Renewable Energy at the University of Cambridge

A proposal for the incorporation of greater purchasing and production of renewable energy into University policy

Submitted by
Cambridge Zero Carbon Society

for the consideration of the
Environmental Strategy Committee

January 2012

This proposal is related to the activities of '**Energise Cambridge**':
a student campaign group, jointly run by Cambridge Zero Carbon Society and the Cambridge Hub, aiming to persuade the University to increase its use of renewable energy,
and encourage Cambridge students to reduce energy use, while engaging in meaningful action on climate change.

Authors of this submission: Daisy Haywood, Jessica Walsh, Isobel Braithwaite, John Wallis, Rhiannon Mulherin and Christopher Barry.

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Renewable Energy at the University of Cambridge – Submission from Zero Carbon Society *Contents:*

Executive Summary

As an international centre of learning, research and critical thought, the University of Cambridge has a key role to play in tackling climate change on a number of fronts. The University's decisions and actions over the next few years will determine not only its own environmental impact, but will also define its national and international place as either a leader or laggard in the response to this global challenge.

In 2007 Australia's PM Kevin Rudd said, 'Climate change is now one of the greatest moral and economic challenges of our time.' This sentiment has been echoed by a significant and growing number of Cambridge's own academics, many of whom devote their work to evaluating the impacts of climate change and finding solutions for these issues.

Climate change is a long-term threat, and as such poses a major challenge to human systems of governance and decision-making, which typically operate on much shorter timescales. We believe that the successful implementation of ambitious and practical strategies to reduce emissions quickly will be a key determinant of the degree of change, and that institutions such as Cambridge have a fair level of responsibility in that regard.

This paper outlines our response to the University's current environmental policy on climate change, most notably the Carbon Management Plan, and presents a series of key recommendations we ask the University to consider when choosing and implementing an energy policy. It is also an invitation to engage in a more collaborative dialogue with students and staff on the defining issue of the 21st Century.

Specifically, we ask the University of Cambridge to:

- Commit to a specific and ambitious carbon intensity target to reduce the University's use of fossil fuels, to ensure that the atmospheric CO_2 is stabilised at a concentration which will avoid greater future costs and lessen the risk of catastrophic impacts. For example, the University should aim for a carbon intensity of 100g CO_2(e)/kWh of energy used by 2030, in line with the targets set by the UK Committee for Climate Change in 2008. We envisage that this would be in addition to the existing target to reduce emissions by 34% by 2020 from 1990 levels.

- Recognise that serious action on climate change requires increased investment **now**, and explicitly acknowledge that to reach the existing (and proposed) carbon reduction targets both energy efficiency and renewable generation strategies will be required. To demonstrate their commitment to climate change, the University should adopt a 'cost-effective' policy, rather than a 'cost-neutral' approach towards renewable energy.

- Coordinate and provide funding for a thorough cost-effectiveness analysis on alternative renewable options for the University, to identify cost-effective solutions that will achieve the existing carbon reduction target and the proposed carbon intensity target and to calculate the minimum cost required to implement these solutions.

- Increase the awareness of students and staff on the steps the University is taking to reduce its carbon emissions, including a transparent account of the carbon reductions achievable with the current carbon management budget. This could occur through a public Position Statement or revision of the Cambridge Climate Change Charter (2007).

We also ask that the University acts in a timely manner to implement these recommendations before the next energy contract is finalised in September 2013. We present an action plan that we urge the University to consider and implement within this timeframe, also providing possible options on how to fund renewable energy projects.

This submission has been endorsed in principle by several members and organisations of the University of Cambridge (see Appendix 1).

1. Motivation for this Submission

1.1 The global impacts of climate change on society, the environment and economy over the coming decades are projected to be immense

Climate change is one of the major challenges of the 21st century. The Intergovernmental Panel on Climate Change (IPCC) has stated that warming of the climate system is 'unequivocal', that 'there is *very high confidence* that the net effect of human activities since 1750 has been one of warming' and that 'continued greenhouse gas emissions at or above current rates would cause further warming and induce many changes in the global climate system during the 21st century that would very likely be larger than those observed during the 20th century' (IPCC, 2007).

The IPCC's Fourth Assessment Report (2007) provides thoroughly researched evidence that climate change has already resulted in increases in global surface temperatures and good evidence that we are likely to see rising sea levels, decreases in snow and ice extent and increased frequency and intensity of natural disasters, including flooding and cyclones. These changes in the environment will have dramatic consequences for society, such as decreased food security and increased health issues particularly in developing countries.

At a more local scale, it is expected that Cambridgeshire county will experience hotter, drier summers; warmer, wetter winters; reduced summer rainfall, but more torrential downpours and flooding; more severe, extreme weather events, including storms and droughts; and rising sea-levels, particularly affecting low-lying parts to the North of Cambridgeshire (Cambridgeshire County Council, 2008).

1.2 Mitigating these threats requires bold action at every level, with ambitious carbon reduction targets and practical plans through which to achieve them

Strong local, regional, national and international action is needed to mitigate and adapt to the impacts on climate change. In order to reduce the chances of extreme climate change, global temperatures must not rise above 2℃ from pre-industrial levels (Committee on Climate Change, 2008). This science-driven target requires global emissions to peak before 2020 and then decline rapidly by 2050. In line with this, the UK is committed to cutting its greenhouse gas emissions by 80% by 2050 (Climate Change Act 2008).

Due to the inertia in the climate system – estimated at around 25-30 years or more – the impacts of climate change will increase for several decades even if emissions can be reduced and the atmospheric CO_2 concentration stabilised at much lower levels in the near future. A review recently published in Nature Climate Change evaluated 193 studies of modelled emissions pathways designed to avoid temperature increases over 2℃, and found that many were already obsolete (Rogelj *et al.*, 2011). The only set of model scenarios in which they found a 'likely' (greater than 66%) chance of remaining below 2℃, was when emissions were modelled to peak between 2010 and 2020 and fall to a median level of 44 Gt CO_2 equivalent (e) in the atmosphere in 2020.

They conclude: 'our analysis confirms that if the mechanisms needed to enable an early peak in global emissions followed by steep reductions are not put in place, there is a significant risk that the 2℃ target will not be achieved.' There is still a 40% gap between the 2 degrees climate goal and current international emissions targets through to 2020. Evidently there is a need for significant and urgent changes in policy and practice at a range of levels – individual, institutional, national and international – if we are to avoid runaway change and damage to the natural systems capable of climate regulation and buffering services.

Box 1: Principles behind setting emissions reductions targets

Targets should reflect scientific evidence, and should represent an **equitable** contribution to climate stabilisation, be time bound and have a clear timeline for progressive reductions. They must be responsive to current scientific understanding of the climate system and the consequences of climate change, including the levels of greenhouse gas stabilisation required to prevent 'dangerous' climate change - widely used to refer to the 2℃ threshold above which the view of many climate scientists is that the change may become irreversible.

An equitable response must reflect the principles of common but differentiated responsibilities and respective capabilities outlined in the United Nations Framework Convention on Climate Change (UNFCCC). Developed societies must make larger percentage reductions to fulfil these responsibilities, because of their greater historical contribution to the problem and higher capacities for mitigation and adaptation, and to allow for increased energy access in developing societies. The precautionary principle also advises anticipating likely increases in the required response. These considerations increase the rate and extent of reductions needed locally, compared with global targets.

The **sole criterion** for setting over-arching targets for the University should be to define a **sufficient response**, as outlined above. Therefore, cost and feasibility should not be considerations in setting targets, but only in identifying means for their achievement.

Adapted from the Submission to the Vice Chancellor on Sustainability at the University of Queensland, UQ Climate for Change, 2009.

1.3 Why should the University reduce its carbon emissions, commit to serious action to mitigate climate change and choose to purchase renewable energy?

