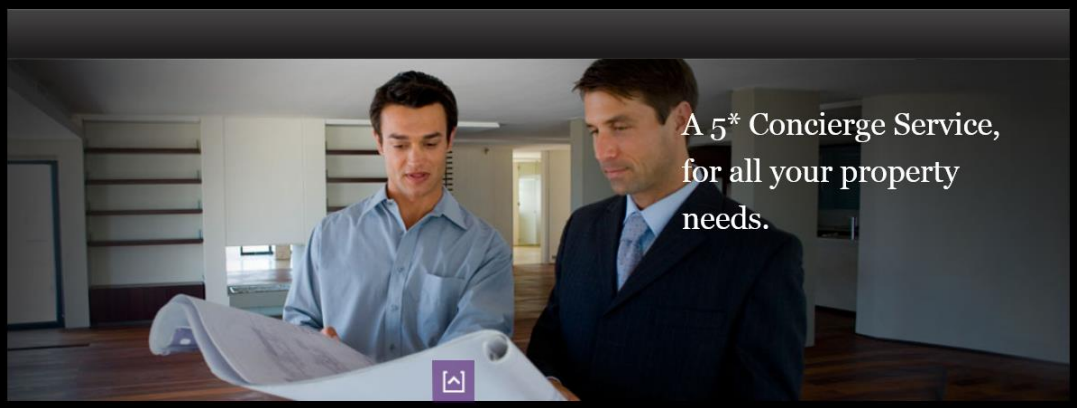
Winsper

Property Specialists

Sales | Lettings | Design | Build

Sustainable Development



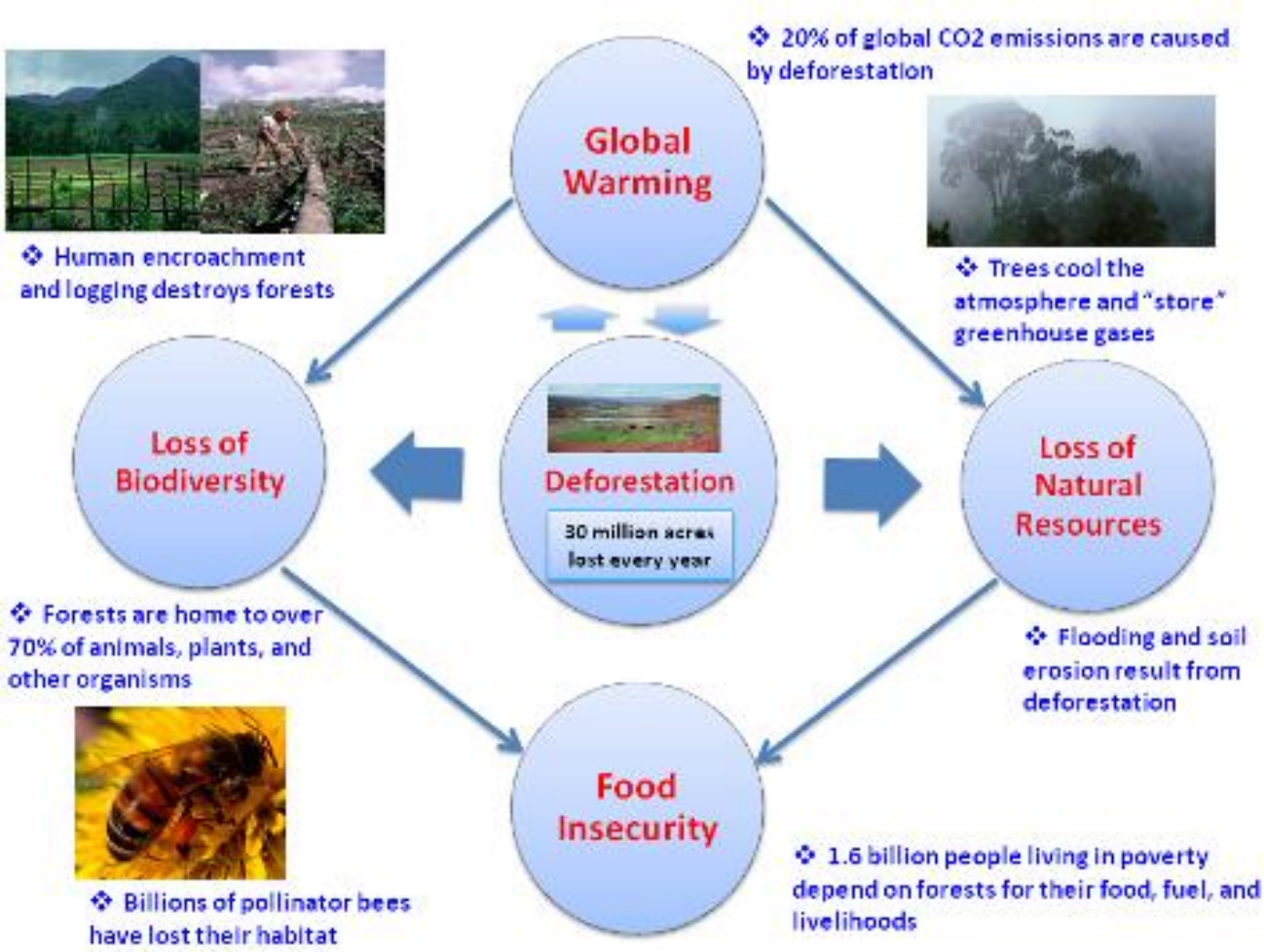
As At
06 October 2013

Author
D Winsper

PROLOGUE

Think Local, Act Global

Many of the decisions we make in the construction and property industry have unintended consequences on people and environments well beyond the immediate locale or region of operation. The materials we choose, the way buildings are heated and cooled, procurement methods and site management can all affect the impact a development will have on the world environment.



