

Architecture & Recycling Technologies

Ar. Bindu Agarwal¹, Ar. Dhenesh Raj²

^{1, 2}*School of Architecture and Planning,
Graphic Era Hill University, Dehradun, Uttarakhand*

Abstract: Recycling technology is a strategy of minimization of waste. It is a method of recovering waste materials into new useful valuable material otherwise it is considered waste. Recycling of waste is attractive in a region where shortage of both landfill area and raw material. It dramatically reduces energy use and carbon emissions. Recycling is important component one of the three modern waste reduction components – Reduce, Reuse and Recycle.

The prime objective of writing this paper is to reduce air pollution, water pollution, consumption of fresh raw materials and energy usage. Aim is maximum use of waste material because global warming is controlled by reduction of carbon dioxide from the atmosphere by active utilization of waste to save our natural resources to a great extent.

This paper deals with Recycling resources such as rainwater harvesting, Grey water collection and building material recycling. Example of same will be taken into account to understand these resources. Best example of building material recycling is “Plastic House” in Blue Mountains, Australia built of fully recycled P.E.T material used in different grains. Building material that can be recycled are steel, aluminum, gypsum plaster board, timber, concrete, glass, carpet, bricks and tiles, plastics. Recycling of a material would produce a fresh supply of the same material.

Keywords: Reduce, Reuse, and Recycle, Rain water harvesting, Grey water collection and P.E.T.

1. INTRODUCTION

Recycling is important in today’s world if we want to leave this planet for our future generations. It is good for the environment & to save earth from effects of global warming. . Since, we are making raw materials from the unnecessary substances or impurities i.e. a waste which has no use to us by using waste we are saving landfills and energy.

Architecturally, best out of waste is not our choice its mandatory so that world can be cleaner and better place to live in. A large part of world is controlled or developed by Architects. In fact, according to a 2009 data, housing in UK entails 30 percent of total carbon footprint from industries in architecture. There are radical’s changes in its construction and planning. Due to population, low availability of space and

industrialization the wonderful development in the field of architecture. The contemporary architecture includes architectural styles such as Blobitecture, deconstructivism, modern, digital novelty and high-tech architecture. This type of architecture styles improved and superseded all the old styles in variety and design with the invention of high-tech new materials and new techniques. New materials include steel, glass, plastic, cement and bricks and prefabrication techniques. Today, on one hand the A 10-storey building built in 48 hours in November last year, in Mohali, Chandigarh but on the other hand the amount of resources and energy expended to build such structures is huge both in magnitude and scale. The effect of this type of construction on the environment is worst.

In today’s world “going green” has become a top priority in our society. In sustainable building designers are using reduction components i.e. Reduce, Reuse & Recycle which are at the forefront of this green revolution. While many designers are focusing on passive and active energy systems, the reuse of recycled materials is beginning to stand out as an innovative, highly effective, and artistic expression of sustainable design. Recycling is the contemporary scope of eco architecture is spatial clever utilization of recyclable resources. In the contemporary eco buildings recyclable resources such as rainwater harvesting, grey water recycling and material recycling should be implemented to save energy.

2. RECYCLABLE RESOURCES

2.1 Rain Water Harvesting (RWH)

India receives average 100 cm rainwater every year in 100 days of monsoon. This rain falls in 100 hours. But 80% of the rain falls in 20 hours with very heavy intensity & is therefore lost as run-off i.e. 80-90% of it is wasted. Thus we are not harvesting all the available rain, if we wisely harvest all the rainwater we won’t face water scarcity in our life now, situation has arrived when even a single drop of water matters. We have not realized the seriousness of this issue and initiated efforts to overcome those problems but also water management systems, where conservation of water was the prime concern.

A rainwater harvesting system can be installed in a building to reduce mains water usage and maintain water supplies in period of drought. It is a process of collecting, conveying & storing water from rainfall in an area. If rainwater is used only for the garden and car washing, simple solution is to connect water to existing rainwater pipes. If there is surplus rainwater, it can be used in the building for non drinking purposes like flushing in toilets and to fill a washing machine.

