DESIGN APPROACH

3 / THEORY

3.1 / BRIEF HISTORY

3.1.1
THE BIRTH OF ECOSYSTEM DESIGN

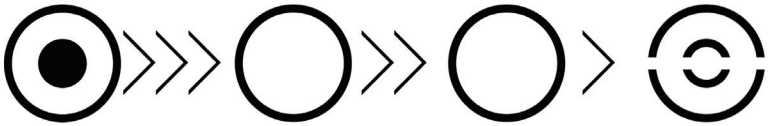
The concept of ecology in architecture was first introduced by Patrick Geddes (Vidler, 2010: 26). His study of urban growth patterns stimulated by the mass movement of people was published in 1915 (Mang, et al, 2012: 3). Geddes believed that a city is a living organism and that an understanding of a city's context is required before the problem of unsustainable growth can be solved. It is accepted that his work was inspired by 1880's 'To-morrow: A Peaceful Path to Social Reform', a book written by Ebenezer Howard (Mang, et al, 2012: 3). In his book, Howard applied ecological thinking to human settlement. It made clear his desire to use natural systems instead of engineered ones to reconnect humans with nature (Mang, et al, 2012: 3). Patrick Geddes is, however, accredited with the origin of ecological design. Twenty years later, in 1935, an entirely new concept of ecology was popularized by Arthur Tansley. He proposed the term 'ecosystems' to describe the relationship between living things and their non-living habitats (Mang, et al, 2012: 4). The years that followed saw the conclusion of many projects centered on ecosystems. Tansley also influenced the work of Ian McHarg in 19697 and Robert Rodale in 1980; both used the word 'regenerative' to explain the concept of architecture going beyond sustainability to the renewal and regeneration of agricultural resources (Mang, et al, 2012: 6). Since the start of the 1900s, the issue of sustainability, leading to environmental conservation and ecological responsibility, has been present in architectural discourse (Vidler, 2010: 26). Its potential has not been fully realized and sustainability foundered in the face of development pressure and financial constraint. It has prevailingly eluded the architectural profession (Vidler, 2010: 26). The regenerative design approach, emerging at present, might be a potential breakthrough to the renewal and regeneration of resources.

3.1.2
THE EMERGING FIELD OF REGENERATIVE DESIGN

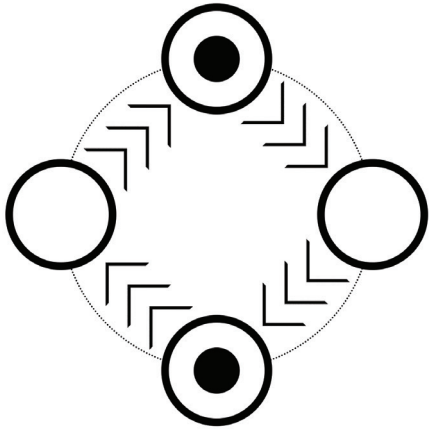
In 1984, John Tillman Lyle defined human ecosystems as "places where humans and nature might be brought together again for mutual benefit". His book 'Design of Human Ecosystems' introduced key concepts that formed the basis for his successive works on regenerative design (Mang, et al, 2012: 6). In 1996, he published the first handbook guide to regenerative design called 'Regenerative Design for Sustainable Development'. It established the principles, framework and strategies for a design tool that proposes the reverse of environmental damages originating from the industrial revolution (Mang, et al, 2012: 7).

"Where nature evolved an ever-varying, endlessly complex network of unique places adapted to local condition."
John Tillman Lyle. (Mang, et al, 2012: 7).

[7] Ian Mcharg 'Design with Nature', pioneering a technology for ecological land-use planning based on understanding natural systems



3.1_ “One-way-linear-flow”, from source to sink.
Humans replaced natures continual cycling and recycling of materials and energy process with a one-way-linear-flow. a one-way system destroys the landscape on which it depends. (Author, 2015)



