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Importance of Net Zero Energy Building

Reshmi Banerjee
Department of Electrical Engineering,
Guru Nanak Institute of Technology, WBUT

Abstract – 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 do not increase the amount of greenhouse gases in the atmosphere. The wording "Net" emphasizes the energy exchange between the building and the energy infrastructure. By the building-grid interaction, the Net ZEBs become an active part of the renewable energy infrastructure. Zero net energy (ZNE) has unprecedented potential to transform the way buildings use energy. This ultra-efficiency goal is one that owners can define, design teams can reach for and occupants desire. An increasing number of buildings are meeting this standard, raising confidence that a ZNE goal is realistic given current building technologies and design approaches.

Keywords – Net zero energy building, Energy plus buildings, Near zero energy buildings, Energy reduction strategies, Zero net site energy use, Zero net source energy use, Net zero cost, Net off site zero energy use.

I. INTRODUCTION

Fig. 1: Net zero energy

Buildings that produce a surplus of energy over the year may be called "energy-plus-buildings" and buildings that consume slightly more energy than they produce are called "near-zero energy buildings" or "ultra-low energy houses". 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.

Advantages of zero energy buildings are:

- Isolation for building owners from future energy price increases.
- Increased comfort due to more uniform interior temperatures.
- Reduced requirement for energy austerity.
- Reduced total cost of ownership due to improved energy efficiency.
- Extra cost is minimized for new construction compared to an afterthought retrofit.
- Higher resale value as potential owners demand more ZEBs than available supply.

Disadvantages of zero energy buildings are:

- 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.
- Challenge to recover higher initial costs on resale of building, but new energy rating systems are being introduced gradually.
- 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 optimized 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.

