

# **SPECIFYING A BRIGHT FUTURE:**

**DECARBONIZING AND DETOXIFYING LIGHTING SYSTEMS**

**BRAD KOERNER**

# GLOBAL CARBON ACTION



Bill Gates on the need for climate innovators

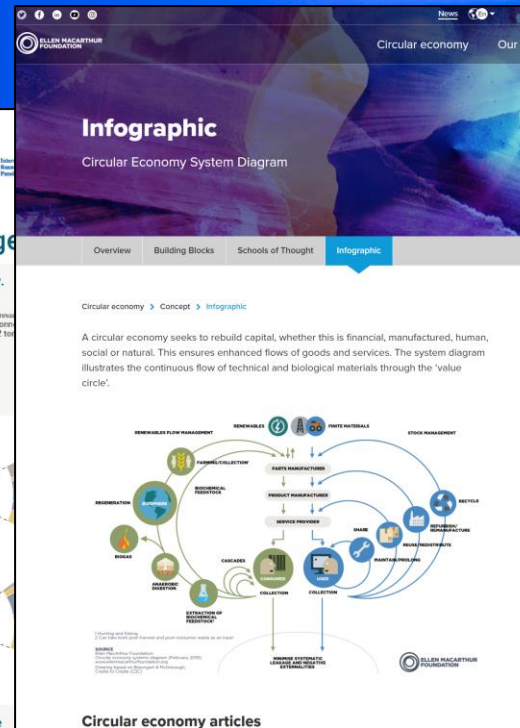
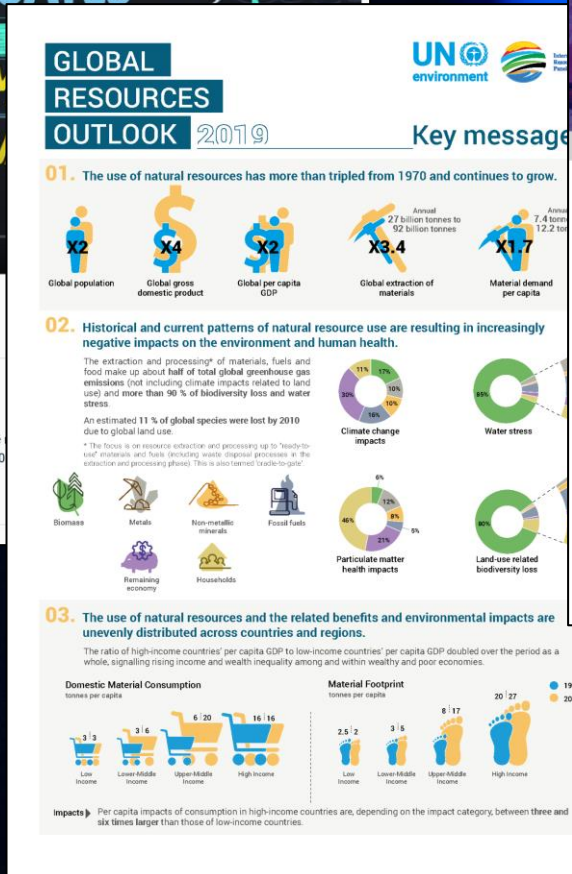
175,309 views • Oct 17, 2018



Bill Gates  
2.7M subscribers

To prevent the worst effects of climate change, we need to reduce emissions in every sector of the economy within 50 years. Learn more at <https://b-gat.es/2RH4oUj>

SHOW MORE





# A LOUD AND GROWING CHORUS OF DESIGN PROFESSIONALS

In use  
Low energy, optimisation  
**circular economy approaches in lighting design**  
Right light

Check out this very nicely constructed presentation on engaging with circular economy design principles in architectural lighting projects from Mark Ridler, Head of Lighting Design at BDP, a global architecture/engineering design firm. From this year's **LpS Digital Symposium** (associated with industry journal **LEDs Professional**).

**LpS DIGITAL CONFERENCE**

**Overview about Circular Economy Approaches in Lighting Designs and Projects**

Mark Ridler, Head of Lighting at BDP

Watch on

Glad to see many of the **core principles I've espoused over the years** coming together in real projects.

## SUSTAINABLE LIGHTING: HOW CAN WE DO BETTER

Published on April 22, 2021

**Paul Nulty**  
Founder, Nulty Bespoke, Studio N, London, Dubai, Miami, Bangkok,  
Architectural lighting design consultant

84 articles Following

### ENVIRONMENTAL IMPACT

Words by **Paul Nulty**

The life of a lighting designer is a double-edged sword. On the one hand it's our job to improve the quality of spaces for people. We fill these spaces with emotion, interest and drama; we create more user-friendly environments, improve efficiencies in the workplace help retailers sell more goods, create experiences and destinations, save energy and even assist end-users through improved health and wellbeing.

Yet for all the benefits we bring to a space we have to wrestle with the detriments. Every watt of energy we use on a project is another watt of energy burned. Designing energy-efficient lighting schemes is always a priority, but we also understand that creating an emotional connection between a user and a space isn't always conducive to the most efficient solution. (Most energy-efficient schemes often have maximised spacings of luminaires and relatively homogeneous light levels – functionality over design.) So, as designers, we're often using a little more energy to generate a lot more "emotion and connection". But it's still *more* energy, which means *more* cost and does *more* harm to environment.

Like Comment Share

32 / 4 comments

THE SOURCE FOR NEXT WORK ENVIRONMENTS

Expert Insights

## In Plain Sight: Calculating The Climate-Shifting Carbon Chain

by David Cordell and Jon Penndorf

*Perkins&Will's David Cordell and Jon Penndorf explore how the A&D community can address embodied carbon to help combat climate change in the spaces they design.*

The sources of carbon that fuels climate change range from automobile emissions to volcanic eruptions. But they also hide in plain sight, masquerading as benign construction and furnishing materials like gypsum board and carpeting. Inside the home or office, embodied carbon compromises the future of everyone and everything, from schoolchildren to the American bullfrog in Rock Creek Park. What is embodied carbon? It's the total amount of carbon emissions released during a product's manufacture, transportation, use and disposal.

RECENT ARTICLES

5 Workplace

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## Creating a Better World

Today's business and civic leaders are interested in learning how they can restructure their organizations and communities to become more resourceful, resilient and regenerative. As designers and strategists, we remain committed to providing clients with design solutions that create a better world to live, work and play.

### Ten ways in which architecture is addressing climate change

Lizzie Crook | 19 hours ago | 2 comments

To honour Earth Day, we've rounded up 10 ways architects are reshaping the built environment to benefit both people and the planet.

Architecture has a large environmental impact, with the built environment accounting for 40 per cent of the UK's carbon emissions in 2019, according to the Green Building Council.

With a 2018 United Nations report warning that humanity now has less than 10 years to slow-down global warming, the architecture industry is one of many to have been forced to reassess the ways in which it works.

From reducing waste and maximising urban greenery to collaboration and lobbying for change, solutions to reduce pressure on the planet are now taking centre stage.

Read on for 10 ways in which architects can contribute to a healthier planet:

**Gensler** Research & Insight Expertise Projects People Offices About News Careers

## Creating a Better World

**Key Metrics:**

600+	188	110
million sq ft of sustainable work	million sq ft registered for LEED certification	million sq ft of LEED certified projects
150	1.2	700+
million tons of waste diverted	billion gallons of water saved annually	USGBC certified projects
		1200+
		LEED accredited professionals

### Sustainable Leadership

Gensler uses a whole systems view to gain an understanding of our client's context and challenges, applying the appropriate lenses of community, wellness, ecology, materials, water and energy. This approach reveals connections between lenses, enabling design solutions that enhance human wellness, performance, collaboration and experiences.

### Workplace Design for Climate Change

**Buildings Contribute 40% of Global Greenhouse Gas Emissions. We have an Opportunity to Make a Big Impact**

IMPACT BY DESIGN 2020  
GENSLER RESEARCH INSTITUTE

**CLIMATE & RESILIENCE SHAPING THE FUTURE OF CITIES**

Impact by Design 2020  
Design Strategies for a More Resilient Future  
GENSLER RESEARCH INSTITUTE

### Leveraging the Power of Design

Sustainable design is producing results that matter to our clients: reduced first-cost and lifecycle energy and operating costs; improved brand recognition; and a quality of life that promotes health and wellness. Our process is tuned for design decision support with robust project information modeling that incorporates computational geometry and performance simulation. A holistic, economical, ecological view informs all of our sustainable design solutions.

Learn more about Gensler's Sustainable Design Services to the right:

**Sustainable Design**

Gensler provides turnkey sustainability support from strategy and planning to implementation and refinement. Our design team provides:

**Design Performance**

Our integrated sustainability delivery model provides complete sustainable design services including LEED strategy and LEED

# DECARBONIZED, NET ZERO & CIRCULAR STANDARDS

CLF

Carbon Leadership Forum

THE CARBON CHALLENGE

WHO WE ARE

WHAT WE DO

POLICY

OUR SPONSORS

NEWS AND EVENTS

DONATE

CONNECT WITH CLF

Join us in decarbonizing the built environment – better buildings for a better planet.

The building and construction sector have a vital role to play in eliminating carbon, as it is responsible for nearly 40% of greenhouse gas emissions. [Learn More](#) | [Watch Video](#)

Resource Toolkit

Embodied Carbon Policy

Explore

Resource Library

Vote

CLF Community: Discussion, Collaboration, Innovation

Take Action to Decarbonize Buildings and Materials

The Carbon Leadership Forum's goal is to eliminate embodied carbon in buildings and infrastructure by inspiring innovation and spurring change through co...

Research

We investigate the pathways for maximizing research with materials experts, NGOs...

RecOlight

Recycling

Compliance

Collections

Consumers

WEEE Info

About us

COLLECTION

WEEE recycle all WEEE lighting Batteries and electricals

SIGN UP FOR COLLECTION

Contacting Recolight

We have limited abilities to handle incoming phone calls, emailing us will help us direct your request & respond faster.

Light Producer Members, for WEEE Compliance, email Member team – [member@recolight.co.uk](#) | For waste collections and all other enquiries, email Customer Service team – [info@recolight.co.uk](#) We will phone or email you back. Thank you.

COMPLIANCE

For producers of lighting products and all electricals included in the WEEE Regulations, FREE recycling of lamps & luminaires for you & your customers.

LEARN MORE

COLLECTIONS

Free recycling for lamps covered by the WEEE Regulations. Collection and recycling service for luminaires, batteries, and electrical items too.

LEARN MORE

DROP-OFF NETWORK

UK network of drop-off points for all WEEE lighting. For consumers and businesses. Enter your postcode to find one close to you.

SEARCH MAP

WEEE REGULATIONS

Learn all about the WEEE Regulations, Open Scope and what it means, and how we recycle. Along with useful links and downloads of guidance papers.

LEARN MORE

MANAGING YOUR WASTE

Lamps are fragile and need to be treated with great care. Recolight have extensive guidance to help you manage your site, containers, and collections.

LEARN MORE

WEEE PAPERWORK

WEEE requires paperwork – for storing, moving, and for proof that it's been recycled responsibly. WEEF guide you through all that is required by the environmental agencies.

LEARN MORE

lighting for good

Approach

Our Charter

For Suppliers

For Designers

Awards

Eco-Products

Community

About

Contact

You are a supplier.

You are a designer.

Be part of the solution

As a luminaire manufacturer, you can further enhance your products and environmentally

Be part of the solution

As a specifier, or designer, you can work with products that have a maximum score in an effort to safeguard our planet.

Rate your products →

lighting for good

GreenLight Alliance

JOIN NOW!

OUR VISION

To light up the world, without depleting its resources.

GREEN LIGHT ALLIANCE

OBJECTIVES

We will work together to help everyone in the lighting sector understand their role in adopting and promoting the circular economy. We will work towards industry standards that are universally recognised, trusted and sought-after.

About

LEED

Credentials

Education

Membership

Store

Resources

Directory

Articles

Donate

Account

v4 - LEED v4

Direct Current Power Systems

Pilot credits

EAPc126 | Possible 18 Points

Share on

Language

Guide

Resources

Addenda

Forum

All credits

Intent

To achieve increasing levels of energy system efficiency, resilience and reliability by integrating DC power systems into buildings.

Requirements

Projects must document all Minimum Energy Performance prerequisites separately.

OPTION 1: Prescriptive approach for major energy systems (1 point)

Operate 95% of the load of at least one major energy system in the project directly off DC power, from a central DC source such as an on-site PV system, fuel cell, shared DC power supply or battery storage.

Qualifying systems in

- Elevators
- Escalators
- Indoor Lighting
- Outdoor Lighting
- Electric Vehicle
- Heating
- Cooling
- Ventilation
- Fans
- Plug Loads
- Information Tech
- Process Loads

OPTION 2: Whole

for Optimize Enc

Comply with all required Building Energy Simu

Declare.

ZAM\* Corrosion Resistant Coated Steel WHEELING-NIPPON STEEL, INC.

Final Assembly: Hefei Iron & Steel Co., Ltd. Life Expectancy: 100+ years (100+ years) End of Life Options: Recycle (100%)

Ingredients:

Unnamed Material: Dens: Metal Alloy: Metal Alloy Coating ASTM 1015175

Living Building Challenge Criteria: Core Criteria

I-13 Red List:

