PASSIVE SOLAR DESIGN

This research covers the basics of passive solar design and how it increases energy efficiency. Buildings consume 40% of the total energy use worldwide, and it could easily increase if no energy efficient matters are taken. Passive solar design is an affordable way to help buildings be more energy efficient and harness the energy of the sun. Building design is more important to energy efficiency than technology in the buildings, and this is critical to think about in the design phase. Passive solar design is able to increase daylighting, heating, and also passive ventilation and cooling. Green roofs are also a large supplement to passive solar design. Overall, passive solar design reduces heating, cooling, and electrical needs of the building and reduces the building's carbon footprint.

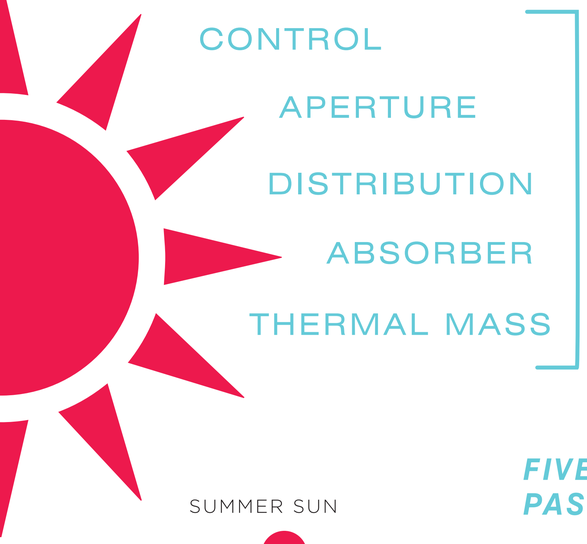
For part of this research, a conceptual building was designed in Maui, Hawaii. The building features large overhangs, a green roof, daylighting potential, and optimal positioning for the site. The structure also features permeable pavement for the road and for the parking area to allow better water management of the site. Xeriscaping was used in the landscaping of the design. Material selections of the building were also taken into account. This includes durability, local sourcing, and life-cycle analyses of the materials.

QUESTION:
How is it possible to reduce energy costs by utilizing the building design?

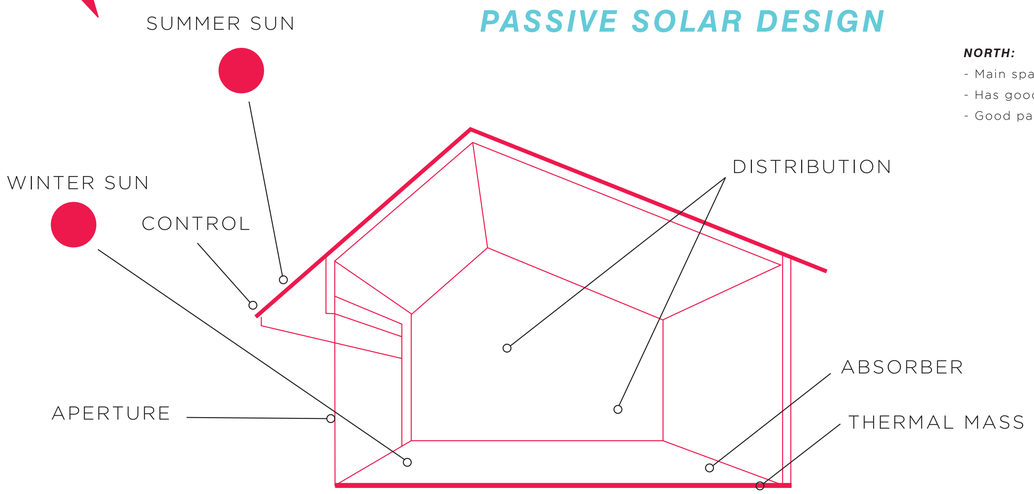
PROCESS:
By studying green building principles and becoming a LEED Green Associate, many factors for green building design have been taught to the Interior Architecture & Design class. Through learning these principles first hand, I was able to utilize some of this knowledge in designing a passive solar building for Lahaina City in Hawaii. The process started by sketching out ideas of what the building could look like and by emphasizing certain energy-efficient features for the building. This building contains overhangs on the south side for sunlight control in the summer months, as well as apertures and the ability of the windows to distribute light into the space in the winter months. Bronze rainscreen walls on the interior help absorb some of the energy and retain thermal mass. The sunlight that enters the interior space from the apertures distributes heat and energy at a more continuous rate.

FINDINGS:
Through secondary research, I have discovered that passive solar heating of buildings is a dynamic process. Solar energy is transmitted through glazing and then absorbed by the interior building components and released to the indoor air over time. Building design above technology is a relatively inexpensive way to reduce energy costs for buildings. By reducing the energy consumption of buildings, you lay the foundation for a more sustainable and regenerative society.

WELCOME CENTER DESIGNED IN LAHAINA, MAUI, HAWAII



FIVE ELEMENTS OF PASSIVE SOLAR DESIGN



SOUTH:
- Glazing
- Overhangs
- Openings into interior spaces
- Windows should face within 30 degrees of true South
- Provide window shades to avoid overheating

NORTH:
- Main spaces should be north facing when possible
- Has good daylight most of the day
- Good passive solar gain most days of the year

EAST:
- Elongate design along the East/West axis for more energy efficiency
- Best light in the morning
- Thick thermal mass for the floor will soak up solar heat

WEST:
- Avoid large windows or openings to reduce heat gain
- Avoid putting entrances to buildings on the west
- Ensure materials can take extensive heat and sun damage