

Towards a Cleaner Sleat



An Evaluation of the Clean Sleat Project

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Executive Summary

This study was done by students of the University of Flensburg/Germany on behalf of the Sleat Community Trust to follow up the Clean Sleat Project (CSP), which was introduced in 2009 as a consequence of the ecological footprint study done in 2008 by a group of fellow students from the same University.

Its objective was to evaluate the aforementioned project in terms of its relevance, effectiveness, impact and sustainability. Based on its overall objective and the various activities done within the last 2 years the change in CO₂ emissions, the satisfaction of the community with the services offered, as well as the awareness and attitudes of the Sleat population towards the problem of carbon dioxide emission were assessed. To find out the CO₂ emission reduction, the savings were related to the project activities. Changes in CO₂ emissions that did not relate to project activities were not considered and therefore a new footprint calculation was not undertaken.

The same impact areas as in the 2008 study were used, namely Direct Energy, Transportation, Waste, and Food. In the present study however the water and material sector were not considered because they were not addressed by Clean Sleat Project activities. The time boundary of the study is from February, 2008 when the baseline was conducted up to the end of 2010.

The findings in the different sectors are in brief:

Direct Energy

The highest emission reductions could be achieved in the direct energy sector. The CO₂ emission reduction in this sector was 336 tonnes which accounts for 70% of the total reduction. Main reasons for the reduction of the CO₂ emissions due to the project activities were the increase in the use of firewood in households, the substitutions of LPG with woodchips in the college, the improvement in the house insulations and the installation of energy saving bulbs. The level of satisfaction of the respondents with the different activities of the CSP was high in general.



Waste

CSP's main waste management activities focused on waste recycling and reuse. The project lobbied with the Highland council to provide Sleat residents with bins in order to reduce the waste that was being sent to land-fills. These activities contributed 20% of the total CO₂ emissions reduction in Sleat. It was found that the degree of awareness increased since 2007 and the amount of recyclable material doubled due to the waste separation.

Transport

The transport sector is the third largest contributor of CO₂ emissions in Sleat. The data analysis from households and providers of public services showed that the replacement of car travels by bicycle or public transport contributed 9% to the reduction of CO₂ emissions. It had also been noticed that people are more aware of using public transport and bikes in order to reduce their carbon footprint.

Food

The activities that the Clean Sleat Project conducted in the food sector were lending out a rotavator and a shredder to promote local production of vegetables and fruit. The number of households that increased the use of compost and own production of food was assessed. The CO₂ emissions reduction was 0.9 tonnes, which represents 0.2% of the total emissions reduction.

Overall it can be concluded that the Clean Sleat project was relevant because almost all activities were seen relevant by the residents. The project contributed to reduce the CO₂ emissions in Sleat by 3.3% compared to 2007 (See Table 3-21). This figure shows that the project was only partly effective because it did not reach its ambitious goal of a 33% reduction in CO₂ emissions. But the 478 tonnes of CO₂ which were saved show that it had already a considerable impact. The largest share of this reduction was through the use of biomass and woodchips. That shows how important the activities in this area were. The project has also contributed to raise awareness of the issues of climate change within the community.



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List of Abbreviations

CFL	Compact Florescent Lamp
CO ₂	Carbon Dioxide
CSP	Clean Sleat Project
EEM	Energy and Environmental Management
EF	Emission Factor
GSCW	Great Sleat Cycle Weeks
IC	International Class
LPG	Liquefied Petroleum Gas
MTCE	Metric Tonnes of CO ₂ Equivalent
n.d.	No date
SCT	Sleat Community Trust
SESAM	Sustainable Energy Systems and Management
SMO	Sabhal Mor Ostaig
UK	United Kingdom
US EPA	United States Environmental Protection Agency
WEEE	Waste Electrical and Electronic Equipment

List of Units

°C	Degree Celsius
kg	Kilogram
kJ	Kilo Joule
km	Kilometre
kWh	Kilowatt hour
l	Litre
m ²	Square meter
MJ	Mega Joule



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1. Introduction

Between February 14 and March 20, 2011, a team of graduate students of Energy and Environmental Management (former SESAM) from the Flensburg University conducted an evaluation of the activities of the Clean Sleat Project. This study determined in how far the project objectives have been met. The study was undertaken on behalf of the Sleat Community Trust and in cooperation with Community Energy Scotland as part of the Student's research assignment at their Master of Engineering course.

The Sleat Peninsula is located at the southern tip of the Isle of the Skye. The population of Sleat in 2010 was estimated to be around 878 with 394 (Sleat Community Trust 2005).

This is a follow-up study. In 2008 an initial study on the ecological footprint of the Sleat Peninsula was completed by a group of fellow students from the University of Flensburg. The 2008 study revealed that Sleat residents used more natural resources than the Scottish average consumption. These findings led to the implementation of the two year Clean Sleat Project with an initial goal to reduce the carbon emission on the peninsula by 33% over the project time.

The Clean Sleat Project (CSP¹) was launched in 2009 as a local initiative. Its main function was to facilitate implementation of useful community based renewable energy, energy efficiency and other environmental activities. The Clean Sleat Project is led by a seven member voluntary working group with Angus Robertson as the project manager. The Sleat Community Trust (SCT) received a grant of £99,000 from the "Scottish Government Climate Change Fund". The fund was intended to increase the awareness of climate change and to reduce carbon emission over two years in the community (Sleat Community Trust 2010).

The CSP activities mainly focused on residential energy consumption, household waste management, transportation and vegetable and fruit production. To meet the envisaged targets the Clean Sleat Project provided information and free services to households and business enterprises.

The present study assessed the change in the carbon footprint attributable to project activities and the awareness and attitudes of the Sleat population towards the problem of carbon dioxide emission. Further, the study suggested possible focus areas for future projects.

¹ In the course of this report we use either the full wording, Clean Sleat Project, or the abbreviation, CSP or the Project



In conducting this research, the study team set its own vision and mission. Accordingly, the vision of this project was, “Foot Print towards Sustainability”, and the mission was to effectively execute the team’s tasks using their intercultural experiences by cooperating with the local communities to provide options towards sustainability.

1.1. Objective of the Clean Sleat Project

The main objective of the Clean Sleat project was to reduce the carbon footprint of Sleat through local initiatives and community engagement (Clean Sleat Project n.d.). A reduction target of 33% was initially envisaged. In order to achieve this goal, the project devised a number of activities. These activities were designed to address the main impact areas of the carbon footprint which included direct energy, waste management, transport and food.

1.2. Expected Outcomes of the Clean Sleat Project

Project activities were targeted at:

1. increasing household energy efficiency
2. Increasing the use of renewable energy resources
3. improving waste management
4. increasing the use of public transport and bicycle
5. Increasing local vegetable and fruit production.

In order to achieve the above targets, the Trust worked with the local school, community groups and businesses (Sleat Community Trust 1 n.d.).

1.3 Activities of the Clean Sleat Project

The following were the activities of the Clean Sleat Project:

1. Conducting energy audits in households to promote residential energy efficiency
2. Distributing energy saving bulbs (Compact Fluorescent Lamps –CFL)
3. Distributing stand-by energy savers
4. Distributing real energy meters
5. Lending out a log splitter to encourage the use of woodfuel
6. Providing information on reducing, reusing, and recycling of waste
7. Lobbying for the creation of collections points for mobile phones and batteries at the local school, the Post Office, Kilmore Church (Sleat Community Trust 3 n.d.)



8. Lobbying for an on island green disposal of waste and a local 'Swap/Recycle' scheme for unwanted items (ibid)
9. Encouraging to reuse clothes by sending them to Blythewood or Rag Tag Textiles in Broadford (ibid)
10. Encouraging the use of reusable nappies
11. Encouraging the use of local materials in building and construction works
12. Lobbying for an improved public transport service from the local ferry and bus companies
13. Lending out cultivator and shredder to promote local production of vegetable and fruit

Awareness programmes were organized through several community events such as polytunnel construction and solar panel building workshops, energy savings tips, a solar car boot sale, showing of the “Age of Stupid” climate change film, crofters market, etc. Other community events included the Great Sleat Cycle Weeks with which were many mini events such as bike repair workshop, family bike ride, bike to school week. Two “waste to useful product” competitions at the local school were organised as well as a “Mini Renewables and Energy Efficiency Day”. The Community Trust contributed green pages to the Sleat Tourism website

1.4 Scope of Work

The scope of this study was to evaluate key areas of the Clean Sleat Project. The focus areas where direct energy, waste management, transport and food. Based on the project activities, the study included a quantitative and qualitative evaluation. While the 2008 Study focused on the calculation of the ecological footprint of Sleat, the present study focuses on the contribution of the Clean Sleat Project activities to the carbon footprint reduction between 2008 and 2010. The carbon footprint is a part of the ecological footprint. Thus, the work covered included:

- a quantitative assessment of the reduction of the carbon footprint by the Clean Sleat Project
- a qualitative evaluation of attitudinal changes of the Sleat residents towards climate change and carbon footprint.

The work did not include an assessment of the carbon footprint of Sleat. Therefore factors that could have led to a change in the total carbon footprint, but were not related to the Clean Sleat Project, such as demographic changes, improvements of the emission factor of the Scottish electricity mix etc. were not considered in this study.



2. Methodology of the Study

This chapter discusses the methodology and approaches followed in the evaluation of the Clean Sleat Project. It elaborates on the various aspects and the boundaries of the evaluated project, the tools used for the survey, the sample size and its representativeness, data collection and analysis as well as the assumptions and limitations of the study.

2.1. Approach of the Study

According to international criteria of project evaluation (OECD n.d.), we looked into aspects such as relevance, effectiveness, impact and sustainability of the project, but we deliberately left out to check project efficiency, as this was not requested.

The impact assessment included the reduction in the carbon footprint as well as the attitudinal change within the community as a result of project activities. However, we found it difficult to attribute changes to the Clean Sleat project only. This was mainly because there were other influencing activities such as energy audits conducted by the Energy Saving Trust or the Highland Council as well as information the community received through the media.

The 2008 study in Sleat categorized the footprint into food, waste, direct energy and transport. Calculations of the footprint from these categories, which in the 2008 study were called “impact areas” (SESAM 2008 ,23.), basically followed the “component method”. This method focuses on a bottom-up approach, where all ecological footprints of individual products consumed by the population are counted and summed up. The “compound method” on the other side follows a top down approach using national production, as well as import and export data to determine the total consumption of a nation (Chamber 2007, 68). In this study the component method was primarily used. However when required the compound method was also applied to complement the analysis.

The specific methodology used for each of the sectors, namely direct energy, waste, transport and food is outlined in the chapter on findings and analysis.

Based on the 2008 study the Clean Sleat Project was introduced. So the main assumption of our survey was that there is a reduction of carbon footprint in Sleat in 2010 compared to 2007.



On the basis of project activities quantitative and qualitative aspects were identified. In the quantitative assessment we estimated the reduction in the carbon footprint of the Sleat peninsula in 2010 in areas where project activities were implemented. This was then compared with carbon footprint from the 2008 study. In this way the assumption of the study was tested.

In the qualitative aspects of the study we assessed:

- The community's attitudinal change. This change may or may not necessarily be reflected in the reduction of the carbon footprint.
- Community's level of awareness of the Clean Sleat Project and its associated project activities,
- Community's level of satisfaction from services rendered

2.2. Defining the Boundaries of the Study

In order to determine changes in the carbon footprint of Sleat, boundaries of sectors were defined in similar ways to those of the IC 2008 study. The water sector was excluded from this study, as according to the 2008 report, it did not contribute significantly to the total carbon footprint of Sleat. Besides responsibility boundaries, time boundaries were also considered in this study due to the nature of the objectives.

Detailed responsibility boundaries for each sector (SESAM 2008, 11) are described below and compared with what the IC 2011 team did in the present study.



Table 2-1: Responsibility boundaries for different sectors

Sectors	IC 2008		Differences of IC 2011 from IC 2008
	Included activities	Excluded activities	
Direct Energy and water (Excluding transport)	Energy and water consumption within Sleat region in all sectors. Energy and water consumption of tourists staying in hotels, B&B and self-catering accommodation.	Energy and water consumption of Sleat resident outside Sleat boundaries. Domestic water, which is provided through local sources.	Water sector was excluded. Only energy consumption of households, institution and hotels were evaluated, other sectors were excluded.
Transport	All modes of travel of Sleat residents	Tourist transportation to and within Sleat	Air travel was excluded
Materials and waste	Long lifetime material consumption within Sleat region in all sectors. Short lifetime material considered under waste. The material required for infrastructure both private (new houses) and shared e.g. road		Long lifetime materials were excluded. Only mobile phones and batteries were included as short lifetime materials.
	Waste generation within Sleat region in all sectors. Waste treatment outside Sleat boundaries	Bulk waste (considered as material). Construction waste (assumed to be reused). The specific waste produced by commercial sector which are not collected by Municipal Solid Waste (MSW)	Waste generation from households, institutions and hotels were evaluated, Other sectors were excluded. Only textile, glass and plastic bottles were considered in recycling waste. Other categories are excluded.
Food	Food consumption by resident within Sleat.	Food consumption of self-catering tourists.	Total food consumption was not evaluated. Only replacement of non-local vegetables and fruit production of residents within Sleat in the last 2 years were evaluated. Animal food was excluded.

Source: IC 2011, based on IC 2008 Report

The time boundary of the study was defined based on the specific time schedule of Clean Sleat Project activities during the period February 2008 to December 2010.



2.3. Survey Tools

Three major tools were used for conducting the study: literature review, questionnaires and interviews.

In the literature review the Ecological Footprint of Sleat (2008 IC Study), websites of Clean Sleat Project and relevant reports of the Highland Council were reviewed to use as main sources of the baseline data for the study.

Based on the main objectives of the study, six questionnaires were drafted, discussed with representatives of the project and tested, including

- A standardized general household questionnaire for obtaining information from households, which relate to general and background information, transport, waste, materials and food.
- Five specific (standardized) questionnaires for obtaining information of households that either participated in the Clean Sleat Project activities or implemented energy related measures themselves.
- Questionnaire guidelines were used in expert interviews for collecting data from relevant institutions in Sleat, such as the primary school, college, local transport company and hotels.

The questionnaires were completed through face-to face interviews. The interviewer read the questions to the respondent and recorded the responses. Interviews were carried out with households, institutions and key personnel of Clean Sleat Project.

2.4. Sampling and Data Collection

A sample of 208 households from the 394 households in Sleat was contacted for household interviews. Of these 164 households were successfully interviewed. 44 households declined to be interviewed.

2.4.1. Sample of Number of Households in Sleat

Table 2-2 shows the breakdown of interviewed households per village. This was representative of the contacted households in relation to the population.



Table 2-2: Distribution of household interviews in Sleat

Village	Total number of Households (Approx.) in 2010	Households contacted	Households Declined	Interviews conducted	Interviews conducted in %
Achnaloich	23	11	3	8	35%
Tarskavaig	40	15	1	14	35%
Kilbeg	60	29	6	23	38%
Eilean Iarmain / Camacross	65	45	15	30	46%
Drumfearn	17	9	3	6	35%
Armadale	26	7	2	5	19%
Calligarry and Ardvasar	77	35	6	29	38%
Aird of Sleat	31	18	1	17	55%
Teangue	24	15	4	11	46%
Saasaig	21	6	2	4	19%
Cruard	7	6	1	5	71%
Tokavaig	10	3	-	3	30%
Ord	30	9	-	9	30%
Holiday homes (approx.)	105				
Estimated No. of Household	394 ²	208	44	164	41,6 %
Total	499				

(Source: EEM 2011)

The sample was made by targeting all the households that could be reached through door-to-door interviews. The aim was to reach as many households as possible. The number of households was estimated by counting from Google Earth. This was then compared with a list of households that were physically visited. There were few interviews conducted in Armadale because most of the potential respondents were not at home at the time of the visit. Sasaig is also underrepresented because there are a lot of unoccupied houses, which were assumed to be holiday homes. On an average the sample represents about 41.6% of the total households in

² [1] Projected number of households based on the Sleat Community Trust. "A Community Plan for Sleat." June 2005.



Sleat. Based on this sample and a total of 394 households at a confidence level of 95% a confidence interval or margin of error of 5.77% was achieved. This means that it is fairly representative

2.4.2. Estimated Number of Sleat Residents

According to the Sleat Community Trust, it was expected that there would be an increase of 44 households by 2011. Using this projection, we estimated that there would be 394 households in 2010. The Community trust plan further projected that Sleat would have a population of 878 in 2010. (Sleat Community Trust 2005). Up to date figures of both the number of households and the population could not be found from Scottish neighbourhood statistics website. The Scottish neighbourhood statistics estimated a population of 902 by 2009.

To overcome this challenge the 2011 study assumed the households in Sleat were distributed according to the sample of the 2008 Study. Using this profile, a population for Sleat was calculated to be 932. So our key assumptions were that:

- there is a constant structure of households
- the number of households is 394 as predicted in the Community Plan for Sleat

Although this leads to a fictitious number of residents (932), it allows for the exclusion of demographic factors, which are beyond the responsibility of the community, such as change of household structure and population growth. As the reduction of the carbon footprint is later calculated per capita the absolute figures can also be determined for the population number in 2007. However, the method might lead to an underestimation of the absolute per capita carbon footprint reduction in the range of 6%.



3. Findings, Analysis and Interpretation

This section presents the findings, analysis and interpretations of the data. The findings are presented broadly in the four focus areas namely, direct energy, waste separation, transport and food.

3.1. Direct Energy

According to Chambers et. al. direct energy includes energy used in homes, by commercial & public services such as hotels, education & health services for lighting, space & water heating, electrical appliances, communication & entertainment (Chambers, et al. 2005, 1)

The main objective of the study in this section was to quantify CO₂ reduction resulting from the implemented energy measures. Specific questionnaires were used to gather data on energy saved during the project period under review. However, since a number of respondents could not quantify the saved energy, standard Scottish household energy saving data was used (Energy Saving Trust 2011) to estimate the energy saved by each of the implemented measures.

The activities of the Clean Sleaford Project regarding direct energy were:

- conducting energy audits in Sleaford residences,
- disseminating CFL lamps,
- distributing stand-by savers,
- conducting a solar water heater workshop,
- lending out a log splitter to Sleaford households,
- encouraging the use of biomass,
- disseminating real time energy meters.

For those interviewees who participated as a beneficiary in any of these activities, a specific questionnaire was administered not only to quantify their savings but also to get some feedback from their experience with the respective activity.

A summary of the number of beneficiaries who were interviewed is presented in Table 3-1.



Table 3-1: Beneficiaries interviewed for each activity

	Interviewed	Percentage of the sample (n=164)	Total number of beneficiaries	Percentage of the total number of beneficiaries *
Energy audits	23	14%	52	44%
CFL dissemination	70	43%	200	35%
Stand-by saver dissemination	20	12%	80**	25%
Solar Water Heater Workshop	11	7%	16	69%
Log Splitter users	10	6%	16	62.5%
Real time energy meters distribution	19	12%	30	63%
Non participant in any of the above activities	78	48%		

Source: EEM2011

*) sums up to more than 100% as some households benefitted from several activities

***) number of energy savers which were distributed, some households received two

In order to have a comparison with people who did not participate in the activities, the same energy related specific questionnaires were administered to people who did not participate in the corresponding Clean Sleet Project activity but implemented some energy saving measures on their own. Table 3-2 shows the number of respondents who either benefitted from the Clean Sleet Project activities or implemented energy related measures on their own initiative.



Table 3-2: Specific section respondents

Specific questionnaire	Detail	Total number	Percentage of the sample	
Energy audits and home insulation	Improved the insulation on own initiative	24	45 *	27%
	Had an energy audit and applied one or more measures	11		
	Had an energy audit and didn't apply any measure	10		
CFL users	Received CFL from CSP	70	126	56%
	Installed CFL on own initiative	56		
Stand-by savers users	Received Stand-by saver from CSP	20	24	15%
	Installed Stand-by saver on own initiative	4		
Solar Water Heater: Workshop and users	Attended workshop	11	11	7%
	Attended workshop and installed solar water heater	0		
	Installed a solar water heater on own initiative	0		
Firewood	Hired the log splitter (and increased the use of firewood)	9	38	23%
	Hired the log splitter (and did not increase the use of firewood)	1		
	Not hired the log splitter but increased the use of firewood or purchased a wood stove after February 2008	28		

Source: (EEM 2011)

*) Two more interviewees received an energy audit from the Clean Sleet Project, but they were not asked the questions of the specific questionnaire because they had been interviewed by the Sleet Community Trust.

Within this section an extrapolation factor of 2.41 was used to extrapolate the CO₂ savings from the sample to the population. This factor is derived as the ratio of the estimated total number of households in Sleet to the surveyed number of households (2.41=395/164).



3.1.1 Energy Audits and Improvements in Home Insulation

The Cleans Sleat Project offered to conduct energy audits in the homes of Sleat residences. Those residents interested in receiving a home energy audit were contacted by the trust and the energy audit was carried out by the Energy Saving Trust.

The reduction of CO₂ emissions due to improved insulation of houses was quantified using typical figures of CO₂ savings from the Energy Saving Trust webpage (Energy Saving Trust 2011). The webpage provides figures of CO₂ savings for common home insulation measures given the energy carrier used, the type of house (detached, semidetached, etc.) and the number of bedrooms. When the measures provided by the respondent could not be adequately described or did not match the one listed in the webpage, the lower value was chosen to avoid overestimation of savings. By this approach, it was possible to quantify the following savings:

Table 3-3: CO₂ emission reductions due to house insulation

	Interviews conducted	CO ₂ emission reduction in 2010 (tonnes of CO ₂)	
		Sample	Total Population
Energy Audit participants	21	6.3	15
Non participants	24	9.1	22
Total	45	15.4	37

(Source: EEM 2011)

The level of satisfaction with the energy audit carried out by the CSP is shown in Figure 3-1.



Are you satisfied with the energy audit service carried out by CSP?

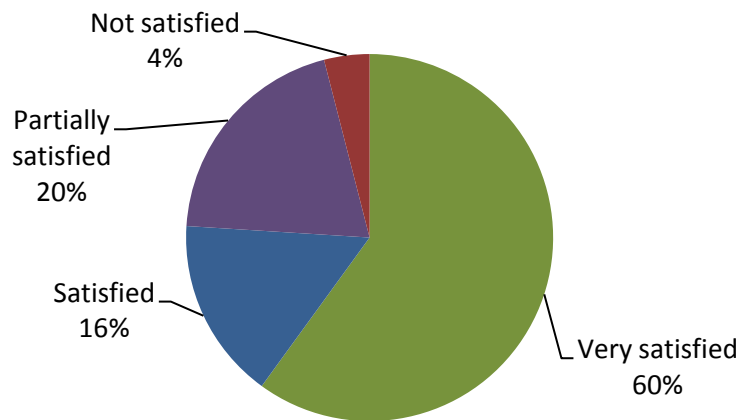


Figure 3-1: Level of satisfaction with the energy audit carried out by the CSP

In the sample 24% of the households were partially or not satisfied at all (four people are partially and two people are not satisfied). One of the respondents stated that the audit recommendations were not specific to the house but were rather generic and applicable mainly to old houses. Further, three respondents mentioned that they found it hard to understand the audit report. They indicated that the main challenge was that the audit reports were very technical; too much paper work and very difficult to understand, especially the thermal images. Five respondents found some of the recommendations challenging with respect to the high cost involved. They stated that they were constrained both financially and with time to implement the suggested measures. The high initial cost of implementing the measures and the long payback period further discouraged them from investing in energy saving measures. Some (two of the respondents) were not satisfied with the service because they had to deal with a lot of phone calls and paper works.

One of the respondents who is very satisfied with the energy audit service mentioned that some of the audit recommendations are very difficult to implement in houses with a solid concrete foundation. Another satisfied interviewee of the energy audit was not permitted to implement the recommendations according Scottish housing laws (i.e. insulation of timber frames in very old houses build before approx. 100 years ago). She had also expected to have information on different alternative energy sources which could cut her current heating energy cost.



Figure 3-2 shows in how far the beneficiaries of the energy audits applied the measures suggested by the audit.

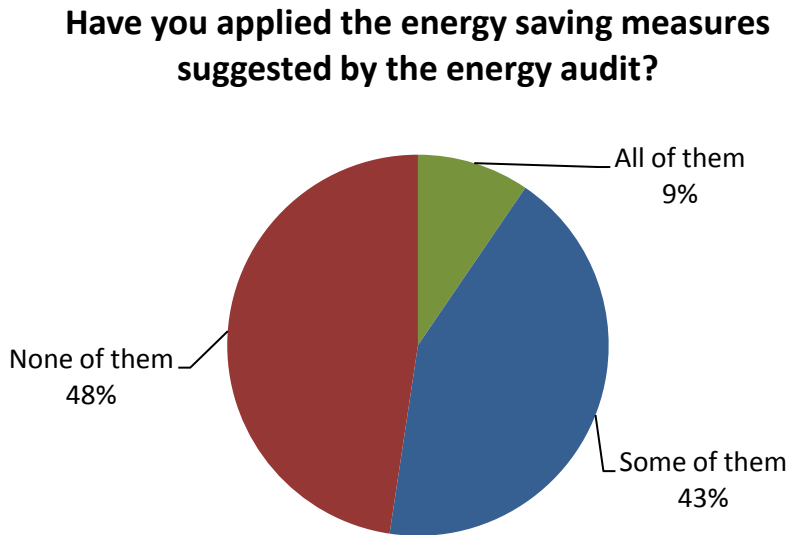


Figure 3-2: Measures applied by energy audits participants

The reasons for not implementing the measures could be grouped as in Figure 3-3.

