A future vision of interior space formation technologies in light of the basic determinants of the regenerative environmental architecture

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Abstract …

Regenerative design carries a great future vision for a new era of sustainability and positivity in interior space, and until now, there are many buildings that achieve environmental standards to match the surrounding environment. In this regard, we present a future vision for the design of the regenerative environmental interior space, as environmental regenerative design is a new design trend that calls for a regenerate design of the interior spaces with all its elements. Meaning that the materials and energy that go into a product or process can be reintroduced into the same process or system, which requires little or no input to maintain it, there is a strong link to where the product is extracted and the process of its production, use and disposal at the end of its life. Since both architecture and interior design complement each other, so the importance of studying this trend in interior design with all its elements came to the interior designer, as this trend helps to provide complete solutions to many design problems and contributed to answering the question about the possibility of being truly sustainable in our buildings, and how the environment can produce and regenerate its resources (a positive environment rather than a negative environment). As the surrounding environment is one of the most important foundations for the designer to serve his/her creativity and configurations that suit the needs of the user. To activate this, the concept of innovative design thinking that affected the internal and external spaces was defined, and its principles were divided in a way that makes it easier for the learner to study and understand all of its elements and the technique of using it in the contemporary interior space, and a new vision of the contemporary internal space was presented formally and functionally. That the designer should focus on applying the principles and strategies of regenerative environmental design during the early design stages, and that the design teams are familiar with a richer understanding of the principles of regenerative design so that they can come up with design solutions and integrate them into the design from the beginning to create elements and solutions for architectural design, and to choose materials. Regenerative environmental design with a positive impact at every stage of the environmental design.

Keywords:

Regeneration environment. . interior design. . determinants

الملخص:

يحمل التصميم المتجدد رؤية مستقبلية كبيرة لعصر جديد من الاستدامة والإيجابية في تصميم الفراغات الداخلية ، وحتى الآن ، لا توجد مبانٍ خضراء ذات تأثير إيجابي شامل على البيئة والصحة. و في هذا الصدد نقدم رؤية مستقبلية لتصميم الفراغ الداخلي البيئى التجديدى ، حيث أن التصميم البيئي التجديدى هو اتجاه تصميم جديد يدعو إلى تصميم متجدد للفراغات الداخلية

بكل عناصرها . بمعنى أنه يمكن إعادة إدخال المواد والطاقة التي تدخل إلى منتج أو عملية في نفس العملية أو النظام ، الأمر الذي يتطلب القليل من المدخلات أو لا يتطلب أي مدخلات للحفاظ عليها ، فهناك ارتباط قوي بالمكان الذي يتم فيه استخراج المنتج وعملية إنتاجه واستخدامه والتخلص منه في نهاية عمره الافتراضي.

و نظرًا لأن كلا من العمارة والتصميم الداخلي يكملان بعضهما البعض ، لذا جاءت اهمية دراسة هذا الاتجاه في التصميم الداخلي بكل عناصره للمصمم الداخلى ، حيث يساعد هذا الاتجاه في تقديم حلول كاملة للعديد من مشاكل التصميم و ساهم فى الاجابة على السؤال حول امكانية أن نكون مستدامين حقًا في مبانينا ، وكيف يمكن للبيئة أن تنتج وتجدد مواردها (بيئة إيجابية ومتجددة بدلاً من بيئة سلبية غير متجددة). حيث أن البيئة المحيطة من أهم الأسس للمصمم لخدمة إبداعه والتكوينات التي تناسب احتياجات المستخدم . ولتفعيل ذلک ، تم تعريف مفهوم التفكير التصميمي التجديدى الذي أثر على الفراغ الداخلى و الخارجى ، وقد تم تقسيم مبادئها بطريقة تسهل على المتعلم دراسة وفهم جميع عناصرها وتقنية استخدامها في الفضاء الداخلي المعاصر، و تم تقديم رؤية جديدة للفراغ الداخلي المعاصر تشكيليا ووظيفيا ، حيث تم التوصل الى أنه يجب أن يركز المصمم على تطبيق مبادئ واستراتيجيات التصميم البيئى التجديدى خلال مراحل التصميم المبكرة ، وأن تكون فرق التصميم على دراية بفهم أكثر ثراءً لمبادئ التصميم التجديدى حتى يتمكنوا من التوصل إلى حلول تصميم ودمجها في التصميم من البداية لإنشاء عناصر وحلول للتصميم المعماري ، واختيار مواد التصميم البيئية المتجددة ذات الأثر الإيجابي والمتجدد في كل مرحلة من مراحل التصميم البيئي.

الكلمات المفتاحية:
البيئة التجديدية ;الفراغ الداخلى ; محددات

Introduction …

Both of interior and exterior designs face many challenges, which leads us to the necessity to search for and benefit from each update, in order to overcome the difficulties imposed by the advanced technology data and requirements.

The aim of this study is to explore the principles of regenerative environmental architecture in the design of interior space.

At the beginning of the twenty-first century, a new term appeared in design and interior design, known as “environmental regenerative architecture,” where the architects and designers sought towards a regeneration and eco-design with positive aspects.

Tech of environmental regenerative design is very interested in engaging the environment as a mediator and generator of designs. Where regenerative environmental design thinking is based on two main pillars:

1- Focusing on reducing the building's environmental impacts, which is reflected in the choice of materials, low energy consumption, and smart design.

2- Treating the environment as the basis for any design of the space, whether internal or external.

