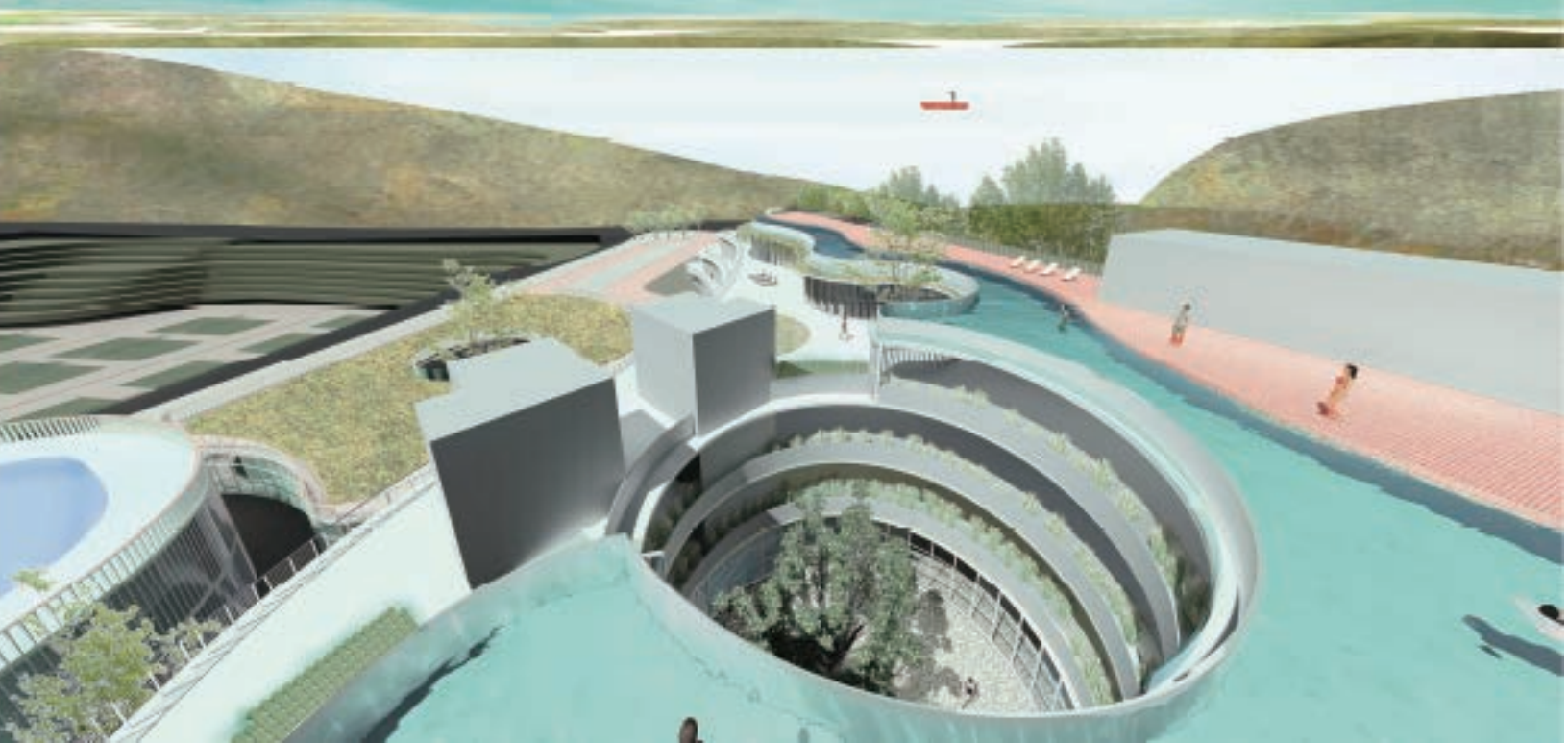
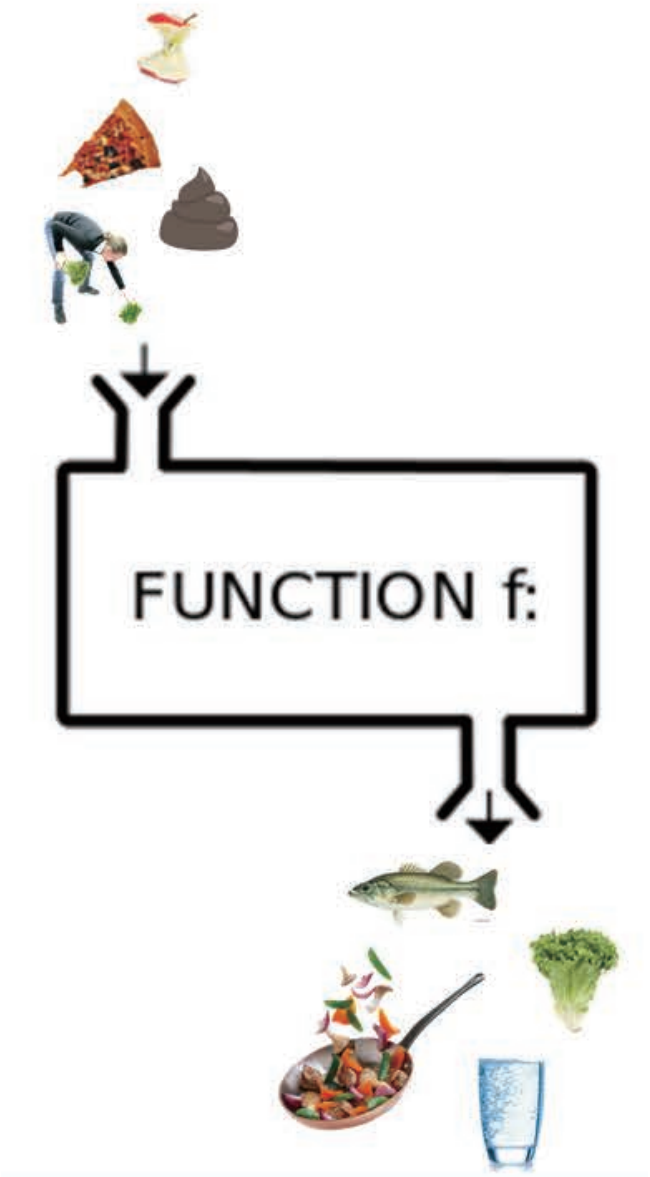
SHARING AND LIVING

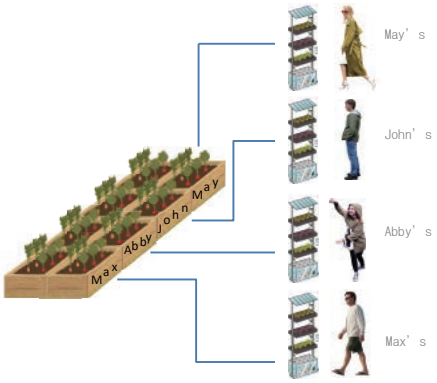


CONCEPT



Food, clothing, households, transportation, education, entertainment are our daily routine. However, since we only have vague awareness of the energy consumption during these activities, they have lead to a big impact to our environment.
In our design, we like to create a energy recycling mechanism. This mechanism not only can harvest alternative energies and transfer them into electricity but also has its social function- to help people interact with each other.

CONCEPT



We try to design a student housing community that not only encouraging residents to talk to each other, but also share with each other's life, and interactive with surrounded neighborhood—at the same time, to be an energy self-sufficiency community.

