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CONSERVATION AND IMPLEMENTATION OF SOLAR ENERGY IN GREEN BUILDING

Rajesh K
M.Tecm CEM
Dr.M.G.R. Educational and research institute

ABSTRACT

The world is fast becoming a global village due to the increasing daily requirement of energy by all population across the world while the earth in its form cannot change. The need for energy and its related services to satisfy human social and economic development, welfare and health is increasing.

Returning to renewables to help mitigate climate change is an excellent approach which needs to be sustainable in order to meet energy demand of future generations. The study reviewed the opportunities associated with renewable energy sources which in cludes: Energy Security, Energy Access, Social and Economic development, Climate ChangeMitigation, and reduction of environmental and health impacts.

Despite these opportunities, there are challenges that hinder the sustainability of renewable energy sources towards climate change mitigation. These challenges include Market failures, lack of information, access to raw materials for future renewable resource deployment, and our daily carbon footprint. The study suggested some measures and policy recommendations which when consideredwould help achieve the goal of renewable energy thus to reduce emissions, mitigate climate change and provide a clean environment as well as clean energy for all and future generations

The world is fast becoming a global village due to the increasing daily requirement of energy by all population across the world while the earth in its form cannot change. The need for energy and its related services to satisfy human social and economic development, welfare and health is increas ing. All societies call for the services of energy to meet basic human needs such as: health, lighting, cooking, space comfort, mobility and communication and serve as generative processes (Edenhofer et al., 2011). Securing energy supply and curbing energy contribution to climate

change are the two over-riding challenges of energy sector on the road to a sustainable future (Abbasi & Abbasi, 2010; Kaygusuz, 2012). It is overwhelming to know in today's world that 1.4 billion people lack access to electricity, while 85% of them live in rural areas. As a result of this, the number of rural communities relying on the traditional use of biomass is projected to rise from 2.7 billion today to 2.8 billion in2030 (Kaygusuz, 2012). Historically, the first recorded commercial mining of coal occurred in 1,750, near Richmond, Virginia. Momentarily, coal became the most preferred fuel for steam engines due to its more energy carrying capacity than corresponding quantities of biomass- based fuels (firewood and charcoal). It is noteworthy that coal was comparatively cheaper and a much cleaner fuel as well in the past cen turies (Abbasi, Premalatha, & Abbasi, 2011). The dominance of fossil fuel-based power generation (Coal, Oil and Gas) and an exponential increase in population for the past decades have led to a growing demand for energy resulting in global challenges associated with a rapid growth in carbon dioxide (CO_2) emissions (Asumadu-Sarkodie & Owusu, 2016a). Sustainable development has become the centre of recent national policies, strategies and devel opment plans of many countries. The United Nations General Assembly proposed a setof global Sustainable Development Goals (SDGs) which included 17 goals and 169 targets at the UN in New York by the Open Working Group. In addition, a preliminary set of 330 indicators was introduced in March 2015 (Lu, Nakicenovic, Visbeck, & Stevance, 2015). The SDGs place greater value and demands on the scientific community thandid the Millennium Development Goals. In addressing climate change, renewable energy, food, health and water provision requires a coordinated global monitor ing and modelling of many factors which are socially, economically and environmentally oriented (Hák, Janoušková, & Moldan, 2016; Owusu, Asumadu-Sarkodie, & Ameyo, 2016).

INTRODUCTION:

Energy efficiency is the key to achieve sustainability in green building. Loweringthe energy consumption in construction is starting to become a significant improvement chance for many organizations. According to International Energy Agency (IEA) (2015), energy efficiency refers to the lesser energy

usage to provide the same quality of service. Green building is known as sustainable building (Hwang & Tan, 2012); (Samari, Godrati, Esmaeilifar, Olfat, & Mohd Shafiei, 2013) or "high performance" building (Howe, 2010). Sustainable building is put into practice all over the whole phases of building, from preconstruction to removal of the construction, lower the dangerous or toxic effect on the environment of building (Hwang & Tan, 2012), is similar with green building is the development of constructing and building structures, and utilizing procedure that are environmental and resource efficient in a construction's activities (Kamarudin, Mohd Fazli, Md Nor Hayati, Ismi, & Norhana, 2011). In general, green building intended to decrease the environment impacts of the construction activities and it is sustainable. Energy efficiency bring a number of benefits to society, is a key andimportant point to attain sustainability in green buildings and organizations.