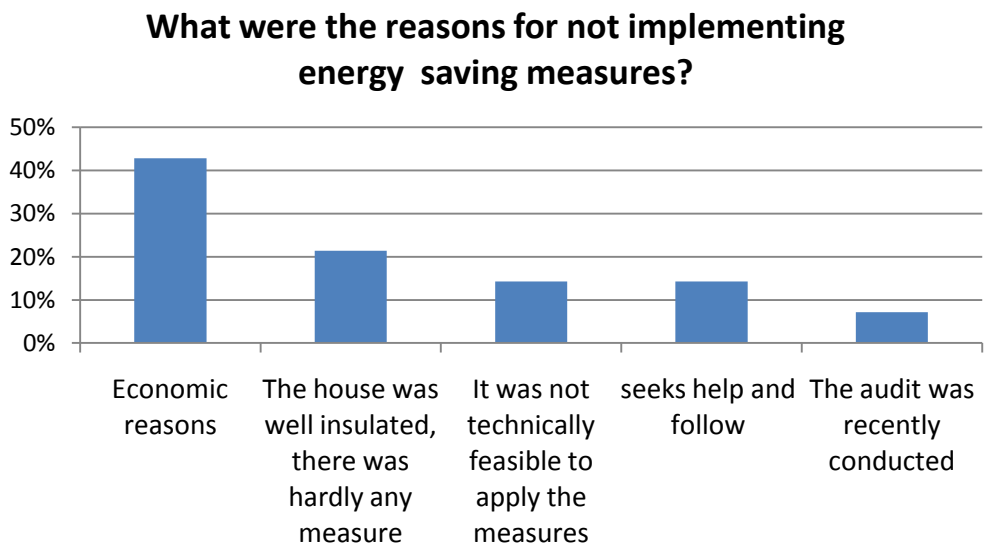


Figure 3-3: Reasons for not implementing the measures suggested by the energy audit

The suggestions for further energy audits are shown in Figure 3-4.



Do you have any suggestions to improve the energy audit service?

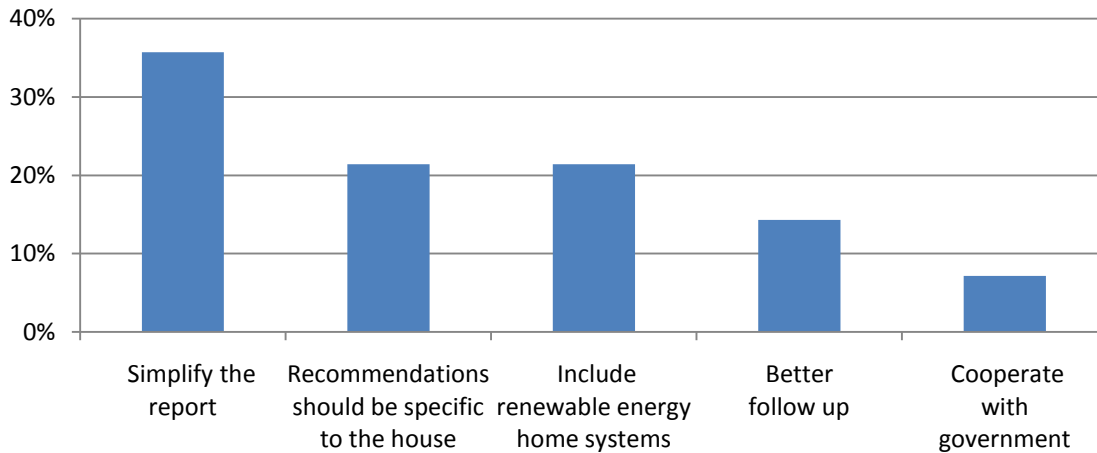


Figure 3-4: Suggestions for future energy audits

36% of the interviewees (5 households) suggested a report in a language easy to understand with understandable thermal imaging. A further 21% (3 household) proposed to formulate the recommendations more specifically for the house type. Another 21% of the respondents (3 households) suggested including renewable energy home systems such as solid fuel cooking systems and solar heating systems. Two interviewees suggested a follow up on the energy audits to encourage the implementation of the measures.

It was also asked from where the respondent heard of the energy saving measures applied in their homes. Figure 3-5 describes the respondents' sources of information about energy saving measures.



How did you hear about the energy saving measures applied in your home?

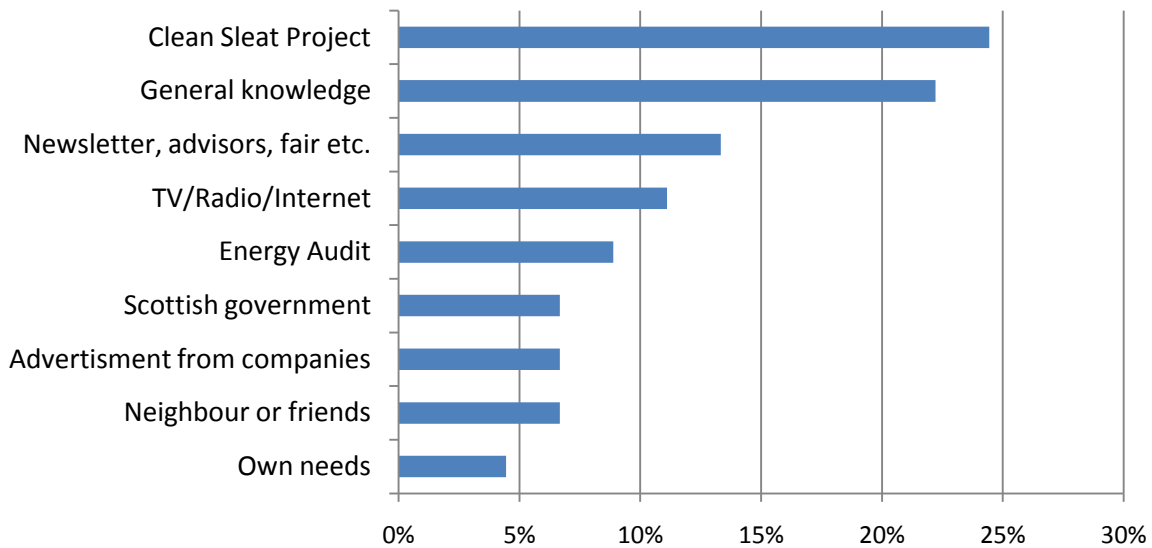


Figure 3-5: Sources of information on the energy saving measures (n=45, energy audit participants and those that implemented energy saving measures on their own)

In the sample, about one fourth of the households (11 households) stated that they came to know about the energy saving measures either from the Clean Sleaf Project in general or through its energy audit programme.

3.1.2 CFL Users

The results of the study revealed that 77% (302) of the households in Sleaf have installed energy saving lamps. Further it shows that 56% (168) of the households have benefitted from the Clean Sleaf Project by receiving free CFL.

The figure presented below shows that most of the Sleaf residents were satisfied or very satisfied with the dissemination program. However, some (17%) of them were not or only partially satisfied, mainly with the quality of the CFL. They mentioned that the light was not sufficient for several activities and that it takes too long to light up after switch on. Some interviewees expressed concern on the challenges of CFLs disposal as it contains mercury. One of the main suggestions of the respondents for future activities was to introduce collection points for old CFL to protect the environment.



Are you satisfied with CFL Dissemination program of the CSP?

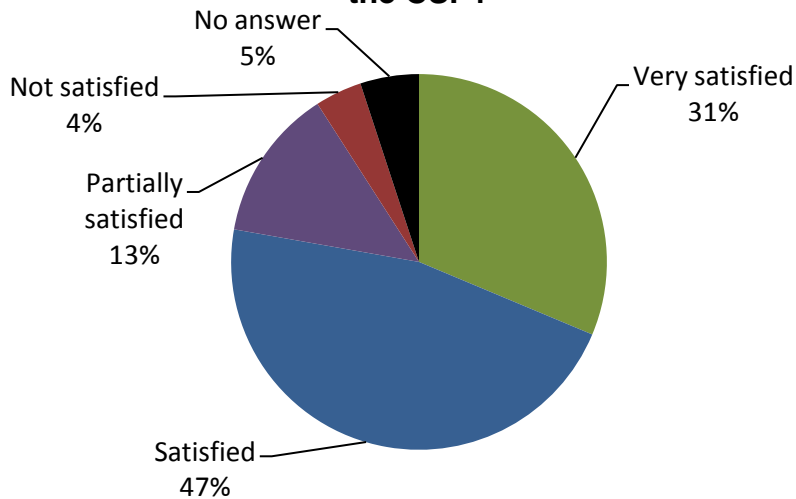


Figure 3-6: Satisfaction with the CFL dissemination program

What persuaded you to install the CFLs?

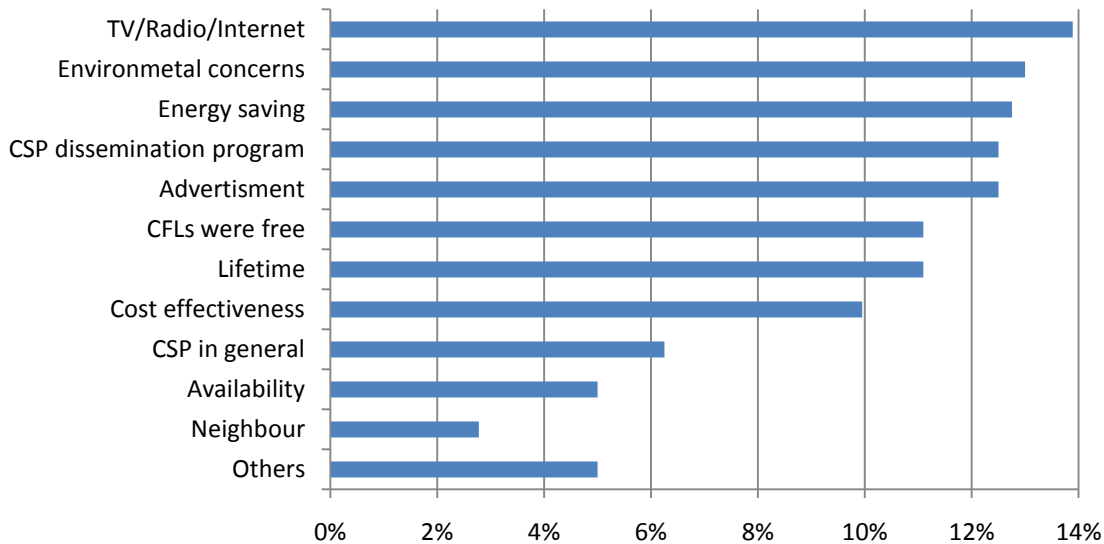


Figure 3-7: Influence of different sources of information on the decision to install CFL

Figure 3-7 shows that about 15% of the respondents were persuaded to use CFL either by the Clean Sleet Project in general or by its CFL dissemination programme. Due to the phasing out of incandescent lamps most people are aware of CFL and already install CFLs by themselves.

The CO₂ emissions were calculated for each respondent, using the average wattage of the CFLs installed, the average wattage of the incandescent lamps replaced and the average hours



of use provided. It was assumed that only two lamps were on at the same time. Based on these assumptions it was found that 23 tons of carbon dioxide emissions have been saved from CFLs. This represents a 0.54% reduction of the direct energy emissions in 2007.

3.1.3 Stand-by Saver Users

The stand-by savers were distributed free of charge to Sleat residents who attended some of the different activities organized by the Clean Sleat Project. Out of a sample of 24 interviewees, 20 had received a stand-by saver from the Clean Sleat Project and 4 had acquired it by their own initiative. Two different types of stand-by savers were distributed; one suitable for computers and the other suitable for TV and entertainment equipment.

From the respondents who received the stand-by saver from the Clean Sleat Project, 15 actually installed it, while four did not. The reasons for not installing the equipment were:

- The instruction seemed complicated and difficult to understand (2 respondents)
- The effect it would have on the computer was not clear from the instruction (1 respondent)
- The respondent did not have many electrical equipments (1 respondent)

The respondents who installed stand by-savers had different motivations. As can be seen from Figure 3-8 it is quite obvious that the Clean Sleat Project was one of the reasons that influenced respondents to install the stand-by saver.



What persuaded you to install the stand-by saver?

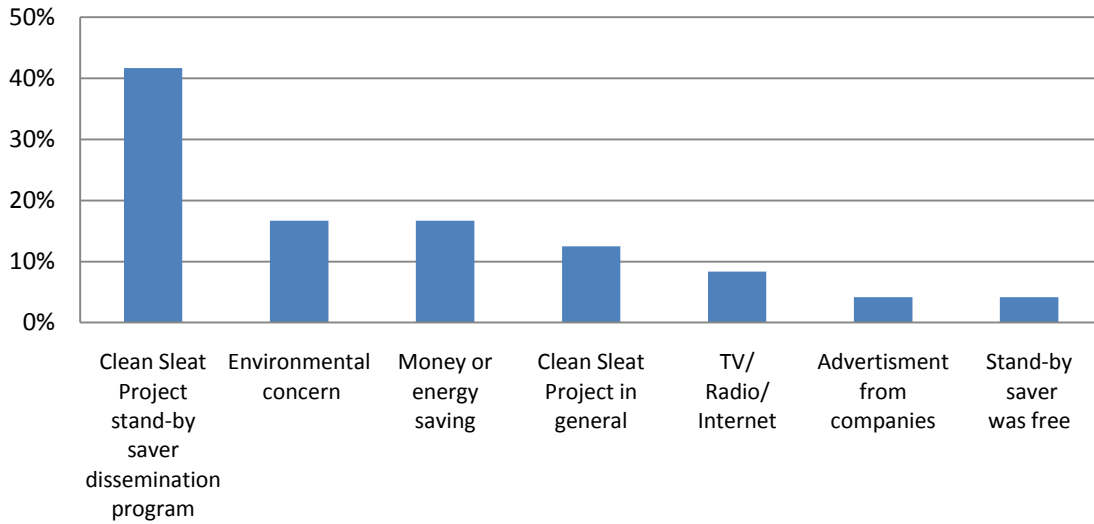


Figure 3-8: What persuaded you to install the stand-by saver? (n=24)

More than half (56%) of the respondents who received a stand-by saver from the Clean Sleat Project were satisfied with the dissemination program, but still there were 35% percent who were not completely satisfied or did not answer (See Figure 3-9).

Are you satisfied with the stand-by savers dissemination program of the Clean Sleat Project?

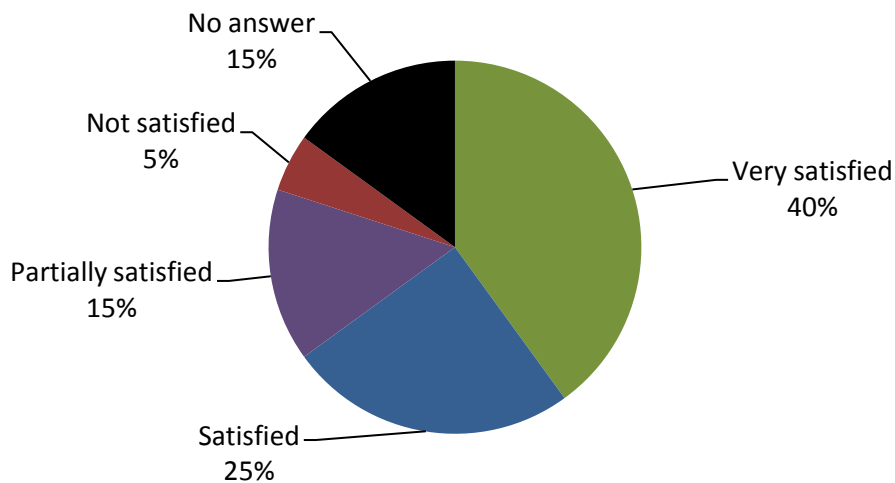


Figure 3-9: Satisfaction with the dissemination program (n=20)



Respondents who were not completely satisfied with the program were those who could not install the equipment. The respondents reported that they were not able to understand the instructions; or that they had expected to receive a stand-by saver that they could connect to the TV and other appliances, instead of connecting only to the computer.

When asked for suggestions for future dissemination programs, the answers received were:

- To provide more information on how to connect the stand-by savers (2 respondents)
- To make more promotion of the stand-by savers (2 respondents)
- To provide more stand-by savers for PC (2 respondents)
- To provide more stand-by savers for TVs and VCR's (2 respondents)

The list of equipments connected to the stand-by savers and their corresponding standby hours were obtained from the respondents. With this information the energy savings were estimated, assuming some typical values for the stand-by losses of the equipment connected. The standby savers contributed in total 1.2 tons of CO₂ saving.

Table 3-4: CO₂ savings due to stand-by savers

Savings	
Energy savings (kWh)	CO ₂ Saving (ton CO ₂) *
2967	1.2

*) Derived using an emission factor of 0.406 kgCO₂/kWh.

54% of those respondents who installed the standby savers answered that the Clean Sleaf Project persuaded them. To sum up, it could be seen that the stand-by savers were not widely used among the residents, and the majority of those who used them came to know about them through the dissemination project. Furthermore this activity contributed to reduce the CO₂ emission of Sleaf by 1.2 ton of CO₂. On the other hand, according to the view of some respondents the Clean Sleaf Project did not make sure that the beneficiaries were informed on the installation of the equipment and on the type appliances the stand-by savers were supposed to switch off.



3.1.4 Firewood Use

The Clean Sleet Project promoted the use of firewood by acquiring a log splitter that was lent out to the community for free. Ten log splitter users were interviewed in order to find out whether they had used more firewood because of the availability of the log splitter lending service.

The same questionnaire was administered to 31 households who, without using the CSP log splitter, meet more of their heat demand from firewood, or had bought a new wood burning stove after February 2008.

Households that used the log splitter

Nine of the log splitter users said that they meet more of their heat demand from firewood. However their motivation was mainly the cost of other fuels (in three cases). The fact that the wood was easily available or for free (three cases); or the combination of both was the motivation for the others. The other three said that the availability of the log splitter was one of the factors that persuaded them to increase the use of firewood.

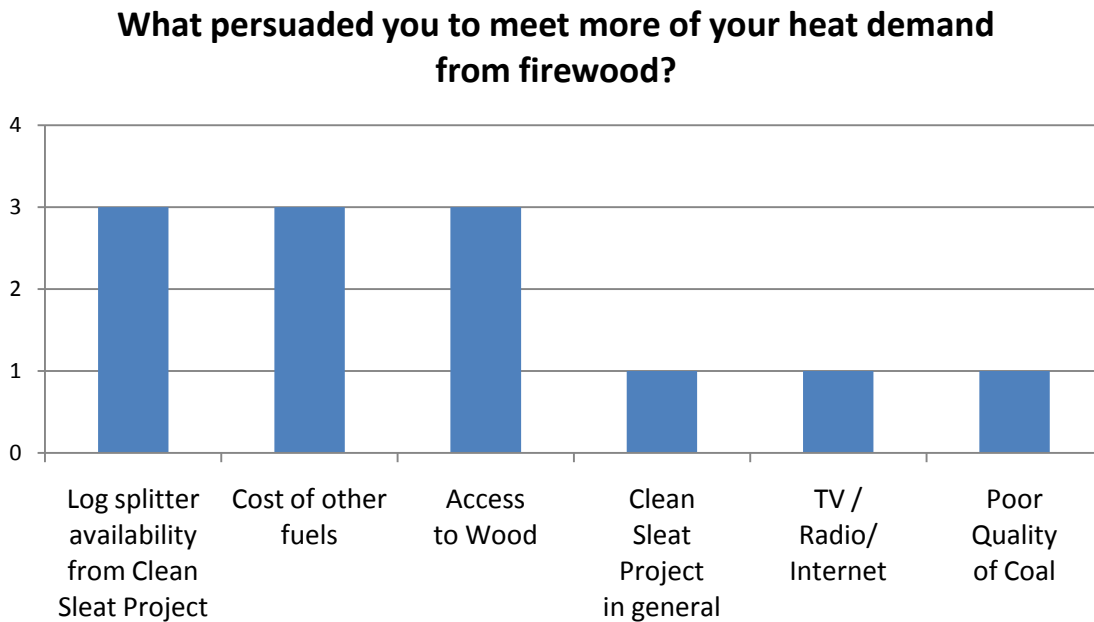


Figure 3-10: Motivation to meet more of the heat demand from firewood (n=10, more than one answer was possible)

Therefore the log splitter availability has been a motivation for people to increase the use of firewood.



Eight of the respondents who used the log splitter said they were satisfied or very satisfied with the hiring service, while two respondents didn't answer.

Four respondents had suggestions for improvement of the service, which included:

- delivery of the equipment to the house;
- keeping track of who has topped up or changed the oil, so the users can know if the previous user did it or not;
- buying a bigger log splitter; and
- buying more log splitters.

The willingness to pay for the service varied greatly. One respondent said that he would not be willing to pay but would instead look for an alternative. All others were willing to pay for it between five pounds per weekend, and twenty pounds per day, with majority saying that they would be ready to pay ten pounds per hire.

Households that increased the use of firewood

Thirty four of the interviewed households said that they had increased the use of firewood, which represented 21% of the sample. This includes households that used the log splitter and households which did not use it.

The motivation for meeting more of the heat demand with firewood was mainly the cost compared to other fuels. This was followed by firewood being more available, environmental concerns, and availability of efficient woodstoves. This is shown in Figure 3-11 (multiple reasons are possible, therefore they don't add up to 100%).



What motivated you to meet more of your heat demand from firewood?

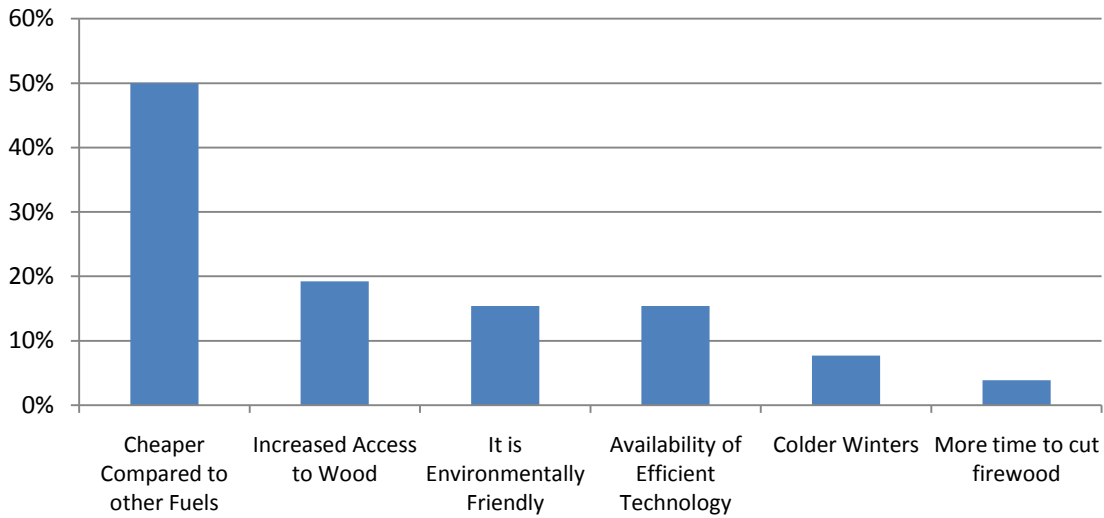


Figure 3-11: Motivation to meet more of the heat demand from firewood

When asked what the factors were which persuaded the respondent to increase the use of firewood, the answers were as depicted in Figure 3-12.

What persuaded you to meet more of your heat demand from firewood?

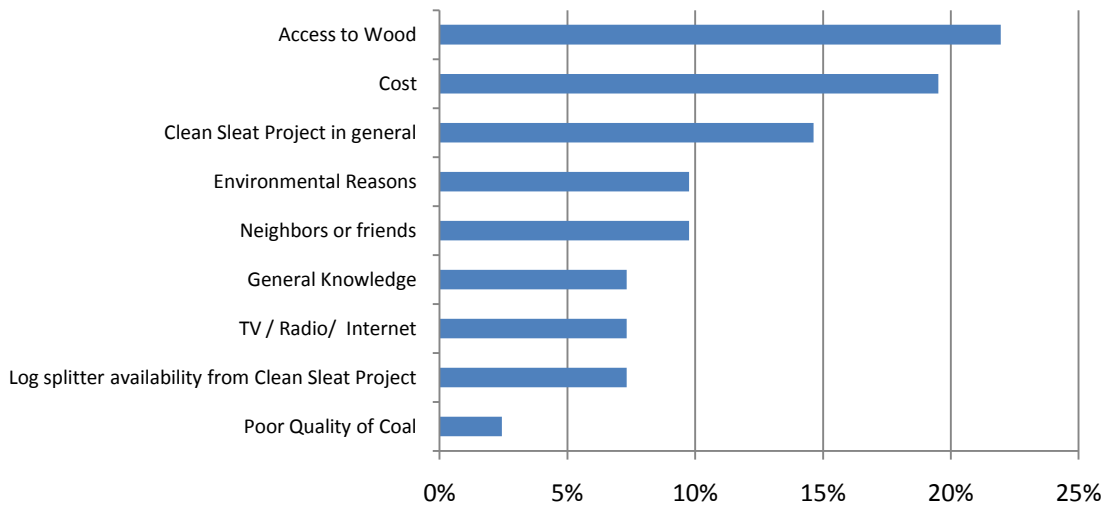


Figure 3-12: Reasons for increasing the use of firewood (n=41)



Almost 15% said they were persuaded by the Clean Sleaf Project, directly or by the log splitter service provided by the project.