In 2009, 35% of the UK's domestic carbon footprint was produced by the energy supply sector - some 200 million tonnes carbon dioxide equivalent ($MtCO_2e$) (Department of Energy and Climate Change, 2011). Since fossil fuel use accounts for the largest proportion of CO_2 emitted worldwide, we argue that switching to alternative sources of energy and investing in low carbon energy generation technology is one of the biggest steps an institution can take to reduce its carbon footprint.

People and nations who contribute the most to climate change are often the least affected by its impacts (UNFCCC, 2007). Those in developing countries, as well as future generations, have no choice but to live with the environmental impacts that occur in the next decade. Therefore, each of us, and particularly large emitters, have a moral responsibility to reduce their emissions as much and as quickly as feasible.

Action on climate change also makes financial sense. The benefits of averted damage in the future significantly outweigh the immediate costs of mitigation by moderate investment (Stern, 2006). By investing in energy efficiency measures the University can make major cost savings on its electricity bills providing another incentive, as recognised in the Carbon Management

Plan (University of Cambridge, 2010). By reducing our reliance on fossil fuels, the University will increase its long-term energy security and avoid the rising costs of non-renewables due to scarcity and environmental legislation. Furthermore, in the context of peak oil and price volatility, reducing dependence on limited supplies of fossil fuels makes sense for a number of other reasons. By supporting renewable energy research and industry, Cambridge has the power to improve the economic viability and growth of the renewable energy sector and help to drive the transition to a low-carbon economy.

It is in the University's own interests to be a leader when it comes to tackling climate change through real emissions reductions, without compromising the quality or quantity of research produced. The general public and Cambridge students are becoming increasingly interested in how Universities are responding to this responsibility, and top academic institutions around the world have made some impressive steps in reducing their impact and responding to climate change (Appendix 2). It also presents a unique opportunity for all members of the University to work together towards the long-term vision of the University, providing the possibility of new and fruitful collaborations between management, research and education.

1.4 A call for stronger action and commitment

It is for these reasons, we, the Cambridge Zero Carbon Society, call for urgent and immediate action on climate change. As young people, we will have to face the consequences of the decisions made today, and therefore seek to ensure that our needs and those of future generations for climate stability are met. While the University is already making progress on reducing its emissions and overall environmental impact, we are calling for stronger action and an increased commitment to building a sustainable future.

In October 2011, the Cambridge Zero Carbon Society and Cambridge Hub jointly launched 'Energise Cambridge' - a campaign group with the dual aim to persuade the University to increase its use of renewable energy and to encourage Cambridge students to engage in and promote meaningful action on climate change. This group is in the process of gathering support for this submission from members of the University, through endorsements by relevant academics and groups within and outside the university, and through a survey to gauge interest and support for renewable energy by students and staff (Appendix 1).

Above all, we are calling upon the University of Cambridge's managers, staff and students to take ambitious and meaningful action on climate change and environmental sustainability, with the urgency and commitment that the unfolding global emergency demands.

1.5 Guiding principles for environmental decision-making at the University of Cambridge

In consideration of University of Cambridge's high profile as a corporate citizen, a platform for research and innovation, a major employer and a public educator, we see the following principles as vital in framing the University's response to climate change and a pro-active approach to sustainability:

1. The only ethically acceptable path that we can take is one directed to preventing dangerous climate change and environmental degradation. Therefore, University policy should be based on, and responsive to, the most up-to-date climate science and reach a targeted emissions reduction (refer to Box 1).

2. University strategies should be inclusive to all stakeholders and have a transparent decision making process.
3. Forward thinking is vital: university planning and actions should be preparing for the future, so that we mitigate irreversible impacts and save money in the long term.
4. The University should adopt a strong leadership position in the international response to this environmental crisis.
5. Most importantly, the University should acknowledge that additional financial expenditure on cost-effective solutions is required as soon as possible to implement actions that significantly reduce carbon emissions and future climate change impacts. Current 'business-as-usual' expenditure is not adequate to reach a safe climate.

We see the fifth principle as a priority, given the University's current policy that additional actions to reduce carbon emissions, other than energy efficiency schemes, should be 'cost-neutral' (refer to section 2.2).

2. Energy usage at the University of Cambridge

The University understands that its impact on the environment should be minimised and is active in improving its environmental practices and management, as stated within the University Environmental Policy. In December 2007, the University signed the Cambridge Climate Change Charter (see section 3.1), which acknowledges the increasing impact of climate change and makes a commitment to tackle this issue. Initiatives include energy conservation and efficiency within buildings, high environmental standards for new buildings, a requirement that all new large buildings generate at least 10% of their energy from on-site renewables, and engaging in research and local and national initiatives on climate change[1].

2.1 Current and past energy usage

In 2008/2009, the University Estate used 109.9 million kWh of grid electricity and has been on an upward trend for several years, mainly due to expansion of research activity. The total usage of electricity is forecast to be approximately 122.9 million kWh in 2011/2012.

Fig. 1 Wind turbines at the Burton Wold Wind Farm

For reference, this amount of electricity would require approximately 28 E70-E4 wind turbines at 2 MW nameplate capacity, similar to the 10 turbines at Burton Wold Wind Farm (see Fig. 1). Through a long term power-purchase agreement with E.ON UK[2], this wind farm will contribute £280,000 to a local community fund during its 25 year life. This demonstrates that the scale of the University's energy usage is by no means trivial, particularly when taking into account the temporal profile of energy demand and production, and we recognise that the creation of new renewable sources will not be feasible without associated costs.

[1] http://www.admin.cam.ac.uk/offices/em/sustainability/
[2] https://solutions.mckinsey.com/climatedesk/

The carbon dioxide emissions associated with energy use in buildings at the University of Cambridge almost doubled between 1990 and 2009. Total emissions, which included not only those from grid electricity, but also natural gas, heating oil, steam and vehicle fuel, were 77,660 tonnes of CO_2(e) in 2008/2009. This places the University of Cambridge as the fourth highest CO_2(e) emitter of all UK HEIs (Carbon Management Plan, 2010).

2.2 Energy procurement

The majority (97%) of this energy is bought from Scottish and Southern Energy and a very small fraction is produced by on-site renewables. The electricity Scottish and Southern supply to the University currently is composed of 29% coal, 59% natural gas and 10% renewables. Since 2008/09, when the University paid £11.8m for this electricity, the cost actually decreased in 2010/2011 to £8.505m, with estimated figures for 2011/2012 at £8.790m. This was due to a change in the energy contract, with a reduction in the price of electricity, and savings through energy efficiency projects throughout the University. In addition to the purchase of electricity, the University will be required to pay £1.03m in carbon taxes for 2011/2012 as a result of the implementation of the Carbon Reduction Commitment (CRC) Energy Efficiency Scheme. This figure does not include the emissions from the colleges or University occupied buildings at the Addenbrookes Hospital.

Before 2006, the University procured a proportion of its electricity requirements from renewable sources on a cost-neutral basis (due to a complex relationship between Climate Change Levy, VAT and the 'green premium'). In 2004, the University secured a two year contract with Scottish & Southern, where 23% was green energy (wind, wave, solar and biomass), 76% from hydroelectric sources and 1% from fossil fuel sources. However, in 2006, the University's Planning Committee decided not to renew the contract, preferring to prioritise energy efficiency measures instead. This is discussed further in Section 4.

2.3 Challenges and opportunities

National legislation will undoubtedly continue to demand stronger action on climate change from higher education institutions (see section 3.4). Beyond this, the University is in a privileged position to influence wider understanding of the implications of climate change, and promote national and international commitment to tackling it. We believe it has a significant responsibility to maximise its impact in enabling the transition to a sustainable environment, economy and society.

The University of Cambridge Carbon Management Plan (2010) has an extensive list of proposals for the University's energy management, and these should be fully explored immediately. One component we feel deserves significantly more attention is the sourcing of electricity from renewable energy (section 5.3.4 WA4), for reasons explained in section 1.3.

