Zero Energy Building

Analysis of Zero Energy Building

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***Abstract*—In analysis of ZEB (Zero Energy Building), we will compare the results of the analysis of one conventional residential building and one ZEB designed by us using the methods currently in practice. Goal of this project is to see the benefits of ZEB over Conventional Residential building for long duration. Currently CO2 emissions resulting from energy needs of buildings are about 40% of total and using ZEB techniques we can considerably reduce that amount.**

***Index Terms*—Near-Zero Energy Buildings, Ultra-Low Energy Houses, Integration of Renewable Energy Resources, Reduce CO_2 Emission.**

I. Introduction

A zero-energy building, also known as a zero-net energy (ZNE) building, net-zero energy building (NZEB), or net zero building, is a building with zero net energy consumption, meaning the total amount of energy used by the building on an annual basis is roughly equal to the amount of renewable energy created on the site. These buildings consequently, do not increase the amount of greenhouse gases in the atmosphere. They do at times consume non-renewable energy and produce greenhouse gases, but at other times reduce energy consumption and greenhouse gas production elsewhere by the same amount.

Most zero-energy buildings use the electrical grid for energy storage, but some are independent of grid. Energy is usually harvested on-site through a combination of 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.

II. Definitions of Zero Energy Building

Despite sharing the name "zero net energy", there are several definitions of what the term means in practice, with a difference in usage between North America and Europe.

Zero net site energy use:
In this type of ZNE, the amount of energy provided by on-site renewable energy sources is equal to the amount of energy used by the building. In the United States, "zero net energy building" generally refers to this type of building.

Zero net source energy use:
This ZNE generates the same amount of energy as is used, including the energy used to transport the energy to the building. This type accounts for losses during electricity transmission. These ZNEs must generate more electricity than zero net site energy buildings.

Net zero cost:
In this type of building, the cost of purchasing energy is balanced by income from sales of electricity to the grid of electricity generated on-site. Such a status depends on how a utility credits net electricity generation and the utility rate structure the building uses.

Net off-site zero energy use:
A building may be considered a ZEB if 100% of the energy it purchases comes from renewable energy sources, even if the energy is generated off the site.

III. Zero Energy Building Renewable Energy Supply Option Hierarchy

Option Number	ZEB Supply-Side Options	Examples
0	Reduce site energy use through low-energy building technologies	Daylighting, high-efficiency HVAC equipment, natural ventilation, evaporative cooling, etc.
On-Site Supply Options		
1	Use renewable energy sources available within the building's footprint	PV, solar hot water, and wind located on the building.
2	Use renewable energy sources available at the site	PV, solar hot water, low-impact hydro, and wind located on-site, but not on the building.
Off-Site Supply Options		
3	Use renewable energy sources available off site to generate energy on site	Biomass, wood pellets, ethanol, or biodiesel that can be imported from off site, or waste streams from on-site processes that can be

		used on-site to generate electricity and heat.
4	Purchase off-site renewable energy sources	Utility-based wind, PV, emissions credits, or other "green" purchasing options. Hydroelectric is sometimes considered

Table: - ZEB Renewable Energy Supply

Figure: - Zero Energy Building

IV. Advantages and Disadvantages

Advantages:

isolation for building owners from future energy price increases, 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, improved reliability, 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.

Disadvantages

Initial costs can be higher – effort required to understand, apply, and qualify for ZEB subsidies, 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.

V. Cost Analysis

Cost of Conventional Building

Sr. No.	Investment	Item	1-year cost	5-year cost	10-year cost
1	Initial Investment	Construction Cost	885236	177047	88524
2		Equipment Cost	225140	45028	22514
3	Running Cost	Electricity Cost	67988	339940	679880
4		Maintenance Cost (Assume 5% of Equipment Cost)	11257	56285	112570
Total Cost			1189621	618300	903488

Table: - Cost of Conventional Building

Cost for Zero Building Energy

Sr. No.	Investment Type	Item	1-year cost	5-year cost	10-year cost
1	Initial Investment	Construction Cost	885236	177047	88524

2		Equipment Cost	235840	47168	23584
3	Running Cost	Electricity Cost	18250	91250	182500
4		Maintenance Cost (Assume 5% of Equipment Cost)	11792	58960	117920
5	Initial Investment (will give return in form of energy saving)	Solar Power System Cost	231050	187250	132500
Total Cost			1382168	561675	544758

Table: - Cost of Zero Building

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