Sharing Strategies:

A. Student Farms

We designed a housing community with "layers of terrace with farms and ponds" to encourage students to learn how to be a net zero user from the food resources. Students can claim a field or fish pond to cultivate by themselves.

B. Indoor and outdoor activity areas

We create lots of indoor and outdoor social areas from open kitchen, roof swimming pool (facing Lake Merced) to layers of indoor and outdoor party terraces, bike paths and so on. This is to encourage residents to take chances to share their life together and to make the community full of lively vitalities and be friendly.

2000 people 💩 /year

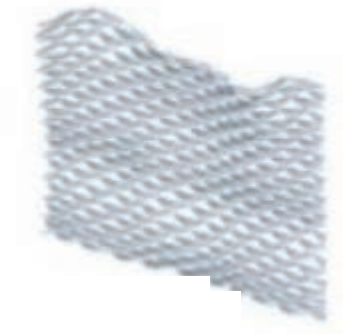
+

Organic garbage

Cooking for 1 year

wind

+



600 m2 fog harvesting

1000cc per people per day

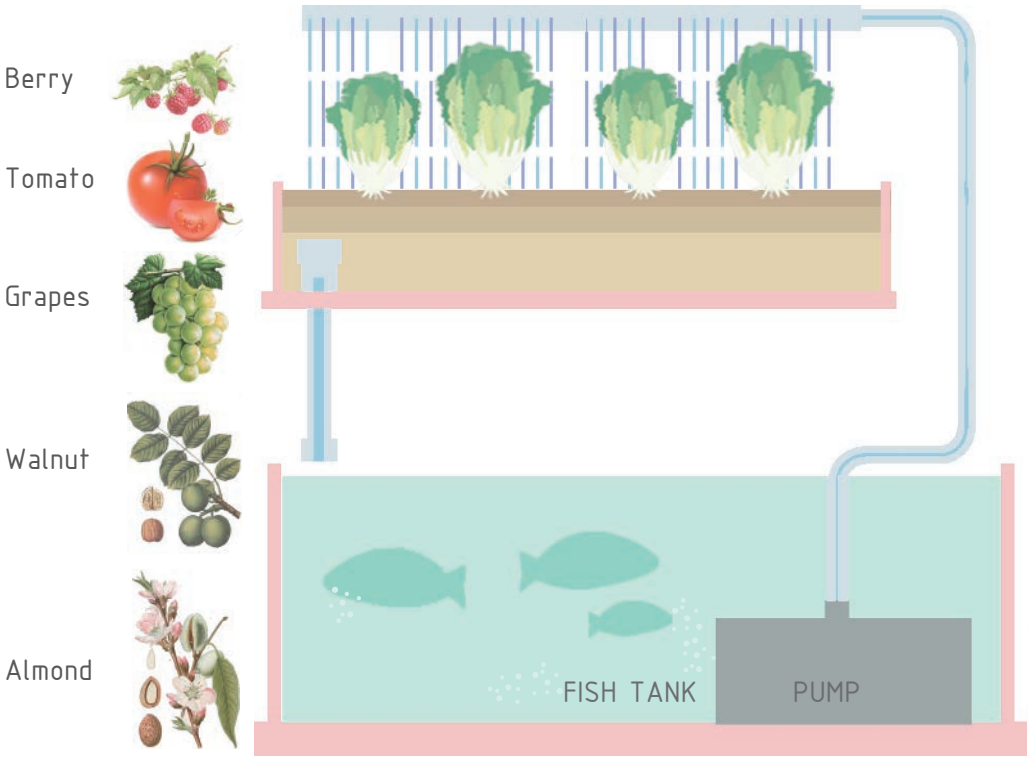
AQUAPONICS

We have combined aquaculture and hydroponics together to form a closed-loop system that results in zero waste. Recycled water are using in this system, and removes the use of fertilizers or chemicals, this ingenious methodology produces roughly one pound of fish for every 10 gallons of water.

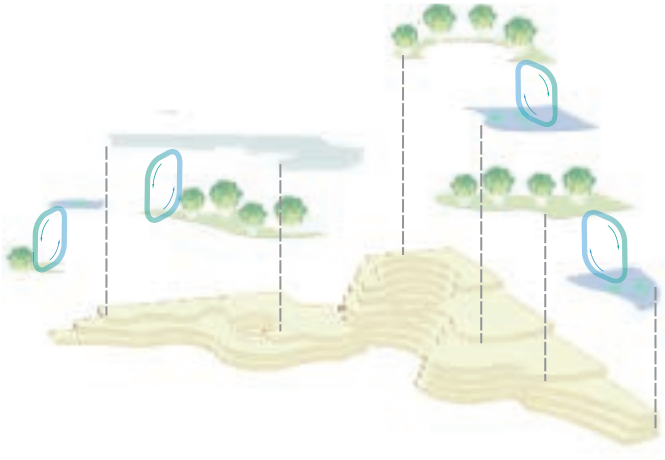
When growing fish in a controlled environment, their waste has to be removed or the buildup of ammonia could poison them. Instead of pouring that waste back into the environment, it is infiltrating through a filtration system to remove solids, and then through soilless beds of an aquaponics system where it delivers nutrients to plants' roots. By the time the water cycles back to the recirculating aquaculture system, it's clean and ready to be used again.

Once the original water has been added to the tanks (most experts recommend first-timers start with a 55- to 225-gallon bin for the fish), this zero-waste ecosystem only loses small amounts of water through transpiration and evaporation. Thereafter, a slight top-off approximately once a week or so should keep water levels in check. Compare this to a plot of land that needs regular irrigation, or an aquaculture system that has to be replenished on a continual basis to ensure fish don't perish from their own waste.

San francisco's crops



San francisco's fish species



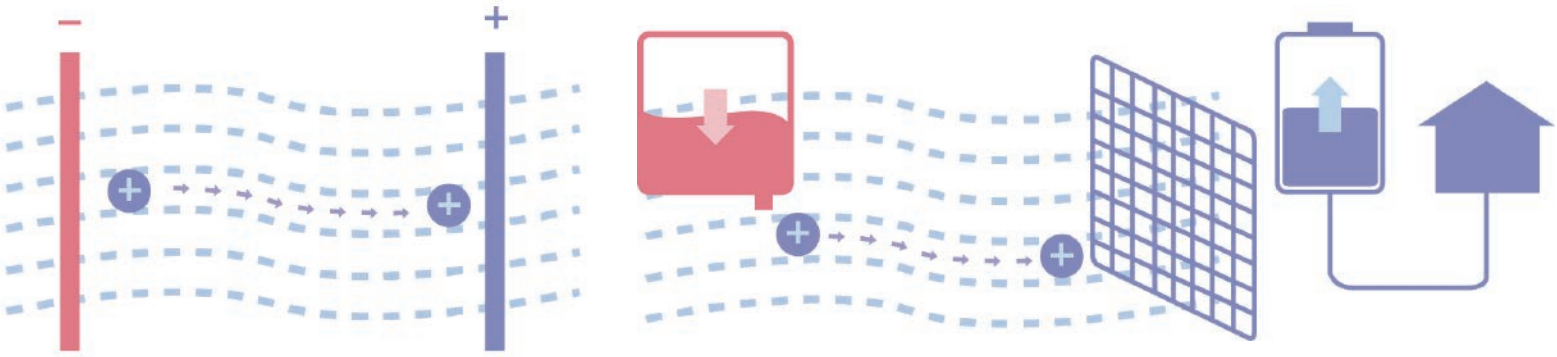
Student Farms

Layers of terrace farm situate at the top of each floor residence, students can easily go out from the residence to learn how to be a net zero user from the food resources.

