Developing a sustainable, low carbon 2050 vision for the Christ Church estate

Executive Summary

Canterbury Christ Church University undertook in the 2010-15 Carbon Management Plan to develop a low carbon vision for 2050. This document sets out some key principles, more detailed considerations and actions to reduce significantly the emissions from the estate and to improve its overall environmental sustainability. These are to be used to inform designs and developments realised under the University's Estates Framework and Masterplan. Action is required to ensure that the University can reduce Scope 1 & 2 emissions from the University estate in line with national and sector targets for 2020 and 2050. The decisions taken in the next ten years will determine not only the ability to meet the emissions targets but also the mitigation of business risks from long term fuel security and increasing energy costs that the University will face in the period to 2050.

Key Principles

- This document covers the sustainability of the built environment and the Scope 1 direct emissions and Scope 2 grid electricity emissions from the University estate.
- Estate rationalisation to achieve higher space utilisation rates will create the greatest impact on emissions reduction.
- The remaining estate must be redeveloped to achieve the highest standards of environmental performance.
- Consumption requirements are to be minimised first before the remaining energy supply requirements are decarbonised.
- In assessing alternative construction methods and technologies a whole life evaluation is to be made of embodied carbon, emissions and costs.
- Significant gains have already been made from recent sub five year payback carbon reduction projects, so where appropriate longer payback periods up to 15-20 years should be considered acceptable.

Consumption reduction measures

- New-build projects are to meet a BREEAM rating of "Outstanding", increased from the current standard of "Excellent". New buildings are to be designed to be essentially "zero carbon" with a DEC rating of A+ or minimum of A. This will help to offset emissions from the legacy estate.
- Passive measures such as building orientation, exposed thermal mass, supreme insulation and triple glazing are to be optimised first to reduce consumption needs. Glazing and shading are to be designed to optimise the benefits of solar gain in the winter and minimise its impact in the summer months.
- An active choice is to be made early in any new build concept to specify the use of either natural ventilation or to use the Passivhaus standard if mechanical ventilation is required or preferred. Cooling use should continue to be restricted.
- For refurbished buildings the requirement will be to target "Outstanding" and achieve a minimum of an "Excellent" under the BREEAM Refurbishment standard.

Where more appropriate the Passivhaus EnerPhit standard may be used for major refurbishment or the RICS SKA "Gold" rating for internal refits.

Energy decarbonisation measures

- Across its campus network there are opportunities to use Combined Heat & Power (CHP) to meet winter heating and electricity needs where possible linked to district heating systems to link buildings and use a central energy source. The most suitable sites will have larger and well matched heating and electricity demand and independent means of summer hot water generation. Any servers the University retains should be co-located so that absorption cooling can be used to further increase efficiency.
- Before taking any unilateral action the University should explore using a third party Energy Supply Company (ESCO) to help fund and develop these developments.
- To improve long term fuel security and to reduce carbon emissions the use of alternatives to natural gas for heating is required. A feasibility study to explore the use of gasification of Refuse Derived Fuel (RDF) will be undertaken for the largest sites, contrasted against the use of Biomass or Glycerol fuel as alternatives to power a CHP. Emissions from natural gas fired CHP or boilers/grid electricity are to be used as the baseline so that an active choice can be made.
- The use of biofuels for heating is generally less preferred by the University unless they are coming either from waste sources or land which would not support food production. Biomass boilers for stand-alone building locations are therefore to be carefully considered before adoption taking into account fuel source and availability. In urban locations the use of heat pumps, natural gas fired small scale CHP or boilers may remain preferable in the shorter term 10-15 year horizon.
- Ground source heat pumps, air source heat pumps, LED lighting, solar photovoltaic arrays and solar thermal hot water are all proven technologies already in use in the University's buildings. Their usage is to be increased as part of any new build or refurbishment project.

Other key considerations for a sustainable estate

- The development of the estate should reflect the University's values, its relationship and partnership with the community it serves and should reflect and enhance the important heritage values of the University's operational locations. At all locations the University's Bioversity initiative should be used to inform the external grounds design, linking the sense of place and educational purpose to the planting schemes. Green walls and green roofs should be used to further increase biodiversity and soften the largely urban sites.
- Travel to and from sites will be influenced by both the University and local council travel strategies. Car parking provision will be likely to remain at or below existing levels due to current planning policies and the University's own travel plan. Greater adoption of electric vehicles will require proliferation of charging points. The need to match demand for cycle storage and showers will remain.

