

GREEN DESIGN PRINCIPLES

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LEARNING OBJECTIVES

- _ the man, seen as the central element of the architectural project
- _ implementation of green design methodology
- _ architectural contextualism integration on sustainability principles background
- _ critical mechanism for the contemporary architectural design in Romania
- _ outlining basic features/principles adaptable in Romanian architecture



LEARNING OBJECTIVES

COURSE AGENDA

PART 1

1. Introduction. Concepts of Sustainable Development in Architecture

PART 2

2. The Designing Process - Concept of Metadesign (design of the project)
3. Preliminary studies of the architectural project
4. Defining the architectural concept of the intervention
5. Defining the Bioclimatic Design Principles
Selection of design principles, related to the unique context of the insertion site



LEARNING OBJECTIVES

COURSE AGENDA

PART 3

6. Defining the Bioclimatic Design Strategies
Extraction of design strategies, through conceptual functioning scenarios of the building

PART 4

7. Presentation of case studies
8. Theoretical Application



LEARNING OBJECTIVES

COURSE AGENDA

PART 1

1. Introduction. Concepts of Sustainable Development in Architecture

Sustainability Concept in Architectural Design

Eco-compatible architecture topics

Concepts of eco-compatible architecture

2. The Designing Process - Concept of Metadesign (design of the project)

PART 2

3. Preliminary studies of the bioclimatic architectural project

4. Defining the architectural concept of the intervention

5. Defining the Bioclimatic Design Principles

Selection of design principles, related to the unique context of the insertion site



LEARNING OBJECTIVES

1. Concepts of Sustainable Development in Architecture



LEARNING OBJECTIVES

1. Concepts of Sustainable Development in Architecture

ARGUMENT:

FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE



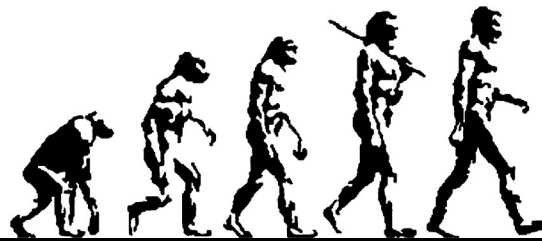
// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

ARGUMENT:

FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE

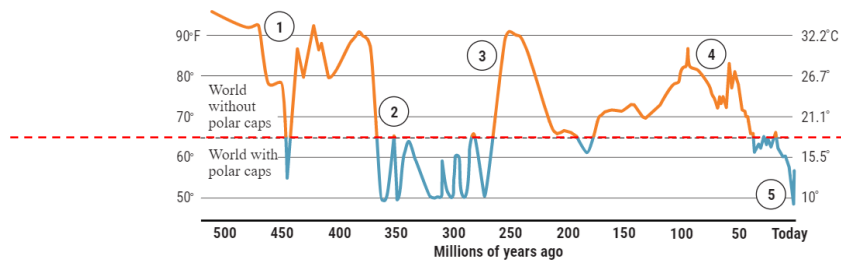
Man, climate and architecture



ASPECTE TEORETICE // THEORETICAL ASPECTS

ARGUMENT:
FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE

Man, climate and architecture



SMITHSONIAN INSTITUTION NATIONAL MUSEUM OF NATURAL HISTORY, ADAPTED BY N. DESAI/SCIENCE

- 1) Diversification of ocean life in high temperature conditions
- 2) Formation of terrestrial flora by absorption of (CO₂) and formation of ice caps
- 3) Large variations in CO₂ concentrations caused by volcanic eruptions
- 4) The evolution of mammals
- 5) The trend of global warming caused by human activities

<https://www.climate.gov/news-features/climate-qa/whats-hottest-earths-ever-been>

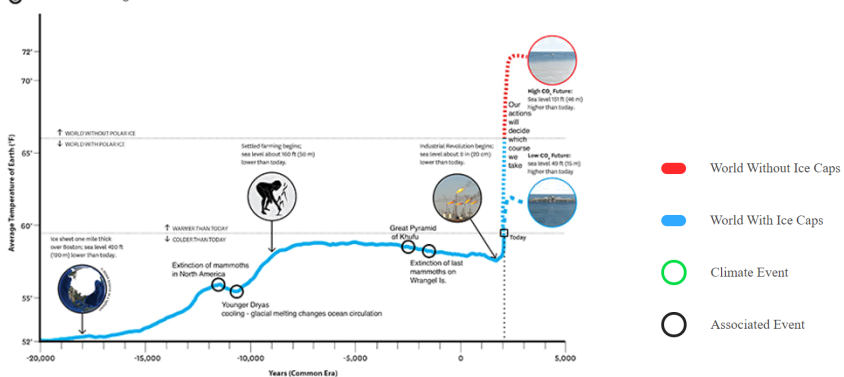


ASPECTE TEORETICE // THEORETICAL ASPECTS

ARGUMENT:
FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE

Man, climate and architecture

Global Temperature
Since the Last Ice Age



ASPECTE TEORETICE // THEORETICAL ASPECTS

ARGUMENT:
FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE

Man, climate and architecture

Gilgamesh tale

2700-2500 î.Hr.

The epic Sumerian tale of Gilgamesh describes vast tracts of cedar forests in what is now southern Iraq. According to the story, Gilgamesh defies the gods by cutting down the forest, and in return the gods say they will curse the land with fire and drought (as described in the ancient tablet seen here). In fact, the Sumerians likely deforested the land, causing widespread desertification. By 2100 B.C., soil erosion and salt buildup had devastated agriculture, forcing residents to move north to Babylonia and Assyria. Further evidence for this theory? Some of the first laws ever written to protect forests were decreed in the Sumerian settlement of Ur.



<https://www.treehugger.com/ancient-man-made-environmental-catastrophes-4869139>

<https://www.ancientpages.com/2015/10/09/missing-lines-from-epic-of-gilgamesh-shed-new-light-on-humbaba/>



ASPECTE TEORETICE // THEORETICAL ASPECTS

ARGUMENT:
FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE

Man, climate and architecture

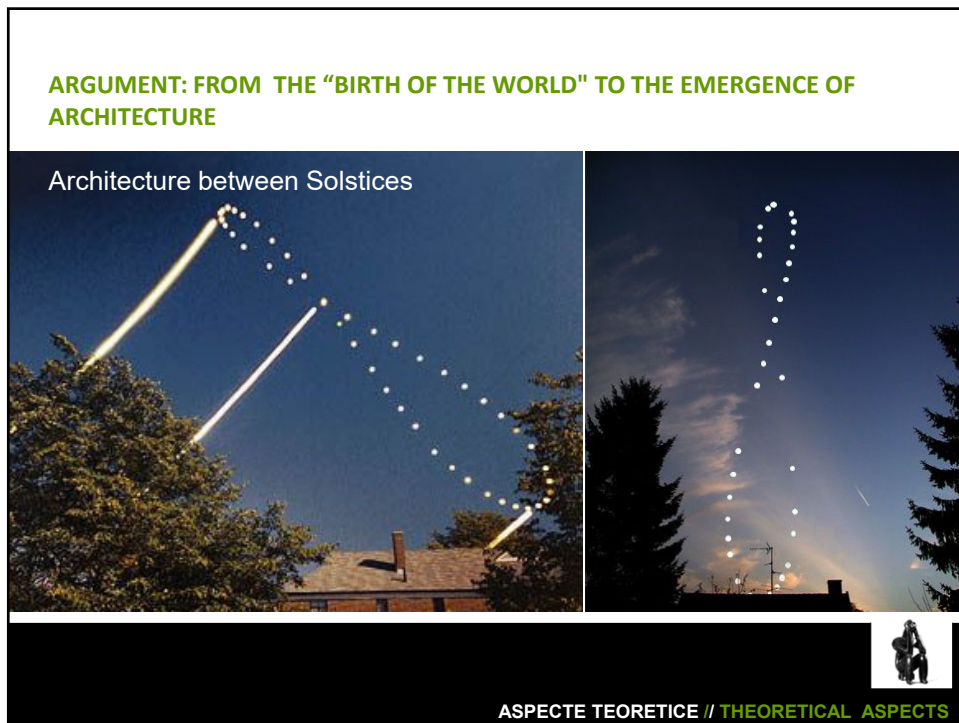
Easter Island (Chile) phenomenon
Sec XVIII e.n.

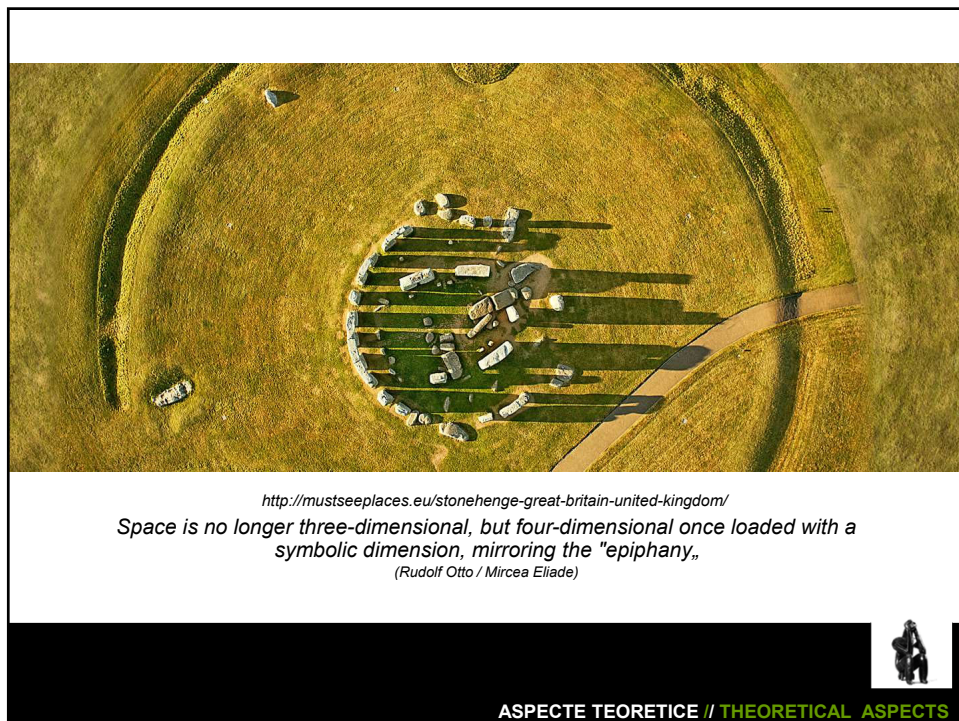
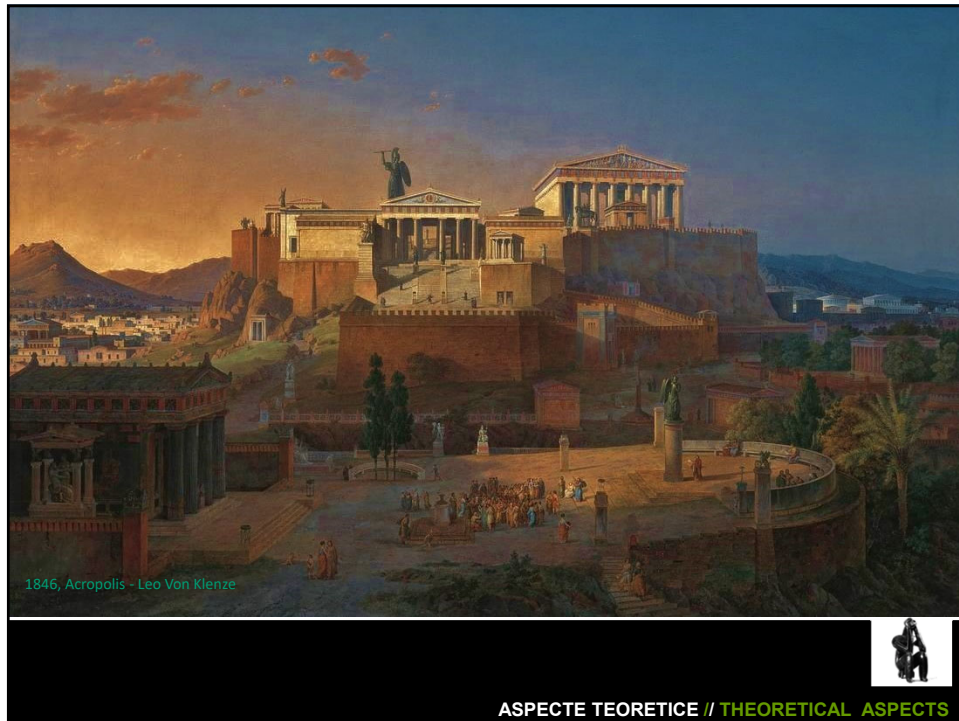


<https://phys.org/news/2017-01-humans-climate-australian-megaflora.html>



ASPECTE TEORETICE // THEORETICAL ASPECTS

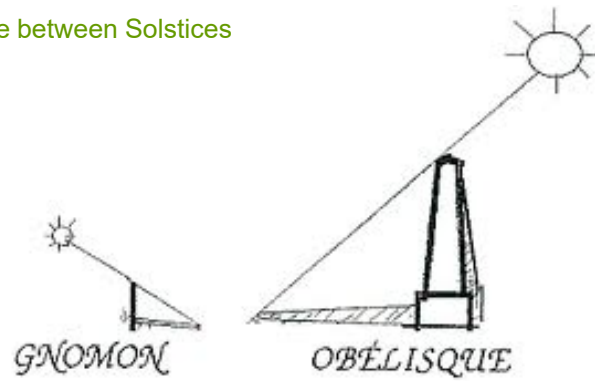




1. Concepts of Sustainable Development in Architecture

ARGUMENT: FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE

Architecture between Solstices



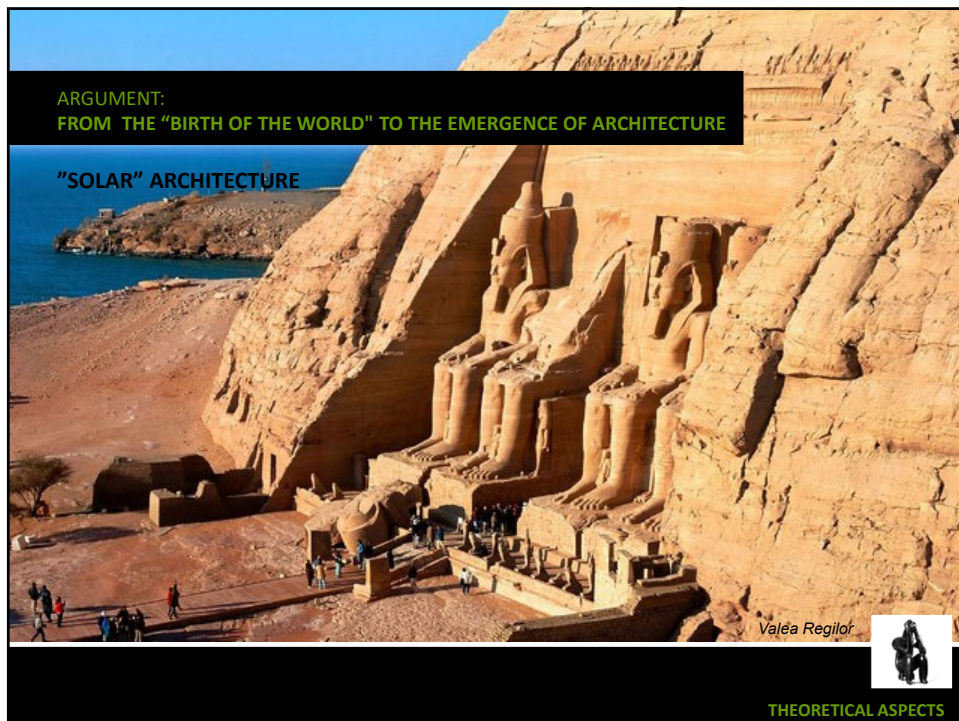
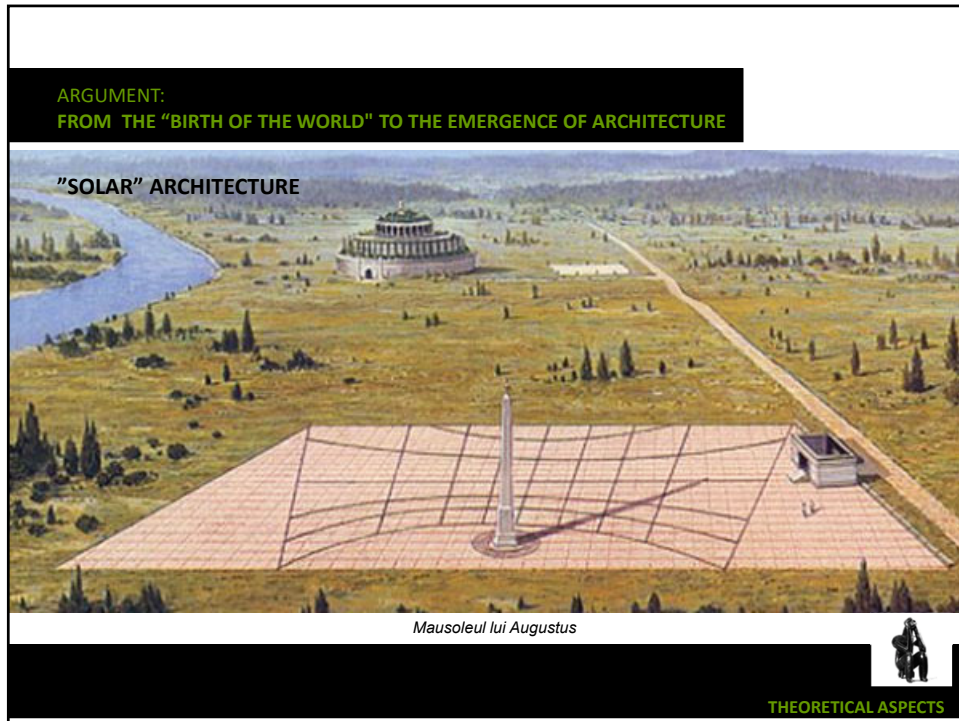
ASPECTE TEORETICE // THEORETICAL ASPECTS

**ARGUMENT:
FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE**

"SOLAR" ARCHITECTURE




THEORETICAL ASPECTS




ARGUMENT:
FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE

"SOLAR" ARCHITECTURE



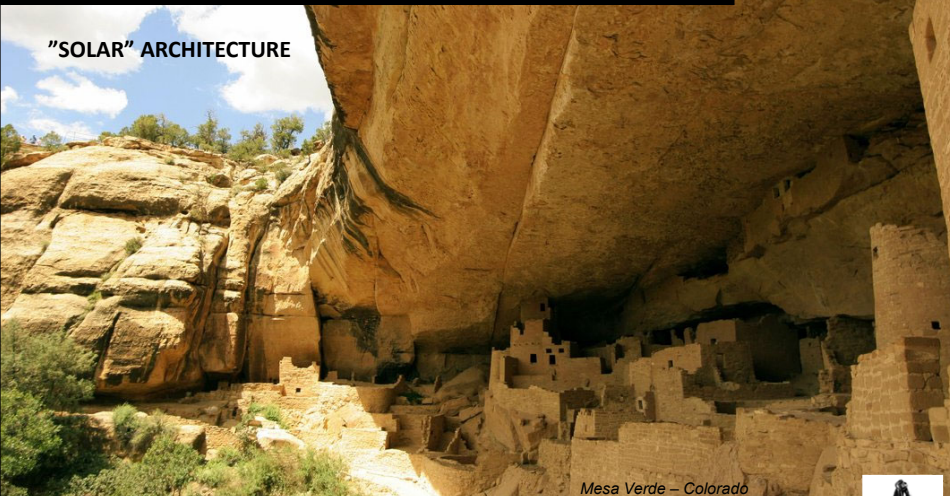
Sun alignment illuminates King Ramses II's face at Abu Simbel
22nd of February / October




