

# Retrofitting Glazed Facade to Green Facade

Isha Singhal<sup>1</sup>, Angad Kasliwal<sup>2</sup>, Aayushi Pahwa<sup>3</sup>

<sup>1,3</sup>Fourth Year Student, Department of Architecture, SDPS Women's College, Indore, India

<sup>2</sup>Professor, Department of Architecture, SDPS Women's College, Indore, India

**Abstract:** The innovative and alternative way of glazed facade is green facade. The vertical landscape is one of the best ways to retrofit the existing building with green facade. In Indian context, for minimizing the unnecessary consumption of energy and understanding the shortage of horizontal landscape, the need to come up with a solution like vertical landscape is very important. It should be promoted widely for the betterment of environment.

**Keywords:** Green facade, vertical landscape, energy efficient building, green walls, living walls.

## 1. Introduction

According to contemporary architectural trend in India, a lot of building have been designed with glass facade which can be retrofit as green facade. In India, glass facades are designed irrespective of the climatic condition in most of the places, mainly where the temperature goes up to 45°C. This also affects the conditions regarding comfort of human occupancies inside the building. There is a definite need for integration of the vertical landscaping to avoid the adverse effects of the sun. In present date, since the air contains the excessive amounts of CO<sub>2</sub>, green facade will benefit the vertical landscape and also improve the quality of air. It conserves the energy by seizing and controlling the requirement of air conditioning the buildings. The production of carbon footprint is mainly increasing which can be reduce by replacing of glass facade to green facade.

## 2. Related work

### A. Literature review

1) *New green façade as passive system for energy savings on building* (Julia coma, Gabriel Perez, Cristian sole, albert castell, luisa f. Cabeza); 2014

The double skin green facade or green walls provide the obstruction to solar radiation and create a difference between the walls having sunny and shady areas up to 18°C. Green walls provide various function like energy savings, cutting out the atmospheric temperature from the inside of the building as well as urban scale. There are 4 passive systems, which are used by the green walls: shadow by plants, insulation by plants, water transferred to atmosphere which provides cooling effect, and obstacle to wind. According to experiments, the shadow effect by the species of plants, which can conserve better from the solar radiation has a lot of impact over reducing the energy consumption and building wall temperature. In an experiment,

during summer, approximately 50% area covered on south facade by plants showed low energy consumption.

2) *Vertical gardens as an adaptation strategy for urban areas: a review* (ar. Puja verma); 2018

The environment having green facade, vertical green infrastructure, strengthen the microclimate, reduces air pollution from urban areas, and makes the building aesthetically pleasing. The design in which the eco-friendly material is used on the elevation changes pursuant to climate and season. Urban heat island effect decreases due to green wall and helps to improve the temperature of the structure as well as increases urban wildlife habitat. The structure with vegetation should have strength with the restriction of not applying the vegetation on north facade without any design demand. The vertical landscape need not much space to harvest and can be installed easily on vertical plane, which gives clean air to the environment.

### B. Case study

1) *A case study of green walls on consorcio santiago building, Santiago, Chile*

This commercial building of Santiago constructed in 1993 on which the north and the west facades are vertically landscaped. The site where the average annual temperature is 14.4°C and the direction of wind flow is from south-west to north-east. The value of the solar radiation is 976 Wh/m<sup>2</sup>, which is maximum value that can be seen on December 21, and 815 Wh/m<sup>2</sup>, which is minimum value that can be seen on June 21. The height of the building is 58m and the building has 17 stories that are divided into three sections vertically, that is 4th to 8th floors, 10th to 12th floors, and 13th to 14th floors. During summer, the deciduous plants gives solar shade and maintains the temperature of the building. Approximately, 2,293 sq. m. area is covered by plants.

## 3. Scope of study

In India, there are large existing glass facade buildings which have additional consumption and adverse effect of sun that can be reduced by vertical landscape. With the increasing of population, the horizontal surface is falling off that is why the vertical landscape is the way to get the better micro and macro environment by retrofit the existing building and incorporate this technique in future.

#### 4. Types of green wall system

Green walls are basically built by either plants grow in modules place on the facade or climbing plants grow in the ground. Trellis system: The system in which the plants growing from the ground or by upholding the trellis. The types of plants like vines and climbers are used, that can climb easily and naturally which takes time. Modular panel system: The system in which the plants growing in panel or module that is designed in proper combination.