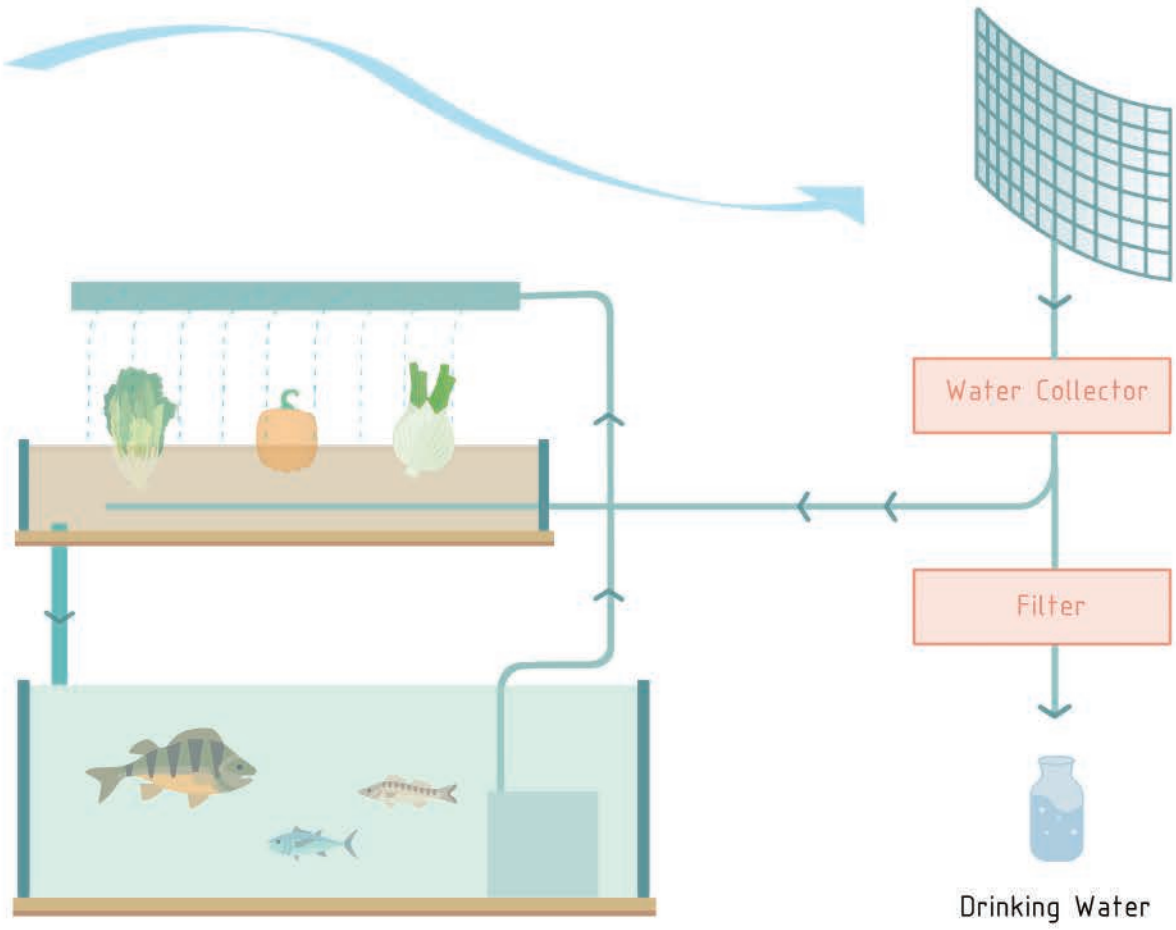
And this shows that how the aquaponics works in our project.

WINDENERGY CONVENTOR

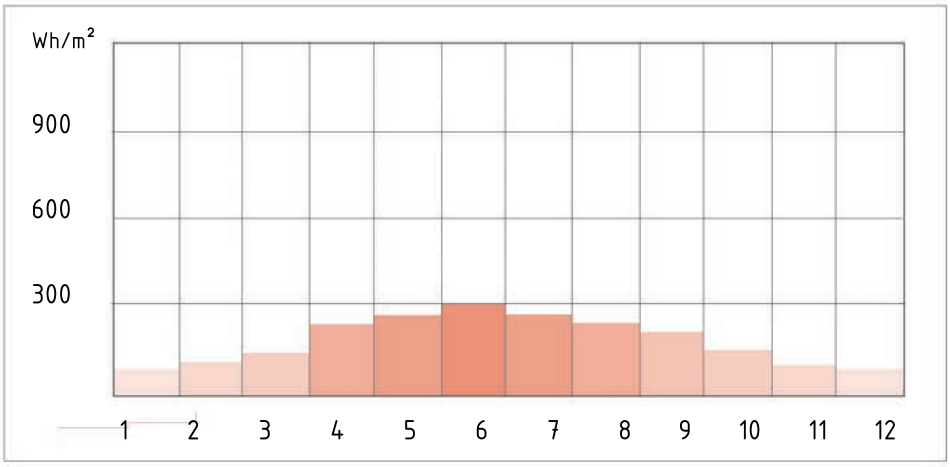
The key here is a bladeless wind turbine with no moving parts that produces electricity using charges water droplets. The technology, called EWICON (Electronic Wind Energy Converter) creates energy through the direction of charged particles by the wind in the opposite direction of an electrical field. Each tube features several electros and nozzles which release positively-charged water into the air, through a process that's been dubbed "electrospraying".



