Chapter five

Technical solutions

Structure Plan: -

System One: -

Beam and post steel system

System Two: -

Steel arched beams covered with cladding

System Three: -

Main space-truss arch supported by horizontal bands and sloped
Trusses to support curtain wall (8 meters between each one).

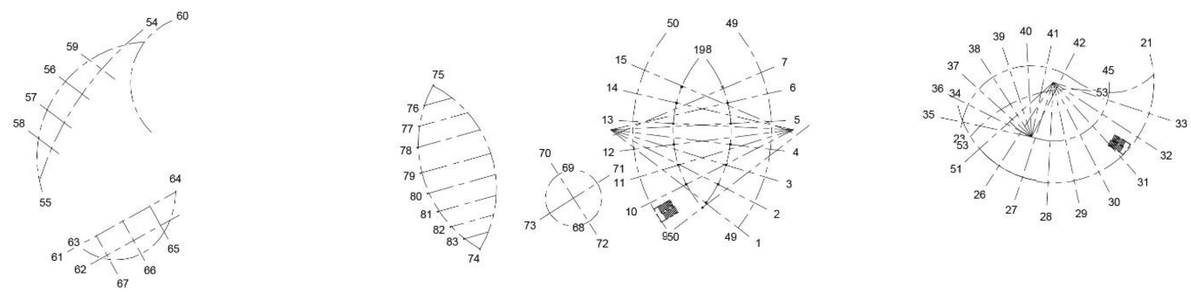

FIGURE 5-1: STRUCTURE PLAN

Structure Plane: -

large greenhouses supported by a mega-structure main arch which provides stability to the whole structure. It is equipped with horizontal band-truss which provides lateral stability & integrity to the whole structure. Slopped vertical trusses connected to the main arch support the curtain walls as well as resistance to wind.

FIGURE 5-2: DETAIL ONE

FIGURE 5-3: DETAIL TWO

FIGURE 5-4: DETAIL THREE

Beam and post steel system

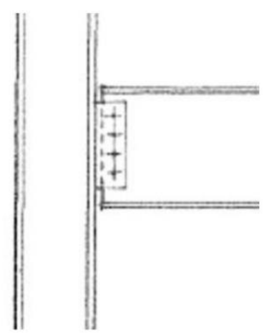

FIGURE 5-5: STRUCTURE SYSTEM DETAIL A

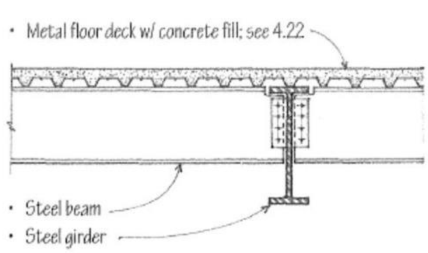

FIGURE 5-6: STRUCTURE SYSTEM DETAIL B

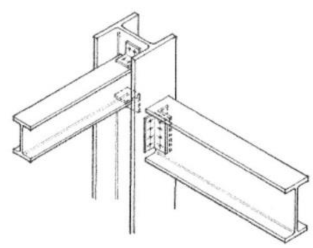

FIGURE 5-7: STRUCTURE SYSTEM DETAIL C

Floor Finishing in Reception: -

*60*60*2 cm dark beige marble tiles 2cm mortar C/S1:6 plate 2cm thickness shear connects plates by welding reinforced concrete slab 15cm plate 2cm connected to column by bolts.

Floor Finishing Inside the Conf-Hall: -

Turkish dark red carpet
carpet glue 2cm plain concert 1:3:6

Chairs: -

hall chair moving angle 180 upholstered with genuine dark gray leather, installed on ground by legged ferrous as poles pinned down by reinforced concrete.

Walls Finishing Inside the Conf-Hall: -

walnut dark brown wood panels 1cm
wood support 5*5 sound insulation polyethylene 3 cm
screed C/S 1:6 mix red brick wall 20 cm thickness
screed C/S1:6 mix light brown paint

Bathrooms Finishing: -

20*20*2 cm ceramic tiles
2cm mortar C/S 1:6 D.P.C 3 faces layer 0.6cm thickness reinforced concrete flat slab 1:3:6 shear connectors connected to plate by welding plate 2 cm

