Net Zero Energy Building

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ABSTRACT

Essentially a Zero Energy Building is one that generates as much power as it consumes over a given period, usually one year . When it comes to energy generation the main sources today are solar , wind , geothermal and biogas. When it comes to energy consumptions there is an emphasis on smart building techniques , materials and technologies to minimise heat losses and improve energy efficiency.

A NET ZERO ENERGY BUILDING (ZEB) is residential or commercial building with greatly reduced energy needs through efficiency gains such that the balance of energy needs can be supplied with renewable technologies. Despite the excitement over the phrase " zero energy ," we lack a common definition , or even a common understanding, of what it means. In this paper , we use a sample of current generation low-energy buildings to explore the concept of zero energy. What it means , why a clear and measurable definition is needed . and how we have progressed toward the ZEB goal.

The way the zero energy goal is defined affects the choices designers make to archive this goal and whether they can claim success. The zero energy building definition can emphasize demand-side or supply strategies and whether fuel switching and conversion accounting is appropriate to meet a ZEB goal. Four well-documented definitions – net zero site energy ,net zero source energy , net zero energy costs , and net zero energy emissions –are studied; ,pluses and minuses of each are discussed. These definitions are applied to a set of low energy buildings for which extensive energy data are available. The reports show the design impacts of the definitions.

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OBJECTIVE OF PROPOSED DISSERTATION WORK

1. Study the design of existing NET ZERO ENERGY BUILDING
2. Understood the develop a NET ZERO ENERGY BUILDING

METHODOLOGY

1. Collection and study of data
2. Study of material
3. Study of new implementation

INTRODUCTION

Most zero net energy buildings get half or more of their energy from the grid, and return the same amount at other times. Buildings that produce a surplus of energy over the year may be called energy plus building and buildings that consume slightly more energy than they produce are called "near-zero energy buildings" or "ultra -low energy house ".

Traditional buildings consume 40% of the total energy in the US and European Union and are significant contributors of greenhouse gases. The zero net energy consumption principle is viewed as a means to reduce carbon emissions and reduce dependence on fossil fuels and although zero-energy buildings remain uncommon even in developed countries, they are gaining importance and popularity. To read about recent examples of newly built houses with zero net energy use and examples of renovated existing houses with a zero net energy use see here.

Most zero-energy buildings use the electrical grid for energy storage but some are independent of the grid. Energy is usually harvested on-site through energy producing technologies like solar and wind, while reducing the overall use of energy with highly efficient HVAC and lighting technologies. The zero-energy goal is becoming more practical as the costs of alternative energy technologies decrease and the costs of traditional fossil fuels increase.

ADVANTAGE AND DISADVANTAGE

ADVANTAGES

- Increased comfort due to more-uniform interior temperatures (this can be demonstrated with comparative isotherm maps).
- Reduced requirement for energy austerity.
- reduced total cost of ownership due to improved energy efficiency
- reduced total net monthly cost of living
- reduced risk of loss from grid blackouts
- improved reliability – photovoltaic systems have 25-year warranties and seldom fail during weather problems – the 1982 photovoltaic systems on the Walt Disney World EPCOT (Experimental Prototype Community of Tomorrow) Energy Pavilion are still working fine today, after going through three recent hurricanes
- extra cost is minimized for new construction compared to an afterthought retrofit.
- higher resale value as potential owners demand more ZEBs than available supply
- the value of a ZEB building relative to similar conventional building should increase every time energy costs increase
- future legislative restrictions, and carbon emission taxes/penalties may force expensive retrofits to inefficient buildings.
- contribute to the greater benefits of the society, e.g. providing sustainable renewable energy to the grid, reducing the need of grid expansion .isolation for building owners from future energy price increases.
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Dis-Advantages

initial costs can be higher – effort required to understand, apply, and qualify for ZEB subsidies, if they exist.

- very few designers or builders have the necessary skills or experience to build ZEBs

possible declines in future utility company renewable energy costs may lessen the value of capital invested in energy efficiency

- new photovoltaic solar cells equipment technology price has been falling at roughly 17% per year – It will lessen the value of capital invested in a solar electric generating system – Current subsidies will be phased out as photovoltaic mass production lowers future price
- challenge to recover higher initial costs on resale of building, but new energy rating systems are being introduced gradually.[34]

• while the individual house may use an average of net zero energy over a year, it may demand energy at the time when peak demand for the grid occurs. In such a case, the capacity of the grid must still provide electricity to all loads. Therefore, a ZEB may not reduce the required power plant capacity.

• without an optimised thermal envelope the embodied energy, heating and cooling energy and resource usage is higher than needed. ZEB by definition do not mandate a minimum heating and cooling performance level thus allowing oversized renewable energy systems to fill the energy gap.

ZERO ENERGY VS GREEN BUILDING

The goal of green building and sustainable architecture is to use resources more efficiently and reduce a building's negative impact on the environment.[35] Zero energy buildings achieve one key green-building goal of completely or very significantly reducing energy use and greenhouse gas emissions for the life of the building. Zero energy buildings may or may not be considered "green" in all areas, such as reducing waste, using recycled building materials, etc. However, zero energy, or net-zero buildings do tend to have a much lower ecological impact over the life of the building compared with other "green" buildings that require imported energy and/or fossil fuel to be habitable and meet the needs of occupants. Because of the design challenges and sensitivity to a site that are required to efficiently meet the energy needs of a building and occupants with renewable energy (solar, wind, geothermal, etc.), designers must apply holistic design principles, and take advantage of the free naturally occurring assets available, such as passive solar orientation, natural ventilation, daylighting, thermal mass.

