

Energy Efficient Building using Solar Energy and Adoption of Green Building Techniques

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ABSTRACT

The field of "ENERGY EFFICIENT BUILDING", or building design and constructions that prioritizes energy efficiency and sustainability, is young but rapidly developing. This report's analysis of building construction practices includes description of methods that are currently being employed by the construction industry to increase energy efficiency methods to decrease the amount of energy used in building operating systems, and methods that are currently known to improve energy efficiency but are not yet commercially viable.

As energy consumption from residential building is predicted to rise by more than 8 times by 2050 under the business as usual scenario, it is of vital importance for India to develop energy efficiency strategies focused on the residential sector to limit the current trend of unsustainable escalating energy demand. This study investigates methods of restraining growth in energy consumption in the Indian residential sector and documents energy saving potentials that can be achieved with focused policy and market efforts.

The report examines other methods of encouraging the public to use energy more efficiently. Also discussed are possibilities for the state of mandate greater energy efficiency in the private sector, primarily through amendments to the building code and to land use and zoning policies. Due to current economic factors, this option may promote a state of policy of energy conservation more than attempting to encourage efficiency with incentives. The ultimate aim is to make the residential building as eco-friendly.



KEYWORDS: Energy efficiency, sustainability, eco friendly, solar energy

ENERGY EFFICIENT BUILDING

The idea of energy efficient design is to modulate the conditions such that there always within or as close as possible to comfort zone. In current times of rapid infrastructure growth and looming energy crisis, there is a

strong need to address and incorporate good practices for efficient energy and resource use while planning for buildings, be it for residential purpose or for commercial buildings.

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ENERGY EFFICIENCY

"Reducing the amount lost- also known as increasing efficiency- is an important to our energy future as finding new sources because gigantic amount of energy are lost every minute of every day in conversion".

WHY ENERGY EFFICIENCY IS IMPORTANT FOR BUILDINGS

There are solid business reasons why energy efficiency is important for your new building including:

- Providing energy costs savings incentives to you or your tenants
- Future- proofing new construction investment as energy efficient
- Increasing tenant demand for comfortable and energy efficient working environment
- Contributing to the sustainability of organization

The opportunity to design the building efficiently from the start enables more and better efficiency measures to be used. The more new technologies and practices that are adopted in new construction, the more cost will come down and the measure become standard practice. By incorporating energy efficiency, renewable energy into a building at the outset, you can play a significant role not only controlling your building energy consumption but also contributing to achieving a sustainable energy structure for our society.

New buildings present a very real opportunity to achieve significant energy avoidance savings over the long term, especially when developers and building owners use a comprehensive systems approach to energy efficiency. Building to higher energy efficiency standards requires an upfront commitment to a whole new way of thinking about design, construction and investment.

The benefits of building to higher standards of energy efficiency or for reaching and nearly immediate and benefit occupants for generation to come. By designing a new building holistically, with energy saving goals in mind, you can help to ensure that all systems work together effectively and you can incorporate major energy efficiency components that could be difficult or impossible to retrofit and will save you significant amounts of money over your buildings life.

ENERGY EFFICIENCY PROVISIONS GIVEN

Electricity is the largest source of energy for buildings, and that predominance has grown. Natural gas is the second largest energy source. Building demand for electricity was the principle force behind the 67% growth in net electricity generation from 1985- 2016.

To make an energy efficient residential building for a nuclear family we give the provisions like

- Solar panels
- Readymade kitchen waste bio-gas plant
- Sewage treatment plant
- Sun pipe
- Rainwater harvesting

OBJECTIVES OF ENERGY EFFICIENT BUILDINGS

- Efficient energy use, sometimes simply called energy efficiency, is the goal to reduce the amount of energy required to provide products and services.

- For example, insulating home allows a building to use less heating and cooling energy to achieve and maintain a comfortable temperature.
- Installing fluorescent lights, LED lights or natural skylights reduces the amount of energy required to attain the same level of illumination compared with using traditional incandescent light bulbs.
- Improvements in the energy efficiency are generally achieved by adopting a more efficient technology or production process or by the application of the commonly accepted methods to reduce energy losses.
- Energy efficiency and renewable energy are said to the "Twin Pillars", of a sustainable energy policy. Both strategies must be developed concurrently in order to stabilize and reduce carbon dioxide emissions.
- Efficient energy use is essential slowing the energy demand growth so that rising clean energy supplies can make deep cut in fossil fuel use.