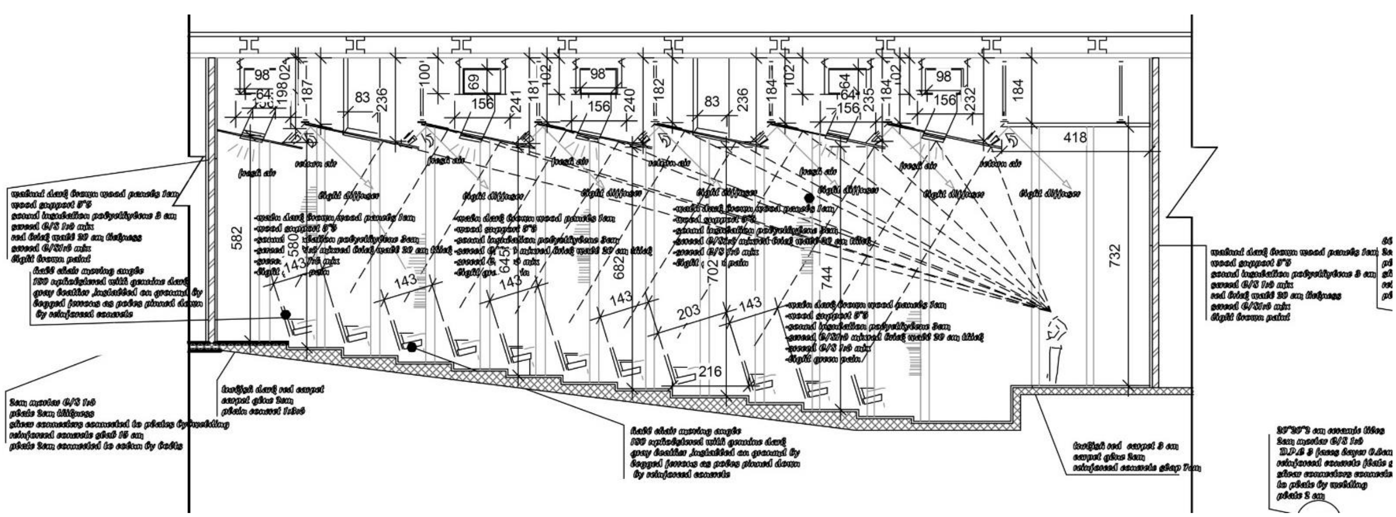

FIGURE 5-8: CONFRENCE HALL PART SECTION

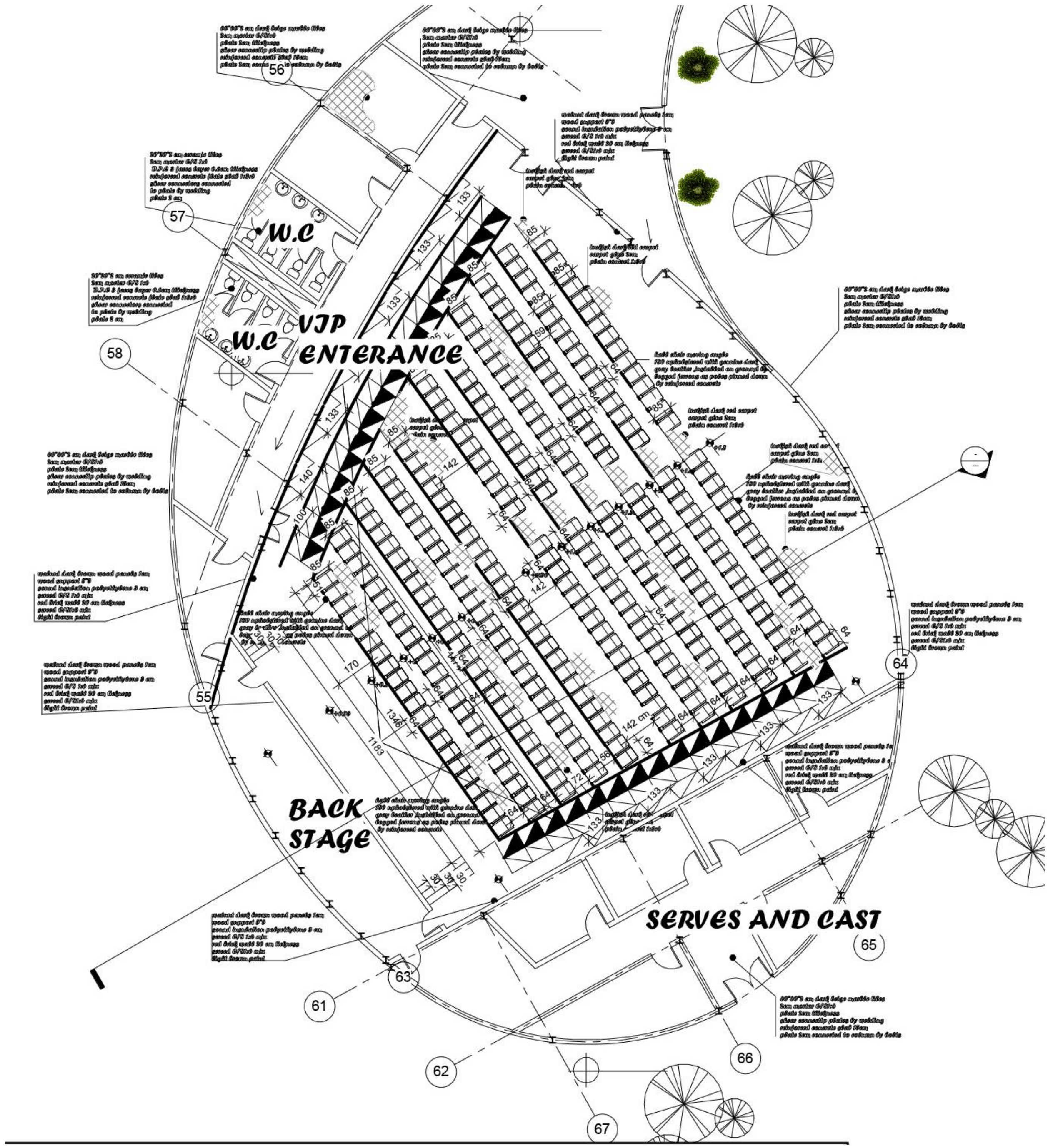

FIGURE 5-9: CONFRENCE HALL PART PLAN

Green House: -

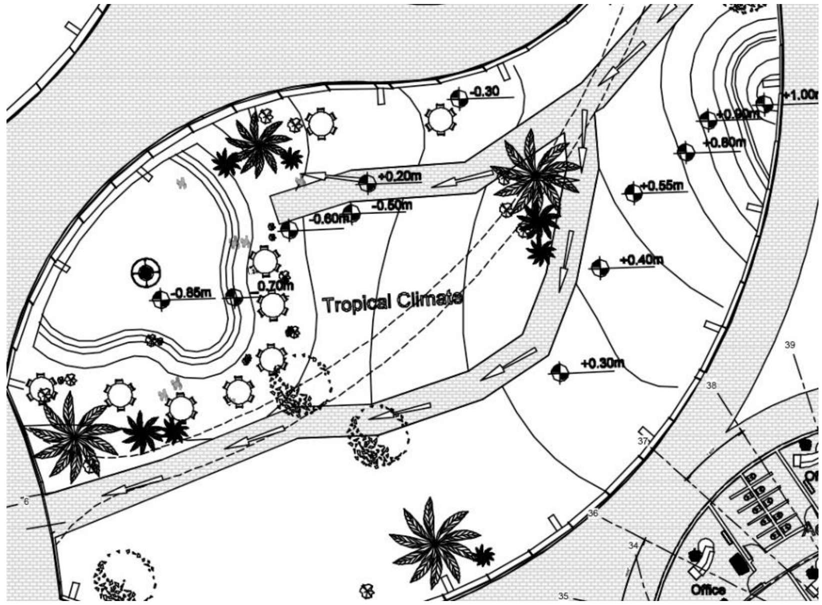

FIGURE 5-10: GREEN HOUSE PART PLAN