THEORETICAL ASPECTS

ARGUMENT:
FROM THE "BIRTH OF THE WORLD" TO THE EMERGENCE OF ARCHITECTURE

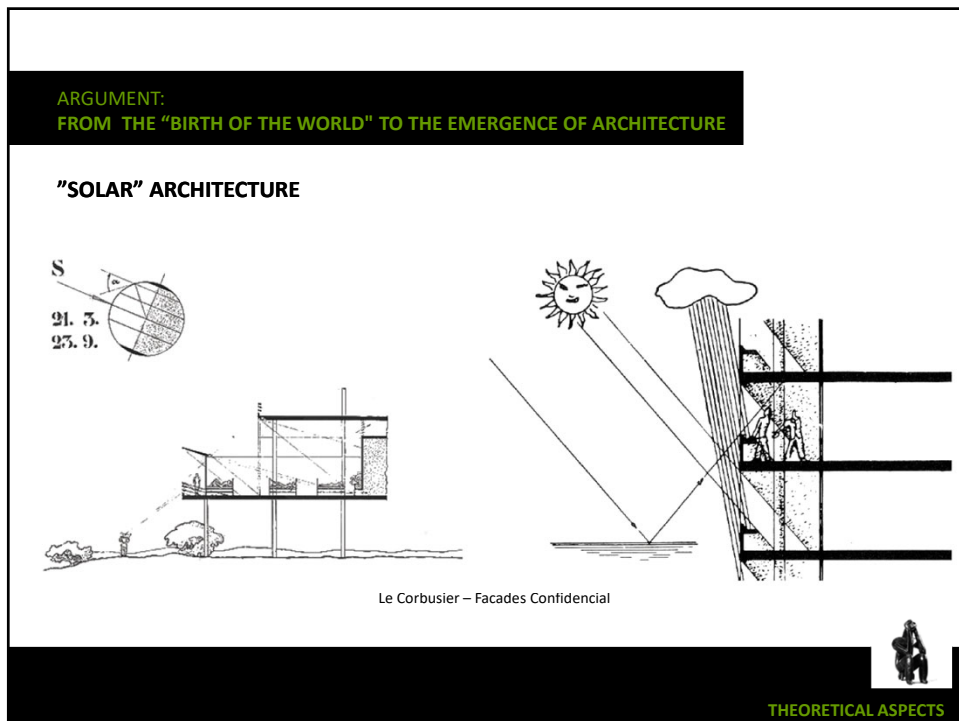
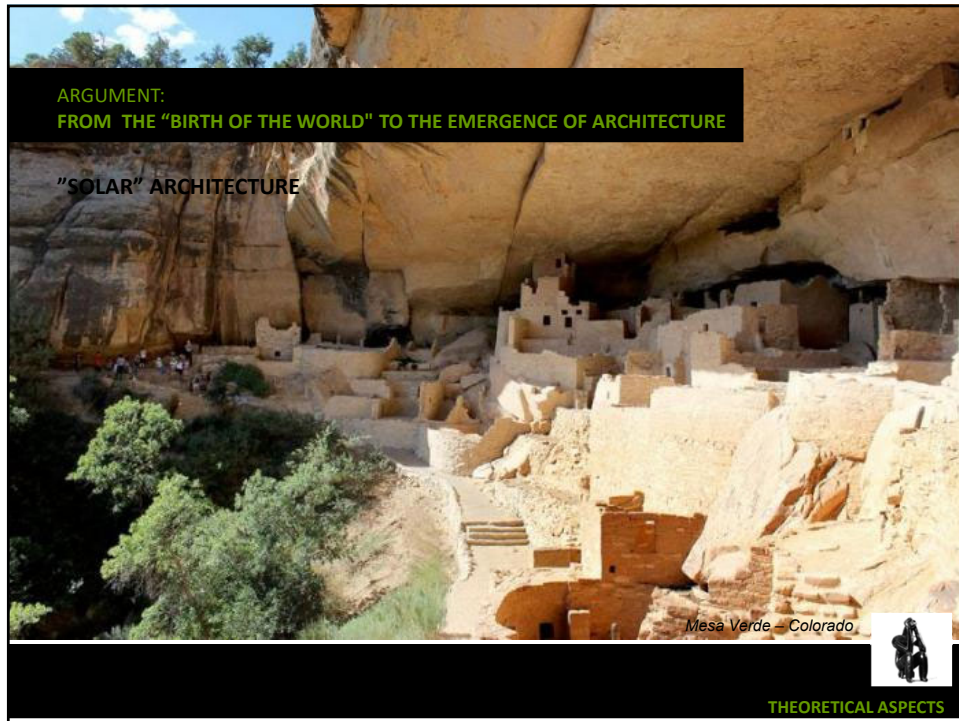
"SOLAR" ARCHITECTURE



Mesa Verde – Colorado



THEORETICAL ASPECTS



BUILDING AND CONTEXT

ADAPTED SHELTER – THE IGLOO

ASPECTE TEORETICE // **THEORETICAL ASPECTS****BUILDING AND CONTEXT**

ADAPTED SHELTER – THE YURT

ASPECTE TEORETICE // **THEORETICAL ASPECTS**

BUILDING AND CONTEXT



ADAPTED SHELTER – HOT HUMID CLIMATE



ASPECTE TEORETICE // THEORETICAL ASPECTS

BUILDING AND CONTEXT



ADAPTED SHELTER – HOT ARID CLIMATE



ASPECTE TEORETICE // THEORETICAL ASPECTS

BUILDING AND CONTEXT



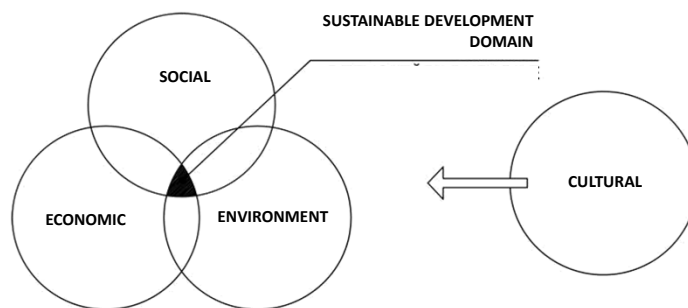
ADAPTED SHELTER – TEMPERATE CLIMATE



ASPECTE TEORETICE // THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

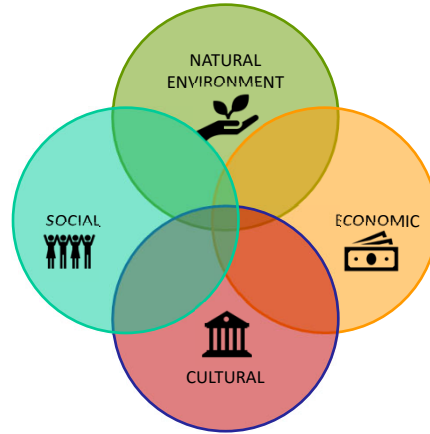
Sustainability Concept in Architectural Design



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

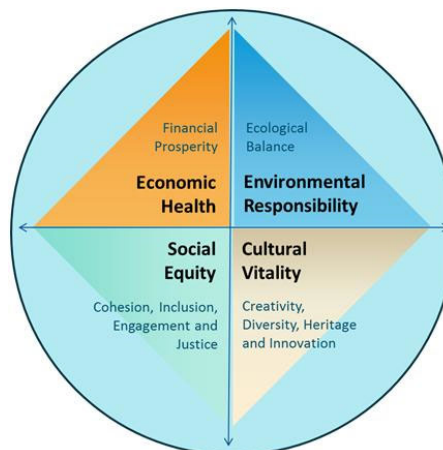
Sustainability Concept in Architectural Design



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Sustainability Concept in Architectural Design



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Sustainability Concept in Architectural Design

SUSTAINABLE DEVELOPMENT

The World Commission on Environment and Development (WCED) in the "**Our Common Future**" report, also known as the **Brundtland Report**: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

SUSTAINABILITY - Quality of anthropogenic activity to take place without exhaustion of available resources and without destroying the environment, thus without compromising the possibilities to meet the needs of the next generations. The 1992 World Conference on the Environment in Rio de Janeiro paid particular attention to this concept, which involves balancing economic growth with environmental protection and finding alternative resources. When referring to the overall economic development of a country or region, the term synonymous sustainable development is usually preferred. (DEX)



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Sustainability Concept in Architectural Design

1972 - UN Conference on the Human Environment / **Stockholm Conference** (Sweden, June 5–16 in 1972);

1987 - Brundtland Report - „**Our Common Future**“, "*development that meets the needs of the present without compromising the ability of future generations to meet their own needs*". (Gro Harlem Brundtland Oslo, 20 March 1987);

1992 - United Nations Conference on Environment and Development convened in Rio de Janeiro in 1992 (the **Rio Earth Summit**)

2002 - World Summit on Sustainable Development in Johannesburg and the 2012 United Nations Conference on Sustainable Development (Rio+20) (**Earth Summit**)

2001 - General Conference of UNESCO - "**Universal Declaration on Cultural Diversity**" (Paris, 2 nov. 2001)

2011 – ICOMOS XVII General Assembly – The Paris Declaration "**On heritage as a driver of development**" (Paris, 2 dec. 2011)



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Sustainability Concept in Architectural Design



The 2030 Agenda for Sustainable Development,

adopted by all United Nations Member States in 2015, provides a shared blueprint for peace and prosperity for people and the planet, now and into the future. At its heart are the 17 Sustainable Development Goals (SDGs), which are an urgent call for action by all countries - developed and developing - in a global partnership. They recognize that ending poverty and other deprivations must go hand-in-hand with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests.

<https://sustainabledevelopment.un.org/sdgs>



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Sustainability Concept in Architectural Design



Sustainable Development Goals



<https://sustainabledevelopment.un.org/sdgs>



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Eco-compatible architecture topics

The eco-compatible approach of an architectural project is characterised by three „paradigms“, theses substantiated over the years, discussed in architectural literature, and accepted today in the world of the domain's specialists:

- i. ecological paradigm*
 - focus on ecology (nature and health)
- ii. bioclimatic design and rational use of energy paradigm*
 - energy consume
- iii. environmental paradigm*
 - holistic approach of sustainable development

Grosso, M. (2004), p.35;



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Eco-compatible architecture topics

- i. ecological paradigm - focus on ecology (nature and health)*



F.L.Wright, The falling water house



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Eco-compatible architecture topics

i. the ecological paradigm

- Focused on ecology (nature and health)
- "Ecological architecture"
- "Vernacular Architecture"



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Eco-compatible architecture topics

ii. bioclimatic design and rational use of energy paradigm - energy consume



Rolf Disch, Heliotrope



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Eco-compatible architecture topics

ii. bioclimatic design and rational use of energy paradigm

- *methods of rationalization of energy production and consumption*
- *"Bioclimatic Architecture"*



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Eco-compatible architecture topics

iii. environmental paradigm - holistic approach of sustainable development



Renzo Piano Building Workshop, Tjibaou Cultural Centre, New Caledonia



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Eco-compatible architecture topics

iii. environmental paradigm

- "bio-architecture" (baubiology) - emphasis on hygiene and human health
- a holistic approach to sustainable development
- Life Cycle Thinking (Life Cycle Management)
- "environmental footprint analysis"



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Eco-compatible architecture topics

Having a more detailed look on the environmental component from the sustainable development area, we find what we often define as „eco-compatible architecture“, like the intervention compatibility from the environmental impact point of view.

There are different expressions like: green architecture, sustainable architecture, eco-architecture, solar architecture, bioclimatic architecture, passive architecture, bionic architecture, biophilic architecture etc., that this current work doesn't aim to define, but to demarcate distinctly the limits of the interest of eco-compatible design.

Therefore, the defining of concepts like „ecological architecture“, „vernacular architecture“, „bioclimatic architecture“, „bio-architecture“ are taken into consideration.



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Concepts of eco-compatible architecture



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Concepts of eco-compatible architecture

The American Institute of Architects – 10 measures for a sustainable architecture:

1. *Proiectare și Inovație (Design & Innovation)*
2. *Proiectare Regională și la nivelul Comunităților (Regional/Community Design)*
3. *Utilizarea terenului și Ecologia sitului (Land Use & Site Ecology)*
4. *Proiectare Bioclimatică (Bioclimatic Design)*
5. *Lumină și Aer (Light & Air)*
6. *Circuitul Apei (Water Cycle)*
7. *Fluxuri Energetice și Viitor Energetic (Energy Flows & Energy Future)*
8. *Material și Construcție (Material & Construction)*
9. *Viață îndelungată, Adaptabilitate Ușoară (Long Life, Loose Fit)*
10. *Înțelegere Colectivă și Cicluri de Feedback (Collective Wisdom and Feedback Loops)*

<http://www.aia.org/practicing/groups/kc/AIAS074684> și Sarté, S.B., (2012), p. 46;



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Concepts of eco-compatible architecture

Lechner R. - 11 measures of sustainable architecture:

1. *(Save Energy: Design and build energy-efficient buildings)*
2. *(Recycle Buildings: Utilize existing buildings and infrastructure instead of developing open space)*
3. *(Create Community: Design communities to reduce dependence on automobiles and to foster a sense of community)*
4. *(Reduce Material Use: Optimize design to make use of smaller spaces and utilize materials efficiently)*
5. *(Protect and Enhance the Site: Preserve or restore local ecosystems and biodiversity.)*
6. *(Select Low-Impact Materials: Specify low-environmental-impact, resource-efficient materials)*

<http://www.aia.org/practicing/groups/kc/AIAS074684> și Sarté, S.B., (2012), p. 46;



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Concepts of eco-compatible architecture

Lechner R. - 11 measures of sustainable architecture:

7. *(Maximize Longevity: Design for durability and adaptability)*
8. *(Save water: Design buildings and landscapes that are water-efficient)*
9. *(Make the Buildings Healthy: Provide a safe and comfortable indoor environment)*
10. *(Minimize Construction and Demolition Waste: Return, reuse, and recycle job-site waste, and practice environmentalism in your business)*
11. *(“Green Up” Your Business: Minimize the environmental impact of your own business practices, and spread the word)*

<http://www.aia.org/practicing/groups/kc/AIAS074684> și Sarté, S.B., (2012), p. 46;



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

Themes of Ecologic Architecture

Richard Hyde notes the following principles of eco-compatible architecture:

- *Comfort and health of inhabitants*
- *Re-stabilizing of ecological values*
- *Passive design systems*
- *Renewable energy use*
- *Use of sustainable materials*
- *Life Cycle Thinking, evaluations and costs*

Hyde, R., ed., (2008), *Bioclimatic housing; Innovative designs for warm climates*, Earthscan, London pp. 41,42



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

BIOCLIMATIC ARCHITECTURAL DESIGN THROUGH THE PERSPECTIVE OF A SUSTAINABLE DEVELOPMENT

Sustainability Concept in Architectural Design

Defining bioclimatic design in the context of eco-compatible buildings concepts

- The Architectural Bioclimatic Project
- The Structure of the Bioclimatic Project



// THEORETICAL ASPECTS

1. Concepts of Sustainable Development in Architecture

“Becoming” of BIOCLIMATIC DESIGN CONCEPT

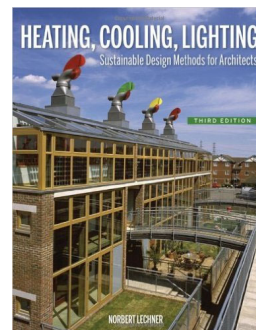
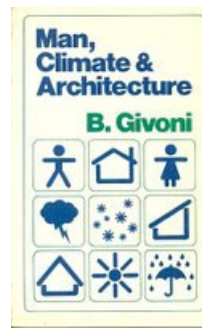
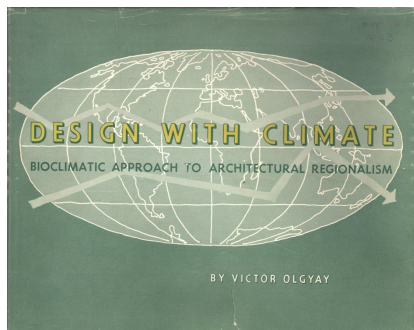
- _ firsts design theories, initiating with Victor Olgyay’s studies
- _ bioclimatology
- _ regionalism in architecture



// THEORETICAL ASPECTS

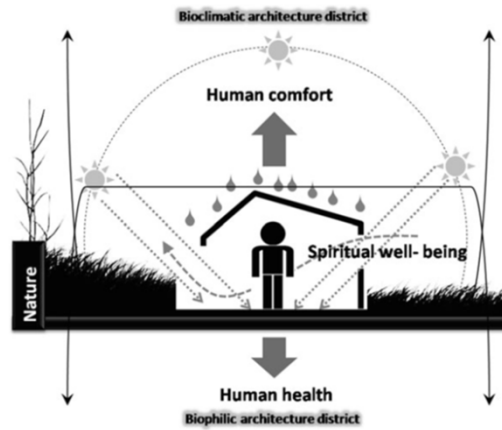
1. Concepts of Sustainable Development in Architecture

“Becoming” of BIOCLIMATIC DESIGN CONCEPT



// THEORETICAL ASPECTS

Main characteristic of bioclimatic design is “building with climate”



[Almusaed, A., (2011), p. 10]



// THEORETICAL ASPECTS

Bioclimatology is „the science studying the influence of the climate on living beings” [1], and implicitly the distribution of vegetation and fauna on the Earth, depending on the climate characteristics.

Bioclimatic design is the set of design solutions that allow the comfort conditions in a building to be adapted to the climatic conditions of the site, using as less as possible systems that support energy consumption from conventional resources. [2]

[1] Institutul de lingvistică din București, DEX, pag. 85;

[2] Armenciu, D., p.30;



// THEORETICAL ASPECTS

_ "**bioclimatic design**" is understood as a particular approach, integrated into a holistic system that generates the complexity of the final architectural investment.

_ It's improper speaking about a "**bioclimatic architecture**" as a style of architecture, but perceive it as a design attitude



// THEORETICAL ASPECTS

COURSE AGENDA

PART 1

1. Concepts of Sustainable Development in Architecture

PART 2

2. The Designing Process

Concept of Metadesign (design of the project)

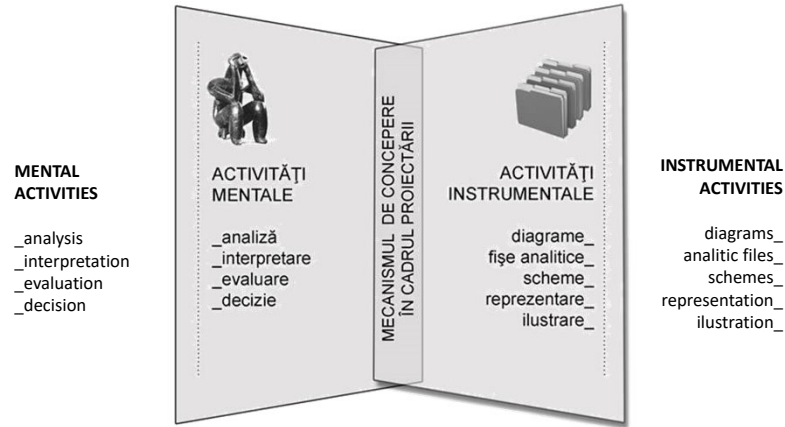
3. Preliminary studies of the bioclimatic architectural project
4. Defining the architectural concept of the intervention
5. Defining the Bioclimatic Design Principles
Selection of design principles, related to the unique context of the insertion site



LEARNING OBJECTIVES

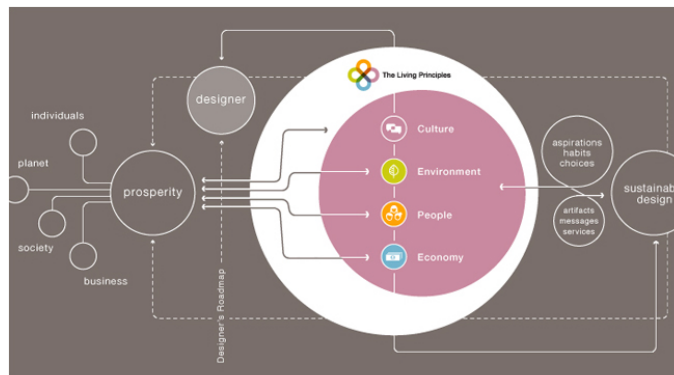
2. The Designing Process

Designing the project



// THEORETICAL ASPECTS

2. The Designing Process



Four Streams of Integrated Sustainability¹



Adaptated after Adam Werbach, Strategy for sustainability

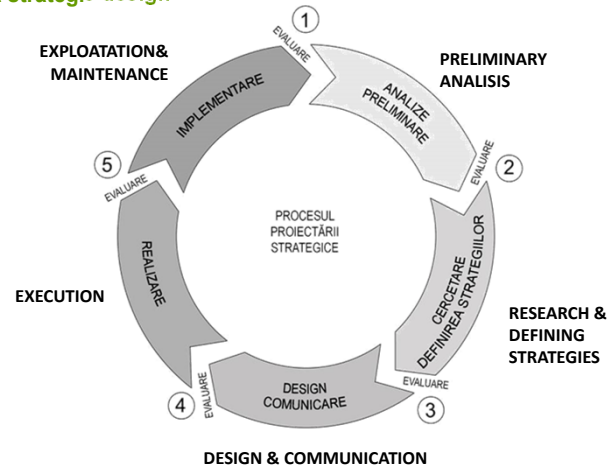


// THEORETICAL ASPECTS

2. The Designing Process

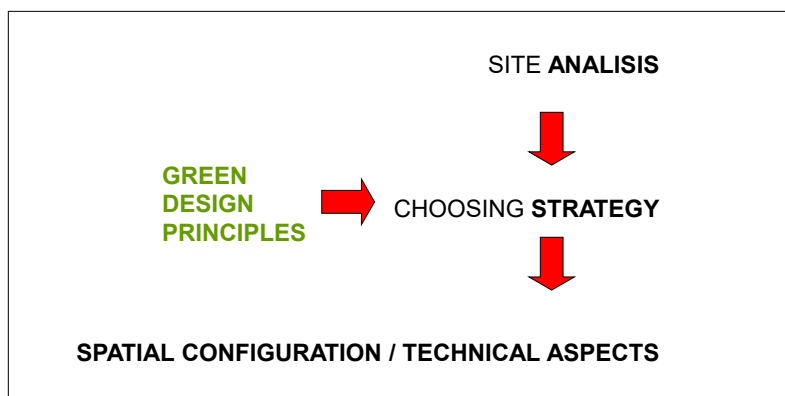
Designing the project

Diagram of a strategic design



// DESIGN METHODOLOGY

2. The Designing Process



The research area: design phases (the metadesign)

