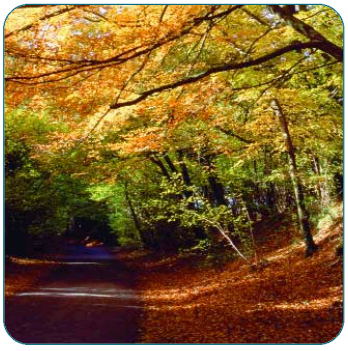
Taking Stock | managing our impact

an ecological footprint of the South East region

TAKING STOCK

managing our impact



Biffaward Programme on Sustainable Resource Use

Contents

www.takingstock.org *for more information*

The Biffaward Mass Balance Programme

Objectives

This report forms part of the Biffaward Programme on Sustainable Resource Use. The aim of this programme is to provide accessible, well-researched information about the flows of different resources through the UK economy based either singly, or on a combination of regions, material streams or industry sectors.

Background

Information about material resource flows through the UK economy is of fundamental importance to the cost-effective management of resource flows, especially at the stage when the resources become 'waste'.

In order to maximise the Programmes full potential, data will be generated and classified in ways that are both consistent with each other, and with the methodologies of the other generators of resource flow/ waste management data.

In addition to the projects having their own means of dissemination to their own constituencies, their data and information will be gathered together in a common format to facilitate policy making at corporate, regional and national levels.

In December 1997 Biffa Waste Services agreed to donate landfill tax credits to the Royal Society for Nature Conservation (RSNC) to administer under the fund name Biffaward. Grants made from the fund currently amount to more than £57 million, supporting many worthwhile environmental projects.

Biffa is a part of Severn Trent Plc and is one of the largest single suppliers of waste management services in the UK. It collects, treats, recovers and disposes of municipal, commercial and industrial waste nationwide and in Belgium.

Supported by

Biffaward investing in the environment

SEEDA South East England Development Agency Working for England's World Class Region

1 Foreword by James Brathwaite CBE,

Chairman South East England Development Agency (SEEDA)

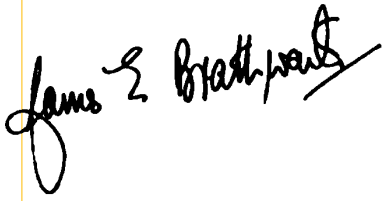
The South East is the most successful of any UK region, with wealth creation, business activity and quality of life in the premier league – it is the driver of the UK economy. But with this success comes the downside of environmental pressures and unsustainable outcomes which are plain to see – congested roads, housing shortages, a looming waste mountain, and all the flooding and coastal defence problems of accelerating climate change. Furthermore, these impacts extend beyond the region – we know that the wealth of the South East in part depends on importing materials and products from other parts of the world, where environmental problems are often more serious.

The key regional bodies in the South East have endorsed the Regional Sustainable Development Framework and are committed to the sustainable development of the region. The Regional Economic Strategy published by SEEDA is firmly based on sustainable development principles and promotes a sustainable approach to the use of resources and materials. There is broad national and regional support for a strategy of sustainable consumption and production, which focuses on improving quality of life, whilst reducing environmental impacts and advancing social and economic inclusion. To deliver these key aims however requires a clear understanding of resource and material flows, together with good quality data – until now, this vital information has been sadly lacking – for example, we have had little idea of how much material actually flows through the region. Taking Stock fills that gap, for the very first time.