EXECUTIVE SUMMARY

Future planning and development within England, irrespective of scale, must ethically and morally conform to the United Nations Earth Charter, in conjunction with the Kyoto Protocol 2007 *et al* and must be cognitive of the Committee on Climate Change (CCC), the Department of Energy & Climate Change (DECC) and The Royal Society's perspective of Climate Change, overarched by legislation, to ensure the planets longevity not just intergenerational, but for future generations and reduce the CO^2 output from 549.3 M^TCO^2 pa (2011) to c136 M^TCO^2 by 2050.

Therefore any development must be 'Sustainable', with the most utilised and accepted definitions falling from Brundtland 1987 or Gland, 1991, apportioning accountability to *'Matter'* and *'Energy"*, of which it cannot be created or destroyed (Antoine Lavoisier), global ownership of which is problematic.

Any newly proposed Sustainable Development to the built environment should only be undertaken, when the existing *'Built Asset'* stock is performing at 100% capacity, thus ensuring that historical and existing impacts on the biosphere, are not futile. Case studies exist, across the globe, demonstrating 100% Non-Occupation (Chenggong, China – 100, 000+ Empty Units), through to the modern world (Orlando, USA – 20% Unoccupied). This current stock should be utilised and retrofitted, in earnest, to be carbon Neutral, prior to any new endeavours.

However, as the population ever increases their will be a need for future sustainable developments and as such careful consideration at the design stage should be afforded to;

a. The *'Built Environment'* (Size, space, form, materiel), with a view to Thermal Efficiency and improved Logistics.
b. Energy, placing a greater emphasis on renewables, such as Photovoltaic (PV), Wind etc.
c. Water supply improvements to the supply chain, harvesting and production.
d. Sewage utilisation, not disposal.
e. Waste; No more *'Cradle to Grave'*, but *'Cradle to Cradle'*.
f. Transport, empowering individuals to better choice, through improved and efficient systems.
g. Health / Wellbeing issues addressed to promote sustainable longevity for the development.

This is followed through to the construction and operating phase of the SD, to produce a development that has the lowest possible carbon footprint and is in tune with the biosphere, whilst not raping the planet of resources.

To ensure this, all SD should be constantly evaluated and analysed as an enduring commitment, through a global standard. Whilst various *'Stand Alone'* analysis packages exist, Xing 2007 proposes a more joined up approach with a Construction Sustainable Assessment Model (CSAM).

Thus guaranteeing at best effort, from a developmental perspective, the existence of this planet for millennia.

CONTENTS

Prologue 2

Executive Summary 3

Overview 5

Sustainable Development

Definition 6
Context 6

Planning A Town / City – Exemplars

UK – Beddington Zero Energy Development 7
Global – Chenggong , China / Nova Cidade de Kilamba, Angola / Florida, USA 7

Planning A City – Design, Construct, Operate

Design

Built Environment – Including Part L 7
Resourced Material 8
Energy – Power 8
Water 9
Sewage 10
Waste 10
Transport 11
Health 11
Employment 11

Construct

Pollution 12
Earth Works - Contamination 12
Construction Waste 12

Operate

Functionality 12
Enduring Commitment 12

Building Values 12

Analysis & Assessment 12

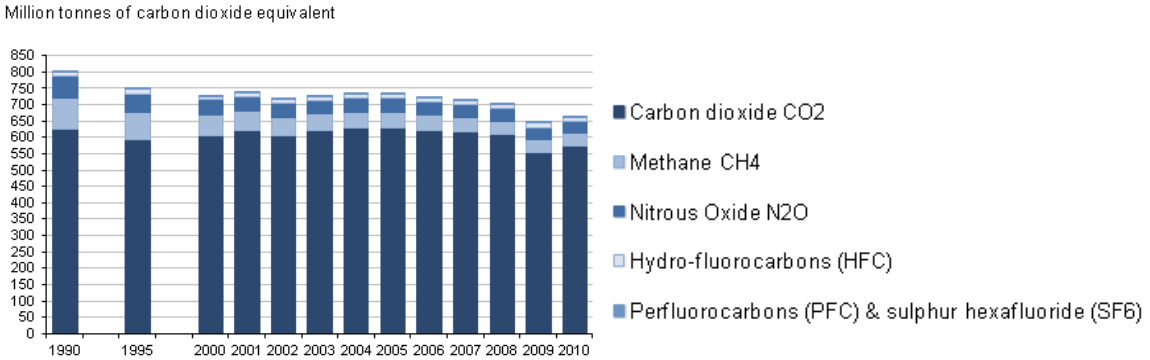
Summary 13

Bibliography 14

Overview

1. Modern thinking dictates that any future *'Built Environment'*[1], irrespective of scale; individual unit, town or city, must be in tune with human development and its concern for the planet, by understanding the capacity and limitations of the *'Biosphere'*[2]. Thus Sustainable Development (SD), encompassing environmental, social and economic needs, will become prevalent on both future generations and intergeneration's, in order to preserve the climate status quo. Within the UK (England – Annex I Signatory)[3], climate change is addressed by legislation, with the introduction of the Climate Change Act 2008[4], which became law in November 2008 and purports to be the world's first, long term legally binding framework. This legislation fell from the instigation of the Department of Energy & Climate Change (DECC – Established 2008)[5], who's current incumbent is the Rt Hon Ed Davey MP. The legislations key provisions are;

a. Legally binding target of at least an 80% cut in Green House Gas (GHG) emissions by 2050, against a 1990 baseline.
b. To guarantee point a. above, a reduction of 34% by 2020.
c. The introduction of a carbon budget system that accounts to parliament every three years.
d. The establishment of an independent Committee on Climate Change (CCC)[6]. This committee is currently chaired by Lord Deben (R[t] Hon John Gummer.
e. Included in this act is a responsibility for international shipping and aviation, emanating from UK waters.
f. To encourage the country to address climate change, a limit has been placed on Carbon Credits, which in 2009 was set at zero.



