GREEN ENGINEERING & ENERGY EFFICIENCY

ZERO CARBON HOME

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1. Introduction

In recent times, enough evidence is being gathered that shows that climate change is real, although eventual impacts are not precise; this evidence helps to make policies and orient actions (policy statement)

Co2 emissions are the main factor contributing to climate change and most of the energy use is related to building and building activities. It is quite important to address housing and all related activities (directly or indirectly) in order to make a recognisable energy reduction.

In respect to this, there I also the issue of housing supply as recently its being noted that demand exceed supply. It's quite apparent that house prices have soared.

With this in mind, it would be noted that there needs to be supply of housing and this needs to be done with careful consideration of the effect it would have on the environment as construction/construction related activities have being known to be a major contributor to the environment.

An attempt is being made here to review the construction activity with a whole life cycle approach from inception of the design idea, through to tendering and planning. A review of construction materials and use of alternatives where possible; Construction process, finishes, energy use during lifetime, dismantling, demolition and possibly recycling.

Policy statement section 1

The policy statement has set out a target of 25% improvement by this year for buildings, 44% by 2013, and 2016 to zero carbon. This target is based on the definition that over a year, the net carbon emission from all energy used in a home would be zero.
Policy statement analysis implementation will increase costs there will also be benefits interms of reduced energy bills. Although short term cost are more predictable, but are harder to access over longer term. The strategy involves changes to building regulations to strengthen the requirement in relation to insulation, ventilation, air tightness, light fittings and heating.

Policy statement section 2

Over time, a gap has developed between supply and demand. House building rate have being noticed to have halved while number of households increased by 30%. To address this issue, supply will need to meet demand to arrive at a balance, and in respect to building, green strategies could be implemented in these new builds.

In review of the policy statement document, 3 main central themes are being highlighted in the document:

- The focus should not deviate from need to improve energy efficiency further in existing building and non residential sector as well.

- The definition of zero carbon will impact achievability and cost of meeting target, consideration of the extent to which the policy affects building standard compared to local standard setting.

- The issue raised by the coverage and definition of zero carbon, defined zero carbon as a house/home where activities ranging from cooking, washing, lighting and hot water usage release no carbon to the atmosphere in the whole year of assessment.

Some contributors to the document did argue for a wider definition of zero carbon in order for each area to be well defined and clarified. One main issue was the incorporation of lifetime carbon impact in respect to transport and household behavior/attitude. The issue of embodied carbon was raised as being practical or realistic in short to medium term, but evidence of cost is weak and varies on how and where manufacture is carried out.

2. Building components

2.1 Foundation

This is the main structural part of the building that takes the loads from the walls and roof of the building and directing it into the ground. There are different types of foundation depending on the type of building or the site/ground conditions. The foundation could be strip, pile, pad and raft foundation (Chudley Greeno, 2004). Loads that act in a building could be grouped into dead, live and imposed loads. The common material used for foundations is usually concrete. The process of cement making for the concrete is a process that involves high embodied energy. A good alternative that could be used for foundation could be the use of natural stones for foundation. Second hand bricks could also be used for foundation as well with in incorporation of timber.

2.2 Floor

Floor for buildings are usually concrete floors or timber floors. Concrete floors could be made up of 1500-400mmm thick depending on the building and floor. At the foundation level it consists of a damp proof and hardcore fill. In recent times suspended floors are becoming common in building designs. A good practice would be to source the timber floor from a local dealer to reduce the carbon trail in respect to transportation. It might also be a good idea for most suppliers to source timber form managed/sustain forest.

2.3 Walls

Walls perform different function in a building depending on its position. Walls could either be internal or external and are used to differentiate space use in the building. Over the years walls could be constructed using different materials like stone, bricks blocks and even earth (Chudley and Greeno, 2004). A major consideration in building walls in the UK is its thermal performance. Most residential building external wall comprise of brick, damp proof membrane, breather membrane, insulation and blocks. Timber walls have also being used in construction over the years as it's a low energy material. Timber stud walls are quite common in buildings these days as internal wall while bricks and blocks are used for external walls. The use of timber in building internal and external walls those have its advantages as the walls of the building could be prefabricated and assembled on site with good thermal performance that could be easily measured and tested in a closed environment. (Lyons, 2003)