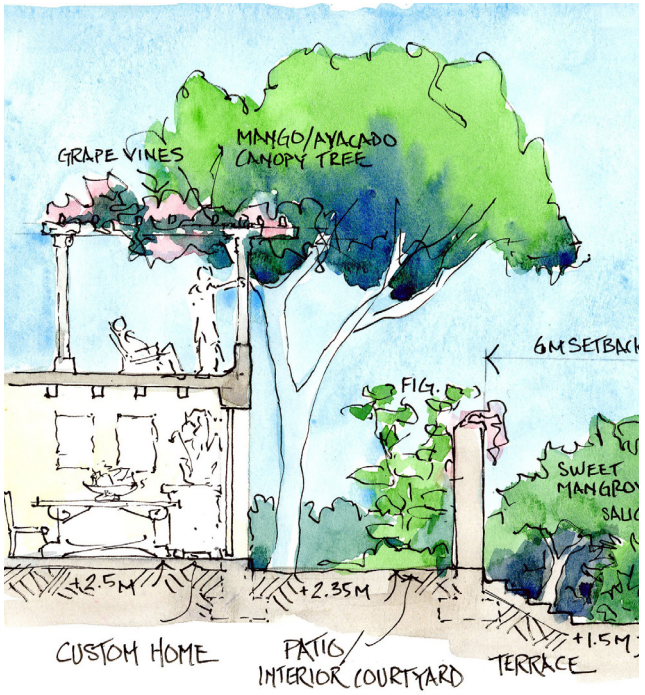
3.2_ Nature’s regenerative design. Cycling flows at sources. Continuous replacement, through their own functional processes of the energy and materials used in their operation (Author, 2015)

The continual depletion of resources, caused by conventional industrial development, leads to the degradation of the environment. It is seen as a ‘one-way-linear flow’ of processing materials and energy and it replaced nature’s cycle of renewing materials and energy (Mang, et al, 2012: 7).

Figure 3.1; Lyle calls this ‘one-way-linear-flow’ a degenerative system. He states that a radically different approach is required, which he named regenerative design (Mang, et al, 2012: 7).

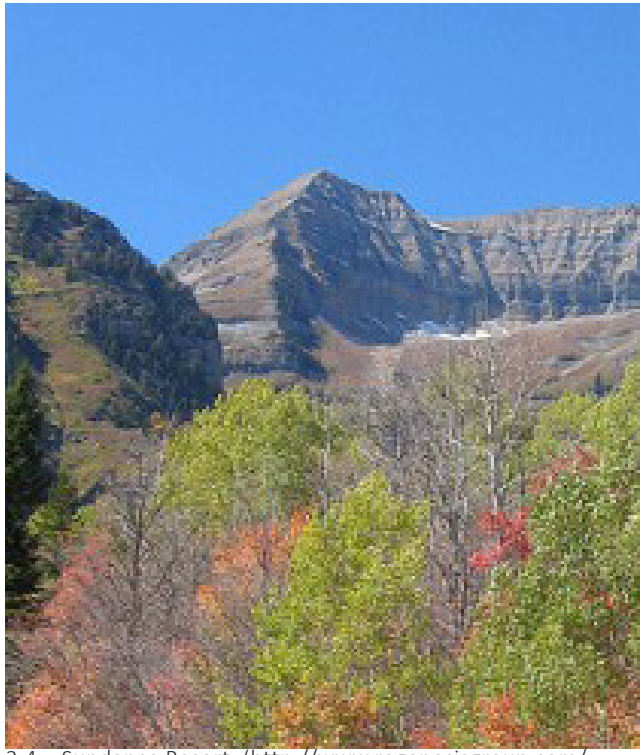
3.1.3
THE ESTABLISHMENT OF THE REGENESIS GROUP

The Regenesis Group, established in 1995, was founded by educators in the field of permaculture (sustainable land use planning). The Group seeks to transform the development industry into an industry that contributes to the health of the planet rather than undermining it. The Regenisis Group act as consultants on existing projects where external pressures are experienced due to environmental implications. They are a world leader in the field of regenerative development, which defines the leading edge of sustainable practice. The group has been involved in 200 projects; across North- and South America, the Caribbean, Africa, and in the Middle East. The Group recognizes that the site is a complex and dynamic system of systems; that needs to be seen as an entirety before the building process starts. Every site has a unique character that originates from its underlying landform as well as the climatic, ecological, historical and social forces that shaped it.
Regenerative development conceptualizes projects as engines of positive or evolutionary change for the systems into which they are built (Haggard, n.d; 1).



