ALGAE-TECH

AN URBAN ALGAE HUB & INNOVATION DISTRICT FOR PRODUCTION, RESEARCH & DEVELOPMENT

THE (FR)AGILE CITY :

An emerging social category referring to the vulnerability of cities brought about by the negative effects of climate change and urbanization. Cities are overwhelmed by the aggregation of multiple risks that overwhelm local systems, contributing to the vulnerability and fragility of a city.

In contrast, the Agile City is defined as combining innovations through sustainability, diversity, and flexibility in order to address rapid changes in urban areas.

CLIMATE CHANGE IN THE (FR)AGILE CITY:

The severe effects of human activity on the Earth's environment have led to increased risks, consequences, and rapid changes on the planet.

76% of greenhouse gases are carbon dioxide emissions

75% of carbon dioxide emissions are generated by cities

The burining of coal, oil, and fossil fuels is the single largest source of global greenhouse gas emissions.

45% of gas emissions are produced by the energy sector
24% from the agriculture sector
21% from industries and waste and 10% from others

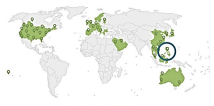
How can we reconcile **urban development** and **expansion** with efforts to reduce carbon dioxide emissions?

WHY ALGAE?

While the world is looking for alternatives to fossil fuels, algae is an emerging source of energy, food, and a remarkable carbon dioxide absorber.

We need to anticipate algae's **GREEN FUTURE** in the core of our urban cities, where the city is most vulnerable due to risks brought about by climate change and urbanization.

THE SITE :



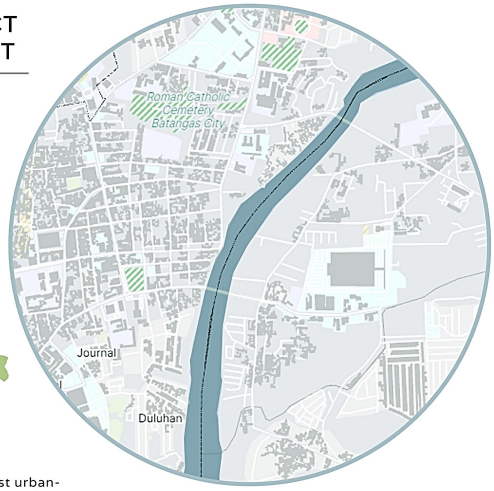
PHILIPPINES
SOUTHEAST ASIA

REGION IV-A
CALABARZON

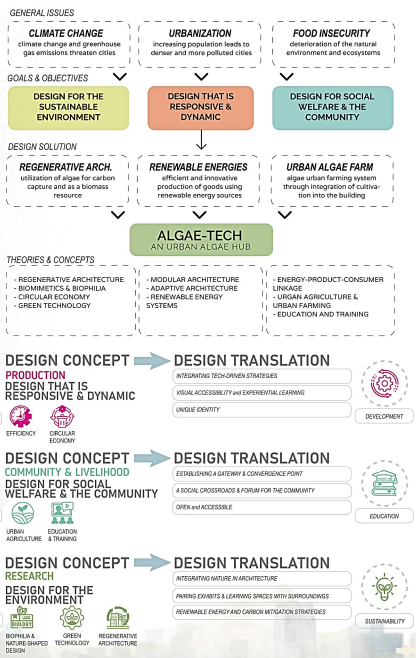
BATANGAS CITY
BATANGAS

BATANGAS CITY :

Known as the industrial Port City of CALABARZON, it is one of the fastest urbanizing cities of the Philippines and an important urban center of the region. There is a need to shift towards sustainable development and energy resiliency.