3. Policy and legislative context

Any strategic action plan to reduce carbon emissions should be written in the context with the current institutional, local, national and international policies and legislations. Failing to do so would make the plan irrelevant, limiting the likelihood of reaching any set targets. It is also important to understand and consider the economic, social and political factors surrounding the issue.

3.1 University of Cambridge Policy

The Cambridge Climate Change Charter was signed in 2007[3]. Compared to many equivalent pledge programmes made by institutions of comparable status (Appendix 2), this charter is somewhat lacking in specificity and limited in its scope. We believe that a new, formal and up-to-date statement of the University's position on the issue, reflecting the current science and state of affairs, would be of tremendous value.

The University of Cambridge Carbon Management Plan 2010, as developed by the Environmental Strategy Committee, sets out how the University can achieve reductions in carbon emissions by 2020 as required by the Higher Education Funding Council (HEFCE) Carbon Reduction Target and Strategy for Higher Education in England. Each HEI is required to contribute to the sector target of 34% reduction on 1990 emissions by 2020.

Due to the almost doubling of emissions associated with energy use in buildings since 1990, it would be necessary for the University to make a 60% cut in its 2005 building-related emissions to comply with the sector target. However, the Carbon Management Plan proposes to treat emissions associated specifically with research activities separately from those associated with buildings and other activities. This would mean that only the carbon intensity of research activities, rather than absolute emissions, would have to be reduced by 34%. Whilst we understand the value of the University's research and the potential for the outcomes of some of it to aid adaptation and mitigation efforts, we nevertheless feel that the University has a responsibility to meet the HEFCE's emissions targets fully.

Limitations of the Carbon Management Plan

The Carbon Management Plan relates only to the University Estate. It does not include the 31 colleges, which also have a responsibility to reduce their carbon emissions. A comprehensive survey of the environmental performance of each college is carried out by the Cambridge University Environmental Consultancy Society each year, with recommendations of improvements for the next year. However, at present any improvements achieved at colleges are based on independent efforts and there is lack of obligation prescribed from an over-arching organisational body.

Furthermore, as required by HEFCE, the Carbon Management Plan only covers Scopes 1 & 2 emissions in its targets, and not Scope 3, which are indirect emissions associated with water, waste, farm animals, business travel, student & staff commuting and procurement. These can be very significant, with De Montfort University finding that Scope 3 emissions accounted for 72% of the footprint for the baseline year of 2005/06 (People and Planet Green League Table, 2011). The University of Cambridge, along with the entire sector, should pursue a way of measuring them accurately so they can be included in Carbon Management Plans in the future.

3.2 Cambridge City Council

The Cambridge Climate Change Strategy and Action Plan sets the target to reduce the city's carbon dioxide emissions from 6.2 tonnes per person in 2005 to 4.8 tonnes per person by 2020 (23% cut) and 0.7 tonnes by 2050 (89% cut). Local plans promote renewable energy

[3] http://www.admin.cam.ac.uk/offices/em/sustainability/environment/climate/charter.pdf

generation (e.g. the Cambridge Local Plan 2006 and the Sustainable Design and Construction Supplementary Planning Document). If students are included in these stated aims, significant action will be necessary at college level both to facilitate and promote such changes, and this could be an area in which collaboration with the council to achieve the necessary reductions would be beneficial to both parties.

3.3 Cambridgeshire County Council

In 2008, the County Council adopted a revised Climate Change and Environment Strategy which includes a target to reduce carbon dioxide emissions by 2% a year and to increase the proportion of renewable energy produced and used in the county. The Cambridgeshire Renewables Infrastructure Framework (CRIF) is currently examining the potential opportunities to generate renewable energy in Cambridgeshire[4].

The Council has taken an ambivalent attitude to the building of wind turbines on public land, having scrapped proposals for four major wind-farms in 2011. This was for reasons of visual pollution. This position is, however, being reconsidered, and a proactive endorsement of this kind of renewable energy by the university would potentially be influential in persuading the Council to follow suit, with highly beneficial results.

3.4 National policies

The UK adopted the Climate Change Act in 2008, which sets a target for the UK to reduce carbon emissions to 80% below 1990 levels by 2050. The UK's Renewable Energy Strategy was launched in 2009, and outlines how the UK aims to move towards generating 15% of its energy from renewable sources by 2020. The Carbon Reduction Commitment (CRC) Energy Efficiency Scheme is a mandatory carbon emissions reporting and pricing scheme to cover all organisations that have more than 6,000MWh of half-hourly metered power consumption, including the University of Cambridge.

This scheme does not take into account the particular emissions factor for the power used by a particular organisation, and instead bases its calculations and payments on the average carbon intensity of National Grid electricity. The CRC scheme is intended to promote efficiency savings, which are important whether energy supply is renewable or not since capacity is limited and new infrastructure is expensive. This is based on the assumption that work towards decarbonisation of the grid is happening on a separate basis and will not proceed faster simply because a large number of consumers decide to switch to renewable suppliers. The CRC scheme will therefore not reward a switch to renewable energy supply, and we anticipate that this will be considered an argument against moving to renewable energy any faster than the grid as a whole. However, we argue that both efficiency measures and investment in renewable capacity are essential to meet this challenge responsibly, and that this should be considered as a separate matter.

3.5 International commitments

The Kyoto Protocol, established by the United Nations Framework Convention on Climate Change (UNFCCC) and ratified in 1997, set legally binding targets for 37 industrialised developed countries to reduce greenhouse gas emissions by 5% from 1990 levels in 2008-2012.

[4] www.crif.citizenscape.net

In December 2011's Climate Summit in Durban, the international community made significant progress in working towards a global treaty that is hoped to come into effect from 2020. However, as pointed out by WWF-UK's Head of Climate Change, Keith Alliott, the scale of the reduction proposals under discussion at Durban are commensurate with projected temperature rises of around 3.5-4ºC according to mainstream climate modelling. After the Copenhagen Accord, Japan and Norway are the only two developed countries to make sufficient pledges (Rogelj *et al*., 2010). This is significantly above the 2℃ incr ease, which is considered the threshold for dangerous climate change (IPCC, 2007). It is in this context that we feel it is particularly important for the University to take action that goes beyond its legal obligations, as a signal that it is taking this threat seriously and is acting accordingly in its own affairs.

4. Alternative options for renewable energy

In this section, we discuss a range of options for how the University could significantly reduce its carbon emissions. We would have preferred to have investigated these options in more detail, conducting a cost-benefit analysis for each proposal, incorporating the energy embedded in the creation of new infrastructure and including estimated pay-back times for each option. However, due to lack of available data, we suggest that this analysis should be a major outcome of this report, as a collaborative effort between students and staff.

4.1 Light green renewable energy tariff

Electricity suppliers have a statutory obligation to supply a rising percentage of green electricity to customers (the Renewables Obligation (RO)). Many suppliers now offer 'green tariffs' at a premium, including Scottish and Southern Energy. We attempted to collect information from other energy providers about their capacity to provide the University of Cambridge with renewable energy, their sources of renewable energy and an estimated cost of purchasing green electricity. However, we were largely unsuccessful since we are not officially involved with the energy procurement procedure of the University.

The complexity of the electricity market may not be grasped by the general public and it is difficult to prove that this premium reflects actions that generate and supply renewable electricity that are additional to the regulatory requirement of the RO - so called 'regulatory additionality'. This is why these tariffs are often labelled 'light green' and offer no real measurable carbon reduction when a nationwide perspective is taken. Whilst in the long run it is hoped that such tariffs will displace high carbon sources and decarbonise the grid, this will only take place after demand has stopped growing. It is therefore, not likely that such a switch to a light green tariff would make a significant difference in an institution's carbon emissions. It was for these reasons that the University chose to end its green energy contract in 2006.

