Mukti Mitchell

Low Carbon Lifestyles are easy and fun, good for the planet and improve your quality of life! By making simple choices in the way we live, we can easily reduce our CO_2 and play our part in reducing national carbon dioxide emissions. This guide shows in simple steps just how to do it.

In the 2007 Low Carbon Lifestyle tour, Mukti Mitchell is sailing around Britain to promote low carbon lifestyles, endorsed by HRH The Prince of Wales, Tony Blair, David Cameron, Menzies Campbell, and leading environmentalists from James Lovelock to Zac Goldsmith.

Mukti lives by the sea in Devon. He designed and built the zero emission microyacht "Chance", nominated innovative boat of the year 2005, and the Resurgence Personal Carbon Dioxide Calculator, widely recognised as the best on-line. He has pioneered a low carbon lifestyle for 10 years, and his CO_2 emissions are 5 tonnes a year (half the national average).

Cover Printed on Greencoat Velvet 80% recycled, totally chlorine free. Text printed on Cyclus Offset, 100% post-consumer recycled waste. Printed using soya-based inks (vegetable).

Published by
The Low Carbon Lifestyle Tour
www.lowcarbonlifestyle.org

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THE LOW CARBON LIFESTYLE TOUR

The Low Carbon Lifestyle Tour 2007 - Sailing around Britain in a zero-emission microyacht to promote low carbon lifestyles. Endorsed by HRH The Prince of Wales, Tony Blair, David Cameron, Menzies Campbell, Caroline Lucas, James Lovelock, Jonathon Porritt, Zac Goldsmith, Tim Smit, Tony Juniper, Satish Kumar, Stephen Tindale, Crispin Tickell, Gerard Morgan Grenville and Jonathan Dimbleby. Sponsored by Resurgence, Co-operative Membership, The Phone Co-op, Ecotricity, Samskara Design, Annery-Kiln web design, The RH Southern Trust, The Ashden Trust and John Pontin Group. In association with The Green Blue.

For more information visit **www.lowcarbonlifestyle.org**

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Published in 2007 by
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Design by Samskara DESIGN www.samskara-design.com +44 (0)1803 840956

This guide book is available as a free electronic download from
www.lowcarbonlifestyle.org for the duration of the
Low Carbon Lifestye Tour 8th April – 14th October 2007.
During this period it may be distributed freely electronically,
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1. Introduction

A low carbon lifestyle is easy and fun, good for the planet, and improves your quality of life.

The planet is warming up, and the majority of the world's scientists say that humans are causing it by burning fossil fuels. We are doing this partly out of ignorance, and partly because we think changing might make us unhappy. The low carbon lifestyle may help to solve both problems at once.

Activities that create carbon dioxide are driving cars, heating homes, generating electricity, flying planes, making goods in factories and transporting things a long way. So in a low carbon lifestyle you share a lift to work, insulate your home, take the train on holiday, buy British products and eat local food. It's a better life too!

By making lifestyle choices we can reduce our CO_2 emissions, and the new lifestyle improves our quality of life. Fresh food and daily exercise are good for your health, mood and concentration. Quality products last for years so you don't have to keep buying them again. Public transport and lift sharing relieve the stress of driving and allow you to talk, read and relax. And buying local and national products creates more jobs and better wages in the UK.

This booklet contains the information you need to reduce your carbon emissions by 75% in ten years, though a target of 3% per year is suggested. It looks at 10 lifestyle areas, and shows the easy ways to reduce CO_2 in each. There is an online carbon dioxide calculator, which you can use to calculate your own CO_2 emissions. This gives you the satisfaction of seeing your reductions every year. A 3% reduction per year is easy to achieve, and most people will find they achieve much more in the first year.

Some simplified explanations of the science behind carbon dioxide and global warming are included to help see how lifestyle choices reduce carbon dioxide emissions. For a greater scientific understanding, readers should study books on the subject, some of which are listed at the end of this booklet.

2. Getting started

Before we look at each lifestyle area in turn there are a few things to know that will help us understand carbon dioxide reductions.

1. Most forms of energy we use produce CO_2. The amount of CO_2 produced is roughly proportional to the amount of energy used. Less energy = less CO_2.

2. Fossil fuels are basically carbon. When burnt, each carbon atom "grabs" two oxygen atoms from the air and makes Carbon Di - Oxide. CO_2 is not a small bi-product of fuel. It is the whole fuel turned into gas form, with a weight of oxygen added. So for every kilogram of fuel put into a car around 3kg of carbon dioxide comes out from the exhaust pipe. If the engine is more efficient, the car will travel further on that kg of fuel, but the CO_2 emitted is always proportional to the amount of fuel used. Food is also carbon and humans produce CO_2, but in much smaller quantities than machines.

3. There are other gases that create global warming more than CO_2. They are all called "greenhouse gases" because they trap heat inside Earth's atmosphere. These include Methane, which is 20 times worse than CO_2, and Nitrous Oxide, which is 300 times worse. To calculate the effect of certain activities, these gases are shown as CO_2 equivalent, i.e. 1kg of methane is calculated as 20kg of CO_2.

4. The energy in different fuels is given different names. KWh for electricity, calories for food, amp-hours for batteries and thermes for gas. In this book these are all converted to kWh to give one common reference point.

Here are some examples of how much energy is used by various activities over one hour, and how much CO_2 is created:

Table 1.

Activity	Energy (kWh)	CO_2 (kg)
Drive a car	45	**12**
Ride a bus	13	**3.3**
Cycle	0.019	**0.074**
Fly in an airplane (per person)	1,000	**400**
Run an electric radiator	2	**1**
Watch TV	0.07	**0.03**
Listen to the radio	0.002	**0.001**
Boil a kettle (5 mins)	0.15	**0.07**
Go for a walk	0.009	**0.036**
Sleep	0.004	**0.016**

2007 Average UK CO_2 emissions per person per day = 27kg.

3. Electricity

Energy used in the home creates 25% of national CO_2 emissions. Around 75% of this is used for heating. The rest is for electrical appliances, which we will look at here. A typical house uses 5,000 kWh on appliances per year, creating around 2,000 kg (2 tonnes) of CO_2.

Here is a table of electricity use in a typical house with 2 adults and 2 children. There are 9 simple steps to reduce this by 60%. The improved electricity use is in table 3.

Table 2.

Typical house electricity use

Appliance	Cost per use/hour	Uses/hours per day	Cost per year	kg CO_2 per year
Bath (100l @ 40°C)	41.8p	1	£152	546
Shower (20l @ 40°C)	8.4p	3	£91	327
Bar Fire (6 months/yr)	24.0p	2	£87	313
Washing Machine (2hrs)	24.0p	1	£87	313
Cooker	24.0p	1	£87	313
10 Appliances on standby	0.6p	24	£52	188
Boil full kettle (4mins)	2.0p	6	£44	157
Fridge	1.8p	6	£39	141
Hall Light	1.2p	8	£35	125
Kitchen Light	1.2p	6	£26	94
Television	0.8p	7	£21	77
Landing Light	0.7p	6	£16	56
Living-room light	0.7p	4	£10	38
Bathroom light	1.2p	2	£9	31
3 Bedroom lights	0.7p	2	£5	19
Other lights	0.7p	2	£5	19
Computer	0.6p	2	£4	16
CD Player	0.4p	1	£1	5
Radio	0.02p	1	£0.09	0.3
Total			**£775**	**2,777kg**

In a typical house baths cost £150 a year, showers £90, a bar fire £90, and the washing machine £90. It also mounts up when you leave on a low-energy appliance for a long time. Ten appliances left on stand-by for a year cost £50. Cost is proportional to energy used, which is proportional to CO_2 emitted.

Nine steps to save CO_2 and money.