2.4 Windows

Widows are basically made up of glass framed made form timber, stone or metal. In inner workings of window like doors is quite not as simple as often perceived as this is usually an area that is done by specialist industries. Glass manufacture comprise of fusing together soda, lime and silica with other minor materials such as magnesia and alumina (Chudley and Greeno, 2004). Doors and windows are known to be parts of the building where energy is lost. To regulate heat in the building, windows have being made double glazed units and triple glazed. in respect to glass for windows, there is hardly a building material performs in all aspect like glass in terms of function. A good practice would be the greener way of glass production. PVC encased windows could be reduced in their usage as they require more energy usage in terms of production compared to timber frame windows.

2.5 Doors

Doors are entry points into buildings and different space use in buildings. They could open, slide or swing. Standard door could be 2100mm high and 900mm wide, but door height and width could vary depending on the amount of human traffic, specification or purpose. Door materials vary from wood, PVC, glass or metal. Most doors are made from timber with different specification and design. As long as the timber is sourced from a sustainable source, it is a good use as a door material.

2.6 Roofs

The basic function of a building roof is to offer protection against the weather and securing the building. Roof could be either flat or pitched. Flat roof are inclined at relatively low angle. Pitched roof are inclined at 30 degrees or more and vary from gable, hipped, mansard or gambrel. UK roofs are either warm or cold roofs depending on the function/specification to be met. Insulating materials to be used for roofs is best if it's inorganic. In recent times, green roof have being built into the structure of buildings. Green roofs help increase the atmospheres oxygen and also help in management of runoff rainwater. Where green roof are employed, it's not advisable to incorporate a rainwater recycling system. It is also advisable to take into account the loading the roof will impose on the building structure.

In review of the table below, comparisms could be made between the available alternatives of roofing materials and a list could be drawn of three best fit materials and other consideration could be mad on the readily available and the one that meets the best life cycle assessment at that point in time.

Energy use ratings are for energy per m² for roofing, rather than energy per unit weight. Detail of how figures were obtained are given in table 1, p.146

		£	Production								Use				
		Unit Price Multiplier	Energy Use	Resource Depletion (non-bio)	Resource Depletion (bio)	Global Warming	Ozone Depletion	Toxics	Acid Rain	Occupational Health	Recycling/Reuse/Disposal	Durability/Maintenance	Health	Other	*ALERT!*
'Natural' Tiles															
Clay Tile		0.8-2	●	•		●		●	●					•	
Natural Slate		2-4.6	•	●	•	•								•	
Cement Based Tile															
Concrete Tile		0.6	•	●	•	●		⬤	●	●	●		•	●	**Haz. Waste?**
Fibre Cement Tile	Glass Fibre	1	•	●		⬤		⬤	●	●	●		•	●	
	Synthetic Fibre	1	•	●		⬤		⬤	●	●	●		•	●	**Haz. Waste?**
	Cellulose Fibre	1	•	●	•	●		●	●	●	●		●	●	
Resin Bonded (reconstructed) Slate		1-1.6	•	●	•	●		●	●	●	●		●	●	**Haz. Waste?**
Polymer Modified Cement Slates		-	•	●		⬤		⬤	●					●	**Haz. Waste?**
Ferrocement		-	•	●		⬤		●	●	●	●		●	●	**Haz. Waste?**
Asphalt Shingles															
Organic/Cellulose Mat		-	●	⬤		●		●	●	•	●		●	⬤	
Glass Fibre Mat		0.6	●	●		⬤		⬤	●	•	●		⬤	⬤	
Metal Sheet															
Steel Sheet	Alu. Coated	-	●	●	●	●		⬤	●		●		●		**H.D.**
	Galvanised	0.7	●	●	•	⬤		⬤	●		●		●		**H.D.**
Additional Impacts of Organic Coatings for Steel Sheet	PVC	-	●	●		●		⬤	●		⬤		●		**H.D.**
	Polyester	-	●	●		●		●	●		●		●		
	Acrylic	-	●	●		●		●	●	⬤	●		⬤		
Stainless Steel Sheet		2.4	•	•		●		⬤	●				●		**H.D.**
Aluminium Sheet		1.4	⬤	●	⬤	•		⬤	•				•		
Lead Sheet		2-3.7	⬤	●	●	⬤		⬤	●	●		●			

H.D. = Hormone Disruptor

Unit Price Multiplier

The unit price multiplier in this issue is for materials plus labour cost per m². This is in order to account for materials which have a low purchase cost, but high labour costs, such as copper sheet. The multiplier is derived mainly from prices listed in Spons Architects and Builders Price Book,[61] and calculated using the cost of 'Eternit' fibre-cement tiles (21.58m² inc. labour) as a base cost.

