Sustainable architecture as a strategy to reduce the exacerbation of the problem of global climate change towards warming

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The research sheds light on the most important strategies that should be taken into consideration within the international protocols to contribute to reducing the causes of the aggravation of the problem of climate change towards the greenhouse effect, because of the economic, environmental and political effects of this problem that were directly and indirectly reflected on the fate of man and his future.

The research reviewed, analyzing the relationship between the excessive use of fossil fuels as a dependent variable, and the amount of electrical energy produced as an explaining variable, as well as the relationship between the effect of fossil energy consumption as an explaining variable and the level of concentration of heat-retaining air pollutants within the Atmosphere represented by greenhouse gases (GHG) , which in turn is divided into **chlorofluorocarbons** (CFCS), **hydrochlorofluorocarbons** (HCFCS), and **hydrofluorocarbons** (HFCS) as dependent variables for the period from the late nineteenth century to the beginning of the twentieth century, as the acceleration in the production of huge quantities of gaseous pollutants added to The Atmosphere - an inevitable, indirect result of the spatial and climatic inadequacy for the implementation of architectural design curricula as one of the most important determinants of the level of electrical energy consumption and dependence on fossil energy, starting from the Renaissance architecture to the products of modern architecture to postmodern architecture.

The architectural implementation process for design approaches was taken Motives and justifications for its design characteristics that depend on functional requirements, away the climatic aspects of spatial convenience, climatic adaptation, which created building that cause more damage to the environment directly and indirectly, as it created a building which are inefficient in energy consumption due to the absence of climate control with autonomous systems related to the (design and planning) characteristics of the building, which negatively affected the level of thermal performance, and the efficiency of the thermal performance of the building.

With this Effective systems have replaced autonomous systems in climate control in architecture, those systems that depend on air conditioning and heating devices, which increased the architecture's consumption of electrical energy, and from here the research justifications came to make the philosophy of ecological architecture with its different names (sustainable design, zero-energy architecture, and green architecture) - a tool for rebalancing global ecosystems, which can contribute to reducing one of the most important causes of accelerating climate change towards global warming in the future. The research ends with a set of results and recommendations that can be summarized as follows:

1-The architectural design curricula of the Renaissance and modernity stages have increased the concentrations of greenhouse gases, due to the increase in their consumption of fossil energy at a rate that ranged between (30-100%) compared to the energy-efficient architecture model, due to the

increasing loads for the purposes of meeting comfort requirements. The bioclimatic, and visual comfort for the occupants of the building, as the rates of energy consumption ranged (10-20%), (5-7%), and (3-14%) for heating, ventilation, and lighting, respectively.

2- The increase in the consumption of fossil energy for the purposes of climatic adaptation of architecture means an increase in the emission of heat-retaining gases, especially carbon dioxide and sulfur, as the fossil energy, especially oil, ranges in percentage of carbon between (83-87%), and sulfur between (0-4). As for coal, carbon ranges between (70-90%) and sulfur ranges from (0.5-5%), and accordingly the concentration of carbon dioxide in the atmosphere has increased from (280) parts per million before 1750 to (510) (part per million, which is expected for the year 2100, and this has caused an acceleration in the temperature of the Earth's atmosphere during the period (1990-2001) to range between (1.4-5.8 °C), while the relative rise in the average temperature for the period (1850-2014)) did not exceed (0.8 °C).

3-Sustainable architecture is one of the most important place-making strategies that are least damage environmental systems, especially climatic systems - and from this point of view, green architecture is one of the most important strategies that can determine the level of thermal energy balance within the Atmosphere, and thus contribute indirectly to reducing the aggravation of the problem Climate change to warm.

4-Architectural design approaches should be re-evaluated to ensure climate adaptation according to the characteristics of global climatic regions in order to find designs and a planning pattern for zero-energy architecture.

5-Subjecting the implemented architectural design approaches to LEED standards and on an annual basis for the architectural projects being implemented to ensure the implementation of the most adaptive and climatic environmental architectural designs and the least environmental damage, and to obligate countries to ecological architectural design standards within the Kyoto Protocol (UNFCCC) and the Paris Convention (UNFCCC). and others.

Keywords: climate change, sustainable architecture, green architecture, zero energy architecture

العمارة المستدامة كستراتيجية للحد من تفاقم مشكلة تغير المناخ العالمي نحو الدفء

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يسلط البحث الضوء على أهم الاستراتيجيات التي ينبغي أخذها بالاعتبار ضمن البروتوكولات الدولية للمساهمة في الحد من أسباب تفاقم مشكلة تغير المناخ نحو الدفء، لما لهذه المشكلة من آثار اقتصادية و بيئة و سياسية انعكست بشكل مباشر وغير مباشر على مصير الانسان و مستقبله.

أستعرض البحث محللاً العلاقة بين الافراط في استخدام الوقود الاحفورية كمتغير (تابع)،وكمية الطاقة الكهربائية المنتجة كمتغير (مفسر)، كما استعرض العلاقة بين أثر استهلاك الطاقة الأحفورية كمتغير (مفسر) ومستوى تركز الملوثات الهوائية الحابسة للحرارة ضمن الغلاف الغازي و المتمثلة بالغازات الدفيئة (GHG) ،و التي تنقسم بدورها الى المركبات الكلورفلوركاربون (CFCS) ،ومركبات الهيدروكلوروفلوروكاربون(HCFCS)، ومركبات الهيدروفلوروكاربون (HFCS) كمتغيرات (تابعة) للمدة من اواخر القرن التاسع عشر الى بداية القرن العشرين ، اذ كان التسارع في انتاج كميات هائلة من الملوثات الغازية و المضافة الى الغلاف الغازي - نتيجة حتمية غير مباشرة لعدم الملاءمة المكانية و المناخية لتنفيذ مناهج التصميم المعماري كأحد أهم العوامل المحددة لمستوى استهلاك الطاقة الكهربائية و المعتمدة على الطاقة الأحفورية ،ابتداءً من عمارة عصر النهضة الى نتاجات عمارة الحداثة الى عمارة ما بعد الحداثة ، أذ اتخذت عملية التنفيذ المعماري لمناهج التصاميم دوافع و مسوغات لخصائص تصميمها مختصرة على المتطلبات الوظيفية مبتعدة بذلك عن الملاءمة المكانية ذات المغزى المناخي (التكيف المناخي) ،مما اوجد عمارة أكثر ضرراً على البيئة بشكل مباشر و غير مباشر، كما اوجد عمارة غير كفوءة في استهلاك الطاقة بفعل غياب التحكم المناخي بالأنظمة الذاتية ذات الصلة بالخصائص (التصميمية ،و التخطيطية) للعمارة ،مما انعكس سلبا على مستوى الاداء الحراري ، وكفاءة الاداء الحراري للعمارة، وبهذا حلت الانظمة الفعالة محل الانظمة الذاتية في السيطرة المناخية في العمارة ،تلك الانظمة التي تعتمد على اجهزة التكييف و التدفئة ،مما زاد من استهلاك العمارة للطاقة الكهربائية، ومن هنا جاءت مسوغات البحث لتجعل من فلسفة العمارة الايكولوجية باختلاف مسمياتها (التصميم المستدام ،و العمارة صفرية الطاقة، والعمارة الخضراء)- اداة لإعادة توازن الانظمة البيئية العالمية و التي يمكن أن تسهم في الحد من أحد أهم مسببات التسارع في تغير المناخ نحو الدفء مستقبلا.

اخلص البحث الى جملة نتائج و توصيات يمكن ايجازها على النحو الاتي:

1- لقد عملت مناهج التصميم المعماري لمرحلة عصر النهضة، ومرحلة الحداثة على زيادة تراكيز الغازات الحابسة للحرارة، وذلك بفعل تعاظم استهلاكها للطاقة الأحفورية بنسبة تراوحت بين (30-100%)مقارنة مع نموذج العمارة الكفؤة لاستهلاك الطاقة، بفعل تزايد الاحمال لأغراض تلبية متطلبات الراحة البايومناخية ،والراحة البصرية لشاغلي العمارة ،اذ تراوحت نسب استهلاك الطاقة (10-20%)،و(5-7%)،و(3-14%) لأغراض التدفئة، والتهوية، والاضاءة على التتالي.

2- ان التزايد في استهلاك الطاقة الأحفورية لأغراض التكيف المناخي للعمارة يعني تزايد في انبعاث الغازات الحابسة للحرارة وبخاصة ثاني اوكسيد الكاربون و الكبريت ،اذ ان الطاقة الأحفورية وبخاصة النفط تتراوح نسبة الكاربون فيها بين (83-87%)،والكبريت بين(0-4%) ،اما الفحم الحجري يتراوح فيه الكاربون بين (70-90%)والكبريت يتراوح نسبته(0.5-5%)،وتبعا لذلك ارتفع نسبيا تركيز غاز ثاني اوكسيد الكاربون في الغلاف الجوي من (280)جزء بالمليون قبل عام 1750 الى (510)جزء بالمليون وهو المتوقع لعام 2100، وقد تسبب ذلك في تسارع ارتفاع درجة حرارة الغلاف الجوي للأرض خلال المدة (1990-2001)ليتراوح الارتفاع بين (4.1-8.5م°) ،في حين ان الارتفاع النسبي لمعدل درجة الحرارة للمدة (1850-2014) لم يتجاوز (0.8م°).

3- تعد العمارة الخضراء أحد أهم استراتيجيات صناعة المكان الاقل ضرراً على الانظمة البيئية وبخاصة الانظمة المناخية– ومن هذا المنطلق تعد العمارة الخضراء أحد أهم الاستراتيجيات التي يمكن ان تحدد مستوى توازن الطاقة الحرارية ضمن الغلاف الغازي، وبالتالي تسهم بطريقة غير مباشرة في الحد من تفاقم مشكلة تغير المناخ نحو الدفء.

