Alternative architecture as a new approach to achieve energy efficiency
"Guiding bio-mimicry in architectural design"

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Keywords:
Alternative architecture - Energy efficiency - Bio-mimicry design

Abstract:
Undoubtedly The environmental problems are all connected we cannot ignore the environmental return of the wrong use of energy and building materials and their negative impact on environment construction sector contributes significantly to the rate of global energy consumption and residues construction leads to emissions of dioxide gas Carbon.

Moreover, it was urgent need to find a technology more compatible with the environment which was the beginning of using eco-friendly materials returning to nature which is not new it has started to appeal by the Architect "Hassan fathy" who started environmentally compliant architecture.

Currently, the idea of alternative architecture addressed in the research is like alternative medicine where return to the original. Alternative medicine has begun to approach the use of natural methods and the dimension of chemical substances and their long-term and short-term impact. the interest of the world at present in the preservation and sustainability of the environment which is adopted by alternative architecture thinking through an alternative way of thinking to save energy with almost non-existent impact with natural base by reunion architecture with the mother of nature to rationalize energy consumption in architectural design.

Introduction:
The world is now witnessing a growing interest in environmentally sustainable development issues, as it has grown to realize that current development paradigm is no longer sustainable after resulting consumer lifestyle has been associated with serious environmental crises, studies have confirmed that the rationalization of energy consumption through environmental conservation sustainability is an important subject both in field of thought politics and Recently in field of architecture.

Absolutely the idea of alternative architecture addressed by the research is the flame of alternative medicine in architectural way it is (alternative architecture) in terms of using a natural innate approach that God created by using the inspiration of mother of nature by applicate the rules of bio-mimicry

All try to introduce environmental and humanitarian considerations into the process, hence the role of research in finding a design entry through monitoring and evaluation of the most important indicators of alternative architecture, which calls

to return to meditation of nature through form and function that add much to the architectural design that calls for reducing energy consumption within buildings designed and responsive to the surrounding environment through framework that achieves sustainability and its principles.

Research problem:

When you are living in a globalized economy and a globalized world, you cannot live in isolation; all the problems and solutions are interconnected" Kailash Satyarthi, Nobel Peace Prize winner 2014.

Studies indicate that construction sector alone consumes (40-50%)[1] Of the world's energy consumption where statistics from the British Government show that buildings contribute for 40% of CO_2 emissions and energy consumed on the same EU region it is all down to:

- Neglecting the energy consumption problem of developing countries especially "Egypt" our dependence on electricity generated from one source of energy is a big mistake rather than looking for alternative and more efficient energy methods.
- Instead of doing research and studies resorting to the method of construction to each designing environment the companies use traditional and polluting methods of construction.
- The absence of exploitation nature as a teacher inspired by architects their ideas in dealing with environmental and architectural problems.

Aim of research:

The call continues to deal with the environment more evenly, especially by architects looking for designing alternatives inspired by nature which take advantages of Natural energy resources explicating Cooperation of (sustainability-bio-mimicry design) in architecture to achieve energy efficiency in buildings

1. Traditional architecture and energy consumption

"Building-sector construction-material transportation" consumes 40% to 50% of total energy consumption worldwide types of research have carried out many researches and investigations to find materials that can reduce the environmental emissions trying to equalize the balance between total energy consumption and environmental impact of the building sector.

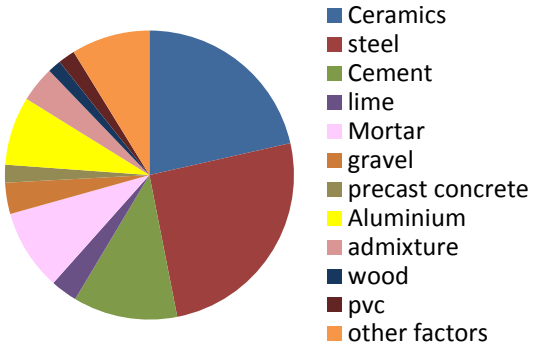
A study was done on 60 studies of different buildings and this study carried out on 9 different countries (Germany-Sweden-Australia-Canada-Japan) found that the proportion of energy embodied in the materials used between (9 % To 46%) of the total energy used within the building, when dealing with low-power buildings using natural methods based on the "good insulation – natural ventilation – good direction of the building-.... This energy is between 2% to 38% in traditional buildings [2.]

The traditional model of buildings consumes approximately 150 L of oil, each square meter emits CO2 emissions of about half a ton, and consumes energy of about 5745 MJ This ratio varies based on different shapes and designs.

