STUDY ON ENERGY PERFORMANCE OF SOLAR GREENHOUSE

Shailendra Kumar Bohidar[1], Dhaneshwari Sidar[2], Prakash Kumar Sen[3]

[1]*Ph.D. Research Scholar, Kalinga University, Raipur (India)*

[2]*Student ,Mechanical Engineering, Kirodamal Institute of Technology, Raigarh, Chhattisgarh, (India)*

[3]*Student of M.Tech Manufacturing Management, BITS Pilani (India)*

ABSTRACT

Solar energy is radient energy that is produced by the sun.every day the sun radiates,or sends out, an enormous amount of energy. The sun radiates more energy in one second than people have used since time. Solar radiation is one of the most important energy resources of our planet.Solar greenhouses are the enclosures where crops, vegetables or flowers are provided proper environment under adverse climatic conditions for plant growth and production. Solar energy is in the first rank of renewable energies. In cold countries winter greenhouse is used where solar isolation is low is use. In tropical countries ambient temperature is quite high so summer geenhouses can be designed for reducing the inside temperatignure and the plants receive sufficient of sunlight required for photosynthesis ,solar power plant is the best way to find the optimums of its performances. The most important factor affecting plant growth is solar radiation, and the most crucial solar radiation-requiring process governing plant growth is photosynthesis. Therefore, the characteristics of the greenhouse cladding materials, which can affect the level and quality of the transmitted radiation, are of primary concern for greenhouse cultivation. Solar radiation is an energy resource that will remain available until the end of time. In this paper described that the greenhouse systems have a great potential to improve quality of living and energy performance of the buildings. However, it is now important to adopt a valid evaluation method to assess the project efficiency.

Keyword: Greenhouse, History of Greenhouse, Types of Greenhouse, Greenhouse Gases, Principal and Design of Greenhouse.

I. INTRODUCTION

Green house provide crop cultivation under controlled environment. A green house is a structure covered with transparent material that utilizes solar radiation to grow plants a may have heating, cooling and ventilation equipments for temperature control. [1] Greenhouse is also able to store heat during the winter season reducing the energy demand of the building. [2] They may be covered with glass and glass substitute when covered with plastic films, they are called platic greenhouses, when covered with glass fibre reinforced plastic panels, they are called fibre glass greenhouse. [1] the most important factor affecting plant growth is solar radiation and the most crucial solar radiation-requiring process governing plant growth in greenhouse cultivations is photosynthesis. Therefore, the characteristics of the greenhouse cladding materials, which can affect the level and quality of the transmitted radiation, are of primary concern for greenhouse cultivation. [3] Solar radiation is a green energy source and inexhaustible. Capture solar energy also provides an energy source that is environmentally friendly. Solar power costs nothing to produce: it replaces the energy they buy, since it reduces energy costs. [4] It is possible to take advantage of solar energy through the improvement and promotion of photovoltaic systems by optimizing performance and efficient operation in all vital sectors such as public, mainly in agriculture and in enhancing the energy independence of greenhouses as strategic self sufficiency in housing and in all areas to wider public use. [5] The composting greenhouse is an integral part of our market gardening effort, suiting commercial use better than the other (solely solar-heated) greenhouses at New Alchemy, with better soil heating, light, C02 levels and air circulation. Many of the solar-heated greenhouses that have been built in the last ten or fifteen years function quite well at keeping the air warm, but their typically high capital cost and low light levels limit their commercial potential. [6]

II.HISTORY OF GREEN HOUSE

The idea of growing plants in environmentally controlled areas has existed since Roman times. The Roman emperor Tiberius ate a cucumber-like.[7] vegetable daily. The Roman gardeners used artificial methods (similar to the greenhouse system) of growing to have it available for his table every day of the year. Cucumbers were planted in wheeled carts which were put in the sun daily, and then taken inside to keep them warm at night. The cucumbers were stored under frames or in cucumber houses glazed with either oiled cloth known as specularia or with sheets of selenite (a.k.a. lapis specularis), according to the description by Pliny the Elder. [8] The concept of greenhouses also appeared in Netherlands and then England in the 17th century, along with the plants. Some of these early attempts required enormous amounts of work to close up at night or to winterize. There were serious problems with providing adequate and balanced heat in these early greenhouses. Today, the Netherlands has many of the largest greenhouses in the world, some of them so vast that they are able to produce millions of vegetables every year.[9] Active' greenhouses, in which it is possible for the temperature to be increased or decreased manually, appeared much later, Sanga yorok written in the year 1450 AD in Korea, contained descriptions of a greenhouse, which was designed to regulate the temperature and humidity requirements of plants and crops. One of the earliest records of the Annals of the Joseon Dynasty in 1438 confirms growing mandarin trees in a Korean traditional greenhouse during the winter and installing a heating system of Ondol. [10]