1. Low Carbon Lifestyles should be fun, so use the tv, computer, hi-fi and radio as much as you like, as they use little power.
2. If you bath every day, consider bathing once a week and showering on other days. The CO_2 saving for one person reducing their number of baths from seven times a week to once a week would be around 470kg CO_2 and £130 a year.
3. If four people in the house shower four times a week instead three people showering seven times a week, there would still be a saving of around 78kg CO_2 and £22 a year.
4. Improve house insulation so that you don't need to use the bar fire. Save around 313kg CO_2 and £87 per year.
5. Only wash clothes when dirty. For example underwear after a day, over- garments less often. (Washing wears clothes out faster than wearing.) Washing can often be reduced by half, saving around 134kg CO_2 and £37 a year.
6. Turn off all appliances at the plug. Save around 188kg CO_2 and £52 a year.
7. Only fill the kettle with the amount of water you need. Save around 91kg CO_2 and £25 a year.
8. Fit low-energy bulbs, and turn off lights when not in the room. Save around 325kg CO_2 and £91 a year.
9. You have saved around 1,600kg CO_2 and £455 a year. You deserve a treat. A really nice massage? (Human powered activities create negligible CO_2.)

Here is the improved electricity table. Only items in bold have been changed.

Table 3.

Improved Electricity Use

Appliance	Uses/hrs Per day	Uses/hrs Per Wk	Cost per yr	Kg CO_2 Per yr	£ Saved	CO_2 Saved
Bath (100l @ 40°C)		**1**	£22	78	£131	468
Shower (20l @ 40°C)		**16**	£70	249	£22	78
Bar Fire (6 months/yr)		**0**	£0	0	£87	313
Washing Machine (2hrs)		**4**	£50	179	£37	134
Cooker	1		87	313	£0	0
10 Appliances on standby	**0**		£0	0	£52	188
Boil 1/4 kettle (1min)	**10**		£18	65	£25	91
Fridge	6		£39	141	£0	0
Hall Light	**4**		£3	13	£31	113
Kitchen Light	6		£5	19	£21	75
Television	4		£12	44	£9	33
Landing Light	**2**		£1	3	£15	53
Living-room light	4		£2	7	£9	31
Bathroom light	2		£2	6	£7	25
3 Bedroom lights	2		£1	3	£4	15
Other lights	2		£1	3	£4	15
Computer	2		£4	16	£0	0
CD Player	1		£1	5	£0	0
Radio	1		£0	0	£0	0
Total			**£319**	**1,145kg**	**£455**	**1,632kg**
% Reduction			**60%**	**60%**		

4. Food

Food causes CO_2 emissions in 4 ways: How it is produced, packed, stored and transported.

Production

All food comes from plants. The CO_2 caused to get food to the dinner table depends on how much has happened to it since it was a plant. Fruit and vegetables cause the least CO_2 emissions. They are simply grown, shaken off, transported, washed once, cooked once and eaten. Grains are next. They are threshed and dried, taking a little more energy.

Processed foods use more energy again. Dairy products are processed by cows themselves, who emitting a lot of methane gas as they digest their food. (1 kg of Methane is equivalent to 20kg of CO_2 in causing global warming.) Cheese needs to be heated in vats, stored and kept cool, all using energy. Foods that need cold storage use a lot of energy between the plant and the dinner table.

Meat uses more energy than processed foods. The animals themselves are the "machines" that process plants into meat, and they use a lot of energy doing this. An acre of land produces seven times more vegetables than meat [1].

Organic foods avoid the use of fertilisers. Nitrogen fertiliser releases nitrous oxide. This is 300 times more effective than carbon dioxide at creating global warming. Nitrous oxide emissions are the greatest problem with agriculture, so eating organic food is a good way of reducing your greenhouse gas emissions.

In a low carbon lifestyle you eat mainly fresh foods, vegetables and grains, processed foods are kept for side dishes and special occasions, and meat can be eaten in less quantity and more quality.

[1] *Climate Change Begins at Home* – Dave Reay

Packaging

It takes more energy to produce a tin can than the energy value of the food inside it. Tinned food is ideal for travelling, camping and emergency supplies, but is best not used as a regular part of a diet. Plastic takes energy to produce, to put onto food, and to carry away as waste.

But food needs some packaging to preserve it. The best thing to do is firstly buy as much unpackaged food as possible, like fruit and vegetables. Secondly look for paper bags, boxes, sacks and packaging such as Ryvita use. And thirdly look for minimal packaging. This could mean buying in bulk. E.g. 5kg of porridge oats uses less packaging than five 1kg packs.

Transportation

Transporting food can use more energy than production and packaging. A general rule is buy local first, then British, then shipped food, and last of all air-freighted food for special occasions only. You can get some foods locally for part of the year, nationally for part of the year, and abroad for the rest of the year.

Table 4.

Food Sources Through the Seasons

Vegetables	Local 6 mths	Britain 3 mths	Abroad 3 mths
Fruit	Local 3 mths	Britain 3 mths	Abroad 6 mths
Dairy	Local 12 mths		
Grains		Britain	Abroad
Meat	Local 12 mths		
Beer		Britain	Abroad
Wine		Britain	Abroad
Treats	Local	Britain	Abroad

Here is a list of foods, and some suggestions on how to source them.

Vegetables

In the UK you can get local vegetables for around 6 months of the year, from June to November. Vege-box schemes are very energy efficient as they only deliver locally. Look out for grocers who know where their vegetables are from. In winter there are generally a lot of stored vegetables from the UK. The spring is the most difficult time as the stored vegetables have finished and the summer ones have not yet arrived. April and May were traditionally known as the hungry gap. So you may need some vegetables from abroad.

Fruit

British summer fruits are delicate and best bought locally. The autumn brings local apples, and British stored apples are normally available until February. (Having tested it for ten years, I can say that an apple a day really does keep the doctor away.) In spring you may need some fruit from abroad. Oranges store well and one a day will keep you healthy.

Dairy and Eggs

Britain is a great dairy producer and you should be able to get local milk, butter, cheese and eggs locally all year round.

Grains

Look out for a local supplier, and if you find one, buy everything you can from them. You are supporting a neighbour and the local economy. Ask your shopkeeper where things come from and they can ask their wholesaler.

If an item is not available nationally, such as pasta and rice, then buy from abroad. The low carbon lifestyle is about sourcing locally where possible. This will still cut the national emissions by 75% in 10 years without giving up any important parts of your life.

Meat

Britain is a big meat producer, so local meat can be found all the year round. Look out for farmers' markets, farm shops and local names. The meat may be expensive, but eating better quality meat less often may be more satisfying and better for your health.

Beer

Local ales involve least transportation, and national beers are next best. Drink foreign beers on holiday or special occasions. Draft beer is transported in kegs so avoids packaging altogether.

Wine

Bulk carrier ships are roughly 8 times more efficient than rigid lorries, so shipping wine from other parts of the world does not emit much more CO_2 than driving them from Spain or Italy. Here are the approximate CO_2 emissions for transporting one bottle of wine to the UK from various countries (not including transport inside the UK):

Table 5.

CO_2 emissions for transporting one bottle of wine to the UK

Country	Grams CO_2
South France	70
Central Spain	130
South Africa	90
Chile	130
Australia	170

France is definitely the best, South Africa next, Spain and Chile are about the same, and Australia creates 2.5 times more emissions than France.

Treats

The low carbon lifestyle has room for treats on special occasions, so why not have mangoes, papaya, sweet potatoes and a bottle of Tequila on your birthday! By eating locally for most of the year, you will have cut your carbon emissions drastically, and an exotic treat is even tastier if only had occasionally. However avoid air-freighted goods, as air transport is roughly 20 times more damaging than road transport, taking into account the extra damage caused by high altitude emissions.

5. Transport

Here is the CO_2 per mile for different modes of transport and the number of miles you can travel on 1kg of CO_2:

Table 6.

CO_2 per mile for different modes of transport

Transport Type	CO_2/Mile in grams	No. of miles you can Travel on 1 kg CO_2
Bicycle	7	135
Walk	12	82
Train	40	25
Ferry	50	20
Bus	100	10
Car	346	3
Airplane*	870	1

** Air figures include a factor of 3 for the extra destructivity of high altitude emissions*

For each mile in a car, you can travel about 3 miles by bus, 8 miles by train and 45 miles by bicycle. You could only travel 1/3 mile by airplane.