4- ينبغي أن يعاد تقييم مناهج التصميم المعماري بما يضمن التكيف المناخي وفقاً لخصائص الاقاليم المناخية العالمية بهدف ايجاد تصاميم ونمط تخطيط للعمارة صفرية الطاقة.

5- اخضاع مناهج التصميم المعمارية المنفذة لمعايير النظام (LEED) وبشكل دوري سنوي لما يتم تنفيذه من مشاريع معمارية لضمان تنفيذ التصاميم المعمارية البيئية الاكثر تكيفاً مناخياً و الاقل ضرراً بيئياً، والزام الدول بمعايير التصميم المعماري الايكولوجي ضمن بروتوكول كيوتو (UNFCCC) ،واتفاقية باريس (UNFCCC) .

<u>الكلمات المفتاحية</u>: تغير المناخ ، العمارة المستدامة، العمارة الخضراء، العمارة صفرية الطاقة

Introduction:

The issue of global climate change has received the attention of political and economic decision-makers on a local, regional and global scale, although all the proposals to limit the exacerbation of the problem of climate change have not developed clear-cut strategies to be included in international protocols, and this was only due to political pressures at times and economic pressures at other times. Others, which prompted the direction of putting forward ideas of local specificity that lacked comprehensiveness and universality in vision and treatment.

Hence the importance of the research emerged to shed light on a global issue that needs an objective presentation of a number of strategies with a global vision for one of the most important contemporary human activities represented by sustainable architectural design with its holistic philosophy so that sustainable architecture occupies a distinctive position in solving the problems of the global environment, by employing the characteristics of that architecture according to the characteristics of regional climate to establish a strategy to control the issue of global climate change towards the greenhouse through energy efficient architecture.

Accordingly, **the research problem** was posed in the form of questions centered on the following points:

1- Does energy-efficient architecture have a role in limiting the aggravation of the problem of excessive emission of greenhouse gases worldwide?

2- Is there a causal relationship between the variable of the amount of energy consumption in architecture as a dependent change, and the variable of the level of control of self-design and planning systems at the implementation level as an explanatory variable?

3- Is there a causal relationship between the variable of the level of control of autonomous systems designing and planning, at the implementation level as an explanatory variable - and the level of greenhouse gas emissions as a dependent change?

4- Did the philosophy of sustainable architecture include theses that are strategic alternatives to contribute to limiting the aggravation of the global climate change problem towards the greenhouse?

Accordingly, the research **hypotheses** were put forward in the form of temporary answers to the research problems, which revolve around the following points:

1- Energy-efficient architecture has a role in limiting the aggravation of the problem of emission of greenhouse gases worldwide.

2- The variable of the amount of energy consumption in architecture is related to the variable of the level of control of autonomous systems (design and planning) at the level of implementation.

3- Neglecting the level of control of the autonomous systems (designing and planning) at the implementation level had a role in increasing the emissions of greenhouse gases.

4- The philosophy of sustainable architecture included theses that are strategic alternatives to contribute to limiting the exacerbation of the global climate change problem towards the greenhouse that needs periodic academic evaluation of architectural design curricula to make it a sustainable design.

For the purpose of subjecting the research hypotheses to scientific analysis to prove their proof or falsity, the research followed the descriptive analytical approach in reviewing the research variables with the aim of linking, analyzing and evaluating alternatives to identify strengths and weaknesses within three strategies that can be adopted within international protocols to enhance options to contribute to limiting the aggravation of the problem Global climate change is the core objective of the research.

1-The first axis: global trends in the level of fossil fuel consumption Fossil fuel energy

used in economic activities after the industrial revolution is one of the non-renewable sources, which include coal, oil and natural gas[1], as hydrocarbon energy is produced by the union of hydrogen with carbon [2]. Our world today is going through a stage of significant growth in consumption of non-renewable energy that predicts consequences worth stopping and looking to the future with an objective scientific view, as statistics have proven that the level of global energy demand for fossil fuels in the year (2020) tripled compared to the seventies of the last century. [3]

As a result of the composition of the materials that are included in the composition of fossil fuels represented by the carbon element, which ranges between (83 - 87%) [4], (70 - 90%) for each of oil and coal, respectively, as the fixed carbon content affects the energy content of coal The higher the fixed carbon content, the higher the energy content of coal [5], when coal is burned, all its constituent elements oxidize to appear in their oxidized forms at a rate ranging from (5-15%) of the initial weight of coal as fly ash in the form of gas emissions [6] .

The above explains the assertion of many scientists that the steady increase in the consumption of fossil fuels is the largest source of greenhouse gas emissions, burning which amounts to billions of tons of carbon annually causing an increase in the concentration of greenhouse gases[7]. **(see Figure 1).**

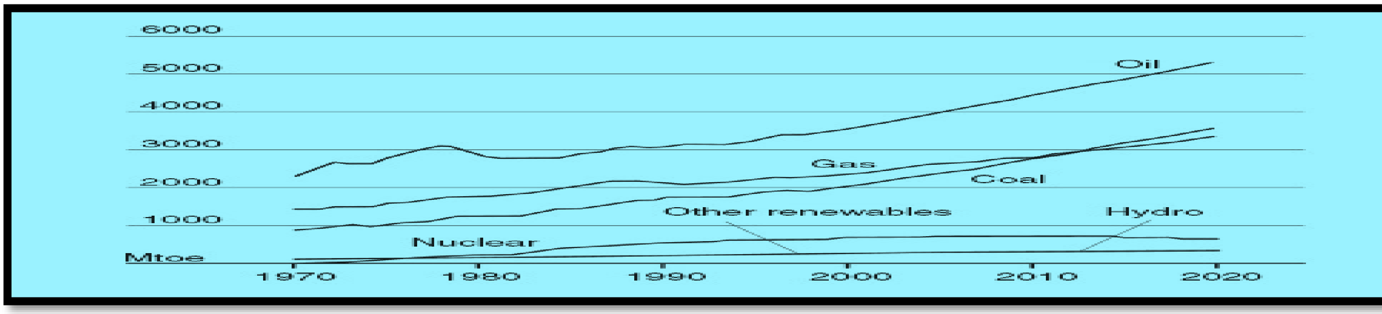

Figure (1) The trend of different energy consumption (fossil, hydrogen, renewable, and nuclear) from (1970 - 2020) in the world.

Source: Raghad Alaa Aboud, Design Processes for Zero Energy Buildings in Iraq, Master Thesis, Department of Architecture, University of Technology, 2012, p. 5.

2-The second axis: the characteristics of gaseous emission in light of the non-responsiveness of architecture design to the climate.

Many studies of sustainable architecture have put forward many models of energy-efficient architecture, represented by architecture Passive building, which is characterized by its relatively low energy consumption, while ensuring an acceptable level of bioclimatic comfort with minimal loads for heating and cooling purposes, due to the use of thermal insulation methods and a standard ventilation system according to climate-adapted design standards, in addition to introducing Models of zero energy building designs that guarantee zero consumption of fossil energy, and accordingly it is assumed that carbon emission will be zero over the operation of the architecture itself, in addition to putting forward models of energy plus building designs, a building that produces more energy than It is consumed based on the use of renewable energies available on the site by adopting low-energy architecture techniques such as insulation and orientation (8).

From the foregoing, it is clear that the trend towards energy conservation in architecture can be achieved by taking into account two variables. **Figure (2)** can be summarized as follows (9):

The first variable: It is represented in increasing technical efficiency and harnessing it to serve the architectural work, which is known as Active Systems, such as the emergence of modern adaptive devices that consume less energy compared to traditional devices.

The second variable: It is represented in reducing the need for energy consumption through climatic design, which takes the variable of climatic elements within design considerations during design, which is what is known as Passive Systems, despite the aforementioned architectural theses, which aim to reduce the consumption of electrical energy that depends on fossil energy, but its implementation is still limited to a limited scale due to economic, technological, scientific and cultural determinants ,This is reflected in the limited implementation of sustainable architectural projects that ensure efficient use of energy, that are concerned with self-processing and efficient systems, and consume less energy than similar buildings by a percentage ranging from (30 - 100%) [10].

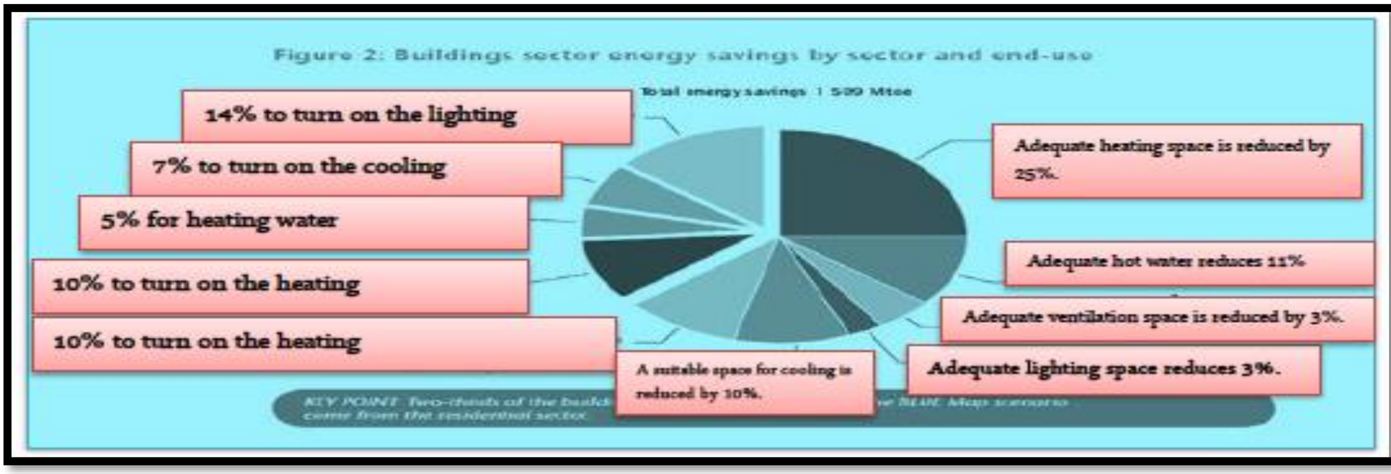

Figure (2) Functional classification of energy consumed in architecture.

