Modest Means to Reduce Carbon in Croydon Schools

June 25th 2009

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Abstract

Croydon Council's Environmental and Sustainability Team is helping the borough of Croydon to reduce its carbon emissions. The focus of this project was to help schools reduce emissions since they represent 50% of the borough's energy use. We piloted a training program with staff from five volunteer schools, teaching them CarbonHub (software that allows a school to track its carbon emissions), researching potential problems, and developing tools to make the CarbonHub experience as simple as possible. This data was combined with previous energy audits and direct observations of energy practices and problems in each school to devise school action plans to reduce energy consumption.

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1 Executive Summary

Carbon emissions are slowly raising the mean temperature of the earth and will cause severe weather extremes in the City of London as well as the Borough of Croydon. The globe has risen in temperature 0.4 degrees Celsius over the past thirty years (Bernstein, Lenny, et al. 2007), and the oceans have risen 55 mm between 1961 and 1990 (Glenn, Elert, et al.). Croydon is a progressive borough in terms of reducing energy use from fossil fuels. Despite its current initiatives, the borough needs to take further action to achieve its goal of 9.5% reduction from 2005 carbon emission levels by 2011. The main challenge the borough faces is involving organizations and the community in this goal of reducing carbon emissions. There are 130 public schools in Croydon, along with numerous non-profit organizations, all of which are conscious of the environment, yet most lack the knowledge to substantially reduce their carbon emissions.

The Environment and Sustainability Team (EaST) is the division of the Croydon Council that is responsible for reducing carbon emissions from schools, businesses, and the community. Currently the 130 schools in Croydon account for about 50% of energy consumption of the borough government. The main challenge with reducing emissions from schools is that these schools are scattered all over the borough, complicating central management, and each school has different problems that must be addressed.

The overarching goal of our IQP was to implement a carbon footprinting tool, called CarbonHub, in Rockmount Primary, Riddlesdown High, Thornton Heath, Wolsey Primary and Junior, and Heavers Farm Primary as well as to develop an action plan for one of these schools. Due to its strong interest and availability of basic energy use data, Rockmount Primary School was selected. This action plan needed to be specific to the school and give them a chronological list of actions to follow with specific implementation techniques. In addition, this action plan needed to provide an easy method to track the reduction in carbon emissions as each action was implemented.

In order to accomplish this overarching goal, our group outlined three objectives. First, to find most effective methods for reducing carbon emissions, we needed to summarize the

energy use data and recommendations from thirteen existing school audits. The next objective was to determine how to implement CarbonHub software in the five schools so that other schools and EaST can track their progress. The third objective was to identify barriers or resources to reducing carbon in these individual schools, mainly at Rockmount.

In examining the audits, we focused on learning about the biggest energy wasters. These included excessive heating/cooling, leaving electrical equipment running, poor usage of lighting (both natural and artificial), and the use of inefficient bulbs. Then we looked through the audits to find the respective zero-cost recommended solutions which schools could use to substantially reduce their energy consumption, including closing windows and turning off electrical equipment when not in use. We also read and summarized several expert documents provided by East to find further energy saving methods for schools. We calculated the possible monetary, energy, and carbon savings from implementing these changes in each of the audited schools and compiled this data in three respective pie charts that were presented to EaST. We could not determine Rockmount's savings per year because of their lack of complete data and an audit, however we estimated, based on similar school audits, that they could save around two thousand GBP a year.

The second objective focused on finding the most effective method for training school staff in CarbonHub software and determining how well adapted CarbonHub was for schools. First, we adapted ideas for change implementation from Preston (1999) as we developed a 2 ½ hour training session for the eight staff members we trained. We gave the teachers a summarized training guide to follow as we walked them through CarbonHub. This training guide was one page in length so that teachers could post it near the computer as a quick reference for using CarbonHub. To get feedback on this training session, we used a short survey that asked questions about the ease of their data collection, use of suggestions, our training, as well as what the staff members would like to get out of their partnership with the Environmental Climate Change Partnership (ECCP). We found that pre-planned training sessions made the training easy to follow for the teachers. Teachers rated our training session as very good. The survey found that the actual use of CarbonHub was very easy for the staff member. Data collection was the most difficult component of using CarbonHub, however our

observations led us to believe that this difficulty depended on the involvement of the site manager in meter readings. Furthermore, the staff members from Rockmount and Thornton Heath wanted continued support from the ECCP: Heavers Farm wanted funding from the ECCP; Wolsey and Riddlesdown indicated they didn't need further support from the ECCP.

In order to judge the suitability of CarbonHub software to the schools, we reflected on three problems that we encountered. We compiled our personal observations from the training sessions, including the session where we were trained to use the software, into a list of difficulties and potential barriers in the use of CarbonHub software. The biggest problem for the schools was the collection of the annual data required for input in CarbonHub. The surveys revealed that all five schools found it impossible to find data for at least one field, the Commuting field. To address this issue, we developed a comprehensive excel program, named CarbonTracker, that took monthly or weekly inputs and returned the annual totals for the school, including the Commuting field. We also found that all of the staff members became confused when CarbonHub used corporate language or corporate specific questions, such as referring to businesses, procurement of materials, and warehouses. Although the staff members recognized that these questions did not pertain to them, we sent this, and all of our other observations, to the administrator for the Croydon version of CarbonHub, Mairi Brookes, so that future users would not have to make decisions about what questions apply to their school.

To identify the barriers and resources to reducing carbon emission in Rockmount Primary school (the one school we chose to develop a full action plan for) we relied solely on our visits to the school. Through our presentation at Rockmount, followed by a Q&A session with students and staff, we identified several resources, including a guidance councilor and a student organization called the Eco-Council. In Rockmount, a guidance councilor ran an Eco-Council that organized activities to raise the environmental awareness of the school. Her contact with most of the students, her relatively relaxed schedule, and personal motivation meant that she would be more likely to spend the time to coordinate the actions outlined in our action plan. Furthermore, the Eco-Council had a representative from most of the classrooms so any actions or ideas could easily be dispersed throughout the school. To contrast

Rockmount, at Wolsey we found that the site managers would be the coordinators of change because of their more flexible schedules and their knowledge of the technical problems within the school.

Finding barriers to the implementation of carbon-reducing measures was far easier than finding the resources. To find barriers, we toured the grounds, took photos of potential problems and talked with the staff members for a few hours during the training. We were able to summarize these problems into three categories: the perception of CarbonHub data entry as more "needless" work, lack of a reward for decreasing energy use, and poor maintenance of current energy saving technology. The main barrier to implementing CarbonHub and the Action Plans may be that the faculty, who have little time for additional tasks such as collecting energy use data or implementing our suggested actions, are being asked to do more work. Rockmount was fortunate to have a guidance councilor able to dedicate the time to this task as other schools, such as Riddlesdown, don't have a staff member with the necessary time. It may be critical to make CarbonHub a pleasant and less time consuming experience so that busy staff members are willing to use the software.

To help address these problems, we discussed three things: how to make the teacher feel the importance of our work, how to make CarbonHub easier to use, and how to prolong the changes suggested in our action plan. First, we ensured participation through personal contact with each school staff member to make this task feel more personal and urgent, rather than just another impersonal memo coming from the Croydon Council. Coupled with the appropriate choice of school personnel, this yielded good participation. Second we developed CarbonTracker so the data collection was spread across the year because schools do not keep well-organized and detailed records of utilities data. Even if the schools did have the appropriate data, the summation of it into yearly totals is a lot of work and errors can be made; both are substantially reduced by CarbonTracker. This excel sheet was colorful, protected from user alterations, and followed similar data entry as in CarbonHub. Thirdly, from our tours of the schools, we found that some of the initial attempts to reduce energy use weren't properly set up or maintained. In Rockmount, the light sensors were incorrectly calibrated and the recycling bins were overflowing. At Wolsey, the computers were set to be turned off however

the screens were not being turned off as well. All of these problems are maintenance related; we therefore pointed them out and made suggestions in our action plans.

The main deliverable for this project was a detailed action plan for Rockmount. Since the implementation of CarbonHub was an integral part of the main deliverable, we developed another deliverable, an Excel program we named CarbonTracker, to greatly simplify the data collection for CarbonHub. The third deliverable was a short presentation that was developed to give 6th year students a basic understanding of global warm as well as why every little effort helps reduce the rate of global warming. The last two deliverables we developed were meant to be tools for our sponsor to use to help him reach more schools across the borough. The fourth deliverable was a list of twelve non-profit environmental organizations that our sponsor could use as representatives of the council that would go into schools and show staff members how to use CarbonHub. To support this effort we developed new content to update our sponsor's website as our fifth deliverable. The content summarized the strategy of the Environmental Climate Change Partnership, gave suggestions about simple energy reduction actions that anyone could do to save energy, and links to the footprints of the schools with CarbonHub profiles.

The action plan for Rockmount consisted of two parts: a chart of the actions with a description and a timeline, and written description of each action that the school should pursue. The ten tasks are: turn off the heating in May, turn down the heating by three degrees Celsius for the rest of the year, have students and staff turn off the hall lighting until the motion sensors can be fixed, use half of the lights in a classroom by harvesting natural light from windows, have the monitors in the ICT suite hooked up to a common switch, experiment with turning off the air conditioning in the ICT suite and opening the windows for air circulation, install TRVs in classrooms, contact the Croydon Council to revise recycling pickup and to get more recycling bins, put smaller bins throughout the school so the students and staff can recycle, and have the motion sensors in the school fixed or recalibrated.

Based on our training and research experience in the schools, we made some recommendations to EaST for continuing with CarbonHub training:

1. Work with schools that have a fairly dedicated staff member who focuses on the environmental impact of the school. After the success of this program is established, strongly encourage other schools to designate a champion before starting to work with them on their action plan.

2. Personally visit each school to teach a staff member how to use CarbonHub since personal interaction was key to the success of the training.

3. Walk through the school to find and evaluate unique possibilities to save energy since we found that the recommendations were better if adapted specifically to the unique problems and resources of individual schools.

4. Use the free audits done by the Carbon Trust as a way to augment these observations and CarbonHub recommendations.

5. Establish an awards system so that the schools can be publicly recognized for their accomplishments.

6. For future improvements, contact non-profit environmental organizations (NEOs) that offer free services to communities and schools. These NEOs can help develop the action plans for schools and community organizations across the borough. We researched these organizations and found The Global Action Plan is willing to work specifically with schools. EaST could easily coordinate activities with this group to broaden the effect of their initiatives.

2 Introduction

Carbon emissions are slowly raising the mean temperature of the earth and will cause severe weather extremes in the City of London as well as the Borough of Croydon. The globe has risen in temperature 0.4 degrees Celsius over the past thirty years (Bernstein, Lenny, et. al. 2007), and the oceans have risen 55 mm between 1961 and 1990 (Glenn, Elert, et al.). These changes have melted a significant portion of the ice caps and will likely disturb the flow of the density-driven current in the Atlantic Ocean. These changes will likely have a disastrous effect because Britain's weather is determined by the currents in the Atlantic Ocean. The severity of droughts and flood are likely to increase as the global temperature continues to rise.

Ideally, the UK and London could stop using carbon-based sources of energy and thus stop producing carbon emissions altogether. However, the country's current dependence on hydrocarbons is too great to overcome and integration of renewable energy sources is slow moving. In 2005 only about 3.5% of energy in the UK was classed as renewable (Energy Savings Trust, 2005). In 2007 only five percent of electricity in the UK came from renewable sources, even though electricity is the easiest form of energy to obtain from renewable sources (BERR, 2008).

Croydon, a borough of London, is a progressive borough in terms of reducing energy use from fossil fuels. Despite its current initiatives, the borough needs to take further action to achieve its goal of 9.5% reduction from 1990 carbon emission levels by 2011. The main challenge the borough faces is involving organizations and the community in this goal of reducing carbon emissions. There are 114 public schools in Croydon, along with numerous non-profit organizations, all of which are conscious of the environment, yet most lack the ability to substantially reduce their carbon emissions.

The Environment and Sustainability Team (EaST) is part of Croydon Council. Their objective is to work with schools and non-profit organizations in order to reduce their carbon emissions. Currently, there are three obstacles that East faces in achieving this mission, and our project is aimed to address them

First, EaST needs to find relevant tools for tracking emissions and to encourage schools to use those tools so that they can track their carbon emissions. CarbonHub is a tool that takes the annual energy that an organization uses sand then develops a carbon footprint and then helps the school develop a generic action plan. In order for CarbonHub to work effectively, a person trained on CarbonHub has to set up an account and then work with the school. At the time of this project, no training had been done with schools and no research has been done on whether teachers will like CarbonHub interface or whether CarbonHub is optimized for schools to use. Therefore, we undertook this training and study how easily the school staff members picked-up and used CarbonHub.

Schools also need a direct methodology to start to reduce their energy use. By combining their unique energy recommendations from CarbonHub, previous school energy audits that had been conducted by CEN, and our onsite observations of the good and the bad aspects of the school, we were able to be able to give the schools a stronger action plan for reducing energy use based on multiple sources of study. This combined action plan will have the benefit of the broad spectrum of ideas from CarbonHub, the observations in the audits, and the suggestions that were based on systematic observations from two of our group members. These aspects will form a document with effective and feasible suggestions for the school.

Second, In order to address its mission and get community buy in, EaST must utilize all the resources at its disposal. This includes working with other non-profit organizations that offer free services to help educate schools as well as work with community groups. However, it currently lacks a database of contact information on potential non-profit partners and their services. To fill this gap, our project researched other non-profit organizations in London and made a condensed database that listed the available services.

Third, EaST needs to maintain a website to promote its actions so that public and other schools can see what the Croydon Council is doing to reduce carbon emissions. Currently, the website is completely outdated and to an extent misleading. Since the Council plays such an important part in the borough society, our sponsor has requested that this website be updated so that the citizens don't get the impressions that reducing carbon emissions is outdated and hence irrelevant. Thus our third objective was to update and correct the web information

based on our own background research as well as the pertinent documents given to us by our sponsor.

3 Background

3.1 Global Warming

Global warming is the increase in the average of earth's surface temperature. Many acknowledge that global warming is a problem and 97.4 % of climatologists concur that it is caused by human activities (Doran, 2009).

A report by the Intergovernmental Panel on Climate Change found that global average surface temperature has risen approximately 0.4 degrees Celsius over the past thirty years (Bernstein et al. 2007). By 2100 the global surface temperature will rise another 1.5 to 4.5 degrees Celsius (Calderia, Ken, et.al. 2004). According to the Department for Energy and Climate Change the cause of this global warming is carbon dioxide, methane, and nitrous oxides**,** all three of which are anthropogenic gasses (Department for Energy and Climate Change, 2007). These gas molecules absorb a larger range of light wavelengths than other atmospheric gasses causing an increase in their thermal energy (Houghton, John 2004). These gasses transfer their thermal energy into other atmospheric gasses, increasing the global temperature. Figure 1 illustrates that

> "carbon dioxide is the most important anthropogenic greenhouse gas. Its annual emissions grew by about 80% between 1970 and 2004" (Bernstein, et. al., 2007).

Part B of Figure 1 shows that 56.6% of greenhouse gas emissions were generated from the combustion of fossil fuels. Figure 1c shows that 25.9% of these carbon dioxide emissions are generated during power production; this implies that the effort that would produce the most returns would be to cut carbon emissions would be to reduce power consumption and production.

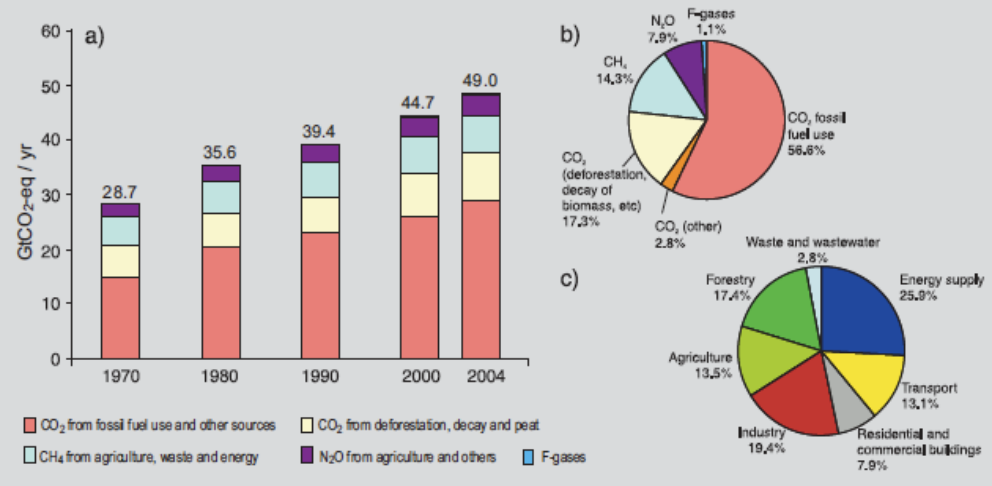

Figure 1: Global Anthropogenic GHG Emissions (Bernstein Lenny, et. al. 2007)

3.2 Policy to Limit the Effects of Global Warming

Since the leading cause of global warming is human activities, then the obvious solution to reducing the rate of global warming is to try and change these activities. The largest source of greenhouse gasses is human activities in industrialized nations. In order to get the leading industrialized nations to commit to reducing carbon emissions, a global treaty had to be set up so that potential economic losses would not hinder a nation's environmental progress. The Kyoto Protocol was implemented as a treaty that would encourage the reduction of global emissions.

3.2.1 Kyoto Protocol

In response to the growing international concerns about global climate change, the Intergovernmental Panel on Climate Change (IPCC) was formed in 1988. In 1990 the IPCC released an official report stating "global warming did pose a threat and was likely the result of human activities" (Thompson, 2007). This report spurred several attempts in the early 1990s to form an international committee but failed due to a lack of an official binding agreement. In December of 1997 the Kyoto Protocol was drafted and signed in Kyoto, Japan and succeeded in garnering the commitments of the requisite 55 countries possessing a combined 55% of industrial emissions. After acquiring these commitments, it was signed into international law.

The Kyoto Protocol has been ratified by 166 countries since its inception in 1997 and has become the international standard for reducing carbon emissions (Thompson 2007). Figure 2 shows the respective status regarding the Kyoto Protocol of the nations across the globe. Nations who have signed and ratified the treaty are colored green, nations who have signed but haven't ratified the treaty yet are colored yellow, nations who have signed but declined to ratify the treaty are red, and nations not participating in the treaty are colored gray.

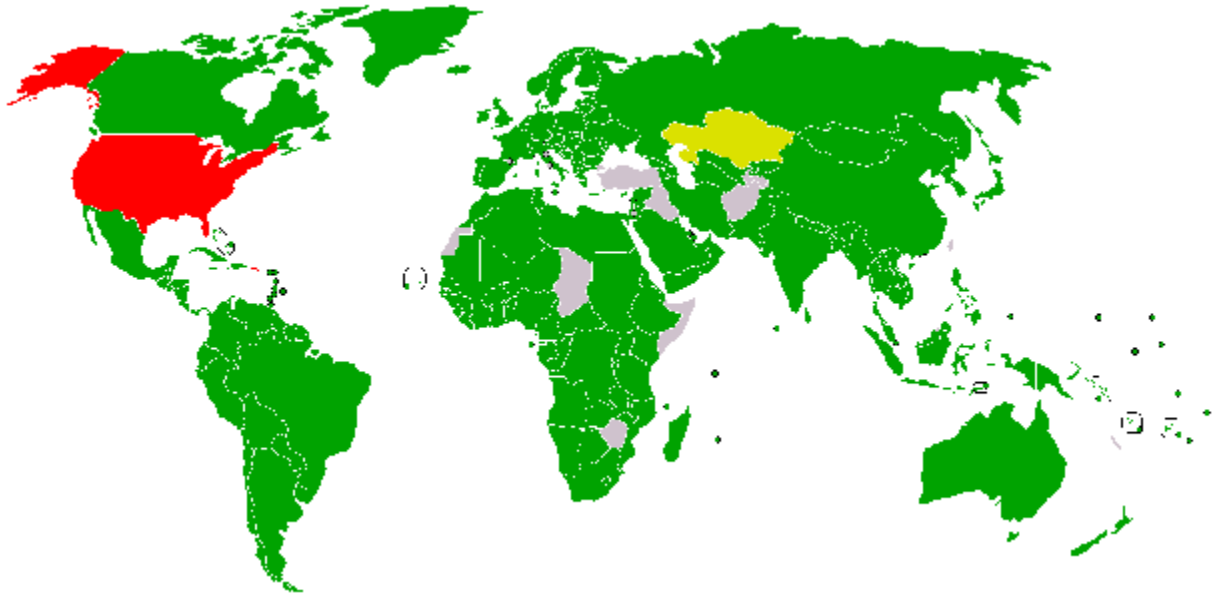

Figure 2: Color-coded map of nations based on Kyoto Protocol Ratification. Courtesy of http://sitemaker.umich.edu/section9group2/the_kyoto_protocol

The goal of the Kyoto Protocol is to reduce worldwide carbon emissions by 5% based on the 1990 emissions. Each nation has a goal tailored to its stage of economic development; for instance, the UK, an advanced economy, has agreed to reduce its emissions 12.5% by 2012.The reduction requirements for each country can be met in any of four different ways. First, a nation can reduce its own carbon emissions through cleaner energy production methods, cleaner mass transportation, etc. Second, a country can fund projects in industrialized nations to reduce their carbon emissions; these reductions will count towards the funding country's goal. Similarly, a country can fund projects in developing countries that will reduce carbon emissions there; again, counting towards the funding nation's goal. Lastly, if a country exceeds their goal, they can sell their surplus emissions to other nations that have not yet met their

goal. All of these methods of reaching one's goal reinforce the concept that carbon emissions are a global issue and that the source of the reduction isn't important, just the fact that it is occurring. This cap and trade system rewards those countries which have exceeded expectations while giving others a way to meet their goal. To increase transparency between countries, all participating nations are required to submit reports on their progress at regular intervals. Every five years, new goals are set, with the next date to establish new goals being in 2012 (Thompson, 2007).

3.3 What Does Global Warming Mean for The UK?

The UK is the global leader in the implementation of the Kyoto Protocol. The weather of the British Isles is heavily influenced by the surrounding ocean and seas, which are in turn heavily influenced by global temperatures. The mouth of the Thames River is in a storm surge hot-zone, thus London, which is situated on the river, would be at an increased risk of flooding if the storm surges intensified due to global warming. This political shift toward environmentally friendly policy was caused by public protest against the inclement climate, and the inherent threat of global warming to the coastline, farmlands, habitats, etc.

