

# ***Looking Beyond Conventional Buildings***

## ***Fundamental Design Strategies with Non-Conventional Repercussions***

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## INTRODUCTION

This presentation first underlines the necessity of “**Non-Conventional Design Strategies**” for various building types and then focuses on:

- **Alternative design approaches for the buildings**, specifically in the Indian context, that are inspired by both the urban and environmental aspects, with long-term sustainability at the core of our thinking,
- **And further trying to seek the lapses being experienced between the theory and practice of Green & Sustainable Architecture.**

It further discusses a few concepts like **Eco-mimesis, Energy Eco-Cells, Eco-linkages** and few other similar theories that are being applied across the globe. We shall also take up a few examples of important cases where these theories are being put into practice.

## THE HYPOTHESIS & ITS RATIONAL

*Given the extent and speed of the urban sprawl of the Indian megacities, green designers, need to mitigate the negative environmental impacts and to make the urban pockets and the constituent building components as humane and pleurably habitable for their inhabitants as possible.*

## **NON-CONVENTIONAL APPROACH:** *A Need of Changing Times*

According to the United Nations some 193,107 new city dwellers are added to the world's urban population every day. By 2050, in about 40 years from now, the world's urban population will stand at over 6 billion – double of what it is today.



**THE URBAN SPRAWL:** A reality that we all are aware of but not fully prepared/ready to address...!?

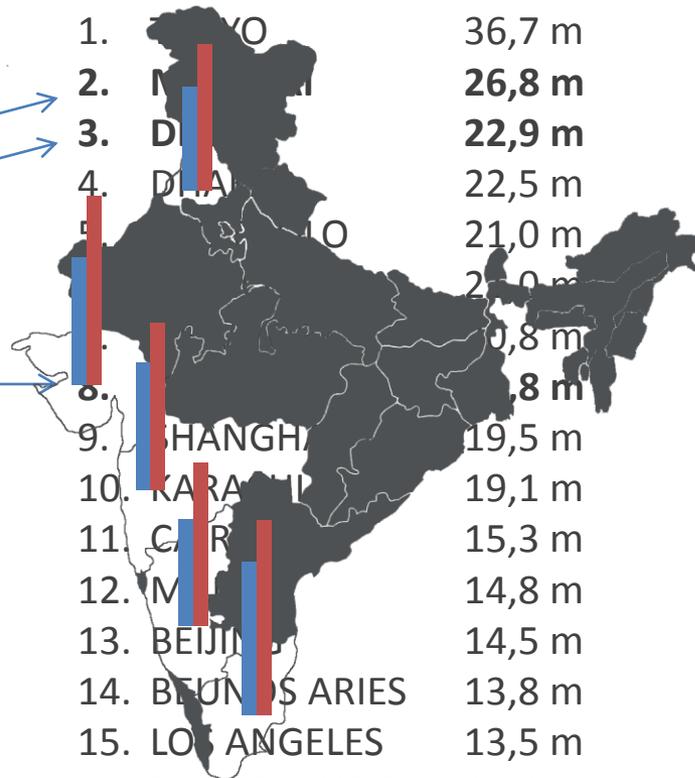
# NON-CONVENTIONAL APPROACH: *A Need of Changing Times*

## POPULATION PROJECTIONS (% OF POPULATION)

	2008	2030
1. TOKYO	35,7 m	
2. MEXICO CITY	19,0 m	67
3. NEW YORK	19,0 m	66
4. SAO PAULO	19,0 m	58
5. MUMBAI	18,8 m	57
6. DELHI	15,9 m	52
7. SHANGHAI	15,0 m	45
8. KOLKATA	14,8 m	40
9. BERNOS ARIES	13,8 m	41
10. DHAKA P.	13,5 m	46
11. LOS ANGELES	13,5 m	32
12. KARACHI	13,1 m	31
13. RIO DE JANEIRO	12,9 m	33
14. OSAKA	11,7 m	40
15. CAIRO P.	11,3 m	26
16. BEIJING	11,1 m	24
17. MUMBAI P.	11,1 m	20
18. MOSCOW	10,5 m	17

## POPULATION 2025

1. TOKYO	36,7 m
2. MUMBAI	26,8 m
3. DELHI	22,9 m
4. DELHI	22,5 m
5. SAO PAULO	21,0 m
6. MUMBAI	20,8 m
7. SHANGHAI	19,8 m
8. SHANGHAI	19,5 m
9. KARACHI	19,1 m
10. CAIRO	15,3 m
11. MUMBAI	14,8 m
12. MUMBAI	14,8 m
13. BEIJING	14,5 m
14. BERNOS ARIES	13,8 m
15. LOS ANGELES	13,5 m
16. RIO DE JANEIRO	13,4 m
17. OSAKA	11,7 m
18. MOSCOW	10,5 m



**THE URBAN SPRAWL:** A reality that we all are aware of but not fully prepared/ready to address...!?

(SOURCE: UN-HABITAT)

## **NON-CONVENTIONAL APPROACH:** *A Need of Changing Times*

To handle issues like **homogeneous urban densities, shrinking city centers, urban sprawl and sustainable future growth**, **A HOLISTIC ENERGY EFFICIENT STRATEGY** will very much have to be a part of our cities. This inference is a direct implication from the optimum utilization of resources based on the urban population density.



## NON-CONVENTIONAL APPROACH: *A Need of Changing Times*

Densities allow for faster movement of goods, people and ideas. **Buildings could play substantial role in this.** Sustainable building is an evolutionary process. It involves many little insights, inventions, initiatives and policies that make buildings gradually more energy friendly, more durable, and so on.



## NON-CONVENTIONAL APPROACH: *A Need of Changing Times*

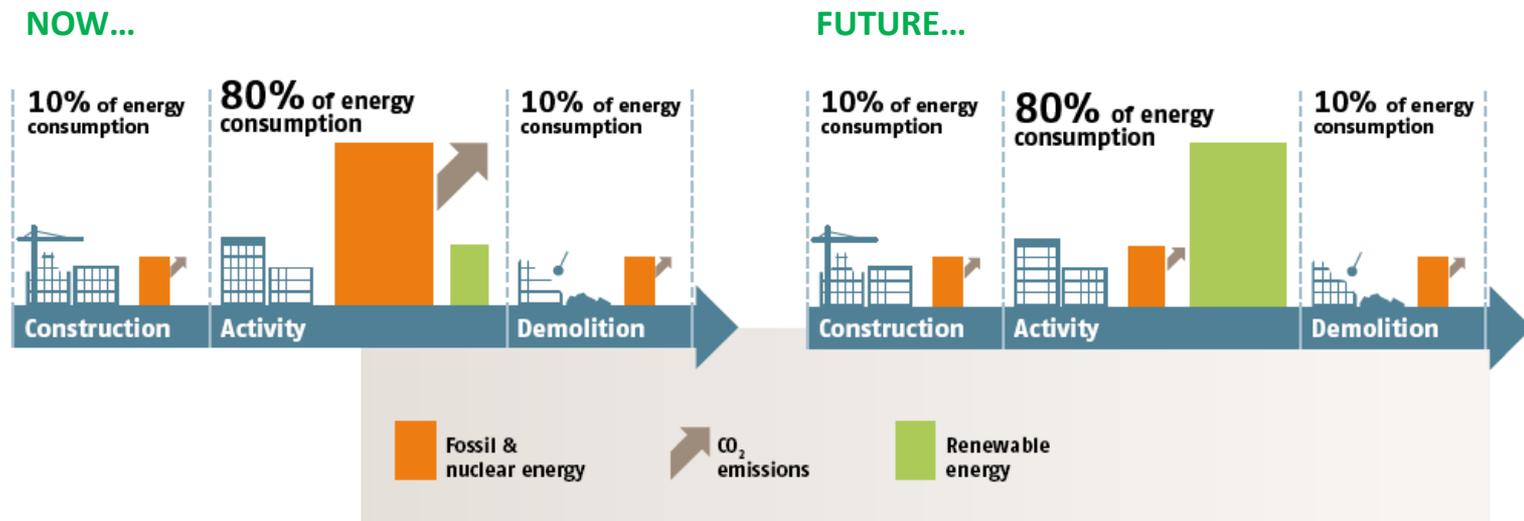
### Meeting current environmental requirements

Buildings alone are responsible for **43% of energy consumption** in Europe!

It is now essential to reduce this figure by promoting the use of natural energy sources such as **sunshine, daylight and outside air**.

### Improving the quality of indoor environments

It is proven that **thermal and visual comfort have a beneficial effect on the occupants' well-being**. Working or living in a more pleasant, healthy environment undoubtedly leads to improved efficiency and productivity.



## NON-CONVENTIONAL APPROACH: *A Need of Changing Times*

Urbanization is a key global mega trend presenting one of the biggest challenges to sustainable development. **Understanding and learning to guide our shifting urban patterns of living has become a priority, something that can lead to solutions such as *Eco-cities*.**

*Conventional Buildings* aren't very ecological in their behavior.

The question then is:

***Why do we need a Non-conventional Holistic Design Approach and what is meant by it?***

And the answer:

We have to look out for economically viable alternative built forms, design strategies and development guidelines, in order to meet the demands of spatial requirement, urban growth and increasing rural - urban migration.



# THE CONCERNS WITH OUR CONTEMPORARY BUILDINGS

Ignorance towards:

- **The local climate,**
- **The Culture, and**
- **The Context**

Instead solutions are being simply 'imported' from the western. This pattern, primarily driven by the motive of glorification has led many to denounce our buildings as anti-environmental.



## BUILDING CHARACTERISTICS

Any building in our urban system can be characterized by the following:

- **Context**
- **Functions**
- **Form, Design & Aesthetic Value**
- **Green Building Practices & Sustainable Development Strategies**
- **Materials & Building Components**
- **Structure & Construction Techniques**
- **Future Vision**  
(Role as a member of an urban family)

**INTRINSIC**

Further, there is yet another character:

- **Market Forces & Demands of the Building in a particular location**

**EXTRINSIC**

## CONTEXTUAL BUILDINGS

Context defines the character of a place, its roots & settings, explains its behavioral pattern and its possible scenarios of further expansion.

- **LOCATION**
- **HISTORY & CUSTOMS**
- **PEOPLE**
- **CLIMATE**

*“There is much more to our current place in architectural history than symbol and iconography. Rather than symbol, the specifics of each environmental condition, culture, lifestyle and the tools and methods we use to build should be the basis for a new kind of high-rise building that would inherently ‘add value’ but also transform cities.”*

**Jeanne Gang, Studio Gang, 2008**



FLATIRON BUILDING, NEW YORK

## CONTEXTUAL BUILDINGS

Context gives us places of strong connection and quality, it gives a sense of belonging.

- Cohesive
- Inclusive
- Cultural & Social Identity
- Functional Explanation

### *Contextual Factors:*

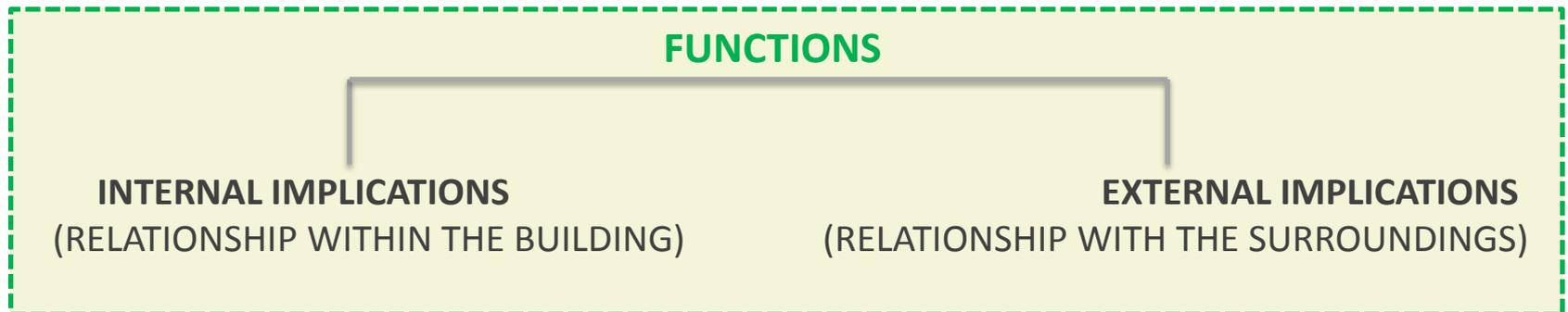
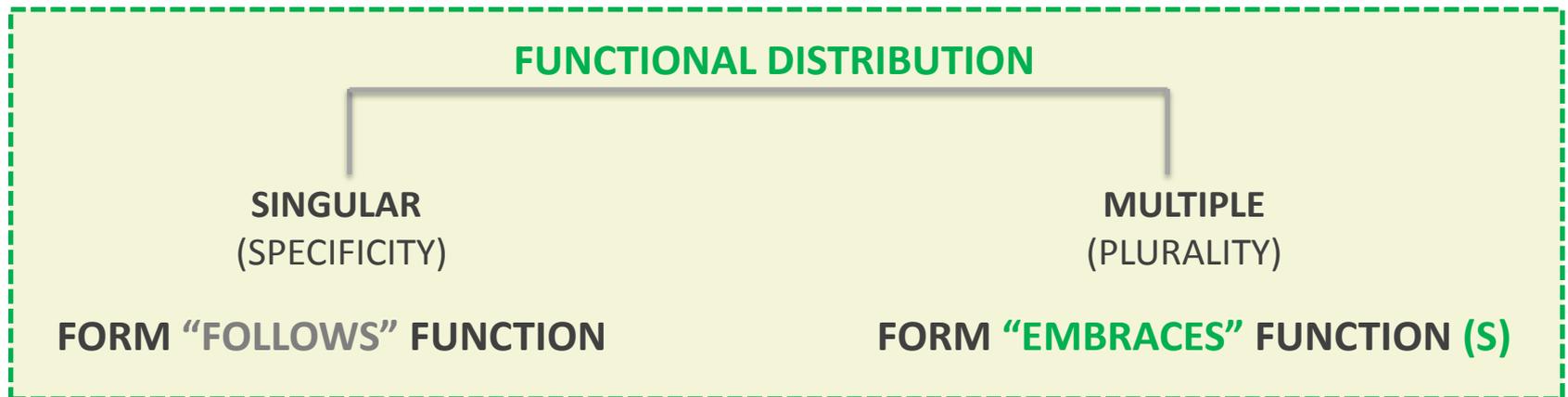
- Building Strategy
- Street Level Impact
- Individual Preferences
- Community Spaces & Nature
- Response to Climate



AN URBAN POCKET OF MUMBAI

## FUNCTIONS

- Define the **AREA & PROJECT BRIEF**
- Define the **SPATIAL ARRANGEMENT** within a building
- Define the **EXTENT OF RELATIONSHIP** of the building with the surroundings



## MULTIPLE FUNCTION APPROACH

- **INTERNAL IMPLICATIONS**

Use of Multi-Purpose Spaces within a building, wherever possible:

REDUCES THE REDUNDANCY OF SPACES,

INCREASES THE AREA EFFICIENCY,

OPTIMIZES CIRCULATION WITHIN A BUILDING,

OFFERS A WIDER SPECTRUM OF PROGRAM DISTRIBUTION

INCREASES THE VIBRANCY OF THE PROJECT

Issues like **FLEXIBILITY, MODULARITY & ADAPTABILITY** are the key to this kind of approach.