Furthermore, energy efficiency assists to manage of increasing energy costs, reduceenvironmental impacts such as lower the greenhouse gas emission, and added the value and to enhance competitiveness of green buildings. By using energy efficiency, it is effortless to show the buildings or construction are really green (Howe, 2010). In this research will explore the methods to apply energy efficiency to achieve sustainability in green building. Problem Statement In thistwenty-first century, environmental issuesare getting serious such as climate change, pollution, and waste problem.

Climate change is causing by greenhouse gases (GHGs) emissions that from construction activities such as utilize of fossil fuels and non-renewable energy (Hwang & Tan, 2012). As construction activities are the major cause of greenhouse gas emission that influence climate changes, applied energy efficiency can lower the impact of GHGs emission. People are less aware about green building, due to lack of information and understanding in sustainability of green building (Zalina & Soebarto, 2013), energy efficiency is one of the criteria in green building and thus this research study will explore the benefits of energyefficiency in green building. Even though green buildings use a lesser amount of energy compare with usual building, energy efficiency still hard to achieve (Howe, 2010), due to some barriers to putinto practice in energy efficiency.

Global warming has become a threat of our time to the existence of habitat on thisearth which has made a clear impact on the level of energy and water consumption. No doubt, increase in the ambient temperature increases indoor and outdoor temperature level of the buildings which catalyzes the use of energy and cost intensive mechanical

air conditioning systems. Depletion of fossils also points to alternate energy sources which are to be essentially soughtfor. Hence thirst for alternate energy is a passion of time for the conducive existence of living creatures in this globe.Research in this area has attained a faster pace where much time and money have been spent to ensure the coexistence of man and living things. Green roof tops belong to such an idea for cutting down the energy consumption and enhancing the comfort level of commercial and residential buildings. A number of collaborative research programmes are underway to reduce the heat in leak to the building and to improve the indoor conditions. Basically green roof technology is a passive cooling system that resists the heat penetrated due to solar radiation. In green roofs, solar radiation is balanced by sensible and latent heat fluxes from the

plants and the soil surfaces and with conduction through the soil substrate. Efficiency of green roof depends on the climatic conditions particularly temperature. Green roofs alsoplay an important role in reducing CO2 in atmosphere, used a medium for storm water runoff, vegetation and reducing the noise level in the building. This article critically reviews the research undertaken on green roof buildings thermal potential. It is an effort to shed light into the potential application of green roofs with an emphasis on energy conservation. The cooling potential and thermal performance of intensive and extensive green roofs, green roofs with solar shading and thermal insulation for commercial and residential buildings are also analyzed.

Green roofs are increasingly recognizedas a passive cooling technique to reducethe heat in leak to the building using growing plants. They inhibit the solar energy to penetration into the buildings, reduce the cooling load, and hence reduce the cost of energy driven systems. Several studies have been conducted to measure the potential benefits of green roofs and the findings indicate that they can offer benefits in summer cooling as well as in winter heating. In green roofs, solar radiation is balanced by sensible and latent heat fluxes from the plants and the soil surfaces and with conduction throughthe soil substrate. Efficiency of green roofdepends on the climatic conditions particularly temperature. The green roof offers other benefits in reducing CO2 in atmosphere, used a medium for storm water runoff, vegetation and reducing the noise level in the building. Energy efficient buildings using green roof has been under the research concerns in the recent past. Many research studies are undertaken to explore the feasibility of using this technique to reduce the heat in leak to the buildings and to improve the cooling efficiency

of global an thropogenic greenhouse gas (GHG) emissions, where concentrations had increased to over 390 ppm (39%) above preindustrial levels (Edenhofer et al., 2011).

CHAPTER-2
REVIEW OF LITRATURE

Renewable energy and climate change: Presently, the term "climate change" is of great interest to the world atlarge, scientific as well as political discussions. Climate has been changing since the beginning of creation, but what is alarm ing is the speed of change in recent years and it may be one of the threats facing the earth. The growth rate of carbon dioxide has increased over the past 36 years (1979–2014) (Asumadu- Sarkodie & Owusu, 2016c, 2016f), "averaging about 1.4 ppm per year before 1995 and 2.0 ppm per year there□after" (Earth System Research Laboratory, 2015). The United Nations Framework Convention on Climate Change defines climate change as being attributed directly

or indirectly to human activities that altersthe composition of the global atmosphere and which in turn exhibits variability in natural climate observed over comparable Renewable technologies are considered as clean sources of energy and optimal use of these re sources decreases environmental impacts, produces minimum secondary waste and are sustaina ble based on the current and future economic and social needs.

