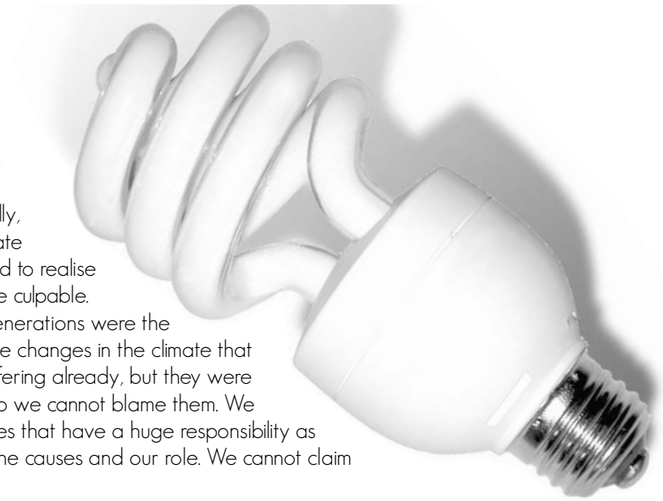
41. RESPONDING TO CLIMATE CHANGE

Brenda Boardman [1]

We are the cause, so we are the solution

There is no doubt now that climate change is occurring and that we, as human beings, are primarily responsible. It is our decisions to put on the light, drive the car, and to fly off on holiday. All our actions, big and small, are causing the rise in carbon dioxide emissions, so we can reduce this threat by similar, more careful decisions. Everything we do can contribute to reducing the problem. All of us can demonstrate greater responsibility both to the disadvantaged of the world and to future generations.

Figure 41.1 *A wind turbine is simply a windmill; it converts kinetic energy in wind into mechanical energy. This energy can then be 'cleanly' converted into electricity.*



We are the first generation to know, categorically, about climate change and to realise that we are culpable. Previous generations were the cause of the changes in the climate that we are suffering already, but they were ignorant, so we cannot blame them. We are the ones that have a huge responsibility as we know the causes and our role. We cannot claim ignorance.

There are major savings to be made in every aspect of our lives, whether through the use of more efficient products, using energy more carefully, switching to lower carbon sources, or changing our lifestyles. A 20% carbon saving by 2020 is the minimum we should be looking to achieve, with at least 60% reduction by 2050.

Some people have major opportunities to bring about change through influential decisions at work – choices that result in the production of more efficient products, enhancing demand for green energy by putting it in the factory or head office or relying on more local sources for components. The options are everywhere.

For the rest of us, the effect of our individual choices will not be so great, but the cumulative impact of our many, small changes will be significant. I believe that gradually all aspects of our lives will change as we understand the ways in which we cause carbon dioxide to be emitted into the atmosphere and decide to limit this effect. And it could well be for the good. We will have less hurried lives, as the conference call replaces the executive trip. The allotment becomes the source of some of our food, rather than flying it half the way round the world. Our well-insulated homes will feel cosy and snug and only need the occasional use of the wood stove to keep warm. We will be fitter as we cycle and walk more, and the dinner table discussion will be about the amount of hot water we have obtained from our solar panels on the roof or the effectiveness of different makes of wind turbine.

For a next step.

I suggest you learn to love your electricity (and gas?) meter and keep inspecting the odometer on your car. Keep a weekly record of how you are consuming energy and try and work out where it all goes. Set yourself an achievable target, even if it is to use less this year than last year. More ambitious goals would be even better, but, as with any addiction, deciding to change is the most important step. That way, you will be contributing to a better world for your old age, your children and future generations – and you will also be saving money.

I suggest you learn to love your electricity meter and keep inspecting the odometer on your car. Keep a weekly record of how you are consuming energy and try and work out where it all goes.

References

1. Dr Brenda Boardman is the head of the Lower Carbon Futures team at Oxford University's Environmental Change Institute, and a co-director of the UK Energy Research Centre. Her main research focus is on how to achieve demand reduction in energy across the UK economy. She was awarded an MBE in 1998 for her work on energy issues.

42. FACING THE PERSONAL CHALLENGE

Andrew Casebow

Figure 42.1 *New sources of renewable energy must be found to ensure energy security.*

Global warming is mainly caused by releases of greenhouse gases. Sir Nicholas Stern, author of the Stern Review, wrote that "the scientific evidence is now overwhelming: climate change demands an urgent global response"[1].

It now falls to us to make a difference.

Towards a low carbon future

Our lead chapter by Dr Brenda Boardman of the Oxford University's Environmental Change Institute, gives us the facts in a forthright way. Remember that most of the energy that we consume is in our homes and for personal transport, and we can and must make a difference. As she says, 'we can no longer claim ignorance'.

Replacing fossil fuels

We must reduce our reliance on fossil fuels. Oil production has already peaked and will decline over the coming decades. Moreover, unstable or hostile governments control much of the remaining reserves of natural gas and oil. This demands greater efficiency and requires that new sources of renewable energy must be found to ensure energy security.

In Guernsey, although we import the majority of our electricity from France, much of which is generated by nuclear power stations, local oil fuelled generators are also used. Unlike our European neighbours, the States currently has no policy to support renewable energy and requires the utilities regulator to act only on economic criteria. The consequence is that there is virtually no renewable energy available to islanders.

Renewable energy

In our next chapters Steve Morris considers the potential for renewable energy in Guernsey, particularly wind, wave and tidal power that can be generated using the tidal flows around our islands; whilst Patrick James discusses the benefits of micro-generation in our homes.

International agriculture can provide renewable fuels, such as ethanol and bio-fuel but much of the drive towards these fuels is based not on a desire to reduce carbon emissions but to provide greater fuel security.

Dianna Bowles from the University of York gives us an insight into how developments in biological science will help to replace fossil fuels.

Low energy homes

Probably the most important thing that most of us could do is to reduce the use of energy in our homes, particularly of oil, coal and gas for heating. This might involve the use of a more efficient boiler or converting our heating systems to electricity, and much better standards of insulation; but for many of us it means just caring sufficiently to turn down the thermostat, and to live in slightly cooler homes and offices. Muir Ashworth discusses opportunities for energy saving in the home and office, whilst Andrew Ozanne considers the potential for new 'eco-housing' projects in Guernsey.

Rebound

We need to guard against 'rebound'. This is the worrying phenomenon whereby someone becomes less careful in their energy usage, following some energy-saving activity. For instance, I may think "it doesn't matter" if I turn up the Thermostat a bit now because I've put some insulation in the roof.

Carbon footprints

Tina Fawcett, from the Environmental Change Institute, helps us to calculate our own personal carbon 'foot-print', and discusses the possibility of personal carbon allowances; whilst Chris Leach considers how Guernsey's businesses can play their part. The recently published British Government's 'Climate Change Bill' set out enabling powers that will allow that government to extend carbon trading across the British economy. In the long term, carbon trading could be extended to individual's own carbon emissions. In Britain every person could have his or her own personal carbon allowance and those whose carbon footprint is less than their allowance might be able to earn money by selling their unused allowances to those who need them.

Offsetting

Another opportunity considered by Nick Day, is for offsetting our use of carbon fuels by investing in third-world energy efficiency projects or forest re-planting.

Transport

Transport and the cost of transporting food to us from around the globe are also considered. For personal transport we might consider purchasing more efficient vehicles with lower carbon emissions, car-sharing to go to the office or to take children to school, linking multiple purposes in one trip, switching to walking or cycling for short trips, using the bus and even re-considering whether we should take long holiday trips.

Local Guernsey case studies

Finally we consider some local Guernsey case studies describing what local Guernsey families have been doing to reduce their use of carbon fuels. This may be by investing in new technologies and better equipment, as outlined by Paul Fletcher, or by the simpler but effective route of just using less energy in our daily lives, as demonstrated by Mandy de la Mare.

Summary

The starting point for Guernsey's transformation into a low-carbon economy is mundane. Energy efficiency starts at home (or office), or to be more specific in the un-insulated walls and roofs that give us a chance to stop wasting energy, save money and help the environment. But that should only be a start!

Energy efficiency is a journey not a destination, and most of us (myself included) have not even started on the road yet.

References

1. Stern Review 2006. The Economics of Climate Change, Executive Summary.

43. RENEWABLE ENERGY – ITS PLACE IN GUERNSEY'S ENERGY 'MIX'

Steve Morris[1]

Figure 43.1 *Home wind turbine.*

The use of renewable energy has been widely promoted across the world to reduce emissions from the combustion of fossil fuels. This chapter focuses on how renewables could contribute to Guernsey's energy mix.

Guernsey's Position in 2007

The only major source of renewable energy is electricity imported from the European grid, where the production base includes renewable sources such as wind and hydro-electricity.

Increasing the Proportion of Renewable Energy

Renewables can be added to the island's energy mix either by large scale development or through the efforts of individuals. This brief resume will consider both scales of development in the context of the local generation of renewables.

Sources of renewable energy are largely the same at either scale, but some sources are more suitable for large scale development whereas others will more readily be deployed at small scale.

Measurement Essentials and a Reference Framework

It is convenient to discuss power output in kilowatts (kW) or megawatts (MW) and energy production in kilowatt hours (kWh) or megawatt hours (MWh).The maximum instantaneous electricity demand of Guernsey is about 72MW and the annual total electricity demand 360 million kWh.

Sources and Application of Renewable Energy

Wind Power

The production of electricity from wind turbines commenced in the 1970s. Given this history of about 30 years there is a wide range of wind turbines available. The output range is from 100 watts up to 3MW. Small machines can be very suitable for use by private individuals when operated in parallel with the electricity grid.

A typical 1kWh turbine on a good site may be expected to produce about 3,500kWh annually. It is most important to place the machine where it will receive a stable flow of wind at the highest possible velocity. The energy output of a wind turbine varies with the cube of the wind speed. Wind turbines must also be sited with regard to potential noise disturbance to neighbouring property.

Larger wind turbines, in the size range 500kW to 3MW, could make a meaningful contribution to Guernsey's energy needs. They are, however, physically very large. A typical 2MW machine requires a tower up to 100 metres tall. Large wind turbines can produce electricity at prices similar to existing local sources but the economics are less favourable for small machine sizes. Similarly, offshore sites would significantly increase the costs.

Solar Power

Modern solar power systems can be divided into two categories – thermal and electric. Both categories are more suitable for small-scale utilisation.

Solar thermal systems are typically used for heating domestic hot water. In Guernsey a household with a solar collector between 2 and 4m^2 mounted in a reasonable south facing position will be able to reduce energy consumption on water heating by 50%. A typical solar array for water heating will have a capital cost in the order of £2,500 to £5,000.

