

Carbon Footprint of the West Wales ECO Centre in 2008

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1. Executive summary

The West Wales ECO Centre specialises in the promotion and showcasing of sustainable energy use. This report provides the ECO Centre with a formal assessment of its own carbon footprint for the first time.

In 2008 16.11 tonnes of carbon dioxide (CO₂) were attributable to the organisation. This included fuels used directly, electricity consumption and indirect energy use resulting from staff commuting plus paper production and use.

Transport by staff travelling to work and business travel was by far the biggest contributor, responsible for 82% of total emissions.

The organisation performs well against benchmarks for similar organisations due to significant efforts already taken to reduce its carbon footprint. Further actions have been identified, which the organisation could take in the future.

2. Introduction

2.1 The West Wales ECO Centre and project aims

The West Wales ECO Centre, based in Newport Pembrokeshire, is a charity and non-profit making business established in 1980. The ECO Centre aims to promote environmental issues; primarily those surrounding climate change and sustainable energy use. It is involved in activities throughout Wales and works with a diverse range of partners including local authorities, utility companies, the Energy Saving Trust and community groups.

The ECO Centre has always strived to practice what it preaches in terms of energy use and energy conservation and is keen to ensure it remains a practical resource for showcasing energy conservation measures from low energy lighting to internal wall insulation as well as renewable energy technologies such as solar PV (photovoltaic's) and solar hot water. As yet the organisation has never undertaken an audit of its own site or published publicly available data about its own carbon footprint. The aim of this report is to provide the ECO Centre with a clear picture of its energy use and associated carbon footprint for the first time, based on the calendar year 2008. The report also identifies achievements already made, as well as improvements that could reduce the Centre's carbon footprint further.

2.2 What is a carbon footprint and why do one?

A Carbon Footprint is an assessment of the amount of carbon dioxide and other greenhouse gases an organisation is responsible for as a result of undertaking its typical activities. Carbon footprints are also commonly calculated for events, products and personal journeys.

In order to address the global threat of climate change it is important organisations understand their impact. Undertaking a carbon footprinting exercise to quantify the greenhouse gases, primarily carbon dioxide, attributable to an organisation is the first step in realising their impact and initiating a programme of activity to reduce emissions. As well as providing the organisation with tool for ongoing energy and environmental management a carbon footprint can be a valuable asset for communicating with stakeholders, promoting the achievements of the organisation and a practical illustration of environmental commitment.

Carbon and environmental accounting is becoming increasingly important as government regulations and reporting requirements such as the Carbon Reduction Commitment are affecting progressively more organisations.

3. Site Information

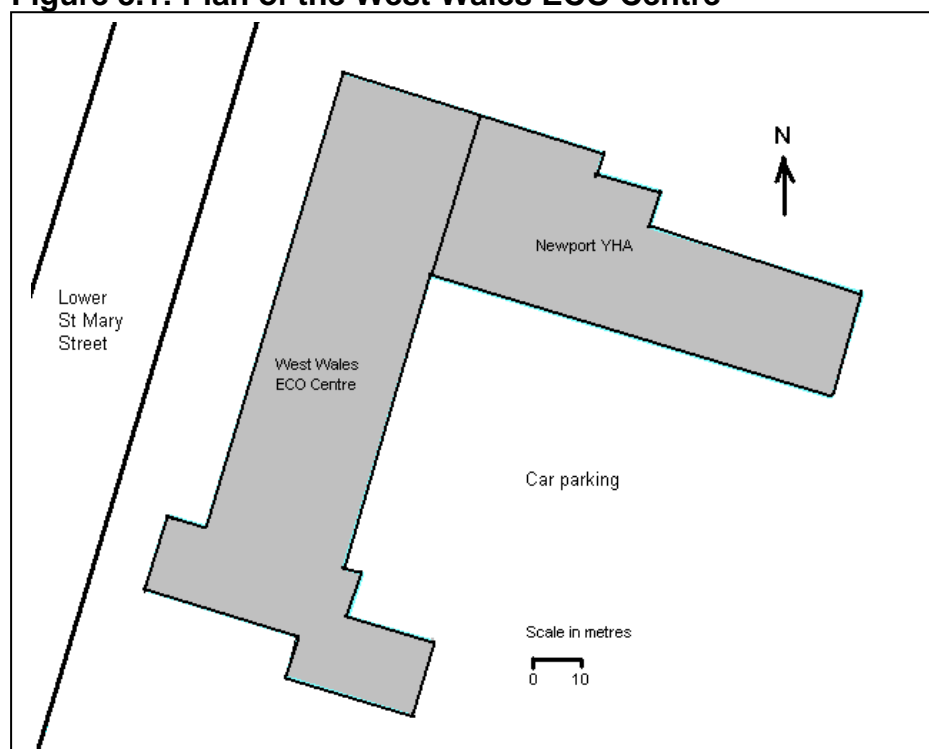
3.1 Location and site description.

The ECO Centre is located within a residential area of the small coastal town of Newport, Pembrokeshire. The 2-storey detached building is of pre 1900 solid stone construction (a typically ‘hard to heat’ building) and was originally used as school. Leased from Pembrokeshire County Council, the ECO Centre shares the site with Newport YHA, which occupies one arm of the building. Location details are given in the table and plan below.