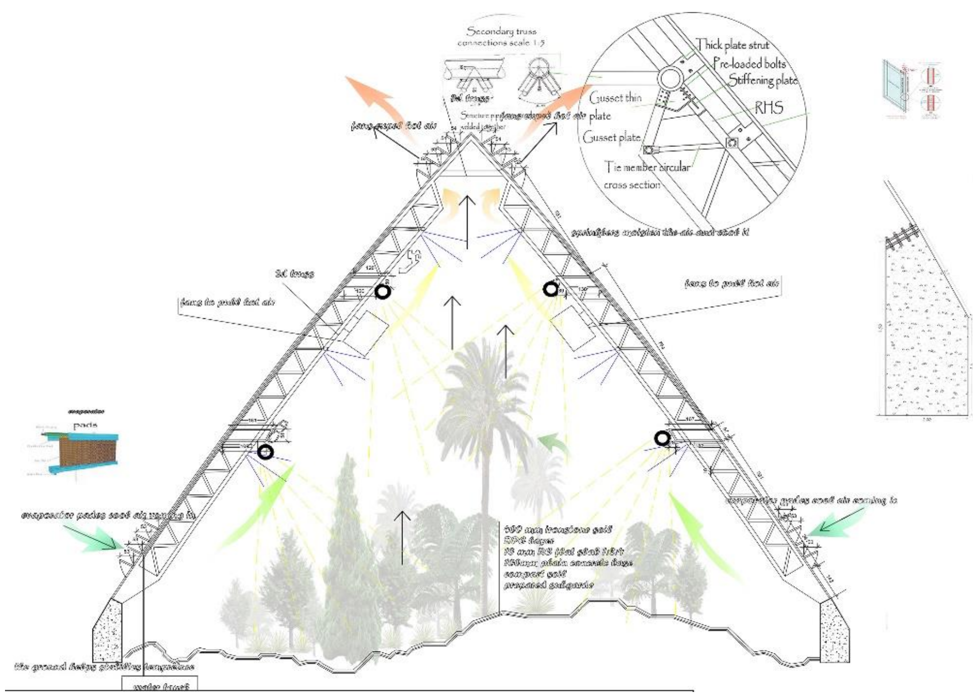

FIGURE 5-11: GREEN HOUSE PART SECTION

Water System: -

water drainage based on sustainability design theory by recycling the wasted water and use it again for plant irrigation by stp system.