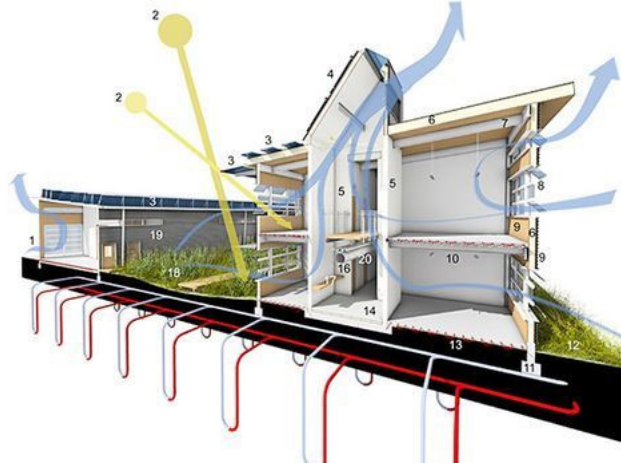


// DESIGN METHODOLOGY

2. The Designing Process

Designing the project

Diagram of a strategic design



// DESIGN METHODOLOGY

COURSE AGENDA

PART 1

1. Concepts of Sustainable Development in Architecture

PART 2

2. The Designing Process - Concept of Metadesign (design of the project)
3. Preliminary studies of the architectural project
Man as a Central Entity in Architectural Design
Comfort Analyses
Environmental and Bioclimatic analysis of the site
4. Defining the architectural concept of the intervention
5. Defining the Bioclimatic Design Principles
Selection of design principles, related to the unique context of the insertion site



// DESIGN METHODOLOGY

3. Preliminary studies of the architectural project

Man as a Central Entity in Architectural Design
Comfort Analyses
Environmental and Bioclimatic analysis of the site



// DESIGN METHODOLOGY

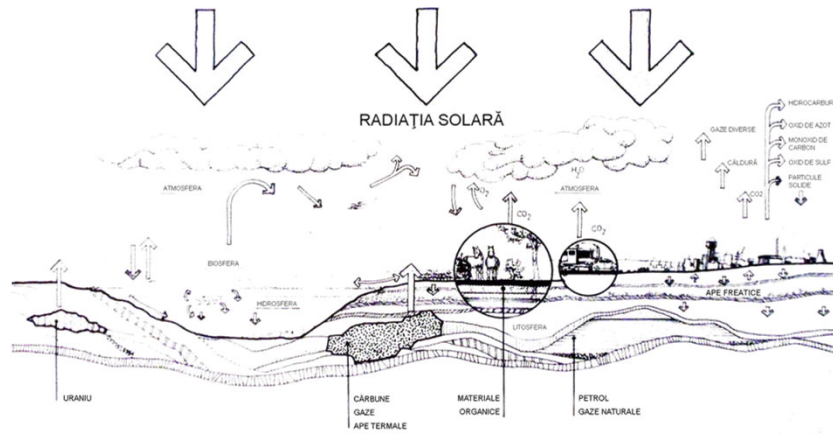
3. Preliminary studies of the architectural project

Man as a Central Entity in Architectural Design



// DESIGN METHODOLOGY

I. PRELIMINARY STUDIES OF THE PROJECT

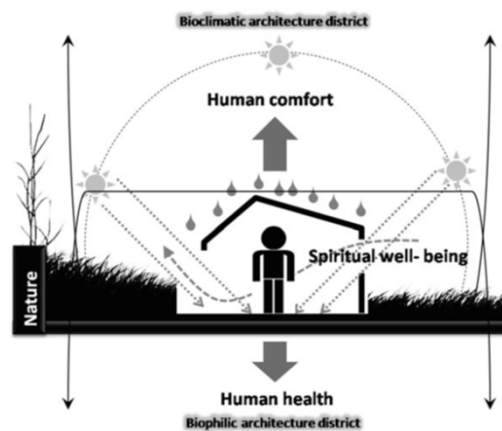


Energy balance on earth level



// DESIGN METHODOLOGY

ANALYSIS SCALES OF BIOCLIMATIC DESIGN



[Almusaed, A., (2011), p. 10]



// THEORETICAL ASPECTS

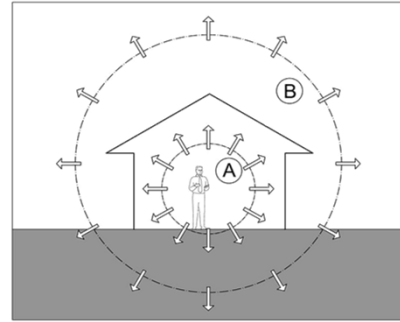
I. PRELIMINARY STUDIES OF THE PROJECT

A. Exigencies and Necessities of Designed Spaces

B. Environmental and Bioclimatic analysis of the site

b.1. Environmental and Cultural analysis

b.2. Bioclimatic analyses



// DESIGN METHODOLOGY

A. Exigencies and Necessities of Designed Spaces



_ function of architectural spaces



_ human activities



_ human comfort



_ psychrometry



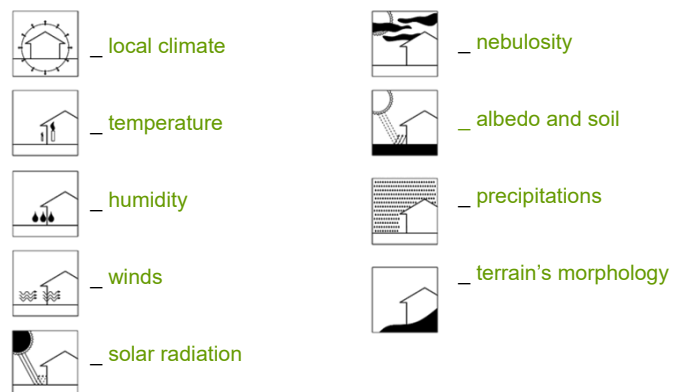
// DESIGN METHODOLOGY

B.1. Environmental and Cultural analysis



// DESIGN METHODOLOGY

B.2. Bioclimatic analyses



// DESIGN METHODOLOGY

COURSE AGENDA

PART 1

1. Concepts of Sustainable Development in Architecture
2. The Designing Process - Concept of Metadesign (design of the project)

PART 2

3. Preliminary studies of the bioclimatic architectural project
4. Defining the architectural concept of the intervention
Functional Synthesis of Environmental Comfort
Spatial-Bioclimatic Synthesis
The Site's Microclimatic Matrix
5. Defining the Bioclimatic Design Principles
Selection of design principles, related to the unique context of the insertion site



LEARNING OBJECTIVES

4. Defining the architectural concept of the intervention

Functional Synthesis of Environmental Comfort
Spatial-Bioclimatic Synthesis
The Site's Microclimatic Matrix

In order to clarify these relations, the following thematic correspondence is proposed, resulting in the various types of "synthesis" that lead to the definition of intervention concepts:

Defining functional and environmental requirements

--» *The functional synthesis of environmental comfort*

Defining the cultural and environmental framework

--» *Territorial cultural and environmental synthesis*

Functional and spatial organization

--» *Spatial-bioclimatic synthesis*

Quantification of space units

--» *Regulations synthesis*



// DESIGN METHODOLOGY

4. Defining the architectural concept of the intervention

Functional Synthesis of Environmental Comfort
 Spatial-Bioclimate Synthesis
 The Site's Microclimatic Matrix

In order to clarify these relations, the following thematic correspondence is proposed, resulting in the various types of "synthesis" that lead to the definition of intervention concepts:

Defining functional and environmental requirements

--» *The functional synthesis of environmental comfort*

Functional and spatial organization

--» *Spatial-bioclimate synthesis*

**The Microclimatic
Matrix of the site**



// DESIGN METHODOLOGY

4. Defining the architectural concept of the intervention

Functional Synthesis of Environmental Comfort

Spatial-Bioclimate Synthesis
 The Site's Microclimatic Matrix

The major principle by which the proposed design methodology is shaped, is focusing on the user of the architectural spaces. The range of activities alleged to take place in a conventional manner in such spaces is extracted; they are associated with certain particularities which define the **type of relation between man and its microclimatic environment**, thus defining the **requirements needed to achieve comfort conditions**.



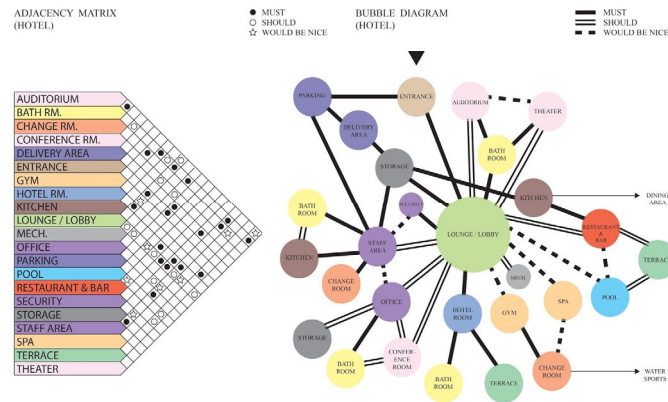
// DESIGN METHODOLOGY

4. Defining the architectural concept of the intervention

Functional Synthesis of Environmental Comfort

Spatial-Bioclimate Synthesis

The Site's Microclimatic Matrix



// DESIGN METHODOLOGY

4. Defining the architectural concept of the intervention

Functional Synthesis of Environmental Comfort

Spatial-Bioclimate Synthesis

The Site's Microclimatic Matrix

In essence, the analytical aspects of **functional** nature cannot be synthesized without their association with the **geo-climatic** ones, because they depend significantly on climatic factors, which give the peculiarities of the site. The purpose of this spatial-bioclimate synthesis is to **outline the premises of intervention on a particular site**. Thus, specific analyses are performed, that characterize the future intervention at a microclimate scale, being the ones determining in a more detailed way the site's particularities in relation to neighbourhoods: **studies of sunlight, air currents movement, land morphology**.



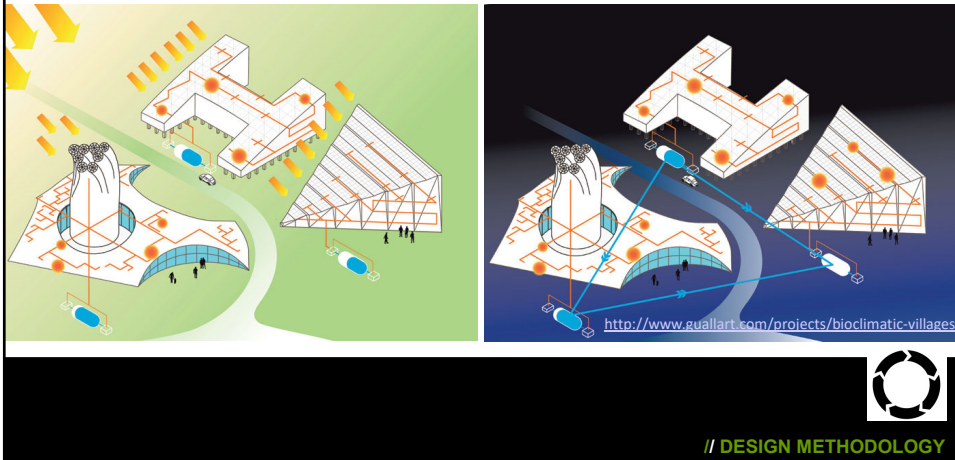
// DESIGN METHODOLOGY

4. Defining the architectural concept of the intervention

Functional Synthesis of Environmental Comfort

Spatial-Bioclimate Synthesis

The Site's Microclimatic Matrix



4. Defining the architectural concept of the intervention

Functional Synthesis of Environmental Comfort

Spatial-Bioclimate Synthesis

The Microclimatic Matrix of the site

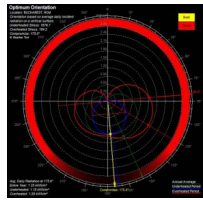
The Site's Microclimatic Matrix represents an overlapping and systematization of a certain series of analyses, as tables, graphical layouts etc. This allows the processing of analytical data and their confrontation with several factors determinant for a bioclimatic approach: **the general form of construction, location and orientation in the neighbourhood.** In these circumstances it is essential to consider the effects caused by sunlight and the shape of calm wind areas. Through their overlap at various times of the year and day, the site climate matrix can be obtained, with graphical results which facilitate the designer's reading of this dynamics and identifying those areas characterized by particular conditions regarding comfort requirements.



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

4. Defining the architectural concept of the intervention

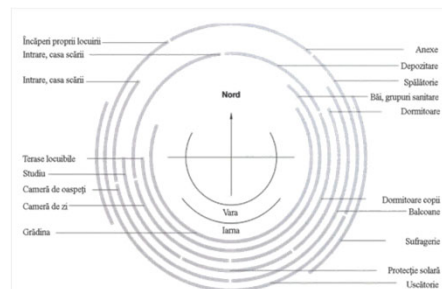
The Microclimatic Matrix of the site



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

4. Defining the architectural concept of the intervention

The Microclimatic Matrix of the site

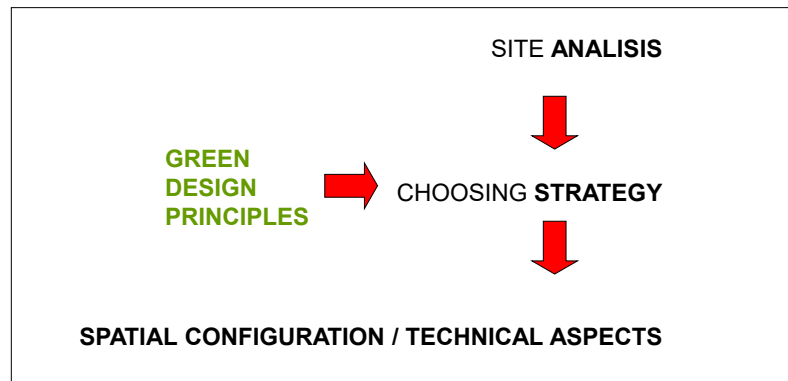


Tipul climii	Poziționarea zonelor cu potențial energetic	Raport optim lungime/lățime	Amplasarea optimă a elementelor masive
Climă rece		1:1	
Climă temperată		1:1,6	
Climă uscată		1:2	
Climă tropicală		1:3	



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

4. Defining the architectural concept of the intervention



METODOLOGIA PROIECTULUI BIOCLIMATIC // **BIOCLIMATIC DESIGN METHODOLOGY**

COURSE AGENDA

PART 1

1. Concepts of Sustainable Development in Architecture
2. The Designing Process - Concept of Metadesign (design of the project)

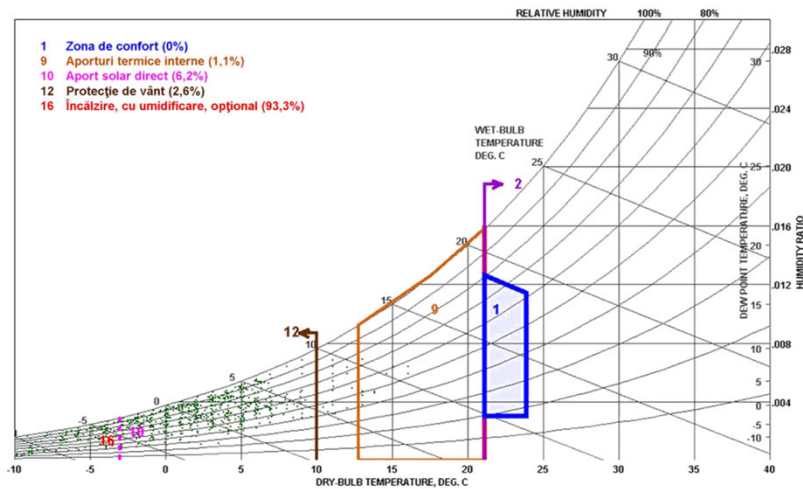
PART 2

3. Preliminary studies of the bioclimatic architectural project
4. Defining the architectural concept of the intervention
5. Defining the Bioclimatic Design Principles
Selection of design principles, related to the unique context of the insertion site



LEARNING OBJECTIVES

Identificarea principiilor bioclimatice în proiectul de arhitectură Defining principles of bioclimatic design



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

THE COMPLETION OF THE ARCHITECTURAL CONCEPT IN THE METADESIGN PHASE

Translation of preliminary analysis and tabulation of the results;
(The bioclimatic model of spatial-temporal comfort)

Bioclimatic Design Principles

Bioclimatic Design Strategies

Basic principles of traditional bioclimatic design, compatible with local climate



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining principles of bioclimatic design

Taxonomy of bioclimatic design principles

- **Principles of functional nature**
- **Principles of using solar radiation**
- **Principles of using the laws of thermodynamics**
- **Principles of using the air flows**
- **Hydrothermal Principles**
- **Precipitations**

Principles of bioclimatic project represent fundamental design elements correlated to essential geo-climatic factors and the physical properties of thermodynamics, that influence the user's comfort or certain choices.



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining principles of bioclimatic design

Direct solar gain
 Solar protection
 Heating
 Cooling
 Natural ventilation
 Thermal mass
 Heat conserving
 Thermal insulation
 Acoustics (lot of authors include it as a bioclimatic principle)
 Natural lighting
 Water collecting and reuse
 Functional distribution referring to activities and climatic factors
 Use of water in microclimatic comfort control
 Use of vegetation in microclimatic comfort control



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

COURSE AGENDA

PART 3

6. Defining the Bioclimatic Design Strategies

Extraction of design strategies, through conceptual functioning scenarios of the building

PART 4

7. Presentation of case studies

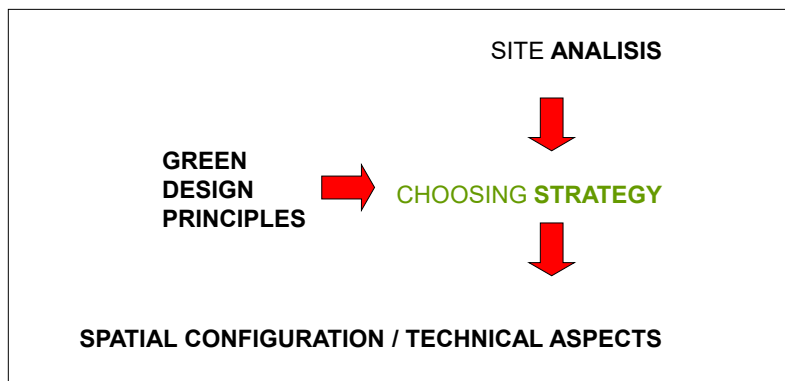
8. Theoretical Application

05:00 pm | Training closure



LEARNING OBJECTIVES

4. Defining the architectural concept of the intervention



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining strategies of bioclimatic design

The principles ensemble, together with the climatic evaluation of the site, are generating a series of sceneries. After a detailed analyze, there are defined the functioning **strategies** of the building, from the eco-compatible point of view.

They are reported to a time period of constant characteristics (season, night/day, particular periods)



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining strategies of bioclimatic design

Referring to traditional - modern relation, Reyner Banham identify 3 models of environmental control, generated in relation with the climatic context answer:

- **Conservative (is based on the internal climatic aspects of the building)**
- **Selective (it responds interactively to external climatic aspects)**
- **Regenerative (complements the external climatic aspects)**

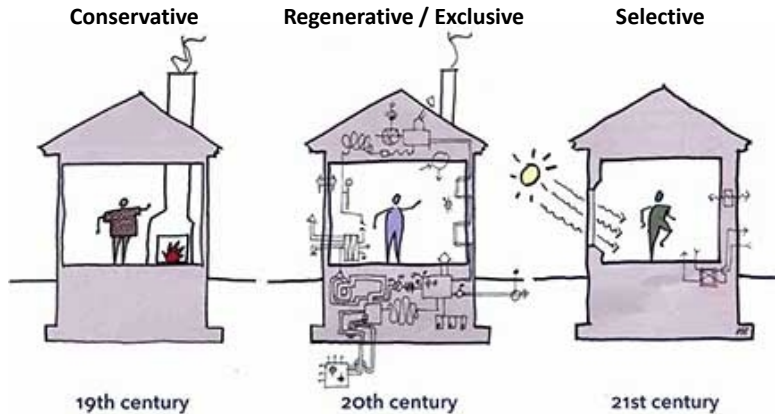
Hawkes proposes a fourth theoretical model:

- **Exclusive (regardless of the climatic aspects)**



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining strategies of bioclimatic design



House Heating Systems: A Brief History

Used with permission of Albert Richter & Tiltmann Architects



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining strategies of bioclimatic design

THE CONSERVATIVE MODEL

It is based on climatic aspects focused on the energy behavior inside the building, constituting the foundation of the principles of passive bioclimatic design.

It is characteristic of the ecological paradigm, respectively of the traditional and / or vernacular architecture.

Specific features:

- It seeks to conserve energy inside the building, disregarding the external environmental conditions;
- Uses positive aspects of the climate (eg. heat from direct solar input) captured at the optimal time, accumulating and conserving energy;
- Thermal insulation of the building envelope;
- Thermal inertia of construction and finishing materials;
- Optimal orientation of the building;
- Maximum benefit of natural light;



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining strategies of bioclimatic design

SELECTIVE MODEL

It responds to the external environment through integrated elements at the level of the building envelope. The main goal is to benefit from maximum energy from the external environment, through an optimal spatial configuration in relation to the dynamics of climatic particularities (seasons, day-night cycles, etc.).

It is identified with the approach specific to bioclimatic design.