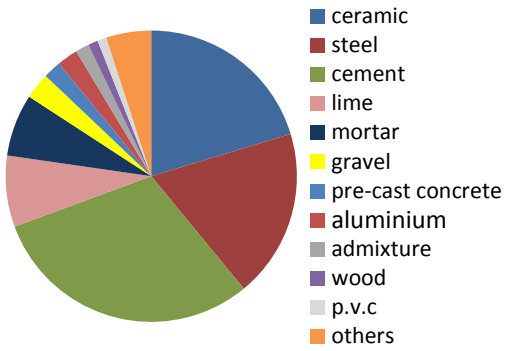
1 Sayigh 2014

2 Construcción e impacto sobre el ambiente: el caso de la tierra y otros materiales 2001

In general, the usage of materials alternative to conventional concretes such as (vacuum tiles - treated straw) instead of ordinary concrete can save up to 20% [3]of the cumulative amount of energy over 50 years for example when using recycled aluminum and Steel it saves 50% of energy consumption. **Figure 1**& **Figure 2** shows the side effects of consumption of energy and carbon emission of different materials



(Figure 1) Consumption of building materials from energy sources\M^2



(Figure 2) Impact of carbon emissions of different materials in the construction sector

Source: (Life cycle assessment of building materials2011)

2. Evaluation of environmental specifications building materials:

The aim of this study is to evaluate environmental standards of (energy consumption water and analysis of the potential) and the study will verify the characteristics of many of the materials used in the construction process, **(Table 1)** show Environmental assessment of different traditional construction material.

Building product	**Thermal conductivity** (W/mK)	**Primary energy** (MJEeq/kg)	**Global Warming Potential** (kg CO2eEq/kg)
Ordinary brick	.95	3.562	0.271
Light clay brick	.29	6.265	-0.004
Ceramic tiles	1	15.649	.857
Fiber cement Roof slate	.5	11.392	1.392
cement	1.4	4.235	.819
Reinforced concrete	2.3	1.802	.179
concrete	1.65	1.105	.137
Sawn-timber ,softwood kiln dried	.13	20.996	.3
Reinforcing steel	50	24.336	1.526
Aluminum	239	136.803	8.571
Polyvinylchloride	.17	73.207	4.267

(Table 1) Environmental assessment of different traditional construction material .
Source (Life cycle assessment of building materials: Comparative analysis of energy and environmental impacts and evaluation of the eco-efficiency improvement potential 2011)
"Author Edit"

3 Life cycle assessment of building materials: Comparative analysis of energy and environmental impacts and evaluation of the eco-efficiency improvement potential 2011

(Cement products- concrete –Ceramic-Aluminum) is one of the largest construction elements affecting the environment negatively, cannot deny the waste sought them they are difficult to deal with or dispose of.

Without the slightest doubt dependence on natural material will create a purer and less severe environment in its environmental impact, wood is a natural material created by God Almighty and is considered an environmentally friendly material

3. Environmental impact of construction sector element:

It is necessary to know the environmental impact resulting from the use of these materials on the environment and to study them seriously, so it was necessary to know the detailed study of each of them on the environment by displaying different models

of design, space and use to know the architectural trends used to solve these environmental problems. **Figure3** shows (Co_2 emission), (**Figure 4)** shows (Greenhouse Gas)[4]

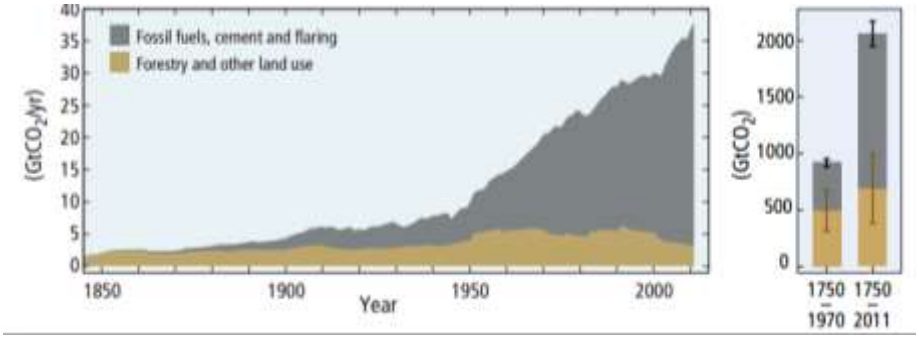


Figure 3 Global anthropogenic CO2 emissions Quantitative information of CH4 and N2O emission time series from 1850 to 2011

Source : (Climate change 2014 synthesis report summary for policy makers 2014)

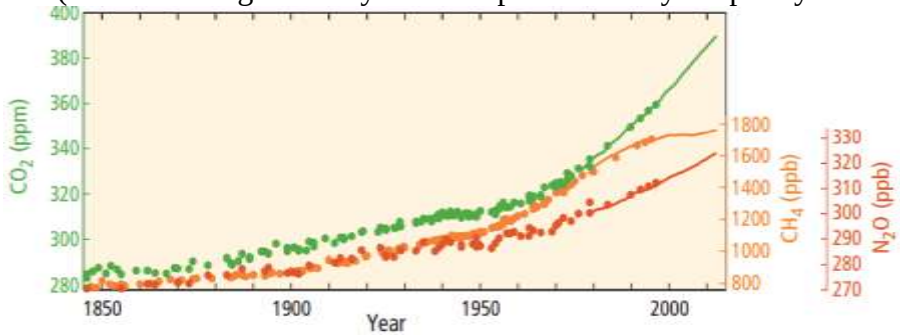


Figure 4 Globally averaged greenhouse gas concentrations

"Source : (Climate Change 2014 Synthesis Report Summary for Policymakers 2014)