3.3.1 The Impact of Global Changes that Apply to the UK

The global environmental consequences from the increase in temperature will follow a very specific progression. Two of the three primary indicators that give clues to the progression of global warming are already being monitored to ascertain the extent of the warming. The coral reefs around the world have started to bleach because of the increase in ocean temperatures. This is destroying some of the most diverse habitats on the planet which are natural carbon attractors due to the rich biomass they support. The loss of this minor carbon filter, however, will not have a huge impact on the UK. The polar ice caps are melting and the west Antarctic ice shelf is starting to split off. There are no immediate effects from the melting of this ice shelf but the effects when the entire ice cap melts are a major cause for concern. As a function of the increasing ocean temperatures and the loss of the polar ice caps, the last

indicator, is the subsiding of the density-driven currents (O'Neill, Brian C., et. al. 2002) which will cause the climate of the UK to become much colder. These indicators may also have other, individual side effects that directly affect the UK. Figure 3 illustrates these side effects as the trends of global temperature and ocean levels from around 1850 to 2004.

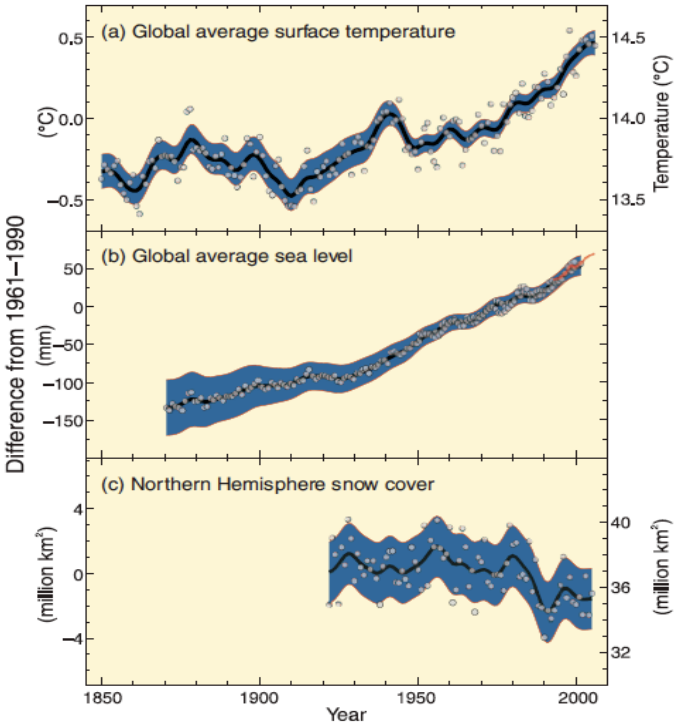

Figure 3: Changes in Temperature, Sea Level, and Northern Hemisphere Snow Cover (Bernstein, Lenny, et. al. 2007)

Figure 3 shows that the ocean level rose approximately 50mm from 1961 to 1990. By taking the ratio of the density of water to ice and multiplying by the surface area of the oceans, approximately 1.96×10^{13} cubic meters of water were added to the oceans since the 1961-1990 level (Glenn, Elert, et. al.). The volume of the ice caps is about 3.3×10^{16} cubic meters thus only .060% of that volume has melted since that time period (Glenn, Elert, et. al.).

3.3.2 The Impact of Global Changes that Apply to London

By 2100, the continued melting of the ice caps could raise ocean levels by four to nine meters, a problem for London as the city is bisected by a river with direct access to the North Sea (O'Neill, et. al., 2002). Another side effect of the increasing ocean levels and temperatures is that storm swells or surges, which are a problem for London because of the shape of the sea floor in the North Sea, could drastically increase (Lowe, J.A., et. al 2005). Figure 3 shows the height of storm surges around the periphery of the North Sea. The arrow points to the mouth of the Thames River where storm surges average around 2.5m.

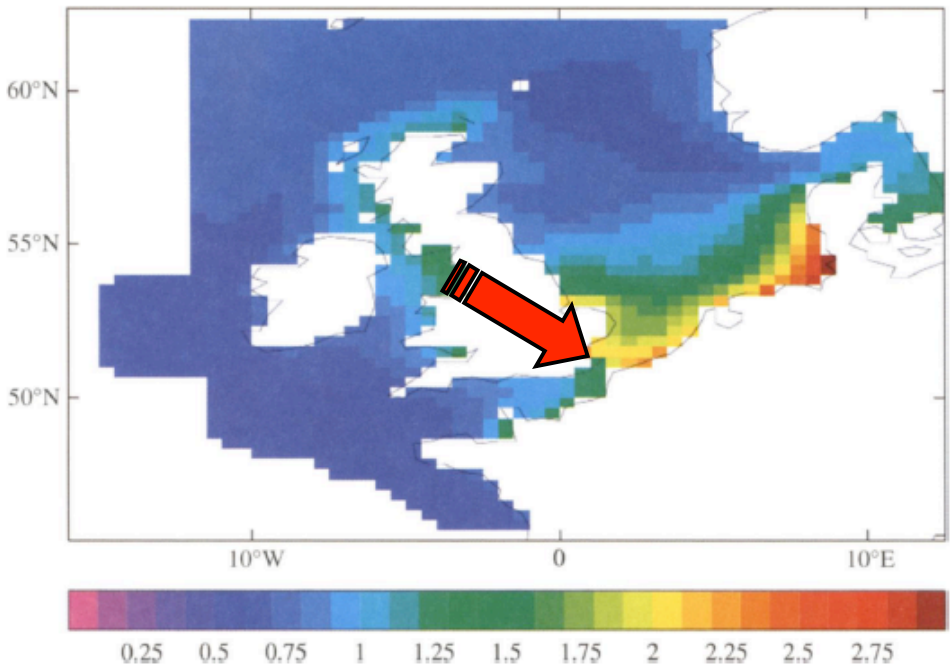

Figure 4: Changes in Temperature, Sea Level, and Northern Hemisphere Snow Cover (Bernstein, Lenny, et. al. 2007)

With the increasing ocean levels and the increased storm surge heights, the Thames River Barrier Dam will encounter much larger swells than it was originally designed for. This will cause extra wear and tear on the barrier, causing it to go out of service earlier than expected.

Figure 5: Picture of the Thames River Barrier Dam. Courtesy of http://www.woodlands-junior.kent.sch.uk/riverthames/barrier.htm.

3.4 Initiatives in Croydon to Reduce Global Warming

Croydon is located 10.4 miles from the old city of London (Rudkin, 2008). Its population of roughly 330,000 people (Census 2001), has risen by about ten percent in the past thirty years (Vision of Britain). Croydon is seen as the leader in energy efficiency, and plans to reduce its carbon emissions by 9.5% by the year 2011 (Croydon's Community Strategy). According to a Croydon Cabinet Report on April 22, 2008,

> Croydon's performance on energy efficiency has also been recognized both in London and nationally. Since 2000 Croydon has been one of the top performing London Authorities and has been consistently in the top quartile nationally. (Agenda Item 13)

The council has instituted a law that all new or remodeled non-residential buildings with more than one thousand square meters of gross floor space must supply at least ten percent of their projected energy needs through renewable sources (Rudkin, 2008). A major source of this renewable energy is photovoltaic cells. Croydon's PV Upscale project provides photovoltaic systems for public buildings in Croydon. In the array shown in Figure 6 the combined installed system has an output of 250 peak kilowatts (Rudkin, 2008). Figure 6 is a picture of photovoltaic cells installed on the Ashburton School in Croydon.

Figure 6: Picture of Photovoltaic Cells Installed on Ashburton School (Rudkin, 2008)

Such visual reminders help local champions get the community involved in less capital-intensive behaviors that reduce the carbon emissions from Croydon. In particular, Croydon has sponsored programs that have trained fifty champions in communities, distributed leaflets to promote central heating, trained tenants how to use new environmental technologies, and given new tenants four energy efficient light bulbs (Croydon Cabinet Report). Consequently, Croydon's commitment to public involvement has led the council to conduct energy audits on selected Croydon schools and to use these reports to reduce their emissions. These will be discussed in detail in the next section. The usefulness of these audits has encouraged the council to have more performed.

3.4.1 Energy Audits in Croydon Schools

The audits performed in Croydon public schools show real, cost effective ways that the schools can reduce their carbon output. Each audit contains a table that summarizes the findings of that audit. These audits show a few key areas, such as unnecessary light use, window insulation, or heating valves, where energy waste in schools can be reduced. According to all thirteen audits, the two largest areas where energy is being wasted are heating loss and lighting misuse. In one school, as shown in Table 1, if the heat was simply lowered a few

degrees the school could save 166,000 kWh of energy per year. If the school used its lighting more efficiently and turned off the lights when they were not needed, the school could save 52,000 kWh of electricity per year (CEN, 2008, 1).

Table 1: Energy audit findings for Riddlesdown High (top) and Forestdale Primary (bottom).

Top No/Low cost Measures	Energy Savings (kWh pa)	Cost Saving (£ pa)	Installation Cost (£)	Payback period (years)
Reduce temperature and better control of heating	166,090	9,714	0	0
Control of Lighting	52009	4420	0	0
Conversion to energy efficient light	29249	2486	0	0
TOTAL[1]	247,129	£16,600	0	0

Top No/Low cost Measures	Energy Savings (kWh pa)	Cost Saving (£ pa)	Installation Cost (£)	Payback period (years)
Reduce Internal Temperature	14,460	804	0	0
Control of Lighting	6,459	550	0	0
Switch Off Equipment	4,844	412	0	0
TOTAL[1]	25,763	1,770	0	0

Since most of the electricity in Croydon comes from coal or oil fired power plants, as is shown in the audits, the decline in energy consumption can be translated into a decline in carbon emissions.

The type of fuel used can have a great impact on the emissions produced. Table 2 shows the difference in carbon emissions per fuel source used (SustainableBuild, 2009).

Table 2: kgC02 / kWh conversion rates (based on SustainableBuild, 2009)

Energy source	Carbon produced from 1 kWh	Carbon produced from 166000 kWh
Gas	0.19 kg	33,200 kg
Oil or Coal	2.975 kg	493,850 kg
Electricity	0.43 kg	71,380 kg

Thus, schools heated with oil or coal would greatly reduce their carbon emissions if they turned down their thermostat by even a couple of degrees Celsius, or better yet, changed their energy

usage to a cleaner source. Unfortunately, due to financial restraints, this is not always a viable option.

Schools can also reduce their energy use by only turning on lights in areas that are being used. Similarly, schools can ensure that blinds are opened more often to make use of carbon-free sunlight. Florescent bulbs use about one fourth of the amount of energy as standard incandescent bulbs, achieve the same light quality, and last about ten times longer (EPA's Green Lights Program, 2007, 5). The following table details the differences between several types of light bulbs.

Table 3: Bulb Comparisons (EPA's Green Lights Program, 2007, 5)

	Standard Incandescent	Tungsten-Halogen	Fluorescent	Compact Fluorescent	Mercury Vapor	Metal Halide	High-Pressure Sodium	Low-Pressure Sodium
Wattage	3-1,500	10-1,500	4-215	4-55	40-1,250	32-2,000	35-1,000	18-180
Average System Efficacy (lm/W)	4-24	8-33	49-89	24-68	19-43	38-86	22-115	50-150
Average Rated Life (hrs)	750-2,000	2,000-4,000	7,500-24,000	7,000-20,000	24,000+	6,000-20,000	16,000-24,000	12,000-18,000

The schools have not received their audits because the Environmental and Sustainability Team (EaST) of Croydon Council wanted our group to create a specific action plan for each school. Of the 114 public schools in Croydon only thirteen were audited as pilot programs for the project designed to reduce Croydon's emissions by 9.5% by 2012. These audits are quite long and list all of the possible means, both the high and the low cost methods, for schools to reduce their carbon emissions. Because the schools' budgets limit expenditure, this pilot program focuses only on the low-cost methods of reducing carbon emissions. The action plan created, in conjunction with the action plan generated from CarbonHub (a carbon foot printing tool that will be discussed later), will outline a clear three year plan for Croydon schools to reduce their carbon emissions by 10%, the goal suggested by our sponsor.

3.4.2 School Campaigns to Reduce Energy Use

In school campaigns to reduce energy use, both students and teachers must be educated with regards to energy use and saving. According to Peter Doran (2009):

> It seems that the debate on the authenticity of global warming and the role played by human activity is largely nonexistent among those who understand the nuances and scientific basis of long-term climate processes. The challenge, rather, appears to be how to effectively communicate this fact to policy makers and to a public that continues to mistakenly perceive debate among scientists.

Thus the school campaigns can be used, in part, to remove the perception of the public that there is a debate about the rising global temperatures.

A number of energy use campaigns have already been launched by a number of groups. One such group is the Massachusetts Technology Collaborative. This organization provides a number of lesson plans focused on energy use and conservation (Massachusetts Technology Collaborative). A sample lesson plan helps to explain to high-school aged students how much energy is required to light their classroom for a year. The plan begins by defining technical concepts such as a Watt and then engaging students in hands-on activities to bridge the theory-to-reality gap of arbitrary measurements. Students are then given the energy consumption data from their school so the students can grasp the magnitude of the energy used by their school. Once this has been accomplished the power bill can be used to show the real-life cost per kWh. The students are then able to understand the cost of lighting and heating their school for one year (Zeismer). From this data the teachers can help the children understand the amount of carbon emitted per kWh of energy and the school's contribution to global warming. The children can then take this same logic home to see the impact of their household on global warming.

3.4.3 Purpose of CarbonHub

CarbonHub is a generic database that has been specialized for schools at the paid request of Croydon Council. Data is entered on an annual basis and incorporates energy use of

the school, vehicles belonging to the school, travel of school personnel, the daily commute of the school population, waste from the school, and water use in the school. The carbon emissions from each section are totaled and a concise carbon profile summary is then generated for the school. Next, each school has to go through and evaluate their level of competence regarding carbon reduction policies. CarbonHub has a large number of generic practices that schools can implement to reduce carbon emissions. Typically schools can choose from three levels that describe their implementation: nothing, something, or a lot. CarbonHub will then generate an interactive action plan based on the user input; the user can then go through the action plan and select items the school would be interested in pursuing, and can then monitor the progress of each item through CarbonHub.

We will use the plan generated by CarbonHub along with the suggestions made in the audits to synthesize an action plan for the school. We will meet with school administrators, present the action plans, and see how quickly the low-cost solutions can be implemented. Ultimately, the final decision on policy changes will lie with the headmaster.

3.4.4 How to Best Implement the Action Plan into Schools

According to the article *Leading Change: Why Transformation Efforts Fail* (Kotter, 1995), there are eight errors that can destroy any attempt to change the current situation in a company. Since our project is dealing with overworked teachers in public schools, there are five errors that we cannot afford to make because we would jeopardize our project as well as the viability of EaST to work with these schools.

The first error is “Establishing a Great Enough Sense of Urgency”. We aren’t dealing with a corporation, however; we do need to worry about motivating school staff members. We need to make sure the staff members understand why we are working to implement CarbonHub in their school. Also we have to be patient enough to answer any of the staff member’s questions regarding global warming and why they are being tasked to create a carbon footprint for their school. The second error is “Creating a Powerful Enough Guiding Coalition”. In schools, there needs to be one teacher to champion a small support team so that continuity of the program will be ensured. This will prevent the creation of a situation where

the death of the general would mean the end of the war. The third error is “Lacking a Vision”. This means that we need to provide a concrete goal or direction for the change, i.e. CarbonHub’s action plan or carbon footprint as well as make a compelling case to the staff members about why they need to be reducing their carbon emissions. The fourth and fifth errors are not pertinent here. The sixth error is “Not Systematically Planning For and Creating Short-Term Wins”. This quite simply means that the program must provide measurable benchmarks for the near future that will allow the staff member to be recognized for their efforts. A program that will not see any noticeable gains for twenty years is hardly motivational; but a program that gives noticeable gains within just a handful of months is sure to inspire more effort in the program. The seventh error is not pertinent here either. The eighth error is “Not Anchoring Changes in the Corporation’s Culture”. This means that obvious displays should be made and efforts should be made to explain the reason and purpose in term of reducing global warming in the classroom. For instance, signs encouraging students and staff to follow the program, dedicated to the person or organization responsible, should be displayed; e.g. “Please turn of the lights when leaving the room. Thank you –The Management”.

The article *Organizational Aikido: Implementing Change Without a Fight* (Preston, 1999) is about constructive arguing with another person. Since we will be dealing with teachers, we must be careful in our approach to solve any issues that arise during our meetings. In this article there are two main points that we should learn from.

The first point is “When pushed, pull”. This means that the implementer of change should not directly confront conflict but should instead hear out the opposing party and ‘pull’ them around to a more amenable point of view. The second point is “Words without practice have little meaning”. This essentially says that lecturing without making a physical example is doomed to fail. A presenter who is trying to change an organization must show the people concerned what he or she will deliver to them. In the case of the schools, the administrators should stand alongside the staff member to have some examples, such as installing PV cells or a ground-source heat pump, to show the school community that reducing carbon emissions is important.

3.4.5 Community Outreach Tools

As stated before, carbon reduction requires a mass effort, one that cannot be achieved through individual efforts alone. As such, the need for involving the community is great, and tools need to be developed in order to do that. One tool that has been proposed is to help interested parties find the resources that they need to achieve their personal emissions goals.

Several companies operate in Croydon that provide services to help reduce carbon emissions. What EaST wants is a database that they can use to help match services provided by these companies with those who approach them looking for them. This will allow EaST to help provide more than they ever could alone.

Another tool that is vital in this digital age is a website that contains useful information for energy consumption reduction. As of now, the EaST website is not very useful. It contains little to no relevant data and is full of pure text. In a day when people first look on the internet for information, this page is not suited for the times. Creating content that will inform visitors of things that they can do will allow real progress to be made through this effort.

4 Methods

In order to help Croydon schools reduce their energy use, we focused on three main objectives. These objectives are:

- Objective 1: Determine the best methods for Croydon Schools to save energy from the school audits.
- Objective 2: Determine the feasibility of implementing CarbonHub in schools.
- Objective 3: Determine the school-specific barriers and resources to implementing carbon reduction plans.

These three objectives will allow us to develop an action plan that will have a chance of being implemented and maximizing the reduction of energy consumption in Croydon schools.

4.1 Objective 1: Determine the best methods for Croydon Schools to save energy from the school audits

Before coming to the UK, we were given audits that were performed on thirteen Croydon schools. Using the following research questions, we extracted the important information that applied to all schools.

Question 1: What are the biggest energy wasters and the low-cost solutions?

It was important to summarize the content of these audits, which where forty or more pages long each, so that the information contained in them was in an easy-to-read format. We decided to summarize the technical data in pie charts, which followed the model in Figure 7, so that it was easy to compare the impact of the suggested actions, which are based around reducing the heating temperature and reducing electrical use. We focused on the four biggest wasters of energy. The other suggestions were much smaller and only applied to a few schools.

It was also important to summarize these totals so that the suggestions could be easily substantiated in our action plans.

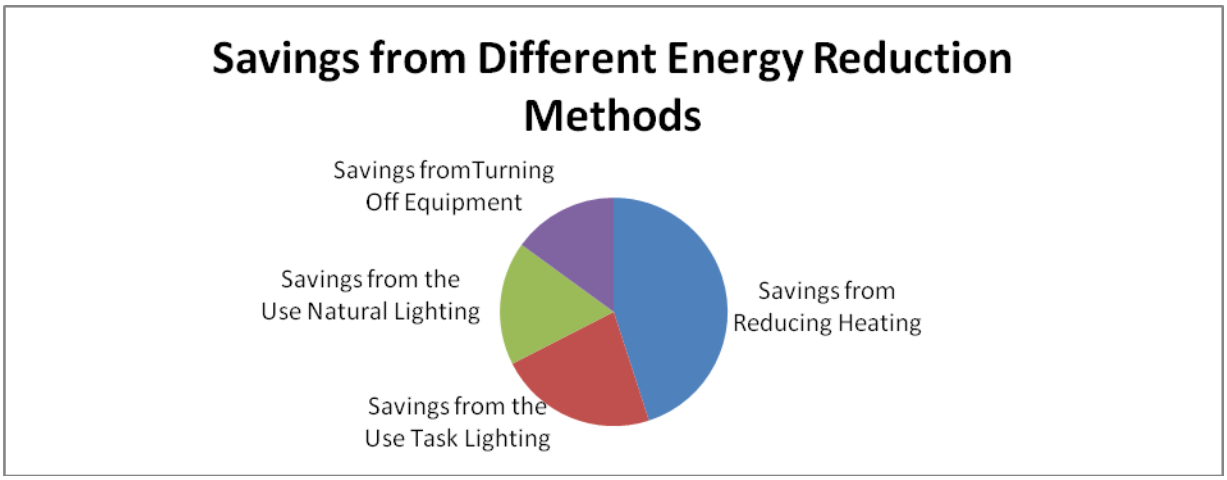

Figure 7: Example of the Comparative Pie Charts

While summarizing the audits, we also pulled out the low-cost solutions to the four biggest wasters of energy. We followed the approach, from the article by John Kotter (Kotter, 1995), of making these suggestions be low-cost so that schools could have some "short-term wins". The end product was four written actions that all schools, even the schools with the incomplete audits, could follow to reduce their energy use.

Question 2: How much money can be saved if audit recommendations are implemented?

Our answer to this research question was solely based on the audits. We made a pie chart representing the savings from the four solutions to the four biggest wasters of energy in order to relatively compare the savings. This comparison was later used to justify the order of suggestions in our action plans.

4.2 Objective 2: Determine the feasibility of implementing CarbonHub in schools

CarbonHub is a tool that can track the carbon emissions for a school. In order to show the school their progress, we had to train school staff members how to use CarbonHub. While

working with the staff members, we answered the following research questions to determine the feasibility of implementing CarbonHub in schools.

Question 1: What is the best way to train school staff members?

To answer this question we first read the article about Aikido by David Preston (Preston, 1999). We understood that we had to work with overworked staff members and thus brainstormed a set of ideas that all group members would follow. Using the three examples from the article we agreed that no member should ever verbally fight with a teacher, group member must accept "no" for an answer to a request, and group members should always respond to questions very quickly as well as eagerly provide any reasonable assistance that a school requests.

After this understanding, selected faculty was trained on CarbonHub tool by teams of two from our group. The basic outline of the training program was as such:

- First we received training on Croydon Hub from our sponsors and then split up into teams of two to train the school staff.
- We used the training sheet that Will Walker used to train our group so that the staff member would have a very detailed guide to using CarbonHub.
- Then we visited and walked each staff member through the Carbon Hub software on a school computer.
- We showed them how to use CarbonHub Data Collection Tool.
- We showed how to get to the specific Carbon Hub database to enter data.
- We showed how to get a basic overview of the collected data.
- After the training, we gave each staff member their own copy of the summarized guide to CarbonHub (See Appendix 1).
- Before we left, we gave the staff members a short survey to gauge the success of our training sessions.

The training required staff members to participate in a roughly three-hour walkthrough of CarbonHub where data, either made up or from the past fiscal year, was used. During this time, one group member verbally walked the staff member though CarbonHub tool while the

other member provided support as well as data for the staff member to enter. Specifically for Rockmount, all four members attended the training session with two group members training while the other two group members made observations; these observations are included in the Results section. During these observations, two group members took notes on issues encountered, in terms of technical and instructional issues, and typed them up in a Word document (See Appendix 2). After this training session, a survey (See Appendix 3) was given to the staff member with the intention of quantifying their opinion regarding CarbonHub and our training. After we left the school, we used the preliminary data from CarbonHub to start developing an action plan for each school.

