight-alliance.com
Sign the Lighting Advocacy Letter

https://www.mindfulmaterials.com/lighting-advocacy-letter
Join the **Next Steps Webinar** this Thursday, March 3rd

[https://www.eventbrite.com/e/lighting-the-way-advocacy-action-for-lighting-design-tickets-219340863427](https://www.eventbrite.com/e/lighting-the-way-advocacy-action-for-lighting-design-tickets-219340863427)
Thank you