3.1Futuristic risks and impacts caused by a changing climate:

Consumption varies from country or region to region according to many factors, including energy sources, products, specifications, differences in manufacturing and complications in economic activities, for example France relies heavily on nuclear energy while The Kingdom of Britain relies more on Gas and electricity, all organizations are not activities related to sustainable development to deal with substances that emit CO_2 emissions and this trend has become more supportive and organized**.(Figure 5)** show Annual anthropogenic CO_2 emissions

4 Climate change 2014 synthesis report summary for policy makers 2014

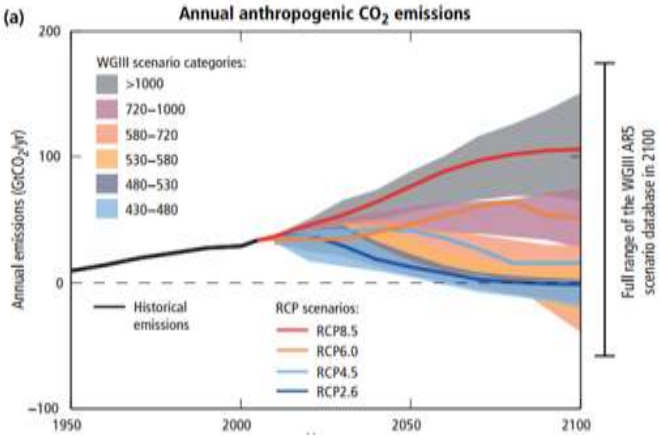


Figure 5 Annual anthropogenic CO2 emissions by 2100
Source :"Climate Change 2014 Synthesis Report Summary for Policymakers"

It is so hard to handle this upcoming crises without dealing with the major problem itself so we have to define a new way and method to solve the problem Now in an era where technology has been controlled in everything and in all areas, the architect or designer has to try as much as possible to take advantage of technology and use it as a tool of the design process.

The relationship between architecture and society is clearly demonstrated thought in meeting the needs of society. So one of the new trends call for attention not only to building or origin but also to the surrounding environment, alternative architecture is a redirect to architecture inspired by nature to use the environment as a source of inspiration not only for the form but also for the purpose of reaching the comfort for the user inside the building itself taking into account the environmental aspects.

4. The philosophy of architecture with environmentally compatible technology and its applications to local architecture:

The problem of Arab architecture in Arab world is multifaceted, where the architecture is linked to modernity, while civilization is formed by the products of interaction between the thought of man and its environment to meet its demands physical and spiritual needs.

"We need to understand architecture in the movement of human civilization and that architecture is the union of man and technology together." And it's not just technology[5]."

The architect Hassan Fathy discovered that construction value of using of local building materials, walls, cellars and domes from local materials and knew how to deal with nature and climatic, in order to get in touch after it dries, when choosing an alternative construction method must be suitable for the conditions in which the origin is located, we cannot use methods of creation that are not suitable for origin, activity or surrounding nature.

Alternative architecture agreed with the traditional architecture advocated by the great architect in addition to the changes that technology has added to architecture in recent times it is the solution of the problem environmentally friendly design,

The following projects **(Table 2)** show the great effort of Fathi as an architect trying to solve environmental problems with local material and design.

5 Architecture for People: The Complete Works of Hassan Fathy paperback 1997

Name	Dar al-Islam village	School al-fares
Location	Abi-quiu united states of America	Fares , Egypt
Architect	Hassan fathy	Hassan fathy
Date	1980	1957
Building type	Religious , urban design	Educational
Building usage	Mosque	High school
Description		
• The mosque was built by and for a new experimental community • low-technology building techniques of vault and dome construction used in upper Egypt. Constructed entirely with mud brick   Source :agha khan organization		• Was built as anew experimental community that was instructed by fathi by using low technology • constructed entirely by mud brick of vault and dome used in upper Egypt  Source :agha khan organization

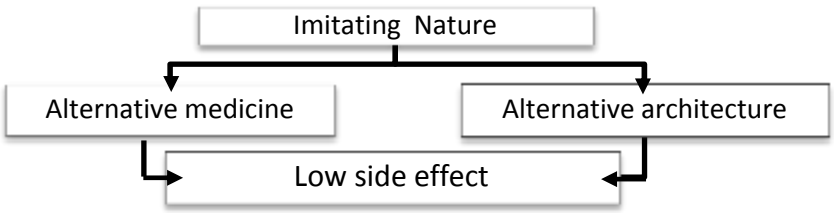
(Table 2)" hassan fathi" trying to solve environmental problems with local material
Source : Author