Question 2: Is CarbonHub software well adapted for use in schools?

Our methodology for answering this question revolved around observing the questions and comments that teachers had during the training as well as our personal observations. We later talked about the questions that arose and how to prevent the confusion-related questions in future trainings. Then we wrote down the problems that we saw as the source to these questions and submitted them to our sponsor. At this point he sent them on to the administrator for CarbonHub so that future versions would not have these problems. Since we found that one of the biggest problems with CarbonHub was the annual data collection, we developed a tool (CarbonTracker) to address this issue. We started by making an excel sheet that could be used and then we tested it in the five schools in order to fine tune the tool. Using comments from the teachers, we refined the tool to its current state (See Appendix 4). Similarly, we noted the parts that teachers seemed to like about CarbonHub. We wrote down these comments and also gave them to our sponsor. Our sponsor then used these comments help promote CarbonHub to other schools.

After we had trained the school and started using the software to develop the actions plans, we noticed some major problems. These problems dealt with the lack of administrator access to the program in terms of seeing the content on each school's profile. We informed our sponsor, in person, of these problems and emphasized the importance of being able to see a school's full profile.

4.3 Objective 3: Determine the school-specific resources and barriers to implementing carbon reduction plans

The schools that participate in the program do so voluntarily, but with much prodding from the Council. This can lead to schools being apprehensive towards the implementation of CarbonHub and the ensuing Action Plan. Determining what these barriers are and working with the available resources was crucial to successfully implementing the carbon reduction plan. The following research questions show how we plan to identify the resources and address these barriers.

Question 1: What are the unique resources in a school that can help reduce carbon emissions?

Besides the comments in the audits, we identified school-specific resources through an extensive walkthrough of the school. We asked the school staff member to walk us through the school while we observed all of the energy consuming aspects of the school. We recorded our observations by taking pictures throughout the school. These observations included positive aspects, such as motion sensors, as well as negative aspects, such as lit but empty classrooms.

Another way that we identified resources was talking with the school staff member. They were able to list the actions that the school was undertaking to reduce carbon emissions. These actions were focused on activities in which the children participated as well as renewable energy projects that the school had installed. These actions were written down so that they would not be included in the action plan.

The third way that we identified resources was through talking to students, though only at Rockmount because of time constraints. These resources were more focused on community initiatives; however, some of them could be applied to the schools. These actions were also written down for consideration in the final action plan.

Question 2: What are the barriers to change in a school?

The task of recognizing barriers was achieved mainly through talking with the contacts we made at the schools along with some observations. During the several hours of training we

casually talked with the teachers in order to gauge their feelings about this new program from the Croydon council. During these conversations there were several common themes, all of them about why they should participate in this program. This being the main issue, we documented specific suggestions from the schools regarding appropriate rewards for their efforts. Also, during our tour, we noticed that certain energy reduction measures were broken or misused. Pictures were taken as a form of documentation and then written up as suggestions. We wrote up all of these suggestions as recommendations and talked several times with our sponsor to discuss reasonable possibilities to resolve these two issues.

5 Results

5.1 Largest Energy Wasters and Solutions

Using primarily on the energy audits, with support from other research, major sources of energy waste were identified, as well as no-cost solutions to them. The most significant source of wasted energy is in the heating of a building. This can stem from many reasons, the first of which can be maintaining a higher-than-necessary temperature. Many buildings set the temperature at 21° C, when 19° C or 18° C would still be a comfortable temperature. Due to the exponential nature of the energy it takes to heat mass, this small decrease in temperature can represent major savings. Also, some schools do not allow for the temperature of rooms to be controlled individually, so when a room becomes overheated, the teachers have no other way to control the temperature other than opening a window, which releases all of that heat energy. By experimenting with the temperature and communicating with the building staff, a comfortable temperature for the school could be found. A better solution would be to allow teachers to adjust the temperature of the rooms on an individual basis. This requires devices such as thermostatic resistor valves (TRVs) to be installed. TRVs allow for individual control of a radiator.

Another source of wasted energy is electronic equipment being left on while not in use. This includes lights, computers, copiers, projectors, etc. that are not powered down when a user finishes using them. One solution would be to raise awareness for turning electronics off by using signs, posters, and stickers to remind people. These materials can be obtained through EaST if the school is participating in the ECCP, or through Carbon Trust, one of the non-profit organizations that were researched.

Inefficient use of lighting is another contributor to wasted energy. Often, rooms are lit with artificial light, but the shades are drawn shut. If these windows were utilized, then the amount of electric lighting necessary would be substantially less. Rooms with large windows can often be lit entirely using natural light. Sometimes the light from the windows is not enough, however the lights farthest away from the windows can be turned on to compensate for this. This can only be done in rooms where the lights are set up in banks that run parallel to

the windows. If this is not how the lights are arranged, or all of the lights in the room are on one switch, then the issue becomes a maintenance one. The lights would have to be re-wired to be properly set up for maximum efficiency. One last way to improve lighting efficiency is to employ task lighting. This means only using the lights that are necessary for what is being done. For example, if only one area of the school is being used after regular hours, there is no reason for the other unused areas to be on.

The final major source is using inefficient bulbs. This can be easily remedied by purchasing energy efficient bulbs, and as the old bulbs burn out, they are replaced by more efficient ones. This includes replacing T12 fluorescent tubes with T8 tubes, which are comparably priced and output the same amount of light while using less energy, as well as replacing incandescent bulbs with energy-efficient fluorescent ones.

5.2 What the Audits Revealed

Before arriving in London, we reviewed thirteen school audits and broke down the energy reduction methods into concise pie charts. The purpose of using the pie charts is to demonstrate what proportion of the savings comes from each method suggested. Of these thirteen school audits, only nine audits contained complete data. These graphs are used to illustrate the potential savings from the four no-cost energy reduction recommendations suggested for the nine schools.

- Method versus Savings

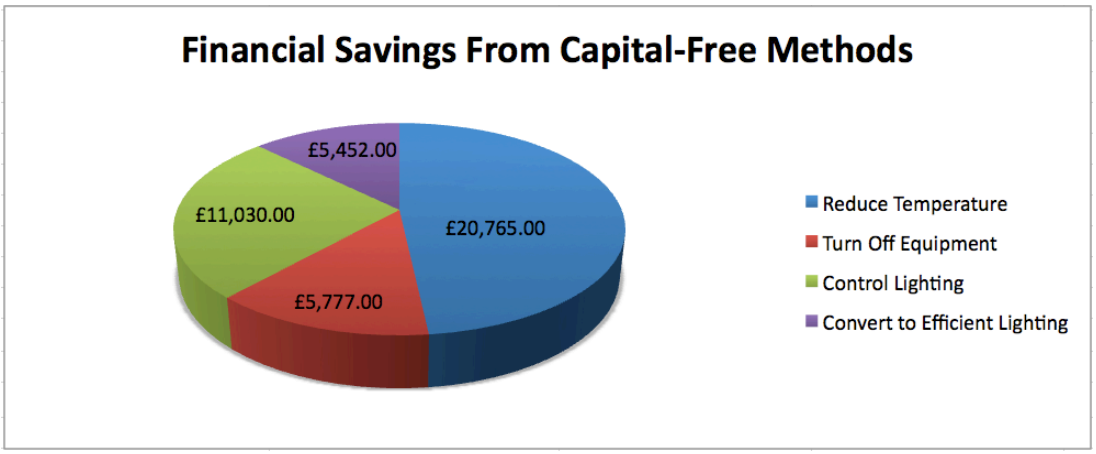

Figure 8: Method vs. Savings for Zero-Cost Methods

Figure 8 shows the total amount of money that the schools could save by implementing these measures. As the graph shows, simply turning down the temperature in the building can represent almost half of the total energy savings.

- Method versus Energy Reduction

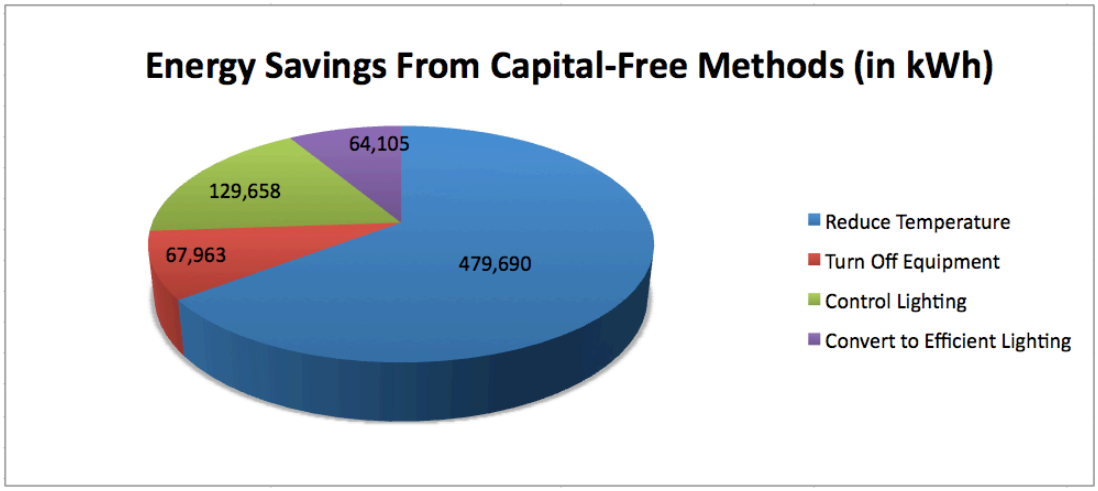

Figure 9: Method vs. Energy Reduction

Figure 9 shows the energy savings, in kWh, of these methods. Again, reducing the temperature represents the majority of the savings with almost two-thirds of the energy saved.

- Method versus CO_2 Reduction

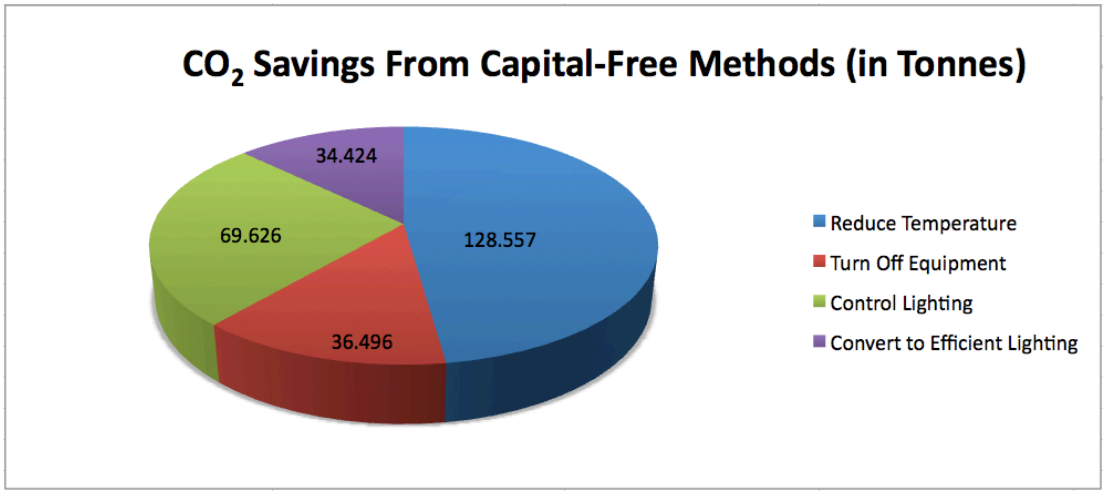

Figure 10: CO2 vs. Method Reduction.

Figure 10 demonstrates the savings in CO_2 emissions from implementing these recommendations, with reducing temperature accounting for almost half of the savings.

These graphs show the total amount of savings from nine schools across the borough. As these graphs show, the savings from the no-cost measures suggested in the audits would provide the push for schools to adopt the policy changes. Thus schools will be more cooperative in adopting the ideas from the Carbon Hub action plan in order to achieve the monetary savings.

5.3 Determine the Best Method of Training School Faculty on the Use of CarbonHub and Collection of Carbon- Related Data

From our personal training of the staff we found that school staff members responded better to personal training (from experience with Rockmount, Heavers Farm, Wosley, and Thornton Heath) rather than training conducted through a paper training guide (from experience with Riddlesdown). From our background research with the school audits as well as working with Interserve we found that this data was often incomplete and poorly compiled. Some schools such as Rockmount, Heavers Farm, and Thornton Heath had a good amount of energy and water data from years past, however it was very poorly organized and difficult to sort through. Wosley and Riddlesdown had none of their energy and water data readily

available. Furthermore, none of the schools had any idea about how much waste they threw away each year or any idea how far the students and staff have to commute each year. Because of the unreliability of the access to data, we found it helpful to bring mock data for the purposes of getting the trainees accustomed to the program.

From our experiences training faculty at the five schools, it was determined that the training takes about two hours, but teachers should be informed that it can take longer. This became an issue in one of our sessions at Wolsey when two of the three trainees had to leave before the training was finished due to other commitments. This should be avoided if possible because it is disruptive to other trainees, as well as the one who is leaving because they will not know the whole program.

There were some issues with the trainees understanding CarbonHub. Some of the common ones included forgetting to check 'section complete' boxes, confusion between the difference between the Travel, Vehicle, and Commuting Sections, and the few suggestions that had no relevance to the school. After the school staff had some experience using this program, we were able to completely clear up these issues through answering questions during the visit as well as showing them how to use CarbonTracker.

5.4 Evaluating CarbonHub and Its Adaptation for Schools

Because CarbonHub was not originally designed to be used in schools, we were asked by our sponsor to evaluate how well it has been adapted, as well as the program overall. There are many strong points to the program. It is very comprehensive, requiring data from across many areas to create a very thorough carbon footprint. All of the data that needs to be entered is very clearly marked in the program and that data is then simply entered into the appropriate box in CarbonHub. The data is difficult to gather, but that isn't a problem with the program itself, but it is a problem that arises with the use of the program. Once the carbon footprint is developed, the software provides a very clear, graphic display of the carbon emissions, making it very easy to see where the most emissions are coming from. Lastly, the action plan that is created is very detailed. It provides many suggestions for how to achieve all of the goals set.

There were some problems with the program from the users' perspective, though they all dealt with errors in the transition from businesses to schools. In several locations the term business is used, which confused some of the trainees. There were also sections in the area where the user answers questions about their school that didn't belong, such as "Goods and Procurement" and "Factory and Warehouse."

From an administrative point of view, we found several other issues with the program. The most glaring issue was the lack of administrative access to accounts. CarbonHub does not show the action plan published by a school on their profile, and we needed access to it in order to develop our own action plan. We struggled to get the password from the school so we could have access to it, and it delayed the development of an action plan by over two weeks. With that in mind, the lack of the action plan being accessible on the profile was another issue. It was determined by the group that it should be available to increase transparency of the school's actions. Students, parents, and teachers should be able to see what a school plans on doing, is doing, and has done, which is all laid out in the action plan on CarbonHub. The final issue was the inconsistency of the input. There were a few sections that allowed for the input of the frequency of an item, such as trash pickup and water usage. This option is not available anywhere else in the program, and to improve consistency, should not be there.

In working with CarbonHub, we discovered other issues that were not defects in the software, yet nonetheless made it difficult to use. One of our first observations was that CarbonHub requires a lot of data, mostly in a per annum amount. We determined that most schools would not have this data, and would have to collect a year's worth of water, gas, electricity, etc. bills, and total them up. We also were surprised that CarbonHub required a year's worth of commuting data, which is difficult to gather and calculate. Doing all of these calculations by hand introduces a lot of human error into the process, as well as takes a lot of time. All of these issues led us to develop CarbonTracker, which is discussed in detail in Section 6.2. CarbonTracker is a partner tool to CarbonHub that allows for the entry of data as the user receives or gathers it, and automatically calculates total usage. It also contains a tool to collect and calculate commuting data. This tool was developed to alleviate all of the problems we

found in collecting the data so that when the data needs to be entered into CarbonHub, it is all at the user's fingertips.

CarbonTracker (See Appendix 4) was developed through ideas from our own training as well as through ideas we gathered after field-testing CarbonTracker. The main feature of CarbonTracker that needed to be tested is the ability to compute the yearly commuting distance of the school. To test the feasibility of implementing this, we used Rockmount Primary as a test school. Through discussions with Ms. Jessel, we agreed on a method of gathering the necessary data to use the tool. One of the members of the eco-council went around to each class and, with the help of the teacher determined how each pupil arrives at school each day using a short survey we developed (See Appendix 5). Then, using a list of students' addresses, four members of the eco-council used Google Maps to determine how far each pupil lived from school. They put this mileage under the correct type of travel in the Commuting Calculator using the data collected about mode of transportation. Based on this trial run of the Commuting calculator, we found that a group of children, as young as nine, could take this data and then enter it for the entire school after about ten minutes of training.

5.5 Identifying a School's Unique Needs and Resources

Every school has its own issues that need to be addressed, but also its own resources to handle them. Using several methods, we were able to determine what these resources were for each school surveyed (See completed surveys in Appendix 6 and a summary of the surveys in Appendix 7). The most effective of these methods was to do a walkthrough of the school. This allowed us to make first-hand observations of the school. We paid attention to a lot of the small details, like signs to turn lights off, shades being open, correct arrangement of lights, correct type of lights, etc. We also took pictures, as shown in Figures 11 and 12, so that when writing their action plan, we can give them direct examples. We also asked to see energy meters to see their accessibility and any initiatives that were in place in the schools to gauge what the school is doing on its own.

Figure 11: Sign from Thornton Heath
These signs had been posted near most lights and we observed that lights were being turned off.

Figure 12: Picture of a new Wolsey Classroom.
Notice the brightness of the room that is lit solely by sunlight.

Another useful source of information is the site manager. It was very useful to have the site manager guide the walkthrough so that any questions that came up could be answered immediately. Also, several of the solutions for issues at the school are ones that would be handled by the maintenance staff, so having them be part of the implementation of the action plan was very helpful. Having done walkthroughs with and without the site manager, the ones with the site manager were unique because we could see all sections of the school. Two aspects of a school that can only be seen by taking a walkthrough with a site manager are show in Figures 13 and 14.

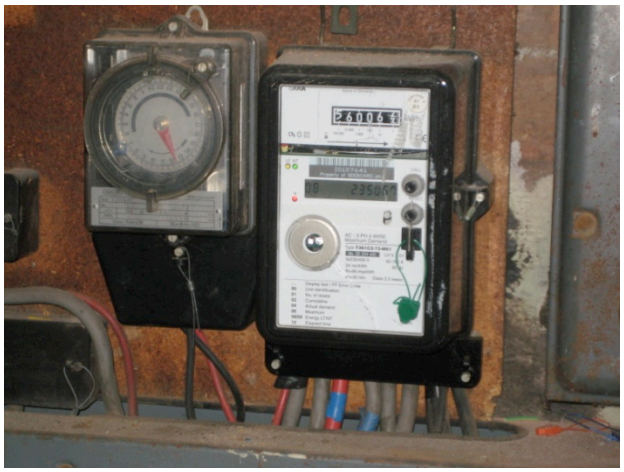

Figure 13: Picture of a Wolsey Electric Meter
The site managers took us on a tour that included showing us the meters for the school.

Figure 14: Picture of bins from Thornton Heath.
The recycling and rubbish bins are sometimes kept in secure cages that only the site manager can access.

The teachers were also a good source for finding resources in a school. Some teachers are more environmentally aware than others and have programs in their own classrooms. They also can provide perspective on some of the issues of the school that would not be shown from administrative personnel. In one classroom, as shown in Figure 15, it was very hot and the windows were open, but the heater was on. When asked, the teacher explained that opening the windows was the only way she could bring her room to a reasonable temperature.

Figure 15: Picture of a Rockmount Classroom.

The last source of information in the schools was that pupils. They make up the majority of the people in the building, so getting their opinions and feelings toward carbon emissions and carbon reduction was very important. We were able to get the children's opinions during and after the presentations. Then pupils we were able to talk with were very enthusiastic and knowledgeable about reducing climate change, which influenced our action plan. They knew about the ground-source heat pump, grocery bag recycling programs, but most importantly why these programs were important. These children seemed to be well informed because over

half the class raised their hand and most of our questions were answered correctly. Thus the students themselves are a key resource, and they should be involved in implementation of the action plan. Getting all of these perspectives of the school allowed for a more thoughtful analysis of where the school is currently, and where they can to go with regard to carbon reduction.

5.6 Identifying and Addressing Barriers

Rockmount and Heavers Farm displayed the fewest barriers to accepting CarbonHub into their school as compared to the other three schools. Our contact at Rockmount was very enthusiastic about the program and the action plan, the school as a whole was very forward-minded about implementing carbon reducing methods, and they had even begun implementing their own ideas on reducing the effects of climate change. This is likely due to the advocacy of our contact at the school, Suzanne Jessel, who has been working with the school for several years to make it more eco-conscious. We identified some barriers in Rockmount, Heavers Farm, Riddlesdown, Wolsey, and Thornton Heath. Table 4 shows the barriers we identified in each of the schools:

Table 4: Barriers to Implementing CarbonHub

Barriers to Implementing CarbonHub	
School	Barriers
Heavers Farm	Lack of funding for some of the desired improvements.
Riddlesdown	During the first two trips there were scheduling and then power issues in the school. This forced us to rely on giving the staff member a paper training guide which proved ineffective. Also, there was no dedicated staff member so email contact was slow and our contact at the school was already very busy

Wosley	The three staff members that we met with were very keen on implementing CarbonHub as long as they gain recognition for their efforts. Their other point was how their efforts would fiscally benefit the school. We were unable to give answers either of these inquiries
Rockmount Primary	Broken light sensors and overflowing recycling bins indicate a lack of funding or of proper maintenance.
Thornton Heath	The "champion" at the school was on maternity leave and on one else filled her place while she was gone. Staff here was not thrilled to get another task to accomplish from the council.

At Heavers Farm, the largest barrier to their carbon reductions seemed to be a lack of funding. The site manager at the school seemed to have several good ideas about how to improve their situation, like replacing light sensors or insulating windows, but he did not have the funds to do so. He was very receptive of CarbonHub, though, and with it, he can overcome the money barrier by suing CarbonHub to find low or no cost ways to reduce the school's carbon.

The main barrier at Riddlesdown was the lack of a dedicated staff member to handle an environmental program. We visited Riddlesdown three times before we were able conduct the training with the staff member. To address this barrier, we suggest that EaST should make sure that the volunteer staff member has the time to maintain the data entry into CarbonHub as well as maintain an awareness of any new initiatives that EaST posts on CarbonHub or their website.

At Wolsey, the main barrier was that the staff members felt unrewarded for their efforts. Through our conversation during the CarbonHub training, the staff members were constantly remarking that they would like to be recognized as a leading school. To address this barrier, EaST should set up a logo for the ECCP that the schools could then place on their letterhead. This simple image seemed to mean a lot for Wolsey.