Fourteen respondents (34%) get their firewood from the Clan Donald Trust, thirteen (32%) get it from their own property, one (2%) from John Muir Trust and the remaining thirteen (32%) get it from other different sources.

Fourteen out of 41 respondents had faced some kind of problem with the local provision of firewood. The main problems were related to the quality of the firewood, especially the high moisture content and the fact that the supply is not readily available when needed. Other concerns include the price and the size of logs and the fact that there is only one supplier.

Do you have any problems with the local provision of firewood?

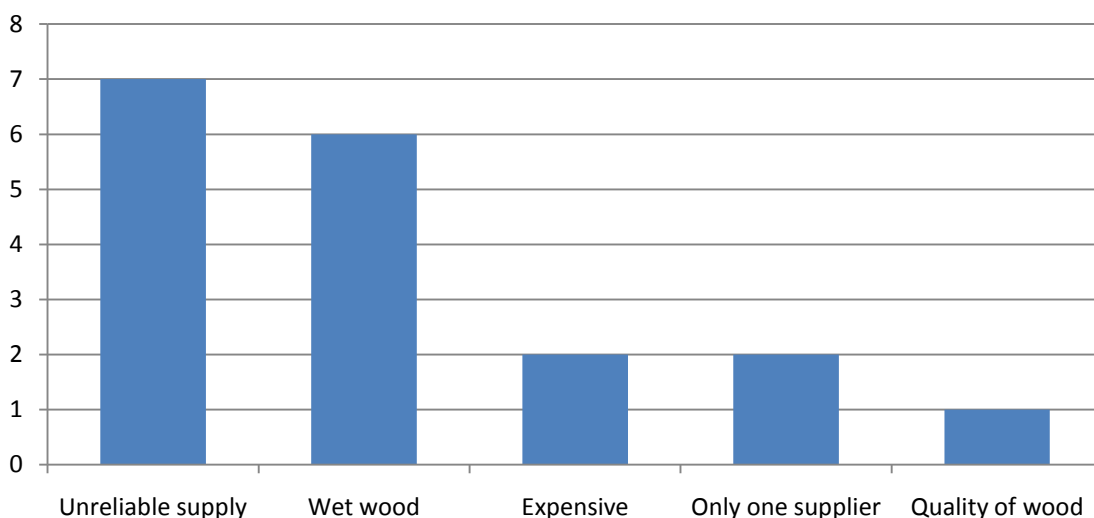


Figure 3-13: Problems faced with the local provision of firewood

Almost half of the people suggested that the trust should supply firewood, which shows that the intention of the trust to buy Tormore forest has a strong back up in the community. Suggestions to improve the quality of the wood mainly refer to the moisture content of the firewood. Other suggestions are to make more firewood available and to have more suppliers, to sell hard wood instead of soft wood, to employ qualified personnel and to give bio-licenses to pick up fallen wood.



Respondents' suggestions on how to improve local supply of firewood

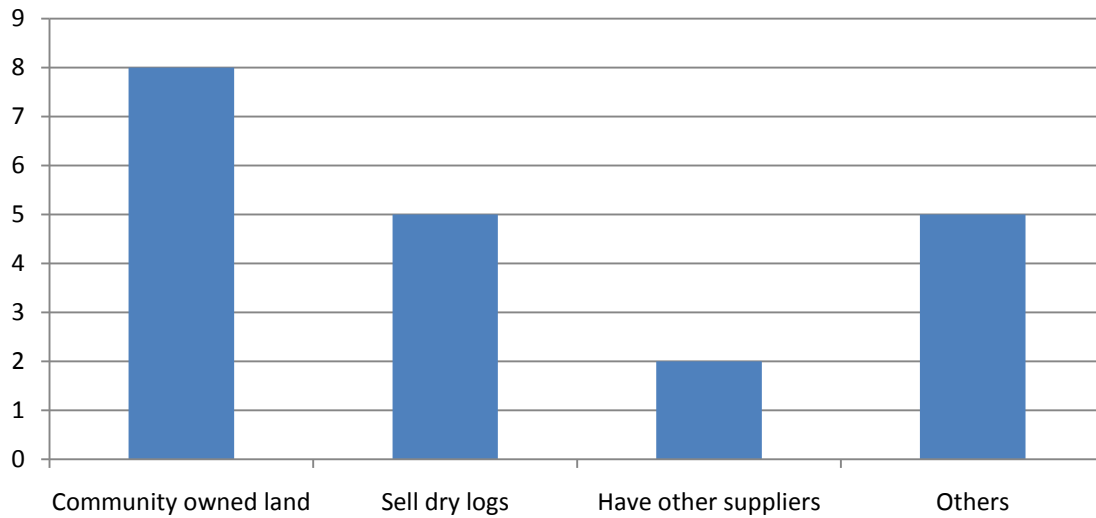


Figure 3-14: Respondents' suggestions on how to improve the local supply of firewood

The reduction of CO₂ emissions was quantified based on the information provided by the respondents on the amount of fuel being replaced.

Table 3-5: CO₂ savings due to the increased use of firewood

CO ₂ Savings (tonnes CO ₂)
193



College

In 2008 the college installed a woodchip boiler to supply the heat demand of the new campus with woodchips instead of LPG. The consumption data of the different years was provided by Dòmhnall MacIllinnein, head of estates & services (MacIllinnein 2011).

Table 3-6: College heat energy consumption from 2007 to 2010

Heat Energy Consumed (kWh)			
	LPG *	Woodchips	Total
2007	920080	0	920080
2008	1165315	67860	1233175
2009	756082	1438110	2194192
2010	647778	1561650	2209428

*) The LPG consumption was derived using a calorific value of 7.361 kWh/litre.

The CO₂ emissions were calculated for the different years. The results are shown in the following table

Table 3-7: College CO₂ emissions from heating from 2007 to 2010

CO₂ emitted (tCO₂)			
	LPG	Woodchips	Total
2007	175	-	175
2008	221	0,1	221,1
2009	144	1,5	145,5
2010	123	1,7	124,7

*) CO₂ emissions of wood chips are based on the delivery of woodchips by West Contracts Ltd from Portree with a 40m³ lorry and an emission factor for the truck of 0.29 kgCO₂/km. LPG emission factor 0.19 kgCO₂/kWh.

In absolute figures the CO₂ savings in 2010 compared to the reference year 2007 are 50 t. However, the college extension came into effect in 2008. Therefore the consumption in 2010 cannot be compared to the consumption in 2007 without accounting for the different sizes of the building. The heat energy consumption in 2007 (without extension) was approximately 75% of the consumption in 2008 (with extension). It is assumed that the heat consumption of the main



college building in 2010 was also 75% of the total heat consumption of the college. This results in CO₂ savings of 82 t for the college main building in 2010 compared to 2007.

Table 3-8: CO₂ savings by replacement of LPG by woodchips in the College

**CO₂ Savings in 2010 with respect to 2007
(tonnes CO₂)**

Savings without considering emissions of the college extension	82
--	----

The college and the Clean Sleaford Project closely cooperate in the promotion of renewable energies and carbon footprint reduction. For example the college has received advice from the Sleaford Community Trust regarding the woodchip boiler, and one of the subsidiaries of the Sleaford Community Trust is one of the College woodchip providers. Due to quality problems of the woodchips supplied by the trust the college presently purchases the wood chips from West Contracts Ltd, based in Portree, 40 miles away from the college. The local supply of woodchips could further reduce the carbon footprint by 1.7 tons of CO₂ which represents a further 0.5% reduction with respect to its 2010 total emissions.

3.1.4 Solar Water Heater Building Workshop

The Clean Sleaford project organised a solar water heater workshop for the residents of Sleaford. The aim of the workshop was to promote solar water heating and renewable energy in general. The participants expected to build their own solar collectors which they would then install.

However, none of the participants of the workshop installed the solar water heater. The reasons the participants gave for not installing can be seen in Figure 3-15.



What were the reasons for not installing the solar water heater?

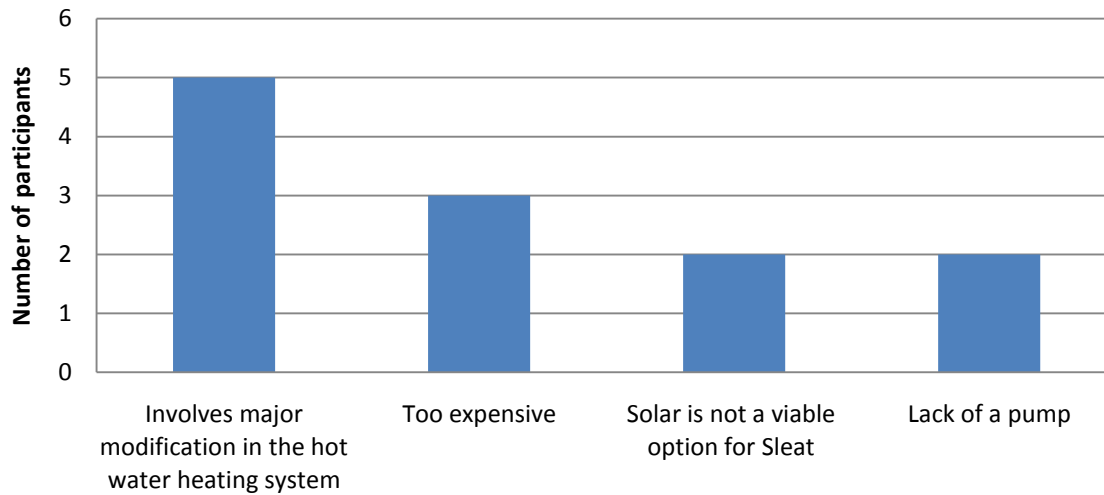


Figure 3-15: Reasons for not installing solar water heaters

Five of the participants interviewed expressed their concern that installing a solar water heater would involve major modifications in their water heating system, in particular that of the hot water storage tank and the piping. Closely related to this is the concern expressed by three of the participants that installing a solar water heater would be very expensive.

Eight of the respondents said that they became interested in solar water systems through the Clean Sleat Project.

How did you become interested in Solar Water Systems?

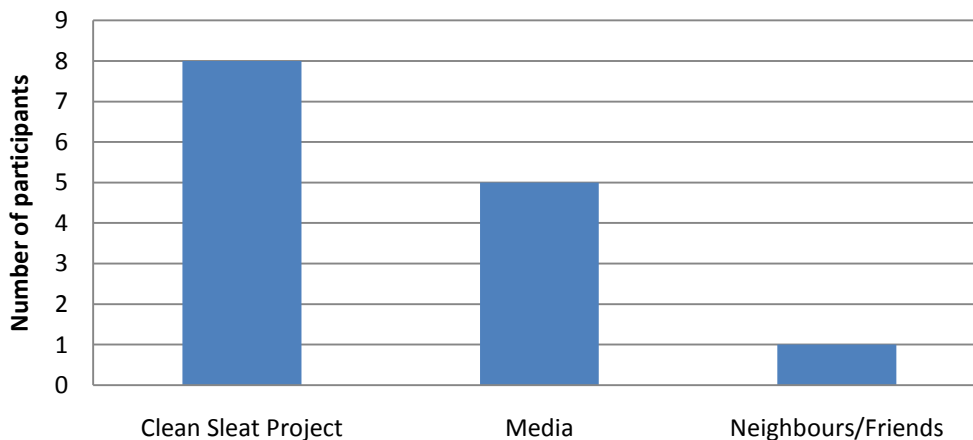


Figure 3-16: Reasons for interest in solar water

Seven of the participants interviewed said their expectations of the workshop were partially met. Two of the respondents felt their expectations of the workshop were fully met. Therefore nine participants had their expectations met to a certain degree but only five of those are considering installing solar water heaters in the future. Four of the respondents did not answer this question. Four respondents did not think that it is viable to install a solar water heater in their houses in Sleat or that the water from the solar heaters is neither hot enough nor adequate enough for usage.

However, a number of solar water heater installations in the Highlands show that solar water heating works well in the Scottish climate. For Example the inhabitants of Ostaig house in Sleat use solar energy for heating their water since May 1996 (MacInnes 2009).

There was a suggestion that future solar workshops demonstrate different solar collectors. These demonstrations might inspire people to install solar collectors. Future solar workshops should address the issues raised by the participants. Instead of building simple collectors future workshops should inform about technologies which are suitable for the Scottish climate and provide information on the benefits as well as the cost and efforts required to install a quality solar water heating system.

Further suggestions for future workshops included alternative forms of renewable energy, solar PV (as opposed to just solar thermal) and other decentralised electricity for domestic use and building materials for solar water heaters.

3.1.5 Impact of the Clean Sleat Project on the Target Areas

The impact that the Clean Sleat Project has had in each of the areas (home insulation, energy saving bulbs, stand-by savers, solar water heaters and firewood use) was assessed. To do so, the respondents were asked what persuaded them to undertake actions in the respective fields of activity. Multiple options, as shown below, were possible. The first one was related to the specific activity, and the last one (other) was an open option:

- Clean Sleat Project activity (i.e. Energy Audit, CFL dissemination program, Stand-by saver dissemination program, Solar Water Heater Workshop, Log splitter availability from the CSP)
- Clean Sleat Project in general
- TV/Radio/Internet



- Neighbours or friends
- Advertisement from companies
- Other

The percentage of respondents that ticked at least one of the first two options was calculated for each of the activities.

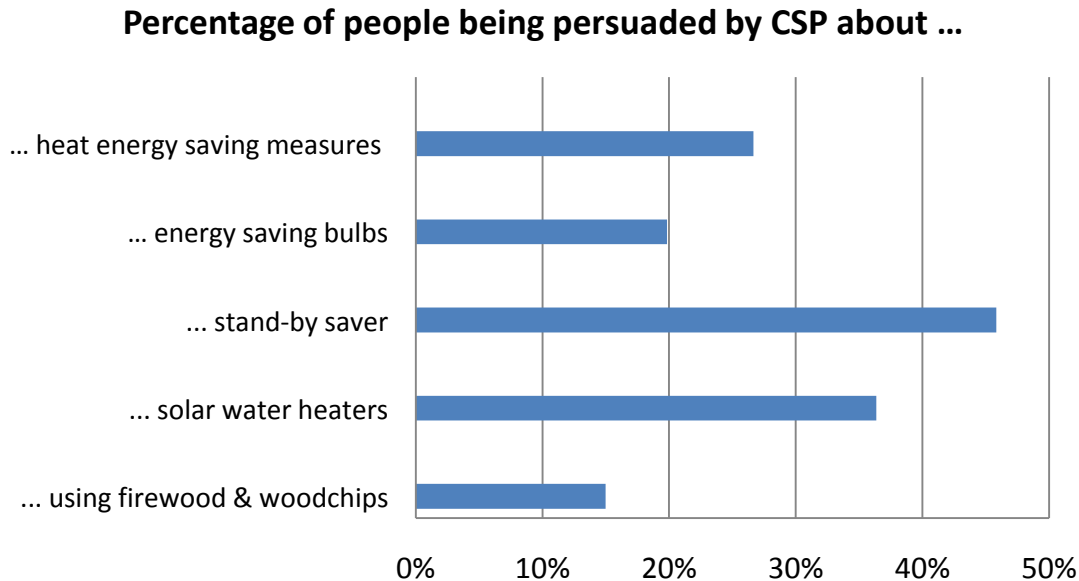


Figure 3-17: Respondents persuaded by the Clean Sleet Project

It can be seen that the Clean Sleet Project had a greater impact in the installation of stand-by savers, heat energy efficiency and on people to become interested in solar water heaters. With respect to more popular and well known measures, namely installing energy saving bulbs and increasing the use of firewood, the percentage of people that attributed their decision to the Clean Sleet Project was still between 15 and 20%. For the energy saving bulbs it could be observed that many people were already using them before the distribution project and for the increase in firewood use the cost of other fuels and more availability of wood were the most common answers.

3.1.6 Respondents Willingness to pay for Products and Services

The survey also asked respondents regarding their willingness to pay for products and services like electricity, heating, food and transport that produced in a sustainable manner. Figure 3-18 shows that around 62% of the respondents are not willing to pay more for these products. For the 38% that are willing to pay more, we found out that the community is not willing to pay a lot



for transport. However they were willing to pay more Figure below shows the different percentage the Sleat Community is willing to pay for sustainable electricity, heating, transport and food products.

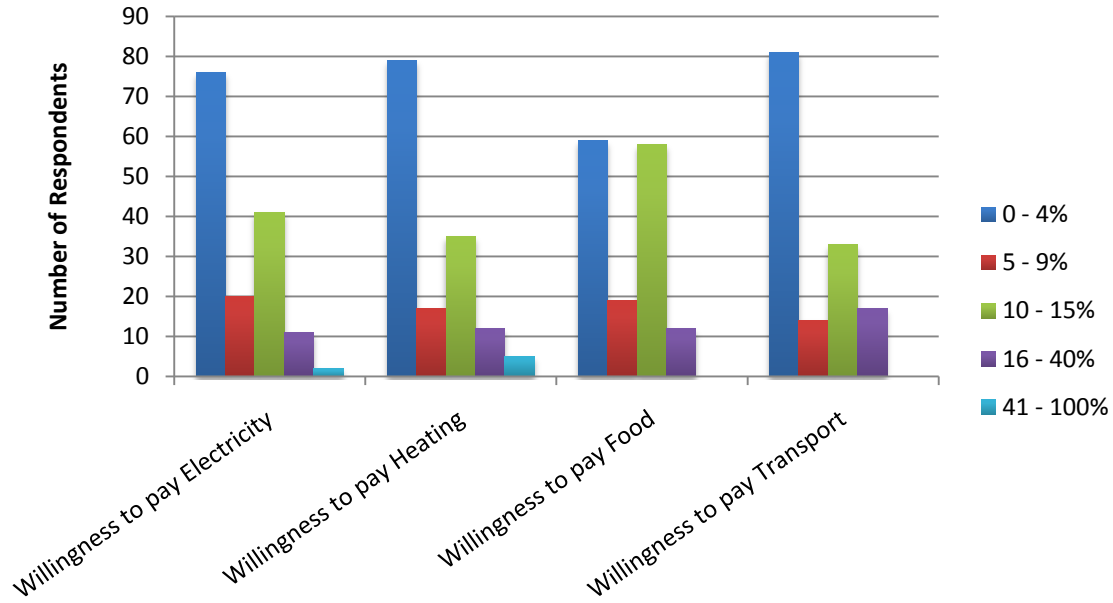


Figure 3-18: Willingness to Pay for Sustainable Products and Services (Questionnaire 2011, 8)



3.2. Waste Management in Sleat

The CSP organised various activities in the Sleat community to encourage the practice of reducing, reusing and recycling in the area of waste. Some activities like the car boot sale could be directly attributed to the CSP while some, like the introduction of the blue bin in 2008 for recyclable materials could indirectly be attributed to the project which lobbied for them. The purpose of the study in the area of waste was to determine the recycling rate in 2010 and compare this to 2007. It was also relevant to look at the local collection points designated for the Sleat community for batteries and mobile phones by the CSP. The interviewees were also asked about the activities organised by Sleat that they participated in and how they would rank these activities in accordance to importance. The activities of the CSP in the waste area included

1. Encouraging reusable nappies
2. Car boot sale
3. Encouraging recycling in general and local recycling in particular
4. Home bin
5. "Waste to useful" competitions at the local school
6. Textile recycling
7. Batteries and mobile phone collection points in Sleat
8. The Clean Sleat recycling website message board

CO₂ savings were calculated as the savings of embodied energy due to the waste related activities. This method is in line with the ecological footprint method and was also applied in the 2008 footprint study. It was however assumed that the CO₂ emissions due to the waste transport remained constant. This is justified by the fact that the recycling bin and the refusal bin are now collected alternating every second week, while the waste was collected weekly before the introduction of the blue recycling bin. There is also not a large difference between the transport from Portree to the recycling plants and the landfill.

Changes of attitude of the community were assessed based on

- Practice of households and institutions in waste classification, recycling at home and sending waste to collecting points.



- Opinions of households and institutions on usefulness of waste management activities of the Clean Sleat Project via a ranking system.
- The satisfaction of households and institutions on the current waste management situation in Sleat.

The 2008 Study and statistical data from The Highland Council provided the baseline data for evaluating the attitude change.

Table 3-9: Waste Classification in Sleat (Highland Council 2009).

Refuse (Green Bin)	Recyclable Materials	
	Blue Bin	Recycling Points
Organic kitchen waste, organic garden waste, envelopes, tetrapaks, aluminium foil, food trays, styrofoam, plastic bags	Paper and Cardboard Rinsed food tins and drink cans Plastic bottles (Milk bottles, Water bottles, Fizzy juice bottles)	Glass bottles and jars Textiles

According to the extrapolated data collected in interviews the total refuse waste was 284 tonnes/annum (refuse waste from Highland Council data is 311 tonnes/annum), total recyclable materials was 82 tonnes/annum (recyclable materials from Highland Council data is 84 tonnes/annum) and the reuse quantity was 1 tonne/annum. The accounted recyclable materials in this case include the recycling materials dumped into blue bin and materials which were dropped at the recycling points.

Table 3-10: Sleat waste arising figures (Highland Council 2010)

	Refuse	Recyclable materials	
		Blue Bin	Recycling Point
Tonnes/year	311	49	35
Percentage (%)	79	12	9



As shown in Table 3-10 the recycling rate of the blue bin was 12% and recycling rate of the recycling points was 9%. Therefore the total recycling rate is 21% for recyclable materials. This is a 10% increase in the recycling compared to 2007 (SESAM International Class 2008). This can be attributed to the introduction of blue bins for recycling materials. The 240 litre wheeled blue bin, which is collected every fortnight, is primarily for paper and plastic (see Table 3-9).

The recycling points in Sleat are located at the Armadale Pier Car Park and the Sabhal Mor Ostaig Car Park. These recycling points accept paper, drink cans, food tins, glass and textile waste.

3.2.1 Waste Carbon Footprint

Table 3-11 illustrates the carbon footprint of Sleat in 2010. The reduction in carbon footprint occurs as an implication of recycling. Recycling reduce carbon emissions by recovering the embodied energy. According to the 2008 study the carbon emissions reduction from recycling was 44.41 tonnes/year, the reduction increased to 111.85 tonnes/year in 2010. Therefore Sleat saved 67 tonnes of CO₂ emissions/year from the recycling activities.

Table 3-11: Household carbon footprint of waste in Sleat (Source: Author)

Recyclable materials (Tonnes/year)		Carbon emissions reduction (Tonnes/year)		Saved carbon emissions (Tonnes/year)
2008	2010	2008	2010	
39.84	84	44.41	111.85	67.44

*: embodied energy factor taken from Barret, J, Simmons, C. 2003. *Providing a Tool to Measure the Sustainability of Local Authorities*. Best Foot Forward, Stockholm Environment Institute. 2003. and waste quantity figures from Highland Council (2010)

3.2.2 Waste Electrical and Electronic Equipment

Regarding Waste Electrical and Electronic Equipment (WEEE), Clean Sleat encouraged the public to drop their waste batteries, and used mobile phone at several recycling collection points such as the batteries collection points at Kilmore Church and Post Office as well as the mobile phone collection box at the Armadale Primary School. According to the data collected during interviews, most (71%) respondents took their batteries to the recycling collection points at the



Armadale Post Office, Broadford Recycling Points, Portree Recycling Points, Inverness Recycling Points. However, 29% of the respondents dump their waste in the green bin together with the other refuse. Figure 3-19 illustrates the disposal practice related to waste batteries into the designated recycling points either inside or outside Sleat.

