

Ethical consideration for materials in renewable energy in Buildings

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Abstract

The influence of the climate change and global warming are caused mainly by the carbon emissions and other human non-ethical activities. The significance to reduce the emissions of carbon has been realized in the recent years and increases day-by-day. The developments of the strategies for reducing the energy consumption and relative carbon emissions are continuous. The report discussed the strategies of reducing the emissions of carbon for a primary school in Kuwait city. The report discusses the structure and the energy use in the school and provided the possible ways of converting the school into a low carbon school and put the strategies to control the conversion. The report also discussed that the cost of converting the school into low carbon might be an obstacle that permits the school's management from performing the conversion but the benefits of converting the school were represented so that encouraging the school's management to perform the change due to the future and near-future benefits.

1. Introduction

1.1 Background

In the recent years, a special awareness is realized towards the sustainable development, sustainability, low carbon design and green environment. their importance have increasingly realized in the last years due to the studies that ensures the danger of the Co2 emissions not on the animals and humans only but on the whole earth including the climate change, the

which was then followed by the complex type of buildings and the huge use of energy to deliver the better accommodation along with the technologies that all contributed in making the life easier for the human; this was linked closely to the availability of the building materials, suitable terrain and the access to various energy sources. The traditional style of buildings is recognized as the type that utilizes the maximum amount of these resources. An energy transition was realized in the last hundred years that involved the shift from the dependence on the sources of renewable energy to the fossil fuels as can be seen in Figure 1 (Lesson 1.1 Buildings and sustainability, Lecture notes).

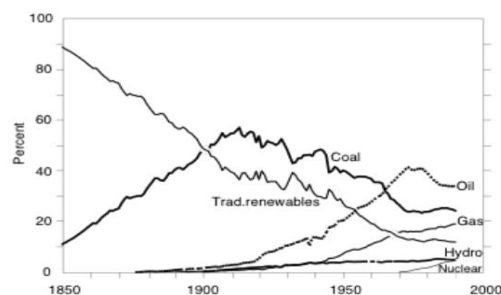


Figure 1: Primary sources of energy in the global energy supply (Nakicenovic and Grubler, 2000)

The availability of the oil, gas and coal resources contributed in supporting the urbanisation and also were a major factor contributed in the development of styles of buildings that rely mainly on the energy in

their operation and construction. The tendency to globalization realized can be considered as the main cause that will increase the distribution of different architectural styles in the globe. However, the interest and care for the sustainable buildings has been important in reversing the trend towards the distribution of different architectural styles in the globe (Lesson 1.1 Buildings and sustainability, Lecture notes).

This assignment report aims to discuss the possible ways including the design and recommendations for converting a primary school in Kuwait into a low carbon organization and hence satisfying the needs and concepts of sustainability.

1.2 Location and local climate

The location selected to study the design of low carbon strategies is Kuwait. Badr al sayed rajab al rifai primary school has been selected to be analyzed and to suggest the possible and appropriate strategies that help the school to produce low carbon and to set the organization as a low carbon organization. The school is located in Al-Yarmouk in Al-Kuwait city.

The location of the school is strategic and is easy to reach from different surrounding areas while it is important to mention that school buses are available to transfer the students from and to the school.

The weather/climate is almost hot in Kuwait and requires the high consumption of energy to make the school, buses and other facilities comfortable. Due to this reason and due to the ability to apply the low carbon strategies in these places, the school located in Al-Kuwait city was selected for analysis and evaluation.