The *'Built Environment'* encompasses all the contributing sectors that of Energy – 40%, Transport – 26%, Business – 15% and Residential – 15% responsible for the release of 549.3 M^TCO^2 pa (2011)[7] into the environment and hence the need for SD.

2. The master plan for any sustainable urban design, falling from SD, must at the macro level address; infrastructure, space analysis, social, physical, economic, transportation, energy and waste issues, through the design, construct, operate, maintain and dispose process. This is overseen by more legislation within England that of;

a. The Town & Country's Planning Act 1990[8].
b. The National Planning Policy Framework[9].
c. Building Regulations – Part L[10].
   i. 2016 – All new homes and schools built are to be CO^2 Neutral.
   ii. 2018 – All new Public Buildings built, are to be CO^2 Neutral.
   iii. 2019 – All new Non-Domestic buildings are to be CO^2 Neutral.
d. The Sustainable Communities Act 2007[11].
e. The Water Industries Financial Assistance Bill[12].

All of the above legislation is an enabler to and not a hindrance for SD, whilst protecting world growth and concurrently reducing GHG output, whilst delivering an urban utopia.

RICS

DEPARTMENT OF ENERGY & CLIMATE CHANGE

Climate Change Act 2008

Committee on Climate Change

Town and Country Planning Act 1990

Sustainable Development

3. **Definition**. The most commonly accepted and utilised definition of SD, as directed by the International Institute for Sustained Development (IISD), is that proposed by Brundtland 1987 from the report, 'Our Common Future' – World Commission on Environment & Development (WCED)[13]. It states;

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs".

The fundamental principles of the above are; needs and limitations in that, essential needs are addressed primarily on behalf of the world's poor whom should have primacy and limitations from the environment whilst acknowledging those needs, from a techno – socio perspective.

4. An alternative definition for *'Sustainability'* is bourn from the report entitled 'Caring for the Earth. A strategy for sustainable living' – Gland, 1991[14].

It states;

"Improving the quality of human life while living within the carrying capacity of supporting eco-systems."

Implying that the sustainability strategy is intuitive from our survival instincts and that of our descendants, whilst understanding that we are reliant on the limited resources of the planet to meet our ever consuming needs, both basic and vital although appreciating that development continues and that if it is spread across the globe uniformly, it becomes more sustainable, for the human races futurity.

5. **Context**. Both definitions highlighted above, whether taken as SD or simple *'Sustainability'* are contestable with two levels of meaning, that of;

a. Unitary, but vague with limited core values.
b. Concepts that are contestable.

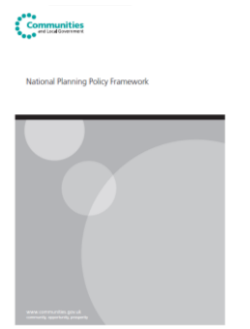
And as such lead to generic faults and the ability to prosecute these meanings on a global scale. These faults are;

a. Environmental protection issues.
b. Equity Issues.
c. Participation.
d. Scope of the subject.

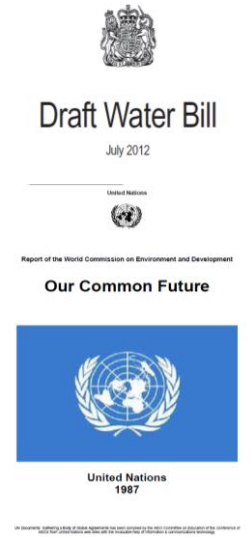
To alleviate these faults and ambiguity, this paper proposes a more factual approach to the meaning of *'Sustainability'*, with no ambiguity and empowering the individual to participate and self-evaluate. A statement that is rooted at the heart of science as the Law of Conservation of Mass by Antoine Lavoisier[15], in that;

"Matter (or Energy) cannot be created or destroyed".

And thus as ancient Greek philosophy dictates – 'Nothing comes from nothing'.



Sustainable Communities Act 2007



Planning A Town / City – Exemplars / Case Studies

6. **United Kingdom (England)**. The newest and at present largest SD within England is the Beddington Zero Energy Development (BedZED)[16], which consists of 82 units catering for social housing, shared ownership, key-worker units and private houses, developed for the Peabody Trust Housing Association[17], in conjunction with the Bio Regional Development Group[18], who located the site, in Sutton (UK). The architect Bill Dunster[19], has also incorporated office space and 'live-work' units overarched by a commitment to provide 'green' lifestyle services, through energy efficiency, renewable energy, water conservation, car club and local organic food deliveries. The build strives to achieve environmental, social and economic sustainability and is the UK's largest Eco Village. In addition, it promotes sustainable 'Social Housing' through its three main bastions of; Sustainable communities, sustainable tenancies and sustainable buildings.