Transport emits around 25% of the CO_2 from a typical lifestyle. A few simple decisions can cut this by 60%. Let us look at the transport for a typical family over a year.

Table 7.

Harry & Jude's Family Annual Transport

Transport	Person	To	Miles	Days per wk	Miles per yr	CO_2 per yr
Car	Harry	Work	40	5	10,000	3000
Car	Jude	Swimming	20	2	2,000	600
Car	J or H	Shopping	20	1	1,000	300
Car	Family	Misc	10	2	1,000	300
Bus	Tom	Trumpet lessons	20	1	1,000	100
Train	Susy	College	10	4	2,000	80
Plane	Family	Holiday in France	1250		5,000	4350
Totals					**22,000**	**8730kg**

The large CO_2 sources are Harry's commute and the family holiday. With the measures listed below, Harry and Jude cut their family's carbon dioxide emissions for transport by 64%:

Table 8.

Harry & Jude's Family Improved Transport

Transport	Person	To	Miles	Days Per wk	Miles per yr	CO_2 per yr
Car	Harry	Work	**45**	**2.5**	5,625	1,687
Car	Jude	Swimming	20	2	2,000	600
Car	J or H	Shopping	**10**	1	500	150
Car	Family	Misc	10	2	1,000	300
Bus	Tom	Trumpet lessons	20	1	1,000	100
Train	Susy	College	10	**2**	1,000	40
Train	Family	Holiday in France	**1600**		6,400	256
Totals					17,525	3,133kg
Reduction					**20%**	**64%**

(Only the figures in bold have been changed.)

What did they do?

1. Harry found a colleague who lives a few miles away. They take it in turns to drive. It's a 5-mile detour and Harry has to leave the house 10 minutes earlier, but it cuts his fuel use by 45%, saving around 1.3 tonnes of CO_2 per year and £500.

2. Jude & Harry decided to start buying food in bulk. They now drive to the supermarket every other week, and use a local farm shop and grocers for fresh produce. This saves 150kg CO_2 a year. They are thinking about doing a joint-shop with their neighbours.

3. Susy has been wanting to get fitter anyway, so she decided to cycle to college on the two days when she starts late. She got bike lights, mudguards, and lightweight waterproofs for her birthday so her bike is now ready to go at any time. She was surprised to find she even enjoys the ?-hr cycle in the rain. This saves her 40kg CO_2 a year, and she has found her mood and concentration have improved.

4. The family now take their summer holiday in France by train. This cuts the CO_2 bill by a wopping 95%, and saves 4 tonnes of CO_2 a year. They also love the journey.

6. Shopping

There are three ways that shopping produces CO_2: (1) You getting to the shops. (2) The product getting to the shops. (3) How the product is made.

Getting to the shops

Table 9.

The Weekly Shopping Trip: Kg CO_2 per year

Transport	10 Miles	20 Miles	30 Miles	40 Miles
Car	150	300	450	600
Bus	50	100	150	200
Bicycle	3.5	7	10.5	14

A weekly 20-mile drive to the supermarket (40-mile round trip) mounts up to 600kg of CO_2 emitted in a year. Buying in bulk could save enough CO_2 over the year for a train ride to Barcelona.

Four Ways to save CO_2

1) Buy in bulk every other week. Save up to 300kg CO_2 & £240 a year.

2) Alternate trips with your neighbour. Save up to 300kg CO_2 & £240 a year.

3) Go by bus. Save up to 400kg CO_2 a year.

4) Cycle to nearby shops. Save up to 586kg CO_2 & £480 a year.

The author's shopping is done as follows:

Flour, pasta, rice, lentils, nuts, raisins, vegetable oil, shampoo and other storing products are delivered in bulk every 2 months. Vegetables come from a market garden a mile away for 9 months of the year. A friend drops off a 5kg piece of cheddar every 2 months. Eggs, milk and other small products come from the village stores. A monthly bus trip is made to a nearby town for herbs, spices and other items. Annual emissions are around 50kg, and there are considerable financial and time savings.

The product getting to the shops

The type of transport is important. Avoid air-freighted goods where possible, as this is very inefficient. Shipping is very efficient.

Table 10.

Distance you can transport 1 kg of goods for 1 kg of CO_2 emissions

Transport:	Ship	Rail	Road	Air
Miles:	33,333	20,000	12,500	370

Most dried products, fruit and bottles are shipped. Dried and concentrated products are best because they save transporting water. For example 1kg rice will feed a family for a week, 1kg bananas will feed a family for one light meal, and a bottle of wine (1kg) is just an accompaniment to one meal.

Here are the CO_2 emissions for transporting 1kg of goods from abroad:

Table 11.

Kgs CO_2 emitted to transport 1kg of goods from abroad

Country	Road	Rail	Ship	Air*	(Miles)
South France	0.06	0.04		2.16	800
Germany	0.06	0.04		2.16	800
Italy	0.12	0.08		4.05	1,500
Central Spain	0.12	0.08	0.02	4.05	1,500
Israel	0.32	0.20	0.04	10.80	4,000
India			0.08	21.60	8,000
Argentina			0.08	21.60	8,000
South Africa			0.08	21.60	8,000
California (sea)			0.10		10,000
California (land/sea)			0.29	21.60	8,000
Chile			0.11	29.70	11,000
Australia			0.15	40.50	15,000
China			0.15	40.50	15,000
Japan			0.15	40.50	15,000

**Air freight includes factor of 3 for extra destructivity of high altitude emissions*

(Figures are approximate and depend on routes)

Rule of thumb

Buy local first. Then buy British. Then work roughly in order of the countries in the table above, being France and Germany, followed by Israel if goods are shipped. Next buy from Spain, Italy, India, Argentina and South Africa, which are about the same. Then come Chile and California for shipped goods. And finally Australia, China and Japan.

In all cases, goods emit more than their own weight in CO_2 when air-freighted. This reaches 10.8kg of CO_2 to fly a kilo of goods from Israel, and 40kg from Australia.

Inside the UK, locally produced products are best, especially if they have not had to travel elsewhere to be packaged and then brought back again.

How the product is made

Product CO_2 emissions have two factors: (1) CO_2 produced in manufacture. (2) Product lifespan.

Cars

According to research by Ford in 1995, manufacturing a car emits approximately the same CO_2 as 1.4 years average use. As you can see from the following table, your choice of car will have a big effect on your annual emissions. Manufacturing a small diesel car emits around 3,900kg of CO_2, which is 328kg per year for a 12 year lifespan. So the total annual emissions for driving 14,000 miles are around 3,100kg. In a medium size car the total annual emissions are 4,600kg, and for an SUV 9,400kg.

Table 12.

Manufacturing CO_2 Emissions for Cars (All CO_2 figures in kg)

Car Type	Car mpg	Annual CO_2 14,000 miles	Manufacturing CO_2 emissions	Yearly share Manufacturing*	Total CO_2 emissions
Small Diesel Car	60	2,814	3,940	328	3,142kg
Hybrid Car	45	3,234	6,403	534	3,768kg
Medium size Car	35	4,158	5,821	485	4,643kg
SUV	20	8,442	11,819	985	9,427kg

** Based on a 12-year lifespan*

(Figures are approximate and vary between manufacturers and models)

Is it worth scrapping your existing car before its time for a more efficient one? It will take a number of years for the CO_2 saving to overtake the CO_2 wasted by not using your old vehicle until the end of its life. The answer to the question depends on how much you downsize.

Table 13.

Years to save CO_2 when replacing a 6 yr-old car with a new car

Replacement	Years to save CO_2
Replace a medium car (35mpg) with a hybrid car (45mpg)	8.6
Replace a medium car with a small diesel car (60mpg)	3.9
Replace an SUV (20mpg) with a medium car	2.8
Replace an SUV with a hybrid car	2.3
Replace an SUV with a small diesel car	1.6

Consider how you might arrange your transport differently, and the minimum size of car you need. If you can downsize considerably, then go ahead. If you need a medium-sized car but would like a hybrid engine, wait until your car is 9 years old before replacing it. Downsizing from an SUV saves CO_2 in 2-3 years, so is always worth it.