Renewable energy technologies provide an exceptional opportunity for mitigation of greenhouse gas emission and reducing global warming through substituting conventional energy sources (fossil fuel based) (Panwar, Kaushik, & Kothari, 2011) Energy Efficiency Energy efficiency is a benchmark of energy utilized for providing a service. By enhancing energy efficiency, public will receive and save more energy from that used energy (Department of Energy and Climate Change, 2012). Energy efficiencyused smaller amount of energy to achieve or produce more works or activities.

Moreover, production with energy efficiency have to be seen as a speedy andlow-cost source of new energy provide asthe cost of supplying energy can be reduced a number of cost (Oyedepo, 2012). According Murer, Alonso-

Herranz, de Waal, Spliethoff1, van Berlo3, and Gohlke (2013), energy efficiency is the essential to achieve sustainability in society. Energy efficiency also take a role to strengten in practices and thus can reduce the energy use to supply more services such as lighting, heating, ventilation, and air conditioning (HVAC) and so on (Weber, 2011); (Oyedepo, 2012). Energy efficiency is generally acknowledged as atool to attain reducing in greenhouse gas (GHG) emissions (Zimmerman, 2012).

Benefits of Energy Efficiency According to Department of Energy and Climate Change (2012), stated the benefits of energy efficiency consist of help in economic development, investment in energy efficiency technology can decrease the cost of innovation, reduce the gas emission, and create a sustainable energy system. Economic studies demonstrate that enhanced energy efficiency can increase the productivity and trim down the inflation problems.

Green Building: Green building is alsothe basis of the sustainable constructiondevelopment (Samari, Godrati, Esmaeilifar, Olfat, & Mohd Shafiei, 2013) , sustainable development has brought out to be a global issue since global climate changes have increasingly turn into a serious concern in the future (Hwang, Zhao, & Tan, 2015). The main objective of green building is to construct a healthy built environment based on efficient apply of resources. Previous research defined that green buildings can decrease energy and material usage and enhance occupant health and performance(Singh, Syal, Grady, & Korkmaz, 2010). In summary, the concern of sustainability in the environment of construction development includes: efficient resource distribution; reduction of energy consumption; reduction of embodied energy; promote activities reuse and recycling; and others method in short term and long term the natural resources are continued.

west; design the wall facing of north andsouth, so the heat will be reduced.

Passive Design: Passive design is also a way of reduce energy consumption and increase energy saving to comply with energy efficiency (Ng & Akasah, 2011). Passive design included orientation, placement of windows, shading, size and shape, planning and design, and construction features. The property development company apply orientation of windows and roofs, orientation of the building, and shading in their development projects. According to the interviewee, passive design such as orientation of windows can help to create daylight and natural ventilation or cross ventilation. Thus, they can reduce the use of external energy such as artificial lighting like light bulb and air conditioner to reduce the indoor temperature. the company planned the orientation of windows appropriately to get sufficiency daylight that can reduce the use of electric lighting such as artificial lighting.

Moreover, to prevent the high indoor temperature, the windows are tinted, to screen out the sunlight enter the building, the glass itself which can reduce heat and only 70 to 80% sunlight. The company also concerned in

the orientation of building to prevent the heating and cooling system. According to interviewee,they avoid the wall facing of east and

CHAPTER 3

CONCEPT

The green roof is a vegetative layer grownon a rooftop. The green roof consists of six layers from bottom to the top: waterproofing, root barriers, drainage and retention, filtration sheet, growing medium and, finally, plants. Two types of green roofs are generally distinguished: extensive and intensive.1.Types of Green Roofs Extensive Intensive Low soil thickness(5-15 cm) High soil thickness (above 15 cm) Difficult to access Easily accessible Light (50-160 kg/m2) Heavy (more than 200 kg/m2) Can be maintained easily Difficult to maintain Less expensive, More expensive.