5. Alternative medicine, alternative architecture and call to return to original " Mother of Nature "

Alternative medicine ،alternative architecture both of them supports {the call to return to the original} The idea of alternative architecture addressed by the research is a confirmation of the call for alternative medicine and access to the link between human environment in various fields. **(Figure 6)** Show The aim of getting back to nature in "Alternative medicine and architecture

Where the world is interested in the present to return to preservation and sustainability of environment, hence the appearance of this concept "alternative architecture", which It aims to meet the needs of future generations without harming the environment, an invitation that is not limited to one of the specific sciences, but its goal is the whole society and in all fields

We cannot deny that contemporary technological progress has many advantages, it became necessary for man to adjust the rates of rapid change in different fields, and unfortunately we also in the developing world have become unable to resist the temptations offered by technology unaware Its dimensions are on the fabric of our culture

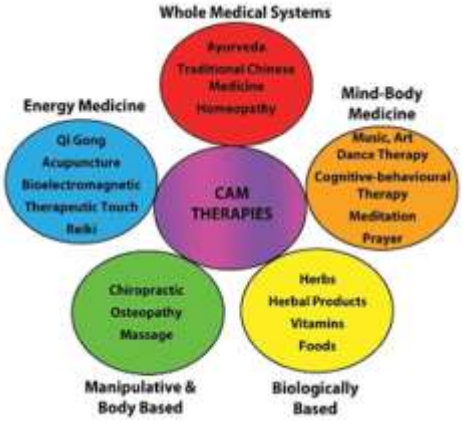


(Figure 6) The aim of getting back to nature in "Alternative medicine and architecture "
Source "Author"

5.1Alternative medicine:

Alternative medicine is a term that describes medical treatments that are used instead of traditional (mainstream) therapies.it is a method of medicine aimed at obtaining satisfactory results For many pathological conditions, but back to the origin of the thing "returning to the original", the beginning of everything created by God almighty lies from nature More than half of adults in the United States say they use some form of alternative medicine The definition changes as doctors test and move more of them into the mainstream Such as "Acupuncture - Chiropractic Medicine Energy Therapy (Magnetic Field Therapy) - Herbal Medicine- Ayurvedic Medicine" , (Figure 7) show Methods used by alternative medicine and achieved by natural methods of the bond between the body and the soul

Alternative medicine or complementary medicine is a different treatment method from modern or traditional medicine offered by doctors in their traditional clinics. This area is also based on the close relationship between the soul so it isn't harmless sometimes alternative medicine is supplemented by modern medical methods, but this field still proves its efficiency and success because it is far from chemicals.



(Figure 7)

Methods used by alternative medicine and achieved by natural methods of the bond between the body and the soul

Source :" www.alternativemedicine.com "

- Alternative Medicinal definitions:

Chiropractic Medicine: This practice focuses on the body's structure mainly the spine and how it functions.

Magnetic Field Therapy: These focus on the energy fields many people believe exist in and around the body. Included in this category are Magnetic Field Therapy

Ayurvedic Medicine: one of the world's oldest medical systems. It started in India more than 3,000 years ago till no

5.2Alternative architecture:

Specialists have warned of the standard methods used in the construction processes currently dependent on the improper exploitation of natural resources in addition to the harmful pollutants caused by the construction method are only a time bomb, which will accelerate in the explosion.

that is why we started The spark of { alternative architecture} inspired by {alternative medicine} and {complementary medicine} trying to solve The problem of mankind with nature needs to be given the status Continuity, so alternative architecture an approach ensures the building is designed in a way taking into account the reduction of energy consumption and the negative impact of the use of

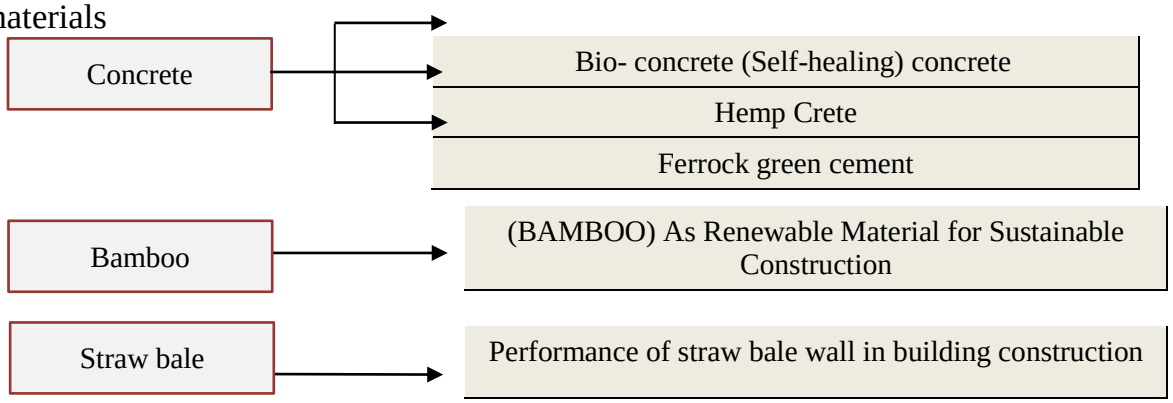
construction materials not also increasing compatibility of designs with ecological aspects within the architectural design process, which respects the surrounding environmental aiming to create a healthy and safe society , **(Table 3)** illustrates comparison the similarities between alternative medicine and alternative