3.3_ Loreto Bay Village. (http://regenesisgroup.com/wp-content/uploads/2015/02/Agua-Viva-Estero-Edge-June-14.1.jpg).

LORETO BAY VILLAGES / Baja California Sun, MX is a 6000-unit eco-resort and mixed-use community development on the estuary of the sea of Cortez. The Regenisis Group collaborated with the planning-; design and construction-; and marketing teams to ensure that the development supports and advances the health of the community and the natural systems that draw people there.



3.4_ Sundance Resort. (http://www.regenesisgroup.com/wp-content/uploads/2015/02/110798006_e080003846_z-400x284.jpg)

3.5_ Playa Viva. (http://regenesisgroup.com/wp-content/uploads/2015/02/PrivCasitaEX2-e1423724536251.jpg)

SUMMARY / It is important for a designer to have prior knowledge of the site characteristics before construction commences. The site must be understood as a whole that consists of systems within systems. Only then can the most important and valuable aspects of the site be considered as design informants.

SUNDANCE RESORT / Sundance Utah
This five-star hotel is located on a glacial moraine through which runs a previously undetected earthquake fault. The company was at risk of losing millions of dollars on liability risk. Regenisis Group saved the hotel by assessing the larger pattern of how the landscape worked as a system. They served as ecological planning consultants and addressed concerns regarding soil and geological stability.

PLAYA VIVA / Juluchuca on the Mexican pacific coast is a 200-acre sustainable resort and residence community. The Regenisis group assisted the developers by designing the master plan, which includes 160 acres set aside for a nature preserve and turtle sanctuary. Playa Viva recycles 75% of its construction waste, solar energy provides 100% of its power and it will donate 1% of all revenue to the community for the creation of an organic farming program that will provide jobs for local farmers.

3.2.1
TRANSITION FROM DEGENERATIVE TO REGENERATIVE

Figure 3.6 explains the transition from degenerative to regenerative design.
It is recommended that both spectrums in this diagram be addressed in unison; as a whole system. It is thus a combination of the high performance approach (focused on reducing the impact on the environment) and an understanding of living systems (focused on the mutual relationship between nature and humans) (Reed, 2007: 2).