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Introduction

Canterbury Christ Church University undertook in the 2010-15 Carbon Management Plan to develop a low carbon vision for 2050. The UK is committed to reducing its greenhouse gas emissions by at least 80% by 2050, relative to 1990 levels and this document is written in response to that requirement, to review what further actions the University must take to respond to this national and international need. This document sets out some key principles, more detailed considerations and actions to reduce significantly the emissions from the estate and to improve its overall environmental sustainability. This document covers the sustainability of the built environment and the Scope 1 direct emissions and Scope 2 grid electricity emissions from the University estate.

This document is intended to be used to inform designs and developments realised under the University's Estates Framework and Masterplan. Action is required to ensure that the University can reduce Scope 1 & 2 emissions from the University estate in line with national and sector targets for 2020 and 2050. The decisions taken in the next ten years will determine not only the ability to meet the emissions targets but also the mitigation of business risks from long term fuel security and increasing energy costs that the University will face in the period to 2050.

Background

Why 2050?

The human influence on climate change and global warming has until recently been viewed as either a point of science fact or something for sceptics to challenge. However the recent Fifth Assessment Report (AR5) from the Intergovernmental Panel on Climate Change is more conclusive stating that *"It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century."*[1] In the UK the Climate Change Act 2008 sets in statute the national requirement to reduce Scope 1 & 2 CO_2 emissions by 34% by 2020 and 80% by 2050 from a 1990 baseline, to help the transition to a UK low carbon economy. Scope 1 emissions are direct greenhouse gas emissions i.e. from the burning of gas and Scope 2 emissions are from the use of grid electricity. Scope 3 emissions are the indirect emissions associated with the organisations operations, which are not currently subject to statutory reduction targets and are not covered within the scope of this document. The reduction in Scope 3 emissions by changed educational and business practices should form part of the debate for the forthcoming Strategic Plan development.

What is the Government response to the legislation?

Whilst the UK is behind parts of Europe in reducing a dependency on energy from fossil fuels we are ahead of others globally and amongst few who have made the need to reduce carbon emissions a statutory requirement. To achieve an 80% reduction as a nation we will need to dramatically reduce our use of natural gas, which has become our default for heating, and deal with the replacement of our electricity generation capacity with something greener, most likely a mix of nuclear, carbon capture fossil fuel and some

renewables. If we continue with our appetite for personal mobility and travel, then means other than mineral oil fuelled cars and planes will need to be at the fore. The Energy Bill was passed in December 2013 which commits to decarbonisation targets for electricity generation by 2030 and to Electricity Market Reform intended to stimulate low carbon generation. The Department of Energy & Climate Change (DECC) has created a 2050 low carbon pathways tool to help inform the debate on how to transform the UK economy while ensuring secure, low-carbon energy supplies to 2050. This includes a "My 2050" on line model[1] intended to let the British public work out for themselves how to balance the supply and demand issues affecting individual and national choices. This was used to inform discussion in the preparation of this paper

Energy security - fossil fuels are a finite resource

The world's fossil fuel resources are finite. How much of these resources remain yet to be used is debatable. Whether and when we will reach "peak oil" is still a matter of conjecture. As the easier to extract resources become depleted (e.g. North Sea oil & gas, Middle Eastern oil, Russian gas) then increased market prices help cover the costs of the more difficult extraction (i.e. Arctic oil, shale gas and even UK coal). Those who control these resources will ultimately have most control over supply and market prices until the point when there is insufficient to meet global demand. Concerns over energy security are highly likely to increase towards 2050.