Experimental Approach The various experiments done by eminent researchers from different countries in the field of green roof efficiency are discussed in this session. Onmura et al. [1], in 2001, in his studies in a three story building in Japan, investigated the evaporative cooling effect from roof lawn gardens and it was confirmed that the surface temperature of the roof decreased by 6 0 to 30oC during day time which was estimated to be a reduction of 50% heat flux.

An experimental study on the selection of appropriate plants for the green roof was done by Liu et al. (2011).The experiment was done at the top floor of an eight floorbuilding located in Taiwan [10]. The results indicate that the plants from CAMfamilies, Portulacaceae, Crassulaceae andEuphorbiaceae are more droughts tolerant by humans. The results showed that the temperature reduction decrease with plant height in the following pattern: 35cm>15cm>10cm. The results also indicate that the plants with green coloredleaves are more effective in roof top heat insulation

CHAPTER 4

METHODOLOGY:

Methods to apply Energy :Efficiency Energy efficiency policy is one of the methods to apply and boost energy efficiency. For example, energy efficiencyin the United State has performed a wide range of policies to

promote energy efficiency, which were initially publicizedduring the energy crises of the 1970s.

Additionally, the energy efficiency policy in Nigeria is also can be concerned, the countrywide energy policy and the outlineof energy master plan include fundamental policies and approaches for energy efficiency and conservation. The energy efficiency policy in Nigeria consists of a few terms provides for the following: The encouragement of energy efficiency and conservation in manufacturing, industrial, housing, and transport sectors, creating a program onmanufacturing or industrial energy efficiency and conservation in cooperation with Manufacturers Association of Nigeria (MAN) and professionals in higher institutions and research centres, Introduction of fuel efficiency classifying programme in the transportation sector for different types ofvehicle, set up codes and measures for energy efficiency and conservation technologies, and implementing the codesand measures (Oyedepo, 2012).

According to Milner et al. (2015), decreasing uncontrolled ventilation of residences will also help to enhance energy efficiency and can defend againstthe entrance of pollutants from the outdoor environment.

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Barriers of to Attain Energy: Efficiency Barriers that hinder employing industrial end-use energy efficiency are stated in the following three main categories which are economic and financial, regulatory, and informational (United States Department

of Energy, 2015). Moreover, according to Department of Energy and Climate Change (2012), consists of four barriers to deploy energy efficiency which are embryonic markets means undeveloped marketplace, lack of information, misaligned financial incentives in enhancing energy efficiency and underestimating energy efficiency. It is quite similar with the United States Department of Energy stated as above.

Greenough and Tosoratti (2014) stated investment of energy efficiency in new develop building or present buildings in the preparing and industrial engineering sector; build up a taxonomy of the barrier to energy efficiency commercial buildings is the gap between the chance for cost effective in investment of energy efficiency and the stages of investment in performance.

Qualitative method: Qualitative method was conducted in this research for the purpose of this study. Eco World Development Sdn. Bhd. as a property development company is chosen to interview in this research. Qualitative method is the most appropriate method for this research because it is morenarrative the real about the situation in the company which will be researched and interviewed and the time constraints for this research. Qualitative data are analysed for what the data explain about personal's experiences, opinions, and meanings such as they ought not to be made to match to the pre-existing philosophies (Koch, Niesz, & McCarthy, 2014). There are two types of data such as primary and secondary data and were be used in this research. Primary data for this research were obtained from an interview with an executive from Eco World

Development Sdn. Bhd. and observation method also occurred since it usually will be associated with interview together. In this research, secondary data was obtained through literature review, the references from books and electronic media such as websites of internet, articles, journals conference papers, and reports which related to the research.

Data Collection Methods : Data collection in this research was obtained by interview and observation, a property development company which is Eco World Development Sdn. Bhd. was chosen in this research. Interview is a keyof qualitative data gathering method which is commonly applied in performingfield studies (Qu & Dumay, 2011). In- depth interview is also known as

semi structured interview. Semi- conducted interview can present trustworthy and comparable qualitative data (Newton, 2010). Semi-conducted interview was selected to collect data in this research because it is useful information from executive in the company, which is Eco World Development Sdn. Bhd in Penang, Malaysia to explore about the practices of energy efficiency and green building applied by their company in development project. The researcher had prepared a set of questions as an interview guide to achieve the research objectives.