Specific features:

- It seeks to conserve energy inside the building, disregarding the external environmental conditions;
- Uses positive aspects of the climate (eg. heat from direct solar input) captured at the optimal time, accumulating and conserving energy;
- Thermal insulation of the building envelope;
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METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining strategies of bioclimatic design

THE REGENERATIVE MODEL

It is based on a strategy that almost completely excludes external environmental conditions, focusing on artificial energy production. Complementary elements are applied that tend to improve the comfort conditions using equipment and installations. Any kind of bioclimatic approach is therefore excluded.

It corresponds to the design philosophy of buildings specific to modern architecture.

Specific features:

- Energy saving is not a priority;
- Mechanized heating / cooling systems, consuming energy from conventional sources;
- Ventilation and air treatment equipment;
- Artificial lighting replaces natural light;



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining strategies of bioclimatic design

EXCLUSIVE MODEL

It completely ignores particular climatic aspects of the external environment.

Specific features:

- The environment is automatically controlled and is predominantly artificial;
- The shape is compact, seeking to minimize the interaction between indoor and outdoor environments;
- Orientation is relatively unimportant;
- The windows are generally small in size;
- Energy comes mainly from conventional sources and is used throughout the year in a relatively constant amount;



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Defining strategies of bioclimatic design

The set of principles, together with the climate assessment of the site, generates a series of **scenarios**. After a detailed analysis, the **operation strategies** of the building are defined, from an ecologically compatible point of view.

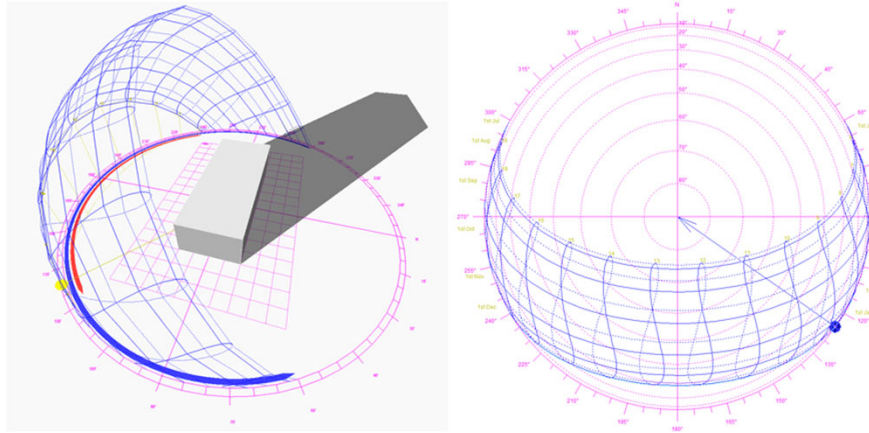
Defining scenarios by period:

- Seasons (winter / summer / equinoxes);
- Night / day;
- Other special periods;



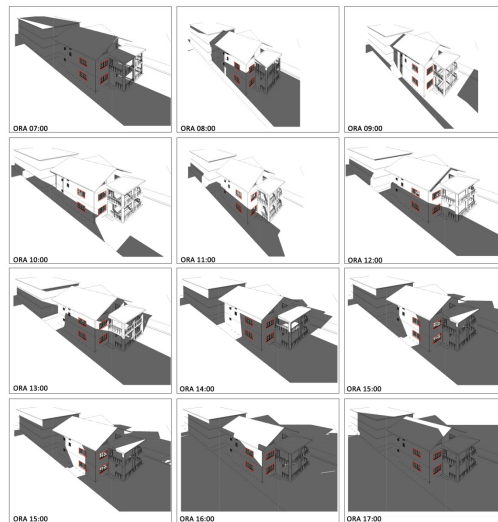
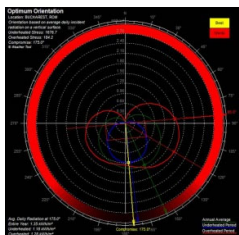
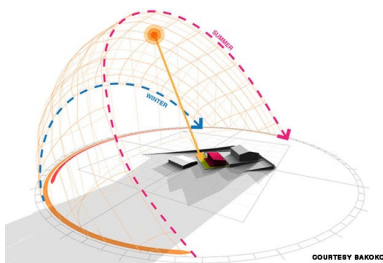
METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Sun studies



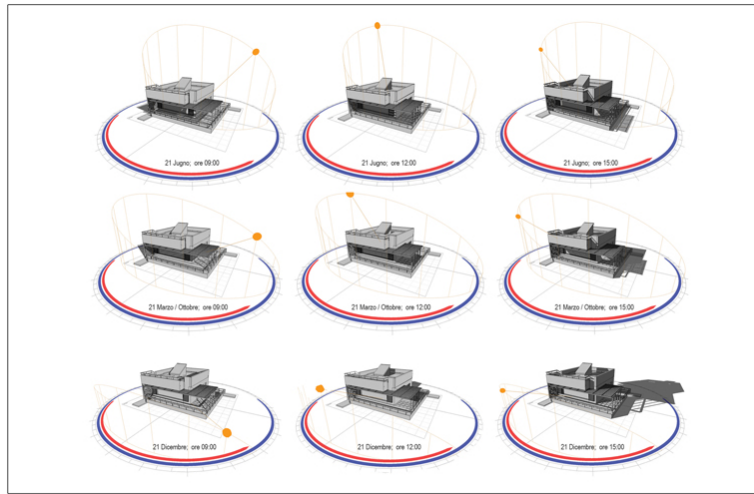
METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Sun studies



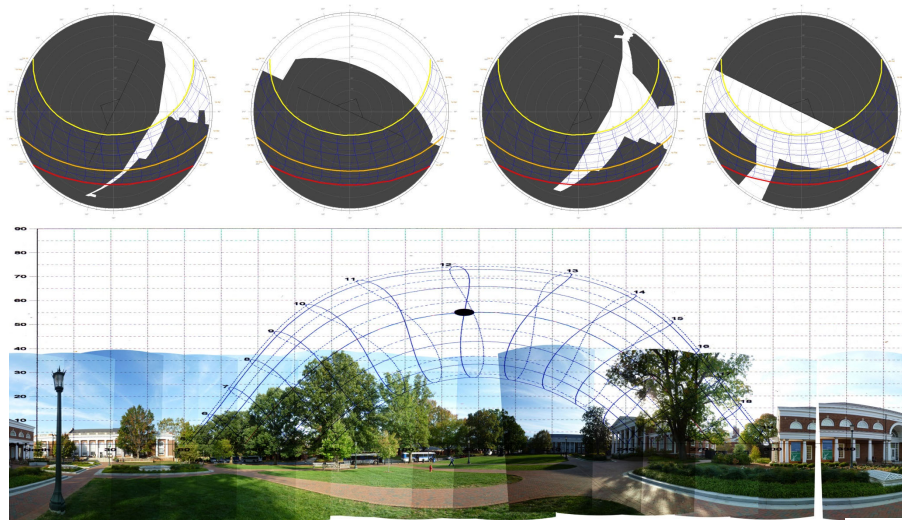
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Sun studies



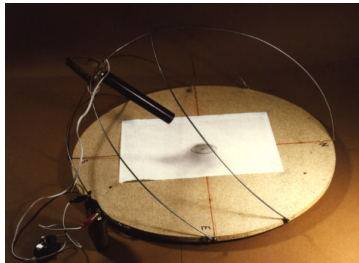
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Sun studies

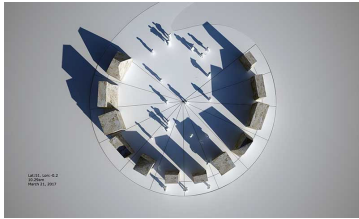


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Sun studies



Sky model



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Sun studies

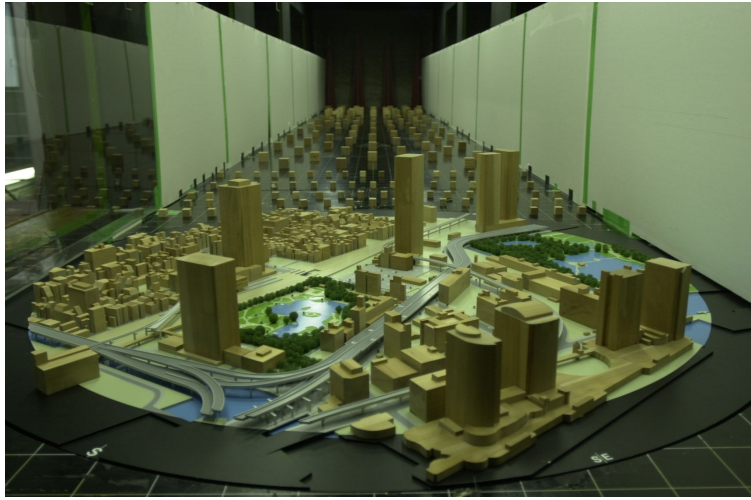


Sky model



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Air movement studies

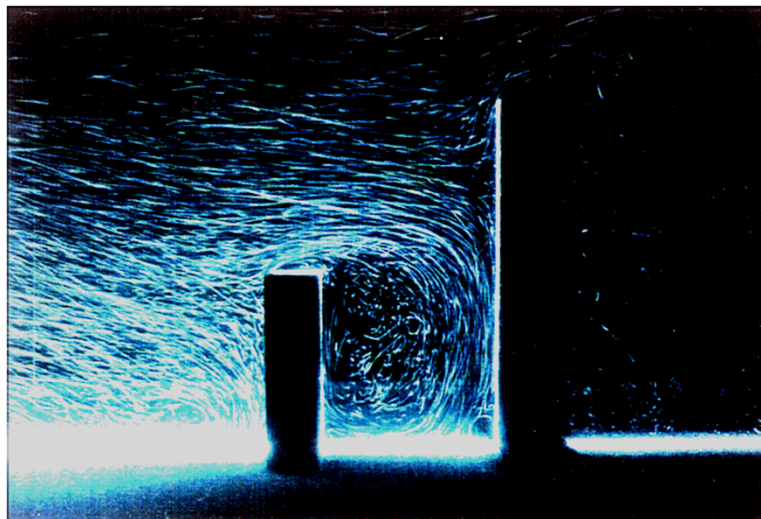


Wind tunnel simulation



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Air movement studies



Wind tunnel simulation



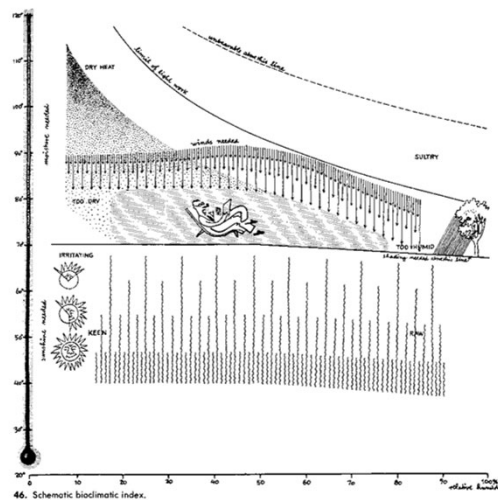
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Microclimatic site matrix



METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Hydrothermal comfort

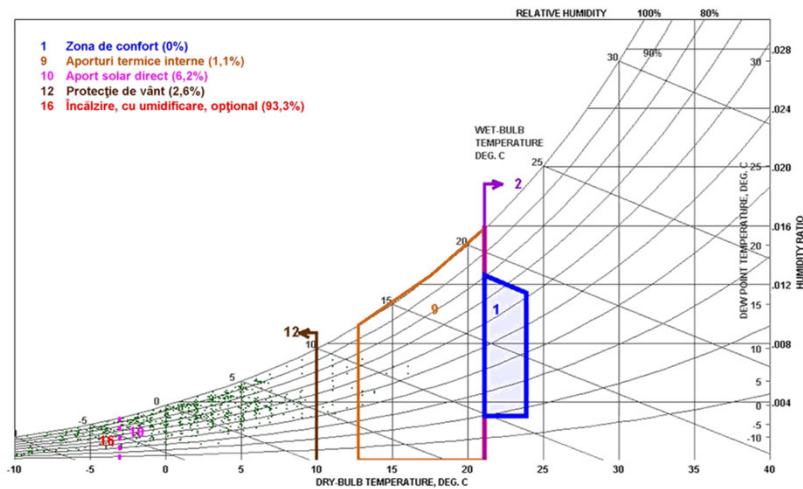


"Design with Climate", autor: Victor Olgyay



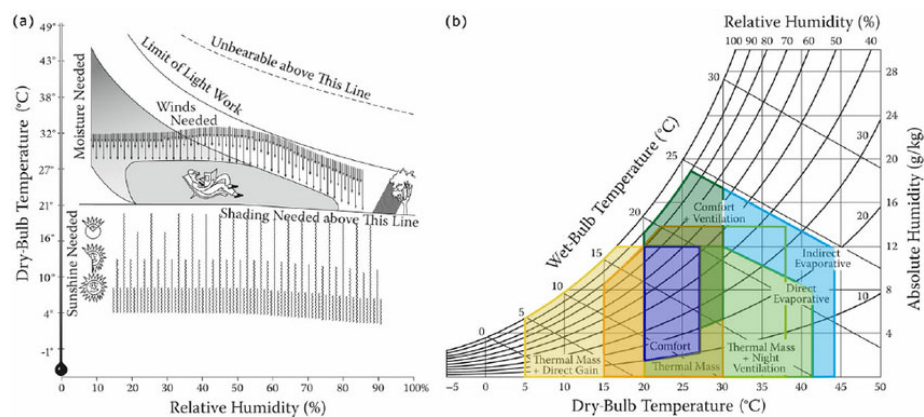
METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Identification of bioclimatic principles in architectural design
HYDROTHERMAL COMFORT CONDITIONS – THE PSYCHROMETRIC CHART



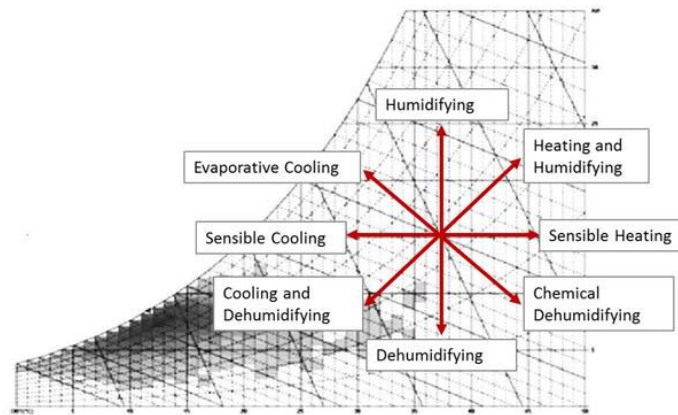
METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Identification of bioclimatic principles in architectural design
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METODOLOGIA PROIECTULUI BIOCLIMATIC // BIOCLIMATIC DESIGN METHODOLOGY

Identification of bioclimatic principles in architectural design
HYDROTHERMAL COMFORT CONDITIONS – THE PSYCHROMETRIC CHART



METODOLOGIA PROIECTULUI BIOCLIMATIC // **BIOCLIMATIC DESIGN METHODOLOGY**

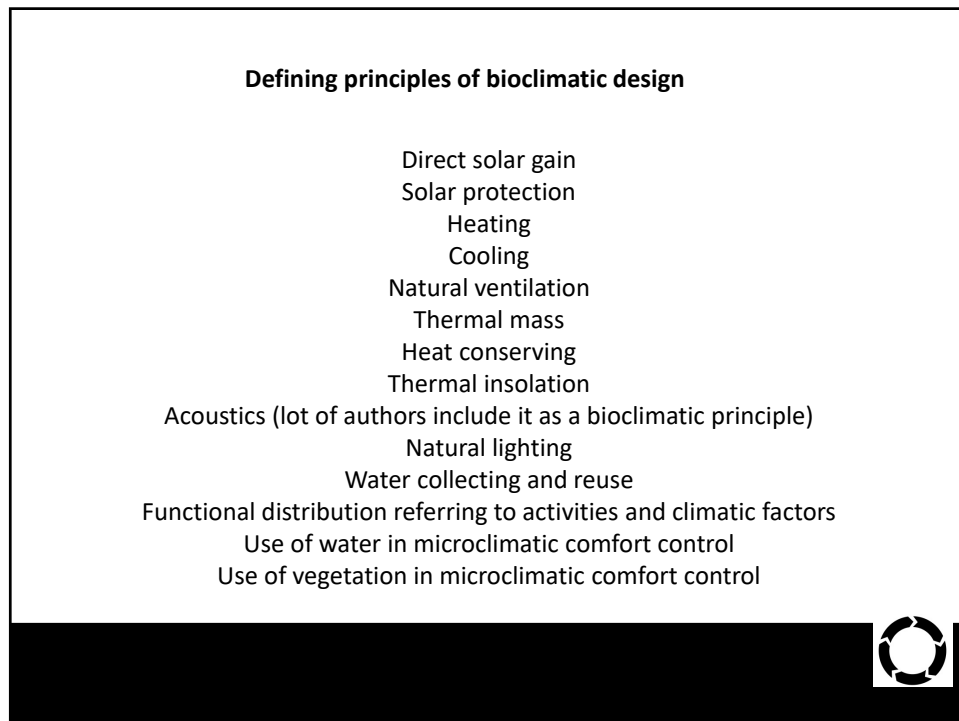
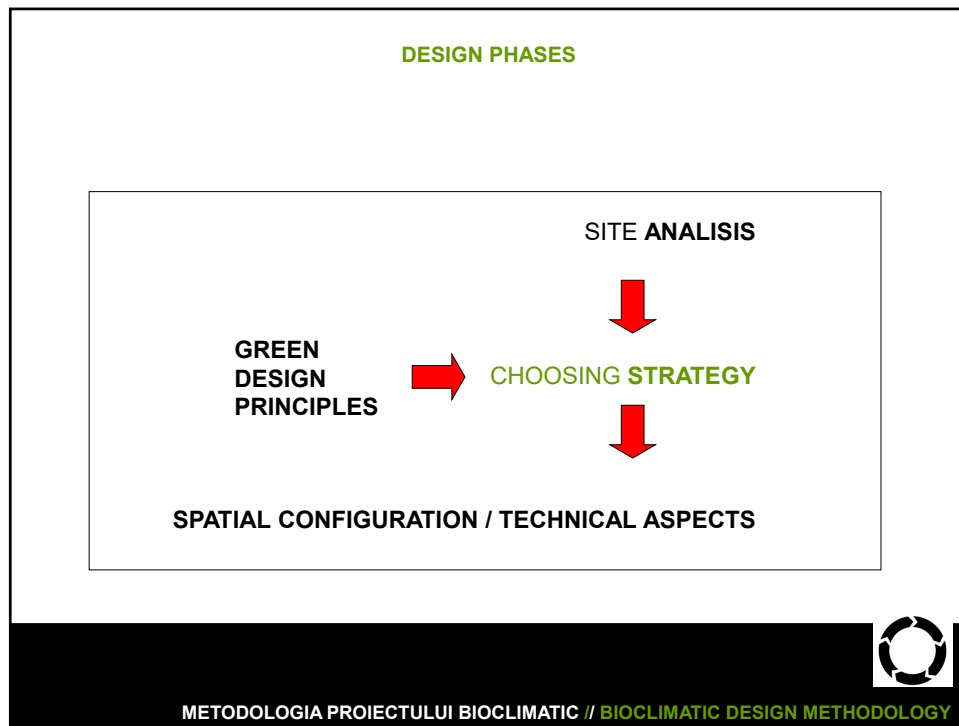
Defining principles of bioclimatic design