Energy costs will rise

Energy prices are almost bound to rise in the period to 2050. Since the start of the current Carbon Management Plan in 2009 the University's half hourly electricity unit cost, covering two thirds of consumption, has risen from 7.71p/kWh to 11.59p/kWh, a rise of 50% in five years. Cost pressures will continue from market forces, fuel availability and the level of pricing control that the energy companies may have. There will be a pass on of the costs of creating a new electricity generation infrastructure, either through unit prices or taxes. In June 2013 the Energy Consortium (TEC), the UK HE sector buying vehicle, were forecasting that prices would double by 2020. DECC make projections on oil and gas prices which in turn will drive utility costs. The July 2013 projections show the High Scenario cost of oil increasing by 68% and Gas by 71% by 2030[3]. The DECC Central scenario shows a more moderate 20% increase by 2030 and the Low scenario shows a reduction. In 2013/14 electricity and gas costs were £1,754,072. With further price rises being almost inevitable an increased focus should be taken on energy use reduction and cost avoidance.

How should the University respond?

Promoting a Sustainable Future formed one of the five goals of the 2010-2015 Strategic Plan and should remain a key focus of future plans. Having held a First Class position in the Green League for three years the University should maintain a position of being amongst the leaders in the sector, reflecting the initiatives being taken in promoting sustainable development through education in the actions it takes to ensure that the physical estate minimises its impact on the environment. The University should look to its institutional

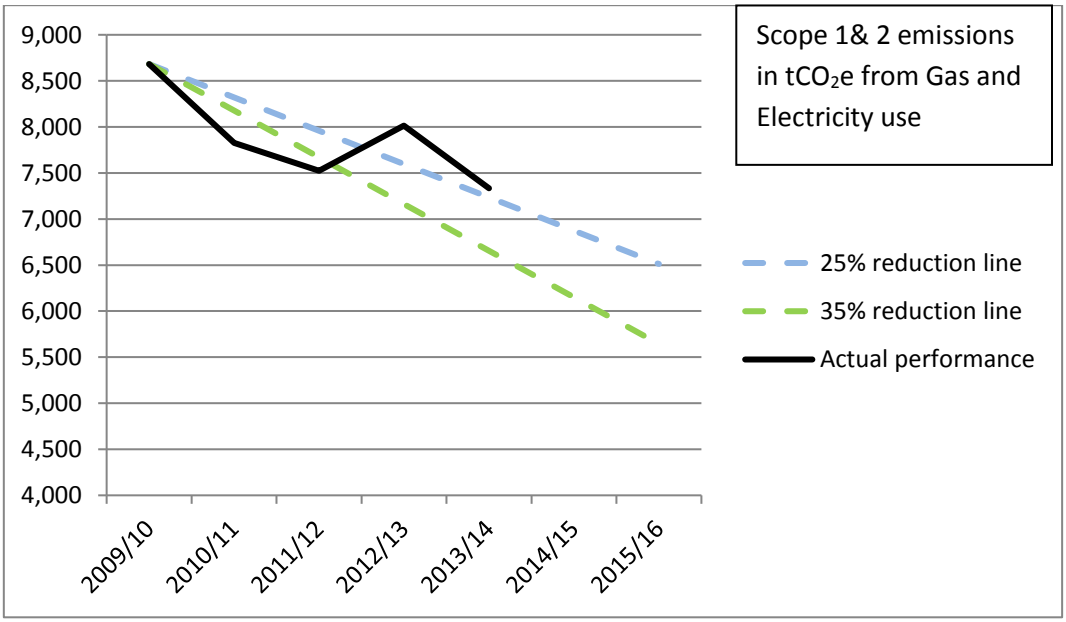
values in deciding which behaviours it should adopt to operate in a sustainable, low carbon manner.

To help both business continuity and cost avoidance for the medium and longer term the University's energy purchasing strategy should focus on decreasing the dependency on natural gas for heating, diversification into other cleaner heating fuel sources, increased self-generation of electricity and supporting the transition of grid electricity to low and zero carbon sources.

In assessing alternative building construction methods and energy reduction technologies a whole life evaluation is to be made of embodied carbon, whole life emissions and costs. Significant gains have already been made from recent sub five year payback carbon reduction projects, so where appropriate longer payback periods up to 15-20 years should be considered acceptable in order to achieve the reduction targets.