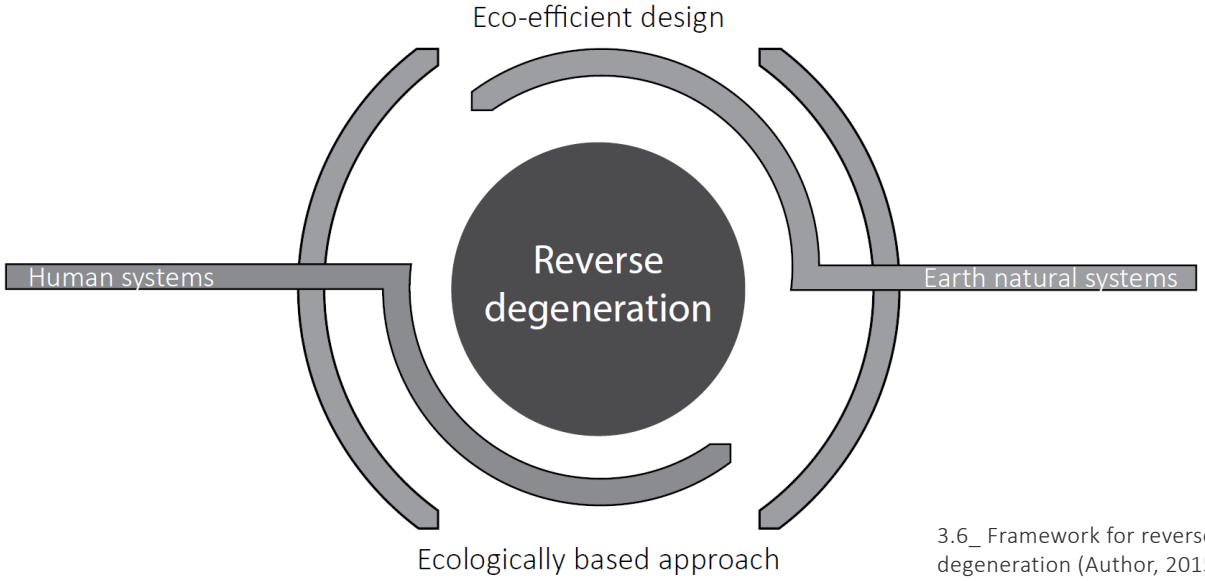
3.2.2
RECIPROCAL RELATIONSHIPS

The ecological world view acknowledges both the necessity of change and that it is the diversity of life on earth and its quality that needs to be sustained (Peres et al, 2015: 40).
The emerging field of regenerative development and design rose from the ecological stream. At the moment it is redefining sustainability regarding what the built environment encompasses and what its role must be (Mang, et al, 2012: 9). Life is a process of reciprocal relationships, meaning there exists continuous exchanges between two or more living organisms which are beneficial to all parties involved.

"Life is a process by which living things support and are supported by a larger whole" (Reed, 2007: 1).

Life evolves constantly and is never in a static state (Reed, 2007: 1). Reed (2007: 2) defines restoration as a system that can progressively self-organize and evolve. As something cannot be restored to its original state the aim must then rather be restoration than enables an innate ability to self-organize and evolve. Reed (2007:2) remarks that regeneration views all the extensions of life and restores them in parallel. Our role as the human inhabitants of this planet is to have a positive impact on the environment. The following are basic principles to follow in order to achieve this positive impact (Reed, 2010):

1. At the moment we are occupying the land, we should rather inhabit the land.
2. Instead of living lightly on, we should commit and live fully with nature.
3. We should look at our goal as a whole, and should not try and fix pieces of the issue.
4. Therefore, we should re-purpose our role as



3.6_ Framework for reverse degeneration (Author, 2015)

humans.

5. We should develop a mind-set that can see life's development and our role within it.

The purpose is for humans to build a relationship with the natural world and its processes. The only way to build such a relationship is to acquaint ourselves with the natural world and learn about it. Acquaintance with the natural process and patterns will become devotion, which will lead to safe-guarding.

"Living systems are capable of regeneration, resiliently adapting to pressures in order to sustain life."
(Peres et al, 2015: 40)

3.2.3
REGENERATING

Framing restoration as a whole means an engagement between earth systems, biotic systems and the characteristics of a place.

Figure 3.6; Advocates of the regenerative design approach in the built environment propose that an ecologically based approach must be integrated with the eco-efficient design. Such integration will ultimately reverse the degeneration of both the earth's natural systems and of human systems (Mang, et al, 2012: 9). For example, human settlements can actively regenerate the condition of their environment as a whole when they participate with the natural systems and the processes. Regenerative design encourages a co-evolutionary partnership between natural systems and the human condition, instead of human management or domination of the natural environment. This boosts social and natural capital instead of weakening it (Cole, 2012: 3). Regenerative design theory protests the current approval of "Green" building practical tools. It conveys the positive message that a building can give back more than it receives and through that action can abolish the building's social and cultural capital (Cole, 2012: 4). Regenerative design should lay the foundation for future development and benefits, while consciously focusing on pressing current environmental issues, such as, climate change and the loss of biodiversity.

3.2.4
UNDERSTANDING THE PATTERNS OF PLACE

Every site for which a building needs to be designed is unique and the design process starts with an understanding of the life process in that place (Reed, 2007: 5). For an ecosystem to be restored, a certain pattern must be established so it can commence regenerating itself. A site needs to be seen as a living organism; an organism is a living system; every living system has a purpose.

Reed (2007: 5) explains three aspects that provide a foundation for a regenerative relationship with a place:

1. Experience the whole system of that place and understand its greater potential to evolve towards a more resilient place.
2. The story of place. Other stakeholders need to be inspired by the place as a living system.
3. Apply a constant dialogue process as part of the design and operating process, to regulate the goal of the stakeholder within the nature of the place.

For a regenerative approach, design needs to accept and react to the unique characteristics of places (Cole, 2012: 3). Therefore, the shift towards a regenerative design approach must endorse the complicated and steadily evolving interrelationships between natural systems, technical systems and humans (Cole, 2012: 3).