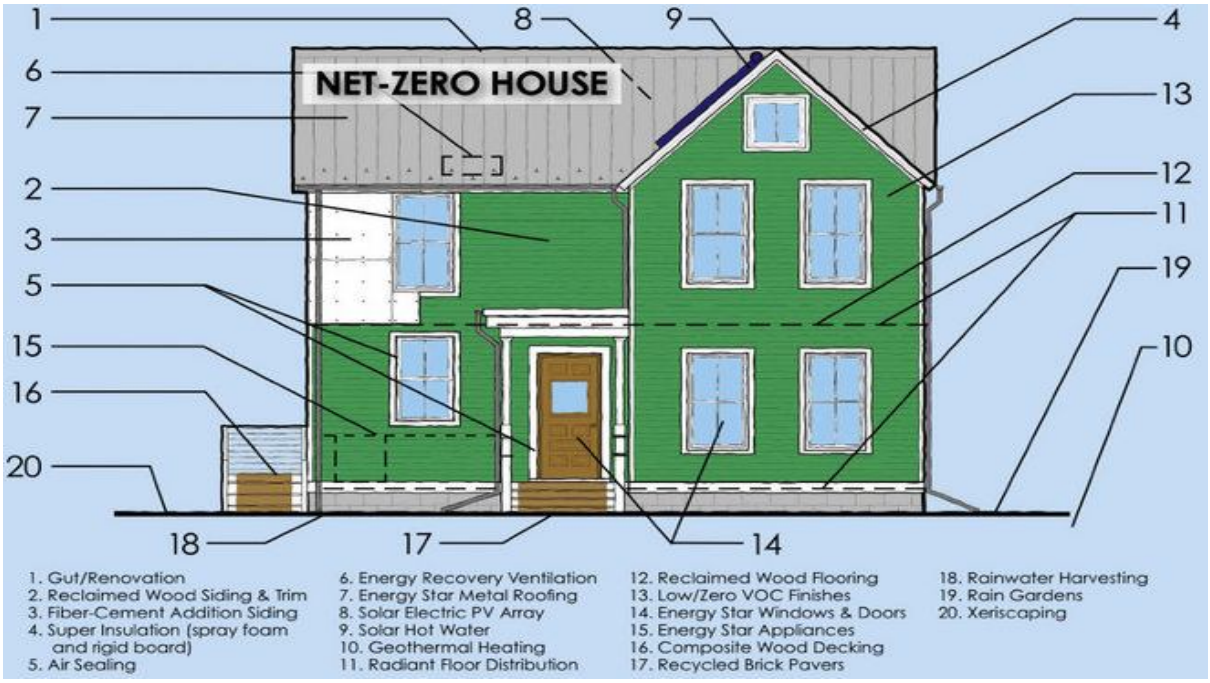

Fig. 2: Net zero house

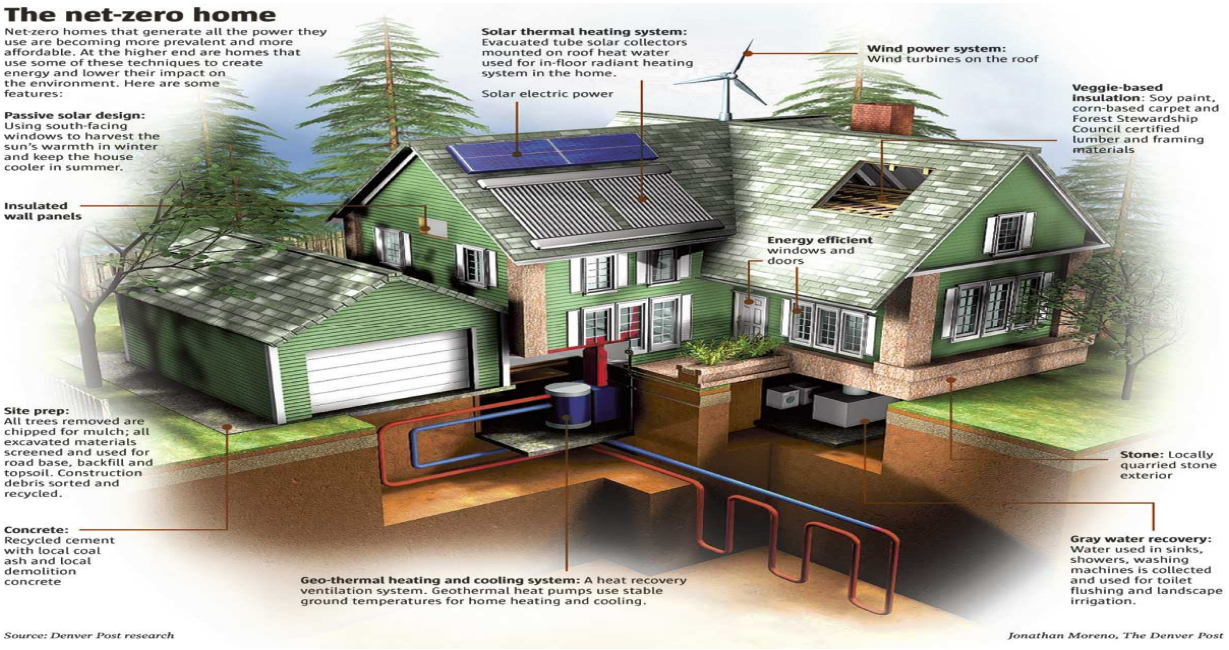

Fig. 3: Features of net zero house

II. METHODOLOGY

- Most zero net energy buildings get half or more of their energy from the grid, and return the same amount at other times.
- The most cost-effective steps toward a reduction in a building's energy consumption usually occur during the design process. To achieve efficient energy use, zero energy design departs significantly from conventional construction practice. Successful zero energy building designers typically combine time tested passive solar, or artificial conditioning, principles that work with the on-site assets. Sunlight and solar heat, prevailing breezes, and the cool of the earth below a building, can provide day lighting and stable indoor temperatures with minimum mechanical means. ZEBs are normally optimized to use passive solar heat gain and shading, combined with thermal mass to stabilize diurnal temperature variations throughout the day, and in most climates are super insulated.