Household Appliances

The CO_2 produced in manufacturing is called the "embodied CO_2" of a product. On the following page are some figures for the embodied CO_2 in household appliances:

Table 14.

Embodied CO_2 in manufacturing appliances

Appliance	Embodied CO_2 in kg	CO_2 per yr 5-yr life	CO_2 per yr 10-yr life	CO_2 per yr 25-yr life
Cooker	509	102	51	20
Fridge	955	191	95	38
Washing machine	764	153	76	31
Tumble dryer	318	64	32	13
Microwave	191	38	19	8
Dishwasher	700	140	70	28
Electric Kettle	11	2	1	0.4
Electric Drill	15	3	2	1
Total	**3,463kg**	**693kg**	**346kg**	**139kg**

A typical range of appliances in a house have emitted 3.5 tonnes of CO_2 in their manufacture. If they last 5 years, this works out at around 700kg a year. If they last 25 years, it works out at 140kg a year. The energy it takes to make long lasting products is little more than short-life products. So it is worth buying quality products wherever possible. They give more satisfaction too.

If you have the choice between repairing a product or buying new, and they both cost the same, repair it. The CO_2 emitted will be much less.

The bigger the item you buy, the more CO_2 has been emitted to make it. For the above appliances, around 20kg of CO_2 is produced for every kilo of goods manufactured, and this can be used as a rough estimation for most products made of plastic, glass and metal.

The less we buy and the longer we make it last, the less CO_2 is produced. This frees up time that used to be spent in shopping for recreation.

7. House Insulation

Around 20% of the nation's CO_2 emissions come from heating our homes. Houses with one-foot-thick of insulation on walls, floors and roof lose so little heat that human body warmth alone will keep them warm.

The Duvet Effect

Here is a scene to illustrate household heating: Harry goes to bed in the middle of winter. He only has a thin blanket so he takes a hot water bottle. He cuddles it to keep warm. Then the bottle cools and he gets cold. He goes downstairs and makes two hot water bottles. He is lovely and snug for a while, but they cool again and he gets cold. Then Harry has an idea! Out to the garden he goes, shuddering in his nightgown, to get a hosepipe from the shed. He attaches one end to the bath's hot water tap, runs the pipe into the bedroom, make several coils round the bed, leads it back into the bathroom and puts the end down the plughole. He turns on the hot tap, and dives back into bed. It's deliciously warm. In fact, it's so hot, Harry throws off the blanket and sleeps with just the sheet. Lovely. At the end of the month Harry's electricity bill arrives. It's more than the cost of a king-size duvet.

None of us would dream of central heating our bed instead of using a duvet – a duvet is such an obvious way of keeping warm. It is pure insulation, trapping a layer of still air over our bodies. But we centrally heat our houses and let the heat pour out through the walls and windows. We need to put a duvet over the house. A duvet for a house comes in the form of rock wool, polystyrene and similar products. Just like a thin blanket, 100mm (4") of insulation is not enough to keep us warm in winter. The house needs 300mm (12") all round. With this amount human body heat alone will keep the whole house warm, just like under a duvet. (One human emits 300W of heat – 1/3 of a single electric bar fire.)

8 Ways to reduce heatloss

Here are some measures you can take to insulate your home. They are listed in order of cost, least expensive first, with the typical energy saving for each measure[2].

1. **Wear winter clothes and turn down the heating 2 degrees. Save 30%.**

Get dressed in warm jumpers and trousers or skirts. Then adjust the heating to suit. Keep spare jumpers on hand in case a friend turns up without.

2. **Insulate your hot water tank. Save 10%.**

Also fit an adjustable thermostat and turn down to 60 degrees.

3. **Draught-proof doors and windows. Save 20%**

If your house is draughty, you can DIY-fit sealer-tapes and brush-strips on doors and windows. This is inexpensive and very effective.

4. **Insulate the attic. Save 20%**

Lay 300mm of rock, glass or sheep's wool[3] in the attic. This conforms to new building regulations, and costs under £200 for a typical house.

5. **Double Glazing. Save 20%**

This could be double, triple, or secondary[4] glazing.

6. **Insulate Cavity Walls. Save 20%**

Specialist companies can pump insulation onto your cavity wall space.

[2]Measures add up to more than 100% because they have a compound effect. I.e. if you turn down heating first, roof insulation will save 20% of your remaining energy bill.

[3]The type of wool does not matter – the trapped air does the insulation, like in a duvet.

[4]Secondary glazing is a second window fitted inside the existing one. The interior window can be of light construction, as it does not need to face the weather. Secondary glazing is suitable for listed buildings as the exterior window is left untouched. The interior window opens, and can be cheaper and just as effective as double-glazing.

7. Dry-line Walls – 30%

Insulate all your exterior walls by adding an insulated layer on the inside. This could be 300mm of rockwool faced with plasterboard.

8. Suspend Floors – 10%

If your ground floor beds onto the earth, this can be dug out. 300mm insulation is laid on a damp-proof course, and a suspended wooden floor laid on top.

Money saved on fuel bills for inexpensive measures can be spent later on the more expensive measures. Most old houses can reduce their heatloss by 75% through good insulation, and heating itself is around 3/4 of your house fuel bills.

The UK Government plans to make all new houses zero-emission from 2016, i.e. these houses will have enough insulation that human body heat alone will keep them warm.

8. Rubbish

Britain's landfill sites emit the equivalent of 8% of the nation's CO_2 emissions. We are also running out of landfill sites in which to bury our rubbish.

When we use the phrase "throw it away" we need to remember that there is no such place as "away". The phrase really means "bury it in the earth".

Five tips to reduce your rubbish

1. Keep food leftovers for the next day or give to the birds.

2. Put vegetable off-cuttings onto a compost. This could be your own compost bin, or take it to a local market garden.

3. Recycle empty tins, bottles, jars and good paper.

4. If you have a fire, use newspaper and cardboard to light it. Otherwise put cardboard on the compost with the kitchen waste. Cardboard contains a lot of carbon, which balances out the high nitrogen in kitchen waste, and makes better compost.

5. If you have a fire and can burn wood rather than coal, the ash makes excellent compost. Wood takes a little more maintenance than coal as it needs to be seasoned, and emits less heat. But the CO_2 emissions are lower since the trees growing in its place are absorbing CO_2.

6. Avoid buying goods in plastic wrapping whenever possible.

Once rubbish has been put in all these places, there should be little left for landfill.

9. Recreation

There are two main areas of CO_2 production for recreation: the recreation itself, and getting to the place of recreation. Here are the annual CO_2 emissions for some recreational activities:

Table 15.

Recreational Activities

Annual emissions for 2 hours per week, 25 weeks per year

Activity	Kg CO_2	Notes
Walking	2	
Cycling	4	
Cinema	10	0.4kg per visit
Indoor Sport	8	0.5kg per visit
Theatre	15	0.6kg per visit
Indoor Swimming	25	Old pool up to 1kg per visit. Insulated pool much less.
League Sport away games	52	40 miles return, 3 persons per car, alternate weekends
Jet Skiing	347	3 litres petrol per hour
Speed Boating	578	5 litres petrol per hour
Car Racing	578	5 litres petrol per hour

* Figures are approximate and vary between venues and accessories

For recreational activities themselves, most group and team activities and entertainment are very efficient due to the large numbers of people who attend. The large emitters are motorised sports. These can be either enjoyed on special occasions, or the individual may wish to save CO_2 in other lifestyle areas in order to pursue their passion in this area.

Table 16.