- LBC Red List Free
- LBC Red List Avoided
- LBC Red List Declared

% Disclosed: 100%

at 100ppm

VOC Content: Not Applicable

I-10 Interior Performance: Not Applicable

I-14 Responsible Sourcing: Not Applicable

WELL-B001

WELL-B002

Original Issue Date: 2020

Third Party Verified





**AND YET...**

**MANUFACTURERS REMAIN FROZEN**



**WHY DO OUR LIGHTING PRODUCTS  
USE SUCH ENERGY INTENSIVE  
MATERIALS?**



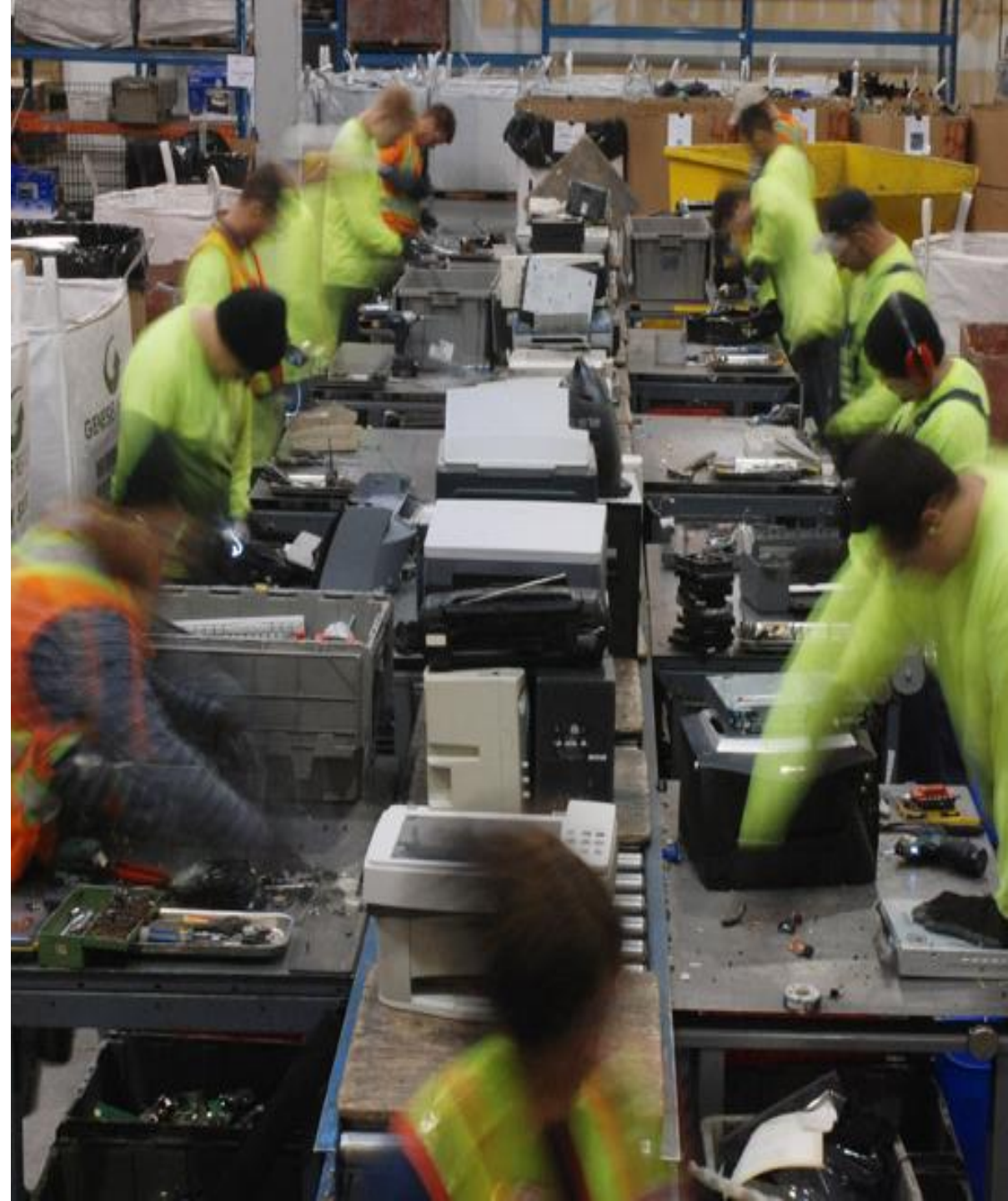


**WHY DO OUR LIGHTING PRODUCTS USE  
SO MANY TOXIC PETROCHEMICALS?**





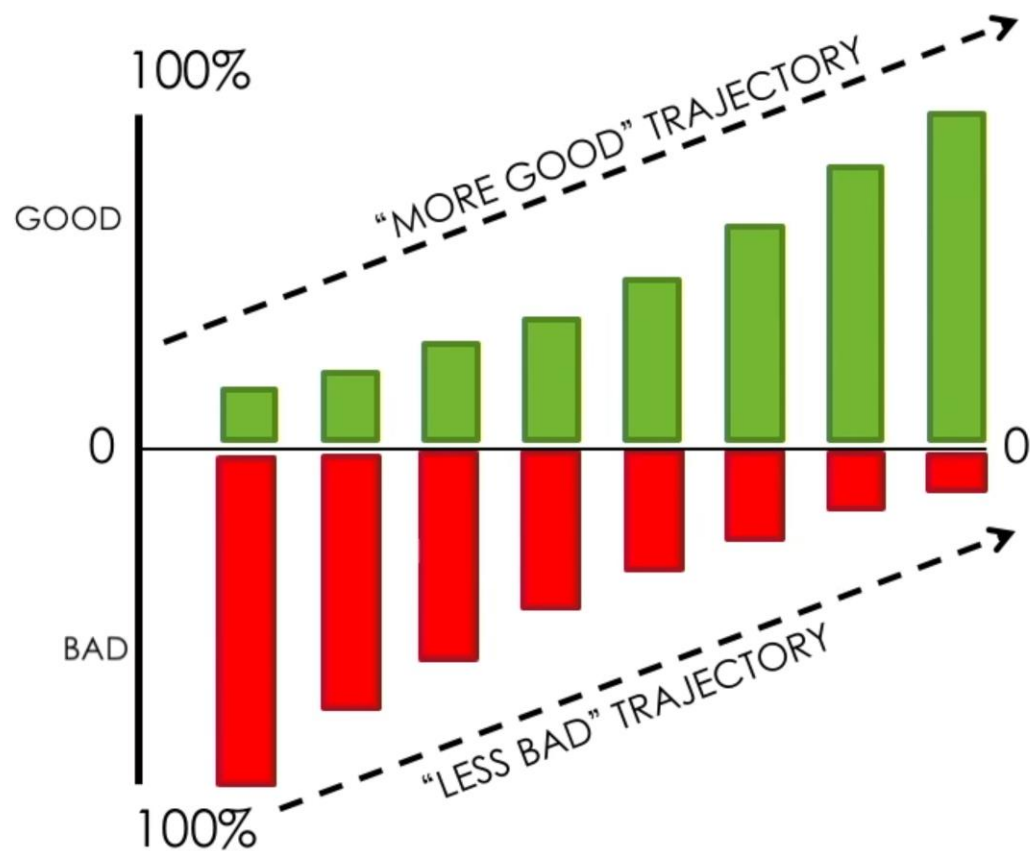
**WHY DON'T PROJECT  
OWNERS HOLD THE LIGHTING  
INDUSTRY ACCOUNTABLE  
FOR LIFECYCLE COSTS?**





A man with dark, curly hair is shown from the chest up, wearing a white toga with a dark, patterned sash. He has a neutral expression and is looking slightly to his left. In the background, there are two statues. On the left is a statue of a devil figure, dressed in a red suit with a cape and holding a pitchfork. On the right is a statue of an angel, dressed in a white robe with large white wings and a halo, holding a sword. The background is a plain, light-colored wall.

**LESS BAD VS MORE GOOD**

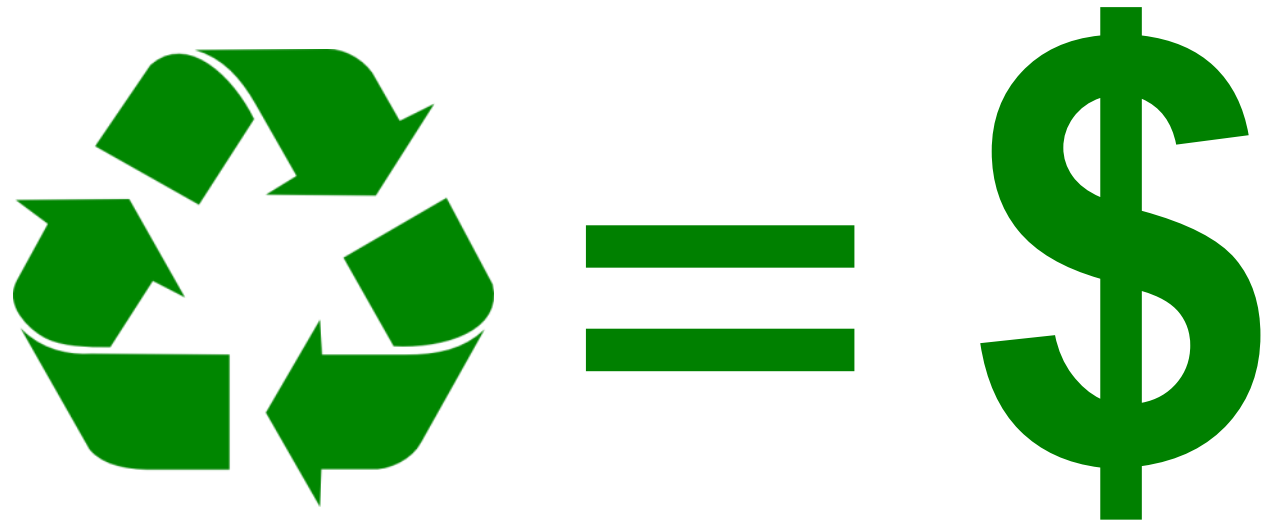


***“Being less bad is not also being good.”***

**–William McDonough**







**DOES “DEEP-GREEN” SUSTAINABILITY  
LEAD TO RADICAL COST REDUCTIONS?**

A woman with long blonde hair, wearing a light green jacket and a striped beanie, is hugging a large tree trunk in a forest. She has her eyes closed and a peaceful expression. The tree trunk is covered in moss and lichen. The background is a soft-focus forest with many trees and green foliage.

**TREE HUGGING HIPPIES?**



A woman with long blonde hair, wearing a green and white striped beanie and a light green jacket, is hugging a large tree trunk in a forest. Her eyes are closed, and she has a peaceful expression. The background is a lush green forest with many trees and ferns.

# **TREE HUGGING HIPPIES?**

- **ELIMINATING TOXIC MATERIALS**
- **ELIMINATING OVERSPEC'D MATERIALS**
- **ELIMINATING NEEDLESS COMPONENTS**
- **FAST DISASSEMBLY**
- **REPAIRABLE, MODULAR**
- **RECLAMATION OF RESIDUAL VALUE**



A woman with long blonde hair, wearing a green and white striped beanie and a light green jacket, is hugging a large tree trunk in a forest. The background is a lush green forest with many trees and ferns.

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- **RECLAMATION OF RESIDUAL VALUE**

***GREAT SUPPLY CHAIN MANAGEMENT!***



# 8 years ago...

## 2014 US DOE Solid State Lighting R+D Workshop

### The Evolution of Adoption

2014 US DOE Solid State Lighting R+D Workshop

Philips Energy

### Does "deep-green" sustainability lead to radical cost reductions?

(OMG!)

### Customers will hold the lighting industry accountable for lifecycle costs.

(OMG!)

### PERFORMANCE ECONOMY

- Contracts for holistic lifecycle costs
- Planned performance upgrades
- System leasing plans
- "Pay-per-lux" billing
- "Take back" programs

### PERFORMANCE ECONOMY

### CIRCULAR ECONOMY

### Externalities...

...internalized?

"The transition from a linear to a circular economy is a necessary boundary condition. A circular economy requires innovation in the areas of material components and product reuse, as well as related business models."

...economic growth will eventually be decoupled from the use of natural resources and ecosystems. In such an economy, the lower use of raw materials allows us to create more value."

-Frans van Houten, CEO Royal Philips

### Peak Design

Design  
Specification  
Procurement  
Installation  
Commissioning  
Operation  
Maintenance  
Disassembly  
Reclamation/Reuse

### Performance Economy

### Drive adoption by lowering the upfront price?

Leasing?

Residual value of the fixtures?

Energy services?

Shared value?

Pay-per-use?

Pricing for light-as-a-service?

### Residual Value?

Place your bets: Asset or Liability?

Year 1 Year 10

### The Fashion Cycle?

What is the residual value of the fixtures?

### Extracting value at "end of life"

Reuse → Used Lighting Market?

Rebuild → Maintenance?

Reclaim → Separation/OEM Parts?

Recycle → Biological?

Recycle → Technical?

### Extracting Value?

Z Zhaaga

200 lm/w L70 - 50,000 hrs

140 lm/w L70 - 50,000 hrs

100 lm/w L70 - 50,000 hrs

70 lm/w L70 - 50,000 hrs

### Where could the DOE invest?

**Reduce the junk:**  
system consolidation

**Shrink the fixture:**  
treat light as a material

**Go "deep green":**  
eco-materials + lifecycle

### Reduce the junk:

system consolidation

### Reduce the junk: Simply, simply

### Reduce the junk: "miniaturization of smart" drivers

### Reduce the junk: integrate drivers?

### Shrink the fixture: treat light as a material

### Why are our lighting systems constrained to "fixtures"?

We're selling gaslight era fixture formats instead of architectural lighting systems.

### Seagram Building

NYC Energy Audit

Build: 1931 out of 100

Modern: 68 out of 100

Seagram: 1 out of 100

### Can we treat lighting just like gypsum board?

On highly complex, customized projects, how can we efficiently produce, ship and install sheets of light?

### Lock-Benching MIT Media Lab

### LuxExcel

20 lumens per watt

### Coolidge Lighting

### Secondary benefits of package-integration R+D?

### Cut it? Bend it? Mold it? Stamp it? Glue it?

### LED modules and digital fabrication may lead to innovations in how we manufacture lighting fixtures.

### Go "deep green": eco-materials, lifecycle, material bank

### Why do our lighting products use such energy intensive materials?

Do we really need steel, aluminum and plastic in our lighting products?

### How can we use renewable, natural materials?

Molded bamboo fiber pulp

### How can we use reclaimed, recycled material streams?

Examples: Recycled plastic lumber products

### SUSTAINABLE MATERIALS STRATEGY

What Goes In

What Comes Out

### Bio-derived or bio-degradable parts?

### Designing electronics?

### Do the current safety codes allow for eco-friendly material use?

### Where could the DOE invest?

Reduce the junk:

Shrink the fixture:

Go "deep green":

### Another L-Prize?

Is it possible to create a "vertical economy" solution for all the components of an LED lighting system - materials to assembly?

**Circular Economy Prize**

**Featherweight Prize**

### THANK YOU!

Brad Koerner  
Director of Experience Design  
Philips Lighting

www.lucept.com

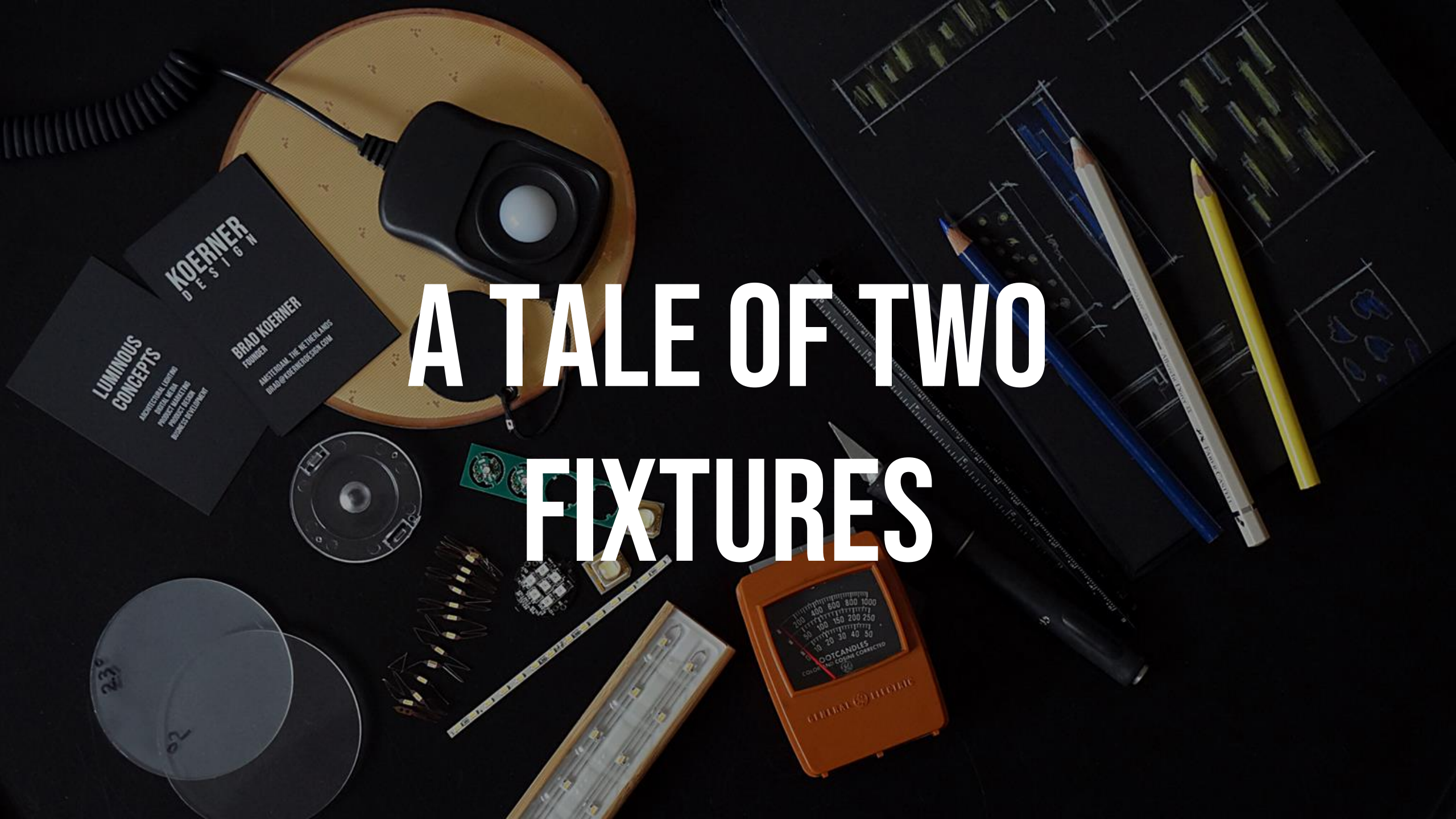
brad.koerner@philips.com

### What sort of future are we specifying today for tomorrow's world?

<https://lucept.com/2014/02/10/us-doe-ssl-rd-workshop/>



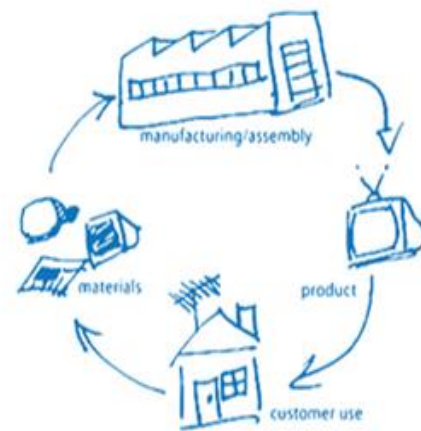
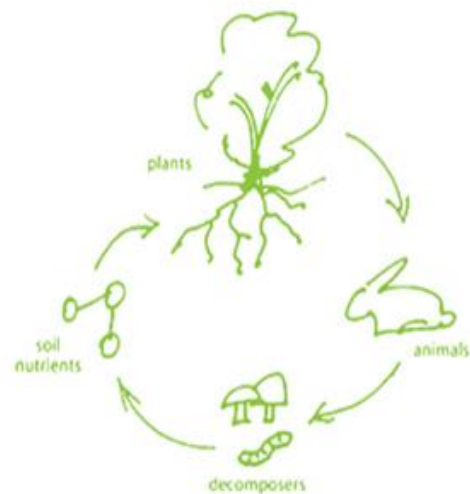
# A TALE OF TWO FIXTURES











Cradle to Cradle® is a trademark of McDonough Braungart Design Chemistry, LLC.