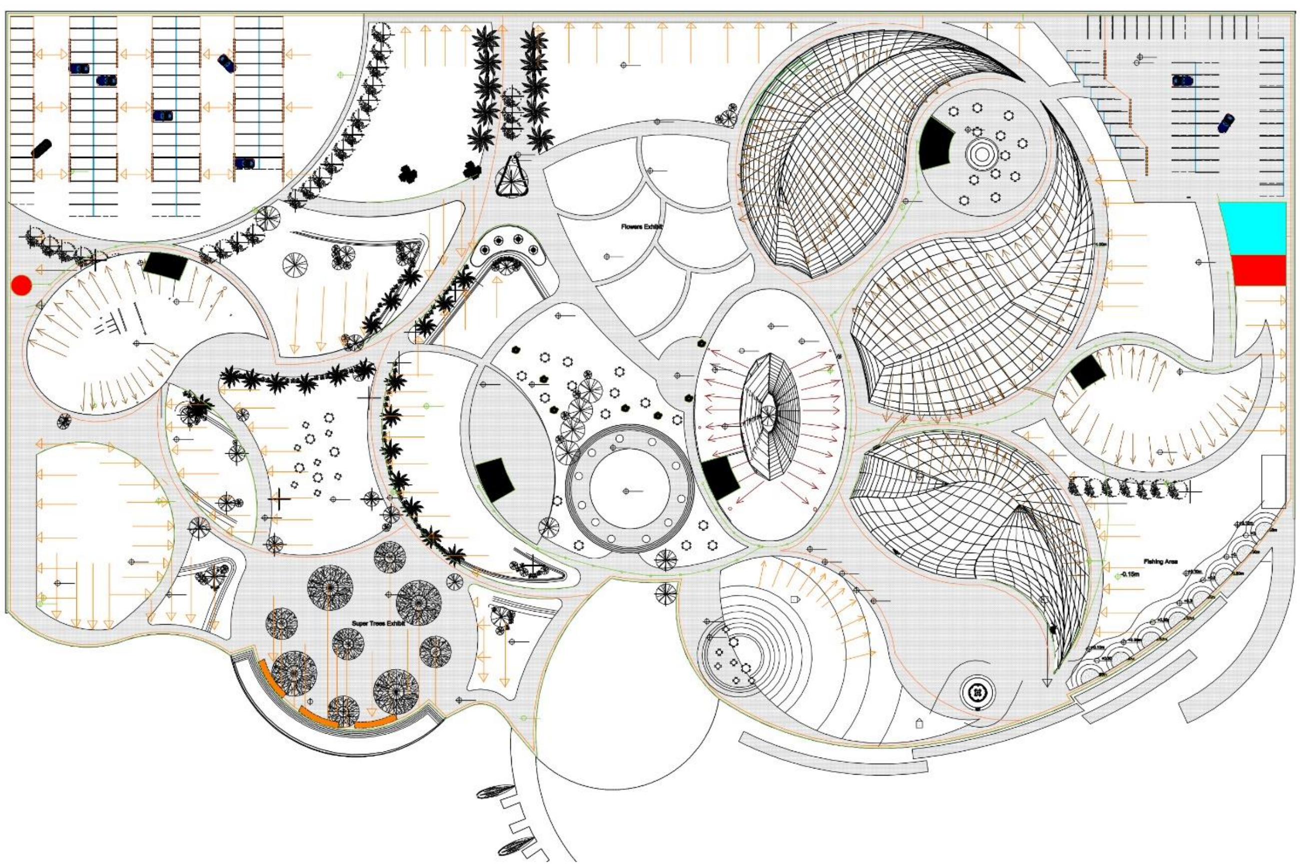

FIGURE 5-12: DRAINGE SYSTEM

Electric System: -

the main concept of the electric system in the building based on generating electricity from available sources using: -

- the solar panels on the top of the super trees
- the biomass boiler
- the urban distribution of electricity