Current status

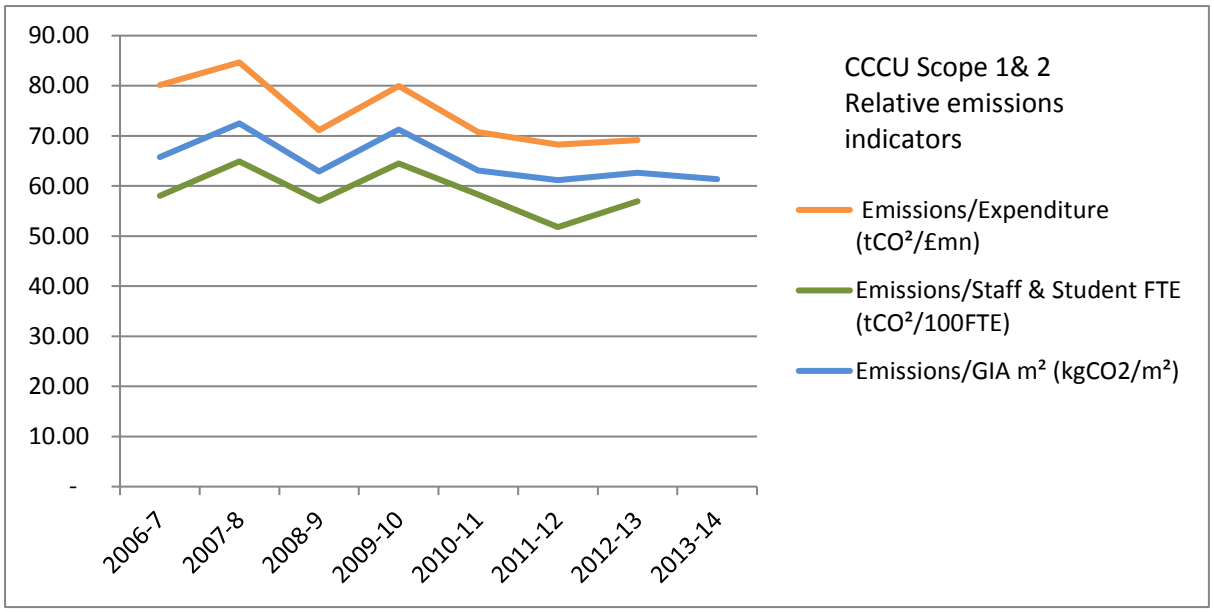
In 2009/10 Scope 1 emissions from natural gas use and Scope 2 emissions from grid electricity use were 8,682 tCO_2e. Through the actions implemented to date through the 2010-16 Carbon Management Plan (CMP) emissions at the end of 2013/14 have been reduced by 16% to 7,334 tCO_2e. In the CMP a target of a 35% reduction by 2016 was set and against the 2010-15 Strategic Plan a KPI of a 25% reduction by 2016 was set, moderated by changing government attitude towards the national targets at that time and the University's ability to invest in change projects in the altered financial climate following the fee structure changes in HE. The performance against these targets is shown graphically below. At the end of 2013/14 performance is just above the 25% reduction line.



The significant reduction in the first year of the plan was due to the reduction projects most notably voltage optimisation, Building Management System improvements and a high level of staff involvement. In the following year progress was been slower with mostly lighting projects and in 2012/13 the combined impact of the opening of the St Georges Centre and

a very cold winter saw an increase in emissions. The reductions in 2013/14 are principally due to the estate reduction through the disposal of Salomons Mansion House & UCF, a significantly milder winter and the impact of lighting projects. Despite greater control through the BMS with the current building stock the influence of a good or bad winter is circa +/- 6% on gas consumption with a corresponding +/2% on carbon emissions. The 2013/14 figures exclude emissions from the former HMP Canterbury site acquired in April 2014 but these will create an upward pressure when included in 2014/15 as the heating is left on to preserve the listed buildings whilst the masterplan is developed.

The HE sector targets are based on a 2005 baseline for which CCCU were recorded with emissions of 6,932 tCO_2e[4]. As emissions now start to approach that level the University may in the future be able to claim an absolute reduction against the sector baseline when further reductions are achieved. For most of the period from 2005 the University was in a growth phase so it is important to look at longer term trends of the relative indices against student and staff FTE and estate size. These are shown graphically below and in detail in Appendix A. In general the long term trends can be interpreted as either slowly reducing or levelling off as the student population has stabilised and the estate size just starts to reduce. Student number continued to grow year on year until 2011-12. Against expenditure the downward trend is stronger but this is mostly reversed if an RPI adjusted figure is used.