	Alternative medicine	Alternative architecture
Users	Patients – Doctors	Current generations - future generations - architects
Imitating Nature	Medical practices do not depend on chemical intervention	Dealing with problems by nature simulation methods of form- function - form and function
Conclusion	Treatment of a lot of (diseases) without chemical intervention and without side effects	Access to an environmentally friendly design guided by the consumption of energy sources already in effect

(Table 3) comparison illustrates the similarities between alternative medicine and alternative architecture "Author"

6. Alternative architectural materials simulating nature in architecture:

Simulation is about (imitation-copying-and building) the essence form or function from images that reflect that origin. Or biologically inspired designs and learning from their balanced genius and aesthetics, such as the nature of systems (Materials-processes and structures) which have long been the best way to inspire solutions to the needs of successive generations, involve solutions to design problems through Simulation of architecture with nature. This is done through imitations (material shapes, models, systems, mechanisms of action and ecosystems) that meet design challenges more sustainably and effectively. It depends on the establishment of a creative dialogue between the original and its image, allowing the field of creativity. To achieve full awareness of the problems of the environmental issues and the growing importance of alternative architecture 's role in building sector which is the bond between Architecture and Nature Science, as shown in this study there is some materials contribute more than others in negative environmental influence such as (concrete products) that is why we need to find a new way to deal with the problem Ecology and Biomimetic show **(Figure8)** Alternative Eco-friendly building materials



(Figure 8) Alternative Eco-friendly building materials
Source "Author"

i. Concrete:

[O] Bio-concrete bacteria-based self-healing concrete

Globally cement production in 2015 accounted for approximately 8% of total carbon [6]dioxide (CO_2) emissions. A number of studies reported that under certain circumstances, small cracks in concrete. Can be heeled by adding bacteria as self-healing agent, **(Figure9)** shows concrete beam specimen with small cracks from day 1 till day 91 has also been considered in a number of published studies the potential of calcite precipitating bacteria for concrete or limestone surface, The Mechanism or (self-healing) agent in Bio-concrete should comply with all or most of the following:[7]

1. Should be able to seal or plug freshly formed cracks to reduce matrix permeability
2. Must be incorporated in the concrete matrix and able to act autonomously to be truly "self-healing"
3. Must be compatible with concrete, i.e. its presence should not negatively affect material characteristics
4. Should have a long-term potential activity, as concrete structures are built to last typically for at least 50 years[8]
5. Must not be too expensive to keep the material economically competitive, **Figure (10& 11)** Shows Scenario of crack-healing by bacteria concrete.

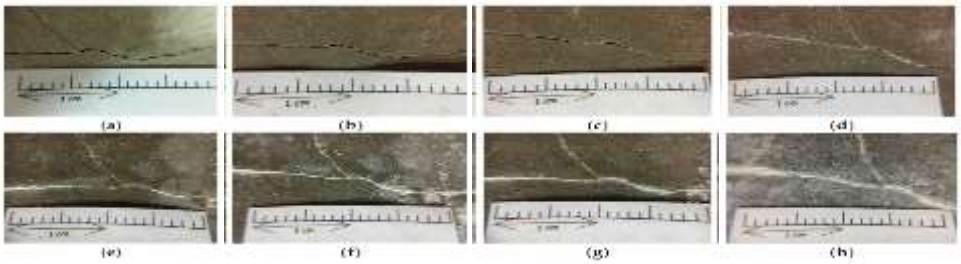
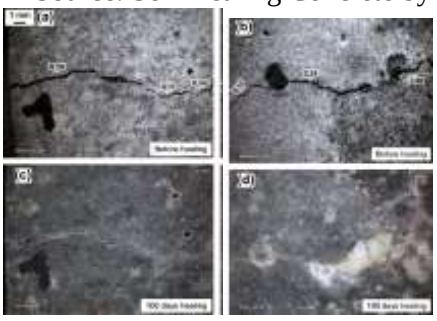
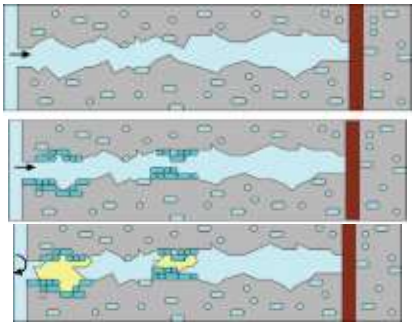


Figure 9 concrete beam specimen with small cracks (Experimental group II): (**a**) Day 1; (**b**) Day 3; (**c**) Day 7; (**d**) Day 14; (**e**) Day 21; (**f**) Day 28; (**g**) Day 56; (**h**) Day 91
Source: Self-Healing Concrete by Biological Substrate Published: 8 December 2019



(Figure 10) Scenario of crack-healing process in control mortar specimen before (a) and after 100 days healing and after 100 days healing (d).