The main barrier at Rockmount was maintenance issues. Despite their highly motivated and involved guidance councilor, the site manager has to ensure that the school's efforts are properly maintained so they don't waste their money. We were unable to meet with the site manager so we recommend that future trainers at least talk with the site manager to find out their responsibilities.

The largest barrier at Thornton Heath seemed to be that there was a lack on interest in carbon emissions reduction. Although there was someone at the school who was very enthusiastic about carbon reduction, this person was not present when we gave our training. The person who did receive the training seemed to simply want to get it over with and did not regard it as an important issue. If this opinion of carbon emissions persists, it is unlikely that the school will take the necessary action to make any changes to their policies. This barrier may be an issue but can hopefully be fixed through continual support from the Croydon Council. Eventually, the woman who was very interested in carbon reduction will return and will be able to drive the school.

These barriers were identified through our personal conversations with the staff members and the pictures we took during the walkthrough. There is no way that anyone could have predicted the specific barrier to each school without having a long conversation with the staff members or have a walkthrough of the school. These barriers bring up several important points, though. Riddlesdown shows the benefits of in-person training. It removes the possibility of a future plan to send out training materials so the staff members can train themselves how to use the program. Staff at Wolsey was very interested in getting some recognition for their efforts. This is a very reasonable desire that was overlooked by our group, as we focused on the financial and environmental benefits. Thornton Heath demonstrated the vulnerability of an environmental awareness program. When a program depends on only one person, it can quickly fall by the wayside if that person left. This demonstrates the need for several people to be involved in this carbon reduction program because this program needs to outlast the tenure of a staff member in order to reduce global warming.

6 Deliverables

6.1 The Action Plan

The purpose of the action plan is to give the schools a guide to how they should reduce their energy consumption. The schools need this guide to give them a realistic and guided plan to reduce their emissions in a significant and measurable way. This document will give the schools a sequenced set of steps to follow, providing them first with simple tasks for guaranteed and fast success and later with tasks that require more investment. In addition, a chart is provided to give the schools an implementation timeline that they can follow. We have developed one detailed and specific action plan for Rockmount Primary. This action plan explains the steps necessary to implement each task listed in the plan. We have also developed a second and more general action plan for the use by EaST, so that they can easily make action plans similar to Rockmount's for a larger number of schools.

6.1.1 The Written Plan

Rockmount's action plan is presented below. In addition, a generic written action plan for all the schools, which is based on the audits and our observations, is included in Appendix 1.

Rockmount Action Plan

Action Plan Suggestions

After reviewing the school's CarbonHub account, any audits of the school that were available, and our own observations of your school, we created an action plan. Any suggestions that were made from CarbonHub that fit with your school have been added to the plan, and have been modified if necessary, to provide more personalized help. We also incorporated suggestions from your school's audits in a similar manner. Additional suggestions were made based on the team's observations from a walkthrough of your school. By following these suggestions the school can help the Borough of Croydon to reduce its carbon emissions.

Heating

Audits from a number of schools show that heating is a large waste of energy (CEN, 2008, 1). The energy used to produce that heat could be saved, thus reducing the carbon emissions This is true in Rockmount in particular. Your heating bills indicate that heating is left on during the summer months. If heating systems were turned off when not needed, the school could save a large amount of money instead of paying for that heat. This can be completed by the site manager by August.

- *Turn off the heating in early May,*
- *The heating should be turned back on when necessary, most likely sometime in September.*
- *If your heating is turned off for May, June, July, and August, you can subtract the capital and carbon emissions from heating for those months.*

In addition, the heat in the school can be turned down by three degrees year-round. These three degrees should not produce a noticeable change in the comfort of the school, but due to the exponential nature of the energy required to produce heat, a large amount of energy can be saved by such a small change (CEN, 2008, 1). This can be completed by the site manager by October.

- *Turn down the heat by 3 degrees permanently,*
- *If the heat is left 3 degrees lower year round, it can reduce the school's energy by 15 to 20 percent.*

It also may be worth installing individual temperature regulators in each classroom. These regulators can be useful in reducing the school's heating bill (CEN, 2008, 1). That way, if one room becomes too warm for the people in it, a teacher can turn down the temperature. The team observed one teacher opening windows to cool a room where the heat was on, and so the energy used to warm the room was wasted. If a teacher can turn down the heat by himself or herself, that energy can be saved. This can be completed by the site manager by December.

- *Buy thermostatic regulator valves.*

- *Have the site manager install them on heating pipes in rooms.*
- *This could save about 20% of the heating bill.*

Cooling

A large source of wasted energy often comes from placing cooling equipment, i.e. air conditioners, nearing the same space as heating equipment, e.g. computers. It may be possible to keep the ICT Suite cool enough by keeping the windows open instead of using the air conditioner. This would save the energy spent on the air conditioner. This can be completed by the site manager by November.

- *The site manager should turn off the air conditioner and leave the windows open for a week.*
- *If the room is too hot, close the windows and turn on air conditioner at a lower power than it was at to begin with, for a week.*
- *If the room is still too hot, turn the air conditioner back up a little for the next week. If it is still bearable, try turning the air conditioner down further for a week.*
- *Try to use the least amount of energy possible to cool the room.*

Figure 16: Air Conditioning Unit in the ICT Room

Lighting and Electricity

Lights in the hallway can be turned off during the day because most of the hallway is lit very well by windows. On darker days or in shady areas some lights may be necessary, but it should be protocol to turn only these necessary lights on. Using sunlight to light rooms wherever

possible is a simple but large energy saver (EPA's Green Lights Program, 2007, 5). This task can be completed by the site manager and/or teachers by November.

- *As teachers or staff walk through halls they should turn on lights as needed, and turn them off when they are no longer necessary.*
- *This provides instant savings and can make the school feel cooler to the occupants.*

The same issue, where the entire ceiling does not need to be lit, arises in the classrooms. It seems that most classrooms are lit well enough using only one bank of lights, and leaving any other banks turned off. By using lights in this way, teachers can save energy (EPA's Green Lights Program, 2007, 5) as well as set an example about saving energy to the students (Croydon Cabinet Report). This task can be completed by teachers by November.

- *When teachers require lighting in the classroom, they should only turn on one bank of lights.*
- *If more lighting is required, lights should be turned on one bank at a time until sufficient light is provided.*
- *This provides instant savings, and could reduce your electric energy use by 10 to 15 percent.*

The monitors in the ICT Suite should be linked to a common switch so that they can be turned off when not in use. About 75% of energy used by a computer is used by the monitor, even if a screen saver is on (CEN, 2008, 1). If all of the monitors are linked to one of the switches on the wall of the ICT Suite, then a teacher can turn off all of the monitors easily when a class is done with them. This can be completed by the site or ICT manager by December.

- *The monitors in the room should be tied to a few outlets so that a teacher needs only to flip a few switches at the wall in order to turn the monitors on or off.*
- *This would provide instant saving of energy of roughly 75% of the electricity needed for the computers in the ICT suite.*

Figure 17: 35 Monitors in Screensaver Mode

Light sensors are a good way to reduce the energy used on lighting (CEN, 2008, 1). While walking through the school, it seemed that some of the sensors on the lights were not functioning properly. When rooms were left empty the lights would stay on. Perhaps the sensors are simply on a very long delay, but it would be worth checking to make sure that all sensors work properly. Any sensors that are broken should be replaced. This can be completed by the site manager by January.

Recycling

The school can save a lot of money by recycling more of its waste. By working with Croydon Council, the school can procure more recycle bins. Every bin of recycling is ten times cheaper to dispose of than a bin of rubbish. This can be completed by the site manager by January.

- *Contact Julie O'Maley at the Corydon Council, at julie.o'maley@croydon.gov.uk, to retrieve another recycling bin.*
- *Place recyclable waste in this bin.*
- *If three of the waste bins are replaced, 38% of the current waste budget could be saved.*

Figure 18: Overflowing Recycling Bin

To fill those recycling bins, it would be worthwhile to place additional recycling bins around the school and in classrooms. Students and teachers could place more of their recyclable waste in these bins instead of in the rubbish. This would help to get the students involved in reducing the school's carbon (Croydon Cabinet Report). This can be completed by the site manager by January.

- *Purchase small bins to place in the classrooms, and inform the children that they should place recyclables in the bin.*
- *The Sixth year Eco-Council members should collect the bins and empty them into the larger recycling bin outside weekly.*

The school should implement as many of these suggestions as it is comfortable with. The Council is enacting similar action plans in schools throughout the borough, and with the help of your school the carbon emissions goal can be reached. If any problems arise please feel free to contact the Council at Will.Walker@croydon.gov.uk. We hope that the school can adopt a carbon reducing mindset, so that carbon reduction can continue into the future. The school can consistently use less and less energy as these plans progress and as the school continues monitoring its emissions with the CarbonHub. Thank you for working with us.

6.1.2 The Summary Chart

In addition to providing schools with the written plan above, we have also created an Excel summary sheet. This Excel sheet has the basic information that was contained in the written action plan. The suggestions are listed, as are the suggested deadline and the person who should be responsible for each task. The carbon and capital saving are compared qualitatively as large, medium, or small. This rating system was used by the CarbonHub, and we have utilized it for the sake of consistency with this format. The source of the suggestion is listed as well, and there is room for any modifications, notes, or a check mark for completion of the tasks.

The following example is a summary chart of the plan for Rockmount that would be used as a chronological checklist that complements the written action

Action Plan Suggestions - Rockmount Primary

Listed from easiest to implement to most difficult to implement

First Stage tasks can be implemented immediately

Second Stage tasks require either some monitary investment or a large amount of time

	Suggestions	Modifications	Carbon Reduction	Capital Saving	Reduction Area	Source	Suggested Deadline	Suggested Personnel	Notes	Check when complete
First Stage	Turn off the heating during the summer months		Large	Large	Heating Bills	Observation	Aug-09	Site Manager		
	Reduce the overall heating by 3 degrees		Large	Large	Heating Bills	CarbonHub	Oct-09	Site Manager		
	Experiment by turning off the A/C in the ICT Suite and letting the air from windows cool the computers		Variable	Large	Electric Bills	Observation	Nov-09	Site Manager		
	Turn the hall lights off during the day		Small	Small	Electric Bills	Audits	Nov-09	Site Manager and Teachers		
	Use one bank of lights in the classroom		Small	Small	Electric Bills	Audits	Nov-09	Teachers		
	Have the monitors in the ICT Suite linked to a common switch so they can be turned off when not in use		Medium	Medium	Electric Bills	Observation	Dec-09	Site Manager		
	Suggestions	**Modifications**	**Carbon Reduction**	**Capital Saving**	**Reduction Area**	**Source**	**Suggested Deadline**	**Suggested Personnel**	**Notes**	**Check when complete**
Second Stage	Install Temperature Controls in all of the classrooms		Medium	Medium	Heating Bills	Audits	Dec-09	Site Manager		
	Check motion sensors on lights and fix broken ones		Small	Medium	Electric Bills	Observation	Jan-10	Site Manager		
	Work with the Croydon Coucil to procure more recycle bins		Medium	Large	Waste Bills	Observation	Jan-10	Site Manager		
	Place recycling bins around the schools so that the children can recycle more of their waste		Medium	Large	Waste Bills	CarbonHub	Jan-10	Site Manager		

Figure 19: Action Plan Suggestions for Rockmount in Chart Form

6.2 CarbonTracker

CarbonHub is a fairly extensive tool that utilizes energy usage data across many areas to create a comprehensive carbon footprint. One downside of the program is that it is difficult to

assemble yearly totals from monthly or weekly bills. We observed this first hand as none of our schools could produce their own data, and we had to rely on the severely understaffed Interserve team in the Croydon Council for each school's energy data from bills.

There were two difficulties we identified, as discussed in the results section. First, the CarbonHub only allows the input of annual data; it requires the user to find all of the bills or readings at the end of the fiscal year and then to add them up and enter the totals into the software. The problems are that none of the schools we worked with had the aforementioned bills and even if the schools had the bills, there is always the possibility of a math error. We aimed to solve these problems with the development of our CarbonHub supplement tool, called CarbonTracker.

This tool was originally intended by our sponsor to be a simple spreadsheet that would allow the schools to identify what data they did, and did not, have before we arrived for our CarbonHub training session. After some thought, our group decided to create something more substantial, something that could be used long after the IQP ended. The tool was meant to help the schools track their energy usage throughout the year instead of scrounging the data together once every year in order to enter it into CarbonHub.

There are individual tabs for Energy, Vehicles, Travel, Commuting, Waste, and Water, CarbonTracker calculates each section, based on bills or information from the students and staff for the Commuting tab, automatically for each school.

Without this tool, the user introduces a slight human error into the mix, affecting the results of the emissions report. To prevent these problems, areas have been created in the tool to allow for the monthly usage (or weekly pickup, in the case of waste) to be input into the tool. The cells will automatically be totaled and displayed to the user. This function allows the work to be spread out over the course of the year and removes the possibility of human error affecting the results. CarbonTracker also makes use of dropdown menus to allow the user to select the source of the data or enter their own if it is not one of the standard options. This function is important because any questionable data could easily be tracked back to hard evidence as long as the user knows where the data came originated. Figure 11 shows the data entry for the Energy Section in CarbonTracker.

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q
1	Energy Section																
2																	
3					Monthly Entry												
4					Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
5	Source of Energy	Total Amount	Source of Info		Amount of Energy												
6	Electricity		234														0
7	Natural Gas	234															0
8	Heating Oil	234	234														0
9	Biomass Boiler																0
10	Renewable Electricity	324	23														0
11																	
12			Source Options:														
13			Bill														
14			Invoice														
15			Expense														
16			Other														

Figure 20: Energy Section of CarbonTracker

Without CarbonTracker, schools' collection of transportation data is very difficult because of the sheer number of people and the age of most of those people. CarbonHub asks for the yearly totals of the distance traveled by the school population separated by mode of transportation. In a Primary or Junior school, there are about 20 to 30 students per teacher. It is quite a chore for that teacher to collect the data from all of the students and then input it into the CarbonTracker in terms of weekly or monthly distances traveled. Instead, CarbonTracker includes a tool to calculate the commuting data of the entire school population. To alleviate much of this work, as a massive amount of data is required, the tool includes a feature where anyone, a designated group of teachers or students, can enter the 1-way travel distance and the mode of transportation for each student and teacher in the school. The tool then takes all the data for each mode of transportation and produces the yearly commuting data to be entered into the CarbonHub. Figure 12 shows the section of CarbonTracker where the data will be entered for each student:

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Commuting Calculation Form												
2	This sheet is to help you calculate the amount of travel per person per year for each method of travel. Each person, both student and faculty, should submit the 1-way distance to												
3	school for each mode of travel. It will automatically be calculated how much that would be over the course of the year for both directions.												
4		Totals	0	0	0	0	0	0	0	0	0	0	0
5	Last Name	First Name	Petrol Car	Diesel Car	LPG Car	Hybrid Car	Motorcycle	Train	Tram	Bus	Underground	Walking	Bicycles
6													
7													
8													
9													
10													
11													
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Figure 21: Commuting Calculation Form in CarbonTracker

To calculate the yearly distance that each student commutes, a homework assignment could be distributed to each student and staff member where they would be asked the distance they travel by each mode of transportation, and then hand it in the next day. Once collected, the teacher trained on the CarbonHub would enter this data into the CarbonTracker. Once entered, the correct yearly travel distances would be produced by CarbonTracker.

In an ordinary excel sheet, users can change the formula assigned to a cell. Extensive measures have been taken to prevent changes to CarbonTracker by protecting each cell so that only the fields that should be edited can be edited. This ensures that the user does not accidentally delete a crucial formula thus making CarbonTracker much more secure and durable.

Work Summary

Energy		Vehicles		Travel		Commuting		Waste		Water	
Elect. Amount	Complete	*Personal Vehicles*	-	*Hire Vehicles*	-	Petrol Amount	Incomplete	*Non-Recycled*	-	Water Volume	Incomplete
Elect. Source	Incomplete	Bicycle Amount	Complete	Hire Car (Petrol)	Complete	Petrol Source	Incomplete	Waste Amount	Complete	Water Source	Complete
Renewable Amt.	Incomplete	Bicycle Source	Incomplete	Hire Source (Petrol)	Complete	Diesel Amount	Incomplete	Frequency	Incomplete		
Renew. Source	Incomplete	Motorcycle Amt.	Incomplete	Hire Car (Diesel)	Complete	Diesel Source	Incomplete	Collections By	Complete		
Nat. Gas Amount	Complete	Motorcycle Source	Complete	Hire Source (Diesel)	Incomplete	LPG Amount	Incomplete	Source	Incomplete		
Nat. Gas Source	Incomplete	Petrol Amount	Incomplete	Hire Car (LPG)	Incomplete	LPG Source	Incomplete	*Recycled*	-		
Oil Amount	Incomplete	Petrol Source	Incomplete	Hire Source (LPG)	Incomplete	Hybrid Amount	Incomplete	Waste Amount	Complete		
Oil Source	Incomplete	Diesel Amount	Incomplete	Hire Car (Hybrid)	Incomplete	Hybrid Source	Incomplete	Frequency	Incomplete		
Biomass Amount	Incomplete	Diesel Source	Incomplete	Hire Source (Hybrid)	Incomplete	Motorcycle Amt.	Incomplete	Source	Incomplete		
Biomass Source	Incomplete	LPG Amount	Complete	Hire Van	Incomplete	Motorcycle Source	Incomplete				
		LPG Source	Incomplete	Hire Van Source	Incomplete	Train Amount	Complete				
		Hybrid Amount	Incomplete	Hire Coach	Incomplete	Train Source	Complete				
		Hybrid Source	Incomplete	Hire Coach Source	Incomplete	Tram Amount	Incomplete				
		People Carriers	-	*Employee Vehicles*	-	Tram Source	Incomplete				
		Petrol Amount	Incomplete	Emp. Car (Petrol)	Incomplete	Bus Amount	Complete				
		Petrol Source	Incomplete	Car Source (Petrol)	Incomplete	Bus Source	Complete				
		Diesel Amount	Incomplete	Emp. Car (Diesel)	Incomplete	Underground Amt.	Incomplete				
		Diesel Source	Complete	Car Source(Diesel)	Incomplete	Under. Source	Incomplete				
				Emp. Car (LPG)	Complete	Walking Amount	Incomplete				
				Car Source (LPG)	Complete	Walking Source	Incomplete				
				Emp. Car (Hybrid)	Incomplete	Bicycle Amount	Incomplete				
				Car Source (Hybrid)	Incomplete	Bicycle Source	Incomplete				
				Employee Van	Incomplete						
				Van Source	Incomplete						

Figure 22: Work Summary Form in CarbonTracker

The last, and most important, feature of CarbonTracker is the work summary as shown in Figure 13. This summary will allow the user to see at a glance what data still needs to be collected, and what data is complete. The summary will not respond to words being entered into fields that require a number. This provides two benefits. The first is that it will prevent false positives in fields where perhaps a wayward keystroke was entered; second, it allows the user to type notes into a field, such as “Ask Jim”. This serves as a convenient reminder about what data needs to be gathered.

All of these features allow the user to have a much easier experience with the CarbonHub. It also allows the tracking of energy usage throughout the year, making data entry

into CarbonHub a year-round process, as opposed to the yearly event it normally implies. It will also alleviate an end-of-the-year scramble to collect it all when teachers are typically busy.

6.3 Sample Presentation for Primary Schools

The purpose of the presentation is to show the evidence of global warming and provide a clear depiction of the impact on all individuals from the continued rise in global temperatures as well as describe means for each individual to reduce their energy consumption. The first part of the presentation contains the following sections:

- The definition of global warming
- The indicators of global warming
- The world-wide effects of global warming
- The effects of global warming on the UK
- The effects of global warming on London
- The effects of global warming on Croydon

The second part of the presentation shows:

- The amount of CO2 emitted per kW of energy converted from various fuels
- The ability of each student help reduce global warming
- The combined effect of our proposed changes on the thirteen schools that were audited
- How to calculate the amount of energy a home uses per year

We used real world data to convey the magnitude of the problem to students. For example, the students have learned about the last ice ages and their impact on the planet. Using the data from our background section, we can show the students what the long-term effects of this temperature change could include.

The next section of the presentation focused on the capital-free ideas in accordance with the current budget of the Croydon Schools. These ideas included basic behavioral changes such as closing windows, turning off unused lights, and lowering the thermostat in the winter. This section had also been designed so that the students can see the benefits of employing these techniques at home. Thus the presentation presented a basic cost versus benefit analysis

for basic upgrades to reduce energy use. After the presentation has ended, a short Q&A session was held with a volunteer group of faculty and students. The goals of this Q&A session were:

- Gather information from the students
  - Determine how interesting the presentation was.
  - Determine the feelings of the audience toward global warming.
  - Determine the feelings of the audience about their ability to help the UK reduce carbon emissions.
  - Gather input on the presentation regarding the facts presented.
  - Gather input on what the audience would like to know more about.
- Deliver answers to the students' questions, filling any gaps from our presentation

These goals were designed to assess the success of our presentation session, so that we could develop a set of recommendations for future presentations about carbon emissions. The slides used in the presentation are included in Appendix 9.

Figure 23: Presenting to the Students of Rockmount

6.4 Non-profit Environmental Organizations in Croydon

This deliverable was important to our sponsor because EaST has eight members who are responsible for reducing the carbon emissions throughout the borough. In our project, four dedicated people were only able to train five schools in seven weeks. Using this relation it would take all eight members of EaST about 88 weeks (1.7 years) to reach the remaining 125 schools. These NEOs will allow EaST to reach a far larger portion of the borough, including the schools, a lot faster without costing the Croydon Council the capital to hire more full time employees. Furthermore, our results showed that personal contact with the school staff members was very important; a simple paper handout is inadequate to train the school staff members. These NEOs have the manpower to go into schools to give presentations as well as work with children to develop action plans for the school. In this deliverable we found 8 NEOs and summarized their capabilities in Table 10.

