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Towards Applying the Global Roadmap for Technology Development for Zero Energy Projects

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ABSTRACT

As a result of climate change, significantly reducing carbon emissions during construction projects has become an urgent concern. As a result of its adoption as a strategic objective, low carbon building has the potential to significantly cut down on carbon emissions if the opposite is done. While many studies have been conducted, few describe the knowledge road map for low carbon building research that is necessary to guide academics and industry professionals.

According to research by Sayigh (2014), the construction industry accounts for 40-50% of global energy consumption. More than half of the world's natural primary resources (approximately 3 billion tons per year) are used in construction, and traditional buildings produce one-third of Greenhouse gases; as a result, there is a persistent call for a more nuanced approach to environmental issues, particularly from architects, who are urged to explore design alternatives to modern buildings and usage of renewable and natural energy sources in development of green cities in in order to reduce their impact.

A zero carbon building (ZCB) and zero energy building (ZEB) is a building that generates no net carbon dioxide (CO2) emissions. ZEB and ZCB have received a lot of attention in recent years since they are regarded as a critical technique for achieving energy conservation and decrease greenhouse gas emissions in many countries. There has been much discussion about the viability of a regulatory strategy for transitioning to ZEB/ZCB in some countries.

The study discusses the myths and facts about (ZEB) and (ZCB) with the purpose of enhancing comprehension also avoiding misleading statements . ZEB and ZCB as key concepts are discussed. Several pilot projects throughout the world, as well as local situations, are analyzed to discover the real-world implications and actual meanings of ZEB and ZCB to our society in the UAE and the United

States. The core challenges both the engineering and architectural approaches for generating ZEB and ZCB are discussed. The feasibility of ZEB and ZCB is examined by reviewing some aspects such as design, technologies used, carbon dioxide emission, and environmental features.

Keywords: Global warming, Zero Carbon Building (ZCB) , Zero Energy Building (ZEB), Eco-design strategies, Technologies for low carbon, energy consumption

1 INTRODUCTION

Global warming is already occurring and has become the most urgent issue we face today. To reduce greenhouse gas emissions, the world should indeed discover ways to switch from current emission-increasing technologies to others that are more advanced. Green buildings are primarily concerned with reducing carbon dioxide emissions while reducing energy consumption inside buildings.

The energy used by and effects on the environment are significantly impacted by buildings. The United States' commercial and residential structures use almost 40% of primary energy and around 70% of the country's electricity. Considering that new structures are being erected at a quicker rate than old ones are being dismantled, construction's energy consumption is expected to continue rising. It is projected that by 2025, commercial building electricity usage would have increased by 50% from its 1980-2000 peak.

2 Problem Statement:

It is urgent that the world switch to renewable and low-carbon energy sources to mitigating the grave global risk of climate change. Up to 45% of worldwide energy consumption and carbon emissions are attributable to the construction industry attempting to make them the single largest contributor to anthropocentric climate change. Zero Carbon Building (ZCB) has emerged as a cutting-edge sustainable development model. However, ZCB delivery faces significant obstacles. As a result, this study represents an effort to extract the global road map for technology development for zero energy buildings. Accordingly, this study represents an endeavor to extract towards applying the global roadmap for technology development for zero energy buildings.

3 Literature Review:

To fighting climate change, transforming cities into low-carbon societies is a global trend (DCLG, 2007; Loper, et al., 2008; NIES, 2009). To meet the carbon reduction target, low or zero carbon design is required. The construction industry has been identified as the major contributor to carbon emissions among all sectors (DCLG, 2006). Global interest in creating carbon neutral, energy-efficient, and low-arbon buildings is rising (ECEEE, 2009; March, 2002; NIES, 2009; NSTC, 2008).

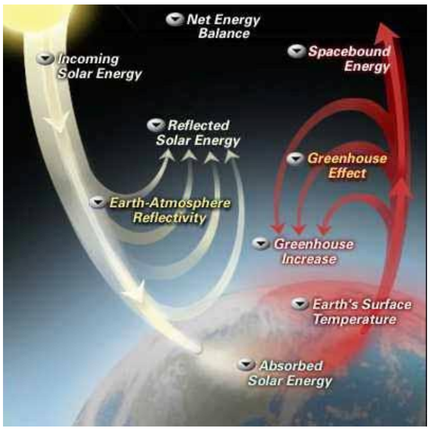
Table 1. ZCB policy Initiatives

Initiative	Description
United Kingdom (UK) Building a Greener Future: Policy Statement (DCLG, 2007)	Achieve zero carbon new homes by 2016, with 25% carbon reduction from building regulations by 2010, and 44% by 2013.
United States (US): Energy Independence and Security Act 2007 (EISA, 2007)	As of 2025, all new commercial buildings must be zero net energy; As of 2050, all commercial buildings must be zero net energy including retrofits of pre-2025 buildings.
US:Presidential Executive order (EO)13514 (Federal Office, 2009)	As of 2020, all planning for new Federal buildings requires design specifications that achieve zero net energy use; As of 2015, at least 15% of any Federal agency's existing buildings and building leases above 500 m² must conform to zero net energy.
European Union (EU): European Directive 2010/31/(recast) (EC, 2010)	As of 31 December 2020, all new buildings are nearly zero energy buildings; After 31 December 2018, new buildings occupied and owned by public authorities are nearly zero energy buildings
US: California BBEES (California Energy Commission, 2011)	As of 2020, all new residential construction in California to be zero net energy As of 2030, all new commercial construction in California to be zero net energy

4 Data Analysis

4.1 The Global Energy Balance:

Maintaining a stable global energy balance depends on the planet's ability to absorb infrared radiation that is otherwise lost to space. Due to the absorption of energy by greenhouse gases and the subsequent warming of the atmosphere, the Earth's surface retains more energy than it would if the atmosphere did not exist. The moon's average surface temperature is -18°C since it orbits the Sun at the same distance as Earth. None exists on the moon, which is not surprising. Alternatively, the average surface temperature of Earth is just 15 degrees Celsius. The term "greenhouse effect" is used to describe this warming phenomenon.



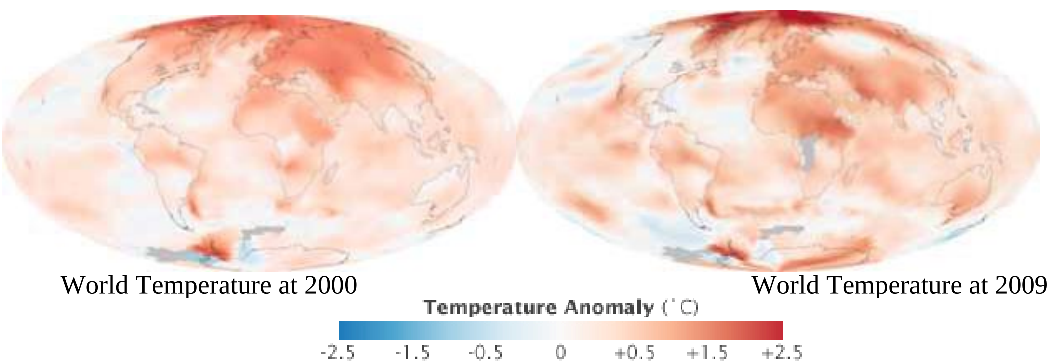
(Fig.1) The global energy balance
The amount of energy gained from the Sun is tempered by the amount of energy wasted into space.