(Figure 11) Scenario of crack-healing by concrete-immobilized bacteria. Bacteria on fresh crack surfaces become activated

Source :Quantification of crack-healing in novel bacteria-based self-healing concrete 2011

6 Self-Healing Concrete by Biological Substrate Published: 8 December 2019
7 Quantification of crack-healing in novel bacteria-based self-healing concrete 2011
8 Cement production technology improvement compared to factor 4 objectives, Habert G, Billard C, Rossi P, Chen C, Roussel N.. Cement and Concrete Research 2010

[P] Hemp-Crete

Hem-pcrete is a natural building material, it is a bio-composite made of the inner woody core of the hemp plant mixed with a lime-based binder. The hemp core or "Shiv" has a high silica content which allows it to bind well with lime. This property is unique to hemp among all natural fibers. The result is a lightweight cementitious insulating material weighing about a seventh or an eighth of the weight of concrete. Fully cured hemp-Crete blocks float in a bucket of water. It is not used as a structural element, only as insulating infill between the frame members though it does tend to reduce racking. All loads are carried by internal framing. Wood stud framing is most common making it suitable for low-rise construction [9], shows **(Figure12)** Details of non-load bearing wall made of hemp-Crete & **(Figure 13)** shows hemp-crete installation at the Highland Hemp House Project in Bellingham

(Figure12) Details of non-load-bearing walls made of hemp-Crete blocks: (a) wall erection; (b) side view; (c) front view

(Figure 13 Hemp-crete installation at the Highland Hemp House Project in Bellingham

Source: Life cycle assessment of building materials: Comparative analysis of energy and environmental impacts and evaluation of the eco-efficiency improvement potential published 2017

[Q]Ferrock green cement

Ferrock, an innovative iron-based binding compound, presents a carbon-negative alternative to cement that utilizes a variety of waste streams to produce a versatile building material The name(Ferrock) is a reflection of its composition – largely iron-rich ferrous rock. It's actually created from waste steel dust which is normally discarded from industrial processes and silica from ground up glass more flexible and greener concrete **(Figure 14)** shows "Ferrock" green cement material, The iron within the steel dust reacts with $C0_2$ and rusts to form iron carbonate its properties:[10]

1. Ferrock is actually five times stronger Compared to Portland cement.
2. It can withstand more compression before breaking and is far more flexible, meaning it could potentially resist the earth movements.
3. it becomes even stronger in salt water environments, making it ideal for marine-based construction projects.
4. Ferrock actually absorbs large amounts of $C0_2$ and binds it.

9 Life cycle assessment of natural building materials: the role of carbonation, mixture components and transport in the environmental impacts of hempcrete blocks 2017

10 Ferrock: A Life Cycle Comparison to Ordinary Portland Cement 2017


(**Figure 14)**"Ferrock" stronger, more flexible and greener concrete
Source : Ferrock: A Life Cycle Comparison to Ordinary Portland Cement 2017

ii. Bamboo (BAMBOO) As Renewable Material for Sustainable Construction.

Bamboo as a natural raw material existed together in the world since the days of man on earth state the fact that bamboo has a natural raw material and a strong capability to that of wood, bricks, also as strong as steel, and it is environmental friendly,

Environmentally bamboo reduces the use of timber consumption in construction as expressed prior, it naturally has a waxy surface which does not oblige paint and this makes it free from health hazards brought about by paints. Because of its quality and strong ability studies have demonstrated that bamboo can be utilized as reinforcement for concrete, and these will diminish the pollution waste of steel factories in Nigeria **(Figure 15)** shows the bamboo application

Advantages of Bamboo as Structural Material:[11]

1. It is a sustainable material. Besides being a renewable resource, it is also the world's fastest growing woody plants. It grows 3 times faster than most other species and usually only takes 3 – 6 years
2. It is an environmental-friendly construction material. Bamboo is a good carbon sequestration agent as it can sequester as much as 12 tons of CO_2 per hectare. Besides, it also generates almost 35% more oxygen than equivalent stands of trees. With this feature, it was believed that bamboo can play a role in climate change and protecting the environment.
3. Bamboo is an economical material as it costs lower than most of the construction materials, such as steel. While having comparable strength, less energy is required to harvest and transport bamboos, thus manufacturing costs would be much lower compared to steel.
4. Bamboo on the other hand, has the lowest production energy-to-stress ratio. This shows that bamboo structures are highly energy saving compared to steel structures, with 98% energy saving in terms of production energy.
5. Bamboo has been proven to have high tensile strength.