On the other hand, if the University were to switch to a light green tariff, they would make a visible statement of commitment to environmental principles, while increasing the demand for renewable energy. This change would have symbolic value and generate good publicity for the University, as it has done for the University of Oxford, who have been on a green tariff for several years.

4.2 Dark green renewable energy tariff

Instead of using a green energy tariff from one of the conventional energy suppliers, the University could switch to a supplier that sources a significant component of its energy from

renewables. Examples of energy suppliers in the UK with strong environmental commitment include Ecotricity, LoCO2 Energy, Good Energy and Green Energy UK (refer to Table 1).

Table 1 Renewable energy providers and their composition of energy sources

Source of energy	Ecotricity	LoCO2 Energy	Good Energy	Green Energy	National average
Coal	17.5%	0%	0.0%	0.0%	28.9%
Natural gas	24.0%	84.0%	0.0%	64.0%	44.2%
Nuclear	2.6%	0.0%	0.0%	0.0%	17.3%
Renewable	54.1%	16.0%	100.0%	36.0%	7.9%
Other	1.7%	0.0%	0.0%	0.0%	1.7%
CO_2(e) emissions (kg/kWh)	0.267	0.311	0.000	0.122	0.450

(Source: www.electricityinfo.org)

Whilst these renewable energy tariffs will significantly reduce the University's carbon emissions, they are likely to be more expensive and could only account for a small proportion of the University's energy usage in the short term, due to limited capacity. Ecotricity's operating model is impressive, since all profit made from energy supplied is reinvested in new renewable infrastructure projects. Even if a small proportion of Cambridge's energy were bought from Ecotricity initially, this would still be of value in the longer term.

Furthermore, if the University were to use one of these tariffs for at least some of its energy supply, it would act as a strong message both to the energy market and the public about Cambridge's commitment to tackling climate change by reducing our use of energy sourced from fossil fuels.

4.3 On-site renewable energy generation

Ten percent of energy requirements of new buildings in the University of Cambridge are provided by on-site renewables to satisfy local planning requirements. While the investment in on-site renewable energy generation of the University could be significantly increased, a major potential problem may be the current local political opposing stance to wind power in the county. Feasibility studies were conducted in 2008 and 2009 to assess opportunities for renewable energy systems and these options should be explored fully.

An increase in on-site renewable energy capacity would be a good long-term investment for the University. It would also enable the University to become less reliant on non-renewable energy sources and avoid increasingly volatile electricity prices. However, government support for renewable energy generation (most notably the Feed-in-Tariffs) can sometimes be inconsistent due to changes in government policy.

Case Study: The University of Ulster

The University of Ulster erected an 800kW wind turbine generator in 2008, with a total project cost of £1.25m. Situated adjacent to the campus playing fields, the turbine is a clear symbol of the University's commitment to environmental sustainability. Annually,

the turbine generates approximately 1.6GWh of electricity and displaces some 870 tonnes of carbon emissions per year. This represents 7% of the University's electricity use and 4.5% in total University carbon emissions. Financially, the wind turbine generator saves the University approximately £230,000 annually, with approximately one third of this coming from the sale of Renewables Obligation Certificates and the remainder from avoided grid electricity costs (People and Planet Green League Table, 2011).

4.4 Off-site renewable energy generation

The University could also further investigate the opportunity for large scale off-site renewable generation schemes on land owned by Cambridge in other parts of the UK, which may include wind turbines and anaerobic digestion. Due to the scale of such schemes, they may be co-developed with another company. Alternatively, the University could lease some of its land to a renewable energy company for the purpose of developing large scale renewable energy schemes.

Such a large scale project would have a potential for good returns and increased protection from market volatility. It would also be a very bold statement of the University's commitment to renewable energy generation. However, such ambition is also likely to face obstacles, including difficulties in obtaining planning permission, due to local resistance towards the installation of renewable energy plants, and inadequate funding opportunities.

4.5 Carbon offsets

Carbon offsets should only be used as a last resort to counter unavoidable emissions. Any offset projects must demonstrably result in a real and permanent net reduction in emissions and an increase in social and/or environmental benefits that would not otherwise have been attained. We do not recommend the University of Cambridge to invest in carbon offsets to reduce their carbon emissions in the immediate future. However, if the University ultimately decided to offset their remaining carbon emissions to achieve a zero carbon footprint, it would be essential that they contract a reputable and responsible company, such as Carbon Retirement[5].

4.6 Combination of options

Of course, it is possible that a combination of the above options may be the most cost-effective method of reducing the carbon emissions of the University, with added benefits of security in diversity.

[5] http://www.carbonretirement.com/

5. Our recommendations

The University of Cambridge has made significant progress so far in its monitoring and management of carbon emissions, particularly in regards to energy efficiency in buildings. However, if the University is to truly take responsibility for its contribution to climate change, more needs to be done. The Cambridge Zero Carbon Society has identified four key recommendations that the University should act upon to move closer and at a faster pace towards environmental sustainability.

5.1 Commit to a carbon intensity target

The vision of Cambridge Zero Carbon Society is to ultimately see the University source 100% of its electricity with renewable energy, or at least energy not derived from fossil fuels, to have a zero (or negligible) carbon footprint. We understand that this may not be possible in the near future given financial and logistical constraints, although it may be a valid longer term ambition.

Instead, we urge the University to commit to reducing their carbon emissions from electricity consumption, through the use of renewable, or at least cleaner, energy. We suggest that the University should commit to a pathway towards a carbon intensity of 100g CO_2(e)/kWh of energy used by 2030, as set in the UK Committee on Climate Change's 2008 report on building a low-carbon economy. This should be set in addition to the existing target of 34% reduction of emissions from 1990 levels by 2020. The carbon intensity target would also adhere to the guiding principles we outlined in section 1.5, and is based on science, rather than budget, feasibility or legislative requirements (refer to Box 1). As a huge energy consumer, by stating the specific carbon intensity that it intends to purchase, the University would help stimulate the market for renewables, encouraging other institutions and organisations to follow suit. This target does not dictate the specific energy mix, providing the University with flexibility.

An alternative option would be to call for a specific target of 'renewable energy' production per year (e.g. 50% of electricity usage to be sourced from renewable energy by 2030). However, we have avoided recommending this path, because it is not aligned with a specific reduction in carbon emissions, making it more of a token gesture rather than a commitment towards science-driven targets. Therefore, we suggest the University should avoid this type of target, and instead adopt a target, based on a reduction in carbon intensity.

Recommendation 1:

> The University should commit to a specific and ambitious carbon intensity target, i.e. 100g CO_2(e)/kWh by 2030, to reduce the carbon emissions produced per unit of electricity, and define this target in the environmental policy. We envisage that this would be in addition to the existing target to reduce emissions by 34% by 2020 from 1990 levels.

5.2 Move from 'cost-neutral' to 'cost-effective'

In order to achieve this reduction in carbon intensity (see section 5.1), the University would be required to spend more than what it is currently investing in climate change action. It is quite possible that the £2 million allocated toward carbon reduction projects currently is also inadequate to achieve the existing target of 34% reductions by 2020. It is evident through

marginal abatement cost curves for greenhouse gas emissions, that additional spending is required to achieve the targets set (McKinsey, 2009, Fig. 2).