In the financial section of the 2010 CMP it was predicted that financing reduction projects would be difficult in the face of changes in University funding: The University invested £656K in carbon reduction projects between 2009-11 and has obtained Salix and HEFCE RGF loan funding of £1,395k from 2009-14. The problem with the loan funding is that this only applies to short paybacks and many of the "low hanging fruit" projects have now been implemented. If the University is to match the HE sector's commitment that it will meet the government 2020 and 2050 targets then a longer term view to investment and payback needs to be taken as well as some more fundamental and radical approaches to reducing energy consumption. The decisions taken in the next ten years will be the ones which determine whether the University can meet the targets.

Actions to significantly reduce Scope 1 & 2 emissions by 2050

The following section of this document covers the actions required to take significant steps in reducing Scope 1& 2 emission to meet the emissions targets and to mitigate of business risks from long term fuel security and increasing energy costs. These are summarised under the sections of

- Do nothing
- Purchase "Green" Electricity ahead of market reform
- Change control limits
- Reduce the Estate size
- Consumption reduction measures
- Energy decarbonisation measures

The recommendation is that they are progressed in parallel through the development and implementation of the masterplan and subsequent projects that support the Estates Framework. The basic premise throughout this development is that consumption needs must be reduced first ahead of the remaining energy use requirements being decarbonised

Do nothing

If the University makes no further changes Scope 2 emissions would eventually decrease as the grid electricity supply is decarbonised. In 2013/14 emissions from electricity use were 5,390 tCO_2e and represented 73% of Scope 1 & 2 emissions. These would reduce by whatever percentage the emissions factor reduces as the cleaner generation becomes available. The University will pay whatever the market price is, including the recovery cost for the generation infrastructure investment. The University already contributes to the Carbon Reduction Commitment (CRC) at a 2014 cost of circa £98K pa, rising to £154k in 2015 and which is likely to continue to rise until 2048 under the current legislation. The Government has the ability to increase this "tax" and can and does charge for Carbon Credits at a cost much higher than the current market prices.

Purchasing "Green" electricity ahead of market reform

In the April 2014 tender the University has fixed prices at for two years at 11.59p/kWh with EDF's Renewables only tariff for its "Half Hourly" electricity, which covers two thirds of the electricity used. This has resulted in a waiver of the "Climate Change Levy" (CCL) previously paid and was essentially cost neutral. The switch of the remaining "non-half hourly" electricity will be considered at tender renewal in April 2015 and is likely to lead to a slight relative cost increase as only the non-residential sites would receive the CCL waiver. Through the use of a Green tariff the University is ensuring that the equivalent electricity used is entering the grid from renewable sources, allowing the University to claim a lower "net" carbon figure and meet its Social and Environmental Responsibility objectives. However for the "gross" carbon figure still has to be used for the HESA Estates Management Record as these are based on energy received from the grid at the average national emissions rate based on all generation sources. More on site generation would be necessary to avoid CRC payments and to reduce declared gross emissions.

Change our control limits

Under the current approved Energy Policy the University heats its buildings to a nominal 21 °C. Moving the set point to 20 °C whilst remaining in the declared 19-23 °C target range would save circa 8% on gas use and about 2.5% on associated emissions. The University's policy to avoid summer cooling other than for certain requirements should continue but to move the minimum cooling set point to 24°C from the current 23°C would reduce the electricity used for cooling by circa 10%.

Reduce the Estate size.