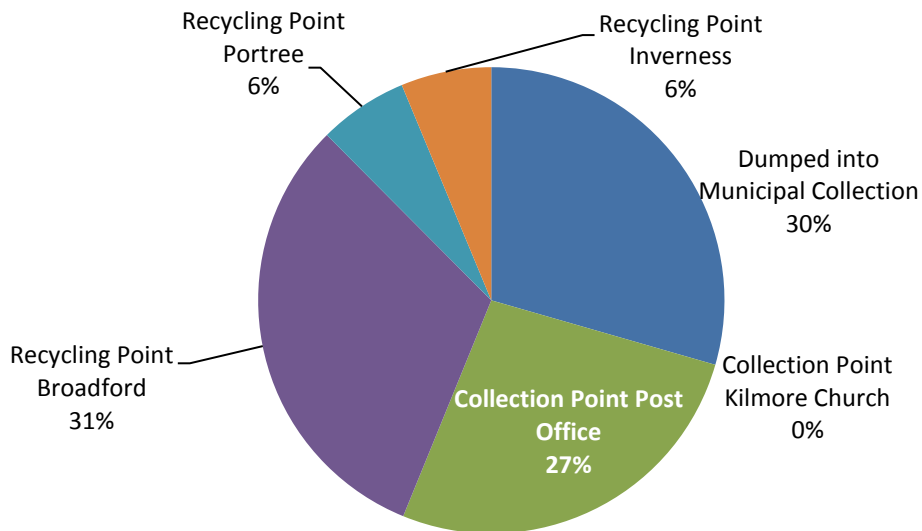


Figure 3-19: Waste batteries disposal locations (Source: Author)

In Sleat, most of the mobile phones (69%) were returned to the phone supplier, given to family members or friends, or sent to charity foundations outside Sleat. The

Figure 3-20 illustrates various ways of mobile phone disposal in Sleat

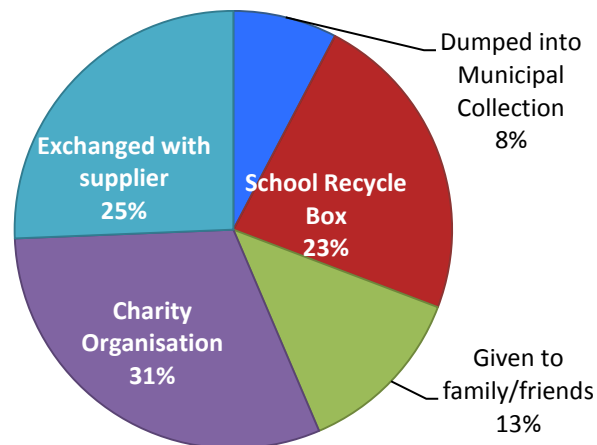


Figure 3-20: Used mobile phone disposal locations (Source: Author)



3.2.3 Waste Management Practices in Sleat

In the waste sector it was important to identify CSP activities which the community took part-in, to evaluate the relevance and impact of these activities towards waste management awareness.

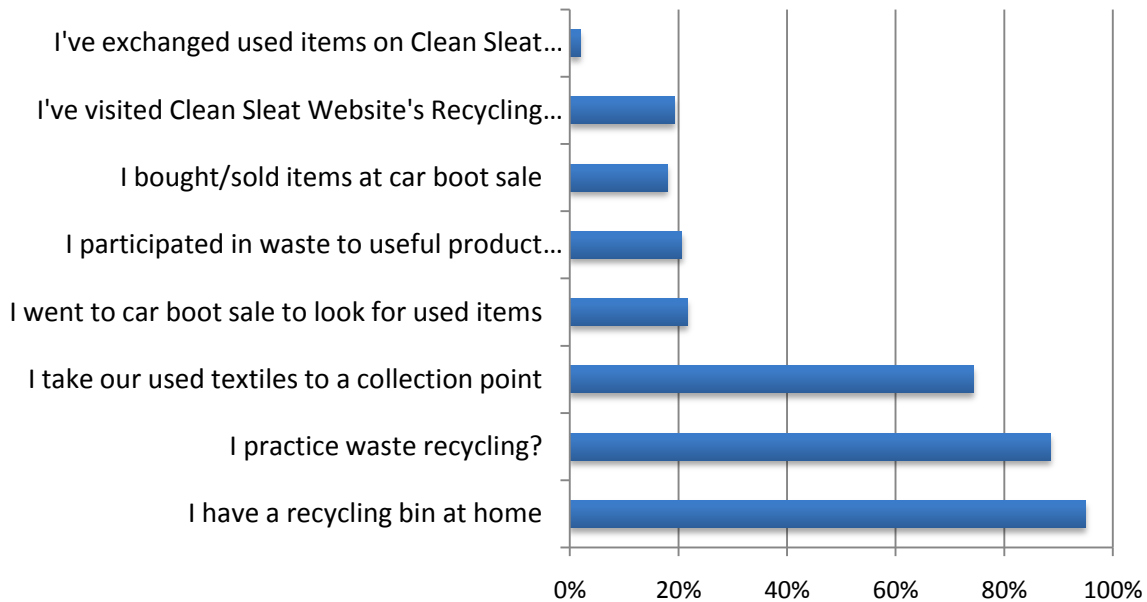


Figure 3-21: Participation of respondents in CSP waste activities (Source: Author)

The result shows that the activities supported by Clean Sleat Project which they took part in and/or practiced were owning a home recycling bin and then practicing recycling.

Furthermore, the interviewees were asked to rank activities of waste management that they think are the most useful for their household. The results are illustrated as follows in Figure 3-22.



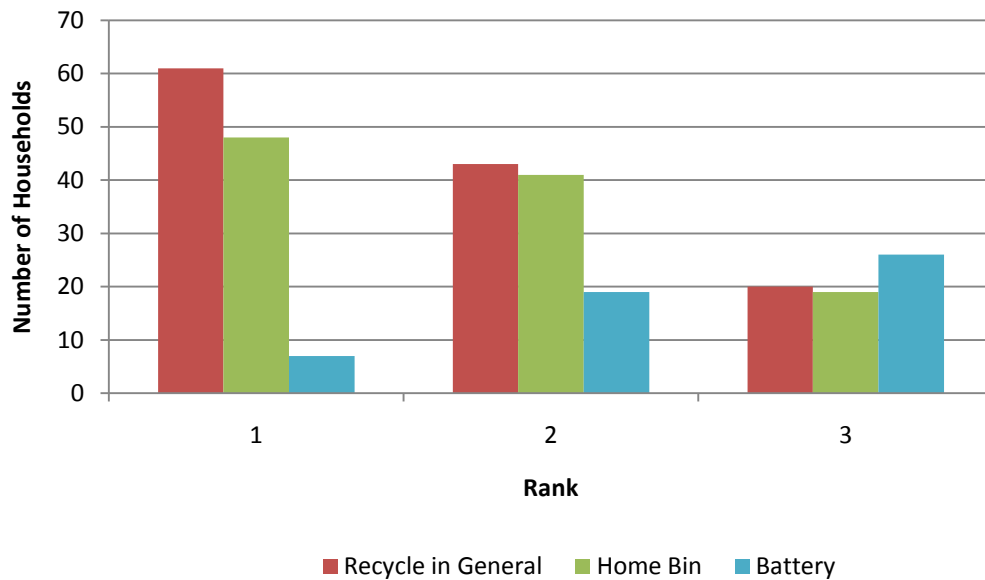


Figure 3-22: Ranking results of respondents in CSP waste activities (Source: Author)

As illustrated in Figure 3-22, the respondents ranked the most significant waste management activities as follows:

- Rank 1: Encourage recycling in general and local recycling in particular
- Rank 2: At home bin recycling
- Rank 3: Batteries recycling collection point

Figure 3-22 and Figure 3-23 shows that the respondents' value the practice of recycling and are content with their recycling bins at home. Figure 3-23 also clearly shows that the residents of Sleat are aware of the need for battery recycling.

3.2.4 Respondents' Impression on the General Waste Management in Sleat

The interview also took into consideration the respondents' level of satisfaction on the general waste management situation in Sleat (see Figure 3-23). More than 60% of respondents were satisfied with the current waste management situation. This satisfaction could be attributed to the Highland Council's blue bin dissemination pilot programme.



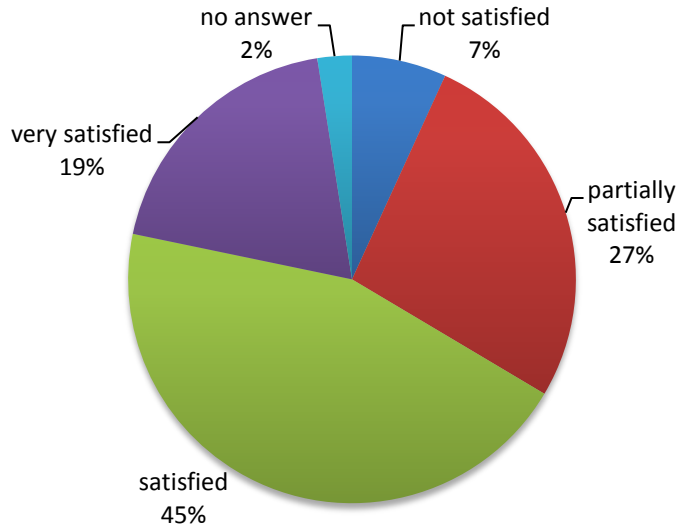


Figure 3-23: Satisfaction on the current waste management situation in Sleat
(Source: Author)

3.2.5 Interpretation of Waste Results

Even though statistics show that 71% of the sample is aware of battery recycling, 29% of the people dump their batteries in the green bin. This may create a challenge not only for the highland council which collects the waste but also for the environment because batteries are hazardous waste and are toxic to the environment. There was the impression from the interviews that most of the households (especially those further away from the local recycling/collecting area like Drumfearn, Ord, and Tokavaig) did not know about the local recycling/collection points for batteries and mobile phones. This was clearly proven in the data collected with no households from Tokavaig and Ord taking their batteries to the local collection points and 67% of the households interviewed in these areas dumping their batteries together with other waste. The interviews revealed that some people are not aware that mobile phones can be recycled hence dump their mobile phones with the other municipal collection. An awareness programme that promotes WEEE recycling and information of proper disposal practice for this particular waste should be considered.

95% of the households have recycling bins at home and 89% of the households practice waste recycling. An estimated 19 households in the whole of Sleat don't have recycling bins at home. If these got bins then the percentage of those who practice recycling would go up. The inconsistency between those who have blue bins and those that recycle is due to the individuals



with the bins who prefer to incinerate their paper and cardboard hence don't use the bin. There is a good understanding in the Sleat community on the importance of textile recycling with 74% of the households taking their textiles to some kind of recycling point either in Broadford, the Armadale pier or Portree. Another area the Clean Sleat project might need to focus on is the market place for exchange of used items on their website. Even though 19% of the sample visited the website only 2% actually exchanged any items via it. This could indicate that internet may not be the most appropriate platform for the project to encourage reuse in the area. This could also indicate that the needs and demands of the interested parties are not being matched on the website. For the car boot sale organised by the Clean Sleat project 22% visited the car boot sale and 18% actually bought/sold something there. This means over 90% of those who attended bought/sold. This might be a better way to promote the reuse of used items than the website.

With 21% of the households having participated in the "waste to useful" product competitions at the local school, it might be worthwhile for the project to look into eco-friendly fun activities for kids that don't target only the local school children but the children in Sleat. This was a suggestion given because not all the children attend the local school. Some parents would like to have their children participate in these activities aimed to teach children about the environment even when they do not attend the local primary school. This could be a way to not only educate children on climate change but involve population groups in Sleat with no school going children.

There was a strong agreement from the respondents that encouraging recycling in general and local recycling in particular is the most useful activity for waste management in Sleat (with 38% of the respondents ranking it as their first choice for most useful activity for waste management in Sleat). This was followed by the home bin recycling which the respondents (30% ranked this as their first choice) felt had helped them a lot when it came to handling their waste. An estimated 68% of the Sleat households agreed that local recycling and the possession of recycling home bins is a useful activity in waste management. This could also explain why the amount of recyclable material in Sleat has increased by 12% in the last 2 years.

The activity of battery collection comes in rank 3 as most useful activity for waste management. As earlier explained that even though some respondents acknowledged that they were unaware of the local collection areas for batteries, the fact that an estimated 38% actually take



their batteries to the co-op in Broadford, Portree or some other areas for disposing indicates the community's awareness of the dangers of battery disposal to the environment and the importance of recycling them. However awareness for battery disposal and mobile phone disposal should not be taken slightly as 37 % of the people still dispose their batteries and mobile phones in the refuse bin.

In the suggestions given on what changes the residents of Sleat would like to be done to improve their waste management situation, the need for more bins for the different categories of waste was the most common suggestion. This particular suggestion was given by 39% of the respondents (43 suggestions from the 110 were about provision of more bins). Even though this suggestion is a good way to increase the percentage of recycling in Sleat it might not be pragmatic. This is because the highland council would have to provide three more bins for just glass bottle recycling as glass can only be effectively recycled when clear, green and brown glass is collected separately. Therefore not only would it be expensive for the highland council to install these various bins but the carbon footprint of Sleat would rise due to transport rounds made to collect the bins.

The second highest option was to increase the local recycling points in Sleat and the third most popular suggestion was on raising awareness in the Sleat community about recycling. The idea of more recycling points is a good idea but it should be combined with the suggestion to promote awareness. If an awareness programme was carried out to promote the current local recycling point in Sleat, it might result in the people efficiently using them hence revealing no need for more points or it might reveal that there is a need for more recycling points to reach those who have difficulty accessing the current local points.

3.2.6 Analysis and Interpretation for School and College

The college generates more waste than the school but it also recycles more.

Table 3-12: Amount of waste collected from primary school and college

Institution	Refuse waste (tonnes /year)	Recycle materials (tonnes/year)
Primary school	12	8
College	47	26



The 26 tonnes of recyclable materials at college recycling point could not be differentiated by the amount exclusively generated by the college or that being dropped by Sleat residents.

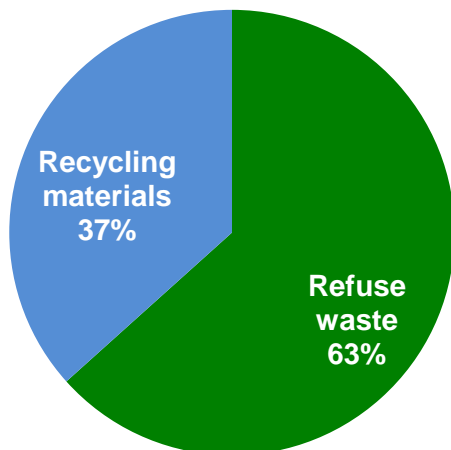


Figure 3-24: Percentage of recyclable materials and refuse waste from school and college

The Figure 3-24 illustrates the percentage of waste collected from the refuse bin and recycling bin at the primary school and college. The college was expected to generate more waste than the local primary school because it has more staff and students than the primary school. Moreover the college also serves as a local recycling point for paper, glass, and textile. The primary school is a local collection point for used mobile phone and printer cartridges.

In order to find out the most useful activities of Clean Sleat Project for the primary school, a ranking question was used. As the result, the most useful waste related activities were encouraging recycling in general and local recycling in particular, school recycling bins, "Waste to useful" product competitions at the primary school, bringing used mobile phone to collection point at the primary school. Beside the CSP activities, the primary school also found the making compost from organic canteen waste very useful for their primary school garden.

It was assessed that the waste awareness program, which was conducted by Clean Sleat Project, contributed effectively to help the primary school educate their pupils on waste management. The activities were suitable with the Scottish EcoProgram(Eco Schools Scotland n.d.) which the primary school applied.



Regarding the suggestions for improving the waste management situation of the primary school, the primary school expressed a need for more bins to practice recycling. This might not be possible since it may not be economically feasible for the Highland Council in the terms of transportation and operating cost. It would be quite useful if the school was also made a local recycling point just like the college not exclusively for used mobile phones and cartridges but for other recyclable materials that are not collected at the college.

According to the interview, the college generates a large quantity of plastic waste but its recycling options are limited. This could be an opportunity for the college to look for reuse practices in the area of agriculture such as growing seedling.

3.2.7 Analysis and Interpretation for Hotels and Small Businesses

The data collected from the surveys shows that the three hotels and small business that were interviewed generated 48 tonnes per year of refuse waste and 24 tonnes per year of recyclable materials.

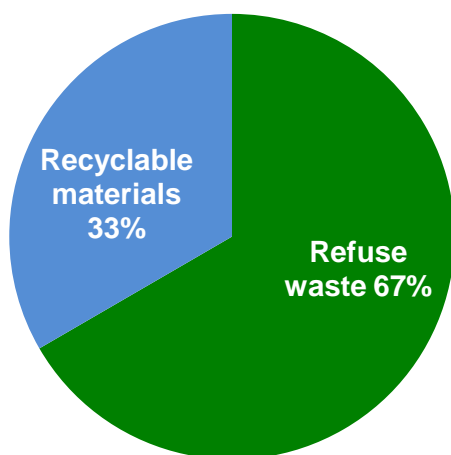


Figure 3-25: Percentage of refuse waste and recyclable materials from hotels and small business

One of the hotels had reused about 100 litres of waste oil and another hotel had also practiced reuse due to an incentive from the Highland Council. One hotel took its used batteries to the



supermarket for recycling. None of the hotels had disposed any mobile phones in the last two years.

In response to Clean Sleaf Project, the hotels had participated in five activities. Significantly, 100% of them had their own recycling bins and took their used textile to collection points. However, one of the hotels did not practice daily waste recycling. The hotel representatives explained that the waste classification took time and was expensive to implement. Regarding the exchange of items via Clean Sleaf recycling website, the hotel had visited it but not exchanged any items. The reason could be the supply source on the website did not meet their needs or demand in either quality or quantity or both. Detailed results of the hotel participation were described in Figure 3-26

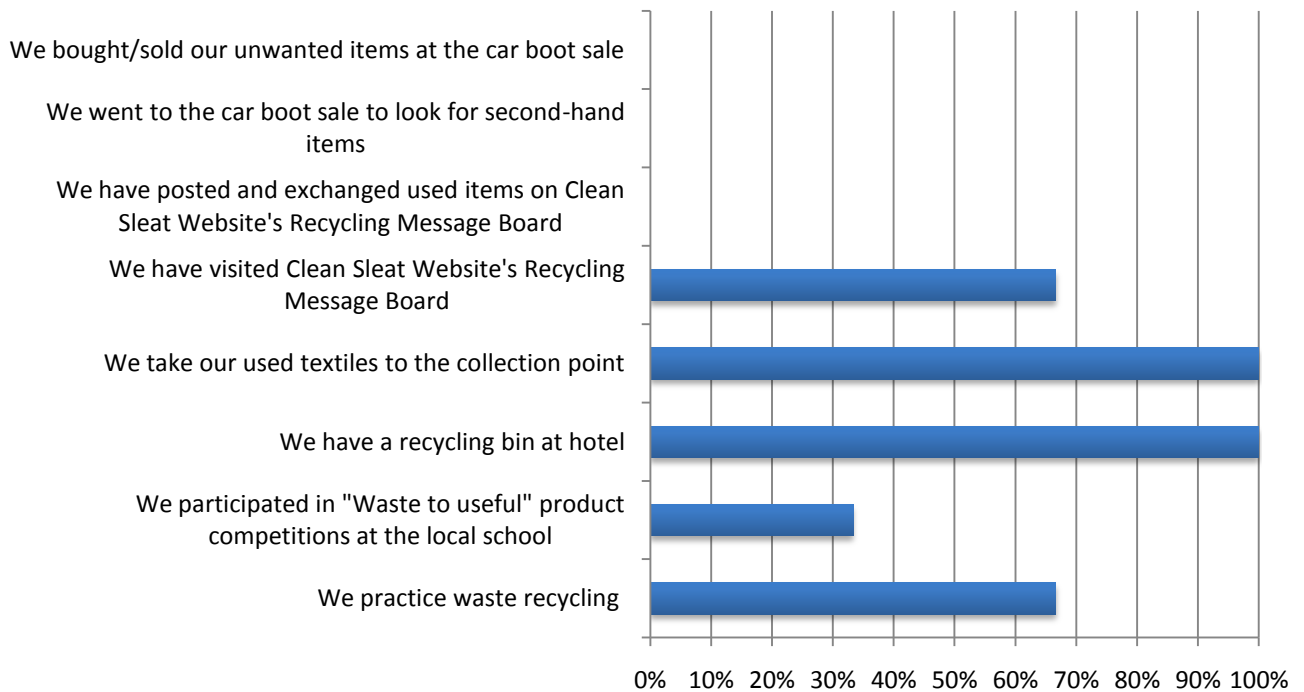


Figure 3-26: Participation of hotels in Clean Sleaf Activities

The survey found that the most useful waste related activities of Clean Sleaf Project to the hotels were installation waste bins at the hotels and textile collection for recycling or reuse. Referring to the above part of participation in Clean Sleaf activities, the result could come from the experience of the hotels as they practiced the activities and found their usefulness. However, car boot sale was not assessed as a useful activity for the business.



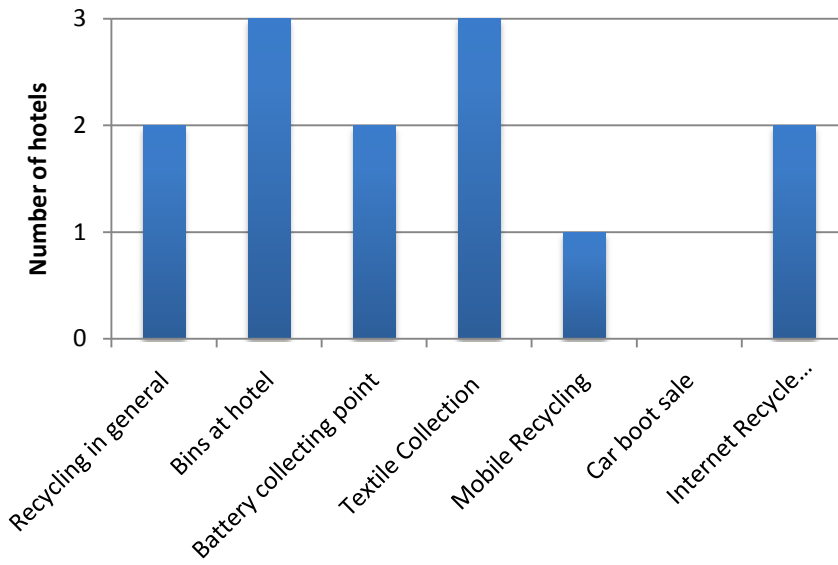


Figure 3-27: Ranking result of the hotels on usefulness of Clean Sleet activities

Due to the expense incurred by the hotel to recycle materials, it might be worthwhile for the hotels to look for ways to reuse and to reduce their waste generation as well as for the Highland Council to establish a fee for the commercial sector. The fees should be reasonable to encourage the commercial sector to recycle more but high enough to prevent them from generating a lot of waste.

Suggestions from the hotels, the Highland Council should include the collection of glass and bottle increase in the frequency of the waste collection. Like the argument from the primary school suggestion this would not be economically feasible.

3.2.8 Waste Carbon Footprint from Institutions, Hotels and Small Business

In total, 35.63 tonnes of CO₂ was yearly reduced by CSP activities on waste management in the institutions* hotels and business. 60% of the reduction was from plastic recycling, 25% from metal recycling and the other 15% from recycling and reuse of paper, glass and clothing.

*institutions are school and college



3.3. Finding and Analysis of Transport Sector

3.3.1 Methodology

The component method was basically used to quantify the transport carbon footprint from the different modes of transport employed in Sleat. On the other hand the qualitative aspects of the study were determined by assessing residents' preferences of the available modes of transport such as private car, or public transport. For example, the attitude change was reflected in the number of people using public transport.

The level of attribution of these quantitative and qualitative changes to the Clean Sleat project is discussed at the end of this chapter.

According to the 2008 study, the transport sector is the third largest contributor of CO₂ emissions in Sleat. Out of 14,397 tonnes of CO₂ emitted by Sleat's residents in 2008, transport contributed 4,044 tonnes after material and direct energy which contributed 4,511 tonnes and 4,283 tonnes respectively (SESAM 2008, 5-6). Under the Clean Sleat Project, the transport sector was one of the main areas considered when attempting to reduce the carbon emissions in Sleat. The activities undertaken in the transport sector include (Robertson 2010):

- Lobbied the local bus and ferry companies for a better service.
- Held two successful Great Sleat Cycle Weeks with many mini events (bike repair workshop, family bike ride, bike to school week).
- Bike Rack donation to Bun-Sgoil Shleite School.
- Subsidized taxi service

3.3.2 Calculation of Reduction of CO₂ Footprint from Transport

Parameters used in calculation

The number of car travel miles households replaced with public transport or use of bicycles was an important parameter obtained from interviews. Emissions from car use and public transport were compared to quantify the change in carbon footprint in Sleat between 2007 and 2010. Furthermore, the number of bicycle rides that replaced car travels, were included in the calculation. Information from interviews with public transport service providers were also considered to verify data collected from households.



Limitation on analysis

- Lack of segregated data on ferry passengers between tourists and local people
- Lack of details about travel destination and mode of travel

Assumptions for analysis

In order to tackle the problem of lack of information in the analysis of carbon footprint from transport, the following assumptions were made,

1. The diesel and petrol cars distribution didn't change since 2008 (i.e. 55% for petrol cars and 45% for diesel cars).
2. The travelled distance per one litre fuel remains the same as in 2008, i.e. 15.43 km/l for petrol car and 14.86 km/l for diesel car.
3. The study did not consider air transport as this was not part of the activities of the Clean Sleat project.
4. Car travels were assumed the same as in 2007 whenever they were not replaced with either bicycles or public transport

With these main assumptions, the reduction in CO₂ emissions was estimated using the fuel consumption and distance that would have been travelled by private cars. On the other hand, as some people switched from private cars to public transport, the corresponding emission was calculated. The net reduction was the difference between the emissions that would have been emitted if the private car had been used and that emitted by using public transport.

3.3.3 Major Findings

The analysis of the household survey shows that 92% of Sleat households own one or more cars. The main purposes of the car use were, from the highest to the lowest, shopping, work and leisure. On bicycle side, the survey shows that 62% of the total households own one or more bicycles. Contrary with car, the bicycles are mostly used for leisure.

