10.016 SCIENCE FOR A SUSTAINABLE WORLD

Material Choice

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MAIN BODY

Frosted glass

- Waterproof
- Rigid to withstand vaccum and water pressure
- Translucent and textured finish to fit aesthetics of product
- Resistant to weather conditions

End of life analysis

- Completely recyclable
- Extremely durable, can be repurposed into tinted windows
- Doesn't lose quality over multiple recycling process
- Does not break down easily

Pollution

- Non toxic, made up of naturally occuring Silica dioxide, poses little concern about leachates into water bodies
- Mining of silica can cause significant damage to biodiversity and environmental damage
- More energy intensive to produce and recycle

Frosted acrylic

- Waterproof
- Rigid to withstand vaccum and water pressure
- Translucent and textured finish to fit aesthetics of product
- Resistant to weather conditions

End of life analysis

- Can be recycled, but often not recycled as it belongs to group 7 plastics
- Loses quality after recycling process
- Breaks down into microplastics

Pollution

- Derived from mostly fossil fuels and non-renewable sources
- Creates microplastic pollution, damaging on the ecosystem and health of all lifeforms
- Less energy intensive to produce and recycle

ROOF

Copper Sheet

- Subjected to similar conditions to roofs in conventional houses
- Resistant to rusting, surface oxidation (patina) is tightly bonded to the surface, avoiding further corrosion

End of life analysis

- Completely recyclable and doesn't lose quality over multiple recycling processes
- Easy recycling process through melting and molding to repurpose into copper wires
- Recovery of leached copper uses electrowinning process that extracts copper from aqueous solutions

Pollution

- One of the most mined metals in the world: Copper mining, smelting and production process produces toxic water and waste residue (leachates)
- Copper ions in water will distrupt metabolic processes of animals, severely impacting biodiversity and the ecosystem

STAND

Concrete

- Resistant to corrosion underwater
- Strong and durable to withstand the weight of product and pressure being underwater

End of life analysis

- Completely recyclable
- Inert substance, does not emit toxic compounds
- Complexed recycling process that requires specialised machines

Pollution

- Long life cycle of ~50 years: reduces generation at the start.
- Raw materials are readily available and will not run out
- Mining for raw materials such as limestone causes soil erosion
- Water intensive to produce