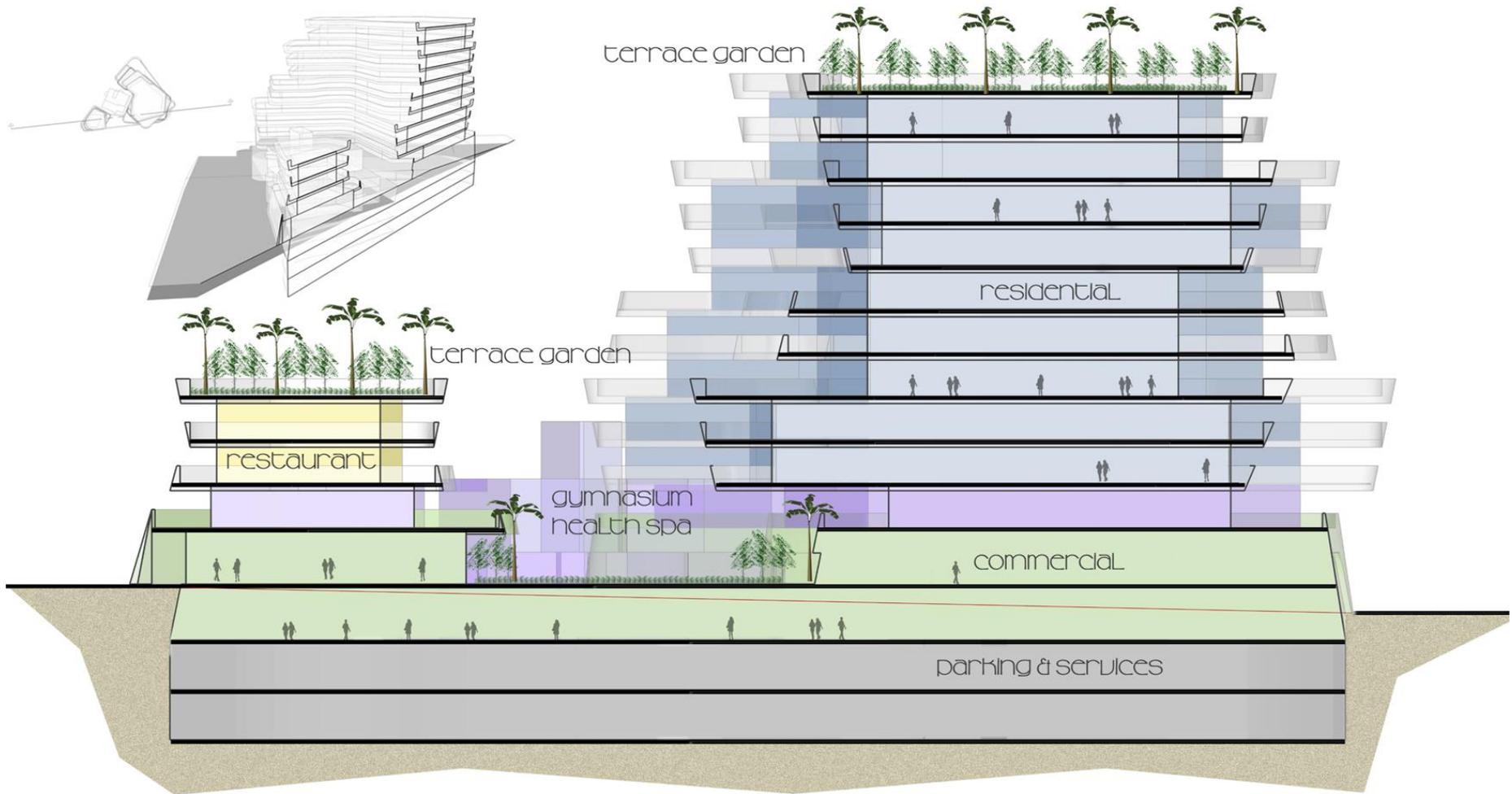
- **EXTERNAL IMPLICATIONS**

Mixed-Use Developments and their impact on the surroundings can result in highly potential urban structure, provided their feasibility is analyzed with care. They can be applied as:

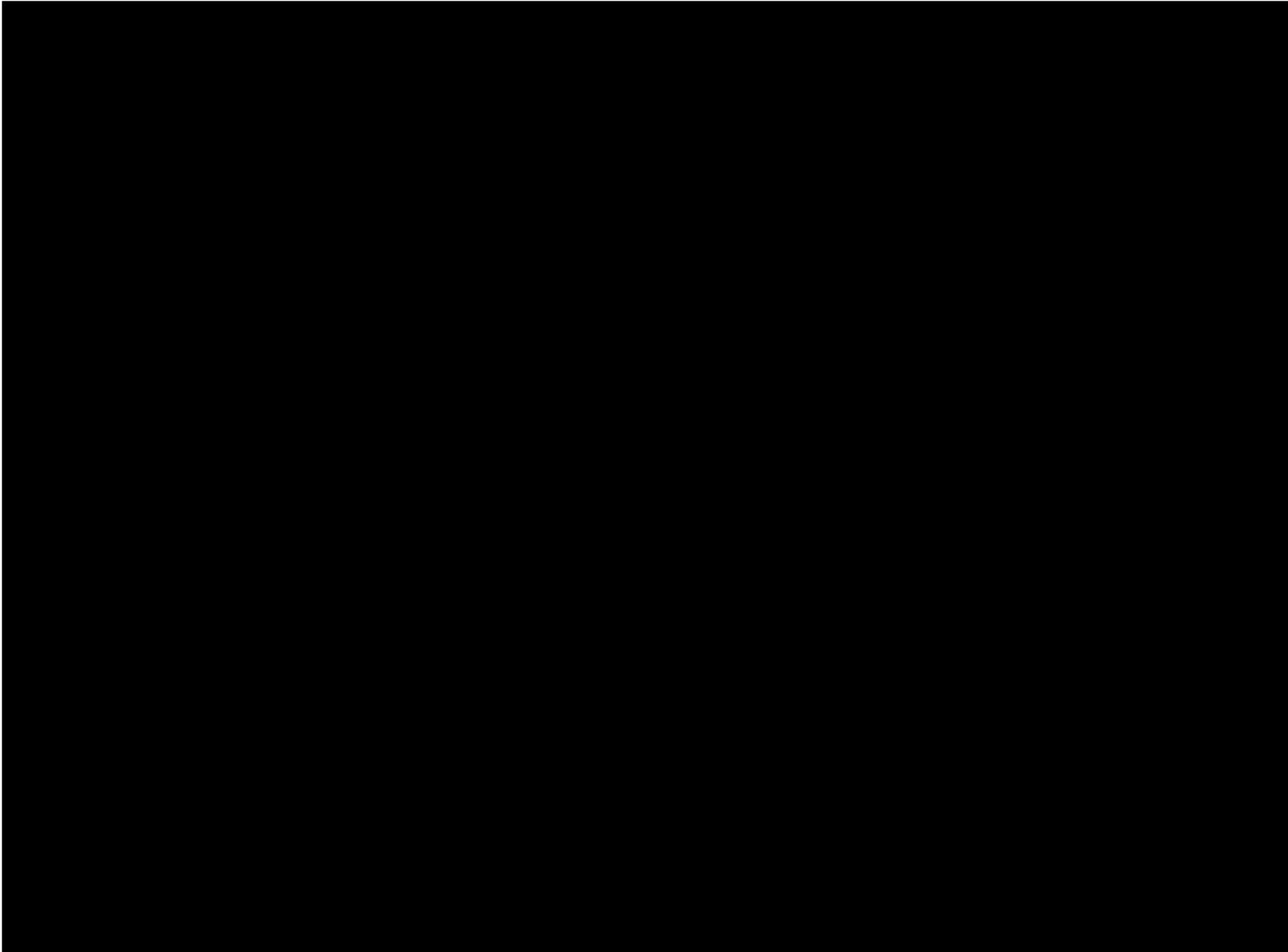
BUILDINGS HAVING MULTIPLE FUNCTIONS SIMULTANEOUSLY,

BUILDINGS HAVING DIFFERENT FUNCTIONS DURING DIFFERENT TIMES OF THE DAY /  
YEAR / SEASON

# MULTIPLE/MIXED USE FUNCTIONS



**3° CIRCLE (MIXED USE DEVELOPMENT), AMMAN (JORDAN)**



## **FORM, DESIGN & AESTHETIC VALUES: Individuality & Uniqueness...**

*"The solution of every problem is contained within itself. Its plan, form and character are determined by the nature of the site, the nature of the materials used, the nature of the system using them, the nature of the life concerned and the purpose of the building itself."*

**- Frank Lloyd Wright (1867-1959)**

### **Each problem is unique**

By approaching each project as a special and unique design, we find that a house we create for one person is completely different than the same type of house for someone else. The thumbprint of the person is etched on to the design.

### **Seek out the individual**

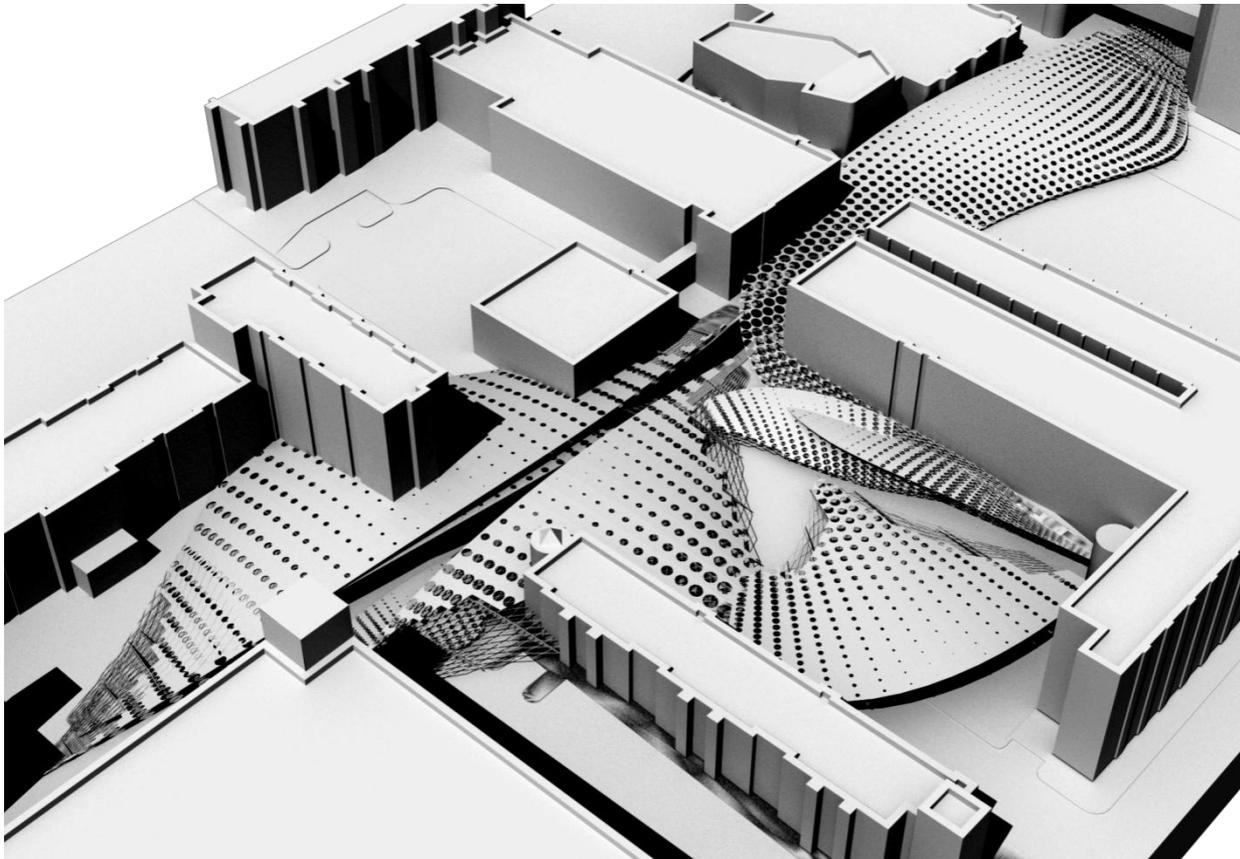
It is not our similarities that make us special, it is our differences. We are not interested in how your house is the same, but how you live differently. We should make the people to question how they live and how they wish to live.

