

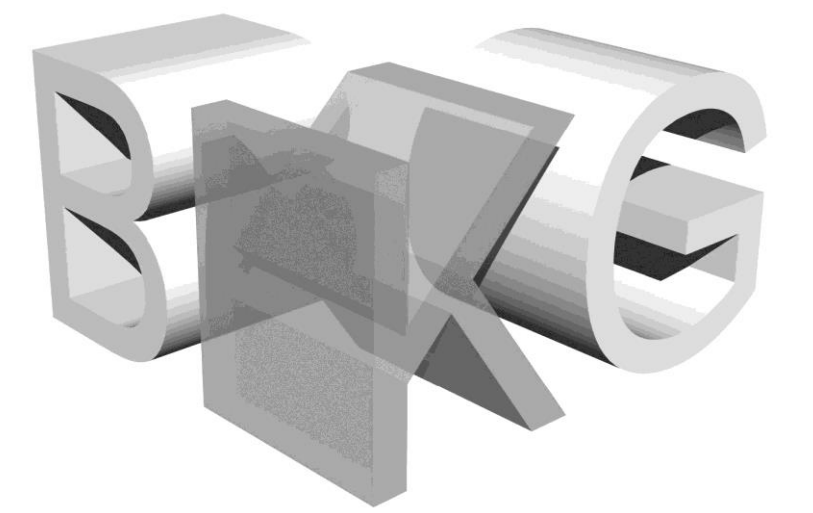
# Constructive Design and Building Construction



TECHNISCHE  
UNIVERSITÄT  
DARMSTADT



Vietnamese - German  
University



Master Thesis – Pham Quang Dong

Application of Green Building to elementary school in Nha Be district, Ho Chi Minh City, Vietnam

## 1. Introduction

Vietnam confronts numerous problems originated from the high urbanization rate.

- Shortage of housing, the contaminated ecological, power consumption increased, etc.
- The process of applying green building in Vietnam has just in the early stages.

Changing people's attitudes to the environment is a troublesome responsibility. So, a good preparation need to be concerned to put into a logical model for energy efficiency, environmental protection for sustainable development in Vietnam

### Research objectives

- Approach green building factors for elementary schools in HCMC focus on three-dimensional goals: economic, ecological and social aspects.
- Suggest appropriate green building concept in converting one exemplary school in HCMC to a green school.
- Analyzes the capable to transfer the green building solutions of the exemplary school to other schools in HCMC. These will help this area become a neighborhood famous for sustainable school - a teaching tool that makes significant changes to mitigate the environmental impact.

### Research questions

- What is green school and to what extents the green school is important for sustainable development in HCMC?
- What is the status of environmental condition in HCMC and how it will affect to elementary green school in HCMC?
- What possible solutions to make elementary green school become an acceptable teaching tool to the society, physical surrounding, and children's learning environment?

### Steps of research

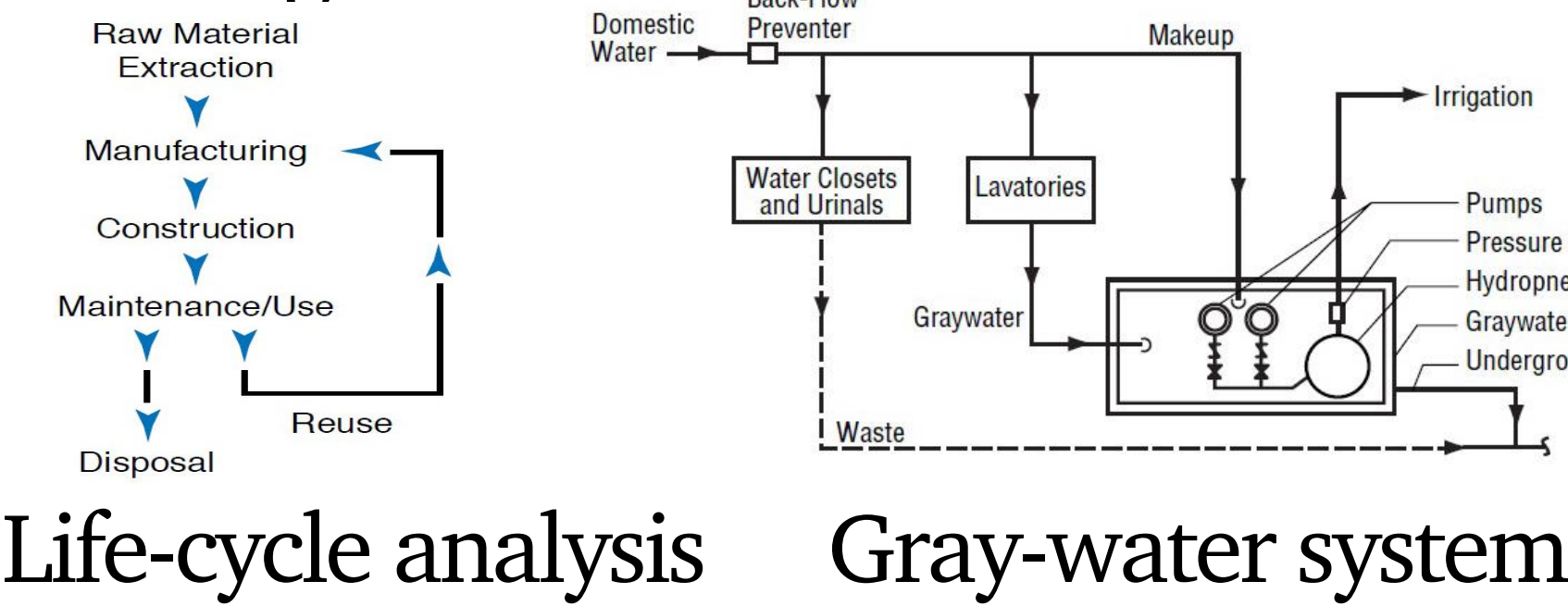
- Study sustainability issues, green school, etc. Then provides the green building elements and the guideline for designing green schools in tropical zones.
- Set up a system of objectives for elementary green school referred to the building code in Vietnam and LOTUS NR standard to evaluate the green school concepts.
- Propose the specific solution for a school in the region that appropriate to the system of criteria and study the applicability of school model for the other schools in HCMC.