Definitions:

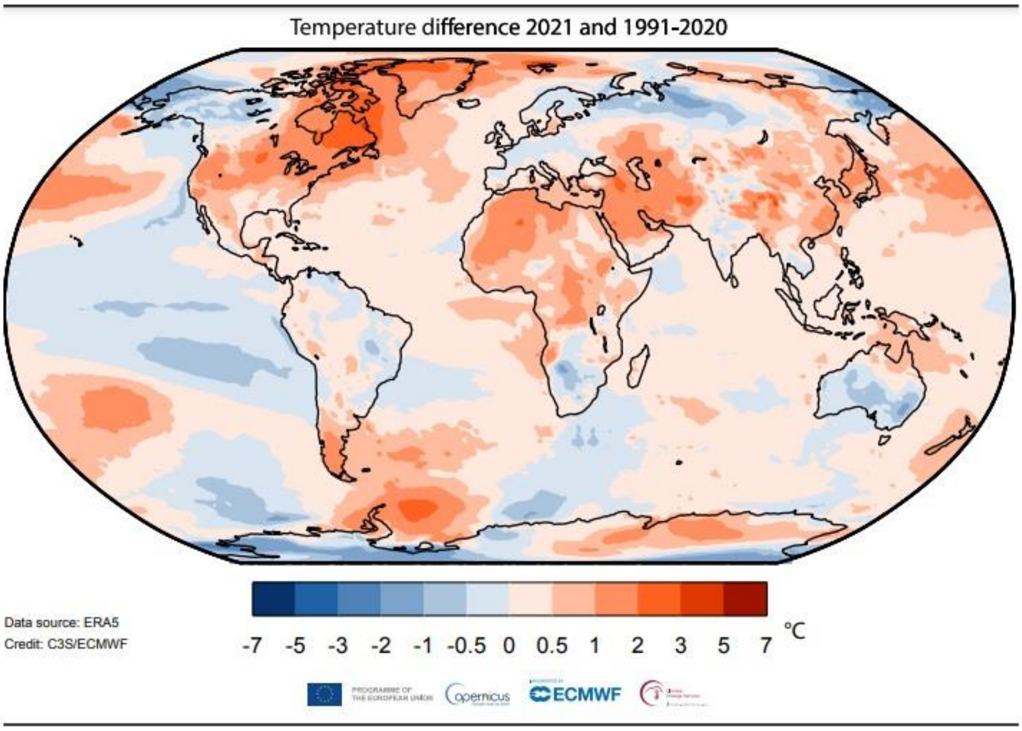
- **The Global Warming**: The predicted continuation of the increase in average temperature of the air and oceans close to the surface of the Earth that has been occurring since the middle of the twentieth century.
- **The Climate Change:** The statistical distribution of weather patterns throughout epochs spanning from decades to millions of years. Either the average weather or the distribution of weather occurrences around an average might change.
- **Zero Carbon Architecture (ZCA):** Architecture that is specifically designed to reduce GHG emissions. As a consequence, (ZCA) buildings emit significantly less (GHG) than regular buildings.
- **Eco-design strategies:** A Solar Heating and Cooling Programmer has started by using the sun, the most plentiful energy source of all. Both uses may benefit from solar thermal energy.
- **The Passive Solar Building Design:** The windows, walls, and floors of a passive solar building absorb, store, and distribute winter solar heat while reflecting summer solar heat.

4.2 The Global Warming (GW):

The average temperature of the Earth's near-surface air and oceans has been rising since the middle of the twentieth century, and this trend is likely to continue. The average temperature of the Earth's surface increased between 1900 and 2100 by 0.74 0.18 °C (1.33 0.32 °F). Natural phenomenon variations, Solar radiation and volcanism, for example, had a little cooling influence after 1950.. **(fig.2)**



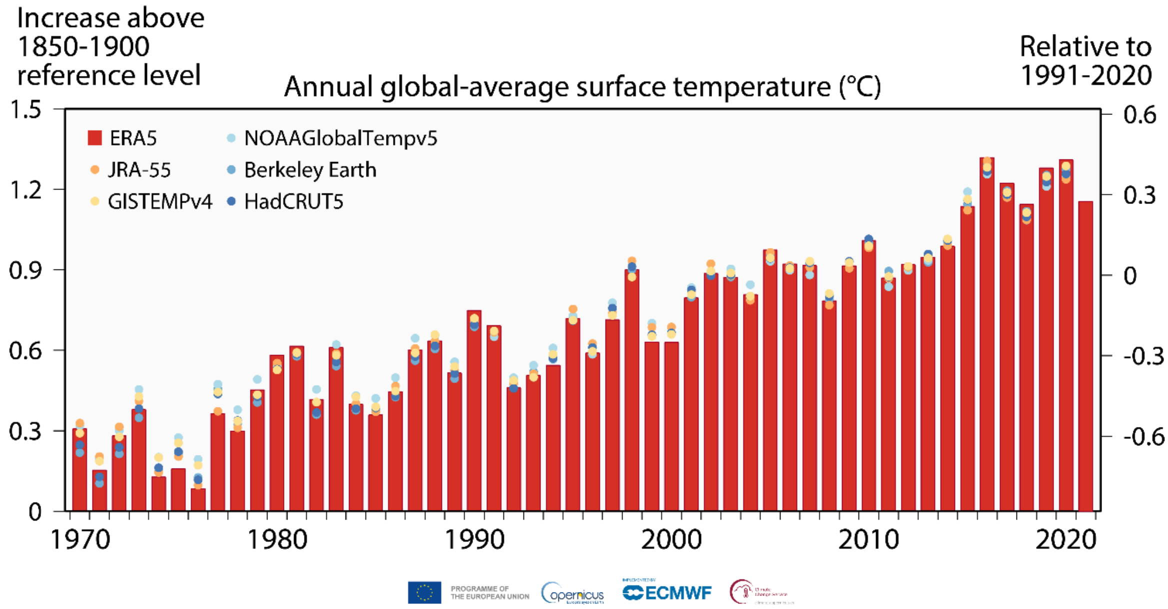
(**Fig.2**) The average surface temperature from 2000-2009 compared to the average surface temperature from 1951-1980.
Source: 2009 Ends Warmest Decade on Record. NASA Earth Observatory Image of the Day, Jan. 22, 2010



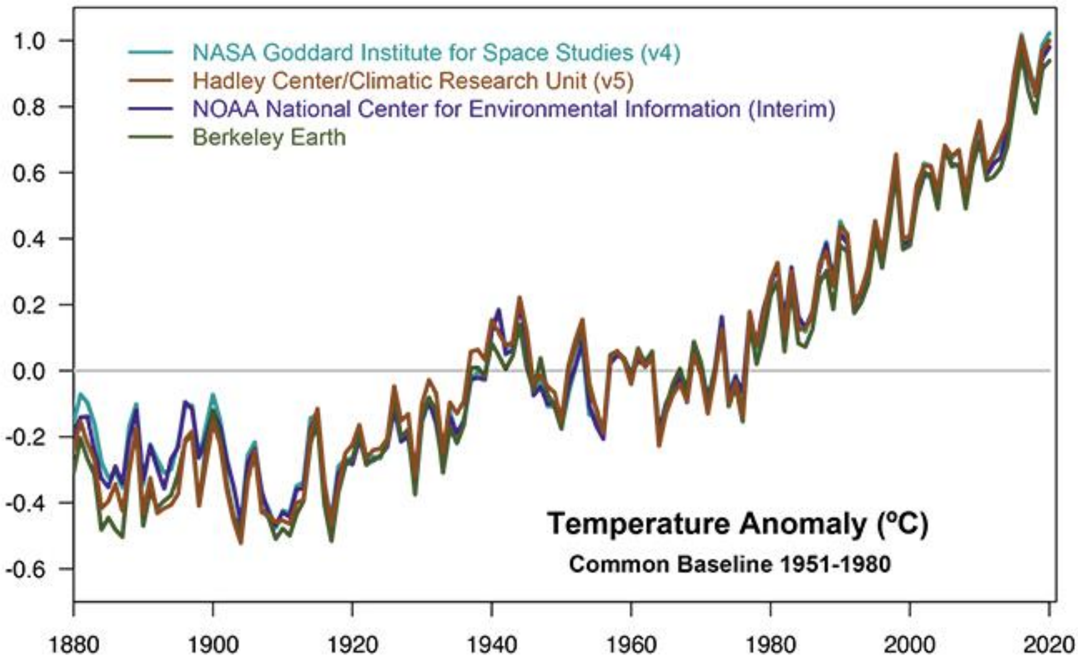
(**Fig.3**) The 2021 two-meter air temperature average compared to the average from 1991-2020. ERA5 is the original data source. Copernicus Climate Change Service and the European Center for Medium-Range Weather Forecasts