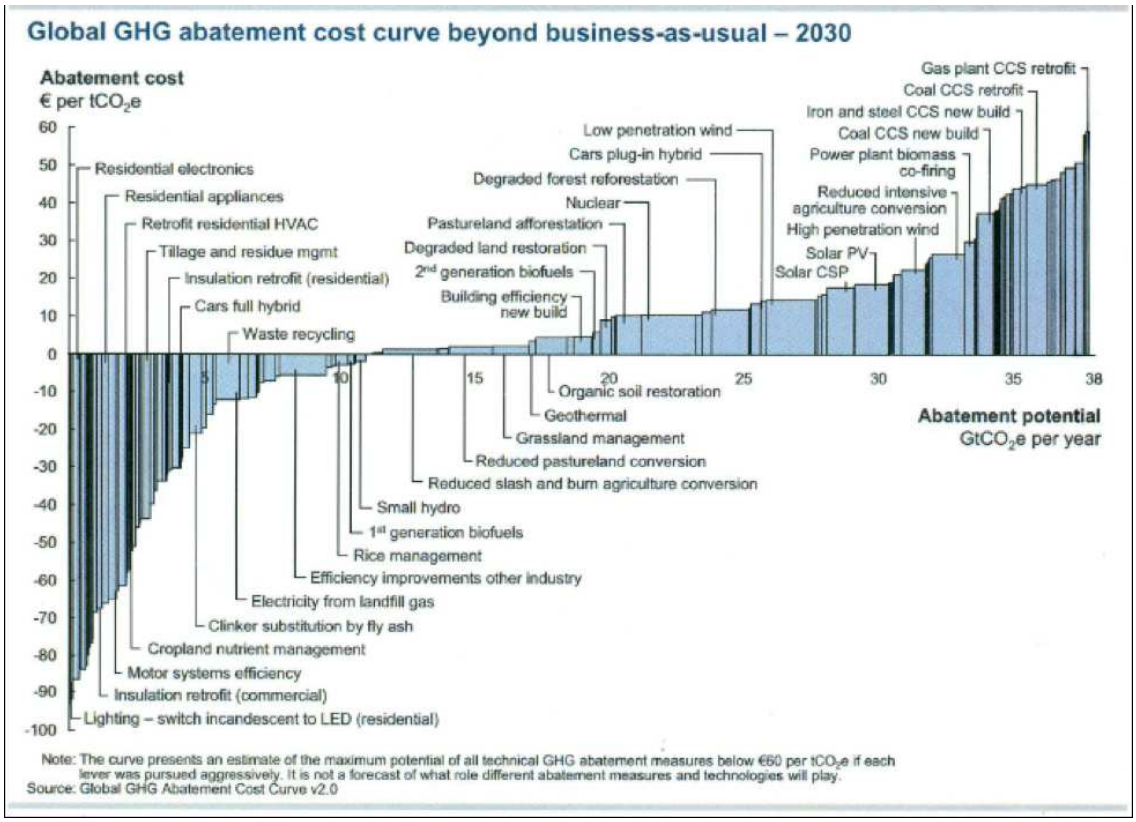

Fig. 2 Global GHG abatement cost curve beyond business-as-usual – 2030 (reproduced from McKinsey, 2009)

We understand that in the current financial situation, the University may be reluctant to pay extra for electricity or invest in renewable energy generation, when there are no legislative requirements, few short-term economic or social incentives, continuous institutional pressure for cost-cutting measures, and apparent obligations as a charity to choose the cheapest option for operational expenditure.

The University should be focusing on the potential savings of purchasing or producing renewable energy over the next 50 years. Rather than being constrained to purchase the cheapest utilities available, the University should include in their environmental policy that they will consider low carbon options, and be prepared to pay a premium for these alternatives if they would result in cost-effective carbon reductions. This frame of thinking has been adopted for the University policy on travel options given to staff, where they are now able to choose a more environmentally preferred method of transport (i.e. train or bus, rather than flying), regardless of cost, in an attempt to reduce Scope 3 emissions. This is supported by the Charities Commission[6], which states that more expensive, environmentally beneficial options may be purchased if they are in the interests of the charity to do so and to accept wider responsibility for society and communities.

It is also important to realise that renewable energy investment would not necessarily have to come from the existing funds available through the University. This funding could be sourced from alternative pools specifically designed for carbon reduction and renewable energy, such

[6] http://www.charity-commission.gov.uk/

as the Feed-In Tariffs and the Renewable Heat Incentive[7], or from generous donors, and the University should take advantage of these opportunities.

For these reasons, in addition to those mentioned earlier about investing in climate change solutions now to avoid future costs, we ask the University to consider environmental benefits when comparing prices of alternative options regarding electricity supply.

Recommendation 2:

> The University of Cambridge should change their stance on the 'cost-neutral' policy in terms of the procurement of renewable energy, to adopt a policy that recognises that serious action on climate change requires increased investment now to prevent the predicted future catastrophic and much more costly impacts. This increased investment should be used to implement 'cost-effective' actions, to ensure that the targets are achieved at a minimal cost[8].

5.3 Conduct a cost-benefit analysis

For the University to commit to a reduction in carbon intensity, in addition to the over-arching target set by the HEFCE to reduce carbon emissions by 34% by 2020, they would obviously want to ensure that the additional funds for climate change action are invested sensibly and that all options are explored, in pursuit of feasible, cost-effective solutions.

To identify renewable energy options that are effective and efficient for such a large-scale project, an in-depth cost-effectiveness analysis would be required. This analysis would calculate the return on investment for each alternative option, and then prioritise investment across the combination of options that would achieve the specified reduction in carbon emissions per unit of energy for the least possible cost. A potential outcome of the cost-effectiveness analysis would be the development of a marginal abatement cost curve for carbon reduction at the University (see section 5.2), demonstrating the cost-effectiveness of all possible options, and highlighting the gap between current carbon reduction budget and the investment required to achieve the existing and proposed targets for the University.

This cost-effectiveness analysis would benefit from expertise in various fields, including but not limited to research in renewable energy technology, environmental policy, economics and financing. We suggest that partnerships are established between the relevant organisations and research groups within the University to build on existing knowledge within each sector, for example the Electricity Policy Research Group and the Climate Leadership Programme.

[7] http://www.fitariffs.co.uk/ & http://www.rhincentive.co.uk/

[8] By cost-effective, we mean achieving a set target for the minimum possible cost, rather than the alternative approach, whereby the objective is to achieve the greatest carbon reductions with a pre-determined budget (i.e. maximum gain). While possibly more realistic due to funding constraints, this 'maximum gain' approach runs the risk of producing actions that are inadequate in making a sufficient reduction in emissions needed to avoid irreversible and run-away impacts of climate change. In the first instance, there should at least be an explicit recognition of the difference between the two approaches, the major obstacles of moving from a budget-focused to a target-focused approach, and the development of a strategy by which this might be achieved.

One attractive option would be for several students to complete year-long internships, in collaboration with the Energy Manager, relevant University research groups and sustainability related initiatives, to conduct this cost-effectiveness analysis. This would allow cutting-edge science and technology to be integrated into important environmental management decisions within the University. It would also create a valuable opportunity for enthusiastic Cambridge students to engage in applied and practical research, while developing problem-solving and decision making skills for their future careers. An alternative option would be to contract a professional consultancy firm. However, this may be quite expensive, may not take advantage of the high-quality research at Cambridge, and would be limited in the opportunities available for collaboration across different research disciplines within the University.

Recommendation 3:

> The University should coordinate and provide funding for a thorough cost-effectiveness analysis on alternative renewable options, to identify optimal, cost-effective solutions to achieve the University's existing carbon reduction target and the proposed carbon intensity target.

5.4 Increase transparency and public awareness of commitments

In addition to our three recommendations on increasing the use of renewable energy at the University of Cambridge, we believe it is important for its members to be informed about the strategies that the University plan to implement to mitigate the impacts of climate change. The Sustainability and Energy website[9] is quite informative and there have been previous efforts to inform stakeholders through presentations such as the Energy Champions Event in March 2011. However, there is much room for improvement. In particular the University should clearly state how the current investments in energy efficiency are predicted to achieve the 2020 target and if it is on track to reach the required reduction of carbon emissions on time. In doing so, it may encourage individuals to change their behaviour to reduce their carbon footprint. This information could be distributed to students and staff via a public Position Statement, brochure, forum or press release, ensuring wide-spread access and publicity.