Table 3.1

Address	Grid Ref	Contact Number	Website
West Wales ECO Centre, Lower St. Mary Street, Newport, Pembrokeshire, SA42 0TS	SN 058 393	01239 820235	www.ecocentre.org.uk

Figure 3.1: Plan of the West Wales ECO Centre



The ECO Centre occupies a total of 7 offices; 4 are in permanent use, 1 is used regularly as a community room and meeting room, the remaining 2 are used sporadically and for storage purposes. In addition two rooms of the ground floor house a small visitor centre, open to the public throughout the year, which provides information and showcases sustainable energy solutions. There is a small kitchen area with tea and coffee making facilities.

In 2008 there were 9 full time members of staff and 2 part time. Working hours are 8.30 to 5.30, approx 252 days a year.

Activities are largely office based and resource consumption is small, with a large proportion of work done electronically. Work activities do however require a relatively large amount of travelling, as the ECO Centre is located in a rural and sparsely populated area.

The building uses quite a complex energy mix. There is a natural gas wet central heating system heating most of the building, plus a wood pellet stove in the largest office. Hot water demand is minimal and provided by small electric instantaneous heaters over the sinks. Electricity is sourced via the national grid, although the ECO Centre also exports a small amount of electricity generated from its own array of photovoltaic solar panels. Imported grid electricity is sourced from a green supply. There are also solar hot water panels installed but at present these only supply a small demonstration tank in the visitor centre. There are two company vehicles; one runs on Diesel the other is a petrol hybrid.

3.2 Defining the scope of the West Wales ECO Centre's carbon footprint

Carbon footprints vary greatly in their complexity depending on the scope of the exercise undertaken. Decisions need to be taken about whether procurement of resources and services are included, if so which ones and how far down the supply chains emissions are traced. The first step in beginning to calculate a carbon footprint of any kind is to clearly define the scope. In order to achieve this in a structured way emissions attributable to the activities of the West Wales ECO Centre have been divided into 3 different groups:

Direct emissions: These result from the activities the organisation has direct control over and include the combustion of natural gas and wood pellets for space heating, also the combustion of diesel and petrol in company vehicles.

Indirect emissions from the use of grid electricity: Emissions associated with electricity that arrives through the grid are not directly within the organisations control. Purchasing electricity from a supplier makes the ECO Centre indirectly responsible for any emissions associated with it, warranting a separate category in this report specifically for grid electricity.

Other Indirect emissions: These are emissions that arise as a consequence of the ECO Centre's activities but again are not directly within its control. In identifying activities for this category of emissions the following considerations were taken into account: Are the emissions attributable to the activity significant compared to the other two categories? Are they activities that would be deemed critical by stakeholders? Do they represent opportunities for the organisation to make emission reductions? Are they activities that are likely to be double counted i.e. also accounted for by the organisation directly responsible for them?

Three activities were discussed with the ECO Centre director; waste disposal, paper production and use and staff travel to and from work. Due to small quantities of waste generation it was decided that paper use and staff travel to and from work represented the most significant and relevant indirect impacts and should be the focus of the 'other indirect emissions' category.

4. Energy Use

4.1 Overall annual energy use.

All the data below refers to the calendar year of 2008.

Total Annual Energy Use = **291.95 GJ**

Total Annual Energy Cost = **£4,064.30**

Monetary costs of indirect use (staff commuter miles and paper production) are not quantified, as they are not paid for directly by the ECO Centre. They could be considered to be embedded in other costs i.e. staff salaries and paper purchase price respectively.

4.2 Breakdown of energy consumption into direct, indirect- electricity and indirect-other categories

As explained in the previous section calculated emissions will fall into 3 groups. The tables below break down the overall energy use into these three groups.

Conversion figures and calculations are detailed in Appendix 1.

Table 4.1: Direct energy use.

Energy Form	Annual quantity				% of total energy use	Annual cost (£)	Energy cost (£/GJ)
	Tonnes	Litres	kWh	GJ			
Natural Gas			13,213	47.57	16.29	£504.55	£10.61
Wood pellets	0.4		1,920	6.91	2.37	£78.5	£11.36
Diesel used in Landrover		398.63	4,345	15.64	5.36	£467.85	£29.91
Petrol used in hybrid car.		1451.66	13,936	50.17	17.18	£1,537.66	£30.65

Table 4.2: Grid electricity consumption (indirect).

Energy Form	Annual quantity		% of total energy use	Annual cost	Energy cost (£/GJ)
	kWh	GJ			
Electricity	8,788	31.64	10.84	£1,475.74	£46.64