### **Look for the problems**

In each project we look for the problems that may not be so obvious. At the beginning, it is easy to see the main problems: x-number of bedrooms, x-number of bathrooms, etc. But very often it is our creative solution to special problems that make the design special. The search for problems is as important as the solution itself.

## New Formations in Architecture

Researches in Architecture in the last years dealt to a great extent with the exploration of the creative potential of **COMPUTATIONAL DESIGN**. The introduction of **NURBS** surfaces, the use of dynamic systems for form finding purposes and especially the script based generation of space and structure compliant to their real affordance instead of the designers assumption lead to stunning and often unforeseen results.



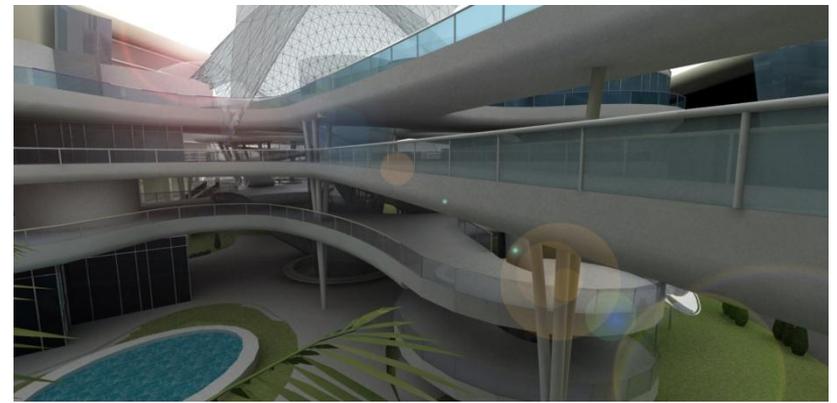
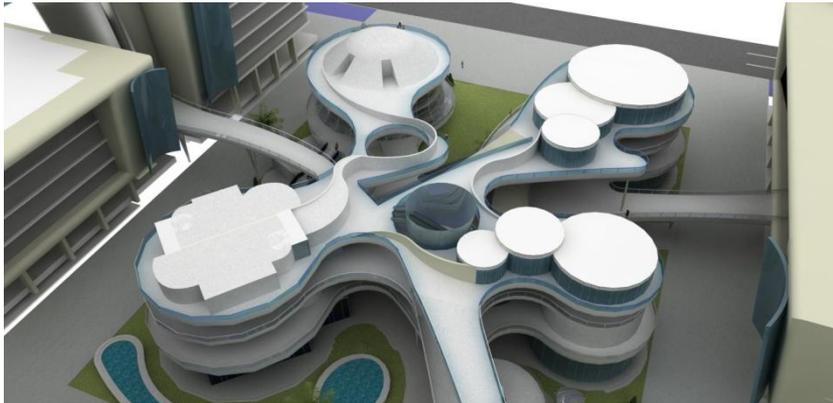
## New Formations in Architecture

The global competition of cities, which are now seen as sites, desires furthermore marketable icons. Buildings may server well in this battle for global attention and capital, as experienced with the *Guggenheim Museum in Bilbao*. This extroverted building by Frank Gehry, catapulted the small city with one bang onto global tableau. Obviously the “**Bilbao-effect**” can’t be repeated easily – but cities worldwide are trying to do so.



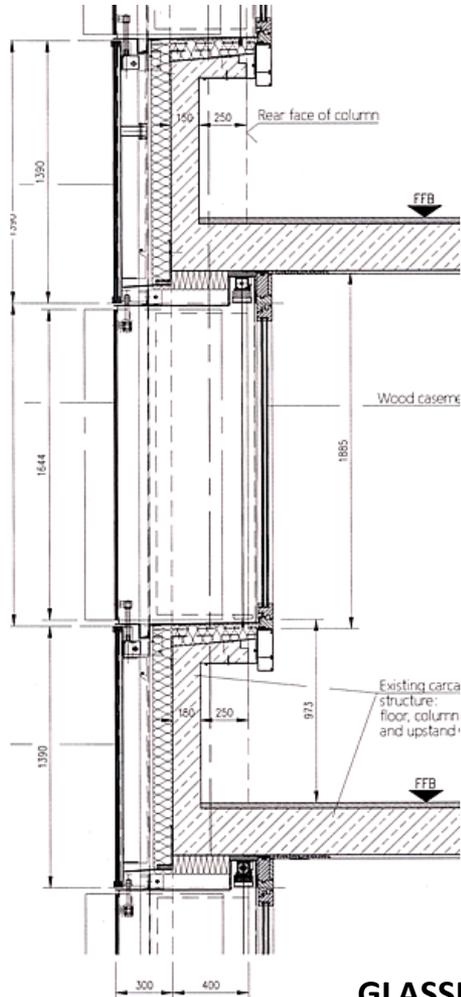
## New Formations in Architecture

In contrast to products of other industries most buildings are as such prototypes, produced only once, reluctant to all kinds of standardization on a higher level than detail level. Building these types of premises is expensive– the erection of highly individual structures is even more.



## Buildings Mass Customization

The outer Perimeter of buildings might benefit from this technique. Deriving from monolithic walls of wood or brick in ancient times, the requirements of modern times changed them to complex compositions of insulating, waterproofing, decorative, electricity and water leading layers.



**GLASSFACADE AT BML BONN**

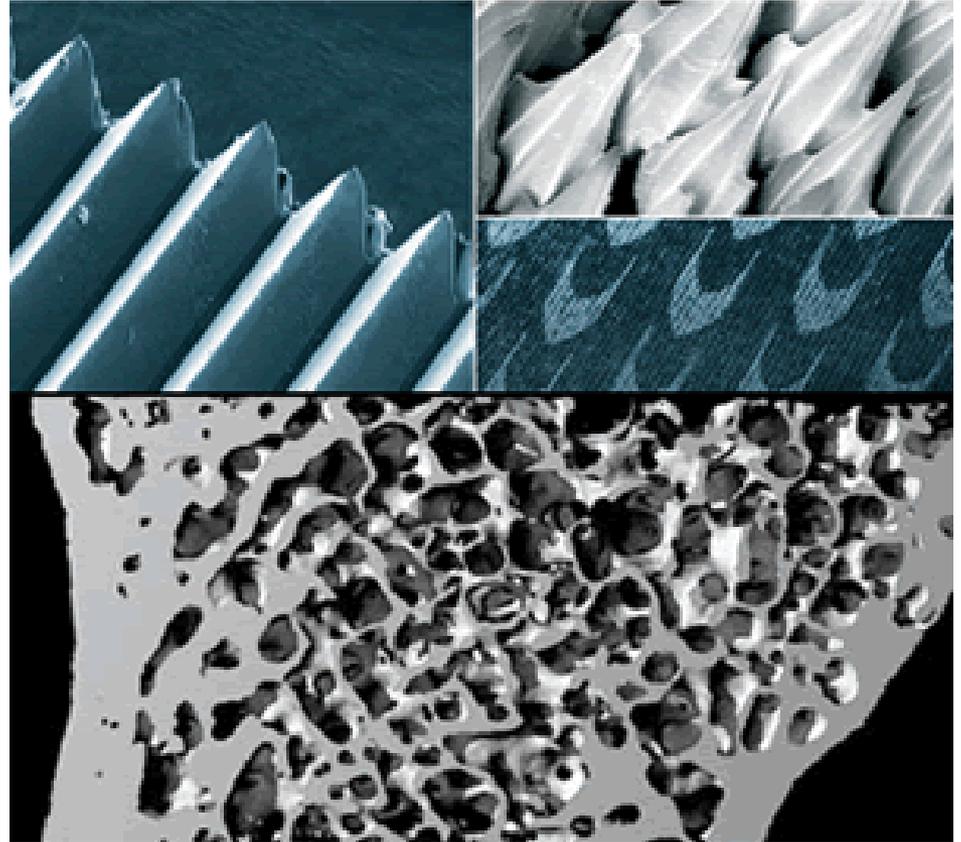


## Minimizing the complexity

This will be the case, when the scaling of 3d-Printing technology succeeds. Researches show the potential application of large scale 3d-Printing Technology to produce structures the size of a house. This scaling of 3D-Print technology will ease the building process.



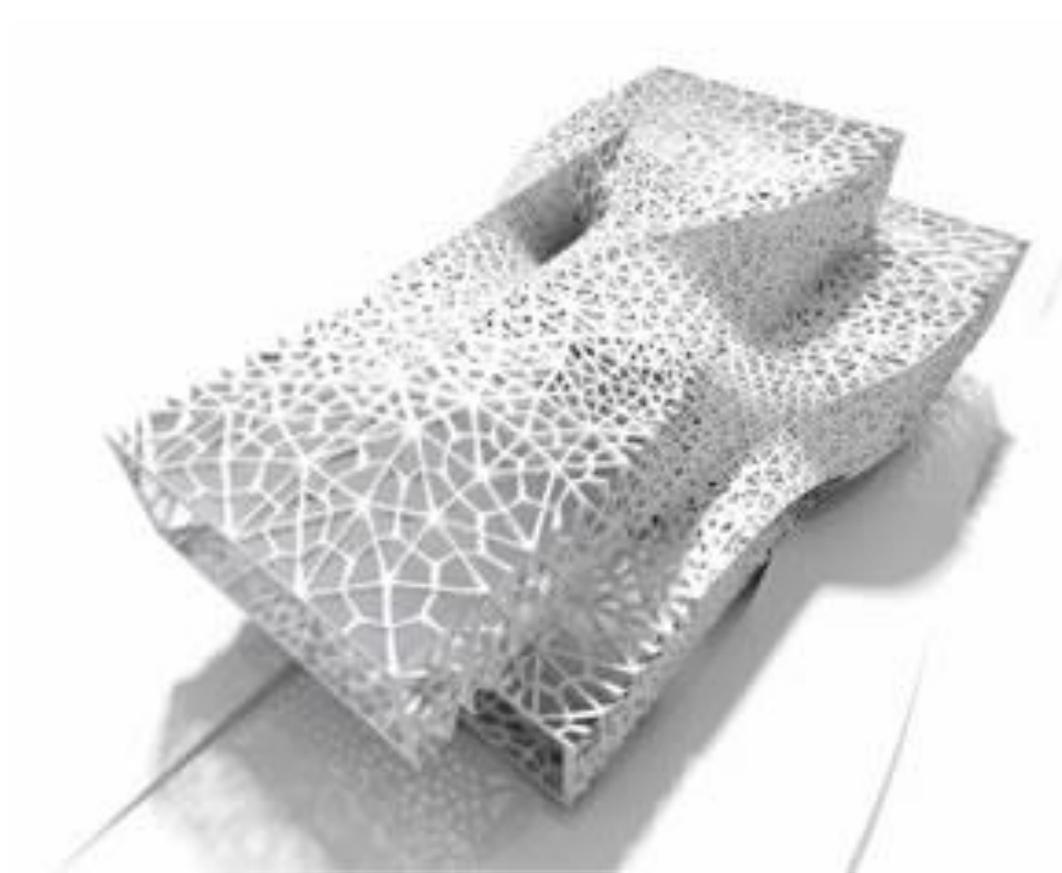
**SLIVER – INTERACTIVE TEXTILE**



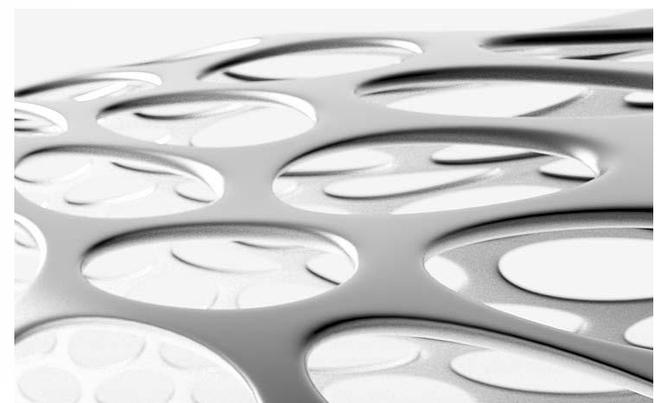
**STRUCTURES FROM NATURE**

## Technique and Technology

Individualized concepts in architecture often lead to complex form. In order to gain full control of the process of their making, not solely the right technology but especially the appropriate Tools and techniques have to be invented.