Application – CLIMATE CONSULTANT Software

<https://www.sbse.org/resources/climate-consultant>

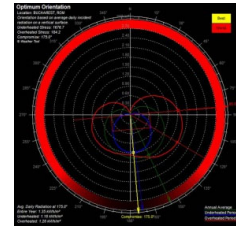


METODOLOGIA PROIECTULUI BIOCLIMATIC // **BIOCLIMATIC DESIGN METHODOLOGY**

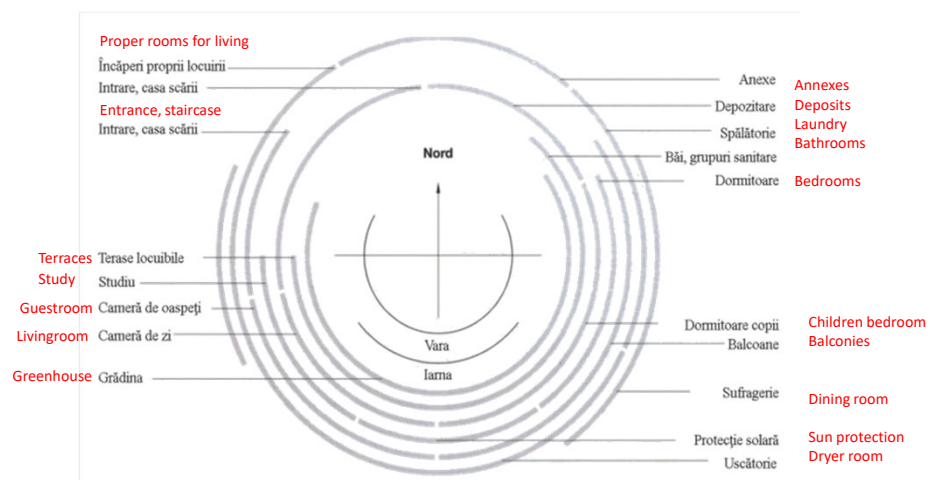


DEFINING STRATEGIES OF BIOCLIMATIC DESIGN

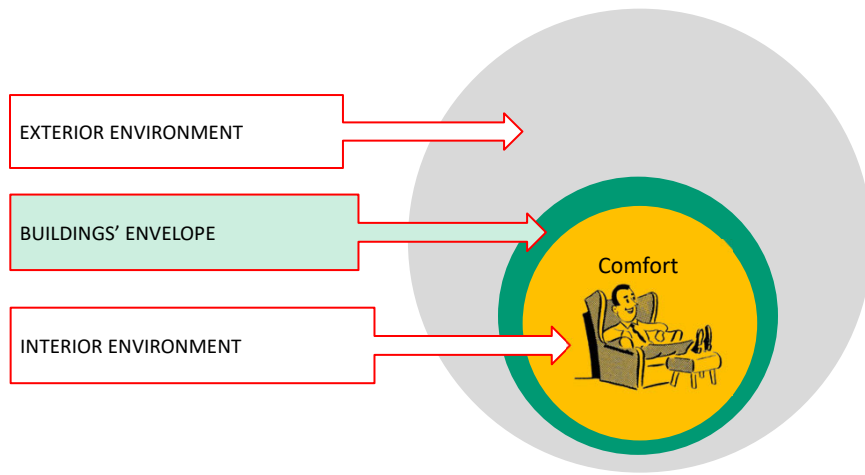
Type of climate Tipul climatei	Energy potential areas Pozitionarea zonelor cu potential energetic	Optimum ratio length / width Raport optim lungime/lățime	Optimum positioning of massive elements Amplasarea optima a elementelor masive
Cimă rece Cold climate		1:1	
Cimă temperată Temperate climate		1:1,6	
Cimă uscată Dry climate		1:2	
Cimă tropicală Tropical climate		1:3	



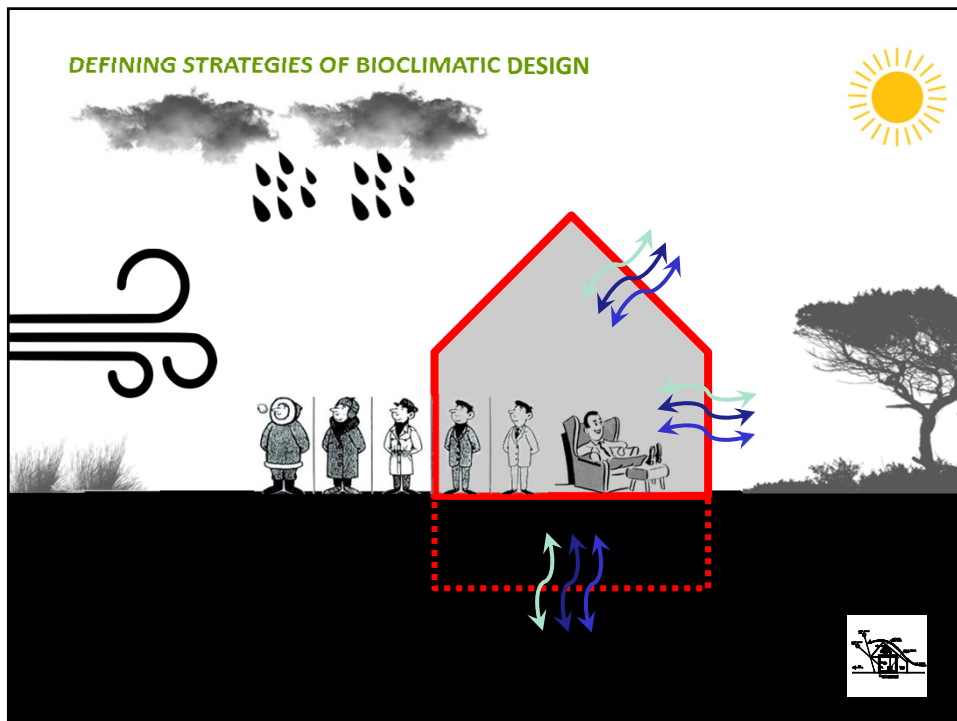
DEFINING STRATEGIES OF BIOCLIMATIC DESIGN



DEFINING STRATEGIES OF BIOCLIMATIC DESIGN



DEFINING STRATEGIES OF BIOCLIMATIC DESIGN



7. Presentation of case studies

- _ particulars of the site that marks the type of context and geographical coordinates;
- _ climatic conditions of the place, to identify the resources or obstacles of the place;
- _ form and layout of buildings
- _ bioclimatic design principles and strategies achieved
- _ their settlement in technological or aesthetic terms.



// CASE STUDIES

Basic principles of traditional bioclimatic design, compatible with local climate



// CASE STUDIES

Basic principles of traditional bioclimatic design, compatible with local climate



House configuration in Transylvania



House configuration in Maramureș



// CASE STUDIES

Basic principles of traditional bioclimatic design, compatible with local climate



House configuration in Banat

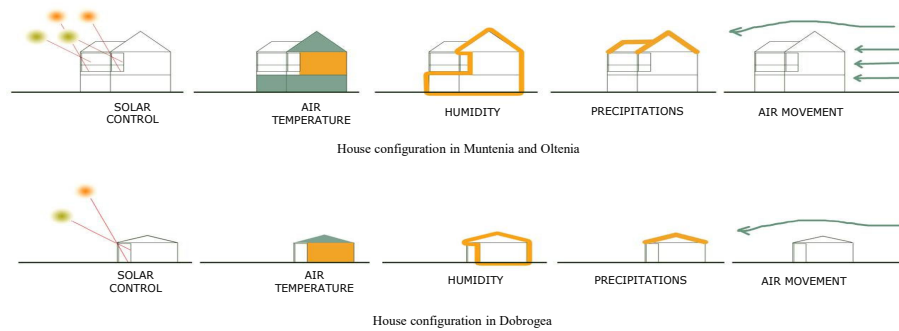


House configuration in Moldova



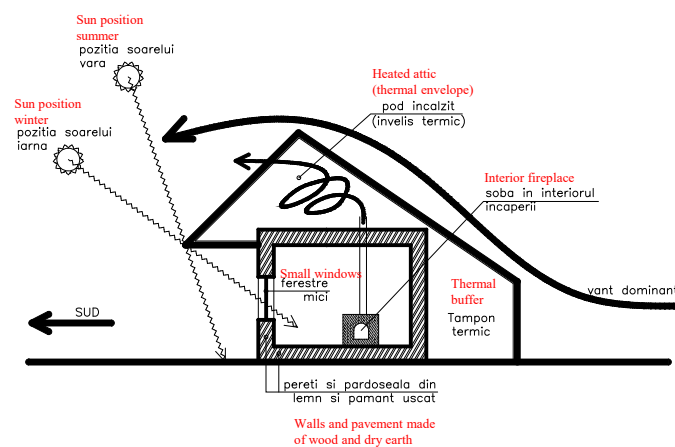
// CASE STUDIES

Basic principles of traditional bioclimatic design, compatible with local climate



// CASE STUDIES

Basic principles of traditional bioclimatic design, compatible with local climate



// CASE STUDIES

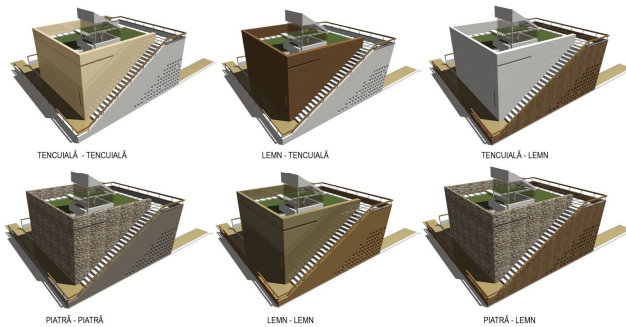
Presentation of case studies



Project **LIVING ENVELOPE**/ authors: arh. Daniel N. Armenciu, arh. Oana Diaconescu, arh. Fulvio Rolando



// CASE STUDIES

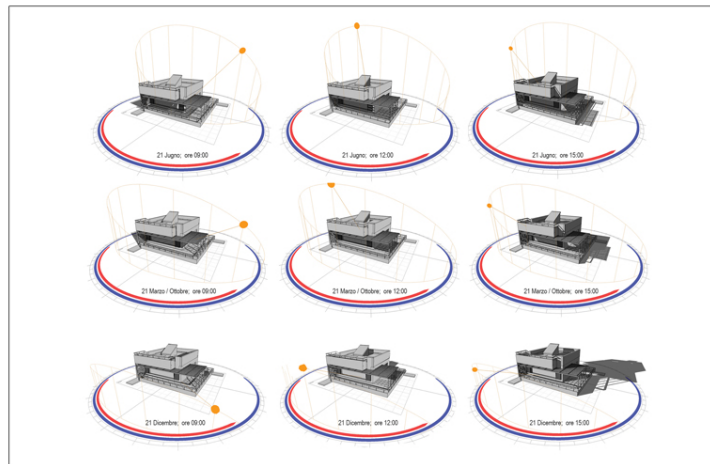


POSSIBILITĂȚI DE TRATARE A ANVELOPEI ÎN FUNCȚIE DE CONTEXUL ARHITECTURAL/PEISAGISTIC

Project **LIVING ENVELOPE**/ authors: arh. Daniel N. Armenciu, arh. Oana Diaconescu, arh. Fulvio Rolando



// CASE STUDIES

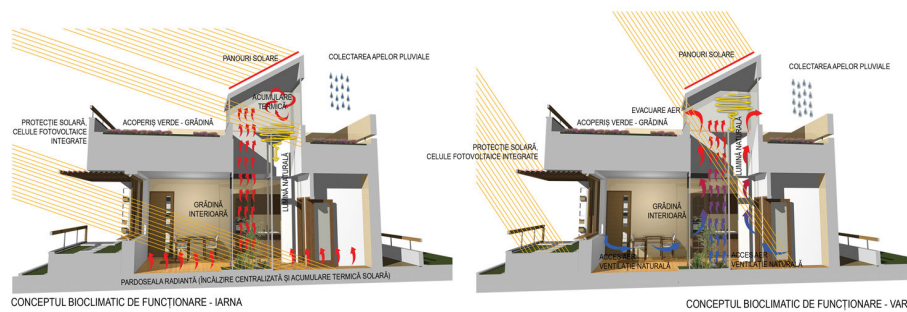


STUDIU DE ÎNSORIRE

Project **LIVING ENVELOPE**/ authors: arh. Daniel N. Armenciu, arh. Oana Diaconescu, arh. Fulvio Rolando



// CASE STUDIES

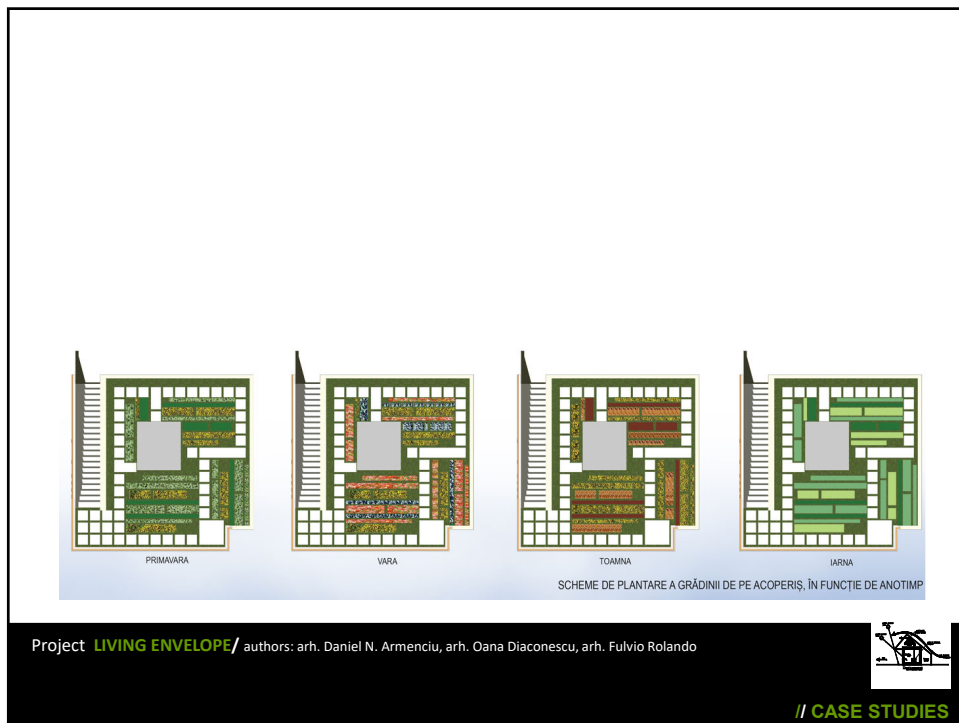


Project **LIVING ENVELOPE**/ authors: arh. Daniel N. Armenciu, arh. Oana Diaconescu, arh. Fulvio Rolando

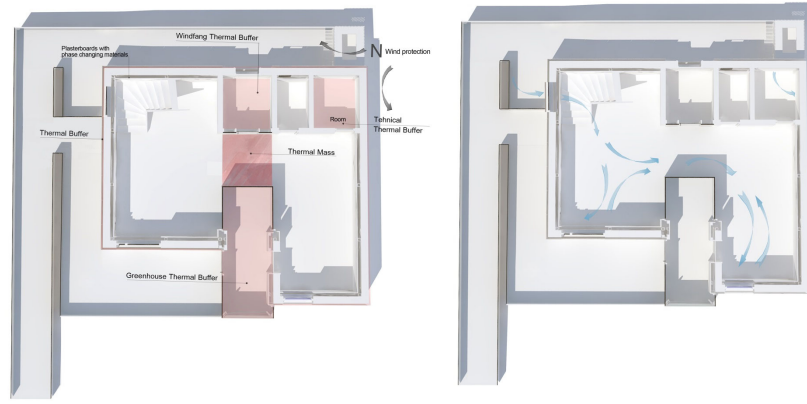


// CASE STUDIES





Defining strategies of bioclimatic design

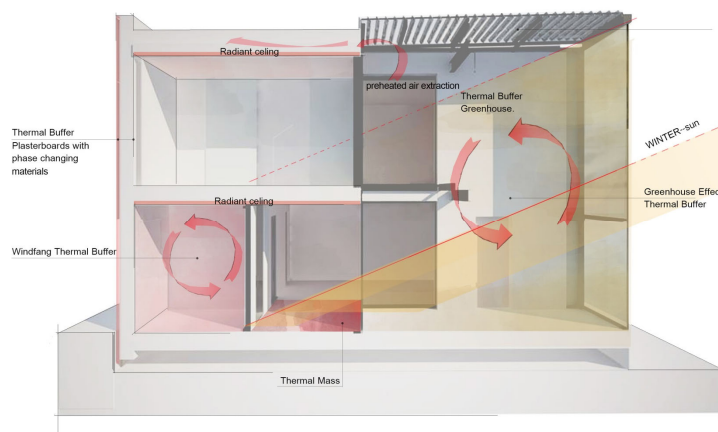


EFdeN Project



// CASE STUDIES

Defining strategies of bioclimatic design

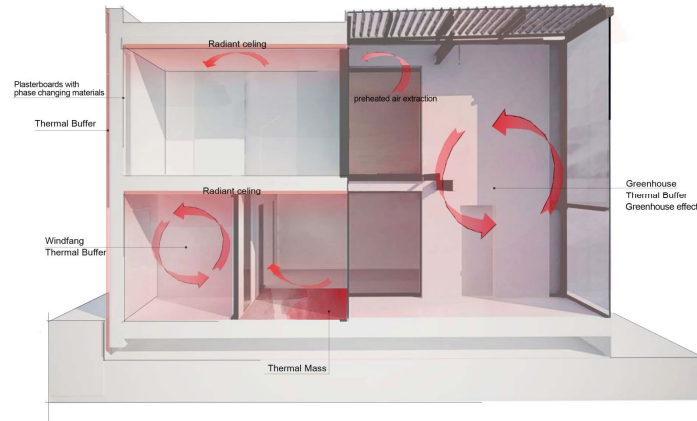


EFdeN Project - Winter, day



// CASE STUDIES

Defining strategies of bioclimatic design

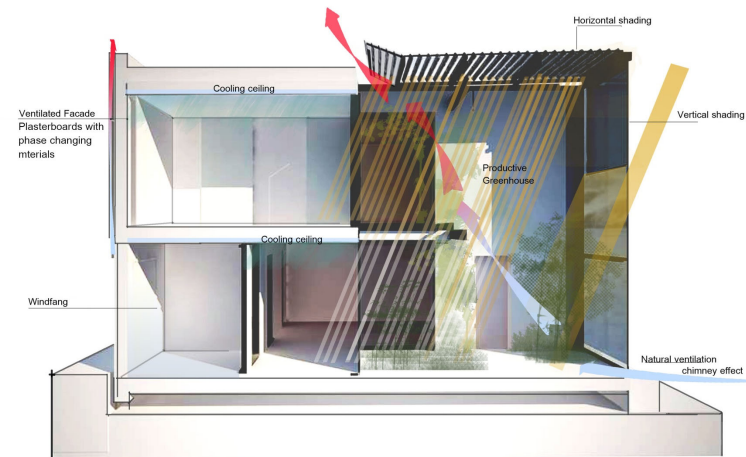


EFdeN Project - Winter, night



// CASE STUDIES

Defining strategies of bioclimatic design

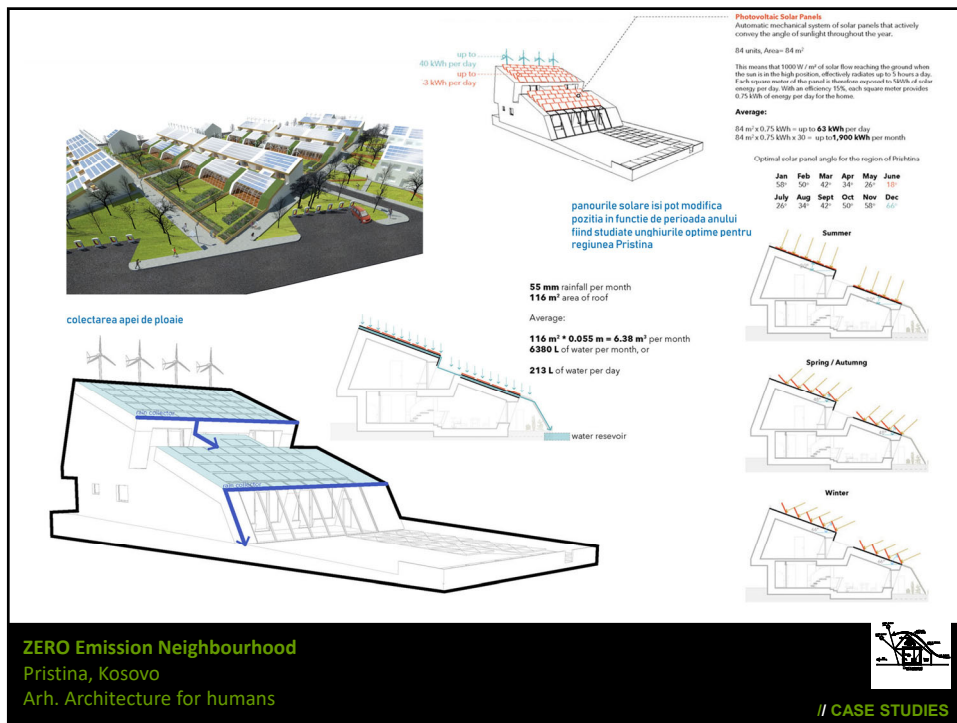
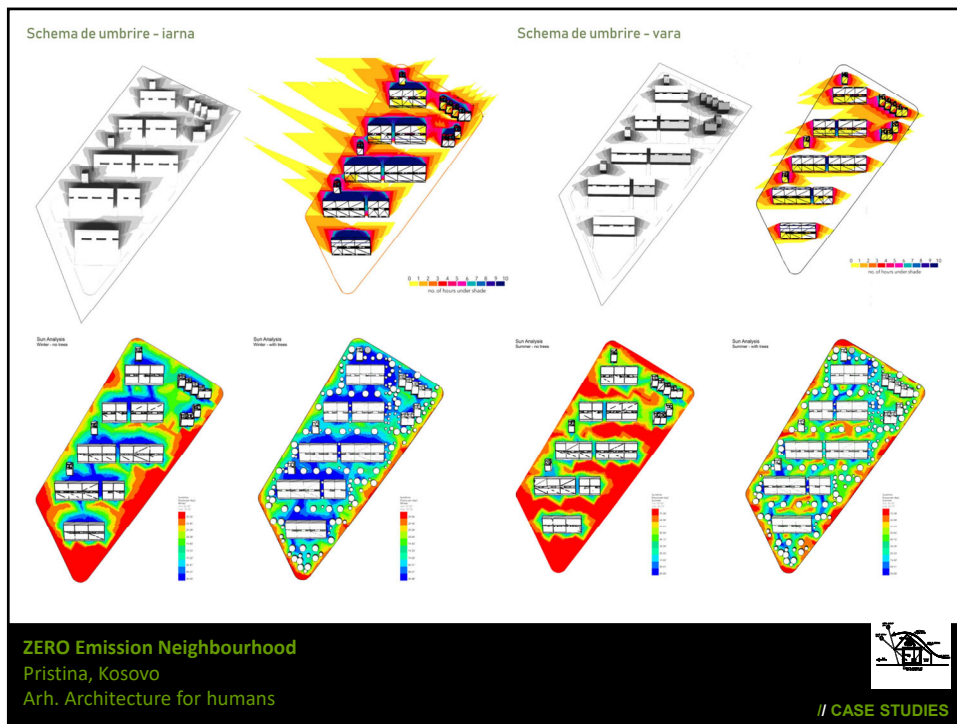