Table 5: Non-Profit Environmental Organizations that Work in Croydon

Organization	Services	Contact Info
EST and CAfE	Courses about energy Funding advice Examples of other projects Carbon footprinting and reduction help Energy saving checklist Waste reduction tips Search for grants Water saving tips Energy saving products Renewable energy explanations	0800 512 012 http://www.energysavingtrust.org.uk/ cafe@est.org.uk
Envirowise	Advice on reducing waste Advise on managing unavoidable waste	0800 585794 http://www.envirowise.gov.uk/

Carbon Trust	Carbon survey Carbon saving workshop Building design advice Carbon footprint calculation Action plan tool Starter pack Enhanced capital allowances Public/private sector energy management Free posters and stickers Applied research grants	0800 085 2005 customercentre@carbontrust.co.uk
Groundwork	To promote recycling For businesses, environment training Recycling plans More activites to make buildings green	020 7922 1230 london@groundwork.org.uk
Thames Water	Education on water use at thames water sites Funding for disadvantaged students to study engineering Water-related resources for teachers Will give talks to schools and organizations about saving water Explains how to audits schools water use	0118 373 8000 customer.feedback@thameswater.co.uk
Global Action Plan	Helps schools to perform audits and develop action plans with students Audits companies Audit and action plan for companies	all@globalactionplan.org.uk 020 7405 5633
Eco-Congregation	Church Check-up Greening Worship	ecocongregation@arocha.org 0114 263 6421

	Provides green concepts for sermons Children, Faith, and the Environment Young People and Environmental Issues Provide two bibles and address for eco-groups Provide green guidelines for keeping church grounds Greening Church Spending Churchyard Conservation techniques Green Lifestyle choices Church-community relations Global Networking	
London Remade	Identify ways to reduce the amount of waste you produce Help you analyse your waste and recycling flows Recommend activities to increase your recycling rates recycling campaign management Organise how to recycle packaging at events Help you buy more sustainably Design your waste management strategy and operations Manage resident participation monitoring and evaluation Assist with contracts, private sector bids and local authority contract specifications	020 70616350 info@londonremade.com
Seltrans	Develop travel plan, to reduce car use	020 8461 7918

	Hold various events to try to encourage people to not use cars	sarah.cummings@seltrans.co.uk
Environment Agency	Tips, checklist to reduce polution form your business Background information on current climate change situation Information about waste and how to deal with it Water reduction tips and generic reduction plan Tips to promote green procurement	08708 506 506 enquiries@environment-agency.gov.uk
ENVIBE	Quick tips about recylcing Quick tips about saving water Quick tips about saving energy Quick tips about travel Quick tips about green procurement Lists about other helpful organizations	020 8760 5536 debbie@envibe.co.uk

The organizations listed provide these services to individuals, small business or to community groups and organizations such as the Croydon Council and other members of the ECCP. The information regarding these organizations was compiled in a report for EaST so that the team can see who they would like to work with. The contact information from these organizations will be used to get in touch with the organizations, and determine more specifics about their services as well as find out if they are interested in working with the ECCP. Also, this table was a valuable aspect of the modified EaST website. It will serve as a quick reference for citizens to research different NEOs that can help them reduce energy in their home.

6.5 Website Content

To make EaST's website meaningful, we updated its content by summarizing a key document and suggesting new items for the website. This deliverable was important because the current website was a waste of a valuable resource to communicate with the borough population. The key document for EaST is the Environmental Climate Change Partnership Strategic Framework. This document provides an in-depth look at why EaST exists and why the work EaST does is important. We summarized the document and broke down each section of the document so the webmaster can put each section on the website. In order to specifically involve the schools' efforts with the community, we provided links to each of the schools' CarbonHub profiles. Our final deliverable is shown in the following:

This is a summary of the Environment and Climate Change Strategy (2009-2011). To read the actual document, click here(hyperlink).

Browse by Section

The Strategy

Croydon's Obligation

Key Challenges and Opportunities for Croydon

- Energy
- Domestic Buildings
- Commercial and Industrial Buildings
- Transportation
- Waste
- Air Pollution

Key Activity To 2011

- Reducing CO_2 Emissions
- Improving Recycling and Reducing Waste
- Continuing Improvement of Street Cleanliness
- Promoting Public Transport

The Strategy

The Environment and Climate Change Strategy was developed by the Environment and Climate Change Partnership (ECCP). The ECCP was created in 2003 with representatives from local businesses, schools, and community and faith groups. This document was designed to outline the short-term goals and methods of the ECCP with regard to achieving Croydon's goal of lowering its emissions 9.5% by 2011.

Croydon is striving to be regarded as an example of a green borough. We are encouraging more use of public transportation, increasing the population of the centre of the borough form 4,000 to 20,000 residents, improving the quality of the parks, and expanding our recycling services, among many other things. The ECCP is responsible for implementing the strategy as well as maintaining the current progress of Croydon. The long-term goals of the Partnership are currently being developed and will be released in 2011.

Croydon's Obligation

Climate change is a huge challenge that will have far-reaching effects on our economy, society and the environment locally in Croydon, as well as globally. It's the responsibility of local government to ensure the future health, prosperity and success of all residents, businesses and wider society in Croydon. We need to cut carbon dioxide emissions from all of the main sources by reducing energy consumption, reusing and recycling resources, switching to zero carbon energy supplies and offsetting the carbon dioxide emissions that can't be avoided.

Key Challenges and Opportunities for Croydon

Energy

Croydon ranks 13th among the boroughs of London with regard to carbon emissions per capita, at 5.5 tonnes. Croydon is in the midst of a £3.5 billion regeneration programme of new buildings offering office accommodation, leisure and shopping opportunities, and homes. While this will ensure low carbon developments, it will create an increased demand for energy. Currently all new buildings are required by Croydon to source 10% of their energy needs from renewable sources, as well as meet Code for Sustainable Homes (hyperlink) Level 4.

Domestic Buildings

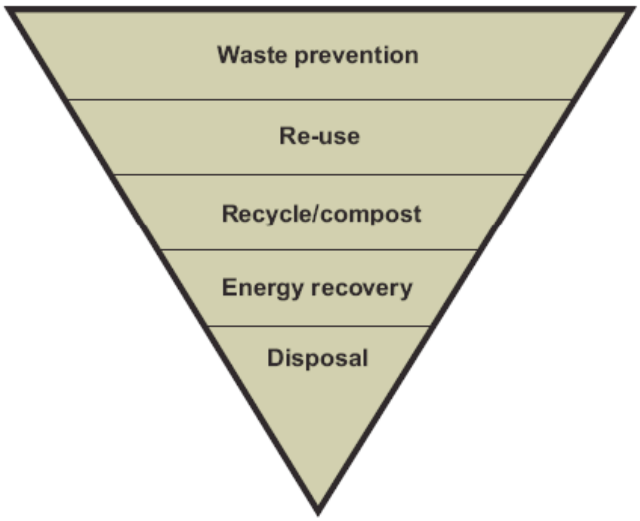
Croydon is London's largest borough in terms of population at over 340,000 residents. Emissions from the domestic sector make up the largest portion of Croydon's carbon footprint. Croydon has the largest private housing sector in London at over 116,000 homes. 26% are pre-1919 and 60% are pre-1945. Due to the age of the buildings, their energy efficiency is very low, leaving room for substantial improvement. The council aims for zero-carbon homes by 2016. Behavioural changes can effect the most change (see What You Can Do (hyperlink) for more information), however other changes can be significant. For example, if every light bulb in every London home was energy efficient, it could save 575,000 tonnes of CO2 and £139 million per year; if all appliances in homes were energy-efficient, this could translate into savings of £150 million from electricity bills and 620,000 tonnes of CO2 every year.

Commercial and Industrial Buildings

Croydon has more office floor space than anywhere else in South London with 58,000 m^2. However, a high share is old stock (1940-1970) and only 6% is new (1990- 2003) compared to 57% in Reading and 60% in Crawley. Commercial buildings are typically refurbished every ten years, and energy efficiency improvements can be more easily made during refurbishment. Over 600 local businesses have already signed up to the Environmental Business Excellence Support programme 'ENVIBE' which offers free tailored support to reduce energy consumption.

Expanding this programme and developing a centralised method for monitoring, recognising and rewarding carbon savings could deliver significant improvements.

Transportation



There has been a dramatic growth in road traffic in the UK over the last few years as a result of changes and growth in population, retail, leisure and commercial activities. The consequences can be seen in increasing congestion in many parts of the borough, deterioration in environmental quality due to pollution, disturbance, severance, and noise and disadvantages to the local economy because of delays caused by congestion. The construction of Croydon Tramlink in 2000 brought a sustainable transport system that regularly carries more than 70,000 passengers and removes more than 7000 vehicles off the roads each day. Croydon will also benefit from the extension of the East London line scheduled to start services in the summer of 2010. A shift towards lower carbon modes of transport can be achieved by increasing the attractiveness of these more sustainable modes and by taking steps to ensure that the cost of each transport mode reflects its true cost in terms of carbon emissions.

Waste

Each year, the UK generates about 100 million tonnes of waste from households, commerce and industry. In comparison with other London authorities, Croydon's performance for diverting waste for recycling and composting has been poor, ranked 23rd with a recycling rate of 20.11%.The Waste Strategy and Recycling Plan 2008/11 (hyperlink) sets out how the Council

will increase the amount of waste re-used and meet the Council's ambitious recycling target of 40% in 2010. A key priority will be reducing waste in line with the waste hierarchy (see image). Also, from September 2008 the South London Waste Partnership (hyperlink?) will work to establish contracts for the transfer, transport and disposal of waste, management of household Reuse and Recycling Centres and management of recycling facilities, composting and additional treatment.

Air Pollution

Clean air is vital to human health. The Environment Act 1995 requires the Council to undertake a process of Local Air Quality Management. As such, the Council has an Air Quality Action Plan containing measures it is currently taking and intends to take in the future to improve air quality. Croydon has met and will continue to meet existing statutory air quality objectives for all but one pollutant: nitrogen dioxide, and this is likely to remain the case beyond 2010.A key priority for the Council is to devote similar levels of activity to the domestic and commercial sector as have been spent on road traffic in terms of bringing down emissions of local air pollutants. In 2009 the Council will produce a draft domestic emissions reduction strategy, aimed at identifying simple, low-cost, quick-win measures that could be taken to reduce emissions of air pollution from homes and identify how these could be funded.

<u>Key Activity To 2011</u>

For more detailed information about what the council is currently doing, and what they plan to do, read the full document here(hyperlink). These summaries provide but a snapshot of the plans currently in place.

Reducing CO_2 Emissions

We hope to achieve our reduction of carbon emissions by 9.5% by 2011, as well as reduce carbon dioxide emissions by 601 tonnes in the domestic sector. Currently there are

programs in place for the installation of insulation in homes, and over 600 businesses have joined ENVIBE. Also, all properties controlled by the Council are under a carbon management plan. These are just a few of the many things the Council is doing, and there are several actions that they plan to do in the coming years. Some of them include increasing the number of business involved with ENVIBE, working with the schools to reduce their carbon emissions, extending the Council's requirements for new developments, and developing grant schemes for the housing sector based on research as to where the most gains can be made.

Improving Recycling and Reducing Waste

Croydon has adopted the national goal of recycling 40% of household waste by 2011. The Council has recently changed some of its recycling policies, including fortnightly collection of glass bottles and jars, mixed cans, paper, textiles and shoes to 120,000 properties, an extended collection of plastic/card from 12,000 to 50,000 households, and introducing recycling of electrical and electronic equipment at 3 recycling sites, just to name a few. Some of the upcoming projects include the expansion of kerbside collections of plastic and cardboard and green waste to all households in 2008/09, and introducing estates recycling sites to a total of 2,350 sites by 2009. Also, campaigns to encourage domestic waste minimisation and recycling participation, including door-knocking, road-shows, attendance at community events, and media adverts – linking in to annual national campaigns, will be started.

Continuing Improvement of Street Cleanliness

We plan to continually improve the appearance of our community in order to provide a clean and healthy environment for all. Some of the foci of our efforts are to reduce the levels of litter and detritus to 17%, as well as removing graffiti and vandalism within 5.5 days. We are currently removing all graffiti and abandoned vehicles with the help of an SMS hotline for residents to contact the Council with information. Also, we are working with local volunteers to maintain the cleanliness using information from the people that live there. We plan on

instituting monthly cleaning of all streets, with extra cleaning for those areas that need it, like the town centre. Litter bins will be installed, and every ward will be visited fortnightly to identify issues, such as graffiti.

Promoting Public Transport

We would are emphasizing and improving the public transport system in order to reduce road congestion, as well as to reduce the air pollution produced by the excessive number of cars on the road. We are currently working with TfL to sponsor new bus lines, as well as looking into the feasibility of extending tram lines, and bike and pedestrian routes. Further, we are trying to route through traffic around Croydon to reduce our congestion and air pollution. To continue our Transportation improvements, we have plans to improve the integration of the various modes of transportation, as well as continue to extend the scope of the tram, bike, and pedestrian routes, among several other projects.

- If you want more detail about targets, performance or how we plan to deliver on each of our priorities you can refer to these documents:
    - The Waste Strategy and Recycling Plan
    - The Air Quality Action Plan and Supplementary Planning Document on air quality
    - Croydon Council's Carbon Management Programme and Energy and Environmental Sustainability Strategy for Council Housing Stock (private sector housing energy and environmental sustainability strategy being developed)
    - The developing Local Development Framework and current UDP

The Croydon Local Improvement Plan relating to transportation

The following links will take you to a webpage that displays the carbon footprint for schools that are part of the ECCP:

Rockmount Primary School

Thornton Heath Children's Centre

Riddlesdown School

Wolsey Schools

Heavers Farm

What You Can Do To Help

Electricity:

Try to use as much natural light as possible! The sun is plentiful and free, and opening shades can reduce your electricity bills.

Remember to turn off things that you aren't using. This includes turning off lights when you leave the room, turning off your computer (or at least the monitor, which accounts for up to 80% of your computer's total use), unplugging chargers, and anything else that doesn't need to be on.

When you buy new light bulbs, buy energy-efficient ones. If you need screw-in bulbs, look for fluorescent ones. If you need fluorescent tubes, look for T8 tubes, which are thinner and use less energy, while producing the same amount of light. If every light bulb in every London home was energy efficient, it could save 575,000 tonnes of CO_2 and £139 million per year.

Heating/Cooling:

Try turning down your thermostat to 19° C or 18° C. This small decrease in temperature can save you a lot of money on heating bills.

If the heating is on and a room is too hot, try avoiding opening windows to cool it down. Instead, adjust the thermostat for a more pleasant temperature. Opening the windows allows all that warm air that you just spent money heating up go right out the window!

Travel:

Look to see if you can use public transportation to get to work. With the addition of the new TramLink system, getting around Croydon is now easier than ever. Using public transportation is cleaner for the environment, reduces congestion on the roads, and can even save you money.

If using public transportation won't work for you, try carpooling to work. It reduces the number of cars on the road, and is much less polluting than each person driving alone.

7 Conclusions and Recommendations

From our research and the visits to selected Croydon schools, we discovered several important things about policy changes, the implementation of carbon emission tracking software (CarbonHub), and the involvement of the students with the reduction of carbon emissions through presentations.

7.1 Implementing Policy Changes

Implementing changes in schools is difficult, so it is essential to work with the appropriate people to affect these changes. In some schools, the person who is being trained is not able to affect the appropriate changes, as they may just be the school 'champion,' or just an interested teacher. Contact with the headmasters and the site manager is essential to implementing the suggested changes. In the schools where the site manager was trained, the essential personnel for implementing policy change were already involved. However, in the schools where teachers were trained, it was much easier to get in contact with the students and spread the changes throughout the school population.

As such, we recommend that schools not train just one person on CarbonHub, but instead train a few people in multiple staff members in the schools' organization. This will have several implications. First, as previously described, the changes will be able to be made in many areas of the school, both in policy and education. Further, if the program hinges on one person, the program can become unstable and the earned changes can disappear if that one person leaves the school. Having several people involved will ensure that the program will continue if someone loses employment at the school or goes on an extended leave.

Teachers have expressed an interest in seeing the effects of their efforts. As such, we advise publishing CarbonHub reports to the entire school. It seems only reasonable that if they are being asked to participate and help that they have access to this information. CarbonHub carbon footprints and energy usage can be posted in classrooms, or on a poster in the hall, to show students where the school stands as far as their carbon emissions is concerned. Using the data that CarbonTracker will already be recording; monthly emails can be sent out to the

teachers with the energy usage trends to allow them to track these as well. This will keep those interested teachers involved, and require minimal effort by the faculty who are in charge of the tracking program.

7.2 Implementing CarbonHub

The selection of the faculty members in the schools has already been discussed, but several recommendations can be made about the actual training of the faculty. First, hands-on training is very beneficial. The faculty is more involved, and someone is there to answer all of the questions that come up, giving the user a much better understanding of the program. Furthermore, the training actually gets done, whereas if training material is dropped off at a school, there is no way to ensure that the appropriate people are receiving and using the material. People were much more willing to sit down and spend some time working with CarbonHub when there was a person there to walk them through the software as evidenced by our survey. Even though it took about two hours on average to complete the training, the trainees did not seem to mind because the continuous interaction with us and the software reduced frustration and increased productivity. Although it may seem like overkill, these training sessions reinforce the training program and stresses how important the program is. However, time constraints are a significant problem for these individual training sessions. Our team did not have trouble with opening our own schedules, but teachers tend to be busy people. This is especially true around the time of exams or term-breaks; hence, we only trained five schools.

However effective the training may be, it cannot guarantee that the person will continue using the training. Thus, training interested personnel is essential. If a teacher is forced to be a part of the process, then they will likely not put any effort into it aside from what they have to. This greatly reduces the efficacy of CarbonHub, because it requires a good deal of effort, and without someone who is willing to put it in, the training might as well not even happen. It was particularly apparent in Thornton Heath, one of the schools that were trained,

that they were not participating because they were interested; it did not appear that they would be working to implement much from CarbonHub.

There was a lot of positive feedback on CarbonHub as well as CarbonTracker. The school staff that was trained found the user interface and the data entry easy to use and understand, and this was reflected in the surveys they completed. In addition, CarbonTracker should increase the ease of use of CarbonHub because school staff will simply have to input weekly or monthly bills into CarbonTracker and it will automatically calculate the yearly totals for each section of CarbonHub. We included an additional tool, the Commuting Calculator, which we found several ways to employ in the schools in order to make data collection easier for the Commuting section, which is the most time-consuming one. When we showed CarbonTracker and the Commuting Calculator to the staff, they were impressed and agreed that all of the sections, especially the ones for commuting and waste management, would now be easier to compute. Thus we would recommend that whenever a school is trained, the previously mentioned tools should be used in conjunction with CarbonHub training.

7.3 Involving Students and Staff

Involving the teachers with the updates about the progress of the school has been previously discussed. The only other possibility for involving the teachers would be to make it their responsibility to do things like turn off lights, and close windows when the heating is on. This should be brought up in faculty meetings and other previously arranged meetings.

The student presentations we gave at Rockmount were very simple. We presented to year 6 students, 11- and 12-year-olds, so going into a lot of detail about the causes of global warming wasn't necessary. We covered many of the causes and effects with broad strokes, and they seemed to understand them. As such, tailoring the material to the audience is an important consideration for future presentations. The students were interested, but it is important to not speak over their heads. Saying that carbon emissions come from burning fossil fuels, with a brief list of them, is enough to get the point across. An older group of students who have a cursory knowledge of chemical reactions can be given a more detailed explanation.

Also, keeping the presentation interactive worked very well; by asking simple questions, such as "Who knows what some of the causes of global warming are?" and "What is your school doing to try and reduce its energy use?" we kept the students involved in the presentation and were able to gauge perceptions and activities in the school. This presentation should include information about what the students can do, like turning off lights, using more sunlight, etc., so that that presentation is informative not only about global warming, but also about steps they can take to stop it.

7.4 Incentives for Schools

In order to implement the action plan, the school staff typically wants a reason to accept this extra work. Starting with the school as a whole, two recommendations that we suggest are a recognition system for the school community or a monetary reward system. Furthermore, we recommend that EaST use CarbonHub to create an inter-school competition where CO_2/person or CO_2/m^2 are the basis for judging. The data from CarbonHub can be made public using the software or the EaST website and used to track the percentage of carbon reduction in the schools, and these percentages can be compared against each other, rewarding those with the highest reduction. A reward system, to be developed and implemented by EaST, could then be implemented from these 'emissions reduction standings.' Another incentive for the schools would be for the council to temporarily increase discretionary spending. The money that they save can be spent as they see fit, hopefully on more energy-saving technologies like TRVs and improved control of lighting. This increase is only temporary though, because part of the reasoning for reducing energy is to reduce costs, not just for the schools, but also for the government. If the schools continually use less energy than they are budgeted for, then the government can cut their energy budget.

7.5 Non-Profit Environmental Organizations

From our research, we found several companies that offered free environmental services to communities. We compiled these organizations into a list that EaST could present to

organizations in Croydon seeking help with environmentally friendly programs. We recommend that EaST work with Global Action Plan because there is only one person in EaST who is partially dedicated to working with the large number of schools in the borough. Global Action Plan is an organization that deals with schools to provide auditing services as well as develop action plans with students. This organization could be used to implement CarbonHub, and possibly present, to schools across Croydon. CarbonHub, and by extension CarbonTracker, provide a convenient way for schools to track their energy use and thus the schools can see the effect of the actions suggested in the action plan. This action is crucial for establishing a long-lasting usage of CarbonHub. In order to lend the school staff some extra help, any of these organizations can provide the personal contact with the schools to help the school staff modify or develop an action plan, or simply help them implement certain parts of one already developed and in place. Furthermore, these organizations can act as local help centers that schools can contact for ideas for an environment awareness day.

7.6 Website Content

Since the Croydon Council needs to support the reduction of carbon emissions in Croydon, the EaST website should be updated. The content our team gathered and condensed from the EaST mission statement and related documents should replace the current content so that visitors can see what the ECCP is and why it is important. Similarly, visitors would like to know what actions they can take to reduce energy use and hence save money. The current website is outdated and hinders anyone's desires to learn about reducing their carbon emissions. Our modifications are a sound start to the site, so that it can become a respectable site where people and organizations can be pointed to learn more about the reduction of carbon emissions, the borough's initiatives, and EaST. Also, the website could provide a much needed central hub that EaST can use to post energy use reports for the borough and potentially recognize the best schools in terms of reducing energy. This type of public recognition would certainly satisfy the school's need to prove that they are doing their part to reduce energy consumption.

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Appendices

Appendix 1: Quick Guide for CarbonHub

Go To **croydon.thecarbonhub.com**

To log in

Type your login name and password and click “login”

To calculate your footprint

Click on the “emissions” tab

Enter your settings

Click on organization

Enter your site

Click on data input

Notice bar of buttons for energy, vehicles, travel, etc, in middle of page

Enter data in appropriate sections for energy, waste, water, etc.

Click “form is completed” at the bottom of every completed form

Un-check “include” if you do not want data included in your footprint

Click on summary to view footprint

To generate an action plan

Click on the “reduce” tab, below the “emissions” tab

Fill in plan settings

Click on “audit” tab, below “reduce” tab

Select options that fit your organization

Click “save” at the bottom of the screen when page is complete

Notice bar of buttons for energy, vehicles, travel, etc, in middle of page

Choose appropriate options for energy, vehicles, travel, etc.

Click on “actions” tab next to “audit” tab

Check actions that your organization is comfortable with

Click “save” at the bottom of the screen when page is complete

Choose appropriate actions for energy, vehicles, travel, etc.

Click on “targets” tab next to “actions” tab

Fill in the targets for your organizations

Click update plan button

Click on “progress” tab next to “targets” tab

Select appropriate progress options

Click on “summary” tab next to “progress” tab

View your summary

To view your profile

Click on “profile” tab next to “emissions” tab

View your profile

To add a friend

Click on “network” tab next to “profile” tab

Click on “invite organizations” tab beneath “network” tab

Enter appropriate information

Click “send invitation(s)” button

To see to community

Click on “community” tab near “profile” tab

Click on appropriate topic

Appendix 2: Rockmount Observations

Rockmount Observations:

For our training session at Rockmount Primary School, two group members trained the staff member while the other two group members observed the process and took notes. We went to the guidance councilor's office where there was one computer. This office was fairly small and the five of us barely fit inside. Also, this office was partly communal so there were several interruptions during the training.