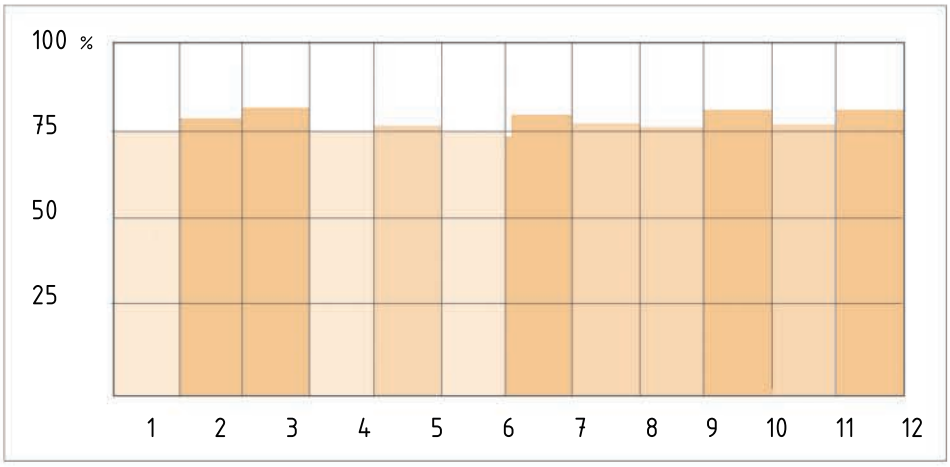
AQUAPONICS & FOG HARVEST NET SYSTEM



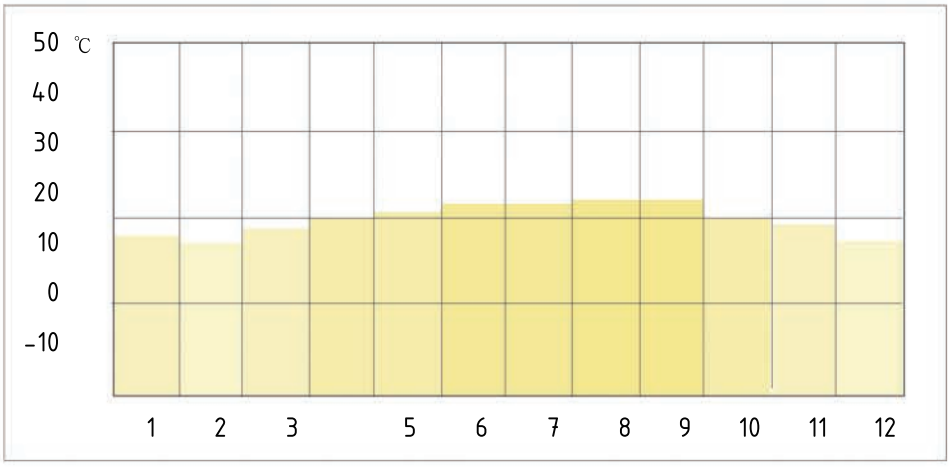
SITE CLIMATE



Sunshine radiation



Relative humidity



Atmospheric temperature

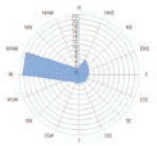
SITE ANALYSIS

Traffic concern

car's main route
people's route
parking area
building area

Parking area is located on the west side of site.

Wind concern



Wind of Sanfrancisco

wind
building's hight

In dealing with the seasonal wind from the west, we set back the west side of building to create comfortable ventila-

Circulation

building area
car's route in site
people's route in site
entry

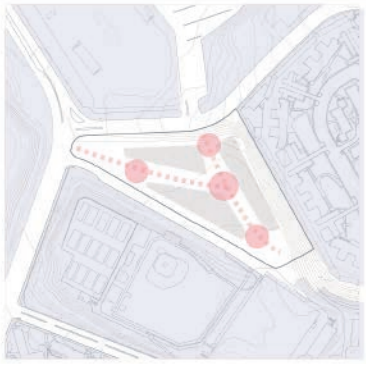
Based on solar and shadow study, we set back the south side of the building to get a better day lighting in the interior spaces and create courtyards to get more sun light and breeze ventilation from outside.

Sun concern

sun
courtyard
building's hight

The project is divided into three areas, each in different size to serve different purpose.

Square in site



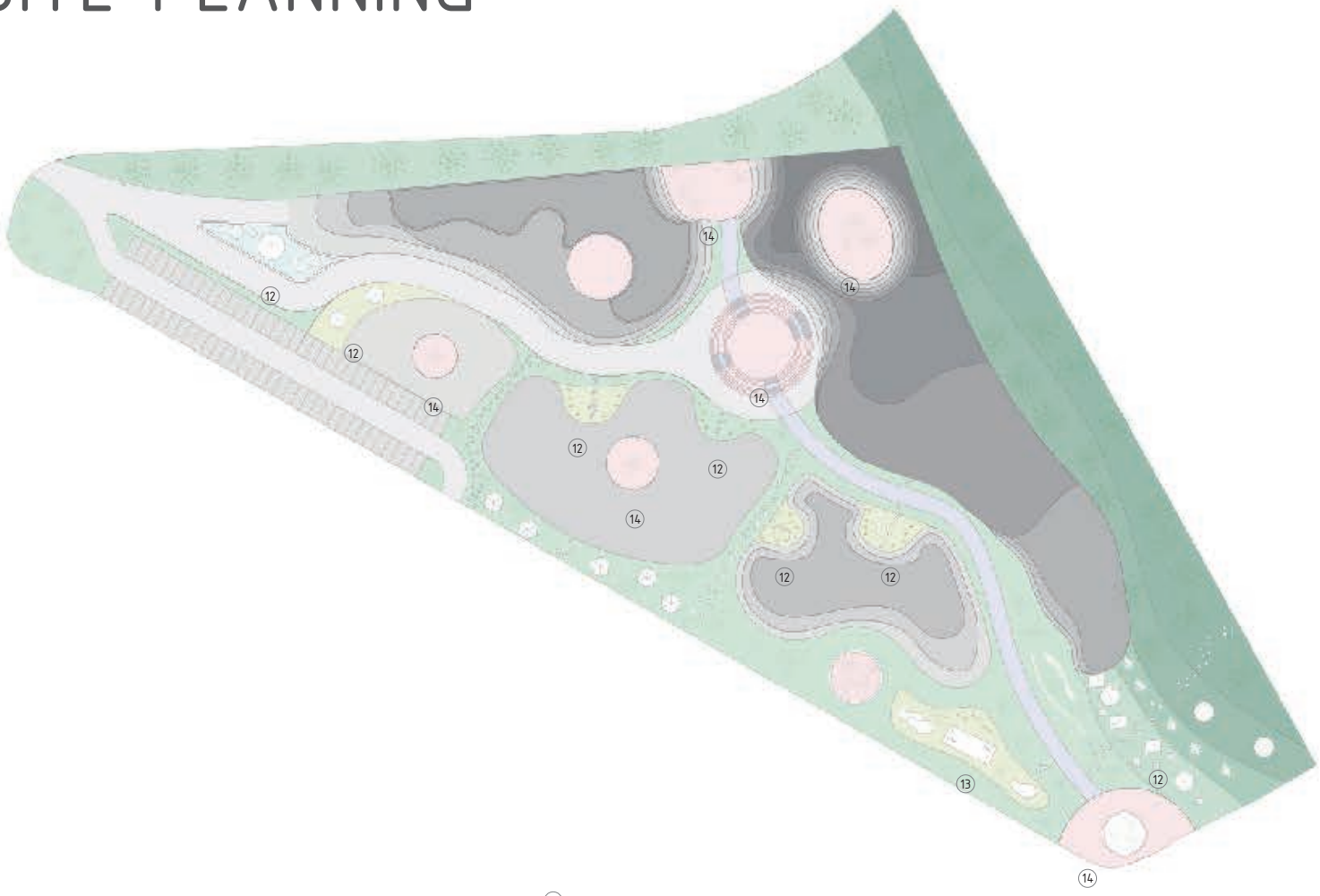
square
building area
car's route in site
people's route in site

