DESIGN BRIEF

Mushroom Community Campus

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MUSHROOM COMMUNITY CAMPUS

A. Vision

Vietnam has a great potential to develop productive lands for agriculture as a foundation to build a sustainable community, however rapid massive urbanization is threatening sustainable development of these areas. We propose the "Mushroom Community Campus" in Sapa not only as an education institution to improve "live, study, play" experience of students but also as an example of sustainable design to cultivate behaviour and raises people's awareness on the environmental issues and sustainable development. The Campus is a vocational education, training and research centre specialized in environment, agriculture, forestry, education and sustainability management. The education program is to teach young people about living sustainability, encourage local people to protect environment and enhance living quality. The design aims to obtain a LOTUS Gold, the highest certification of the LOTUS rating tool by Vietnam Green Building Council (VGBC)

B. Site introduction

Location & Weather

Our Green Campus is located at the edge of Sapa district, Lao Cai province, 350km from Hanoi, Vietnam. The township of Sapa lies on a hill slope at the attitude of about 1,600m above sea level. Famous for its breathtaking landscape, Sapa is one of the most attractive tourist destinations of the country. Especially, a cluster of Ram earth buildings in Sapa shapes a very unique architectural style in this area. The Ram earth Village of Sapa Town looks like several mushrooms raising on the mountain, looking down to the green valley with pure stream running through.

Society and Culture

As a tourist attraction, Sapa is bustling with tourists from all over the country and different parts of the world. Yet the local people in Sapa still maintain their colourful lifestyles and unique cultures.
However, despite the development of tourism and infrastructure to the place, the majority of population's economy is still based on intensive farming on sloping terraces with backward cultivating techniques. Activities such as forest slash and burning agriculture apparently causes serious damage to the environment and threat the ecosystem.

C. Design strategies

The design and construction embodies an integral approach towards development which encompasses the ecological, climatic, cultural, technological, environment and socio-economic dimensions.

1. Vernacular Architecture

We find that vernacular architecture has many relations with green design in terms of energy efficiency and utilizing materials and resources in close proximity to the site. The building is designed in the sense that shows respect to native culture and neighbourhood context, capitalize the native knowledge of how building can be designed to best adapt to its location and climate. The traditional construction techniques such as ramp earth and rice straw walls construction techniques, thatch roof, bamboo treatment methods …) are replicated in the design in a creative way. Local materials are intensively utilized and local labours are used instead of modern machineries. The building is environmentally connected to its surrounding and culturally connected to its community as a whole.

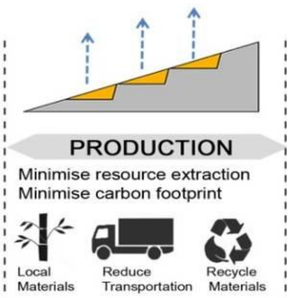
2. Biophilic Design

The design promotes environmentally sustainable practice by demonstrating the efficient use of natural resources, the minimization and mitigation of building's impact on the environment and the positive contribution to the eco-system.

The idea of biophilic design fosters beneficial contact between people and nature in buildings and landscapes when building is seen as a part of the eco-system, "born" from nature and returns to nature in the end. The campus "lives" in harmony with its environment like a **cluster of mushrooms** arising from the soil, blending into its surrounding.

3. Sustainable life cycle

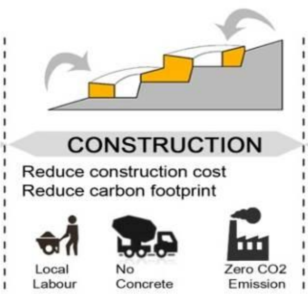
The notion of sustainable life cycle of the building is emphasized in the design as sustainability is taken into consideration in every stage of a building life cycle, from production, construction, occupation to the demolition of the building.