During this meeting we found that it was most effective to have one person explaining the different function of CarbonHub and the other person giving the staff member the data. When both of the group members started to talk, the staff member tried to focus on both people instead of focusing on CarbonHub. Also, the two observing members added an unnecessary distraction to this process and since then we have only had two group members visit a school.

In terms of ease of training, there were a few things that made CarbonHub difficult to use. The first problem was that users had to remember to check the appropriate boxes on each form. If this was forgotten, the form didn't update and we had to trouble-shoot the problem. The second problem was that multiple parts of CarbonHub contained references to businesses. These questions could be ignored but the staff member had to be told to ignore each one of these questions. The third problem was that the commuting data is impossible to estimate without some preliminary data.

During the follow-up we noticed that some problems had emerged. The first issue was that the staff member had forgotten the address of the website despite it being on the quick reference guide we handed to her. The second issue was the staff member hadn't worked with CarbonHub since our training and thus did not have the confidence to navigate around the website. Thirdly, the staff member did not have a method for collecting the data so the existing data collections problems persisted after the training. At this point we introduced the CarbonTracker to the staff member so they could start the data collection themselves. The

staff member was particularly interested in the program because it could be used as a list of all of the information that had to be gathered across the year.

Appendix 3: Survey for Staff Member Training

Carbon Hub Impressions

Please mark the scale with one number per question.

1. How easy was it to collect all the required data for input on the CarbonHub?

(a) Energy

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

(b) Water

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

(c) Travel

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

(d) Waste

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

(e) Procurement

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

2. How helpful did you find the software to be?

(a) With creating a carbon footprint

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

(b) With creating an action plan

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

(c) With reducing energy use

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

(d) With addressing your concerns for the school's carbon emissions

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

(e) With addressing your school's specific energy situation

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

3. How easy to use was this software, overall?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

4. How comprehensive was the software with regard to energy issues?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Not Comprehensive Right Amount Too Comprehensive

5. Do you see monitoring energy use as important?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Important Moderate Very Unimportant

6. How easy to understand was our instruction?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

7. Were the instructors knowledgeable about the software?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Knowledgeable Moderate Very Unknowledgeable

8. What about Carbon Hub did you like or dislike?

9. What features would you like to see added to or removed from Carbon Hub?

10. Do you have any further comments?

Appendix 4: CarbonTracker

Work Summary

Energy	
Elect. Amount	Incomplete
Elect. Source	Incomplete
Renewable Amt.	Incomplete
Renew. Source	Incomplete
Nat. Gas Amount	Incomplete
Nat. Gas Source	Incomplete
Oil Amount	Incomplete
Oil Source	Incomplete
Biomass Amount	Incomplete
Biomass Source	Incomplete

Vehicles	
Personal Vehicles	-
Bicycle Amount	Incomplete
Bicycle Source	Incomplete
Motorcycle Amt.	Incomplete
Motorcycle Source	Incomplete
Petrol Amount	Incomplete
Petrol Source	Incomplete
Diesel Amount	Incomplete
Diesel Source	Incomplete
LPG Amount	Incomplete
LPG Source	Incomplete
Hybrid Amount	Incomplete
Hybrid Source	Incomplete
People Carriers	-
Petrol Amount	Incomplete
Petrol Source	Incomplete
Diesel Amount	Incomplete
Diesel Source	Incomplete

Travel	
Hire Vehicles	-
Hire Car (Petrol)	Incomplete
Hire Source (Petrol)	Incomplete
Hire Car (Diesel)	Incomplete
Hire Source (Diesel)	Incomplete
Hire Car (LPG)	Incomplete
Hire Source (LPG)	Incomplete
Hire Car (Hybrid)	Incomplete
Hire Source (Hybrid)	Incomplete
Hire Van	Incomplete
Hire Van Source	Incomplete
Hire Coach	Incomplete
Hire Coach Source	Incomplete
Employee Vehicles	-
Emp. Car (Petrol)	Incomplete
Car Source (Petrol)	Incomplete
Emp. Car (Diesel)	Incomplete
Car Source(Diesel)	Incomplete
Emp. Car (LPG)	Incomplete
Car Source (LPG)	Incomplete
Emp. Car (Hybrid)	Incomplete
Car Source (Hybrid)	Incomplete
Employee Van	Incomplete
Van Source	Incomplete
Other	-
Air Travel (Domestic)	Incomplete
Domestic Source	Incomplete
Air Travel (Short)	Incomplete
Short Source	Incomplete
Air Travel (Long)	Incomplete
Long Source	Incomplete
Taxi Distance	Incomplete
Taxi Source	Incomplete
Taxi # Journeys	Incomplete
Train	Incomplete
Train Source	Incomplete
Train # Journeys	Incomplete
Tram	Incomplete
Tram Source	Incomplete
Tram # Journeys	Incomplete
Hotels	-
Nights in UK	Incomplete
UK Nights Source	Incomplete
Nights Abroad	Incomplete
Abroad Source	Incomplete

Commuting	
Petrol Amount	Incomplete
Petrol Source	Incomplete
Diesel Amount	Incomplete
Diesel Source	Incomplete
LPG Amount	Incomplete
LPG Source	Incomplete
Hybrid Amount	Incomplete
Hybrid Source	Incomplete
Motorcycle Amt.	Incomplete
Motorcycle Source	Incomplete
Train Amount	Incomplete
Train Source	Incomplete
Tram Amount	Incomplete
Tram Source	Incomplete
Bus Amount	Incomplete
Bus Source	Incomplete
Underground Amt.	Incomplete
Under. Source	Incomplete
Walking Amount	Incomplete
Walking Source	Incomplete
Bicycle Amount	Incomplete
Bicycle Source	Incomplete

Waste	
Non-Recycled	-
Waste Amount	Incomplete
Frequency	Incomplete
Collections By	Incomplete
Source	Incomplete
Recycled	-
Waste Amount	Incomplete
Frequency	Incomplete
Source	Incomplete

Water	
Water Volume	Incomplete
Water Source	Incomplete

Instructions

Thank you for using CarbonTracker, the partner tool for CarbonHub that allows you to track your year-round usage across all six areas in an easy-to-use package. CarbonTracker provides a simple way to log monthly bills, weekly rubbish collections, and other relevant data that you may collect over the course of the year so that when the annual CarbonHub data entry comes around, everything you need is right at your fingertips. CarbonTracker is just as intuative as CarbonHub, with a few extras to save you time and effort. Just input your data in the proper field! Want to know about some of the features of CarbonTracker? Keep on reading!

Features:

Monthly Bill Entry with AutoSum

CarbonHub asks for totals of energy usage, distances traveled, waste, etc. for the entire year. Adding up all of that data is tedious and time-consuming. With CarbonTracker that is no more. All data that is accumulated throughout the year can be entered as you get it to prevent this pileup of work. Next to each data field is an area to enter monthly usage, with the total automatically displayed at the end of the row. By inputing the bills every month, the last month of the year requires as much work as the first! Waste data entry is only slightly different, with the allowance for weekly rubbish collections, and the entries being vertical as opposed to horizontal. These totals can be copied directly into the appropriate field.

Simple Source Selection

Every piece of data needs to be cited as to where it came from. Every source box is actually a drop-down menu with all of the common options for the source. If there is a common source for your data that is not on the list, just select 'Other' from the list and then type the name of the source in the yellow box next to 'Other' in the 'Source Options' area. You can also type the name of the source directly into the box. To clear a cell, simply select it and press 'Backspace.'

Commuting Distance Calculator

One thing that CarbonHub asks for is the total distance traveled by all of the employees and students, separated by type of transportation, for the entire year. That is a very tall order. However the Commuting Calculator makes the task much more managable. Each person is entered into the calculator with their one-way travel data, separated by mode. The calculator will then extrapolate that data across the entire school year, for both directions. Able to handle up to 1470 people, the calculator will be more than adaquite for most facilities. Have more than 1470 people? Simply use a second form and add the totals. The totals can be copied directly into the 'Commuting' tab for entry into CarbonHub.

This data can be acquired through moderately simple means. An email survey can be sent to employees, and a simple homework assignment can be given to the students. Then the data just needs to be entered into the form. This part may be time consuming, but not nearly as time consuming as doing it by hand. Also, if your organization has an eco-council or similar body, the work can be split amongst all members.

Summary Tab

This feature makes it very easy for you, the user, to see at a glance what has been completed and what hasn't. In plain english it will display 'Complete' or 'Incomplete' depending on the data entry for that particular field. If a field requires a numeric input, such as distance, the summary will display 'Complete' only when a number has been entered. This allows you to enter notes into a field, such as 'Ask Ted,' while still maintaining the accuracy of the summary tab. Unfortunately, this feature does not work for the source field, because you can enter anything into that field, as your souce could be any number of things, and CarbonTracker needs to be able to recognize all of them. Each piece of data has its own field on the Summary Tab, so that you can see very specifically what information you need to track down.

Notes:

→ The tabs colored green are the only ones that are entered into CarbonHub.

Energy

Source of Energy	Total Amount	Source of Info
Electricity (kWh)		
Renewable Electricity (kWh)		
Natural Gas (kWh)		
Heating Oil (litres)		
Biomass Boiler (kg)		

Source Options:	
Bill	
Invoice	
Expense	
Meter Reading	
Other	

Monthly Entry

Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Amount of Energy												
												0
												0
												0
												0
												0

Vehicles

Can be in miles or km, but all must be in the same units.

Organisation-owned Personal Vehicles

Type of Vehicle	Total Distance/Quantity	Source of Info
Bicycles		
Motorcycles		
Petrol Cars		
Diesel Cars		
LPG Cars		
Hybrid Cars		

Monthly Entry

Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Distance Traveled OR Quantity of Fuel												
												0
												0
												0
												0
												0
												0

Organisation-owned Goods and People Carriers

Type of Fuel for Carrier	Total Distance/Quantity	Source of Info
Petrol		
Diesel		

Distance Traveled OR Quantity of Fuel												
												0
												0

Source Options:	
Bill	
Invoice	
Expense	
Other	

Travel

Can be in miles or km, but all must be in the same units.

Hire Vehicles (for work-related activities)

Method of Travel	Total Distance/Quantity	Source of Info	Monthly Entry: Distance Traveled OR Quantity of Fuel												Total
			Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	
Hire Car (Petrol)															0
Hire Car (Diesel)															0
Hire Car (LPG)															0
Hire Car (Hybrid)															0
Hire Van															0
Hire Coach															0

Employee Vehicles (for work-related activities)

Employee Car (Petrol)															0
Employee Car (Diesel)															0
Employee Car (LPG)															0
Employee Car (Hybrid)															0
Employee Van															0

Other Transport (for work-related activities)

			Number of Journeys	Avg. Distance												
Air Travel (Domestic)																0
Air Travel (Short Haul)																0
Air Travel (Long Haul)																0
Taxi																0
Train																0
Tram																0

Hotels

Location	Nights	Source of Info													
In the UK															0
Abroad															0

Source Options:
Bill
Invoice
Expense
Other

Commuting

The Commuting Calc. tab can be used to calculate the yearly commuting of the students and staff using their daily travel data.

Can be in miles or km, but all must be in the same units.

Method of Travel	Total Distance/Quantity	Source of Info
Petrol Car		
Diesel Car		
LPG Car		
Hybrid Car		
Motorcycle		
Train		
Tram		
Bus		
Underground		
Walking		
Bicycles		

Monthly Entry

Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Distance Traveled OR Quantity of Fuel												
												0
												0
												0
												0
												0
												0
												0
												0
												0
												0
												0
												0

Source Options:	
Bill	
Invoice	
Expense	
Other	

Waste

Non-Recycled Waste

By Weight	OR	By Bin Types							
Weight(kg)		1100	940	660	360	240	Bag	8ydFEL	6ydFEL

Collection Frequency		
Collected		times per year

Please mark with an X.

Collections Made By:	
Croydon Council	
Other	

Source of Info

Source Options:
Bill
Invoice
Expense
Other

Non-Recycled Waste Log (kg)			Bin Types Log (Number Per Pickup)							
	Weight		1100	940	660	360	240	Bag	8ydFEL	6ydFEL
Pickup 1										
Pickup 2										
Pickup 3										
Pickup 4										
Pickup 5										
Pickup 6										
Pickup 7										
Pickup 8										
Pickup 9										
Pickup 10										
Pickup 11										
Pickup 12										
Pickup 13										
Pickup 14										
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Pickup 19										
Pickup 20										
Pickup 21										
Pickup 22										
Pickup 23										
Pickup 24										
Pickup 25										
Pickup 26										
Pickup 27		OR								
Pickup 28										
Pickup 29										
Pickup 30										
Pickup 31										
Pickup 32										
Pickup 33										
Pickup 34										
Pickup 35										
Pickup 36										
Pickup 37										
Pickup 38										
Pickup 39										
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Pickup 41										
Pickup 42										
Pickup 43										
Pickup 44										
Pickup 45										
Pickup 46										
Pickup 47										
Pickup 48										
Pickup 49										
Pickup 50										
Pickup 51										
Pickup 52										
Total	0		0	0	0	0	0	0	0	0

Recycled Waste

By Weight	OR	By Bin Types							
Weight(kg)		1100	940	660	360	240	Bag	8ydFEL	6ydFEL

Collection Frequency		
Collected		times per year

Source of Info

Source Options:
Bill
Invoice
Expense
Other

Recycled Waste Log (kg)			Bin Types Log (Number Per Pickup)							
	Weight		1100	940	660	360	240	Bag	8ydFEL	6ydFEL
Pickup 1										
Pickup 2										
Pickup 3										
Pickup 4										
Pickup 5										
Pickup 6										
Pickup 7										
Pickup 8										
Pickup 9										
Pickup 10										
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Pickup 21										
Pickup 22										
Pickup 23										
Pickup 24										
Pickup 25										
Pickup 26										
Pickup 27		OR								
Pickup 28										
Pickup 29										
Pickup 30										
Pickup 31										
Pickup 32										
Pickup 33										
Pickup 34										
Pickup 35										
Pickup 36										
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Pickup 43										
Pickup 44										
Pickup 45										
Pickup 46										
Pickup 47										
Pickup 48										
Pickup 49										
Pickup 50										
Pickup 51										
Pickup 52										
Total	0		0	0	0	0	0	0	0	0

Water

	Total Volume	Source of Info
Cubic Meters of Water		

Source Options:
Bill
Invoice
Expense
Meter Reading
Other

Monthly Entry

Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Total
Volume in Cubic Meters												
												0

Commuting Calculation Form

This sheet is to help you calculate the amount of travel per person per year for each method of travel. Each person, both student and faculty, should submit the 1-way distance to school, in miles or km as long as it is consistent, for each mode of travel. It will automatically be calculated how much that would be over the course of the year for both directions.

	Yearly Total:	0	0	0	0	0	0	0	0	0	0	0
Last Name	First Name	Petrol Car	Diesel Car	LPG Car	Hybrid Car	Motorcycle	Train	Tram	Bus	Underground	Walking	Bicycles
Last Name	First Name	Petrol Car	Diesel Car	LPG Car	Hybrid Car	Motorcycle	Train	Tram	Bus	Underground	Walking	Bicycles

Appendix 5: Survey Sheet for Commuting Tab

School Travel Survey

Please find out how far, in miles, you travel to school, and write it in the box next to how you get to school

Petrol Car	mi.
Diesel Car	mi.
LPG Car	mi.
Hybrid Car	mi.
Motorcycle	mi.
Train	mi.
Tram	mi.
Bus	mi.
Underground	mi.
Walking	mi.
Bicycles	mi.

School Travel Survey

Please find out how far, in miles, you travel to school, and write it in the box next to how you get to school

Petrol Car	mi.
Diesel Car	mi.
LPG Car	mi.
Hybrid Car	mi.
Motorcycle	mi.
Train	mi.
Tram	mi.
Bus	mi.
Underground	mi.
Walking	mi.
Bicycles	mi.

School Travel Survey

Please find out how far, in miles, you travel to school, and write it in the box next to how you get to school

Petrol Car	mi.
Diesel Car	mi.
LPG Car	mi.
Hybrid Car	mi.
Motorcycle	mi.
Train	mi.
Tram	mi.
Bus	mi.
Underground	mi.
Walking	mi.
Bicycles	mi.

School Travel Survey

Please find out how far, in miles, you travel to school, and write it in the box next to how you get to school

Petrol Car	mi.
Diesel Car	mi.
LPG Car	mi.
Hybrid Car	mi.
Motorcycle	mi.
Train	mi.
Tram	mi.
Bus	mi.
Underground	mi.
Walking	mi.
Bicycles	mi.

Appendix 6: Surveys from the Five Croydon Schools

Rockmount Survey

Carbon Hub Impressions

Please mark the scale with one number per question.

1. How easy was it to collect all the required data for input on the CarbonHub?

(a) Energy
--1--X--2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(b) Water
--1--X--2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(c) Travel
--1-------2-------3--X--4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(d) Waste
--1--X--2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(e) Procurement
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

2. How helpful did you find the software to be?

(a) With creating a carbon footprint
--1-------2--X--3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(b) With creating an action plan
--1-------2-------3-------4--X--5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(c) With reducing energy use
--1-------2-------3--X--4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(d) With addressing your concerns for the school's carbon emissions
--1--X--2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(e) With addressing your school's specific energy situation
--1--X--2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

3. How easy to use was this software, overall?

--1--X--2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

4. How comprehensive was the software with regard to energy issues?

--1-------2--X--3-------4-------5-------6-------7-------8-------9-------10—
Not Comprehensive Right Amount Too Comprehensive

5. Do you see monitoring energy use as important?

--1--X--2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Important Moderate Very Unimportant

6. How easy to understand was our instruction?

--1--X--2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

7. Were the instructors knowledgeable about the software?

--1-------2--X--3-------4-------5-------6-------7-------8-------9-------10—
Very Knowledgeable Moderate Very Unknowledgeable

8. What about Carbon Hub did you like or dislike?

Straight Forward

9. What features would you like to see added to or removed from Carbon Hub?

None

use of paper –

10. Do you have any further comments?

Many thanks

11. Is there is anything that you would like from the ECCP?

- Meeting up with the Eco Council
- Work along side some Yr6 pupils to help them set up a survey/access computer data base
- Assembly on ~~tea~~ 'Ways to Reduce our School Carbon Footprint'.

Thornton Heath Survey

Carbon Hub Impressions

Please mark the scale with one number per question.

1. How easy was it to collect all the required data for input on the CarbonHub?

(a) Energy

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

(b) Water

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

(c) Travel

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

(d) Waste

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

(e) Procurement

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Easy Moderate Very Difficult

2. How helpful did you find the software to be?

(a) With creating a carbon footprint

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

(b) With creating an action plan

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

(c) With reducing energy use

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

(d) With addressing your concerns for the school's carbon emissions

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

(e) With addressing your school's specific energy situation

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—

Very Helpful Moderate Very Unhelpful

3. How easy to use was this software, overall?

--1------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

4. How comprehensive was the software with regard to energy issues?

--1------2------3-------4-------5-------6-------7-------8-------9-------10—
Not Comprehensive Right Amount Too Comprehensive

5. Do you see monitoring energy use as important?

--1------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Important Moderate Very Unimportant

6. How easy to understand was our instruction?

--1------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

7. Were the instructors knowledgeable about the software?

--1------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Knowledgeable Moderate Very Unknowledgeable

8. What about Carbon Hub did you like or dislike?

Easy to use, not too time consuming.

9. What features would you like to see added to or removed from Carbon Hub?

10. Do you have any further comments?

11. Is there is anything that you would like from the ECCP?

Ongoing support

Heavers Farm Survey

Carbon Hub Impressions

Please mark the scale with one number per question.

1. How easy was it to collect all the required data for input on the CarbonHub?

(a) Energy
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(b) Water
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(c) Travel
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(d) Waste
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(e) Procurement
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

2. How helpful did you find the software to be?

(a) With creating a carbon footprint
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(b) With creating an action plan
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(c) With reducing energy use
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(d) With addressing your concerns for the school's carbon emissions
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(e) With addressing your school's specific energy situation
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

3. How easy to use was this software, overall?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

4. How comprehensive was the software with regard to energy issues?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Comprehensive Moderate Not Comprehensive

5. Do you see monitoring energy use as important?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Important Moderate Very Unimportant

6. How easy to understand was our instruction?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

7. Were the instructors knowledgeable about the software?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Knowledgeable Moderate Very Unknowledgeable

8. What about Carbon Hub did you like or dislike?

EASY TO USE

9. What features would you like to see added to or removed from Carbon Hub?

10. Do you have any further comments?

11. Is there is anything that you would like from the ECCP?

FUNDING!

Wolsey Primary and Juniors Survey

Carbon Hub Impressions

Please mark the scale with one number per question.

1. How easy was it to collect all the required data for input on the CarbonHub?

(a) Energy
--1-------2-------3--/---4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(b) Water
--1-------2-------3--/---4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(c) Travel
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(d) Waste
--1-------2-------3--/---4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(e) Procurement
--1-------2-------3-------4-------5-------6-------7-------8-------9--/---10—
Very Easy Moderate Very Difficult

2. How helpful did you find the software to be?

(a) With creating a carbon footprint
--1-------2-------3---/--4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(b) With creating an action plan
--1-------2-------3--/---4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(c) With reducing energy use
--1-------2-------3-------4--/---5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(d) With addressing your concerns for the school's carbon emissions
--1-------2-------3--/---4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(e) With addressing your school's specific energy situation
--1-------2-------3---/--4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

3. How easy to use was this software, overall?

--1-------2-------3-------4--/----5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

4. How comprehensive was the software with regard to energy issues?

--1---/---2-------3-------4-------5-------6-------7-------8-------9-------10—
Not Comprehensive Right Amount Too Comprehensive

5. Do you see monitoring energy use as important?

--1---/---2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Important Moderate Very Unimportant

6. How easy to understand was our instruction?

--1-------2-------3--/----4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

7. Were the instructors knowledgeable about the software?

--1-------2--/----3-------4-------5-------6-------7-------8-------9-------10—
Very Knowledgeable Moderate Very Unknowledgeable

8. What about Carbon Hub did you like or ~~dislike~~? Yes

9. What features would you like to see added to or removed from Carbon Hub? No

10. Do you have any further comments? No

11. Is there is anything that you would like from the ECCP?

Riddlesdown Survey

Carbon Hub Impressions

Please mark the scale with one number per question.