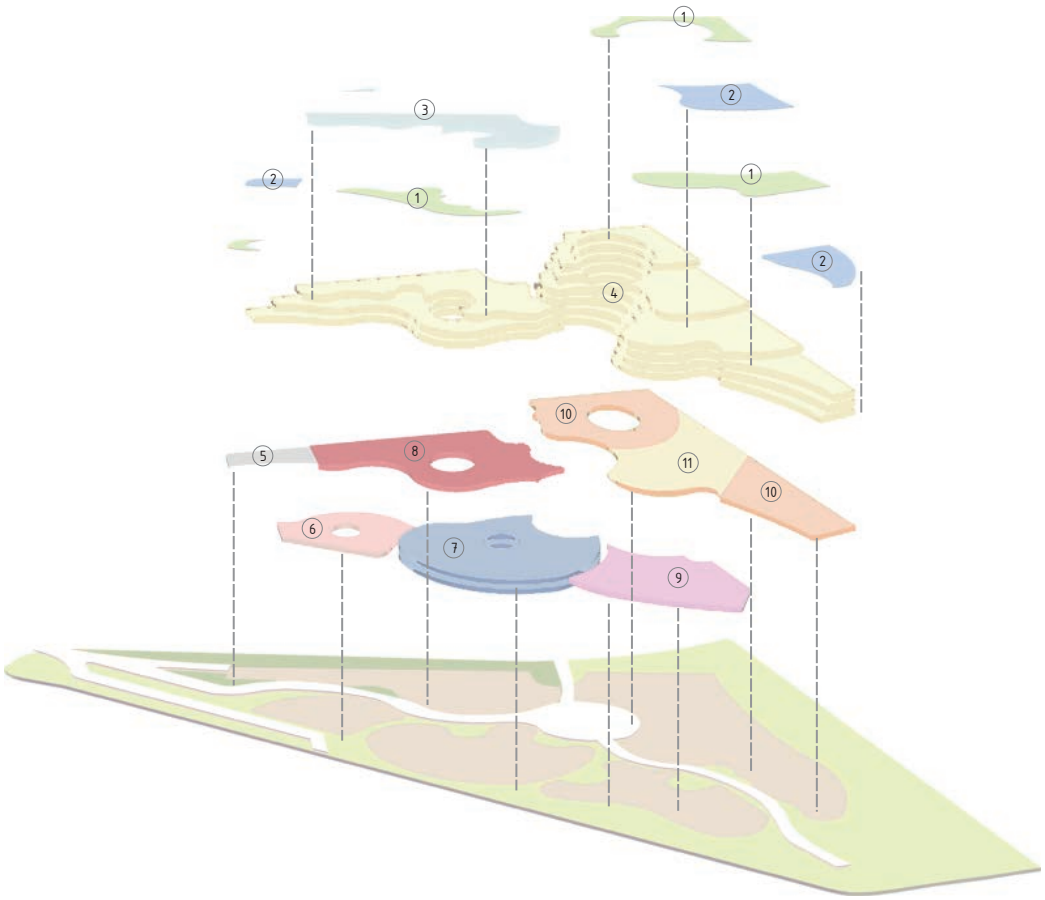
We also create squares and add some intermediary spaces.

residence
recreation area
education area
public level

We also create squares and add some intermediary spaces. The open spaces close to the recreation areas are more for public uses and the ones close to the residential area are

SITE PLANNING





roof

1. field
2. fish pond
3. swimmingpool

2-7floor

4. residence

groundfloor

5. parking
6. cafe
7. dining center
8. children care center
9. student lunge
10. meeting lunge
11. lecture hall

landscape

12. leasure place
13. sports area
14. square

WINDOW_TO_WALL RATIO

Calculate the window--to--wall ratio for each elevation and the entire building.
The window--to--wall ratio of
a building is the percentage of its facade taken up by light--
transmitting glazing surfaces, including windows and
translucent surfaces such as glass bricks.
It does not include glass surfaces used ornamentally or as opaque cladding, which
do not provide transparency to the interior.
Only facade surfaces are counted in the ratio, and not roof surfaces. Here is
the procedure for classifying facades that do not face a cardinal direction. In
general, any orientation within 45o of true north, east, south, or west should
be assigned to that orientation. If the orientation is exactly at 45o of a cardinal
orientation, use the diagram at right to classify the direction of the façade. For
example, an east--facing surface cannot face exactly northeast, but it can face
exactly southeast. If the surface were facing exactly northeast,
it would be considered north--facing. As the window--to--wall calculation is a ratio,
you may enter area in square feet or meters.

North

Step1: Total area of light transmitting glazing surfaces on north facade: 6965 SF

Step2: Total area of north façade: 11380 SF

Window-to-wall ratio of north façade = $\frac{\text{number from step 1}}{\text{number from step 2}}$ = 61.2%

East

Step1: Total area of light transmitting glazing surfaces on north facade: 10145 SF

Step2: Total area of north façade: 21312 SF

Window-to-wall ratio of north façade = $\frac{\text{number from step 1}}{\text{number from step 2}}$ = 47.6%

South

Step1: Total area of light transmitting glazing surfaces on north facade: 5309 SF

Step2: Total area of north façade: 12012 SF

Window-to-wall ratio of north façade = $\frac{\text{number from step 1}}{\text{number from step 2}}$ = 44.2%

West

Step1: Total area of light transmitting glazing surfaces on north facade: 6054 SF

Step2: Total area of north façade: 18457 SF

Window-to-wall ratio of north façade = $\frac{\text{number from step 1}}{\text{number from step 2}}$ = 32.8%

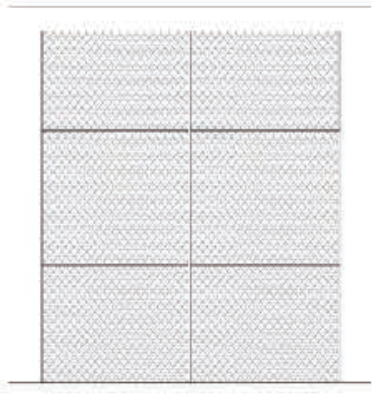
WINDOW_TO_WALL RATIO

Total Building Windowa toa Wall Ratio

Step1: Façade area total = 28473 SF Step2: Light transmitting glazingtotal = 63161 SF

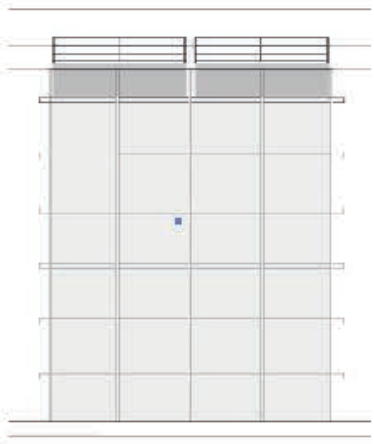
Total window-to-wall ratio = number from step 1 / number from step 2 = 45.1%

WINDOW OPENING



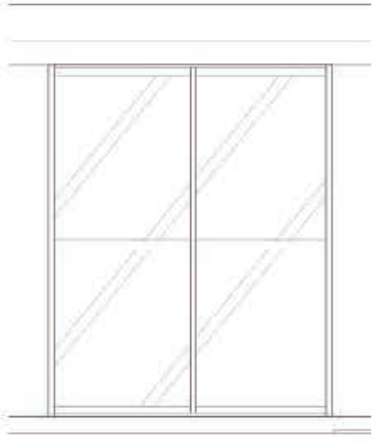
WEST - Fog Harvesting Mesh

Due to the frequency of heavy fog and the strong seasonal winds from west in Bay area, a designed fog collector façade system is used to collect the fog on the west side of the building. This system can also transfer the wind power to electricity.



SOUTH - Planting Grid + Solar Panels

There is sufficient light to provide a good shade effect. The solar panels on the south side has reached the maximum efficiency, to provide part of school power demand.



NORTH - ceiling window

The north side is lack of direct sun light, so we design a larger window with light reflector to bring the light into the room.

END USE BREAKDOWN

Residential Units

END USE	Kwh/yr	kBtu/sf/yr
HVAC		3.44
LIGHTING		1.71
REFRIGERATION	191	0.58
COOKING	587	1.79
LAUNDRY	63	0.17
MIS DWELLING PLUGS	360	1
DHW		0.66
TOTAL		9.35

Service Area

END USE	Kwh/yr	kBtu/sf/yr
HVAC		11
LIGHTING		2.62
PLUG LOADS		8.7
DHW		6
TOTAL		28.32

RENEWABLE ENERGY

SOLAR ENERGY

RESULTS

273,287 kWh per Year *

System output may range from 262,602 to 277,933kWh per year near this location.