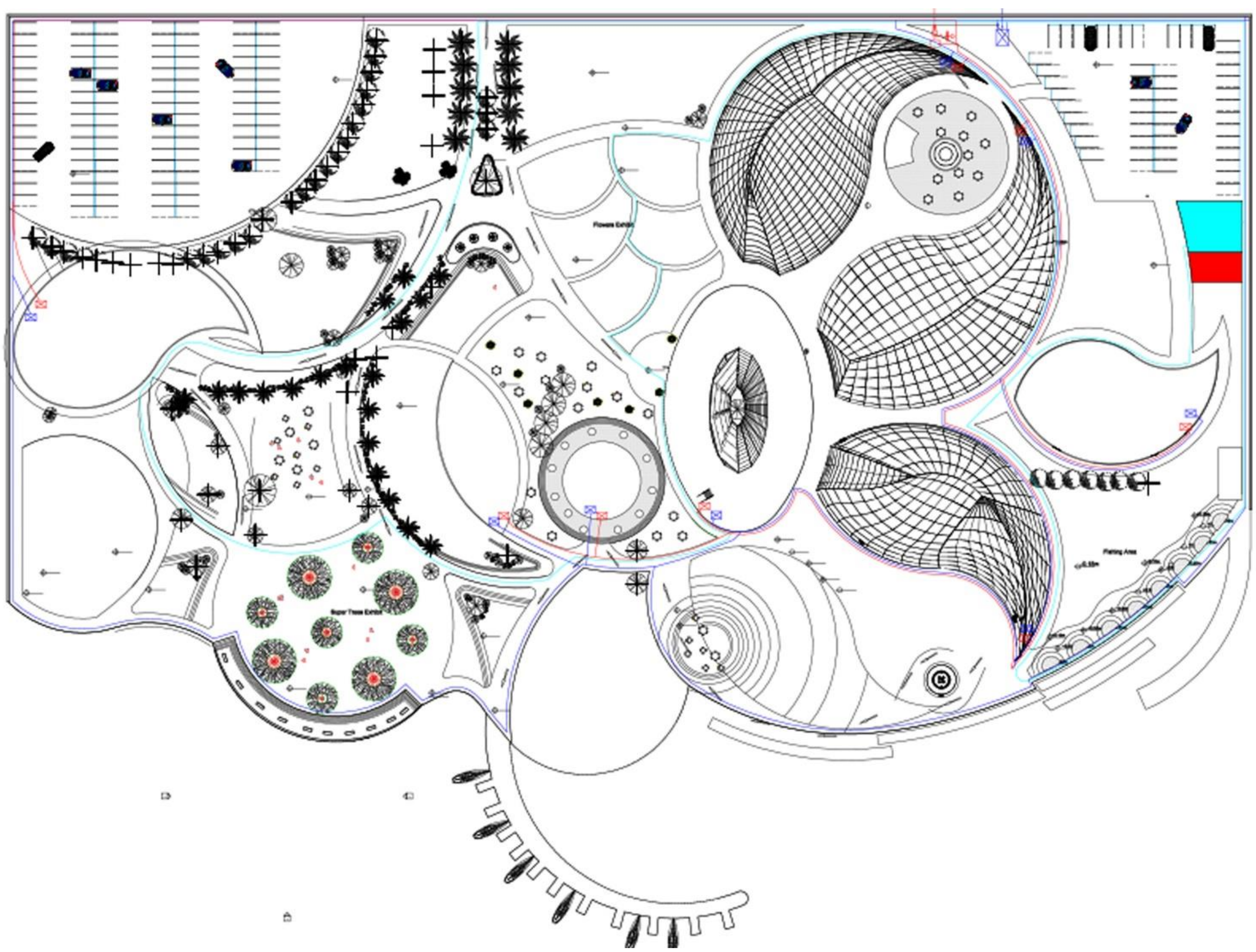

FIGURE 5-13: WATER& Electricity System

Site eco System Section: -

Main components: waste treatment area that has biomass burner, filter ponds, energy center that controls the greenhouses and the super trees that produce energy and exhaust flue gases