Research problem

The search problem lies in the next question:

- Is there a possibility to reach an integrated and specific methodology to link the internal space with the environmental surroundings according to the architecture of the regenerative environment?

Research goals:

Apply the basics and concepts of regenerative environmental architecture in the design of interior spaces through:

- Shedding light on one of the most important contemporary trends and design thinking on which it was founded, formally and functionally.
- Putting forth a future vision of communication between the internal space and the surrounding environment in regenerative manner.

Research hypotheses and questions

This study belongs to the interior design related to environmental science and systems that assume that:

- Interior design according to regenerative environmental architecture works to integrate the inner space with the environmental surroundings through form and content to reach an unconventional, regenerative interior space.
- The interior design according to regenerative environmental architecture opens up advanced technological futures to integrate the interior space with the surrounding environment.

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Research Methodology

To achieve the research hypotheses, the following approaches are followed:

- A historical approach: through which the history of environmental design and interior design is researched locally and internationally by shedding light on the concept of environmental regenerative in design in the past and contemporary time as it has developed.

- Analytical descriptive method: through an analytical study of regenerative environmental architecture concepts and their reflection on interior design.

Environmental Regenerative Design Concept:

1- "Regenerative environmental architecture ". It is a new concept in architecture and interior design, regarding both formative and functional aspects, the practice of engaging the natural world as a medium and generator of the architecture. It responds to and utilizes the living and natural systems and these concepts have been reflected in the design of the internal and external spaces in order to reach new solutions.

2- It is a design that integrates with everything that surrounds it and interacts with it and is regenerated in response to environmental, design, and humane requirements through the use of modern technology and information technology with a focus on reducing the negative environmental impacts of spaces, and this is embodied in the choice of materials, low energy consumption, and smart design.

3- The concept of regenerative environmental design is mainly based on anticipating the multiple jobs and building renovations used in the future in a rapidly changing environment, where buildings must be able to adapt and regenerate quickly with changes, as new social, cultural and demographic issues. Therefore, it is necessary to anticipate these changes and the integration of renewable environmental design parameters that allow the building to adapt to a variety of uses over time.

From the above we find that:

Interior design + Regenerative environmental architecture =
Environmental Regenerative Design

From the previous definitions, we can compare between the ultimate goal of sustainable development and Environmental Regenerative Design as follows:

Sustainable design: is to meet the basic human needs of today, focuses on reducing damage to the environment and human health, optimizing the use of resources, and slowing down the degradation of the natural systems of the environment.

Environmental Regenerative Design: is to reintegrate with the environment and to develop dynamic, permeable and beneficial repair systems for humans and other species through a network of mutual support relationships. This process aims to revive societies, human and natural resources, for some, and for society as a whole.

Differences will be studied in detail when studying the basics of regeneration in the space forming techniques of the internal.

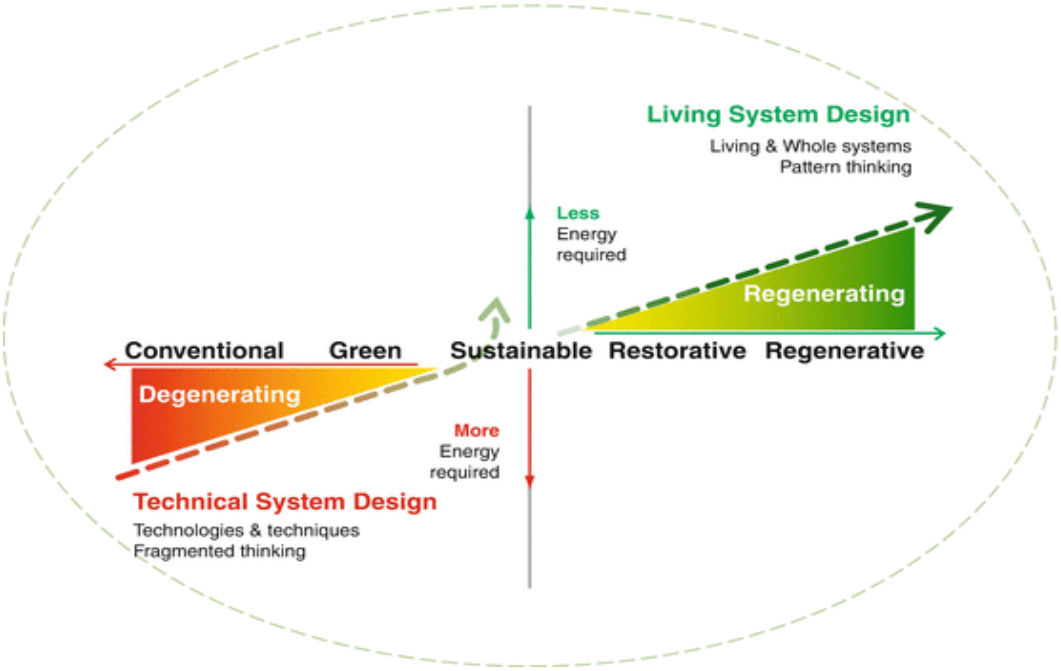


Figure (1) difference between tech Sustainable design and Environmental Regenerative Design

Historical background:

Since the beginning of the twentieth century there have been five influential models that have shaped sustainability in design and the built environment. As the "Environmental Regenerative Design" has been greatly affected by the economic and environmental crisis associated with industrialization, with a better understanding of the evolution of the concept of sustainability.