1. How easy was it to collect all the required data for input on the CarbonHub?

(a) Energy
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(b) Water
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(c) Travel
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(d) Waste
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

(e) Procurement
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

2. How helpful did you find the software to be?

(a) With creating a carbon footprint
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(b) With creating an action plan
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(c) With reducing energy use
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(d) With addressing your concerns for the school's carbon emissions
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

(e) With addressing your school's specific energy situation
--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Helpful Moderate Very Unhelpful

3. How easy to use was this software, overall?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

4. How comprehensive was the software with regard to energy issues?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Not Comprehensive Right Amount Too Comprehensive

5. Do you see monitoring energy use as important?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Important Moderate Very Unimportant

6. How easy to understand was our instruction?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Easy Moderate Very Difficult

7. Were the instructors knowledgeable about the software?

--1-------2-------3-------4-------5-------6-------7-------8-------9-------10—
Very Knowledgeable Moderate Very Unknowledgeable

8. What about Carbon Hub did you like or dislike?

Ease of use -
Detail given -

9. What features would you like to see added to or removed from Carbon Hub?

—

10. Do you have any further comments?

At early stage but looks very useful for the school.

11. Is there is anything that you would like from the ECCP?

Not at present.

Appendix 7: Summary of Survey Results

Summary of Results from the CarbonHub Impressions Survey					
Scale from 1 to 10 were 1 is the most positive impression					
Question	Riddlesdown	Heavers Farm	Wosley	Rockmount	Thornton Heath
1) How easy was it to collect all the required data for input for the CarbonHub?					
a) Energy	1	1	3.5	1.5	6
b) Water	4	1	3.5	1.5	10
c) Travel	10	5	No Answe	3.5	6
d) Waste	5	3	3.5	1.5	8
e)Procurement	7	5	9.5	No Answer	6
2) How helpful did you find the software to be?					
a) With creating a carbon	2	1	3.5	2.5	3
b) With creating an action	3	1	3.5	4.5	3
c) With reducing energy use?	4	1	4.5	3.5	3
d) With addressing your	3	1	3.5	1.5	3
e) With addressing your	3	1	3.5	1.5	3
3) How easy to use was this	3	1	4.5	1.5	1
4) How comprehensive was the	3	1	1.5	2.5	2
5) Do you see monitoring	2	1	1.5	1.5	1
6) How easy to understand	1	1	3.5	1.5	1
7) Were the instructors	1	1	2.5	2.5	1
8) What about the CarbonHub did you like or dislike?	Ease of use, Detail given	EASY TO USE	Yes	Straight forward	Easy to use, not too time consuming.
9) What features would you like to see added to or removed from the CarbonHub	No Answer	No Answer	No	None	No Response
10) Do you have any further comments?	At early stage but looks very useful for	No Answer	No	Many thanks	No Response
11) Is there anything that you would like from the ECCP?	Not at present.	Funding!	No Answer	Meet up with the Eco Council. Work along side some yr6 pupils to help them set up a servey/access computer data base. Assembly on ways to Reduce our School Carbon Footprint.	Ongoing support.

Appendix 8: The Generic Action Plan

Action Plan Suggestions

After reviewing the school's CarbonHub account, any audits of the school that were available, and our own observations of your school, a suggested action plan has been compiled. Any suggestions that were made from CarbonHub that fit with your school have been added to the plan, and have been modified if necessary, to provide more personalized help. The same was done for suggestions from audits of the school. While walking through the school, suggestions have been made by the team as well, which have been added to the plan. These suggestions seem like they could be reasonably accepted and followed by your school. It is hoped that by following these suggestions the school can help the Borough of Croydon to reduce its carbon emissions.

Check to see if the heating is left on during the summer months. If this heating were turned off when it was already warm in the building, your school could save a large amount of money instead of paying for that heat. In audits from a number of schools, it has been shown that heating is a large waste of energy (CEN, 2008, 1). The energy used to produce that heat could also be saved, reducing your carbon emissions. This task can be completed by a site manager by the end of one month.

- *If the site manager simply turns off the heating in early May, this task should be accomplished.*
- *The heating should be turned back on when necessary, most likely sometime in September.*
- *If your heating is turned off for May, June, July, and August, you can remove the heating bill for those months.*

In addition, the heat in your school can be turned down by three degrees year-round. These three degrees should not produce a noticeable change in the temperature of the school, but due to the exponential nature of the energy required to produce heat, a large amount of

energy can be saved by such a small change (CEN, 2008, 1). This task can be completed by a site manager by the end of three months.

- *If the site manager turns down the heat by 3 degrees once and leaves it there, this task is accomplished.*
- *If the heat is left 3 degrees lower year round, it can reduce the school's energy by 20 to 25 percent.*

Also, lights in the hall way can be turned off during the day, as most of the hallway is lit very well by windows. On darker days or in shady areas some lights may be necessary, but lights could be turned on by necessity instead of turned on be default. . Using sunlight to light rooms wherever possible is a simple but large energy saver (EPA's Green Lights Program, 2007, 5). This task can be completed by a site manager or by teachers by the end of four months.

- *As teachers or staff walk through hall,s they should turn on lights as needed, and turn them off when they are no longer necessary.*
- *This provides instant savings and can make the school feel cooler to the occupants.*

In the classroom, the same issue arises, where the entire ceiling does not need to be lit. It seems that most classrooms are lit well enough simply by using one bank of lights, and leaving any other banks turned off. By only using lights where necessary, teachers can save energy (EPA's Green Lights Program, 2007, 5) as well as set an example about saving energy to the students (Croydon Cabinet Report). This task can be completed by teachers by the end of four months.

- *When teachers require lighting in the classroom, they should only turn on one bank of lights.*
- *If they require more lighting, they should turn more lights on one bank at a time until sufficient light is provided.*
- *This provides instant savings, and could reduce your electric energy use by 10 to 15 percent.*

Your school can lower some of its electricity bills by opening windows in warm areas of the school. Often, open windows are a cheap and carbon-free way of cooling down rooms. Air conditioning is often used in excess and can be replaced by open windows. If open windows are not sufficient, try simply lowering the air conditioning level. This task can be completed by teachers by the end of four months.

- *The site manager should turn off air conditioners and leavewindows open for a week.*
- *If a room is too hot, close windows and turn on air conditioner at a lower power than it was at to begin with, for a week.*
- *If the room is still too hot, turn the air back up a little for the next week. If it is still bearable, try turning the air down further for a week.*
- *Try to use the least amount of energy possible to cool the room.*

T8 bulbs are an easy way to save energy. They last longer, shine just as bright, and use less as energy than incandescent bulbs, halogen bulbs, or even the older tungsten models (EPA's Green Lights Program, 2007, 5). Check to see if you can replace the bulbs in your school to more efficient bulbs. If your lamps are not compatible with T8 bulbs, see if your school can afford replacing those lamps with lamps that could accommodate a T8 bulb. This task can be completed by a site manager by the end of five months.

- *Walk around the school checking to see if your school uses T8 bulbs.*
- *If not, purchase some.*
- *When a bulb dies, the site manager can replace it with the T8 bulb.*
- *Each bulb will use about 75% of the energy that an incandescent bulb uses.*

If the windows in your school are not double paned, that is a good way that you can save on your heating. A large amount of heat can escape through single paned windows, but with double paned windows, the heat stays in the building (CEN, 2008, 1). This way, your building will use less heat, saving your school money and reducing carbon emissions. This task can be completed by a site manager by the end of five month

- *The site manager should check to see if each window of the school is double paned.*
- *If not, the school should purchase as many double paned windows as necessary.*
- *The site manager should replace all single paned windows with double paned ones, preferably before the winter months.*

It also may be worth installing individual temperature regulators in each classroom. These regulators can be useful in reducing the school's heating bill (CEN, 2008, 1). That way, if one room becomes too warm for the people in it, a teacher can turn down the temperature. Otherwise, the teacher will open a window to cool the room, and that heat energy will be wasted. If the teacher can turn down the heat by him or herself, that energy can be saved. This task can be completed by a site manager by the end of six months.

- *Buy thermo-regulator valves.*
- *Have the site manager install them on heating pipes in rooms.*
- *This could save about 20% of the heating bill.*

Try to install sensors on the lights in your school. Often lights are left on in empty rooms, and this wastes electricity. If the lights were on a timer, the light would shut off automatically and save that electricity. Light sensors are a good way to reduce lighting use (CEN, 2008, 1). If you already have light sensors in your school, check to see if they need to be repaired. A few of the schools in the borough have broken light sensors which make the lights stay on longer than necessary. Make sure that your sensors are working and calibrated to turn lights off after only several minutes. Any sensors that are broken should be repaired or replaced. This task can be completed by a site manager by the end of six months.

- *Walk into a room to turn on the lights and then leave the room.*
- *Check if the lights turn off in a reasonable amount of time.*
- *If they do not, have the site manager fix existing light sensors or buy and install new ones.*

Your school can save a lot of money by recycling more of its waste. By working with Croydon Council, your school can procure more recycle bins. Every bin of recycling is ten times cheaper to dispose of than a bin of rubbish. This task can be completed by a site manager by the end of six months.

- *Contact Julie O'Maley at the Corydon Council, at julie.o'maley@croydon.gov.uk, to retrieve another recycling bin.*
- *Place recyclable waste in this bin.*
- *If three of the waste bins are replaced, 38% of the current waste budget could be saved.*

To fill those recycling bins, it would be worth while to place smaller recycling bins around the schools. Students and teachers could place more of their recyclable waste in these bins instead of in the rubbish. . This would help to reduce the school's carbon as well as work as an example to the students to promote recycling (Croydon Cabinet Report). This task can be completed by a site manager by the end of seven months.

- *Purchase small bins to place in the classrooms, and inform the children that they should place recyclables in the bin.*
- *The Sixth year Eco-Council members should collect the bins and empty them into the larger recycling bin outside weekly.*

Your school should check to see if it is a good candidate for sources of renewable energy like solar panels or wind turbines. Sources of renewable energy can be very costly at first but will usually pay the school back whatever it has spent in energy savings over time. Renewable sources of energy also serve as a great example to students and the rest of the community of carbon reduction efforts. This task can be completed by a site manager by the end of seven months.

- *Contact the Environment and Sustainability Team of the Croydon Council at* Will.Walker@croydon.gov.uk *to find out if you school is eligible for funding towards renewable energy.*

- *Request information about non-profit organizations in Croydon that help to find funding for energy savings, and contact those organizations.*
- *If funding is available, contact the Croydon Council to have your renewable energy source plans created.*

With these suggestions, you school should implement as much as it is comfortable with. The Council is enacting similar action plans in schools throughout the borough, and with the help of your school we can reach our carbon emissions goal. If any problems arise please feel free to contact the Council at Will.Walker@croydon.gov.uk. We hope that your school can adopt a carbon reducing mindset, so that carbon reduction can continue into the future. Your school can consistently use less and less energy as these plans progress and as you continue monitoring your emissions with CarbonHub. Thank you for working with us.

Action Plan Suggestions

Listed from easiest to implement to most difficult to implement
First Stage tasks can be implemented immediately
Second Stage tasks require either some monitary investment or a large amount of time

	Suggestions	Modifications	Carbon Reduction	Capital Saving	Reduction Area	Source	Suggested Deadline	Notes	Check when complete
First Stage	Turn off the heating during the summer months		Large	Large	Heating Bills	Observation	Aug-09		
	Reduce the overall heating by 3 degrees		Large	Large	Heating Bills	CarbonHub	Oct-09		
	Turn the hall lights off during the day		Small	Small	Electric Bills	Audits	Nov-09		
	Use one bank of lights in the classroom		Small	Small	Electric Bills	Audits	Nov-09		
	Open windows instead of using air conditioning		Medium	Small	Electric Bills	Audits	Nov-09		
	Suggestions	Modifications	Carbon Reduction	Capital Saving	Reduction Area	Source	Suggested Deadline	Notes	Check when complete
Second Stage	Replace less efficient bulbs with T8 bulbs		Medium	Medium	Electic Bills	Audits	Dec-09		
	Insulate windows		Medium	Medium	Heating Bills	Audits	Dec-09		
	Install Temperature Controls in all of the classrooms		Medium	Medium	Heating Bills	Audits	Jan-10		
	Install motion sensors on lights or fix broken ones		Small	Medium	Electric Bills	Observation	Jan-10		
	Work with the Croydon Coucil to procure more recycle bins		Medium	Large	Waste Bills	Observation	Jan-10		
	Place recycling bins around the schools so that the children can recycle more of their waste		Medium	Large	Waste Bills	CarbonHub	Feb-10		
	See if your school is eligible for renewable energy sources or grants		Large	Medium	Electic Bills	Audits	Feb-10		

This is the Excel Sheet that goes with the written report:

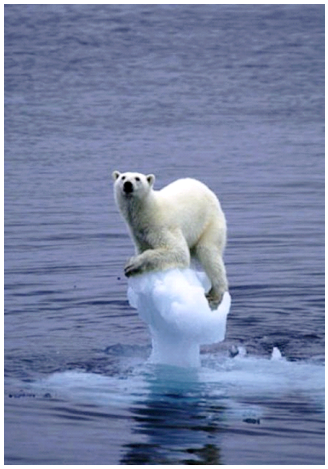
Appendix 9: The Rockmount Presentation

TAKING CROYDON BEYOND CARBON

Rockmount

Global Warming

- What is it?
- Where does it come from?
- How can we tell?



What does that do to us?

- In the UK?
- In London?

What are we doing?

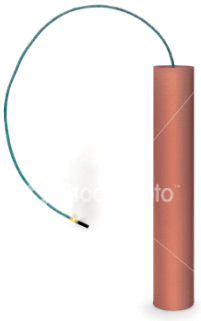
- In the UK?
- In Croydon?

CROYDON COUNCIL

- EaST!
  - ECCP

Energy?

- Dynamite vs Candle



Why are we here?

- CarbonHub
- Action Plans

carbonhub®
powering low carbon communities

How can you help?

- At school?
- At home?

Appendix 10: Energy Audit Summary Sheets

Virgo Fidelis Convent Senior School

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	466686	18	37676	37	-	-
Gas	2197461	82	63375	63	-	-

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Draft and implement an energy policy	955	26641	6.571	0	0
Install Building Energy Management System	4753	164810	30.49	25800	5.4
Install 2 variable temperature circuits to main plant room	3761	130428	24.129	20000	5.4
Fit thermostatic radiator valves (TRVs) to all radiators	2868	99444	18.397	5300	1.85
Reset heating system times in main building plant room	2393	82984	15.352	0	0
Replace T8 switch start lighting (electromagnetic ballast) with electronic ballast T8 lighting.	1232	16170	8.683	19050	15
Install radiator panels to all radiators mounted to external solid walls	563	19519	3.611	820	1.5
Install cavity wall insulation to St Edwards	559	20487	3.79	3542	6.3
Install occupancy sensors	318	4176	2.243	1800	5.66
Install timers to all photocopiers and printers bar hot wax printers	271	3351	1.799	300	1
Renewable Energy Options					
Installation of a Wind Turbine	505	4000	-	10000	20

Cyprus Juniors

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	75326	24	6400	44	32390	42
Gas	235441	76	8240	56	44730	58

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Reduce Internal Temperature	1013	28930	-	0	0
Switch off equipment	480	5649	-	0	0
Control of lighting (Task Lighting)	350	4080	-	0	0
Conversion to higher efficiency bulbs	167	1959	-	0	0
Roof Insulation	1055	30140	-	4130	3.9
Insulate pipes	-	-	-	Inexpensive	0.5 - 2
Draught Proofing	-	-	-	Inexpensive	-
Turning off office equipment when not in use	480	5649	-	0	0
Install Water Aerators	-	-	-	£5/faucet	-
Install water saving devices in toilets	-	-	-	0	0
Install water butts to down pipes	-	-	-	£30/butt	-
Renewable Energy Options					
Solar Photovoltaics (Hall Roof)	228	3252	1.399	25200	111
Solar Photovoltaics (Year 3 Roof)	512	7318	3.147	23625	92

Forestdale Primary

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	64590	22	5490	30	27260	33
Gas	70970	24	2484	14	13770	17
Oil	155000	53	10075	56	40920	50

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Reduce Internal Temperature	804	14460	-	0	0
Control of Lighting	550	6459	-	0	0
Switch Off Equipment	412	4844	-	0	0
Draught Proofing	-	-	-	Inexpensive	-
T12 to T8 Lighting Conversion	287	3373	-	0	0
Renewable Energy Options					
Solar Photovoltaics (Flat Roof)	852	7100	3.053	47250	55
Solar Photovoltaics (Flat Roof Small Installation)	463	3861	1.66	30240	65

Heavers Farm

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	147260	25	12520	45	62140	42
Gas	436010	75	15260	55	84590	58

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Reduce Internal Temperature	2702	77200	-	0	0
Switch Off Equipment	939	11045	-	0	0
Energy Efficient Lighting	332	3900	-	144	0.43
Train Staff to Use Thermostatic Radiator Valves	122	-	-	0	0
Control of Lighting	300	3520	-	0	0
Install Timer on Ventilation System	-	-	-	200	-
Renewable Energy Options					
Solar Photovolatics (Large Installation)	3604	51485	22.138	292950	81
Solar Photovolatics (Small Installation)	465	6643	2.857	42000	90

Howard Primary

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	114677	35	9750	57	49000	55
Gas	210571	65	7369	43	40000	45

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Switch Off Equipment	731	8601	-	0	0
Reduce Internal Temperature	472	13480	-	0	0
Control of Lighting	440	5130	-	0	0
Train Staff to Use Thermostatic Radiator Valves	590	-	-	0	0
Insulate pipes	-	-	-	Inexpensive	0.5 - 2
Install water saving devices in toilets	-	-	-	0	0
Install water butts to down pipes	-	-	-	£30/butt	-
Renewable Energy Options					
Solar Photovoltaics (Hall Roof)	376	5371	2.31	34650	92
Solar Photovoltaics (Main Roof)	171	2441	1.05	18900	111
Solar Photovoltaics (West Roof)	228	3255	1.4	25200	111
Solar Photovoltaics (All Roof Spaces Used)	775	11068	4.759	78750	105

Riddlesdown High School

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	520090	17	44,210	23	21948	25
Gas	563630	18	19727	10	109340	13
Oil	2031560	65	132051	67	536330	62

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Reduce temperature and increase heating control	9714	166090	-	0	0
Control of lighting	4420	52009	-	0	0
Conversion to energy efficient light	2486	29249	-	0	0
Renewable Energy Options					
Solar Photovoltaics (Pitched Roof)	-	5086	2.187	31500	-
Wind Turbine	-	5819	2.502	20000	-
Solar Photovoltaics (All Available Roof Space)	-	85449	36.742	238140	-

Ridgeway Primary

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	87480	18	7,440	35	36920	32
Gas	398510	82	13948	65	77310	68

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Control of lighting	740	8748	-	0	0
Switch off equipment	558	6561	-	0	0
Conversion to energy efficient light	724	8508	-	0	0
Double glazing windows	106	3030	-	-	-
Renewable Energy Options					
Ground Source Heat Pump	1546	69340	5.704	32544	21
Splar Photovoltaics (Large Installation)	1124	9368	4.026	63000	56
Splar Photovoltaics (Small Installation)	468	3903	1.678	26250	56

St James

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	95960	32	8,160	53	40500	50
Gas	207800	68	7273	47	40310	50

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Control of lighting	820	9596	-	0	0
Conversion to energy efficient light	791	9298	-	0	0
Switch off equipment	612	7197	-	0	0
Renewable Energy Options					
Solar Photovoltaics (Adding To Original Display)	1424	11868	5.103	73500	52
Solar Photovoltaics (Pitched Roof)	712	5934	5.225	36750	52
Solar Photovoltaics (All Roof Spaces Used)	2136	17801	7.655	110250	52

Thornton Heath Children's Centre

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	67670	94	5,750	97	28560	97
Gas	4320	6	151	3	840	3

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Reduce internal temperature	131	1540	-	0	0
Control of lighting	120	1440	-	0	0
T12 to T8 Conversion	105	1230	-	0	0
Cavity wall insulation	80	1000	-	580	7
Renewable Energy Options					
Solar Photovoltaics	216	3090	1.329	26200	117

West Thornton Primary

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	117611	33	10,000	55	-	-
Gas	233889	67	8186	45	-	-

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Reduce Internal Temp	1449	41410	-	0	0
Install TRV's	654	-	-	-	-
Roof Insulation	1048	29940	-	6104	5.8
Lighting Behavior	1000	11761	-	0	0
Turing Off Equipment	750	8821	-	0	0
Renewable Energy Options					
SE Rear Roof Photovoltaic	1138	16262	6.993	47250	42
SW Yr 5 Roof Photovoltaic	171	2439	1.049	9450	55
SW Yr 6 Roof Photovoltaic	154	2195	9.44	9450	61

Whitehorse Infant

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	119430	16	10,150	31	50400	29
Gas	642980	84	22504	69	124740	71

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Install TRV's	179.9	-	-	720	-
Reduce Internal Temp (1C)	1440	41150	-	0	0
Lighting Control	1020	11943	-	0	0
Turn Off Equipment	761	8957	-	0	0
Install Boiler	5000	142890	-	20000	4
Renewable Energy Options					
Roof Area A Photovoltaic	1567	22379	9.623	63370	40
Roof Area B Photovoltaic	617	8816	3.791	27300	44
Roof Area C Photovoltaic	119	1695	0.729	6300	53
Roof Area D Photovoltaic	356	5086	2.187	15750	44
Roof Area E Photovoltaic	1282	18310	7.873	51030	40

Wolsey Infants

Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	65880	16	5,600	32	27800	30
Gas	341680	84	11958	68	66290	70

Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Reduce Internal Temperature	1470	41990	-	0	0
Install TRV's	-	-	-	354	-
Lighting Control	560	6588	-	0	0
Roof Insulation	1531	43740	-	0	0
Turn Off Equipment	420	4941	-	0	0
Renewable Energy Options					
Large Photovoltaic	3497	49962	21.484	143640	41
Small Photovoltaic	621	8875	3.816	28350	46

Wolsey Juniors

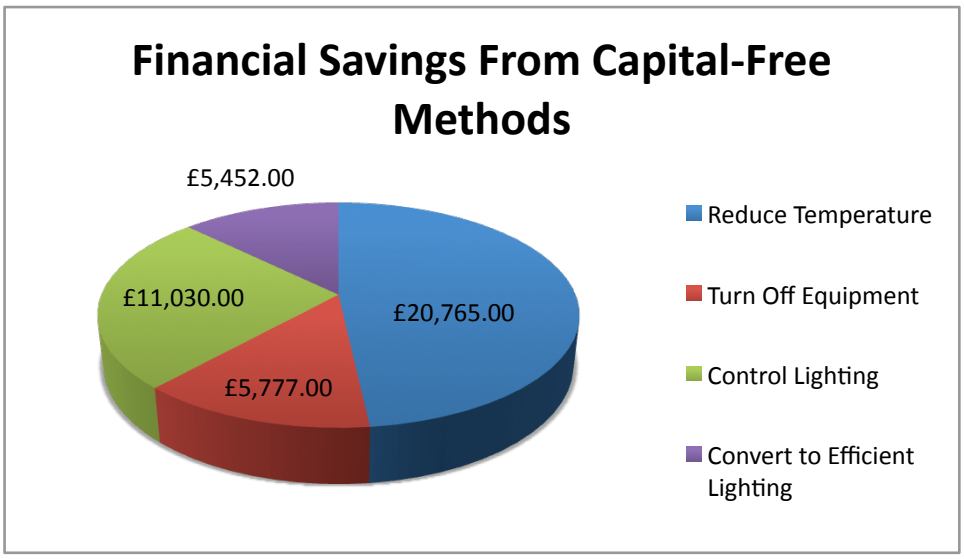
Current Energy Consumption

	Annual Consumption		*Annual Cost*		*Annual CO_2 Emissions*	
Utility	kWh	%	£	%	$kgCO_2$	%
Electricity	83844	16	7,130	32	35382	30
Gas	434870	84	15220.45	68	84364	70