Table 4.3: Indirect energy consumption from other activities

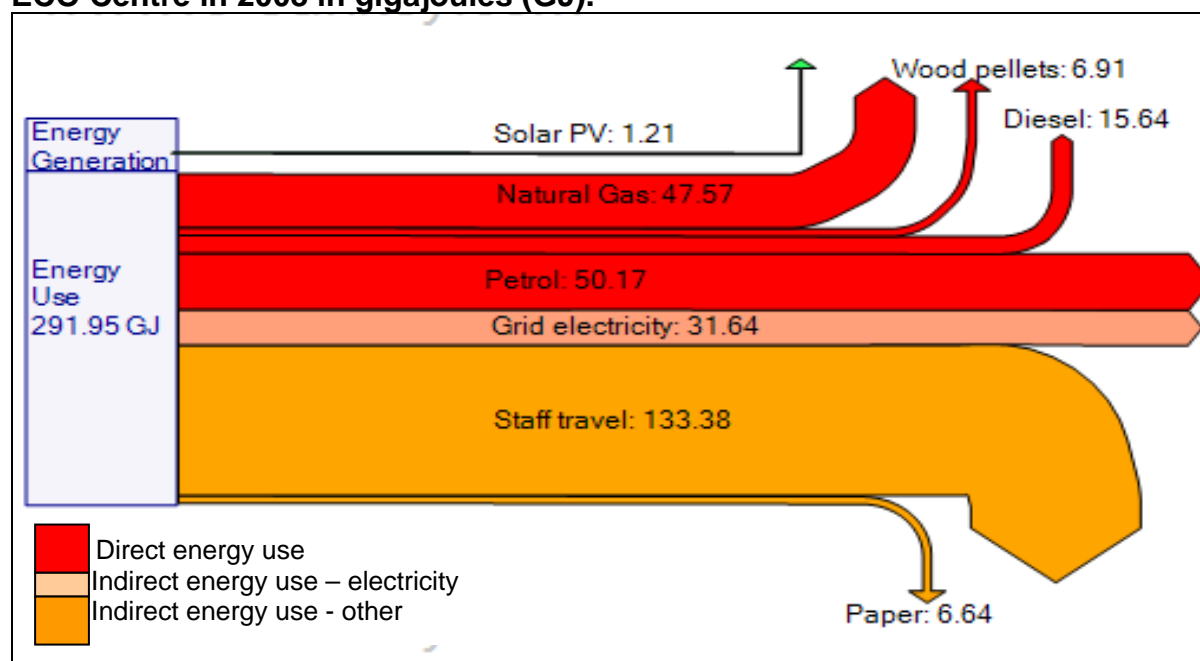
Energy Form	Annual quantity		% of total energy use
	kWh	GJ	
Staff travel to and from work	37,051	133.38	45.69
Paper	1,844	6.64	2.27

Table 4.4: Electricity generated on site and exported to grid.

Energy Form	Annual quantity		Annual income	Energy income (£/GJ)
	kWh	GJ		
Electricity	335	1.21	£15	£12.40

The data in tables 4.1 to 4.4 is summarised in the Sankey diagram below. All the different energy flows attributable to the ECO Centre are shown proportionately by the width of the arrows. Staff travel is clearly the largest energy user, with more energy being used by this one activity than all the direct energy uses added together and 46% of total energy use.

Figure 4.1: Sankey diagram showing energy flows at the West Wales ECO Centre in 2008 in gigajoules (GJ).



5. Calculation of the ECO Centre's Carbon Footprint

In 2008 the West Wales ECO Centre's Carbon Footprint was 16,108kg (16.11 tonnes) of CO₂. Equivalent of 64kg per working day.

This included energy used on site plus energy involved in the production of paper used by the ECO Centre and miles travelled by staff commuting to work by car.

Figure 5.1: 2008 Carbon Footprint of the West Wales ECO Centre in kg's of CO₂.