EFdeN Project – Summer, day



// CASE STUDIES



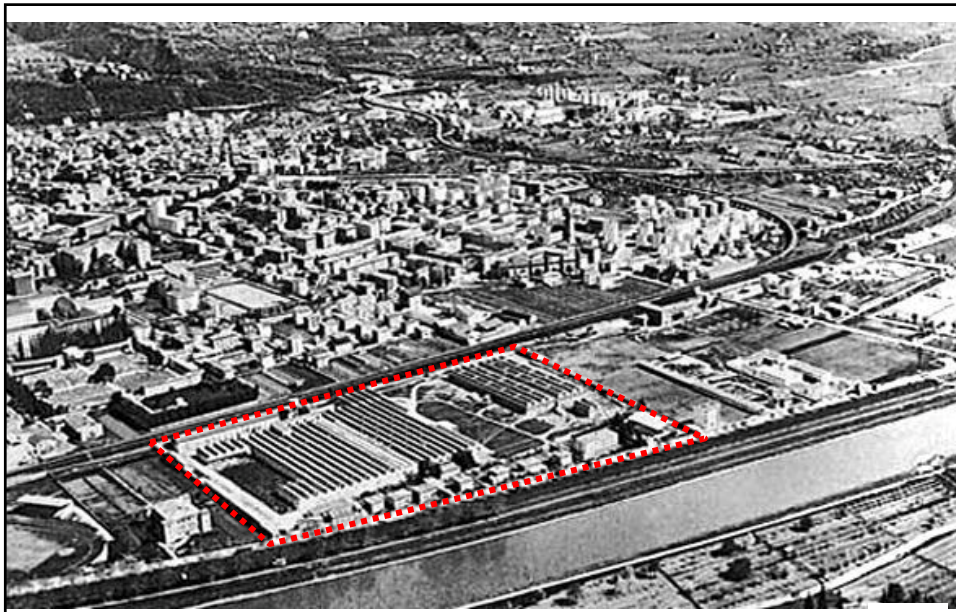




Urban regeneration, Le Albere neighborhood
Trento, Italia
Arch. Renzo Piano Building Workshop



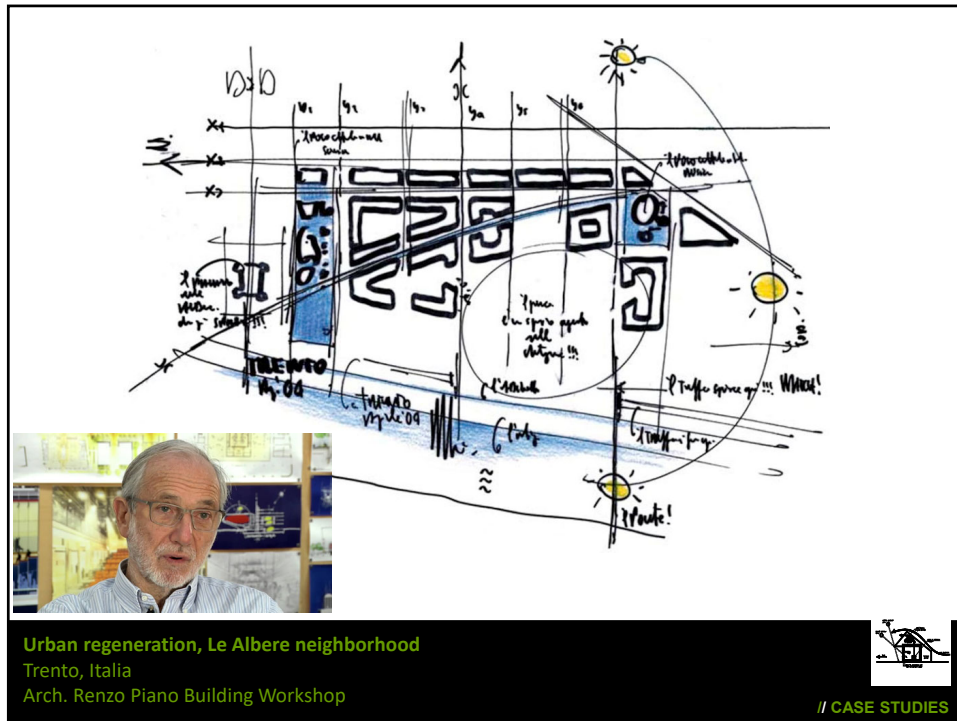
// CASE STUDIES



Urban regeneration, Le Albere neighborhood
Trento, Italia
Arch. Renzo Piano Building Workshop



// CASE STUDIES









Urban regeneration, Le Albere neighborhood
Trento, Italia
Arch. Renzo Piano Building Workshop



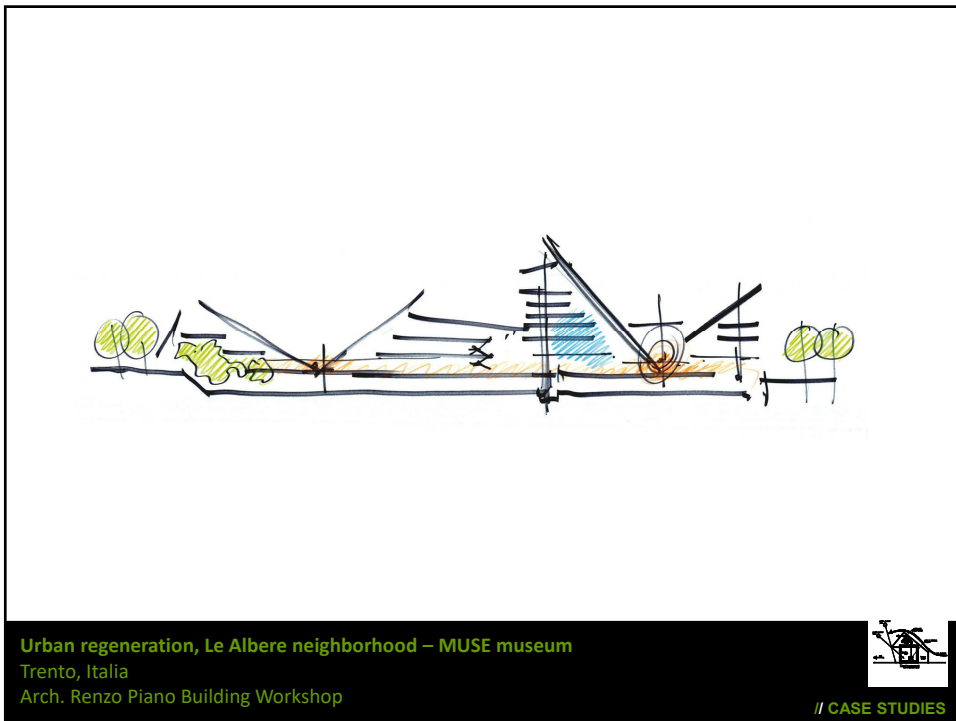
// CASE STUDIES

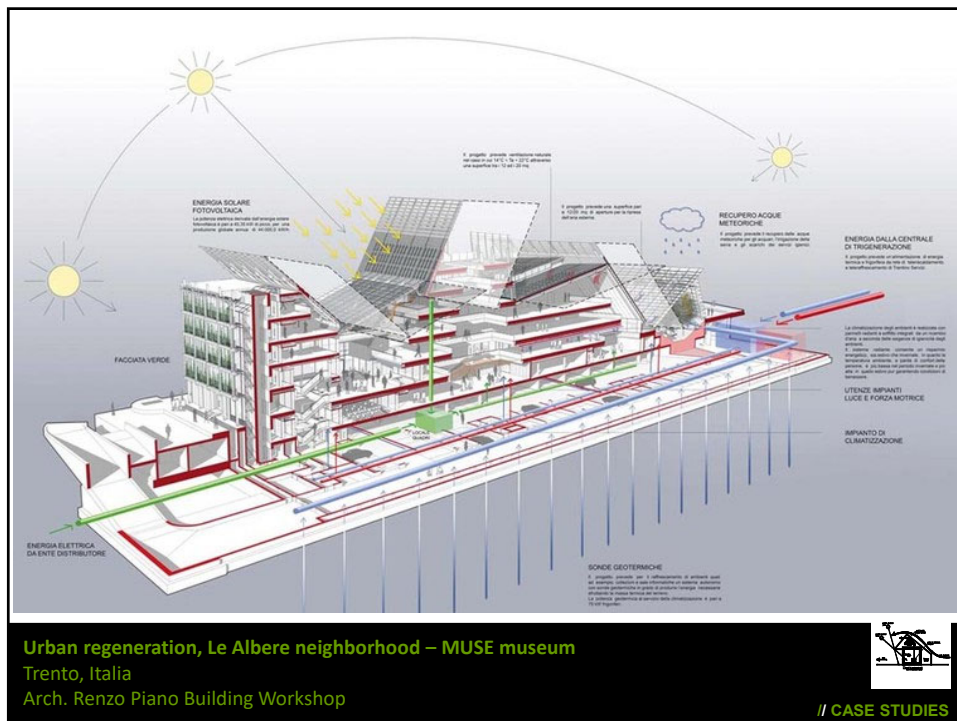
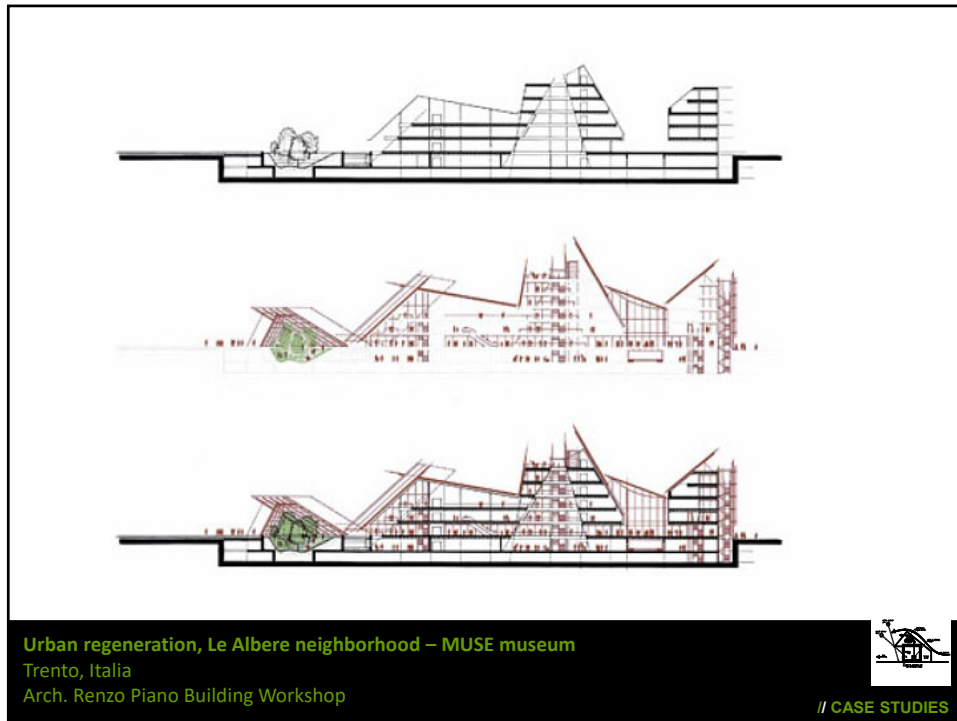


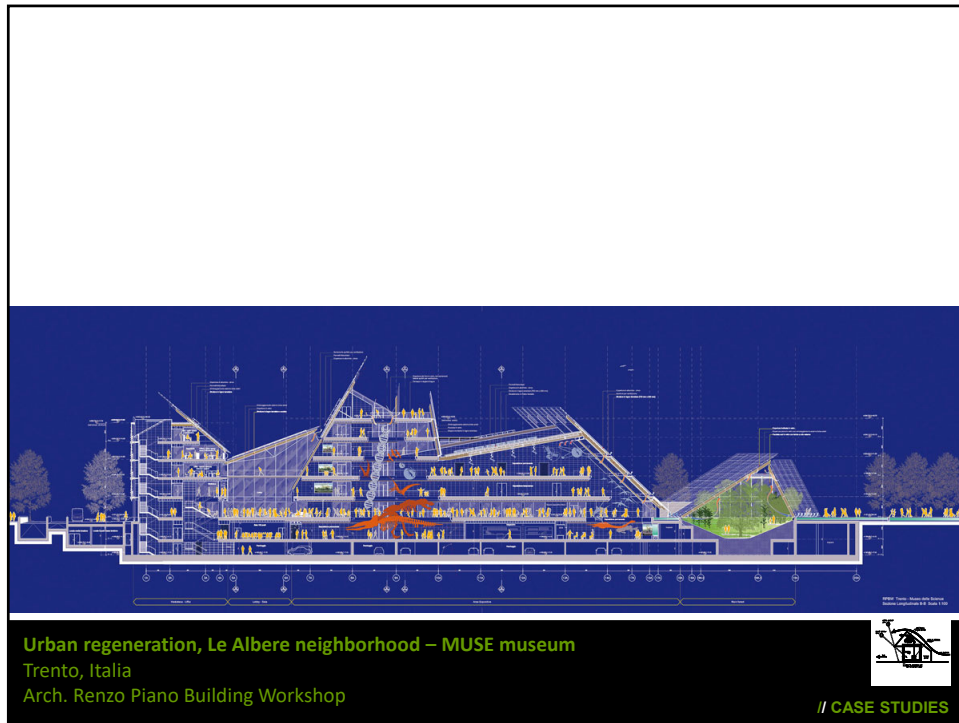
Urban regeneration, Le Albere neighborhood
Trento, Italia
Arch. Renzo Piano Building Workshop

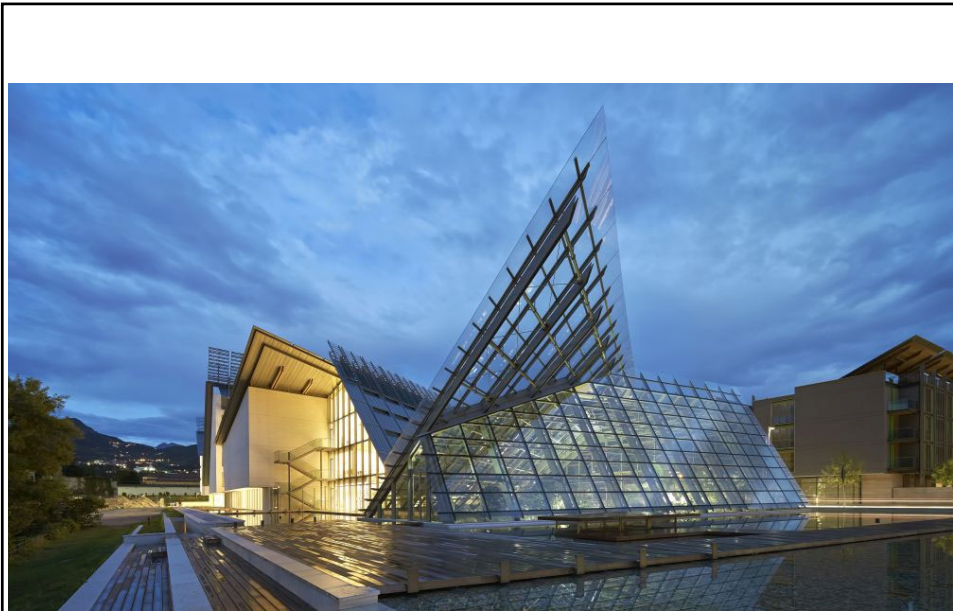


// CASE STUDIES









Urban regeneration, Le Albere neighborhood – MUSE museum
Trento, Italia
Arch. Renzo Piano Building Workshop



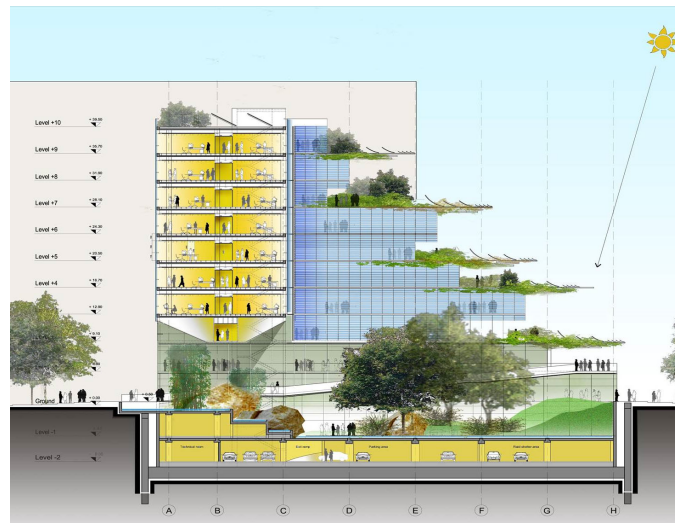
// CASE STUDIES



Urban regeneration, Le Albere neighborhood – MUSE museum
Trento, Italia
Arch. Renzo Piano Building Workshop



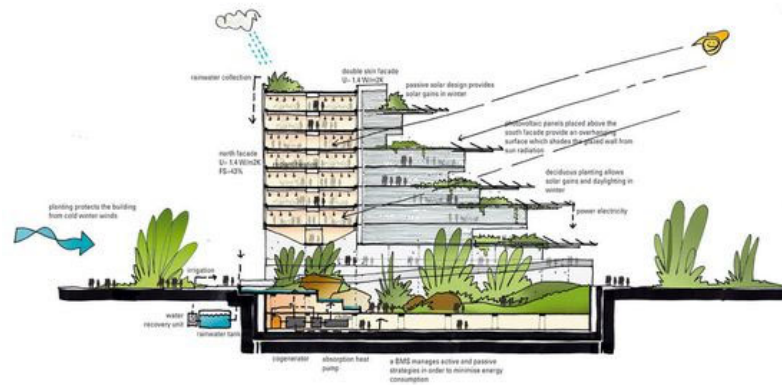
// CASE STUDIES



SSIEB - Sino-Italian Ecological and Energy Efficient Building
Tsinghua University, Beijing – China
arch. Mario Cucinella and Politecnico of Milano



// CASE STUDIES

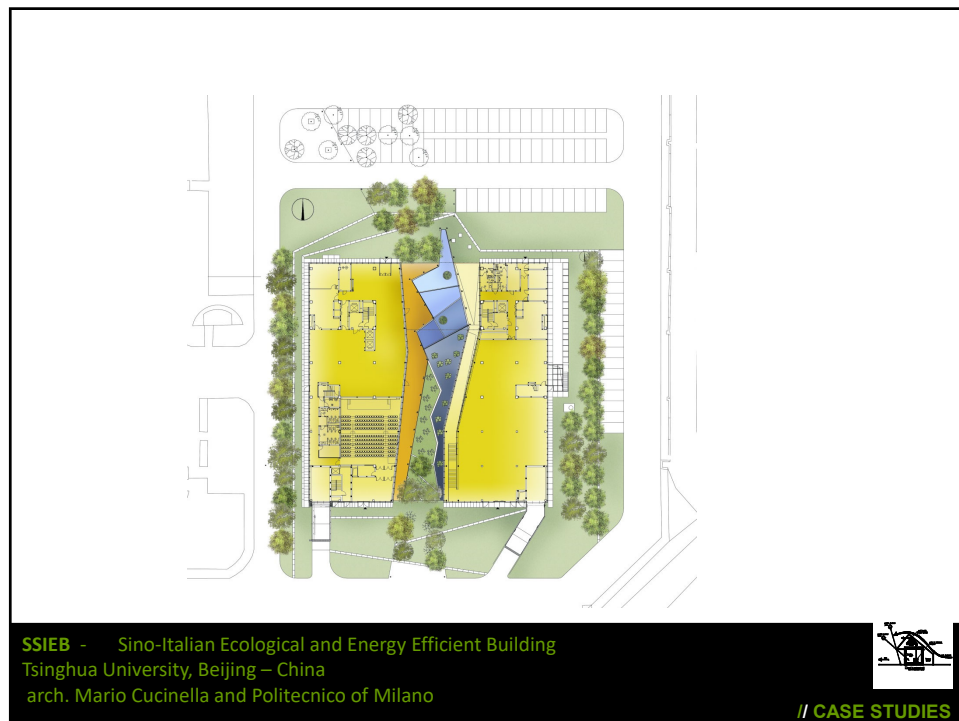
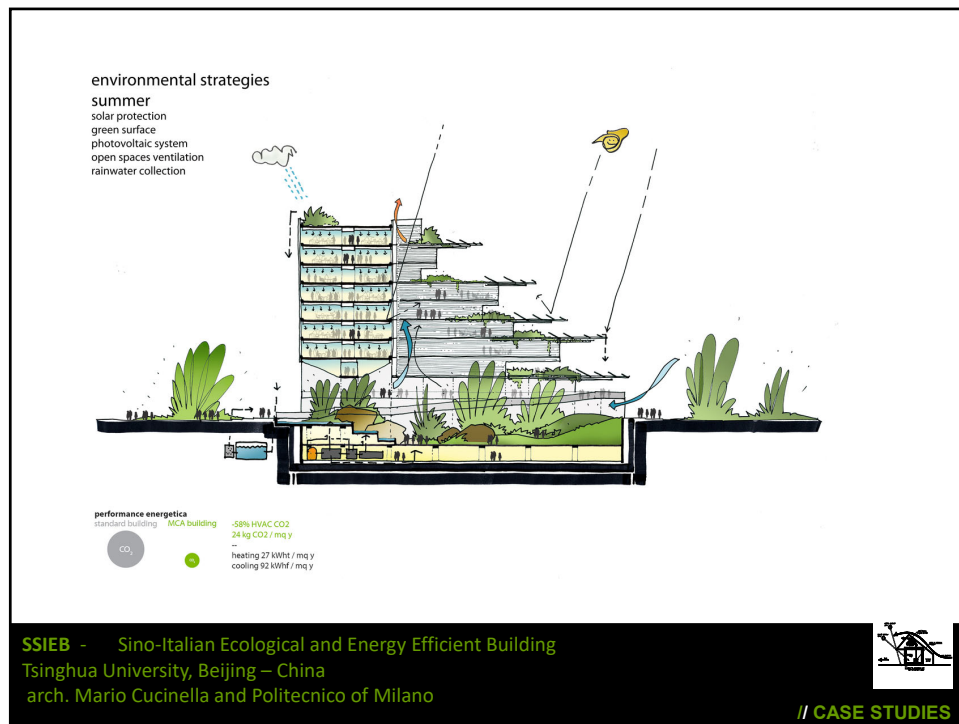