Bamboo in interior as flooring Bamboo wall for temporary design Bamboo Roofing samples

11 Bamboo (The Emerging Renewable Material for Sustainable Construction 2019


Figure 15 Bamboo scaffolding. Reproduced from Correal, J.F., 2016. Bamboo design and construction. In: Harries, K.A., Harma, B. (Eds.), Nonconventional and Vernacular Construction Materials.
Source "Bamboo: The Emerging Renewable Material for Sustainable Construction2019"

bamboo compared to other building materials, steel has the highest production energy-to-stress ratio, followed by concrete and wood as shown in **(Table 4)**

Material	Energy for production (kg\m^3)	Production energy to stress ration
Steel	234.000	1500
Concrete	1920	240
Wood	600	80
Bamboo	300	30

Table 4 energy for production of different building material
Source "Bamboo: The Emerging Renewable Material for Sustainable Construction2019

Future Directions in Structural Bamboo Research:

Bamboos, which is organic in nature, is highly susceptible to especially in tropical countries with hot and humid weather like Malaysia. Also, actual sized bamboo structures must be erected and the structural integrity must be monitored continuously for 5–20 years.

iii. Straw bale: Performance of straw bale wall in building

(Figure 16) Map of the global diffusion of straw bale buildings around the world
Source:" An innovative straw bale wall package for sustainable buildings: experimental characterization, energy and environmental performance assessment November 2019

It can be observed that the majority of straw buildings are concentrated in the countries where a regulation on this kind of construction exists, as shown in **(Figure 16)** The country with the largest amount is USA, with 784 buildings followed by France with 700. In these countries also the census at national level is more accurate and the numbers are surely more realistic [12]. Straw is a waste material from cereal

12 Performance of straw bale wall: A case of study 2011

harvest, made up of dead stalks of cereal plants. This by-product of cereal farming can be re-grown annually and it so that their use in building construction can give a valuable contribution to sustainability, Since the 80 Northern Europe and United Kingdom witnessed to the spread of many straw bale constructions.

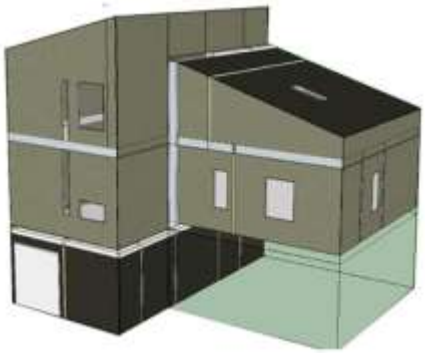
7. Energy simulation and case study

The envelope was designed according to the "post and beam" technique. The building will be built in the area of Pescara, a city located in central Italy. The analysis of energy saving potential of the building provided with the new wall package was carried out comparing its energy performance, (Table 5) case study parameters & **(Figure17)**The case study: render and IDA ICE model Pescara ,Italy

Additionally, the simulations were carried out in the IDA ICE 4.8 software environment the single family house consists of three floors, a basement, a ground floor and a first floor. (Table 6) presents the material of all the simulation element:

Parameters	Value
Model floor are (M^2)	266.6
Model ground area (M^2)	107.7
Model envelope area(M^2)	572.3
Window / Envelope (%)	3.5 %

Table 5 case study parameters



(Figure17) The case study: render and IDA ICE model Pescara ,Italy

Source:" An innovative straw bale wall package for sustainable buildings: experimental characterization, energy and environmental performance assessment November 2019

7.1 Case study material specification

The basement envelope	Concrete
Foundations	Concrete
Other external walls	Straw bales
The pitched roof	Wood with a layer of OSB insulating board
Windows	Triple glazing system filled with argon

(Table 6) the case study specifications

Source:" An innovative straw bale wall package for sustainable buildings: experimental characterization, energy and environmental performance assessment November 2019

7.2 Thermal properties of construction materials (SBB).

Thermal properties of whole construction material used in case study illustrated in**(Table7)**

Material	λ [W/mK]
Perforated brick partition wall	0.215
Concrete	1.700
Light insulation	0.036
Wood	0.120
Gypsum	0.220
Chipboard	0.130
Raw earth plaster	0.982
Straw bale "On Edge"	0.066

(Table 7) Thermal properties of construction materials (SBB).

Source:" An innovative straw bale wall package for sustainable buildings: experimental characterization, energy and environmental performance assessment November 2019

8. This following tables shows [Materials, equivalent carbon emission] of straw wall & traditional wall

a) Straw wall as an alternative way of construction method Materials, equivalent carbon emission **(Table 8)**

Straw wall	PHASES	EE (MJ)	GWP (kg CO_2)
Plaster and finishing	Production and transport	64 ˙312	4 ˙280
Straw		13 ˙100	378
Wood		64 ˙134	2 ˙550
Raw Earth based plaster		40 ˙750	2 ˙009
Electricity + Water	Construction at the yard Fuel Usage	26 ˙464	1 ˙474
Fuel		2 ˙165 ˙000	134 ˙500
Electricity		496 ˙000	27 ˙000
Total		**2 ˙869 ˙760**	**172 ˙191**

(Table 8) [[Materials, equivalent carbon emission] of straw wall

Source:" An innovative straw bale wall package for sustainable buildings: experimental characterization, energy and environmental performance assessment November 2019

b) Traditional wall construction method Materials, equivalent carbon emission **(Table9)**