Table 1 showing roof materials and energy use (Woolley et al., 1997).

3.7 Frames

Frame /prefabricated structures permit for rapid construction. The prefabrication could be in the form of walls or roofs in the build (Chudley and greeno, 2004). Fabricated structures could come in the likes of SIP panels (structural integrity panels) which are built indoors in factories and the properties/required recommendations are easily achievable as in the indoor environment gives control to the manufacturers. This could also help in areas where site storage is an issue, as these panels could be erected as they are delivered to site

2.8 Pipe work

Although piping network is not very visible part of the building, it those help the survival of the occupants. Common materials used include copper, steel or plastic polyvinyl chloride (PVC). Advantage of use of PVC is in it being light weight, flexible to handle and quite cheap. Copper is however resistant to corrosion, quite strong and small diameters pipes are achievable with its use. In use of steel, a good method of low energy usage in production would have to be adopted and good recycling (also applicable to other piping materials as well).

As different materials have its relative advantage over others, a careful review will need to be made depending on the target to be achieved to make a good decision on what to use.

2.9 Paint and finishes

Building finished vary from material to location (internal and external) recent practice has seen the use of lime as finish in buildings and water based vinyl paints are also more widely used

2.10 Insulation

Insulation is a very key part of building component, as it aids the regulation of internal temperature (Ding and Langston, 2001) insulation is also a key consideration in terms of sound transfer and materials vary according to physical form or material origin(lyons,2003). There is need to regulate internal temperature to achieve comfort. A better fabric of insulation also needs to be adopted to minimise energy consumption and energy loss. The table gives a list of organic and inorganic materials used in insulation and their relative energy efficiency and effect on the environment

	£	Production										Use					
	Unit Price Multiplier	Energy Use	Resource Depletion (bio)	Resource Depletion (non-bio)	Global Warming	Ozone Depletion	Toxics	Acid Rain	Photochemical Oxidants	Other	Energy Use	Durability/Maintenance	Recycling/Reuse/Disposal	Health	Other	
Insulation Materials																
Cellulose Fibres	n/a	•												?		
Compressed Straw Slabs	n/a	•	•										•			
Cork	7.2	•											•			
Foamed Glass	16.7	⬤		•			●	●	●	●						
Glass Wool	1.0	●		●			⬤	●	●	⬤			●	●		
Phenolic Foams	n/a	⬤		●	?	?	⬤	●	●	⬤				●		HFCS, HCFCS
Polystyrene - Expanded	3.1	⬤		●			⬤	●	●	⬤				•		
Polystyrene - Extruded	8.2	⬤		●	?	?	⬤	●	●	⬤				•		HFCS, HCFCS
Rigid Urethane Foam	4.9	⬤		●	?	?	⬤	●	●	⬤				●		HFCS, HCFCS
Rock Wool	1.0	●		●			⬤	●	●	⬤			●	●		
Softboard	9.5	•	•										•			
Softboard + Bitumen	8.7	●	•	•			•	•	•	•			•			
Urea-Formaldehyde Foam	n/a	⬤		●			⬤	⬤	●	⬤				⬤		
Vermiculite (Expanded)	n/a	●		●						●				?		
Wood-Wool Slabs	11.8	⬤	•	•	•		•	•	•	•			•			
Wool	10.4	•														

Table 2 Showing insulation materials and energy with effect on the environment. (Woolley, et al. 1997).

2.11 Lighting

Lighting a building is usually in the form of artificial or natural daylight form passive design considerations in buildings. This could amount for about 14% of space heating demands (Harris and Borer, 2005). In recent times, low energy lighting bulbs have being introduced as the main option on most shelves from retailers, which is a good initiative. Passive design consideration to gain max heat and light energy should take into account solar glare and unwanted heat/overheating of internal space.