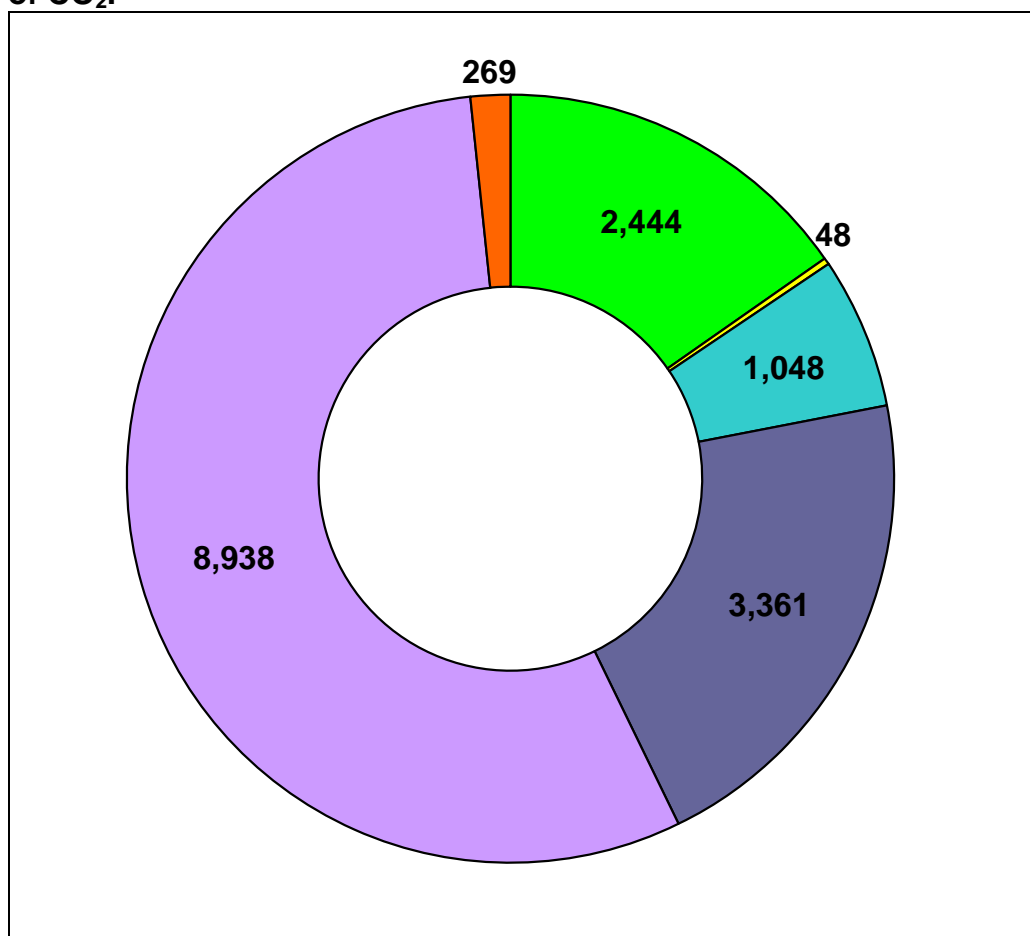


Table 5.1: Key and CO₂ data

		Kg's of CO₂
	Natural gas	2,444.41
	Wood pellets	48
	Diesel	1,048.40
	Petrol	3,360.60
n/a	Imported grid electricity	0
	Staff travel	8,937.65
	Paper	269.12
	Total:	16,108.41

Conversion figures and calculations are outlined in detail in Appendix 1 and 2.

6. Achievements and potential improvements

6.1 Performance against sector benchmarks

In order to get some indication of how the ECO Centre's energy consumption and attributable CO₂ emissions compare with other similar organisations data from this report was entered into the Carbon Trusts online benchmarking tool for offices. The tool takes account of direct energy and electricity use. It does not deal with any indirect factors such as commuter travel or resources and services used by an organisation. The graphs below were calculated using treated floor space area of 218.78 m². This area is exclusive of units 1 and 2; as they are unheated, with minimal energy use and used very sporadically it was felt that their inclusion could skew results. The 114 units of electricity use associated with these units were also excluded from the benchmarking calculation.

Figure 6.1: Direct fossil fuel use

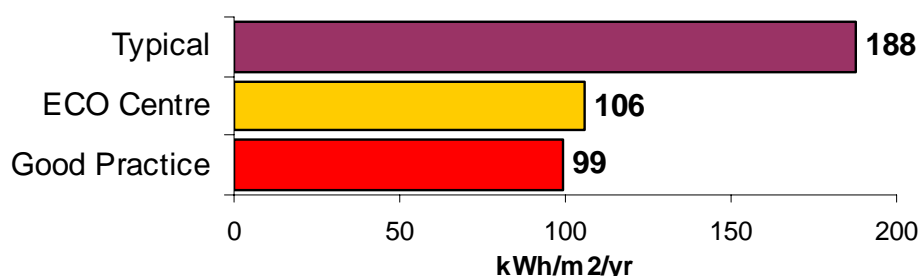


Figure 6.2: Grid electricity use.

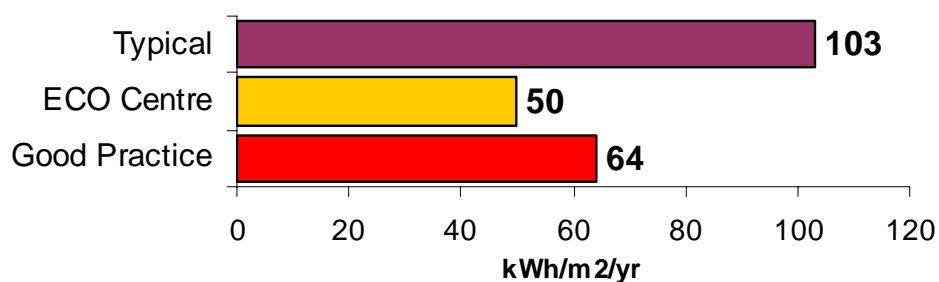
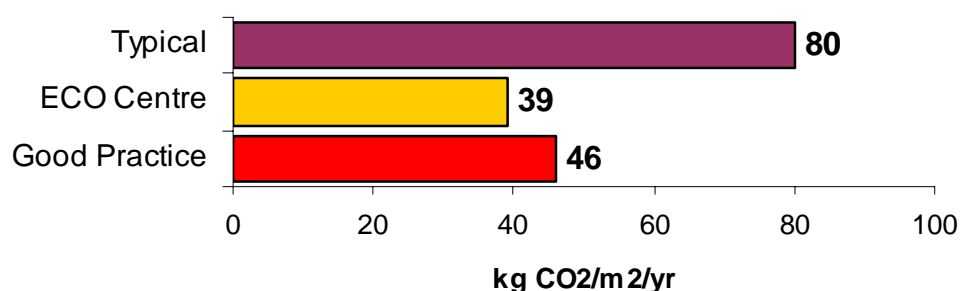


Figure 6.3: Carbon dioxide emissions associated with direct fossil fuel and grid electricity use.



The graphs show the ECO Centre performs well in all 3 categories; direct fossil fuel use, grid electricity use and relative CO₂ emissions, exceeding typical performance in each area and even exceeding good practice benchmarks for electricity use and CO₂ emissions.