LIGHTING

LED

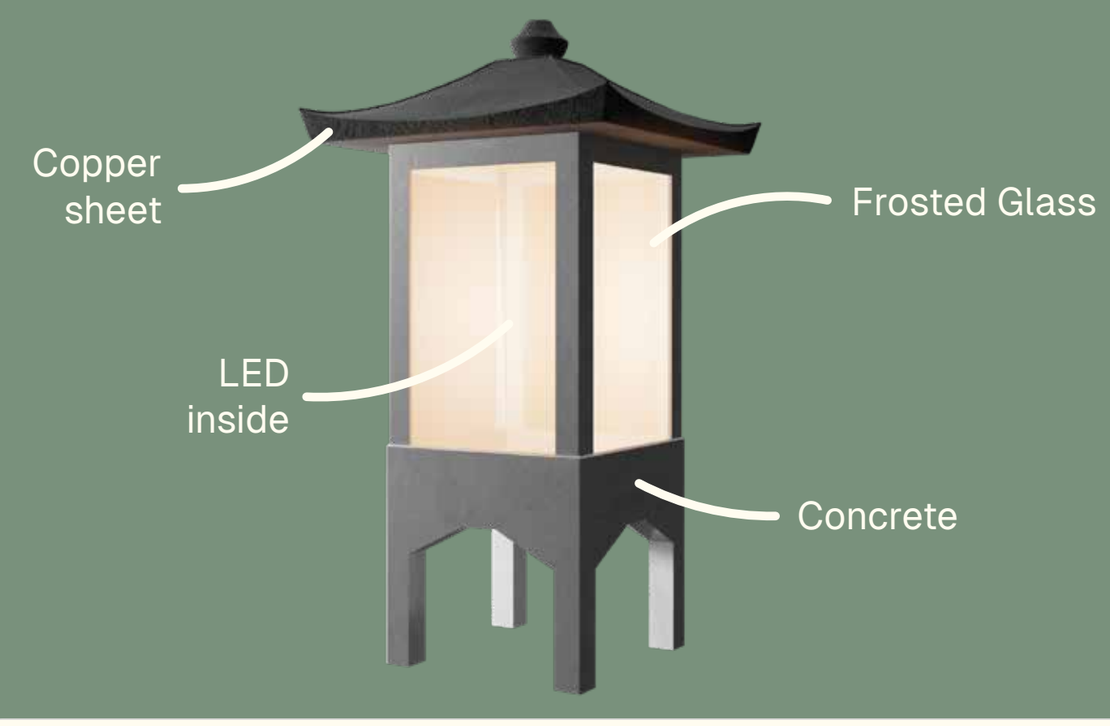
End of life analysis

- Can be recycled, however, requires disassembly into glass and rare earth metals such as indium and gallium
- Repurposed into commercial light bulbs
- High durability than halogen: abscence of filament cause it to be more resistant to vibration and stress
- Higher life expectancy than halogen: ~15 years vs ~2 years
- More energy efficient: uses 85% less energy
- Dimmable to control lighting effects of product

Pollution

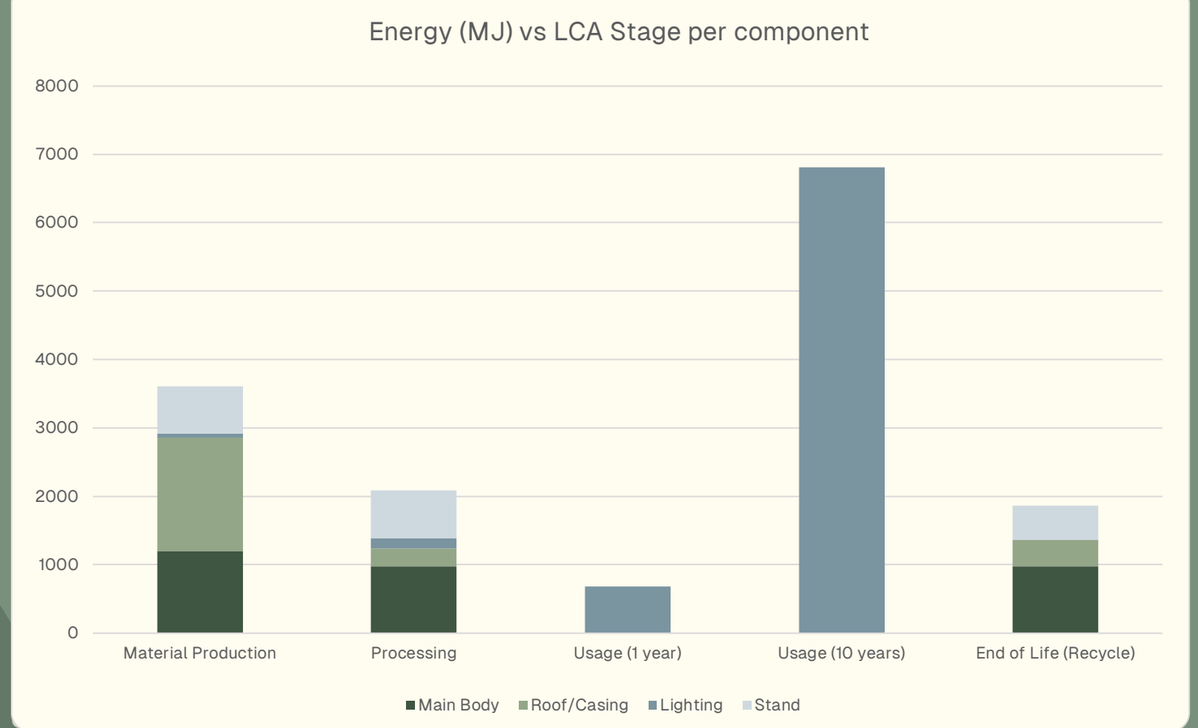
- Extremely long usage lifespan ~15 years: reduces generation at the start (Very significant reduction in consumption)
- Requires significant energy to recycle due to the disassembly and sorting ofthe different materials