Data Analysis Method :According to Koch, Niesz, & McCarthy (2014), data analysis with inductively is importantfeature of qualitative research. Collectingand analyzing data are completed in continuous iteration, through analysis conducting more data gathering (Arendt, et al., 2012; Koch, Niesz, & McCarthy, 2014). Interview's reactions, personal experiences and life stories must be recorded in depth because it is an essential data in data analysis process (Carter & Little, 2007). The primary datais the answers given by the interviewee from the company. In addition, secondarydata was obtained from literature review from books and electronic media. The researcher will analyze the collected data and make the finding for the company to achieve the company sustainability.

Modeling and Theoretical Prediction:A mathematical model of the dynamic thermal behavior of actual green roofs was studied by Barrio et al. [17], 1998. Several parametric sensitivity analyses were carried out to evaluate the cooling potential of green roofs in summer. He formulated the most important design considerations for green roofs. Among them the most important factors were selection of plants with large foliagedistributed mainly in horizontal direction and selection of light soils, that reduces the thermal conductivity as well as weight. The main conclusion of these analyses was that green roofs will act as insulation ones, reducing the heat flux through the roof. A detailed analysis of the thermal properties and energy performance study through mathematical approach was done by Niachou et al. in 2001. The analysis was done in two stages: during the first stage, extended surface and air temperature measurementswere taken

at the indoor and outdoor where green land was installed and in the second stage the energy savings were examined. In his findings the greatest energy savings during a whole year period was 37% for non-insulated buildings

Green Roofs: Other Benefits Reduction of Carbon dioxide Studies shown that green roofs play a role in the reduction of CO2 in the atmosphere. Carbon is a major component of plant structures and is naturally sequestered in plant tissues through photosynthesis and into the soil substrate via plant litter and root exudates. A green roof will serve as a carbon sink.Getter et al. [22], 2009, in his study in Michigan, USA over a period of two years estimated the carbon sequestered byfour species of Sedum in a 6.0 cm substrate depth extensive green roof. The ground plant material and root biomass stored an average of 168 g C m-2 and 107g C m-2 , respectively, with differences among species. Substrate carbon content averaged 913 g C m 2. In total, this entire extensive green roof system net carbon sequestration totaled 378 g C m-2

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Reduction of Noise Level: Van Renterghem and Botteldooren, et.al. 2008, analyzed the effects of intensive and extensive green roofs on noise level. There is a linear relationship between the roof space covered with canopy and the reduction in sound [24]. Because green roof growing substrates tend to be coarse,sound waves enter the pore space and areattenuated by the numerous interactions with the substrate particles. Botteldooren, et.al. in 2009, analyzed that a green roofwas able to reduce 10 dB over the frequency range from 500 to 1000 Hzcompared to a bare roof. Increase in substrate depth up to a depth of 20 cmimproved the noise reduction rate.

The reduction in runoff generally ranges from 50% to 100% depending on the type of green roof system, substrate composition and depth, roof slope, plant species, preexisting substrate moisture, and the intensity and duration of the rainfall. A study was conducted by Hilten,et.al. [25], (2011) on the effectiveness of green roofs to mitigate storm water using computer simulation. Simulation results for runoff in terms of peak flow reduction, retention, and detention time were evaluated for the green roof. Storm data collected as part of a green roof study in Athens were used to validate the HYDRUS-simulated runoff. It was shownthat the green roof with growth media depth of 10 cm provides complete retention for storms up to 2.0 cm in depth, while providing detention for storms as large as 7.93 cm when assuming initial soil moisture content of 0.1. Detention time for storms between 5cm and 7.93 cm

were approximately 12 hrs. Concerning the effectiveness of green roofs to reduce storm water runoff, simulations showed that green roofs are highly effective for small storms. For larger storms (>2.54 mm), green roofs can act to extend runoffduration thereby reducing surge normallyevident with impervious surfaces

USE OF SOLAR ENERGY IN

BUILDING: These are buildings that ensure that waste is minimized at every stage during the construction and operation of the building, resulting in low costs, according to experts in the techniques associated with the `Green Building' include measures to prevent erosion of soil, rainwater harvesting, use of solar energy.

