Abstract—The growing concern with environmental and ecological conditions have led to the discussion/search for ‘energy conscious’, ‘Eco friendly’, ‘energy efficient’ building designs. For the better growth of the future, keeping in view the environment related issues, the first objective of the designer is sustainable development i.e. environmentally compatible building designs. Sustainable architecture also referred as green architecture is a design that uses natural building materials e.g. earth, wood, stone etc (not involving pollution in its treatment) that are energy efficient and that make little or no impact on the nature of a site and its resources. This paper discusses issues related to Sustainable/environmental architecture. It also considers possible solutions related to these issues.

Index Terms—Sustainable, Green, Architecture, Building, Design, Efficiency.

I. INTRODUCTION

The words "Green", "Ecological" and "Sustainable" are terms used by environmentalists to indicate modes of practice. From global economics to household features these practices minimize our impact on the environment and generate a healthy place of living. In a deeper sense the words involve as to what can be done to heal and regenerate the earth's ability to bear life[1-4].

A. Principles of Environmentally Oriented Design

In Architecture there are many ways a building may be "green" and respond to the growing environmental problems of our planet. Sustainable architecture can be practiced still maintaining efficiency, beauty, layouts and cost effectiveness. There are five basic areas of an environmentally oriented design. They are Healthy Interior Environment, Energy Efficiency, Ecological Building Materials, Building Form and Good Design.

- Healthy Interior Environment: It has to be well insured that building materials and systems used do not emit toxic unhealthy gases and substances in the built spaces. Further extra cars and measures are to be taken to provide maximum levels of fresh air and adequate ventilation to the interior environment.

- Energy Efficiency: It has to be well ensured that the building's use of energy is minimized. The various HVAC systems and methods of construction etc. should be so designed that energy consumption is minimal.

- Ecological Building Materials: As far as possible the use of building materials should be from renewable sources having relatively safe sources of production.

- Building Form: The building form should respond to the site, region, climate and the materials available thereby generating a harmony between the inhabitants and the surroundings.

- Good Design: Structure & Material and Aesthetics are the basic parameters of defining design. They should be so integrated that the final outcome is a well built, convenient and a beautiful living space.

These principles of environmentally oriented design comprise yet another meaningful and environmental building approach called Green or Sustainable design. Architects should use their creativity and perception to correlate these principles to generate locally appropriate strategies, materials and methods keeping in mind that every region should employ different green strategies [5-7].

B. Definition

Sustainability means 'to hold' up or 'to support from below'. It refers to the ability of a society, ecosystem or any such ongoing system, to continue functioning into the indefinite future (without being forced into decline through exhaustion of key resources).

Sustainable architecture involves a combination of values: aesthetic, environmental, social, political and moral. It's about one's perception and technical knowledge to engage in a central aspect of the practice i.e. to design and build in harmony with the environment. It is the duty of an architect to think rationally about a combination of issues like sustainability, durability, longevity, appropriate materials and sense of place [8-10].
The present environmental conditions have led to the discussion/search for ‘energy conscious’, ‘Eco friendly’, ‘energy efficient’ building designs. For the better growth of the future, keeping in view the environment related issues, the first objective of the designer is a sustainable development i.e. environmentally compatible. This paper discusses issues related to Sustainable/environmental architecture. The main focus of the paper is on sustainable architecture - its need, solutions and impact on the future.

II. NEEDS AND ISSUES

The ecological crisis today is very serious and till date much of the debate still focuses on the symptoms rather than the causes. As a result there is an urgent need to emphasize and workout the best possible approach towards environmental protection thereby minimizing further degradation.

Architecture presents a unique challenge in the field of sustainability. Construction projects typically consume large amounts of materials, produce tons of waste, and often involve weighing the preservation of buildings that have historical significance against the desire for the development of newer, more modern designs. Sustainable development is one such measure, which presents an approach that can largely contribute to environmental protection. A striking balance between Environmental protection and Sustainable development is a difficult and delicate task.

Sustainable design is the thoughtful integration of architecture with electrical, mechanical, and structural engineering. In addition to concern for the traditional aesthetics of massing, proportion, scale, texture, shadow, and light, the facility design team needs to be concerned with long term costs: environmental, economic, and human as shown in Figure 1.

Some of the major causes, which greatly contribute to these two aspects, can be listed as:

- **Rapid Urbanization and Industrialization:**

  The consequences of this can further lead to Population explosion, Geological deposits of sewage and garbage, Unsustainable patterns of living & development, Environmental degradation (pollution of air, water, soil etc, food web disruption). Thus sustainable urban development is crucial to improve the lives of urban populations and the remainder of the planet. Both people and ecosystems impacted upon by their activities.

- **Natural Calamities:**

  Natural calamities like volcanic eruptions, earthquakes, flood, famine etc. which are being further aggravated by mankind add to the list of other ill effects like atomic explosion, green house effect, ozone depletion etc. Sustainable design attempts to have an understanding of the natural processes as well as the environmental impact of the design. Making natural cycles and processes visible, bring the designed environment back to life.