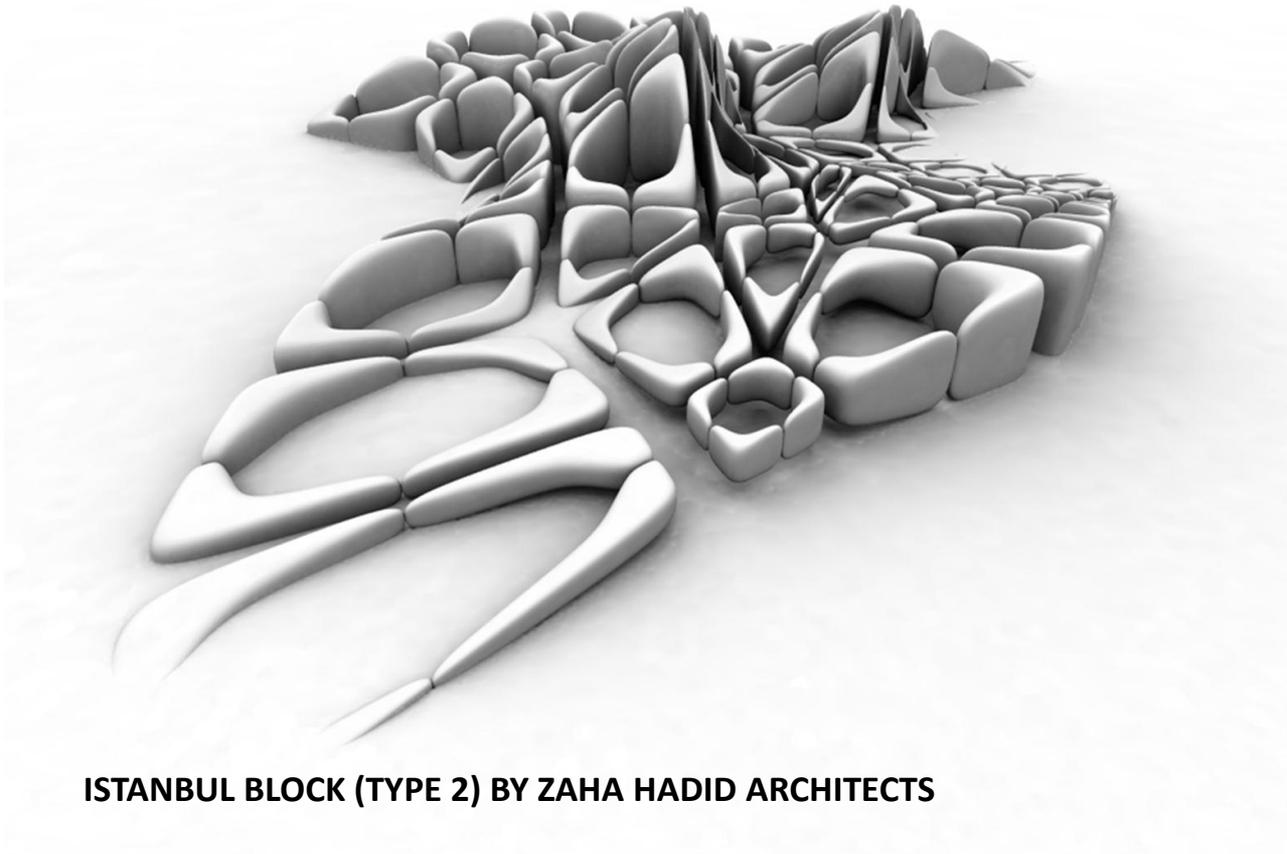
**JELLYFISH HOUSE - IWAMOTO SCOTT ARCHITECTS**



**STABILIGHT BRIDGE PROJECT**

## Technique and Technology

In future, fully mass customized elements made by direct metal casting would be producible, which could for instance serve as a system of joints for a complex geometrical structure. A parametric design approach describes primarily the way of thinking design, rather than a specific part of the design process. Thus this method can be deployed in every step of design, from the very preliminary phase to the creation of the construction.



**ISTANBUL BLOCK (TYPE 2) BY ZAHA HADID ARCHITECTS**

## New expressions

The change in technology and technique not only allows for a change but in addition these techniques might allow engineers, architects and designer to program their structures to the needs of site and inhabitant in an much better way within reasonable planning efforts and probably gain for more identity giving individualized buildings.



**THE OLYMPIC SWIMMING POOL (WATER CUBE) AT BEIJING**

## FORM, DESIGN & AESTHETIC VALUES: *Principles & Unwritten Rules...*

Good design understands that for anything to be truly beautiful, that it must possess **SIMPLICITY and REPOSE**. Architecture, like any other art, must not fall victim to fashion and trends and maintain its course.

The elements of good design is to *follow Nature's example* and have the form and function be one and the same. The arrangement of the design must be such that removing any one piece would destroy the intended composition.

Good design is expressive to each *UNIQUE circumstance*. Given this, I propose that there should be as many types and styles of Architecture as there are Individuals.

A building should **GROW** from its site as Nature grows: from the inside out, and shaped by the forces which surround it.

The nature of the **MATERIALS** should be expressed throughout the building as inherent to their quality and ability. False or fake materials made to mimic others create false architecture.

We require from our buildings, as we do from people, an **INTEGRITY and HONESTY** in all it expresses. It should be true to itself and its environment.

## FORM, DESIGN & AESTHETIC VALUES: Why Build Green...?

### The site is the solution

The understanding of surrounding systems is the key to sustainable design. This includes the systems of construction, the systems of materials production and, especially, the existing systems of the site. By observing and designing in harmony with all of these systems, we can join and not destroy our environment. The systems of the site provide our solution before our eyes.

### Nature is our inspiration

By creating a place which complements the environment, other systems will begin to regenerate. Understanding our place with Nature, allows us to better observe our impact. Nature inspires our work and informs our actions. By striving for a regeneration of Nature, rather than a depletion from it, we are taking responsibility for our lives. We become more alive. As our surroundings come back to life, so do we. Sustainable design works with the processes of Nature.

### Learn from our actions

Understanding the effects of your relation to your environment will inform your design possibilities. The impact you create will eventually reconnect back to you.

### Design is just the beginning

The collection of Individuals involved all contribute to the design process. Great design is the beginning of a lifelong educational process. The design begins a journey which continues as your live in harmony with your design.

# GREEN BUILDING PRACTICES & SUSTAINABLE DEVELOPMENT STRATEGIES

## WHAT IS A BIO-CLIMATIC DESIGN...



Bioclimatic architecture basically:

- Reduces the impact of the built environment on the natural environment
- Maintains an ecological approach
- Maintains environmental bio-integration at every possible level
- Acknowledges the visual impact and alteration it creates in nature
- Is concerned by the pollution it generates
- Tries to reconcile the energy saving issue with the quality of the environment inside the buildings

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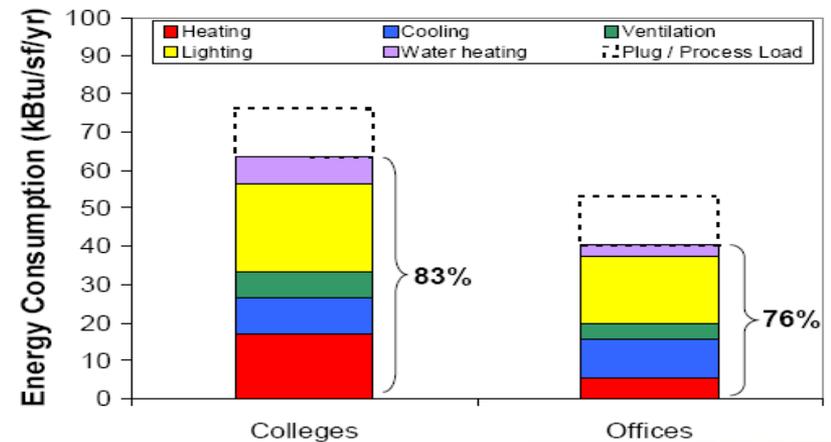
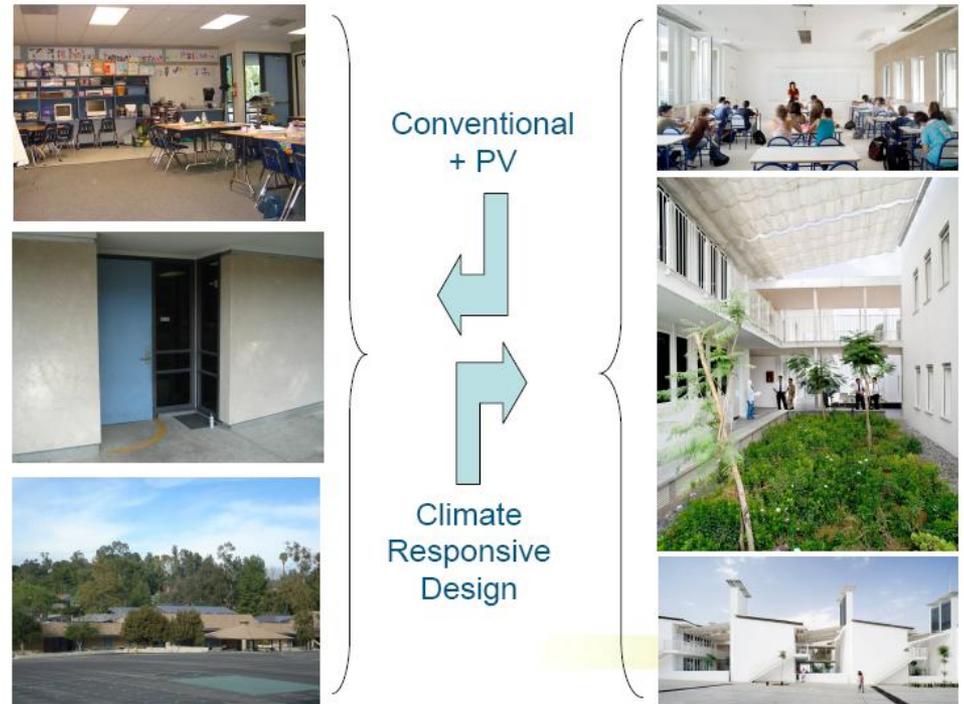


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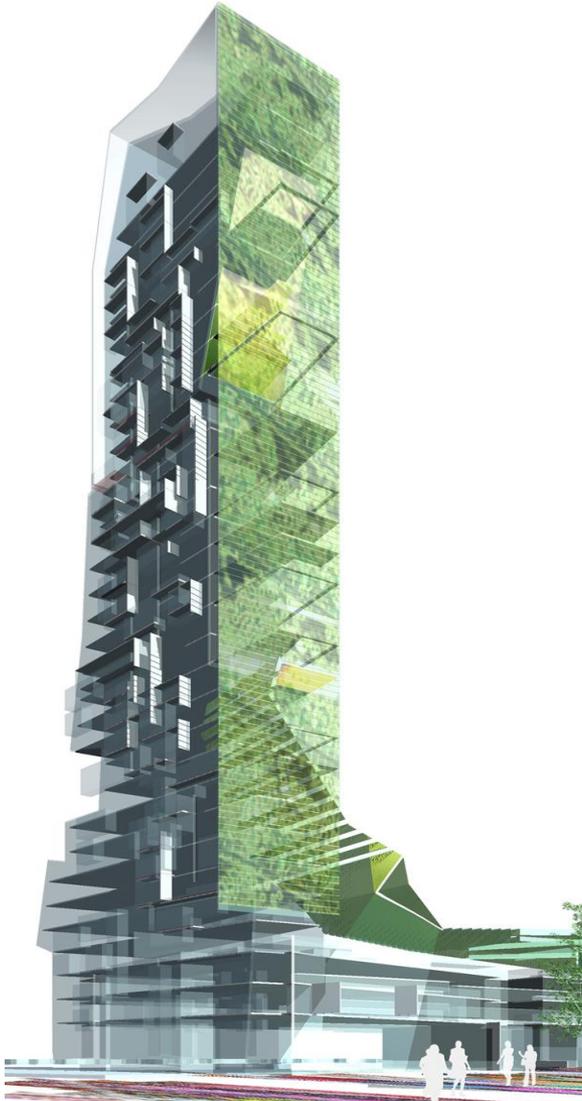
**EDITT TOWER (SINGAPORE), BY KEN YEANG**



# GREEN BUILDING PRACTICES & SUSTAINABLE DEVELOPMENT STRATEGIES

The points vital to bioclimatic building design are:

- **variability in facade and building performance in response to climate and location**
- **alignment of building along the solar path**
- **flexibility to adjust to different climatic needs throughout the year**
- **use of entirely passive means of lighting and ventilation whenever possible**
- **material selection based on ecologically sound principles**
- **Relation between the form of a structure, and its environmental performance in relation to its external climate.**
- **own little environmentally interactive community as well as interacting with the surrounding community.**



## HOW TO MAKE A BUILDING GREEN AND SUSTAINABLE...?

Aiming for energy efficiency, **sustainability** and optimal density in building means:

- Looking at both inputs and outputs,
- Lookout for the need for low ecological impacts and the financial considerations,
- Considering the peculiarities of local conditions and the need for a holistic approach.

Use of **bio-mimicry techniques** in architecture more closely reflect the local environment. Designing a Bio-climatic skyscraper involves configuring its built form and operational systems so that they integrate with nature in a benign and seamless way over its life cycle, by imitating the structure, processes and properties of ecosystems, an approach referred to here as **Eco-mimesis**, and introduced by the architect **Ken Yeang**. This is part of an ecological design process, in which one tries to incorporate existing flows into the design of the building, so they become an integral part of it.

***In the nutshell, the process of imitating the phenomenon of the environment can be termed as Eco-mimesis.***

***Eco-mimesis or Environmental Bio-Integration: The key***

## ECOMIMESIS: Equations & Guidelines...

*The much needed **balance between the biotic and the abiotic** components of the environment is the key to preserving the natural biodiversity.*

*Establishing **linkages between the built and natural environment** is also very important. The natural and the synthetic should embrace each other.*

*It is important to pay attention to the **local conditions**.*

*There is a need for not just a careful study of the land use pattern, but also comprehension of **the future trends of development**.*

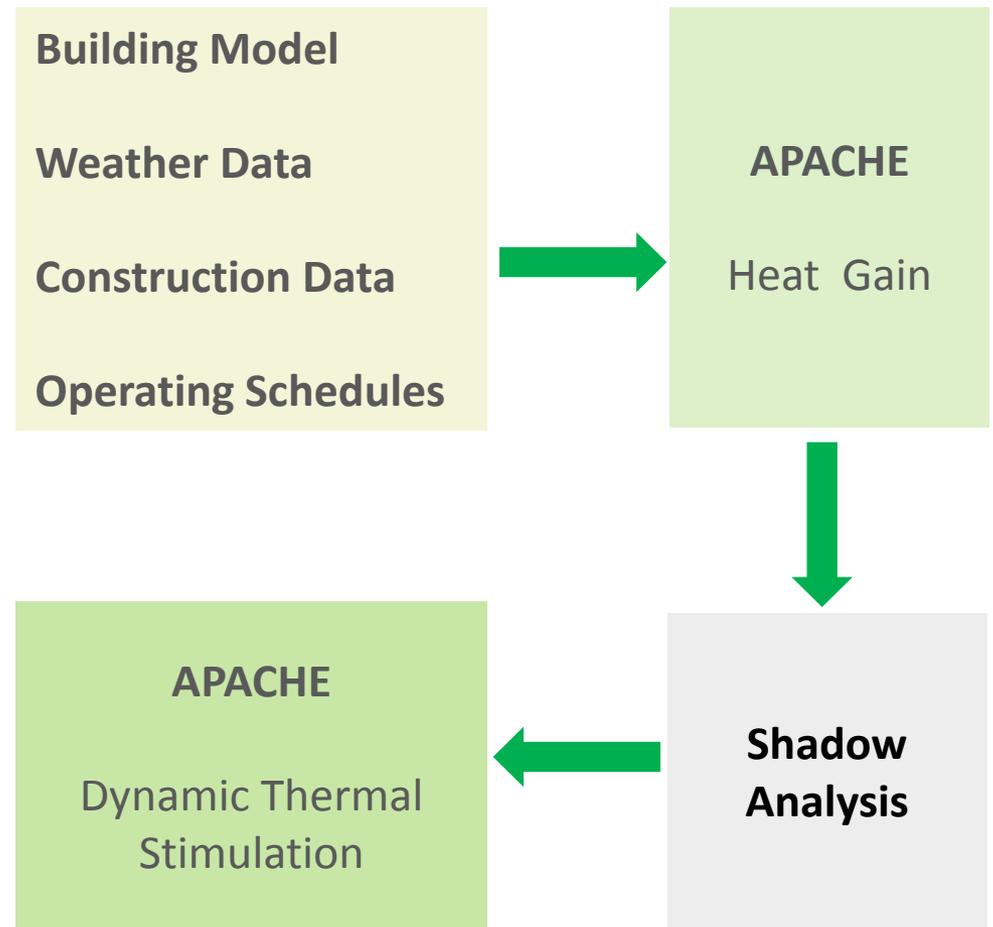
*Using **green building materials and products** also promotes conservation of dwindling non-renewable resources.*