## 2. Green school guidelines in tropical climates

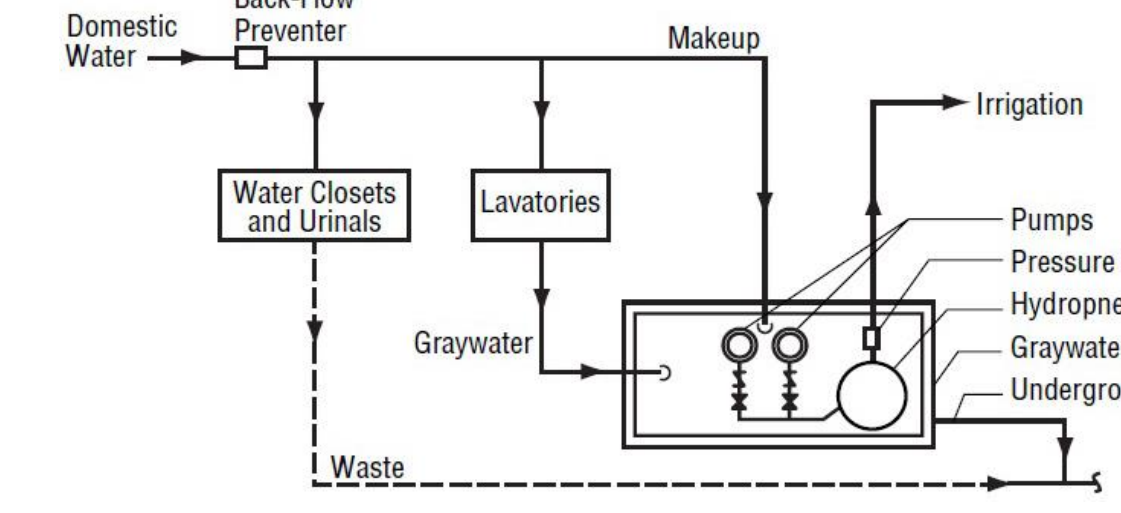
• **Site and landscape design:** Protecting local ecosystems. Consider green solutions for both horizontal and vertical spaces.

• **Energy efficient:** Energy efficient building shell - Electrical lighting systems - Mechanical and ventilation systems - Renewable energy systems.

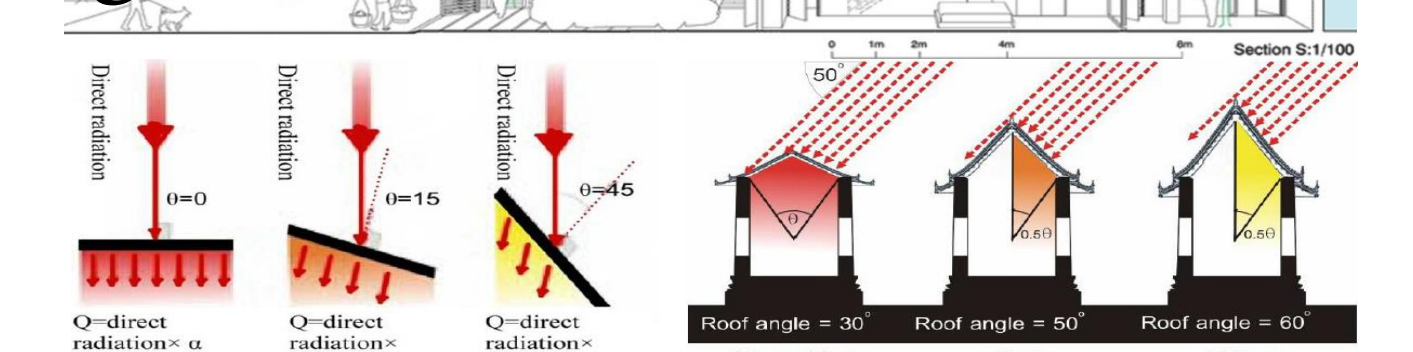
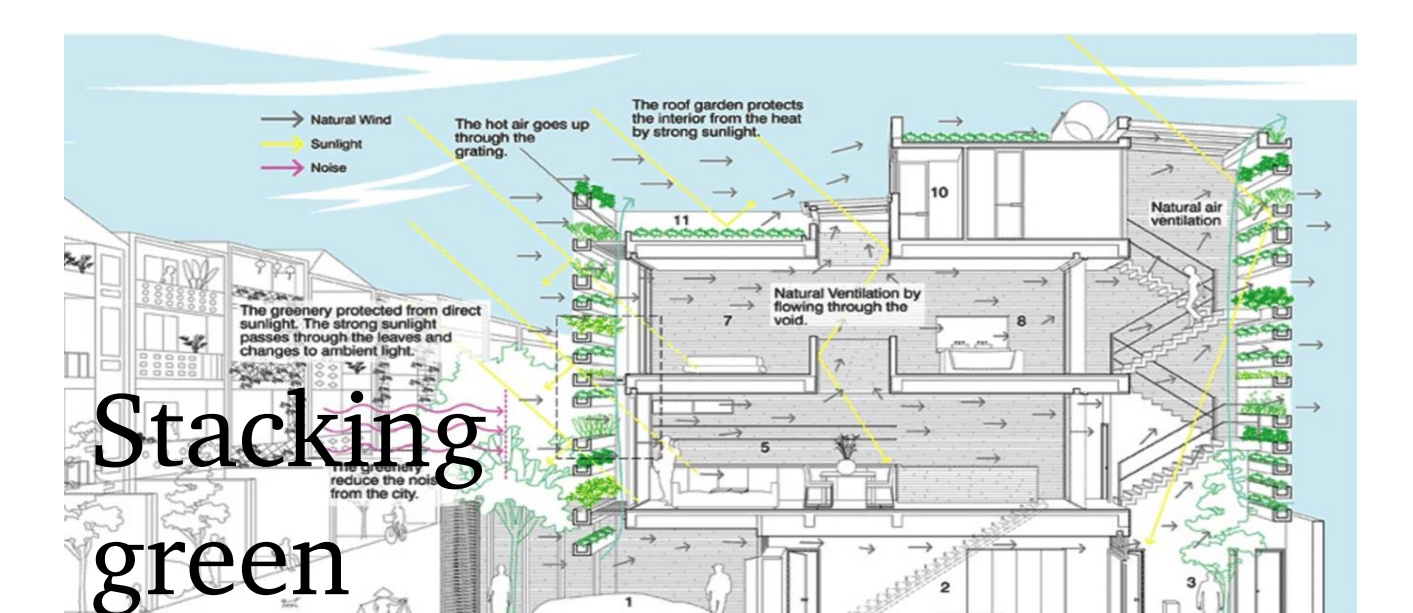
• **Water conservation:** Water-conserving fixtures - Rainwater management - Gray-water Systems - Water-conserving landscaping strategies