4.3 Changes in Temperature:

The increased trend in globally averaged temperatures near to the Earth's surface is the most often used indication of global warming. As a linear trend, this temperature climbed by 0.74 °C 0.18 °C till 2020. Warming almost doubles in the second half of the time period (0.13 °C 0.03 °C per decade against 0.07 °C 0.02 °C per decade). According to NASA's Goddard Institute for Space Studies, 2005 was the hottest year on record since precise and widely accessible instrumental data started in the late 1800s. This year even outperformed 1998's record high by a little margin. The effects of changing global temperatures are diverse. The rate at which land temperatures have been rising since 1979 (0.25 °C per decade) is roughly twice that of ocean temperatures (0.13 °C per decade). **(Fig.4)**



Different dataset's estimates of the yearly average change Somewhat on left and right, changes in global air temperature at a height of two meters during the pre-industrial period and relative to 1991-2020 are shown. GISTEMPv4 (NASA), HadCRUT5 (Met Office Hadley Centre), NOAAGlobalTempv5 (NOAA), JRA-55 (JMA), and Berkeley Earth are the dots; ERA5 is the bar (ECMWF Copernicus Climate Change Service, C3S). Copernicus Climate Change Service and the European Center for Medium-Range Weather Forecasts



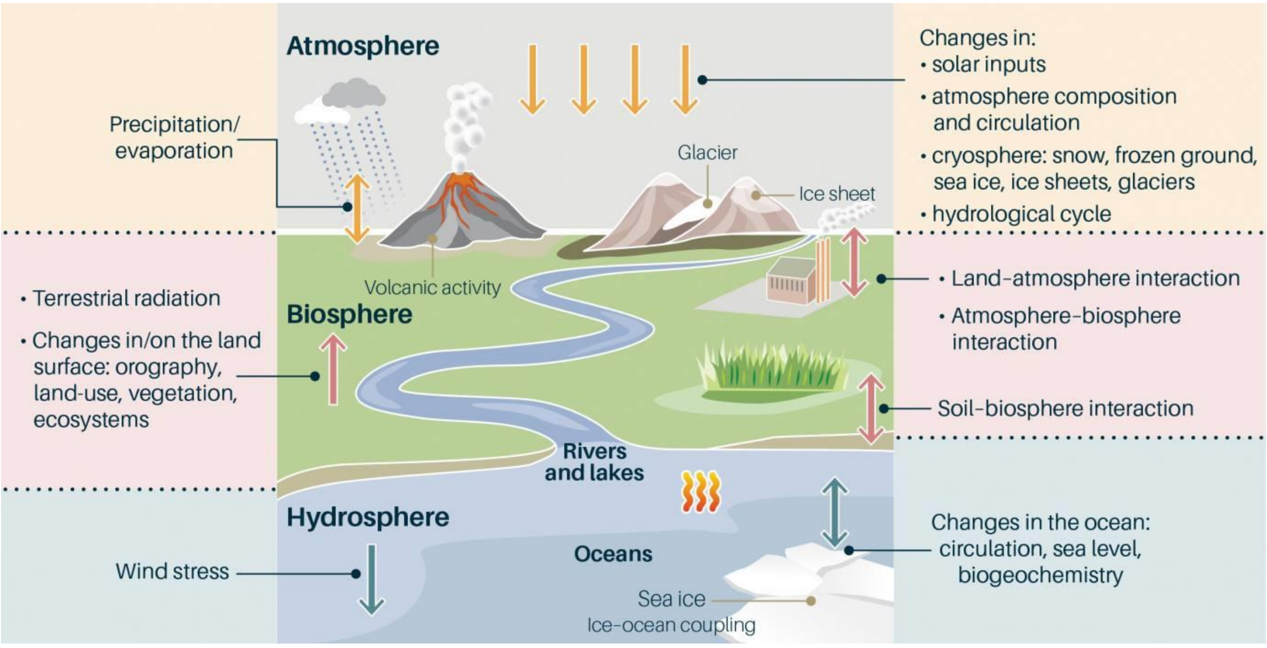
(**Fig.4**) Temperature changes from 1980 to 2020 compared using records from the ground (blue) and satellites (red: UAH; green: RSS)

5. The Climate change:

Alterations to the weather distribution statistics on time ranges ranging from decades to millions of years constitute climate change. Both average conditions and the frequency distribution of extreme weather events are subject to change. Alterations to the global climate may be localized or widespread.

Climate change Causes: Climate forcing refers to variables that may have an impact on the climate. These processes include variations in solar radiation, deviations in Earth's orbit, mountain-building and continental drift, and changes in greenhouse gas concentrations.. **(Fig.5)**

- **Plate Tectonics**
- **Solar Output**
- **Orbital Variations**
- **Volcanism**
- **Ocean Variability**
- **Human Influences**



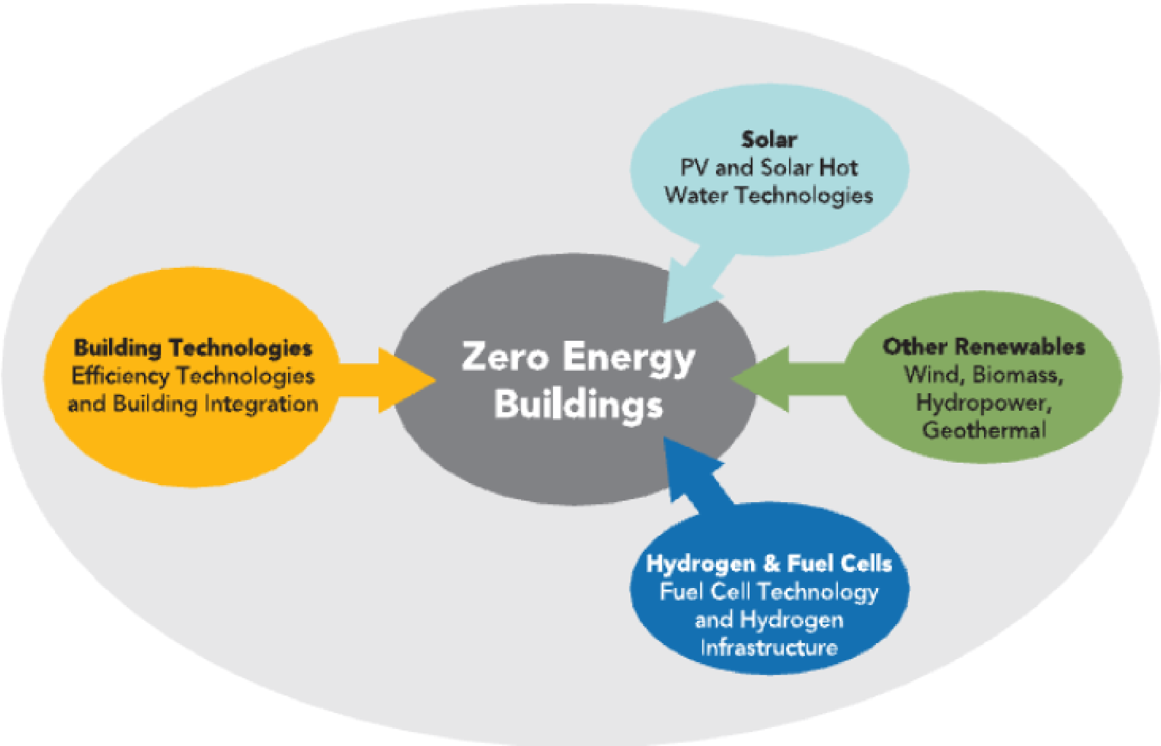
(Fig.5) Major elements required to comprehend the climate system and climate change.