Production

-***Minimise resource extraction*** by using renewal and fast growing resources of materials (bamboo), utilizing waste from crops (grass straw and rice straw) and using materials with low embodied energy and CO2 emission (timber)

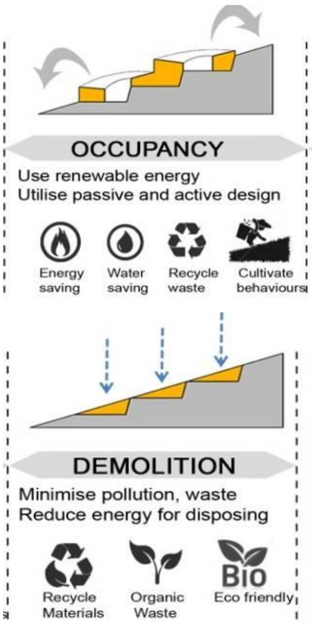
-***Minimise energy for manufacturing and transportation*** by using materials which requires low energy for manufacturing (earth wall, bamboo roof ...) and using material with high local avalability to minimise energy and carbon emission for transportation.



Construction

Energy for construction and transportation is minimised by using local labour for construction instead of machinery, using material with high local availability to minimise energy and carbon emission for transportation

Waste in construction is minimised by reducing the use of industrial products and materials.



Occupation

Energy efficiency is achieved through natural lighting and ventilation strategies, wind capture strategy and using of high thermal mass material (earth wall)

Water efficiency

Rain water and water from natural sources (spring) are harvested and treated for different purpose use (potable, flushing, irrigation ...)

Grey water and storm water are recycled through sewerage system that transfers waste water to treatment plant. Bio-waste is collected and recycled to generate energy.

Demolition

Waste is minimised by using environmentally friendly materials that minimise waste to landfill and reusing and recycling of material and assemblies

The demolition and disposing of eco-friendly materials not only save energy for transportation but also minimise pollution and contaminants into soil, water and air.

4. Energy Efficiency

a. Natural Ventilation

As a wind catcher system, the roofs are carefully angled to capture prevailing winds and direct air flow to encourage natural ventilation of the whole building. Air flows also facilitated by movable louvers systems and landscaping within site, divert air flows to rooms, and shade paved areas to reduce heat island effects.

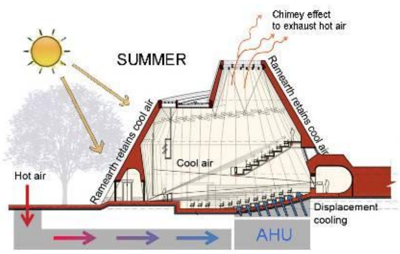
b. Natural lighting

The court yard system ensures natural daylight for the classes and offices. The roofs formation supports the transmitting of diffuse sunlight to the building.

c. Evaporative Cooling in earth-air Tunnel with AHU for Auditorium

Passive earth-air tunnel is coupled with the HVAC system. The earth air tunnel drastically reduces the energy required for conditioning of air by utilizing the thermal properties of earth as exchanger, a 64% reduction in energy consumption by HVAC system compared to baseline model.

Case	Temp. Reduction	Temp. Difference
Baseline (Active):	From 35°C to 24°C	where ΔT = 11°C
Earth-Air Tunnel (Hybrid):	From 28°C to 24°C	where ΔT = 4°C
*Cooling Load Q = mc*ΔT, where m & C are constants*		



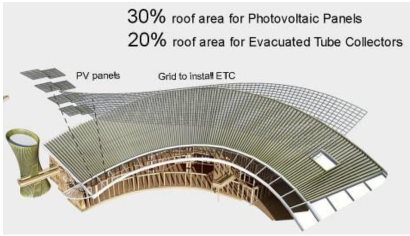
$$Saving\ Ratio = \frac{Q1}{Q2} = \frac{mc * \Delta T1}{mc * \Delta T2}$$

$$\%\ of\ saving = \frac{(11°C - 4°C)}{11°C} x\ 100\%$$

$$= 64\%$$

d. Solar Self Sufficiency – BIPV Panels

1500m2 roof top building integrated photovoltaic panels with grid connectivity metering and stand alone facility for 4 hours operation. Plug load, lightings and lifts can run on solar power during the day. Post sunset, with the generation dwindling, the system automatically switches to grid supplied electricity, a 91% reduction in electricity compared to baseline model.