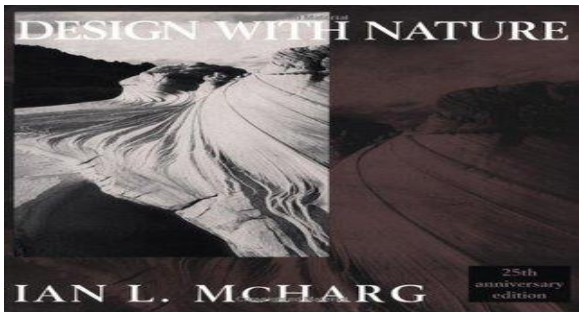
The following table (1) provides a brief overview of the historical development of "Environmental Regenerative Architecture"

No	Paradigm	Years	Influencer	Paradigm	principals
1	**Bioclimatic design** Figure (2)	1908–1968	Olgyay, Wright, Neutra	Discovery	Combine academic research with cutting-edge practice. Where the design was transferred to scientific and experimental research that is based on foundations and limitations.
2	**Environmental design** Figure (3)	1969–1972	Ian McHarg	Harmony	The domination of the environment and biology from the inner space to the outer space.
3	**Energy awareness design** Figure (4)	1973–1983	AIA, Balcomb, ASES, PLEA	Energy efficiency	Design dominated by adapting to the idea of saving energy, using solar energy and the energy standards that were devised.
4	**Sustainable design** Figure (5)	1984–1993	Brundtland , IEA, Feist	Resource efficiency	Natural systems function, remain diverse and produce everything it needs for the ecology to remain in balance.
5	**Green design** Figure (6)	2006–2015	UN IPCC, Mazria	Resilience	The design was dominated by more complex and more specific environmental considerations.
6	**Environmental Regenerative Design** Figure (7)	2016–Future	Lyle, Braungart, Benyus	Recovery	Where over the next twenty years it will determine the determinants of renewable environmental design.

Table (1) Sustainability paradigms influencing design in the 20th and 21st centuries, Paradigm Years' Influencers.

The first model called Bioclimatic Design, dominated Ideas, Wright in 1906 … Figure (2)

The second model called "environmental engineering" McHarg's 1963 Ideas About Designing With Nature (McHarg and Mumford 1969) .. Figure (3)



The third model called "Energy awareness", Climatic Architecture 1968 Olgay, Wright... Figure (4)

The fourth model called "sustainable design" Fathi's design matched nature's designs to build architecture from Under Our Feet (Fathy 1973) .. Figure (5)

The fifth model called "Green Design",Baker on green designs 1991) , Baker's works, such as this house, blend seamlessly into the natural settings.. Figure (6)

PILA Selected to Redesign the Facade of the Abandoned Piraeus Tower in Greece changes in design imitation of the environment, and positive effects on the internal and external spaces. Figure (7)

The sixth model called "Environmental Regenerative Design"

Since 1996, he started and brought about many changes in design from cradle to cradle, imitation of the environment, and positive effects on the internal and external spaces, and this is what will be studied in detail in this research

principles of Environmental Regenerative Design and its impact on the interior design:

- In the beginning, the term LEED (**Leadership in Energy and Environmental Design)** must be clarified to clarify its relationship to each of the following principles of Environmental Regenerative Design and its impact on the interior design separately.
- LEED V.4 : It is one of the internationally recognized international organizations that aims to maintain a clean environment and award certificates and ratings for environmentally friendly buildings.
- The LEED V.4 program has developed with enough flexibility to become the first pioneer in the world to keep pace with all modern trends and from them and to provide solutions not only for interior space but for all types of projects. So the US Green Building Council (USGBC) introduced LEED version 4.
- LEED V.4 for all types of buildings and all phases of construction including new construction and interior equipment, operations, maintenance, and essence and dandruff. The target of LEED V.4 can be summarized in the following equation:
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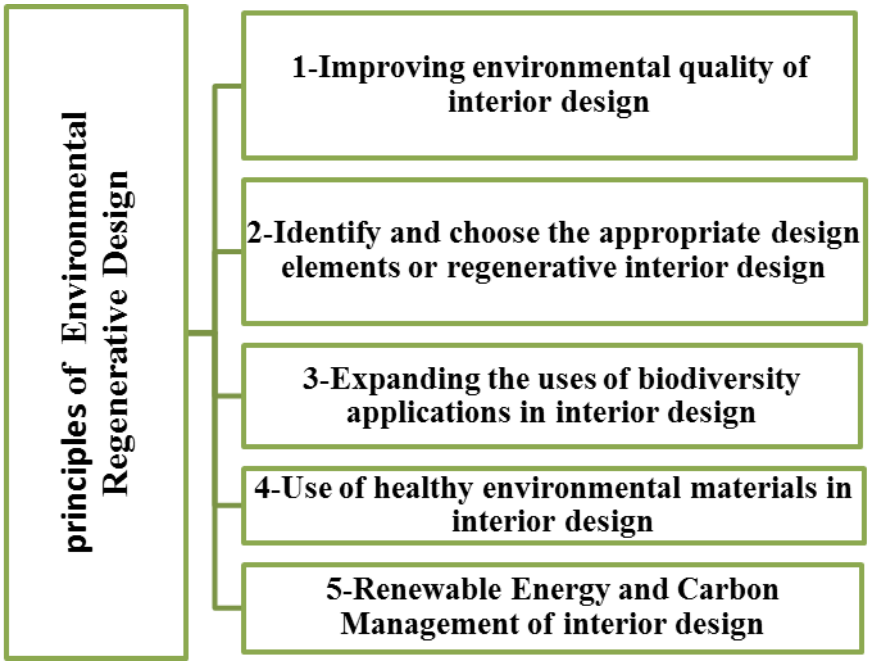
Healthy people in healthy places = a healthy economy