Source: Raghad Alaa Aboud, Design Processes for Zero Energy Buildings in Iraq, Master's Thesis, Department of Architecture, University of Technology, 2012, p. 5.

Architectural engineering systems in developed countries have realized the importance of the human problem with nature in the need to give nature an adequate continuity as a source of life. Architecture with a climate-responsive design is ultimately an architecture designed in a manner that respects the environment. This early realization of the importance of climate design prompted the production of architectural designs with a high level of efficient thermal performance to meet the global challenge facing decision makers in architectural design to conserve resources and reduce environmental pollution resulting from traditional architecture, despite the difficulty of reaching a radical solution to the basic problems in the process of modern construction [11], Under the pressure of the rapid growth of urbanization and the development of human societies, which were accompanied by a number of architectural activities, which are characterized by the absence of a vision of climate design in most countries, especially the developing ones, and accordingly the inevitable result of development and growth and the need to meet the needs of new jobs is the increase in energy consumption in those countries, Consequently, the use of fossil fuels increased significantly, which led to the need to reduce its consumption. Architectural theses recommended the need to implement energy-efficient architecture, although its implementation is limited in developed countries [12].

The post-modern phase was characterized by overlap and conflict in its complex requirements within a single activity, and this characteristic became a feature accompanying the development of civilization[13], the world today is changing fundamentally and with a relatively large acceleration, and this was accompanied by unprecedented quantitative and qualitative transformations in architectural design, which calls for making an extraordinary effort to understand the process the ongoing change at the economic, social, cultural, and civilized level, and to identify the characteristics and direction of development of human societies so that architecture is consistent with and adapting to those changes [14].

The architectural revolution that took place at the beginning of the twentieth century and the accompanying social, economic and political developments and transformations focused on abandoning all traditional architectural styles[15], its infancy, the architecture of modernity produced works different from what was prevalent, architecture as an activity is a social art with complex functions. It is directly affected by the variables of public life, which reflected on its design problems, which created architectural designs that aim to meet multiple purposes[,(16)] according to different methods and approaches, in which the climate may be present as a variable sometimes and absent from it at other times [17].

Postmodern architecture has affected the Earth's environment in multiple ways, positively and negatively, according to the life style that architecture reflects_Life styles are a composite of motives, needs, and desires, and are influenced by factors such as culture, social level, and civilization. [18] the variation in the implementation of the climatic architectural design and its characteristics has a significant impact on the level of energy consumption, as the choice of the type and quantity of resources that are used in the architectural construction, which as a whole affects the amount of energy consumed to produce a single building and the emissions resulting from it, as well as its impact on operating energy through the level of performance With thermal conductivity and the possibility of recycling buildings [19].

Accordingly, the implementation of architectural projects varied according to the energy waste criterion, which created a difference in environmental problems. This is why the climate change agreement signed by most industrialized countries stipulated the determination of emissions from (Co_2), but most developed countries could not fulfill this agreement under the influence of the pressures on economic decision-makers, while developing countries lacked adherence to the standards of those agreements due to the lack of sufficient awareness of the importance of the environment at times, and the limited possession of advanced technology in the field of architecture at other times, so the problem of energy waste in architecture in developing countries is one of the most prominent environmental problems in addition to its problems economic due to the operation of architecture [20]. **See table (1).**

Table (1) Percentages of environmental pollution from construction and operation of buildings (pollution as a result of construction from overall pollution (%).

Pollution	Pollution as a result of construction of the overall pollution %
Air Purity (Cities)	24

greenhouse gases	50
Drinking water pollution	40
surplus land waste	20
HcFc2/cFc2 CFC/HCFC	50

Source: Raghad Alaa Aboud, Design Processes for Zero Energy Buildings in Iraq, Master's Thesis, Department of Architecture, University of Technology, 2012, p. 3.

Accordingly, a discrepancy appeared in the costs of maintaining the operation of the architecture, resulting from the variation in the amount of energy required to maintain the limits of bioclimatic comfort, which generates a variation in the amount of heating and cooling loads [21].

3-The third axis: the effect of the level of air pollution on the characteristics of the energy balance of radiation within the atmosphere

The atmosphere has undergone a profound change in the system, including the change in the concentrations of a mixture of gases, and the changing gases include water vapor (H_2o), carbon dioxide (Co_2), methane (CH_4), and nitrous oxide (N_2o), and ozone (O_3). [22] Which led to a change in the amount of absorbed rays from the long-wave terrestrial radiation [23], **see figure (3)**

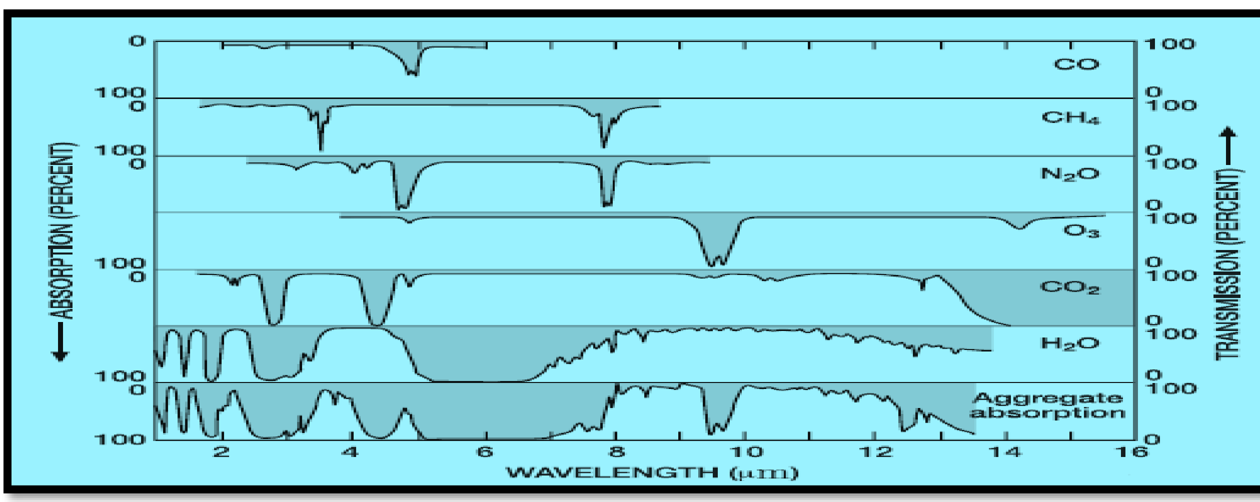

Figure (3) Absorption of energy from gases in terms of wavelength.

Source: Brasseur, G. P., and Solomon, S: Aeronomy of the Middle Atmosphere Chemistry and Physics of the Stratosphere and Mesosphere. 3rd ed. Springer, USA., 2005, p:651

Since there is a spatial discrepancy in the radiant energy emitted by the sun, there is a spatial variation in the amount of energy that is absorbed in the Earth system and the atmosphere into space, which has created a spatial discrepancy in the level of maintaining a state of energy balance to cover wavelengths of thermal infrared rays (**see Figure).** [24]

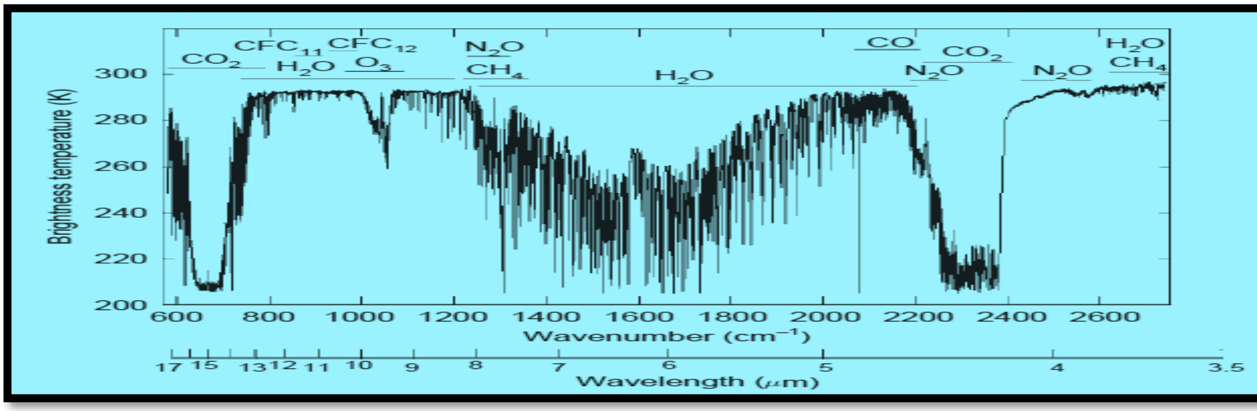

Figure (4) The absorption of long wave radiation occurs within a series of bands.

Source: Archer, D: Global Warming: Understanding the Forecast. University of Chicago press, USA., 2009, p: 220.

And according to the spatial variation of the emission of (Co_2), which is effective in absorbing shorter positive lengths within the radiation emitted from the earth, which carries a relatively higher energy. **see figure (5)**

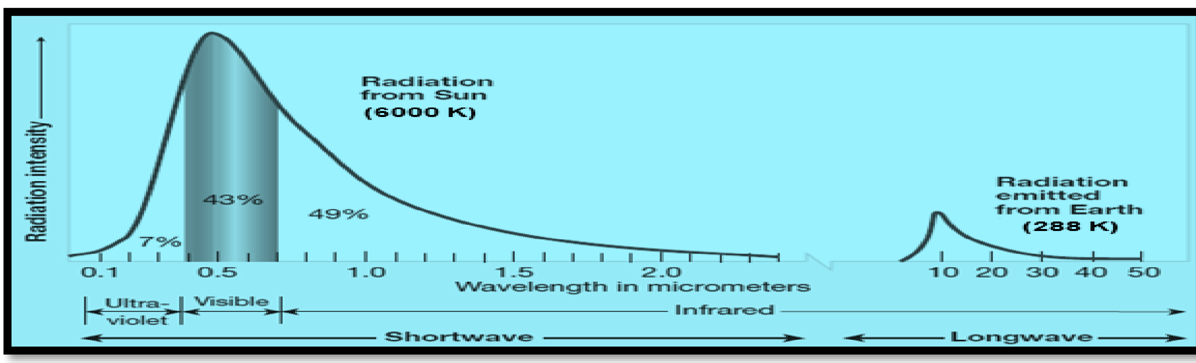

Figure (5) Comparison of the intensity of solar radiation and the radiation emitted by the Earth.