III.TYPES OF GREEN HOUSE

Some broad classifications of greenhouses includes following:

- **Attached greenhouses**, which may be joined onto almost any suitable building structure.
- **Porch type greenhouse**, which may be designed as the entrance to a house, factory or office.
- **Free standing greenhouse**, which may be suited on any convenient porch or piece of waste water.
- **Pit type greenhouse**, which are usually employed on differing level or sloping land scrapes, and for the purpose of heat retention.
- **Cold frame type of greenhouse**, which are simply hot beds or plant facing frame equipped with a sloping roof. [1]

IV.GREENHOUSE GASES

The three most powerful long lived greenhouse gases in the atmosphere are carbon dioxide, methane, and nitrous oxide. In addition we will consider the class of compounds known as halogenated organic compounds (of which CFCs are a subset), SF_6, and ozone in the lower and upper atmosphere. [11]

4.1. Carbon Dioxide (CO_2)

Discussion of the human impact on the levels of carbon dioxide (CO_2) in the atmosphere is complicated by two factors. First, emissions of CO_2 associated with human activities, while large on a human scale, are small when compared to natural fluxes of CO_2 associated with photosynthesis, respiration, uptake into ocean water, and release from ocean water. Second, there are several large reservoirs of CO_2 (e.g. atmosphere, upper ocean, deep ocean, biosphere) which are continually exchanging CO_2. [12]

4.2 Methane (CH_4)

Methane (CH_4) is the most abundant well mixed greenhouse gas after carbon dioxide. In contrast to carbon dioxide, methane is removed from the atmosphere via chemical reaction with hydroxyl (OH) radicals. Methane plays an important role in atmospheric chemistry and it can influence the levels of other important trace species via its reaction with OH. [13].

4.3 Nitrous Oxide (N_2O)

Nitrous oxide (N_2O) is the third most abundant well mixed greenhouse gas after carbon dioxide and methane. Natural sources of N_2O associated with emission from soils and the oceans are estimated to deliver the atmosphere. Anthropogenic emissions of N_2O are associated with biomass burning, fossil fuel combustion, industrial production of acidic and nitric acids, and the use of nitrogen fertilizer. Photo dissociation in the stratosphere is the major (90%) loss mechanism for N_2O in the atmosphere. [14]

4.4 Halogenated Organic Compounds

Halogenated organic compounds are organic compounds containing one or more halogen atoms. Halogenated organic compounds can be fully substituted where all of the hydrogen in the molecule has been replaced by halogen atoms, or partially substituted where some hydrogen's remain. Chlorofluorocarbons (CFCs) and per fluorocarbons (PFCs) are two subsets of halogenated organic compounds in which all hydrogen atoms have been substituted by fluorine and chlorine atoms, or solely by fluorine atoms. [15]

4.5 Sulfur Hexafluoride (SF_6)

On a per molecule basis, sulfur hexafluoride (SF_6) is one of the most potent greenhouse gases known. Its potency stems from its intense absorption at 10.3 µm (969 cm^{-1}) in the atmosphere and its extremely long atmospheric lifetime of 3200 years. SF_6 is present in small amounts in fluorites and degassing from these minerals provides a small natural source. SF_6 is a useful industrial chemical used as an insulating gas in electrical switching equipment. As a result of anthropogenic emissions the current level of SF_6 in the atmosphere is approximately 400 times that of the natural background. Very recently a new SF_6-like greenhouse gas was detected in the atmosphere: SF_5CF_3. The concentration of SF_5CF_3 is very low and this compound does not play any significant role in global warming it is of interest because on a per molecule basis it is the most potent greenhouse gas yet identified in the atmosphere. [16]