3. Building materials and resources

The process of extraction, processing, transportation, use and disposal of construction materials do have a significant impact on the environment (Edwards and Hyatt, 2002). Although most of these materials don't have any effect to the environment during usage, they do require processing which involve the use of energy associated with fossil fuel. Building materials used today are based on the fact that they are available, cost effective and deliver the required specification/recommendation, this is a criterion that would have to be a pass for alternatives as well.

Most building materials in the construction industry are being extracted and then converted to the relative use before being used in construction. The energy entailed in converting a building material from its original state to the state which it can be used in construction is termed Embodied energy in looking at the table below, it would be noted that most of the building materials are quite known by builders and people today. It is evident that humans feel more comfortable with things they are familiar with, in respect to trying out new materials. This however those not mean all past materials are harmful to the environment, when faced with making a good choice, the whole life cycle analysis of the building material should be considered prior to selection.

Material	*Density*	*Low value*		*High value*	
	(kg m^{-3})	*GJ $tonne^{-1}$*	*GJ m^{-3}*	*GJ $tonne^{-1}$*	*GJ m^{-3}*
Natural aggregates	1500	0.030	0.05	0.12	0.93
Cement	1500	4.3	6.5	7.8	11.7
Bricks	~1700	1.0	1.7	9.4	16.0
Timber (prepared softwood)	~500	0.52	0.26	7.1	3.6
Glass	2600	13.0	34.0	31.0	81.0
Steel (steel sections)	7800	24.0	190.0	59.0	460.0
Plaster	~1200	1.1	1.3	6.7	8.0

GJ = giga joule, a unit of energy, 1 GJ = 278 kWh.
Source: Building Research Establishment, 1994.

Table 3 Embodied energy of different materials (Roaf and Thomas, 2003)

being employed in construction as part of management scheme. Landfill sites have to be properly managed by capping to prevent water and soil contamination, and have to be sent undisturbed for a long time for the constituents to break down naturally. In recent times landfill sites are getting low in number and there is a higher need to recycle these materials. (Sarsby and Felton, 2007)

	£	Production									Use					
	Unit Price Multiplier	Energy Use	Resource Depletion (bio)	Resource Depletion (non-bio)	Global Warming	Ozone Depletion	Toxics	Acid Rain	Photochemical Oxidants	Other	Energy Use	Durability/Maintenance	Recycling/Reuse/Disposal	Health	Other	ALERT!
Bricks																
Ordinary Clay	1.0	●					•	•	•	•						
Flettons	0.8	·					●	●	·	●						
Soft Mud/Stocks	1.0	●					•	•	•	•						
Perforated Clay	1.0	•					·	·	•	·						
Calcium-Silicate	0.9	●		•	•		•	•	•	●						
Re-Used	1.4															
Concrete Blocks																
Ordinary Dense Blocks	0.3	•	·	●	●		●	•	•	●						
Lightweight Aggregate	?	•	·	•	●		●	•	•	●				●		
Aerated	3.2	●	·	·	•		●	•	•	●						
Composite Insulating	1.4	•	·	●	●	●	●	•	•	●						CFCs?
Stone																
Local	3.2									•						
Imported	?	•								•						
Reclaimed	3.2															
Artificial	1.4	•	·	●	●		●	•	•	●						
Mortar Ingredients																
Ordinary Portland Cement	n/a	●		•	●		●	•	•	●			·	•		Haz. Waste
Pure Lime	n/a	●		•			•	•	·	●				•		
Hydraulic Lime	n/a	●		•	●		•	•	·	●				•		
OP Blastfurnace Cement	n/a	•		·	•		·	·	·	·			·	•		
OP Pulverised Fuel Ash	n/a	•		·	•		•	·	·	·			·	•		
Masonry Cement	n/a	●		·	●		•	·	·	●			·	·		
Sand and Gravel	n/a		·	●						•						

Table 4 showing some building materials and their relative energy use as well as environmental impact (Woolley et al, 1997)