Figure 5.1 in the previous section reflects the fact that the ECO Centre purchases its electricity from Good Energy, who source their electricity from renewables, as a zero conversion factor has been applied in line with Defra and Carbon Trust guidance. However, it is not reflected in figure 6.3 above as there is no facility on the benchmarking tool to account for a renewably sourced electricity supply.

6.2 Achievements

The ECO Centre has already taken significant steps towards reducing its carbon footprint, for which due credit should be given. These are summarised briefly below.

6.2.1. Condensing boiler and heating controls package.

The offices are heated by a 2 year old 24kW Worcester Greenstar Ri, condensing boiler. The SEDBUK (Seasonal efficiency Rating for Domestic Boilers in the UK) rating is 90.2%. A condensing boiler will reduce fuel consumption by 30-40% relative to an old, inefficient standard boiler. The ECO Centre also uses a full controls package; programmer, room thermostat and thermostatic radiator valves, to ensure efficient operation of the heating system and aims to service the boiler annually.

Estimated annual saving based on an assumed 35% reduction in gas consumption = 1316kg CO₂/yr

6.2.2. Lease of a hybrid company car.

The company currently leases a hybrid car, which is used by all members of staff for company business. Defra recommend a conversion factor of 0.2031 kg/CO₂/mile, which compared to the conversion factor for a comparable size petrol car of 0.3479 represents a 42% saving of 0.1448 kgCO₂/mile.



Estimated annual saving based on 2008 mileage = 1,411 kg/CO₂/year

6.2.3. Purchase of recycled paper and recycling after use.

The company has committed to purchasing recycled rather than virgin pulp paper and also re-uses and recycles waste paper rather than sending it to landfill. Based on data from the Environmental Defense (U.S.) paper calculator this results in a saving of 870kg CO₂e (carbon emissions equivalent) per metric tonne of paper produced and used.

Estimated annual saving = 158kg/CO₂e/year

CO₂e is specified here as there are other greenhouse gas emissions, largely methane, which are associated with landfilling waste paper, these are accounted for by the paper calculator.

6.2.4. Use of renewable energy.

The wood pellet stove, which is situated in the largest open plan office has replaced the need for supplementary electric heating in winter. In addition every unit of electricity imported from the grid is all sourced from a renewable supply. The Carbon Trust recommends a conversion figure of 0.537 kg CO₂/kWh for standard electricity.



Estimated annual saving = 5,702 kg CO₂/yr



6.2.5. Generation of renewable energy.

Mounted on the south facing roof of the ECO Centre is an array of 6 Siemens M-75 modules, with a peak output of 450 watts (450 joules per second) and a predicted annual output of 315kWh. Although the panels are exceeding predictions, with an output of 335 kWh in 2008, the relative level of electricity

generation is very small, just 3.8% of the total electricity demand in 2008. Electricity generated is sold to Southern Electric but the income is poor-approximately £12.40/GJ compared to the £46.64/GJ it is purchased at. However the solar p.v. array provides an important demonstration to visitors to the ECO Centre and also represents an opportunity for the ECO Centre to begin generating even more electricity on site, as discussed in the next section.

6.3 Areas for improvement

The ECO Centre has clearly made significant attempts to reduce its carbon footprint, however there are some areas where further savings are possible. These are discussed in turn, the primary recommendations and their potential costs and savings are then summarised in table 6.5.

6.3.1 Staff travel in and out of work.

55% of the ECO Centres carbon footprint (and 46% of total energy use) is attributable to staff travel to and from work. Whilst some are able to walk to work the majority live more than 3 miles away and rely on a car. The high proportion of car reliant commuters is inevitable to some degree due to the rural nature of the county and also the fact that the ECO Centre is located in a town where housing costs are particularly high due to the desirable coastal location. However, Newport does have the advantage of being on the main Fishguard to Cardigan road, serviced by an hourly bus service and heavily used by other commuters travelling between these towns.

The tables below demonstrate the possible CO₂ savings of implementing a car-sharing scheme or partial use of buses.

Table 6.1: Estimated potential savings from implementing car sharing on the Mathry – Newport route for approx. 50% of journeys

	Miles travelled in 2008	CO ₂ emissions in 2008	Miles if 50% of journeys car shared	CO ₂ emissions with car sharing
Mathry	5,460	2,268	5,460	2,268
Harmony	5,040	1,227	2,520	613.5
Dinas	1,260	367	630	183.5
Totals:		3,862		3,065

Potential saving = 797kg CO₂/yr , 8.9% of staff travel emissions, 4.9% of total emissions.

Table 6.2: Estimated potential savings from utilising bus transport between Fishguard and Newport for 50% of journeys.

	Miles travelled in 2008	Kgs of CO ₂ in 2008	Miles if Fishguard to Newport stretch bussed for 50% of journeys.	Kgs of CO ₂ with bus use.
Mathry	5,460	2,268	3,990 car 1,470 bus	1657.05 130.98
Harmony	5,040	1,227	3,570 car 1,470 bus	875.72 130.98
Dinas	1,260	367	630 car 630 bus	183.5 56.13
		3,862		3,034.36

Potential saving = 828 kg CO₂/yr, 9.3% of staff travel emissions, 5.1% of total emissions.