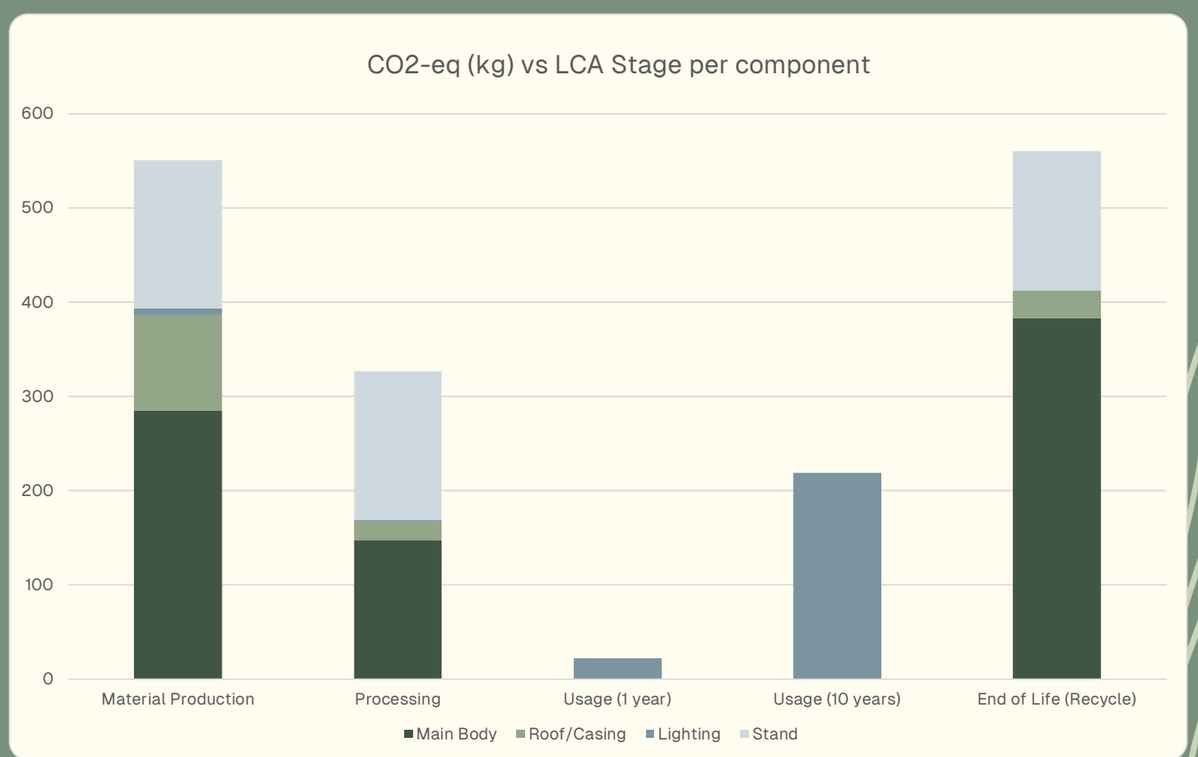
Render with material choices



Life Cycle Analysis (LCA)

***Recovery not included as materials cannot be incenerated to generate electricity**





Overall Analysis

1. The life cycle of our product is limited by the life cycle of LED (~10-15 years)
2. The lighting needs the least amount of resources, energy and carbon footprint but requires the most amount of energy when using it to the fullest life cycle (10 years).
3. The most significant amount of energy is used up when our product is in use (in 10 years), however, we should still continue to prolong the usage time or repurpose the materials as the production and processing energy is equivalent to 10 years of usage.
4. Since recycling requires almost as much energy and carbon emissions as other stages of LCA, it is not the most environmentally sustainable option, and reusing/repurposing the components after their end of life is more effective.
5. All of our materials (other than plastic parts of LED) cannot generate energy in WTE plants for recovery, thus these materials are best repurposed/reused.

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