6. The Effect of Global Warming:

- Some butterflies, foxes, and alpine plants have relocated to higher cooler areas.
- Hurricanes and other storms are predicted to become more powerful. Some diseases and viruses will spread, such as malaria , COVID 19 , …Etc.
- There has been a global increase in precipitation such (rain and snowfall).
- There will be less water available. If the Quelccaya ice cap in Peru continues to melt at its present pace, it will be gone by 2100, leaving thousands of people without access to clean water and dependable energy.
- Droughts and floods will occur more frequently. Already drought-stricken Ethiopia may see a further 10% decrease in rainfall over the next half-century.

7. Eco-design strategies:

•The International Energy Agency has launched the Solar Heating and Cooling Program in an effort to increase interest in the use of solar energy, the most abundant renewable resource. Both of these applications can benefit from solar thermal energy.



(Fig.6) Net-Zero Energy Building strategies, Ref. NSTC 2008

8. ZEB and ZCB design strategies :

Constructing a Zero Energy Building (ZEB) or Zero Carbon Building (ZCB) can be challenging because each design solution must be adapted to the site, where it will be built (Australian Government, 2008). Designing for the site's characteristics, the intended function of the building, the feasibility of incorporating sources of renewable energy, and anticipated energy needs of the structure are all part of this process (CIBSE, 2004).

Table 2. Summarizes the basic strategies of design of ZEB and ZCB.

ZEB and ZCB strategies of design
Integrate energy-saving strategies and renewable energy solutions into the project from the beginning.
Select a location that emphasizes renewable energy while reducing overall on the need for both transportation and food production.
To reduce energy demand, maximize passive design strategies in home design.
To decrease energy consumption, maximize passive design strategies in design.
Use appropriate materials by using low-embodied-energy materials that also contribute to passive design.
To decrease energy consumption throughout the buildings.
Striking a balance between using less energy and using renewable sources is essential. It's crucial that renewable energy sources aren't over utilized. in buildings with low energy efficiency.

Domestic water heating, space heating, pool heating, drying operations, and some industrial processes are only some of the many low-temperature heat-generating applications for solar technologies. When the number of hot summer days is proportional to the number of people who need to be cool indoors, solar cooling is at its most efficient. The Agency cites high initial investment prices, the fact that present government policies favor non-solar technologies, and a failure to account for the environmental costs of utilizing fossil fuels as the primary impediments to a wider adoption of solar power.

Table 3. The strategies of Eco-design

Source: IEA task 13 low energy buildings (1989-1993)) cited in United Nations Environment Program (UNEP), Buildings & Climate Change, Status, Challenges and Opportunities, 2007.

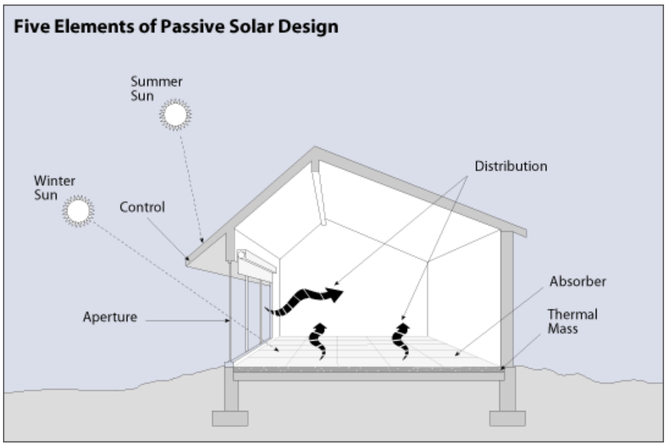
Super insulation of materials	Insulation materials of the highest efficiency, often containing gases with insignificant heat transfer
High-performance openings (windows)	High-light-penetration, low-heat-transfer windows, such as double-glazed ones, seem to be appropriate.
Heat / Ventilation systems	The ventilation system is designed to preheat the incoming cold air with the warm air that is being exhausted from the building.
Ground couple heat exchangers	The incoming air temperature is adjusted based on the more stable ground temperature (colder on hot days and warmer on cold days).
Sunspaces	Direct sunlight heats up spaces.
Materials with high thermal storage capacity	Materials that preserve their temperature over long periods of time even when the temperature of the surrounding atmosphere changes, allowing heat gained during a hot day to be used to heat the structure during a freezing night, and vice
Active solar water heating systems	Water heating through direct sunshine, such as through leading water Sunlight is directed through pipes placed in the center of concave steel mirrors. on the
Photovoltaic cells and systems	Semiconductor cells and panels turn sunlight into energy.
Integration of the mechanical systems	Sunshades, for example, are automated architectural components that adjust to incoming sunlight or internal temperature to maintain appropriate settings.
Building automation systems	Computer controlled cooling, heating, and ventilation adjusts indoor temperature and ventilation based on preset criteria, frequently with the goal of minimizing energy use.
Energy-saving lighting and appliances	Appliances and lighting that fulfill the minimal energy consumption standards per Output. Low-energy bulbs with .approximate range (30 – 40 %) .

9. Passive solar building design:

Through the structure's windows, passive solar building design receives, stores, and distributes solar heat in the winter and rejects solar heat in the summer. , walls, and floors. It may also make the best use of sunshine for indoor lighting.

Passive solar structures are designed to provide indoor thermal comfort thereby reducing the demand for active heating and cooling systems during the sun's daily and yearly cycles

Passive solar building design is a sort of green building design in which active systems such as mechanical ventilation and photovoltaic panels are not used.



(Fig.7) Elements of passive solar design.

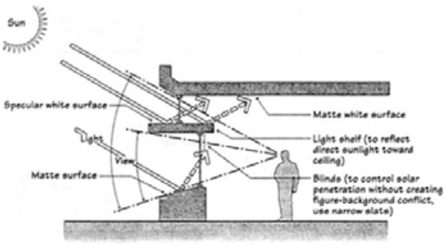
i. Daylight:

The term "daylight" refers to the combined rays of sunlight that reach the Earth's surface during the course of a 24-hour period ,included are not just rays from the sun but also those from the sky and the Earth and other terrestrial objects.

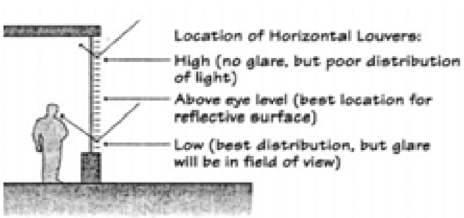
There is daylight at a given location so long as the sun is above the horizon. Day-lighting refers to the technique of locating windows and other openings and reflecting surfaces so that natural light can be used to effectively illuminate an interior space during the day. **(Fig.8)**