Source: Lutgens, F. K., and Tarbuck, E. J: The Atmosphere: An Introduction to Meteorology. 12th ed. Pearson Education, Inc, USA, ., 2013, p:533.

The terrestrial radiation budget for the surface and atmosphere (standard) is more complex than that of solar radiation due to the re-emission of radiation from the atmosphere, known as the greenhouse effect. (114) units of terrestrial or long-wave radiation emitted from the earth's surface; Of which, (102) units are absorbed by the atmosphere and the remaining (12) units are lost in space through the atmospheric window. The atmosphere retransmits (95) units to the Earth's surface, so the net long wave flux from the surface is only (19) units. The surface gains (49) units by solar radiation and therefore has a net excess of (30) units of total radiation (solar and land) To maintain the thermal balance of the surface, it is necessary to transfer this excess heat to the atmosphere by convection and by evaporation of water. The atmosphere absorbs (102) units of long-wave radiation emitted from the surface, but sends back (95) units to the surface and (57) units to space, including (48) units emitted by the atmosphere and (9) units emitted by clouds). Therefore, the atmosphere has a net long-wave radiation deficit of 50 units comprising (69) units of outgoing long-wave radiation minus 19 units representing the long-wave flux from the surface [25]. It should be noted here that the energy balance according to standard energy units is hypothetical rather than actually achieved. The reality includes a temporally and spatially different energy balance due to climatic and environmental variables that created a discrepancy in the amount of air pollutant concentrations, which architecture comes as one of the most important variables determining those pollutants, as The Earth's surface reflects only (9) units back into space, and thus the Earth's surface and the atmosphere must lose the necessary energy in order to maintain thermal equilibrium, Heat is at the same rate as it is absorbed by solar radiation [26], so the amount of long-wave radiation energy emitted and received by the Earth's surface is one of the most important factors explaining global warming and related to the change in the level of concentration of human and natural greenhouse gases [27]. Although the ratio of the absorbed and reflected solar radiation in terms of wavelengths by the layer of clouds and aerosols, and polluted gases (H_2o) ، (O_3) ،(Co_2)varies spatially and temporally at the global level, as there are second absorption bands Carbon dioxide is only in the infrared region, specifically in the areas (1-2, 2.05 - 2.7, 4.3 - 12.9 and 12.9 - 17.1 microns), as studies have proven that the strongest absorption area is at the wavelength (4.3 microns), and the importance of the wavelength beam increases between (12.9 and 17.1 microns), because it is a wide beam and in which the highest heat emission from the atmosphere occurs [28], and the absorption of long-wave radiation occurs in a series of wave beams [29] by secondary natural absorbers; Such as carbon monoxide and nitrogen oxide [30].

4-The fourth axis: the impact of the change in the energy balance in the atmosphere - on the level of climate change towards the greenhouse effect:

The spatio-temporal variation in the effectiveness of absorbing infrared wavelengths emitted from the Earth's surface is related to the spatio-temporal variation in the level of concentrations of heat-trapping gases, which was reflected on the spatio-temporal variation in the level of the Earth's environment temperature rising above its natural limits, which is related to a causal relationship with the use of fossil fuels and the burning of materials. Organic and anaerobic decomposition of organic matter by landfills and others [31]. That variance related to the gas life cycle $life\ cycle\ CO_2(LCCO_2)$, which represents the largest percentage among the greenhouse gases [32], which created a spatial and temporal variation in the level of environmental balance and the necessary extreme weather phenomena, and the increase in the number and intensity of storms, hurricanes, and forest fires And the occurrence of heat waves, drought and desertification, and the extinction of many living organisms [33], through the effect of the level of thermal emission of long-wave rays on the mechanism of cloud formation in the atmosphere, and therefore the formation of clouds is indirectly related to the level of concentration of many gases, foremost of which is gas Carbon dioxide CO_2, water vapor H_2O, nitrous oxide N_2O, methane CH_4, ozone O_3, and chlorofluorocarbons [34] **.(see Figure 6).**

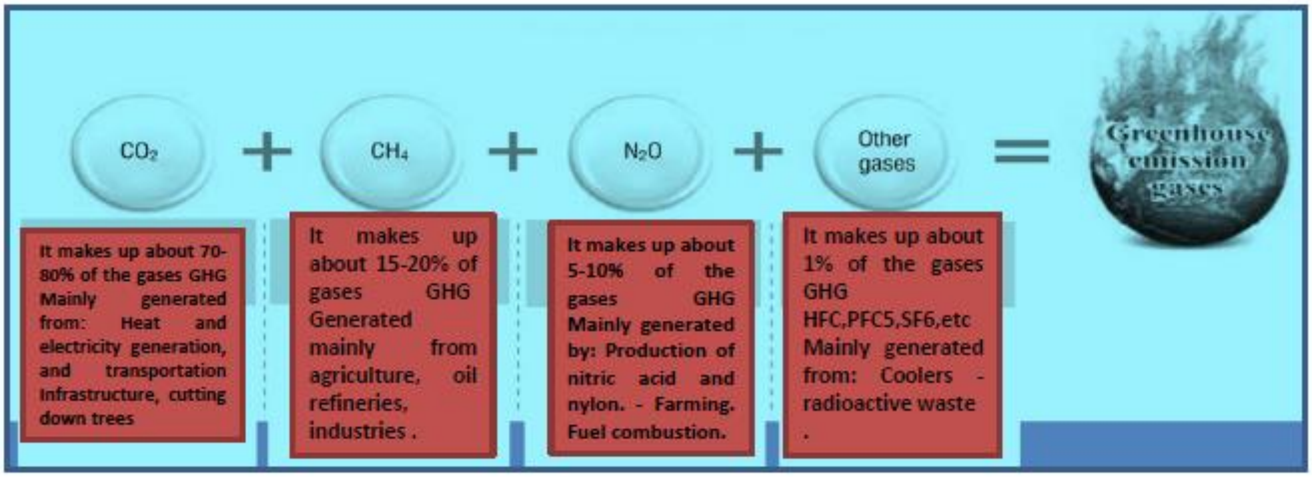

Figure (6) Greenhouse gases.

Source: Mayekar, Avinash; Devadiga, Parinita; Bhole, Jayashree K, "Green Building Concepts: An Approach Towards Sustainability", technopak perspective, Vol.04, ., 2010, p:57.

Under the direct influence of the spatio-temporal variation of the greenhouse effect in the atmosphere in terms of gases $(CO_2), (H_2O)$ and other trace gases are selective absorbers - find a spatio-temporal variation in the mechanism of cloud formation, and this was accompanied by a discrepancy in the level of absorption Clouds of direct solar radiation on the one hand and long-wave terrestrial radiation on the other hand(35), in addition to the effect of concentrations and compounds of hydrochlorofluorocarbons (HCFCS), hydrofluorocarbons (HFCS), chlorine and bromine, which contain halocarbons(36), those gases whose relatively high concentrations have depleted the ozone layer and so on. Accompanied by the penetration of a relatively high percentage of high-energy ultraviolet rays given that HC gases (Hydrocarbons) are incompletely combusted chemical compounds generated during the internal combustion process, and consist mainly of numbers of carbon and hydrogen atoms (37).

The increase in the concentration of greenhouse gases resulted in a change in the characteristics of the climate elements for a long period that extended for decades, but the acceleration in the change in the earth's temperature from its general average has increased relatively over the last four decades. As a result of the expansion of human activities, including architecture, in addition to factors that fall within the scope of the globe, natural factors (38). The impact of climatic changes on the characteristics of the environment at the local and global levels was reflected, and the accompanying temporal and spatial change of the precipitation distribution map. The negative impact of climatic changes has expanded within the desert climate region. Sub-tropical, causing the problem of food security, a threat to biodiversity, rural displacement, the emergence of new diseases and a change in the pattern of human exploitation of the land (39). And all these negative effects on the global environmental balance were an inevitable result of the relative increase in the concentration of carbon dioxide from (280) parts per million since the pre-industrial revolution to (376) parts per million in 1999, knowing that this gas contributes (60%) to the Global climate change (40), and the contribution of the energy sector has also increased in light of the expansion of architecture implementation of the Renaissance era and modernity architecture from (72.52) parts per million since the pre-industrial revolution to (95.05) parts per million in 1999, **see Table No. (2)**

Table (2) The contribution of the energy sector to the emission of carbon dioxide in the atmosphere until the year 2100.

Contribution of the energy sector/ppm	ppm by volume	Time period
72.52	280	1750 Before
81.58	315	1958
88.83	343	1984
89.35	345	1985
91.42	353	1992
94.63	365	1998
95.05	367	1999
132.09	510	2100

Source: Based on Sufyan al-Tal, Global Warming, World of Thought Magazine, Volume 37, Issue 2, Kuwait, 2008, p. 51.

It began with the eighteenth century, an increase in the amount of economic activities, and accordingly the negative impact of human resources on the ecosystem increased after the industrial revolution. **Table (3),** due to the accompanying expansion in production and consumption of (non-renewable) energy sources to operate factories [41].