7. **Global**. New cities purported as SD are emerging globally and emanating from the BRIC's countries, with China at the fore, committing to twenty new build cities a year, for twenty years. However, a key fundamental may have been overlooked, that of demand in austere times. A Case Study for this lies in the southern province of China, near Hong Kong, namely Chenggong[20], where over 100, 000 residential housing units, public buildings and open spaces lie dormant, due to over capacity. With a bi product of over inflated built asset prices of between 30% – 50% (Data from Chinese Academy of Social Science), with average asset prices remain artificially high at $80,000, due to market conditions, whilst China in this construction bent remains the world's highest consumer of steel, cement and iron ore per capita. Other Case Studies emphasising poor understanding of demand can be found across the emerging countries i.e. Nova Cidade de Kilamba, Angola at a cost of £2.2 Billion[21].

8. These empty cities also bring attention to under capacity cities globally and thus question the need for bespoke new SD cities, when it would benefit the biosphere to ensure 100% occupation of existing stock, thus negating the further depletion of building material. Examples can be found in the USA, where vacant units run at 14.3Million Units c 2011[22], with Orlando Florida hiding a 20% availability of vacant / disused stock, which through retrofitting could become Carbon Neutral units.

Planning A City – Design, Construct, Operate

Design

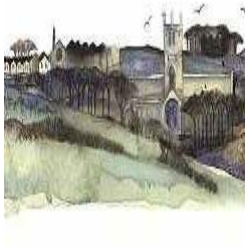
9. At the macro level the SD design will begin with a Master Plan, in conjunction with the National Planning Policy Framework[9], the Town & Countries Planning Act[8] and the DECC[5], falling from this will be the Urban Design and Infrastructure, Space and Built Analysis will lead to Sustainability Issues and Form Massing, with Reforms (Social, Physical & Economic) implemented in the Architectural Details. Overarching this will be constant analysis through various Integrated Sustainability Assessment Tools (ISAT) and Knowledge Management Systems (KWS) and Building Regulations.

10. **Built Environment – Including Part L.** The 'Built Assets' contained within SD will cover the complete spectrum of structures at the metropolitan level, from individual domestic units through to large commercial outlets, including infrastructure buildings namely public buildings; Town Hall, Hospital, Transport Hubs through to bespoke designer concept buildings with potential to be the heritage of the future and thus adding value. Whatever the 'Built asset', all should be designed and resourced with a zero carbon foot print, as per the impending legislation and in conjunction with various academic papers,

including the Journal of Planning Education & Research[23] and be in tune with the planet, as any proposed new SD city will have direct and indirect consequences, through land usage leading to habitat fragmentation. Form of these assets will be driven by function, with some weight given to repetition for ease of construction and thus minimizing not only fiscal costs, but GHG costs, as repetition alleviates construction problems and the need for materiel intensive solutions.

Irrespective of usage, each structure can benefit from both low tech' and high end advances in environmentally friendly fabric and products;

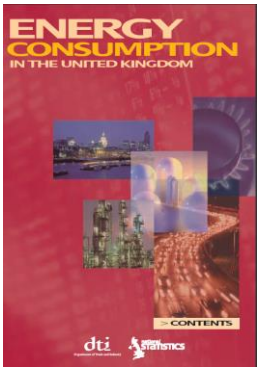
a. Sustainable / Recycled insulation products.
b. Thermally efficient bricks & Blocks.
c. Thermally efficient roofing products.
d. Floor & Sub Floor insulation fabrics.
e. Triple Glazing.
f. Thermal Doors, Windows and Vents.



All of which will aid Thermal Efficiency and thus reduce the draw from energy. Larger solutions include building orientation, where the unit can make best use of the solar / wind energy to lower the carbon foot print, per unit, through to low end energy saving light bulbs.

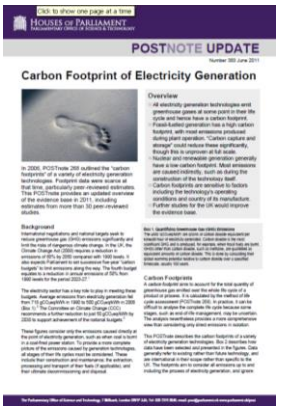
11. Size and density should also be addressed, as compactness alleviates the land and habitat pressures on the biosphere. The city concept, derived from Middle English is obscure, as can be seen by St David's in Wales[24], with only a handful of built units, centred on a cathedral, but will be generally regarded as a pivotal town, centred on a borough, with post Norman cities tied to a cathedral.

SD Forms can either be; a Neotraditional Development, Compact City, Urban Containment or Eco-City[25] and all have different weighting to size and density.

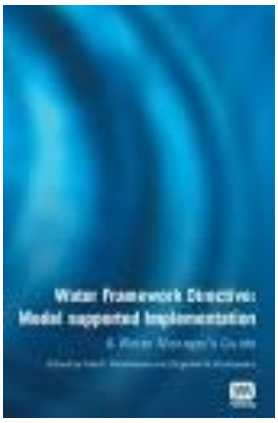


12. The location of any future SD City within England will be driven by the National Planning Policy Framework[9] and as such, will be on a *'Brownfield'*[26] site. This area will therefore be contaminated with at best, old building stock or at worst *'Landfilled'* material. To counter this, at minimal cost, any proposed land allocated containing sub surface waste can be *'Landfill Mined'*[27], to not only neutralise and clean the land, but aid the planet through a secondary effect of turning that waste into energy production. This has the potential to bring back on line c11,000 hectares of now prime building land, without encroaching onto the *'Green Belt'*[28] and thus protecting valuable habitat.