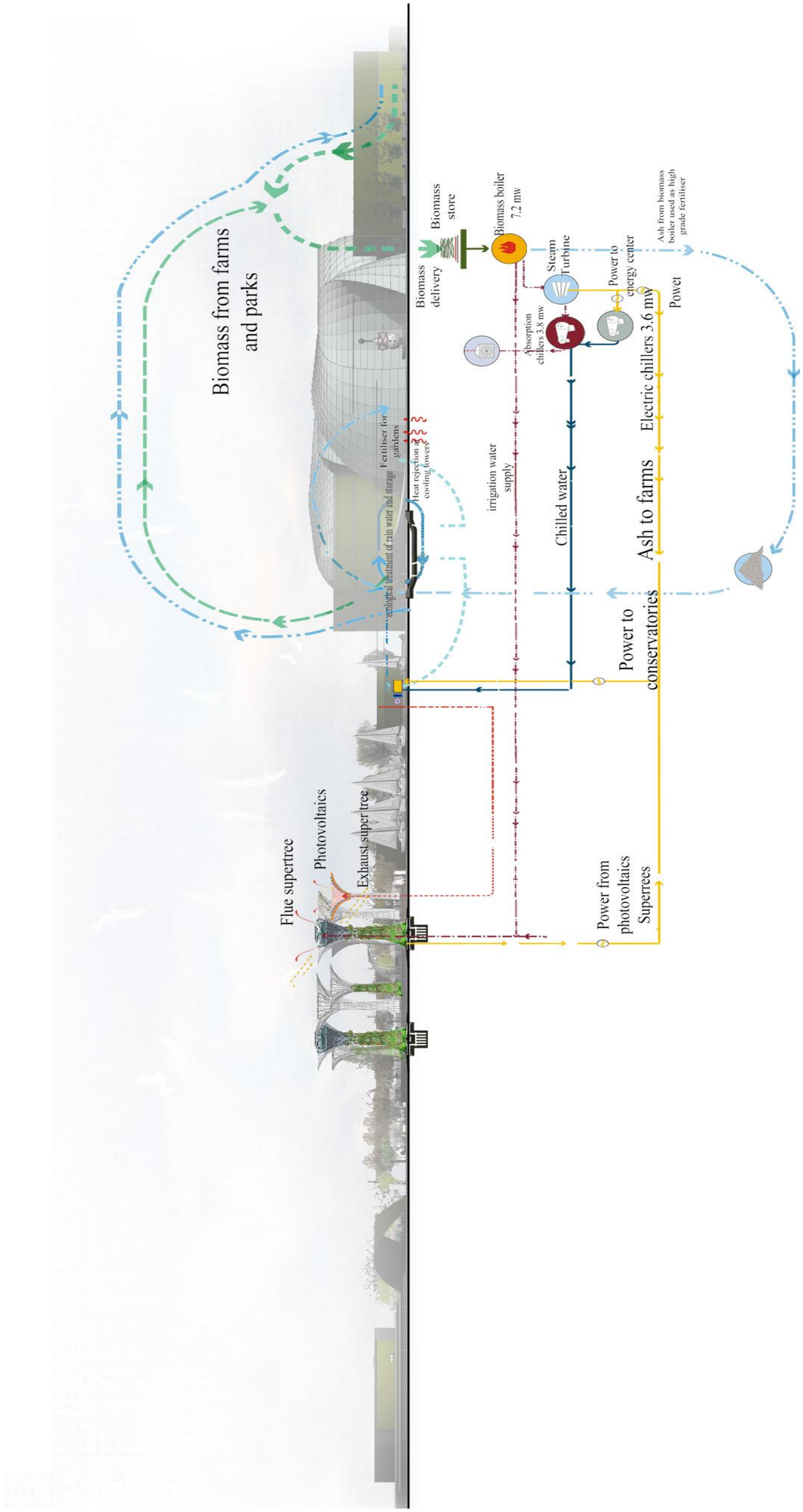

Figure 5-14: Site eco System Section

1.Biomass Boiler: -

Human and plants waste is collected and burned at a biomass burner in the waste treatment area, energy produced is sent to the energy center while the flue is ejected from the super trees.

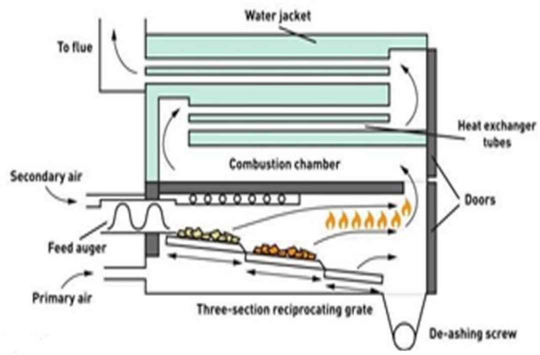

Figure 5-15: Biomass Boiler

2. Filter Ponds: -

Storm water and sewage water is filtered at the filter ponds, sludge is used as a fertilizer and water used for irrigation.

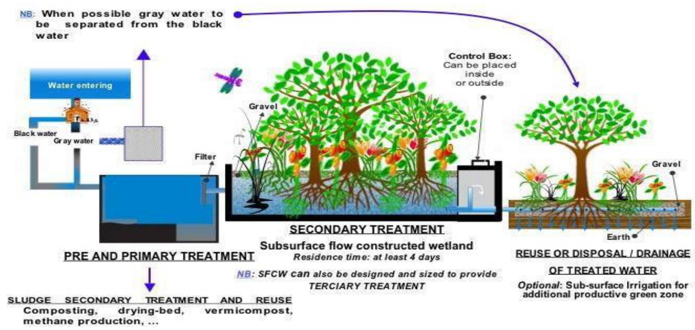

Figure 5-16: Filter Ponds

3 .Super Trees: -

The super trees are made of hollow tube concrete columns that are covered with wall panels to give it a fan shape, then its is covered with metal rods to mimic tree branches and finally planting panels to hold the vines. Solar panels are fitted on the core head. Their heights range from 25-50 m and some function as exhaust for flue while others generate power and collect water. They are also fitted LED lights that glow at night.