Table (3) Types of atmospheric greenhouse gases caused by human activities

variable	**CF_4**	**HFC_{23}**	**CFC_{11}**	**NO_2**	**CH_4**	**CO_2**	**O3 tropospheric ozone**
Focus before the age of industry	**40 parts/trillion**	**zero**	**zero**	**270 parts/billion**	**700 parts/billion**	**280 ppm**	**0**
Focused in 2005	**80 parts/ton**	**14 parts/ton**	**700 parts/trillion**	**319 parts/billion**	**1774 parts/billion**	**379 ppm**	**58 parts/billion**
rate of change of concentration	**1 part ton/year**	**0.55 part ton/year**	**1.4 parts/ton**	**0.8 ppb/year**	**0.7 ppb/year**	**1.1% part / year**	**a variable**
Duration of stay in the atmosphere	**Less than 50,000 years old**	**2 years 60**	**65 years - 75**	**114 - 120 years**	**1 year 2**	**50 - 200 years**	**days**
Gas capacity to raise	**22200**	**unknown**	**3800**	**310**	**Between 23-**	**1**	**2000**

temperature /CO2					**25**		
The contribution of gas to the greenhouse	**variable**	**%8**	**%11.5**	**% 5**	**% 16**	**% 60**	**variable**

Source: UNEP, Annual Report. Climate change. 1998 . p. 9

Patrick L. Abbott . Natural Distress . 5th Edition ; San Diego University . 2006 . p.311

In addition to the negative impact of deforestation processes, which are the optimal work for absorbing greenhouse gases, especially (CO_2), in addition to the effectiveness of natural factors such as volcanoes and dust storms, (42). Although the majority of greenhouse gas sources come from human activities, as it contributes (25.9%) of the sources of greenhouse gases, followed by the industrial sector with a percentage of (19%), which together with the energy sector constitutes (45.3%) of the total sources (43). Based on the foregoing, the global average temperature has increased by (0.8°C) since (1850) and most of this change has occurred in the last four decades. **Figure (7)** looks at the anomaly in global temperature from (1850-2014), showing a rapid rise in temperatures In the past few decades (44).

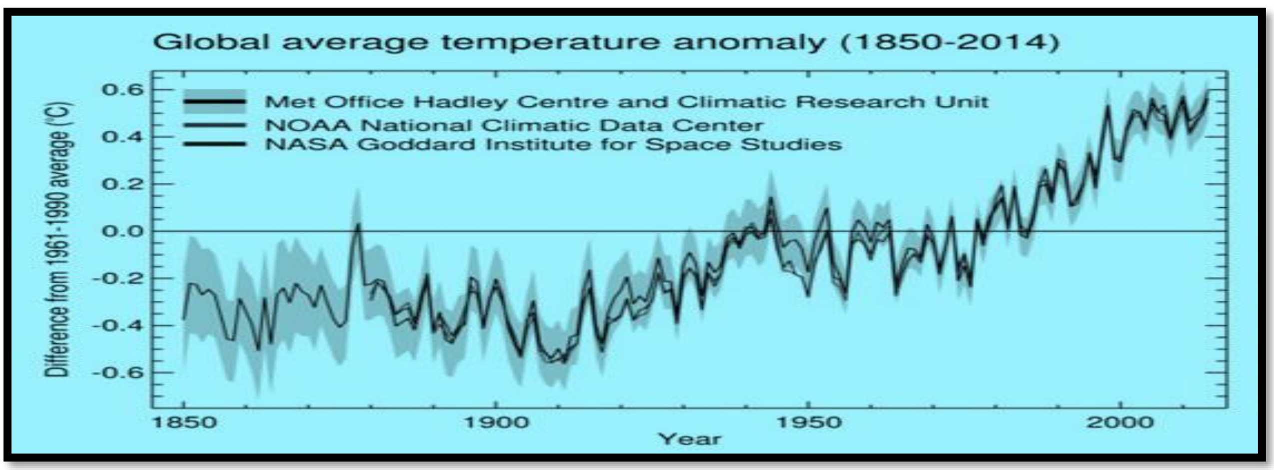

Figure (7) The average global temperature for the period (1850 - 2014).

Source: NASA (National Aeronautics and Space Administration), 2015 Earth Temperature Record [Available online at http://www.earthobservatory.nasa.gov].

The causal relationship can be observed between the amount of gas concentration (CO_2) (as an explanatory variable), and the increase in the surface temperature of the earth (as a dependent variable), which represents an overall increase in the average atmospheric temperature ranging from (1.4-5.8 °C) for the period From (1880 - 2010). (45). **See figure (8).**

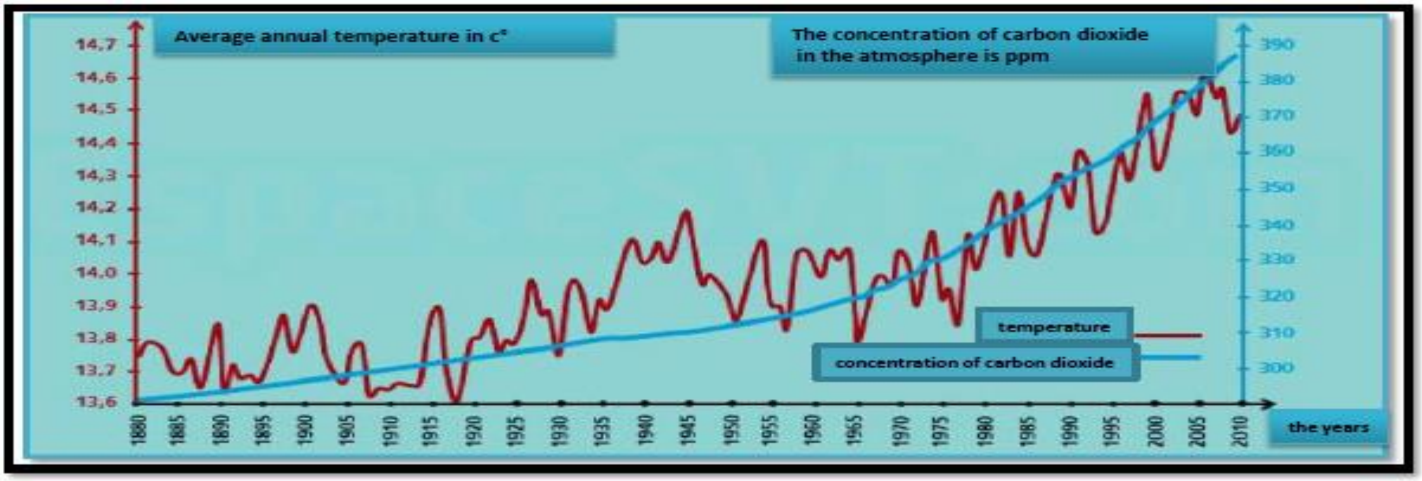

Figure (8) the relationship between global temperature and atmospheric carbon dioxide from (1880 - 2010).

Source: Dean E.Abrahamson,Sustainable Development &Energy options,2009,p:104.

Therefore, scientists believe that there are four scenarios for climate change within the atmosphere, assuming the stability of the factors (natural and human) that determine the level of pollution, and the change of the factor represented (the level of commitment to plans to reduce emissions of carbon dioxide), and this depends on the level of commitment of countries to reduce pollution at present and In the future [(46)], **and as in Figure (9).**

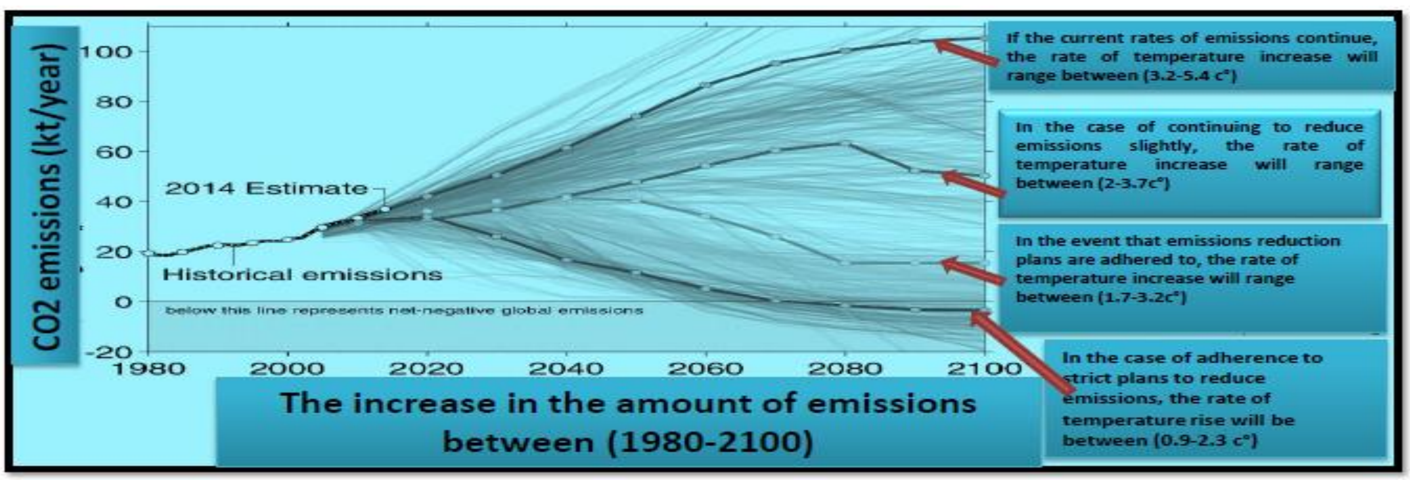

Figure (9) Scenarios of global climate change according to the level of commitment of countries to reduce pollution. **Source: Muhammad Salman Dawood, The Role of Modern Building Techniques in Reducing Pollutant Emissions to the Local Environment, Master Thesis, Department of Architectural Engineering, University of Technology, 2017, p. 24.**

5-Fifth Axis: Ecological Theses as Strategies for Limiting Climate Change:

5-1- Energy efficient architecture (green architecture) as a model:

The green approach in architecture is not a new trend [47], through the history of man with architecture, clear evidence appears in his respect for the environment to preserve the environment [48], and as a result of the deterioration of the earth's environment - a philosophical current emerged within the architectural systems that emphasizes the Assessing architecture systems to reach green architecture designs, where the Building Research Foundation in the United Kingdom began developing the first known classification system (BREEAM), [49] because green architecture has a wide potential to achieve a reduction in the amount of energy consumption, especially within the semi-tropical desert climate region in a way that can Avoid direct solar heating [50], in order to improve the quality of the detailed climate characteristics and the healthy environment within the interior spaces of the building to achieve environmental, social and economic benefits [51]. From the foregoing, a definition of green architecture can be formulated as "the architecture whose design, construction, operation, maintenance and demolition has the least impact on the environmental systems inside and outside the concept, and with a high level of energy efficiency and environmental resources [52]". With this green architecture, it is a new vision of architects' thinking for the integration and success of architecture goals to create spaces in which bioclimatic comfort is achieved, and to reduce its impact on the environment, by using environmentally friendly materials and resources, for its entire life cycle, starting with a design phase building demolition phase [53], so the architect Gerry Yudelson defines it as "High-performance architecture that takes into account reducing its impact on the environment by using less energy through the best applications in site development, design, construction, operation, maintenance, demolition, and possible reuse of materials [54], and the benefits of green architecture in the climatic context lie in reducing inappropriately Directly from the gases that led to global climate change, **see Figure (10).**

Figure (10) Reducing the consumption of electrical energy is one of the most important benefits of green building. **Source: Mayekar, Avinash; Devadiga, Parinita; Bhole, Jayashree K, "Green Building Concepts: An Approach Towards Sustainability", technopak perspective, Vol.04, 2010,p:59.**

This explains the assertion of architectural experts, including (Kwok & Grondzik 2007) the embodiment of the principles of zero-based architecture, energy efficiency as one of the most important forms of green architecture [55]. From the foregoing, it is clear that the sustainable design of green architecture has created an architecture philosophy that guarantees zero energy as one of the most important design trends [56], given that the Zero Energy Building (ZEB) with its design characteristics drew the attention of those interested in environmental issues worldwide, so it was presented as a strategy to reduce carbon emissions that cause global warming. [57], Therefore, the zero-energy architecture philosophy focused on rationalizing energy consumption to a zero-consumption limit, considering that green architecture, is the architecture in which the total consumption rate is equal to the minimum amount of energy produced for renewable energy sources on site [58], by integrating environmental values and concepts of energy availability and using the possibilities of available locally to reach zero energy in consumption [59], with the help of innovations in the field of chemical and mining industries in providing new material alternatives that have been able to prove their effectiveness in reducing heating and cooling loads [60].

Thus, Materials Technology is one of the most important pillars of the innovation of Eco cement, which has proven effective in reducing the level of gas emissions (CO_2)by more than one billion tons, because it can be used in (80%) of the current uses of ordinary cement [61], Considering that (Eco Cement) depends in its manufacture on magnesium carbonate instead of calcium carbonate in ordinary (Portland) cement, and therefore works to absorb (CO_2) gas during the period of its hardening, and since making cement causes about (7%) emission from the total concentration of (CO_2)gas due to various human activities, while the contribution of (Eco-cement) cement does not exceed half of this amount because it consumes less heat compared to ordinary (Portland) cement [62], **see figure (11).**

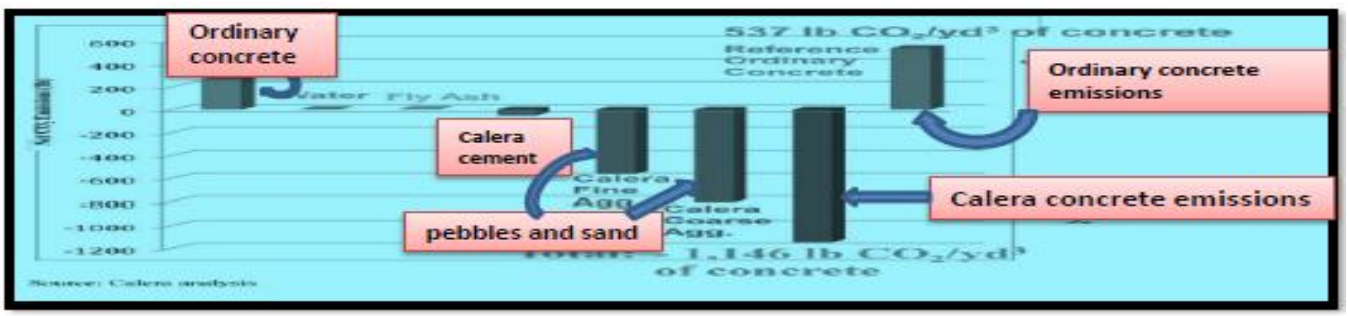

Figure (11) The production of carbon-negative concrete (Calera cement) (318 kg) (CO_2), while conventional concrete produces (680 kg) from (CO_2).

Source (Calera), citing: Muhammad Salman Daoud, The Role of Modern Building Techniques in Reducing Pollutant Emissions to the Local Environment, Master Thesis, Department of Architectural Engineering, University of Technology, 2017, p. 31.

Accordingly, the production of green cement, Calara, using Biomimcry technology, has expanded, especially in technologically advanced countries and the first to realize global environmental deterioration, considering cement as one of the biggest causes of pollution of its various types, which prompted research centers to invent many different types of cement with efficiency, the most important of which is Cement Calera, which imitates the natural order in oyster organisms[63]. **(see Figure 12).**

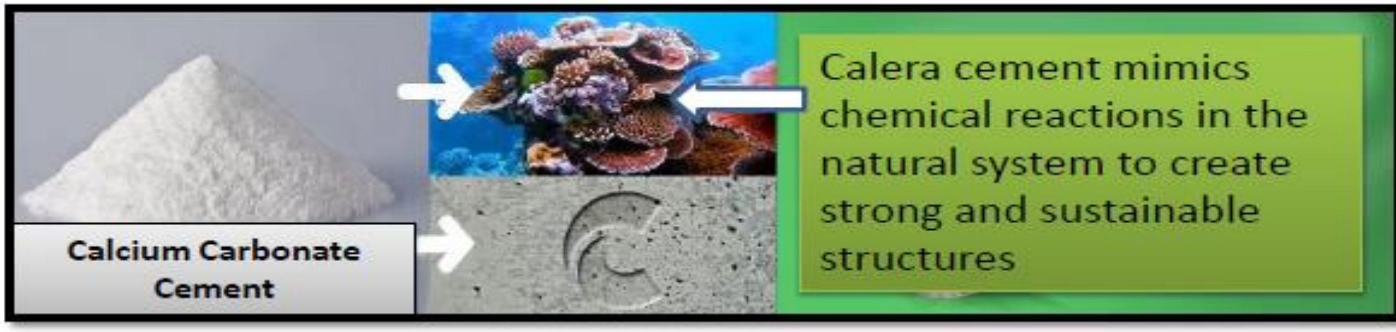

Figure (12) is the basis of Calera's work.

Source: Muhammad Salman Dawood, The Role of Modern Building Techniques in Reducing Pollutant Emissions to the Local Environment, Master Thesis, Department of Architectural Engineering, University of Technology, 2017, p. 30.

The ecological benefits of using the Calera manufacturing process can be summarized: [64]

1- Carbon capture and storage, as the carbon capture and storage process is designed in a way that does not require a large amount of energy and can deal with high concentrations of gaseous pollutants.

2- The Calera process removes sulfur compounds from the gas envelope by (95%) or more.

3- The manufacturing process by the (Calera) method converts carbon materials into rubble, which leads to a reduction in the energy consumption process to obtain these components and stores the carbon, so that these materials have a negative carbon production. From the foregoing, it is clear that the interest in environmental performance has increased as an important variable in the manufacture of building materials for most countries of the world, especially the developed ones. The construction materials research centers have paid attention to the environmental aspect with the aim of achieving the principles of sustainable environmental development. Resulting from various human activities and called for reducing waste and pollutants and preserving the natural resource base for future generations [65], benefiting from research achievements that had a role in creating building materials to achieve a wide difference between traditional architecture and zero energy architecture [66], **see Table (4).**

Table (4) The percentage of energy consumption between traditional architecture and zero energy architecture.

Energy End Use	Base House Annual Consumption (kWh)	Percent of Total (%)	Net-Zero Annual Consumption (kWh)	Percent of Total (%)
Heating	12,749	47	2,110	26
Cooling	5,100	19	850	11
Water Heating	3,627	13	167	2
Ventilation Air	0	0	175	2
All Other Loads	5,730	21	4,833	59
Annual Consumption	27,206	100	8,135	100

Source: Raghad Alaa Aboud, Design Processes for Zero Energy Buildings in Iraq, Master Thesis, Department of Architecture, University of Technology, 2012, p. 15.

5-2 Smart architecture as a strategic alternative to reduce the excessive consumption of fossil energy:

Before delving into the philosophy of smart architecture, it is necessary to give a picture of the concept of the term sustainability in its comprehensive concept, in order to clarify the importance of sustainable architecture from the perspective of smart architecture[67]. **Katz** has pointed out that sustainability means “the integration of natural systems with human patterns to give continuity and uniqueness to the creation of the place.” While **Brain Edwards** emphasized another concept of sustainability, focusing on the necessity of taking into account regional variations in understanding the philosophy of sustainability, which should not focus on global issues, such as climate change (climatic change), but include local issues that are addressed according to their regional characteristics. [68]. Sustainability as a philosophy, according to the above-mentioned thesis, is synonymous with the term green approach, as each of the two terms aims to deal better with energy and natural resources, given that green architecture represents a step towards sustainable architecture. Global [69], and as an inevitable result of global interest in green orientation in architectural design in pursuit of global environmental balance - the Intelligent Tropical Buildings philosophy emerged, as long as technology plays a key role in the development of responsive architecture adapted to the prevailing climate [70].