Electricity can be generated directly from sunlight using photovoltaic cells (PV). There is a wide range of PV cells, ranging in output from about 30W to 5.5kW. A typical 1.5kW (peak) PV array will have an area about 12m^2 and a cost of about £10,000 plus additional costs to allow its output to be converted to suit the mains. Such an array could be expected to produce about 1,100kWh annually, provided it is sited in a good, unshaded, position.

Tidal Power

Energy can be extracted from tidal streams by mounting a device looking rather like a windmill in a suitable place where it will encounter a fast flowing tidal stream. Islanders will be well aware that Guernsey enjoys current flows of 5 to 6 knots.

As with a wind turbine, the amount of energy delivered will increase by the cube of the water velocity. The greater density of water with respect to air makes the size of a water turbine much smaller than a wind turbine for the same output power.

Like the tides, the production of energy from a tidal stream device is largely predictable.

Tidal stream energy is a relatively new concept with only prototypes demonstrated to date. The first commercial scale pre-production machine will be deployed in Northern Ireland in the near future.. Unlike wind and solar, tidal stream energy is only suitable for major developments.

Wave Power

Interest in harnessing wave power started in the 1970s and various prototypes have been constructed to demonstrate possible extraction techniques.

Globally the wave power resource is very large. It has been forecast that 25% of the UK's electricity demand could be generated from reasonably economic wave power sites around the coastline. The economics, however, are largely unproven, since the machines are still pre-commercial, but a promising design has recently been tested.

As with tidal power, wave power is really only suitable for large-scale developments.

Conclusion

Guernsey is well situated to make use of locally generated renewable energy, with usable wind, tidal and solar resources and an extensive electricity grid with import/export facilities. However, local renewable utilization will require economic stimulus.

Figure 43.2 *Thermal solar panel.*

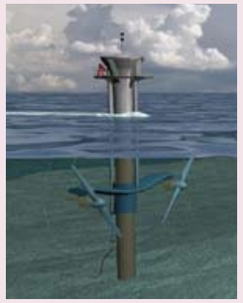


Figure 43.3 *Schematic drawing of an offshore tidal power station.*

Figure 43.4 *Wave power station.*

References
1. Steve Morris BSc, C.Eng., MIET. is Engineering Director of Guernsey Electricity.

44. MICRO-GENERATION IN THE BUILT ENVIRONMENT

Patrick James [1]

In Guernsey, the built environment is responsible for most of the energy consumed. A major component of this is associated with housing, notably through space heating, hot water, cooking, lighting and consumer appliances. Micro-generation in the built environment is associated with low carbon technologies such as photovoltaics (PV), solar thermal, combined heat and power (CHP), ground source heat pumps and micro wind turbines which can achieve energy conversion at their point of use. With rising fuel prices and an increasing awareness of the environment, micro-generation is viewed as one of the key ways to reduce the carbon footprint of housing.

Consider the 'de Garis' who live in a 1930s semi-detached house. They have extended their house by the addition of a conservatory, a space which they now heat electrically in the winter months. What can they do reduce their carbon footprint and save themselves money? The house consumes approximately 20,000 kWh of energy per year in terms of space heating (~11p /kWh from gas) and 4,000 kWh of electricity (~12p/kWh normal rate).

The most important factor is to understand the energy flows associated with their building – where are the heat losses and what are the energy hungry appliances? Measures include: enhance the level of loft insulation, eliminate drafts, fit double glazing, install cavity wall insulation (if possible) and replace the thermal barrier (doors) to the conservatory. These measures, which could halve the heating demand, should be undertaken before micro-generation is considered.

The next step is to understand the energy resources essentially the sun, the wind and the ground. Houses in Guernsey have a potentially excellent wind resource and high levels of solar radiation. Solar thermal (evacuated glass tubes) can provide the majority of hot water, roof mounted PV could supply 50% of the electrical demand of the de Garis' house with a wind turbine contributing perhaps 10-20%. However, care must be taken with micro-wind turbine site selection. The power output of the turbine is proportional to the cube of the wind speed. Therefore, wind shadow effects from surrounding buildings or terrain can dramatically reduce the energy yield from a turbine.

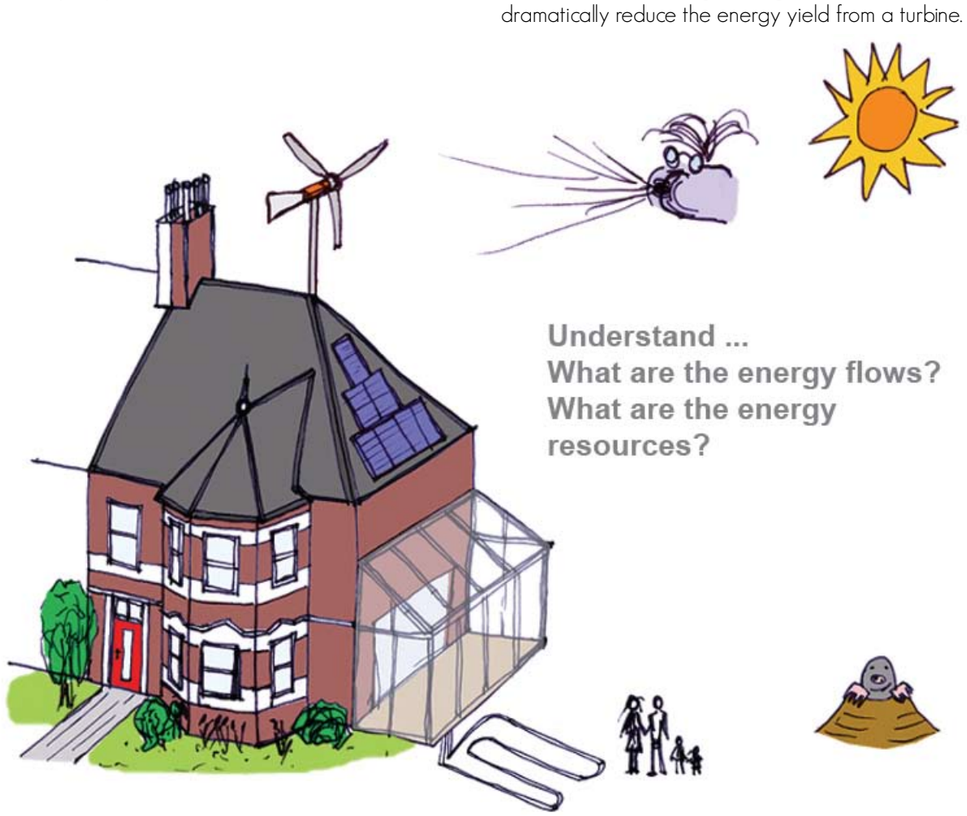
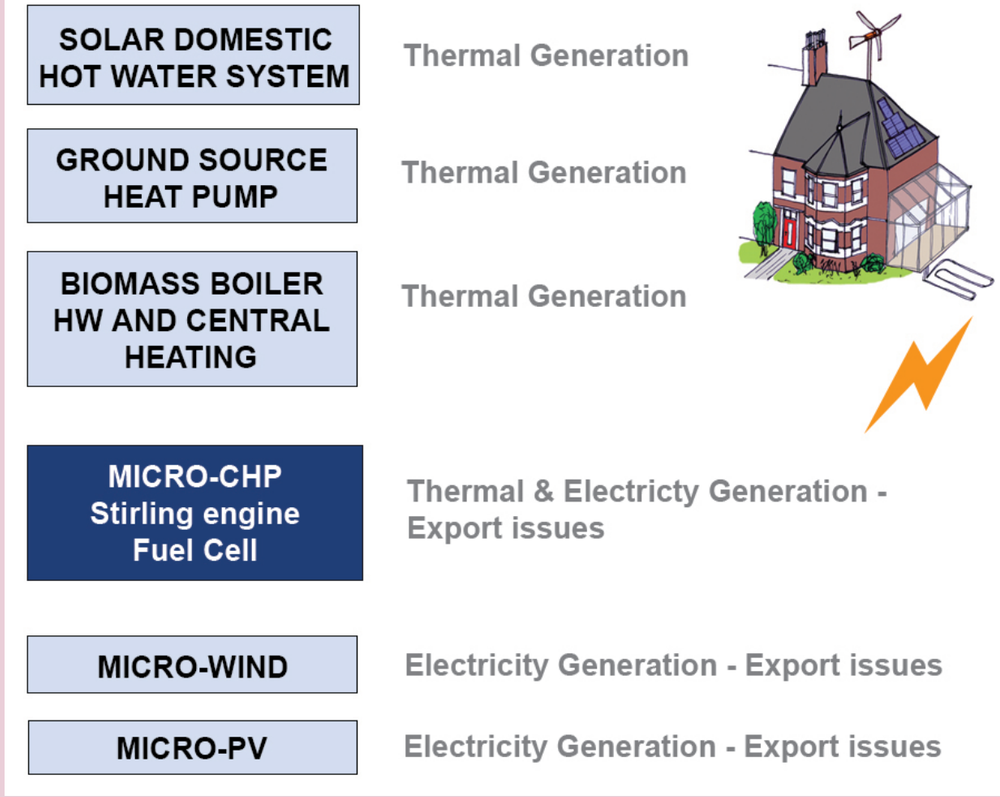


Figure 44.1 *The 'de Garis' live in a 1930's semi . . .*

Ground source heat pumps consist of a network of fluid filled pipes buried in the ground 1-2m below the surface. These systems provide base level heating during the winter and summer cooling with the system operating in reverse. However, they require large gardens and disruptive groundworks to install which reduces their potential application.

Micro-CHP (combined heat and power) is an emerging technology in which the existing boiler in a house is replaced by a unit that produces both heat and electricity at the same time. Whilst this is not a renewable energy, the overall conversion of fuel to 'useful energy' within the home may be better than if the fuel was used to generate electricity in a power station, and heating provided by a gas fuelled domestic boiler. However, the price of gas in Guernsey means that unlike the rest of the UK, micro-CHP is uneconomic for domestic users who mainly use oil-fuelled boilers. CHP at a larger scale may be suited to companies with large heat demands. In Guernsey this could include hotels (especially those with large swimming pools) and heated glasshouses although other alternatives such as ground source heat pumps may result in a lower carbon footprint.

Figure 44.2 Micro-generation Technologies



However, with all these micro-generation technologies the most important criteria is the impact of user behaviour. If, for example, people leave windows open in winter, electrical appliances on standby, or fit an air-conditioning unit to their house, the benefits of having applied micro-generation will have been lost.