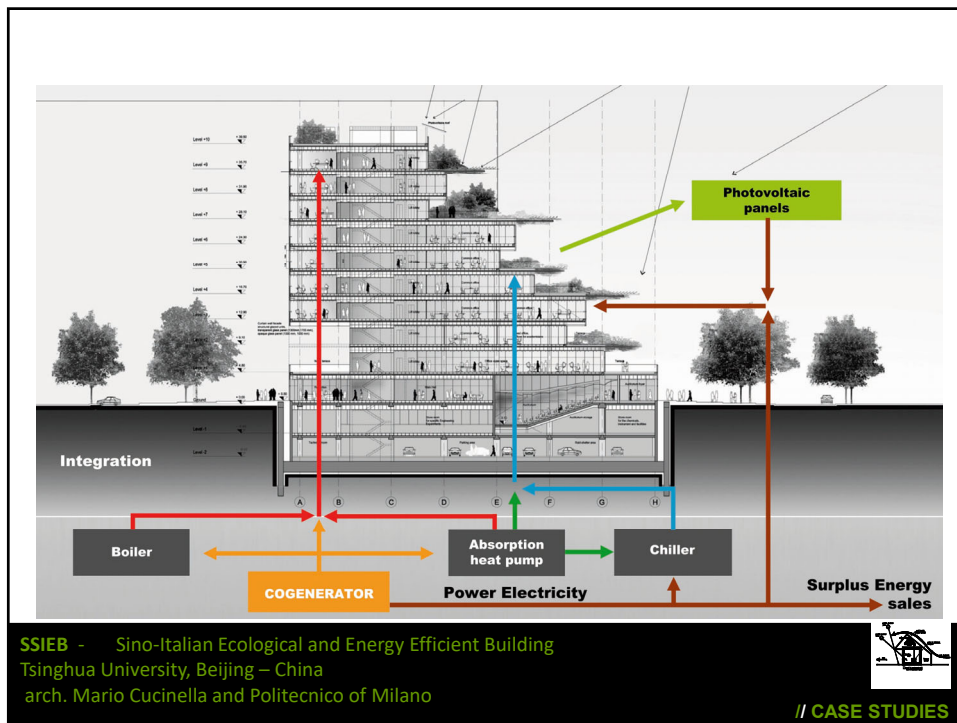
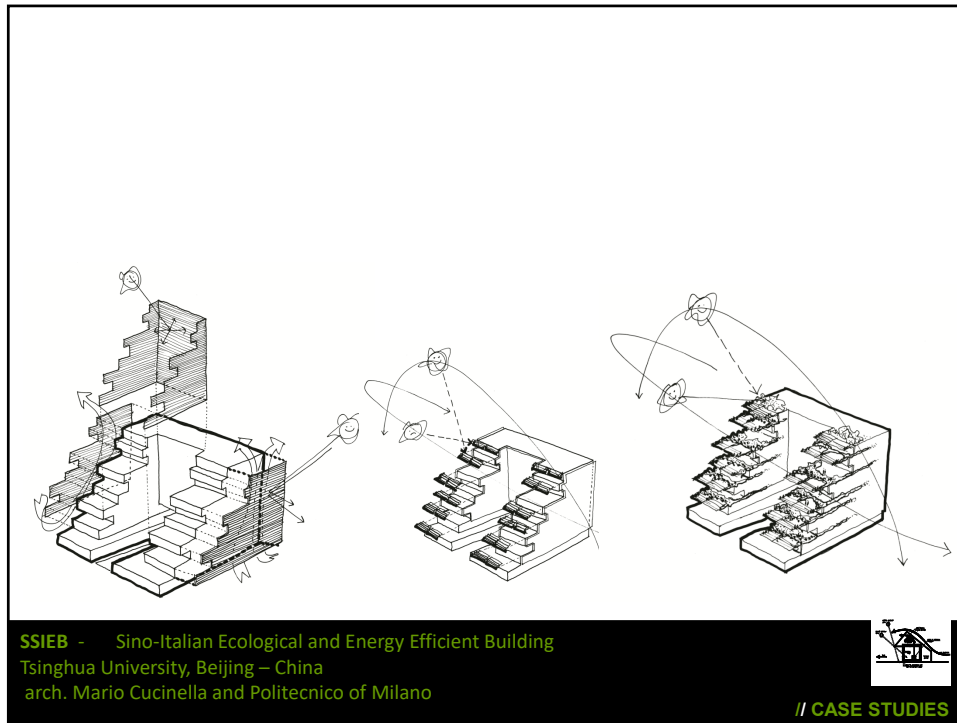
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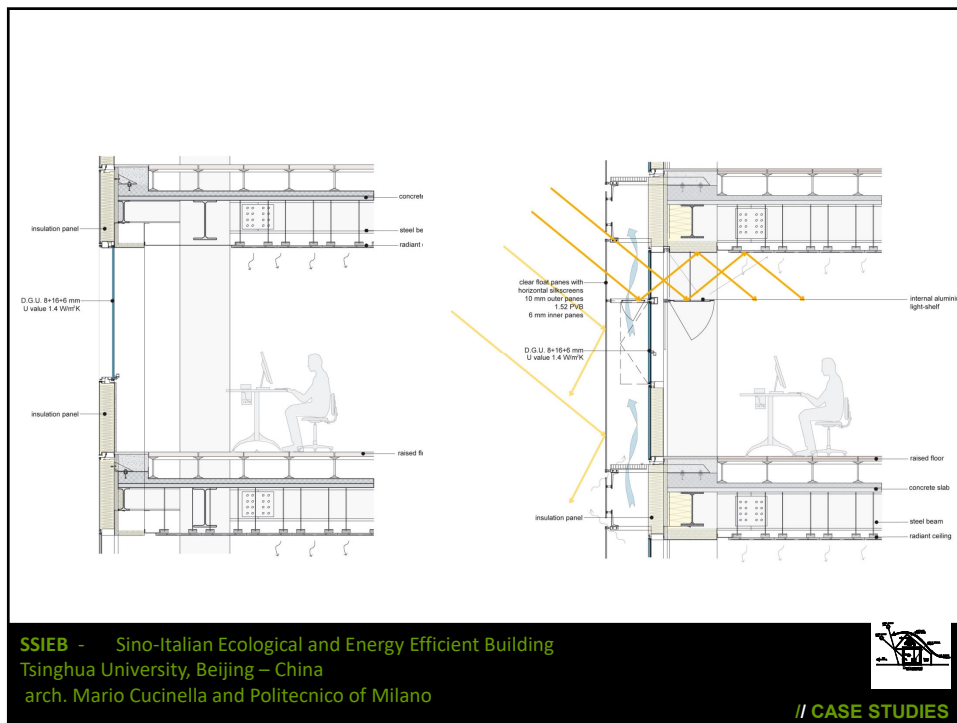
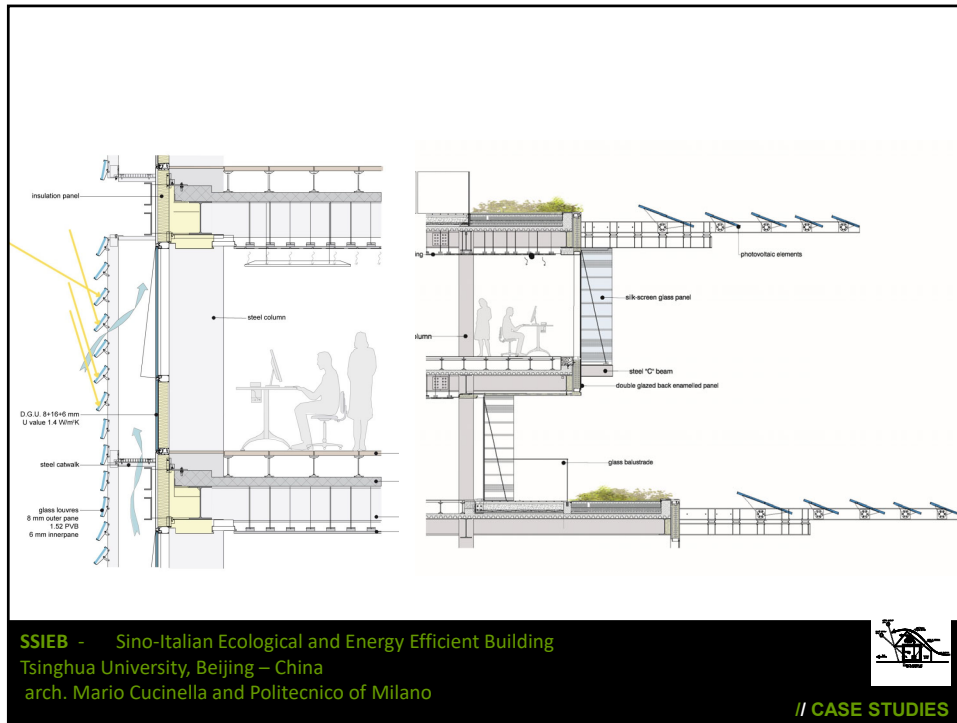
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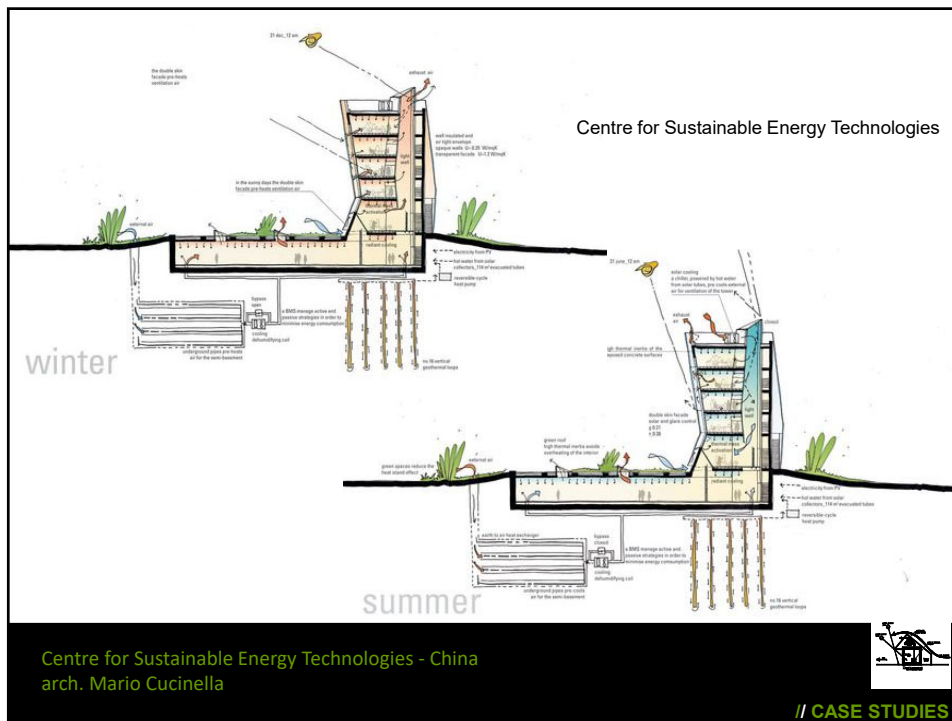
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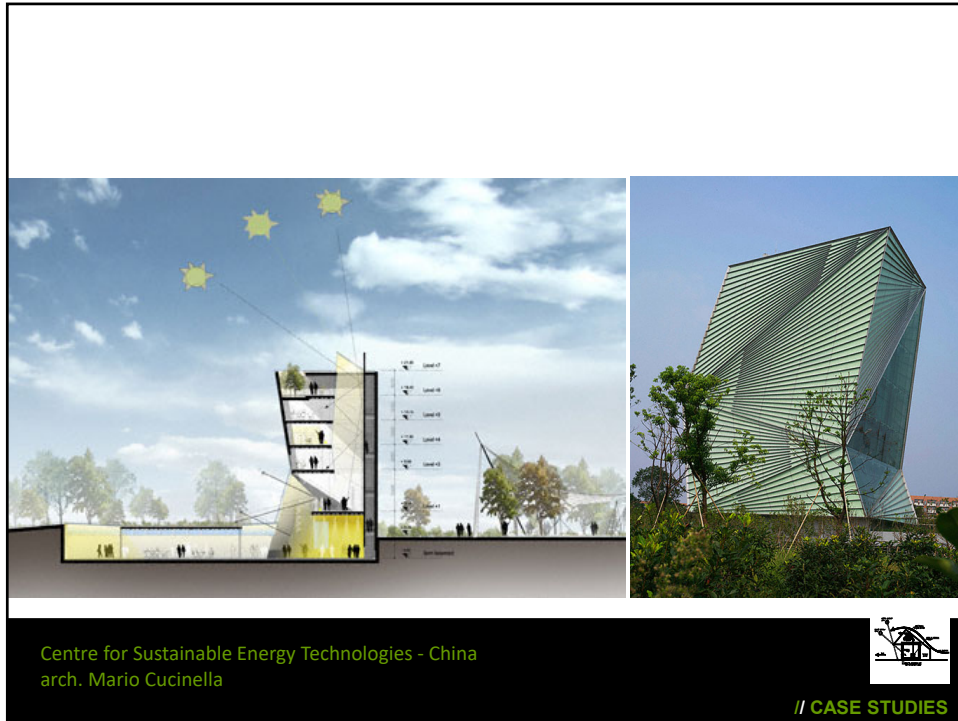
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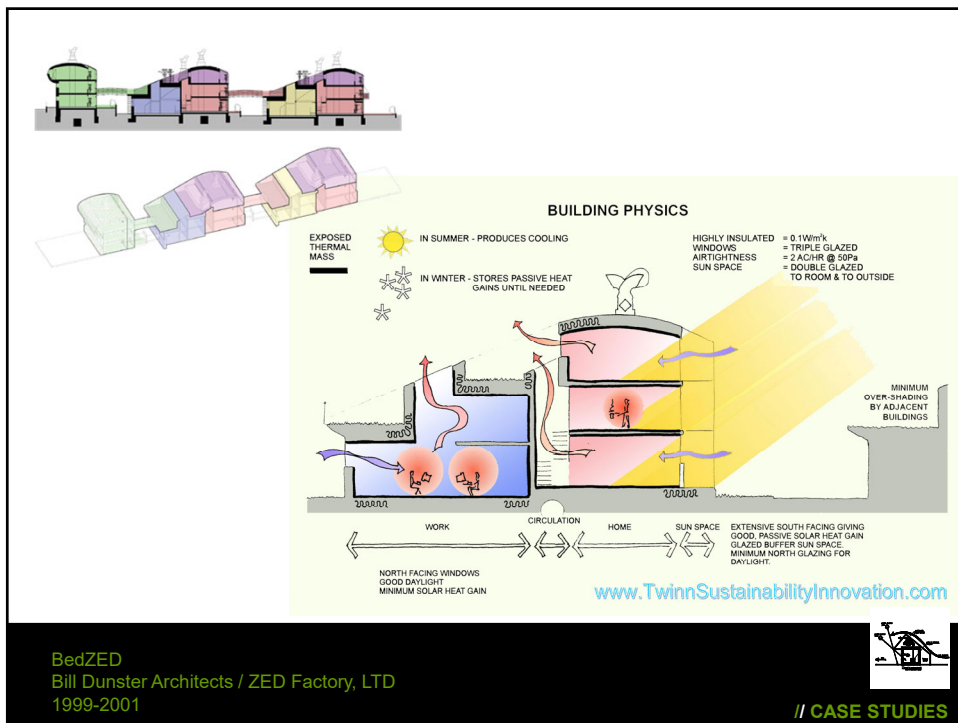


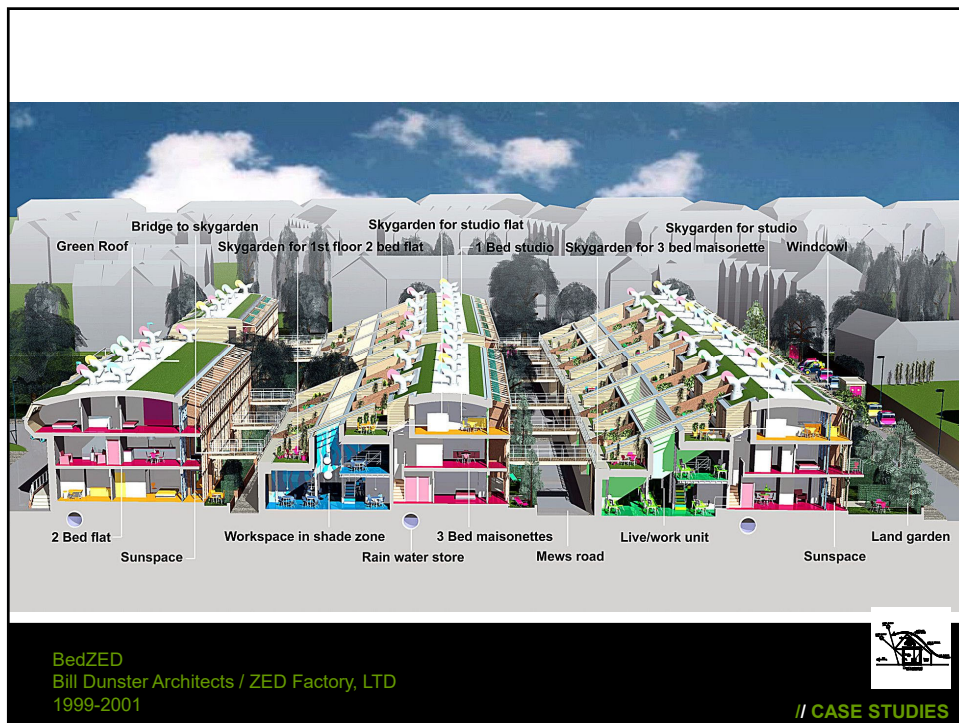
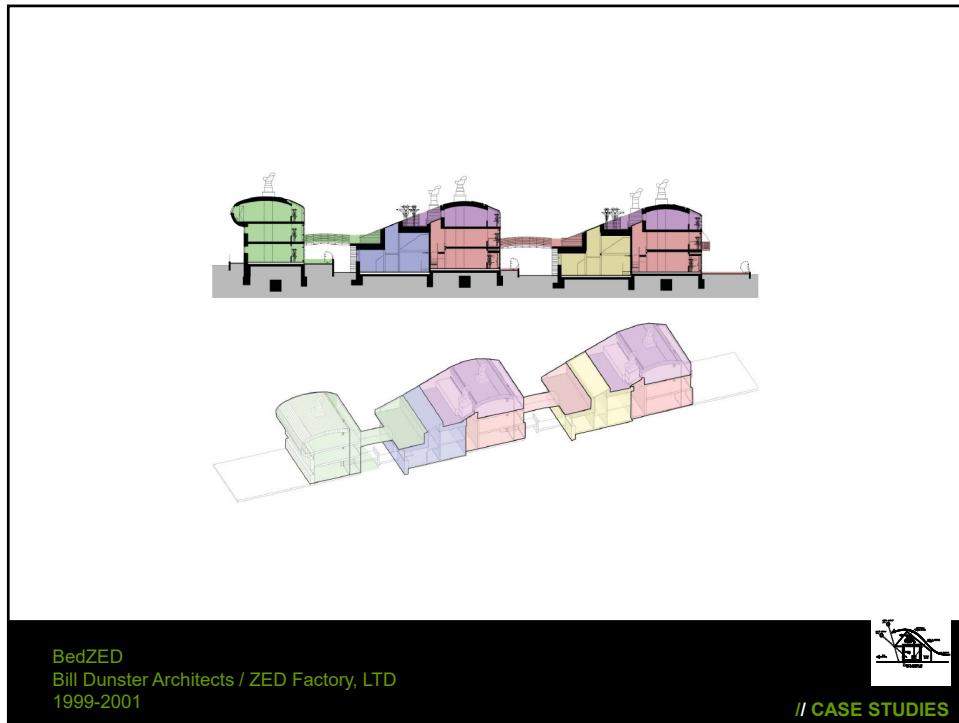
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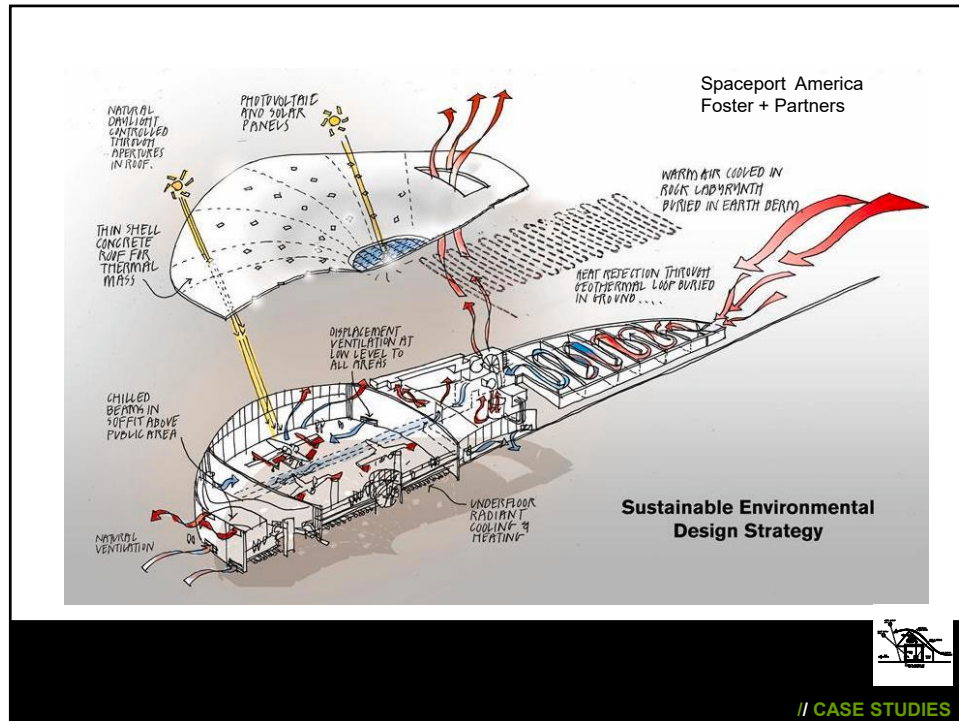