*An ecosystem generates **no waste**, one species' waste being another species' food.*

*A **systemic integration of our built forms and its operational systems** and internal processes with the ecosystems in nature is the core of this concept.*

## KEY BIO-CLIMATIC DESIGN FEATURES

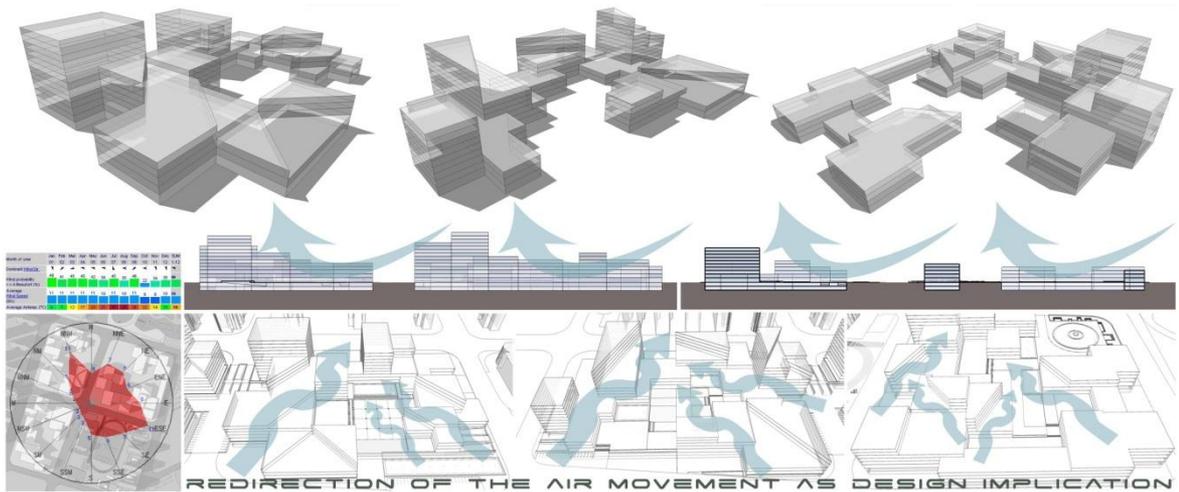
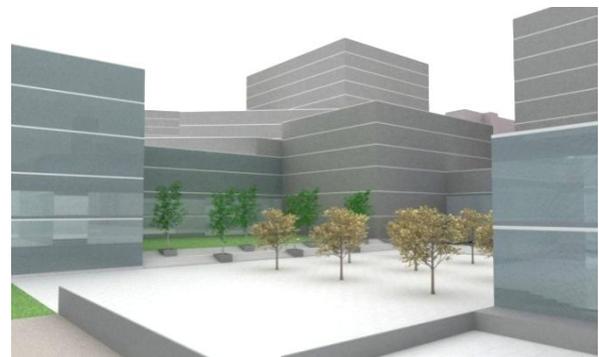
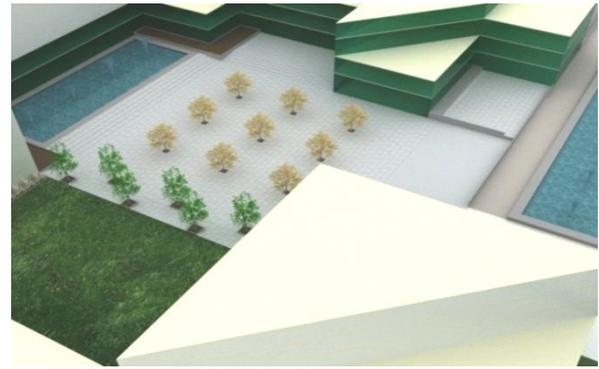
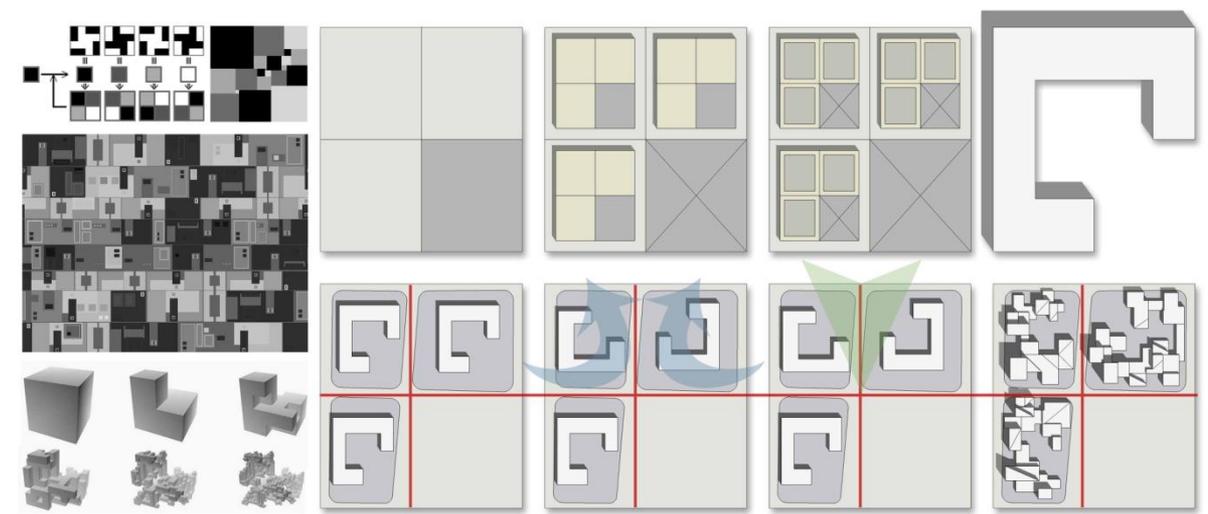
- Building form & Orientation
- Service core positioning
- External shading (vertical)
- Passive solar energy exploitation
- Climatically responsive facades
- Natural ventilation & day lighting based on local wind & solar path
- Vertical landscaping
- Sky-courts and balconies
- Use of *Eco-cells, Bio-swales, etc.*
- Roof as fifth façade
- Water harvesting & management



### METHODOLOGY: THE SIMULATION PROCESS

Tested through extensive simulation study using 'generic' models and 'bioclimatic/designed' models

# BUILDING FORM & ORIENTATION STUDIES

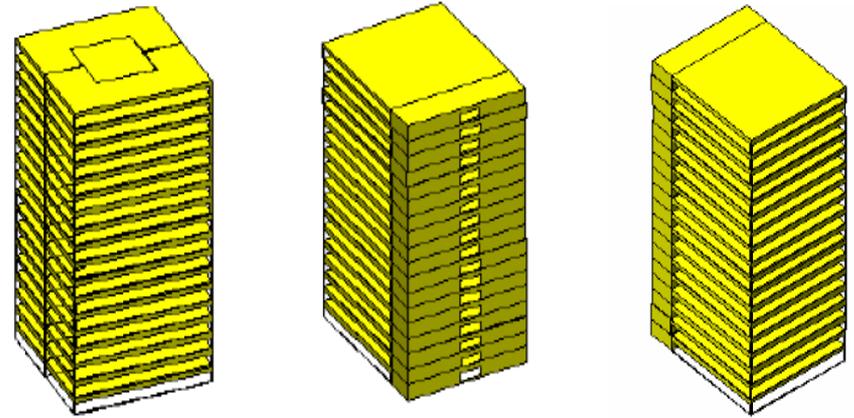


HONGKOU DISTRICT CENTER (MIXED USE DEVELOPMENT), SHANGHAI

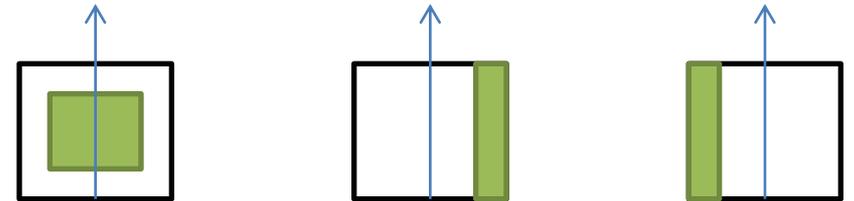
# SERVICE CORE POSITIONING



**K SKYBRIDGE (MIXED USE DEVELOPMENT), ABU DHABI**



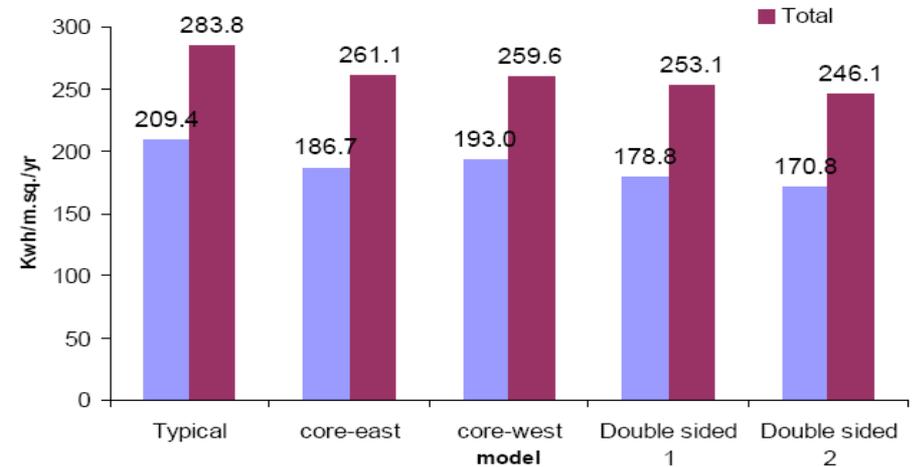
**PLACEMENT OF CORES IN SKYBRIDGE TOWER**



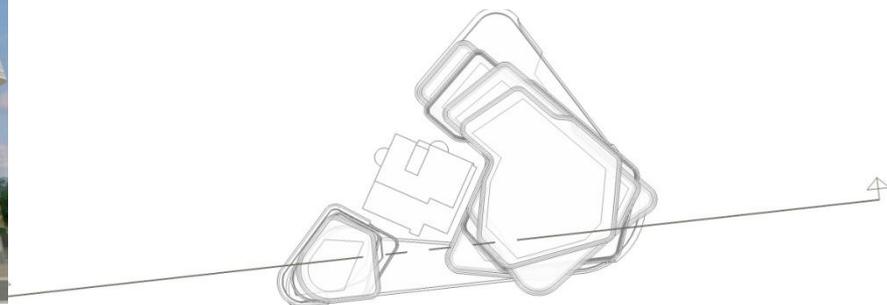
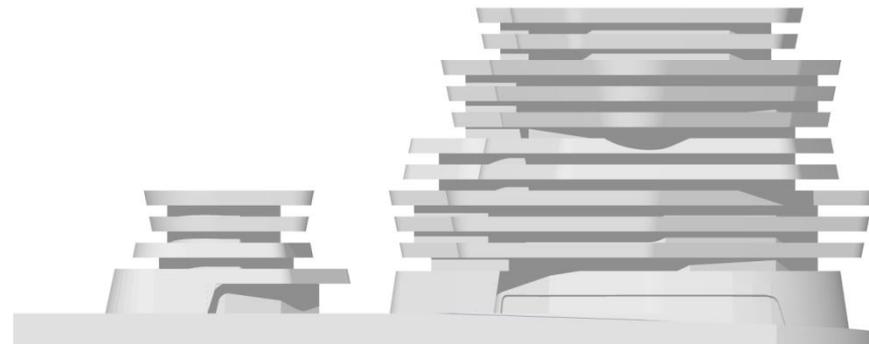
**GENERIC**