$$Solar\ Energy\ Self-sufficiency = \frac{Energy\ Generation\ by\ PV}{Total\ Energy\ Consumption}$$

$$= \frac{Global\ Insolation\ x\ Module\ Area\ x\ Module\ Efficiency\ x\ Performance\ Ratio\ (PR)}{Energy\ Consumption\ from\ energy\ calculator}$$

$$= \frac{1838\ x\ 1100x\ 0.17\ x\ 20\%\ x\ 80\%}{60{,}811} = 91\%$$

e. Evacuated tube collector (ETC)

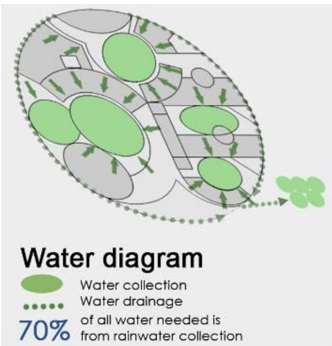
ETC based solar water heater of 110 litres per day capacity to meet hot water requirements. The small water tank in the solar heater has a thermal insulation which provides constant hot water supply

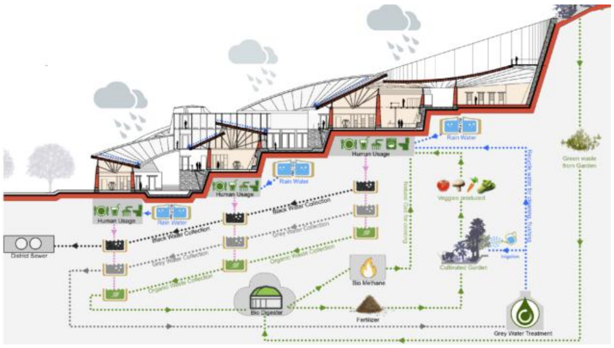
Diversification of energy sources are applied to green campus to offset almost all the lighting, HVAC, plumbing and transportation energy demand.

5. Water Efficiency

a. Water Self-sufficiency - Rainwater Harvesting

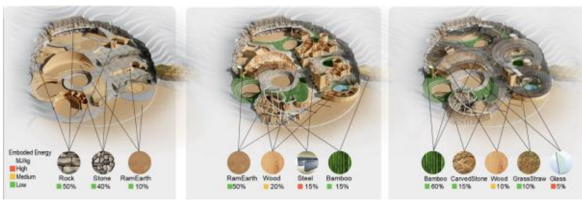
The campus landscaped areas are irrigated via a large-scale rainwater recycling system. Rainwater is collected and stored in underground tanks with total storage of 1415m2. Rainwater runs through RO filter system to create pure water for human usage. By using water recycling system, the building can minimize the waste water and then reduce annual water consumption to meet 70% of all water need in the building.





Cascade water usage is applied to maximize the level of water usage, from rainwater to clean water for human usage (drinking, bathing) and finally grey water recycling for irrigation, washing and flushing. Overall, a closed-loop water and waste system is formed, in which waste from one system would be the resources of the other systems.

6. Use of low-embodied materials



Materials being used are eco-friendly and locally available to ensure low carbon footprint and embodied energy which benefiting the community socially and environmentally. Low embodied energy materials are fully utilized phase by phase during the construction to minimize carbon footprint. The more embodied energy, the less percentage of using materials.

Environmental Advantages
Since ram earth, bamboo, timber used in the campus are locally available, the amount of materials transported by road decreases. Ram earth from the ground can be completely re-utilized and return to the ground so that the amount of waste material to be disposed of reduced.

Functional Advantages
The roof's ribbons of bamboo, timber and grass straw are light weight, and naturally pest- and mould- resistant. Wall and floor are mainly made of ram earth, carved stone and paving stone which are with advantage of good thermal performance, highly durable and good acoustic properties.