PROVISIONS TO ATTAIN A GREEN AND ENERGY EFFICIENT BUILDING

SOLAR ENERGY

Solar photo voltaic technology looks quite lucrative. By implementing the solar PV technology in villa would effectively reduce our electricity bills and increase green foot print.

If our construction is in a peak city like Coimbatore or Chennai , then the area will be having less frequent power cuts, so that there we can implement Grid connected solar PV system to reduce the electricity bills.

GRID CONNECTED SPV SYSTEM

There is no need to buy batteries as whatever electricity is produced through the system , it can be sold to our electricity board.

Now somebody question us that, why would our electricity distribution board want to buy electricity from us?

This is where the government comes in and the policy introduced by the government helps. India has severe electricity storage in several parts of the country. We need electricity not only to cover the storage, but also for a number of other infrastructural requirements.

Sunlight is the free resource and it is plentiful in our country. Thus to mark good use of the free resource, (i.e) solar energy, the government has started implementing policies which allow each and every individual house or building that has plenty of open space to become a producer of electricity.



WORKING SYSTEM OF GRID CONNECTED SPV

In grid connected system, a Net-metering is placed. In this system, we have a single new bi-directional meter. When we consume electricity from grid, the meter reading will move forward; but when we produce electricity and end it to the grid, the meter readings shall move backing

Example, suppose we use 10 units of electricity in a day and produce 8 units, your meter will show a reading of 2 units as used. And if you use 10 units of electricity and produce 12 units, then your meter will show 2 units supplied to the government. Our bill at the end of month will be based on net units consumed or produced. If you generate extra electricity in any month you will be paid .

At the end of a year, if our total production is more than that what we consumed, then we will get paid for the net surplus electricity produced at the cost decided by our state's electricity regulatory commission.



SOLAR PARKS IN INDIA

S NO	SOLAR POWER PARLS IN INDIA	PRODUCTION
1	Kamuthi solar power project, Tamil Nadu	678 MW
2	Charanka solar park, Gujarat	1637MW
3	Pavagada solar park, Karnataka	600MW
4	Bhadha solar park, Rajasthan	115MW
5	Kurnool Ultra Mega solar park, Andhra Pradesh	100MW

READY MADE BIOGAS PLANT

Waste is a material that no longer serves a purpose and so is thrown away. In some cases what one person discards may be re-used by somebody else. All wastes is particularly hazardous. If not carefully disposed of, it will have an impact on the environment, whether it be unsightly litter in urban streets or contaminated air, soil and water. But what is equally important about waste is that it is recyclable.

In India we produce 300 to 400 grams of solid waste per person per day in town in normal size. The figure is 500 to 800 grams per capita per day in cities like Delhi and Bombay. The composition of average domestic dust that contains food wastes are around 23% out of 100%.

Anaerobic digestion (AD) is a promising method to treat the kitchen wastes. Anaerobic digestion is controlled biological degradation process which allows efficient capturing and utilization of biogas (approximately 60% of methane and 40% of CO₂) for energy generation.

The variability in gas evolution is based upon hydrolysis and acidogenesis stage, which produce bacteria for

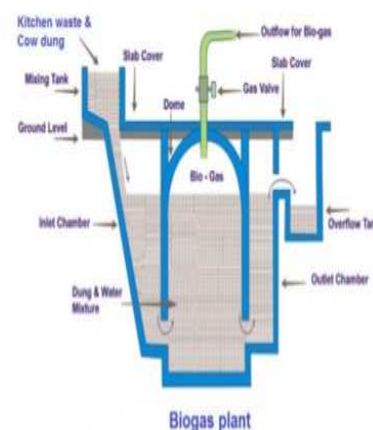
methanogenesis. It has been seen that the production of biogas goes on decreasing at first stage because hydrolysis and acidogenesis reaction is very fast as bacteria waste more readily.



Structure of a Biogas plant

Parts of Biogas plant :

- Mixing tank
- Inlet chamber
- Digester
- Gas holder
- Outlet chamber



PROCESS IN BIOGAS PLANT

- The biogas plant consists of a digester tank, where the organic material is stored and the microorganisms work on them and release gas.
- The gas thus produced is collected in a tank known as gas collector. In a floating type model, this tank is floating in the slurry and moves up-and-down based on the amount of gas stored in it . A guide pipe helps the gas collector tank to move up-and-down inside the digester tank
- Waste is fed through feed pipe inside the digester tank
- The fully digested slurry drains out through the outlet pipe. This can be collected, diluted and used as fertilizer for plants
- The gas pipe line from the gas collector tank helps in utilizing the gas for cooking and lighting



SEWAGE TREATMENT PLANT

Sewage treatment is the process of removing contaminants from waste water, primarily from household sewage it includes physical, chemical and biological processes to remove these contaminants and produce environmentally safe treated waste water.