Hence, a trend appeared towards (technology) as an applied science to obtain practical purposes that fit the goals of material civilization by adapting nature by man to meet his needs [71], and from here emerged the philosophy of sustainable design on the basis that sustainable design is nature itself, the process of sustainable design requires That each product or process be responsible and reviewed from a new perspective that includes environmental impacts, as a primary and not a secondary variable, on which design decisions are based [72]. Decision-making should be based on a new method of thinking, based on the integration of social, economic, and environmental aspects, with the aim of reducing environmental impact and optimal use of resources, and that the standard of integration in the implementation of standards is the basis for the success of sustainable design of architecture [73].

Based on the aforementioned sustainable architecture philosophy, many ideas were put forward that aim to integrate technology into architecture to build a contemporary model that represents a super modern architecture, which combines the characteristics of smart architecture and ecological architecture in order to reduce the negative effects on the environmental balance to a minimum [74], by including the characteristics of Smart architecture ecological standards and foundations to achieve a balance between the natural and artificial environment using modern technologies [75]. For this reason, the concept of smart building (IB) has received increasing attention during the past two decades, considering that the smart building provides a productive and cost-effective environment while ensuring the achievement of bioclimatic comfort for the occupants of the architecture [76]. It should be noted that there are pillars for introducing technology to architecture representing the basic concepts that determine the inputs of smart architecture, and at the forefront of these pillars is Material Technology, by adopting knowledge and technical development, which worked to provide material and service products that affected the building systems through the creation of methods of termination and isolation It had a role in changing the performance of spaces and establishing new foundations for internal space connections with outer space [77].

Smart materials were not limited to building materials only, but also included smart dust, which represents sensors or miniature sensors the size of dust particles. It can conduct bi-directional communications up to (100 m) approximately from improving heating and cooling systems in architecture, by monitoring Temperature and light, as these sensors work with solar energy to connect the particles with each other by radio waves [(78)]. In addition to using, dynamic, kinetic, smart interfaces were used to control the climate on four main variables that collectively constitute the detailed climate characteristics within the interior space of the architecture, and they can be summarized as follows [(79)]:

1- Thermal control of solar energy through automatic control of the amount (heat gain or loss)

2- Controlling the level of natural lighting for the interior spaces.

3- Controlling the level of natural ventilation of the interior spaces.

4- Automatic generation of effective energy (thermal and photovoltaic).

Considering that the use of the self-moving facade system will reduce the need for fossil energy consumption by reducing undesirable variables represented in the increase in solar heat gain or loss, in addition to increasing the regulation of the use of natural lighting, and the exploitation of renewable energy on the site and location architecture, and thus reduce the energy consumed for the purpose of cooling and heating loads[(80)], through the use of smart materials property changing, which are materials that change one or more of their properties (chemical, mechanical, electronic, magnetic, or thermal) as a direct response to change The temporal and spatial characteristics of the climatic elements of architecture within its external surroundings [(81)], with the aim of automatically controlling the solar air temperature (Sol-Air temperature), given that the solar air temperature is the effect of the outside air temperature and solar radiation at a specific time on the outside surface. Its calculation depends on the characteristics of the outer surface in terms of color and roughness [(82)]. Thus, controlling the solar air temperature, through the use of smart materials with variable properties, will lead to determining the amount (the amount of thermal energy traveling through the wall), as long as the variable amount of heat energy gained and lost between indoor and outdoor spaces in summer and winter - is an indicator of the efficiency of the building envelope In achieving thermal control of the interior spaces, which negatively affects the level of efficiency of the overall Micro climate[(83)].

This explains the interest in the characteristics of smart windows, given that windows are one of the most responsive parts of the outer shell to heat transfer, and with the introduction of smart window technologies, the transparent part of the outer shell becomes more able to control the amount of energy transmitted through it automatically, and controls the amount of energy transferred through it, depending on the level of illumination or the outside temperature [(84)]. It should be noted that the smart glass of the type (Suspended particle display) is effective in controlling the amount of energy through it, as the glass used for this technology consists of a number of layers of different materials, absorbing the light falling on it, and this layer is located between two layers of conductors, When the electric current passes, these molecules are organized to allow light to pass through them according to criteria to be determined on the basis of the visual comfort requirements of the occupants of the architecture [(85)]. As for the (photo chromic technology) type of smart glass, it absorbs the radiation reaching it, which causes a reversible chemical change. reflective or transmittance (absorbing) of wavelengths within the electromagnetic spectrum [(86)], According to the climatic importance of smart materials - a clear interest has appeared within the trends of contemporary research on smart windows, given that more than (40%) of the energy consumption is responsible for the level of building temperature control (87), due to the relative importance of windows in controlling the amount of thermal energy compared to the parts of the outer shell of the building represented by (walls, ceilings) (88), **see figure (13).**

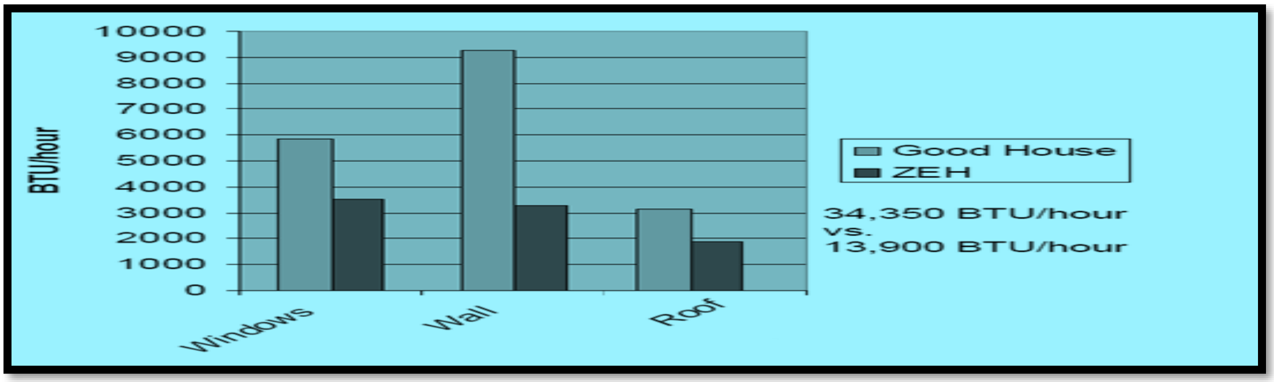

Figure (13) The difference in heat transfer between a traditional building and a zero-energy building based on smart materials technology in window design.

Source: Raghad Alaa Aboud, Design Processes for Zero Energy Buildings in Iraq, Master Thesis, Department of Architecture, University of Technology, 2012, p. 16.

The introduction of technology and smart materials was not limited to controlling the thermal balance of architecture, but rather included the redistribution of natural lighting systems through the employment of tubular ceiling openings, **see figure (14)**, mirrors, light wells or skylights, or the so-called skylights (89).

Figure (14) Light tubes.

Source: Phillips. Derek: Day Lighting, Natural Light In Architecture, Elsevier & Architectural , 2004, p:33.

With the aim of controlling, directing and redistributing natural lighting despite the multiplicity of its means, it is either vertical, horizontal compound, or between fixed and moving, and despite this diversity, all of them aim to reduce both heat gain and optical dazzle while ensuring an acceptable level of visual comfort.(90)

5-3- A strategy for adapting the climatic design curricula for architecture according to the characteristics of the climatic region.

The suitability of adaptation according to design curricula has witnessed fundamental transformations through the historical stages. In the Renaissance, the architectural design strategy was transformed into purely academic principles. Since the beginning of the fifteenth century, the architectural design has become dependent on the architect's own ability, so the design decisions came out according to the unique creativity approach. Thus, the architectural design process was separated from being a vital and social need that reflects a collective vision to being unique personal expressions in terms of characteristics (91), moving away from being a means to achieve benefit through the transformation of rational thought (ratio, mathematics), and the most important characteristic of architectural design in the Renaissance They are designs in most of them that did not take into account the philosophy of unity between man and nature (92). **See figure (15).**

Figure (15) models of architecture representing the Renaissance.

Source: Banar Abdel Hamid Al-Jaf, Expressive Suitability in Contemporary Architectural Production, Master's Thesis, Department of Architecture, University of Technology, 2015, p. 15.

As for the architecture of modernity, a shift has appeared in the objective and content of the philosophy of adaptation of the climatic design curricula. The architectural design has moved away from rational thought and the attempt to unite between man and nature, by adopting the functional theory of architecture under the influence of meeting the requirements of the utilitarian content within architecture, given that the evaluation of spatial appropriateness The design approaches are linked to a causal relationship between the functional forms on the one hand, and the constructional architecture on the other hand (93)**, see Figure (16).**

Figure (16) models of buildings representing modernity architecture.

Source: Banar Abdel Hamid Al-Jaf, Expressive Suitability in Contemporary Architectural Production, Master's Thesis, Department of Architecture, University of Technology, 2015, pp. 16-17.

Thus, a shift occurred in the architectural design approaches from the unconscious self-design that was prevalent within the traditional (pre-modern) design approaches to the conscious design so that architecture according to the vision of its designers is an inevitable result of the actual social, civilizational and cultural need for architecture [(94)]. Thus, the design methodology moved away from the methodology based on the black box method (unconscious) to the philosophy of the transparent box (conscious) [(95)], and this is the shortcoming of the design methodology according to the (black box) perspective. As for the shortcomings of the (transparent) fund approach to the stage of modernity - this approach focused on justified logical thinking, and orientation towards solving problems related to architecture itself without paying attention to environmental and climate issues, according to the perspective of awareness of what architecture is from the practical and technical sides, so the implementation of projects led Architectural imbalance events in the global ecosystem [(96)].