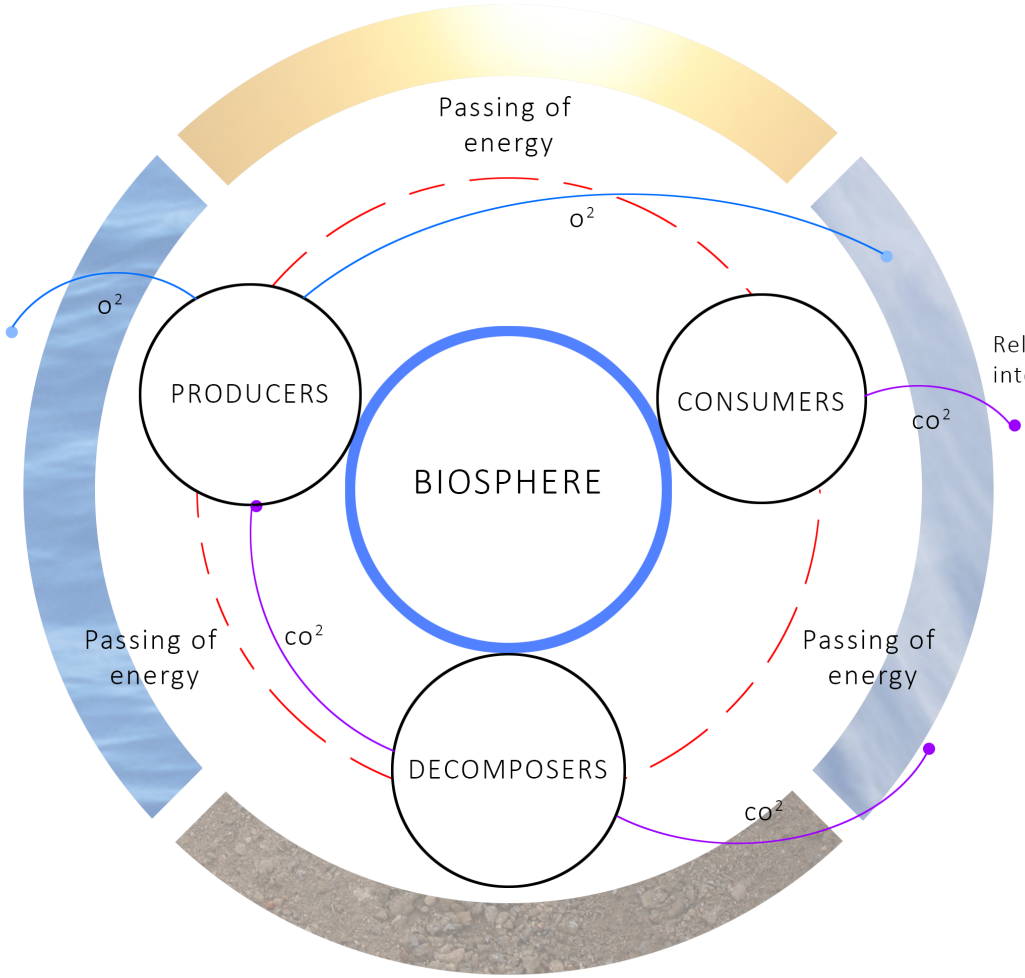
3.3 / ECOSYSTEMS IN NATURE

Despite the fact that humans have a deep-rooted need to be part of nature, they still abuse natural systems as resources, without concern over the long-term consequences (Peres et al, 2015: 41). The destruction of natural systems through human activities threatens the very existence of human beings. It is an urgent requirement that natural cycles be allowed to continue on their natural path of flow (Daily, 1997: 4). The deterioration of the environment reveals a set of demanding challenges for scientists worldwide (Daily, 1997: 1). These challenges are rapidly accumulating and cannot be controlled in isolation anymore. For action to be instigated for the conservation of the remaining of the planet's natural resources, it is imperative that the general public be informed and guided to understanding the challenges facing mankind (Daily, 1997: 1). The character and value of natural ecosystems should be incorporated in publicly distributed information.

"Environmental flow is the quantity, timing and quality of water flows required to sustain ecosystems, human livelihoods and the well-being that depends on these ecosystems" (Pahl-wostl et al, 2013: 342).