Researchers have studied renewable energy power plants and their applications in different regions. Kalla et al. have studied single-phase

independent microgrid power systems. The research carried out by Kalla and his colleagues is worthy of reference for independent power plant research. These power plants make use of the potential of renewable energy in a certain field; Maturi et al. conducted an experimental study on the heat dissipation effect

of photovoltaic panels on their powergeneration efficiency. Two forms

of photovoltaic panels (with fins and without fins) Fins) were compared experiments Wei et al. compared the economics of domestic hot water systems

and photovoltaic building integrated systems Bakos et al. used a computerized renewable energy technology assessment tool to compare the grid Feasibility analysis of BIPV system Based on the above comparative studies, the current utilization of solar energy resources mainly maximizes its efficiency from the perspectives of solar hot water utilization, solar power supply,and economy. As a clean, pollution-free renewable energy, solar energy is expected to play an active role in the future energy diversification plan due to its environmental friendliness, and has very sufficient availability; developmentof renewable energy utilization

technologies applied to buildings, such as The efficient combination of the solar energy utilization system and the externalstructure of the building makes it a part ofthe building structure, which is one of thedevelopment directions of building energy saving.

GENERAL FLOOR PLANSERVICE CENTRE FLOOR PLAN

OVERALL RENDERING

International Research Through Innovation

A crucial component of sustainable architect`ure is the incorporation of solar energy systems into building plans. Solar energy is one example of a renewable energy source that may help lower a building's carbon footprint and promote amore sustainable future.

The direction and shading of the structure must be taken into account when incorporating solar energy into building design. The quantity of solar energy that abuilding's solar panels can harvest depends critically on its direction.

Buildings facing south receive the most direct sunshine all day long and are mostsuited for solar integration. It is crucial totake these aspects into account when constructing a building since they can also affect how much solar energy a building can gather due to shade from nearby structures or trees.

Photovoltaic (PV) panels, concentrated solar power (CSP), and passive solar design are a few examples of solar energytechnologies that may be included into building design.

In order to produce energy directly fromsunshine, photovoltaic (PV) panels are included into the planning and construction of structures.

Building-integrated photovoltaics (BIPV), where the photovoltaic panels act as both a functional and aesthetic component of the building, and freestanding systems, wherethe solar panels are positioned on the building's roof or exterior, are two examples of this sort of integration.

Photovoltaic panels may be integrated into building design to reduce greenhouse gas emissions, save energy costs, and promote a more sustainable future, amongother advantages. Technology advancements have made solar building integration more and more feasible for both residential and commercial structures.

Solar Energy Building Codes andRegulations

Building rules and guidelines for solar energy are a crucial component of sustainable architecture and are intended to encourage the use of renewable energysources, including solar energy, into building design.

Standards for energy efficiency, buildingdesign, and construction are determined by these rules and regulations, which arecreated and enforced by several government agencies and organizations.

Energy efficiency and the usage of renewable energy sources are often prioritized by building rules and laws thatsupport solar energy integration. They may, for instance, set a minimum standard for energy efficiency for new construction, or they might provide incentives for structures that use solar panels and other renewable energy sources.

Additionally, certain laws and regulationsmay provide precise specifications for theinstallation of photovoltaic (PV) panels, such as the necessary size of the system, the building's orientation, and the panel spacing.
Solar energy building codes and regulations can encourage the development of new and innovative building technologies in addition to encouraging energy efficiency and theusage of renewable energy sources.

They may encourage architects and builders to experiment with fresh and cutting-edge ideas that contribute to a more sustainable future by establishingcriteria for the integration of renewableenergy sources into building design.

The promotion of sustainable architecture and the incorporation of renewable energy sources into building design is greatly aided by solar energy building norms and standards.

They give architects and builders a framework to operate within and promote the creation of cutting-edge building technologies that contribute to a more sustainable future.

Solar Energy and BuildingConstruction Materials

Modern improvements in building materials and construction methods have made it easier to incorporate solar energy into buildings. The quantity of energy that can be caught and held inside a structure determines the efficiency and efficacy of solar energy systems, hence building materials are crucial.

Insulation is a crucial factor to take into account when choosing building materials while using solar energy. High-quality insulating materials can aid in the retention of heat produced by solar panels, increasing the system's overall efficiency. Materials like cellulose, fiberglass, or spray foam insulation can be used to accomplish this.

