

# Achieving energy efficiency in commercial buildings

[Business](#)



The energy spent on construction constitutes a significant part of the total amount of energy consumed in the world. Apart from consuming substantial amounts of energy, the construction energy is also responsible for a huge amount of carbon dioxide emissions. Additionally, the office buildings consume approximately 1055.5 MJ/ m<sup>2</sup> of energy per Annum.

Additionally, office buildings represented up to a fifth of all the energy delivered and consumed by commercial buildings. However, not all of this energy is as a result of constructing the building. However, it also includes of the large number of electrical and mechanical equipment that has to be incorporated into the building, intended for the heating, ventilation and air-conditioning (HVAC hereafter). Therefore, commercial buildings form a fundamental focus area for the improvement of energy efficiency (Herzog, 1997) From an environmental standpoint, approximately out of the 6 billion tonnes of carbon emissions from industrialized countries, 4.5 tonnes is as a result of constructing buildings. Building structures that are more energy efficient may lower the amount of carbon emitted by up to 60%.

This value translates up to 1.35 billion tonnes of carbon; a significant amount. Energy efficiency refers to the provision of an improved service level while utilizing reduced amounts of energy, therefore, cutting costs spent on energy. By setting efficiency standards, certain states such as California, are able to increase their economic prosperity by protecting the consumer from exorbitant costs on energy. Furthermore, they help in the stabilization of the state's supply of energy by lowering the overall state demand of energy.

The state of California leads efforts in achieving energy efficiency in commercial buildings by applying Zero Net Energy (ZNE hereafter) policies. However, this implementation requires vast improvements in the efficiency of constructing commercial buildings. This research paper will discuss the process of achieving energy efficiency in commercial buildings by considering the various protocols and the various strategies aimed at achieving this goal. The paper proposes several recommendations that can be implemented in order to achieve this goal. Buildings considered Zero-Net Energy, combine renewable power generation found on site and energy efficiency.

These represent an opportunity to regulate the cost of energy and also to meet the goals of greenhouse gas emission. A Zero-Net Energy building refers to a building in which the amount of societal energy used within a period of one year; is equal to or less than the amount of societal energy that is renewable generated at the site. Societal value of energy refers to the cost of energy projected over time. This includes such factors as the value linked with the amount of carbon emissions, the peak demand cost as well as other externalized costs. In order to come up with buildings which are ZNE compliant, the use of energy in the buildings has to be reduced as much as possible. This can only be achieved by efficiently utilizing energy.

This means that the level of energy used up in the building has to be lowered to the point that the demand of energy by the building can be sufficiently met by the installed photovoltaic cells or external renewable sources of energy (Jayamaha, 2006). Additionally any future updates done on the

building should be following the energy efficiency plans of the building. Apart from the building modifications that need to comply the new appliances that may be installed in the building also have to be energy efficient. In order to achieve high energy conservation standards, the state of California implemented several strategies. The current efforts geared towards the attainment of an energy efficient environment rely on several policy initiatives that have a wide range of objectives from creation of jobs, to protecting the environment, to economic development. Most of California's housing units, as well as commercial buildings, came up before 1978.

Therefore, these buildings present an opportunity for the state of California to accomplish its goals and objectives of reducing the amount of green house gases emitted. As a result, the governor of California, Governor Brown inculcated the policy of enhancing energy efficiency as a part of his Clean Energy Jobs Plan. This plan empowered the Energy Commission to come up with energy regulation ratings and improvements for the existing buildings. This gave a state agency the power to make use of this opportunity if enhancing energy efficiency; a power that was previously not there (Torcellini et al, 2006). According to Governor Brown's plan, there are several key actions that can be used to ensure the attainment of energy efficiency. One of the key steps suggested is that stronger standards need to be implemented concerning the appliances used for lighting and other consumer electronics.

He also proposes the creation of new standards of efficiency that have to be met on constructing new buildings. Furthermore, he proposes increment in

public education and enhancement of efforts geared at meeting these standards. Finally, he suggests the need to transform the existing buildings to become more efficient especially those constructed before the implementation of the current building standards. Apart from Governor Brown's policies, there are several acts that also endeavor to ensure the achievement of energy efficiency in commercial buildings and any other building constructed in California. One such act is The Warren-Alquist Act. It is this act that mandated the California Energy Commission to come up with, implement and adopt standards which require either the maximum allowable energy consumption for appliances or the minimum acceptable energy efficiency in buildings.