AIM OF THE PROJECT

• Energy efficiency and green houses gases

• Low embodied energy

• Water conservation

• Health and comfort

• Waste minimisation

• Low pollutant emissions

• Durability

SOLAR ENERGY

Solar energy transformation is the energy that is in sunlight. It has been used for thousands of years in many different ways by people all over the world. As well as its traditional human uses in heating, cooking, and drying, it is used today to make electricity where other power supplies are absent, such as in remote places and in space. It is becoming cheaper to make electricity from solar energy and in many situations it is now competitive with energy from coal or oil. A solar cooker can be used for cooking food.

The sun is radiant light and heat harnessed to provide solar energy. The evolving technologies such as solar thermal electricity, solar architecture, solar heating and solar photovoltaics are used for this solar energy. Based on the way to capture, convert and distribute solar energy, these solar technologies are classified into two types as active solar and passive solar. The electrical energy generated from the solar energy is called as Solar Power Energy.

WIND POWER ENERGY

Wind power is the use of air flow through wind turbines to provide the mechanical power to turn electric generators. Wind power, as an alternative to burning fossil fuels, is plentiful, renewable, widely distributed, clean, produces no greenhouse gas emissions during operation, consumes no water, and uses little land. The net effects on the environment are far less problematic than those of fossil fuel sources.

Wind farms consist of many individual wind turbines, which are connected to the electric power transmission network. Onshore wind is an inexpensive source of electric power, competitive with or in many places cheaper than coal or gas plants. Offshore wind is steadier and stronger than on land and offshore farms have less visual impact, but construction and maintenance costs are considerably higher. Small onshore wind farms can feed some energy into the grid or provide electric power to isolated off-grid locations

BIO-GAS ENERGY

Biogas refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas is a renewable energy source.

Biogas is produced by anaerobic digestion with methanogen or anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials.. This closed system is called an anaerobic digester, biodigester or a bioreactor.

Biogas can be compressed, the same way as natural gas is compressed to CNG, and used to power motor vehicles. In the United Kingdom, for example, biogas is estimated to have the potential to replace around 17% of vehicle fuel.It qualifies for renewable energy subsidies in some parts of the world. Biogas can be cleaned and upgraded to natural gas standards, when it becomes bio-methane. Biogas is considered to be a renewable resource because its production-and-use cycle is continuous, and it generates no net carbon dioxide. As the organic material grows, it is converted and used. It then regrows in a continually repeating cycle. From a carbon perspective, as much carbon dioxide is absorbed from the atmosphere in the growth of the primary bio-resource as is released. when the material is ultimately converted to energy.

A biogas plant is where biogas is produced, and that's a first fact in answer to "**What are Biogas Plants**" for those seeking **the meaning of "biogas plant"** and *Biogas Plant Information*. Biogas is a gas mixture which is generated when organic compounds are fermented in the absence of air (anaerobic fermentation). This gas mixture is mainly made of carbon dioxide (CO2) and methane (CH4). Methane is a combustible gas, which means it can be burned. It can be used as a sustainable renewable fuel for cooking and lighting.

A standard type of **biogas plant** used to collect biological gas has **five main components**: the **inlet**, the **fermentation chamber**, the gas, the **gas storage bag** or tank, and **the outlet** and **the exit pipe** through which the gas is removed.

RAINWATER HARVESTING

Fig no. 8.1 Rain Harvesting

Rainwater capture and storage system at the Monterrey Institute of Technology and Higher Education, Mexico City

Rainwater harvesting is the accumulation and storage of rainwater for reuse on-site, rather than allowing it to run off. Rainwater can be collected from rivers or roofs, and in many places, the water collected is redirected to a deep pit (well, shaft, or borehole), a reservoir with percolation, or collected from dew or fog with nets or other tools. Its uses include water for gardens, livestock,[1] irrigation, domestic use with proper treatment, indoor heating for houses, etc. The harvested water can also be used as drinking water, longer-term storage, and for other purposes such as groundwater recharge. Rainwater harvesting is one of the simplest and oldest methods of self-supply of water for households usually financed by the user.

CONCLUSIONS:

With the advancement in renewable technology . NET ZERO ENERGY BUILDINGS are the future. Many governments have framed Zero Energy Building laws. Few government are also providing subsides to individuals and organizations for creating Zero Energy Buildings. But the goal of zero energy buildings would not be fulfilled till the time all the people don't understand their responsibility and contribute toward reducing energy consumption.

RESULT

1. Client buildings Isolation for building owners from future energy price increases.
2. Increased comfort due to more uniform interior temperatures.
3. Reduced total cost of ownership due to improved energy efficiency.
4. Extra cost is minimized for new construction compared to an afterthought retrofit.
5. Higher resale value as potential owners demand more ZEBs than available supply.
6. The value of a ZEB building relative to similar conventional building should increase every time energy costs increase
7. Isolation for building owners from future energy price increases
8. Increased comfort due to more-uniform interior temperatures
9. Reduced requirement for energy austerity
10. Reduced total cost of ownership due to improved energy efficiency
11. Reduced total net monthly cost of living
12. Reduced risk of loss from grid blackouts