The ECO Centre could consider incentives to encourage staff to implement initiatives that reduce the impact of their journeys into work. For example bus travel can in fact be the more costly option, one incentive could be to subsidise those using the bus, or offer time-off credits.

In addition to looking at the way in which people travel to work, some thought could be given to measures that reduce *need* to travel. These include flexi working, home working, compressed working week and even staff or premises re-location.

6.3.2 Business Travel

Another 27% of the Carbon footprint is attributable to business travel using the company vehicles. Added to staff commuting a total of 82% of the ECO Centre's carbon footprint is attributable to the combustion of diesel and petrol for transport purposes.

The ECO Centre has already acknowledged the impact of business travel and addressed this by leasing a hybrid car in order to use petrol more efficiently. Whilst the landrover is a highly inefficient vehicle it is considered a necessary piece of equipment for taking a display trailer to summer shows and events. As with staff travel in and out of work a key consideration for business travel is how to reduce the need to travel. Measures could include: video conferencing, use of train for longer journeys where possible and journey planning.

6.3.3 Heating

Whilst the intention is to service the boiler annually a full service has not actually been completed since the boiler was installed 2 years ago. Annual servicing of the boiler will maintain optimum efficiency by ensuring correct fuel to air ratios and maximising general burner efficiency and heat transfer. It is also recommended that the ECO Centre begin taking regular gas readings (electricity meters are already read weekly) this would enable the company to chart its gas use for heating against degree day data. If the heating system is being managed effectively, trends in energy consumption will mirror trends in degree-days data. Any deviation would quickly alert the company to a problem.

6.3.4 Electrical use

Although electrical use won't have an impact on CO₂ emissions energy, as the ECO Centre sources all its electricity from renewable sources, efficient use of electricity remains an important principle. General energy housekeeping is good, staff minimise standby consumption and desks are located to make use of natural light where possible etc. However during discussions with the company director two specific areas of interest arose; the majority of workstations still have old CRT screens, plus the fluorescent tube lighting throughout the office is largely the more inefficient T12 bulbs. Tables 6.3 and 6.4 below illustrate the savings that could be made by upgrading the screens and bulbs respectively.

Table 6.3: Potential savings from changing old CRT screens to LCD.

Number of CRT screens in use.	Assumed hours/year/ screen	Estimated current annual consumption	Annual consumption with LCD screens. (36w on, 1w sleep)	Annual saving	
				kWh	CO2
11	On mode – 1,050 hours @ 61w Sleep mode – 420 hours @ 4w	723kWh	420kWh	303	0

Table 6.4: Potential savings from switching to T5 fluorescent tubes.

Type of bulb	Number of bulbs	Assumed hours/year	Estimated current annual consumption	Consumption if T12's and T8's replaced with 28 and 35W T5's	Annual saving	
					kWh	CO2
T8 1200 36W	5	2268	408 kWh	318 kWh	90	0
T12 1500 75W	21	2268	3,572 kWh	1,667 kWh	1,905	0
				TOTAL:	1,995	0

A policy of “replacement with energy efficient alternative at end of life” would help spread the cost of these measures as well as avoiding any debate about whether disposal of working products in favour of energy efficient ones is actually more resource consuming than using old ones until they expire.

6.3.6 PV generation.

Generating an equivalent of 3.8% of the total electricity demand the ECO Centre is by far a net importer. With increasing public interest in small scale and community scale renewable energy projects the ECO Centre is interested in extending the current PV array, enabling it to generate enough electricity to claim ROC's (Renewable Obligation Certificates). The UK Renewables Obligation is a legislative requirement on all licensed electricity suppliers to source an increasing percentage of their electricity from renewables. The acquisition of ROC's by suppliers, through purchase or self-generation, is the means of implementing the RO. One ROC accompanies every MWh of renewable electricity produced, therefore to generate enough electricity for 1 ROC the ECO Centre would have to increase the size of its current solar array by 3-4 times. This would be a high cost initiative motivated primarily by the ECO Centre's interest in showcasing renewable energy systems and promoting understanding of renewable energy markets.

In order to properly evaluate the full implications and opportunities of an activity like this a detailed feasibility study is required. This would need to include a full economic analysis as well as investigating associated issues such as planning, the different available technologies and the regulatory system surrounding the buying and selling of ROC's.

6.3.7 Energy management procedures

The ECO Centre has excellent monitoring procedures for electricity. Monitoring of other fuels is undertaken but primarily through financial records. In order to effectively manage energy and related CO₂ emissions it is important to regard it as a controllable resource rather than a business overhead. To achieve this a more thorough monitoring system is needed that pools information about all the different fuels used in one place and enables the organisation to relate energy consumption patterns to other factors that affect it such as staffing levels or weather patterns.

Having a clearer overview of annual energy use is the first step in establishing a systematic monitoring and targeting programme, whereby there is a continuous cycle of reviewing energy use, setting appropriate and achievable targets, justifying expenditure, monitoring improvements and identifying new opportunities. In addition good energy management quickly alerts an organisation to areas of energy wastage that arise and provides useful feedback for staff and other stakeholders.

The ECO Centre does have a Green Dragon Environmental Management System in place and this could provide a useful framework for developing energy management procedures.