**CORE: EAST**

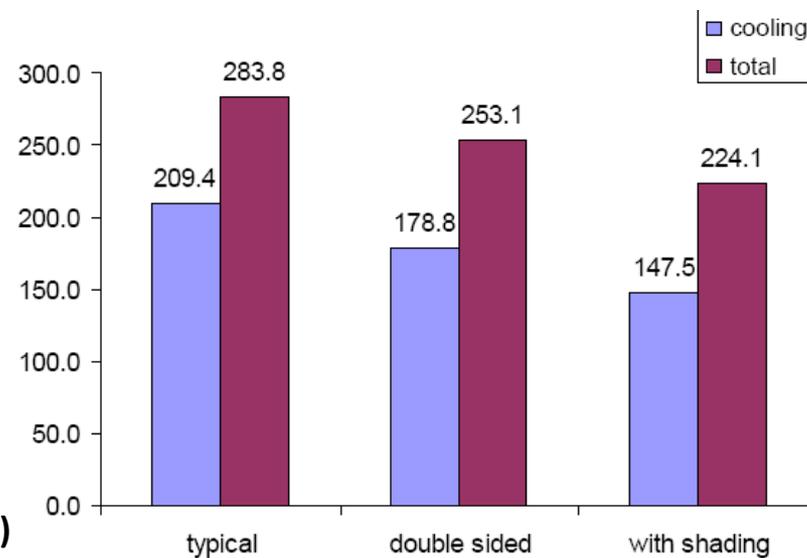
**CORE: WEST**



# PROJECTIONS & SHADING DEVICES

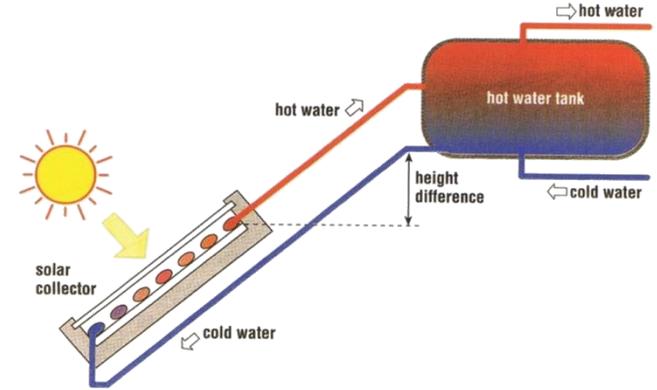
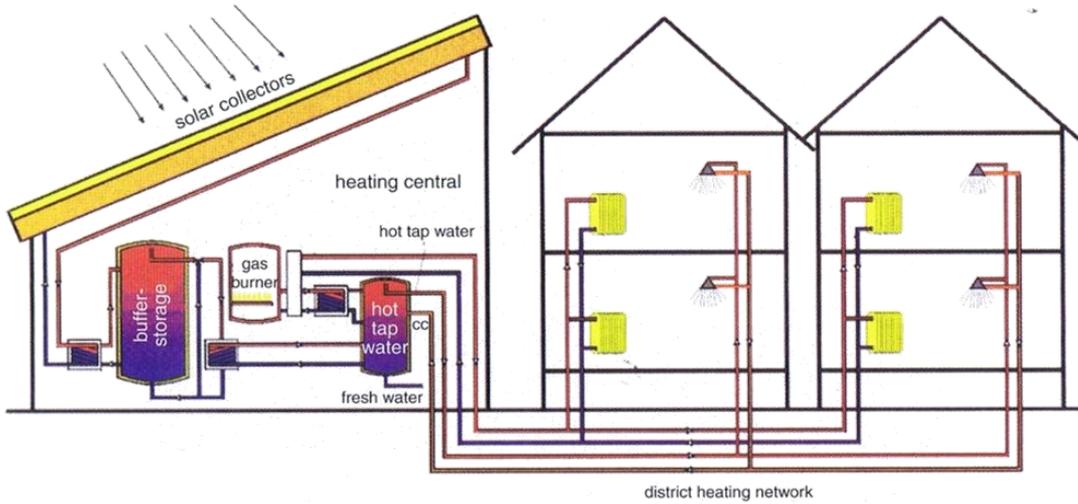


PROJECTED FLOOR PLATES AS SHADING DEVICE

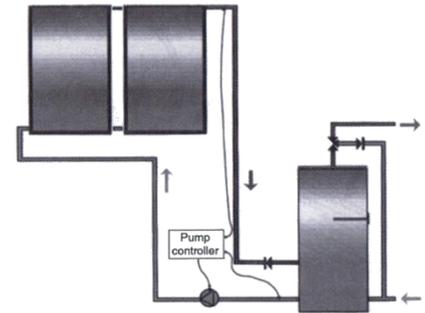


3° CIRCLE (MIXED USE DEVELOPMENT), AMMAN (JORDAN)

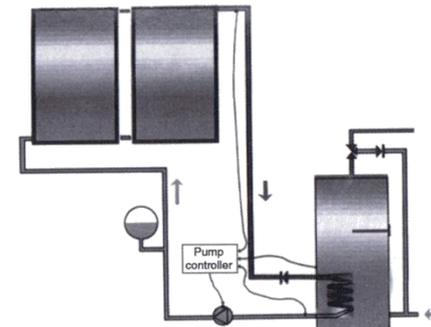
# PASSIVE SOLAR ENERGY EXPLOITATION



**ELITHIS TOWER (BY ARTE CHARPENTIER ARCHITECTS), DIJON (FRANCE)**



Open loop pumped circulation system (courtesy of *Renewable Energy World*)



Closed loop (indirect) pumped circulation system with internal coil heat exchanger

## CLIMATICALLY RESPONSIVE FACADES

### Adding value and longevity to the investment

Designing the façade based on bioclimatic principals reduces energy-related costs. **The initial investment for integrated automatic shading is returned after just a few years.** In renovation projects, **the peak load** can be efficiently reduced. Thermal efficiency assessments in the service sector also entails that a building's resale value will be significantly affected by its energy consumption rate. The automatic control of solar shading represents another major advantage for building owners: centralized controls reduce operational costs as outdoor weather sensors protect external shading products, **extend the life** of shading **and lower maintenance cost.**

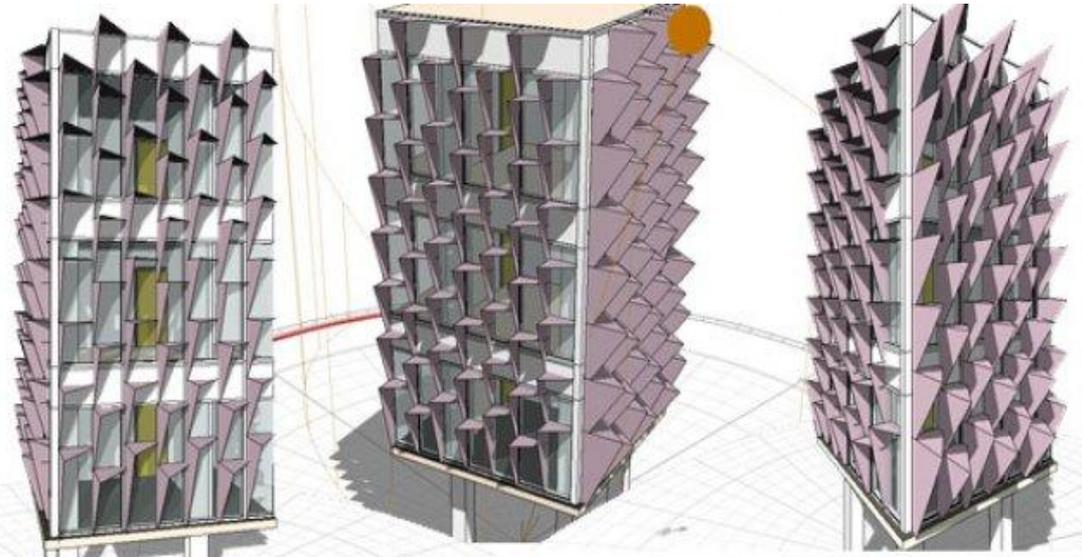
### Allowing complete architectural freedom

Bioclimatic façades represent a genuine opportunity, allowing architects to design large openings without compromising the visual comfort for building occupants. They give professionals greater freedom at every stage of the architectural design process.

### Choosing the components in the façade

The type of façade, the type of glazing, the use of indoor or outdoor sun protection devices and the type of fabrics have all a significant impact on the performance of the building. When designing bioclimatic façades, it is essential to define comfort and energy performance levels before choosing the elements in the façade.

# CLIMATICALLY RESPONSIVE FACADES



**HELIO TRACE FACADES (KINETIC SOLAR RESPONSIVE FACADES)**  
**DEVELOPED BY S.O.M. REDUCE HEAT GAIN BY 80%**

## CLIMATICALLY RESPONSIVE FACADES

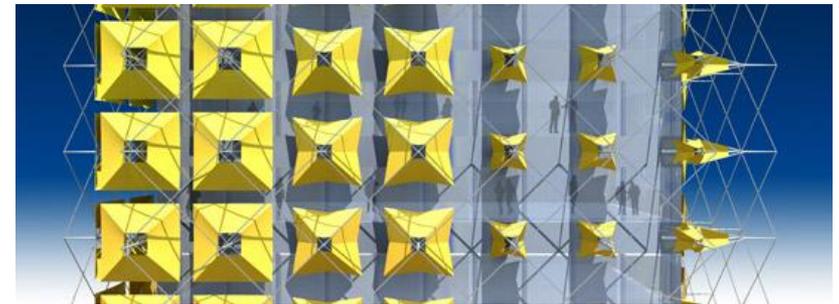


Illustration showing use of climatically responsive façades at different times of a day, designed to change in orientation and aperture in order to capture maximum light, and air movement for building interior spaces, while avoiding overheating.

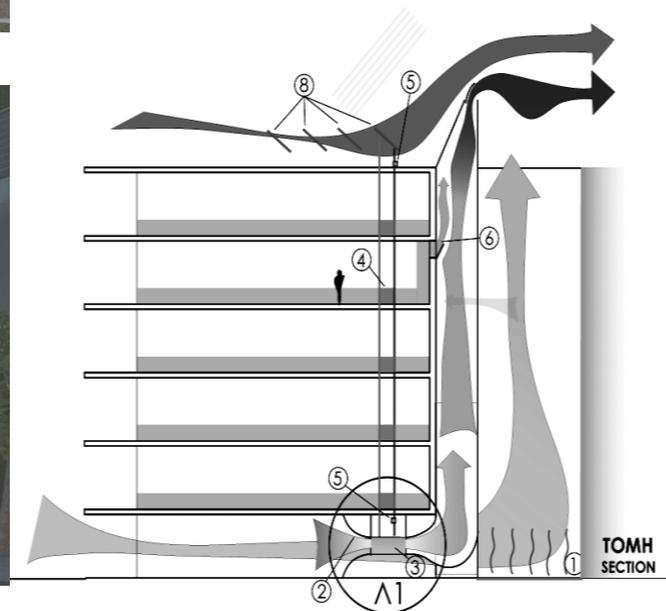
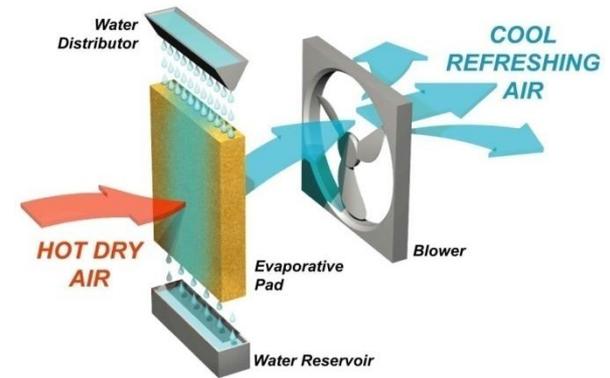
**PIRAEUS TOWER, ATHENS  
(BY GREEK ARCHITECT MARCO ACERBIS)**

# NATURALLY VENTILATED GROUND / LOWER FLOORS

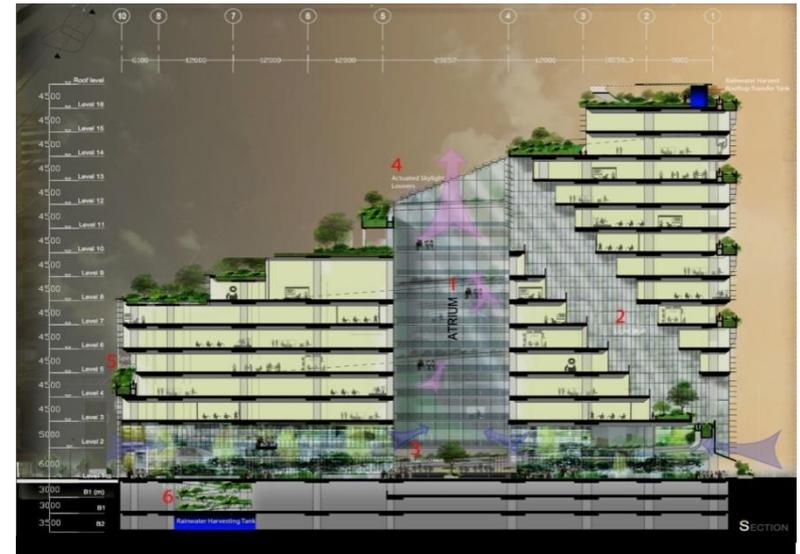
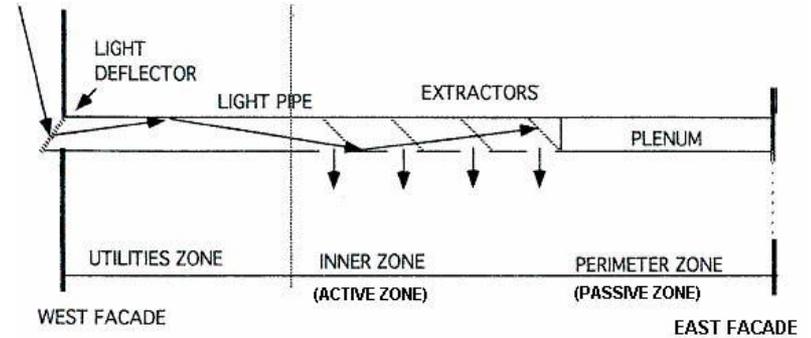
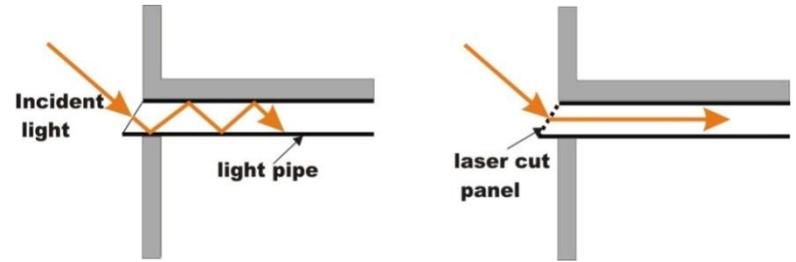
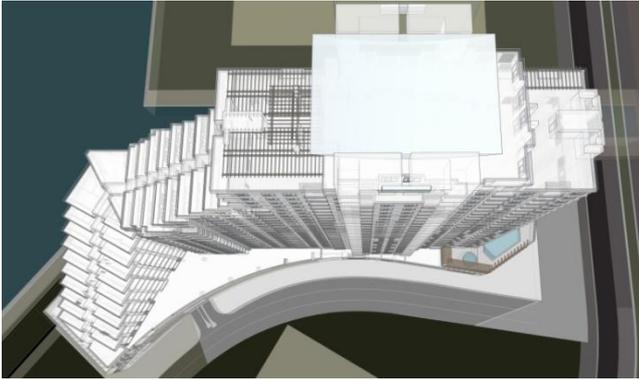


