DOI : https://doi.org/10.56452/6-3-685001
ISSN: 0974-5823 Vol. 6 No. 03 December, 2021
International Journal of Mechanical Engineering

Renewable Energy Powered Sustainable Home

Namra Joshi[1]

[1]Assistant Professor, Department of Electrical Engineering, SVKM's Institute of Technology, Dhule, Maharashtra, India
E-mail: er.nrjoshi@gmail.com

Abstract: Sustainability improves the quality of our lives, protects our ecosystem, and preserves natural resources for the next generations. In the corporate community, sustainability is related to an organization's comprehensive approach, considering all, from manufacturing to planning to consumer service. Reduced production of waste and the rationalization of production and energy consumption must also be implemented. The idea of sustainable development is based on a set of demands. Power that can be replenished within a human lifetime and so cause no long-term damage to the environment. Sustainable energy includes all renewable energy sources, such as hydroelectricity, biomass, geothermal, wind, wave, tidal, and solar energies.

Keywords: Sustainable Development, Renewable Energy Sources, Solar Energy, Daylighting

Introduction

In our day-to-day life, the population increases throughout the year. So, the requirement is increasing. So, it is suggested that the size of the population the planet can sustain depends on the amount of energy sources available. Efficient usage of resources refers to getting things done in the right manner, in minimal time with the minimal cost acquired with no dispersal of resources. So renewable energy is the most important and essential part of a sustainable home. So, it is creating economic development, installation, and more. Energy capability refers to the amount of energy required to provide accurate light. The specific requirements of a lighting system depend on the type of tasks to be accomplished, in a particular space.

Literature Review

Sr. No	Authors	Year	Title	Findings
1	B.Tangwiwant and K. Audomvongseree[1]	2018	Benefits and cost Analysis of the Installation of Rooftop Solar PV with Battery System	In this article we have reviewed about the solar energy from sunlight and discussed about their future trends and aspects.
2	R.K.Kodali[2]	2017	Smart wastewater treatment	This paper reviews the use of wastewater treatment technologies to remove contaminants from wastewater.

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3	Timucin Harputlugil[3]	2017	Energy Efficient Building Design Development: A Retrospective Approach	This paper aims to describe an overview of energy efficient building.
4	S.Li, A. Pandharipande and F.M.J. Willems[4]	2016	Daylight sensing LED Lighting system	In this paper, we propose LED luminaries that can perform the dual function of illumination and daylight sensing.
5	F.R. Pazheri, Tiju Baby, Safoora O.K.[3]	2014	Rooftop Solar Projects Enhance the Environmentally Friendly Power Dispatch in Kerala	Kerala static electric power scenario and pollutants emission from fossil fuel-based plants has investigated.

Summary of Literature Review

Based on the literature review conducted following points can be concluded.

- Daylight can be used as an effective source of illumination.
- By treatment of wastewater, we can use the same water for different domestic non-drinking purposes.
- By installing rooftop solar day to day-to-day power requirement is fulfilled.
- By rainwater conservation system we can increase the groundwater level which further can be extracted for different applications.

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The key components of the Proposed System are as follows:

A. Daylighting System
B. Wastewater treatment plant
C. Rainwater conservation system
D. Solar power plant Rooftop

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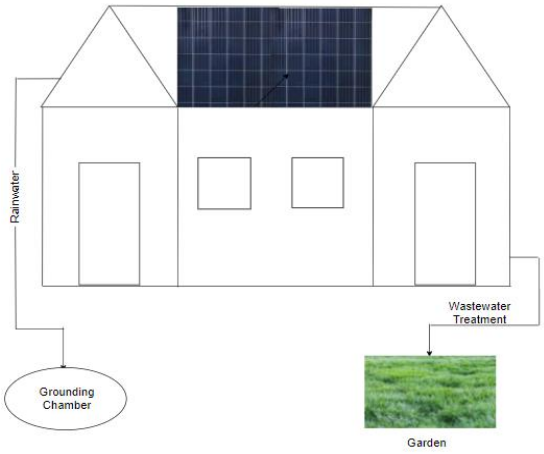