Month	Solar Radiation (kWh / m^2 / day)	AC Energy (kWh)	Energy Value ($)
January	3.10	13,678	2,098
February	4.11	16,292	2,499
March	4.94	21,840	3,350
April	6.19	26,088	4,002
May	6.80	29,627	4,545
June	7.09	29,693	4,555
July	7.59	32,531	4,990
August	6.90	29,530	4,530
September	6.40	26,290	4,033
October	4.90	20,972	3,217
November	3.34	14,174	2,174
December	2.82	12,574	1,929
Annual	**5.35**	**273,289**	**$ 41,922**

Location and Station Identification	
Requested Location	San Francisco State master plan
Weather Data Source	(TMY2) SAN FRANCISCO, CA 11 mi
Latitude	37.62° N
Longitude	122.38° W
PV System Specifications *(Residential)*	
DC System Size	175.8 kW
Module Type	Standard
Array Type	Fixed (open rack)
Array Tilt	20°
Array Azimuth	180°
System Losses	14%
Inverter Efficiency	96%
DC to AC Size Ratio	1.1
Economics	
Average Cost of Electricity Purchased from Utility	0.15 $/kWh
Performance Metrics	
Capacity Factor	17.7%

RENEWABLE ENERGY

BIO ENERGY

1 person / year = 5kw (Bio energy)

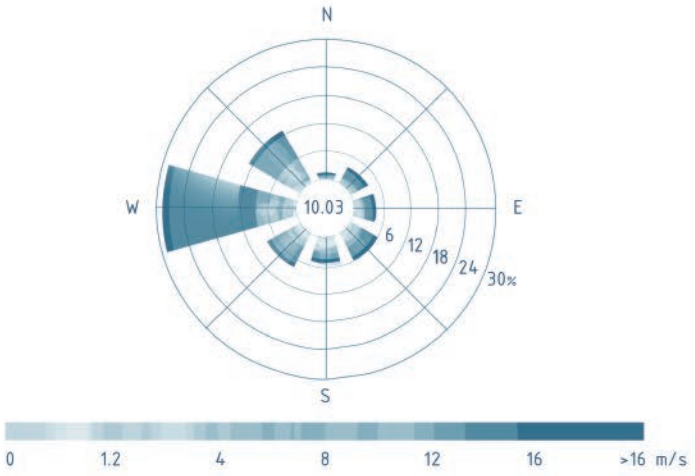
5 kw * 1130 (person) = 5650 kw / year

WIND ENERGY

1 sf / hour = 10.2 W

10.2 * 1000 * 24 * 365 = 89352 Kwh/yr

wind rose

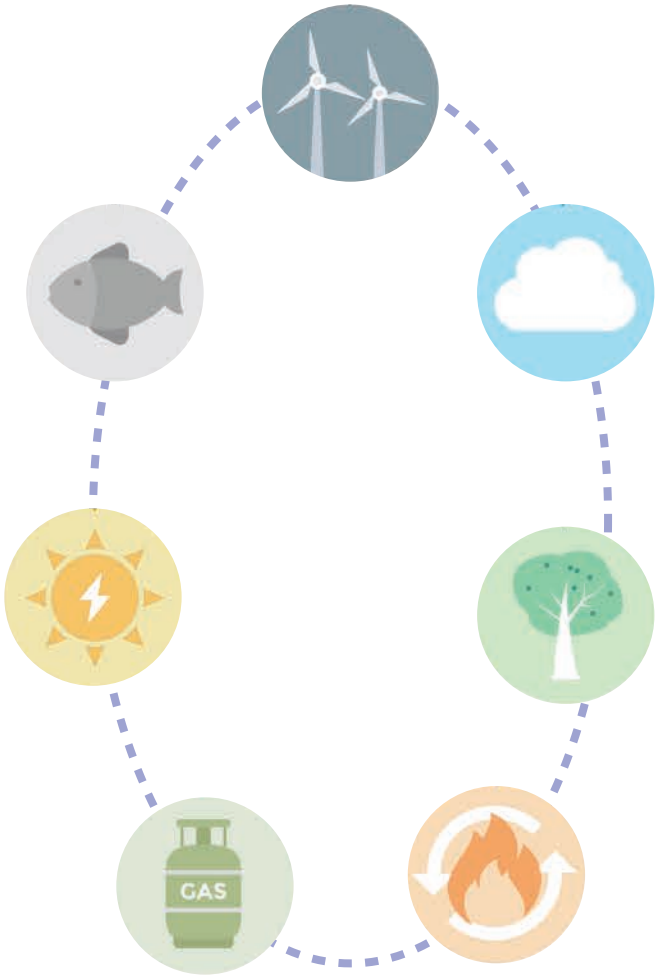


ENERGY TYPE	Kwh/yr	Energy Ratio
SOLAR ENERGY	273,287	0.74
WIND ENERGY	89,352	0.24
BIO ENERGY	5,650	0.2
TOTAL	368,289	1

BUILDING ENCLOSURE DETAILS

Net-Zero Strategies:

A. Water Recycle—we have design the fog harvesting system located on west side of the buildings in order to deal with the frequent heavy fog in San Francisco. The condensed water from fog harvesting system can also be recycled for bath, kitchen and vegetation.
1m3 fog have 0.05~0.5g water. 40sqm fog harvesting net may collect about 250L water.If one people neesd 1,000CC/day.
2,000(people)* 1000cc=2000000cc=2000L
2000/250=8(40sqm fog harvesting net)
A 40sqm fog harvesting net cost 1000-1500$ and it can be used for 10 years



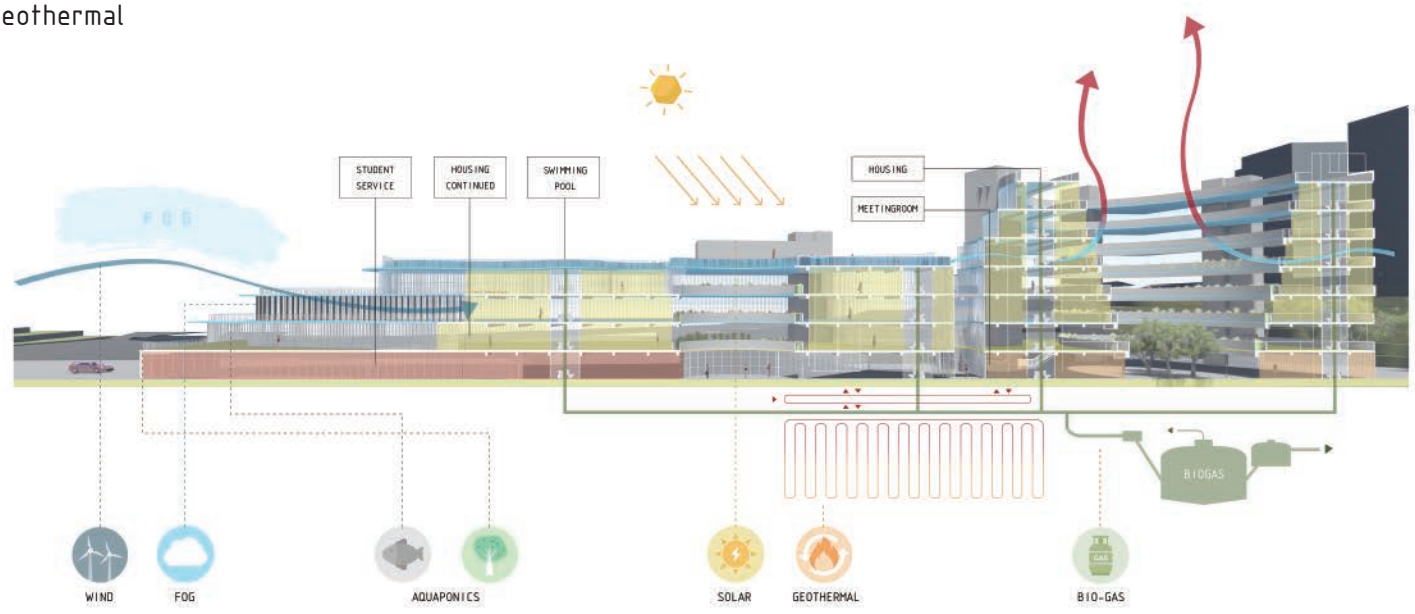
B. Wind Tower Generator—Put Wind Power Generator toward the west to take advantage of seasonal wind years around.