2. Building layout and design features

2.1 Low energy design and thermal performance

Thinking about the ways to save energy in Badr al sayed rajab al rifai primary school starts from thinking about the good day lighting in Kuwait and mostly all over the year. The standard working hours of the

school starts from 08:00 AM to 03:00 PM through which the day lighting is delivered efficiently. The location of the school is not surrounded by high buildings or towers and hence the luminance reaching the overall organization from four areas is equal and high through the day. Figure 2 shows the student's court in the school. The structure of the school is efficient; this was noted by the arranged classes along the length of the school's area through which the light can enter easily into all classes. Moreover, the places through which the light is minimum before the mid of the day (12:00 PM) are utilized for the sports and other activities. A large football playground is placed and doesn't require the use of energy for cooling especially in the very hot and humid summer and this contributes to the low energy use and need in the playgrounds. Moreover, the classes of football and other outside activities are arranged to be done in the early morning of the summer days (April, May, September and October) while it is worth mentioning that the summer vacation starts from 1st of June and continues till 15th of September. The school being closed in this duration minimizes up to large degrees the use of energy required to cool the inside areas of the schools including classes, teachers rooms, management and other facilities within the school.



Source:

<http://www.baderalrifaischool.com/nathafa.htm>

[Last accessed 15th May, 2012]

Figure 2: The student's court

The dependency on the day light can reduce and even save the energy by minimizing the time of running the artificial lights in the building. The consumption of electrical energy is hence reduced. In the school, however, the white tube lights are used but still those lights provide the heat caused by the heat loss of the electronic components of the circuit and hence maximizing the energy required by the cooling systems to minimize the temperatures to the balance and stable temperature. The day lighting consist of sky light and the direct sun light, both contribute to minimize the use of energy for lighting the school. Figure 3 shows the possible use of these both lights to minimize the dependence on the artificial lights. The figure shows the successful and proper utilization of the sun and sky lights to deliver the required luminance to one of the class rooms in the school (Lecture notes, Lesson 1.1: Buildings and sustainability).



Source: <http://www.baderalrifaischool.com/er.htm>

[Last accessed 15th May, 2012]

Figure 3: The utilization of the sky and direct sun lights

For low energy design, the school is suggested to change the structure of the classes and rooms to follow the shape in figure 4.

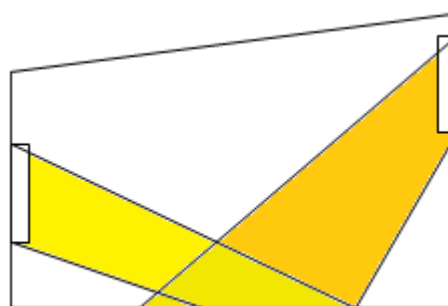


Figure 4: The recommended design for rooms and class rooms

The suggested design of rooms ensures the better and more achieving of the light from the sky and sun and improves the entrance of the luminance into the class room and hence reducing the energy and carbon emissions.

2.2 Cooling/Heating system

The cooling and heating systems are considered as major consumers of energy while difference researchers show the ways of minimizing the energy required by those systems and hence reducing the carbon emissions to the environment (Lecture notes, Lesson 2.1: Building Heating and Cooling Energy Demands).

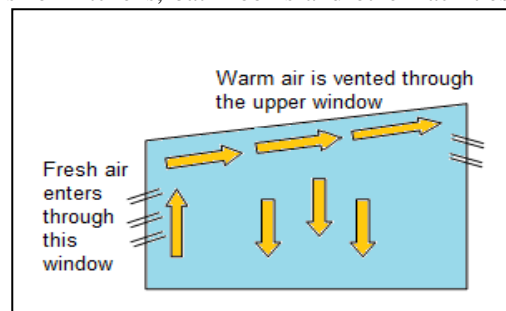
It is therefore important to realize that the need for reducing the use of electricity in the school is important to reduce the carbon emissions, conservation of fossil fuels and the energy costs also.