Getting to the place of recreation

Kg CO_2 per year for one return journey per week, 25 weeks of the year

Transport	10 Miles	20 Miles	30 Miles	40 Miles	50 Miles	60 Miles
Bicycle	2	4	5	7	9	11kg
Train	10	20	30	40	50	60kg
Minibus (12 persons)	13	25	38	50	63	75kg
Car (4 persons)	18	35	53	70	88	105kg
Bus	25	50	75	100	125	150kg
Car (3 persons)	25	50	75	100	125	150kg
Car (2 persons)	38	75	113	150	188	225kg
Car (1 person)	75	150	225	300	375	450kg

You can enjoy recreational activities at a reasonable distance if transport is carefully selected. At one end of the spectrum a 10 mile return journey by train, 25 times a year, emits just 10kg of CO_2. At the other extreme, a 60-mile trip alone by car 25 times a year emits 450kg. If you wish to make longer journeys, choose public transport, minibus or a full car, because the vehicle's CO_2 emissions are divided between the number of passengers.

To emit a minimum of CO_2, first look for recreational activities available close to home. Then consider the multitude of low-carbon activities available, including: TV, radio, music, singing, acting, theatre, local sports, board games, darts, pubs, special interest groups, massage, yoga, gymnastics, martial arts, reading, poetry, rowing, sailing, surfing, running, darts, snooker, parties, cooking, gardening, painting, pottery, crafts, bird-watching, horse-riding, fishing, chatting, dancing and love-making.

10. Energy Sources

Let us look at the CO_2 emissions at point of use for various types of energy. The unit of energy used for comparison is the kilowatt-hour (kWh). CO_2 at point of use means the CO_2 emitted by for example burning coal, but does not include the petrol for the delivery lorry. Biofuels are made from plants. CO_2 emissions at point of use for biofuels are the amount of CO_2 emitted by burning them, not taking into account the CO_2 they absorb when being grown.

Table 17.

Energy source CO_2 emissions at point of use

Energy Source	CO_2 per kWh	Cost/kWh
Renewable Electricity	0.00kg	16p
Gas	0.19kg	4p
Oil	0.23kg	3p
Biofuel Oil	0.23kg	5p
Coal	0.33kg	3p
Wood – logs	0.35kg	2p
Wood – pellets	0.35kg	4p
Electricity	0.43kg	14p

Costs vary widely between suppliers

As we can see for the table some fuels appear to create less CO_2 per kWh of energy than others. This has to do with the impurities in the fuel which make it difficult to release the energy when burning. Hence gas, the purest fuel, creates the most energy compared to its CO_2 emissions.

We can also see that the fuels with lowest CO_2 emissions are not necessarily the cheapest. Renewable electricity is the clearest example.

Conventional electricity is mainly generated by burning fossil fuels. It has high CO_2 emissions per kWh because around half of it gets lost as it travels across the country. Therefore electricity is not cost effective or CO_2 efficient when it is used for heating, but is the only option for lighting and electrical appliances.

Biofuels are said to be "carbon neutral" because the amount of CO_2 they emit was absorbed recently from the atmosphere by the plants they are made from. While a biofuel is being burnt, biofuel plants growing elsewhere are reabsorbing the CO_2.

However, in the case of wood it takes around 50 years for a tree to grow and absorb it's full quota of CO_2, and this can be burnt in a few days. This 50 year absorbtion time is too long in the current global warming context, because we need to reduce global CO_2 emissions in the next 25 years.

Biofuel from rapeseed and fast growing plants does not have such a long time delay. But some plants would be growing on that land anyway, and absorbing CO_2 which might not be put straight back into the atmosphere, so this argument is questionable. Even if we used all the world's agricultural land for growing biofuels, it would not meet our current energy demands, and we need that land to grow food. The only true solution is to reduce energy use by saving wasted energy.

This book considers biofuels to be better than fossil fuels, but not a complete solution to reducing CO_2 emissions. It therefore gives biofuels and wood a "50% loading" of CO_2 emissions.

The revised table considering a fuel's whole life cycle is below:

Table 18

Energy source CO_2 emissions over whole life cycle

Giving a 50% loading for bio-fuels and wood

Energy Source	CO_2 per kWh	Cost per kWh
Renewable Electricity	0.00kg	16p
Biofuel Oil	0.12kg	5p
Wood – logs	0.18kg	2p
Wood – pellets	0.18kg	4p
Gas	0.19kg	4p
Oil	0.23kg	3p
Coal	0.33kg	3p
Electricity	0.43kg	14p

Costs vary widely between suppliers

The table shows that some fuel sources are better than others to reduce CO_2 emissions. The efficiency of a heating device is another factor. Central heating is a very efficient way of heating a house. But centrally heated houses are often kept at a higher temperature than other houses and therefore use as much fuel. Make insulation your priority, then consider more efficient heating systems.

If your fuel is delivered by road, transportation emissions should be considered. The more fuel delivered at once the more efficient. Here are DEFRA figures for transporting goods by rigid lorry based on a 50% loading:

Table 19.

Transporting fuels

Kg CO_2 to transport one tonne of fuel by road

Miles:	50	100	200	300	400	500
Kg CO_2:	40	80	160	240	320	400

If your fuel comes a very long way, there may be nearly half a tonne of CO_2 from transportation for every tonne of fuel delivered. This is one argument for using locally sourced timber.

11. The Workplace

All employment creates a product or service that is sold to a member of the general public. Therefore CO_2 emissions from any type of work can be accredited to the customer, not the workers. For example, the CO_2 emissions for flying a rock-star to a US concert can be divided by the number of tickets and a figure put on each ticket stating the ticket holder's CO_2 share. The ticket holder then adds this to their personal annual CO_2 quota. The CO_2 emitted by a car factory can be divided by the number of cars produced and a CO_2 label put on each car, which the customers incorporate into their CO_2 quotas. Steel manufacturers pass their CO_2 emissions on to the car manufacturer, who adds it in to the car CO_2 label. The CO_2 emitted by a bank's annual activities can be divided by the turnover, and a CO_2 label given to each customer according to the amount of money that went through their account. Every single human work activity from services to manufacturing, and from art to government ends up with a product or service for a member of the public, so all CO_2 emissions in the workplace can be passed on to the customer.

However, a product with a low CO_2 label will sell better, because that leaves the customer more CO_2 to spend in other areas of their lifestyle. So there are benefits to reducing CO_2 in the workplace, and saving money at the same time.

Measures to reduce CO_2 emissions in the workplace:

- Leave lights off at night.
- Turn off all standby appliances at night.
- Insulate the building.
- Provide parking and changing facilities for cyclists.
- Create a travel notice board for bus and train timetables, and lift-share notices.
- Source goods and services from as near as possible.
- Find customers as locally as possible.
- Ask suppliers for CO_2 labels on their products and services.
- Install heat exchangers in ventilation systems. These run outgoing air through thin pipes across incoming air and save 80% heat loss.
- Share commuting CO_2 quotas 50/50 with employees to encourage both parties to reduce commuting distances.
- Audit company CO_2 emissions. This is done by adding up all the energy bills, travel miles and suppliers' CO_2 labels for a year and putting the figures through a calculator such as the Resurgence Personal Carbon Dioxide Calculator[5]. A simple way to put these onto products is to divide the total CO_2 by the annual turnover, and put a CO_2 label onto each product according to its price. If you can breakdown the CO_2 lifecycle for individual products, that is of course better.

[5]The Resurgence Personal Carbon Dioxide Calculator was designed by the author. It is widely recognised as one of the best carbon calculators on line, and is used by companies to calculate their carbon dioxide emissions. The calculator is at www.resurgence.org/energy

12. Holidays

Table 20.