C. Solar Energy—Design 10780.8 sft2 solar panels facing south to alleviate on-site energy demand.

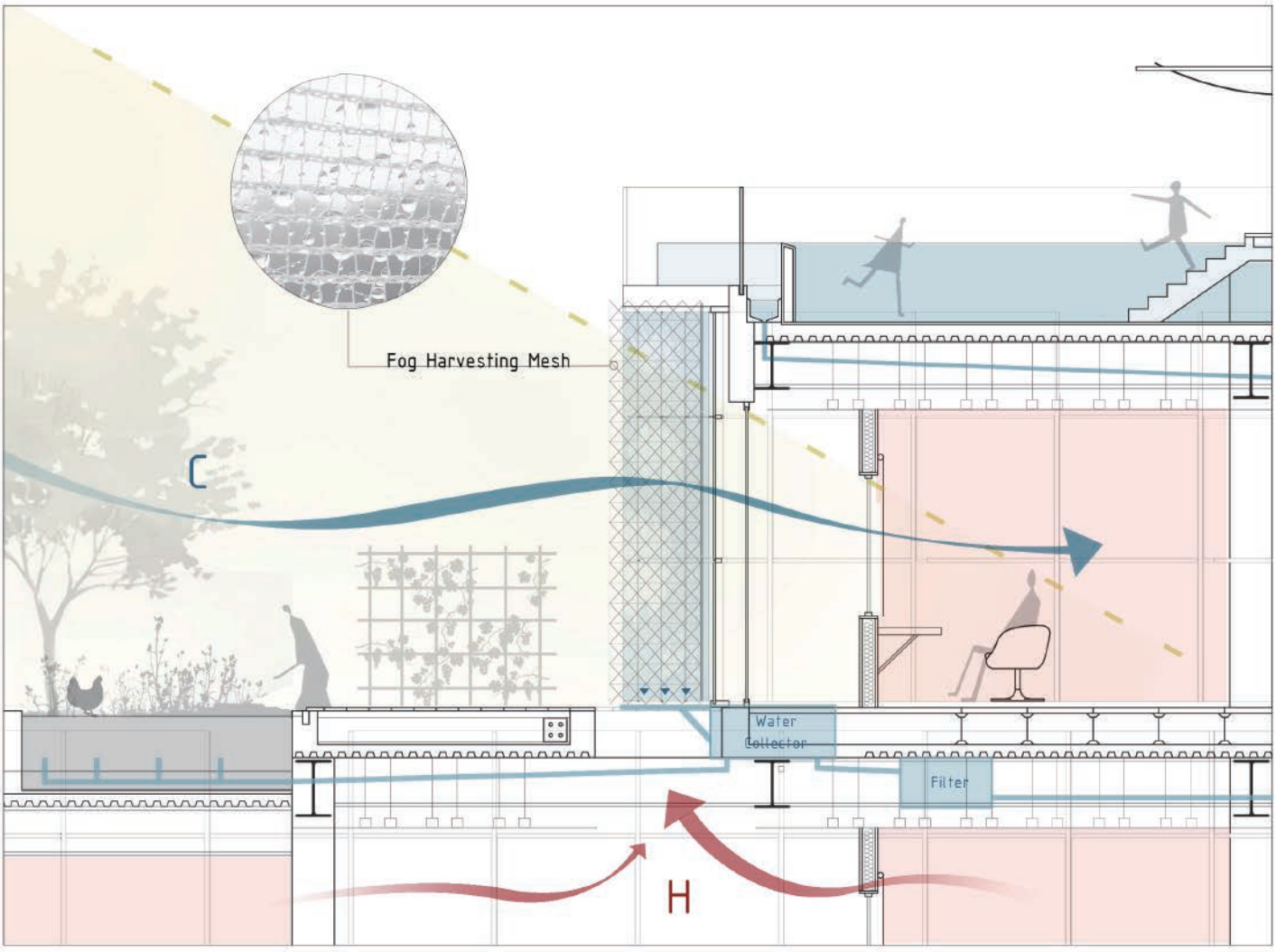
D. Bio-Gas and Geothermal System—
2/3 of Kitchens, bathrooms are linking with bio-gas energy system. And the geothermal system is using to exchange the heat from underground.

E. Bio-gas-One people may provide 360 lb/year
And the bio-gas that provide by one people can cook 13times/0.5hour. If we want to balance the energy . We need about 550 toilet(every toilet will be used by 4 people). However, the bio-gas can provide more energy, so it not just for cooking only.