- **Design and Function:**

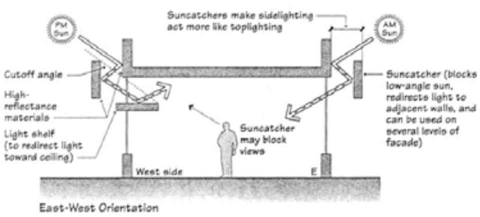
1. Sun Light Redirecting Devices



2. Light shelves



3. Sun-catchers

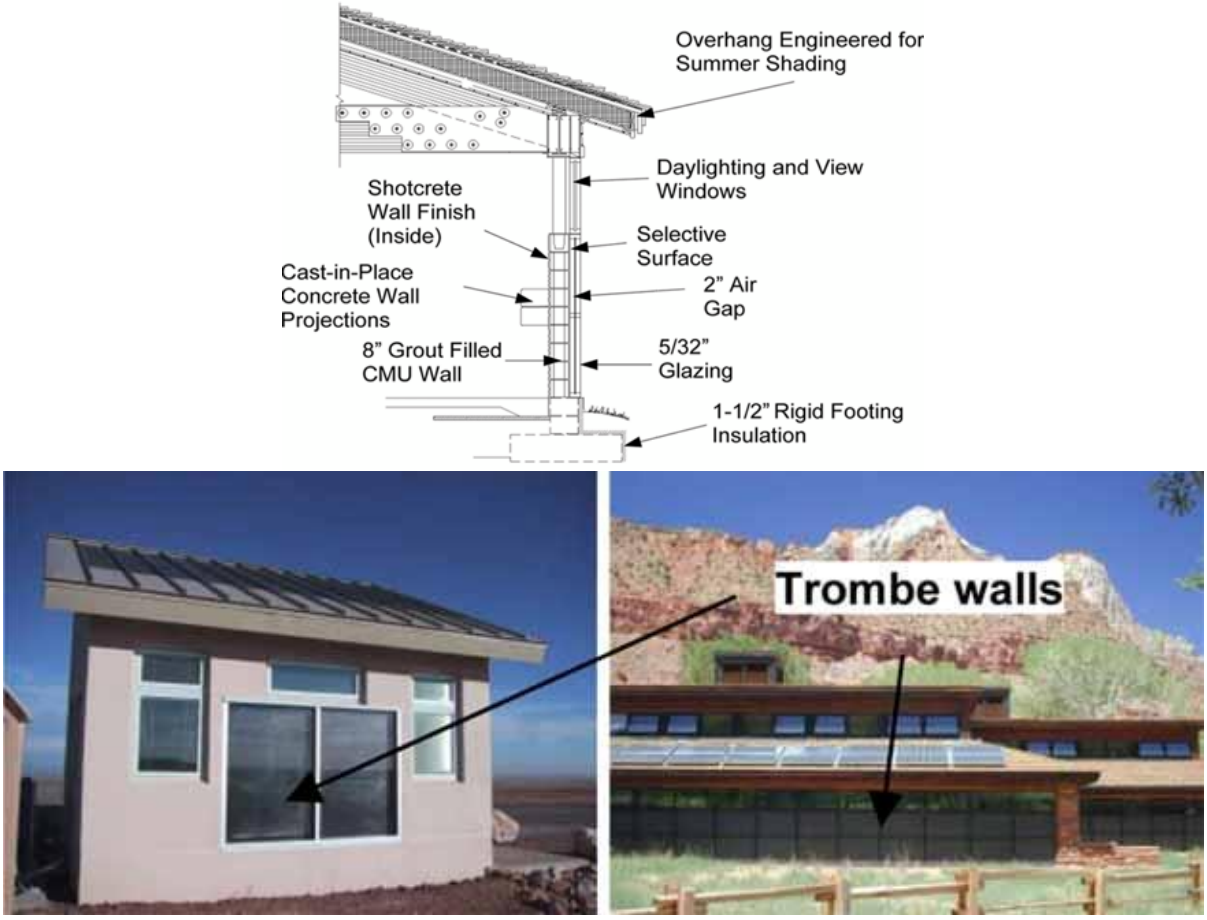


(Fig.8) A skylight providing internal illumination

ii. Trombe Walls:

Since ancient times, people have built their homes with thick walls of adobe or stone in order to store the sun's heat during the day and gradually release it at night.

These conventional methods are often expanded upon in modern low-energy buildings by the incorporation of a heat storage and distribution system. known as a Trombe wall.. **(Fig.9)**



(Fig.9) Trombe Walls concept

iii. Light tubes (Advanced eco-design):

Natural or artificial light is transported or distributed via light tubes or light pipes. In the context of day illumination, Some other names for these devices include sun pipes, sun scopes, solar light pipes, and daylight pipes, because they have a smaller surface area, they do not enable as much heat transmission as skylights. **(Fig.10)**

(**Fig.10) light tube section design**

A. The Green roofs:

A green roof, also known as a vegetated roof or eco-roof, is a roof that has plants and a growing media planted on top of a waterproofing membrane. **(Fig.11)**

(Fig. 11) Nan yang Technological University
Ref. www.dreamstime.com update10.2022

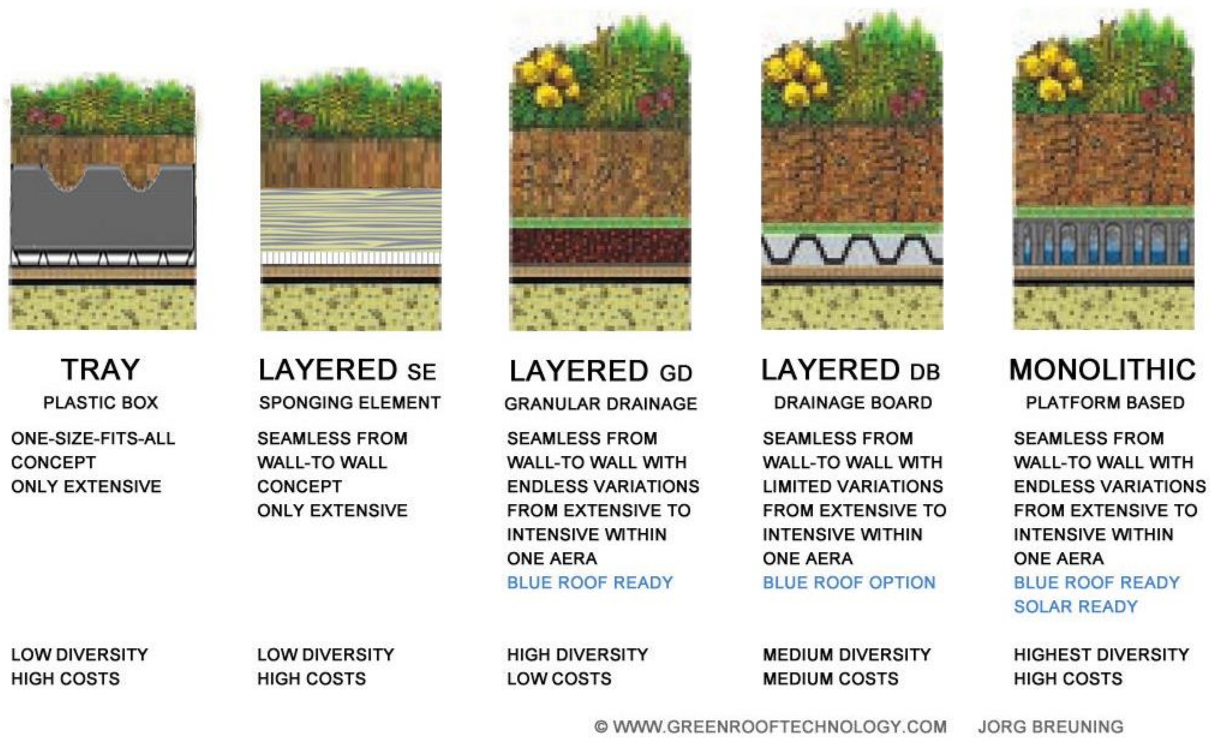
i. Fight The Global Warming:

It has been calculated that if all the traditional roofs in a city were replaced with green roofs, enough carbon dioxide emissions would be avoided over the course of a year to cancel out the annual emissions of 10,000 mid-sized SUVs and vehicles. Their study is the first to investigate the potential of green roofs to mitigate climate change by sequestering carbon. No one would have previously quantified the effect of green roofs on carbon dioxide levels in the atmosphere, despite the fact that this gas is a key greenhouse gas that contributes to global warming.

ii. Design and Function:

Putting a membrane over the top of the natural roof will keep the structural supports from becoming damaged. The root barrier and membrane protection work together to prevent roots from damaging the roof membrane. Insulation is useful for regulating a building's temperature, making it more bearable during the warmer months and during the colder ones.