Subsidized taxi service

The introduction of the subsidised taxi was presented by the Sleat Community Trust to the Highland Council as an alternative solution to the transport problems in the community. The main reason for subsidising taxi services was to assist people who don't own cars or who were unable to drive to undertake some of their activities requiring a car. These activities included



appointment with doctors, shopping from the local shop, attending some social events in the community. The subsidised taxi also allows connecting to the other means of public transport, in particular the busses and the ferry. This subsidy scheme started in 2010 and 118 travels have been registered as shown in Table 3-13.

Table 3-13: Comparison of taxi service before and after subsidies

Year	No. of passengers		Distance covered [km]
	Subsidised	Non subsidised	
2009	0	7146	196420
2010	118	6398	193200

Source: (Peggy 2011)

Great Sleat cycle weeks

Different activities were organised during the Great Sleat Cycle Week (GSCW). The main ones included the bike repair workshop, family cycle ride and children bike day. The objectives of the cycle week were (Sleat Community Trust 2009):

- To provide a free bike health check and carry out any minor repairs that are required to get the bike back into the road
- To provide cycling advices and bikes for sell for those who are ready to by them
- Encourage family cycle ride
- Encourage children to go to school by bike



Table 3-14: Summary of Great Sleat Cycle Week Assessment

Household	Number	Percentage
Total number of households (extrapolated from 2008 study)	394	100
Interviewed households (of total households)	164	42
Households with 1 or more bikes (of the sample)	102	62
Households who heard about GSCW (of the sample)	101	68
Households who attended the GSCW(of who heard about GSCW)	28	28
Households who were satisfied with the GSCW (of the attendees)	28	100

Source: Analysis by the author from household questionnaires

On top of these activities, the Bun Sgoil Sheite School got a bike rack from the Trust as a facility to assist the school to securely attach the pupils' bikes. The school administration confirmed that after the cycle week, the number of pupil's going to school by bike increased even though the increase was not quantified.

In overall, the replacement of car travels by bike has contributed to a certain reduction of carbon emissions as shown in Table 3-15.

Table 3-15: Contribution of bike rides in carbon emission reduction

Travelled distance by bike [km]	Saved CO ₂ [Tonnes]
32,629	7.6

Source: Analysis by the author from household questionnaires

Lobbied the local bus and ferry companies for a better service

With reference to the 2008 study, Sleat's residents travel more miles with private cars than with public transport, which increase their transport carbon footprint as the emission factor for private cars is higher than that of public transport as shown in Table 3-16.



Table 3-16: Emission factors for different modes of transport

Unit	Petrol cars	Diesel cars	Bus	Train	Ferry
kgCO ₂ per passenger kilometre	0.207	0.197	0.115	0.078	0.115

Source: (Defra 2008, 18,20,21,24,26) based on load of private cars of 2 passengers and average UK load for local bus, ferries and trains.

From the Table 3-16 it is evident that the use of public transport such as bus, ferry and train would reduce considerably the emissions. Lobbying the local bus and ferry company to improve their services so that more people can use them was one of the activities of Clean Sleaford Project in transport sector. To evaluate the achievement of this activity the households were asked if they have an impression that the service of public transport has improved within the last two years.

The findings of the analysis of the improvement of ferry and bus services are shown in Figure 3-28 to Figure 3-31.

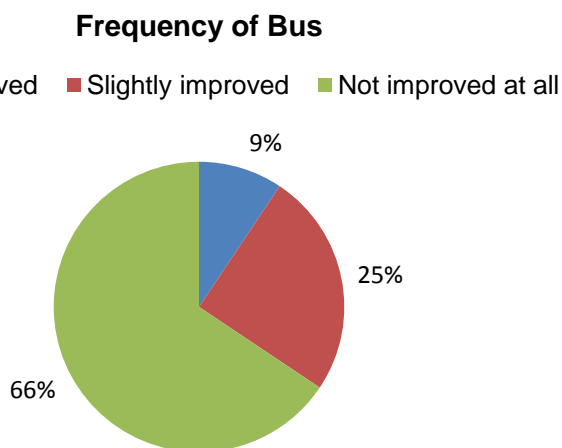


Figure 3-28: Assessment of improvement in frequency for bus service

Source: Analysis by the author from household questionnaires

From Figure 3-28 it is clear that the majority of the interviewees (66%) are not satisfied with the bus service in terms of frequency. Contrarily with the bus service (Figure 3-29), only 20% of the



people said that the frequency of the ferry service has not been improved while 39% were of the opinion that it has improved very much.

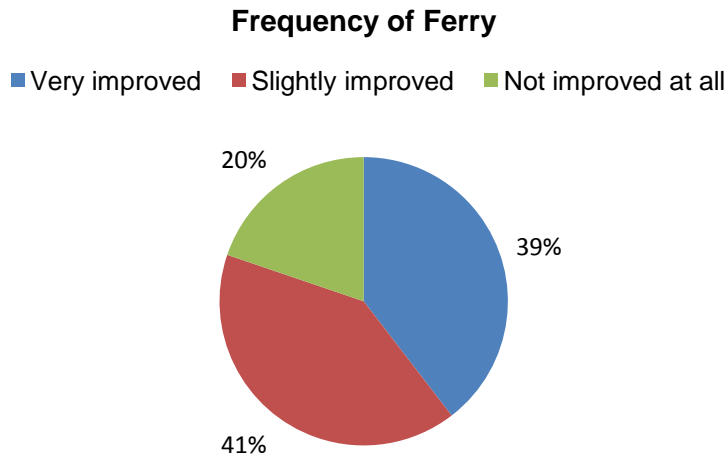


Figure 3-29: Assessment of improvement in frequency for ferry service

Source: Analysis by the author from household questionnaires

Regarding punctuality, the ferry seems to have more improved than the bus, but still, 30% do not see any improvement (Figure 3-30 and Figure 3-31).

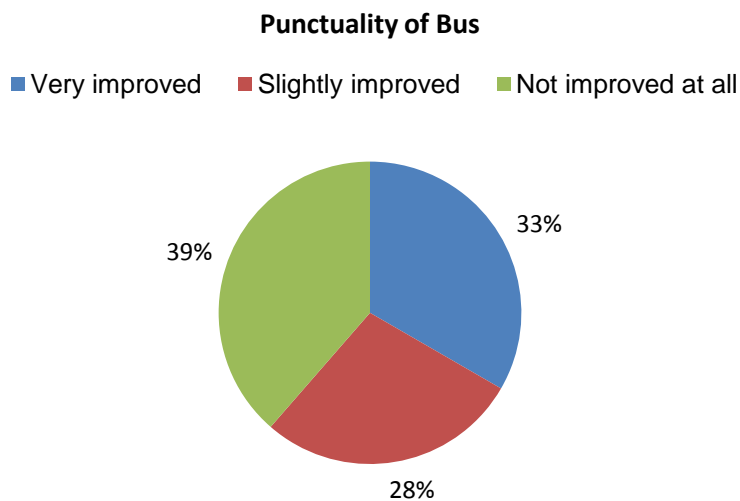


Figure 3-30: Assessment of improvement in punctuality for buses



Source: Analysis by the author from household questionnaires

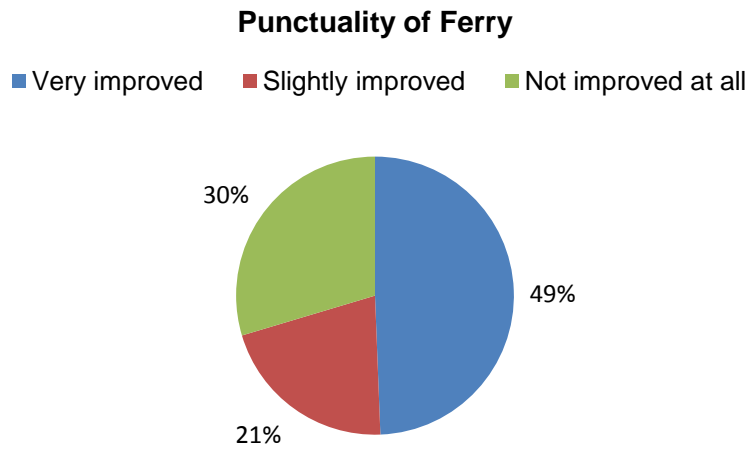


Figure 3-31: Assessment of improvement in punctuality for ferry

Source: Analysis by the author from household questionnaires

Both, the ferry staff at Armadale terminal and the management of the bus company (Stagecoach in Skye and Lochaber) stated in personal interviews and email conversation that they have improved their services. The improvement of ferry services includes the introduction of more ferries in winter and on Sunday. The bus company assured us that they adjusted its time table according to the customer's needs.

Our study confirms that about 223 058 km of car travels have been replaced by 122 516 km of public transport (i.e. ferry, train and bus). The CO₂ emissions related to the increase in public transport usage is calculated in Table 3-17. The travelled distance was determined by estimating the distance to different destinations as stated by the interviewees, and extrapolation has been done to the total population. The net total CO₂ emission reduction was then calculated by subtracting the emitted CO₂ of public transport from the avoided emissions due to replaced car travels.



Table 3-17: Distance and carbon emissions released by increased public transport

Mode of transport	Distance travelled with public transport [km]	Car km replaced by public transport [km]	Avoided CO ₂ emissions of cars [Tonnes]	Emitted CO ₂ of public transport [Tonnes]	Net CO ₂ savings [Tonnes]
Bus	53,183	223,058	51.7	14.3	32.5
Ferry	1,946			0.6	
Train	65,532			4	
Taxi	1,855			0.3	
Total	122,516	223,058	51.7	19.2	32.5

Source: Analysis by the author from household questionnaires

The calculations assume that the main destinations were Glasgow, Fort William and Inverness as some of the respondents specified their destinations. The net CO₂ savings due to bike rides and replacement of car travels by public transport are shown in Table 3-18

Table 3-18: Net carbon emission reductions and equivalent fuel savings

Replacement of cars by	Amount of fuel savings [litres Diesel equivalent]	Amount of CO ₂ savings [Tons]
Bike rides	2100	7.6
Public transport	9,000	32.6
Total	11,100	40.2

Source: Analysis by the author from household questionnaires

Per capita this represents 470 kg of CO₂ savings or about 1% emission reduction in comparison to 2007.



3.3.4 Interpretation of Findings of the Transport Sector

The following sections will give interpretations to the findings of the transport sector with respect to the use of cars, bikes and public transport.

Car Use

The high percentage of Sleat resident owning cars is mainly due to three reasons: the next supermarket, bank and other stores are located in Broadford, which is 25 km miles from Armadale; the bus goes only along the main road until Ardvasar so that villages like Ard of Sleat, Tarskavaig, Togavaig and Ord have no bus connection and the schedule and frequency of the bus are not convenient to enable Sleat residents to use it at all times.

According to our interviews the car is used for shopping, work, leisure and business (from most important to less important). The same ranking was found in the 2008 study (SESAM 2008, 31). Shopping is still the main purpose the car is used for, because the Ardvasar shop offers the only possibility to shop in Sleat.

Bike Use and Cycling Weeks

Bicycles are used mainly for leisure activities. The road conditions and landscape explain why bikes are not used more often, either for leisure or for other purposes. The roads are very narrow except for the main road which could pose a risk to the biker if a car comes and the landscape is hilly. With respect to taking the bike for shopping another difficulty has to be considered: the supermarket is far and households usually buy supplies for several days thus it is difficult to transport everything with a bike.

To promote the use of bikes the Clean Sleat project initiated the Great Sleat cycle weeks. 68% of the households heard of them. From the households where one or more persons own a bike 28% participated in the cycle weeks. Although, at first glance, this figure seems to be not high the cycle weeks can be considered as successful. One activity during the cycle weeks was, for example, that on one day of the week car travel was replaced by bike ("Cycle to anywhere day") (Community Trust 2009). But for some people the workplace is too far away to cycle there, so they could not attend the event. Other activities addressed children or families ("Children's bike days", "Family cycle ride and picnic"), so that households without children could not participate (Community Trust 2009). Therefore it is not astonishing that the survey showed that a majority of the participants of the cycling activities during the cycle weeks were children.



Another activity of the cycle weeks was a repair workshop. The sample showed that more adults participated in the repair workshop compared to the cycling activities. And although 61% said that they knew how to repair bikes before the cycle weeks all attendants of the cycle weeks were satisfied and had their expectations met. The repair workshop was a good initiative to show children how to repair a bike and for the adults it was a refreshment of their knowledge on bike repair because all households who participated in the repair workshop stated that they repair the bikes on their own. Furthermore, a health check of the bikes was provided which could encourage people to use their bike more often if it had problems before.

Overall, the cycle weeks helped to promote the use of bikes. Despite the challenges of using a bike in Sleat, mentioned above, a total of 32 629 km of car travels were replaced by bike rides in 2010. This subsequently contributed to the reduction of the transport carbon footprint. Furthermore, 23% of the households which own bikes acquired one or two of their bikes in 2010.

Public transport

In total, an estimated 40 tonnes of CO₂ were reduced in the transport sector compared to the study in 2008. This amount, in part, was from the car travel replaced by bike but the larger share (81%) is from the replacement of the car travels by public transport. In 2010 223 058 km (this distance equals to 693 times a round trip from Armadale to Inverness) of car travels were replaced by bus, ferry, train and taxi, although the people did not have the impression that the service of the public transport had significantly improved and many suggestions were made with respect to possible improvements.

Particularly for the bus service the people had the impression that the service had not improved. Within the different categories of the service (frequency, fee, punctuality, comfort) the frequency was ranked the lowest. This was also found in the suggestions for improvement where 27% of the respondents were asking for a more frequent bus and ferry service and 13% of the respondents requested a timetable which is more convenient for local people (especially improvement for people who want to use the bus or ferry to go to work). Improvement in the bus time table are probably tailored to suit tourists (who account for two third of the total passengers according to the information of the bus company) and not residents. The respondents recognized that there was an increase in the ferry service with respect to. However, they still made suggestions for a more frequent service in winter time including a ferry on Saturday.



The bus company stated that they adjusted their timetables to meet connecting trains and ferries on a seasonal basis (winter and summer schedule). However, with 47% the most frequent suggestion for improvement of the service of the public transport was the coordination between bus, ferry and train timetable. The problem of getting connecting public transport was perceived as the biggest hindrance for the residents of Sleat in public transport use. That means that further effort should be made to improve the coordination of bus, ferry and train and these efforts should also be communicated to the potential customers.

In 2010 a subsidised taxi service was introduced by the Sleat Community Trust and 118 travels were done through this service. There are three possible reasons why the service was not used more frequently although 80% of the taxi fee was covered through the Community Trust. First of all people did not feel well enough informed, although the service was advertised in the community newsletter. Several interviewees stated that they did not know about this service. Secondly, the procedure to book the taxi service was perceived as too bureaucratic. One had to first call the trust who in turn called the taxi. Thereafter the Trust called the person to give him/her a reference number. Probably people were reluctant to use the taxis as a result, because this booking procedure could have been perceived as intrusive to their privacy. To improve the service the procedure to book the taxi should be improved and the service has to be promoted further. But a suggestion found from the questionnaires was to tailor the subsidised taxi more to people without a car and people who are unable to drive. From the perspective of carbon emissions reduction this suggestion should be considered. If car travel is replaced by taxi travel (with the same number of people) the emissions will increase as the taxi travels at least twice the distance of an individual car.

Of the households owning a car 23% replaced car travels by public transport and 15% of the households owning a bike replaced car travels by bike rides in 2010. Although this might partly be caused by the increased fuel price and the economic crises it can also be attributed to an increase in the awareness of the negative impacts of transportation on the environment. The suggestion to encourage car sharing is as well an indicator for this awareness. To turn awareness into activities, promotion programmes should continue to further encourage people to use public transport and bikes instead of the car.



3.4. Food

This section discussed the methodology, findings and interpretation of food sector. The main activities discussed under this section were composting and hire of rotavator and garden shredder.

3.4.1 Carbon Footprint Methodology for Food

Data on vegetable and fruit production were gathered from households, primary school, the college, and hotels. The focus of information was the production of vegetables and fruits. This was done to assess how far the hire of the rotavator and the garden shredder led to an increase in the production of vegetables and fruit. The composting and equipment hire were targeted at promoting an attitude change in the lifestyle of the Sleat residents which could lead to reduction of the food carbon footprint.

The change in the net consumption was calculated by aggregating the reported increases in vegetables and fruit production. It was assumed that this replaced an equivalent amount of vegetables and fruit that normally would have been bought from the supermarket. The change in the embodied energy was, in part, attributed to the Clean Sleat Project activities.

It was assumed that the use of the rotavator and the making of compost resulted in an increase of the vegetables grown locally in Sleat. The increase in the vegetables and fruit attributable to the Clean Sleat project was then multiplied by the energy embodied [EmbEn, (Mj/kg)] to give the total energy for each product consumed. The embodied energy data come from the Global Footprint Network database which has been derived from the UN COMTRADE³ database (Kitzes, et al. 2008).

The practices and attitudes of Sleat residents towards growing their own vegetables and fruit were assessed with respect to the following aspects:

- Frequency of using the community rotavator and garden shredder for growing vegetables and fruit.

³The COMTRADE database gives the embodied energy for each traded good and quantities for each country. The carbon emissions associated with internationally traded items are calculated based on the global average carbon intensity of fuels used for heating and electricity production from the national footprint accounts



- Household's involvement in composting and equipment hire from the Clean Sleat Project.
- The degree of satisfaction derived from using the hired equipment.
- The household's willingness to pay for the equipments hired

3.4.2 Findings and Interpretations

According to the ecological footprint study of 2008 the total food consumption for residents and tourists in Sleat in 2007 was 483 tonnes of which tourists accounted for 53.3%. This led to a calculated 650 tonnes CO₂ emission from food (0.77 tonnes per capita) in 2007. The annual food consumption profile of Sleat residents in the 2008 study showed that vegetables and fruits constituted the second largest portion of food consumed.(SESAM 2008, 38-9). In our study we found the total CO₂ emission savings due to food between 2008 and 2010 is 0.93 tonnes of CO₂.

The rotavator uses fossil fuel for operation and therefore has a carbon footprint associated with it. However, the carbon footprints of vegetables and fruit that are not locally produced are significantly higher. This is mainly due to the energy embodied in the transportation of such items from location of their production until they end up in supermarket. Therefore to grow vegetables and fruits locally results in a reduction of CO₂ emissions.

Compost Making Activities

As the sample size of data collected through household interviews was 164, this had to be extrapolated to a population of 394 households. These figures showed that 245 households out of the 394 made compost which is 62% of all households in Sleat. 67 of these households (about 27%) started composting after 2008. This change could partly be attributed to the Clean Sleat Project since the households were also persuaded to compost through other means.



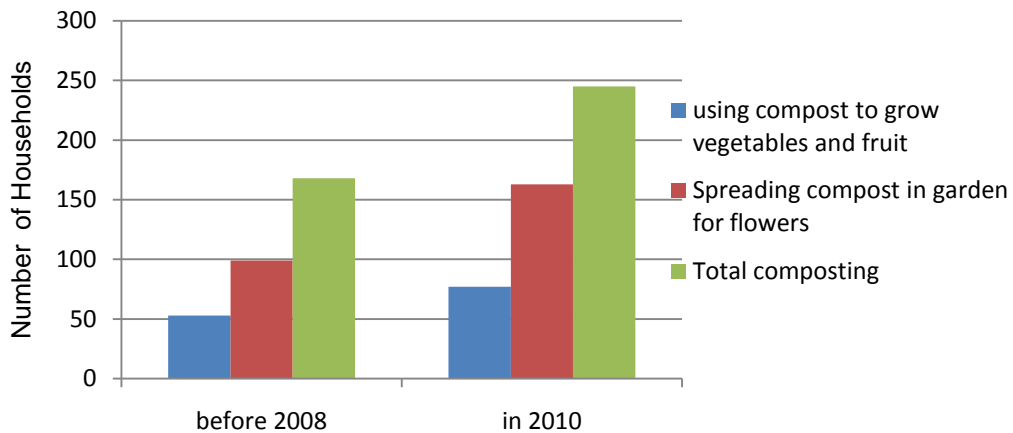


Figure 3-32: Household uses of compost (Source: Analysis from the household data)

As shown in Figure 3-32, a higher share of compost was used to grow flowers before and after 2008. An increase in the use of compost to grow vegetables and fruit might lead to an increase in production. As was mentioned above, growing own food reduces carbon footprint as compared to buying it from a supermarket.

26% of total households do not practice composting. Nearly 10% of these households fed their pets and domestic animals on the organic waste that would have been used for composting. About 11% of the households that did not compost said they had no time, no interest and no use for compost. It was found that 249 households had land for growing vegetables and 76% (189) of these households were composting. This shows that the majority of households which have land practice composting.

Sabhal Mòr Ostaig College cultivated their own vegetables and fruits within the project period. They used mainly composting to produce a yield of 250 kilograms per year since 2009 which replaced to some extent their fruits and vegetable purchased from suppliers.

Two hotels and one cafeteria reduced their carbon footprint by replacing their vegetables and fruit purchases from suppliers with locally produced ones.



Equipment Hire

Clean Sleat project provided a rotavator and a garden shredder to encourage local vegetable and fruit production in the Sleat community. Below in Table 3-19 is a brief summary of this activity.

Table 3-19. Equipment hire (Source: Analysis from the household data)

Activity	Number of Households
<i>Rotavator Hire</i>	31
Garden Shredder Hire	17
Average frequency of hiring rotavator or garden shredder per year = 1	

Seventeen households stated that they had an increase in their vegetables and fruit production in the last 2 years. These 17 households' assigned figures to the increases in vegetables and fruit production. Ten out of this 17 consequently reduced their purchases of vegetables and fruits from the supermarket on a weekly basis. It was interesting to note that only these 10 out of the 17 households that had increased production in the vegetables and fruits actually participated in both making compost and hiring of the rotavator. Therefore it can be assumed that the increase in vegetable production between 2008 and 2010 of the households is attributed to composting and rotavator hire. The role of other factors like weather, soil conditions and agricultural practices in the vegetable and fruit production should not be ignored.

Twelve out of 17 households (70%) that hired the rotavator or shredder from the Clean Sleat project had problems with operating them. The major concern of these households was the fact that there was no delivery track to deliver the rotavator. Five households also mentioned assistance was needed for delivery since the equipment is heavy. According to the data two household had clogging problems with the garden shredder during its operation. It was also said by 7 households to be too small in size to cut or trim bigger branches. The fact that the equipment hire depends on seasonal gardening activities might have influenced the hiring of the equipment and discouraged households that are yet to use it. .

The Clean Sleat project did not charge a fee for the use of the rotavator and garden shredder. To measure the attitude change with respect to the hiring of these two items, respondents were asked if they were willing and able to pay for their use. . 71% of the households that hired the rotavator in the past were willing to pay an average of £7.00 per day. This means that



households which used the rotavator derived benefits enough to allocate a charge to its use. Two of the households that used the garden shredder were willing to pay even £20 and £35 for its hire. It was noticed that these two households participated in almost all activities of the Clean Sleaford project which shows that they were very much interested in the project.

The local production and purchase of vegetables and fruit contributed to reducing the carbon footprint of Sleaford in the past two years. As mentioned above, the households and the college were the main local producers of vegetables and fruit. The two hotels and one cafeteria contributed to the reduction of footprint by replacing their purchases of vegetables and fruits from suppliers with local produce.

The carbon footprint for food for households was calculated based on the reported increase in the vegetables and fruit production. The households that increased their food production said it was on the basis of 4% average per year of their production in 2008. Table 3-20 below shows various categories and the amount they contributed to the food footprint reduction. The total food footprint savings for 2010 is 0.94 tCO₂.

Table 3-20: Calculation of the carbon footprint for food

Category	Activity	Production in Kilograms	CO ₂ Emission savings (tCO ₂)
17 Households	Composting and hiring equipment to grow own food	330	0.183
College	Composting to grow own vegetables	250	0.14
2 Hotels and 1 Cafeteria	Purchase of locally produced vegetables	1100	0.612
Total		1,680	0.94

(Source: Analysis from the household data)



Suggestions for improvements on Composting and Equipment Hire

These suggestions were derived from the comments and problems as stated by the respondents during the survey.

1. There were 19 households that never tried composting and 7 others who claimed composting was a difficult process. This neglect and hesitation could be addressed through an awareness programme and training workshops on how to make and use compost.
2. Seventeen households said they did not have use for the compost. An arrangement could be made where organic waste from these households could be collected and sent to local farmers with bigger compost bins. Households should also be encouraged to exchange organic waste or compost.
3. 10 households had problems with the equipment they hired such as transportation, logging and handling. The respondents suggest a maintenance team be employed to address operational problems

Assessment of Attitudes towards local vegetables and fruit production

It was difficult to attribute emission changes or savings directly to the Clean Sleaford Project activities of composting and equipments hire because other influencing activities were concurrently taking place.

Nevertheless the following attitude changes with respect to composting were found to be:

- In practice: An increase of 27% of households that composted within the two year period of the project shows the readiness to composting. It is a good basis to build upon.
- In Knowledge: The understanding of and perceptions about the use of compost is mostly clear
- In Satisfaction: Most households were satisfied with benefits of composting although they did not have very significant yields.