Figure 3.7; An ecosystem is a set of living organisms (biotic) in partnership with non-living components (abiotic) that interact harmoniously with their environment, as a system of energy flows and nutrient cycles (Esparza et al, 2009: 29), (Water and ecosystems. Global water partnership: 1).
The goods and services that flow from the processes of

THE SUN
Plants use solar energy which is the ultimate source of energy for all living things



WATER
(HYDROSPHERE)
All living things need water to survive

AIR
(ATMOSPHERE)
Oxygen from plants and carbodioxide from animals enter into the atmosphere

EARTH
(LITOSPHERE)
Plants use minerals obtained from the soil and all living things add organic material to soil on death and decay

3.7_ Ecosystems in the biosphere (Author, 2015)

natural ecosystems are considerably underestimated by society, even though they need to be incorporated in our daily lives (Daily, 1997: 2). This necessity is on account of the significance of ecosystem services to the resilience of social-ecological-systems (SES) (Pahl-wostl et al, 2013: 341). Ecosystem services sustain and inform human life through the processes of natural ecosystems. They also maintain the biodiversity that directly supports life on the earth (Daily, 1997: 3) (Pahl-wostl et al, 2013: 341). There is an increased need for ecosystem services, which are being harmed through the destruction of ecosystems due to the above-mentioned external factors (Global water partnership: 1) (Österblom et al, 2013: 1).
Gretchen Daily (1997: 4) lists the following types of ecosystem services that support life functions, such as, cleaning, recycling and renewal:

1. Support of diverse human cultures.
2. Moderation of temperature and the force of winds and waves.
3. Partial stabilization of climate.
4. Maintenance of biodiversity, from which humanity has derived key elements of its agricultural, medicinal, and industrial enterprises.
5. Dispersal of seeds and translocation of nutrients.
6. Control of the vast majority of potential agricultural pests.
7. **Pollination of crops and natural vegetation.**
8. Generation and renewal of soil and soil fertility.
9. Detoxification and decomposition of waste.
10. Mitigation of floods and droughts.
11. **Purification of air and water.**

None of the services listed above can be viewed as a single entity with its own functioning organisms. They must rather be viewed as a functioning whole that benefits, as a living system, the entire spectrum. Soil organisms, for example, play a valuable role in the circulation of material matter in all ecosystems; they alter the chemical and physical deportation of nutrients to plants and to larger organisms (Daily, 1997: 4). Simultaneously, if the service of pollinators were terminated, there would be severe social and economic ramifications (Daily, 1997: 4).

To conclude, human beings are inadequately prepared for the consequences that they themselves have unknowingly set in motion. Natural functions can simply not be replaced by artificial functions.

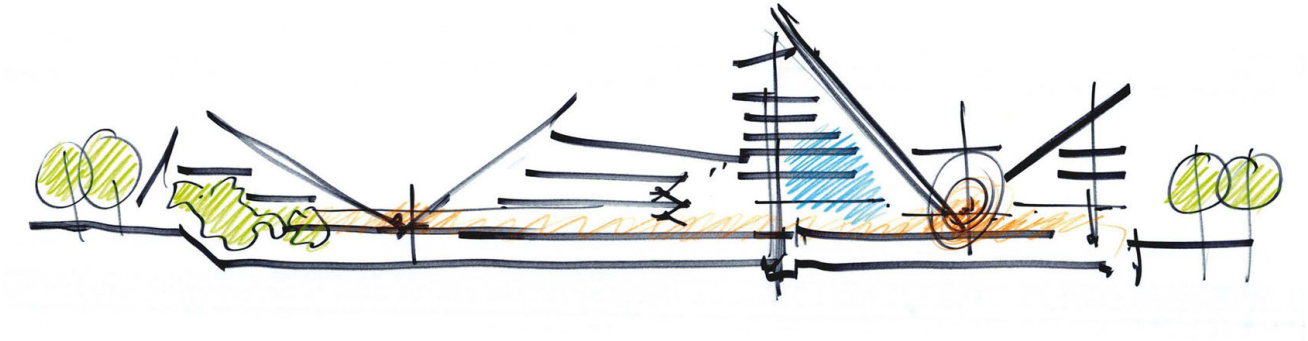
3.4 / SUSTAINABLE APPROACH IN ARCHITECTURE

For the state of many ecosystems there is no solution or cure. There is, therefore, an expanding urgency of the "How?" question (Osterblom et al, 2013: 1). The buildings below show designs that use nature as the main driver for a sustainable outcome.