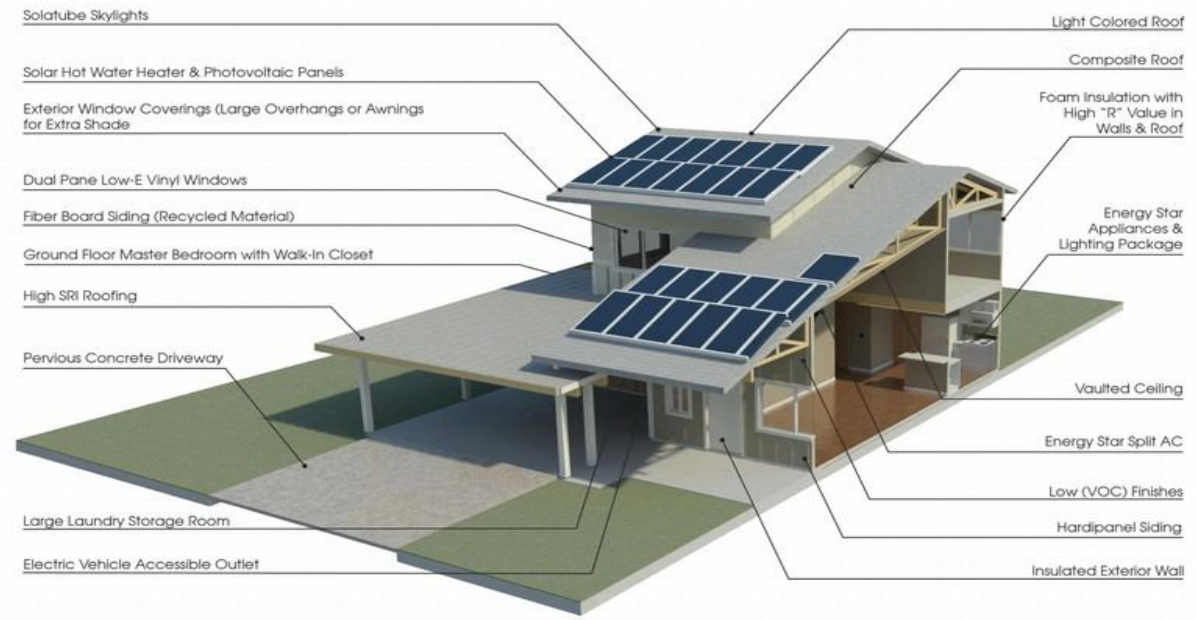

Fig. 4: Steps to reduce energy consumption

- Sophisticated 3-D building energy simulation tools are available to model how a building will perform with a range of design variables such as building orientation (relative to the daily and seasonal position of the sun), window and door type and placement, overhang depth, insulation type and values of the building elements, air tightness, the efficiency of heating, cooling, lighting and other equipment, as well as local climate. These simulations help the designers predict how the building will perform before it is built, and enable them to model the economic and financial implications on building cost benefit analysis, or even more appropriate – life cycle assessment.
- Zero energy buildings are built with significant energy saving features. The heating and cooling loads are lowered by using high efficiency equipment, added insulation, high efficiency windows, natural ventilation, and other techniques.