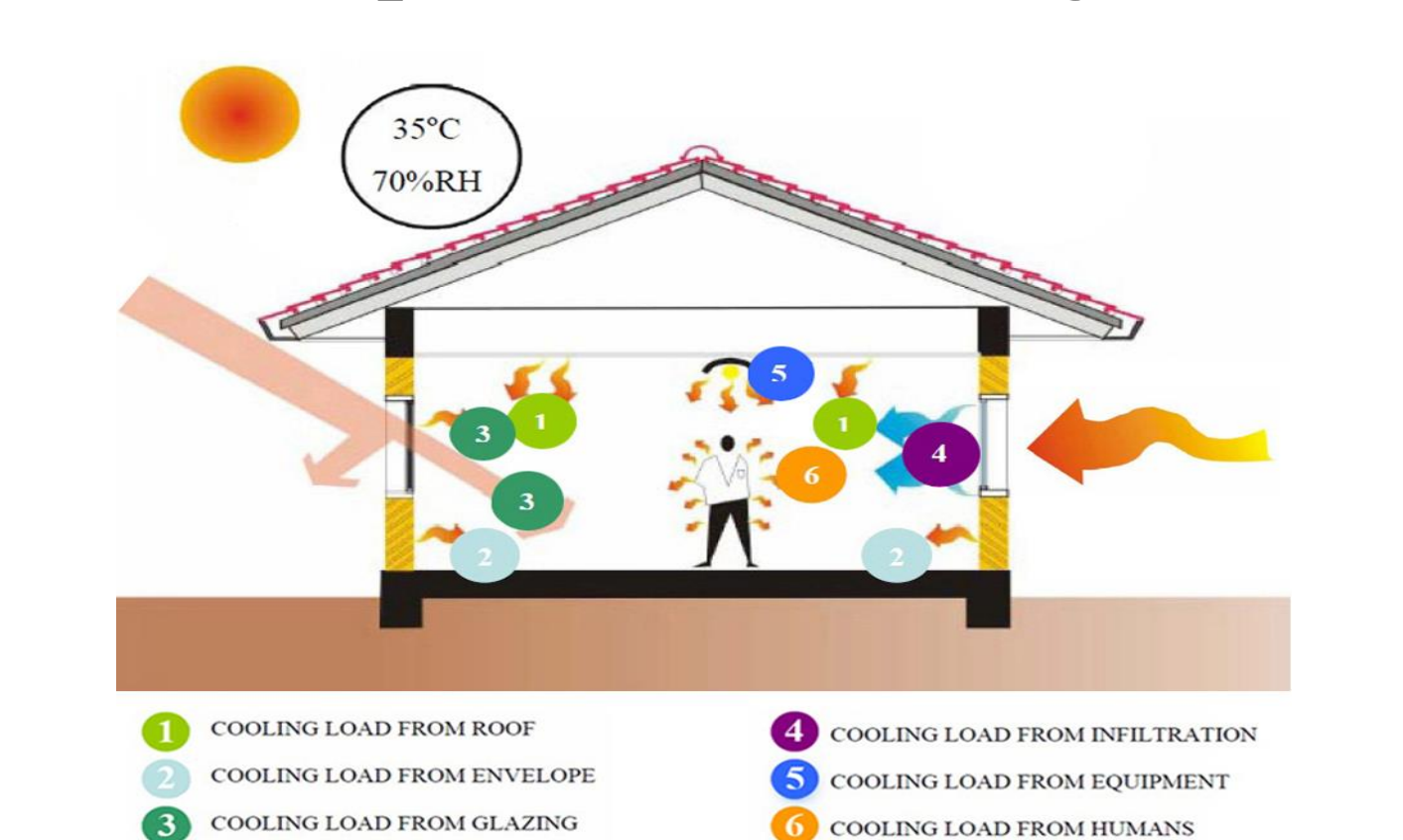
Life-cycle analysis



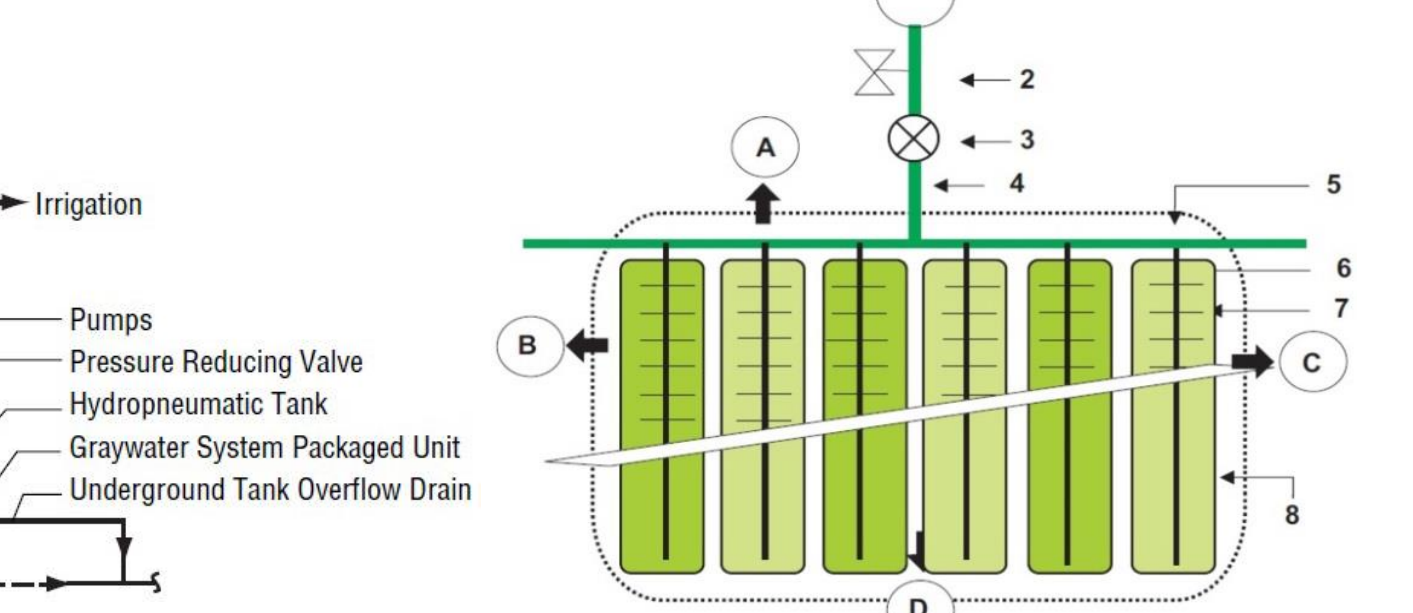
Gray-water system



The impact of roof angle



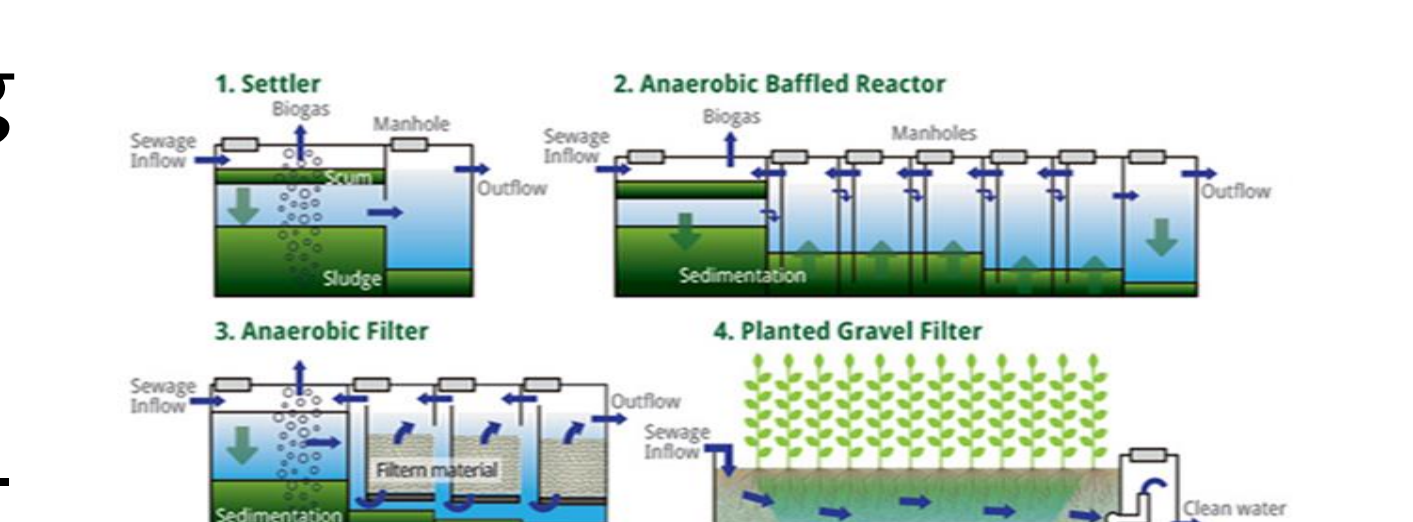
Cooling load



Drip irrigation systems

• **Resource-efficient building products**

• **Environment:** Waste water treatment - Recycling systems and waste management