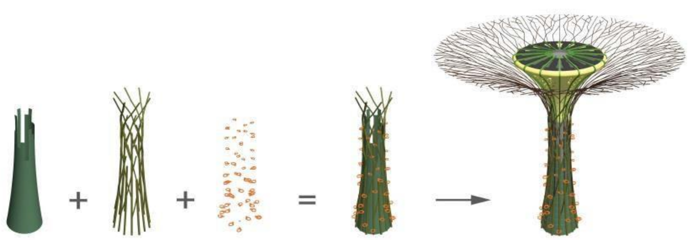

Figure 5-17: Super Trees

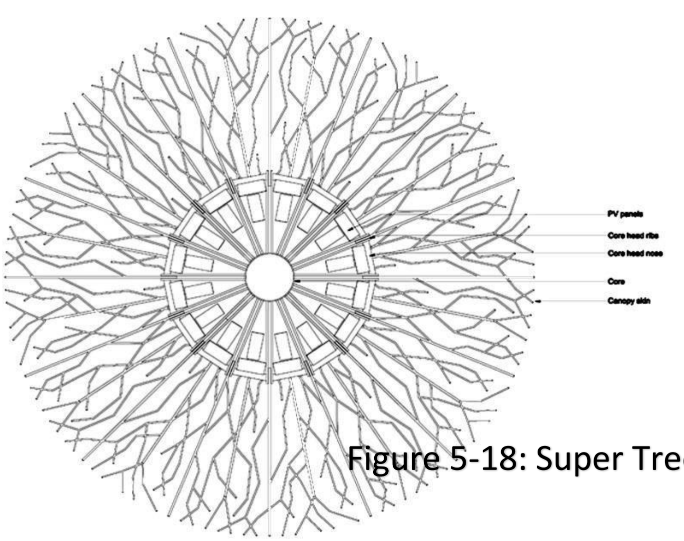

Figure 5-18: Super Tree plan

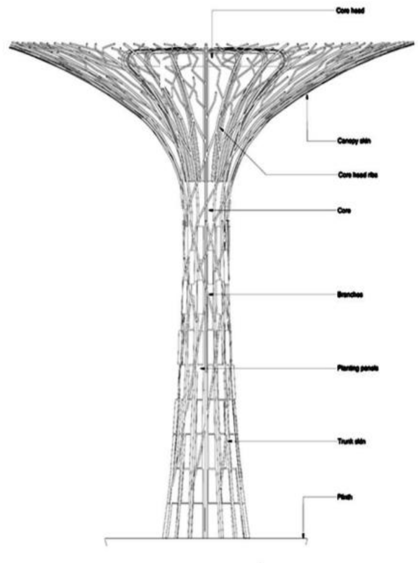

Figure 5-19: Super Tree elevation

Section :the foundation is made of concrete piles that range depending on the height of the super tree

Figure 5-20: Super Tree section

4. Energy: -

Energy comes from biomass boilers, super trees and the main electric grid if needed. The energy center houses the chillers, coolers, heaters and water tanks to control the temperature, humidity and sun radiation in each exhibit by controlling:

5. Smart Glass: -

Is naturally opaque but becomes transparent when a current run through it, the control system decides the transparency depending on the radiation neede

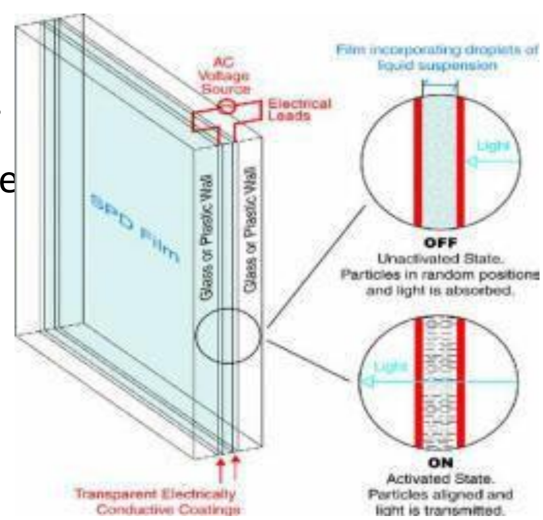

Figure 5-21: Smart Glass

6. Evaporative Cooling Pads: -

Straw pads fixed with fans cool the air entering the exhibit by increasing its humidity.

(look at part section)

evaporative pad mechanism

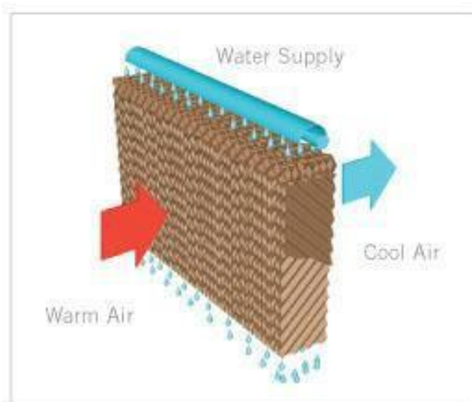

Figure 5-22: Evaporative Cooling Pads A

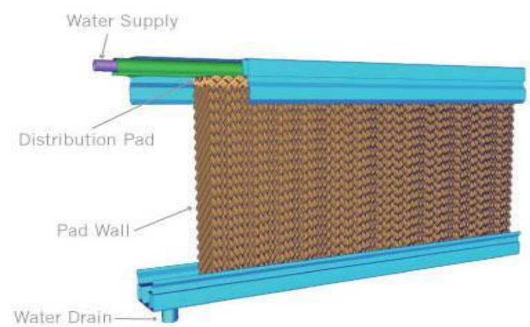

Figure 5-23: Evaporative Cooling Pads B

7. Hot Air Vents and Fans: -

hot air rises because it is lighter than cold air . Fans at the top of the exhibit help suck the hot air out to speed up the process.