13. **Resourced Material**. If the material resourced and utilised to provide a Low U effect, to the short-sighted benefit of the development, has travelled across the globe via shipping routes, then this has left a bigger Carbon Footprint, than a lesser product resourced locally, thus resourcing material is key and should be factored in at the design stage for any SD.



14. **Energy** – Power. As per the Department of Trade & Industries Energy Review in 2006[29], fossil fuelled energy plants (35% Energy Efficiency) must be reduced and more low carbon technologies[30] brought online, such as Biomass, Photovoltaics (PV), Marine Technologies that of wave & Tidal, Hydro Plants, Wind Farms and Nuclear Power Plants. Reducing the Fossil Fuelled plants has the greatest potential to lower the 'Carbon Footprint', thus any future SD city must embrace these technologies across all levels from the Power Plant, to the individual production of energy, at the domestic level, with the opportunity to sell any unused energy, back to the community. Further reductions through Carbon Capture & Storage are actively pursued, but have not been established in the energy industry.



15. Of note is the Life Cycle Assessment (LCA) of all energy sources, demonstrating that all solutions still retain a Carbon Footprint, however low, due to the production, maintenance cycle and raw materials used in the construction phase.

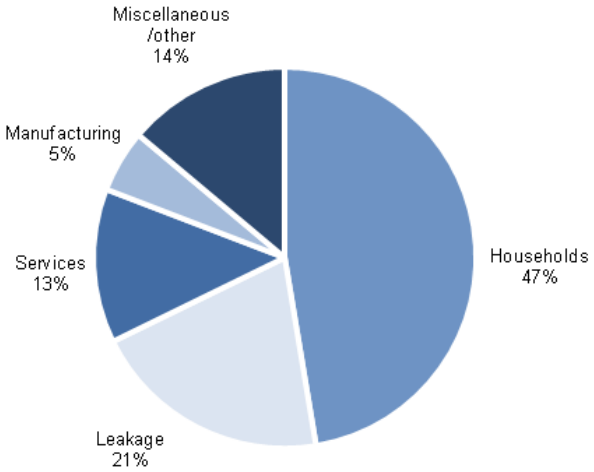
16. Thus, at the macro level the future SD city will rely on banks of Wind Farms, as demonstrated by the *'London Array'* [31]in the Thames Estuary and at the micro level have inbuilt PV, Wind Turbines and Heat Sinks, to power individual units, as low carbon technologies.

17. **Water**. The water infrastructure within the proposed 'Built Environment' is legislated by the Water Framework Directive 2000, DEFRA[32] with a bent to water conservation (To include Ground Water, Surface Water, Rain Water, Storm Water, Rivers and Streams). Therefore;

a. **Ground Water**[33]. Any SD should not lead to pollution or adversely affect the water table.
b. **Surface Water**[33]. This should be afforded natural or porous manmade surfaces to allow peculation.
c. **Rain Water**[33]. This natural resource should be harvested within any legitimate SD and recycled as either potable or non-potable.
d. **Storm Water**[33]. Any future city, must not adversely affect its habitat and surrounds by inadvertently causing flooding where flooding was historically not present.

Telegraph

18. Water reservoirs and dams within England at present do not deliver the product to 100% storage capacity, due to an antiquated and poorly maintained pipe network.



Whilst much focus is with the end user, to reduce the demand and/or the supply pipeline, from leaks (3.4 Billion Litre pa)[32] within the pipe infrastructure, or via environmental systems such as 'Grey Water Harvesting' and SUDS, the solution must surely rest at the start of the supply chain and lays firmly at the door of the Water Plant, its design and location.

19. If the type, style, design of the plant, can deliver more water (Thus alleviating leak issues), from a never depleting source, which is cost effective and more importantly

profitable to the company, then the water company themselves will restructure their business model, thus by-passing government policy. As this big *'Blue' Planet*, is covered on the surface by 71% water, albeit of the salty variant and thus non-potable, is it cost effective and viable to turn the oceans into the direct water source and pump direct to the end user.

20. Desalination plants take salt water and through a process of reverse osmosis, pressing salty water through ultrathin, semipermeable plastic membranes, thus turning it into potable water. The first plant within the UK, opened in the spring of this year 2012, at a cost of £270M and will supply 150M litres of water per day, from the River Thames, direct to 1.4M customers[34].

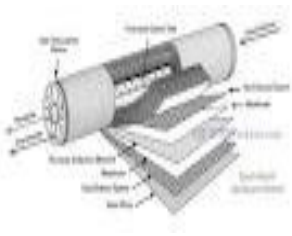
It is predicted that this technology will exceed 10M gallons of water supply by 2016. This would be double its output, as at 2008[35].

21. As per Charles Hendry speech to MENA, Chatham House - "Investing for the Future in Turbulent Times" , found within DECC[36],

"**Saudi Arabia's decision to build the largest solar-powered water desalination plant in the world in the city of Al-Khafji**, and Algeria's decision to become a partner in the Desertec Initiative, to develop large scale solar power in the Sahara, **are prime examples of these ambitions"**

Hence, Desalination Plants with the advent of new technologies and the improvement on existing technologies are now a must for future SD.