It can be argued that the most environmentally friendly building for the University is the one it does not have. The first steps have been taken with the disposal of the Folkestone and part of the Salomons operations in July 2013, saving 618 tCO_2e during 2014/15 as a result. The recently approved Estates Framework signals potential further reductions in the Estate size with a target of 40% space utilisation by 2025. The AUDE benchmarking tools indicate that net internal area could reduce by a further 10,000m^2 for the University to operate in the manner of the most efficient in the sector. To run at this level of space efficiency will require significant changes in the way we operate. The improvements in space utilisation need to be balanced against operational costs and the impact on student experience and quality so a reduction to that scale may not be desirable or achievable. However there are institutions from which we can learn; for example Liverpool John Moores University published their utilisation in 2009 as 48% compared with our own 29% in 2013. The University has identified a gross area of 9,032m^2 of buildings for potential disposal by 2025 which would save 916 tCO_2e (10% of our 2009/10 emissions baseline)

Consumption reduction measures

- To offset emissions from the legacy buildings any new build that the University undertakes should be essentially be "zero carbon" buildings. There are many definitions of this but essentially the building itself should reduce its own emissions from heating, lighting and ventilation to as low as possible and then use local renewable generation to offset the remainder. Offsetting the emissions from the operations within the building (e.g. IT use, catering) is more difficult and requires levels of renewable generation that cannot realistically be contained within our sites. The University should move to a standard for new build to achieve BREEAM "Outstanding", from the current requirement of "Excellent". Achievement of a Display Energy Certificate rating of A+ or A should also be specified. The University should follow best practice in the sector and retain a BREEAM assessor to work on the client side to ensure that the maximum score is targeted in each area. In assessing alternative technologies and constructions a whole life evaluation should be made of embodied carbon, emissions and costs.
- Passive measures – the use of passive measures is the least cost way of ensuring any new build has the lowest possible emissions by measures which are embedded within the building structure. The buildings orientation, use of thermal mass, glazing and shading need to work such that the maximum winter benefits from solar gain can be taken whilst avoiding greenhouse effect overheating in summer. However this

also has to be considered with other conflicts from trying to find the best balance between the use of natural daylighting and electric lighting. The use of supreme insulation, air tightness and triple glazing with well-matched and efficient ventilation is the most effective way of further reducing the buildings demands for heating or cooling.

- Natural ventilation – wherever practicable the use of natural ventilation should be employed in place of mechanically driven ventilation. In the simplest of buildings this can continue to be by opening windows. In larger more complex buildings integrating it into the control system, using openable louvres, tempering the air and using cross flow ventilation and stack effect to maximum effect. The Design Building at Loughborough University is an exemplar to study its performance against our own more modern buildings.
- Passivhaus - as an alternative using the Passivhaus design standard should be considered in each new build case and particularly when building massing may preclude natural ventilation. The Passivhaus methodology reduces building leakage losses to a minimum, approximately a tenth of that currently allowed by UK building regulations, providing a residual level of full fresh air ventilation with heat recovery that is closely matched to the occupancy. Heating requirements are thus restricted to 15 kWh/m^2per annum compared with the University current average of 95-10 kWh/m^2 pa. The University of Bradford STEM building and Hadlow Rural Regeneration centre are the first educational Passivhaus buildings which should be studied as exemplars.
- Restrict cooling to essential areas – the statement in the University's Energy policy to restricting cooling to only the areas for which it is essential should remain. The use of the measures described above should help to ensure this.
- Engage with users before occupation – engaging with building users during the design stage and before and after occupation can lead to a greater understanding of how to interact with and use the building to the best effect.
- Refurbishment of the legacy estate - after any disposals it is still likely that in 2050 some 60-80% of the buildings the University will occupy are ones that it is using today. For some it may be best to consider demolition and either replacement or leaving vacant sites for future expansion. For other buildings constructed between 1960-2000 there are refurbishment options which can dramatically improve their environmental performance. Many are suitable for over-cladding and the use of triple glazing, which together with better insulated roofs will help bring heating demands down significantly. These measures should be programmed into any change of use or major refurbishments. Managing the older and listed buildings is more difficult but not impossible.
- For refurbished buildings the requirement will be to target "Outstanding" and achieve a minimum of an "Excellent" under the BREEAM Refurbishment standard. Where more appropriate the Passivhaus EnerPhit standard may be used for major refurbishment or the RICS SKA "Gold" rating for internal refits.