The efficiency standards of appliances require manufacturers to be able to cover all energy reductions that are feasible without sacrificing the expected consumer safety or comfort while using the appliances (Herzog, 1997). The California's Clean Energy Futures Initiative promotes activities and initiatives aimed at reducing the amount of carbon emitted as well as those aimed creating green jobs. The Global Warming Solutions Act - AB 32 has initiated a drive that aims at returning the amount of carbon emitted from California back to the 1990 level by the year 2020. The act notes that the single most notable way of lowering the amount of carbon emitted into the environment is by constructing new energy efficient buildings. However, there is an urgent need to improve the energy efficiency of those buildings constructed prior to 1978.

There is a wide discrepancy in the amount of energy consumed across the population as well as the types of buildings. Building under the Energy Efficiency Standards aims at minimizing the costs of building energy to consumers while as technically feasible as possible, not limiting the use of energy. For one to come up with a design for an energy efficient building there needs to be a design geared towards the same. The design must put into consideration the characteristics of the environment. Additionally, it must be able to maximize the passive opportunities that will ensure the reduction of energy necessary for heating and cooling the entire building.

This is a logical means through which the energy efficiency of a building can be enhanced. The environmental characteristics for consideration include the weather, the variations in temperature and optimization opportunities that are site specific including; orientation towards light. Constructing energy efficient buildings can also be enhanced by incorporation of high efficacy mechanical and lighting systems in the design of the building. The Building Energy Efficiency Standards and the Appliance Efficiency Standards provide the necessary mechanisms needed to lower the energy requirements of a building. The standards promote the use of modern technology that is energy efficient such as the use of compressor less heating, cooling and ventilation systems as well high-efficiency luminaries for the building lighting system. This makes it possible to maintain the buildings at minimal energy while not sacrificing the comfort of the users (Jayamaha, 2006).

There are several challenges associated with the construction and implementation of energy efficient buildings. There are still several

challenges that need to be solved in order to achieve meaningful progress in achieving energy efficiency in buildings. Despite having the policies and laws that regulate the building of energy efficient buildings, it is up to the manufacturers of appliances, the distributors and construction engineers to abide by them. Approximately 30% of energy saved through implementation of energy efficient buildings goes to waste as a result of non compliance with the set regulations. Non compliance involves such aspects as not installing HVAC systems and improper sealing of air ducts. In exchange for stimulus funds, California has pledged to achieve compliance by the year 2017.

There exists a lack of proper enforcement of standards and implementation of other strategies of enhancing energy efficiency. These challenges increase the costs of construction and energy demand in such buildings. This is a serious setback to the efforts made towards enhancing energy efficiency. In order to curb this problem, it is mandatory that all efficiency measures commonly installed poorly be inspected and verified by energy inspectors who are independent. The third part energy inspectors are referred to as HERS raters.

Their mandate includes; use specific diagnostic tests and field verification protocols to establish the quality of the installed appliances. They thus protect the consumer by making sure that the equipment bought is as energy efficient as possible and saves them costs. Building departments also face tremendous challenges in implementing energy efficiency in buildings. Most of the barriers that the building department faces are as a result of lack of sufficient funding. These departments are dependent on permit fees and,

therefore, do not have any surplus that they can use to keep track of the contractors without permits. There are also poor HVAC change outs and repairs.

Reports show that only 10 % of all HVAC systems are installed correctly and have the required permits to operate (Herzog, 1997). There are several recommendations that can be made to ensure implementation of the policies and regulations to achieve an energy efficient commercial building. Firstly, creating public awareness and outreach will help to disseminate the benefits of energy efficient buildings. Furthermore, it is of considerable importance to come up with a dedicated workforce focused on constructing energy efficient buildings. There is a vital need to enhance enforcement and compliance with the set rules and regulations that ensure construction of energy efficient buildings.

Energy efficient buildings are now preferred all over the world as a means of controlling greenhouse effects. Additionally, they help reduce the amount of carbon emitted into the atmosphere. Therefore, they form a fundamental part of policies implemented in the construction industry. In conclusion, the benefits of energy efficient commercial buildings cannot be under estimated. Apart from being environmentally friendly, they drastically cut costs spent on energy. Resources can, therefore, be channeled towards other developments.

Additionally, they help the state to become more independent. However, despite the importance attached to the implementation of this policy, it is necessary for the industry to determine the solutions to the challenges it

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faces. It is imperative to note that the 30% energy loss due to non-compliance is unnecessary. Furthermore, improper installation of HVAC systems is a problem that can readily be solved by using certified professionals (Jayamaha, 2006). The importance of achieving energy efficiency in buildings cannot be overemphasized.

This is because it is one of the most viable solutions to the problem of carbon emission. The devastating effects of carbon emission to the environment need urgent addressing; building energy efficient buildings provides one of the means through which it can be tackled. It is, therefore, essential that governments implement policies that will ensure the construction industry adopts energy efficient construction techniques.