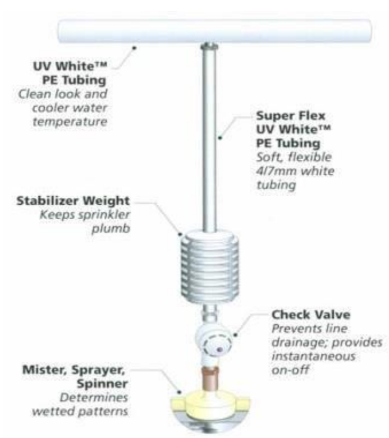

Figure 5-24: Fog and Mist System

8 .Fog and Mist System:

sprinklers fixed near the plants and visitors coo l the air by increasing the humidity. Water is supplied from the ground tank.

Hydronic Radiant Floor Cooling: -

Why Did I Choose this System?

Cooling the exhibits' entire huge air volumes would be a waste when it is only needed at the visitor level: So cooling from below is more sustainable.

Figure 5-25: Hydronic Radiant Floor Cooling

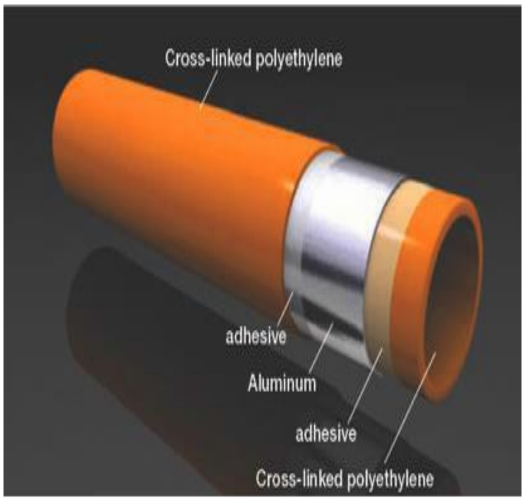

Figure 5-26: Hydronic Radiant Floor Cooling Detail A

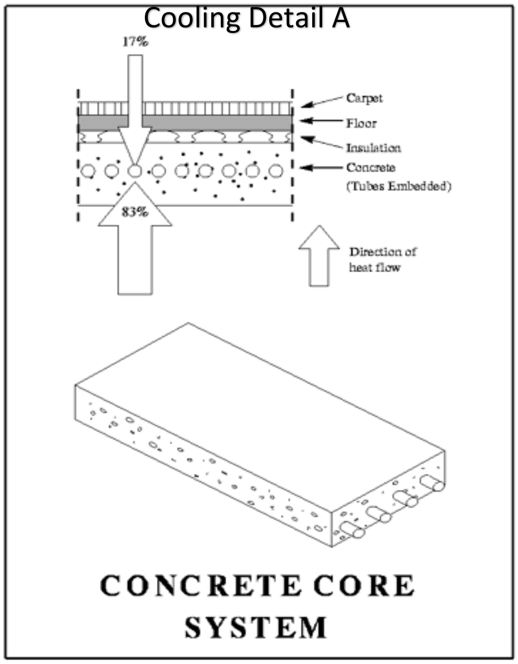

Figure 5-27: Hydronic Radiant Floor Cooling Detail B

System Details: -

- It is an air-water system that uses plastic tubes full of cold water embedded in the concrete to cool the floor and surrounding area (concrete core system). Water is cooled using a cooling tower at the roof and chiller at the basement in the HVAC room.
- It separates the tasks of ventilation and thermal space conditioning by using the primary air to fulfill the ventilation requirements and the secondary water system to thermally condition the space; it reduces the amount of air transported.
- The entering chilled water temperature should be above the room dew point, by at least 1.5 K to allow for control tolerance, in order to avoid any possibility of condensation forming on the cooling surfaces. Typically, chilled ceiling systems have a flow water temperature of 14–15°C and a temperature increase across the exchange device of 2–3 K. The dehumidifying capacity of the air supply is also important for control of the dew point and, in consequence, a design margin of the order of 20 per cent should be provided.

- Because of the properties of water, it uses less than 5% of the energy a fan would need to remove the same amount of thermal energy.

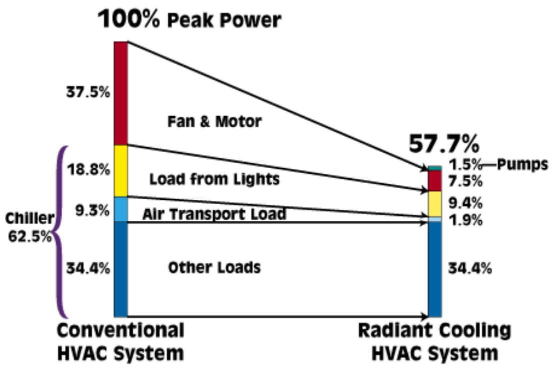

Figure 5-27: Hydronic Radiant Floor Cooling Detail C