4. Renewable energy

Fossil fuel dependence has made carbon concentration in the atmosphere high compared to the past. "*Then wherever possible we should use solar based renewables, such as sun, wind or biomass, rather than fossil fuels...*" (Woolley, T. et al., 1997, p. 28). In review of this, one can say that life on earth is quite dependent on the suns energy as 30% is being reflected, 21% drives winds, 40% moves water cycle and fraction of about 1% is used for photosynthesis. One of the earth key energy source that has being well harnessed is water, which is some areas have being used to generate hydro electric power. It should be noted that this is quite dependent on location. "*On site renewables are great if u have lots of space, light and flexibility, but are not hugely helpful if you don't, as in London*" (Kauntze, 27/07/07, p . 34).

4.1 The sun energy

Energy from the sun is either direct or indirect form of gain. Solar devices capture the suns energy by reflection and covert them to necessary usage. Proper channelling of radiation could help in space heating, water heating and even electricity production. The principle of how the sun energy could be harnessed is one that should be properly analysed to help for better energy generation and utilization.

Proper understanding of solar geometry would help in the proper design of overhangs, windows and shading devices so as not to overheat a building space. In respect to this solar geography should also be looked into as this principles work hand in hand. The main area where these factors come to play is in building orientation and solar space heating. In order to get a proper lightning and effective heating from the suns energy the geography and geometry aspect of the sun needs to be considered as the earths rotation brings about different amount of suns energy over day as well as the year.

4.2 Solar thermal panels

Solar thermal panels employ the principle of converting the suns heat to drive electrons which in turn produce electricity. They are two basic broad categories namely flat and evacuated tubes.

4.3 Photovoltaic cells

PV cells as they are well known, convert the suns energy directly into electrical energy. The energy type is either direct current or alternating current. *"PV panels take advantage of the photovoltaic effect, whereby photons of light transfer their energy to electrons in silicon crystal"* (King, 08/06/07, pp.50-51). Direct current can either be used directly, stored in batteries for later usage. Early appearance of this technology could be found in calculators, watches and remote telecommunication systems.

Advantages of this system include:

Relatively reasonable compared to other electrical generating alternatives
Secure supply of energy
Good savings in the long run
Good source of energy in most regions
Its could relatively be a green energy source in all aspects if properly looked into
Long term usage ahs its advantage.

A few issues would have to be addressed in order for the proper installation and usage of this system. It would also be a good idea to employ services of professionals to help ascertain the feasibility and gains of the system with respect to the location.

- Average sunlight of an area
- Total daily load requirement
- Solar Module type/ sizing
- Determine peak and base periods.
- Choice of inverter.
- Choose the type of system composition (AC, DC, attachment to national grid, batteries).
- Orientation angle
- Wiring method (this could also be affected by type of connection established)
- Local councils regulations on PV cells
- Health and safety