- So we can summarize the principles of "**Environmental Regenerative Design "for** any interior space in the following figure (8):

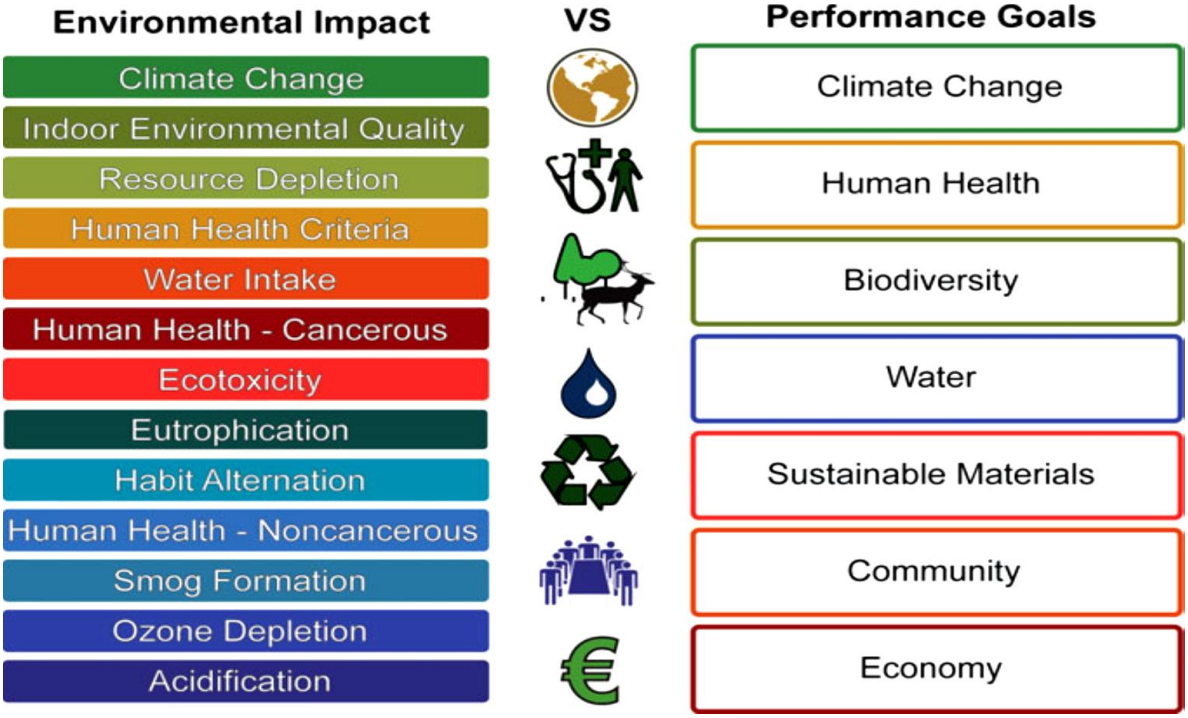


In the following lines, we will deal with each of them in detail, and analysis of one of the applied projects for each component and its relation with both interior design and LEED V.4.

1-Improving environmental quality and its impact on the interior design:

The measurement of performance indicators for internal and external spaces in **sustainable buildings differs from that in environmentally regenerator buildings**, as the former was

based on one standard, while the latter was based on multiple criteria (operation phase - production and construction phase - end of life phase)



The figure (9) shows some of the environmental impacts related to the space, internally and externally, and a suggested performance indicator for them

Applications of using "Environmental Regenerative Design" strategies in interior space: Examples of using the fundamentals of innovative environmental design in space, internally and externally, are: **Green roofs, Cladding, Isolation, light ….. all in interior space**

Figure (10) shows examples of some surface treatments for environmentally regenerative buildings in design and technology, Green roofs are fairly common in the building design (interior , exterior) industry today , like designing buildings with roofs that clean the surrounding air and trap carbon. Rain water collection because each of them has an effect on interior design.

https://www.greenroofs.com/projects/gardens-by-the-bay-cloud-forest-conservatorys-cloud-mountain/

Figure (11) shows examples of applied" leed4 in "Environmental Regenerative Design "Racagni Primary School" in Parma has been built with the aim of providing a modern, safe and eco-friendly building to the people of this borough of Pablo.2015

We can summarize the above as: LEED v.4 presents the basic requirements that must be met in the internal environment, and it's related to external space, which must be taken into account in the renewable environmental design of the interior space, and are summarized as follows:

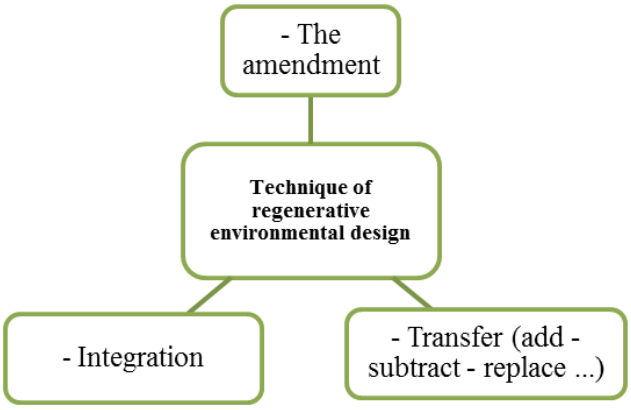
1- A new option within the environmental tobacco smoke control prerequisite that recognizes potential limitations in the treatment of smoking in areas beyond the control of the in-house project - smoking is still prohibited in the entire LEED v.4 project space and enhances the quality of the surrounding environment (biodiversity - the effect of heat - ....)