William McDonough + Partners  
Architecture and Community Design



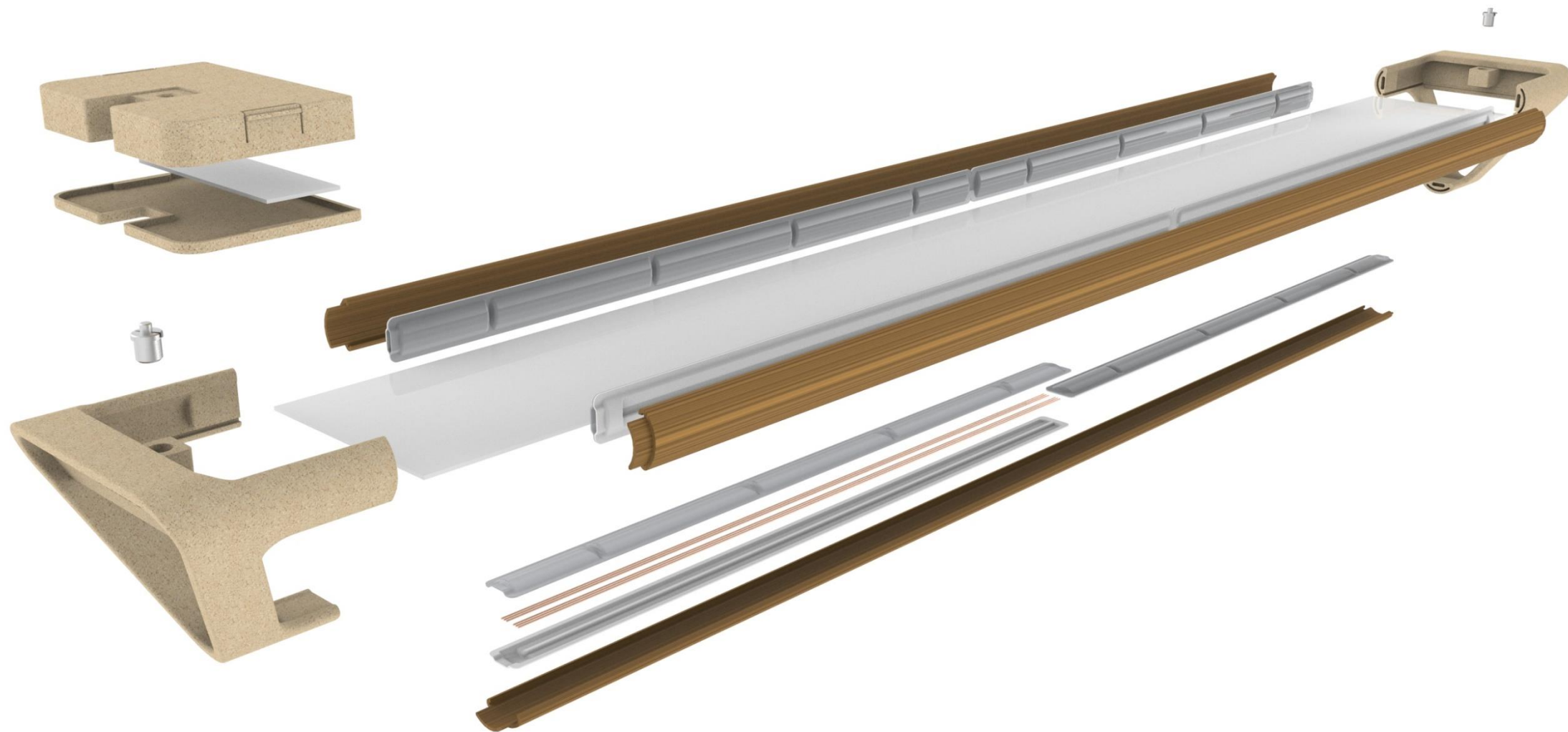




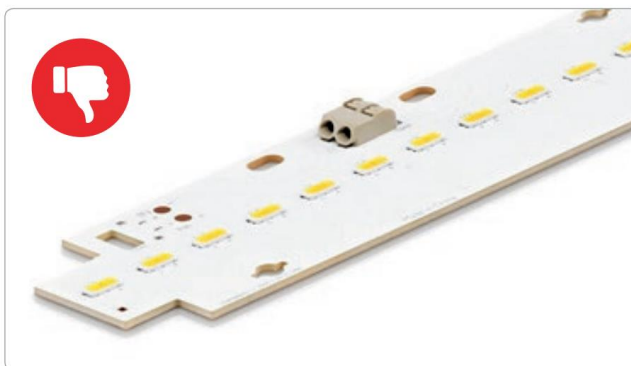




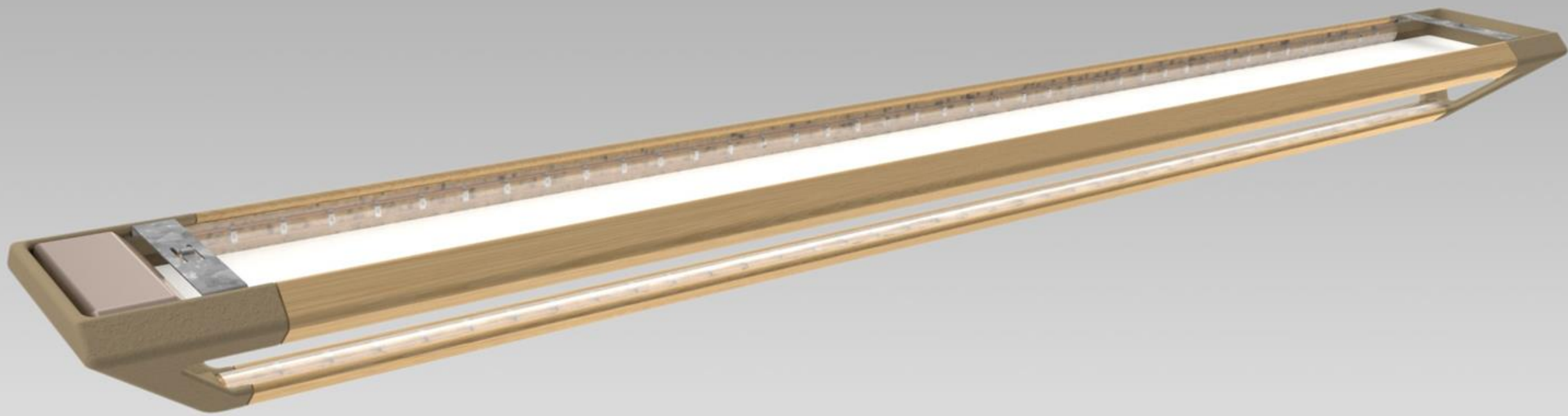




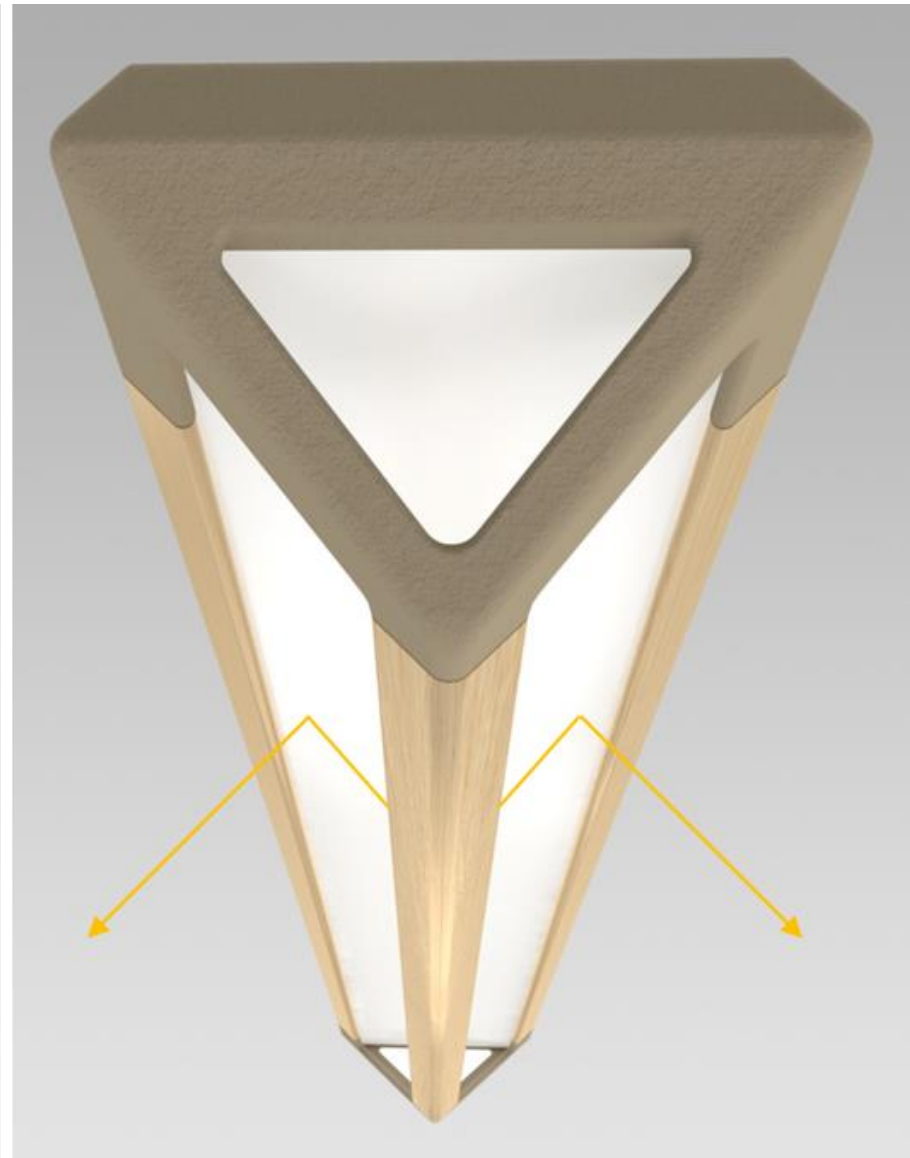
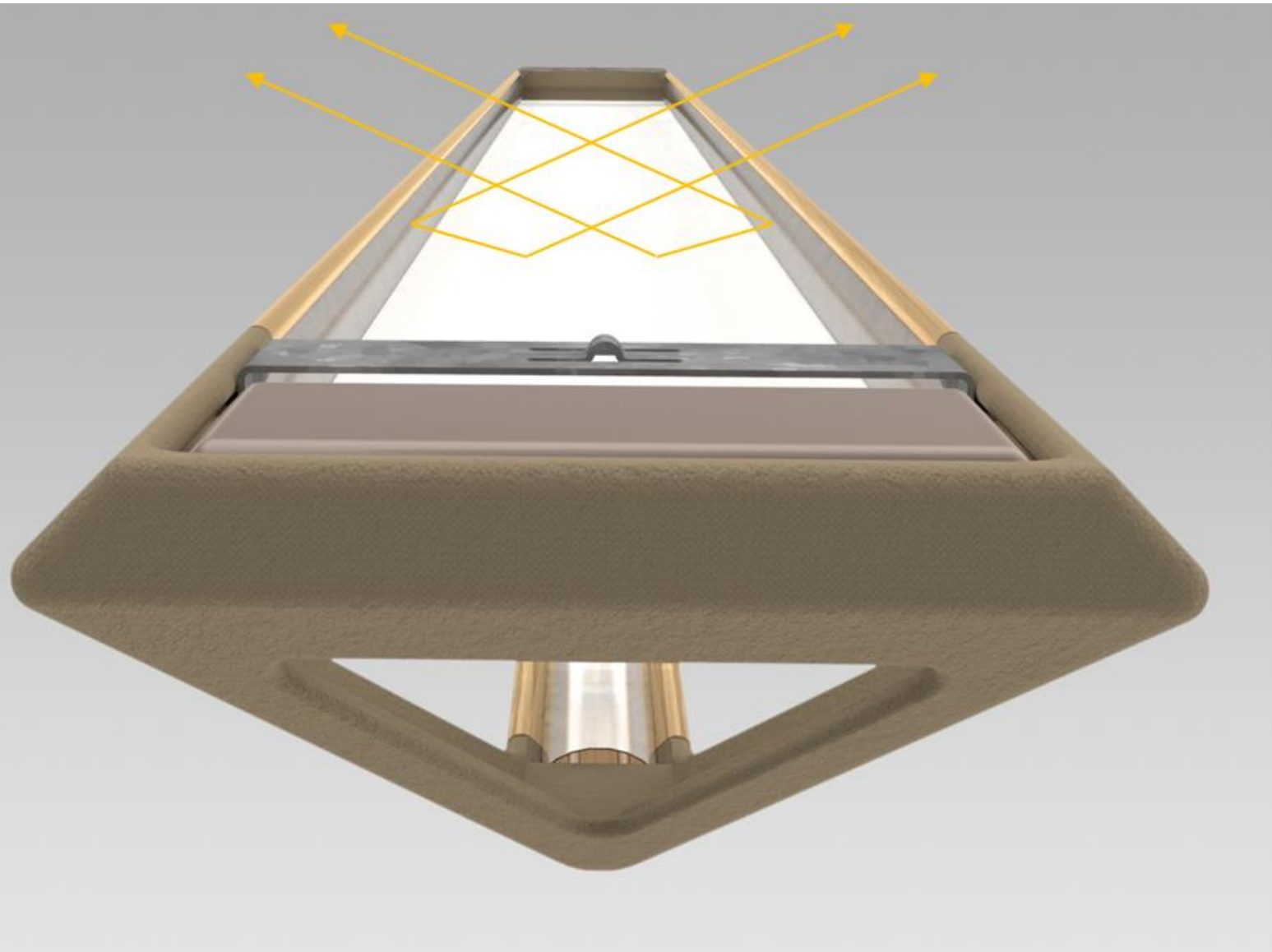














**MOUNTING BRACKET**  
*STAMPED*

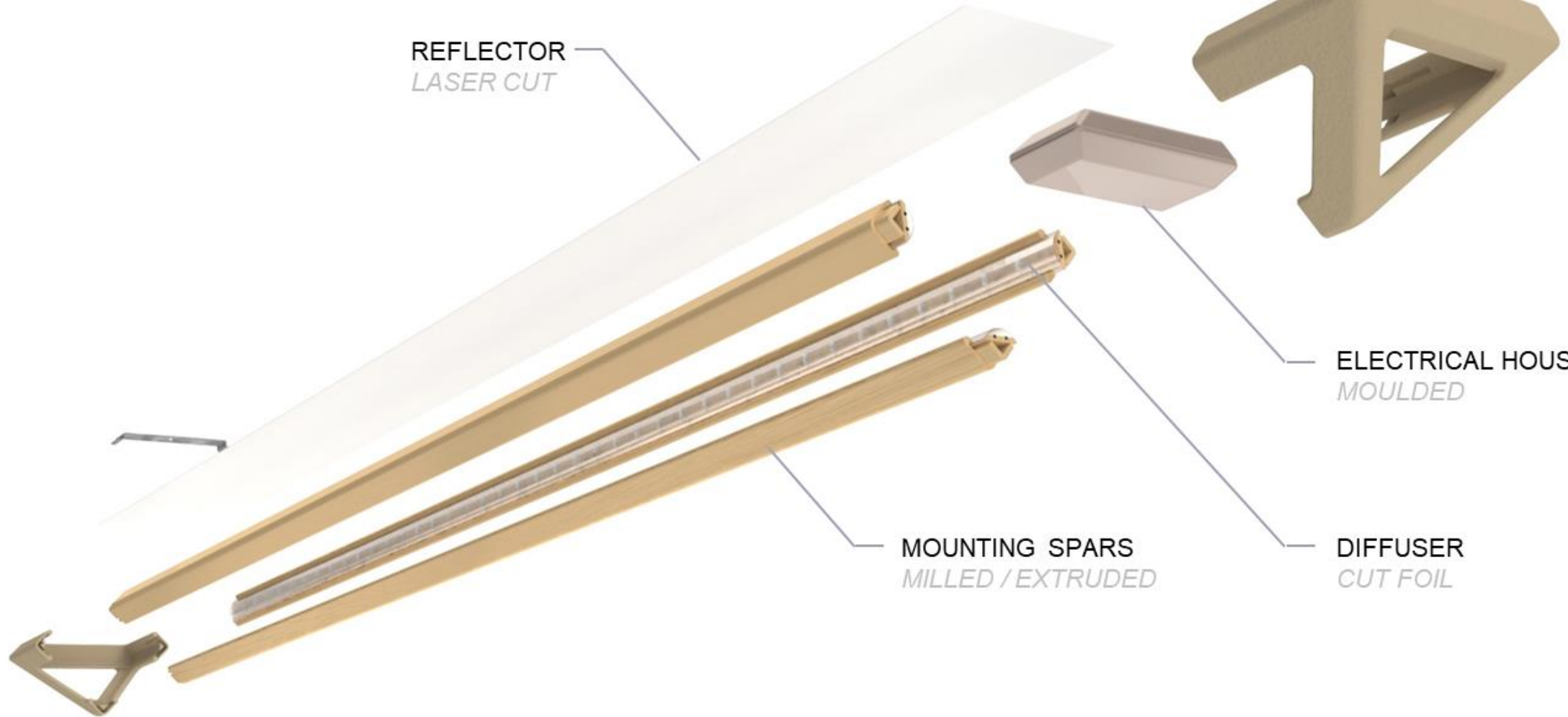
**END-CAP**  
*MOULDED*

**REFLECTOR**  
*LASER CUT*

**ELECTRICAL HOUSING**  
*MOULDED*

**MOUNTING SPARS**  
*MILLED / EXTRUDED*

**DIFFUSER**  
*CUT FOIL*





# What does it mean to be **green**?

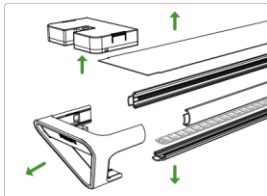
## Circular Economy Office Luminaires



## Radical approach in luminaire construction

### Design for disassembly

Push-fit construction = easy disassembly



### Dramatically reduced part count

80% less weight than existing luminaires

90% less components used

No secondary coatings/finishings

## Super-green light engine design

### Eliminate printed circuit boards

Common printed circuit boards use energy intensive materials and chemically intensive production processes, plus recycling circuit boards is nearly impossible.