We also suggest that the University should update and improve the Cambridge Climate Change Charter (2007) to reinforce the University's commitment towards sustainability and climate change action. A revised version could include stronger commitments and information on past achievements in energy reductions. A revision of the document would be fairly easy to complete and could have many potential benefits, particularly through enhanced public perception about the University's stance on climate change and by reminding other local businesses of their commitments on the Charter.

Recommendation 4:

> The University should work towards improving the transparency and visibility of their efforts and commitment to reducing carbon emissions, with the aim of increasing public awareness and participation in climate change action. This could occur through a public Position Statement or revision of the Cambridge Climate Change Charter (2007), and should include an explicit account of the carbon reductions achievable with the current carbon management budget.

[9] http://www.admin.cam.ac.uk/offices/em/sustainability/

6. Implementation of an action plan

In response to our four recommendations to the University of Cambridge (see section 5), we envisage an action plan that would follow three streams of action: (i) policy formulation, (ii) policy implementation, and (iii) project financing. These streams would allow the actions to be implemented by the existing working groups under the Carbon Management Framework (as specified in Fig. 13, Section 5.2, Carbon Management Plan, 2010). As detailed below, we find it of utmost importance to complete the first stages of this action plan before September 2013, which is when a new energy contract will be decided. Therefore, we encourage the University to initiate discussions and begin the planning process immediately to facilitate the rapid delivery of sensible and measurable outcomes in less than two years.

6.1 Policy formulation

There are two aspects to the University of Cambridge Environmental Policy that would require attention by the Environmental Strategy Committee and Planning and Resources Allocation Office. These aspects directly relate to our Recommendations 1 and 2, falling under the responsibility of Working Activity 1 – Policy development and management, in the Carbon Management Plan (2010).

The Environmental Strategy Committee and the Planning and Resource Committee, should agree on a science-based 20-year carbon intensity reduction target in addition to the existing targets to reduce energy consumption and emissions by 2030. This should be written into policy before April 2012.

The Environmental Strategy Committee should agree to move away from a ‘cost-neutral’ approach to renewable energy to the stance that extra investment into ‘cost-effective’ renewable energy projects is required now to avoid climate disasters in the future. Topics of discussion around this debate should include the options that could be considered in the cost-benefit analysis (refer to section 6.2), methods for funding additional renewable energy projects (refer to section 6.3) and the strength of public support for this investment. This policy document should be prepared in conjunction with the new carbon intensity target, to be finalised and accepted before April 2012. The development of these policies should involve staff and student engagement, be transparent and be guided by science (refer to section 1.5).

6.2 Policy implementation

Policy implementation would be carried out under the responsibility of the working groups ‘Emissions Reduction Schemes’ (WA3) and ‘Low Carbon Energy Generation’ (WA4). The first step would be to conduct a cost-benefit analysis on all low-carbon energy options to determine the most cost-effective solutions to reach the carbon intensity target (sections 5.1 & 6.1). This would occur once policies on the target to reduce carbon intensity and the University’s commitment to invest in more renewable energy have been passed in April 2012.

Initially, the terms of reference for this study should be drafted by the Energy Manager, outlining how this study should be conducted, the required outcomes, who is responsible for the research, possible partnership opportunities and the source of funding. This would be completed by the end of April 2012 – one month after agreeing on the newly formulated policies (see section 6.1). As discussed in section 5.3, we believe that this analysis should be carried out by Cambridge students as part of several year-long internships, with each intern

focusing on a specific aspect of the project. Recruitment for these students could occur in May and June, with the programme promptly starting at the end of the Easter Term. These internships should be conducted in collaboration with the Environmental Strategy Committee, the Energy Manager, the Cambridge Environmental Initiatives network and research groups in the university that focus on climate change policy and innovation, renewable energy technology and economics.

The outcome would be a joint report (produced with input from several students and/or interns), presenting the benefits and costs of alternative options to reduce the University's carbon intensity. This would enable decision makers to clearly compare the reductions in carbon emissions achieved for each pound spent on the alternative options and the amount of money required to achieve the set targets. The report would also include several options on how the carbon intensity target could be achieved under different climate and economic scenarios. We believe that it is also important to assess the social equity and acceptability over the life-cycle of each option, to avoid unforseen social or environmental issues.

This report should be completed in June 2013, giving the Energy Manager and the Environmental Strategy Committee time to decide on the best long-term and short-term paths of action, before a new energy contract for the University's electricity is required in September 2013. The findings of the cost-effectiveness analysis should also be incorporated into the Carbon Management Plan (2010-2020), focusing on the long-term financing and implementation aspects of renewable energy projects, in order to reach the 2020 and 2030 targets in just eight and eighteen years time, respectively.

The commitments the University has agreed to should be publicised to students and staff, particularly ensuring that the likelihood of reaching the set targets is transparent and clear. The Environmental Coordinator could work to update the Cambridge Climate Change Charter to reflect the University's current position on climate change, within six months of this submission. This exercise could be completed in collaboration with other members of the Charter, or as an individual organisation, depending on the willingness of other signatories. Alternatively, this information could be incorporated into a Position Statement or brochure.

6.3 Funding for renewable energy projects

Initiatives for sustainability will require investment of new funds and resources, especially to establish those with higher initial costs. It is vital to have a longer term focus on a wider range of benefits than is conventionally applied, while still ensuring the economic viability of the University's full operations.

Purchase and generation of renewable energy should be supported by new funds and by re-investment of savings from efficiency and demand reduction initiatives. A Carbon Reduction Fund could be set up to finance core costs of switching to renewable energy; to generate leverage for accessing corporate, national and private funds; and to facilitate the re-investment of savings generated through efficiency and reduction measures or via trading of emissions reductions or renewable energy certificates. This fund could resemble the model employed by the Harvard Green Campus Initiative[10]. Whether it would be separate from the existing Revolving Green fund and the Salix fund for energy efficiency projects or a pooled fund for both energy reduction and renewable energy projects should be a decision for the Environmental Strategy Committee, depending on the positives and negatives of each option.

[10] http://green.harvard.edu/loan-fund

This Carbon Reduction Fund could draw on internal funding, for example, through capital works as a percentage of building energy costs and through voluntary contributions from departments, research institutions and organisations associated with the University. It is likely to attract interest from the corporate sector and from University Alumni who seek to leave a positive legacy. Another successful financing venture may involve collecting renewable energy bonds from Alumni and other interested stakeholders[11].

7. Conclusion

Zero Carbon Society believes that Cambridge University has the opportunity to be a leader in response to climate change and the challenges of sustainability. We believe that to do less than the measures we recommend in this submission would forsake key responsibilities and opportunities, and would only defer action to a time when it may be both more costly and less effective. Even though there is no legal obligation for the University to reduce its emissions through the purchasing of renewable energy, we should move to low carbon sources in addition to current efforts to reduce our electricity consumption.

We harbour no illusions that switching to low carbon energy will be easy, for Cambridge or the rest of the UK, given the vast amounts of energy involved. Even if major efficiency savings were in the order of 50%, there would still be a major shortfall in renewable supply. In the words of Prof. David MacKay, Professor of Natural Philosophy in Cambridge and DECC's Chief Scientific Advisor, 'It's not going to be easy to make an energy plan that adds up; but it is possible. We need to get building.'

At a national and global level, the windows of opportunity for preventing dangerous climate change and for charting a sustainable path of development are narrowing. Richard Gledhill, PwC's Partner on Climate Change and Sustainability said after the recent Durban Summit that, 'while we now have a road map... the precise destination remains unclear. ... Reaching two degrees will require a revolution in how we produce and use energy.' Institutions such as the University of Cambridge have a decisive role to play in this agenda, through their influence on their stakeholders and on political leaders. It is arguable that no institutions carry a greater responsibility in this regard than our universities (Flannery, 2008).