Utilizing reflecting or light-colored materials on a building's roof or façade is a crucial component of choosing construction materials for solar energy integration. The total effectiveness of thesolar system may be increased by using these materials to reflect sunlight and lessen the amount of heat that is absorbedby the structure.A structure's aesthetics and ability to blend in with the surroundings may both be influenced by the building materials used. Solar panels can be more seamlesslyintegrated into the architecture of a structure, for instance, by using building- integrated photovoltaics (BIPV). This may provide a more aesthetically pleasingbuilding that fits in with its surroundings as opposed to sticking out as a distinct technological advancement.

In conclusion, careful evaluation of the building materials and their effect on theefficiency and efficacy of solar energy systems is necessary to incorporate solar energy into the design of buildings. By using the correct material choices, architects and builders can help create buildings that are both visually beautiful and ecologically responsible, as well as sustainable and energy-efficient.

olar energy and may be used in a numberof ways in building design.

In order to minimize dependency on non-renewable energy sources and lessen the effects of climate change, sustainable building design that uses solar energy hasgrown in popularity in recent years. Photovoltaic panels, which turn sunlightinto electricity, are a tool for capturing

The panels, for instance, might be incorporated into the building's façade, mounted on the roof, or even utilized todesign a shade system.

Solar panel utilization may reduce a building's overall energy consumption, save operating expenses, and enhance theinternal environment by lowering the need for artificial lighting and conditioning in addition to offering a clean and sustainable energy source.

Moreover, by providing a source of electricity during power outages, solar energy may assist a building's resilienceby being included into its design.

Overall, using solar energy in sustainable building design is a win-win situation thathelps the environment and the people wholive there.

We can design buildings that are not onlyenergy-efficient but also offer a cozy andhealthful indoor atmosphere while lowering our carbon footprint by adding this technology into the process.

Solar energy is radiant light and heat fromthe sun. The technology enable the sunradiant light to be transform into electricalenergy that can be used for the daily purposed. Some of the solar technologies are solar heating, solar photovoltaic, solarthermal electricity and solar architecture. Solar technologies are basically divided into two which are active solar energy system or passive solar energy system depend on the way they capture, convert and distribute solar energy. Active solar energy system is the use of photovoltaic panel and solar thermal collectors to harness the energy. While, passive solar energy system is the technique to harness the solar energy passively. For example, by adjusting the building orientation to capture natural sunlight and to capture theheat from the sun to provide comfortable environment in the building [4]. It has become a trend for the large firms, and some of the famous architect to joining the forces with energy specialist to design the building based on the solar integrated energy system. Solar integrated energy system is no longer a system that only provides renewable energy either provide the passive solar energy

Active Solar Heating is a method of heating the air inside of the building. This method uses mechanical equipment including: pumps, fans and blowers to help collect, store and distribute heat throughout the building. − Active Solar Heating is a method of heating the building with water using the sun and pumps to circulate the water or heat- transfer fluid through the system. − Passive Solar Energy refers to the harnessing of the sun's energy without the use of mechanical devices. Using south- facing windows to provide natural lighting and heat for home are examples of passive solar energy. There are a variety of solar applications that a homeowner can use to take full advantageof passive solar energy.

− Utilizing thermal mass to absorb the solar energy entering the windows for release during the night. Thermal mass is simply a solid or liquid material that will absorb and store warmth and coolness until it is needed. Examples of thermal mass include: brick, stone, concrete and water. − Insulating the building to minimize heat loss. Passive Solar Coolingutilizes many of the methods listed belowto minimize the impact the summer sun has on the building and thereby reduce or eliminate building need for mechanical cooling systems. Passive Solar Cooling techniques include [5]: − Orienting building and landscape so that it can take advantage of cooling breezes. − Designing building to minimize barriers to air paths through the buildng to allow for natural ventilation. − Using the right size and type of windows in order to minimize the heat gain in the summer and that enable ventilation by opening. − Using both structural features and landscaping to create shading. − Insulating the building to maintain a comfortable temperature.

Solar energy is receiving much attention in green building energy system because of its abundant and clean being.

Generally, the newer green buildings combine several of solar technologies. As for example, they may be both energy efficient, solar heated and cooled, and PV powered in one building. They are simply just solar buildings. Solar integrated energy system is the combination of different solar-related technologies. Solar energy is a renewable resource that can beused in many ways for water heating,space heating .