To find out more about micro-generation visit our website www.energy.soton.ac.uk.

References
1. Patrick James is a member of the Sustainable Energy Research Group, School of Civil Engineering & Environment, University of Southampton.

45. THE NEW BIO-BASED ECONOMY

Dianna Bowles [1]

Figure 45.1 *Rapeseed fields in the UK. Rapeseed is an alternative to fossil fuel; its pure oil product can be used to generate electricity, and in the manufacture of biodiesel for powering motor vehicles.*

A new era is beginning: the replacement of the current economy based on fossil reserves with a new economy - based on agricultural raw materials and biological resources.

As we all know, fossil reserves are finite and increasingly there are issues of security and cost of supply. Society's dependence on fossil-derived energy to drive our economy is well recognised. Less well known is the dependence of our chemical industries on those fossil reserves. Petrochemicals are used throughout the chemical and pharmaceutical industries as feedstocks for consumer goods such as plastics, health-care and drug products and agrichemicals, including fertilisers.

With fossil reserves of oil and gas diminishing and their costs increasing, global manufacturers are seeking alternative raw material feedstocks for the production of energy, chemicals and materials. These economic drivers complement society's need for sustainable and environmentally-friendly technologies in industrial production, which are together driving a new, emerging commitment to a bio-based economy.

The complete shift in the basis of the global economy will have major impacts on agricultural production. The bio-based economy of the 21st century will rely on the biosciences and their associated technologies. Biology is the science of the natural world. Through the use of our existing knowledge and the new understanding we develop through research, many opportunities can be realised for the sustainable manufacture of bio-products and bio-fuels.

The ability of green plants, whether terrestrial or aquatic, to capture solar energy and use carbon dioxide to manufacture chemicals, is clean technology. This clean technology is sustainable; plants are capable of high capacity production of chemicals such as oils, starches and proteins, as well as complex natural 'scaffolds', well beyond the ability of the global chemical and pharmaceutical industries.

In our current economy, oil is processed in oil refineries to separate different components for different uses. In the bio-based economy, biorefineries will replace the oil refineries and agricultural feedstocks will be separated and processed for many different products and uses.

New opportunities over the coming years for the farming community of Guernsey and elsewhere globally, are immense. Farmers are the producers of the agricultural raw materials that will be used increasingly for industrial production. It will become essential to develop new policy and regulatory frameworks to determine relative land use. Land will be required for food, feed for livestock, and industrial feedstocks for energy and chemicals. Following reform of the Common Agricultural Policy (CAP), markets will play a much greater role in the strategic decisions of farmers, since subsidy will become minimised. Land-based production is important for the bio-based economy, but marine resources are also considerable, with a vast diversity of aquatic organisms also capable of using solar energy to manufacture biomass and biochemicals.

There continue to be bottlenecks in the efficient use of agricultural feedstocks, whether resources from the land or the sea. Efficiency, both in terms of economics and environmental impacts of the process and product, must be considered. Science, particularly bioscience, will play a significant role in helping to overcome these bottlenecks.

In recognition of the need for integration across supply chains from research to deployment and using the products and know-how from the farming, marine, energy and chemicals sectors, the Knowledge Transfer Network (KTN), Bioscience for Business, is taking forward a new UK initiative: the BIOHUB (www.biosciencektn.com). The initiative is industry-led and aims to help ensure UK competitiveness in the new bio-based economy. For further information and regular updates on progress and opportunities, please register at the website.

Figure 45.2 *'All life depends on sunlight and a green leaf'.*

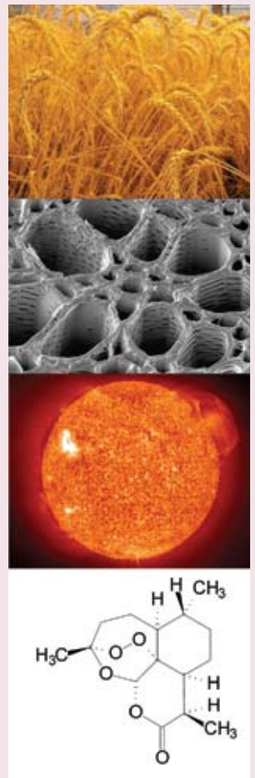


Figure 45.3 *Plant biomass is capable of producing high capacity, complex natural bio-chemicals, fuels and materials by capture of solar energy.*

References

1. Professor Dianna Bowles holds the Weston Chair of Biochemistry at the University of York. She is Director of the Centre for Novel Agricultural Products and Chair of the KTN, Bioscience for Business.

46. RENEWABLE FUELS

Andrew Casebow

Professor Dianna Bowles has described how "the use of agricultural raw materials as feed stocks for industrial production is key to the new bio-based economy." This is based on the ability of green plants to capture solar energy into plant biomass that can be used as the basis for new fuels and bio-chemicals. Just as ancient sunlight created fossil reserves that are processed in oil refineries, the sunlight of today and tomorrow is captured in bio-renewable feedstocks that can be processed in bio-refineries.

Fuel Security

Oil supplies are now at their peak of supply, whilst worldwide demand is increasing (Figure 46.1). The US and European supplies are likely to run out first, meaning that these countries will increasingly depend for their future supplies on potentially unstable or antagonistic governments.

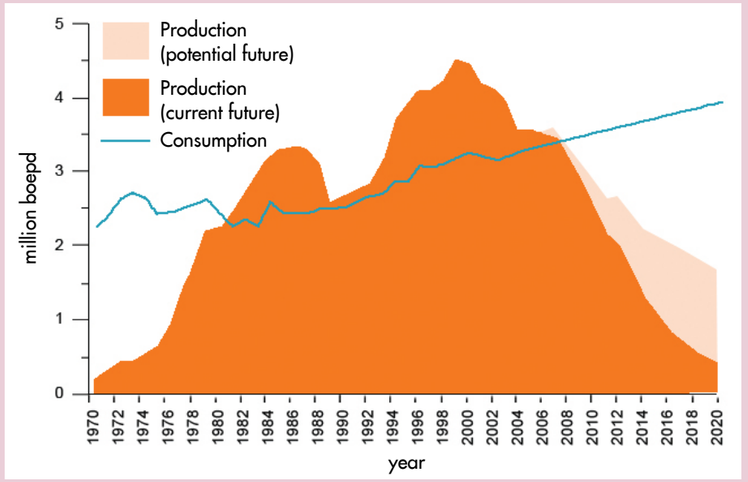


Figure 46.1 *Rate of oil production from 1970 to 2020.*
Source UKOOA / DTI.

The British Government is obligated to obtain 10% of its energy requirements from renewable sources by 2010, and 20% by 2020. The principle driver for this is the 'Renewable Obligation Certificate' (ROC) scheme where by a premium price is paid for electricity generated from renewable resources. Similarly, the British Government enacted a Renewable Fuels Transport Obligation (RTFO) in 2005, which mandated a 5% renewable fuels inclusion in UK transport fuel supply by 2010.

If the UK is to achieve its renewable energy targets, dramatic changes in land use must take place. Energy production, from crops such as willow coppice, will take place alongside food production, wind farms will proliferate on higher ground, and bio-fuels will provide new non-food markets for agricultural crops.

Renewable fuels

Renewable fuels produced by agriculture include:

- **Biogas.** Produced using well-established 'anaerobic digestion' technology that uses farm slurry and food waste as the feedstock to produce gas that is then used to power small-scale electricity generators. There are several thousand farm and community based biogas digesters operating successfully in Germany and Denmark.

- **Biomass.** The growing of coppiced willow, or miscanthus (elephant grass), will be possible on a field scale in Guernsey. Willow grows up to 6m high and is harvested every 3 years (Figure 46.2). It could be successfully grown in wetland areas but could have landscape consequences. Willow plantations are very beneficial to biodiversity and wildlife. The wood chip produced could be used in small-scale micro-generation systems for electricity and heat, such as the heating of schools, business centres, glasshouses or community housing developments. Biomass might also be available from arboriculture (wood chips) and from recycling of waste wood and other products.

- **Bio-fuels (bio-ethanol and bio-diesel).** Bio-ethanol is produced from a variety of agricultural products (maize grain in the USA, sugar cane in Brazil, and feed wheat in Europe) and blended with gasoline (petrol). Vegetable oils are produced in Britain from oil seed rape and blended with diesel oil. There is mounting concern about the clearance of forest to grow palm oil for bio-diesel production in South America and South-east Asia.

There has recently been a massive growth in bio-ethanol plants in the USA where, in the State of Iowa alone, there are currently 56 plants in operation or planned. Similar plants are planned in Britain. This has increased the price of grain, and reduced the amount that is available to alleviate starvation in 'third world' food aid schemes [1].

In Britain a 5% blend of ethanol with gasoline would require the production of about 1 million tonnes of bio-ethanol, which could be manufactured from 3 million tonnes of feed wheat (produced from over 1 million acres of land). This has already increased the price of wheat leaving Britain's farms by 30%, which will have a 'knock-on' effect on food prices. If the vegetable oils for a 5% inclusion in bio-diesel were also produced in the UK, it has been estimated that biofuel production would require up to one third of all arable land in the UK.

Second Generation Fuels

Looking into the future, it is likely that the '2nd generation' renewable fuels will be produced directly from cellulose, which is contained in the cell walls of plants so grasses and other crops could be utilised. A UK Department for Transport (DFT) RFTO feasibility document concludes that once 2nd generation bio-fuels come on stream, the UK could be growing 30% of its transport fuel requirement by 2050. This will have a significant and far reaching effect on food prices and wildlife in Britain.

Conclusion

It is likely that blended ethanol fuels will become available, but the scale of operation means that these could not be produced within Guernsey. Biogas production is unlikely to be viable in Guernsey unless subsidised and required to further reduce waste pollution. A potential use of some agricultural land would be the production of wood chips from willow coppice or miscanthus, if a specific market for micro-generation and heat developed. It is perhaps more likely that, as food prices increase, it will become more profitable for farmers and growers to grow more vegetables and livestock for local consumption.