22. **Sewage**[37]. A by-product of waste water treatment, sewage in its sludge variant can be utilised primarily to return damaged land to prime land as an alternative to *'Top Soil'*, as it contains major nutrients along with prized trace elements and allows the land to return to a vegetative state, however abhorrent the process can be viewed. True SD will contain this methodology and treatment plants to produce the sewage sludge should again operate via low carbon energy plants.

23**. Waste**. The UK National Waste Strategy[38] underpins how any SD must operate. It categorises the recycling process into reusing, burial or incineration. Of the three, reusing, *'Cradle to Cradle'* and incineration, through the bi product of energy production are the only viable options for the SD, as the *'Cradle to Grave'* of burial only serves to waste land, as an asset of the *'Built Environment'*. This at the macro level is unfortunately overarched by fiscal profit, placing finance before ethics with no guarantee that items sifted and sent for recycling (Reusing), by the end user, are actually recycled.

24. In 2008, of the 400 Local Councils in England surveyed, of the responding 209, 75% admitted the practice of sending a percentage of recycling to landfill sites due to costs and the financial downturn. In many UK local authorities it became financially unviable and 3 out of 4 Local Authorities started to dump a percentage (Estimated at 200,000 Tonnes pa)[39] of their recycling waste into landfill sites. The worst offenders were Medway and Portsmouth County Council, which admitted to sending over 11% of household sifted recycling, including bottle banks, to landfill sites. Additional to this, Pembrokeshire County Council confessed that 19% of Kerbside recycling would end up in landfills. Some

councils were countering the financial effect, by storing recycling until the market became more viable (Profitable), such as Plymouth.

On the 17th of this month (October 2012), Stroud News and Journal[40] reported that Stroud District Council, via its private partner Veolia would take cardboard on non-recycle weeks and that it would go direct to landfill.

25. Thus any future SD must incorporate a '*cradle to cradle'* approach to all waste and more importantly engage with Corporate Waste Institutions to ensure that as part of any waste contract, irrespective of profit, the end result is guaranteed.


Sustainable urban transport: Four innovative directions

Todd Goldman *, Roger Gorham b

26. **Transport**. Falling from the Technology In Society Sustainable Urban Transport 2006[41] report, the following four approaches have been identified for use in any future SD City;

a. **New mobility** – This targets the individual, having an average commute to work time of c1Hour and encourages mobility choice and ownership, placing the decision in the lap of the individual on psychological and economic grounds.
b. **City logistics** – This attempts to group future SD environments, into relevant and adjoining sectors that can be serviced by better route planning, thus cutting distance and time, to the benefit of fuel. This will have a direct bearing on SD layout and commercial zoning. However, this may be to the detriment of commercial competition.
c. **Intelligent system management** – Public buildings again become grouped, as per the commercial / retail sector and hence routes are shortened, with the obvious beneficial effects s above. It also goes some way to automate traffic flow, to the benefit of the environment.
d. **Livability** – Coming full circle to the individual needs, but addressing them at a group level and providing excellent public transport infrastructure, to promote utility and usability, thus attempting to reduce individual new mobility.

At the micro level, this starts with car sharing / pooling and the introduction of mobility bikes (Transport For London)[42].

27. **Health**. The promotion of health and more importantly wellbeing is a must in any SD. This is over and above any Hospital or GP service which is catered for in the built environment, but focusses on the usability of the space, to promote a stress free, yet motivated and inspiration way of life. Thus alluding to '*Green space'*, natural light and other lifestyle aids. The Wellbeing and happiness index highlighted by Nobel laureate James Tobin and William Nordhaus in the 1970's[43], is another avenue that should be pursued in the holistic approach to SD.


IHBC

Valuing Historic Places

Introduction

Value and Benefits of Heritage

Social, Economic and Environmental Value

28. **Employment**. Any SD must address the '*Work, Life'* balance and in an ideal closed world the future city will have gainful work, which satisfies the populous of that city, hence limiting the impact on the environment, through transportation and resource costs (Energy / Fuel) and needs. However, this utopia is aspirational and the reality is that the migration of populous on a daily basis will ebb and flow from any future SD city. Therefore, it highlights all of the above vignettes have to be designed with SD in mind, so that any marginal gain (GHG Reduction), has the potential to be amplified.

Construct

29. If the design phase has been a success in SD then much of the construction phase has been mitigated of environmental impact. However, some issues are inevitable;

30. **Pollution**. Contamination of any site, through plant usage, is hard to negate and thus great care should be afforded in this aspect and how, on a large scale city development, it could lead to long term disaster. Conversely, as can be seen by the St Marys Island Development[44], Chatham, Kent, ground contents can prove unpredictable even with soil analysis and will have to be environmentally contained.

31. **Earth Works – Contamination**. Whilst planned, irresponsible Mass / Haul can change the landscape for good and thus adversely affect the natural habitat, eco-system and thus biosphere. Modelled at the planning stage, there can be no substitute for the real efflux of time to understand the physical effects.

32. **Construction Waste**. This should be kept to a minimum if designed and planned with SD in mind and thus benefits the environment through effective resource management.

Operate

33. **Functionality**. On-going changes will be required through effective analysis of the proposed city, in all of the areas underlined in the planning / design stage, to ensure minimal impact is placed upon the biosphere, from effective traffic management through to energy demands, across the whole spectrum above.

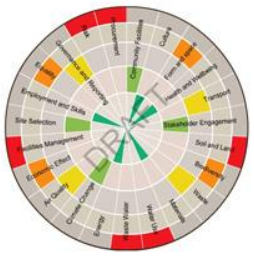
34. **Enduring Commitment**. Thus any SD in the future will be an enduring commitment and should be viewed, resourced and managed as that.