We are striving to reduce and eliminate our use of printed circuit boards where possible.

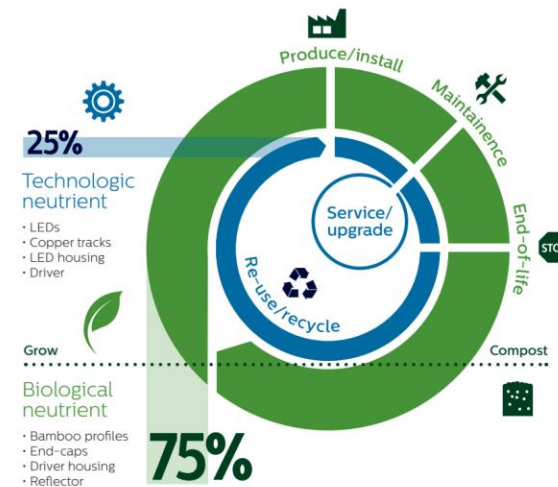


## Design for a circular economy

### Closed cycle

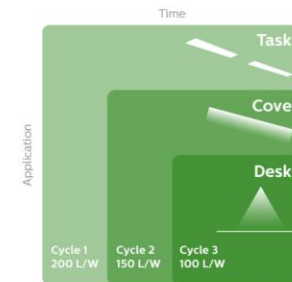
The luminaire comprises of 2 main types components:

- Natural compostable materials with low embodied energy (bamboo profiles, bioplastic end-caps)
- Electronic components that can be re-used or replaced easily (other applications, state-of-the-art energy efficient components)



### LEDs are durable

As LED efficiency increases, so does their long term value. With LEDs demonstrating efficacy of 200 lm/w, even after several 50k usage periods those LEDs are still highly efficient light sources that could be reused in lower-value applications



## Beautiful factories

### Natural, bio-degradable, raw materials

Think a material is 'green'? Would you want to live next to the factory?



We are striving to increase our use of natural materials with low-embodied energy, such as fast-growth woods and agriculture waste products

## Maximizing the benefits of LED technology

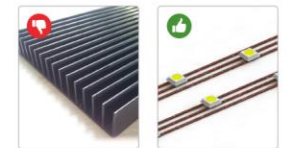
### LEDs are safe

LEDs enable use of innovative materials



### LEDs are efficient

We no longer need material-intensive heat sinks





**“SUSTAINABILITY DOESN’T SELL HERE IN EUROPE”**

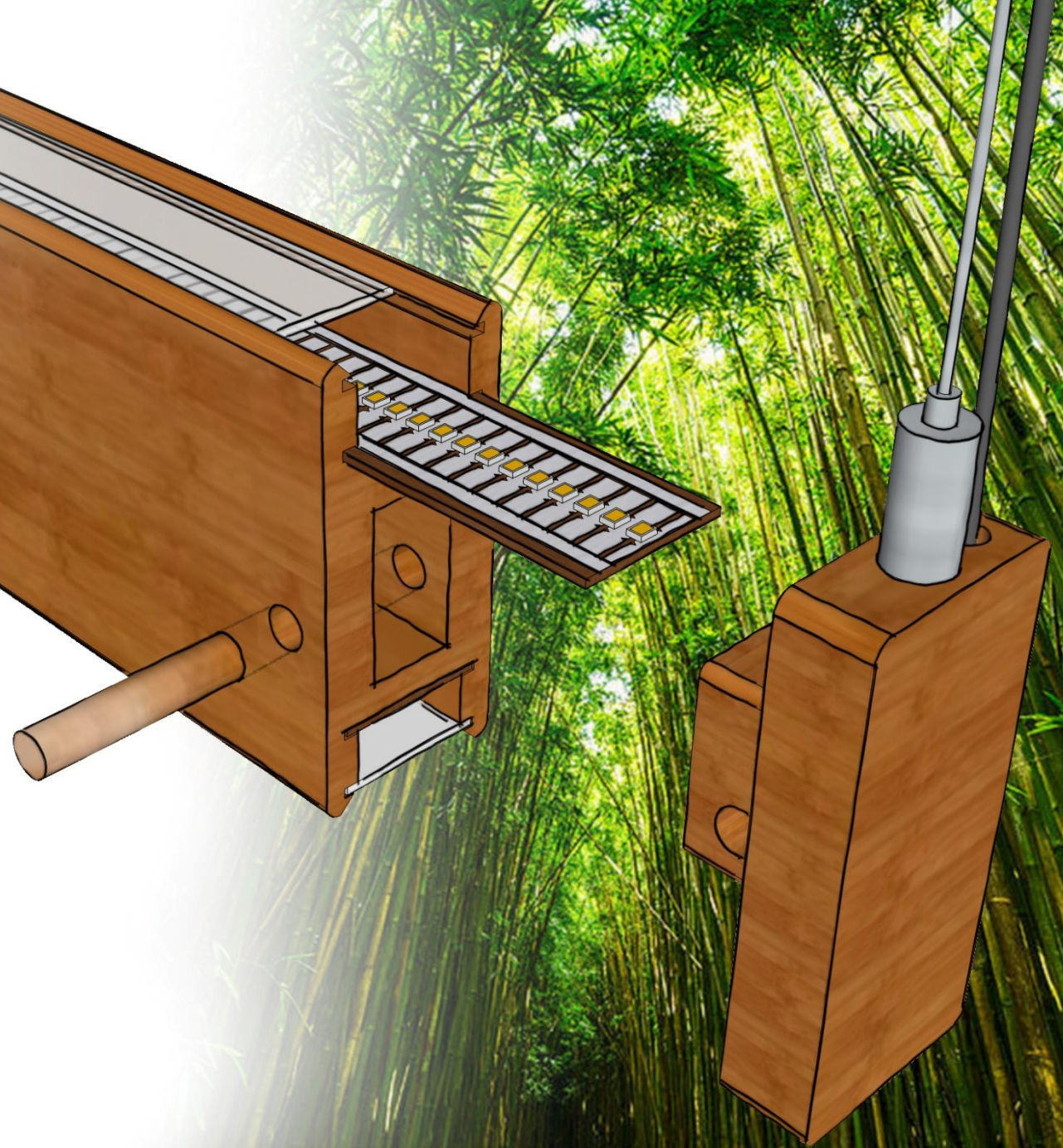


# BAMBOO PENDANT

GRAND PRIZE WINNER

2019 MANUFACTURING INNOVATOR CHALLENGE:  
SUSTAINABLE MANUFACTURING OF LUMINAIRES

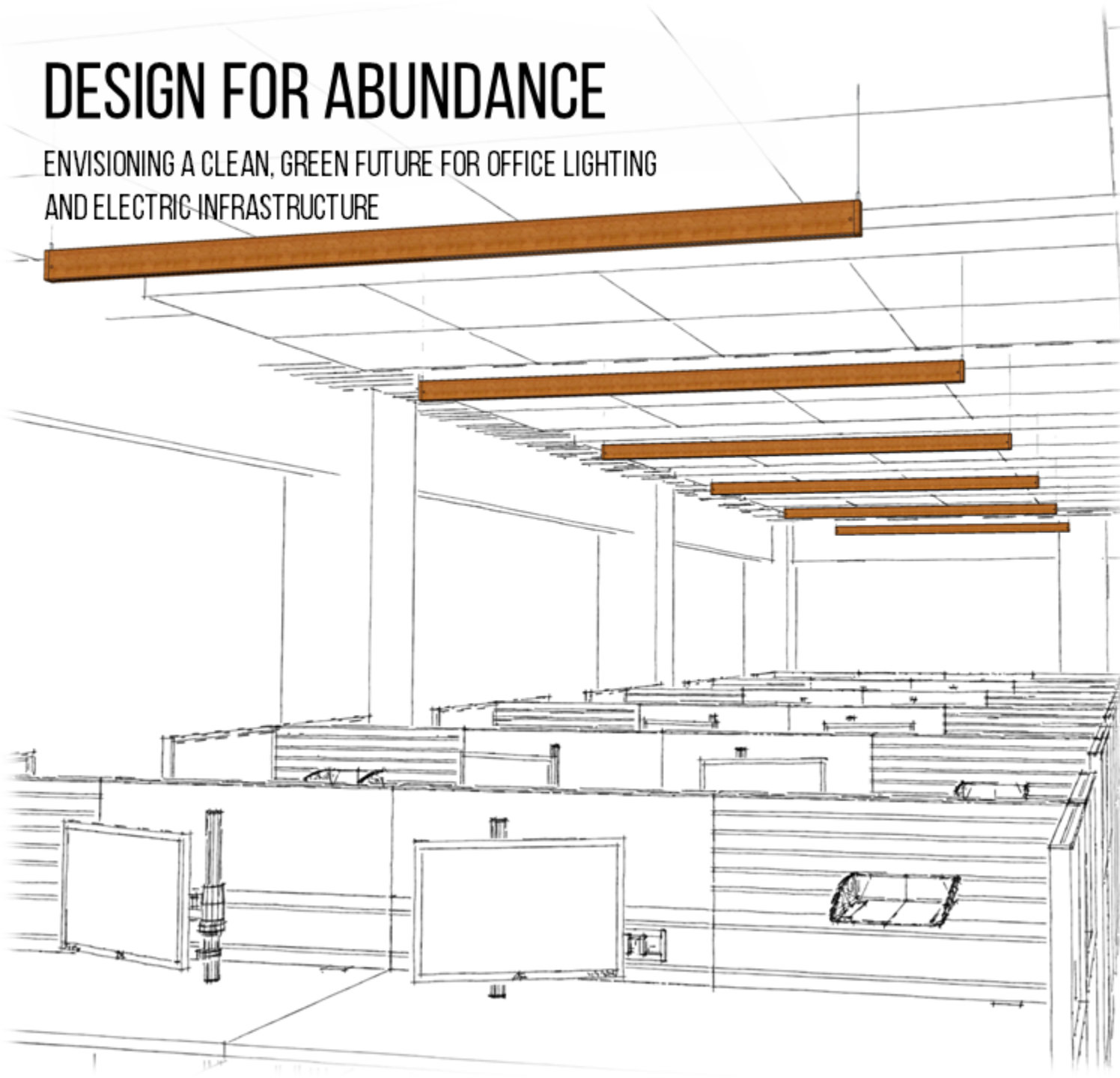
**KOERNER**  
DESIGN





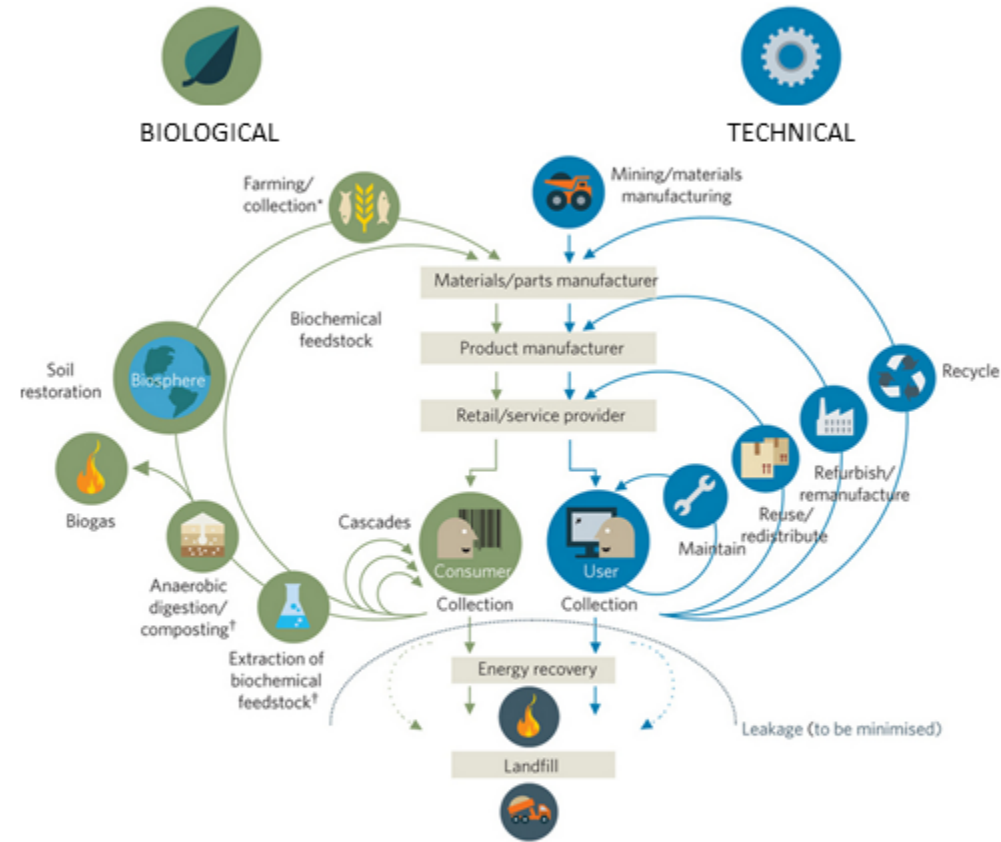
# DESIGN FOR ABUNDANCE

ENVISIONING A CLEAN, GREEN FUTURE FOR OFFICE LIGHTING  
AND ELECTRIC INFRASTRUCTURE



## Design for the circular economy:

Our design aims to reduce the lighting industry's dependence on "technical" materials and increase our use of "biological" materials



## Directly supporting sustainability initiatives:

Lighting hardware as a positive to be celebrated, not minimized

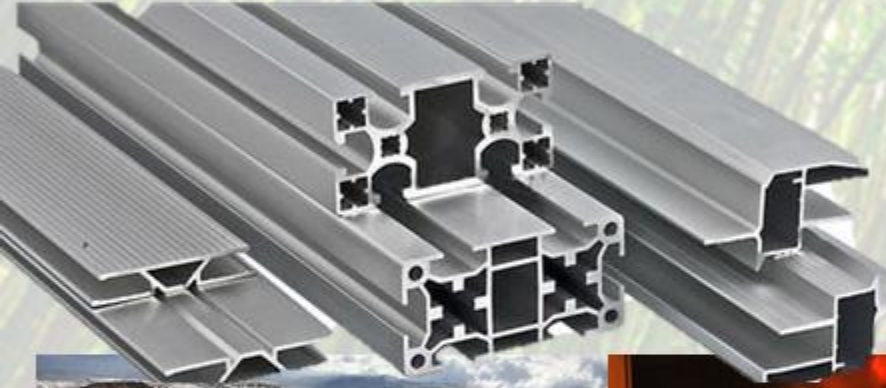




# BEAUTIFUL FACTORIES

## ALUMINIUM VS. BAMBOO WHICH IS “MORE SUSTAINABLE”?

Do you want to live next to any  
part of the supply chain?



VS





# BAMBOO

## Fast growing and plentiful resource

- Bamboo is one of the most rapidly renewing resources on the planet
- Laminated structural bamboo is a low-embodied energy, non-toxic, durable material

## Can light fixtures make the world a better place?

- Instead of merely "mitigating our impact" we want to help correct excess CO2 levels
- The laminated bamboo in our fixture sequesters 10.72 lbs of CO2 per 4' length (even after considering CO2 released during manufacturing processes of laminated product)

## Safe

- Class B Fire Rating per ASTM E84 testing standards for standard product (not treated with flame retardants)

## LEEDv4 Credits

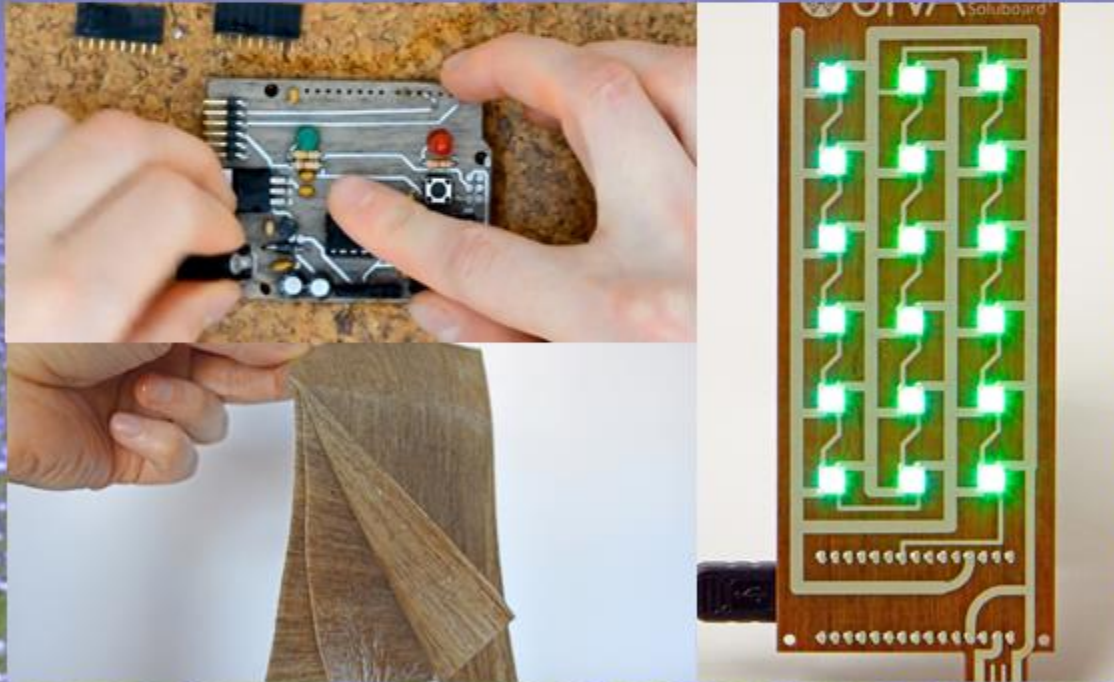
- Our products may offer the following LEED Credits:
  - MRc3: Sourcing of Raw Materials
  - EQc2: Low Emitting Materials (No added formaldehyde)
  - INc1: Innovation in Design (Life Cycle/Environment Impact)





# BIO-BASED PRINTED CIRCUIT BOARDS

ELIMINATING THE TOXIC LEGACY OF FIBERGLASS, EPOXY RESINS  
AND E-WASTE FROM THE LED REVOLUTION



Jiva Materials SOLUBOARD  
Flax-based compostable circuit board



Will this be the legacy of LEDs? Poisoning children in Ghana?