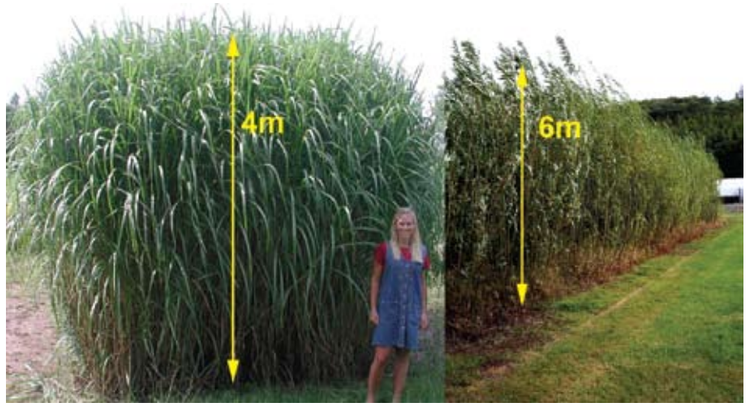


Figure 46.2 *(a) Miscanthus, and (b) Willow plantations.*

References

1. An increasing amount of world grain production is likely to be diverted into ethanol production for fuel in the future. This is likely to cause ever greater food shortages and higher prices. At the same time the human population is predicted to rise by about 50% by 2050, from 6.4 billion to over 9 billion people (which is more than twice the world population in 1970).

47. FOOD MILES AND SUSTAINABILITY

Andrew Casebow

Figure 47.1 *Eat the view! Cows watching a local farmer, wildlife adviser and the author discussing a field bank wildlife habitat.*

Food miles are the measure of the distance that a food travels from field to plate. This has become accepted as a convenient indicator of sustainability; and has led to a general movement towards local production and local consumption.

Most of the food consumed in Guernsey is imported from the UK, and an increasing proportion comes from much further away in the rapidly 'globalising' market.

Agriculture and food now account for nearly 30% of all goods transported on UK roads and 19 million tonnes of carbon dioxide emissions annually. Transport of food by air is increasing. Although it accounts for only 1% of food tonne miles, it produces some 11% of total food transport emissions.

Food Miles as an 'Indicator'

The UK Department of the Environment, Food and Rural Affairs (DEFRA) commissioned a report to look at 'The Validity of Food Miles as an Indicator of Sustainable Development' [1]. The Report identified four dramatic changes in the food production and supply chain that have occurred over the last 50 years. The most striking changes have been:

- Globalisation of the food industry with increased imports and exports and ever wider sourcing of food within the UK and overseas.
- Concentration of the food supply base into fewer, larger suppliers, partly to meet demand for bulk year-round supplies of uniform produce.
- Major changes in delivery patterns with most goods now routed through supermarket regional distribution centres using large heavy goods vehicles.
- Centralised sales in supermarkets, where a weekly shop by car has replaced frequent food shopping on foot at small local shops.

However, the report concluded that the transport of food was a complex issue and 'food miles' was an inadequate indicator of sustainability. There are so many variables, such as the energy used in growing the crop and the type of transport used getting it to the consumer.

Why does food travel so far?

One reason why food travels further now is because the centralised system in the UK has taken over from local markets. A litre of milk can be transported many miles to be processed and packaged at a central depot and then sent many miles back to be sold near where it was produced.

How far has my food travelled?

It's difficult to be sure. The food's origin might be on the label, but that will not tell you the means of transport. Importing joints of lamb by boat from New Zealand may have a lower environmental impact than a shorter journey by road.

Animal welfare

The transport of live animals by road to slaughter is an important animal welfare issue. Whereas animals slaughtered in Guernsey have a short journey to the local abattoir, animals slaughtered in other countries may be subjected to a long road journey to a large centralised slaughterhouse.

Fresh local produce

We have the opportunity to purchase freshly gathered vegetables and we often know the farm where they were produced. Milk comes from the local breed of Guernsey dairy cows, renowned for high quality milk. Our Guernsey cows are tested free of many cattle diseases that have become commonplace in the UK and Europe, and precautions are taken to ensure that livestock diseases do not spread to this island. Guernsey potatoes and vegetables are available in local shops and Guernsey beef, pork and lamb are available from local butchers (see Figure 47.2).

"Eat the view"

Our decisions as consumers can have a big influence on the way farmland is managed. The character of the landscape, local wildlife habitats and the quality of the environment are all linked to the farming of the land. Our sustainable farming systems provide quality products whilst maintaining environmental quality and the diversity of the countryside.

Community supported agriculture!

Community supported agriculture is about reconnecting people with the farm on which their food is grown.

Some useful addresses:

http://www.soilassociation.org
http://www.freedomfoods.org.uk
http://www.foodroutes.org

References
1. AEA Technology Environment (2005). The Validity of Food Miles as an Indicator of Sustainable Development, DEFRA.

Figure 47.2
(a) Potato packing at Guernsey Farm Produce, St Saviours.

(b) Fresh Guernsey beef at Meadowcourt Farm, St Andrews.

(c) Tostevin's Vegetable stall, Forest.

(d) Guernsey Farmhouse Ice Cream, Le Hechet Farm, St Saviours.

48. OPPORTUNITIES FOR ENERGY SAVING IN THE HOME AND OFFICE

Muir Ashworth[1]

One of the most significant ways that we can reduce emissions of carbon dioxide is by minimising energy consumption. The Building Research Establishment has estimated that 30% of all CO_2 released to the atmosphere is due to energy use in dwellings; for the average household this can be illustrated as follows:

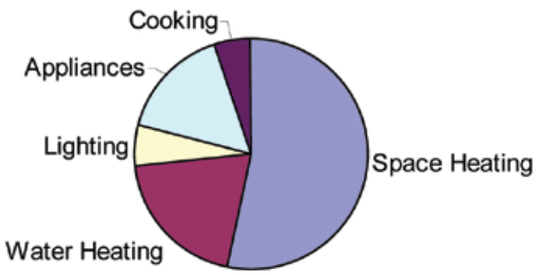


Figure 48.1 *UK domestic carbon emissions.* *Source HM Government (2006) Climate Change, the UK Programme.*

It is relatively easy to improve efficiency of energy use in all these areas (and so reduce the 'carbon footprint') by:

Improving thermal insulation:

- Insulating wall and loft spaces (as a financial spin off, cavity wall insulation on average pays for itself within 3 years).
- Fitting low emissivity [2] double glazing.
- Insulating hot water cylinders.
- In winter, turning heating down and wearing more clothing.

More efficient heating:

DEFRA have identified that a 'normal' heating boiler can achieve a seasonal efficiency of about 78%, whilst a condensing boiler can reach 88%. Further enhancements to overall efficiency can be gained by fitting state of the art programmable heating controls (including thermostatically controlled radiator valves).

- Sealing draughts, without compromising controlled ventilation.
- Careful use of heating and electrical appliances:
- Turning off lights when not needed, changing to energy efficient bulbs, not leaving TVs, computers, chargers etc. on standby (this wastes on average £25 per year per household).
- In the office, ensuring that heating and air conditioning are set to minimum comfort levels and keeping windows shut if either is in use.
- Using hot water efficiently, whether for washing or cooking, for example by not overfilling kettles or over boiling saucepans and ensuring that washing machines and dishwashers are filled to optimum capacity before use. Showers are more energy efficient than baths.

An efficiency plan such as this can be monitored by checking electric/gas/oil bills, which will not only highlight reduced energy use, but will also show the added benefit of reduced costs.

Indirect energy consumption also adds to CO_2 creation; nearly every aspect of home and office use encompasses the use of energy (including transport of essentials such as food and fuel) and so there is opportunity to reduce CO_2 release by purchasing such items from sources as close to the island as possible.

When building new dwellings or offices, the use of timber frame construction with rigid foam insulation is the best construction method available locally for high thermal efficiency (with the benefit of low embodied carbon).

Figure 48.2 *There are many good reasons why timber frame is the fastest growing method of construction in the UK. Its environmental, delivers high build quality, and is a faster and more efficient construction process.*

Figure 48.3 *Rigid foam insulation contains hundreds of millions of densely packed air cells. It gives very effective insulation and is practically impossible to be penetrated by moisture.*

References
1. Muir Ashworth, BSc (Hons), ICIOB, graduated from the University of Bath with a degree in engineering, and from the London Southbank University with a degree in Construction Management. He spent 23 years with a local manufacturing company and now works for Norman Piette specialising in construction materials.

2. 'emissivity' is a measure of the efficiency by which a surface emits thermal energy.

49. THE POTENTIAL FOR ECO-HOUSING

Andrew Ozanne[1]

Figure 49.1 *Completed in 2002, the Beddington Zero Energy Development (BedZED) is the UK's largest carbon-neutral eco-community - the first of its kind in this country.* *Image © Bill Dunster.*

We all understand how to measure architectural design, construction and maintenance in terms of financial cost. However, to apply the objective of living more 'sustainably' we need to measure the construction and building use in terms of 'environmental impact'.

In Guernsey houses are typically constructed with a dense concrete block cavity wall. This form of construction is considered thermally heavy. The internal space is slow to warm due to the time taken for the structural mass to warm up. However when the heat source is removed the mass cools down slowly releasing heat, which maintains the temperature of the space enclosed. In Scandinavia buildings are traditionally constructed of timber frame with high levels of thermal insulation. These are considered thermally lightweight. The internal space heats up quickly as the heat is contained within the space but the space cools down quickly as there is no thermal storage in the external fabric. Thermally heavy spaces make use of solar gain whereas thermally light spaces do not. Thermally heavy spaces if designed correctly can be better when the heat source is intermittent.

Thermally heavy spaces are used when there is an intention to use passive solar techniques, i.e., through large south facing conservatories or windows. A study in New Zealand showed that an insulated ground floor slab provided a heat reservoir.

Externally

The main façade of the dwelling should face as close to south as possible and endeavour to avoid over-shading. Site contours can often be exploited to maximise solar gain or minimise adverse affects of cold winds. Overheating of conservatories can be overcome by the planting of deciduous trees or shrubs, which can offer summer shade whilst allowing winter sun penetration.

Internally

Isolate heated areas within the house from unheated spaces. This can be done by insulated dividing partitions. Install low e-glass or triple glazing where possible. Select your window frames on the basis of energy efficiency and ensure that any joints in the building fabric are sealed or protected from cold bridges. Think carefully about the use of a conservatory, as they are extremely inefficient in retaining heat. The advantages gained through passive solar heat gain are quickly lost, creating an energy deficit if you centrally heat the space.

Plan layout

Rooms should be placed on the appropriate side of the building, either to benefit from solar heat gain or to avoid it where necessary. Window shades or blinds can reduce overheating yet enable winter solar gain. Maximise south facing windows and minimise north-facing windows. Traditional granite masonry walls level out the peaks and troughs of temperature due to the thermal mass of the construction. Conservatories, in addition to being a buffer space can be used to preheat incoming ventilation air.