Attitude changes with respect to equipment hire were as follows:

- In practice: Despite the activity being relatively new, (rotavator bought in March 2010 and shredder October 2010) respondents were aware of it. Currently 41 households have used the equipment.
- Opinion on equipments: The households had identified some concerns with the use of the equipments but, the benefits they derived from using them outweighed the problems.



- Satisfaction: There is willingness to pay for the use of the equipment, although it was initially free. This is a good sign of derived satisfaction and taking responsibility/ ownership of the equipment and realizing the benefits it has.

3.5 Summary of CO₂ Savings

This section summarises the estimated carbon dioxide emission reduction that have been quantified during the study. A total of 478 tonnes CO₂ has been reduced through the various activities of the Clean Sleet Project. The table below shows the reductions per capita of the CO₂ emissions for the various sectors.

Table 3-21: Summary of CO₂ savings

Sector	Activity	Reductions per activity [kgCO ₂]	Reductions per sector [kgCO ₂]	Reductions per capita [kgCO ₂]
Direct Energy	Energy audits and home insulation	37 000	336 000	390
	CFL dissemination	23 000		
	Stand-by savers dissemination	1200		
	Increased use of firewood in the residential sector	193 000		
	Wood chips in College	82 000		
Transportation	Bike rides	7600	40 200	43
	Public transport	32 600		
Waste	Household	65 000	101 000	107
	Institutions, hotels and small business	36 000		
Food	Local vegetable and fruit production	930	930	1
TOTAL			478 130	541



4. Scenarios

The results of the study indicated that in total 478 tonnes of CO₂ emission was avoided through CSP activities. However, there are still potential opportunities for Sleat to continue reducing the carbon footprint in future. Therefore, three scenarios are proposed based on the current context of the peninsula: replacing brown electricity with green electricity in households and college, improving insulation of residential homes and replacing heating fossil fuel with biomass.

4.1. Green Electricity

This scenario discusses the possibilities of Sleat's residents to reduce the CO₂ emissions if they shift from the normal to the green electricity. Green electricity "is the electricity that is generated from renewable resources with minimal adverse environmental effects" (NAGPI 2008). The brown electricity is that from other sources than renewable or the mixture of renewable and non renewable sources. When green electricity tariffs are chosen, the utilities supply to the consumers the electricity from renewable energy sources, and hence the CO₂ emissions are drastically reduced. More details about suppliers of green electricity can be found on the Living Ethically (Living Ethically 2011). In Scotland however, renewable electricity is eligible for green electricity tariffs if it is additional. Additional renewable electricity is the amount of renewable electricity beyond what the suppliers are required to produce under the Renewables Obligation (RO) (Energy Saving Trust 2011).

According to the study on the ecological footprint of Sleat conducted in 2008, the consumption of electricity for the residential sector was 2.8 GWh which emitted 1,137 tonnes of CO₂ (SESAM 2008, 5-6). Based on this figure we calculated how much the emissions would be reduced if a certain fraction of the population would switch to green electricity. We must say however, that we do not know exactly the percentage of Sleat residents and institutions that is already using green electricity. The Table 4-1 summarises the possible CO₂ reductions for different penetrations of green electricity.



Table 4-1: Carbon emission reductions due to using green electricity

Penetration of green electricity [% of households]	Total green electricity consumption MWh]	Total brown electricity consumption MWh]	CO2 emissions [Tonnes]	emission reduction [Tonnes]
5%	140	2,660	1079.96	56.84
10%	280	2,520	1023.12	113.68
20%	560	2,240	909.44	227.36
30%	840	1,960	795.76	341.04
40%	1,120	1,680	682.08	454.72
50%	1,400	1,400	568.4	565.6

Source: Calculated from 2008 electricity consumption for residential sector.

The figures in Table 4-1 show that with a penetration of 50% green energy, the CO₂ reductions are higher than that achieved when all activities undertaken by the CSP are combined (478 tonnes from CSP against 565.6 for green electricity). In addition to this, the college alone consumes 610,000 kWh of electricity per year. If the college purchased its electricity from a green electricity supplier this would reduce the carbon footprint of Sleat by 247 tonnes. If the college and 50% of the households purchased green electricity this would double the CO₂ reduction that has been achieved in the past 2 years. The emission reductions will increase if the hotels, medical centre and small businesses shift also to green electricity.

The implementation of this scenario requires an additional payment of 30£ to 50£ per household per year, depending on the consumption and the tariff chosen for the brown electricity. According to the analysis of the interviews, more than 50% of the interviewed households are willing to pay 5% and above more for electricity produced in a sustainable way. This is a good sign for awareness of the Sleat's residents toward sustainability.

4.2. Improved Insulation of Residential Homes

According to the 2008 study (SESAM 2008, 27) approximately 159 households in Sleat depend on oil as their heating source and consume more than 28000 kWh/year. Referring to SESAM International Class (2009, 12), the average annual heating fuel demand per household is 20,000 kWh. The purpose of this scenario is to bring the heat energy consumption of these households



in Sleet down to the Scottish average of 20000 KWh. The following sub-scenarios have been considered:

1. Improving heating consumption of 159 old houses using oil heating system down to the Scottish average of 20000 kWh
2. Switching the 159 household heating fuel source from oil to LPG and bringing them down to the Scottish average of 20000 kWh

Criteria of selection:

- a. Households with an oil heating consumption of more than 28000 kWh/year
- b. All 159 households are detached with 3 or more bedrooms

The results of both alternatives are shown in Table 4-2.

Table 4-2: Energy and CO₂ Savings on Housing Heating Insulation

Sub-scenario	Number of Households consuming more than 28,000 KWh	Before improvement		After improvement		Savings	
		Heating consumption (KWh)/year	CO ₂ * (tonnes)	Heating consumption (KWh)/year	CO ₂ (tonnes)	Energy saving (KWh)	saved CO ₂ (tonnes)
Improved insulation only	159	4593253	1194	3172500	825	1420753	369
Improved insulation plus LPG instead of oil	159	4593253	1194	3172500	603	1331652	591

*: oil emission factor = 0.26 kg CO₂/kWh and gas emission factor = 0.19 kg CO₂/kWh

The improvement of housing insulation can be done by the following energy saving measures (Energy Saving Trust 2011):

1. Installing cavity wall insulation
2. Topping up the loft insulation
3. Fitting energy saving recommended windows (double glazing)
4. Fitting draught proofing
5. Installing floor insulation
6. Fitting pipe insulation
7. Turning the thermostat down by 1°C



The energy savings assumed for an improved insulation in the table are in the range of what usually can be achieved already with improved loft insulation (Energy Saving Trust 2011).

Through the Energy Assistance Package (Energy Saving Trust 2011), the Scottish Government provides funding for improving the insulation of old houses to reduce energy consumption and emissions from homes. The above energy alternatives show that housing improvement in thermal insulation can have a significant impact on reduction of direct energy carbon footprint of Sleat. A combination of improved insulation and a new heating system would yield approximately the same carbon emission savings which have been achieved by the Clean Sleat Project over the past 2 years.

4.3. Replace Heating Fossil Fuel with Biomass

According to this study, households saved 193 tonnes CO₂ and the college 82 tonnes CO₂ during the year 2010 by replacing LPG and Oil with biomass. If 20% of the fossil fuels be replaced by biomass, households would save 296 tonnes CO₂. 50% replacement of fossil fuel by the hotels will save 43 tonnes CO₂. If wood chips were provided locally for the college it could save 1.7 tonnes CO₂. In the following table carbon dioxide savings, energy savings and replacement of fossil fuel with fire wood are compiled.

Table 4-3: CO₂ saving using firewood

Description	Fuel replacement		Energy saving (GWh)	CO ₂ saving(tonnes)
Replacing 20% of LPG, oil, coal and peat consumption in households by fire wood	LPG	60,462 (litre)	14	296
	Oil	85,254(litre)		
	Coal	65.5 (tonnes)		
	Peat	1.16(tonnes)		
Replacement of 50% oil and LPG in hotel by wood chips	LPG	25,444(litre)	.2	44
	Oil	3,050 (litre)		
Delivery of wood chips for college by local provider				1.7

The UK government published the Renewable Heat incentive (RHI) on 10th March 2011. This is one mechanism which increases the proportion of renewable heat in Scotland, England and



Wales from 1% of the total heat consumption to at least 12 % by 2020. To encourage the biomass heating, Carbon Trust (UK wide) and the Energy Saving Trust (Scotland) help customers to get a loan from this scheme.

(energy, http://www.hwenergy.co.uk/news_item.asp?id=26 n.d.)



5. Conclusions and Suggestions

This study aimed at evaluating the achievements of the Clean Sleat Project. The main objective of the project was to achieve, by 2010, a reduction of 33% in CO₂ emissions through implementation of different activities. The undertaken activities focused on residential energy consumption, household waste management, transportation and vegetable and fruit production. The objectives were evaluated against their relevance, effectiveness, impact (quantitative and qualitative) and sustainability.

For the sector of direct energy all activities except for CFL and stand-by-saver dissemination were found to be relevant for achieving the project goals. The effectiveness and impact could be seen for all energy activities which were relevant and also for the CFL dissemination, because almost all households are using CFL (in total direct energy this contributed about 70% of the total reductions). With respect to sustainability one has to differentiate between the activities. Energy audits are only sustainable if they are focused on improving old buildings with respect to their energy consumption. The promotion of increasing the use of firewood is sustainable, because the buyout of Tormore forest by the community ensures local supply of firewood on a long term. The college currently buys its firewood from suppliers outside Sleat. Hence it would become more sustainable once a local supply of woodchips by the community is ensured.

In the transport sector the Clean Sleat project introduced a subsidised taxi service and lobbied the bus and ferry company to improve their service. The lobbying with the bus and ferry company was relevant, but only slightly effective, because people were still not satisfied with the service. With respect to its impact it was found that Sleat residents replaced car travels by public transport in 2010, but the number could be increased if the effectiveness is improved (the transport sector contributed around 8.5% to the reductions). The activity was sustainable, because the companies will most likely keep on with this service if they recognize the positive effect it has on the number of passengers.

For the subsidised taxi service it was found that it was only partly relevant and had a small impact, because not many people used it so far. If it would be promoted for its initial purpose (being the linkage for people in remote villages to the ferry terminal and the main road so that they can use the bus) it would be more relevant, probably have a higher impact and also be more sustainable.

The waste sector concentrated on home bin recycling and local recycling points. Waste recycling with respect to the home recycling bin is relevant and the impact of this activity is



evident (with an 11% increase in the recycling rate from 2007 to date and 21% contribution to CO₂ reductions). Therefore it can be concluded that this activity has been effective. With respect to sustainability, a large portion of the community is in possession of a home recycling bin and do practice recycling. Even though local recycling points are relevant, the impact of this activity has not been seen. This would also imply that this activity has not been so effective. Local recycling points are only sustainable if more people begin to use them. Therefore sustainability in this case is directly linked with local recycling awareness programmes.

In the food sector the activities of equipment hire and composting were the focus areas. It should be noted that the equipment loaned by the community trust was acquired in October 2010. Therefore it is fair to conclude that the relevance of this activity is too early to be determined and the impacts have not fully been felt (contribution to total reductions less than 1%). Nevertheless, the activity seems to be sustainable, because even though the equipment is being borrowed for free, there is a willingness to pay for it by most users. Producing compost may not be directly related to the project activities in the food sector, but it is of great relevance especially to the people who use compost to grow their food. This has resulted in the increase of local food production in the area by some households.

Overall it can be concluded that the Clean Sleaford project was relevant because almost all activities were seen relevant by the residents. The project contributed to reduce the CO₂ emissions in Sleaford by 3.3% compared to 2007. This figure shows that the project was only partly effective because it did not reach its ambitious goal of a 33% reduction in CO₂ emissions. But the 478 tonnes of CO₂ which were saved show that it had already a considerable impact. The largest share of this reduction was through the use of biomass and woodchips. That shows how important the activities in this area were.

One of the scenarios shows that there is still the potential to achieve more: if 20% of the households would replace fossil fuels by biomass the CO₂ emissions could be reduced by another 296 tonnes.

The Clean Sleaford Project also aimed at increasing the awareness of the residents with respect to climate change and the environment. This was quite successfully done as 32% of the households stated that they learnt more about the issue of climate change through the Project. Almost two third of the households (64.5%) pointed out that they do their best to reduce their carbon footprint which shows again the increased awareness. But awareness is just the first



step and should be followed by action. To really change attitude takes a long time so that promotion programmes should be continued.

In general, the residents of Sleat care for the environment and are even willing to pay in average 8 – 9% more for products and services produced in a sustainable way. This positive attitude could be used for future activities and projects. From the suggestions we got from the interviewees and our analysis we think the following aspects should be considered for the different sectors:

Direct energy

- Energy audit reports could be tailored so that beneficiaries are able to understand them. The audit should also target firstly the old houses as the new ones were built according to the standards. Follow up services and advise in implementing energy efficiency measures are essential.
- Due to the fact that CFLs contain mercury, the issue of how they are disposed of should be carefully considered. Other technologies, such as LED are now penetrating in the market. This should be observed carefully.
- The Trust should assist in provision of firewood by either lobbying the suppliers or becoming the supplier. It is essential that the Trust ensures a good quality of the firewood and woodchips provided.
- The follow up for solar water heaters is required. We suggest that the Trust continues to organise events and workshops to promote the use of solar water heaters and links up interested residents with qualified installers.
- Three scenarios have been suggested regarding buying green electricity, replacing heating fossil fuel with biomass and improving the insulation of residential homes.

Waste

- Organize fun activities to involve all children of Sleat in the awareness raising not only those who attend the local primary school

Transport

- Continue the lobbying of the providers of public transport to improve their service and also communicate this to Sleat residents as their potential customers
- Analyse how car sharing could be promoted
- Promoting the subsidised taxi service tailored to its initial target of connecting remote villages to the main road



- Analyse how the car travels for shopping could be reduced through either making the local shop more attractive or the possibility of a food delivery service

Food

- Keep on with the promotion of cultivator and garden shredder and encourage the Sleat residents to grow their own vegetables and fruit
- Introduce a local weekly market where people can buy and sell locally produced vegetables and fruits

From our point of view the Community Trust should within its means continue to support the initiatives towards carbon reduction irrespective of the Clean Sleat Project's phasing out. It is important to keep on with the promising first steps of awareness raising and encouraging people to actively reduce their carbon footprint.



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7. Annex

Annex 1: Questionnaires

EEM-SESAM IC 2011 General Household Questionnaire

The aim of this study is to evaluate the Clean Sleaford Project (CSP), determine how many of its objectives have been met and measure its impacts. We conduct this assessment on behalf of the Sleaford Community Trust (SCT) and in cooperation with Community Energy Scotland (CES) as part of our research assignment at the MEng. Course Energy and Environmental Management at the University of Flensburg/Germany (UFL).

We want to appraise the changes that have taken place since the initial study was completed in 2008 by another group of fellow students from UFL on the ecological footprint of the Sleaford community (this is a measure of how much 'nature' is available and how much of it is used). The earlier study found that the residents of Sleaford use more natural resources than the Scottish average consumption. Based on these findings the CSP was launched in January 2009 with the goal to reduce carbon emissions on the Peninsula by 33%.

We rely on your input into this follow up survey for the successful evaluation of the project and kindly ask for your cooperation. Your responses will be treated strictly confidential. We would like to invite you to participate in the presentation of the findings of our survey around 18.3.2011.

A.BACKGROUND INFORMATION

- Questionnaire number (to be filled by the interviewer): _____
Interviewer: _____
Date: _____
- Sex of respondent
 ¹ Male
 ² Female
- Please indicate your housing type.
 ¹ Detached (single family Dwelling)
 ² Semi-detached
 ³ Terraced house
 ⁴ Flat/maisonette
 Other (please specify) _____
- 3.1. In which year and month did you move in your current house? _____
- How many bedrooms does your house have? _____
 4.1. Did you make any extension to your house since 2008?
 1 Yes (please specify in m²/ft²) _____
 2 No
- What is the ownership status of your house? (Please tick the appropriate option)
 ¹ Owned
 ² Rented/Leased
 Other, please specify: _____
- How many members do you have in your households?

Age group	Number of person
0-3 (baby)	s.1
4-12 (child)	s.2
13-19 (teenager)	s.3
20-59 (adult)	s.4

60 and over (senior)	s.5
Total	s.6

- Do you use any of your rooms for bed and breakfast at your home?
 ¹ Yes
 ² No (Please go to question 9)
- What was the total number of bed nights in your bed and breakfast in the past year?

- Do you run any other business from your home?
 ¹ Yes (Please specify) _____
 ² No
- Have you heard of the "Clean Sleaford project"?
 ¹ Yes
 ² No
- From whom or where did you hear about the Clean Sleaford Project? (More than one answer are possible)
 ^{11.1} Clean Sleaford Project promotion programs
 ^{11.2} Friends or neighbors
 ^{11.3} Community newsletter/email
 ^{11.4} TV
 ^{11.5} Radio
 ^{11.6} Newspaper/magazine
 ^{11.7} Others, please specify: _____

B.Energy

(Please complete the questions 12 to 14 before you proceed to the specific sections)

- Have you participated as a beneficiary in any of the following Clean Sleaford Project activities? (More than one answer is possible)
 ^{12.1} Energy audit (If you ticked this box, please go to question 2 in the Section "Energy Audits and miscellaneous energy saving measures")
 ^{12.2} CFL dissemination (If you ticked this box, please answer the questions in the Section "CFL Users")
 ^{12.3} Stand by saver dissemination (If you ticked this box, please answer the questions in the Section "Stand by savers")
 ^{12.4} Solar Panel Building Workshop (If you ticked this box, please answer the questions in the Section "Solar Water System users and Solar Panel Building Workshop Participants")
 ^{12.5} Log splitter hire (If you ticked this box, please answer the questions in the Section "Wood Stove Owners and Log Splitter Users")
 ^{12.6} Real time energy meters distribution
 ^{12.7} None of the above

(If you ticked any of the options 1-6, go to question 14)

- What was the reason for not participating in the Clean Sleaford Project Activities? (Multiple options are possible)
 ^{13.1} I was not interested
 ^{13.2} I didn't know about it
 ^{13.3} I didn't have time
 ^{13.4} I think changing my behavior will not have a real impact on the climate change.
 ^{13.5} It is too expensive to implement all the action suggested by Clean Sleaford Project.



^{13.8} Other _____

14. Which of the following energy related measures have you implemented since February 2008?
(More than one answer is possible)

- ^{14.1} I installed CFL lamps
(If you ticked this box, go to question 3 in the Section "CFL Users")
- ^{14.2} I installed Stand by losses savers.
(If you ticked this box, please go to question 3 in the Section "Stand by savers")
- ^{14.3} I improved the Insulation of my building (If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
- ^{14.4} I installed a Solar Water Heater
(If you ticked this box, please go to question 4 in the Section "Solar Water System users and Solar Water Heating Workshop Participants")
- ^{14.5} I installed a wood burning stove
(If you ticked this box, please go to question 3 in the Section "Wood Stove Owners and Log Splitter Users")
- ^{14.6} I increased the use of firewood
(If you ticked this box, please go to question 4 in the Section "Wood Stove Owners and Log Splitter Users")
- ^{14.7} Other _____
(If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
- ^{14.8} None of the above

C.Food

15. How does your household dispose of organic waste?

- ¹ Composting
- ² It is collected by municipality
- ³ Both of the above
- Other (Please Specify) _____

(If you make compost go to question 17)

16. Please specify why you do not make compost

- ¹ I have never tried to make compost before
- ² It is a difficult process
- ³ I am not interested
- ⁴ It takes too long before it can be used
- Other please specify _____

17. In which year did you start making compost? _____

18. Please specify what you did with the compost you made.

- ¹ I used it to grow my own food
- ² Gave it to my friends
- ³ Spread it out in the Garden
- Other (Please specify) _____

19. Do you have any land that you use for growing vegetables and fruit?

- ¹ Yes
- ² No (Go to question 32)

20. Did you hire any of the following equipment from the Clean Sleaford Project in the past two years?

- ¹ Community Cultivator

- ² Garden Shredder
- ³ None of the above (Go to question 32)

21. How many times did you use any of this equipment in the past two years?

- ^{21.1} Community Cultivator _____
- ^{21.2} Garden Shredder _____

22. Please state what you liked about the Community cultivator (Multiple options are possible)

- ^{22.1} It made land cultivation easier
- ^{22.2} It made land cultivation faster
- ^{22.3} It increased my food production
- ^{22.4} Other (Please specify) _____

23. Please state what you liked about the Garden shredder (Multiple options are possible)

- ^{23.1} It made handling of garden waste easier
- ^{23.2} It increased the volume of waste that I could use for making compost
- ^{23.3} I used the shredded material as mulch in my garden (*Mulch is a protective cover placed over the soil to retain moisture, reduce erosion, provide nutrients, and suppress weed growth and seed germination*)
- ^{23.4} Reduced the amount of garden waste
- ^{23.5} Other (Please specify) _____

24. Was there any increase in the amount of vegetables and fruit you produced over the past two years?

- ¹ Yes
- ² No (Go to question 28)

25. What quantities of food did you produce in 2008?

	Quantity	Unit (eg, kg, lb, sacks, etc.)
Vegetables	^{25.1.1}	^{25.1.2}
Fruit	^{25.2.1}	^{25.2.2}

26. By how much did your food production increase with respect to 2008?

	Less than 10%	Between 10% and 25%	Between 25% and 50%	Between 50% and 75%	More than 75%
^{26.1} Vegetables	¹	²	³	⁴	⁵
^{26.2} Fruit	¹	²	³	⁴	⁵

27. On a weekly basis, by how much have you reduced the amount of vegetables and fruit you buy from the super market?

	Quantity	Unit (eg, kg, lb, sacks, etc)
Vegetables	^{27.1.1}	^{27.1.2}
Fruit	^{27.2.1}	^{27.2.2}

28. In the past two years the equipment was used for free, if a fee was charged in the future how much would you be willing to pay to use any of the equipment?

- ^{28.1} Community Cultivator _____
- ^{28.2} Garden Shredder _____

29. Did you have any problems with any of the equipment you used?

- ¹ Yes
- ² No

30. If yes, please specify what problems you encountered in using any of this equipments

- ^{30.1} Community Cultivator _____



^{30.2} Garden Shredder _____

31. Do you have any suggestions to improve the service of lending of the cultivator and shredder?

D. Waste

32. How much waste (excluding electronic waste) did you generate per month in 2010?

Type of waste (Destination)	Number of bins per month	Bag size (Litre)	Collected by	Remarks
Refuse	32.1.1	32.1.2	32.1.3	
Blue bin	32.2.1	32.2.2	32.2.3	
Recycling point				
Internal reuse				

33. How did you dispose of the following waste item in the last 2 years? Please fill-in the quantity and tick the appropriate option

Item	Quantity	Dumped together with household waste to municipal collection	Collection point			Others, specify in below column
			Kilmore church	School recycling box	Post Office	
Mobile phone	33.1.1	33.1.2		33.1.4		33.1.6
Batteries	33.2.1	33.2.2	33.2.3		33.2.5	33.2.6

34. Which of the following activities supported/organized by Clean Sleat Project did your household take part in?

Activities	¹ Yes	² No
^{34.1} We practice waste recycling		
^{34.2} We participated in "Waste to useful" product competitions at the local school		
^{34.3} We have a recycling bin at home		
^{34.4} We take our used textiles to the collection point at Broadford		
^{34.5} We have visited Clean Sleat Website's Recycling Message Board		
^{34.6} We have posted and exchanged used items on the Clean Sleat Website's Recycling Message Board		
^{34.7} We went to the car boot sale to look for second-hand items		
^{34.8} We bought/sold items at the car boot sale		

35. Rank the 5 most useful activities (1-5) for waste management in Sleat? 1-most useful 5-less useful.

Activities	Rank	Comments/Suggestions
Encouraging use of reusable nappies instead of disposables	35.1.1	35.1.2
Encouraging recycling in general and local recycling in particular	35.2.1	35.2.2
At home bin recycling	35.3.1	35.3.2
"Waste to useful" product competitions at the local school	35.4.1	35.4.2
Batteries collection at Kilmore church and/or Post Office	35.5.1	35.5.2
Textile collection in Broadford	35.6.1	35.6.2
Mobile phone recycling at school	35.7.1	35.7.2
Car boot sale to encourage reuse practice	35.8.1	35.8.2
Recycling message board on website	35.9.1	35.9.2
Others _____		

36. How satisfied are you with the current waste management situation in Sleat?

- ¹ Not satisfied
- ² Partially satisfied
- ³ Satisfied
- ⁴ Very satisfied
- ⁹⁹ No answer

37. Do you have any suggestions to improve the waste management situation in Sleat?

E. Transport

38. Does your household own one or more vehicles (excluding tractors and trucks)?

- ¹ Yes
- ² No (go to question 40)

39. Please rank the main purposes your household uses the vehicles for (1 for highest and 3 for lowest rank)

Activity	Rank
Shopping	39.1.1
Work	39.2.1
Taking children to School	39.3.1
Leisure	39.4.1
Business	39.5.1
Others (Please specify)	39.6.1

40. Does someone in your household own a bicycle? (Please tick the appropriate box(s))

- ^{40.1} Myself
- ^{40.2} My partner
- ^{40.3} Children
- ^{40.4} No

41. Did your household acquire any of the bicycles in 2010? (Please tick the appropriate box(s))

- ^{41.1} My bicycle
- ^{41.2} My partner's bicycle
- ^{41.3} Children's bicycle(s)
- ^{41.4} No

42. Please rank the main purpose the members of your household use their bicycles for (1 for highest and 3 for lowest rank)

Activity	Myself	My partner	Children
Shopping	42.1.1	42.1.2	42.1.3
Work	42.2.1	42.2.2	42.2.3
Leisure	42.3.1	42.3.2	42.3.3
School	42.4.1	42.4.2	42.4.3
Business	42.5.1	42.5.2	42.5.3
Others (Please specify)	42.6.1	42.6.2	42.6.3

43. How many miles per week on average do the members of your household ride their bicycles?

- ^{43.1} Myself _____
- ^{43.2} My partner _____
- ^{43.3} Children _____

44. Compared to 2008, did your household replace any car travels with bicycle rides in 2010?

- ¹ Yes
- ² No (Go to question 46)

45. How many miles per week (approximately) did you replace car travels by bike rides?



_____ miles

46. Have you heard of "Great Sleet cycle weeks"?
- ¹ Yes
- ² No (Please go to question 53)
47. Has anyone in your household attended the "Great Sleet cycle weeks"?
- ¹ Yes
- ² No (Please go to question 53)

Please tick the appropriate box(s) in the table below.