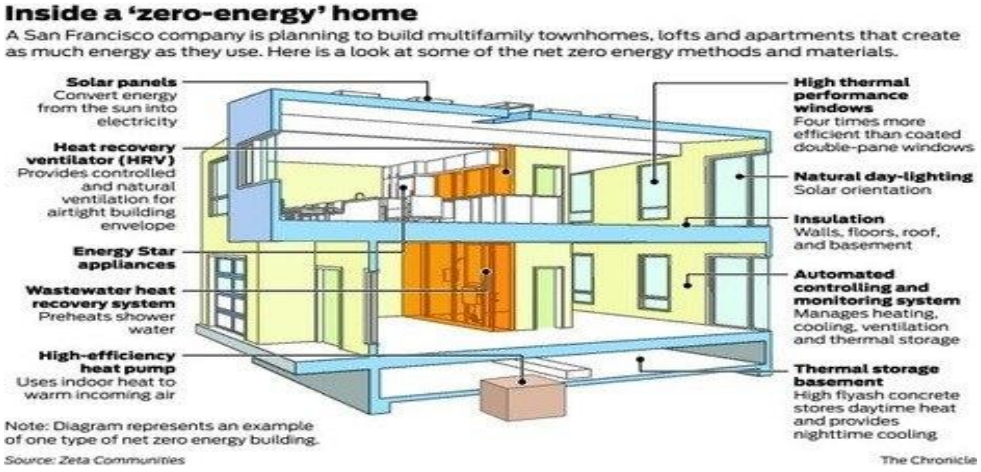

Fig. 5: Inside a zero energy home

- Zero energy buildings are often designed to make dual use of energy including white goods, for example, using refrigerator exhaust to heat domestic water, ventilation air and shower drain heat exchangers, office machines and computer servers, and body heat to heat the building. These buildings make use of heat energy that conventional buildings may exhaust outside.

III. RESULT

- The zero net energy consumption principle is viewed as a means to reduce carbon emissions and reduce dependence on fossil fuels.
- Connection to energy grids prevents seasonal energy storage and oversized on site systems for energy generation from renewable sources like in energy autonomous buildings.

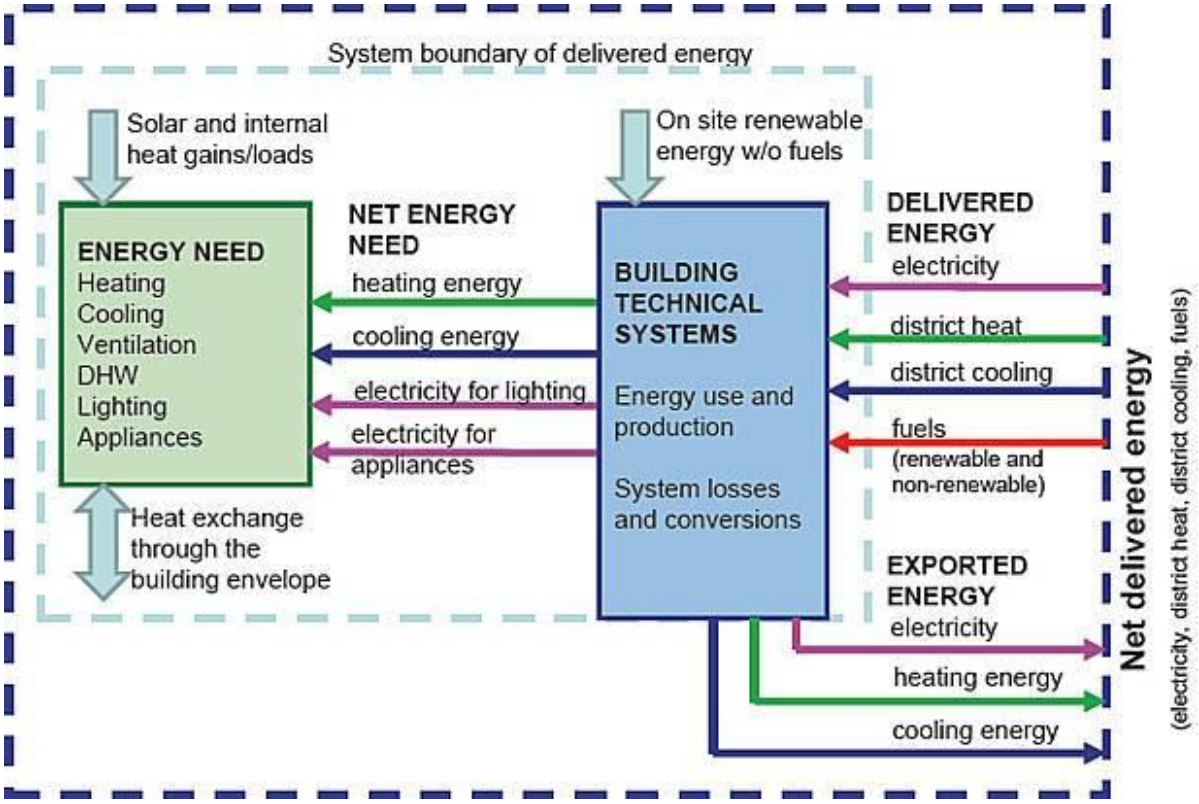

Fig. 6: Net delivered energy

- Requirement for energy austerity is reduced.