RENZO PIANO / MUSE National Science Museum
Location: Trento, Italy

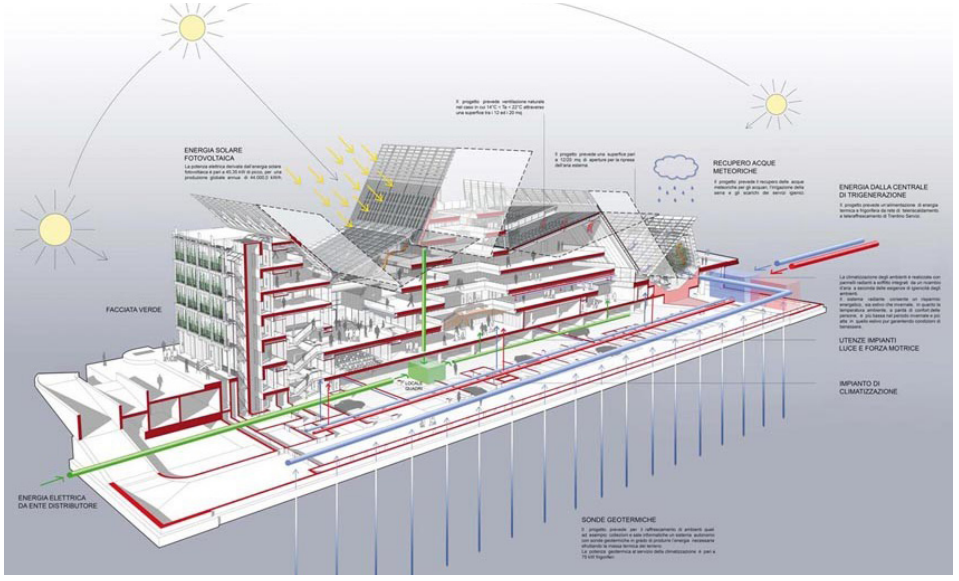
This building is designed to have a sustainable impact on the bigger city framework and on the micro level. Renzo Piano achieves this by connecting the Adige Riverfront with the city center and by creating a public attraction through the revitalization of a former Michelin tires manufacturing plant, which was mostly a brownfield site (Loomans, 2015: 1).

The building reduces energy use by taking advantage of photovoltaic panels on the roof; geothermal energy; and an excellent passive cooling design. The use of potable water is reduced by 50%, as rainwater collected on the roof is used to irrigate the indoor garden.



3.8_ Conceptual diagram of the MUSE museum (http://www.rpbw.com/project/146/muse-museo-delle-scienze/)

3.9_ How the conceptual diagram translated to final sections (http://www.archdaily.com/423101/muse-renzo-piano/52213764e8e44eeef9000036-muse-renzo-piano-diagram)



3.10_ Diagram showing the systems incorporated in the design (http://www.archdaily.com/423101/muse-renzo-piano/52213757e8e44e711f000023-muse-renzo-piano-diagram)

3.11_ Photo of the finished building (http://www.archdaily.com/423101/muse-renzo-piano/522136f-fe8e44e711f00001e-muse-renzo-piano-photo)

DR KEN YEANG / EDITT Tower
Location: Waterloo Road Junction, Singapore

EDITT stands for “Ecological Design in the Tropics”. The building is designed to increase its location’s bio-diversity and rehabilitate its ecosystem in Singapore’s ‘zero culture’ metropolis (Kain, 2012: 1). The design includes passive systems; the building is wrapped in organic vegetation to allow for passive cooling and natural ventilation.

The skyscraper also makes use of photovoltaic panels that provide 39.7% of the building’s required energy. Rainwater is collected and integrated with gray-water systems to provide for both plant irrigation and toilet flushing, at an estimated 55% self-sufficiency rate (Kain, 2012: 1).

SUMMARY /

The MUSE museum building is sustainably designed and displays great knowledge of the environment, where climatic factors were a major design informant. However, it lacks implementation of ecosystemic design and of man’s relationship with nature.

The EDITT tower can be considered a regenerative design as it makes provision for the rehabilitation of ecosystems to enhance existing bio-diversity. Ken Yeang understands that designing with nature can be extremely beneficial.

3.12_ Diagram of the EDITT Tower (https://archiandesigns.files.wordpress.com/2014/08/editt-tower-singapore-by-the-architect-ken-yeang-of-malaysia-3.jpg)