It is a system of catching rainwater where it falls directly. It may be terrace, courtyard, or paved or unpaved open ground. In rooftop rain water harvesting, the roof becomes the catchments, the roof may be flat RCC/stone roof or sloping roof and the rainwater is collected from the roof of the house/building. It can either be stored in an underground water tank or diverted to garden area. This method is less expensive and very effective and if implemented properly helps in increasing the ground water level of the area.



Fig 3: Rain water harvesting in a pot – traditional way

Harvested rainwater is used for direct usage or for recharging aquifers. It is most important to ensure that the rainwater caught is free from pollutants. Following precautionary measures should be taken while harvesting rainwater:-

- Roof or terraces uses for harvesting should be clean, free from dust, algae plants etc.
- Roof should not be painted since most paints contain toxic substances.
- Do not store chemicals, rusting iron, manure or detergent on the roof.
- Nesting of birds on the roof should be prevented.
- Terraces should not be used for toilets either by human beings or by pets.
- Provide gratings at mouth of each drainpipe on terraces to trap leaves debris and floating materials.
- Provision of first rain separator should be made to flush off first rains.
- Suitable arrangements of filtering should be provided.
- Filter media should be cleaned before every monsoon season.
- During rainy season, the whole system (roof catchment, pipes, screens, first flush, filters, and tanks) should be checked before and after each rain and preferably cleaned after every dry period exceeding a month.

At the end of the dry season and just before the first shower of rain is anticipated, the storage tank should be scrubbed and flushed off all sediments and debris.



Back up supply from water main

Fig 1: Rain water harvesting in a House

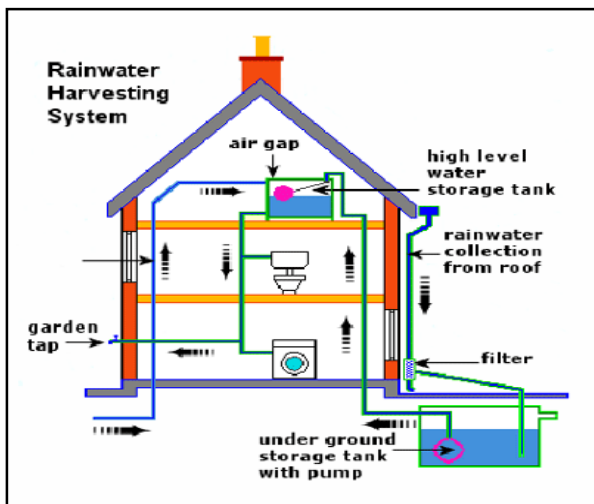


Fig 2: Rain water harvesting system-section

2.2 Grey Water Collections

Grey water is waste water generated from domestic activities such as showers, laundry, tubs, spa, bathing and dishwashing etc. which can be recycled on site. A typical grey water recycling system collects waste water from baths and washbasins. The water is then treated and stored until it is required for toilet flushing, irrigation and construction works.