IT CORPORATE OFFICE BUILDING (PHASE 1), GURGAON

## How Evaporative Cooling Works...

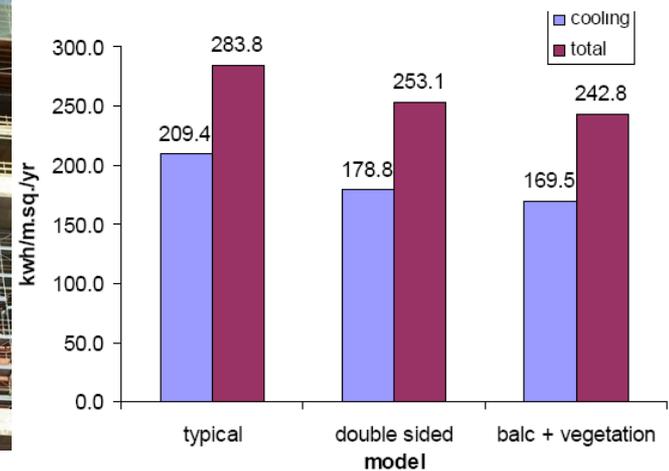


# NATURAL DAYLIGHTING BY USE OF LIGHT PIPES



**MANGROVE PLACE APARTMENTS, ABU DHABI**

# VERTICAL LANDSCAPING & GREEN TERRACES

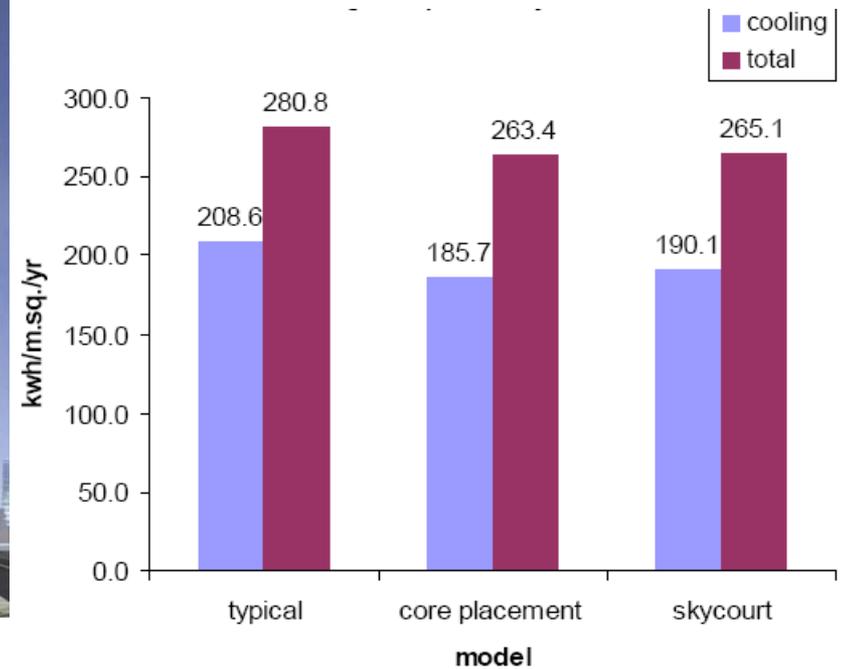


**BADEL BLOCK CENTER (ZAGREB) & BOSCO VERTICALE (MILAN)**

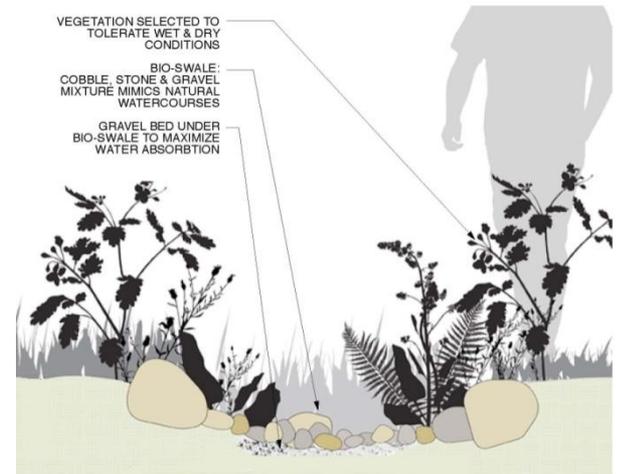
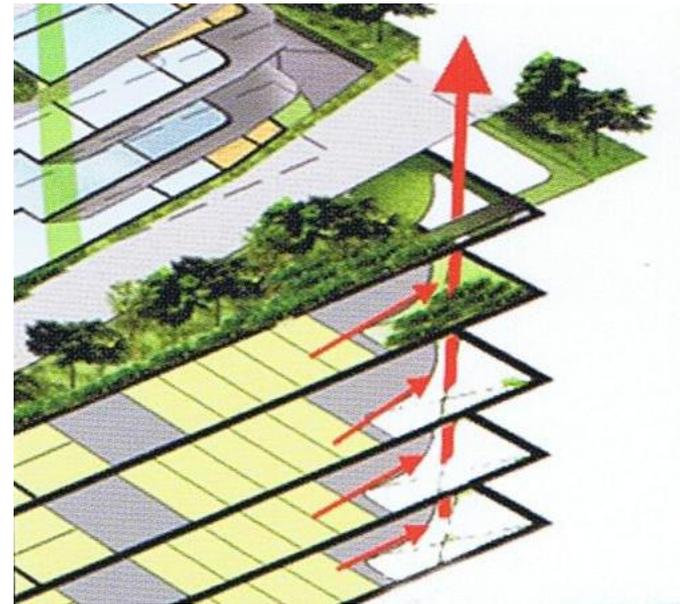
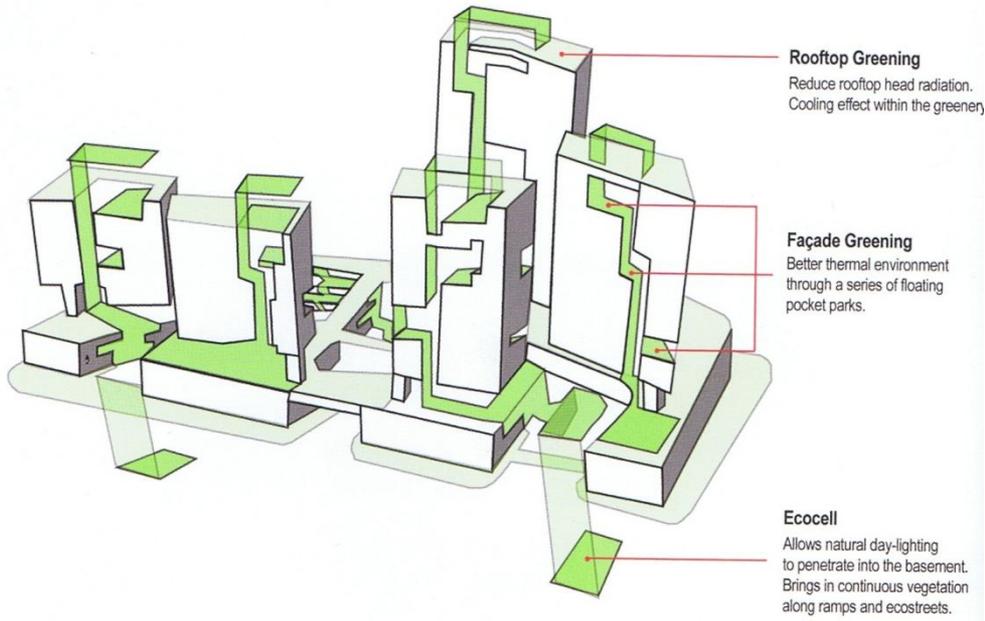
# SKY-COURTS & GREEN TERRACES



SINGAPORE SCIENCE CENTER, (BY Ar. KEN YEANG)



# USE OF ECO-CELLS, BIO-SWALES, ECO-LINKS, ETC.

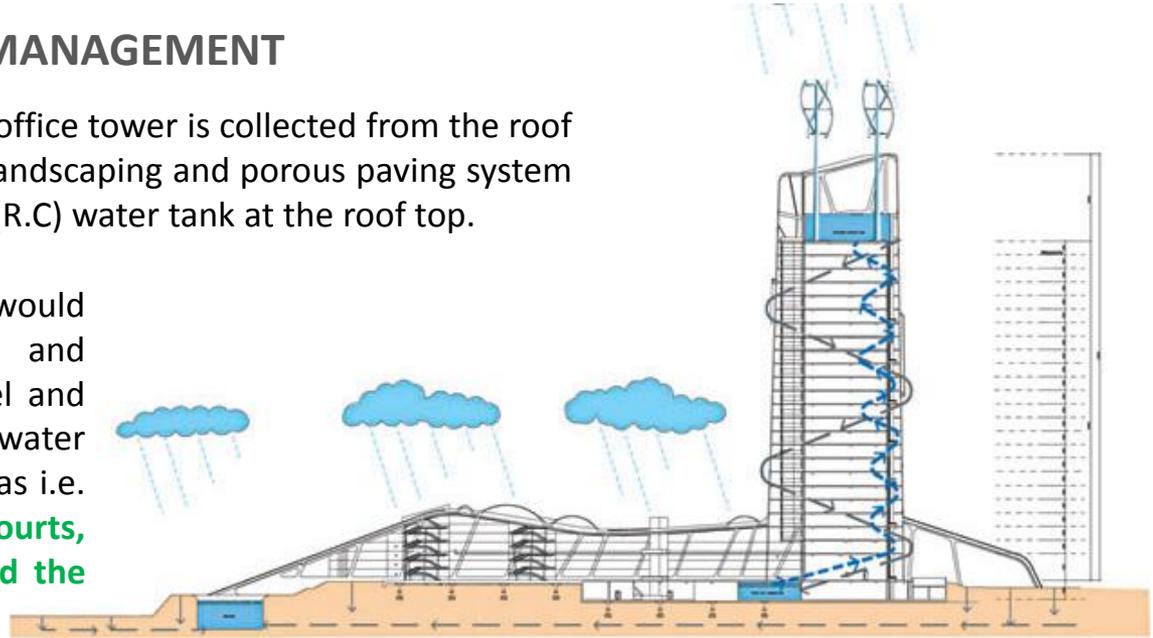


**B.I.D.V. TOWER, HO CHI MINH CITY (VIETNAM), BY KEN YEANG**

## RAIN WATER HARVESTING & MANAGEMENT

The rainwater recycling system for the office tower is collected from the roof garden over the office tower through landscaping and porous paving system and stored at the Reinforced Concrete (R.C) water tank at the roof top.

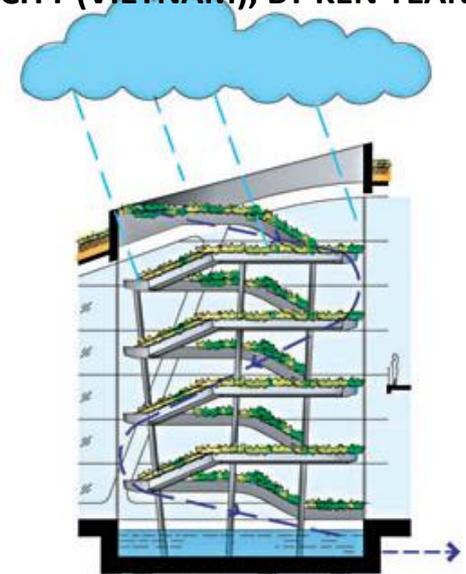
The rainwater from the storage tank would then be channeled to the water and treatment tank at the basement level and the grey water will be used for the water closets and watering of landscape areas i.e. **vegetated ramp on the façade, sky courts, planter boxes and landscaped around the site.**



**B. I. D. V. TOWER, HO CHI MINH CITY (VIETNAM), BY KEN YEANG**

The rainwater at the podium section is collected through eco-cells. **Eco-cells** are vertical cellular voids open to the sky and with **spiraling vegetated ramp.**

The eco-cells are inserted between the Level 1 and the **Roof Garden Level** (over the podium) to harvest and recycle rainwater for watering the landscape areas on the green belt (roof garden over the podium) and to clean the cultural plaza.



## MATERIAL AND CONSTRUCTION SYSTEMS

Every material put into the building is evaluated for its beauty as well as its eco impact at all points along its life cycle. The life cycle is typically seen as:

**PRODUCTION**

- A. Where did they come from?
- B. What are the by-products of their manufacture?

**USE**

- C. How are they delivered or installed?
- D. How are they maintained?
- E. How healthy are the materials?

**RETURN**

- F. How are they re-used when we are done with them?

## MATERIAL AND CONSTRUCTION SYSTEMS

Eco-design requires the designer to use **green materials** and components that facilitate **reuse, recycling** and reintegration for temporal integration with the ecological systems.