Heating

It is important to ensure that heating boilers are appropriately sized and efficient. In traditional central heating systems thermostatic radiator valves are essential. Heating controls such as thermostats should be carefully positioned and their operating system understood. The heating system should be controlled to take account of the actual occupation requirements. Hot water storage should be located as near as possible to the points of use with storage cisterns being designed specifically to meet user needs. If your building can achieve a high standard of air tightness then a heat recovery ventilation system is beneficial if not essential, but you need to manage the risk of condensation.

Material durability

This should be considered due to the energy used in the preparation of materials, and during the construction and use. Similarly, the servicing cost of operating a grey water system must be measured against other forms of energy efficient use.

The 'Beddington Zero Energy Development'

This housing development was built in London by the Peabody Trust (a housing association). The project had to be financially viable and, in order to cover the cost of achieving the excellent energy efficiency, housing densities were high. Locally recycled materials, such as steel and wood were sourced and the fabric of the houses included 300mm of insulation and triple glazed windows. The space-heating requirement was 90% less than a normal house. A central combined heat and power unit fuelled by both gas and wood was installed to generate heat and electricity, with the excess sold to the National Grid. Solar energy units were used to power 40 electric cars in a car pool. Water conservation was achieved by using water saving toilets, dishwashers and washing machines. Rainwater and grey water is collected and recycled and a recycling programme (including organic composting) is operating.

Figure 49.2 *Schematic drawing of the BedZED development shown in the main image Figure 49.1.* *Image © Bill Dunster.*

This development is likely to be a signpost to the 'house of the future'.

Further reading: http://www.peabody.org.uk.

References
1. Andrew Ozanne is a Partner in Lovell Ozanne & Partners, Chartered Architects and Surveyors.

50. WHAT ARE PERSONAL CARBON EMISSIONS?

Tina Fawcett[1]

Figure 50.1 *Air travel is already responsible for twice the emissions of land-based travel.*

All of us are responsible for emissions of carbon dioxide ('carbon' for short) in our daily lives. Every time we fill up the car, switch on the lights or take a flight, carbon is emitted into the atmosphere as a consequence of fossil fuel energy usage. In the UK, household energy and personal transport are together responsible for around half of all carbon emissions. The other emissions in the economy are from organisations that provide us with goods and services.

Personal emissions from direct use of energy vary hugely between people. Emissions are affected by many factors from the efficiency of your house or the heating fuel you use to where you take your holidays and how you get there. A study of a small number of people in the UK showed the highest person emitted thirteen times as much as the lowest (some examples of emissions are shown in Figure 50.2). Even higher emitters with annual footprints above 50 tCO_2e - ten times the national average – have been found in other studies.

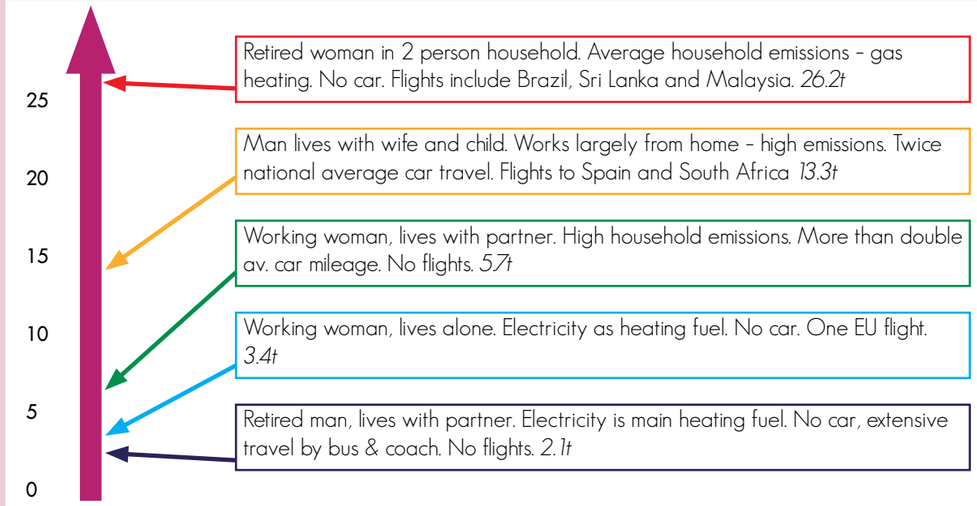


Figure 50.2 *Examples of Personal Annual Carbon Emissions in the UK in 2004 (where air travel is calculated as carbon dioxide equivalent (CO_2e)).*

For UK residents, the biggest contribution to personal emissions comes from household energy use (43% of the total), followed by air travel (34%) and then travel on land (23%). As air travel is rising very quickly, its proportion of the total will increase – indeed some estimates suggest it may be already responsible for twice the emissions of land-based travel.

So, are emissions on Guernsey likely to be very different from those in the UK? Guernsey differs in a number of significant ways from the UK. From Figure 50.2 we can see a number of factors potentially pushing emissions higher than the UK and a number pushing them lower. The combination of Guernsey's location and the affluence of the population probably means people travel significantly more by air, which could overwhelm all other factors and lead to higher personal emissions. It seems unlikely that personal emissions would be much lower than in the UK. With that average figure of 5.4 tCO_2e in mind, how about calculating your emissions to see how you compare?

Factors leading to higher emissions

- Long distance travel inevitably involves either ferries or aircraft which have high climate impact.
- Affluent population – emissions tend to rise with income.
- Main heating fuel – oil is higher carbon than natural gas, the UK majority fuel.

Factors leading to lower emissions

- Less opportunity for day-to-day long distance driving.
- Warmer climate – less need for home heating energy.
- Electricity has lower carbon emissions per unit.

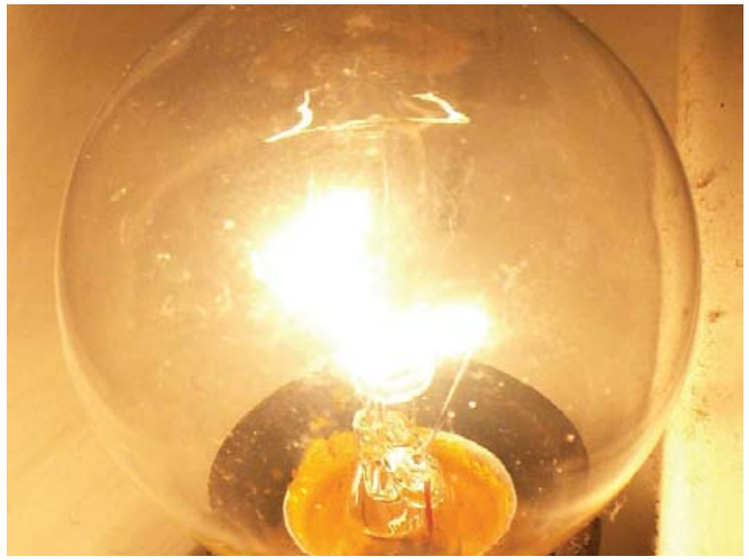


Figure 50.3 *In the UK, 43% of personal CO_2 emissions comes from household energy use. Turning off lights and appliances will help to reduce this.*

References

1. Dr Tina Fawcett works at the Environmental Change Institute, University of Oxford and for the UK Energy Research Centre. She is co-author of the Penguin book 'How we can save the planet' (Hillman and Fawcett 2004).

51. CALCULATING YOUR PERSONAL CARBON EMISSIONS [1]

Tina Fawcett

So where do you fit on the scale of carbon emissions? Are you deep green (less than half the average) or bright red (more than four times the average)?

To calculate your carbon footprint, first of all you need to collect information about your household energy use and distance travelled by different methods. You could either start collecting information now for the coming year, or use existing records and estimates of last year's energy use and travel. Then you can use the conversion factors provided in Table 51.1 to translate these into an annual carbon emissions figure.

Step 1: Collecting information about household energy use

- Electricity – from your electricity bills find out how much electricity in kilowatt hours (kWh) you use per year. It doesn't matter whether the electricity is on-peak or off-peak – it's the overall annual total you need.
- LPG Gas – you need your consumption in kWh.
- Oil – you need your annual consumption in litres of oil.
- Solid fuel – if you use wood for heating, assume zero carbon emissions. If you use coal, one kilogramme of coal produces 2.4 $kgCO_2$.

For all types of household energy divide each total by the number of people in your household, to get your personal energy consumption.

Step 2: Collecting information about personal travel

- Car – only count the distance you travelled as a driver. Car passenger miles are not counted.
- Air travel– work out the distance you flew by using www.webflyer.com – or estimate based on your geographical knowledge.

All distances travelled in miles can be converted to kilometres by multiplying by 1.6.

Step 3: Calculating your emissions

- Put these figures for your annual consumption in the table to the right.
- Then use the multiplier in the next column to get the figure for your carbon dioxide emissions in kilograms ($kgCO_2$).
- Add up your emissions from all your different activities to get an annual figure in kilograms of CO_2, divide by 1000 to get the answer in tonnes.

What next

Having obtained your total, now compare yourself with the average UK resident. If you can, compare yourself with some friends and colleagues as well. How did you do? Work out where most of your emissions come from and where you could cut down.

In addition, think about how your emissions relate to future reductions targets. As the scientific evidence about climate change becomes ever more alarming, deeper emissions cuts are demanded. We may be required as a country and individuals to cut emissions by between 60% and 90% within the next thirty years.

Taking action on your own to reduce emissions can be difficult, so consider getting together with other people. You could create a carbon 'Weightwatchers' club. Already people are starting to take action like this – for examples of UK groups see:

www.carbonrationing.org.uk.

Larger communities are also working together to reduce their emissions see:

www.goingcarbonneutral.co.uk.

Good luck!

Energy Use		YOUR annual consumption	Multiplier	YOUR emissions	Average UK individual
In the household					
Electricity (Guernsey specific figure)		kWh	x 0.205		} 2,350
Gas (LPG)		kWh	x 0.23		
Oil*		Litres	x 3.0		
Personal Travel					
Car**	petrol (as driver)	km	x 2.0		} 1,060
	diesel (as driver)	km	x 0.14		
Rail	Intercity	km	x 0.11		} 100
	Other services	km	x 0.16		
Bus	Local	km	x 0.17		} 90
	express coach	km	x 0.08		
Air***	within Europe	km	x 0.51		} 1,800
	outside Europe	km	x 0.32		
Ferry****		km	x 0.35		
Annual total					5,400

Table 51.1 *Annual carbon dioxide emissions ($kgCO_2e$) for personal energy use.*

* Each tonne of fuel oil generates approx. 780 – 875 kilos of carbon depending on grade of fuel. Multiply by 3.2 to get tonnes of carbon dioxide produced. Therefore, one tonne of fuel oil produces about 2.5 – 2.8 tonnes of carbon dioxide!