Getting There

Kg CO_2 per person for one return journey from London

Holiday Destination	CO_2 Emissions (kg) Train	car (4 people)	Bus	Ship	Plane
UK - 100 miles	8	15	20	10	174
UK - 200 miles	16	30	40	20	34
UK - 300 miles	24	45	60	30	52
UK - 400 miles	32	60	80	40	696
UK - 500 miles	40	75	100	50	870
Paris	24	45	60	-	348
Berlin	64	120	160	-	870
Nice	72	135	180	-	1,044
Santander	96	180	240	70	1,044
Rome	104	195	260	-	1,566
Madrid	104	195	260	-	1,392
Stockholm	120	225	300	-	1,740
Malaga	128	240	320	150	1,914
Athens	176	330	440	300	2,610
Canaries	240	450	600	210	3,480
Middle East	360	675	900	400	5,220
North Africa	360	675	900	300	5,220
Central Africa	540	1,013	1,350	450	7,830
Southern Africa	720	1,350	1,800	700	10,440
India	720	1,350	1,800	700	10,440
The Far East	840	1,575	2,100	900	12,180
USA East	-	-	-	500	8,700
USA West	-	-	-	1,100	13,920
Central America	-	-	-	700	12,180
N. S. America	-	-	-	700	12,180
S. S. America	-	-	-	800	13,920
Australia	-	-	-	1,300	20,880

Figures are approximate and depend on routes

We can look at three types of holiday: Short breaks, annual holidays and sabbaticals. For a sabbatical you may wish to save up CO_2 emissions for several years in order to take a big trip to a distant country. Remember that whatever emissions you save on holidays can be spent elsewhere in your lifestyle. What we find is that ground transport saves so much CO_2 that we can do more travelling and still have lots of CO_2 left for other activities. Here is a list of holidays that someone might take in a year, as well as saving up for a sabbatical.

Table 21.

A typical year's holidays

CO_2 emissions from London	Train/ship	Plane
Short break to Paris	24kg	348kg
Short break to Edinburgh	32kg	696kg
Short break to Berlin	64kg	870kg
Summer Holiday in Nice	72kg	1,044kg
One trip to Argentina in 7 years	114kg	1,986kg
Total annual CO_2	306kg	4,944kg

By using the train the total emissions come to 306kg and by using the plane, 4,944kg. The trip to Argentina is by ship. Berths can be booked on cargo ships via the internet. Costs are higher than by air, for example around £1,500 for a return to Argentina. The journey takes around two weeks. But for a sabbatical of 3 or 4 months it may be far more enjoyable and the travel becomes an important part of the experience. Here are some low carbon holidays:

Family camping in the Lake District for 2 weeks

Emissions 60kg per person in a car of four. Cost: Around £150 per person for petrol, camping and food. Recreation includes sailing, walking, swimming and fishing.

Cycling in the South of France for 2 weeks

Bus from London to Nice, purchase 2nd hand bicycle, cycle to Toulouse, sell bicycle, return by bus. CO_2 180kg per person. Cost: Around £300 per person for bus fares, camping and food.

A week in Madrid

Eurostar and train with hotel, London-Madrid return. 104kg CO_2 per person. Cost: around £250 for train travel. See www.seat61.com for land travel information.

Babs to Brisbane

A low-carbon traveller called Babs worked out the CO_2 to get to her friend's wedding in Australia by land and sea. Here is her journey plan:

Table 22.

Babs to Brisbane

Stage	Transport	Miles	CO_2
Machynlleth - London:	Coach	230	21kg
London – Moscow:	Coach	1,924	173kg
Moscow - Beijing:	Train	5,773	419kg
Beijing - Hanoi:	Train	1,710	198kg
Hanoi – Nougkhai:	Coach	400	36kg
Nougkhai - Singapore:	Train	1,639	190kg
Singapore – Darwin:	Ship	2,350	286kg
Darwin – Brisbane:	Coach	2,143	193kg
Total		16,169	1,646kg
Return		32,338	3,292kg

	Miles	CO_2
Airplane emissions (@ 0.87kg/p/m)	24,000	20,880kg

As Babs has shown, it is possible to get almost anywhere in the world by land and sea, emitting a fraction of the CO_2 caused by air travel. Living in Europe we have a phenomenal variety of landscapes, weathers and cultures on our doorstep that can easily be reached via a very enjoyable train ride. For extended journeys further afield, CO_2 can be saved up over a few years and time off arranged with employers to enable a journey by land and sea.

There are now thousands of yachts traversing the world on pleasure cruises. Most of these invite amateur crew for ocean passages, and no previous experience is required. The author of "The Hitch Hiker's Guide to the Oceans" travelled around the world for free, and her book explains how to do it. To find yacht passages see **www.crewseekers.co.uk**.

13. Earth's Atmosphere

It has only recently become widely known that Earth's atmosphere is created and regulated by the life forms living on her surface. Here is a simplified explanation of how this came about:

The Earth travels through space in an environment unsuitable for life. There are no breathable gases and the sun's rays burn and irradiate. In the beginning life on Earth consisted of tough bacteria that could survive where we could not. These early bacteria gave out gases that enriched the atmosphere, enabling more complex bacteria to evolve. These in turn gave out gases that further enriched the atmosphere, enabling more and more complex and delicate life forms to exist, each playing a special part in enriching Earth's atmosphere. An ocean plankton called 'Emily' evolved, emitting a gas that makes water form into clouds, and creating rain. This watered the land, helping plants to spread. Plants provide oxygen and food for animals.

Earth's life forms have evolved to regulate her atmosphere and temperature. They do this by natural 'feedback'. For example, to maintain a steady temperature on Earth, plants in cold climates develop dark green leaves to absorb the sun's heat. In hot climates they develop light green leaves that reflect the sun's heat back out of the atmosphere. The tropical rainforests have a permanent cloud-cover. This presents a vast white surface to the sun, reflecting masses of heat back out of the Earth's atmosphere, and keeping the planet cool. The self-regulating system of Earth and her life forms has been given the name 'Gaia' by the planetary scientist James Lovelock. Gaia can maintain a reasonably steady temperature while the sun's heat varies with solar explosions and sunspots.

There is also a natural cycle of heat and ice ages roughly every 100,000 years. By analysing bubbles trapped in the polar ice caps, scientists have found that the temperature of Earth rises and falls in relation to the amount of carbon dioxide in the atmosphere. The more carbon dioxide there is, the hotter the Earth gets. This is because carbon dioxide forms a blanket over the Earth, trapping the sun's heat.

Animals produce carbon dioxide, and plants absorb it. In exchange, plants produce carbon and oxygen (carbon di - oxide), and animals breath in the oxygen and eat the carbon as food. This is normally a perfectly balanced relationship, called the 'carbon cycle'.

Then humans discovered oil and coal. These come from dead plants and animals compressed over millions of years, and are basically carbon. When burnt, the carbon mixes with oxygen from the atmosphere to create carbon dioxide. By burning this vast source of carbon that is outside the normal carbon cycle, humans have put far more carbon dioxide into the atmosphere than has been there at any time during the last four heat and ice ages. As a result the planet is heating up faster than at any time in measured history. This is causing climate change, storms, melting ice caps, and rising sea levels.

By living lifestyles that emit low carbon dioxide, humans will stop adding to the carbon dioxide in the atmosphere. Then plants can begin their work to absorb the carbon dioxide.

14. How Energy Works

It is easier to live a low carbon lifestyle when you have some idea of how energy works and what happens when you use it, so this chapter is a simple explanation of what energy is, and how it works.

Energy is a force that can do some work, such as drive a car up a hill, power a laptop, heat food on a cooker or power a human to go for a swim. Energy can be stored for later use. This can be in a chemical form like a fuel or battery, potential form such as pumping water to the top of a hill to let down later through a turbine, or as food for animals to eat.