We need to be *ecomimetic* in our use of materials in the built environment. In ecosystems, all living organisms feed on continual flows of matter and energy from their environment to stay alive, and all living organisms continually produce wastes. **An ecosystem generates no waste**, one species' waste being another species' food. Thus matter cycles continually through the web of life. It is this closing of the loop in reuse and recycling that our human-made environment must imitate.

We should unceremoniously regard everything produced by humans as eventual garbage or waste material. **The question is what do we do with the waste material?** If these are readily biodegradable, they can return into the environment through decomposition, whereas the other generally inert wastes need to be deposited somewhere, currently as landfill or pollutants.

Ecomimetically, we need to think about how the skyscraper's components and its outputs can be reused and recycled at the outset in design. This determines the processes, the materials selected and the way in which these are fabricated, connected to each other and used in the skyscraper built form.

## MATERIAL AND CONSTRUCTION SYSTEMS

- **50% fly ash mixture in the concrete** adds to strength, workability, thermal mass and reduces the amount of Portland Cement (which produces greenhouse gases from its manufacture).
- Salvage **all demolition materials for reuse** in the new project. This includes all removed fixtures, doors, windows, appliances and lighting.
- Use **a natural insulation**, and use more than the minimum required amount. Green-fiber (recycled newspaper) cellulose can be a good option, for example.
- Use **double-paned & low-e windows** to save energy & recycle aluminum windows & door frames
- Use all **natural carpet & healthy paints**. Use a sustainable wood floor, such as bamboo, palm or reclaimed woods whenever possible.
- Avoid the use of products from endangered or threatened tree species
- Substitute Flyash for cement (up to 50%) in concrete to **reuse waste products** and reduce pollution
- Avoid products with short term life spans (unless they are made from low-impact, renewable materials and are recyclable)

## MATERIAL AND CONSTRUCTION SYSTEMS



### Structural Carbon Fiber

Peter Testa, an architect in Santa Monica, Calif., has designed a 40-story skyscraper that would do away with steel for the structure. Instead, Testa's "**woven building**" would be held up by a cross-hatched lattice made of carbon fiber, which is several times stronger than steel.



### Hydrophobic Nano-coating

In the famous **40 Bond Street** in New York, designed by Herzog & de Meuron, the green glass mullion caps feature a self-cleaning hydrophobic nano-coating that repels water and dirt.

### Nano-paint

Buildings with **nano-paint** can act as air purifiers. nano-paint on the face of tall buildings could reduce pollution. When exposed to ultraviolet light, titanium dioxide ( $\text{TiO}_2$ ) nano-particles in paint break down organic and inorganic pollutants that wash off in the rain and decompose air pollution particles like formaldehyde.



### Solar Nanotechnology

Ultra-thin, amorphous silicon, organic and inorganic solar cells derived from nano-crystals can convert sunlight into electricity at a fraction of the cost of silicon based solar cells. With nanotechnology, tiny solar cells can be printed onto flexible, very thin light retaining materials, by passing the cost of silicon.

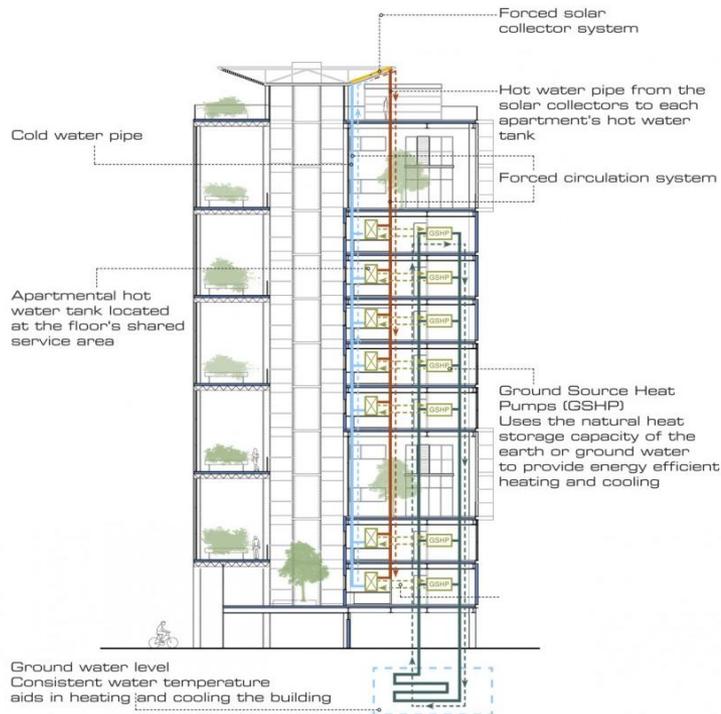
# MODULAR AGRO-HOUSING, CHINA



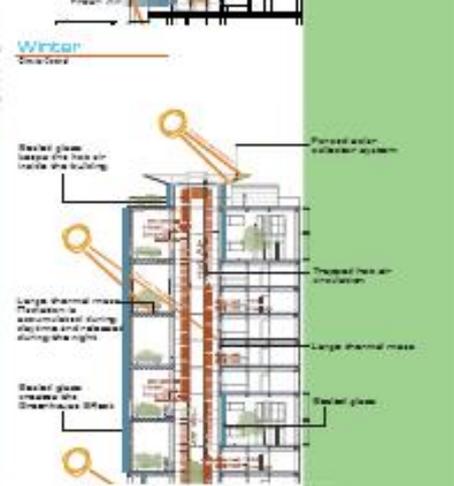
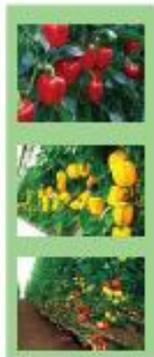
**Agro Housing**



# MODULAR AGRO-HOUSING, CHINA



**Agro-Housing and Sustainability**  
 The Agro-Housing is a combination of housing and urban agriculture. The building is composed of two parts: the apartment tower and the vertical greenhouse. The greenhouse is a vertical structure for cultivation of agriculture crops such as vegetables, fruits, flowers and spices, equipped with a drip irrigation system and natural ventilation and heating system. The Agro-Housing project offers spaces for communal activities. The greenhouse can serve as a place of casual and professional meetings. The roof garden offers an open air green space for recreation and informal gatherings. The rooftop city club is designed to host social gatherings and celebrations, and the underground air ground floor includes utilities close to home and shop premises. The Agro-Housing project provides a diversity of spaces for the benefit of its occupants.



# MODULAR AGRO-HOUSING, CHINA



Roof plan 1:200



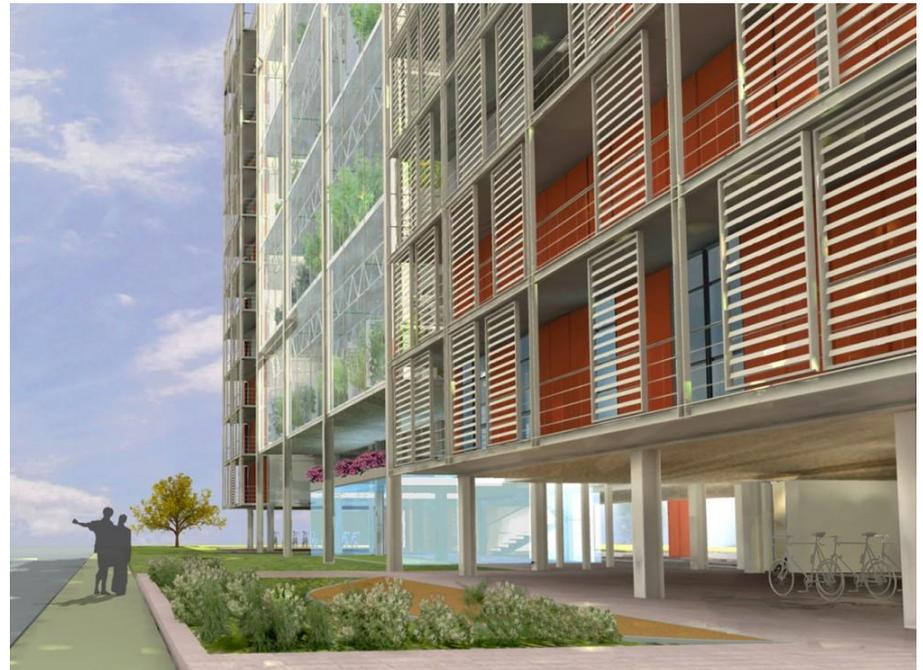
7th floor plan 1:200



6th floor plan 1:200



5th floor plan 1:200



## *“Build me a glass box...”*

Expressing the desire to live in a glass box, a dramatic, naturally lit form encloses an open floor plan and connects to the rear yard. The entire structure is oriented to the sun, not the street. A thermal mass column supports the structure, contains the fireplace and funnels cool air out. A spiral stair ties the floors together.

Glass Box Enclosure  
to allow natural light

Use of Certified Wood

Use of natural stucco  
& locally available  
stone

Wooden ribs as  
frames to blur the  
indoor/outdoor  
transition

Re-use of certain  
Building Parts

Ample of controlled  
natural day-lighting

Use of non-toxic, low-  
vinyl containing paints

Use of “Eco-Resin”  
instead of Glass

Use of recycled  
materials in the interior

### Redwood City Residence, CA (USA)



## EPILOGUE

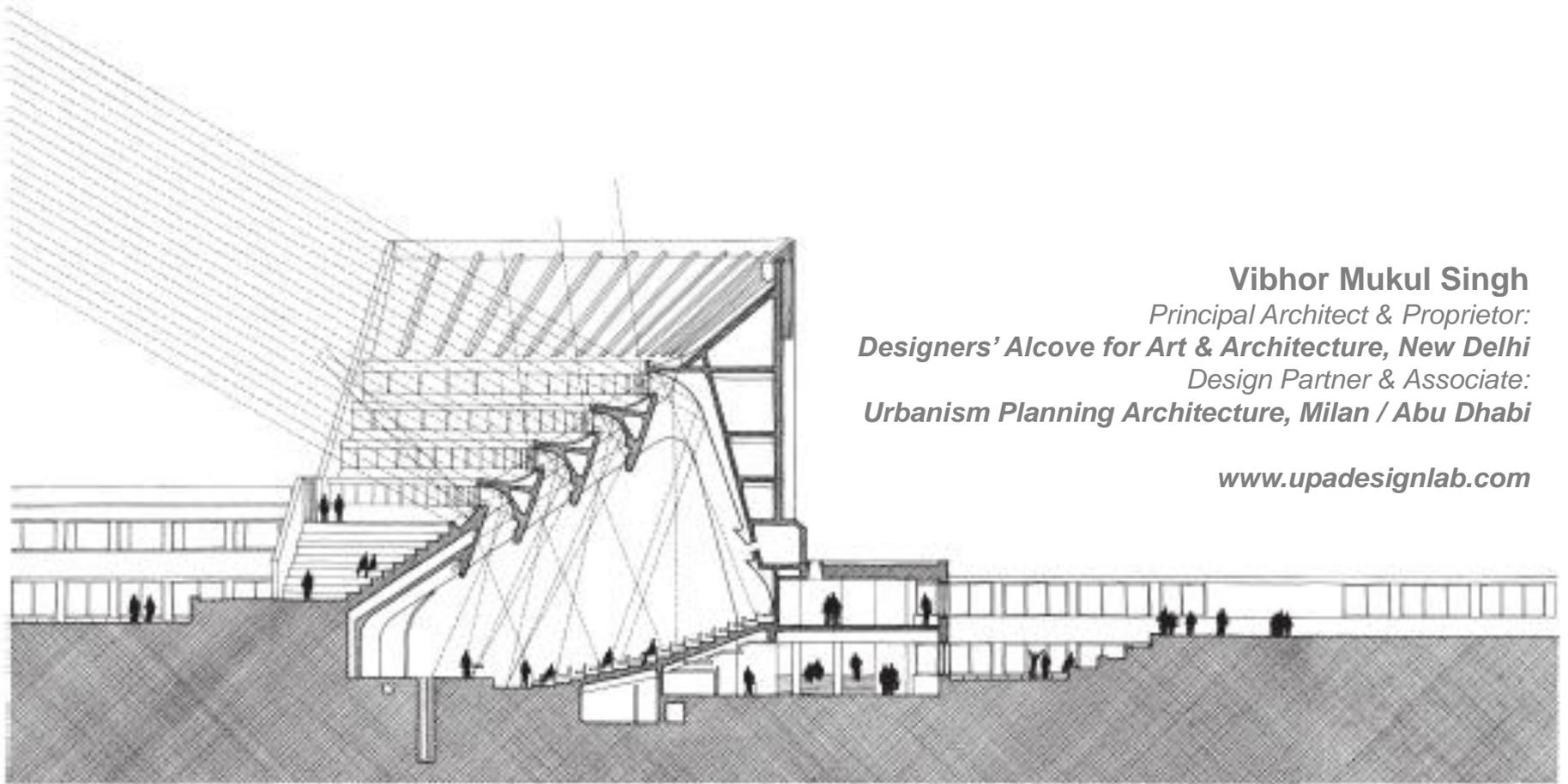
*The various alternatives of green and sustainable buildings developed are signs for the ongoing search for both technological and aesthetic solutions to a building, uniting them into a new synthesis and a typology which has proven to be of fundamental necessities for the city in the 21 century.*

The evolving principles and ideas of **Ecomimesis**, while discussed with regard to the new building typology, are, however, applicable **to the wider role of redesigning our human built environment** and its eco-physical, eco-social, eco-political, eco-economic systems to enable the survival of our human species.

Application of computer programs available in the market might also be useful to proof the claim advantage in more precise technique. Software package such as **Ecotect and ASHRAE Thermal Comfort program** others simulation based program can be used for extensive analysis.

And as we can see that all elements indicate that bioclimatic design has better indoor environment than that of a conventional one.

*Thanking you all in the anticipation of a **Green Future...!***



**Vibhor Mukul Singh**

*Principal Architect & Proprietor:*

*Designers' Alcove for Art & Architecture, New Delhi*

*Design Partner & Associate:*

*Urbanism Planning Architecture, Milan / Abu Dhabi*

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