



Goal and scope:

The goal is to leverage on the hostel park to create a space where busy students can go to relax and de-stress while aiming to achieve maximum sustainability. The aim is to produce the solution with minimal footprint of energy consumption and CO₂-eq generated. The aim is also to run the product with zero-carbon footprint after completion **using light**.

Power consumption estimate:

For a total of 12 hours...

Gazebo Lights

5 45W LED Spotlights

9.72 x 10⁶J energy consumed

7.38 W per m

20 m LED Light Strips

6.38 x 10⁶J energy consumed

Surrounding Lights

20 15W LED lights

1.3 x 10⁷J energy consumed

Motor

For a total of 5 hours / day

1 2kW motor energy

3.6 x 10⁷J energy consumed

Water pump

4.32 x 10⁷J energy consumed

Energy generated by 1 solar panel / day: (about 2kWh)

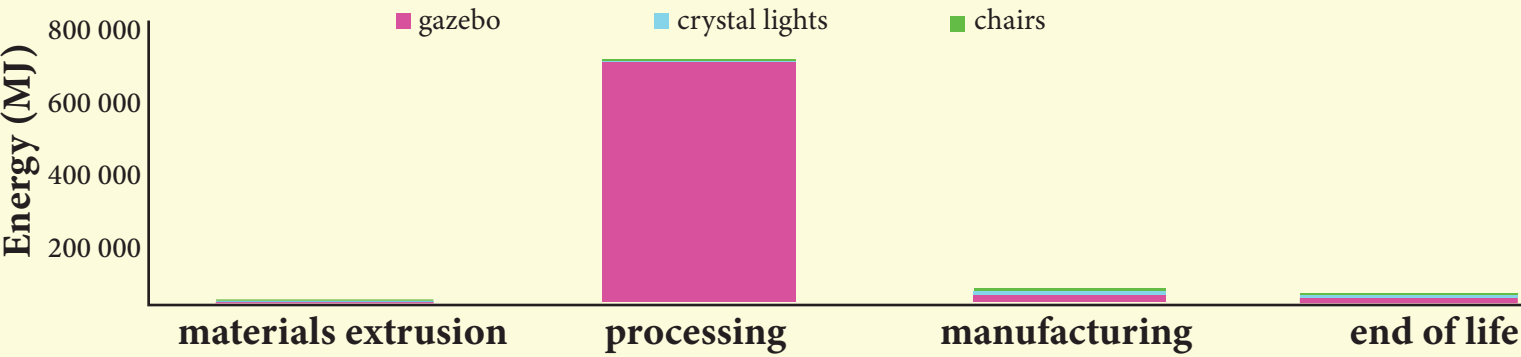
7.2 x 10⁶ J

Total energy consumption /day = 1.08 x 10⁸ J

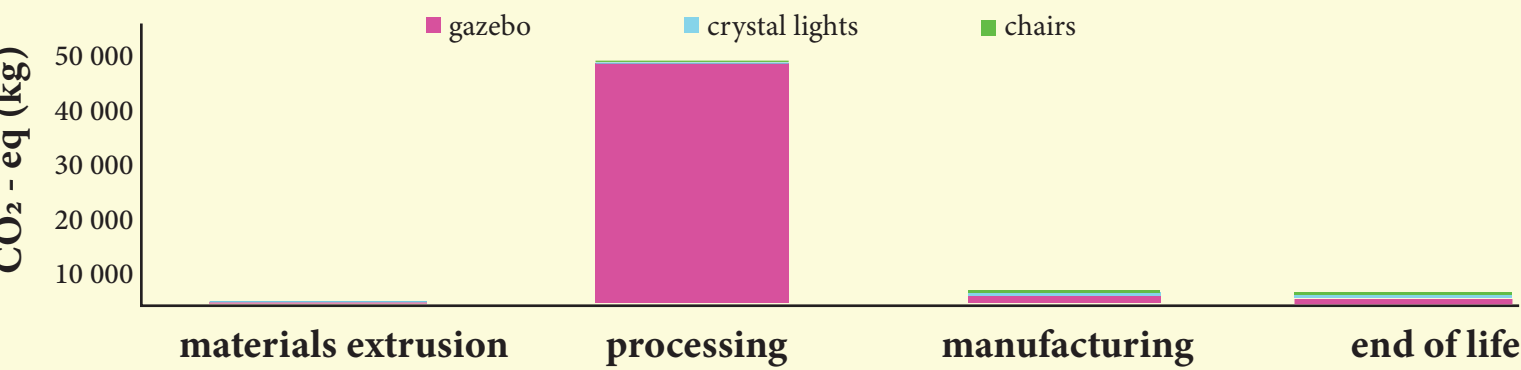
Minimum no. of solar panels needed = 16

Graphs :