Building Values

35. Forward thinking allows any SD to pre plan substantial buildings, of architectural note, that have the potential to become the historic buildings of tomorrow, which if addressed early will benefit the public through; education, economic development, sustainable growth, future urban and rural regeneration, repopulation, improved competitiveness, cultural development, and providing facilities for local communities as per the Institute of Historic Building Conservation (IHBC) and its report *'Valuing Historic Places'*[45]. thus highlighting the Social, Economic and Environmental value which are inherent to these buildings. In addition, this report emphasises the Public Value, that of; Intrinsic Value, Public Support, Local Distinctiveness, Local Empowerment and Urban Design, Quality, Variety. Further it gives value to; Cultural, Learning and Skills Value, which includes; Education, Culture, Skills and Creative New Design.

Analysis & Assessment

36. Throughout the design, construct and operate phase, best practice dictates that true SD must be analysed and assessed constantly. Whilst as yet no industry standard exists, there are a plethora of products available; BREEAM[46], LEED[47], CEPAS[48], BEES[49], DQI™[50], SPeAR®[51] amongst others that produce a mandatory Strategic Environmental Assessment (SEA).



37. . Various papers have been produced, a fore runner for which is 'A Framework Model for Assessing Sustainability Impacts of a Built Environment'[52], from the International Conference on Whole Life Urban Sustainability and its Assessment 2007. This paper highlights remote connectivity and attempts to internalise, external environmental, social, economic and natural resource costs, through a holistic sustainability accounting framework. It utilises a model from the oil industry (BP 1999)[53], that of a Sustainability Accounting Model (SAM). The paper brings to the fore two challenges that need to be

overcome before 'Sustainability Assessments', in whichever guise becomes 'Best Practice' for industry. The two key challenges are;

a. Financial work is directed at corporate level, rather than the Urban Development level and as such has little financial incentive.
b. The difficult and complex nature of Sustainability Assessment, in terms of scientific uncertainty and ideological diversity - requires a multi-dimensional approach (Bebbington et al., 2007).

Therefore, a full cost accounting methodology needs to be ascertained and integrated into a methodical assessment framework. This is proposed by the use of the Construction Sustainable Assessment Model (CSAM), an amalgamation of Building Whole Life Performance Assessment and Sustainability Accounting with a view to analysing the environmental, social and economic costs and benefits in monetary terms at different stages in the life cycle of a built environment.

Summary

38. Any future large scale Sustainable Development, if justified after exploring all underutilised / empty *'Built Asset'* stock, capable of achieving a carbon neutral footprint from retrofitting, should conform to all present legislation, both governmental and environmental (On a global scale). Careful consideration at the design stage should be afforded to; the built environment (Size, space, form, materiel), energy, water, sewage, waste, transport and health / wellbeing, through to the construction and operating phase of the SD, to produce a development that has the lowest possible carbon footprint and is in tune with the biosphere, whilst not raping the planet of resources to allow not only intergenerational usage, but to establish the long term use for future generations. To ensure this, all SD should be constantly evaluated and analysed as an enduring commitment, through a global standard.

[E Signed]

David M Winsper

1118646

Principal
The Winsper Group

david@winspergroup.com
www.winpergroup.com
www.davidwinsper.com

BIBLIOGRAPHY

1. 'Built Environment' definition.
http://www.rics.org/uk/knowledge/research/conference-papers/cobra-2012-influences-that-generate-environmental-outcomes-of-building-projects/

2. 'Biosphere' definition.
http://www.decc.gov.uk/en/content/cms/about/glossary/glossary.aspx

3. 'Kyoto Agreement' & 'Annex I Signatories'.
http://www.decc.gov.uk/en/content/cms/tackling/international/negotiations/kyoto_protocol/kyoto_protocol.aspx

4. Climate Change Act 2008.
http://www.legislation.gov.uk/ukpga/2008/27/contents

5. Department of Energy & Climate Change (DECC – Established 2008).
http://www.decc.gov.uk/

to include;

www.decc.gov.uk › Tackling Climate Change

6. Committee on Climate Change (CCC).
http://www.theccc.org.uk/

7. DECC 2011 UK Greenhouse Gas Emissions, Provision Figures – Statistical Release.
http://www.decc.gov.uk/en/content/cms/statistics/climate_stats/gg_emissions/gg_emissions.aspx

8. The Town & Country's Planning Act 1990.
http://www.legislation.gov.uk/ukpga/1990/8/contents

9. The National Planning Policy Framework.
https://www.gov.uk/government/uploads/system/.../2116950.pdf

10. Building Regulations – Part L.
http://www.nhbc.co.uk/Builders/ProductsandServices/PartL2010support/?gclid=CMzmwOPvjbQCFbMbtAodpj4Aaw

11. The Sustainable Communities Act 2007.
http://www.legislation.gov.uk/ukpga/2007/23/contents

12. The Water Industries Financial Assistance Bill.
http://www.parliament.uk/briefing-papers/SN06234

13. 'Our Common Future' – World Commission on Environment & Development (WCED), Brundtland 1987.
http://conspect.nl/pdf/Our_Common_Future-Brundtland_Report_1987.pdf

14. 'Caring for the Earth. A strategy for sustainable living', Gland, 1991.
http://gcmd.nasa.gov/records/GCMD_IUCN_CARING.html

15. Law of Conservation of Mass, Antoine Lavoisier.
http://www.nature.com/scitable/knowledge/library/the-conservation-of-mass-17395478