SOLAR INTEGRATED SYSTEM APPLIED IN GREEN BUILDING The

green buildings of Shanghai Research Institute of Building Science include an office building for the demonstration of public building and two residential buildings which are for the demonstration of flat and villa, respectively. As demonstration projects, they contain multiple green energy technologies, such as solar thermal technology, solar photovoltaic, natural ventilation, and natural lighting [6]. Here, we designed a solar-

powered integrated energy system including heating, air-conditioning, natural ventilation and hot water supply for the office building. However, only solar hot-water systems were designed forthe flat and villa. All the three systems have continuously run for 2 years.

1. *Data Collection:* The data collection is the first stage in implementing this study onreduction of footprints. Detailed collection of data is done in this stage. Details include the evolution of Green Movement in

the World and also in India, the need for Green Buildings, theadvantages of Green Buildingsover Normal Buildings, the projected costs, case studies.

2. *Rating Systems:* A thorough study on the rating systems is done in this stage. The role of the Indian Green Building Council, the Leadership in Energy and Efficient Design (LEED), LEEDRating System – credit requirements, proposals, pre- requisites etc are observed and studied.
3. *Site Selection For Visit:* In case for site selection we needed Greenbuilding infrastructure so weselected Suzlon One Earth, Hadapsar, Pune. It is one of the best green building construction in India, which is platinum rated green building by LEED. Through these site we get know about implementation of renewable energy sources in buildings. And sustainablmaterial use in greenbuildings.
4. *Site Visit:* Suzlon One Earth, Pune on 22/03/2022
5. *Layout Plan Of Building:* Preparedlayout of society which we were going design in software called Revit Architecture.
6. *Model Preparation:* We prepared model of society in Revit Architecture 2D as well as 3D. We implemented renewable sources in it.

Energy is one of the most fundamental elements of our universe. It is inevitabilityfor survival and indispensable for development activities to promote education, health, transportation and infrastructure for attaining a reasonable standard of living and is also a critical factor for economic development and employment. In the last decade, problems related to energy crisis such as oil crisis, climatic change, electrical demand and restrictions of whole sale markets have a risen world-wide. These difficulties are continuously increasing, which suggestthe need of technological alternatives to assure their solution. Hydro-electric power is a form of renewable energy resource, which comes from the flowing water. To generate electricity, water must be in motion. When the water is falling bythe force of gravity, its potential energy converts into kinetic energy. This kinetic energy of the flowing water turns blades or vanes in a hydraulic turbines, the form of energy is

changed to mechanical energy. The turbine turns the generator rotor which then converts this mechanical energy into electrical energy and the system is called hydro-electric power station. The first hydro-electric power systems were developed in the 1880's.

According to the international energy agency (IEA), large-scale hydro-electric plants currently supply 16% of the world'selectricity.

CHAPTER 5

CONCLUSION

Green roofs are considered as a passive cooling technique and as a sustainable technology that offers benefitsto the environment and society. The effectiveness of the green roof depends on type of plants, climatic conditions, geographic locations etc. The potential benefits of the green roofs are: reduction of energy consumption for energy driven air conditioning systems, improvement in comfort of residential and commercial buildings, reduction in storm water run- off, reduction in CO2 in atmosphere, reduction in noise level etc. Most of the researchers focused on the thermal performance and cooling potential of the green roofs whereas only few studies are seen on the mitigation of air pollution including reduction of CO2, NOx uptake etc. It is observed that most of the research works on cooling potential of green roofs were done in Europe, USA and Greece. Hence research in Indian context is more relevant today than ever before since climatic balance in India has been in turmoil in recent years.

The study brought to light the opportunities associated with renewable energy sources; energy security, energy access, social and economic developmentand climate change mitigation and
re duction of environmental and health impacts. There are challenges that tend tohinder the sustain ability of renewable energy sources and its ability to mitigate climate change. These challenges are: market failures, lack of information, access to raw materials for future renewable resource deploy ment, and most importantly our (humans) way of utilizing energy in an inefficient way.

From the findings, the following suggestions are made that can help improve the concerns of re newable energy being sustainable and also reduce the rate of the depletion of the ozone layerdue to the emissions of GHG especially carbon dioxide (CO2)

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