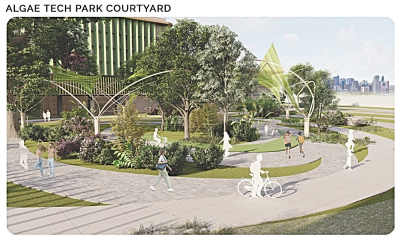


DESIGN FRAMEWORK

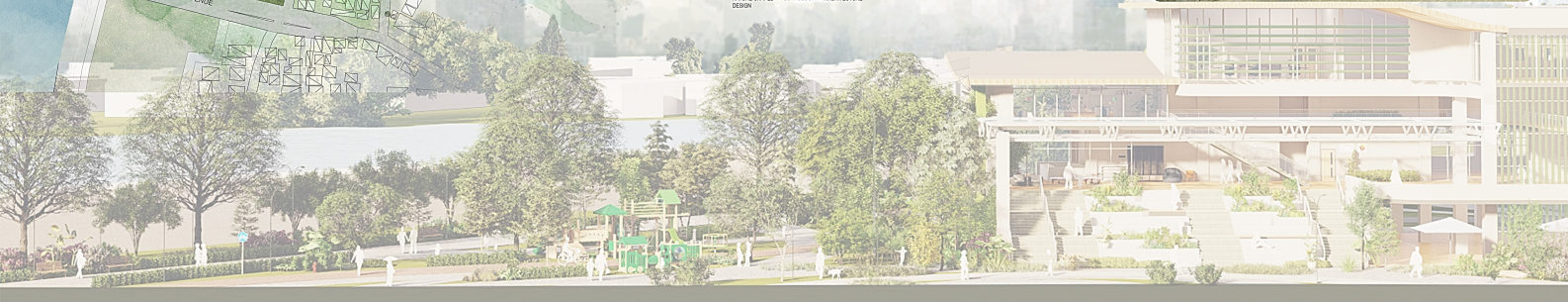


WATERFRONT LINEAR PARK

ALGAE TECH PARK COURTYARD



ALGAE TECH PARK COURTYARD



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WHY ALGAE?

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humans produce approximately **2 tons of CO^2** in a year

1 acre of algae can absorb **2-3 tons of CO^2** in a day

As the demand for renewable energy sources increases worldwide, microalgae offers a viable biomass resource to produce biofuel.

Carbon Sequestration
Algae absorbs CO2 as part of their photosynthesis, producing biomass

Less Land Area
Algae requires less land area for cultivation than other crops, while growing faster than trees

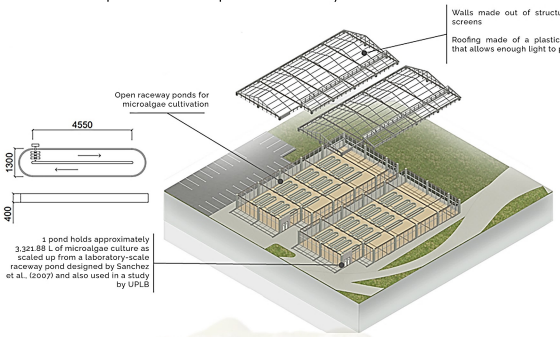
Wastewater Treatment
Algae for wastewater treatment is a developing sustainable and affordable alternative

Byproduct Applications
A potential source of renewable nutrition, pharmaceutical, and nutraceutical products

ALGAE CULTIVATION METHODS

Closed Tubular Photobioreactor:

- Very low risk of contamination compared to open raceway ponds
- No limitation regarding the algae species that can be grown
- Higher productivity in terms of mass per area and day
- Significantly higher volumetric productivity
- Notably higher concentration in terms of mass per liter
- More efficient harvesting procedure
- No evaporation within closed system compared to open ponds
- Water loss is limited to external factors, such as the cooling process
- Biomass quality is highly reproducible due to excellent process control of tubular PBR systems
- High value products or high quality inoculum can be produced with optimum reliability



ALGAE PHOTOBIOREACTOR FACADE

An algae tubular photobioreactor (PBR) facade for cultivation of microalgae on the building. Tubular photobioreactors (PBRs) were selected for this project as the most feasible for building facade application in the Philippines. The selected design was adapted from SCHOTT Tubular Glass Photobioreactors, one of the world's leading manufacturers of glass tubes.