## OUR SUPPLY CHAIN:

Flax-fields in bloom

And our circuit boards can compost back into the  
fields from which they were grown



# LOW EMBODIED ENERGY, LOW TOXICITY

## Laminated bamboo body

- Bamboo is one of the fastest growing, most renewable resources on the planet
- Fully biodegradable and non-toxic adhesives and finishes
- Dimensionally stable, non-sagging across lengths up to 12'-0"
- Standard 2"x4" profile easily channelled to precise profiles on 5-axis moulder
- Elements supplied by Lamboo Technologies

## Flax-based printed circuit board

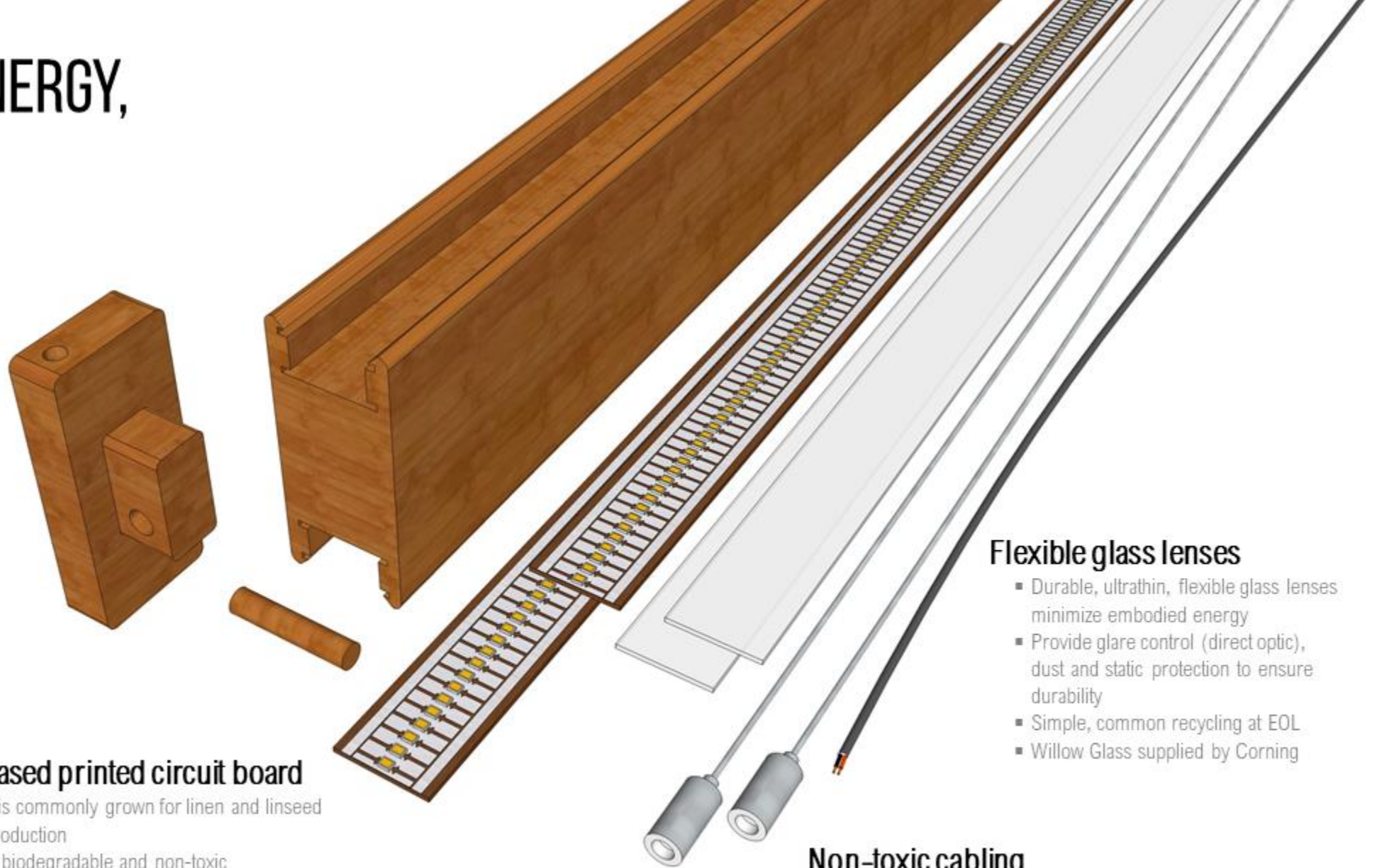
- Flax is commonly grown for linen and linseed oil production
- Fully biodegradable and non-toxic
- At end of life, traces and electronic components dissolve away from substrate
- Substrate is compostable
- Soluboard supplied by Jiva Materials

## Flexible glass lenses

- Durable, ultrathin, flexible glass lenses minimize embodied energy
- Provide glare control (direct optic), dust and static protection to ensure durability
- Simple, common recycling at EOL
- Willow Glass supplied by Corning

## Non-toxic cabling

- Small gauge low-voltage DC wire minimizes copper consumption
- Free of halogen, chlorine, bromine, fluorine
- EcoAcePlus supplied by Furukawa Electric

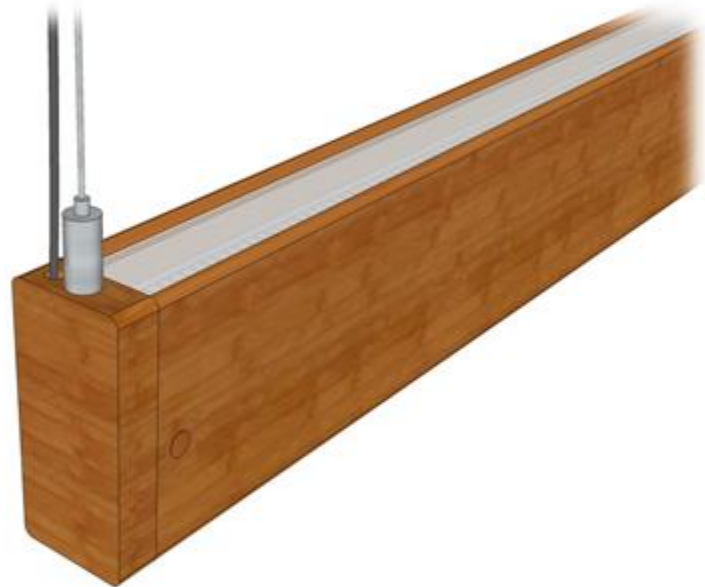




# OLD SCHOOL SIMPLICITY

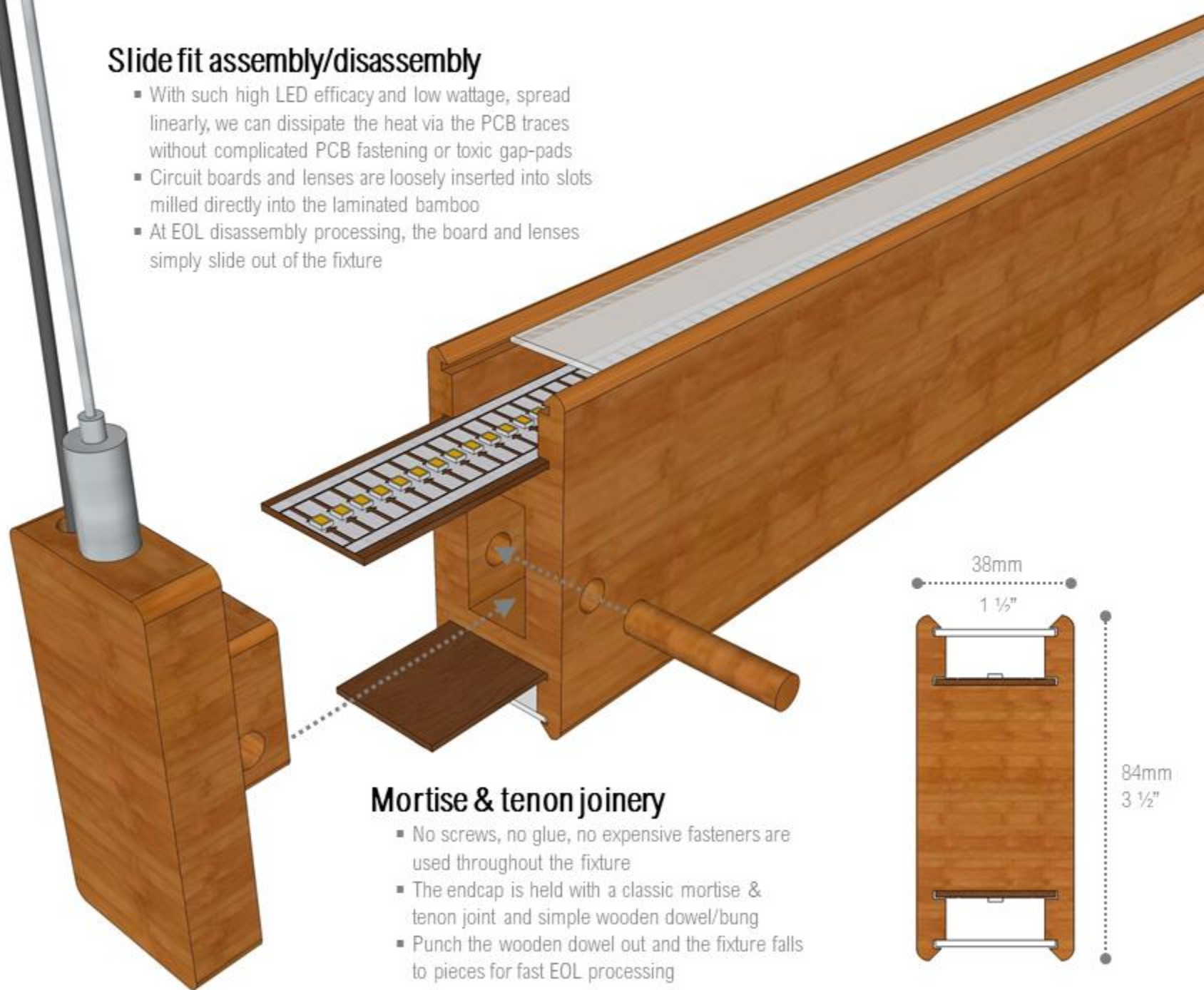
## Slide fit assembly/disassembly

- With such high LED efficacy and low wattage, spread linearly, we can dissipate the heat via the PCB traces without complicated PCB fastening or toxic gap-pads
- Circuit boards and lenses are loosely inserted into slots milled directly into the laminated bamboo
- At EOL disassembly processing, the board and lenses simply slide out of the fixture



## Endcap concept

- To ensure fast assembly and later disassembly for circular economy processing, the end caps hold the fixture components captive
- The aircraft cable support for the fixture and wire strain relief are simply drilled into the end cap, without requiring additional hardware



## Mortise & tenon joinery

- No screws, no glue, no expensive fasteners are used throughout the fixture
- The endcap is held with a classic mortise & tenon joint and simple wooden dowel/bung
- Punch the wooden dowel out and the fixture falls to pieces for fast EOL processing

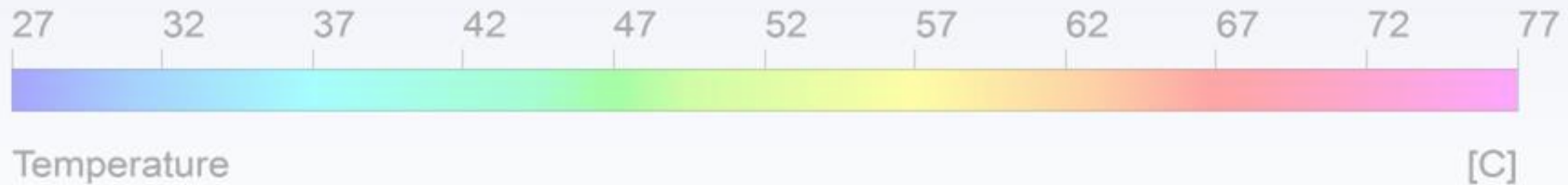








**BUT WHAT ABOUT THE HEAT?**



**230+ LUMENS/WATT EFFICACY OFF THE SHELF!**








POINTS

LINES

PLANES



The image is a composite of two photographs. The left photograph shows a wooden frame on a workbench with a glowing yellow LED strip inside. Various electronic components, wires, and tools are scattered around. The right photograph is a close-up of a digital thermometer with four temperature probes (T1, T2, T3, T4) inserted into a glowing LED strip. The thermometer's display shows the following temperatures: T1: 23.0 °C, T2: 23.0 °C, T3: 23.9 °C, and T4: 26.1 °C. The thermometer has buttons for HOLD, UNIT, MAX, MIN, AVG, and a power button. In the background, a power supply unit with a red digital display is visible.

**THE LIGHTING INDUSTRY NEEDS TO  
UNLEARN THERMAL DESIGN**



A man with a beard and safety glasses, wearing a blue long-sleeved shirt, is seated and operating a large industrial machine. The machine has several vertical pistons or cylinders, some of which are glowing orange, suggesting heat or fire. In the background, another person is seated at a desk with a computer monitor, also working on industrial equipment. The scene is set in a factory or laboratory environment.

**BUT WHAT ABOUT THE FIRE RATING?**



## What is a Class A or Class 1 fire rating?

A class 1 fire rating is the best fire rating of materials that can be achieved. Class A fire ratings indicate a flame spread rating somewhere between zero and 25.

Materials that fall into Class A or Class 1 include things like brick, gypsum wallboard, and fiber cement exterior materials. These materials do not burn well and are very unlikely to contribute fuel to a fire.

---

## What is a Class B or Class 2 fire rating?

A Class B or Class 2 fire rating is the next best rating on the list. The flame spread rating of Class B would fall between 26 and 75. This rating is typical for slower-burning whole wood materials.

A whole wood material would be wood planks that are in the same form as they were when they were cut from the tree. They burn more quickly than Class A materials and more slowly than Class C materials.

---

## What is a Class C or Class 3 fire rating?

A Class C or Class 3 fire rating has a flame spread rating between 76 and 200. This rating incorporates building materials like plywood, fiberboard, and hardboard siding panels. It also includes any of the faster burning whole woods.

Ratings between 201 and 500 would be considered a Class D material, and Class E materials include anything with a flame spread rating above 500. Classes D and E are not considered effective against any form of fire exposure.



The image is a horizontal split-screen composition. The left half shows a large, intense fire with bright yellow and orange flames, with a red fire extinguisher visible in the lower-left corner. The right half shows a person lying in a hospital bed, covered with a blue blanket, with medical wires connected to their chest and arm. The text is centered across the middle of the image, spanning both halves.

**IS THE CONSTRUCTION INDUSTRY  
TRADING SHORT-TERM FIRE LIABILITY FOR LONG  
TERM CANCER LIABILITY?**



# IS THE CONSTRUCTION INDUSTRY TRADING SHORT-TERM FIRE LIABILITY FOR LONG TERM CANCER LIABILITY?

U.S. FIRE DEATHS, 2019:

**3,515**

U.S. CANCER DEATHS, 2019:

**599,601**





**BURNBLOCK®**



### **PRESSURE IMPREGNATION**

Impregnation with Burnblock for Solid Wood, Modified Wood, Plywood and more...



### **PLYWOOD TREATMENT**

Natural fire retardant solutions for industrial manufacturing of plywood.



### **EN45545 PUBLIC TRANSPORT**

R10; HL1/HL2/HL3 (flooring); R1; HL1/HL2 (walls); R7; HL1/HL2 (exterior walls)



### **TEXTILES AND FABRICS**

Textiles and Fabrics for End Use and Industrial Purposes.



### **COATINGS**

Matched Lacquer and Paint for Burnblock treated products.



### **FIBER BOARDS**

Natural fire retardant solutions for OSB, MDF and other fiber boards.