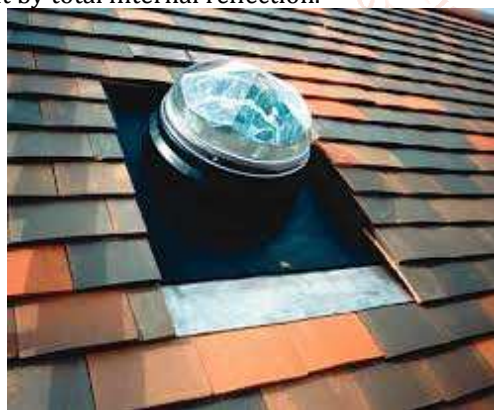
A by-product of sewage treatment is usually a semi-solid waste or slurry, called sewage sludge. That has to undergo further treatment before being suitable for disposal or land application.

Sewage treatment may also be referred to as waste water treatment, although the latter is a broader term which can also be applied to purely industrial waste water for most cities, the sewer system also carry a proportion of industrial effluent to the sewage treatment plant which has usually received pretreatment at the factories themselves to reduce the pollutant load. If the sewer system is a combined sewer then it will also carry urban runoff to the sewage treatment plant.

The average water consumed by a person is 160ltrs per day. Hence a residential building require a small sewage treatment plant of 6000ltrs capacity. The treatment plant can be placed in the backyard of the home. Hence a sedimentation tank is provided for treating the waste waters.

SUN PIPES

Light tubes or light pipes are physical structures used for transporting or distributing natural or artificial light for the purpose of illumination, and are examples of optical waveguides. In their application to day lighting, they are also often called tubular day lighting devices, sun pipes, sun scope, or daylight pipes. Light pipes may be divided into two broad categories: hollow structures that contain the light with a reflective lining, and transparent solids that contain the light by total internal reflection.

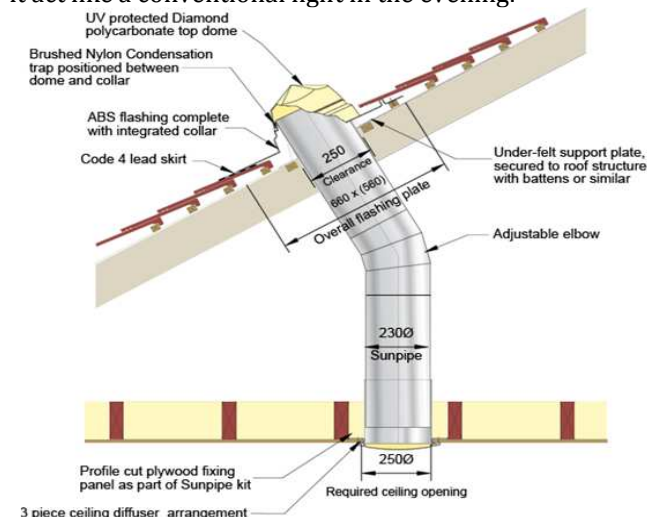


WORKING PRINCIPLE

Sun pipe also known as a tubular skylight, light tunnel or sun tile, a day light system consists of a polycarbonate cover- a dome, square, or tile- sited on a roof or outside wall that sits over an aluminium tube which intern runs through a loft or down a storey into the house.

Natural light travels down the tube to illuminate a dark landing, stairwell or bathroom or any space where you would otherwise need artificial lighting at all times. The interior of the tube has a minor finish that reflects and intensifies light and the dome incorporates a lens that refracts and intensifies the light. A diffuser in the ceiling

spreads the light so that it illuminates the room rather than just the area beneath it- the diffuser can also be wired so that it act like a conventional light in the evening.



The using elbow joints, a tube can turn upto 90 ° angle, meaning that you can install the tube through a flat or a slopping roof, nor does the area to be lit have to be close to the exterior point of the entry: You can add more sections of tubing depending on your requirement. The outside dome and the adjoining tube cum in a range of diameters, with 25 cm, 30 cm and 35 cm the most popular for domestic use. Generally the wider the tube, the further the light can travel- a 25cm diameter tube will be effective at 3.5m and a 53cm tube upto 6m.

The cost of fixing a sun pipe of 25cm diameter is around 20,000 rupees.



ADVANTAGES OF SUN PIPE

Sun pipe use existing nature light, they have many positive.

