Building services engineering science construction essay

This essay will discuss the available green and advanced renewable technology systems to be used in new built extension, the impact on Carbon footprint and effects on the thermal comfort for end users and discuses the building regulations apply.

Building services system

Building services engineers provide the internal environmental conditions that enable business processes to function at an optimum level while providing comfort conditions for occupants to achieve their maximum performance potential. (CIBSE, Choosing Building services).

Designing a building services system is typically a great challenge for designer and the first element to consider is the client needs; this is the key to provide satisfaction and value. However clients relay on advisers to avoid spending great deal of time and effort, and its vary from client to another and use of building therefore each and every client needs should be studied carefully, clients should provide all necessary information in depth to the advisor to help him gain full understanding of what is the client business about and how the proposed project will enhance the business.

Many researchers identified environmental factors provided to work force are fundamental to achieve good productivities specially in commercial or service environment, they have reported relationships between air quality and factors such as; speed and accuracy of work, sick leave, accidents and injuries and cost of product or service.

Carbon footprint has become a popular name in political meetings, media and almost in all commercials advertising for heating products and services,

but what is carbon footprint. A good understanding of the carbon footprint and its effect on the environment should enable designers to understand the importance of selecting the most suitable system to fit the purpose of proposed building, a definition for carbon footprint according to British Petroleum (BP/2007) “ the carbon footprint is the amount of carbon dioxide emitted due to your daily activities”.

How the selection of building system will have effect on carbon footprint?

The UK has passed legislation that introduces the world’s first long-term legally binding framework to tackle the dangers of climate change. The Climate Change Bill was introduced into Parliament on 14 November 2007 and became law on 26 November 2008. The Carbon Plan published in December 2011, sets out the Government’s plans for achieving the emissions reductions committed to in the first four carbon budgets, on a pathway consistent with meeting the 2050 target. This publication brings together the Government’s strategy to curb greenhouse gas emissions and deliver our climate change targets, as well as the updated version of our actions and milestones for the next five years; replacing the draft Carbon Plan published in March 2011. Buildings are responsible of using nearly 40 percent of global energy and therefore they are major emitters of Co2 and other gases, the main common types of end use in buildings are:

Heating (Ventilation and air conditioning systems).

Water heaters.

Lighting

Computers (data centres and electronic appliances).

Refrigerators and all white goods.

Research by Centre for Research in the Built Environment has revealed a significant amount of over- estimating in the amount of internal heat gain in UK office design.

The over design in building services system can lead to over sizing plant, maintenance cost and surely increase in operating cost which leads to emitting extra carbon in to the environment, as well as the under sizing could have same if not larger effect on carbon footprint as the demand for the source (heat, lighting…etc) will continue the satisfaction for the comfort not met will result in continues use of energy.

Ground source heat pumps

The ground source heat pump system extracts heat from the ground, where temperature will be warmer than the air in winter and cooler than the air in summer. For this reason they are more efficient than air source heat pumps, especially in the coldest weather when they are most needed. They last for many years some manufacturing companies generate for minimum of 25 years, the noise from operating very little, and minimal servicing.

The most practical way of extracting this energy is through water circulating through pipes in the ground. The pipes for the ground loop are usually laid in horizontal trenches at two metres deep, but vertical boreholes are an alternative, if more expensive, way of achieving similar results where there is not enough land to lay pipes horizontally.

At depths below six metres, the ground temperature does not vary much from the Mean Annual Air Temperature (around 9°C -11°C in the UK depending on location). At a depth below two metres, there is a large store of warmth that can be tapped for heating in the winter. However, this temperature will drop quickly where a heat pump is extracting a lot of heat from a small ground loop – it is therefore very important that the size of the ground loop matches the heating load of the building.

Advantages of Ground Source Heat Pumps

Heat pumps save money. Heat pumps are much cheaper to run than direct electric heating. They are cheaper to run than oil boilers and can be cheaper than running gas boilers. Because heat pumps can be fully automated they demand much less work than biomass boilers.

Heat pumps save carbon emissions. Unlike burning oil, gas, LPG or biomass, a heat pump produces no carbon emissions on site (and no carbon emissions at all, if a renewable source of electricity is used to power them).

Heat pumps save space. There are no fuel storage requirements.

Heat pumps are safe. There is no combustion involved and no emission of potentially dangerous gases. No flues are required.

Heat pumps require less maintenance than combustion based heating systems.

Heat pumps can provide cooling in summer, as well as heating in winter.

Disadvantages of Ground Source Heat Pumps

GSHPs are more expensive to install than air source heat pumps because of the need to install a ground heat exchanger. However, this connection to the ground is what enables a GSHP to perform much more efficiently than an ASHP – particularly when the external air temperature is low in winter and you most need heating.

Problems arise with ground source heat pumps if the installation is poorly designed or not matched to the heating needs of the building.

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Interseasonal Heat Transfer (IHT)

The Interseasonal Heat Transfer offers sustainable energy source by using new technology observed from the site where installed, by storing the direct heat from the sun to the ground in summer and back the building in winter without using any other source of heat or burning fuel.

By integrating solar thermal collected in summer to heat storage in Thermal Banks to increase the efficiency and coefficient of performance of ground source heat pumps in cold days.

It works also in reverse by transferring captured cold in winter stored in Thermal Banks in the ground to the building to cool down in summer.

(IHT) advantages and disadvantages

Advantages

Could save up to 50% of carbon emission in compare to other heat source such as gas boilers for heating.

Could save up to 80% of carbon emission in compare to the use of standard air condition for cooling.

Could save up to 100% of the cost in running heating system when claiming for producing renewable energy.

Low maintenance.

Disadvantages

Cost of installation

Poor installation will reduce the efficiency of the system.

Solar Panels

The sun provides a rich, free source of clean energy in the form of natural light and heat. It is likely to capture some of this free energy directly to exchange sunlight into electricity using solar photovoltaic (PV) panels.

Solar PV systems convert light into electrical power using a thin layer of semi-conducting material, typically silicon, enclosed between a sheet of glass and a polymer resin. The variety in size from a not many square centimetres, for instance on calculators and watches to systems of hundreds of square metres made from interconnected modules that form any range.

When exposed to daylight electrons in the semi-conducting material turn into energised, these electrons are then able to flow through the material producing a direct current (DC), the DC is carried through wiring to an inverter which converts the current to 240V alternating current (AC) so it can be associated to the building electricity supply.

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Summery

The new technology, the fast developing to the technology and the responsibilities on the building owners and designers encourages the use of green technology and reduce carbon footprint emitted from buildings. In the proposed office extension that faces southwest it would be recommended to use combined of two systems for electricity and heat of solar panels and Interseasonal heat transfer (IHT) to achieve a maximum reduction of carbon footprint and maintain the comfort for staff and end user.

Task 2

Class room 309 according to readings on dry and wet bulb readings were as follow

17 wet

21 dry

Using the Psychrometric chart the wet and dry readings met to 66% Humidity

According to CIBSE (Health Issue in Building Services, TM40, 2006) publication there are no regulations on moisture however its recommendations for normal building are set to be 40% to 70% and the target for design to be 60%.