**This is an average figure for all cars. However, large 4X4s can have emissions three times those of small fuel-efficient cars. So if you have a large car this calculation will underestimate your true emissions. For more details on emissions from your particular car see www.vcacarfueldata.org.uk.

*** Calculating emissions from air travel is still hotly debated. These figures include a multiplier of three to account for the full global warming effect of emissions from aircraft.

**** Emissions factors for ferries are not well known, this is the best current estimate.

Figure 51.2 *Once you have calculated (and reduced) your own carbon emissions, why not turn your attention to reducing emissions from your place of work.*

Further information

Hillman and Fawcett 2004 '*How we can save the planet*'. Penguin. London. (The source for most numbers and calculations used in this article).

icount 2006 '*Your step-by-step guide to climate bliss*'. Penguin. London. (Very lively practical guide from 'Stop Climate Chaos' a coalition of environment and development organisations.).

www.est.co.uk/myhome - comprehensive advice about saving energy at home.

References

1. This calculation is of your personal emissions and does not include other 'national' emissions.

52. COMMERCIAL BUILDINGS – REDUCING BUSINESS CARBON FOOTPRINT

Chris Leach [1]

Figure 52.1 *Commercial light pollution in St Peter Port, Guernsey.* *Pictures reproduced courtesy The Guernsey Press Co Ltd.*

Commercial buildings in Guernsey mainly use gas or oil as fuel for heating, but with the introduction of air-conditioning systems over the past 15-20 years they are also a big consumer of electricity.

Guernsey's commercial sector accounts for 46% of the electricity consumed, and electricity consumption in this sector has risen over 30% in the past 10 years. Some may argue that the majority of Guernsey's electricity is generated from a 'clean' source (i.e. nuclear), but there is no guarantee that this will remain the source of our electricity supply in the long term. It therefore makes sense to look closely at the energy use of commercial buildings.

Energy is one of the largest controllable costs in most organisations and there is usually considerable scope for reducing consumption in buildings.

As an offshore finance centre Guernsey is home to a large number of prestigious offices and commercial buildings. These buildings vary in age and construction and the services within them vary enormously. This provides an opportunity for the occupiers to understand their building and introduce changes that reduce their fuel consumption, thus reducing their annual spending on electricity, oil and gas and, in the process, reducing their carbon footprint.

The majority of commercial building occupiers are not trained in energy management and may struggle to understand how best to reduce fuel consumption, but help is available. A register of qualified Low Carbon Consultants [4] is available on line and these people will provide professional advice. There are also some straight-forward guidelines to follow:

Look at the building fabric:

- Older buildings may require wall or roof space insulation.
- Check the glazing, clear glass generates high solar gains in a building and puts a high demand on air-conditioning systems; external shading or coating the glazing can reduce solar heat gains.

Look at the building services:

- Use heat recovery ventilation, heat pumps and free cooling systems.
- Use condensing boilers, these have a higher efficiency than conventional boilers.
- Use low energy lighting systems (avoid tungsten lamps).
- Use lighting control systems to switch off lights when natural lighting is adequate or to ensure unoccupied areas are not lit; particularly relevant in underground car parks.
- Make use of building control systems to operate plant and equipment; these systems carry out a wide range of automatic operations from basic time-clock control to full energy monitoring.

Monitor Energy Consumption:

- Electricity, oil and gas consumption can be easily monitored either by manual reading of meters or automatically by using data logging equipment.
- Maintain a log book of energy usage. You cannot attempt to save energy until you start to monitor current consumption trends.
- Consumption can be compared against industry benchmarks for particular building types.
- Set targets to reduce consumption and introduce initiatives to help meet these targets.

Benchmarking

Benchmarking is a useful way of seeing how your building's energy consumption compares against other similar buildings. Organisations such as the Building Services Research and Information Association [2] and The Carbon Trust [3] provide typical and good practice energy consumption targets in KWh/m2 per year for different types of commercial building. The energy use of many Guernsey buildings is as much as 50% above the amount considered 'good practice'. There are considerable opportunities for improvement and cost savings.

Energy Saving Initiatives

Contrary to popular belief, energy saving initiatives do not always require a large capital spend. Companies and organisations can follow some simple steps:

- Start with a simple energy policy that involves the staff and encourages their ideas.
- Adopt an organisational structure that recognises employees responsibilities for energy management.
- Adopt a staff suggestion scheme to generate ideas.
- Monitor energy consumption and set targets. This costs little but can save 5% energy consumption.
- Ensure that existing plant and equipment is appropriately maintained, which must include the building services control systems.
- Procure energy efficient equipment when repurchasing (i.e. replacing CRT monitors (40w) with flat screens (20w)).

Legislation

It makes economic sense for organisations to take the initiative and reduce their energy consumption but when Guernsey adopts the latest changes in the UK building regulations many of the suggested initiatives are likely to become mandatory for building operators:

- In the UK, changes in the Building Regulations were introduced in 2006 to achieve a reduction in carbon emissions by up to 27% in non-dwellings, 22% in houses and 18% in flats when compared against 2002 levels.
- The regulation includes the installation of utility meters and regular and detailed monitoring in a building log-book so that 'at least 90% of the estimated annual energy consumption of each fuel can be accounted for', and any changes to a building that would effect the energy consumption are recorded.

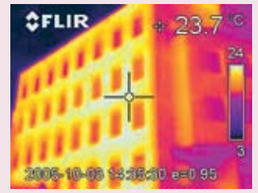


Figure 52.2 *Infra-red imaging shows areas of heat loss.*

Useful information booklets available from The Carbon Trust:

Include:

GPG231 - Introducing Information Systems of Energy Management.

ECG019 - Energy use in offices.

GIR012 - Organisational Aspects of Energy Management.

References

1. Chris Leach has a degree in mechanical engineering and is a member of the British Institute of Facilities Management. He is managing director of Amalgamated Facilities Management.

2. BSRA - http://www.bsra.ac.uk.

3. The carbon trust: http://www.carbontrust.co.uk/.

4. Low Carbon Consultants register: http://www.cibse.org.

53. OFFSETTING CARBON DIOXIDE EMISSIONS

Nicholas Day[1]

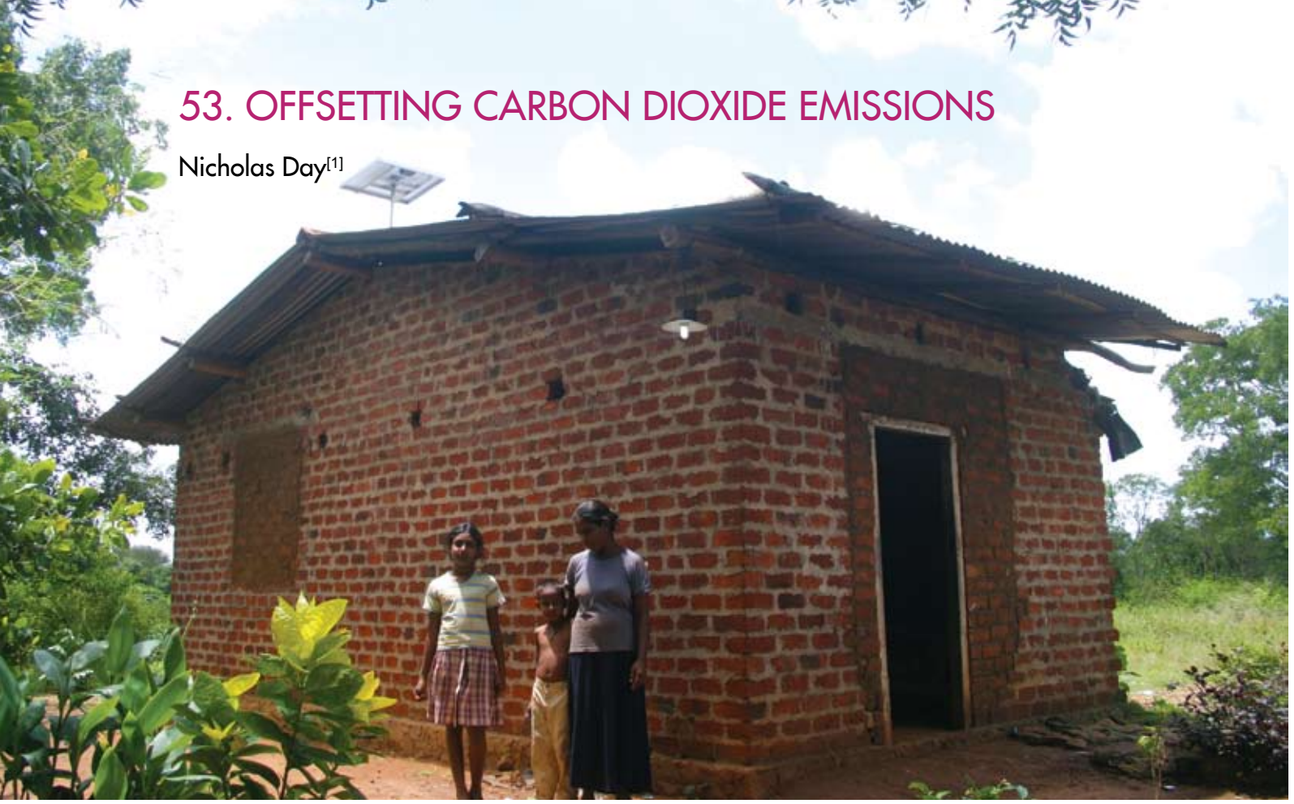


Figure 53.1 *Global Warming is a global problem. Third world countries such as Sri Lanka are benefiting from carbon offsetting. Note the photovoltaic cell panel on roof.*

Carbon 'offsetting' has emerged as an additional way that individuals and organizations can indirectly cut their carbon emissions. Carbon offsets are generated from projects that reduce the amount of greenhouse gases entering the atmosphere.

The most cost effective and environmentally sound way to address an individual's (or organization's) carbon footprint is to first focus on direct emissions. Reduce your carbon footprint and make cost savings by implementing cost-effective energy efficiency measures. Then, if appropriate, consider developing an offset strategy, purchasing only high quality offsets from verified projects that genuinely create reductions in emissions.