- **Depletion of Non-renewable sources:**

  Rapid depletion of non-renewable sources is leading to serious issues related to energy & water conservation etc. Thus the rational use of natural resources and appropriate management of the building stock can contribute to saving scarce resources, reducing energy consumption and improving environmental quality.

IV. SOLUTIONS

A. Sustainable Construction

Sustainable construction is defined as "the creation and responsible management of a healthy built environment based on resource efficient and ecological principles". Sustainable designed buildings aim to lessen their impact on our environment through energy and resource efficiency.

"Sustainable building" may be defined as building practices, which strive for integral quality (including economic, social and environmental performance) in a very broad way. Thus, the rational use of natural resources and appropriate management of the building stock will contribute to saving scarce resources, reducing energy consumption (energy conservation), and improving environmental quality.

Sustainable building involves considering the entire life cycle of buildings, taking environmental quality, functional quality and future values into account environmental initiatives of the construction sector and the demands of users are key factors in

![Fig. 1. Sustainable development](image-url)
the market. Governments will be able to give a considerable impulse to sustainable buildings by encouraging these developments. Further the various energy related issues during the different phases in the construction of buildings can be understood with respect to the chart shown in Figure 2.

![Energy Issues](image)

**Fig. 2. Energy issues in building construction**

### B. Environmentally Friendly Houses

Following the five basic principles of environmentally oriented design can lead to the construction of what can be called as Environmentally Friendly House. An environmentally friendly house is designed and built to be in tune with its occupants, nature, environment and ecosystem. It is designed and built according to the region it is located in, keeping in mind the climate, material, availability and building practices. The basic areas of design need to be considered at this stage can be listed as:

- Orientation
- Reduce Energy Gain or Loss
- Lighting
- Responsible Landscaping
- Waste Management
- External Ventilation

### C. Green Building

A green building places a high priority on health, environmental and resource conservation performance over its life cycle. These new priorities expand and complement the classical building design concerns: economy, utility, durability and delight. Green design emphasize a number of new environmental, resource and occupant health concerns:

- Reduce human exposure to noxious materials.
- Conserve non-renewable energy and scarce materials.
- Minimize life cycle ecological impact of energy and materials used.
- Use renewable energy and materials that are sustainable harvested.
- Protect and restore local air, water, soil, flora & fauna
- Support pedestrian, bicycles, mass transit and other alternatives to fossil-fueled vehicles.

Most green buildings are high quality buildings they last longer, cost less to operate and maintain and provide greater occupant satisfaction than standard development.

### D. Green Roofs & Porous Pavements

As already discussed the rapid urbanization and industrialization is resulting in extensive deforestation as a result the green areas are being covered with pavements and concrete. The rainwater that naturally seeps through land covered with vegetation and trees now just runoff, thereby leading to a major environmental imbalance in terms of groundwater. This problem can be solved to a great extent with the help of the construction of Green Roofs and Porous Pavements.

Green roofs & porous pavements present a unique method of ground water conservation. Vegetation to hold water on rooftops, and pavement that lets it percolate in the ground are some of the latest ways that can save water tables. Visually what might come across may be a roof sprouted with plants and a parking lot that drains water like a sieve—probably the latest in groundwater conservation.

### E. Building Materials

Tons of materials including timber go into building construction. There are three principal approaches to improve the material efficiency of building construction:

- Reducing the amount of material used in construction.
- Using recycled materials that otherwise would have been waste.
- Reducing waste generation in the construction process.

Further as far as possible sustainable harvested building materials and finishes should be used with low toxicity in manufacturing and installation.

### V. CONCLUSIONS

Sustainability often is defined as meeting the needs of the present without compromising the ability of future generations to meet their own needs. A growing number of people are committed to reaching this goal by modifying patterns of development and consumption to reduce demand on natural resource supplies and help preserve environmental quality. Achieving greater sustainability in the field of construction is particularly important, because building construction consumes more energy and resources than any other economic activity. Not only does a home represent the largest financial
investment a family is likely to make, but it also represents the most resource- and energy-intensive possession most people will ever own. Making homes more sustainable, then, has a tremendous potential to contribute to the ability of future generations to meet their own needs. Sustainable housing design is a multifaceted concept, embracing:

- Affordability
- Marketability
- Appropriate design
- Resource efficiency
- Energy efficiency
- Durability
- Comfort
- Health

As a developed society we should not undermine our resource base, the assimilative capacity of our surroundings or the biotic stocks on which our future depends. As a sustainable society our efforts should consist of a long-term and integrated approach to developing and achieving a healthy community. We should realize that the problems associated with sustainable development are global as a result the issues need worldwide attention. If we work together we can bring change faster.

REFERENCES