One member of staff has established his own very thorough monitoring procedure for commuter travel and logs mileage and fuel consumption on a spreadsheet, enabling him to calculate miles per gallon and CO₂ per mile based on actual data. His example provides an illustration of the importance of real-life data, as his self calculated conversion factor of 0.213kgCO₂/ mile for a small petrol engine is somewhat lower than the Defra/Carbon Trust figure of 0.2912. This could be a reflection of official figures used in this desktop study being based on a more urban driving scenario. Awareness of energy consumption and its impacts is likely to be a key factor in motivating staff to be more energy efficient in their behaviour. Therefore a spreadsheet such as this could be cited as an example of best practice and offered as a tool for other drivers.

Table 6.5: Summary of recommendations showing potential impact on carbon footprint.

Description of recommendation	Fuel type	Estimated annual savings			Estimated cost of implementation	Payback period
		Kg CO2	%	£		
1. Implement measures to reduce indirect emissions from staff travelling to work through partial bus use	Diesel /petrol	828	5.1	0	Indirect therefore cost not direct to ECO Centre, although incentive could be offered.	-
2. Regularly service boiler and take gas meter readings	Gas	Maintain high efficiency of new condensing boiler.			Maintenance cost.	-
3. Replace 5 T8 and 21 T12 bulbs on ground floor of main building with T5's	Elec	0 (1,995 kWh)	0	£353	£455 (Lamps approx. £2.50, conversion kits approx £15)	1 year 4 months
4. Replace remaining CRT screens with LCD flat screens.	Elec	0 (303 kWh)	0	£54	£1,100	>10years
5. Improve monitoring procedures, review energy management practices and implement best practice procedures.	Gas	No direct savings. But worthwhile activity as likely to lead to savings by helping identify problem areas, raising staff motivation, developing monitoring and targeting plans and making the case for investment to senior management.				

7. Conclusions

The Carbon Footprint of the West Wales ECO Centre indicates that the indirect impacts are certainly as significant as the direct impacts. Commuter travel to and from work was responsible for 55% of the organisations total carbon footprint of 16.11 tonnes of CO₂ in 2008 and also represents the area with greatest potential for making savings.

Electricity use, direct energy consumption and related CO₂ emissions, perform very well against Carbon Trust benchmarks for both typical and good practice scenarios within the office sector. It is clear the organisation has already taken a lot of significant steps towards reducing its direct carbon footprint. Due to the fact the ECO Centre sources all its electricity from a supplier with a 100% renewables fuel mix the recommendations in this report related to on site energy consumption do not effect the CO₂ emissions, only the annual energy consumption.

The challenge of reducing its carbon footprint further is becoming greater as the ECO Centre needs to increasingly look externally and in more detail at the carbon footprint of its indirect impacts; initially commuter travel but potentially expanded to the goods and services it purchases and their supply chains, all of which are outside the organisations direct control.

An additional challenge for the ECO Centre is that as a small charitable organisation its people/time and financial resources are more limited than those of a large profitable company. Investment, whether it be staff time in developing monitoring and targeting procedures or financial investment options to implement new measures, may be harder to justify .

For the purpose of this report guidance has been taken from the Greenhouse Gas Protocol produced by the World Resources Institute and the World Business Council for Sustainable Development, and also the relatively new publicly available British standard PAS 2050 for carbon footprinting goods and services. There is also an ISO 14064 providing corporate guidance on carbon footprinting. Emerging national and international standards mean there is huge variation in the way calculations are done and the way footprints are expressed. The ECO Centre should be aware of this both when looking at carbon footprints done by other organisations and promoting its own.

Acknowledgements:

Thanks to Jake Hollyfield and other members of the ECO Centre staff for their time and input.

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Appendix 1: Fuel consumption data for 2008

Table 1: Direct fuels:

	Weight (tonnes)	Units	Litres	kWh	Cost
Gas (Information taken from quarterly bills)		422 cubic ft.		13,213	£504.55
Wood pellets (Information from delivery invoices and an estimated apportioning of delivery to calendar year 2008)	0.4 (10kg bags x40)			1,920 (Calorific value given on bag = 48kWh /bag)	£78.5 (£1.75/ bag plus 5% VAT and £5 delivery)
Diesel for Landrover (Taken from fuel card invoice)			398.63	4,345 (10.9 kWh/litre of diesel)	£467.85
Petrol for hybrid car (Taken from fuel card invoice)			1451.66	13,936 (9.6 kWh/litre of petrol)	£1,537.66

Table 2: Electricity consumption:

Meter and corresponding Room/Office	kWh	Area	Notes:
Unit 1– Meter C	92	43.85m ²	
Unit 2– Meter B	22	25.73 m ²	SWALEC
Unit 3 Community Room – Meter A	504	39.67 m ²	Used approx 1 day/wk. Electric heating.
Unit 4 EEAC – Meter D	1,909	70.14 m ²	
Unit 5 Middle Office – Meter E	455	39.76 m ²	
Communal areas - Meter F	936	Communal areas	Paid to council
Old Caretakers House - Meter in visitor Centre	4,870	69.21 m ²	
Totals	8,788	288.36 m²	

Electricity costs for 2008 = £1,475.74

Unit 2

22 units @ 11.23 + standing charge @ 14.25/day + VAT@5% = £57.20

Old Caretaker House, Communal areas, Units 5, 4, 3 and 1

Jan 08 – 14/10/08 (287 days)

6589 units @ 14.60 + standing charge @ 5.96 +VAT @5% = £1,028.06

14/10/08 – Dec 08 (78 days)

2177 units @ 16.87 + standing charge @ 5.93 +VAT @5% = £390.48

NB// Meter F – Is charged for by council on their own rates plus 17.5%. As they are VAT registered they have to charge 17.5% VAT on anything they re-charge for. However, their charging has been quite erratic and it is unclear how the council calculate their charges, therefore for the purpose of this report electricity measured by meter F has been assumed to be subject to the same costs applied to the other meters.