4.6 Ozone (O_3)

Prior to discussing the relationship between ozone and global climate change it is useful to provide a brief background on the atmospheric chemistry of ozone. In contrast to all other greenhouse gases, ozone is not emitted into the atmosphere. Ozone is generated *in-situ* in the atmosphere from two processes: (i) photolysis of molecular oxygen (O_2) which gives oxygen atoms (O) which then add to molecular oxygen to give ozone (O_3) and (ii) oxidation of organic compounds (from natural and man-made sources) in the presence of nitrogen oxides (NO_x).[17]

V. BASIC PRINCIPLES OF SOLAR GREENHOUSE DESIGN

Solar greenhouses differ from conventional greenhouses in the following four ways:-

- Have glazing oriented to receive maximum solar heat during the winter.
- Use heat storing materials to retain solar heat.
- Have large amounts of insulation where there is little or no direct sunlight.
- Use glazing material and glazing installation methods that minimize heat loss.
- Rely primarily on natural ventilation for summer cooling.

Understanding these basic principles of solar greenhouse design will assist you in designing, constructing, and maintaining an energy-efficient structure. You can also use these concepts to help you search for additional information, either on the "Web," within journals, or in books at bookstores and libraries. . [18]

Figure 1. Experimental greenhouse for testing cladding materials

5.1 Solar Greenhouse Designs

Attached solar greenhouses are lean-to structures that form a room jutting out from a house or barn. These structures provide space for transplants, herbs, or limited quantities of food plants. These structures typically have a passive solar design. Freestanding solar greenhouses are large enough for the commercial production of ornamentals, vegetables, or herbs. There are two primary designs for freestanding solar greenhouses: the shed type and the hoop house. A shed-type solar greenhouse is oriented to have its long axis running from east to west. The south-facing wall is glazed to collect the optimum amount of solar energy, while the north-facing wall is well-insulated to prevent heat loss. This orientation is in contrast to that of a conventional greenhouse, which has its roof running north-south to allow for uniform light distribution on all sides of the plants. To reduce the effects of poor light distribution in an east-west oriented greenhouse, the north wall is covered or painted with reflective material. Unlike the shed-type solar greenhouses, these do not have an insulated north side. Polarization of these structures involves practices that enhance the absorption and distribution of the solar heat entering them. This typically involves the collection of solar heat in the soil beneath the floor, in a process called earth thermal storage (ETS), as well as in other storage materials such as water or rocks. [19]

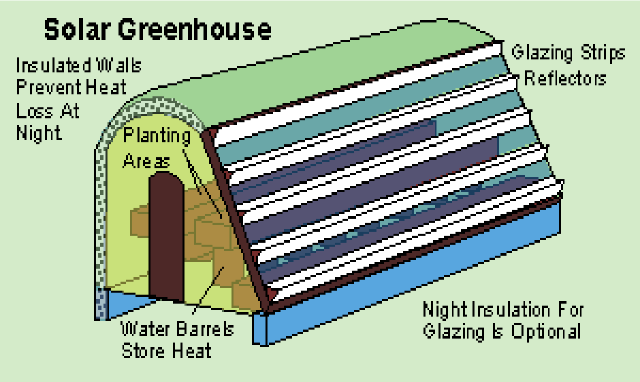

Figure 2. Solar Greenhouse

V. CONCLUSIONS

Throughout history, mankind has benefited from and worked to harness the sun's energy in order to create a more enjoyable living space and save energy. Solar energy has been used for centuries and has only improved with time, as researchers and scientists have developed processes and materials to improve the quality and effectiveness of solar energy. Solar greenhouses are designed not only to collect solar energy during sunny days but also to store heat for use at night or during periods when it is cloudy. They can either stand alone or be attached to houses or barns. A solar greenhouse may be an underground pit, a shed-type structure, or a hoop house. Large-scale producers use free-standing solar greenhouses, while attached structures are primarily used by home-scale growers.In our country, greenhouses is common on the mediterranean region and where there exist geothermal energy.The total greenhouse area in our country is more than 40000 hectare. The most important factor affecting plant growth is solar radiation, and the most crucial solar radiation-requiring process governing plant growth in greenhouse cultivations is photosynthesis. Solar greenhouses commonly rely on large volumes of water or rock mass for passive storage of daytime solar gains to provide thermal stability. On the contrary, passive solar systems use materials that absorb heat, and therefore the floor is warmer and more comfortable.

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