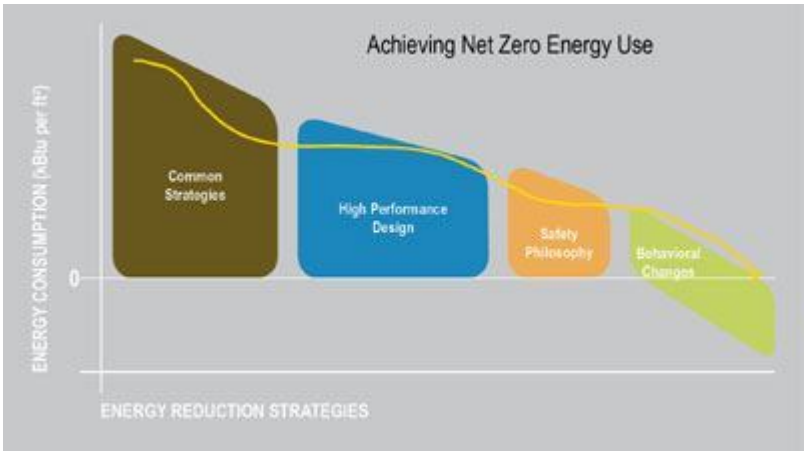

Fig. 7: Energy reduction strategies

- Energy efficiency is improved.

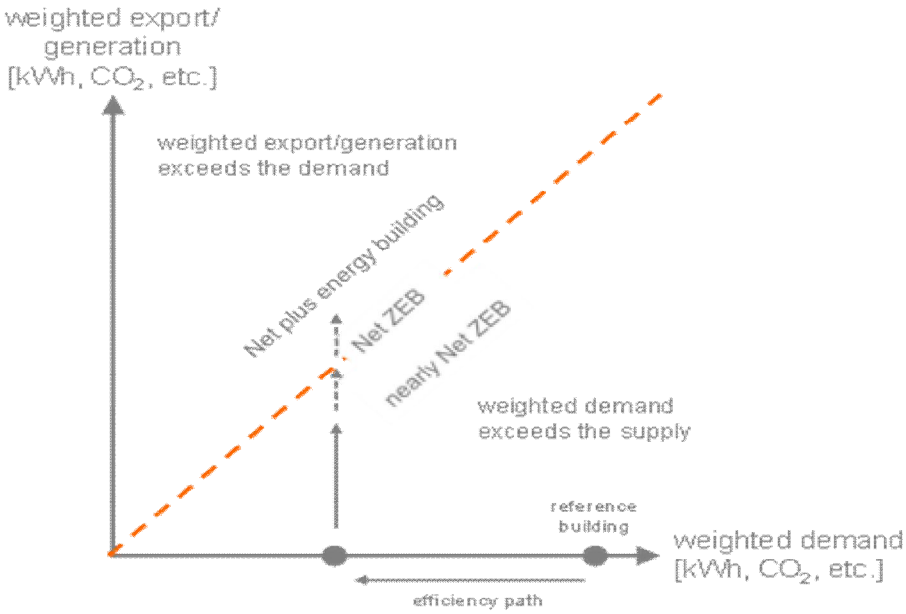

Fig. 8: Net plus energy building and efficiency path

IV. CONCLUSION

Wide acceptance of zero energy building technology may require more government incentives or building code regulations, the development of recognized standards, or significant increases in the cost of conventional energy. The zero energy building concept has been a progressive evaluation from other low energy building designs. Among these, the Canadian R-2000 and the German passive house standards have been internationally influential. India's first net zero building is Indira Paryavaran Bhawan, located in New Delhi. Using standard building techniques and energy cost modelling, zero energy homes can be very affordable to build.

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