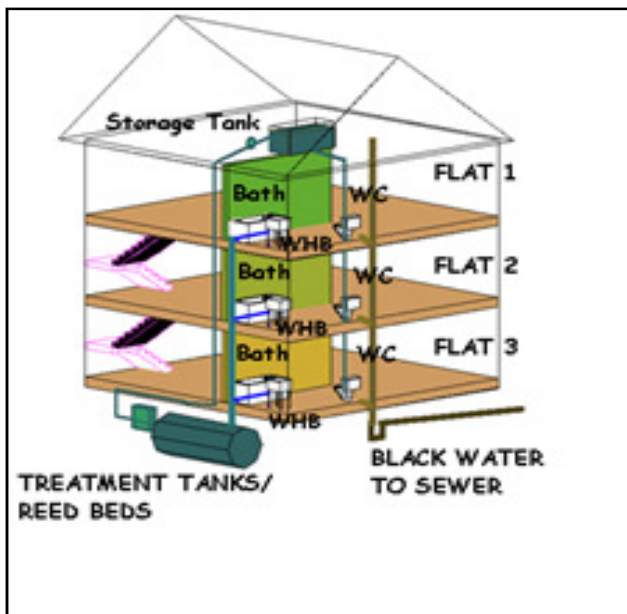
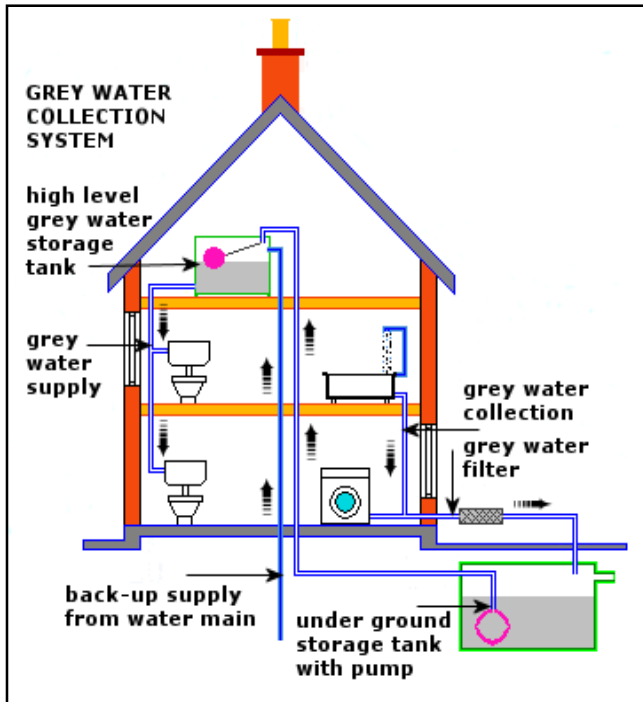


Fig 4 & 5: Sectional view of a Grey Water collection & supply in Apartments

More than 60% - 65% of water goes into bathroom and gardens so; grey water can be used there. The waste water of baths and kitchen has lower risk to reuse in the gardens so it is best opportunity. Grey water differs from sewage water from the toilets which is known as black water it contains highly concentrated chemicals. By capturing Grey water and using it in an appropriate manner as an alternative to water supply, it reduces water consumption. Grey water systems have the potential to save a one-third of domestic mains water usage.

2.2.1 Basic Grey water Guidelines

Greywater is different from fresh water and requires different guidelines for it to be reused.

- Don't store greywater (more than 24 hours). If you store greywater the nutrients in it will start to break down, creating bad odors.
- Minimize contact with greywater. Greywater could contain harmful chemicals, so your system should be designed for the water to soak into the ground and not be available for people or animals to drink.
- Infiltrate greywater into the ground, don't allow it to pool up or run off. Pooling greywater can provide mosquito breeding grounds, as well as a place for human contact with greywater.
- Keep your system as simple as possible, avoid pumps, and avoid filters that need upkeep. Simple systems last longer, require less maintenance, require less energy and cost less money.
- Install a 3-way valve for easy switching between the greywater system and the sewer/septic.
- Match the amount of greywater with plants. It will complete their irrigation needs.

2.3 Building Material Recycling:

Building materials recycling is one of the most sustainable activities associated with built environment. Most common building materials today such as concrete, metal, glass, brick and plastics can be produced with same form of the previously used materials, and this process of production lowers the energy requirement by up to 90% in most cases. By minimizing the energy spent on industrial production, recycling also help in reducing greenhouse gas emission. Further, recycling involves the processing and usage of the core elements of an old product for the production of new products. This helps in saving our natural resources to a great extent.

2.3.1 Case study – Plastic House, Blue Mountains, Australia

This project features use of recycling of plastic as a building material in an artistic expression .While these methods of

reused building materials have become popular in sustainable, contemporary architecture, other designers are experimenting with more untraditional materials instead of traditional material – brick, cement and steel. The Plastic house is built from fully recycled P.E.T.

3. ARCHITECTURAL FEATURES OF PLASTIC HOUSE, BLUE MOUNTAINS, AUSTRALIA

- Plastic House residential building is designed by an Architect Sir Chris Bosse.
- This design concept is ecological plastic house.
- It is built of environmentally friendly, hygienic, nontoxic, uv-stable, energy-efficient and light weight fully recycled P.E.T material. In the US, plastics are all numerically coded according to type, P.E.T polyethylene terphthalate (PETE or PET) code is one.(codes are as per the quality and characteristics of recycled plastic).
- For varied light control and views different colors grain, cloudiness, and surfaces are designed.
- The plan creates a floating space with maximum transparency and interaction with the surrounding site.
- Floor, walls and roof build with one structural element.
- The columns divide spaces for bathrooms, kitchen and bed rooms.
- The bedrooms can be separated with sliding elements, curtains.
- A lightweight prefabricated structure is filled with water, giving thermal mass, and water storage and fire resistance. The water cools in the day and returns the heat slowly during the colder nights.
- The building showcases latest passive ecological technologies, for the client, “ecological homes”.