(For the period 01/04/07 – 31/03/08 the council charged the ECO Centre £92.00 for electricity. Meter readings show approx 936 units were used multiplied by the Good Energy Tariff of 14. 6 pence per unit the cost would have been £136.65 excluding any standing charge or VAT, therefore the council charge was very reasonable)

Table 3: Electricity export:

	kWh	Price per unit
Electricity generated by PV panels and exported Units brought by southern electric	335	Approx 4.3p/unit (Based on £15.00 for 347 units in 2007)

Table 4: Indirect energy use.

	Number/yr	Mileage/yr	CO2 (kg)	Litres	kWh
Reams of paper¹ (Recycled paper, which is then recycled)	80 = 0.182 tonnes		269.12 (1,478.7 kg per metric tonne of paper)		1,844 (10,131.94 kWh per metric tonne)
Staff Mileage²	Assumes travel to work on 210 days/ year.				
Tim Harmony, small diesel engine		5,040 (24 miles/day)	1,227.24 0.2435 kg/mile	466.63 (2.630kg CO2/litre of diesel)	5,086.27 (10.9 kWh/litre of diesel)
Liz Llanfriog, 1.2 litre petrol. (1 day/wk 52 days.)		2,288 (44 miles/day)	666.27 0.2912 kg/mile	287.81 (2.315 kgCO2/litre of petrol)	2,762.98 (9.6 kWh/litre of petrol)
Tim Penycwm, 1.2 diesel. (Jan – May only 88 days)		4,400 (50 miles/day)	1,071.40 0.2435 kg/mile	407.38	4,440.44
Hugh Dinas, 1.4 litre petrol.		1,260 (6 miles/day)	366.66 0.2912 kg/mile	158.38	1,520.45
Darren Mathry, 2.2 litre diesel.		5,460 (26 miles/day)	2,267.54 0.4153 kg/mile	862.18	9,397.76
Jane Eglwysrwrw, 1.6 litre diesel. (April – Dec only, car sharing 25% of journeys– 138 days)		1,656 (12 miles/day)	403.24 0.2435 kg/mile	153.32	1,671.19
Matt Llandysul, 1.1 litre petrol engine.		10,080 (48 miles/day)	2,935.30 0.2912 kg/mile	1,267.95	12,172.32
Staff Mileage Totals:			8,937.65		37,051.41

1 Data used in calculations taken from research done by the Paper Task Force, in particular their report: Lifecycle Environmental Comparison: Virgin paper and recycled paper based systems. Measurements in this report were in American tons. Where appropriate figures were converted to be applicable to metric tonnes; 1 American ton = 0.91 metric tonnes.

2 All conversion figures used in the table above are taken from the Carbon Trusts 2008 update.

Appendix 2: CO₂ conversion calculations

Conversion factors used (Carbon Trust):

Natural Gas = 0.185 kg CO₂/kWh

Wood pellets = 0.025 kg CO₂/kWh. Carbon Trust guidance states that *“biomass is a low carbon, sustainable renewable energy source, but cannot be classed as carbon free. The carbon emissions associated with any agricultural and transport activities must also be taken into account.”*

Diesel = 2.630kg CO₂/litre of diesel

Petrol = 2.315 kgCO₂/litre of petrol

Grid electricity = 0. Defra guidance states a zero conversion factor can be applied if the company *“has entered into a renewables source contract with an energy supplier that has acquired Climate Change Levy Exemption Certificates for the electricity supplied”*. The ECO Centre purchases almost all its electricity from Good Energy, who source every unit from renewable sources and provide the ECO with exemption from the Climate Change Levy. For historical reasons one meter is still with SWALEC, this is also on a green tariff, in addition usage by this meter is minimal (22 units) well below the electricity generated by the ECO Centre PV array. It was therefore considered to apply a zero conversion factor to all the electricity units imported.

	Calculation details	Kg's of CO ₂ e
• Natural gas	13,213 x 0.185 kg CO ₂ /kWh	2444.41
• Wood pellets	1,920 x 0.025 kg CO ₂ /kWh	48
• Diesel	398.63 x 2.630kg CO ₂ /litre of diesel	1048.40
• Petrol	1451.66 x 2.315 kgCO ₂ /litre of petrol	3360.60
• Imported grid electricity	0	0
• Paper	0.182 tonnes x 1,478.7 kg per metric tonne of recycled paper	269.12
• Staff travel	See Table 4 in appendix 1 above for more details.	8,937.65
	Total =	16,108.41