	Myself	My partner	Children
48. In which activities of the Great Sleet Cycle weeks did your household participate?			
Repair Workshop	48.1.1	48.1.2	48.1.3
Cycling	48.2.1	48.2.2	48.2.3
49. Does someone in your household repair bikes? (if no one please go to question 51)			
	49.1	49.2	49.3
50. Where did this person learn how to repair a bike?	50.1	50.2	50.3
¹ From repair workshop			
² Somewhere else			

51. Were your expectations of the "Great Sleet Cycle weeks" met?
- ¹ Yes (go to question 53)
- ² No

52. Why weren't your expectations met?

53. How often per month did you or a member of your household use any of the following public transport in 2010? (if the usage is less than once in a month please fill zero)

	Myself	My partner	My Children
Bus	53.1.1	53.1.2	53.1.3
Ferry	53.2.1	53.2.2	53.2.3
Train	53.3.1	53.3.2	53.3.3
Taxi	53.4.1	53.4.2	53.4.3

(If you don't use public transport go to question 56)

54. Compared to 2008, please estimate how many car travels miles did your household replace with public transport in 2010.

	Myself	My partner	My Children
Bus	54.1.1	54.1.2	54.1.3
Ferry	54.2.1	54.2.2	54.2.3
Train	54.3.1	54.3.2	54.3.3
Taxi	54.4.1	54.4.2	54.4.3

55. Do you have the impression that the service of public transport has improved within the last two years? Rank your opinions (1 being very improved and 3 not improved at all)

	Bus	Ferry	Taxi
Frequency	55.1.1	55.1.2	
Fee	55.2.1	55.2.2	55.2.3

Punctuality	55.3.1	55.3.2	55.3.3
Comfort	55.4.1	55.4.2	55.4.3
Others	55.5.1	55.5.2	55.5.3

56. Do you have any suggestions for improvement of the service of the public transport?

F. General questions

(For respondents who participated in the Clean Sleet Project)

57. Please tell us to what extent do you agree or disagree with the following statements

Statements	Your opinions						I don't know
	Strongly disagree				Strongly agree		
	1	2	3	4	5	6	
57.1 "The Clean Sleet Project has helped me to have a better understanding of climate change."							
57.2 "The 'Clean Sleet Project' has helped me to know the ways in which I can act against climate change"							
57.3 "Clean Sleet Project activities contributed to reduce CO2 emissions of Sleet"							
57.4 "I am doing my best to reduce my carbon footprint"							

58. How much more would you be willing to pay for products and services produced in a sustainable way?

- 58.1 Electricity _____ %
- 58.2 Heating _____ %
- 58.3 Food _____ %
- 58.4 Transport _____ %

59. What other areas/topics/activities should the Clean Sleet Project have covered to meet your expectations/needs? Please list.

Thank you for your kind cooperation!



Questionnaire for College

The aim of this study is to evaluate the Clean Sleat Project (CSP), determine how many of its objectives have been met and measure its impacts. We conduct this assessment on behalf of the Sleat Community Trust (SCT) and in cooperation with Community Energy Scotland (CES) as part of our research assignment at the MEng. Course Energy and Environmental Management at the University of Flensburg/Germany (UFL).

We want to appraise the changes that have taken place since the initial study was completed in 2008 by another group of fellow students from UFL on the ecological footprint of the Sleat community (this is a measure of how much 'nature' is available and how much of it is used). The earlier study found that the residents of Sleat use more natural resources than the Scottish average consumption. Based on these findings the CSP was launched in January 2009 with the goal to reduce carbon emissions on the Peninsula by 33%.

We rely on your input into this follow up survey for the successful evaluation of the project and kindly ask for your cooperation. Your responses will be treated strictly confidential. We would like to invite you to participate in the presentation of the findings of our survey around 18.3.2011.

A. BACKGROUND INFORMATION

Interviewer: _____

Date: _____

Respondent's position: _____

1. How many students/staff members do you have?

Group	Number
Full time resident students	
Full time non resident students	
Full time staff members	
Note: Please convert all part time students and staff into full time students and staff members.	

2. What is the floor area of the:

- Old College (m²/ft²) _____
- College Extension (m²/ft²) _____

3. What is the relationship between the College and the Clean Sleat Project/Sleat Community Trust?

4. What projects did the college undertake with the Clean Sleat Project / Sleat Community Trust?

B. Energy Consumption

5. Please indicate how much energy the college consumed in 2010. (If you have your energy bills, please check them; otherwise please give us an estimate.)

Energy source	Quantity consumed	Unit	Approximate cost (£)
Electricity	^{5.1.1}	kWh	^{5.1.2}
LPG	^{5.2.1}	Kg	^{5.2.2}
Oil	^{5.3.1}	Litres	^{5.3.2}
Woodchips	^{5.4.1}	Tonnes	^{5.4.2}
Others including renewable (please specify) ^{5.5.0}	^{5.5.1}		^{5.5.2}
Others including renewable (please specify) ^{5.6.0}	^{5.6.1}		^{5.6.2}

6. Where does the college buy the woodchips from? _____

7. Does the college face any problems with the use of woodchips?

8. What suggestions do you have to improve the woodchips supply service?

9. Did you implemented any other energy saving measure? Which ones...? When...? How much would the savings be...?



FOOD

10. How do you get vegetables and fruit for your College?

- Buy from supermarket.(Go to question 12)
- Buy from local food producer.(Go to question 11)
- From own college garden.(Go to question 12)
- Others(Please specify)

11. From which local producers do you buy the vegetables and fruit for the college?

- ¹ Sleaf local farmers (please specify by name) _____
- ² Sleaf Households with excess production from their gardens _____
- ³ Other (Please specify): _____

12. What quantities of vegetables and fruit did you buy and produce annually in the last two years?

	Quantity Unit (kg, lb, etc.)			
	own produced	Buying from local producers	Buying from supermarket	External food supplier
Vegetables				
Fruit				

13. Was there any increase in the amount of vegetables and fruit you produced or bought over the past two years?

- Yes
- No (Go to question 16)

14. By how much did the vegetables and fruit you produced and bought increase with respect to 2008

	Less than 10%	Between 10% and 25%	Between 25% and 50%	Between 50% and 75%	More than 75%
Vegetables					
Fruit					

15. Where there any reasons for the increase in the amount of locally (Skye) produced food you bought from within Sleaf? Please specify below.

16. Where there any reasons for the decrease in the amount of locally (Skye) produced food you bought from within Sleaf? Please specify below

C. WASTE MANAGEMENT

17. How much waste (excluding electronic waste) did the college generate per month in 2010?

Type of waste (Destination)	Number of bins per month	Bag size (Litre)	Collected by	Remarks
<i>Refuse</i>				
<i>Blue bin</i>				
<i>Recycling point</i>				
<i>Internal reuse</i>				

18. How did the college dispose of the following waste items in the last 2 years? Please fill-in the quantity and tick the appropriate option

Item	Quantity	Dumped together with household waste to municipal collection	Collection point			Others, specify in below column
			Kilmore church	School recycling box	Post Office	
Mobile phone						
Batteries						

19. Is there any policy of the college regarding reuse waste practice, eg. second hand items car boot sale/flea market, recommend paper print into two sided pages, reuse of plastic container/metal container, etc.

20. How does the college manage its waste?

Furniture:

Textiles:

Paper:

e-waste:

Second hand items:

Nappies (if they have):



21. Which of the following activities supported or organized by Clean Sleat Project did the college take part-in?

Activities	Yes	No
We practice waste recycling		
We participated in "Waste to useful" product competitions at the local school		
We have recycling bins		
We take our used textiles to the collection point at Broadford		
We have visited Clean Sleat Website's Recycling Message Board		
We have posted and exchanged used items on the Clean Sleat Website's Recycling Message Board		
We went to the car boot sale to look for second-hand items		
We bought/sold items at the car boot sale		

22. Rank the 5 most useful activities (1-5) for waste management for the college? 1-most useful, 5-less useful

Activities	Rank	Comments
Encouraging use of reusable nappies instead of disposables	22.1.1	22.1.2
Encouraging in recycling in general and local recycling in particular	22.2.1	22.2.2
College recycling bins	22.3.1	22.3.2
"Waste to useful" product competitions at the local school	22.4.1	22.4.2
Batteries collection at Kilmore church and/or post office	22.5.1	22.5.2
Textile collection in Broadford	22.6.1	22.6.2
Mobile phone recycling at school	22.7.1	22.7.2
Recycling message board on website	22.8.1	22.8.2

23. What activities could the college undertake with the Sleat Community Trust to improve the waste management situation of the college/Sleat?

24. Which challenges/difficulties, if any, does the College have with the current implemented waste management and what are your suggestions to improve it?
Challenges/difficulties:

Suggestions:



Questionnaire for School

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We rely on your input into this follow up survey for the successful evaluation of the project and kindly ask for your cooperation. Your responses will be treated strictly confidential. We would like to invite you to participate in the presentation of the findings of our survey around 18.3.2011

A. BACKGROUND INFORMATION

1. Questionnaire number (to be filled by the interviewer): _____
 Interviewer: _____

Date: _____

Respondent's position: _____

2. How many pupils and staff members do you have?

Group	Number
Pupils	4.1
Staff Members	4.2

B. ENERGY CONSUMPTION

3. Which of the following energy related measures has the school implemented since February 2008? (More than one answer is possible)
- ¹ We installed CFL lamps (If you ticked this box, go to question 3 in the Section "CFL Users")
 - ² We installed Stand by losses savers. (If you ticked this box, please go to question 3 in the Section "Stand by savers")
 - ³ We improved the Insulation of our building (If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
 - ⁴ We installed a Solar Water Heater (If you ticked this box, please go to question 4 in the Section "Solar Water System users and Solar Water Heating Workshop Participants")
 - ⁵ We installed a wood burning stove (If you ticked this box, please go to question 3 in the Section "Wood Stove Owners and Log Splitter Users")
 - ⁶ We increased the use of firewood (If you ticked this box, please go to question 4 in the Section "Wood Stove Owners and Log Splitter Users")
 - Other _____
 (If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
 - ⁷ None of the above

C. FOOD

4. How many pupils and staff per day had lunch in the Canteen in 2007 and 2010?
 2007 _____
 2010 _____

5. How do you get vegetables and fruit for your School?
- ¹ Buy from supermarket. (Go to question 9)
 - ² Buy from local food producer. (Go to question 8)
 - ³ From own School garden. (Go to question 9)
 - ⁴ Others (Please specify)

6. From which local producers do you buy vegetables and fruit for the School?
- Sleaford local farmers (please specify by name) _____
 - 2 Sleaford Households with excess production from their gardens
 - 3 Other (Please specify): _____

7. What quantities of vegetables and fruit did the school buy and/or produce on a weekly basis in the last two years?

	Quantity Unit (kg, lb, etc.)			
	own produced	Buying from local (Sleaford) producers	Buy from supermarket	External food supplier
Vegetables	0.1.1	0.1.2	0.1.3	0.1.4
Fruit	0.2.1	0.2.2	0.2.3	0.2.4

8. Was there any increase in the amount of vegetables and fruit the school consumed that had been produced locally (Sleaford) over the past two years?
- ¹ Yes
 - ² No (Go to question Error! Reference source not found.)

9. By how much did the vegetables and fruit consumption increase with respect to 2008

	Less than 10%	Between 10% and 25%	Between 25% and 50%	Between 50% and 75%	More than 75%
Vegetables	¹	²	³	⁴	⁵
Fruit	¹	²	³	⁴	⁵

10. What were the reasons for the increase/decrease, if any, in the amount of locally produced food the school bought? Please specify below.

Reasons for increase _____

Reasons for decrease _____



C. WASTE MANAGEMENT

11. How much waste (excluding electronic waste) did the school generate per month in 2010?

Type of waste (Destination)	Number of bins per month	Bag size (Litre)	Collected by	Remarks
<i>Refuse</i>	Error! Reference source not found. ^{1.1}	Error! Reference source not found. ^{1.2}	Error! Reference source not found. ^{1.3}	
<i>Blue bin</i>	Error! Reference source not found. ^{2.1}	Error! Reference source not found. ^{2.2}	Error! Reference source not found. ^{2.5}	
<i>Recycling point</i>				
<i>Internal reuse</i>				

12. How did the school dispose of the following waste items in the last 2 years? Please fill-in the quantity and tick the appropriate option

Item	Quantity	Dumped together with household waste to municipal collection	Collection point			Others, specify in below column
			Kilmore church	School recycling box	Post Office	
Mobile phone	12.1.1	12.1.2		12.1.4		12.1.5
Batteries	12.2.1	12.2.2	12.2.3		12.2.5	12.2.6

13. Which of the following activities organized by Clean Sleaford Project did the school take part-in?

Activities	¹ Yes	² No
^{13.1} We practice waste recycling		
^{13.2} We participated in "Waste to useful" product competitions at the local school		
^{13.3} Error! Reference source not found. ³ We have recycling bins		
^{13.4} We take our used textiles to the collection point at Broadford		
^{13.5} We have visited Clean Sleaford Website's Recycling Message Board		
^{13.6} We have posted and exchanged used items on the Clean Sleaford Website's Recycling Message Board		
^{13.7} Error! Reference source not found. ⁵ We went to the car boot sale to look for second-hand items		
^{13.8} Error! Reference source not found. ¹⁰ We bought/sold items at the car boot sale		

14. Rank the 5 most useful activities (1-5) for waste management for the school? 1-most useful, 5-less useful

Activities	Rank	Comments
Encouraging use of reusable nappies instead of disposables	14.1.1	14.1.2
Encouraging in recycling in general and local recycling in particular	14.2.1	14.2.2
School recycling bins	14.3.1	14.3.2
"Waste to useful" product competitions at the local school	14.4.1	14.4.2
Batteries collection at Kilmore church and/or post office	14.5.1	14.5.2
Textile collection in Broadford	14.6.1	14.6.2
Mobile phone recycling at school	14.7.1	14.7.2
Recycling message board on website	14.8.1	14.8.2

15. How effective has the waste awareness program conducted by Clean Sleaford Project helped the school educate children on waste management?

- ¹ not effective
 ² partially effective
 ³ effective
 ⁴ very effective

16. Does the school have any suggestions on how to improve awareness programs for school children?

17. What are the challenges, if any, of the current waste management situation in the school and what would be suggestions to improve it?

Challenges: _____

Suggestions: _____

Transport

18. How has the number of kids coming to school with bicycles changed after the school got the Rack donation?

- ¹ Increased
 ² Decreased
 No change

19. Please quantify the increase or decrease in percentage.

Thank you for your kind cooperation!



Questionnaire for Hotel or Cafeteria

The aim of this study is to evaluate the Clean Sleat Project (CSP), determine how many of its objectives have been met and measure its impacts. We conduct this assessment on behalf of the Sleat Community Trust (SCT) and in cooperation with Community Energy Scotland (CES) as part of our research assignment at the MEng. Course Energy and Environmental Management at the University of Flensburg/Germany (UFL).

We want to appraise the changes that have taken place since the initial study was completed in 2008 by another group of fellow students from UFL on the ecological footprint of the Sleat community (this is a measure of how much 'nature' is available and how much of it is used). The earlier study found that the residents of Sleat use more natural resources than the Scottish average consumption. Based on these findings the CSP was launched in January 2009 with the goal to reduce carbon emissions on the Peninsula by 33%.

We rely on your input into this follow up survey for the successful evaluation of the project and kindly ask for your cooperation. Your responses will be treated strictly confidential. We would like to invite you to participate in the presentation of the findings of our survey around 18.3.2011.

A. BACKGROUND INFORMATION

- Questionnaire number (to be filled by the interviewer): _____
Interviewer: _____
Date: _____
- Name of Hotel/Cafeteria: _____
- Have you heard of the "Clean Sleat project"?
 - ¹Yes
 - ²No (go to question Error! Reference source not found.)
- From whom or where did you hear about the Clean Sleat Project?
 - ¹Clean Sleat Project activities
 - ²Friends or neighbor
 - ³Community newsletter/email
 - ⁴TV
 - ⁵Radio
 - ⁶Newspaper/magazine
 - ⁷Others, please specify: _____

B. Energy consumption

- Which of the following energy related measures has the hotel/cafeteria implemented since February 2008? (More than one answer is possible)
 - ¹We installed CFL lamps
(If you ticked this box, go to question 3 in the Section "CFL Users")
 - ²We installed Stand by losses savers.
(If you ticked this box, please go to question 3 in the Section "Stand by savers")
 - ³We improved the Insulation of my building (If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
 - ⁴We installed a Solar Water Heater
(If you ticked this box, please go to question 4 in the Section "Solar Water System users and Solar Water Heating Workshop Participants")
 - ⁵We installed a wood burning stove
(If you ticked this box, please go to question 3 in the Section "Wood Stove Owners and Log Splitter Users")
 - ⁶We increased the use of firewood
(If you ticked this box, please go to question 4 in the Section "Wood Stove Owners and Log Splitter Users")
 - Other _____
(If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
 - ⁷None of the above

B.

A. FOOD

- How do you get vegetables and fruit for your College?
 - ¹²Buy from supermarket.(Go to question 7)
 - ¹²Buy from local food producer.(Go to question 6)
 - ¹²From own college garden.(Go to question 7)
 - ¹²Others(Please specify)

- From which local producers do you buy the vegetables and fruit for the college?
 - ¹Sleat local farmers (please specify by name) _____
 - ²Sleat Households with excess production from their gardens
 - ³Other (Please specify): _____
- What quantities of vegetables and fruit did you buy and produce on a annually in the last two years?

	Quantity Unit (kg, lb, etc.)			
	own produced	Buying from local producers	Buying from supermarket	External food supplier
Vegetables	0.1.1	0.1.2	0.1.3	0.1.4
Fruit	0.2.1	0.2.2	0.2.3	0.2.4
- Was there any increase in the amount of vegetables and fruit you produced or bought over the past two years?
 - ¹Yes



² No (Go to question 11)

9. By how much did the vegetables and fruit you produced and bought increase with respect to 2008

	Less than 10%	Between 10% and 25%	Between 25% and 50%	Between 50% and 75%	More than 75%
Vegetables	1	2	3	4	5
Fruit	1	2	3	4	5

10. Where there any reasons for the increase in the amount of locally (Skye) produced food you bought from within Sleat? Please specify below.

11. Where there any reasons for the decrease in the amount of locally (Skye) produced food you bought from within Sleat? Please specify below

C. Waste management

2. How much waste (excluding electronic waste) did the hotel or cafeteria generate per month in 2010?

Type of waste (Destination)	Number of bins per month	Bag size (Litre)	Collected by	Remarks
<i>Refuse</i>				
<i>Blue bin</i>				
<i>Recycling point</i>				
<i>Internal reuse</i>				

3. How did the hotel/Cafeteria dispose of its electronic waste in 2010?(Please fill-in the quantity and tick the appropriate option)

Item	Quantity	Dumped together with household waste to municipal collection	Collection point			Others, specify in below column
			Kilmore church	School recycling box	Post Office	
Mobile phone						
Batteries						

4. Which of the following activities supported/ organized by Clean Sleat Project did the hotel/cafeteria take part-in?

Activities	1 Yes	2 No
We practice waste recycling		
We participated in "Waste to useful" product competitions at the local school		
We have a recycling bin at hotel/Cafeteria		
We take our used textiles to the collection point at Broadford		
We have visited Clean Sleat Website's Recycling Message Board		
We have posted and exchanged used items on Clean Sleat Website's Recycling Message Board		
We went to the car boot sale to look for second-hand items		
We bought/sold our unwanted items at the car boot sale		

5. Rank the 5 most useful activities (1-5) for waste management for hotel or cafeteria? 1-most useful, 5-less useful

Activities	Rank	Comments
Encouraging use of reusable nappies instead of disposables		
Encouraging in recycling in general and local recycling in particular		
Hotel / cafeteria recycling bins		
"Waste to useful" product competitions at the local school		
Batteries collection at Kilmore church and/or post office		
Textile collection in Broadford		
Mobilephone recycling at school		
Car boot sale to encourage reuse practice		
Recycling message board on website		
Others (please specify)		

6. Does the hotel or cafeteria have any challenges/difficulties with the current implemented waste management and what would be suggestions to improve it?

Challenges/difficulties: _____

Suggestions: _____

Thank you for your kind corporation!



Questionnaire for Medical Centre

The aim of this study is to evaluate the Clean Sleaf Project (CSP), determine how many of its objectives have been met and measure its impacts. We conduct this assessment on behalf of the Sleaf Community Trust (SCT) and in cooperation with Community Energy Scotland (CES) as part of our research assignment at the MEng. Course Energy and Environmental Management at the University of Flensburg/Germany (UFL).

We want to appraise the changes that have taken place since the initial study was completed in 2008 by another group of fellow students from UFL on the ecological footprint of the Sleaf community (this is a measure of how much 'nature' is available and how much of it is used). The earlier study found that the residents of Sleaf use more natural resources than the Scottish average consumption. Based on these findings the CSP was launched in January 2009 with the goal to reduce carbon emissions on the Peninsula by 33%.

We rely on your input into this follow up survey for the successful evaluation of the project and kindly ask for your cooperation. Your responses will be treated strictly confidential. We would like to invite you to participate in the presentation of the findings of our survey around 18.3.2011 (exact date to be announced)

A. BACKGROUND INFORMATION

- Questionnaire number (to be filled by the interviewer): _____
 Interviewer: _____
 Date: _____
 Respondent's position: _____
- Have you heard of the "Clean Sleaf project"?
 ¹Yes
 ²No (go to question 6)
- From whom or where did you hear about the Clean Sleaf Project?
 ¹Clean Sleaf Project activities
 ²Friends or neighbor
 ³Community newsletter/email
 ⁴TV
 ⁵Radio
 ⁶Newspaper/magazine
 ⁷Others, please specify: _____

B. Energy consumption

- Which of the following energy related measures has the medical centre implemented since February 2008? More than one answer is possible
 ¹ We installed CFL lamps (If you ticked this box, go to question 3 in the Section "CFL Users")
 ² We installed Stand by losses savers. (If you ticked this box, please go to question 3 in the Section "Stand by savers")
 ³ We improved the Insulation of our building (If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
 ⁴ We installed a Solar Water Heater (If you ticked this box, please go to question 4 in the Section "Solar Water System users and Solar Water Heating Workshop Participants")
 ⁵ We installed a wood burning stove (If you ticked this box, please go to question 3 in the Section "Wood Stove Owners and Log Splitter Users")
 ⁶ We increased the use of firewood (If you ticked this box, please go to question 4 in the Section "Wood Stove Owners and Log Splitter Users")
 Other _____
 (If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
 ⁷ None of the above

C. Waste Management

- How much waste (excluding electronic waste) did the medical centre generate per month in 2010?

Type of waste (Destination)	Number of bins per month	Bag size (Litre)	Collected by	Remarks
<i>Refuse</i>	Error! Reference source not found. ^{.1.1}	Error! Reference source not found. ^{.1.2}	Error! Reference source not found. ^{.1.3}	
<i>Blue bin</i>	Error! Reference source not found. ^{.2.1}	Error! Reference source not found. ^{.2.2}	Error! Reference source not found. ^{.2.5}	
<i>Recycling point</i>				
<i>Internal reuse</i>				

- How did the medical centre dispose of the following waste items in the last 2 years? Please fill-in the quantity and tick the appropriate option

Item	Quantity	Dumped together with household waste to municipal collection	Collection point			Others, specify in below column
			Kilmore church	School recycling box	Post Office	
Mobile phone	6.1.1	6.1.2		6.1.4		6.1.6
Batteries	6.6.1	6.6.2	6.6.3		6.6.5	6.6.6

- Which of the following activities organized by Clean Sleaf Project did the medical centre take part-in?