The basic concept of offsetting is appealing. Carbon dioxide emissions are a global problem, and the atmosphere mixes fairly efficiently. It makes little difference to future global atmospheric concentrations where emissions, or reductions in emissions, take place, so there is much to be said for reducing emissions where it is easiest and cheapest to do so.

In much of the developing world, major improvements to a rural community's local economy and way of life can be made by the provision of a non-polluting electricity supply. One example is the supply of photovoltaic solar panels to a rural village in Bangladesh, where previously light had come from kerosene lamps, and electric power from diesel generators. As the number of panels increases, providing an almost cost-free electricity supply, many aspects of local life improve. There are many such examples where the benefits of an offsetting programme can be disproportionately large, given the level of investment made.

Offsetting, however, has received a mixed press. Several environmental groups object to it, suggesting that offsetting is a soft option, giving people an excuse from making the effort to reduce their own emissions, which in the future they will have to do. This counsel of perfection is not easily applied in small island communities such as Guernsey. Transport to and from the island is an essential lifeline, and offsetting the ensuing emissions is the only option until transport technology changes. Additionally, a close relationship with the marine environment is an essential component of many small islands' culture. Much of this 'pleasure boating' is dependent on fossil fuels, which can be made carbon neutral by 'offsetting'.

More substantial reservations have been expressed that some of the offsetting schemes lacked transparency, or any guarantee that the claimed reductions would actually occur. For schemes based on tree planting, additional arguments were raised, that many years would elapse before the full impact would be achieved, and that in the interim the trees could die, be consumed by fire with the carbon returning to the atmosphere, or otherwise not achieve the carbon sequestration claimed.

Clearly purchasers of offsets need to be confident that the emission reduction apparently purchased will actually occur. In order to provide assurance to purchasers of offsets that the requisite reductions will occur, the Department of the Environment in the UK is establishing a system of certification.

There are ten or more schemes in the UK which offer offsetting. Details of most of them can be found at the website www.all-energy.co.uk. They encompass a wide variety of projects. The merits of the different types of project are discussed in some detail in the publication 'The Carbon Trust three-stage approach for a more robust offsetting strategy' that is available free of charge from the Carbon Trust [2].

Many projects, particularly in developing countries, offer wider social and environmental benefits than just the emission reduction. Offsetting, despite the doubts sometimes expressed, is still the only feasible way to eliminate one's carbon footprint. In an island community such as Guernsey, where air and sea travel are indispensable, and many people have a close relationship with the sea, offsetting could have an especially important role to play.

Figure 53.2 *Treadle pumps, supplied by Climate Care [3], used for irrigation in India to replace diesel powered pumps. Each treadle pump saves approximately 0.5 tons CO_2 per year. Image courtesy of Climate Care.*

Figure 53.3 *Smoke-free Patsari stoves in a tortilla restaurant in Mexico. Each stove saves over 5 tonnes of CO_2 per year (compared with an open fire) and Climate Care is funding GIRA to provide 500 more stoves over the next 3 years. Image courtesy of Ashden Awards.*

References

1. Professor Nicholas Day is Emeritus Professor of epidemiology at the University of Cambridge, where he was director of the Institute of Public Health, and co-director of the Strangeways genetic epidemiology research laboratory. He has been associated with Guernsey for almost 50 years.

2. The Carbon Trust three stage approach to developing a robust offsetting strategy. Booklet CTC 621, November 2006. Available as a PDF or as a free printed publication. www.carbontrust.co.uk.

3. www.climatecare.org.

54. GUERNSEY CASE STUDIES: COMBATING RELIANCE ON FOSSIL FUELS

Paul Fletcher [1]

Renewable energy can be provided by new innovative, yet off-the-shelf, technologies and techniques. A combination of energy conservation by improved insulation and efficient technologies, means that energy use and carbon dioxide emissions can be substantially reduced, in some cases by as much as 60 - 70% by these well proven techniques. The technology is available to implement Carbon Zero housing, it just takes planning and investment. Technologically it's not hard to save the planet!

The following local people have made a start:

Nigel Gale

On building a new house, Nigel (a local builder) wished to build in as much energy efficiency as possible. He combined Rockwool filled 100mm cavity walls, 60mm thick Celotex roof insulation, and floor insulation with underfloor heating pipes. An NHER [2] energy assessment worked out the heat loss of the home to size the condensing boiler back up. A bespoke heating and control system was designed to heat the house and pool, utilising some of the heat otherwise lost in winter to the home from the solar pool heating system. Compared to a normal domestic home and pool heated by a conventional oil boiler, Mr Gale has reduced comparative oil use by an estimated 60%.

Figure 54.1 *Solar pool heating collectors.* *Image courtesy of Paul Fletcher.*

Figure 54.2 *Ground loop heating pipes buried in the garden.* *Image courtesy of Paul Fletcher.*

Emma Allen and Tim le Tissier

The first thing to find out for this young couple was the projected energy use of their small granite cottage. An NHER energy assessment was calculated, and the different heating systems based on gas, oil, heat pump, or solar energy were discussed. Their preferred choice was a Ground Source Heat Pump – if the ground loop would fit in their long but narrow garden! It did, and it's all up and running. The system uses 4 times less energy than an oil, gas or electric boiler system, and the running costs are half what one would expect from an orthodox oil boiler. It uses electricity to power the compressor, which can be locally generated by renewable energy from photovoltaic cells (or a wind turbine), and, one-day, off-shore wind or tidal turbines.

Jacqui Golden and Tony Thomas

This system was designed and built with environmental concerns as a first principle. The contemporary house makes best use of natural light, and utilises insulated cavity walls, roof and floor insulation and underfloor heating throughout. Jacqui and Tony wanted an eco-heating system from the start so no gas or oil for them. Ground loop panels were too large for the back garden and a borehole ground loop was difficult. Internal space was at a premium so careful design has integrated latent heat thermal stores, large solar heating collectors on the flat roof, horizontal hot water tank and a 4kW in-line electric boiler. Designed for low power consumption over longer periods the planned 2kW photovoltaic system will be able to displace as much direct electricity as possible to power the heating.

Figure 54.3 *Solar collectors heat water and central heating utilising thermal stoves.* *Image courtesy of Paul Fletcher.*

John and Sally le Couteur

John and Sally wanted to make their life more efficient, easier and less polluting by getting rid of their coal back boilers. With a condensing oil boiler, hot water solar heating system, intelligent heating controls, and a house that could be zoned into two areas, carbon emissions were reduced very considerably. A later addition was to install a grid-connected photovoltaic electrical generation plant. Energy from the sun generates electricity in the special silicon panels. The electricity generated is converted from DC (direct current) by an 'inverter', into the normal AC (alternating current) used in the house. If no electricity is being used it can be exported to Guernsey Electricity.

Figure 54.4 *Photovoltaic cells mounted on conservatory roof with solar water heating.* *Image courtesy of Paul Fletcher.*

References

1. Paul Fletcher is Director of a local company specialising in designing, installing and maintaining advanced technology installations.

2. http://nher.co.uk/.

55. REDUCING OUR PERSONAL USE OF RESOURCES: A LOW-COST GUERNSEY CASE STUDY

Andrew Casebow

Figure 55.1 *Environmentalists Amanda de la Mare and Iain Brouard cycled their way across America.*

Whilst many of us would like to take action, we don't all have the money available to invest in new boilers, heat pumps and the like. People who consume most will have to make the greatest cuts, but we can all contribute, and success will come from a combination of many different initiatives.

We have all seen the lists of possible actions that we can take. Here are a few of them:

- Reducing energy use in the home and workplace – better insulation, energy efficient light bulbs, modern efficient central heating.
- Reducing waste going to landfill – by composting, recycling, and minimal packaging.
- Reducing traffic and pollution – encouraging people to walk or cycle, or to use public transport, etc. Not so easy if you have young children!
- Reducing resource use – consider renewable electricity, efficient use of water, using renewable rather than non-renewable products.
- Using fresh local products - wherever possible instead of imported food.

Probably the most important thing we can do today is to switch off lights, heating and appliances in the home when you are not using them. You will probably save more energy doing this than by initially investing in improved technology.

How local people take action to cut their energy use.

Amanda de la Mare and Iain Brouard live in Castel, and 'Mandy' can often be seen cycling to and from work in St Martins. They are good examples of young people who are trying to do their bit!

Housing

"We have just purchased our own home, a 400 year old Guernsey cottage in need of total renovation and will be using recycled and natural materials when ever possible. Materials, such as reclaimed timber, bricks and pan tiles, lime plaster and sheep's wool insulation. Using these materials will be sympathetic to the cottage's construction and aesthetics whilst also helping the environment and saving us some pennies. We are gathering information from the internet, books and the Centre of Alternative Technology in Wales (www.cat.org.uk), who have been very helpful. We will also be incorporating into the project solar water heating, photo-voltaic cells and perhaps a wind turbine. Hopefully, come spring, the site will be clear enough to start a small veg garden."

Figure 55.2 *'Bru' and Mandy's renovation of a 400 year old Guernsey cottage is both environmentally friendly and cost effective.*

Heating and lighting

"Heating the house is a major challenge. At the moment we have a wood burning stove and they are apparently carbon neutral. We are hoping to install a geothermal system with under-floor heating which is very efficient but unfortunately, as with most new technologies, it is expensive. May be it is time for Guernsey to follow the U.K and Europe's lead and provide grants for energy saving initiatives. We use energy saving light bulbs. Hopefully these will become the norm and incandescent bulbs will be banned from sale as in Australia."

Shopping

"We go shopping on our bikes and use reusable bags. We try to buy local produce and, as we are both vegetarians, buy a lot of our food from hedge stalls. We also belong to a local 'organic box' scheme. It's not always that easy but we try to avoid buying over-packaged goods, or products that have travelled a long way. I use environmentally friendly products to avoid putting chemicals down the drain, which therefore end up untreated in our local waters."

Transport

"We cycle or share a car whenever possible."

Holidays

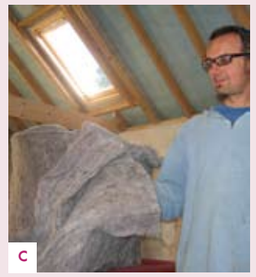
"We like to cycle and camp when on holiday, and we try to avoid flying when ever possible. We also do volunteering work whilst away from home as it's a good way to meet the locals"

We might not all wish (or be able) to cycle as much, or to lead such a 'low impact' lifestyle as Mandy and Bru, but we can all take worthwhile actions to save energy use. However, with so much of the energy that we personally use being in the home and for personal transport, that is the area where we can make the greatest savings.