Decentralized Wastewater Treatment

## 3. System of objectives

• A system of objectives with detail information of credit, criteria, minimum requirements and rankings by point based on LOTUS standard (VGBC)

OBJECTIVE	<i>Elementary green school as a three-dimensional textbook to mitigate the climate change and create healthier environments for students and staff</i>		
<b>SUPERIOR OBJECTIVES</b>	<b>Economic aspect:</b> - Use efficient energy, water and other resources	<b>Ecological aspect:</b> - Adapt to climate change - Control the environmental impact throughout the construction process and the operating lifetime of the building	<b>Social aspect:</b> - Enhance teachers and students' performances and health
<b>SUBORDINATE OBJECTIVES</b>	- Reduce energy consumption for cooling, lighting and water heating - Reduce fresh water utilization	- Promote sustainable materials - Ecological reserve - Control waste and pollution - Adaptation and mitigation	- Increase environment quality aim at promoting health and comfort condition



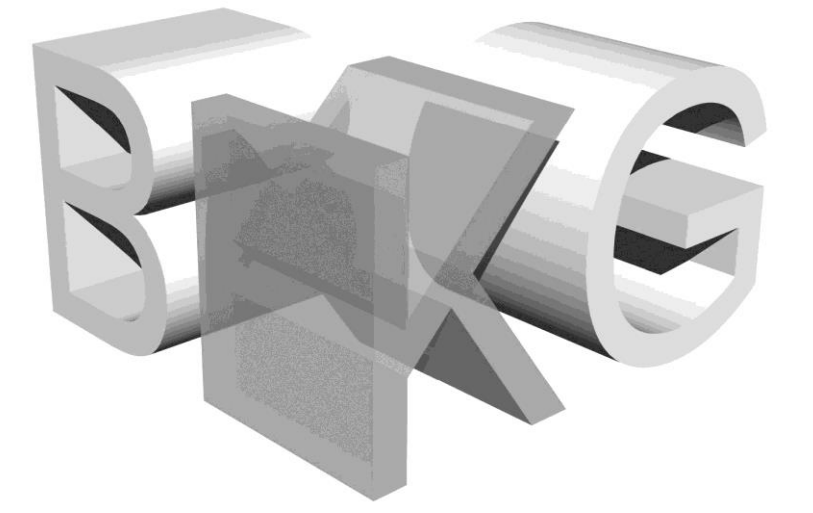
# Constructive Design and Building Construction