The drainage section is necessary to ensure the proper range of water content in the growing medium; the aeration section is necessary to promote optimal vegetation growth; and the water storage section will provide more successful vegetation growth. **(Fig.12)**



(Fig.12) Green roof systems , schematic overview , 2021

- **The Photovoltaic Systems (PV):**

A photovoltaic system is one that directly convert light into electricity using solar cells. **(Fig.15)**. the rest of the system ("balance of system" or "BOS") has a wide range of parts that change with each use case. The BOS is decided by the system type and load profile. In most cases, the goal of system design is to optimize energy output for a given investment. Since the first solar cells were manufactured, the cost of photovoltaic has steadily decreased due to technological advances and increases in manufacturing scale and sophistication.

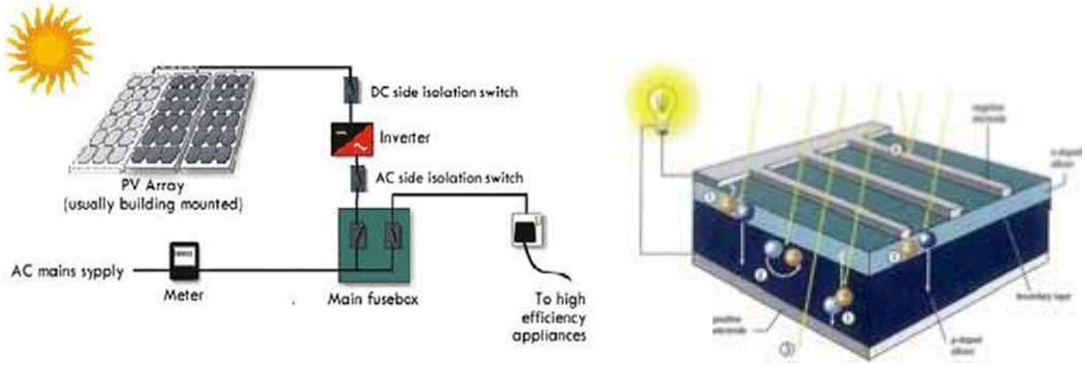
About 1200 kg of carbon dioxide equivalent (CO2) per year, or about 30 tons during the lifetime of a typical residential P.V (photovoltaic) system, might be saved. We can help the United Kingdom meet its target of generating 15% of its energy from renewable sources by 2020 by switching to solar electricity for our home. This is great news for both humanity and the planet.

The size of the system will be determined by your location as well as your power requirements in both AC and DC. It is estimated that a three-bedroom home uses 3,300 kWh annually (not including heating and cooling) , according to the Energy Saving Trust.

(Fig.15) photovoltaic system 'tree' in Styria, Austria

i. Design and function:

Solar photovoltaic (P.V) technologies rely heavily on silicon. Silicon is being used to generate power, which is then sent down a cable to an inverter when the sun hits it. The inverter changes DC power to AC power before it enters the building's main electrical circuit (AC).The system's electricity works in tandem with the existing electrical supply, sharing the same circuitry and wiring. **(Fig.16)**.



(Fig.16) A typical PV system comfy gyration- Design and functioning of a crystalline silicon solar cell

ii. Stand-alone systems :

- Stand-alone system applications:
- Mobile systems in cars, camper vans, boats, SOS phones, parking ticket machines, traffic signal and observation systems, communication stations, buoys, and other off-grid applications
- Gardening and landscaping applications

iii. Grid-connected systems:

A grid-connected PV system primarily consists of the following components:

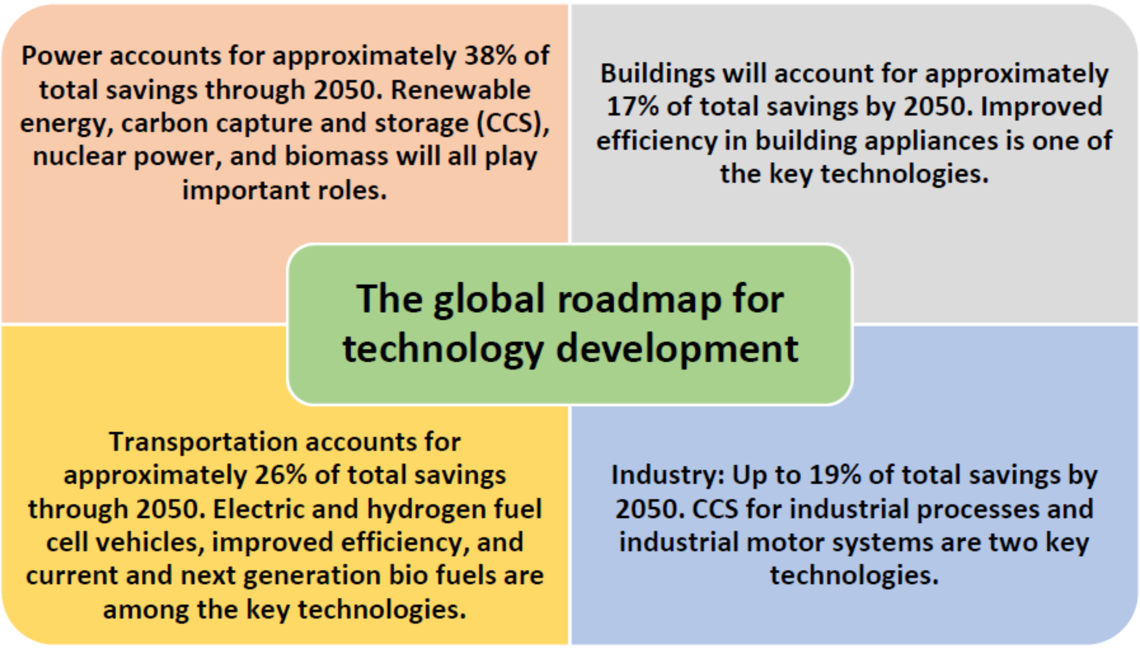
- Photovoltaic modules/array (multiple PV modules connected in series or parallel with Mounting frame).
- PV array combiner/joint box (with protective equipment)

- .Direct current cabling (DC).
- DC main disconnect "isolator switch".
- Inverter.
- AC cabling.
- Meter cabinet with power distribution system, supply and feed meter, and power connection shows the typical layout of a grid-connected PV system. **(Fig.17)**.

(Fig.17) Grid- connected PV system on the urban commercial estate Brockhill in Woking Borough, UK - Shell solar factory in Gelsenkirchen, Germany: Framed laminates - Scheuten

10.The global roadmap for technology development and technologies for low carbon projects:

The global technological development road-map will focus four major sectors:



(Fig.13) A diagram of a green roof – Ref. Notified by Author

Designing technical solutions will demand a precise balance of actions along the innovation cycle. Because innovations are at diverse phases of development, solutions must focus on both near-term commercialization and research, development, and demonstration (RD&D) for those further out... **(Fig.14)**

Power generation sector

CO_2 capture and storage (CCS) – Fossil fuel power generation
Nuclear power plants
Onshore and offshore wind energy
Biomass integrated gasification combined cycle (BIGCC) and co-combustion
Photovoltaic systems (PV)
Concentrating solar power (CSP)
Coal integrated gasification combined cycle (IGCC) systems
Coal ultra-supercritical steam cycles (USCSC)

Buildings sector

Energy efficiency in buildings and appliances
Heat pumps
Solar space and water heating

Transport sector

Energy efficiency in transport
Second-generation biofuels
Electric and plug-in hybrid vehicles
Hydrogen fuel cell vehicles