Bio-secure
protection against bio-contamination and culture crashes

Productive
80 – 160 l/m² photoactive volume, PBR height up to 6 m

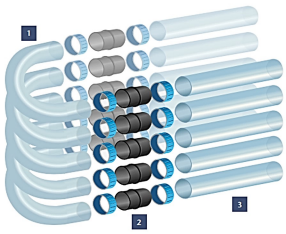
Cost efficient
little maintenance and low total cost of ownership

Durable
sustainable light transmission T > 95 % (air – glass – water), lifetime of 50 years and more

Resistant
against chemicals, corrosion, sagging, scratches, UV-light

Food safe
food and pharma grade

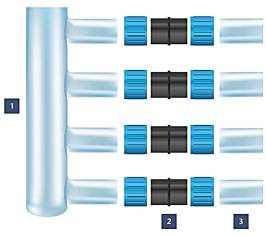
Helical System



1 - U or J-Bend
2 - Coupling
3 - Tubing

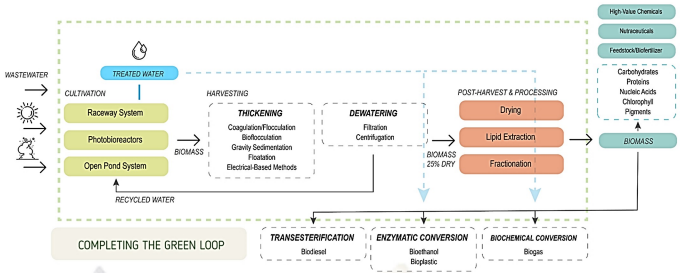
The proposed system makes use of modular joints, couplings, and tubes for easy assembly and maintenance. Individual tubes may also be replaced.

Fence System



1 - Manifold
2 - Coupling
3 - Tubing

The tubes are made out of borosilicate glass, but the use of other materials may also be explored.