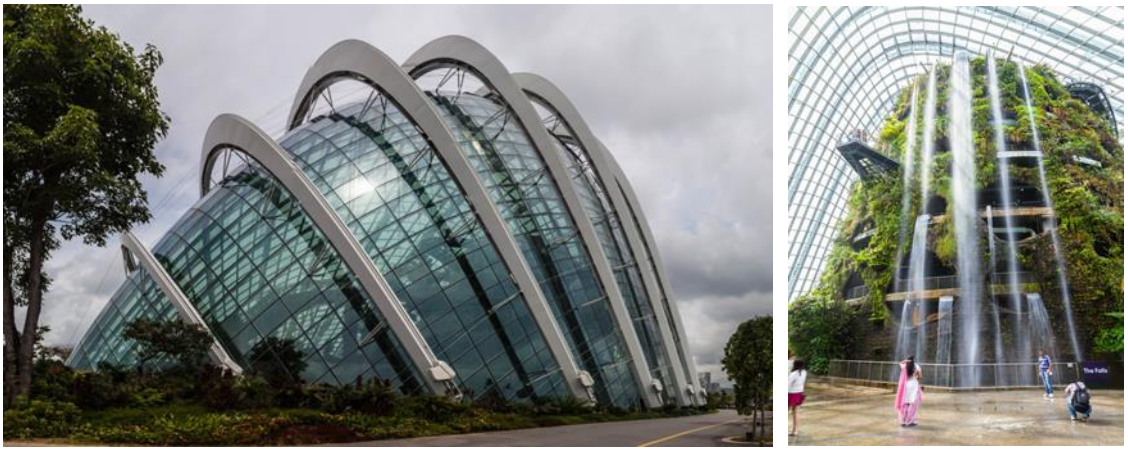
2 - Low entry points for both daylight and acoustic performance balances to encourage more projects to take into account daylight and acoustic performance during design, Figure (11)

3- A greater focus on improving indoor air quality through more accessible air testing options and the use of the latest ventilation standards (humidity - oxygen - sound.)

2-Identify and choose the appropriate design elements or regenerative art and its impact on the interior design:

This is done by selecting technique of regenerative environmental design. The following figure (12) shows the foundations that must be chosen between them to produce "Environmental Regenerative Design**"**:





Figure(13) Designing an interior space in Singapore 2014 that combines nature, technology, environmental management and imagination, and it is inspired by the design idea of the orchid flower, while leaves (ground forms), buds (paths, roads, pathways) and secondary roots (water, energy, and lines of communication) form an integrated network with flowers (gardens with a special character and super trees) at the main intersections and in which biodiversity is preserved through (control over them). With the world's climate, ecological plant conservation, Cloud Mountain in Cloud Forest the opportunity to discover the unique biodiversity and geology of cloud forests).
https://www.greenroofs.com/projects/gardens-by-the-bay-cloud-forest-conservatorys-cloud-mountain/

3-Expanding the uses of biodiversity applications and its impact on the interior design:

Biodiversity is concerned with studying the variation in the characteristics and types of living organisms according to the environment that contain all kinds of these organisms, and it is interested in studying the nutritional levels related to the different environments in which the living organisms live, and it helps in maintaining the ecological balance. All environmental problems such as environmental degradation and climate change are related to the loss of Biodiversity, and it has economic, health and basic importance in designing the internal space and studying the appropriate ventilation and its connection with the surrounding environment ....

Where the following will be incorporated when designing regeneration environmental space:

- Shared technology: applies regeneration environmental design techniques such as: its green roof, which provides a great deal of energy savings, internal heating and cooling that is done by drilling wells.

Organic forms in the built environment that refer directly or indirectly to the importance of compatibility with the surrounding environment.

- Environmental regeneration: the classified complexity and biodiversity with which indigenous Korean plants and organisms reproduce in their native climate and / cooling the ground pipes or cavities, allowing air to pass through the large diameter underground tubes with a pile of space at the height of the level. Moreover, use of rainwater collected from the surface and stored for irrigation and gray water; the collected rainwater is naturally purified as potable water for the entire place.