Industry sector

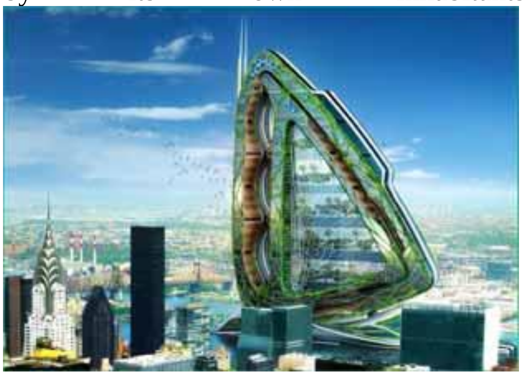
Carbon capture and storage (CCS) – industry, H_2 & fuel transformation
Industrial motor systems

(Fig.14) Priorities for key technologies in technological development
Ref.: Modified from IEA, 2008

11.Cost Consequences

There is a cost involved with zero-carbon building, according to UK-GBC (2007). The cost varies substantially based on the shape and usage of the building. Preliminary calculations, however, suggested that the premium may range from more than 30% to as little as 5% or 10% of current baseline expenses. In practice, ZEB-ZCB are commonly thought to be excessively expensive or to necessitate too many modifications in design and building procedures. Many individuals assume that economies of scale will reduce the cost of environmental technologies; pilot projects and R&D will give a testing ground and information to overcome industrial resistance in practices. Efficiency levels exceeding 30%, according to Jennings (2009), are not commercially viable in the market. Industry must evaluate both what is technically feasible and what is cost-effective for both owners and society.

12. Applying the global roadmap for technology development for zero energy projects

Project	Masdar City	Dragonfly- Metabolic , Farm for Urban Agriculture
Designer	Norman Foster	Vincent Callebaut Architect
Location	Abu Dhabi-U.E.A	New York City, Roosevelt Island
Date	2016	Proposal 2009 – within 2025
Type	Zero carbon city	Vertical farm
Style	Contemporary	Contemporary eco-design
Technologies used	photovoltaic Farms – Renewable energy	Green Structure – eco-design strategy
CO2 Emissions	None	Strategy is reducing emission by green design
Design	Masdar City is a (6-squ.KM) sustainable development that will change city design and construction in the future by combining traditional Arabic planning concepts with existing and future technologies. **Masdar is comprised of five integrated units.:** 1. **Masdar City** is a planned community that will serve as a research and testing ground for clean technology, with a population of 40,000 resident citizens and 50,000 daily commuters. 2. **Masdar Institute of Science and Technology:** which was created in collaboration with the Massachusetts Institute of Technology (MIT), will eventually house 800 students and 200 academic members. 3. **Utilities and Asset Management:** The Utilities team is a renewable energy project developer focusing on concentrated solar power (CSP), photovoltaic (PV), wind, and waste-to-energy both locally and internationally. 4. **Carbon Management:** Aims to accelerate the development of low-carbon economies throughout the world by monetizing carbon emission reduction programmers. The Carbon Management Unit is also constructing a network of carbon capture and storage facilities throughout the Emirate of Abu Dhabi.	As a result, the Dragonfly project proposes creating a prototype of an urban farm with a mixed program of housing, offices, and laboratories in ecological engineering, in addition to farming spaces that are vertically laid out in several floors and partly cultivated by its own inhabitants.  This vertical farm develops all sustainable organic agricultural applications based on intensive production that varies with the seasons. This nourishing agriculture is also recognized for the reuse of biodegradable waste, energy conservation, and the conservation of renewable resources in order to plan for Eco systemic denitrification. The tower combines stock farming, which assures the production of meat, milk, poultry, and eggs, with agricultural grounds, which are actual biological reactors that are continually regenerated with organic humus, floor by floor. To avoid washing of soft substratum layer, it diversifies the planted variety. As a result, the cultures succeed one another vertically depending on their agronomic capacity to supply some ground between planted and gathered essences. Like a result, the tower becomes metabolic and self-sufficient in water, energy, and bio-

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<td></td>
<td>5.Industries:
Developing large-scale, strategic renewable energy projects on a local and worldwide scale, including a PV production plant in Germany and Abu Dhabi, as well as a solar manufacturing cluster covering 4 square kilometers in Abu Dhabi.
</td>
<td>fertilization as a genuine living creature. Nothing is thrown away; everything is recyclable for ongoing auto-feeding.</td>
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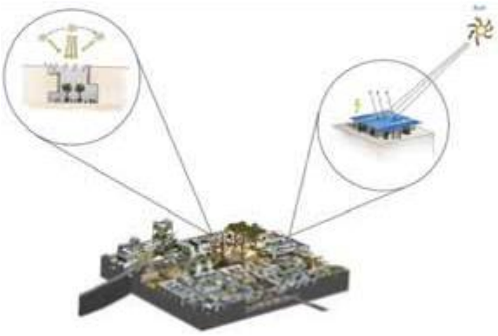
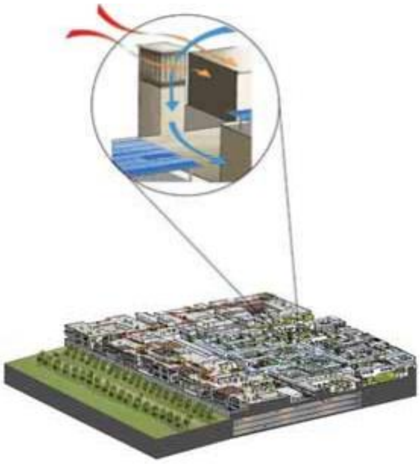
<td>Environmental Features</td>
<td>City's design is influenced by traditional Arabic architecture and urban planning in the region, and it includes numerous instances of how traditional design practices assist to minimize energy use and improve the quality of the environment.

Shaded pathways and narrow roadways minimize glare and solar gain while also providing pleasant and appealing outdoor green areas..

The diagonal orientation of the streets and public areas maximizes the cooling night breezes and reduces the influence of scorching midday winds, while also minimizing the direct sunshine effects also traditional passive elements for example: wind towers, shutters, and sun shades contribute to increased comfort.</td>
<td>Functional organization is expressed architecturally by two rectangular towers symmetrically grouped in pair around a massive climatic greenhouse that connects them and deploys itself between two crystalline wings.
These ultra-light glass and steel wings retake the building's loads and are directly inspired by the structure of dragonfly wings.

Two developed rings around these wings. Their naturally carved exo-structure fits the agricultural cultures' inter-climatic zone, They provide support.</td>
</tr>
</table>

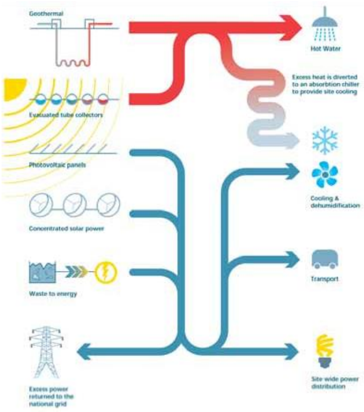
City's structures are among the most advanced in the world. The use of artificial lighting and air conditioning is reduced when residential and business areas are designed intelligently.



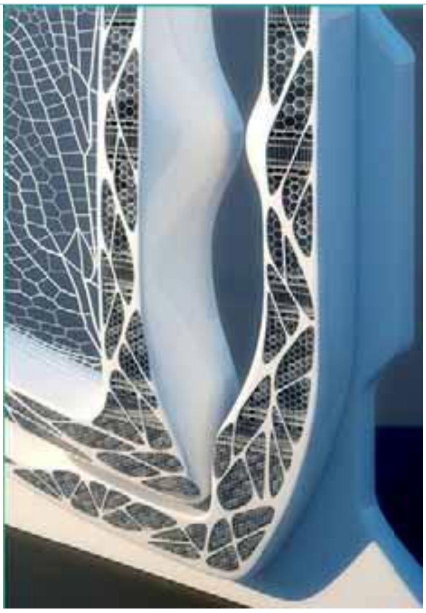
Masdar City is a major contributor to the Estidama programme, which sets new standards in urban planning, architecture, and construction; all of its buildings will exceed the highest criteria now set by internationally recognized organizations.