TECHNISCHE UNIVERSITÄT DARMSTADT



Vietnamese - German University

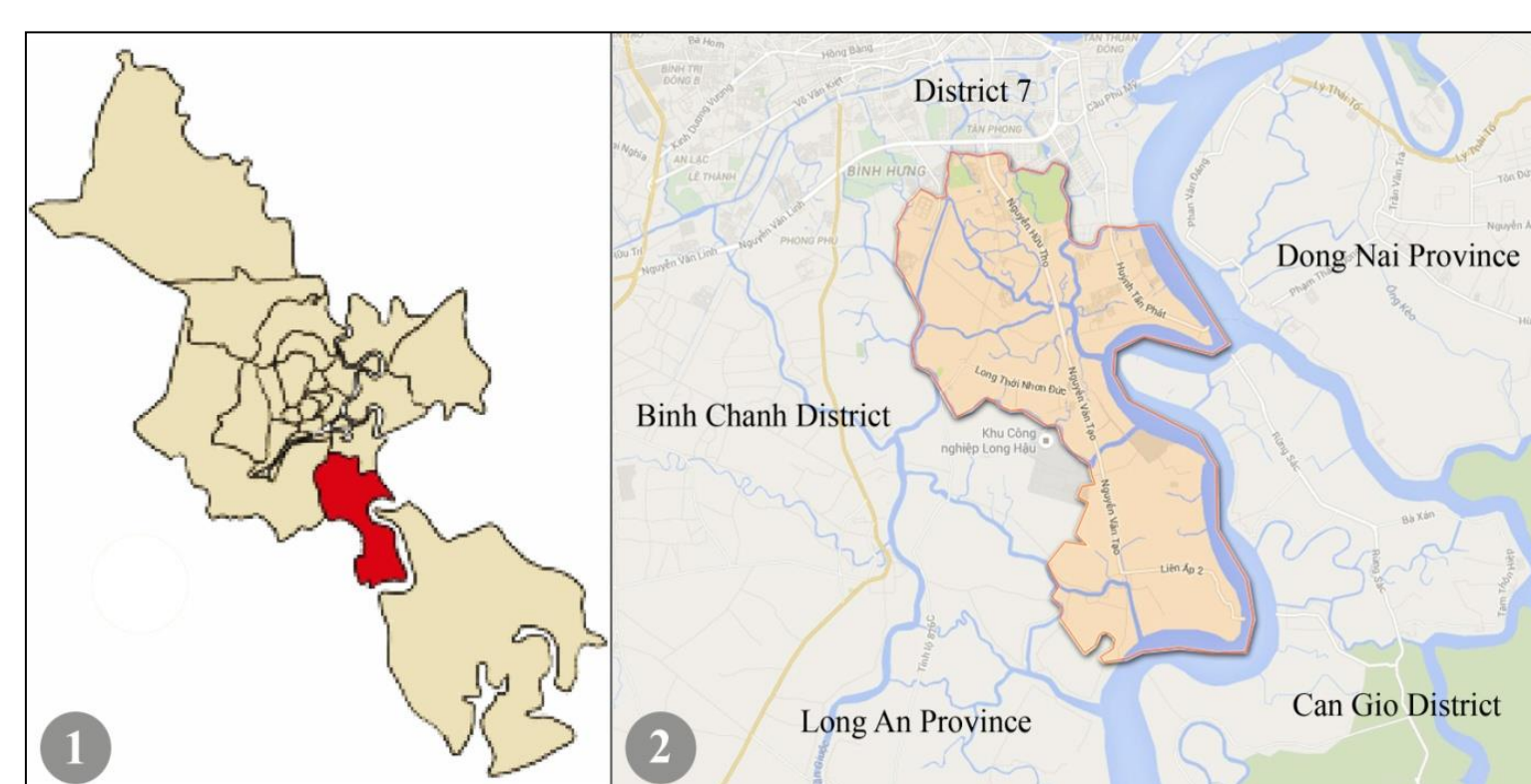


Master Thesis – Pham Quang Dong

Application of Green Building to elementary school in Nha Be district, Ho Chi Minh City, Vietnam

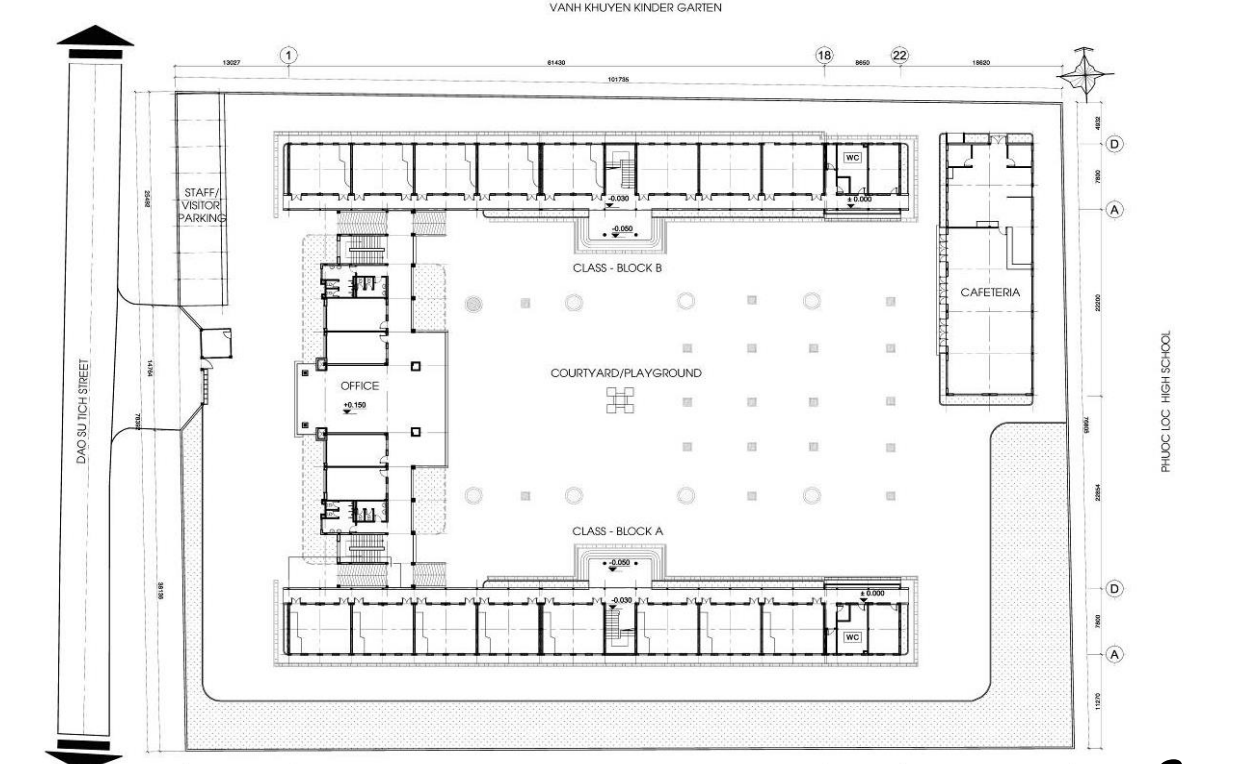
## 4. Case study: Nha Be district

• **Nha Be:** a suburban district of HCMC. This is an area where new harbors, industries and residential neighborhoods are being created in a low lying territory.