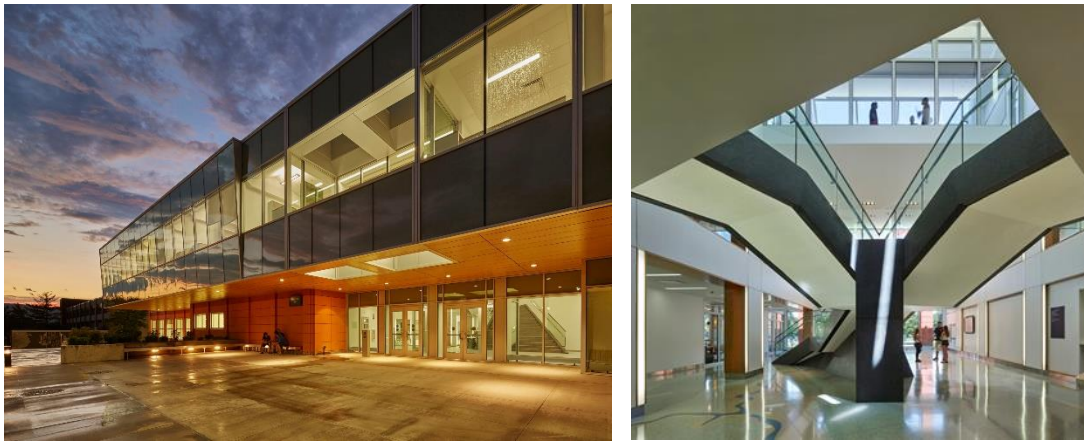


Figure (14) SUNY New Paltz - Wooster Building2018, use of shapes and natural forms of nature and colors in one design creates a pleasant environment affecting the health and well-being.
https://www.usgbc.org/projects/suny-new-paltz-wooster-building

4-Use of healthy environmental materials and its impact on the interior design:

Environmentally regenerative design materials : They are the materials that the designer uses in his designs and are able to feel and respond to the surrounding environment in the way specified before. This benefit is achieved in two ways:

A- The use of smart materials: (through integration between different elements integrated with these materials such as sensors, processors, and microcomputers) and are divided into:

I.Property changing materials:

They are materials that are subjected to change in one or more of their properties (chemical, mechanical, electrical, magnetic, thermal) as a direct response to a change in external factors through the compatibility between the surrounding environment and the material and these changes are reversible and are direct and reversible where there is no need for a system. External control ,where it changes color in response to the change in the amount of ultraviolet rays on its surface. Examples of these materials are:

- Chromic or Color changing material.
- Rheological Property material.
- Conductors materials.

Figure (15) Irvine USD, Portola High School- Irvine,2016, California is a modern school of regenerative design. - The green roof is connected to the HVAC system. - Use of water generated from the air conditioning to irrigate the green roof on hot days.
https://www.enr.com/articles/42898-k-12-education-best-project-irvine-usd-portola-high-school

II. **Energy Changing material:** A detailed explanation will come in energy saving (6-Renewable Energy and Carbon Management)

B- The use of genetic materials : (where the use of ultrafine ores technology or microscopic technology), including the following:

-Materials that change their shape and color.

- Materials that clean themselves automatically according to certain effects.

Check the thermal balance inside the internal space.

Figure (16) Naturally sky light in the lobby with green wall and stairs- Venlo City Hall, The Netherlands. An environmental regenrative terrace to connect the outside with the inside- Liege, Belgium.

c. Recycled material

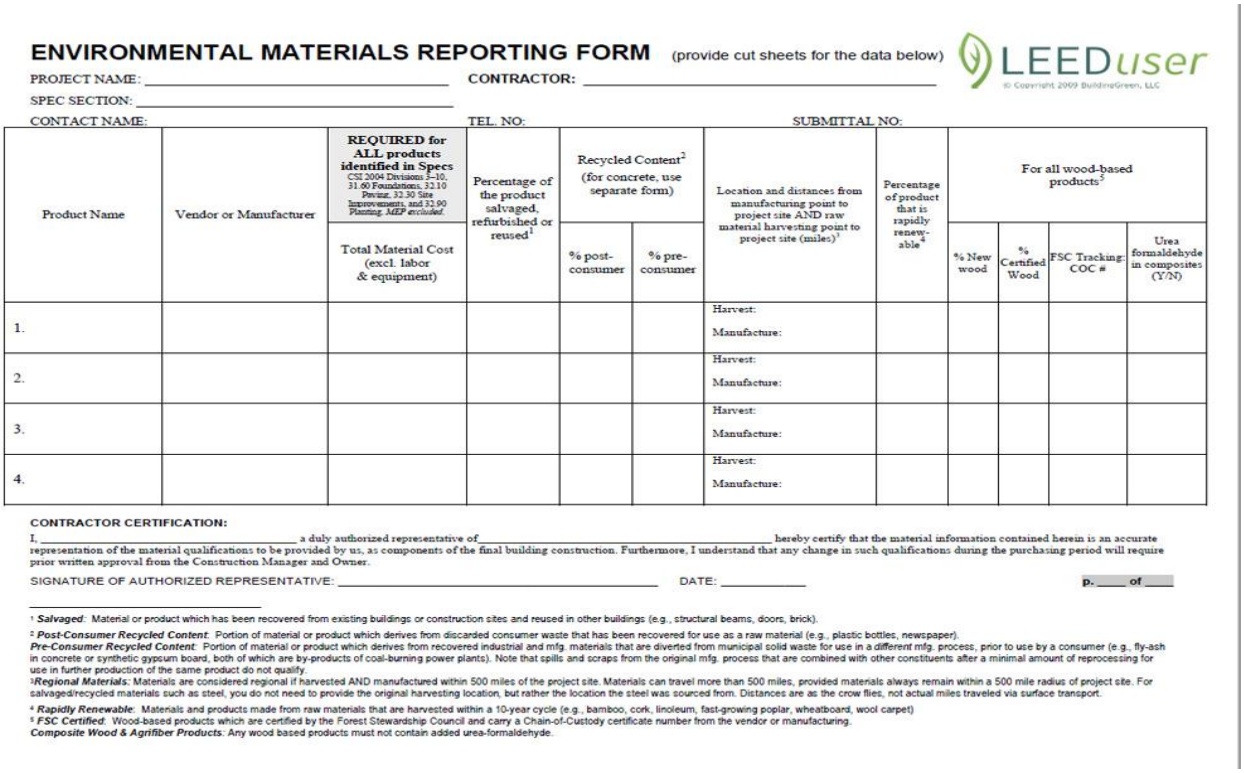
There are **two types** of recycled material:

1. **Post-Consumer:** material already been used and will be reused for another application. Such as: plastic, paper, glass, and metal.
2. **Pre-Consumer**: material form the manufacturer that has not been used and will not be reused Such as: wheat straw, sawdust, fly ash.