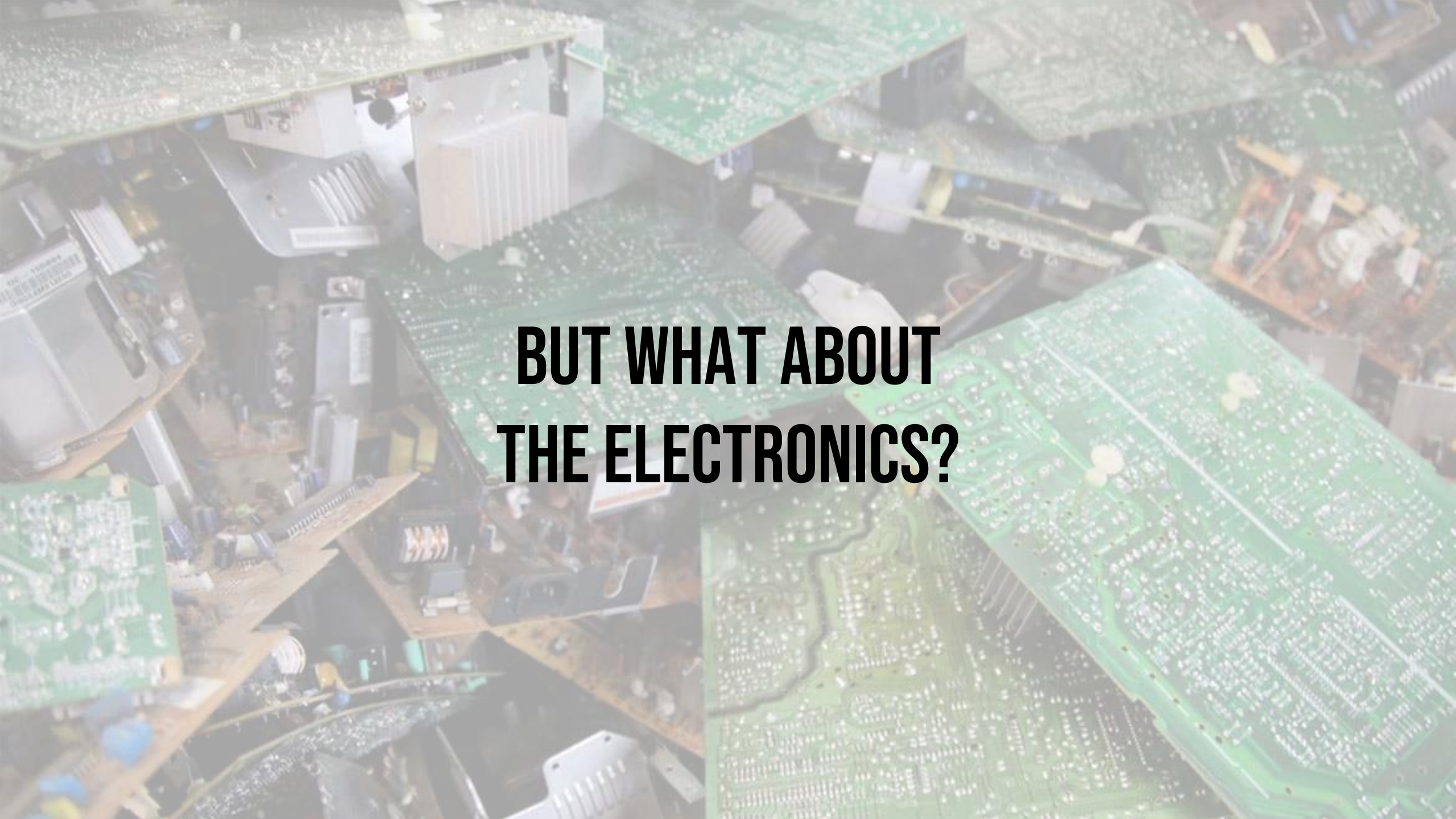
### **NATURAL FIBERS**

Natural fire retardant solutions for natural fibers and natural fiber products.



### **FIT TO PURPOSE**

Tailor made natural fire retardant solutions for special products.



**BUT WHAT ABOUT  
THE ELECTRONICS?**



# SO. MUCH. JUNK.



**SOLAR INVERTERS**



**BATTERY INVERTERS**



**VARIABLE FREQUENCY  
DRIVE INVERTERS**



**LED DRIVERS**



**AC METERS, BREAKERS**



**DATA CENTER PSUS**

**CHARGERS**

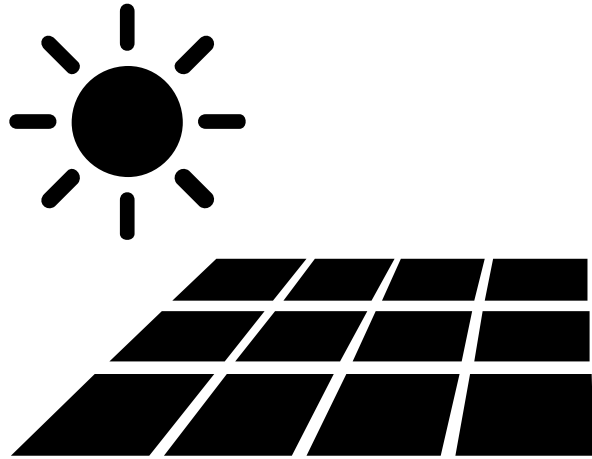




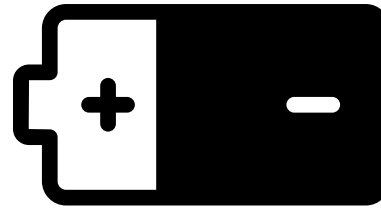




# THE DC POWER STORY



**SOLAR PARITY  
WITH GRID**



**PLUNGING  
STORAGE COST**



Lighting



Sensors



Devices



EV Charging



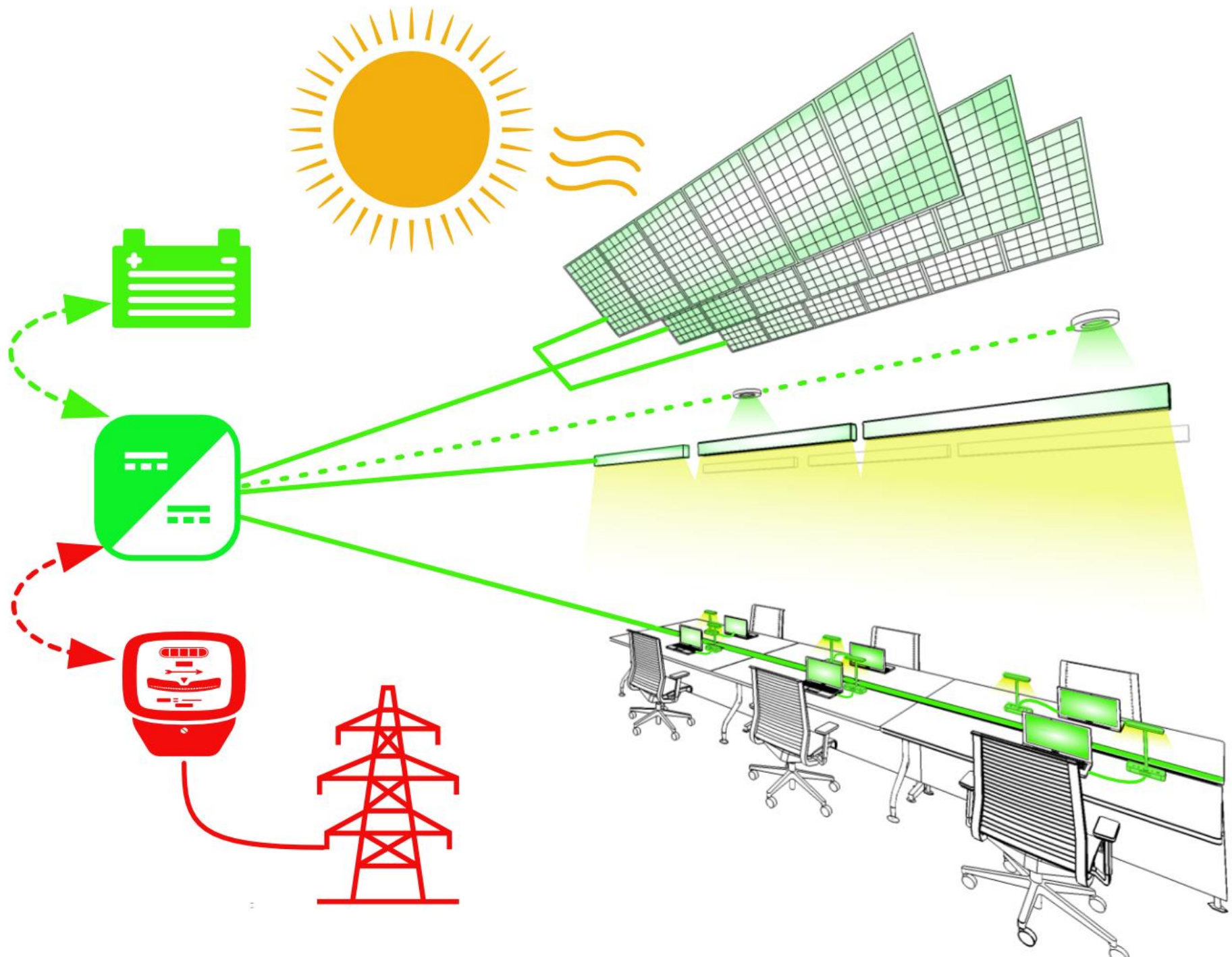
Data Centers



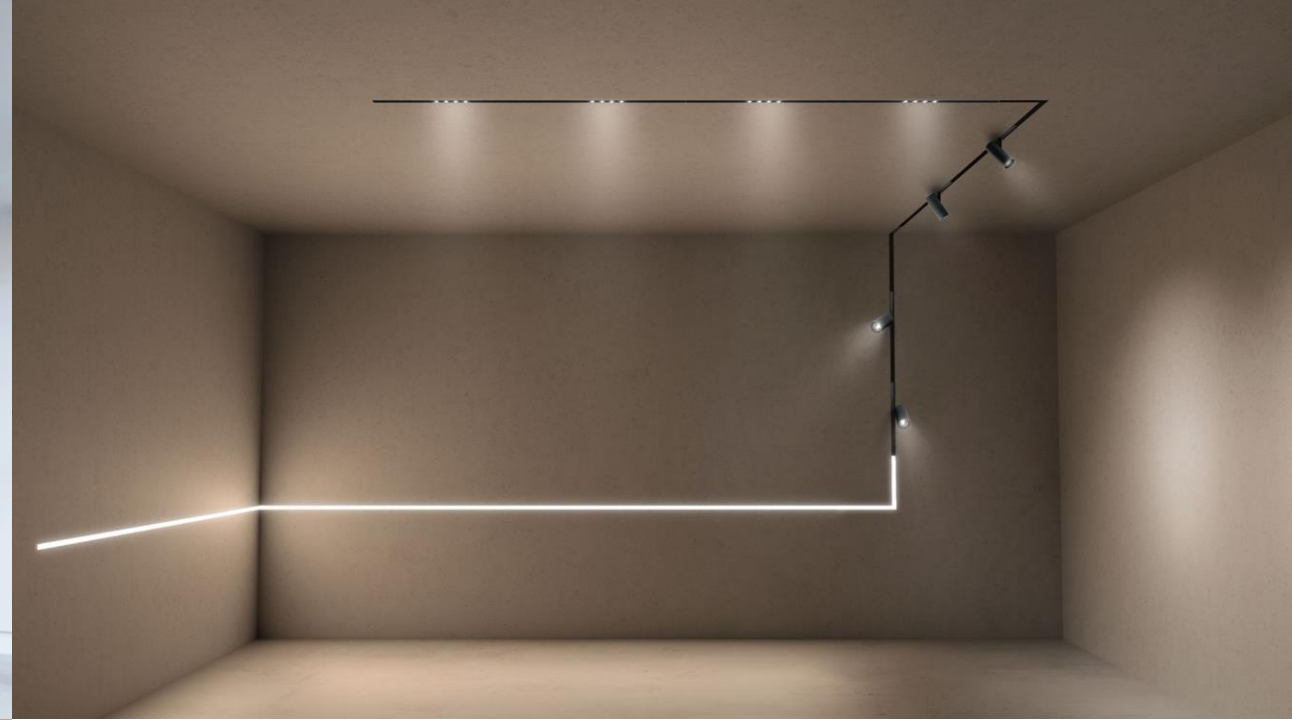
Mechanical

**EVERYTHING IS  
DC POWER**

# GOODBYE LED DRIVERS?







# 48VDC TRACK LIGHTING





**DEP**  
DIRECT ENERGY PARTNERS





SPOT

### PV String-level DC-DC Optimizers

[> Learn more](#)



BOSS

## Bi-Directional DC-DC Optimizers for Storage Systems

[> Learn more](#)



CUBE

### Monolithic, Buck-Boost DC:DC Converters

[> Learn more](#)



GARD

### PV String Level ARC and Ground Fault Detection and Disconnect

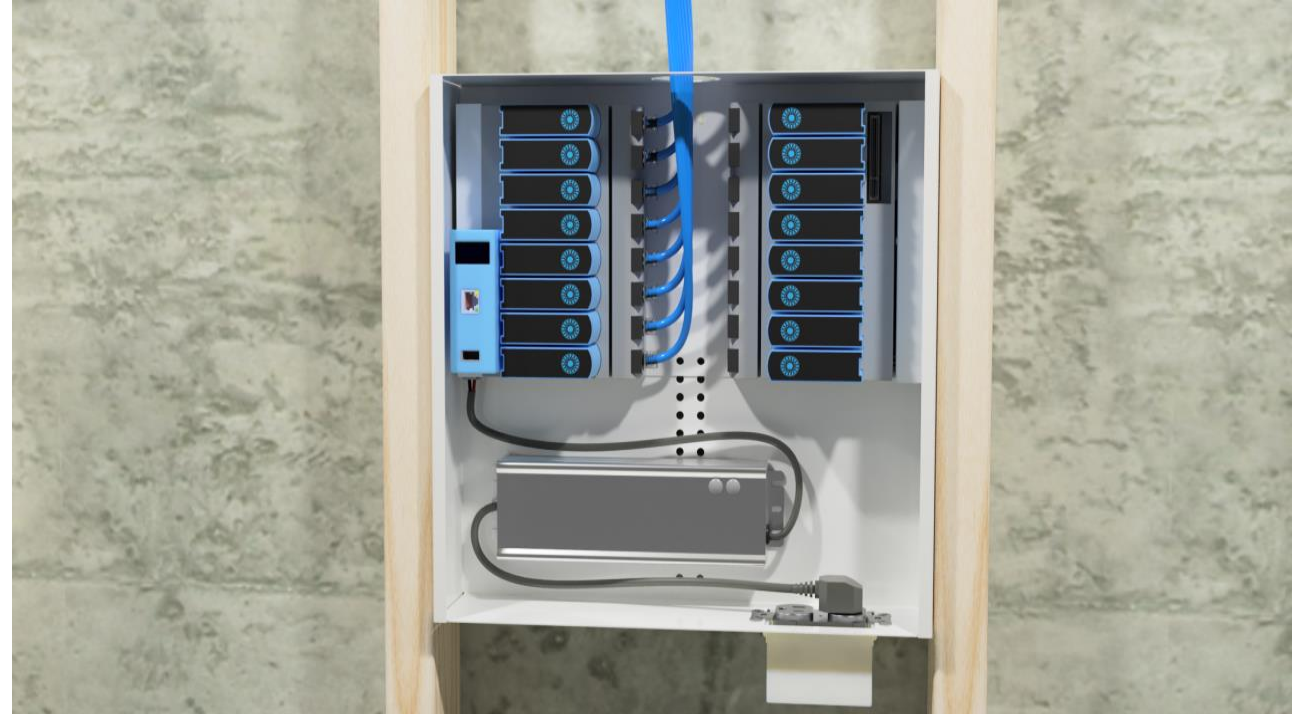
[> Learn more](#)