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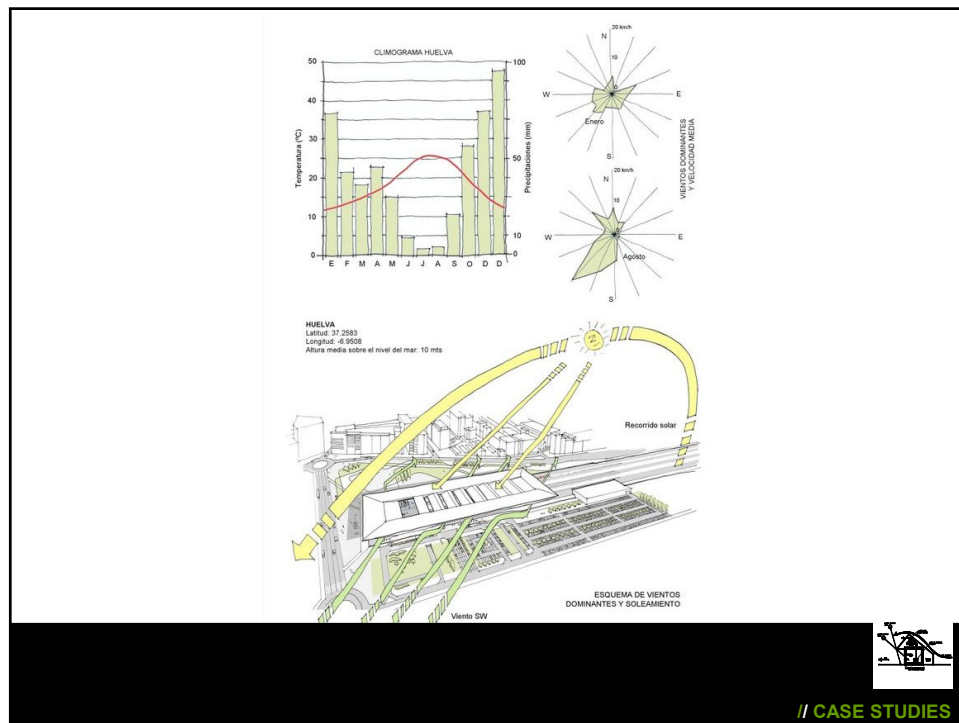
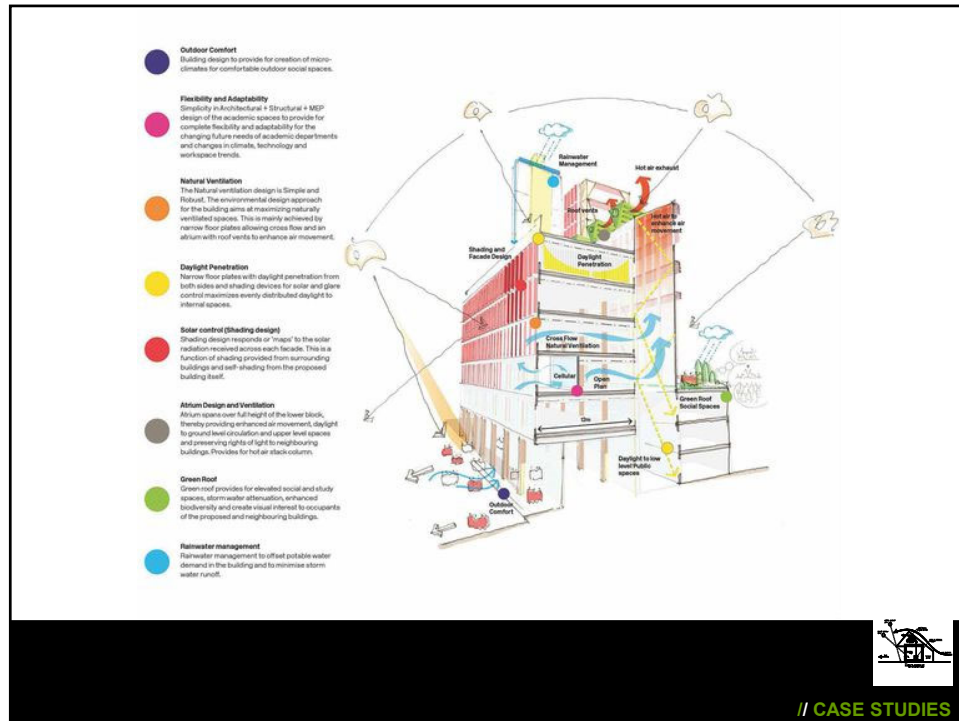


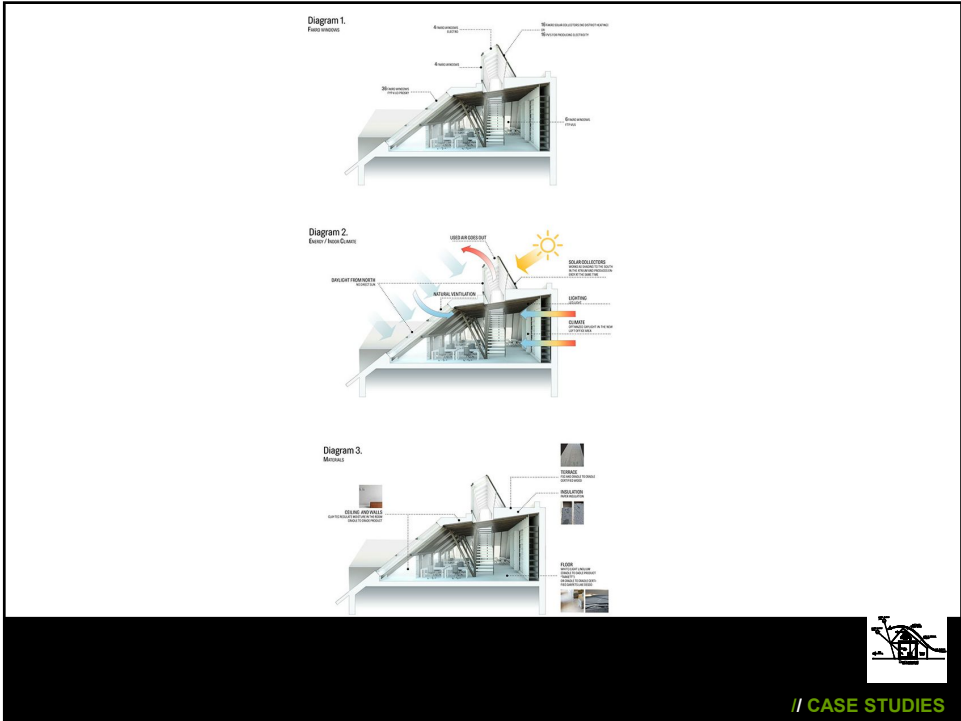
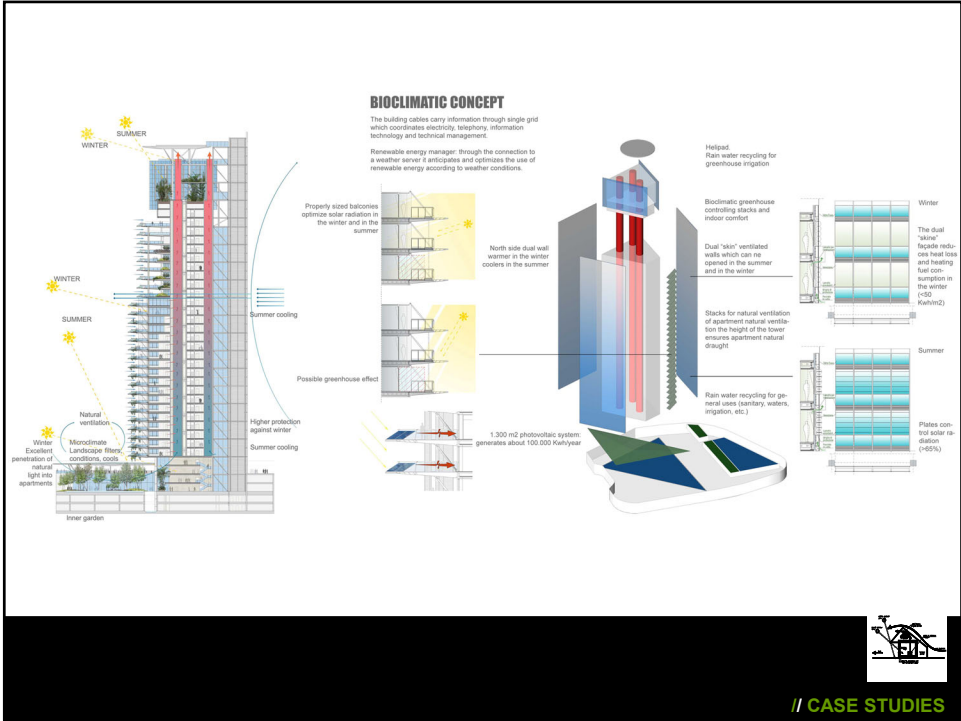


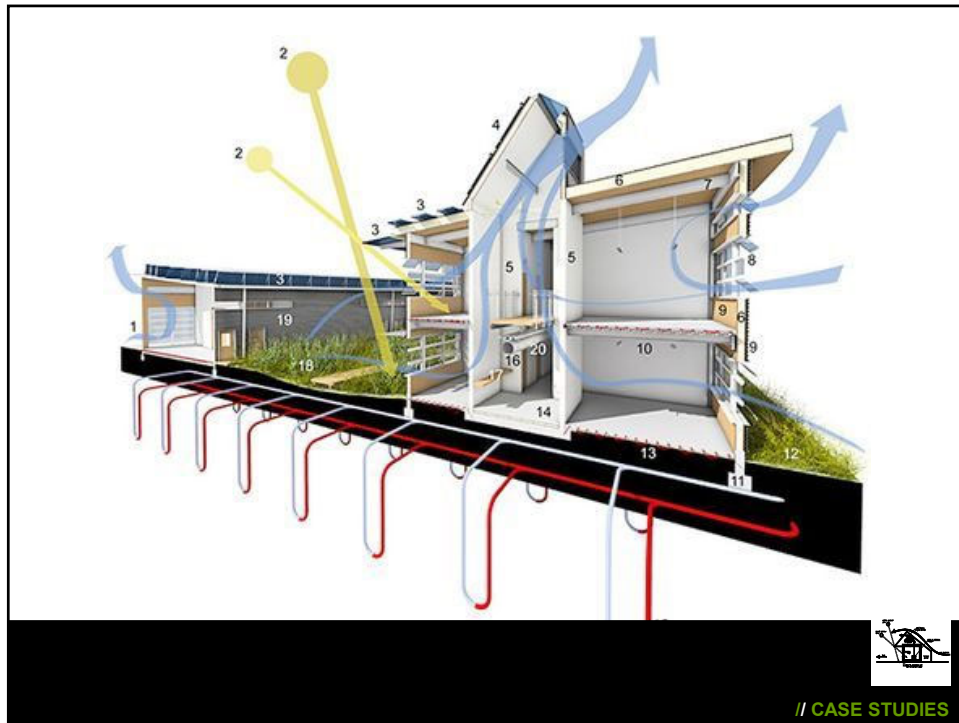


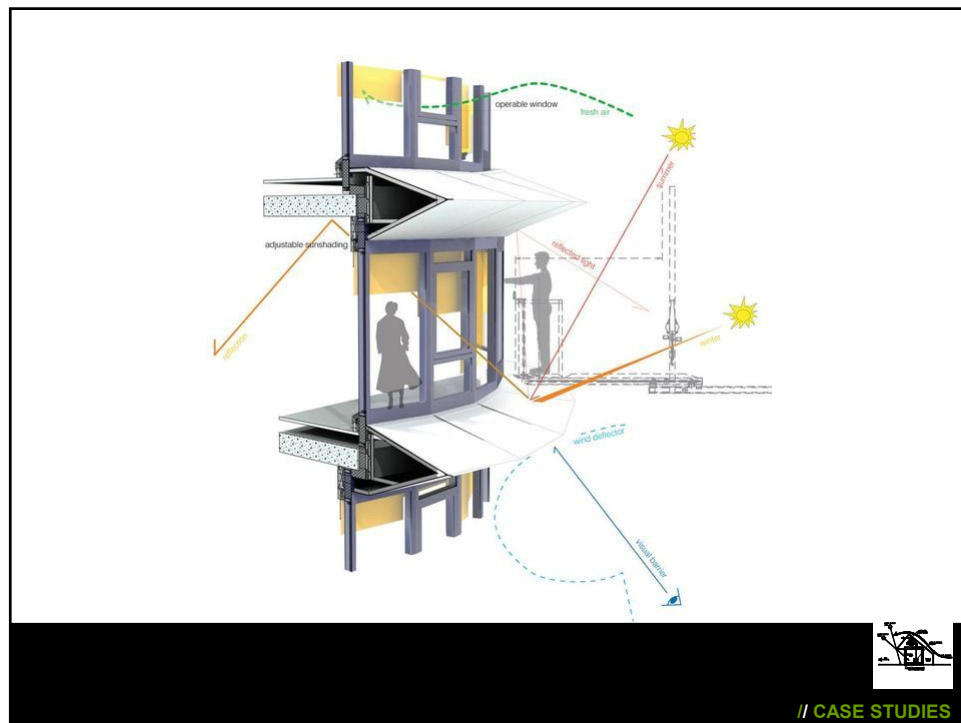
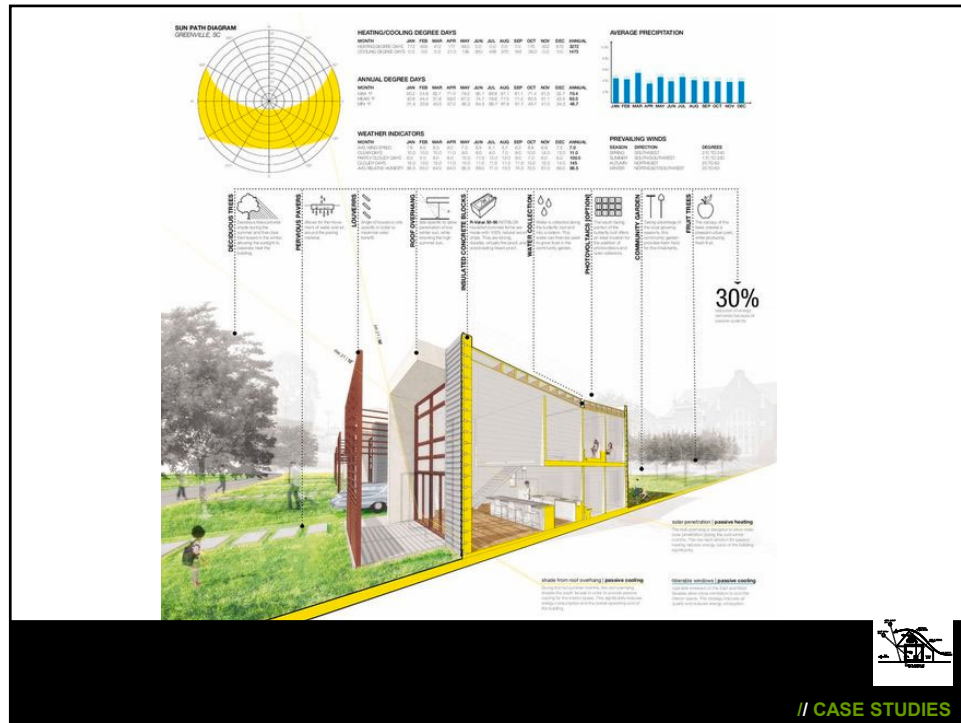












SHAPE OF ARCHITECTURE



Archaic living – Amerindians tribes
Sursa foto: www.antiguamuseums.org



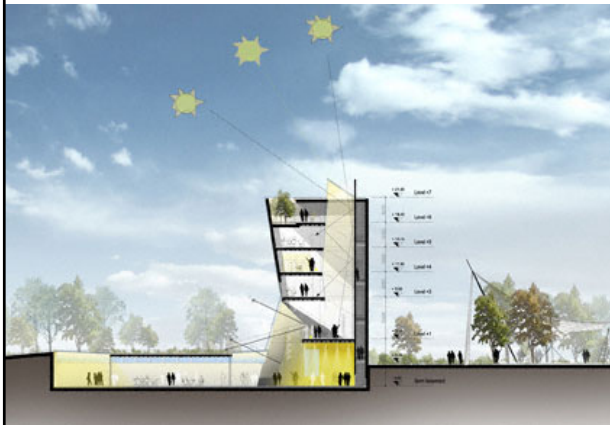
Archaic living – Amerindians tribes
Sursa foto: www.antiguamuseums.org



Renzo Piano; Marie Tjibaou Cultural
Center New Caledonia;
Sursa: www.flickr.com



SHAPE OF ARCHITECTURE



Centre for Sustainable Energy Technologies, China; arh. Mario Cucinella



COURSE AGENDA

PART 3

6. Defining the Bioclimatic Design Strategies
Extraction of design strategies, through conceptual functioning scenarios of the building

PART 4

7. Presentation of case studies

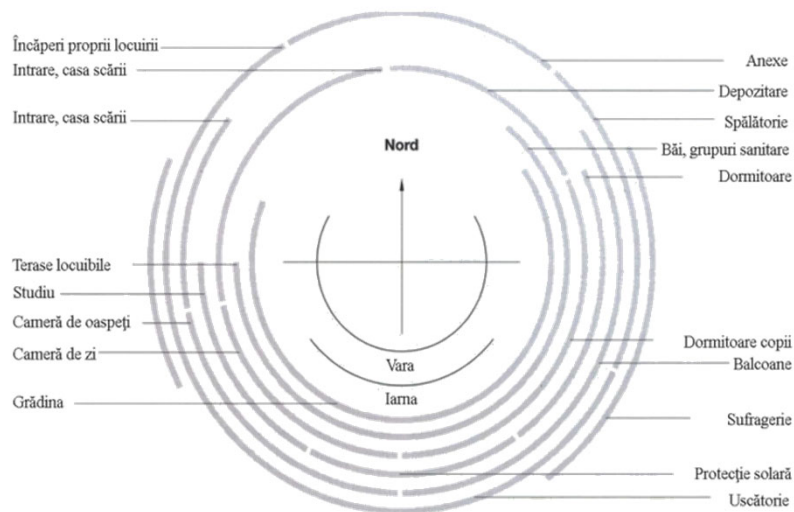
8. Theoretical Application

05:00 pm | Training closure



LEARNING OBJECTIVES

8. Theoretical Application



// APPLICATION

VĂ MULȚUMESC !
THANK YOU!

Lect. Phd. Arch. Daniel Nicolae Armenciu
armenciu.daniel@gmail.com