Fig 6-9 : Steps of recycling of plastic for Plastic House, Blue Mountains, Australia

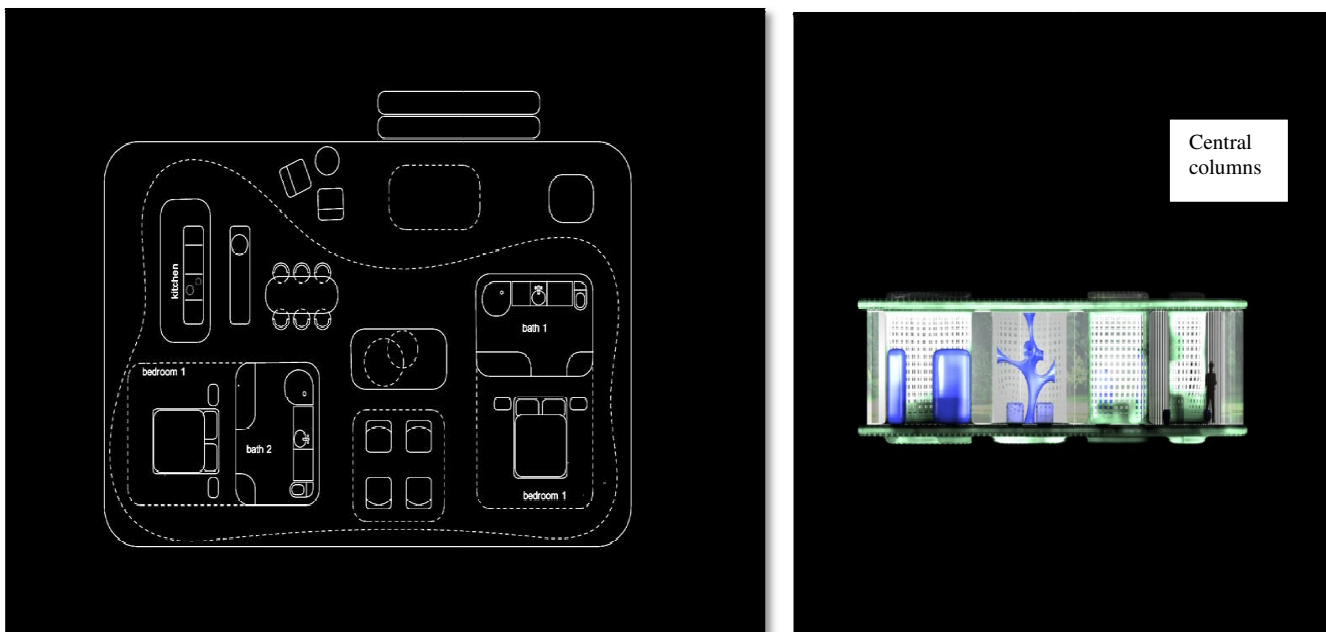


Fig 10-11 : Plan and Elevation of Plastic House, Blue Mountains, Australia

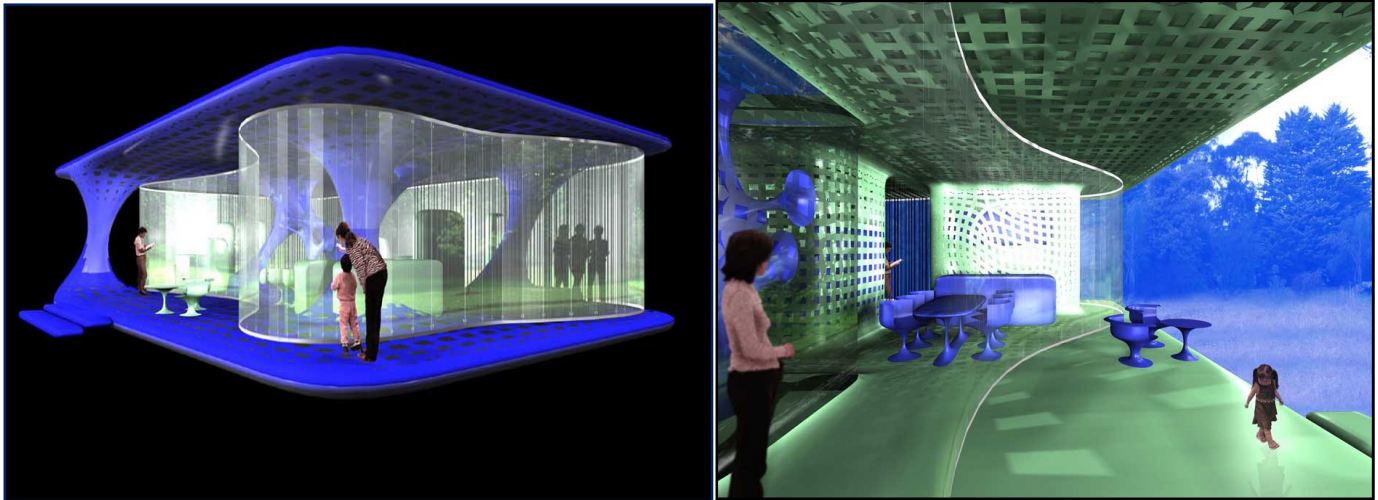


Fig 12-13 : Views of Plastic House, Blue Mountains, Australia

4. CONCLUSION

The total volume of water on our planet and in the atmosphere is estimated to be 1, 400 trillion cubic meters. Fresh water only represents 3% of this enormous volume. Water is thus a precious resource; all the more it is not uniformly distributed. More than a billion people still don't have access to drinking water, and more than 50 countries will be threatened with drinking water shortage by 2025.

With help of this we can save load on water resources by the studies of Rainwater harvesting & Grey water recycling. A significant portion of water is actually consumed for common areas. Rainwater harvesting & Grey water Recycling can help to save 35% to 40% on annual water bill, and while saving money, it will also help to save the environment and provide a better future for children and future generation. The recycled water, as rain water harvesting and grey water, is strictly used for toilets, for irrigation, and construction. It cannot be used for drinking-water system.

The most important step for recycling of construction waste is on-site separation. If the habit of construction waste on-site separation material is established, this can be done at little or no additional cost. Separation can be done with some