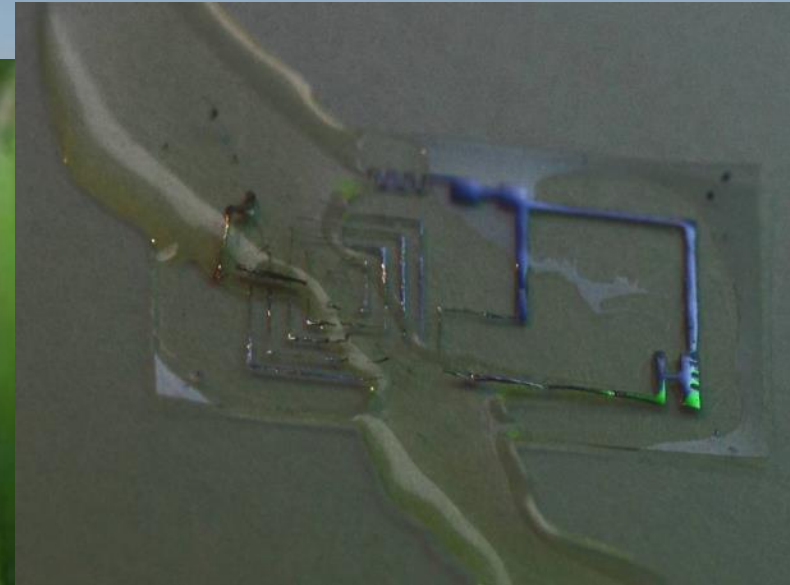
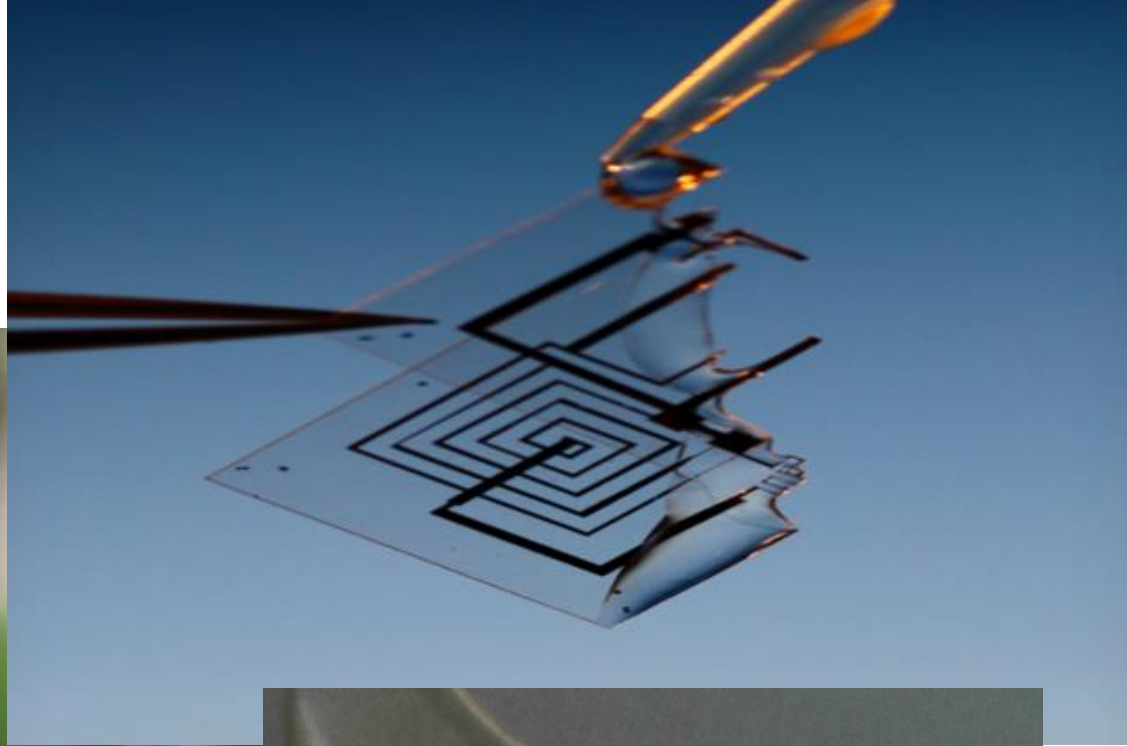
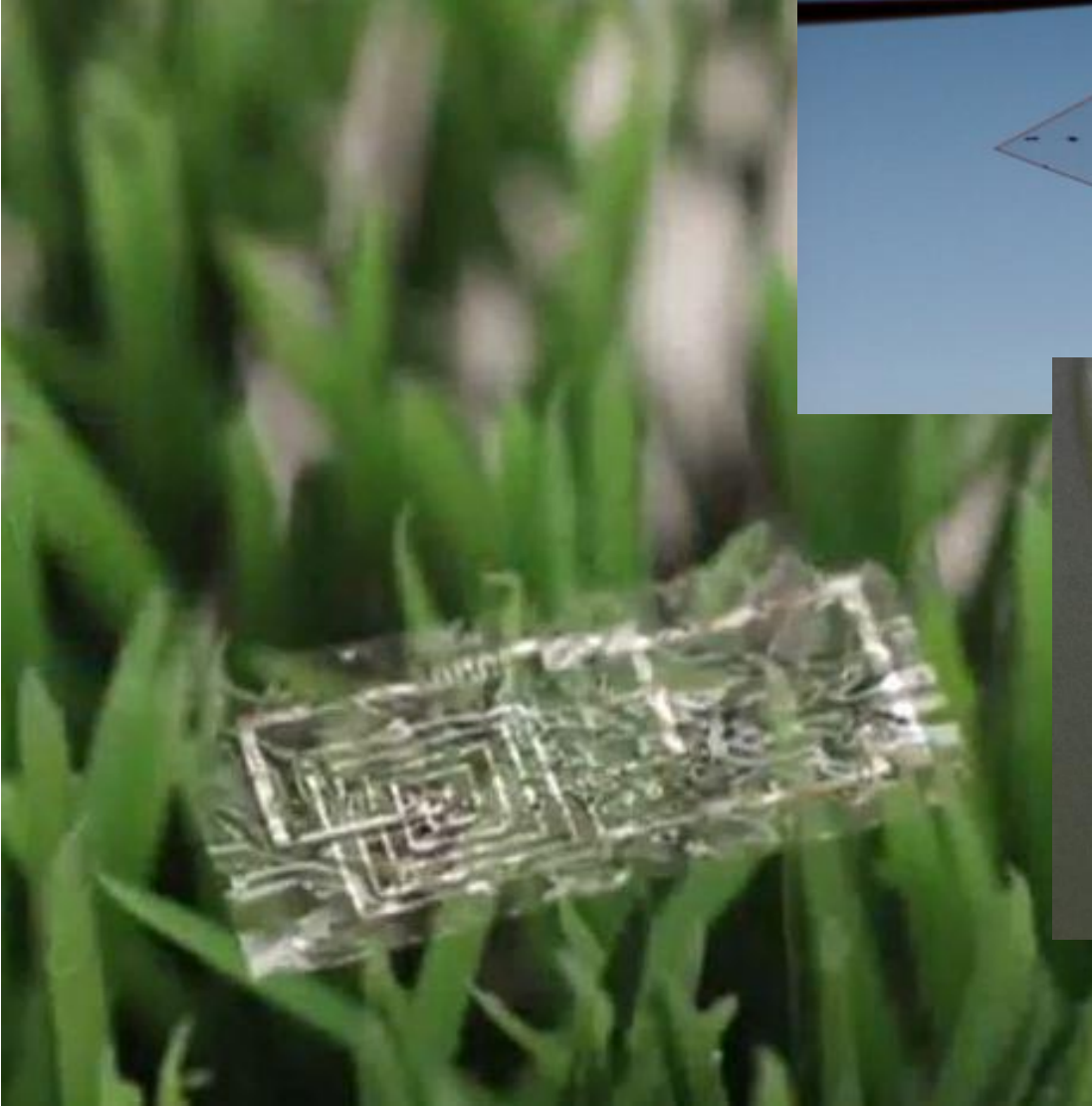
ACE

Remote PV-IOT™ Hardware and Software

[> Learn more](#)

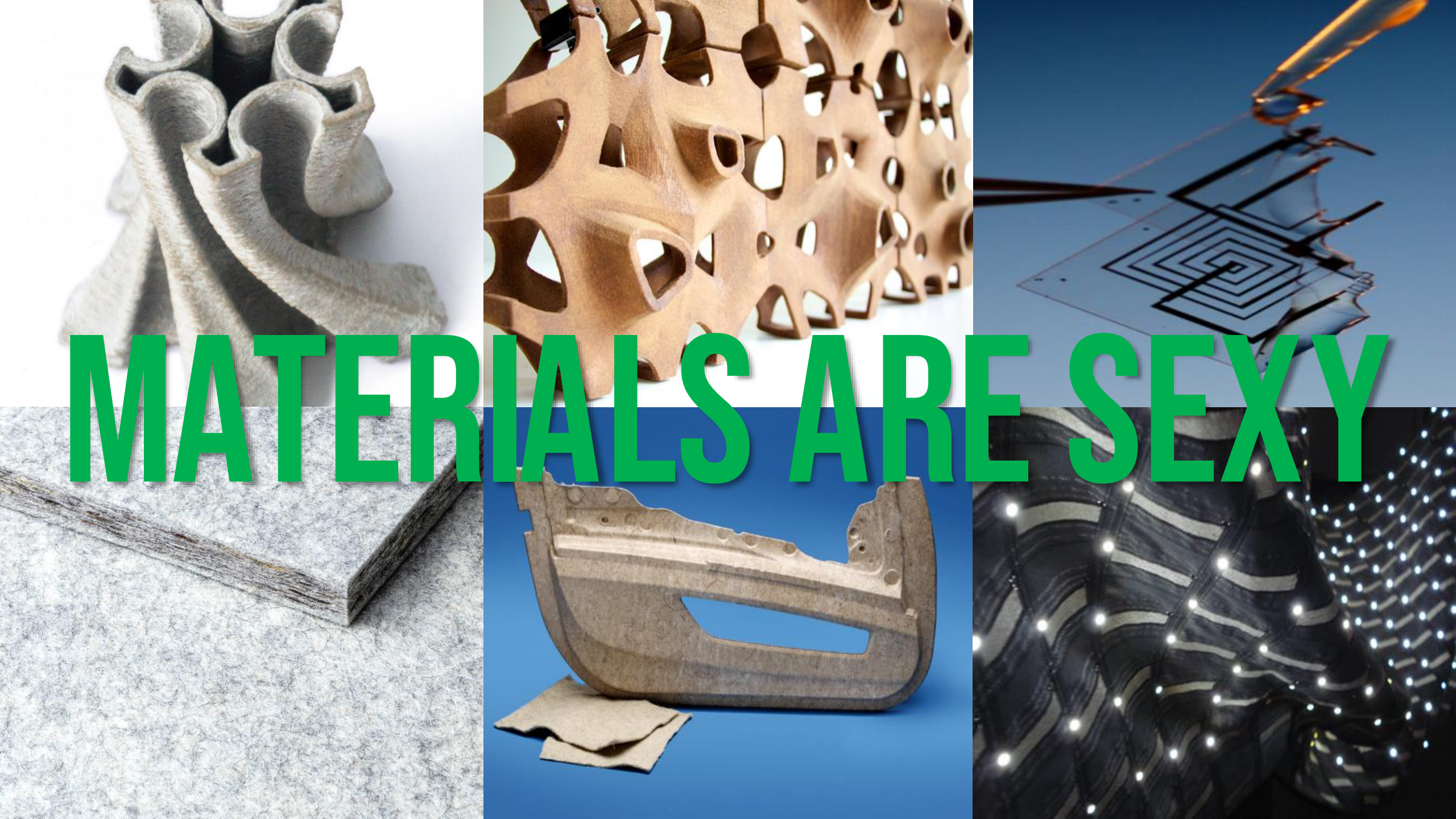


# DISSOLVING ELECTRONICS?



**ROGERS RESEARCH GROUP**  
**UNIVERSITY OF ILLINOIS**





**MATERIALS ARE SEXY**



# HARVEST AND CRAFT







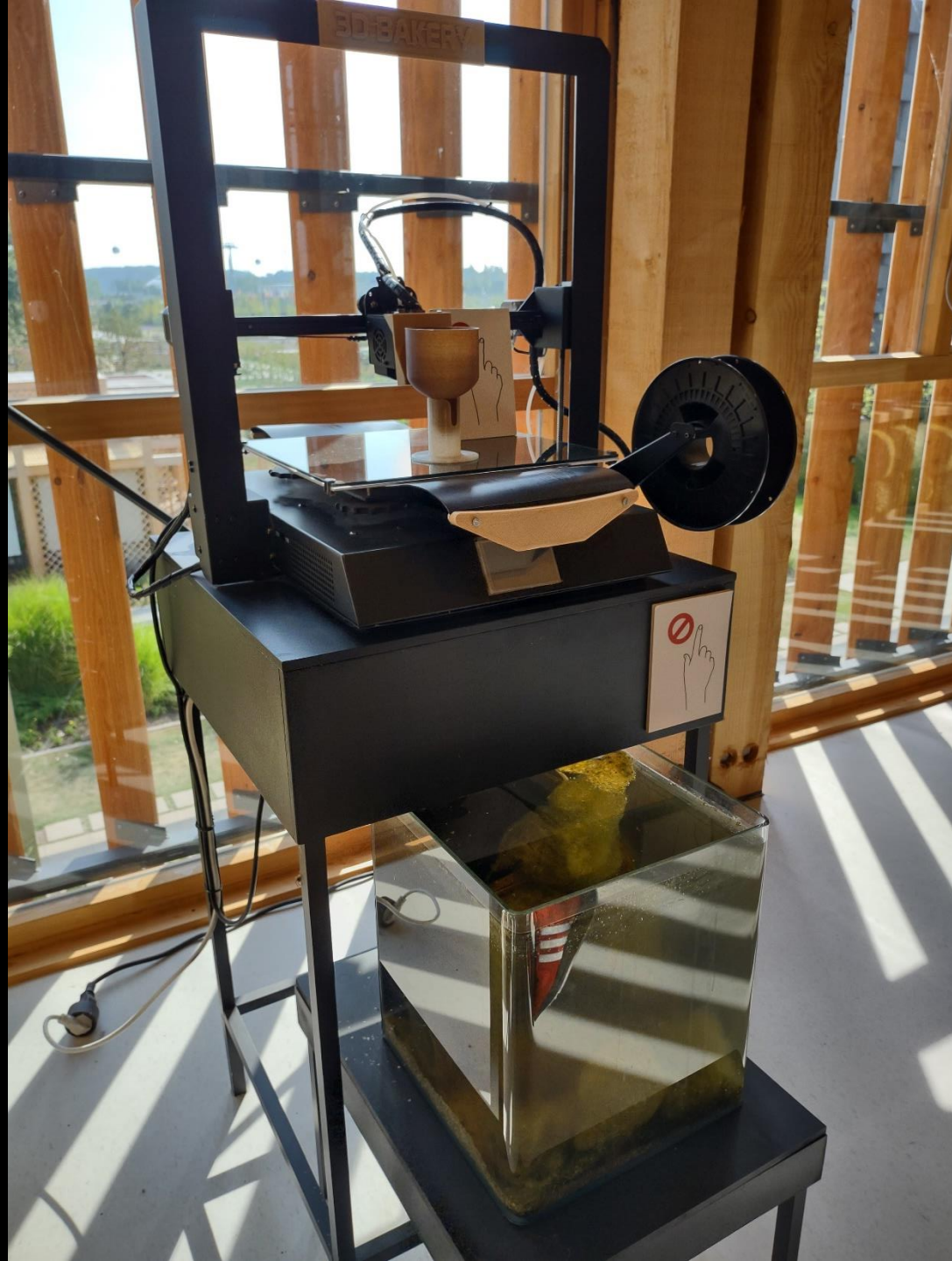
























BIOTOPIA  
GERMANY

ENTER BIOTOPIA

EATTOPIA  
GERMAN RESTAURANT









## Pavillon Francophone

In deze tijd van veel veranderingen en ook verlatenheid  
van de buitenwereld, de buitenwereld, het is belangrijk  
om een verbinding te maken tussen mensen en natuur.  
De paviljoen is een plek waar mensen en natuur  
samen kunnen zijn.

At a time rich in changes and marked by the need for a return  
to nature, the need for a connection between people and nature is  
essential. The pavilion is a place where people and nature  
can be together.













## HEMP FIBERS + ACRYLIC BINDERS



STUDIO AISSLINGER



DRAEXLMAIER











**BEWARE  
MONSTROUS HYBRIDS**



WINK/EYE-BANG HIM 55

2

5

3

6

7

8

0

LET'S PLAY:  
STUMP A SALEPERSON!





WINK/EYE-BANG HIM 55

2

5

3

6

7

8

0

LET'S PLAY:  
STUMP A SALEPERSON!

“PLEASE SEND ME A LIST OF  
ALL THE SUBSTANCES USED IN  
YOUR FIXTURE, BY WEIGHT”



WINK/EYE-BANG HIM 55

2

5

3

6

7

8

LET'S PLAY:  
STUMP A SALEPERSON!