Fig. 1 Block Diagram of Renewable Energy Based Sustainable Home

Daylighting System: It is a combination of all the direct and indirect sunlight available during the daytime. The main objective of daylighting is to minimize the use of artificial light and the main advantage is it reduces electricity bills as it is freely available. Electrical lighting produces more heat as compared to natural lighting as it produces very less heat. If we use daylighting, we are saving at least 15 to 40 percent of energy every year. It also improves one's mental state, enhances moods, boosts focus as well and reduces eyestrain. There should be an amount of heat that enters in home because the sun is a powerful source of light at home, but it produces tremendous heat and if not planned properly it will result in undesirable heat gains as controlling glare is also needed as it produces unnecessary glare in the home.

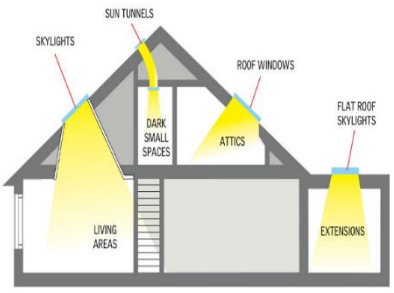

Fig. 2 Daylighting System

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We can use effective daylighting by doing arrangements like

i. Windows with higher height
ii. Use shading devices
iii. Use of skylights by doing roof opening
iv. Filter daylight by using curtains, and vegetation, so that it reduces the harshness of direct light
v. Reflect daylight within a space to increase the brightness of the room

Wastewater Treatment Plant: If we are living in an independent house, wastewater treatment and reuse is an excellent way to meet a large part of your water needs. Most of the water production in and around cities goes to private residences, who very often waste it. In areas where water is scarce, like Australia and the American Southwest, it comes from utility companies rather than wells, as water companies have become overloaded with demand. They are running out of water to supply at the same time that populations are growing. Wastewater in this sense refers to greywater, i.e., water from bathroom sinks, washing machines, and kitchens as well. About 40 percent of the wastewater produced in a home is greywater including contamination like soap, detergent, dead skin, hair, and oil. Each person in a household produces about 90 liters of greywater daily. Once treated, this water can be used for gardening. It can meet up to 40 percent of household water needs.

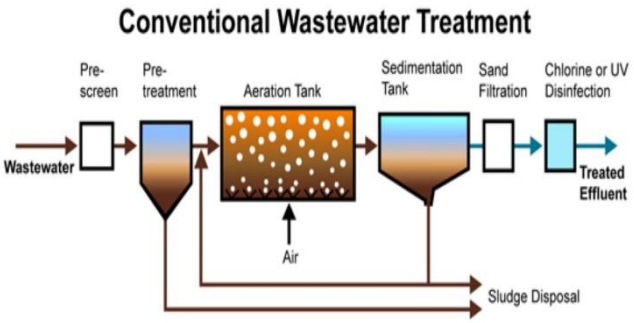

Fig. 3 Wastewater Treatment Plant

Filtration is a process that removes particles from suspension in water. Removal takes place by a number of systems that incorporate straining, flocculation, settling, and surface taking.

Through wastewater treatment, we can do:

- Reduction of water bills
- Use limited water resources
- Cut down the amount of pollution going into canals.
- It helps to save money on new infrastructure for water and wastewater treatment.
- Expanding demand on infrastructure for sewage transfer, treatment, and ejection, allowing it to work better and last longer.

Rainwater Harvesting*:* Harvesting and storing rainwater is an absolute way that can be used to solve the difficulty of the water dilemma in the whole world. The utilization of a rainwater harvesting system comes up with outstanding benefits for all communities. This simple water conservation method can be a raise to a remarkable

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solution in areas where there is sufficient rainfall but not an adequate supply of groundwater. It will not only provide the most sustainable and efficient means of water management but also unlock the vista of several other economic activities leading to the Empowerment of mankind at the grass-root level feed to the demand of ever-increasing domestic, agricultural, and industrial zones of the region. Over the years, it has been observed that the prerequisite for the manipulation of groundwater resources for various everyday needs, like toileting, bathing, cleaning, farming, and drinking water, commercial and ever-changing way of living with mode of transformation is offering rise to massive water wastage.