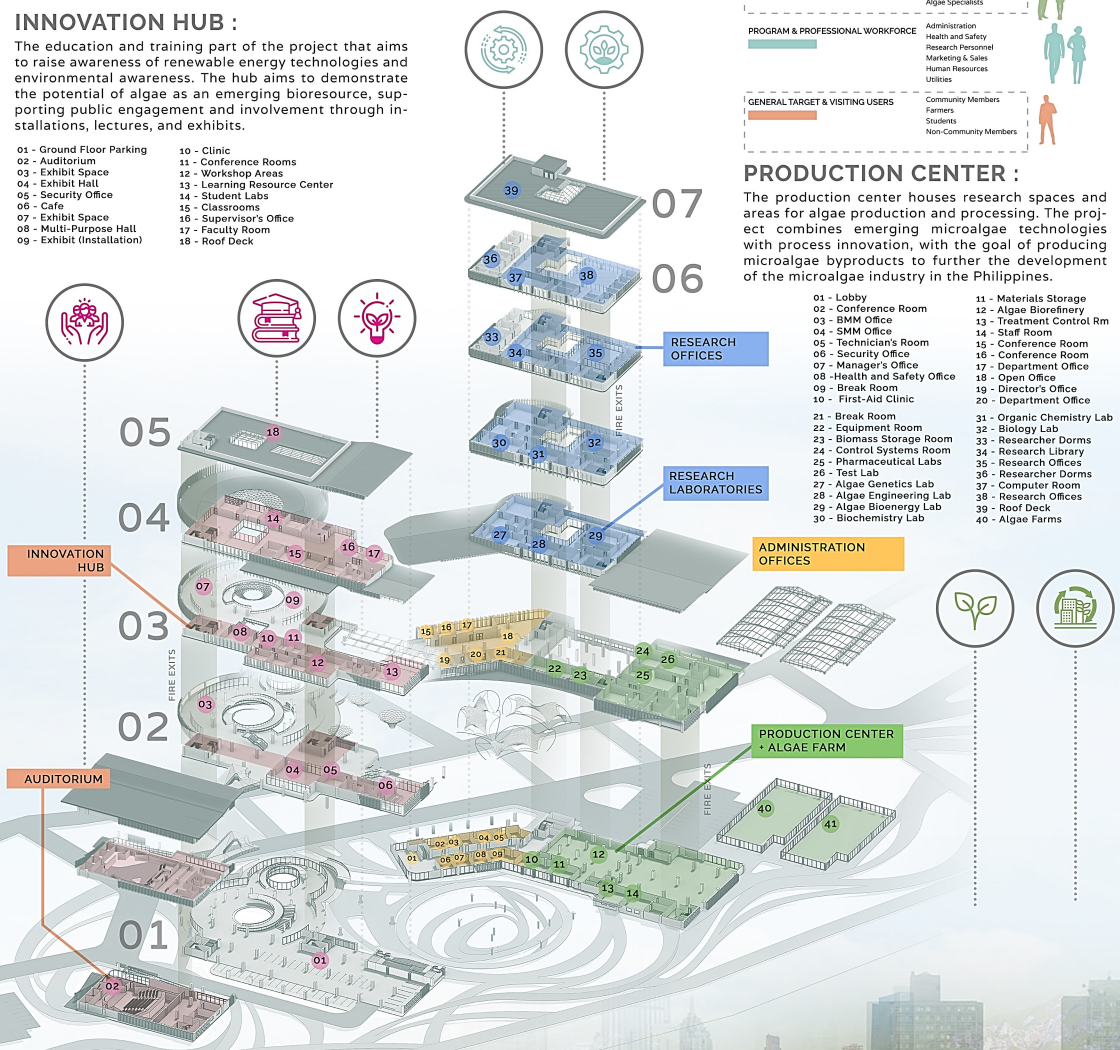


SITE SECTION :

INNOVATION HUB :

The education and training part of the project that aims to raise awareness of renewable energy technologies and environmental awareness. The hub aims to demonstrate the potential of algae as an emerging bioresource, supporting public engagement and involvement through installations, lectures, and exhibits.

01 - Ground Floor Parking
02 - Auditorium
03 - Exhibit Space
04 - Exhibit Hall
05 - Security Office
06 - Cafe
07 - Exhibit Space
08 - Multi-Purpose Hall
09 - Exhibit (Installation)
10 - Clinic
11 - Conference Rooms
12 - Workshop Areas
13 - Learning Resource Center
14 - Student Labs
15 - Classrooms
16 - Supervisor's Office
17 - Faculty Room
18 - Roof Deck



USER PROFILES

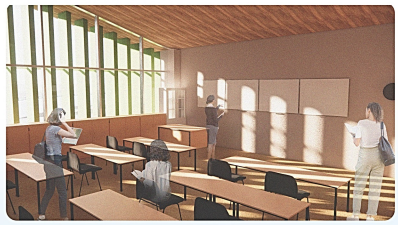
PRODUCTION CENTER :

The production center houses research spaces and areas for algae production and processing. The project combines emerging microalgae technologies with process innovation, with the goal of producing microalgae byproducts to further the development of the microalgae industry in the Philippines.

01 - Lobby
02 - Conference Room
03 - BMM Office
04 - SMM Office
05 - Technician's Room
06 - Security Office
07 - Manager's Office
08 -Health and Safety Office
09 - Break Room
10 - First-Aid Clinic
11 - Materials Storage
12 - Algae Biorefinery
13 - Treatment Control Rm
14 - Staff Room
15 - Conference Room
16 - Conference Room
17 - Department Office
18 - Open Office
19 - Director's Office
20 - Department Office
21 - Break Room
22 - Equipment Room
23 - Biomass Storage Room
24 - Control Systems Room
25 - Pharmaceutical Labs
26 - Test Lab
27 - Algae Genetics Lab
28 - Algae Engineering Lab
29 - Algae Bioenergy Lab
30 - Biochemistry Lab
31 - Organic Chemistry Lab
32 - Biology Lab
33 - Researcher Dorms
34 - Research Library
35 - Research Offices
36 - Researcher Dorms
37 - Computer Room
38 - Research Offices
39 - Roof Deck
40 - Algae Farms

INNOVATION HUB EXHIBIT AREA

INNOVATION HUB CLASSROOMS



PRODUCTION CENTER ALGAE BIOREFINERY

PRODUCTION CENTER LABORATORIES