# Declare.

## Solid Timber Furniture Benchmark

**Final Assembly:** Kintbury, Berkshire, United Kingdom

**Life Expectancy:** 100 Years

**End of Life Options:** Salvageable/Reusable in its  
Entirety, Biodegradable/Compostable, Recyclable

### Ingredients:

**Timber:** Solid Timber (FSC/PEFC Certified);  
**Finishes:** Fatty Acids, Vegetable Oil, Polymers  
with Isophthalic Acid, Pentaerythritol,  
Trimellitic Anhydride and Trimethylolpropane,  
Naphtha (Petroleum), Hydrotreated Heavy,  
Candelilla Wax, Carnauba Wax, Paraffin Waxes  
(Petroleum), Hydrotreated, Fatty Acids,  
Soya, Polymers with Hydroxy-terminated Me  
Ph Siloxanes, Pentaerythritol and Phthalic  
Anhydride; **Wood Glue:** PVA Emulsion Polymer,  
Water; **Fixings:** Steel

### Living Building Challenge Criteria:

BUK-0001

VOC Content: N/A

EXP. 01 NOV 2020

VOC Emissions: CDPH Compliant

### Declaration Status

- ☒ LBC Red List Free
- ☐ LBC Compliant
- ☐ Declared

MANUFACTURER RESPONSIBLE FOR LABEL ACCURACY  
INTERNATIONAL LIVING FUTURE INSTITUTE™ [declareproducts.com](http://declareproducts.com)



WINK/EYE-BANG HIM 55

2

5

3

7

LET'S PLAY!  
STUMP A SALEPERSON!  
\*\*BONUS ROUND\*\*

# Environmental Product Declaration



In accordance with ISO 14025 for:

**OVO Table Collection**

from

**BENCHMARK**

Programme:

Programme operator:

EPD registration number:

Publication date:

Valid until:

The International EPD® System, [www.environdec.com](http://www.environdec.com)

EPD International AB

S-P-01957

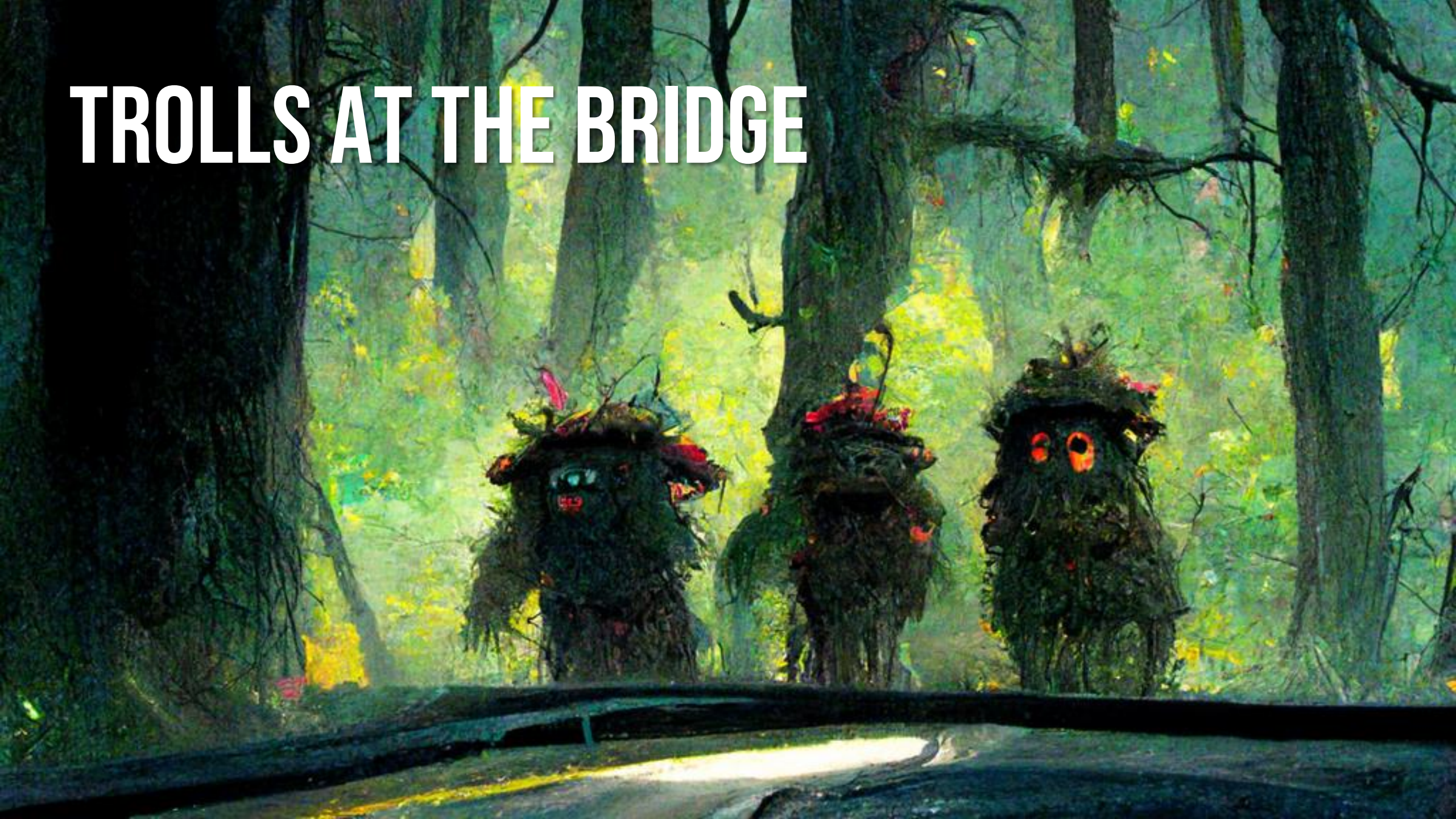
2020-06-09

2025-05-27





# TROLLS AT THE BRIDGE





**HEY ALEXA, I NEED A  
SUSTAINABLE LIGHTING SPEC...**









# NAKED ACCOUNTABILITY



**NOT A PROBLEM IF YOUR FIXTURE IS  
DESIGNED TRULY SUSTAINABLE!**



A close-up photograph of a hand with a silver ring on the ring finger, pointing towards a whiteboard. The whiteboard is covered with various colored markers (yellow, red, blue, green, purple) and small colored clips (red, blue, green, purple). The background is blurred, showing other people in a meeting setting.

**PERFECT IS THE  
ENEMY OF GOOD**





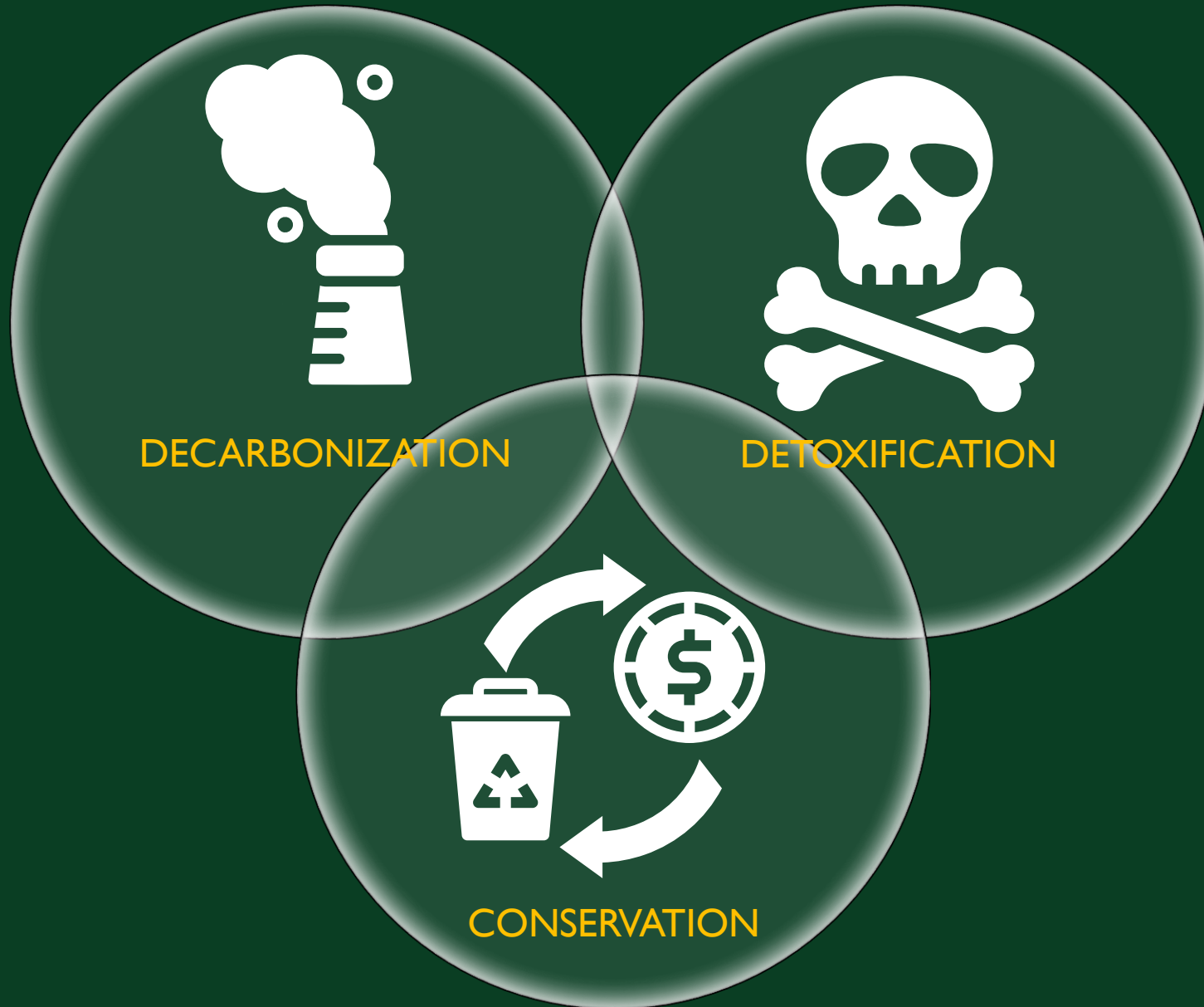




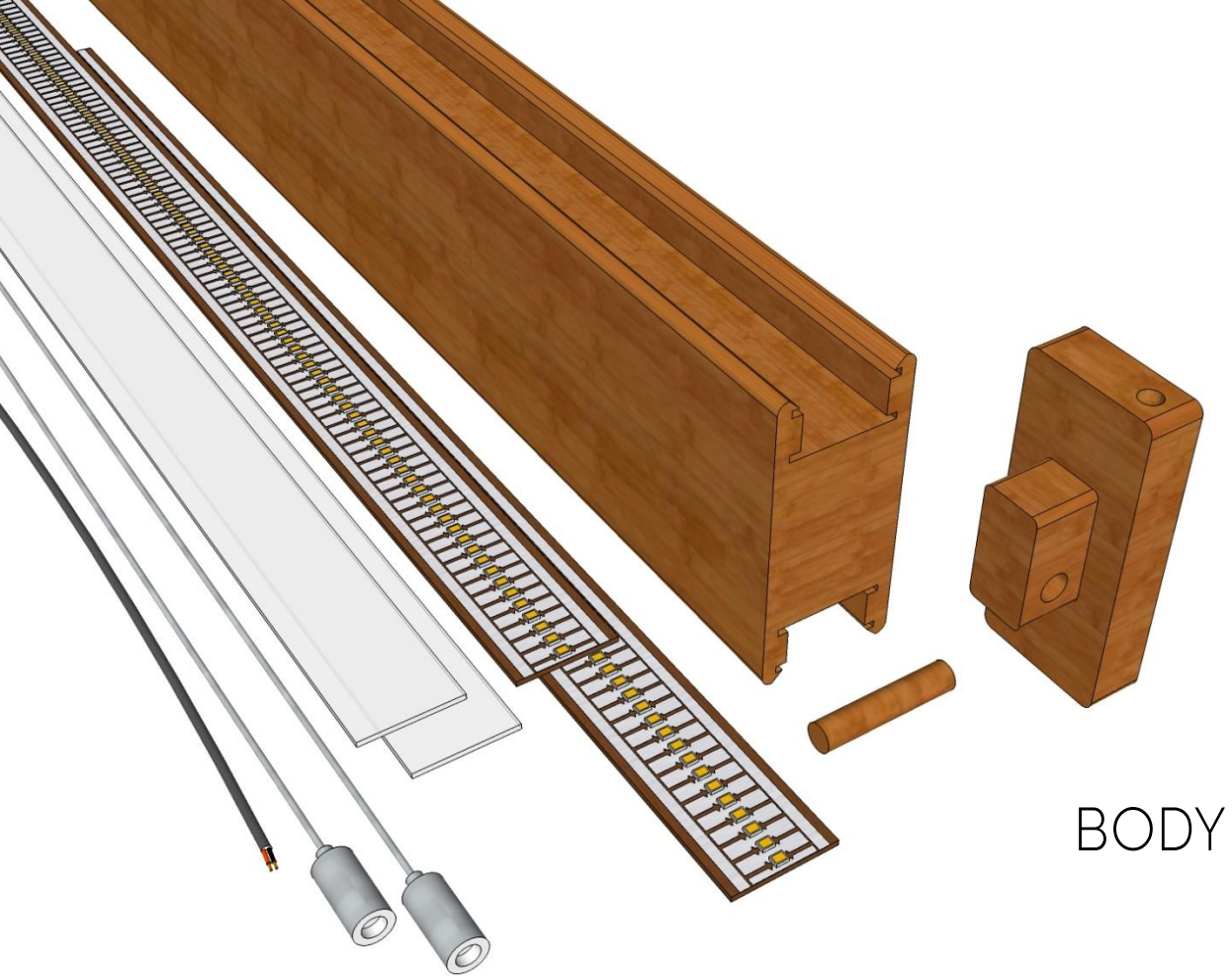












CARBON  
CAPTURE

CARBON  
EMISSION

BODY

LENS GLASS  
GLUE  
FINISH  
LED MODULE

DRIVER

POWER WIRE

CARBON NEUTRAL



# SUSTAINABLE DESIGN SPECIFICATION?



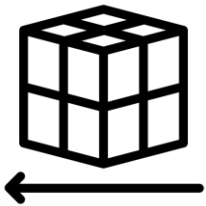
## SUSTAINABLE MATERIALS AND COMPONENTS:

**LOCALLY SOURCED** X **BIODERIVED** X **BIODEGRADABLE** X **DISTANCE TRAVELED**



## EFFICIENT RECYCLING

**LOW-LABOR DISASSEMBLY** X **DISTANCE TRAVELED**



## REDUCTION IN TRANSPORT WASTE:

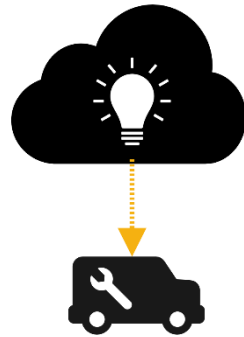
**MASS** X **VOLUME** X **DISTANCE TRAVELED**



# SUSTAINABILITY = LOCAL ADVANTAGE



**REPAIRABLE  
FIXTURES**



**SMART  
MAINTENANCE**



**BEAUTIFUL  
FACTORIES**



**BIO-FRIENDLY  
MATERIALS**



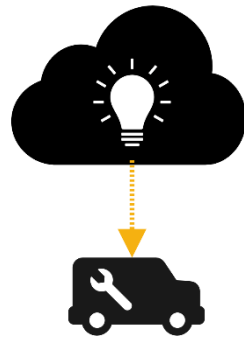
# SUSTAINABILITY = LOCAL ADVANTAGE



**REPAIRABLE  
FIXTURES**

---

**LOCAL SERVICE REVENUE STREAMS**



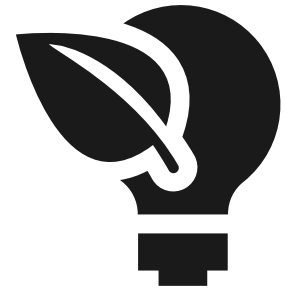
**SMART  
MAINTENANCE**



**BEAUTIFUL  
FACTORIES**

---

**LOCALIZED SUPPLY CHAIN**



**BIO-FRIENDLY  
MATERIALS**



**WHERE'S THE REPS?**

**THINK GLOBALLY, ~~ACT~~ INVEST LOCALLY**





A person wearing a blue uniform and a light-colored cap is seen from behind, reaching up to work on a ceiling light fixture. The person's hands are visible, touching the fixture. The background shows a ceiling with several rectangular light panels and some wiring. The overall image has a semi-transparent grey overlay.

**WHAT ABOUT LIFECYCLE SOLUTIONS?**



# LIGHT-AS-A-SERVICE?

- LEASING PLANS
- PAY-PER-LUX BILLING
- PREDICTIVE MAINTENANCE/IOT
- PLANNED PERFORMANCE UPGRADES
- TAKE-BACK PROGRAMS
- CONTRACTS FOR TOTAL LIFECYCLE COSTS





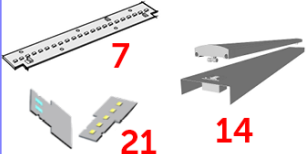
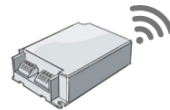


**IF YOUR LIGHTING FIXTURES WERE  
RETURNED AT END OF LIFE, WOULD THEY BE  
CONSIDERED “ASSETS” OR “LIABILITIES”?**

# REPAIRABLE LED FIXTURES?



Book 1-25  
Overview by application

	Office & Industry	Retail & Hospitality	Outdoor
Integrated LED light engines	 <b>14</b> <b>2,8</b>	 <b>17</b> <b>16</b>	
LED modules (non-integrated)	 <b>7</b> <b>21</b> <b>14</b>	 <b>12</b> <b>9</b> <b>5</b> <b>3,10</b>	 <b>4</b> <b>15</b> <b>19</b>
Drivers	 <b>13</b>	 <b>22,23</b>	 <b>24,25</b>
Sensor and communication modules	 <b>20</b>		 <b>18</b>



A low-angle, upward-looking shot of a dense bamboo forest. The bamboo stalks are tall, slender, and light green, with visible nodes. They are densely packed and reach towards the top of the frame. Sunlight filters through the canopy of green leaves at the top, creating a bright, airy atmosphere. The perspective makes the stalks appear to converge towards the top center.

**YOU HAVE THE POWER**





YOU HAVE THE POWER





**WHAT FUTURE ARE WE SPECIFYING TODAY?**



# STARTING YOUR OWN JOURNEY?



ELLENMACARTHURFOUNDATION.ORG

WILLIAM McDONOUGH

MCDONOUGH.COM



WWW.RECOLIGHT.CO.UK



LIGHTINGFORGOOD.ORG



BUILDINGTRANSPARENCY.ORG



CARBONLEADERSHIPFORUM.ORG



LIVING-FUTURE.ORG



MATERIALSPALETTE.ORG





# THANKS!

**BRAD.KOERNER @ GMAIL.COM**

**WWW.LUCEPT.COM**



ENLIGHTEN AMERICAS 2022

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IALD ENLIGHTEN'22