The possible ways and strategies to reduce the use of electricity in the school and hence reducing the carbon emissions include (Energy saving case study, o.j.):

- Avoid the use of air-conditioning in the early winter and instead the windows can be used to deliver the better illuminance and the better weather. However, the weather in Kuwait is extremely hot and dusty and the use of air-conditioning is necessary but the knowledge should be distributed among all that the use of fans, pumps and any other refrigeration equipment contributes to the excessive use of energy and electricity and hence contributing to the damage of the nature and the life on the earth.
- Reduce the use of artificial lights especially that the normal working hours are in the day while the summer is the vacation for the school. By reducing the use of artificial lights, the internal heating and need for extra cooling energy is reduced. For the months through which the cooling is must, this means that the cooling demands are much reduced.
- Avoid the unnecessary use of equipment or lighting devices. Due to the inefficient concern and background in the society relevant to the importance of saving the energy and the impacts on the environment and the life as well. It was realized in the school that the use of lights is excessive while many of the rooms and classes are exploiting the energy at the time that it is not required at all whereas the light from the sky and sun are

sufficient. Awareness should be delivered to the staff and workers so that to utilize the resource properly.

The winter in Kuwait requires the use and run of heaters for kitchens, bath rooms and other facilities.



The use of heaters was realized as improper while it continues for the starting summer months through which the use of heaters is not required at all. Also, heating is activated in the winter to heat the classes, rooms and facilities while the excessive use of heaters especially of the empty rooms must be avoided.

Figure 5: Passive ventilation

Figure 5 shows the design through which heating and ventilation/cooling can be utilized better in both summer and winter. The installation of the windows in the school was realized good but by following the proposed design in figure 4, the illuminance would be better. The same case holds on for the ventilation and

heating. The straight roof is not necessary and instead the inclined roof is better and makes the school a low carbon school. By performing the installation of the proposed structure of windows in the classrooms, the fresh air is supplied without the need of the air-conditioning systems especially at the end of summer and last months of winter and hence reducing the energy demand up to large degrees. The design also suggests the manual open and close of the windows but the windows at the top of the class are controlled by a motor according to the people in the classroom. As the air warms up, the warm air is raised to the higher level of the room and escapes through the windows. Hence, in this way the fresh cooler air is kept in the classroom whereas the lower windows are associated with a hopper that helps in keeping the weather normal in winter (Lecture notes, Lesson 3.1: Passive building design; Energy saving case study, o.j.).

2.3 Emerging technology

Features in the buildings and constructions including the insulation, passive ventilation, and panelled wall construction are necessary to minimize the use of energy and the overall carbon emissions. Such type of features were and are again suggested for the school to reduce the carbon emissions but in this section the installation of one of the most effective emerging technologies is to be suggested for the school that is the installation of solar cells on the floors and the higher level also of the school. This helps in the generation of the renewable and green energy that can supply the school with the required energy at zero carbon emissions. Note that the placement of the solar panels should be inclined to contribute in collecting better sun rays and convert into electrical signals stored in the battery of the system. The panels as shown in the figure is producing the energy and also making the shading somehow that is sufficient in the winter (Energy saving case study, o.j.).

Moreover, another system is effective and must be installed is the solar heating system (water) through which the water is heated from the direct sun and is delivered to the facilities and the bathrooms as well. In this way, the gas used in heating the water in the

boilers is extensively reduced and hence lesser or no emission of carbon.

2.4 Minimizing energy for lighting

In the normal conditions, the vertical windows are usually shaded by different types of objects. Hence the better amount of light is admitted into the building. Based on the location of the school in Kuwait and the orientation, the natural light can be better admitted into the school rooms and classes if the following strategies are followed and applied (Lecture notes, Lesson 3.1: Passive building design; Lecture notes, Lesson 2.2: Building Insulation and Heat Losses; Lecture notes, Lesson 2.3: Daylighting; Lecture notes, Lesson 2.4: Artificial Lighting):

- Use of shelves is significant to improve the daylight uniformity, but the shelves must be always clean and clear in order to work efficiently.
- The common arrangement of windows as currently used in the school is poor and provides poor distribution of light internally and hence the design should be developed as was discussed earlier.
- Use of power saver lights instead of the normal type that consumes higher amount of energy.
- Make Atria which is the change in the design of the rooms, halls and even the whole school to involve a light entered through a set of windows in the core of the room, classroom or the school.

- The sport halls can be redesigned so that the roof is inclined and have windows at the higher level of the hall and the lower level at the opposite side. This will minimize the energy required and deliver the light efficiently with no need for a single lamp during the day; this is shown in Figure 6.