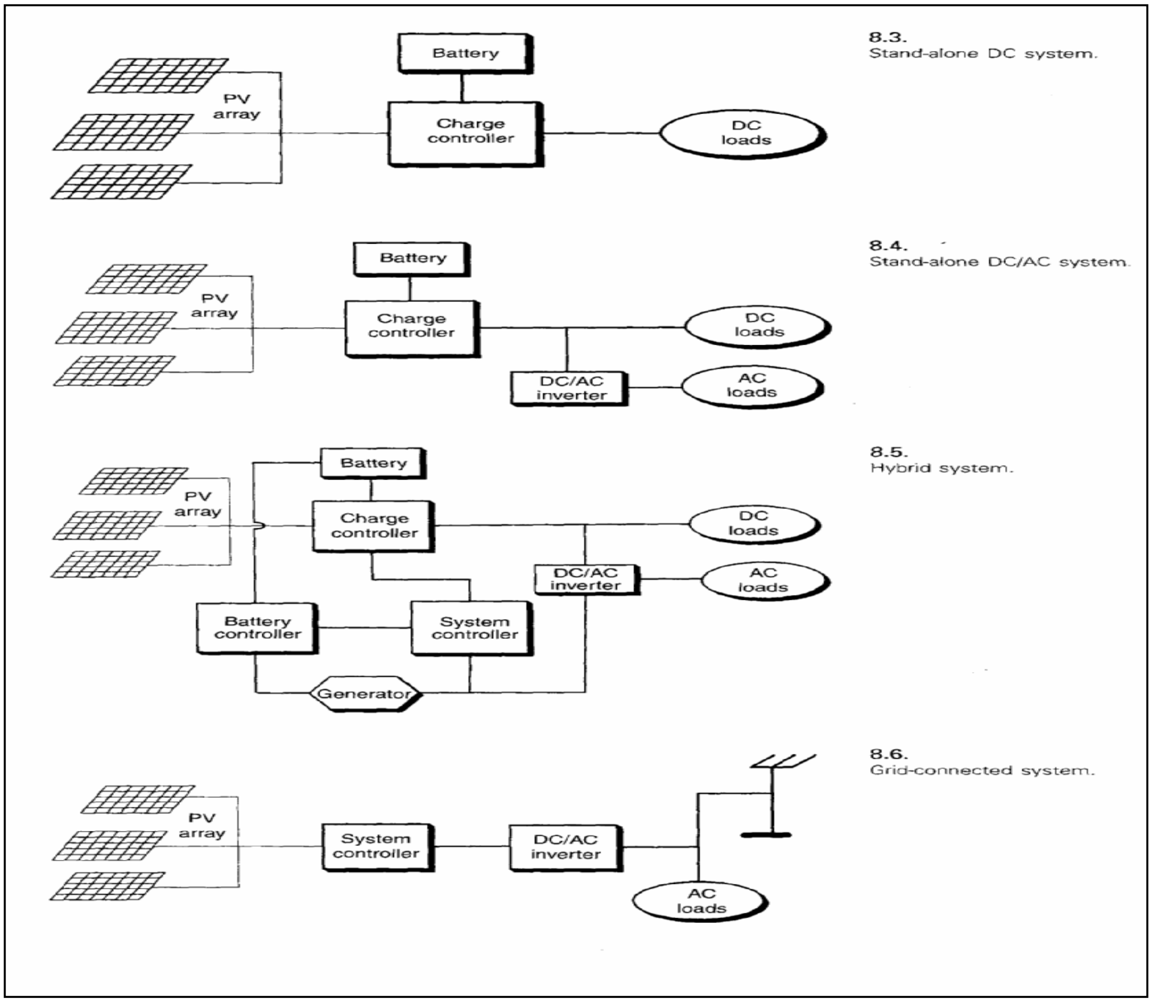

Figure 5 different ways of integrating solar energy into use. (Roaf et al, 2003)

4.4 Wind power

Early forms of wind power could be traced back to wind mills as far back to Persia. Its early arrival in Europe could be dated back to 1270. It is however argued that such installations do take up amount of viable space if they are to be done on large scale. The UK has benefited from the generation of wind power with a known presence of offshore wind turbines. Small scale sized wind turbines have also being seen to surface in residences and some commercial establishments where wind speed is reasonable enough to generate reasonable amount of energy.

4.5 Water

Hydro electricity is a form of energy that involves the conversion of waters kinetic energy into mechanical and into electricity. Dams are built to harness the energy from rivers on large scale demand to supply whole countries. As early mentioned, this source of energy is quiet dependent on location, and most, if not all the viable location for large scale electricity production in respect to dams have already being utilised.

Inn some cases, small scale hydro electric power have being generated for the use in homes and commercials building by harnessing water flow form nearby streams or small rivers, but this again is dependent of the site.

5. People, professionals and the environment

The task of the building from tender to completion/demolition usually falls in the hand of the client and the professionals involved. It is quite important that professionals like architects, designers and people in general are aware of what green building entails. . Designers and architects can make significant contributions by making their client aware of alternative to different building solutions to achieve similar goals. (Walker, 2006).

Its is quite important that people/clients are willing to accept these alternatives as it is quite common for people to be quite sceptical towards change in building design/elements

5.1 Management practices

“Architects and engineers cannot claim to be sustainable practitioners without addressing the complex and sometimes contradictory demands of building materials”. (Edwards and Hyett, 2002, P.58). This is a common scenario that is being faced by designers in general as to what method, approach or decisions to take in respect to projects as a whole. A best approach is to incorporate the idea of sustainable building into the management practice as a whole. In projects , just as the health and safety supervisor and atimes the temporary works coordinator is involves in a project build up, professional advisors/consultants could be contacted in respect to projects right from the start with the client being actively involved in the whole process. In some construction/engineering establishments, sustainable advisors are part of the project team.