- The quality of light is excellent
- Once big critique of CFLs is their harsh white light. Solar pipe bring direct natural sun light into the room
- People suffering from seasonal affective disorder can enjoy natural sun light in rooms without sun facing windows
- The redirected sun light can even help with vitamin D produced by exposure to sun light
- Solar pipes do have electric hybrid model which can light at night allowing 24 hour use

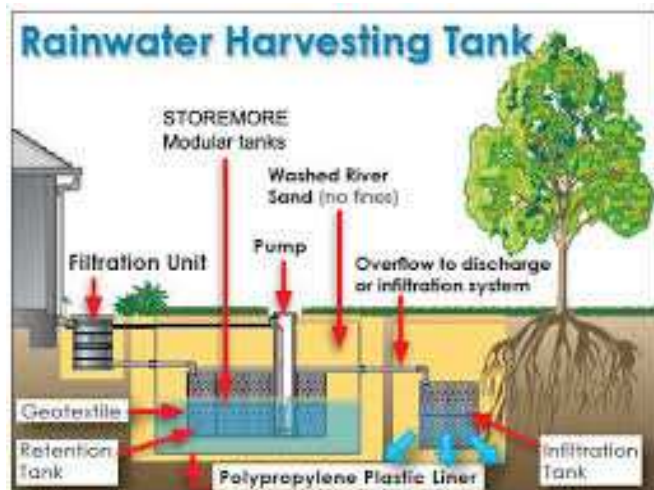
RAIN WATER HARVESTING

Rain water harvesting- collecting and storing rain for later use is an ancient practice. It is still used in many rural places throughout the world, and today it is making a comeback in urban centers as an additional source of water.

At its simplest, RWH consist of a rain barrel placed under the downspout of your home to collect rainwater for garden irrigation.

All RWH systems simple or complex, have the same basic components:

- ❖ A catchment area to capture the rainfall- this is typically the roof of the house
- ❖ A conveyance system to move the water from the roof to a storage area
- ❖ A storage system to hold the rainwater for future use- a barrel, a cistern or a tank
- ❖ A distribution system to get the water from storage top where it is being used. This can range from a watering can to full integration with the existing plumbing system in the house



CONCLUSION AND FUTURE RECCOMENDATIONS

- Detailed energy consumption monitoring of sampled residential complexes, using smart meters, should also be performed in the five climate zone of India, either for whole buildings or end-use, to gain a fuller understanding of energy consumption patterns in residential buildings
- This energy use monitoring should be undertaken in the conjunction with monitoring of environment and operational modes. This essential, and currently unavailable, data will assist in developing accurate energy consumption estimates and will significantly reduce uncertainties in future projections. In addition, it will assist in more reliable simulations and predictions of building energy use. Detailed data will also help in assessing savings potentials if energy efficiency as well as demand-side programmes
- are targeted at residences. This is required for the development of effective energy efficiency policies
- Cost savings achieved from effective building envelops could be used for investment in air-conditioning systems and the energy saved by the envelop could be used to extend the supply of energy. These benefits should be documented and guidelines for such an approach • Currently, most floor space projections are at national level and, while this provides important information for general forecasting, more specific projections should be developed for major cities in India to better plan and design energy-efficiency strategies. With city and country level information factored in, better efficiency plans, appropriate to current urban

plans and the purchasing power of communities, could be developed

- Low energy cooling technology should be evaluated and its suitability for meeting residential comfort requirements explored. As indicted in the projections, air containing penetration and energy use is expected to increase exponentially in coming decades and alternative cooling technologies could lead to significant savings
- Current studies only examine residential energy consumption at unit-level. Not included this energy used for elevators, water pumping and common areas. In order to improve the design of cities and communities, base line facility energy use should be assessed, and saving potentials and best practice guidelines should be developed for the residential sectors. This would provide guidance for developers and policy makers in designing energy-efficient communities

Social and environment changes have increased focus on conservation of natural resources and sustainable living. Recent economic changes have also caused consumers to reevaluate, how they use energy, with new attention being given to maximizing efficiency.

More than one quarter of the world's population is still without access to electric networks and uses fuel- based lighting to fulfil its lighting needs. The fuel- based light sources include candles, oil lamps, kerosene lamps, biogas lamps, propane lamps, and resin- soaked twigs. While electrification is more and more important to adopt energy efficient light sources and lighting systems both in the developing and industrialized countries.

As a result, more builders and consumers are turning to energy efficient building design and construction. Research leading to new ways to conserve energy in the construction and daily use of buildings.

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