<u>Energy decarbonisation measures</u>

- Over that past few years LED lighting has reached a level of performance and cost such that they have become the default for specification in new build and refurbishment, consuming between 20-50% of the electricity of previous technologies.
- Combined Heat and Power – The use of a Combined Heat and Power (CHP) plant feeding an expanded district heating circuit should be explored. The use of a third party Energy Supply Company (ESCO) could be considered as a way of developing funding for such a scheme with shared benefits and risk. The larger sites's electrical load exceeds their heating demand. For winter use a CHP plant would generate electricity and the waste heat can be used to feed the expanded district heating circuit. Co-locating any servers the University runs means that the server cooling loads can also be managed using absorption cooling, improving the overall efficiency of the total plant. Summer hot water loads will remain low so the boilers or other domestic hot water arrangements are required which can and also remain as a level of resilience back up for winter. Using a gas fired CHP initially would bring a significant reduction in emissions compared with using electricity and gas separately and needs to be calculated via a feasibility study. A small scale CHP plant is specified for the Rhodaus student accommodation and will be in use from 2015.
- Energy from Waste – our current waste contract ensures that any waste not recycled is processed into Refuse Derived Fuel. Currently the UK infrastructure for using this is low and the fuel is exported to the Netherlands and Latvia. The level of technology development and scale of plant required for the use of waste fuel use to either provide heat or run a CHP plant may not be available for some years but the technologies for using should be explored further. Planning concerns over flue gases will be overcome by flue scrubbing but will inevitably lead to neighbour concerns to be overcome. Councils are currently being encouraged by national government to support similar schemes and district heating schemes.
- To improve long term fuel security and to reduce carbon emissions the use of alternatives to natural gas for heating is required. A feasibility study to explore the use of gasification of Refuse Derived Fuel (RDF) will be undertaken, contrasted against the use of Biomass or Glycerol fuel as alternatives. Emissions from natural gas fired CHP or boilers/grid electricity are to be used as the baseline so that an active choice can be made.
- The use of biofuels for heating is generally less preferred by the University unless they are coming either from waste sources or land which would not support food production. Biomass boilers for stand-alone building locations are therefore to be carefully considered before adoption taking into account fuel source and availability. In urban locations the use of heat pumps, natural gas fired small scale CHP or boilers may remain preferable in the shorter term 10-15 year horizon.
- Ground Source heat pumps – the use of geothermal energy is an effective way of using cleaner electricity to generate heating or cooling for buildings. Their initial usage at Augustine House has shown that care needs to be taken in the selection of supplier, the integration of the technology with the building management system and the specification of manifolds for the ground source loop

- Air Source Heat Pumps – again when powered by cleaner electricity the use of air source heat pumps is similarly effective for heating and cooling. Concerns remain on the use on low temperature damp days but the down time as the external units defrost themselves is relatively insignificant on a well-insulated building. They are currently in use at Rochester House, Cathedral Court and Allen.
- Solar Photovoltaic – already in use on TOSH, Rochester House and Erasmus. Although the payback periods are getting longer they are effective at helping offset electricity use in the building. Lifetime expectancy is 20-25 years
- Solar Thermal – in use at Lanfranc. This can be used effectively as part of the means of domestic hot water production
- Wind power generation– the wind profiles in Canterbury and Medway are unreliable for this technology to be viable. At Broadstairs the wind profile is suitable but the scale and cost of plant would raise significant neighbour objections. The local large scale offshore generation is more appropriate overall.

Exemplar buildings

The University should consider whether it wants any new buildings to act as exemplars for any particular technology. This paper proposes the setting of high standards but the University should consider whether its sense of purpose is such that it should try and lead the way in some instances, or just follow / meet the direction that much of the HE sector is already taking. On a local level there are very few suitable exemplars to be used as a means of public engagement and this could be considered, particularly in smaller scale student housing projects to showcase what the overall environmental benefits of low and zero carbon domestic scale buildings.

Other Estate sustainability considerations

Whilst not directly impacting on the Scope 1& 2 emissions there are other important considerations for the estate which either drive scope 3 emissions or influence its environmental sustainability.

Embodied Energy & Carbon

The construction of new buildings is the highest sources of overall emissions due to the energy levels required in the extraction and conversion of raw materials into finished building materials. The University should seek to challenge and optimise material selections to try and minimise this embodied energy and carbon in any new build. However the purpose and quality requirements of higher education buildings also mean that some low embodied energy construction methods or material choices may not suit and so this issue needs to be reviewed and tailored to each individual site/building situation. The decision to refurbish rather than replace buildings similarly needs to be considered carefully on a case by case basis and in many instances it may lead to an extensive renewal/refurbishment project rather than a straight demolition and replace. A consideration of whole life energy, carbon and cost should be made as part of the evaluation of these decisions.