Traditional wall	PHASES	EE (MJ)	GWP (kg CO_2)
Traditional Plaster	Production and transport	17 ˙370	2˙108
Thermos – block		141 ˙860	2 ˙290
Foamed polyurethane		111 ˙543	4˙443
Faced clay brick		138 ˙128	9 ˙590
Electricity + Water	Construction at the yard Fuel Usage	84˙122	2 ˙680
Fuel		2 ˙165 ˙000	133 ˙000
Electricity		496 ˙000	26 ˙850
Total		**3˙099 ˙520**	**180˙961**

(Table 9) [[Materials, equivalent carbon emission] of traditional wall

Source:" An innovative straw bale wall package for sustainable buildings: experimental characterization, energy and environmental performance assessment November 2019

Results:

Through the research study which aims to find alternative methods of design by:

(1) The tool of measuring any architectural proposal is to provide a distinctive environmental performance in accordance with the architectural approach must be based on:

- "Rationalizing energy consumption" which has been shown from the study the large amount consumed by the construction method.
- Control of waste from construction and resulting from a large amount of environmental pollution.

(2) Proximity to nature and imitating its behavior help to solve our environmental problems by careful study of the external environment and to come up with design determinants and link function and shape together.

(3) To achieve alternative architecture, it is necessary to integrate the architecture with all other sections between" structural engineering- mechanical- electrical, computer engineering" taking into account architectural aesthetic proportions

(4) Buildings that rely on alternative architecture they will save a lot in the future as the building depends on nature for the internal comfort of its users - and the use of natural energy sources in cooling and heating or operating **(Table 10)**

	The formal metaphor of nature and integration and harmony with it	**Simulation of the formal models of living nature**	**The integration of the built world and nature**	**Site topography simulation**
Field simulation Living Nature	Organic forms	Animal shape	Introduction of green spaces and water pools	A political shape.
	Flowing shapes	Plant shapes	Use of open spaces a tiered shape	Graded shape
	Dynamic shapes		Visual communication between inside and outside	
Field simulation systems Constructed in Nature Live	Simulation of living nature models in the composition of the structural structure (organic structures)	Simulation of living nature-constructing systems	Deriving and generating structures and biostructures	
	Flexibility	Integration of form with the constructed function,	integration of nature and technology	
	Continuity	Efficiency of power tolerance and load distribution		
Environmentally sustainable building decisions	Take advantage of nature's energies and materials, adopt interactive systems and integrate them with design systems			
	Integrating technical and technological solutions to create a balance between the natural and manufactured environment (architecture) Recycling of clean water - rainwater collection and reuse - solar energy exploitation (photovoltaic cells - use of solar breakers - interference and integration with nature			

(Table 10) Indicators and vocabulary of simulating living natural systems in environmental sustainability decisions Source: (author)

Recommendations:

In accordance with the importance of the research problem raised which negatively affects sustainability, which was addressed by the research and the need for research development in the field of construction I proposed these recommendations

(1) Developing local institution connected to international research centers to keep these new construction materials in consideration as it is cleaner and have The traditional material properties but in eco-friendly way achieving alternative architecture

(2) Scheduling the desired targets after 2030 countries must begin to solve their problems to reduce carbon emissions.

(3) Attention to the application of energy saving codes and building conservation

(Table11) shows The proposed method suggested for designing entrance to simulate nature in alternative architecture

Alternative architecture ⟷ Architect				
1. The most effective indicators in the field of natural simulation				
Formal alignment with nature	**Inspired by plant nature**	**The integration between inside and out**	**Climatic alignment of approved forms**	**Using passive renewable energies**
2. The most effective indicators in the field of environmentally sustainable building decisions				
Use of window opening and closing control systems to control the amount of sunlight and wind direction			Use of window opening and closing control systems to control the amount of sunlight and wind direction	
The nature of the material or construction materials used			Ensuring the energy consumed by the building	
The expressive level of the building or location			Use of effective renewable energies (photovoltaic cells, thermal cells)	
3. The most effective indicators in the field of simulation of living nature systems				
Inspired by nature's nature			Materials or construction materials used	
Recycling of consumables			Belonging to biological principles	

4. Indicators selected as a design input for energy conservation	The side that achieves the highest percentage
a) Formal alignment with natural nature	Natural
b) Inspired by plant nature	Natural
c) Inspired by nature	Construction
d) The integration between inside and outside	Natural
e) Expressive level of building or location	The environmental side.
f) Nature of the material or construction materials use	Environmental construction
g) The extent of career coverage	All sides
h) Climatic alignment of approved forms	Construction
i) Belonging to biological principles	Construction
j) Recycling of consumables	Construction
k) Ensuring the energy consumed by the building	The environmental side.
l) The use of passive renewable energies	The environmental and natural aspect
m) Use of effective renewable energies (photovoltaic cells, thermal cells)	The environmental side
n) Use of window opening and closing control systems to control the amount of sunlight and wind direction	Environmental construction

(Table 11) (The proposed method of the design entrance to simulate nature)
Source: "author"

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