Perhaps what makes us reluctant to consider the type of 'low energy' lifestyle essential to a sustainable future is that we have been indoctrinated to believe that consuming less energy inevitably means a lower quality of life. That need not be the case.

a

b



c

Figure 55.3 *This total renovation project will use recycled and natural materials when ever possible, such as (a and b) reclaimed timber, bricks and pan tiles, lime plaster and (c) sheep's wool insulation.*

56. RECYCLING IN GUERNSEY

Chris Regan

Figure 56.1 *Recycling Officer - Dr Keith Russell - at the Salerie Corner super site.*

On average every person in Guernsey throws away their own body weight in rubbish every 7 weeks, or to be more precise, buries their own body weight every seven weeks in the islands only landfill site, Mont Cuet. If we continue at the same rate, Mont Cuet will be full by 2015. We need to reduce the amount of commercial and household waste that is going to landfill to ensure that Mont Cuet remains open as long as possible. Rotting waste in landfill also produces large quantities of methane, one of the greenhouse gases.

Reducing

The good news is that Guernsey residents are recycling more now than ever before. However, there is always room for improvement and there are many ways that we can reduce the amount of rubbish that our families produce. For example:

- Try and buy products with less packaging such as fresh local fruit and vegetables. This not only saves on packaging but also supports local industry.

- Invest in a reusable shopping bag; these can be purchased for a few pence and they will last for months, but remember to keep them in your car so you're prepared when you go shopping. If everyone in Guernsey stopped using plastic bags for one year and switched to a reusable bag, we'd save 7.8 million plastic bags - that's enough plastic to tie around the island 100 times.

- Re-use whenever possible; repair shoes, furniture and clothing etc. Britain has become a throw away nation compared to countries such as India which tend to re-use everything. Avoid disposable 'single-use' items.

Recycling

Household rubbish such as cardboard and paper, glass bottles and jars, aluminium drink cans, food cans, plastic bottles and clothing and household linen (including duvets and pillows, etc, as long as they are clean and in good condition) can be deposited at a number of recycling sites throughout the island.

You can separate your household recycling quite easily into a storage box under the sink or if you have more space you can purchase stacking boxes specifically for this. Grass cuttings, garden waste and some food waste can be thrown on the compost heap; composting kits are available from local garden centres. Garden waste can also be taken to the green waste site at Chouet, Vale.. For information on home composting go to www.gov.gg/recycling.

Household Scrap Metal and WEEE (Waste Electrical and Electronic Equipment) can be deposited in the scrap metal skip at Mont Cuet during opening hours (7am – 4pm, Monday – Friday, 7am – 10am, Saturdays). The Public Services Department also provides regular metal recycling weekends for the recycling of these items. There is also a skip for bulk deliveries of household cardboard available at Mont Cuet.

Nearly 30,000 tonnes of commercial and industrial waste was dumped at Mont Cuet in 2006. All businesses have to pay to dispose of commercial waste, so re-using and recycling is an opportunity to save money whilst being environmentally friendly. For advice on commercial recycling contact the Recycling Officer at the Public Services Department on tel. 717000.

So now you know where to dispose of your recycling but what happens to it after that? The following items are exported or processed as follows:

States of Guernsey

- Clear glass is exported off-island for smelting and re-forming into new bottles, approximately half the cost to do this is recovered. Green and brown glass in crushed on-island and made available for use as building aggregate.

- Food tins and drink cans are collected together and put in to a 'hopper' for magnetic sorting; both aluminium and steel are sent out of the island. Recoveries from steel exportation tends to break even, or generate a small financial surplus, whereas aluminium's surplus is considerably more.

- Soil conditioner produced from composted green waste is used on the Island, and is particularly useful in regeneration schemes.

Commercially

- Paper, cardboard and plastics (HDPE [1] and PET [2]) are exported off-island by Mayside to be re-formed.

- Clothes and textiles are collected on behalf of the Salvation Army. The bags collected are sent to the UK and bulk loads are then transported to the developing world for distribution, providing job creation opportunities, and affordable clothing for the needy.

- Items such as scrap metal, electronic equipment, wooden pallets and tyres, etc, are exported for recirculation, reconditioning or recycling. Some soft products such as wood shavings and clean newspaper is kept on-island for animal bedding.

- 'Wet Recyclables' such as mineral and kitchen oil are exported to the North of England, where they can be recycled into fuel oil.

For recycling sites and quick reference details on how to dispose of further recyclables, see **'Recycling Sites'** overleaf.

For comprehensive information on recycling in Guernsey, visit:

www.gov.gg/recycling

or call the Waste Disposal & Recycling Information Line, tel. 12077.

If everyone in Guernsey stopped using plastic bags for one year and switched to a reusable bag, we'd save 7.8 million plastic bags - that's enough plastic to tie around the island 100 times.

References

1. HDPE: A high-density polyethylene plastic used in packaging such as detergent bottles, margarine tubs and rubbish containers.

2. PET: (polyethylene terephthalate) A type of plastic commonly used to package soft drinks, water, juice, salad dressings and oil, cosmetics and household cleaners.

RECYCLING SITES*

Public Services has eight 'super' bring bank sites where you can recycle household **cardboard**, **paper**, **glass** and **plastic bottles** and **jars, drinks** and **food tins** and **textiles**.

They are at:

1. Safeway, Rohais (Perry's Guide ref 16C4)
2. Checkers (Manor Stores) St Martin's (31E2)
3. Salerie Corner car park, St Peter Port (17H3)
4. Vazon Bay car park, Castel (14B1)
5. Cobo Village (pumping station), Castel (8A3)
6. L'Eree car park, St Peter's (20B1)
7. Chouet headland, Vale (6A1)
8. Longfrie Inn, St Peter's (27F1)

There are also limited facilities at a number of other sites throughout the island.

DOMESTIC RECYCLING ROUTES

- **Aerosols:** Aluminium and steel aerosols with their plastic lids removed can be put into bring banks for cans.
- **Bulk Refuse. Vehicles and bulky household items such as beds, sofas, appliances, oil tanks etc:** Public Services, Bulk Refuse Coordinator (tel: 717227) forms available online at www.gov.gg.
- **Car batteries:** Guernsey Recycling (tel. 245402); Wastenot Ltd (tel. 716580); Scrap-it (tel. 07781 126250).
- **Car, Lorry and Motorbike tyres:** Target Auto Parts (tel. 720986); Sarnia Autos, by arrangement (tel. 07781 126250).
- **Computers, Monitors and printers:** Guernsey Recycling (tel. 245402); Scrap-it (tel.07781 126250).
- **Electrical items such as irons, toasters and kettles:** Metal recycling skip at Mont Cuet during tip opening times (tel. 245106).
- **Ferrous and non-ferrous scrap metals:** Guernsey Recycling (tel. 245402); Wastenot Ltd, only ferrous (tel. 716580); Scrap-it (tel. 07781 126250).
- **Garden and horticultural waste, not diseased or sprayed with pesticide:** Chouet horticultural site (tel. 245106).
- **Granite including building stone, lintels, paving, pebbles, boulders:** Vaudin Stonemasons, La Fontaine Vinery (tel. 248316).
- **Greenhouse and house timber, not rotten:** Portinfer timber yard (tel. 254118).
- **Household batteries - bagabattery.com:** ecomundi (tel. 235580); lucas freight (tel. 724480).
- **Laser and inkjet cartridges:** Edgetech Ltd (tel. 729560); Guernsey Specials Gym (tel. 238800).
- **Mobile phones:** Wave Telecom shop (tel. 818181); Cable and Wireless (tel. 700700); St John Ambulance training hall, Rohais (tel. 727129).
- **Oil filters:** Total Waste Recycling (tel. 07781 426460)
- **Pallets (wood & plastic):** Guernsey Pallet Company (tel. 07781 100999); Waste Not (tel. 716580).
- **Plate glass:** Longue Hougue Reclamation Site (tel. 249628).
- **Recoverable inert waste. Builder's rubble, concrete blocks and bricks:** Ronez (tel. 256426) or Island Waste (tel. 235762), both by arrangement.
- **Scrap metal such as bikes and other appliances, small amounts:** Mont Cuet landfill site (tel. 245106).
- **Spectacles:** Specsavers Opticians, Market Street, St Peter Port (tel. 723530).
- **Uncontaminated inert waste. Rubble, sand, gravel, stone:** Longue Hougue reclamation site (tel. 249628).

*Information correct at time of going to print

57. LEARNING OUR WAY OUT OF THE PROBLEM

Alun Williams [1]

Any book that deals with climate change must leave readers anxious and concerned. If so, the antidote may well be to visit any Guernsey school and experience the positive response and the potential for change amongst the island's young people.

Over the past few years global warming, alternative energy and measuring carbon footprints have embedded themselves in the curriculum of our primary and secondary schools.

And so they should. There is no greater challenge for our future generation than how it will sustain the lifestyle to which Guernsey folk are accustomed.

Schools have taken it upon themselves to inform young people of the issues associated with global change. Most areas of the curriculum have embraced the subject:

- The geography curriculum has, of course, been shaped by the debate. Geography is all about natural systems, climate, countries and cultures so, at its very core, is the earth.
- Science can be brought to the very edge of current thinking about developments in animal and plant life.
- And what about citizenship? Where we teach how communities have to live in harmony with each other and the roles and responsibilities of each individual.

The good news is that the young people are well-placed to take up the challenge and respond to it. In spring 2007 the Guernsey Young People Survey was held that asked 100 questions of 2,000 10-17 year olds. The survey was intended to gauge their attitudes to life in Guernsey. The survey is overwhelmingly positive, and, of particular interest to this book, is their attitude to the future and the environment.

When answering the question 'If I were Chief Minister I would...' the priority issue that they identified was, by far, the environment. Their comments are insightful...

- "Get recycling to be compulsory"
- "Clean up Guernsey and make a limit of how many cars there are on the roads"
- "Try to sort out the sewage problem and help fight global warming"
- "Put wave turbines in to make electricity"

The message from young people was:

- Young People know about the environmental issues facing Guernsey.
- They care about their Island and the impact of climate change.
- They are ready and able to do something about it.

So let's follow the lead of the island's young people. Let's learn our way out of the problem.

Figure 57.1 *The Education Department is ensuring that all its new buildings, including the Sixth Form Centre at the Grammar School, and the Princess Royal Centre for Performing Arts, which are both pictured, are designed to modern environmental standards.*

References

1. Alun Williams is the island's lifelong learning manager.