Power Generation Using Renewable Resources or Adapting Natural Means to Reduce Power Consumption Offer the Largest Carbon Footprint Reductions After City Efficiency Improvements are Made. Power for a typical large city would come from an enormous power plant far away, filled by coal, oil, gas, or nuclear energy. Masdar uses the subsequent technological methods:

- Photovoltaic Technology
- Concentrating solar power
- Evacuated tube collectors
- Geothermal
- Waste to energy

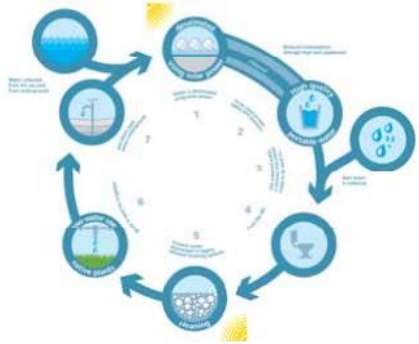
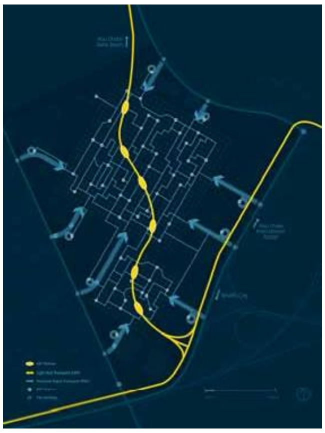


Water : Water is one of the UAE's most valuable resources, and the power required to supply clean, drinkable, and usable water is



The full set comprises a "double layer" design in bee nest mesh that maximizes solar passive energy by storing warm air in the wall's thickness in the winter and cooling the atmosphere in the summer through natural ventilation and plant transpiration.

While the grounds sustain the orchards, the walls and ceilings have been turned into three-dimensional kitchen gardens. The residential and commercial interior frontages project the cantilever of their hydroponic balconies with hexagonal parts toward the New York skyline, expanding the culture layers by floors. The vegetation is abundant, the earth is filled with insects, and low-income urban customers freely grow animals in holding tanks. The architecture is now edible..

	often extreme. Masdar City has been designed to decrease water waste and increase the efficiency of production techniques.  **Transport:** The PRT, or Personal Rapid Transit, is an automated taxi service with the convenience and style of a luxury sedan. Up to 135,000 trips per day can be provided with the help of the over 3000 cars that will be on hand. Since it operates around the clock, the system will make it so that drivers no longer have to deal with traffic, parking, waiting, being lost, or being involved in a vehicle accident.  The city will be traversed by the Light Rail Transit (LRT) system as it travels between Masdar and the airport are connected by a sophisticated rail system. Six LRT stations will be intelligently placed in high-traffic areas to increase the number of people who use the rail system.	
Why Zero	The project will be the most recent of a limited group of perfectly planned, highly specialized, research- and technology-intensive municipalities that incorporate a living environment. It will be entirely dependent on solar energy and other renewable energy sources, and it will have a sustainable, zero-carbon, zero-waste ecology.	The tower is now a truly living organism that is self-sufficient in both of water and energy bio– fertilizing, and its main concept is to establish a vertical farm, inspired by nature in the shape of the design of the building and rely on the green structure.

13.CONCLUSION:

1. Greenhouse gases (GHGs) are discharged into the environment during various stages of a building's life.
   - Construction and building operations.
   - Renovation and demolition of buildings.
   - Annual operation emissions can range from 0 to over 100 kg CO2 e/m2 depending on the region in which the building is located and the building's energy mix.
2. Among the strategies for reducing GHG emissions during operation are:
   - Decrease the energy consumptions.
   - Solar and wind energy are examples of renewable energy sources. - Low-impact hydroelectric - Bio - fuels (in certain circumstances) - Geothermal.
3. The construction sector is essential to the success of any strategic carbon emissions policy since buildings consume so much energy. In order to encourage the market to innovate and adapt low carbon technology, it is helpful to take steps to promote zero energy and zero carbon construction projects.
4. It is believed that ZEB and ZCB will serve as examples of what can be accomplished when money, principles, and sustainable and environment architecture are all pooled together. Much of the change initiative comprises better use of existing technology, while other parts of the equation call for adjustments in attitude and approach.
5. The innovation behind the ZEB/ZCB should be seen as both a process and a product, with both being taken into consideration in any future attempts to reproduce this design. Effective strategies and policies to increase energy/carbon performance may be developed and executed when zero energy or zero carbon is defined pragmatically as a directional aim rather than a set quantitative target..
6. As much as 38% of all human-caused greenhouse gas emissions are caused by buildings (20% from residential and 18% from commercial). To a large extent, the industrial sector is to responsible for global warming. Nonetheless, the IPCC claims that this is also the industry where GHG reductions may be accomplished in the most cost-effective ways.
7. In the future, construction companies may endeavor to improve energy efficiency and declare their buildings "net zero energy" or "carbon neutral." It is expected that our society would accomplish building energy independence. and that ZEB/ZCB will become economically and socially acceptable in the near future.

14. Recommendations

1. Applicability of the demonstration project of zero energy buildings uses the types: further studies, researches, pilot projects can make reference to the design approach and methodology of ZCB and ZEB in addition to applying the necessary modifications for mixed use lager scale development projects.
2. Development of local /regionally manufactured building materials and green building systems: more research and development is needed to faster and increase the supply of quality and cost-effective project products with third party certification, this will greatly improve the financial viability of low / Zero Carbon developments.
3. Policy to mandate ZCB and ZEB , supported by clear definitions of ZCB and ZEB by the industry , there is a need for a stronger push by the government and pull by the green building industry for market transformation is vital for a city wide low/zero carbon building movement .

REFERENCES

[1] P.Torcellini. "Zero Energy Buildings: A Critical Look at the Definition". National Energy Renewable Laboratory (NREL). June 2006

[2] Paul R. Epstein and Evan Mills ,"Climate Change Futures", The Center for Health and the Global Environment , Harvard Medical School,2006

[3] J. T. Kiehl and Kevin E. Trenberth,"Earth's Annual Global Mean-Energy Budget", National Center for Atmospheric Research,* Boulder, Colorado,2000

[4] Raupach, M.R. et al. . "Global and regional drivers of accelerating CO2 emissions",2007

[5] Jennifer O'Connor," Tips for daylighting with window", Ernest Orlando Lawrence Berkeley National Laboratory, 2007

[6] P. Torcellini and S. Pless, " Trombe Walls in Low-Energy Buildings: Practical Experiences " Denver, Colorado,2004

[7] 2009 Ends Warmest Decade on Record. NASA Earth Observatory Image of the Day, 2010.

[8] "The building sector and greenhouse: key facts "(CIE) the Centre for International Economics, Australian, 2008

[9] Shane Tomlinson "Breaking the climate deadlock technology for a low carbon future", 2008

[10] "Planning and Installing Photovoltaic Systems A guide for installers, architects and engineers", USA, 2006

[11] Report "REDUCING CARBON DIOXIDE EMISSIONS IN THE ENERGY SECTOR", APRIL 2009

[12] D. Lloyd Jones, "the solar office: a solar powerd building with a comprehensive energy strategy", 2000

[13] Masdar city brochure report

[14] Rowan T. Sutton, Buwen Dong, Jonathan M. Gregory .Report- "Land/sea warming ratio in response to climate change"

[15] U.S. Environmental Protection Agency. (October 28, 2009). Green Building Basic Information. Retrieved December 10, 2009

[16] Energy and Climate Department of The Bellona Foundation, "How to Combat Global Warming", Oslo, 2008