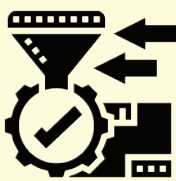
Energy (MJ) vs LCA stage per component



CO₂-eq emitted (kg) vs LCA stage per component



Interpretation / Overall analysis:



1. Highest energy & CO₂ consumption process

Material processing for the components of the product generates the highest footprint of energy consumption and CO₂ production



2. Feasibility

The production of the gazebo is the most footprint-intensive of out product, suggesting we should find alternatives to low carbon steel for the body of the gazebo



3. Most footprint-intensive product

The solution has to run on highly energy efficient electrical components to achieve the goal of powering the product with zero-carbon footprint and reduce energy consumption



4. Sustainability

The gazebo should be built in a way that the components can be easily disassembled to facilitate the recycling process when the components are coming to their end of life. The components can then be reused or recycled after it serves its purpose

Material analysis:



1.POLYCARBONATE
(Dome roof of Gazebo & body of floor crystal):

Choice of material :

Polycarbonate is relatively cheaper and durable to high impact

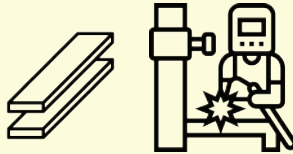
End of life analysis :

Polycarbonate is typically derived from petroleum or natural gas feedstocks, both of which are non- renewable resources. The extraction and processing of these fossil fuels can contribute to habitat destruction, air and water pollution, and greenhouse gas emissions

Environmental impacts / Pollutions :

Polycarbonate is recyclable, and recycling it can significantly reduce the environmental impact compared to disposal in landfills or incineration. However, polycarbonate may contain additives such as bisphenol A (BPA), there may be concerns about the leaching of these chemicals into the environment.

2. LOW CARBON STEEL
(Main structure of Gazebo):



Choice of material :

Low carbon steel is highly weldable due to its lower carbon content, which reduces the risk of cracking during welding. It also exhibit good ductility and is versatile. It is corrosion-resistant and has high strength.

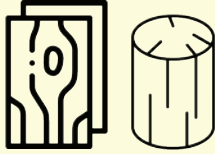
End of life analysis :

Low carbon steel is highly recyclable. Proper disposal or recycling of low carbon steel products minimizes the amount of waste sent to landfills or incinerators, thereby reducing the potential for environmental pollution and habitat destruction associated with waste disposal.

Environmental impacts / Pollutions :

The production of low carbon steel requires the extraction of iron ore, which involves mining activities. Mining can result in habitat destruction, soil erosion, deforestation, and disruption of ecosystems, leading to loss of biodiversity and habitat fragmentation. Steel production is also energy-intensive, requiring significant amounts of electricity and fuel.

3. PLYWOOD
(Chairs in Gazebo):



Choice of material :

Plywood is engineered to be strong and stable. Plywood is less susceptible to changes in temperature and humidity. Despite its strength, plywood is relatively lightweight, making it easier to handle, transport, and install compared to solid wood or other building materials. Plywood is also relatively cheaper to produce.

End of life analysis :

Plywood can be recycled by processing it into wood chips or fibreboard for use in other wood products or as fuel for energy generation. Ply wood may be salvaged and reused in its original form or repurposed for other applications, such as furniture making, craft projects, or construction materials. Plywood is a biodegradable material composed primarily of wood fibres and adhesives

Environmental impacts / Pollutions :

Plywood is made from sustainable and renewable wood sources, and many manufacturers adhere to responsible forestry practices. Additionally, plywood production generates less waste compared to other wood processing methods, as it utilizes smaller and lower-grade wood pieces that might otherwise go unused.