extra efforts. This study recycling technologies reduces energy consumption, since it generally takes less energy to recycle a product than to make a new one. Similarly, recycling causes less pollution than manufacturing a new product, and conserves raw materials. It also increases profitability and

economy for the builder and customer. So to save earth the idea of recycle should be implemented in building design.

Moreover, even beyond the scale of structures, such effective systems directly correspond to the low carbon nature that our construction industry should follow, for a better and sustainable future for humanity's coming generations.

REFERENCES

- [1] Fig 10-13 source <http://www.e-architect.co.uk/australia/plastic-house-blue-mountains>
- [2] Fig 1 & 3 source <http://www.slideshare.net/zenrainman/rainwater-harvesting-2-case-studies>
- [3] Book: Architecture of Low Energy Consumption, Tianjin Branch of Jiangsu people's publishing House.
- [4] <http://blogs.timesofindia.indiatimes.com/foot-soldier/a-10-storey-building-built-in-48-hours-it-happened-in-india/>
- [5] Fig 2 & 4 source : <http://www.theconstructioncentre.co.uk/sustainable-homes/water/indoor-water-use.html>
- [6] <http://www.varshajal.com/varshajal-model-village.html>
- [7] <http://greywateraction.org/content/about-greywater-reuse>
- [8] Fig 6 & 9 source https://www.google.co.in/search?q=plastic+recycling&client=firefox-beta&hs=x63&rls=org.mozilla:en-US:official&channel=fflb&source=lnms&tbn=isch&sa=X&ei=NlzGU8bhGoyNuATY8oLACQ&ved=0CAgQ_AUoAQ&biw=1366&bih=633