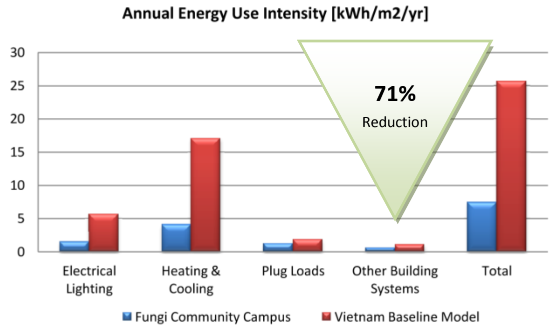
Social Advantages
Ram earth is easy to use and there are no hazardous, toxic and carcinogenic substances in it, as such contributing to improve health and safety in the work environment.

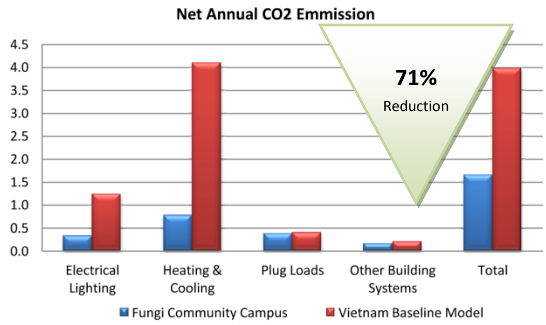
In conclusion, the green campus is well-designed to provide adequate consideration of both passive design and technology to achieve high solar and water self-sufficiency and low embodied energy.

D. Building Assessment

Total Building Energy Use

BUILDING LOADS	Energy Consumption	Annual Energy Use Intensity (EUI)	Net Annual CO2 emmission	% of Total	Energy Consumption	Annual Energy Use Intensity (EUI)	Net Annual CO2 emmission	% of Total
	[kWh/yr]	[kWh/m2/yr]	[Tonnes CO2/MWh]		[kWh/yr]	[kWh/m2/yr]	[Tonnes CO2/MWh]	
	Fungi Community Campus				Vietnam Baseline Model			
Electrical Lighting	12,279	1.5	0.3	20%	46,000	5.6	1.2	22%
Heating & Cooling	33,859	4.2	0.8	56%	139,500	17.1	4.1	67%
Plug Loads	10,041	1.2	0.4	17%	15,000	1.8	0.4	7%
Other Building Systems	4,636	0.6	0.2	8%	8,600	1.1	0.2	4%
Total	60,815	7.5	1.7		209,100	25.7	4.0	





Our team has designed a tool to provide ballpark estimates of energy use, based on inputs from engineer and architect during the initial design stages. Our design included a calibrated mix of active, passive and mixed-mode systems, based on the zoning of activities and variations in occupancy. Main parameters like size of different zones and schedules of occupancy and use are entered into the tool. For each zone, our team picks then from a list of systems, including passive strategies and mixed-mode options, preselected for use in Vietnam. Results are graphically displayed as above and Appendix 1 – 5. Energy estimates for the building are compared with benchmarks for Vietnam as shown above,
Compared to baseline model, our campus is designed with sustainable features which reduced the energy consumption from 25.7kwh/m2/yr to 7.5 kwh/m2/yr. 71% of total energy consumption and net Carbon Dioxide emission is reduced. Detail of calculation is shown Appendix 1 – 5.

LOTUS GOLD Certifications

The campus is then assessed by LOTUS rating of the Vietnam Green Building Council (VGBC). The final design is fully Energy Efficiency Building Code compliant and as a result achieved a GOLD rating on the LOTUS (Total points achieved is **130**)

APPENDIX 3 LOTUS ASSESSMENT RESULT FOR FUNGI COMMUNITY SCHOOL

Item	Categories	Points from Lotus	Points from Campus
1	Energy	34	33
2	Water	15	13
3	Materials	20	15
4	Ecology	13	8
5	Waste & Pollution	13	12
6	Health & Comfort	20	16
7	Adaptation & Mitigation	13	11
8	Community	10	7
9	Management	12	11
10	Innovation	8	4
	Total	158	130

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