Energy can be transferred but never disappears. The sun's rays reached Earth millions of years ago and were absorbed by plants. They stored the energy as carbon in their bodies, which were compressed to make petrol. We burn the petrol, which powers a car along. The engine loses some of the energy in heat, which warms up the air. The rest pushes the car, which pushes air out of the way. That air pushes other air in a domino effect. The heat created warms up the planet. The planet will continue to warm up until the heat is radiated out of its atmosphere. Then the heat will travel across space until is reaches another planet, which it will warm up. *The energy is transferred from one form to another, and from place to place, but is never lost.*

Matter can be transformed but never disappears. Using the sun's energy, plants make food from carbon dioxide in the atmosphere. For every 4.4kg of carbon dioxide absorbed by the plant, it made 1 kg of carbon and 3.4kg of oxygen. When we burn that 1kg of carbon in petrol, it grabs 3.4kg of oxygen out of the air, and produces 4.4kg of carbon dioxide. Carbon dioxide is not a by-product of fuel, it is the whole body of the fuel changed from liquid form into gas form and put out through the exhaust pipe. *The matter is transferred from one form to another, and from place to place, but is never lost.*

There are three main kinds of energy on Earth: Renewable energy, carbon and nuclear. Renewable energy is energy taken from motion in nature such as wind, waves, waterfalls and heat arriving as sun rays or coming out from the Earth's core. It has no by-product because it does not use fuel. Carbon energy includes oil, coal, gas, wood and food. To extract energy from carbon you either burn it or eat it, and in both cases carbon dioxide is produced. (It may be a surprise that petrol and potatoes are the same kind of energy. Some kinds of carbon work well if burnt and if eaten, such as nuts and alcohol.) Nuclear energy is obtained by splitting the atom. The energy released is used to boil water and drive turbines to make electricity. However it creates a by-product that is damaging to human health.

Energy can be measured in kilowatt-hours (kWh), which is 1000 Watts used for 1 hour. So this is the amount of energy it takes to power ten 100W light bulbs for one hour.

Other names for energy are Calories, Joules and Amp-Hours. These are all exactly the same energy as kWh, just in different quantities. For example, there are 15,070 food calories in one kWh. Humans use about 2,000 calories per day, which is 0.13kWh, the amount of energy it takes to light a 100W bulb for 1hr 20 minutes. Imagine the amount of work a human can do in a day, and it shows how incredibly efficient the body is.

15. Quality of Life

"Since I became more environmentally aware, the quality of my life has improved dramatically."
Julia Stephens, The Independent.

What is "quality of life"? We could say it is living the life you really want to. By this I mean doing things you really enjoy, and being in places you like, for as many hours of every day as possible, ideally every hour of every day.

And what is the life we really want to live? Each one of us is different, but there are surprising similarities. A survey of English and Japanese students[6] found they had surprisingly similar dreams. Almost all of them said they wanted to live in a comfortable home, have a garden, a family, a fulfilling job, be able to travel locally when they wanted and further afield occasionally, and have plenty of time to spend with their family and friends. This is all easily achievable in a low carbon lifestyle.

What makes certain activities, company and places more enjoyable than others?

The Senses

We experience life through our five senses, so the most enjoyable experiences feed our senses. My grandmother sometimes points out that sex is the only activity that involves all five senses: Touch, taste, hearing, sight and smell. Surfing feeds the eyes with stunning visual scenery, feeds the skin with the touch of coursing water, feeds the ears with the roar of the breaking wave, and feeds the taste with the occasional gulp of seawater. If you count the subtle smell of salt sea, then it's nearly as good as sex!

[6]Survey conducted by Peter Harper of the Centre For Alternative Technology, Wales

Life is best enjoyed when unpleasant sensations are not present. For holidays many of us flock to secluded places to "get away" from the roar of traffic, the smell of fumes, the harshness of concrete and the constant advertisements. We are looking for things that are pleasant on the senses.

The Body

The first thing we can feel is our body, and everything else is felt through the body. If we are tired, tense, aching, panting, feeling under the weather or have a headache, this worries and bothers us, and it is difficult to enjoy ourselves, wherever we are. When we feel fit and strong, we get great pleasure from the experience of being in our bodies. Imagine you are out running in the rain. At the top of the hill you stop to look out over the town. Your heart beats strong and steady, you breathing is deep and smooth. The cool rain mixes deliciously with the heat of your body, and you feel alive and good. Back at home you can relax for the evening in the pleasant glow of your own warmth. A great sensation, enjoyed with nothing more than your own body.

Keeping an enjoyable level of fitness requires a small amount of daily exercise, so activities to look out for are cycling to work, walking to the shops, carrying things around, and any physical jobs that need doing. These can be seen as free time at the gym.

Some of us may feel it's difficult to get fit. But remember that every human being alive today is genetically the best of the best of 100,000 generations of human beings. Our ancestors lived through ice ages and heat, hunting mammoths and swimming away from tigers, and only the ones who survived everything had children. It's no problem for our bodies, it's our lifestyles that need to be tweaked to include a small amount of daily exercise, and fitness will come easily.

Places

We most enjoy the places where we live, work and play if they are pleasant on the senses. Hence they should be beautiful, smell nice, and sound nice. Outdoor spaces with trees and plants tend to please, and buildings that are well ventilated with lots of light. The sounds and smells of traffic and machines are better reduced. Interiors should be made of natural materials. This is because synthetic materials produce particles called VOCs[7] , which irritate the lungs, throat and eyes and can cause headaches.

Company

Good company makes life a pleasure, and we can all be good company. What makes good company is someone who is relaxed, able to listen, has had a good day, can concentrate, and is feeling well. We can not expect someone to be good company if they have had a stressful day at work, got stuck in a traffic jam on the way home, haven't had any exercise for two weeks, are feeling guilty because they haven't had any time with the kids recently, and have got a headache. If the workplace is pleasant, you read a cracking novel on the bus, cycle home from the bus stop, have plenty of time with the children, and feel physically well, it's easier to be good company. You feel like talking, are able to listen, can concentrate and feel able to move forward in your life and relationships.

The lifestyles that suit the planet by creating low carbon emissions lead to a choice of activities and surroundings that improve the quality of life for humans. Low carbon lifestyles reduce disease and unpleasant experiences and enable us to enjoy life more deeply, with greater satisfaction.

[7]VOC is short for Volatile Organic Compound. In synthetic environments, particles from nylon carpets, synthetic paints and plastics float in the air. When these mix with sweat particles breathed out by humans, they create unpleasant compounds called VOCs. These cause headaches, dry throats, coughing and respiratory problems.

16. Your Carbon Quota

The Earth's plant life can absorb roughly 12 billion tonnes of carbon dioxide per year from human activities. At the moment humans are producing around 36 billion tonnes per year. That is about three times more than plants can absorb, so carbon dioxide levels are rising. If humans can keep their emissions below the level plants can absorb the atmosphere will be stable, and climate change will not increase.

To do this, humans must emit no more than 12 billion tonnes of carbon dioxide per year. If we divide this up fairly, that is 2 tonnes of carbon dioxide a year for every man, woman and child on the planet today.

At the moment the average UK carbon output is 10 tonnes per person per year. Luckily there are lots of people in southern countries that hardly emit any carbon dioxide at all, so the global average is 6 tonnes per person.

Each of us in the UK needs to cut our carbon emissions from 10 tonnes per year to 2 tonnes. If we reduce our carbon emissions by 3% per year we will reach sustainability in 27 years, which is a good target.

Since a large proportion of our carbon emissions are wasted, it will not be difficult for us to reduce them significantly. Around a fifth of UK emissions are due to domestic heating, and if we had fully insulated houses they would require no heating at all. Large CO_2 emissions are caused by transporting goods long distances to places that can provide them locally. Half of the electricity we produce is lost from electricity lines, as it is sent large distances across the country. We manufacture many products to last five years, when it would take little more energy to make them last 25 years. And many of us commute to work when we could live nearby and have more time at home. If we make efficient choices in distribution, manufacture and energy conservation, we will reduce our CO_2 emissions by 80%.

17. Helpful tips for a low carbon lifestyle

By following the guidelines in this book you can cut your carbon emissions without knowing what your overall levels are. However every lifestyle is different, and if you calculate your carbon emissions it is much easier to see which areas of your lifestyle have high emissions, and which are easiest to reduce. You also get the satisfaction of seeing your reductions when you recalculate your emissions after a year. This helps you enjoy the carbon you do use without feeling guilty, because you know you are on track. If you don't calculate your emissions there is a danger of feeling bad about every activity that emits carbon, and worrying about insignificant little actions. Feeling bad does not improve your quality of life, so is not part of this approach. This approach says ENJOY YOUR CARBON EMISSIONS, but work to a target.