Bases for choosing environmental regenrative materials:

- Natural and regenrative.
-Environmentally approved materials from EPD or C2C, or environmentally approved by similar bodies.
-Study the mechanical, thermal, and sound insulation quality of the selected materials.
- Preference for the materials surrounding the space (clay - wood - straw - bamboo - ....)
-Selection of materials that are recyclable and versatile.
- Choosing fire-resistant materials.
-Their manufacturing processes and the technology they use do not leave emissions and waste.

Due to the importance of choosing materials for the interior designer and also as a criterion for evaluating the acquisition of LED, a form was designed to evaluate the selection of materials that summarizes all that has been discussed in the previous lines and measures the type of material (smart - genetic - recycling ...) and sets evaluation points for each type as follows (figure17) :



ENVIRONMENTAL MATERIALS REPORTING FORM (provide cut sheets for the data below) LEEDuser

PROJECT NAME: _____ CONTRACTOR: _____

SPEC SECTION: _____

CONTACT NAME: TEL. NO: SUBMITTAL NO:

Product Name	Vendor or Manufacturer	REQUIRED for ALL products identified in Specs (CSI 2004 Divisions 3–10, 31 60 Foundations, 32 10 Paving, 32 30 Site Improvements, and 32 90 Planting. *MEP excluded.*) Total Material Cost (excl. labor & equipment)	Percentage of the product salvaged, refurbished or reused[1]	Recycled Content[2] (for concrete, use separate form) % post-consumer	% pre-consumer	Location and distances from manufacturing point to project site AND raw material harvesting point to project site (miles)[3]	Percentage of product that is rapidly renew-able[4]	For all wood-based products[5] % New wood	% Certified Wood	FSC Tracking: COC #	Urea formaldehyde in composites (Y/N)
1.						Harvest: Manufacture:					
2.						Harvest: Manufacture:					
3.						Harvest: Manufacture:					
4.						Harvest: Manufacture:					

CONTRACTOR CERTIFICATION:

I, _____ a duly authorized representative of _____ hereby certify that the material information contained herein is an accurate representation of the material qualifications to be provided by us, as components of the final building construction. Furthermore, I understand that any change in such qualifications during the purchasing period will require prior written approval from the Construction Manager and Owner.

SIGNATURE OF AUTHORIZED REPRESENTATIVE: _____ DATE: _____ p. ____ of ____

[1] ***Salvaged***: Material or product which has been recovered from existing buildings or construction sites and reused in other buildings (e.g., structural beams, doors, brick).

[2] ***Post-Consumer Recycled Content***: Portion of material or product which derives from discarded consumer waste that has been recovered for use as a raw material (e.g., plastic bottles, newspaper).
Pre-Consumer Recycled Content: Portion of material or product which derives from recovered industrial and mfg. materials that are diverted from municipal solid waste for use in a *different* mfg. process, prior to use by a consumer (e.g., fly-ash in concrete or synthetic gypsum board, both of which are by-products of coal-burning power plants). Note that spills and scraps from the original mfg. process that are combined with other constituents after a minimal amount of reprocessing for use in further production of the same product do not qualify.

[3] ***Regional Materials***: Materials are considered regional if harvested AND manufactured within 500 miles of the project site. Materials can travel more than 500 miles, provided materials always remain within a 500 mile radius of project site. For salvaged/recycled materials such as steel, you do not need to provide the original harvesting location, but rather the location the steel was sourced from. Distances are as the crow flies, not actual miles traveled via surface transport.

[4] ***Rapidly Renewable***: Materials and products made from raw materials that are harvested within a 10-year cycle (e.g., bamboo, cork, linoleum, fast-growing poplar, wheatboard, wool carpet)

[5] ***FSC Certified***: Wood-based products which are certified by the Forest Stewardship Council and carry a Chain-of-Custody certificate number from the vendor or manufacturing.
Composite Wood & Agrifiber Products: Any wood based products must not contain added urea-formaldehyde.

Figure (17) The model used by LEED V.4 to select and evaluate materials in an interior space when choosing environmental regenerative materials

٥-Renewable Energy and Carbon Management and its impact on the interior design:

The Secretary-General of the Commonwealth of Nations, Patricia of Scotland, announced in May 2017 the launch of the Commonwealth Initiative to reverse climate change through regenerative development. Regenerative development provides ways to deal with climate change and by means that can be adopted by the most vulnerable countries, suitable for the daily life and livelihoods of their inhabitants.

Energy Changing material

They are the ones that convert energy from one form to energy produced in another form, directly and inversely. This necessitates that the material be in a state different from the state of the surrounding environment, and the substance cannot convert energy when it is in an electro-restrictive state such as substances which are confined electrically.

Where it converts electrical energy into elastic energy, which in turn leads to a change in the natural shape of the material, and these changes take place again, directly and inversely.