Our water resources are exhausted each year. Besides, we cannot generate unnatural water and must depend on water sources available on our planet Earth. Because of the population boom and the excessive need for water to suit our ever-enlarging modern lifestyle, water insufficiency is felt all over the world. This has given rise to considerable concerns over water conservation. The recharge pit allows the rainwater to refill groundwater by recharging the underground pore water. It can be constructed to recharge a bore well or just to help the water penetrate into an area. Rainwater harvesting has appeared as one of the appropriate ways to preserve rainwater from streaming away into drain out and put it to use alternately.

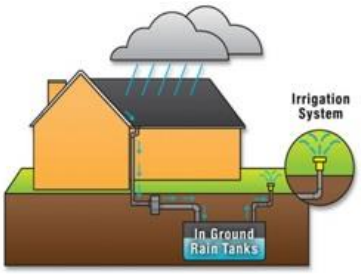

Fig. 5 Rain Water Harvesting System

Groundwater recharge is a hydrologic process where water moves downward from surface water to groundwater. Recharge is the primary technique through which water enters an aquifer. The sinkhole also serves as a spreading system. The inessential rainwater can then be used to recharge groundwater aquifers through unnatural recharge techniques. Almost all state authority has made the integration of the rainwater harvesting system compulsory for building construction or to complete building formation. Regaining and cumulating rainwater is a relevant concept that can be used to mark the problem of water crisis broadly. The use of a rainwater harvesting system provides excellent dignity for every community. This simple water conservation method can be upraised to a magnificent solution in regions where there is ample rainfall but not an adequate supply of pore water. It will not only provide the most sustainable and efficient means of water management but also unlock the outlook of several other economic activities leading to the Empowerment of humankind in the sustainable evolution to the use of moral principles.

Solar Rooftop Plant: Solar panels which placed on a rooftop are the best possible to harness the energy from the sun. Rooftops converted in this manner to hold PV modules are called Solar Rooftops. Solar energy is the light and heat that comes from the sun. There are several energy sources like Biofuel, Biomass, Geothermal, Hydropower, Solar energy, Tidal power, and wind power, among which solar energy is the most widely used energy resource. The photovoltaic cells convert sunlight into electricity. Solar energy, the radiation from the sun is able to produce heat, which will cause changes in substances. Solar energy is the most suitable, systematic source of energy. Solar energy is a limitless supply, so after the 20th century, it is expected that solar energy is the most popular source of energy. In this paper, multiple solar energy conservation techniques have been proposed.

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These techniques have been combined to create a control system for the maximum utilization of solar energy for lighting systems in off-grid homes.

Advantages of the Proposed System:

- Sustainable homes are energy and water-efficient.
- Promotes water and energy conservation
- Low operating costs
- Increased property value
- Energy optimization and reduction of energy consumption.
- By using daylighting and solar rooftops we can reduce electricity bills
- We can reuse water by doing water treatment
- Rainwater harvesting improves the quality and quantity of groundwater
- Rainwater harvesting helps in reducing the water bill
- Very little maintenance is required for solar rooftops.

Limitations of the Proposed System:

- Initial Investment is high
- Daylight causes thermal effects in space itself
- Regular maintenance is needed for Rainwater Harvesting System
- No rainfall or limited rainfall can limit the supply of water
- If the rainwater harvesting system is not properly installed, it may attract mosquitoes and other waterborne diseases
- Solar doesn’t work properly in cool and cloudy seasons

Future Scope: We can use a security system and automated gate opening. Biomass and wind can be incorporated, but it depends on site conditions. By using the solar rooftop there is income generation with the excess harness of solar energy by the individual owner.

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Conclusion

Based on discussion and data about renewable energy-based self-sustained homes will be proven to be the best option for sustainable development in a growing country like India. We can also add up some new features as future scope that is a special security system and automated gate opening system or depending on the geographical situation on the site biomass and wind can be incorporated into the proposed system. Sustainable development mainly covers the use of renewable energy, energy pricing, renewable energy applications, and smart grid technologies. Energy is the heart of many of these sustainable development goals from expanding access to electricity, to reducing wasteful energy subsidies to curbing deadly air pollution that each prematurely kills millions around the world.

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