To calculate your CO_2 emissions you can input your electricity and fuel bills, car mileage and travel details into the Reurgence Personal Carbon Dioxide Calculator at **www.resugence.org/energy**.

Here are some guidelines to help cut carbon emissions and feel good at the same time:

Save here, spend there

You can treat your carbon quota a bit like money: If you save some here, you can spend it elsewhere. Sometimes save, occasionally splash out. If you live in a small or well-occupied house, work close to home, travel by bus, eat local food, buy long lasting products and go on holiday by train, you will save a lot of carbon dioxide. Occasionally feel free to drive 50 miles to an event you really enjoy. That's 20kg of CO_2 a few times a year, in a quota of several thousand kg.

Special occasions

At Christmas you might buy some mangoes from India. A lot of food miles, but it is a special occasion. The planet doesn't mind where you spend your carbon, if you are meeting your target.

Dull emissions, fun emissions

Cut out the high-carbon activities that are dull, and keep the ones that are fun. For example, driving to work every morning is dull as mud. On the bus, you can read a cracking novel. If you love driving, go to a race track once a year and really drive for a day. The emissions from this would be around 200kg when a daily half-hour return trip knocks up around 5,000kg over the working year.

Make the most of your carbon emissions

When you do use carbon, make the most of it. If you really want to go to Africa, save up your carbon quota for a few years, read some books about the place, make a deal with your boss, and go for a few months. That way you get real satisfaction out of it, and you won't need to fly back and forth twice a year. Is two weeks in a Western Hotel in Thailand any better than two weeks in Spain, which can be reached by train?

There's a place for everything

Even high-carbon activities have their place. Our politicians and diplomats will always have to fly. It's better to fly a rock-band across the Atlantic than fly thousands of fans to the US. Our rescue services need to burn carbon to get there in time. The only way to get into space is by rocket. And that's all ok because the planet can absorb a lot of carbon dioxide. Just not enough to waste.

Value Carbon

Lets give thanks for fossil fuel; it is absolutely fantastic stuff. One tonne of petrol makes a 9 tonne helicopter fly like a bird. A small tank of that magic liquid contains enough energy to lift ten times its own weight into the air and keep it there for hours. It is really amazing, precious stuff.

18. Carbon Dioxide Calculator

This calculator enables you to calculate your personal annual CO_2 emissions.

In order to use it you will need to collect your electricity, gas and other fuel bills. Take one type of bill at a time, and on a separate piece of paper, add up the total fuel used for the year. Enter this into the calculator below.

Similarly, for bus, train and plane journeys, on a seperate piece of paper list your journeys for the last year, estimate the milage (or hours on the plane), add the mileage up for each type of transport and enter the total into the calculator.

For the purposes of these calculations, the number of people living in a house is 1 for each adult and 0.5 for each child under 16 years old. Work out the number of people in each house and enter this is where there is a "number of people" box.

Enter your data into the white boxes. Using a pocket calculator, follow the signs and calculate each row. Then add up the columns to get your total annual personal carbon dioxide emissions for last year. If you do this once a year, you can monitor your emissions.

CARBON DIOXIDE CALCULATOR

HOME ENERGY

Electricity	**Year's use**	**Factor**	**kg CO_2**
KWh		x 0.43 =	
Gas	**Year's use**	**Factor**	**kg CO_2**
Piped (kWh)		x 0.19 =	
Piped (Thermes)		x 5.5 =	
Piped (m3)		x 1.77 =	
Bottled (kg)		x 2.78 =	
Oil	**Year's use**	**Factor**	**kg CO_2**
Litres		x 2.68 =	
Coal	**Year's use**	**Factor**	**kg CO_2**
Kg		x 2.41 =	
Wood	**Year's use**	**Factor**	**kg CO_2**
Kg		x 1.04 =	

Total Home Energy CO_2 emissions =

Divide by number of people in house

= CO_2 emissions per person for Home Energy

SHOPPING CO_2 EMISSIONS

I eat meat, fish, eggs and dairy products	**Factor**	**kg CO_2**
(a) Very often (meat around twice a day)	x 1250 =	
(b) Quite often (meat once a day, eggs/dairy often)	x 750 =	
(c) Not often (vegetarian)	x 300 =	
(d) Never (vegan)	x 100 =	

My food shopping is best described by:	**Factor**	**kg CO_2**
(a) I buy fresh food from the supermarket, and don't check the labels to see where it's from. I buy lots of packaged and convenience food.	x 1250 =	
(b) I buy most shopping from the supermarket, and some from local markets.	x 750 =	
(c) I buy mostly seasonal organic produce, and few tinned or processed foods.	x 300 =	
(d) I only buy local, organic, seasonal foods, grow some fruit and veg, and eat very few packaged items.	x 100 =	

My other shopping is best described by:	**Factor**	**kg CO_2**
(a) I like to have up to date gadgets, and regularly replace old ones.	x 2500 =	
(b) I use what I have and replace only when products break.	x 1500 =	
(c) I repair and re-use goods, check appliance energy ratings and use rechargeable batteries.	x 600 =	
(d) I buy locally produced, hand made goods wherever possible, and fix rather than replace.	x 200 =	

Total Shopping CO_2 emissions =

OTHER CO_2 EMISSIONS

Car	**Year's miles**	**Factor**	**kg CO_2**
Small		x 0.26 =	
Medium		x 0.3 =	
Large		x 0.35 =	

Bus	**Year's Miles**	**Factor**	**kg CO_2**
		x 0.1 =	

Train	**Year's Miles**	**Factor**	**kg CO_2**
		x 0.04 =	

Plane Journeys	**Year's Hours**	**Factor**	**kg CO_2**
		x 435 =	

Base Industry Share	**(Per Person)**	**Factor**	**kg CO_2**
	1	x 1000 =	1,000

Car Ownership	**No. of Cars**	**Factor**	**kg CO_2**
		x 500 =	

Total other CO_2 emissions =

GRAND TOTAL

Now add up the totals for house, shopping and other to get your grand total personal annual CO_2 emissions =

19. References

For a greater scientific understanding of global warming, the following books may be of assistance:

Climate Change begins at Home, Dave Reay

Global Warming - A very short Introduction, Mark Maslin

The Ages of Gaia, James Lovelock

Data sources for tables in this booklet, by chapter:

C5 Ferry Emissions: CAN EUROPE

http://www.climnet.org/publicawareness/transport.html

Other Transport Emissions: DEFRA see below

Air Travel Emissions: DEFRA figures multiplied by 3.0 for the extra destructivity of emissions at high altitude.

C6 Goods transported from different countries: DEFRA

http://www.defra.gov.uk/environment/business/envrp/gas/envrpgas-annexes.pdf

Mileages by Mukti Mitchell.

C6 Cars (Ford, 1995) Gil Friend, Ask the Experts

http://www.greenbiz.com/news/columns_third.cfm?NewsID=30152

Manufacturing emissions are estimated to be approximately 10% higher for hybrid cars than normal cars.

C6 Household Appliances: Australian Government Department of the Environment

http://buildlca.rmit.edu.au/casestud/Ee/EEresiden.html#location-8

Milne & Readon

http://www.greenhouse.gov.au/yourhome/technical/fs31.htm

C10 Energy Sources:

http://www.umweltbundesampt.de/uba-info-daten-e/daten-e/carbon-dioxide-emissions.htm

http://www.woodgas.com/fuel_densities.htm

Biofuel: The 28.35p per litre duty on biodiesel for motor use can be reclaimed from HM Customs & Excise if used for home heating use. See hmrc.gov.uk, search "biofuel", public notice 179E section 5

C18 Carbon Dioxide Calculator:

The Resurgence Carbon Dioxide Calculator **www.resurgence.org/energy**

Neil Carlson, Readers Digest April 2006.

Calculation Notes:

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