Cambridge is by all accounts an internationally acclaimed institution, and in the eyes of millions of people around the world its name stands for academic integrity and top-quality scholarship. It is therefore crucial that it lives up to this reputation in regards to its own sustainability and position statement, and is seen to act both rapidly and decisively on climate change. The University should be guided by a sense of urgency and responsibility to younger and future generations in all levels of decision-making.

The Cambridge Zero Carbon Society request a response to this submission and would welcome further engagement with the Environmental Strategy Committee or a representative, to discuss the development and implementation of further initiatives for renewable energy and increased student engagement in energy-saving measures at the University of Cambridge.

[11] http://energybonds.org.uk/

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Appendix 1: Endorsements of this Submission

We the under-signed give our endorsement to the principles set out in this submission, and support the request that its recommendations be considered in full by the Environmental Strategy Committee and higher decision making committees at the University of Cambridge.

Douglas Crawford-Brown Professor Emeritus
Director of 4CMR
See attached letter of support and endorsement.

Simon Redfern
Professor of Mineral Physics, Department of Earth Sciences:
I fully endorse the aims of the Energise Cambridge Campaign. The University of Cambridge could and should be leading the way in a tangible commitment to climate change mitigation, and as a priority should be considering the most responsible way to meet its energy needs through renewable sources. I note that routes to achieving significant improvements already exist through switching to suppliers such as Good Energy.

Dr Nigel Woodcock
Reader in Structural Geology, Department of Earth Sciences:
I support this document in principle.
I agree that the University is in a good position to have a more ambitious plan to reduce its carbon footprint, and to set a good example on carbon reduction both nationally and internationally.

Hans-F Graf
Professor for Environmental Systems Analysis, Department of Geography:
Congratulations for this very well thought of memorandum! I wish you all possible success along these lines and certainly endorse this action.

Professor Stephen J Gillam
Director for Public Health Teaching, Cambridge Clinical School:
I certainly wish to endorse the submission and commend the work of the Cambridge Zero Carbon Society and Energise Cambridge in helping to tackle this vitally important challenge. As the authors state, this is a pressing public health priority and, with its global reach, one that the University should lead on by example.

Robert S. White FRS
Professor of Geophysics, Department of Earth Sciences

Lindsay Galbraith, MA.
PhD Candidate (mobilisation of the idea of climate change through large project planning events) Department of Geography

Lisbeth Jamila Haider and Beatriz Fernandez
University of Cambridge Graduate Union – Environmental Officers
We, the Environmental Officers of the University of Cambridge Graduate Union endorse the submission of “Renewable Energy at the University of Cambridge” by Cambridge Zero Carbon Society and view this as in important step in reducing the University’s carbon emissions and supporting energy from renewable sources.

Cambridge University Student Union

UK Youth Climate Coalition (UKYCC)

Appendix 1 cont: Support from University of Cambridge students

We have also gained support from University of Cambridge students through a survey to gauge their concern for climate change and general interest for renewable energy within the University. We are still collecting responses, although the preliminary results show that our views on climate change are reflected by a broad range of students from many areas of the University.

Over 180 students have responded (47 postgraduate, 127 undergraduates and 7 Alumni), sampled across many schools and faculties, including 47 international students. Over 93% of these students agree or strongly agree that climate change is a serious threat to humanity and the environment at a global level and 87% are concerned or extremely concerned about climate change.

The majority of students believe that the University has equal responsibility in comparison to other sectors to act to prevent climate change (55%) (Fig. 1a). Another 41% of students believed that the University should have a higher responsibility to act, compared to other sectors. Half of the students thought that the University of Cambridge is reducing its carbon emissions, though is not doing enough, while 12% of all respondents thought that the University was doing a reasonable amount (Fig. 1b). More importantly, 20% of students did not know whether the University is doing enough to reduce its carbon emissions. This highlights the need for increased education and promotion of the University's response to climate change.

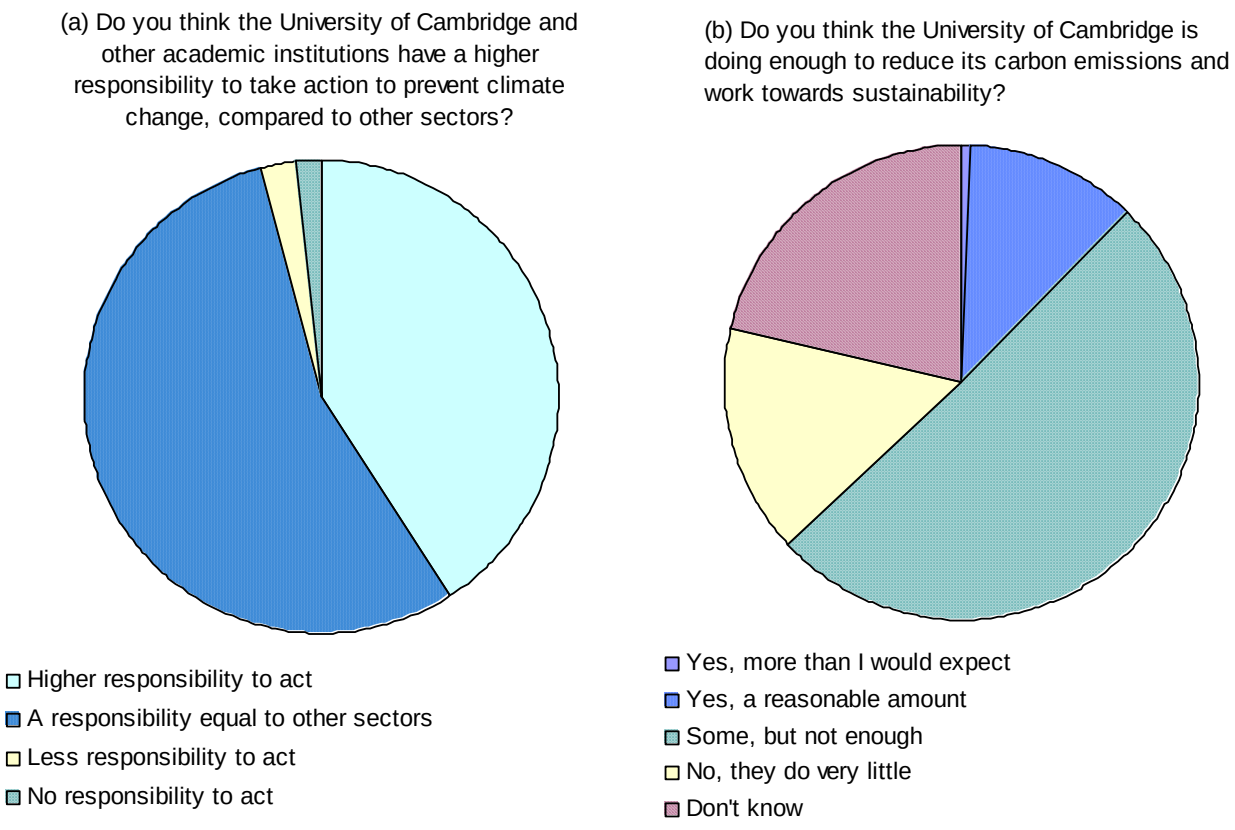
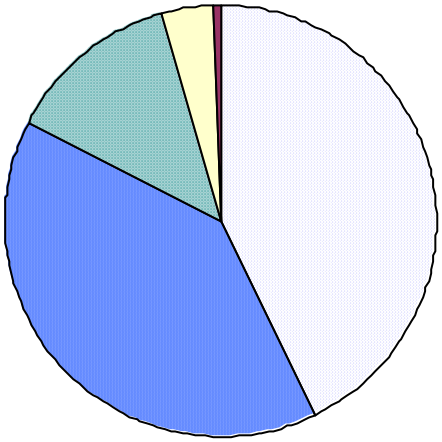


Figure 1 (a) The responsibility of the University to act on climate change prevention compared to other sectors, and (b) the students' opinions about whether the University of Cambridge is doing enough to reduce its carbon emissions (n=182).