#### 5. Planning and construction of green walls

There are many things to be considered while planning the vertical garden that is climate, location of plantation, construction materials, and types of plants. Construction of living walls consist of 3 steps:

- *Designing:* The vertical garden design has different strategies and use different types of plants for exterior and interior walls. The plants are selected on the basis of their color, texture, patterns and size and should grow naturally. The green walls have different patterns made up of different types of species of plants that look aesthetically good. The plants help to maintain the microclimate which can reduce the energy consumption and spread clean air to the environment. The double skin green facade is provided to the structure that should have more stability.
- *Installation:* The plants are installed on vertical surface easily with a particular method. Initially, for module system, metal frame is attached to the structure walls and place the modules in various patterns. For minimizing the use of water, irrigation system is installed which automatically supplies definite amount of water to every plant. The modules depend on the need of the natural light in the building which helps to reduce the energy consumption.
- *Maintenance:* The design is said to be good when the structure needs less maintenance. The scale of the project and the types of plants are considered to minimize the maintenance. These considerations should be taken while the construction to get less maintenance for long time in the future. This system will make environment better and provide benefits ecologically.

Plants can be used for vertical gardens in India: *Nephrolepis exaltata*, *Epipremnum aureum*, *Hedera helix*, *Liriope gigantean*, *philodendron scandens*, *Geranium dissectum*, *Stephanotis floribunda*, *Spathiphyllum wallisii*, *trachelospermum jasminoides*, *Lavandula*.

#### 6. Passive strategies for energy efficient building

The design strategies for energy efficient building are those in which the materials like glass are not used. There are some considerations which should be kept in mind, such as avoiding

materials like glass and choose sustainable materials, climatic conditions of the microenvironment, amount of solar radiation, and the wind power. According to the climate zones, the different strategies are used.

- *Temperate region:* Deciduous trees are provided on south and west facade to act as a shade device during summer and allow the sun to raise during winter.
- *Hot arid region:* The roofs, walls and windows need maximum shade for cooling the interior of building and wind should be accessible to the non-air-conditioned building.
- *Hot humid region:* The plants, that need less water, are used to avoid humidity in the building and give more shade to the building.
- *Cool region:* The deciduous trees are planted to stop cold winter winds and avoid the plantation on south facade to get reduction of harsh raise on south façade. These plants can be provided on south for shading purpose.

#### 7. Benefits of vertical landscape

- Vertical landscape is aesthetically good which increases the economy of the building.
- Vertical landscape makes the building green and sustainable.
- Plants helps to remove the harmful gases and provides clean air to the environment.
- Living walls try to maintain the temperature which reduces the energy consumption.
- Living walls create a type of natural barrier which reduces the noise level.
- It also helps to minimize the water consumption by providing irrigation system.

#### 8. Conclusion

It is concluded that vertical landscape is the technology which can be used to retrofit the glass facade to green facade. Living walls can be easily installed anywhere depending upon the climatic conditions and the plants. Living walls are considered as sustainable materials which helps to get better environment. For the Indian context, retrofitting must be done from glazed facade to green facade.

#### References

- [1] Get to know about the benefits and limitations of vertical garden <https://medium.com/@infinitypools/get-to-know-about-the-benefits-and-limitations-of-vertical-garden-d57cc80d5a98>
- [2] Coma, Julià & Perez, Gabriel & Solé, Cristian & Castell, Albert & Cabeza, Luisa F, (2014). New Green Facades as Passive Systems for Energy Savings on Buildings. *Energy Procedia*. 57. 1851-1859.
- [3] Vertical gardens as an adaptation strategy for urban areas: a review
- [4] Bahrami, Payam. (2014). Green Walls in High-Rise Buildings.
- [5] Jain, Ritu. (2016). Vertical Gardening: A New Concept of Modern Era.
- [6] Top 10 ornamental plants for vertical garden <https://www.greenmylife.in/top-10-ornamental-plants-vertical-garden/>

- [7] Kanter, İdil. (2016). Energy Efficient Plant Design Approaches: Case Study of the Sample Building of the Energy Efficiency Training Facilities. International Journal of Electrical, Computer, Energetic, Electronic and Communication Engineering. 10. 1362-1367.
- [8] Landscaping for energy efficiency: zero energy project  
<https://zeroenergyproject.org/2014/10/01/landscaping-for-energy-efficiency/>
- [9] <https://www.ambius.com/green-walls/benefits/>