From the foregoing, it is clear that justified logical thinking is farther from the architectural design approach within the modernity stage than the development of design treatments to reduce excessive energy consumption, especially fossil ones, which contributed to those designs indirectly aggravating the problem of air pollution, and this resulted in the exacerbation of the problem of climate change towards the greenhouse . the designers sensed the depth of the environmental problem resulting from the architectural design of the modern period - which prompted the emergence of (postmodern) design approaches under the pressure of the negative impact of modernity architecture on the ecological balance [(97)]. As an inevitable result of the negative aspects of architecture within the modernity stage, it had a significant impact on the exacerbation of global environmental problems, which pushed the architectural engineering system towards a new philosophy that created a method for architectural formation at some stage. after modernity, as a reaction to what modernity architecture has brought about, with this postmodern architecture has sought to reintegrate man and the environment [(98)].

Here a question arises, did the anti- and supportive stances for postmodern architecture centered around criteria for climate adaptation for architectural designs, or were other criteria taken for them to adopt stances toward postmodern architecture? In order to answer this question, it is necessary to distinguish between the essence of the approach and its purpose as an analogy between the design approach to architecture for the phase of modernity and post-modernity, and advanced architectural studies have proven that the design approach to modern architecture focuses on the specific steps of the engineering thought of design more than on the problems (environmental, economic, and social, in contrast to the design approach of postmodern architecture, so Simon suggested within the engineering thought of postmodern architecture to focus on appropriate or satisfactory solutions to all problems resulting from architecture and causing it [(99)].

The environmental problems resulting from the excessive use of fossil energy, and the accompanying environmental problems, including climate change, have caused great interest by postmodern architectural design approach, due to the fact that those curricula realized the future effects of global environmental problems represented by the problem of global climate change towards the greenhouse [100], This explains the interest of postmodern design curricula in the philosophy of green architecture in its cosmic context, given that the built environment in the postmodern era is one of the important environmental issues that began to threaten the global ecological balance, because that architecture consumes natural resources causing its depletion, and what it produces. of waste and pollutants [101], in industrialized countries it consumes about (40%) of natural resources and (70%) of electric energy, and architecture produces during its life cycle (45-65%) of waste and (45%) of emissions of greenhouse gases[102]. As specialists in the study of climate change attribute that (90%) of global climate change is the result of architect activities [103].

As a result of the foregoing, he pushed for the conclusion of the United Nations Framework Convention on Climate Change (UnFccc), the most prominent of which was the Kyoto Protocol, which included articles of the agreement, and the most prominent of these items was the international commitment to determine the causes of emissions of greenhouse gases, in addition to setting standards to ensure the reduction of emissions of polluting gases. According to specific criteria with the aim of promoting sustainable environmental development[104]. It also put forward the Paris Agreement within the framework of agreements on climate change (UnFccc) with the aim of keeping global climate change below (2°C) below the levels of the beginning of the industrial era and trying to limit climate change to 1.5°C [105].

With regard to architecture, buildings in general, like any civilized product, affect and are affected by their surroundings, and that their impact on their environmental surroundings continues throughout the period of use, and consumes large quantities of the earth's resources in the form of energy and materials to ensure its existence, operation and disposal of its surpluses and waste [106], This explains the interest of institutions and architecture research centers in offering many alternatives for the purpose of environmental assessment of architecture, periodically, in accordance with the criteria of the architecture life cycle assessment system, as the system through which energy and consumable materials can be evaluated from the first extraction, manufacture and use of materials in construction and maintenance. Until the building is demolished or the waste is disposed of [107].

Through the environmental assessment of the building, according to the criteria of the architecture life cycle system, it is possible to determine the main characteristics of sustainable design in choosing the appropriate materials that it is self-sufficient by at least (80%) [108], and for the purpose of achieving integrated architecture with Ecosystems _ It is necessary to provide all the requirements of bioclimatic comfort for the occupants of architecture, and at the same time take the variable of ecosystems within the biosphere of architecture, as a specific variable for the level of energy use [109].

Proceeding from the philosophy of ecological integration of architecture with environmental systems - the strategy of integrated solar systems within architecture (as an approach in post-modern architectural design) was proposed to make architecture energy-producing instead of only consuming it, and BIPV aims to exploit the technique for harnessing the energy of solar radiation, especially in the desert climatic regions in the semi-tropical offers [110], **see Figure (17).**

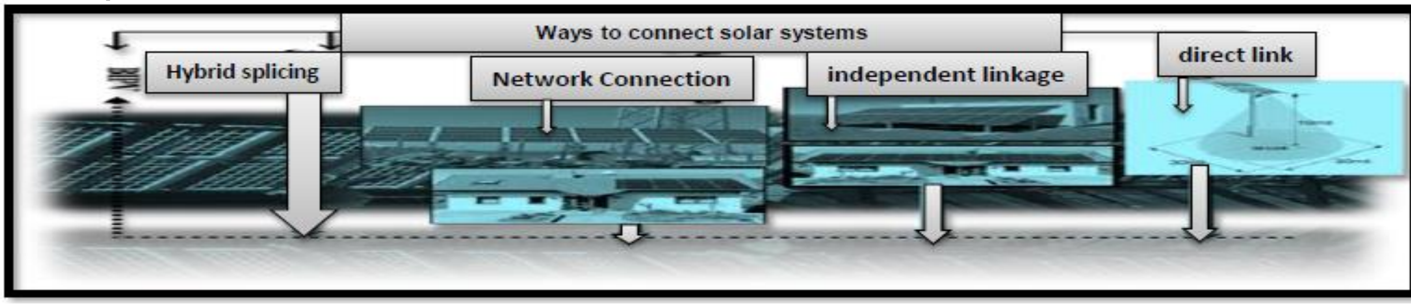

Figure (17) Methods of linking solar systems and their relationship to the BIPV system for models of postmodern architecture.

Source: Ihsan Ali Al-Jad Raji, Employment of Solar Systems in Architecture, Master's Thesis, Department of Architectural Engineering, University of Technology, 2009, p. 30.

It should be noted here that the efficiency of the application of the energy strategy according to the (BIPV) system depends on many spatial factors represented in the characteristics of the site and the location of the architecture, and their arrangement in relation to the neighboring buildings to ensure an acceptable level of investment in renewable solar energy (111), In order to ensure the embodiment of the philosophy of sustainable architectural design based in its comprehensive concept on a set of indicators which are capacity (capacity), fitness, flexibility (resilience), diversity (diversity), and balance (balance), and in a manner that ensures spatial balance for the effectiveness of dimensions (economic, social, environmental) for architecture (112).

Conclusions

1- The architectural design curricula of the Renaissance and Modernity phases have increased the concentrations of heat-trapping gases, including carbon dioxide gases, chlorofluorocarbons, hydrochlorofluorocarbons, and hydrofluorocarbons, which increased the amount of absorption of these gases to thermal infrared rays, especially for lengths(1 -2 micron), and (2.05-2.7 micron).

2- Most of the architectural design approaches of the Renaissance and modernity were characterized by a relative increase in energy consumption for heating purposes, ranging between (10-20%), and for ventilation (5-7%) for lighting (3-14%). Which led to an increase in energy loads and this was reflected in the relative increase in the demand for electrical energy based on fossil energy.

3- Studies have proven that fossil energy, especially oil, has a carbon content of between (83-87%), sulfur (0-4%), and coal with carbon ranging between (70-90%) and sulfur (0.5-5). %), and thus the increase in energy demand in architecture will lead to an inevitable result represented by an increase in the emission of carbon dioxide in the gaseous atmosphere worldwide.

4- Energy consumption increases proportionally within the architecture of the Renaissance and the architecture of the modernity stage by a rate ranging between (30-100%) compared with the energy-efficient architecture model, due to the abstraction of the architecture of the Renaissance and the architecture of the modernity stage from the energy-efficient architecture index.

5- As a result of the expansion in the implementation of architecture projects according to the architecture approach to the modern stage - the demand for electric power based on fossil energy increased, which led to a relative rise in the concentration of carbon dioxide in the atmosphere from

(280) parts per million before 1750 to (510))ppm, which is expected for the year 2100, and based on the contribution of energy production, which amounts to (25.9%) of carbon dioxide emissions, and thus, it is expected that the energy sector will contribute in gases emissions up to (132.09)ppm for the year 2100.

6- The steady increase in the concentration of heat-retaining pollutants, especially carbon dioxide, was reflected in the acceleration in a relative rise in the atmospheric temperature. Studies have shown that the relative increase in temperature during the period (1990-2001) ranged between (1.4-5.8 °C), while the relative increase in the average temperature for the period (1850-2014) did not exceed (0.8 °C), which indicates an acceleration in the rate of relative rise in global temperature.

7- Contemporary engineering thought created within the post-modern architecture multiple architectural philosophies represented (green architecture, zero energy architecture, smart architecture, and positive energy architecture) - which created an architecture with less energy consumption at one time, and an energy-producing architecture at another time, which worked on environmental balance, but the percentage of implementation of these types in sustainable architecture is still limited according to economic and technological determinants, especially in developing countries.

Recommendations

1- Adopting energy and environmental design standards as one of the most important standards that require adherence to within the international framework protocols as approved treatments to limit the aggravation of the global climate change problem towards the warmth.

2- The absence of self-regulation and climatic adaptation of architecture from the Renaissance to the modern stage - a reason for the academic re-evaluation of architectural design curricula, present and future.

3- Adopting the institutions related to the implementation of architectural projects with the principles of zero-energy architecture in accordance with regulations taken on a local and international scale, in order to ensure the achievement of relative efficiency in energy use and the promotion of an environmentally sustainable site by taking into account the criteria of spatial and climatic appropriateness of design and planning factors.

4- Adoption of the relevant institutions to implement architectural projects using the principles of green architecture and interest in the production and use of pollution-reducing cement (eco-cement), which ensures the transformation of architecture from air pollution-producing architecture to carbon-negative architecture.

5- Adopting smart architecture technology to ensure automatic control of heat gain and loss, and the use of daylight and ventilation in order to reduce heating and cooling loads and thus reduce electrical energy consumption.

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