Activities	¹ Yes	² No
^{7.1} We practice waste recycling		
^{7.2} We participated in "Waste to useful" product competitions at the local school		
⁷ Error! Reference source not found. ^{.3} We have recycling bins		
^{7.5} We take our used textiles to the collection point at Broadford		
^{7.7} We have visited Clean Sleaf Website's Recycling Message Board		
^{7.8} We have posted and exchanged used items on the Clean Sleaf Website's Recycling Message Board		
⁷ Error! Reference source not found. ^{.9} We went to the car boot sale to look for second-hand items		
⁷ Error! Reference source not found. ^{.10} We bought/sold items at the car boot sale		

- Rank the 5 most useful activities (1-5) for waste management for the medical centre? 1-most useful, 5-less useful

Activities	Rank	Comments
Encouraging use of reusable nappies instead of disposables	6.1.1	6.1.2
Encouraging in recycling in general and local recycling in particular	6.2.1	6.2.2
Medical centre recycling bins	6.3.1	6.3.2
"Waste to useful" product competitions at the local school	6.4.1	6.4.2
Batteries collection at Kilmore church and/or post office	6.5.1	6.5.2
Textile collection in Broadford	6.6.1	6.6.2
Mobile phone recycling at school	6.7.1	6.7.2
Recycling message board on website	6.9.1	6.9.2

- What are the challenges, if any, of the current waste management situation in the medical



centre and what would be suggestions to improve it?

Challenges: _____

Suggestions: _____

Thank you for your kind cooperation!

EEM-SESAM IC 2011

Specific section - Energy Audits and miscellaneous energy saving measures

Questionnaire number (same as main questionnaire): _____

Interviewer's name: _____

1. Was an Energy Audit carried out in your home?
 - ¹ Yes
 - ² No (if you answered no, go to question 6)

2. Are you satisfied with the Energy Audit service?
 - ¹ Not satisfied
 - ² Partially satisfied
 - ³ Satisfied
 - ⁴ Very satisfied
 - ⁵ No answer

3. Have you applied the energy saving measures suggested by the energy audits carried out in your home?
 - ¹ All of them (Go to question 5)
 - ² Some of them
 - ³ None of them

4. If you haven't applied the proposed energy saving measures suggested by the energy audit, what was the reason?

5. Do you have any suggestion to improve future Energy Audits services?

If you didn't implement any energy saving measure or renewable energy technology this section ends here.

6. How did you hear about the energy saving measures and renewable energy technologies that you have applied in your home? Please, mark one of the following options. (Multiple options are possible)
 - ^{6.1} Energy Audit
 - ^{6.2} Clean Sleaford project in general
 - ^{6.3} TV/Radio/Internet
 - ^{6.4} Neighbors or friends
 - ^{6.5} Advertisement from companies
 - ^{6.6} Other _____

7. Which energy saving measures and renewable energy technologies have you applied since 2008 and how much approximately have your annual savings in 2010 been compared to 2007?

Measures (Use one row for each fuel)	Year and month of implementation	Fuel/Energy carrier that has been saved	Annual Energy Savings		Annual Money savings (GBP)
			Quantity	Unit (e.g. kWh, kg, liters, gas cylinders)	
7.1.1	7.1.2 2008,	7.1.3	7.1.4	7.1.5	7.1.6
7.2.1	7.2.2 2008,	7.2.3	7.2.4	7.2.5	7.2.6
7.3.1	7.3.2 2009,	7.3.3	7.3.4	7.3.5	7.3.6
7.4.1	7.4.2 2009,	7.4.3	7.4.4	7.4.5	7.4.6
7.5.1	7.5.2 2010,	7.5.3	7.5.4	7.5.5	7.5.6
7.6.1	7.6.2 2010,	7.6.3	7.6.4	7.6.5	7.6.6

Thank you for your kind cooperation!



EEM-SESAM IC 2011

Specific section - CFL users

Questionnaire number (same as main questionnaire): _____

Interviewer's name: _____

1. Have you installed the CFL lamps provided by the SCT?
- ¹ Yes (go to question 3)
 - ² No

2. What were the reasons for not installing them?
- _____
- _____

(Go to question 6)

3. Are you satisfied with CFL dissemination program of the Clean Sleet Project?

- ¹ Not satisfied
- ² Partially satisfied
- ³ Satisfied
- ⁴ Very satisfied
- ⁵ I cannot judge since I didn't participate in the dissemination program
- ⁹⁹ No answer

4. What persuaded you to install the CFL? (Multiple options are possible)

- ^{4.1} Clean Sleet Project CFL dissemination program
- ^{4.2} Clean Sleet Project in general
- ^{4.3} TV/Radio/Internet
- ^{4.4} Neighbors or friends
- ^{4.5} Advertisement from companies
- ^{4.6} Other _____

5. Please provide details on the CFL you have installed in 2008 and 2009.

Number of CFL you have installed (total)	Number of CFL provided by Clean Sleet project	Wattage CFL	Hours of use per day	Type of lamps which have been replaced	Wattage of lamps which have been replaced	Quantity of lamps which have been replaced
S.1.1	S.1.2	S.1.3	S.1.4	S.1.5	S.1.6	S.1.7
S.2.1	S.2.2	S.2.3	S.2.4	S.2.5	S.2.6	S.2.7

6. Do you have any suggestions to improve future CFL dissemination programs?
- _____
- _____

Thank you for your kind cooperation!

EEM-SESAM IC 2011

Specific Section - Stand by savers

Questionnaire number (same as main questionnaire): _____

Interviewer name: _____

7. Have you installed the stand-by saver provided by the Clean Sleet Project?
- ¹ Yes (go to question 9)
 - ² No

8. What were the reasons for not installing it?
- _____
- _____

9. What persuaded you to install the stand-by saver? Please, mark one of the following options.

- ^{9.1} Clean Sleet Project stand by saver dissemination program
- ^{9.2} Clean Sleet Project in general
- ^{9.3} TV/Radio/Internet
- ^{9.4} Neighbours or friends
- ^{9.5} Advertisement from companies
- ^{9.6} Other _____

10. Please indicate which appliances you have connected to stand-by savers and how many hours per week these appliances are in active mode.

Appliance connected	Type/Brand name/Size	Year of purchase	Average hours of use in active mode per week
0.1.1	0.1.2	0.1.4	0.1.5
0.2.1	0.2.2	0.2.4	0.2.5
0.3.1	0.3.2	0.3.4	0.3.5
0.4.1	0.4.2	0.4.4	0.4.5
0.5.1	0.5.2	0.5.4	0.5.5
0.6.1	0.6.2	0.6.4	0.6.5

11. Are you satisfied with the stand-by savers dissemination program of the Clean Sleet Project?

- ¹ Not satisfied
- ² Partially satisfied
- ³ Satisfied
- ⁴ Very satisfied
- ⁵ I cannot judge since I didn't participate in the dissemination program
- ⁹⁹ No answer

12. Do you have any suggestions to improve future stand-by savers dissemination programs?
- _____
- _____

Thank you for your kind cooperation!



EEM-SESAM IC 2011

Specific section - Solar Water System users and Solar Water Heating Workshop Participants

Questionnaire number (same as main questionnaire): _____

Interviewer name: _____

1. Did you install the Solar Water Heater you made during the workshop?
 ¹Yes (go to question 4)
 ²No

2. What were the reasons for not installing it?

3. Are you interested in installing a solar water heating system in the future?
 ¹Yes
 ²No (Why are you not interested?) _____
 ³Only if _____

4. How did you become interested in Solar Water Systems? (Multiple options are possible)
 ^{4.1}Clean Sleaf Project Solar Water Heater System Workshop
 ^{4.2}Clean Sleaf Project in general
 ^{4.3}TV/Radio/Internet
 ^{4.4}Neighbors or friends
 ^{4.5}Advertisement from companies
 ^{4.6}Other _____

5. Is the Solar Water Heating System working properly?
 ¹Yes (go to question 7)
 ²No
 ⁴I did not install it
 ⁹⁹No answer

6. What problems does the system have?

7. Please provide details on the annual savings you have achieved with your solar water heating system compared to 2007.

Year of implementation	Fuel/Energy carrier that has been saved	Annual Energy Savings		Annual money savings (GBP)
		Quantity	Unit (e.g. kWh, kg, liters, gas cylinders)	
4.1	4.2	4.3	4.4	4.5

8. To what extent were your expectations of the solar water heating workshop met?

- ¹Not met
 ²Partially met
 ³Fully met
 ⁴I cannot judge, as I did not participate in the workshop
 ⁹⁹No answer

9. Do you have any suggestion for future workshops?

10. Do you have any suggestion for future promotion of Solar Water Heaters?

Thank you for your kind cooperation!



EEM-SESAM IC 2011
Specific Section - Wood Stove Owners and Log Splitter Users

Questionnaire number (same as main questionnaire): _____

Interviewer's name: _____

1. Are you satisfied with the log splitter service?

- ¹ Not satisfied
- ² Partially satisfied
- ³ Satisfied
- ⁴ Very satisfied
- ⁹⁹ No answer

2. Do you have any suggestions to improve the log splitter service?

3. Do you meet more of your heat demand from firewood compared to 2007?

- ¹ Yes
- ² No (If no, go to the end of the questionnaire)

4. What motivates you to meet more of your heat demand from firewood?

5. What persuaded you to meet more of your heat demand from firewood? (Multiple options are possible)

- ^{5.1} Log Splitter availability from Clean Sleaf Project
- ^{5.2} Clean Sleaf project in general
- ^{5.3} TV/Radio/Internet
- ^{5.4} Neighbors or friends
- ^{5.5} Advertisement from companies
- ^{5.6} Other _____

6. How much firewood did you use? Please fill in the following table.

Year	Quantity of wood used	Unit (e.g. kg, m ³ · ft ³)	Substituted Fuel	Quantity of fuel used	Unit (e.g. kWh, kg, liters, gas cylinders)
2007	S.1.1	S.1.2	S.1.3	S.1.4	S.1.5
2010	S.2.1	S.2.2	S.2.3	S.2.4	S.2.5

7. Where do you usually get your firewood?

- ¹ Clan Donald
- ² John Muir Trust

Other _____

8. Do you have any problems with the local provision of firewood?

9. Do you have any suggestion on how to improve the local supply of firewood?

(Only for log-splitter users)

10. In the past two years the log splitter was used for free, if a fee was charged in the future how much would you be willing to pay to use it?

Thank you for your kind cooperation!



Questionnaire for Office & Small Businesses (farms & shops)

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We want to appraise the changes that have taken place since the initial study was completed in 2008 by another group of fellow students from UFL on the ecological footprint of the Sleet community (this is a measure of how much 'nature' is available and how much of it is used). The earlier study found that the residents of Sleet use more natural resources than the Scottish average consumption. Based on these findings the CSP was launched in January 2009 with the goal to reduce carbon emissions on the Peninsula by 33%.

We rely on your input into this follow up survey for the successful evaluation of the project and kindly ask for your cooperation. Your responses will be treated strictly confidential.

We would like to invite you to participate in the presentation of the findings of our survey around 18.3.2011 (exact date to be announced).

A. BACKGROUND INFORMATION

- Questionnaire number (to be filled by the interviewer): _____
Interviewer: _____
Date: _____
- Type of Business: _____
- Have you heard of the "Clean Sleet project"?
 - ¹Yes
 - ²No (go to question 6)
- From whom or where did you hear about the Clean Sleet Project?
 - ¹Clean Sleet Project activities
 - ²Friends or neighbor
 - ³Community newsletter/email
 - ⁴TV
 - ⁵Radio
 - ⁶Newspaper/magazine
 - ⁷Others, please specify: _____

B. Energy consumption

- Have you participated as a beneficiary in any of the following Clean Sleet Project activities? (More than one answer is possible)
 - ¹ Energy audit (If you ticked this box, please go to question 2 in the Section "Energy Audits and miscellaneous energy saving measures")
 - ² CFL dissemination (If you ticked this box, please answer the questions in the Section "CFL Users")
 - ³ Stand by saver dissemination (If you ticked this box, please answer the questions in the Section "Stand by savers")
 - ⁴ Solar Panel Building Workshop (If you ticked this box, please answer the questions in the Section "Solar Water System users and Solar Water Heating Workshop Participants")
 - ⁵ Log splitter hire (If you ticked this box, please answer the questions in the Section "Wood Stove Owners and Log Splitter Users")
 - ⁶ Real time energy meters distribution
 - ⁷ None of the above (Go to question 7)
- Where or from whom did you hear about the indicated activity/activities? (multiple answers possible)
 - ¹ Clean Sleet Project promotion programs
 - ² Friends or neighbors
 - ³ Community newsletter/email
 - ⁴ TV
 - ⁵ Radio
 - ⁶ Newspaper/magazine
 - Others, please specify: _____

(Please go to question 8)
- What was the reason for not participating in the Clean Sleet Project Activities?
 - ¹ I was not interested
 - ² I didn't know about it
 - ³ I didn't have time
 - ⁴ I think changing my behavior will not have a real impact on the climate change.
 - ⁵ It is too expensive to implement all the action suggested by Clean Sleet Project.
 - Other _____
- Which of the following energy related measures have you implemented since February 2008? (More than one answer is possible)
 - ¹ I installed CFL lamps (If you ticked this box, go to question 3 in the Section "CFL Users")
 - ² I installed Stand by losses savers. (If you ticked this box, please go to question 3 in the Section "Stand by savers")
 - ³ I improved the Insulation of my building (If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
 - ⁴ I installed a Solar Water Heater (If you ticked this box, please go to question 4 in the Section "Solar Water System users and Solar Water Heating Workshop Participants")
 - ⁵ I installed a wood burning stove (If you ticked this box, please go to question 3 in the Section "Wood Stove Owners and Log Splitter Users")
 - ⁶ I increased the use of firewood (If you ticked this box, please go to question 4 in the Section "Wood Stove Owners and Log Splitter Users")
 - Other _____ (If you ticked this box, please answer the questions in the Section "Energy Audits and miscellaneous energy saving measures")
 - ⁷ None of the above

C. Food



small farms

9. Do you grow any vegetables and fruit on your farm?
 ¹Yes

²No

10. How much vegetables and fruit do you grow on your farm in 2010?

	Quantity	Unit (e.g. kg, lb, sacks etc.)
Vegetable	10.8.1	10.8.2
Fruit	10.9.1	10.9.2

11. In the past two years the amount of vegetables and fruit produced:

¹has increased (Go to question16)

²has decreased

³has not changed

12. By how much did your vegetables and fruit production increase with respect to 2008?

	Less than 10%	Between 10% and 25%	Between 25% and 50%	Between 50% and 75%	More than 75%
Vegetables					
Fruit					

13. In the past two years, whom or where did you sell vegetables and fruit to and in what quantities?

	Quantity	Unit (e.g. kg, lb, sacks etc.)
Residents	Error! Reference source not found. ^{1.1}	Error! Reference source not found. ^{1.2}
College	Error! Reference source not found. ^{2.1}	Error! Reference source not found. ^{2.2}
Restaurants	Error! Reference source not found. ^{3.1}	Error! Reference source not found. ^{3.2}
Ardvasar Shop*	Error! Reference source not found. ^{4.1}	Error! Reference source not found. ^{4.2}
Broadford shop	Error! Reference source not found. ^{5.1}	Error! Reference source not found. ^{5.2}
Other (Please Specify)	Error! Reference source not found. ^{6.1}	Error! Reference source not found. ^{6.2}

ArdvasarShop

14. Did you sell any locally produced vegetables and fruit in your shop in the past two years?

¹Yes (go to sub-question 20)

²No (go to question number)

15. From where did you get the vegetables and fruit items you sold in your shop?

^{0.1}Sleat local farmers

^{0.2}Sleat Households with excess production from their gardens

^{0.3}Other (Please specify)

16. What quantities of each of the locally produced food items you mentioned in question 14 did you sell annually in the last two years?

	Quantity	Unit (e.g. kg, lb, sacks etc.)
Vegetable	10.8.1	10.8.2
Fruit	10.9.1	10.9.2

17. In the past two years the amount of vegetables and fruit sold:

¹has increased (Go to question16)

²has decreased

³has not changed

18. By how much did your vegetables and fruit production increase with respect to 2008?

	Less than 10%	Between 10% and 25%	Between 25% and 50%	Between 50% and 75%	More than 75%
Vegetables					
Fruit					

19. To whom did your shop sell the locally produced fruit and vegetables

	Percentage (%)
Residents	19.1.1
College	19.2.1
Tourists	19.3.1
Restaurants	19.4.1
Other (Please Specify)	19.5.1

20. From where did you get the items you sold in your shop?

^{0.1}Sleat local farmers

^{0.2}Sleat Households with excess production from their gardens

^{0.3}Other (Please specify)

D. WASTE

21. How much waste (excluding electronic waste) did you generate per month in 2010?

Type of waste	Number of bags per month	Bag size (Litre)	Percentage sent to recycling points (%)	Internal reuse (%)	Collected by
Un-separated Waste	21.1.1	21.1.2			21.1.3
Separated Waste	21.2.1	21.2.2	21.2.3	21.2.4	21.2.5

22. How did you dispose of the following waste item in the last 2 years? Please fill-in the quantity and tick the appropriate option

Item	Quantity	Dumped together with household waste to municipal collection	Collection point			Others, specify in below column
			Kilmore church	School recycling box	Post Office	
Mobile phone	22.1.1	22.1.2		22.1.4		22.1.5
Batteries	22.2.1	22.2.2	22.2.3		22.2.5	22.2.6



23. Which of the following activities organized by Clean Sleat Project did your household take part in?

Activities	¹ Yes	² No
^{23.1} We practice waste recycling		
^{23.2} We participated in "Waste to useful" product competitions at the local school		
^{23.3} We have a recycling bin at home		
^{23.4} We take my used textiles to the collection point at Broadford		
^{23.5} We have visited Clean Sleat Website's Recycling Message Board		
^{23.6} We have posted and exchanged used items on the Clean Sleat Website's Recycling Message Board		
^{23.7} We went to the car boot sale to look for second-hand items		
^{23.8} We bought/sold items at the car boot sale		

24. Rank the 5 most useful activities (1-5) for waste management in Sleat? 1-most useful 5-less useful.

Activities	Rank	Comments/Suggestions
Encouraging use of reusable nappies instead of disposables	24.1.1	24.1.2
Encouraging recycling in general and local recycling in particular	24.2.1	24.2.2
At home bin recycling	24.3.1	24.3.2
"Waste to useful" product competitions at the local school	24.4.1	24.4.2
Batteries collection at Kilmore church and/or Post Office	24.5.1	24.5.2
Textile collection in Broadford	24.6.1	24.6.2
Mobile phone recycling at school	24.7.1	24.7.2
Car boot sale to encourage reuse practice	24.8.1	24.8.2
Recycling message board on website	24.9.1	24.9.2

25. How satisfied are you with the current waste management situation in Sleat?

- ¹ Not satisfied
- ² Partially satisfied
- ³ Satisfied
- ⁴ Very satisfied
- ⁹⁹ No answer

26. Do you have any suggestions to improve the waste management situation in Sleat?

Thank you for your kind cooperation!



EEM-SESAM IC 2011

Interview with Bus Company

Interviewer's name: _____

1. Please provide us with the following information

Year	No. of passengers		Fuel consumption
	Residents	Tourist	
2007			
2008			
2009			
2010			

2. Have you heard of the Clean Sleet project?

- Yes
- No (Please go to question 19)

3. Have you made any changes in the service you provide since 2008?

- Yes
- No (Please go to 6)

4. What did you change?

5. Has Clean Sleet project contributed to the improvements you made in your service?

- Yes
- No

6. What could you do to improve your service?

Thank you for your kind cooperation

EEM-SESAM IC 2011

Interview with Ferry Company

Interviewer's name: _____

7. What is the distance travelled by the ferry? _____

8. Please provide us with the following information (estimation of tourist among passengers)

Year	No. of vehicles		No of passengers		Fuel consumption
	Winter	Summer	Winter	Summer	
2007					
2008					
2009					
2010					

9. Have you made any changes in the service you provide since 2008?

- Yes
- No (Please go to 11)

10. What did you change? (Frequency, Fee, Punctuality, Comfort, Coordination with bus and train)

11. Have you heard of the Clean Sleet project?

- Yes
- No (Please go to question 13)

12. Has the Clean Sleet project contributed to the improvements you made in your service?

- Yes, please specify _____
- No

13. What could you do to improve your service?

Thank you for your kind cooperation



EEM-SESAM IC 2011

Interview with Taxi Company

Interviewer's name: _____

14. Please provide us with the following information

Year	No. of passengers		Distance travelled	Remarks
	Subsidised	Not subsidised		
2007				
2008				
2009				
2010				

15. Which travels are subsidised? _____

16. Have you heard of the Clean Sleet Project?

Yes

No (Please go to question 19)

17. Has the Clean Sleet Project assisted you to improve your service?

Yes

No (Please go to question 6)

18. What was the contribution of Clean Sleet Project in improving your service?

19. What could you do to improve your service?

Thank you for your kind cooperation



Annex 2: Direct Energy

Conversion factors

1 bag of coal	50	kg
1 Medium truck load	7,5	tonnes
1 6.5" log	0,0023	m ³
1 log of wood	2	kg
Density of pine wood	545	Kg/m ³
1 bag of wood	10	Kg
Density of Heating Oil	890,13	Kg/m ³
1 litre of gas	0,51	Kg
1 Gas cylinder	47	kg of gas

Heating values IPCC

Wood	25,9	MJ/Kg
Peat	28,4	MJ/Kg
Bituminous Coal	24,4	MJ/Kg
Heating Oil	19,8	MJ/Kg
Gas (Propane)	18,9	MJ/Kg

Emission factors for combustion

Wood (Renewable Forests)	112	t CO ₂ /TJ
Peat	106	t CO ₂ /TJ
Bituminous Coal	95	t CO ₂ /TJ
Heating Oil	74	t CO ₂ /TJ
Gas (Propane)	73	t CO ₂ /TJ
Electricity	0,41	kg CO ₂ /kWh

Formulas used



Annex 3: Waste

Volume of waste arising (Highland Council, 2010)

Sleat RCV collected (tonnes)		
	2007	2010
Refuse	423	311
Recycling	-	49
Total	423	360

Sleat recycling points (tonnes)		
Material	2007	2010
Glass	18	14
Paper	25	17
Cans	2	1
Textiles	-	4
Total	45	35

Density of waste components (SESAM International Class 2009)

	kg/l
Plastic	0.023
Paper	0.048
Glass	0.326
Food waste	0.505
Clothing	0.139
Cans	0.037
Mixed waste	0.133

CO₂ emissions (kg/year)



Waste Carbon Footprint

a. Highland Council Sleat waste arising data (2010)

recyclable materials (ton/a)		carbon emissions reduction (ton/a)		saved carbon emissions (tonnes/a)
2008	2010	2008	2010	
39.84	84	44.41	111.85	28

b. Institutions (primary school, college), hotel and small business (survey result)

Type of Waste	2007	2010	recycle arising tonnes/a	embodied energy MJ/tonnes	saved Embodied Energy MJ/tonnes	saved CO2 emissions tonnes/a
	recycling	recycling (blue bin & recycling point)				
	tonnes/a	tonnes/a				
Institutions*, hotel, small business						
Plastic	0	4.65	4.65	80000	40800	21.42
Paper	6.34	12.22	5.88	15000	7650	5.07
Glass	9	9.03	0.03	21000	10710	0.04
Clothing	1	1.16	0.16	20000	10200	0.19
Metal	0.30	2.89	2.58	60000	30600	8.92
Total	16.64	29.95	13.31			35.63

*: institutions are primary school and college



Annex 4: Transport

Unit	Transport mode							
	Petrol Cars	Diesel Cars	Bicycle (Replacement of petrol car)	Bicycle- Replacement of Diesel Car	Bus	Train	Ferry	Taxi
Transport mode-kms	122 682	100 376	17 946	14 683	53 183	65 532	1 946	1 855
Average km per Litre	15.43	14.86	15	14.86	14.86			
Total fuel consumption	7 951	6 756	1 163	988	3 579.51			
kg of CO2 emission per p-km					0.05	0.06	0.28	0.11
Uplift factor	1.45	1.45	1.45	1.45	1.60			
Weight of CO2 in Kg per litre of fuel	2.36	2.50	2.36	2.50	2.50			
Corresponding CO ₂ emissions in kg	27 209	24 490	3 980	3 583	14 318.02	3 932	545	204
Total CO ₂	51 699		7 563		14 318.02	3 932	545	204
Net savings in kg	40 200							



Annex 5: Food

Calculation for Household		
Total Increase of Food production for food and vegetable	329.57	kg
Embodied energy	4	MJ/kg
Energy	1318.28	MJ
Total CO ₂ reduction	0.18324092	t CO ₂
Calculation for Hotel		
Total Increase of Food production for food and vegetable	1100	Kg
Embodied energy	4	MJ/kg
Energy	4400	MJ
CO ₂ reduction	0.6116	t CO ₂
Calculation for College		
Total increase of food production for food and vegetables	250	Kg
CO ₂ reduction	0.139	t CO ₂
Total CO₂ reduction of household, hotel and college	0.933841	tCO₂



Annex 6: Scenarios

Heating Insulation Scenario

Total Heating Consumption (KWh)

CO₂ emissions (kg/year)

CO₂ emissions factor (SESAM International Class 2008)

Energy Source	kg CO ₂ per kWh
Electricity	0.406
Gas	0.19
Oil	0.26
Wood	0
Coal	0.3
Peat	0.3816

Energy savings

CO₂ savings