Figure 6: The improved design for the sports halls
(Energy saving case study, o.j)

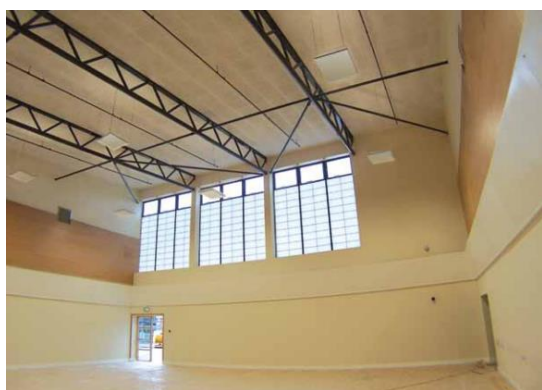
2.5 Control strategy

When applying a change, then the control of the achievements and the successful results is must. The people should always be reminding for the importance of saving the energy and the possible ways to save energy in the school. Also, limitations should be put in order to control the strategies put and applied while those that are not following must be remind for more than one time and then punished for being not concerned with the changes that will save the energy and the environment (Lecture notes, Lesson 5.1: Energy and Carbon Emissions: The Legislative Framework).

2.6 Cost

The changes in the school according to the design strategies put so far in the report require from the school management to incur the cost that might be relatively high, while if the benefits on the long run and the ethics of applying such strategies are understood and gained, then the costs will be not very high because the application of the suggested strategies will ensure the reduction of the carbon emissions in the school, use of energy and will also reflect the better use of the natural resources in order to save the environment and to the creatures as well.

Mostly we consider the current situation and don't think about the future and the necessity of improving the current status because humans in general resist the change and likes the current status, but the management of change must be associated with the understand and distribution of its importance to the self, the surroundings and the whole earth. If this is well understood, then the changes and the costs that will be incurred on the school are appropriate with the developments and enhancements that will be achieved along with the savings to the environment and nature.



3. Conclusions

Based on the completion of the research carried to investigate into the ways and strategies necessary to convert a primary school in Kuwait city to a low carbon school, the following conclusions is derived. The school was selected from Kuwait due to the climate change and the high temperatures in the summer while the school is placed in an area that is not surrounded by high buildings or towers and hence the rays delivered to the school are not limited by surrounding factors. The report have presented the current structure of the school and the possible design strategies to make the school low carbon and to save the energy that might be utilized in improper way. The design involved the strategies of distributing the windows in the classrooms for better illuminance and ventilation inside the room. Moreover, strategies were put involving the use of solar panels and solar water heating system in order to minimize the use of energy and to apply the necessary emerging technology. Furthermore, the cost and the control strategies were discussed for the installation of the system and the future considerations.

4. References

Nakicenovic, N. and Grubler, A. (2000) Energy and the protection of the atmosphere, *International Journal of Global Energy Issues*, Vol. 13(1/2/3).

Energy saving case study, WINDYGOUL PRIMARY: A LOW CARBON SCHOOL BY EAST LOTHIAN COUNCIL, Carbon trust. Available at: <http://www.scotland.gov.uk/Resource/Doc/91982/097088.pdf> [Last accessed 12th May, 2012]

Lecture notes, Lesson 1.1: Buildings and sustainability.

Lecture notes, Lesson 1.2: Introduction to energy use and carbon emissions in the building stock

Lecture notes, Lesson 1.3: Climate, comfort and wellbeing in buildings

Lecture notes, Lesson 1.4: Introduction to building forms and structures

Lecture notes, Lesson 2.1: Building Heating and Cooling Energy Demands

Lecture notes, Lesson 2.2: Building Insulation and Heat Losses

Lecture notes, Lesson 2.3: Daylighting

Lecture notes, Lesson 2.4: Artificial Lighting

Lecture notes, Lesson 3.1: Passive building design

Lecture notes, Lesson 5.1: Energy and Carbon Emissions: The Legislative Framework