- Photovoltaic materials
- Electro thermal materials
- Electrified materials by pressure
- Electrophoresis and magnetic materials

Figure (18) The Pierce College Library in San Fernando Valley in Los Angeles is a certified example of LEED Platinum for Regenerative Design, where energy was saved in a number of ways including:
- Includes high performance building envelope to save energy and collect water on site.
-Photovoltaic cells that produce renewable energy for the building and achieve efficiency in water and energy use.
-Educating visitors about the environmental performance of the building and its importance
- Take the design approach to maximize water and energy conservation and reduce the environmental impact of the building.https://hmcarchitects.com/news/photo-essay-pierce-college-library/

From the above study, we can say that when applying the principles of renewable environmental design in the interior space, the following must be taken into account when choosing the design and technology for each of its elements as follows:

- Windows (material - technology - shape)
- Ceilings (greening roofs - insulation)
- Walls (cladding - technology - insulation)
- Flooring (raw material - thermal and moisture insulation)
- Lighting (natural - energy saving)
- Spaces (multiple uses - Regenerative Design - Environmental recyclable)

Examples of elements of interior design and its complements that can be studied to achieve the principles of Environmental Regenerative Design:

Idea for designing an eco-resort in the Philippines, designed by the architectures Vincent Callebaut, the basics of regenerative environmental design techniques will be applied on this project as follows:

1-Improving environmental quality

The project depends on natural sources of energy (Zero-Emission, Zero-Waste, Zero-Poverty), and includes a sports center, apartments, hotels and a research center ..

The resort features a series of spiraling apartment buildings and shell-shaped hotel buildings, which themselves sit on the Fibonacci spirals from the ground in a coastal lake. At the center of the collection, the mountain-like complex brings together a school, recreational pools, gymnasiums, resort kitchens, and an array of laboratories for ecologists. The hotels and apartments can accommodate up to 500 guests (figure 17)

Disseminating the principle of triple ecotourism in renewable environmental designs:

- Zero emissions
- Zero waste
- Zero poverty.

Figure (19) The general location of the project

https://inhabitat.com/visionary-eco-resort-design-for-the-philippines-features-rotating-seashell-towers/vincent-callebaut-nautilus10/

2-Identify and choose the appropriate design elements or regenerative art

- The resort's spiral design was inspired by the "Fibonacci" sequence of numbers.

Inspired by natural beachy shapes, using the product widely from cradle to cradle.

The principles of environmental renewable design were the basis for the project in the design, as environmental threats in the Philippines were identified as the inspiration for the design.

- The resort's goal is a symbiosis through which ecotourism will finance the work of the resort's ecologists.

- Spreading the idea of regenerated environmental design among the visitors of the place through their meeting with scientists, engineers and environmental scientists to learn more about the environment and efforts to preserve it.

- The participation of visitors in ensuring the preservation of the cleanliness of the place and exposure to the scientific knowledge that is created in laboratories.

-Encouraging more interactions between scholars and visitors.

Figure (20) shows the foundations (amendment, integration) that chose to produce a regenerative environmental design.

3-Expanding the uses of biodiversity applications:

Designed to conserve biological diversity after increasing fear that the Philippines will be threatened by the abundance of harmful gas emissions from tourism, the Philippines is currently facing environmental issues including overfishing, mass tourism and massive pollution due to waste.

Figure (21) Boat bottoms are designed flat to prevent damage to the marine environment.

4-Use of healthy environmental materials

Use of recycled materials from islands such as bio-concrete in hotel facades, green walls, and interlocking timber in the central complex.

Figure (22) facades, green walls, and interlocking timber in the central complex.

٥-Renewable Energy and Carbon Management:

- Use of a variety of renewable energy sources, including tides and solar energy.
- The proposed primary transportation system for the resort is by boat, in an effort to prevent the imposition of road infrastructure.
- The constellations follow the path of the sun, so that guests can make the most of the rays throughout the day.

Figure (23) Using natural lighting in a variety of ways in the internal spaces of the project

Summarize : Interior design features in the project include Energy Star Appliances , recycled glass tables, WaterSense Fixtures, LED lighting, locally sourced glass and mirrors, cast iron sinks, antique and recycled lamps, and environmental paints in interior / exterior spaces .

Results:

- The necessity to delve into the study of environmental renewable architecture techniques in order to increase the impact of their determinants formally, technically and economically.
- The need to use the technological determinants of "Environmentally Regenerative Design "to reach an internal space of zero energy.

- One of the principles of renewable environmental design is the reliance on renewable energy technologies to generate the energy consumed by the internal space of the building (achieving recycling of elements such as water, achieving natural ventilation of interior spaces using architectural elements, and achieving natural lighting at a rate that reduces the use of artificial lighting in the interior space with taking care of managing the internal space during the operation to control energy).
- Regenerative environmental designs work on integrating the internal space with the environmental surroundings through form and content to reach unconventional formations in the internal space.

Recommendations:

- **The role of the educational institution:** Academic and official institutions should adopt the technological principles of Environmentally Regenerative Design and the technology of using it in the internal space.
- **The role of the state:** The state must play a big role to develop internal spaces with their elements in line with the principles of environmentally regenerative design and converting them into basic determinants for evaluating the performance of environmentally regenerative buildings.
- **The role of the designer:** The designer should perform all principals of Environmental Regenerative Design in their designs such as excess of some materials and high-tech economically in the interior space by studying the extent of their environmental compatibility and regenerative qualities.

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