F. Geothermal

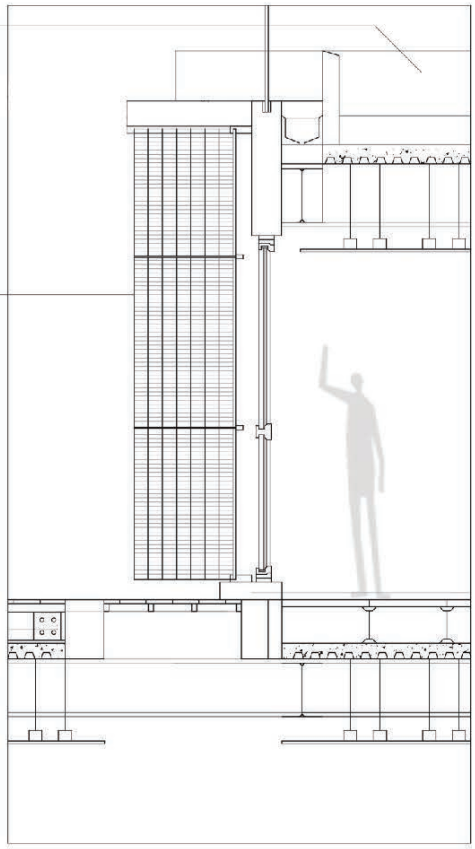


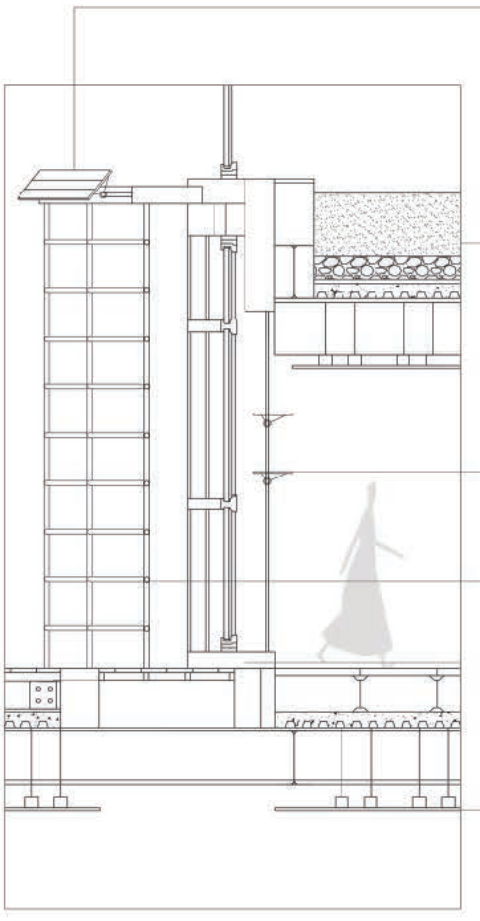
BUILDING ENCLOSURE DETAILS



BUILDING ENCLOSURE DETAILS

We hope to promote intergeneration-al interaction with fish dishes., so we will plant and water space sacttered on the roof platform. This layer of the roof for the water cycle children play pool, and fog harvester water for drinking and irrigation planting, to save the energy.

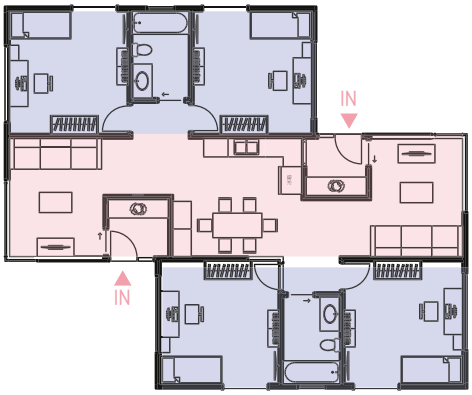




The south side are planted wall and solar panels.There are the sunlight guide that can control the radiation and light enter to the indoor.

RESIDENTIAL UNIT SYSTEM

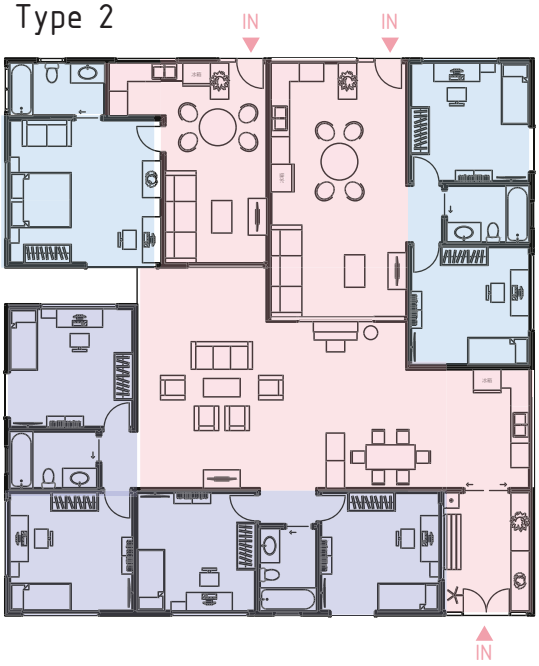
Type 1



We try to design a communicative student housing that not only encouraging residents to talk toeach other, but also share with each other's life, and interactive with surrounded neighborhood—at the same time.Therefore, we create three types of student suits.

Type1
2 shared suit(2 bedroom+1 restroom)
shared the livingroom, kitchen and diningroom.

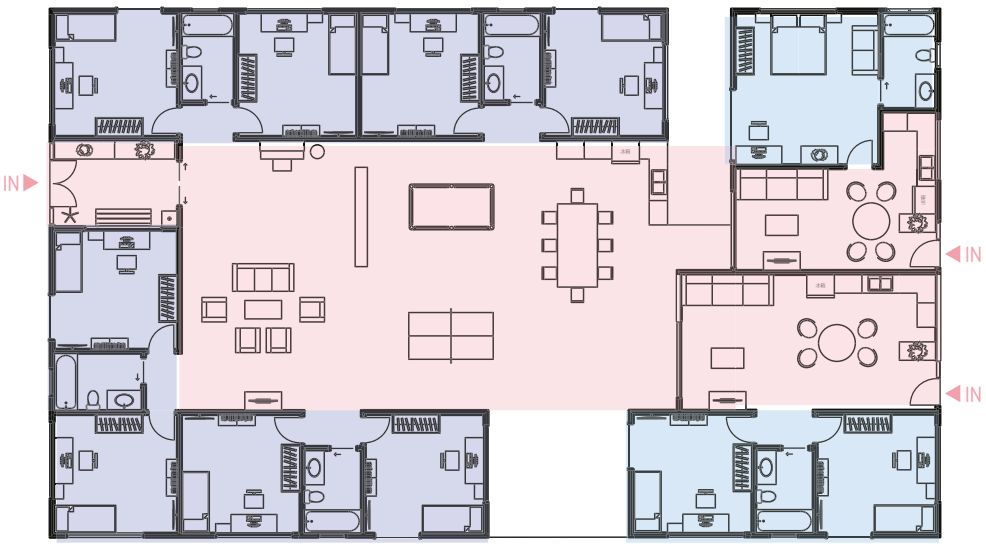
Type 2

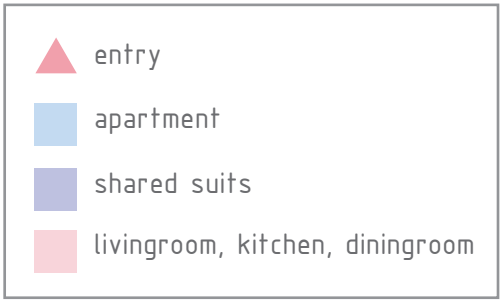


Type2
1 apartment with a double bedroom+
1 apartment with 2 bedroom+
2 shared suit(2 bedroom+1 restroom)
Each of them have there livingroom, kitchen and diningroom, but they can easily meet another room's student by the public area.

Type 3
1 apartment with a double bedroom+
1 apartment with 2 bedroom+
5 shared suit(2 bedroom+1 restroom)
The type 3 combine more rooms in one unit. People can have more interaction in this kind of combination.

Type 3





NATURAL VENTILATION

Type 1

$$\sum \alpha(VA\alpha + CA\alpha) = NVP(\text{Natural ventilation potential})$$

Type1 :

$$\frac{117.98+10.72}{146.81} = 0.88$$

Type2 :

$$\frac{139.35+179.62+67.04+22.24}{500.65-14.54-18.6} = 0.87$$

Type3 :

$$\frac{232.41+27.66}{313.22-5.18} = 0.84$$

Type 2

We try to create a vertical opening around each unit so that each space can have a good ventilation environment. Our natural ventilation rate has a good performance, so that each space need no air-conditioning system to be comfortable.

Type 3

RESIDENTIAL UNIT SYSTEM

Thlird floor typical floor plan

The typical floor plan shows that how three unit groups are organized on the same floor. To bring the sun light into the space and make the ventilation better , we create some small court-yards and balconies.

The small courtyard is also act as social place where people can interact with others.


enterprise