Bioversity, Site Heritage and Stakeholder Accessibility

In the past four years the University has developed its Bioversity initiative seeking to develop its external grounds to maximise biodiversity whilst retaining a sense of history and of place and linking directly to the University's current and future educational purpose. This has influenced planting schemes in areas in the North Holmes pocket habitats such as the Jubilee Orchard, wild life pond, Physic Garden and Sound Garden. It is now starting to break out of the confines of the original "monastic" wall to start to develop and work with other partners sharing the Canterbury St Augustine's World Heritage site. The University occupies part of this site and gives it a unique international identity, but it also brings constraints with part of the site being a scheduled monument with the remainder, including the Prison site, in an Area of Archaeological Importance. The links and views to and from the Cathedral, Abbey and St Martin's Church sites are important to any redevelopment as are reflecting the heritage value of the site pre and post the C16th dissolution of the monasteries. As all three campuses are in essentially urban environments the use of green roofs and green walls should be adopted where possible to enhance biodiversity. At Medway the facilities form part of the important development and regeneration of Medway after the closure of the dockyard. At Broadstairs the site sits on former agricultural land but reflects to an important part of the regeneration of Thanet. The University's position, links with and accessibility to the communities it serves are important considerations to the redevelopment plans.

Pedestrian, vehicle and waste flows.

Three other competing demands for the use of external space come from pedestrian and vehicle flows, car parking and waste management. The sense of arrival and routing through the main sites for pedestrians is an important consideration. At North Holmes the sense of arrival and welcome from Lady Wootton's Green needs remodelling and the entrances at Old Sessions need re thinking in conjunction with the Prison. The opportunity to recreate the Pilgrim's route from the Cathedral to St Martins should be reviewed. Vehicle flows remain important, although the University's drive through its travel plan is to encourage higher adoption of alternative means of transport by students and staff. The update of the 2009 Travel Plan and a resurvey of staff and student habits will be conducted in parallel to the master planning exercise. The revised travel plan will need to respond to the Canterbury City Council Travel Strategy forming part of the 2014 Local Plan, which focuses on improved traffic flows, reduced car parking, improved park and ride and public transport. The overall number of parking spaces available is unlikely to increase; whilst a short term increase has been achieved from the acquisition of the former prison these will be offset by reductions as properties are disposed. Planning policy severely restricts the number of spaces allowable under any new development. A pilot for a pay at cost electric car charging point will be planned for Old Sessions and as demand starts to increase charging points will need to proliferate across the estate. The need to match demand for cycle storage and showers will remain. The University waste policy is driving higher levels of separation of waste streams, increased recycling and a waste contract which is ensuring that a reducing mass of non-recyclable waste is going to energy production rather than landfill. Waste flows, intermediate marshalling areas and final exit points need to be considered at all sites.

Summary

The University's Estates Framework confirms that any redevelopment of the Estate should seek to minimise its environmental impact and that any new build should be built to the highest environmental standards. The proposals within this low carbon vision document are to be fully considered as part of the master planning exercise to ensure that this requirement is met to enable the University to meet national emissions targets for 2020 and 2050.

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Reference 1: A key finding of the WGI AR5 is, "It is extremely likely that human influence has been the dominant cause of the observed warming since the mid-20th century." [WGI AR5 SPM Section D.3, 2.2, 6.3, 10.3-6, 10.9]

http://www.ipcc.ch/

Reference 2: DECC 2050 pathways

https://www.gov.uk/2050-pathways-analysis

Reference 3: DEC 2013 Fossil Fuel Price projections

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/212521/130718_decc-fossil-fuel-price-projections.pdf

Reference 4 : HEFCE 2010: Carbon baselines for individual Higher Education Institutions in England

https://www.hefce.ac.uk/media/hefce/content/pubs/2010/rd1410/rd14_10.pdf

Appendix A - 2013-14 Annexes A to E V3 100914 MW_RT