5.2 Existing building

One major concern that the green policy document did focus on is the ability of existing building to go green.

5.3 Government and building industry initiatives

"In the UK it is estimated that the production of building materials is responsible for about one-tenth of energy consumption and CO_2 emissions" (Roaf, 2003). It's important to note that construction materials due account for a significant amount of carbon being added into the atmosphere as well consume a large amount of energy. In review of this, one could say that if the amount of energy used in the production of these materials is not green then the whole life cycle assessment of that material is not as well. The government could make reasonable viable attempt to help production and manufacturing industries willing to invest in green energy generation by programme incentives. These incentives should also be made known to companies as many are unaware of such schemes.
The companies should make an effort in categorising their materials and service that they offer to clients so as to make available in a glace to client which materials are green and are good alternatives and which are more environmentally unfriendly.

6. Concept

"It is estimated that the new homes built between now and 2050 could account for up to One third of the total stock of housing in 2050" (NHBC Foundation, 2009). The future plan of making new homes greener could be viewed as a move that targets home builders but with the view that the amount of supply to meet demand over the years would require building a significant percentage of homes. In review of this, one can also say that the demand would make the percentage of energy use be on the high. It is therefore relevant that new homes be made more energy efficient and existing building as well in order to

make the environment safer for the future. The concept here is to entail these ideas into the core of all building projects, design and other construction and engineering related activities. In order to achieve a reasonable control over energy usage and co2 emissions it's important to try and control trigger factors to this situations. The whole life analysis approach is therefore the best approach as it targets every sphere of the building design activity direct or indirectly related from design ,building and right through to demolition and possible recycle of materials

6.1 Proposed concept life cycle analysis

It is quite important to note that the measures that have being put in place are quite flexible in approach and the question of if the targets to be achieved should be a mandatory part of the building regulations is one that has being under consideration. The incorporation into the legislation could help deliver results but this could also put a strain on the builders and suppliers.

With this in mind one can say that if every facet of construction/engineering production does make a small percentage reduction in energy use and carbon offset, this could also help add up to a significant amount of energy usage reduction. In looking at a good lifecycle assessment, all facets of construction or engineering could start from the extraction of raw materials and set out energy efficient process for extraction. One key area that could be looked into is the sourcing of raw materials in respect to transportation. As most materials need to be transported to site it quite important to source locally available materials or local alternatives in order to reduce the carbon trail. In situations where the material has to be sourced from a distance, environmentally friendly transportation systems could be sorted. In review of if transportation carbon trail will be higher than alternatives, and then local alternatives should be sorted.