Geographical location of Nha Be

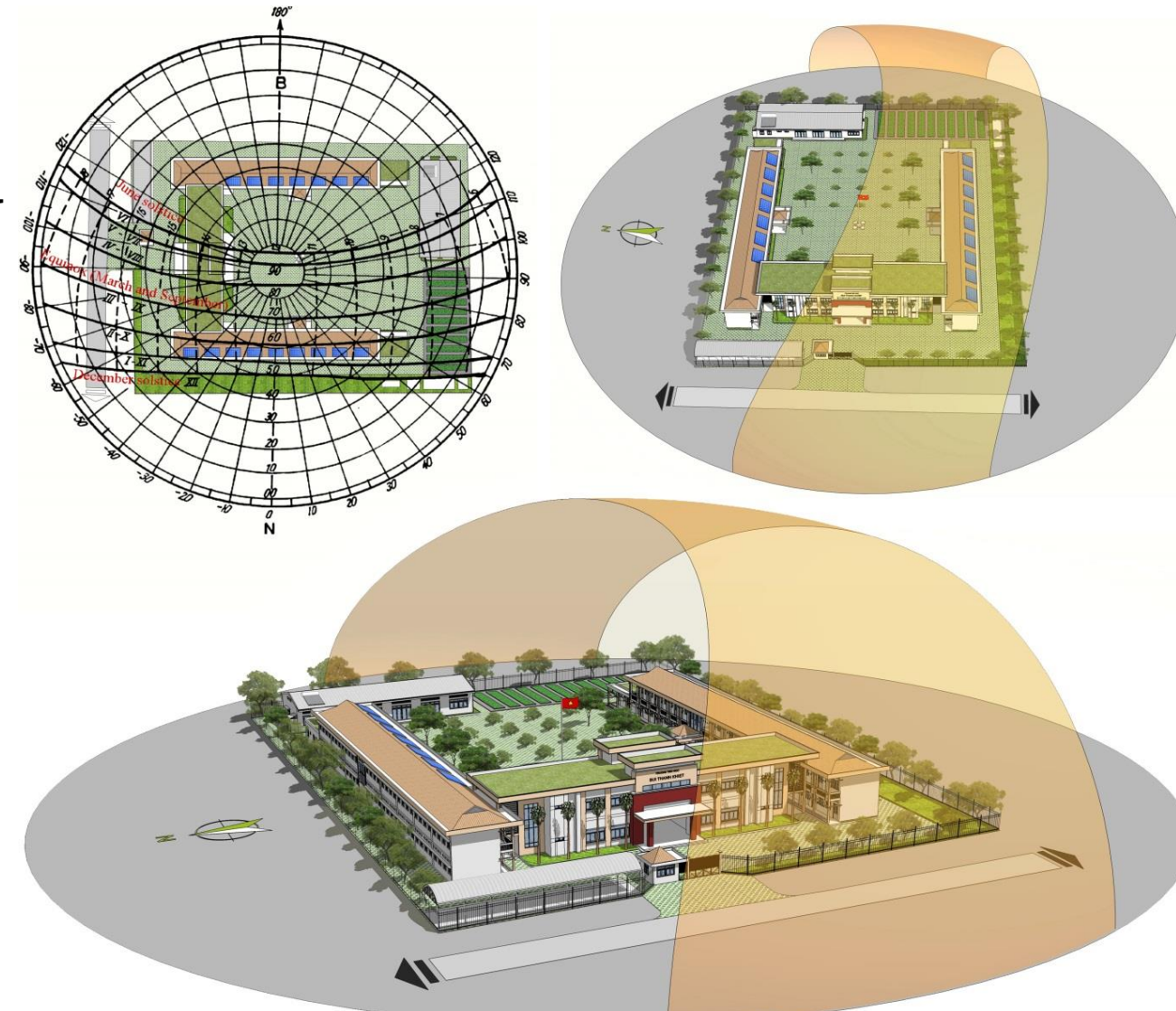
• **Bui Thanh Khiet School** - A 2-storey building includes 21 classrooms and other rooms for many functions (library, meeting room, etc.) which are built in 7869.8 m<sup>2</sup> area located in Phuoc Loc residential area



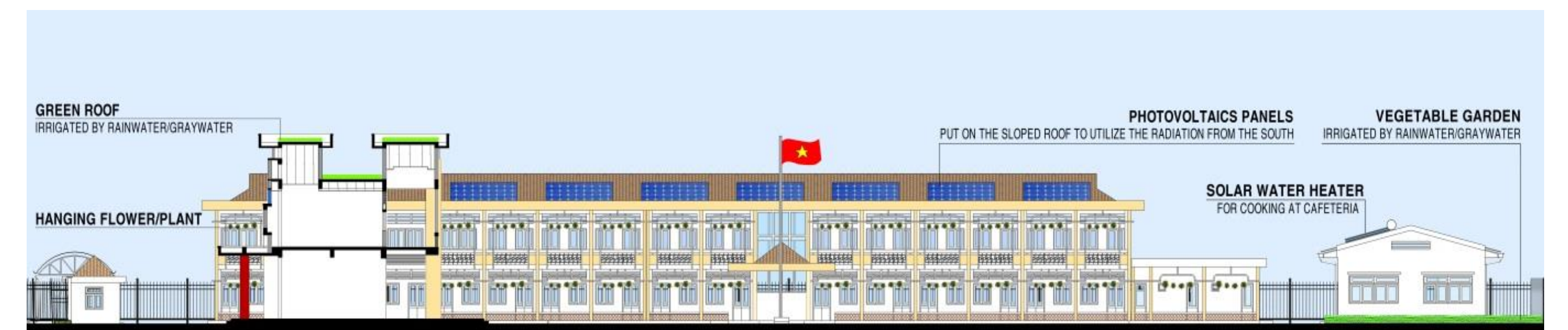
Status quo of Bui Thanh Khiet school

## 5. Green elementary School proposal

• The building is checked with the regulations of the Energy Efficiency Building Code by the Ministry of Construction of the Socialist Republic of Vietnam and LOTUS NR standard of VGBC.