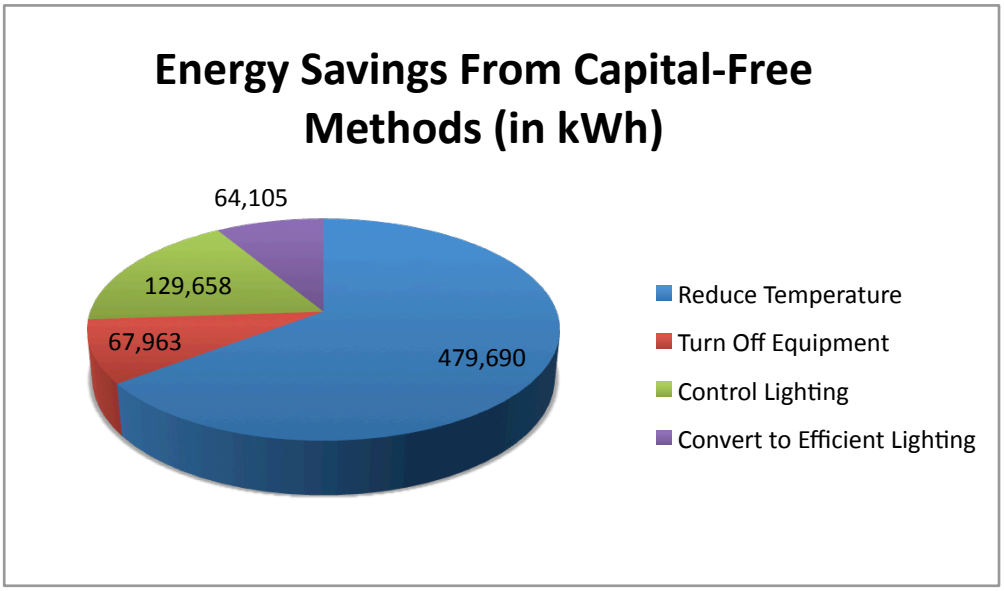
Proposed Energy Saving Methods

	Estimated Annual Savings				
Description	£/yr	Energy Savings (kWh/yr)	CO_2 (Tonnes/yr)	Cost of Upgrade (£)	Payback Time (Years)
Reduce Internal Temp	1870	53440	-	0	0
Install TRVs	121	-	-	576	-
Lighting Control	710	8384	-	0	0
Turn Off Equipment	534	6288	-	0	0
Renewable Energy Options					
Large Photovoltaic	2694	38486	16.549	107258	40
Small Photovoltaic	605	8647	3.718	26775	44

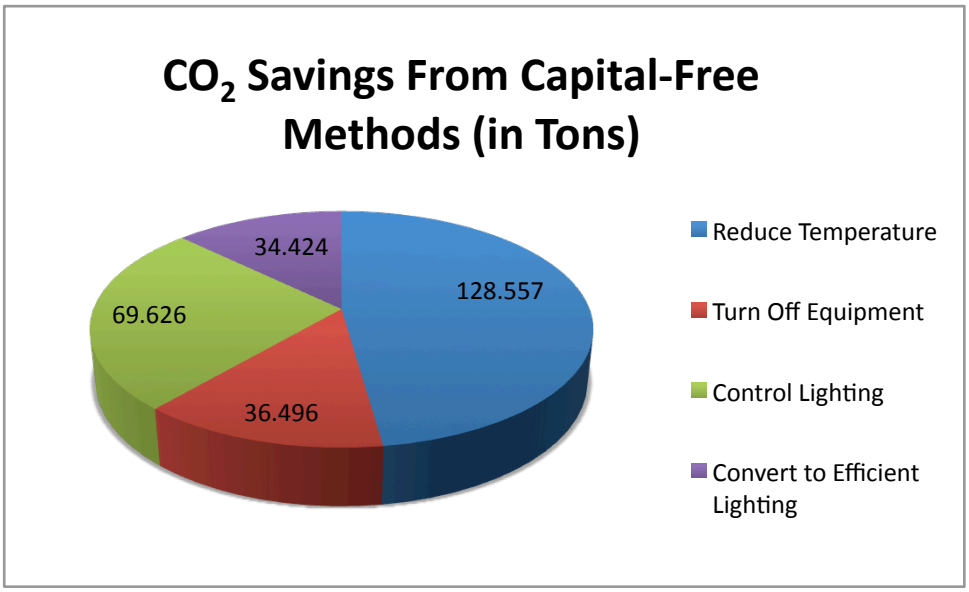
	Zero-Cost Measures Totals
Reduce Temperature	£20,765.00
Turn Off Equipment	£5,777.00
Control Lighting	£11,030.00
Convert to Efficient Lighting	£5,452.00
Total No-Cost Savings:	£43,024.00



	Zero-Cost Energy Totals
Reduce Temperature	479,690
Turn Off Equipment	67,963
Control Lighting	129,658
Convert to Efficient Lighting	64,105
Total No-Cost Savings:	741,416



	Zero-Cost CO_2 Totals
Reduce Temperature	128.557
Turn Off Equipment	36.496
Control Lighting	69.626
Convert to Efficient Lighting	34.424
Total No-Cost Savings:	269.104



Appendix 11: "How To Collect Better Data" Sheet

How to Gather CarbonHub Data

Data for CarbonHub is required in 6 different areas:
Energy, Vehicles, Travel, Commuting, Waste, and Water

Energy

- Designate a faculty or staff member for the job of reading the meter for electricity, gas, and oil monthly.
- This person should record the numbers and enter them into CarbonTracker on the last day of each month.
- Where there is no meter, the bill should read and recorded as if it were a meter reading.

Vehicles

- Designate a log book for each vehicle owned by the school. In each log book the type of vehicle and type of fuel used should be specified. When a driver enters a vehicle, he or she should record the mileage of the car in the log book. When a driver leaves a vehicle, the mileage of the vehicle should be recorded.
- Designate a faculty or staff member for the job of reading and compiling the logs in CarbonTracker on the last day of each month.

Travel

- Designate a faculty or staff member to keep a record of vehicles not owned but still used by the school. This person should keep a record of each type of vehicle and type of fuel used, as well as distance traveled every trip and how many trips made per year. This person should record this data in a computer in CarbonTracker the last day of each month.

Commuting

- Have each student and faculty member determine the distance from their house and the school, as well as the method they use to cover that distance. The attached form explains how to use Google Maps to calculate distance.
  Collect this data from them and place it into the Commuting Calculator tab of the CarbonTracker. Place the results from the Commuting Calculator into the Commuting tab of CarbonTraker. Update this yearly.

Waste

- Designate a faculty or staff member to be in charge of counting the bin number and size of both trash and recycling bins that get collected every week. This person should record this data in a computer in CarbonTracker every week.

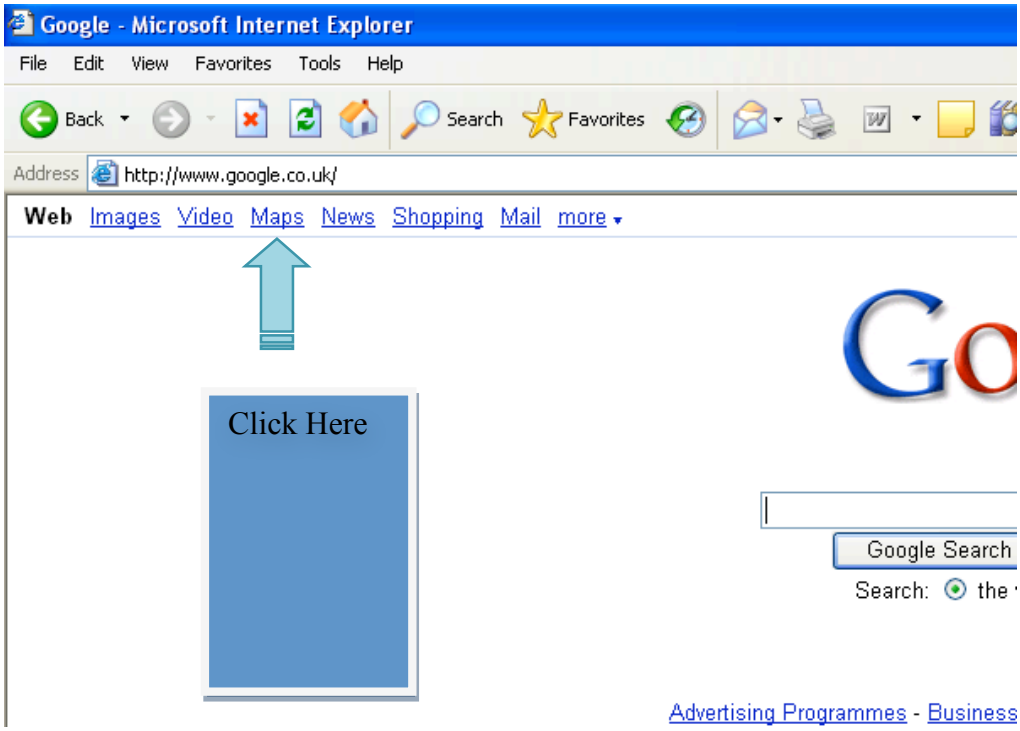
Water

- Designate a faculty or staff member to read your water meter monthly and record it in a computer in Carbon tracker CarbonTracker on the last day of each month.

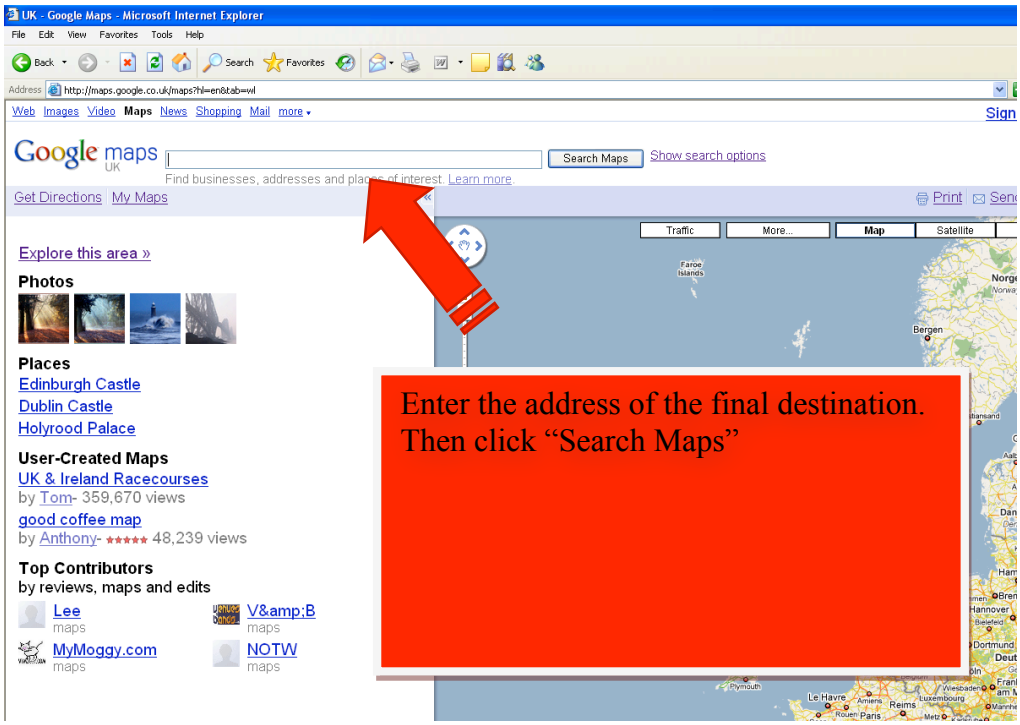
When the time comes to determine your carbon footprint for the year with **CarbonHub**, all of your data will be ready for you in the **CarbonTracker**!

Appendix 12: Visual Steps for Using Google Maps

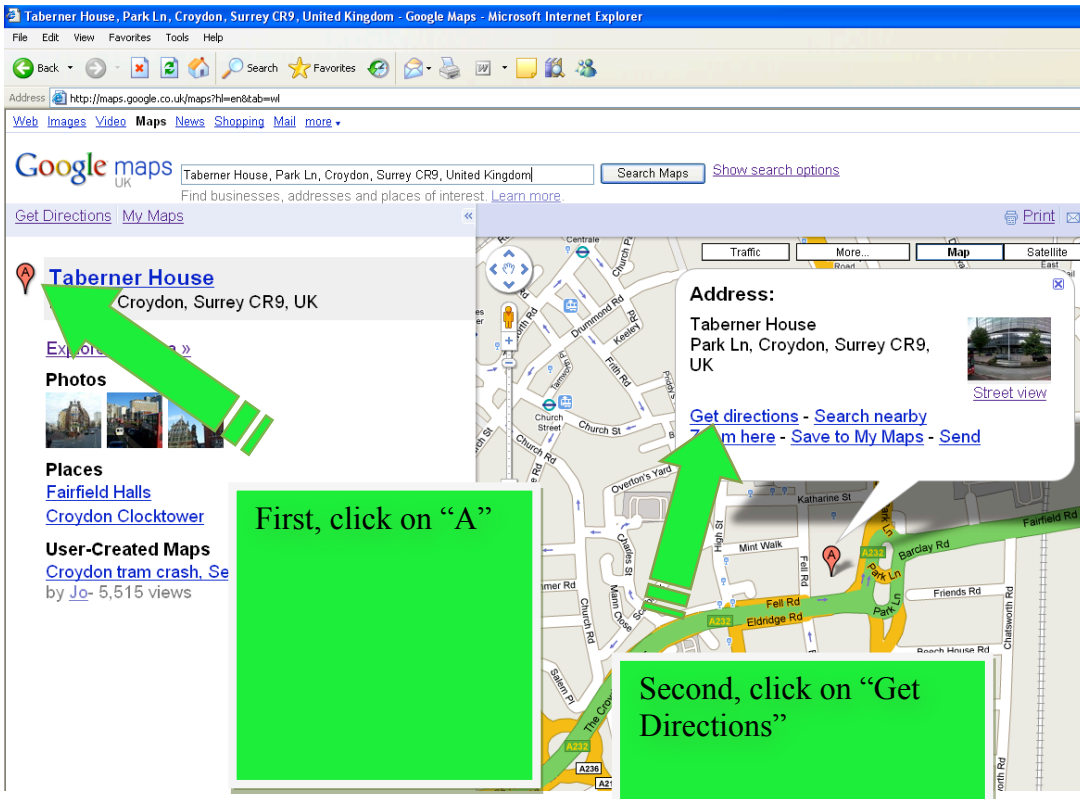
Step One:



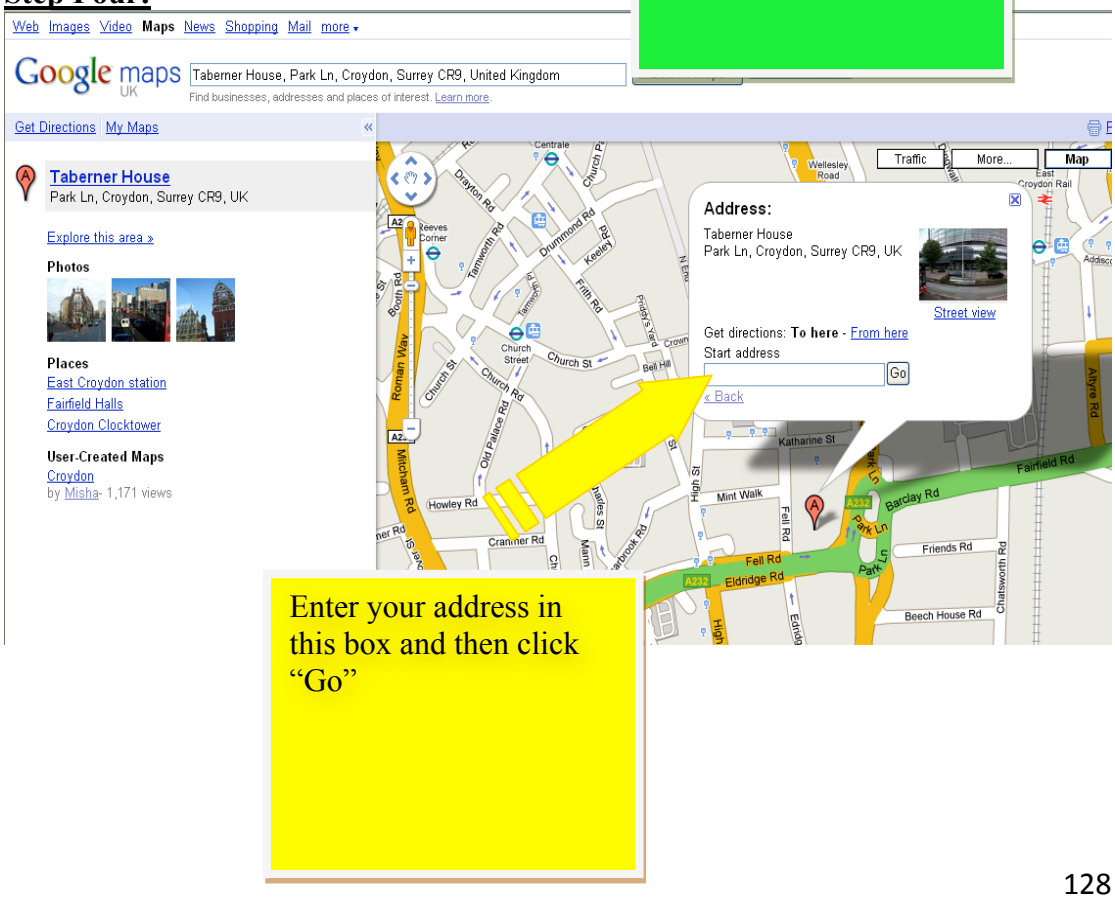
Step Two:



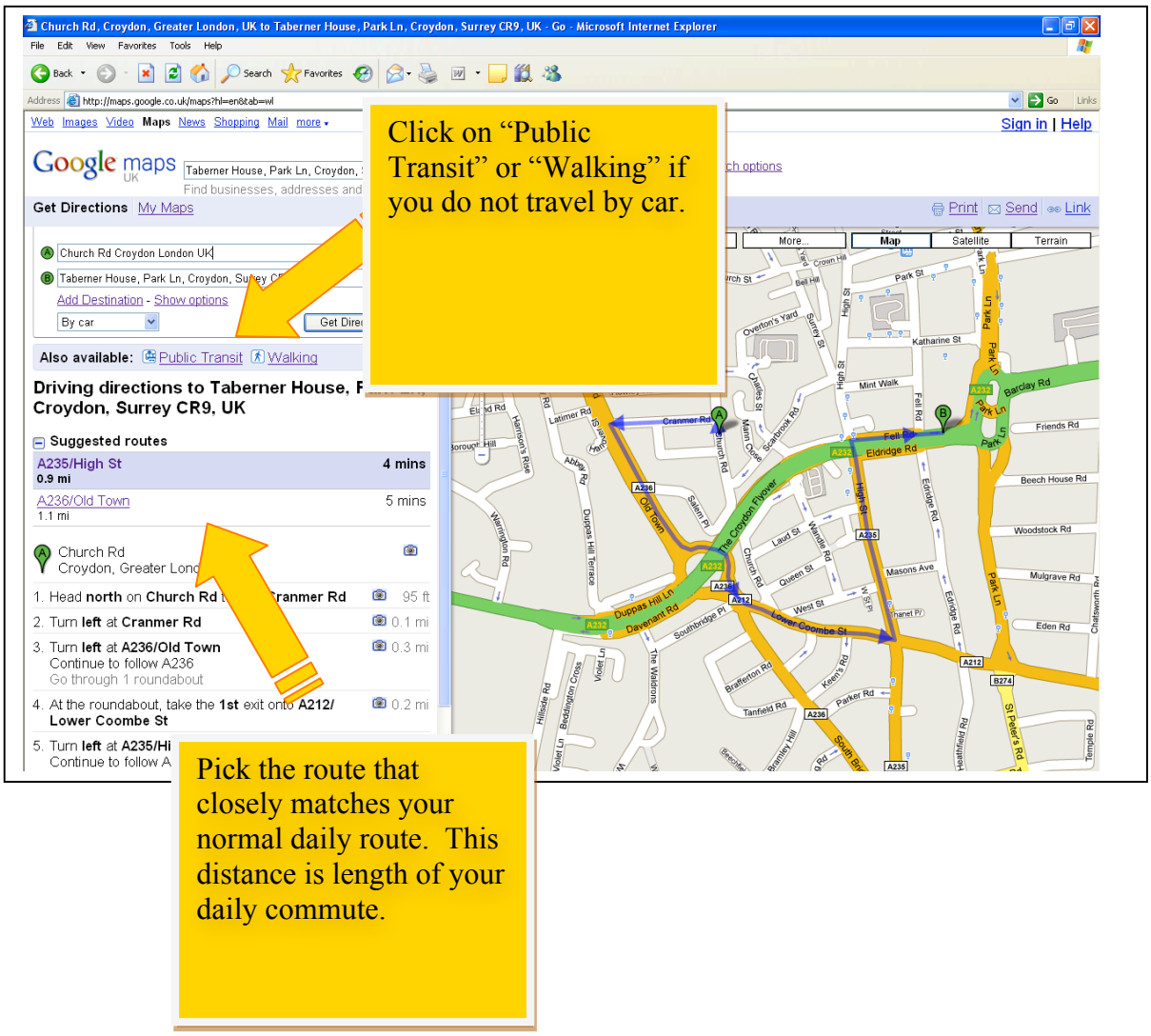
Step Three:



Step Four:



Step Five:


Church Rd, Croydon, Greater London, UK to Taberner House, Park Ln, Croydon, Surrey CR9, UK - Go - Microsoft Internet Explorer
Click on "Public Transit" or "Walking" if you do not travel by car.
Church Rd Croydon London UK
Taberner House, Park Ln, Croydon, Surrey CR9, UK
Add Destination - Show options
By car
Get Directions
My Maps
Also available: Public Transit Walking
Driving directions to Taberner House, Park Ln, Croydon, Surrey CR9, UK
Suggested routes
A235/High St 0.9 mi 4 mins
A236/Old Town 1.1 mi 5 mins
1. Head north on Church Rd
2. Turn left at Cranmer Rd 0.1 mi
3. Turn left at A236/Old Town 0.3 mi
Continue to follow A236
Go through 1 roundabout
4. At the roundabout, take the 1st exit onto A212/ Lower Coombe St 0.2 mi
Pick the route that closely matches your normal daily route. This distance is length of your daily commute.