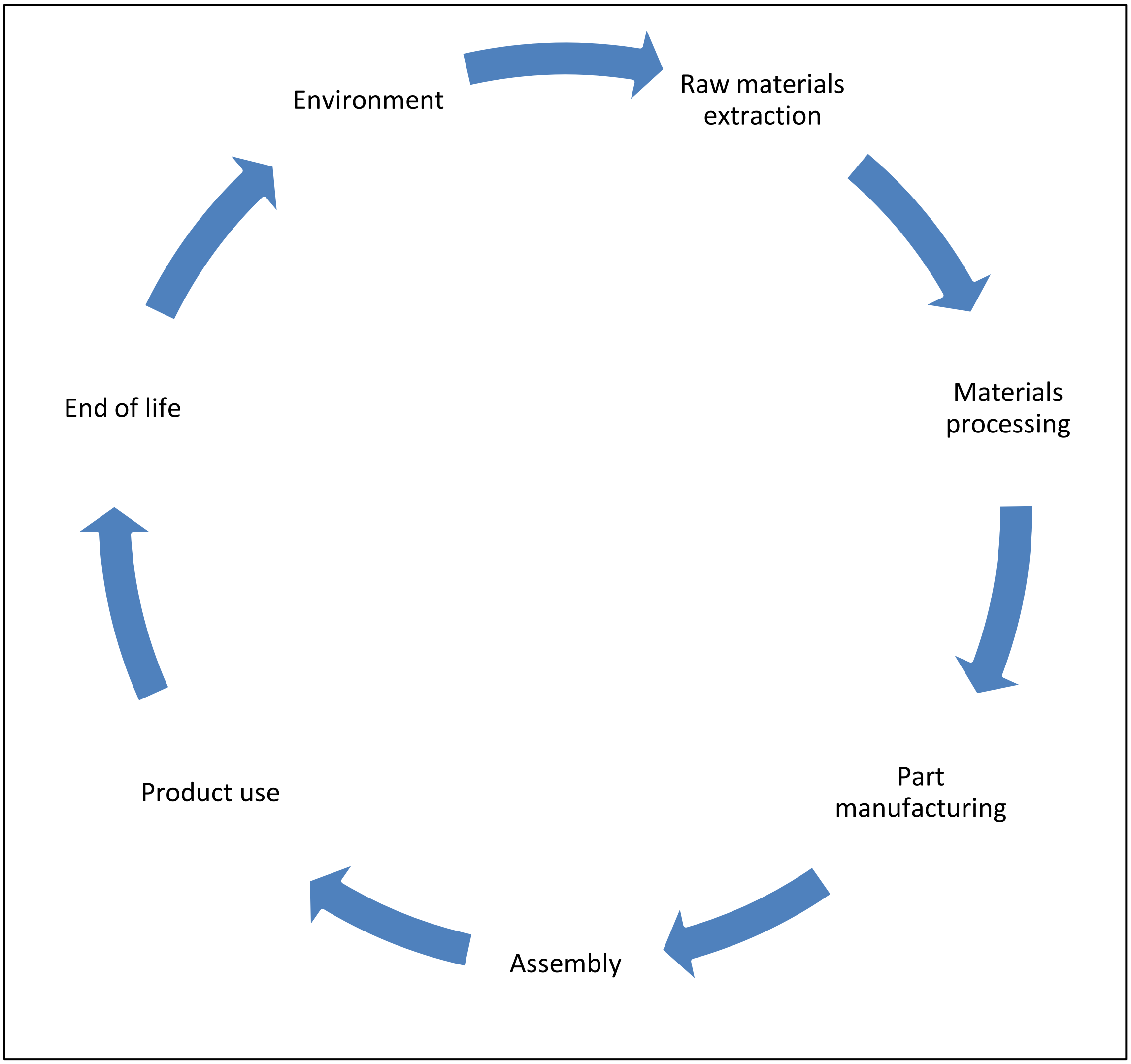

Figure 6 life cycle assessment (arrows representing transportation)

The diagram above illustrates the cycle that is quite common with the whole life analysis of building. If an attempt is made to make every stage of the products and industries/stage involved go green, it is quite likely that there would be a reduction of carbon being introduced into the atmosphere. It quite important to also establish a central body that deals with green building a smaller sector that deal in particular to each specific process and stage involved.

7. Conclusion

There is a need to make the building regulations simple and more understandable by the average person. The need to make aware the average home owner what requirements need to meet. Good incentives need to be in place to help designers, engineering and technology innovators to help create and design in energy efficient ways. a lot of lessons could also be learnt from past attempts to make green building available and affordable by builders. One good example is the Barrat green homes BRE (2009).
a few recommendation that could be drawn from the review of the green policy document and other publication could be:

1. The use of mixed construction technology on site
2. Sourcing products from local manufacturers
3. Setting realistic goals in terms of targets to be met.
4. The use of a variety of insulating materials
5. Reasonable materials procurement
6. Consideration of employing a specialist in terms of advice on green building
7. Consideration of mixing or sorting alternative materials.
8. Materials with low embodied energy should be given consideration
9. Consideration of green energy generation for home use with best recommendation from a specialist in respect to what type best suites the sit

In review of this, a few lessons could also be learnt from case studies in an attempt to go green this could help further address issues faced and provide more practical ways of dealing with more realistic issues. Examples of such attempts are:

- Barrat green house (BRE, 2009).
- Oxford house (According to Roaf, S. et al. (2001);
- Bells court Shropshire (Harris and Borer, 2005).
- Martzdorf house in Islington.

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