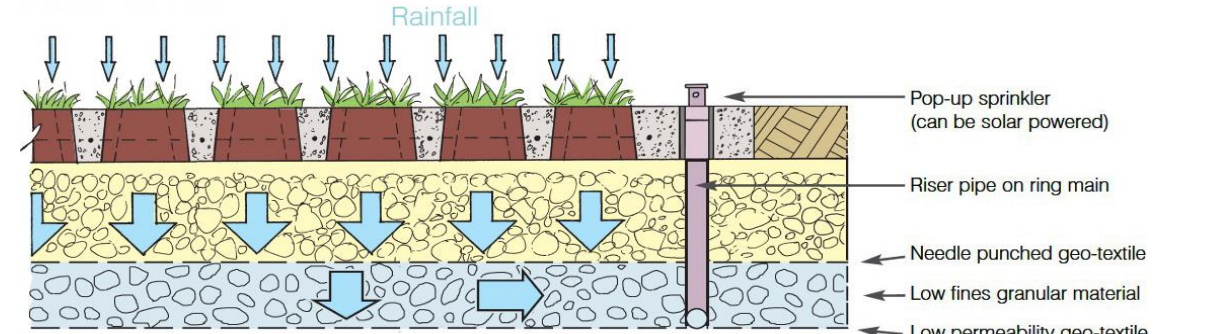
Sun path diagram for Bui Thanh Khiet school



Green school proposal illustrated by sections



Efficiency water systems



Irrigation detail for grass-crete



Green spaces solutions

**The strategies to renovate Bui Thanh Khiet become a green school**

- Reduce energy consumption for cooling, lighting and water heating
- Reduce fresh water utilization
- Ecological reserve
- Solid waste management
- Materials solutions

• Assess Bui Thanh Khiet elementary School based on the system of objectives.

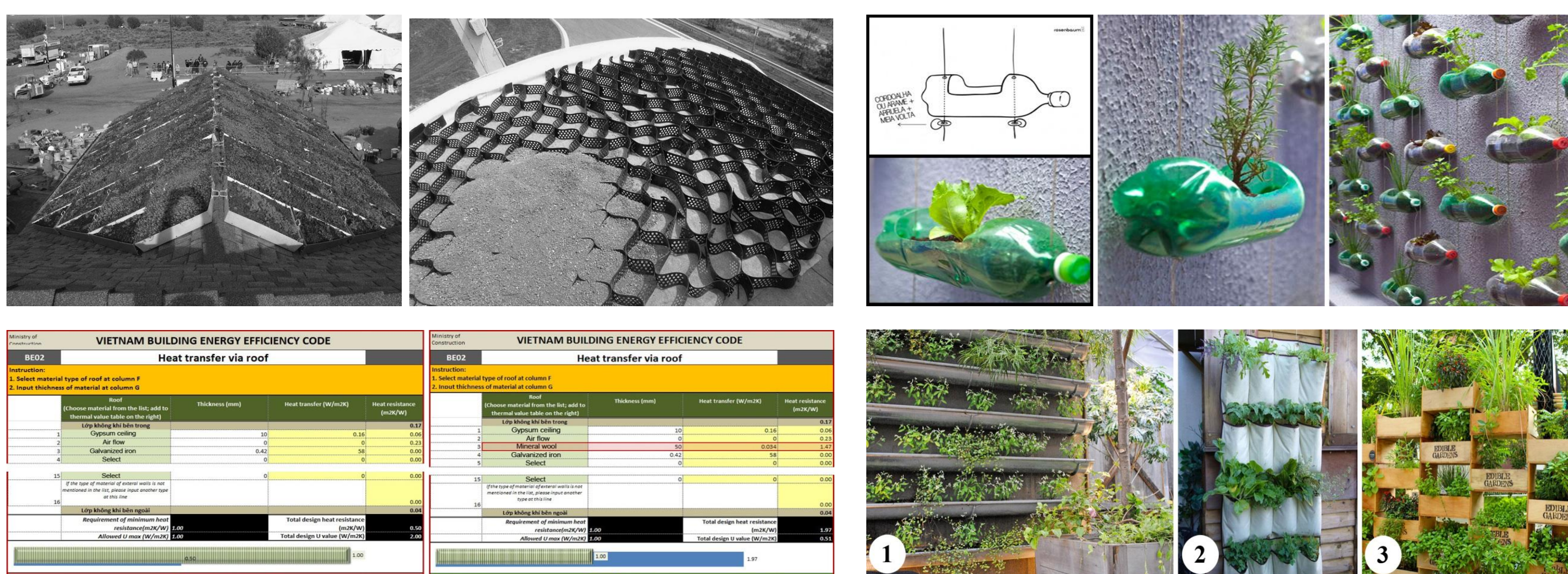
• The solutions to renovate Bui Thanh Khiet School become a green School is almost low cost and familiar solutions. Essentially, the solutions achieve green building standards of Vietnam.



STATUS QUO

RENOVATION

## 6. Recommendation for other Schools



Solutions for the other schools

• Similar to Bui Thanh Khiet school, green solutions for other schools in HCMC promote local resources, oriented to build simple solutions appropriate to the level of local construction, easy maintenance and reasonable cost. Many schools can apply various solutions of Bui Thanh Khiet School; the others have to change to match with their actual conditions. The application of formulas proposed in LOTUS standard and EEBC code is a necessary step to assess and propose reasonable green solutions.