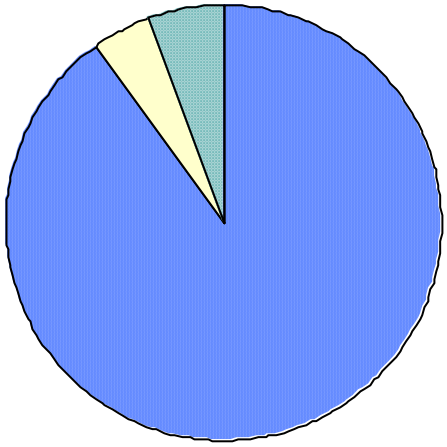
Forty percent of students said that they would support the University switching to 100% green energy, even if it costed a lot more than electricity sourced from fossil fuels, while another 40% said that they would support the switch if it wasn't too expensive (Fig. 2a). Another 13% would prefer the University switch to a smaller percentage of renewable energy. However, 4% of students would not support renewable energy at all. Following on from this question, an overwhelming majority of respondents (90%) would be prepared to pay an extra £10 per year in university fees to help fund the purchase of renewable energy (Fig. 2b).

(a) Would you support the University switching to 100% green electricity?



- Yes, even if it costs more than electricity from fossil fuels
- Yes, if it is not too expensive
- Not 100%, but I support purchasing a smaller percentage
- No, not at all
- Don't know

(b) If the University were to switch to renewable energy, would you be prepared to pay an extra £10 per year in university fees to help fund this venture?



- Yes
- Maybe
- No

Figure 2 (a) shows the support of students for the University of Cambridge to switch to 100% green energy, and (b) whether students would be prepared to pay £10 per year to help the University switch to renewable energy (n=182).

The final question asked whether students would support plans for the installation of a wind turbine close to the Cambridge township to provide renewable energy to the University. Over 80% of the participants in the survey would strongly approve (51%) or approve (28%) this venture.

Here are a few of the general comments that students had about the University's policy and actions towards climate change. The authors are happy to provide a full list on request.

- *'An institution as large as this should probably be looking at making renewable capacity rather than just using it. After all, the goal is more renewable energy in Britain, not just more support.'*
- *'I hope the university and colleges would contact us more regularly to reassure us on their actions towards climate change.'*
- *'Should provide funding to final year students to research into improving the university's position with regards to energy consumption. In particular, engineering students. It is much cheaper than contracting the work and there is not a loss of time.'*
- *'We should be doing more! But the university has started and seems to be switched on about the issues, which is reassuring and positive.'*

Appendix 2: Sustainability initiatives at other Universities

Other universities, both in the UK and internationally, are demonstrating leadership on sustainability issues through substantial commitments to reducing their ecological footprints, integrating environmental principles in their management of built and natural environments, and through innovative approaches to teaching and research for sustainability.

This appendix gives key examples of leadership and innovation for sustainability from around the world. Initiatives such as these are likely to have an increasing influence on public perceptions of universities and other institutions alike, and on the decisions of prospective staff and students concerning the location and fields of their work and study.

International University partnerships for Sustainability:

Association for University Leaders for a Sustainable Future http://www.ulsf.org/
ULSF serves as the Secretariat for the Talloires Declaration, co-ordinates research projects, consultations and sustainability assessments, and promotes environmental education based on the Earth Charter.

Global Higher Education for Sustainability Partnership (GHESP)
http://www.unesco.org/iau/sd/sd_ghesp.html
GHESP is a partnership of four international organisations that seek to make sustainability a central element of curriculum, research, outreach and operations throughout higher education institutions.

Universitas 21 Water initiative http://www.universitas21.com/water.html

UK Institutions and Position Statements:

Royal Society http://royalsociety.org/policy/climate-change/ and http://royalsociety.org/policy/publications/2009/joint-academies-climate-change/

Geological Society's Statement on Climate Change http://www.geolsoc.org.uk/webdav/site/GSL/groups/ourviews_edit/public/Climate%20change%20-%20evidence%20from%20the%20geological%20record.pdf

UCL's Climate Change Statement http://www.ucl.ac.uk/climate-change/ and Environmental Change Research Centre http://www.ecrc.ucl.ac.uk/

Oxford University's Environmental Change Institute http://www.eci.ox.ac.uk/ and web page to connect the media better access to Climate Change experts http://www.ox.ac.uk/media/news_releases_for_journalists/ccexperts.html

LSE's Grantham Research Institute on Climate Change and the Environment
http://www.lse.ac.uk/granthamInstitute/

Bristol University's Sustainability Department, http://www.bris.ac.uk/environment/, Cabot Institute http://www.bris.ac.uk/cabot/ and Sustainability Team http://groupspaces.com/bust/

Edinburgh University's Climate Change Network http://www.hss.ed.ac.uk/climatechange/

Manchester University's Bruntwood Initiative for Sustainable Cities
http://www.sed.manchester.ac.uk/research/marc/research/projects/ecocities/ecocities.pdf

Leading US and Canadian Associations and Universities:

The US Association for the Advancement of Sustainability in Higher Education http://www.aashe.org/. Provides resources, professional development, and a network of support to enable institutions of higher education to model and advance sustainability in everything they do, from governance and operations to education and research.

Harvard Center for the Environment http://environment.harvard.edu/index.htm

Harvard Green Campus Initiative: http://www.greencampus.harvard.edu/

Tufts Climate Initiative http://www.tufts.edu/tie/tci/index.htm to catalyse change through emissions reductions, research, education, and outreach

University of British Columbia Sustainability Office http://www.sustain.ubc.ca/ oversees the campus-wide Sustainability Strategy for operations, research, teaching and outreach.

Yale Project on Climate Change Communication http://environment.yale.edu/climate/

Stanford University's Climate and Energy Project http://gcep.stanford.edu/

Princeton's Environmental Institute http://www.princeton.edu/pei/ethics-climate/ and Carbon Mitigation Initiative http://cmi.princeton.edu/

MIT joint program on the Science and Policy of Climate Change http://globalchange.mit.edu/

Australian Consortia and Universities

Australian Universities Climate Consortium http://www.monash.edu.au/research/climate/ucc/ – comprising ANU, UNSW, Monash, CSIRO, and the Bureau of Meteorology

NCCARF National Climate Change Adaptation Research Facility http://www.griffith.edu.au/research/nccarf/ – hosted at Griffith University, as a consortium with James Cook University, Macquarie, Murdoch, QUT, USQ, USC and the University of Newcastle.

ACTS Australasian Campuses Towards Sustainability http://www.acts.asn.au/ – a non-profit umbrella body for sustainability initiatives in the Australian and NZ tertiary sectors. ACTS mission is to promote the integration of the principles of ecologically sustainable development (ESD) within the curricula and operations of the tertiary sector. It provides web-based resources and forums, and an annual conference.

Group of 8 Australian Universities http://www.go8.edu.au/about/go8.htm

Australian National University – ANUgreen Sustainability Office http://www.anu.edu.au/anugreen/ including initiatives for Sustainability at Work and the ANU Green loans fund providing interest free loans for projects that have a ten-year or less return on investment.

Monash Sustainability Institute http://www.monash.edu/research/sustainability-institute/index.html

University of Queensland Carbon Strategy http://www.uq.edu.au/sustainability/campus-sustainability, Solar Project http://www.uq.edu.au/news/index.html?article=20999 and Global Change Institute http://www.gci.uq.edu.au/

University of Sydney Centre for Integrated Sustainability Analysis http://www.isa.org.usyd.edu.au/index.htm