16. Case Study – Beddington Zero Energy Development (BedZED).
www.bioregional.com/files/.../BedZEDCaseStudyReport_Dec02.pdf

17. Peabody Trust Housing Association.
http://www.peabody.org.uk/

18. Bio Regional Development Group.
http://www.bioregional.co.uk/

19. Bill Dunster Profile.

www.zedfactory.com/

20. Case Study – Chenggong.
http://www.ft.com/cms/s/0/47cfb09c-1f0f-11df-9584-00144feab49a.html#axzz2Eq5a6vu2

21. Case Study – Nova Cidade de Kilamba, Angola.
http://inhabitat.com/nova-cidade-de-kilamba-is-a-huge-candy-colored-chinese-built-ghost-city-in-angola/

22. USA Housing Data, Non-Occupancy of Existing Stock.
http://www.forbes.com/2009/02/12/cities-ten-top-lifestyle-real-estate_0212_cities.html

23. Journal of Planning Education & Research.
http://jpe.sagepub.com/

24. St David's City, Wales.
http://www.stdavids.co.uk/

25. Journal of Planning Education & research – Sustainable Urban Forms.
http://jpe.sagepub.com/content/26/1/38.abstract

26. 'Brownfield' Definition.
http://www.legislation.gov.uk/ukpga/2008/29/contents

27. Landfill Mining.
http://www.landfillmining.co.uk/

28. 'Green Belt' definition.
http://www.legislation.gov.uk/ukpga/2008/29/contents

29. Department of Trade & Industries Energy Review in 2006.
www.**dti**.gov.uk/**energy**/statistics/publications/ecuk/page17658.html

30. Parliamentary Office of Science & Technology – Carbon Footprint of electricity Generation.
http://www.parliament.uk/documents/post/postpn_383-carbon-footprint-electricity-generation.pdf

31. London Array, Wind Farm.
http://www.londonarray.com/

32. Water Framework Directive 2000, DEFRA.
http://www.defra.gov.uk/environment/quality/water/legislation/water-framework-directive/

33. Local Institutional Development & Organizational Change for Advanced Sustainable Urban Water Futures.
http://www.ncbi.nlm.nih.gov/pubmed/18027015

34. Britain's First Desalination Plant, Telegraph Article.
http://www.telegraph.co.uk/earth/earthnews/9141282/Drought-first-desalination-opens-in-mainland-Britain-as-water-bosses-warn-of-price-rises.html

0r

http://www.treehugger.com/clean-water/uks-first-desalination-plant-opens-on-thames-to-quench-londoners-thirst.html

35. National Geographic – Fresh Water Crisis Article.
http://news.nationalgeographic.com/news/2011/08/110804-fresh-water-crisis-desalination-environment-science/

36. . Charles Hendry speech to MENA, Chatham House - "Investing for the Future in Turbulent Times"
https://www.decc.gov.uk/en/content/cms/news/hendry_ch/hendry_ch.aspx

37. Sewage.
http://www.water.org.uk/home/policy/positions/sewage-sludge

38. UK National Waste Strategy.

http://www.defra.gov.uk/publications/files/pb13540-waste-policy-review110614.pdf

39. Telegraph Article – Councils Dumping Recycling.
http://www.telegraph.co.uk/earth/earthnews/3852372/Councils-dumping-more-than-200000-tonnes-of-recycling-every-year.html

40. Stroud News And Journal – Recycling Article.
http://www.stroudnewsandjournal.co.uk/news/9989741.Recyclable_cardboard_dumped_in_landfill_at_orders_of_Stroud_District_Council/

41. Technology In Society Sustainable Urban Transport 2006.
http://www.thepep.org/ClearingHouse/docfiles/Sustainable.Urban.Transport.pdf

42. Transport For London, Bike Schemes.
http://www.tfl.gov.uk/roadusers/cycling/14808.aspx

43. The Wellbeing and happiness index, J Tobin & W Nordhaus, c1970.
http://www.iea.org.uk/sites/default/files/publications/files/IEA%20Pursuit%20of%20Happiness%20web.pdf

44. St Marys Island Development, Chatham, Kent.
http://www.stmarysisland.uk.com/index.php?page=home

45. Institute of Historic Building Conservation (IHBC), *'Valuing Historic Places'.*
http://www.ihbc.org.uk/policy/docs/IHBC%20Valuing%20Historic.pdf

46. BREEAM.
http://www.breeam.org/

47. LEED.
https://new.usgbc.org/leed

48. CEPAS
www.bd.gov.hk/english/documents/index_CEPAS.html

49. BEES.
http://www.nist.gov/bfrlpubs/build01/PDF/b01080.pdf

50. DQI.
http://www.dqi.org.uk/website/default.aspa

51. SPeAR.
http://www.arup.com/Projects/SPeAR.aspx

52. 'A Framework Model for Assessing Sustainability Impacts of a Built Environment', International Conference on Whole Life Urban Sustainability and its Assessment, 2007.
http://download.sue-mot.org/Conference-2007/Papers/Xing.pdf

53. Sustainability Accounting Model (SAM), BP 1999.
http://www.forumforthefuture.org/sites/default/files/project/downloads/accounting-sustainability.pdf

54. National Strategy For Sustainable Development.
http://archive.defra.gov.uk/sustainable/government/gov/strategy/index.htm

55. The Royal Society, Climate Change: A summary of the science.
http://royalsociety.org/policy/publications/2010/climate-change-summary-science/