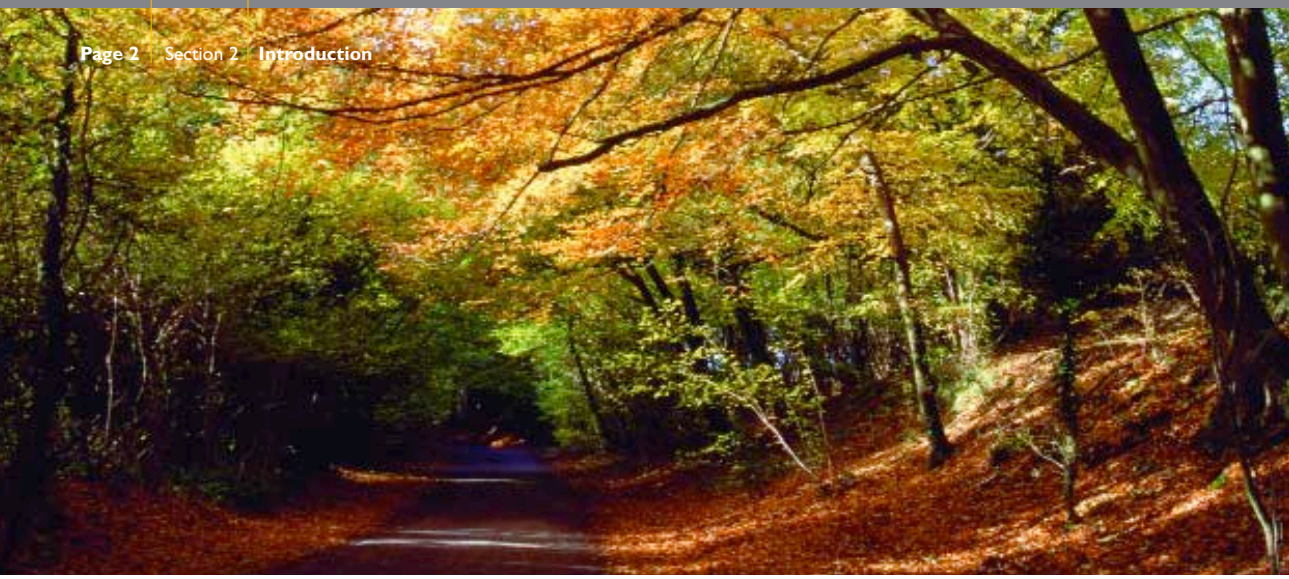
A step beyond the idea of material flows leads to the concept of 'Ecological Footprint' – the amount of productive land and sea required to maintain current consumption in a region. As a single visible image for a host of factors, the ecological footprint provides a powerful insight into regional impacts, and a basis for assessing regional policy on waste, energy, transport regeneration and economic development overall. It also brings home, in dramatic fashion, the legacy which our current way of life is set to pass on to future generations.

The Taking Stock project is a brave first step along the road towards a more sustainable South East region. It shows us vividly that the South East is living far beyond its means, and it shines a torch into the medium future to see where the region is currently heading. In response, it provides some powerful signposts to show what can be done to provide a more sustainable future for our children and grandchildren.

SEEDA has been pleased to support the Taking Stock project from the outset, and we will be playing our part in delivering its critically important messages to the region - and, indeed, beyond its boundaries. Taking Stock and the Ecological Footprint represent a wake-up call to all who live and work in the South East – we need to rethink our attitudes to the use of materials and resources and adopt a more sustainable perspective if we want to maintain our quality of life and to enable future generations to do the same. Far from imposing a constraint, however, there is a wealth of evidence to suggest that such a rethink will stimulate whole new areas of opportunity.



James E Brathwaite CBE



2 Introduction

The Taking Stock project set out to analyse the material and resource flows of the residents of the South East region of England, and to investigate ways to reduce its global impacts. In essence we have been 'taking stock' of the South East.

- The project has analysed the entire physical throughput of materials and energy in the South East region, using best available data for the year 2000. This is known as a ***Materials Flow Analysis***.
- The ***Ecological Footprint Analysis*** assesses material consumption and its impacts based on where the benefit is experienced. It includes imports of all kinds consumed in the region, anything produced and consumed in the region, and other activities that are of benefit to South East residents such as air travel. It excludes exports. As many industries and supply chains are increasingly global in scale, this is a more meaningful and comprehensive analysis.
- The project has also reviewed current policies and strategies in the region, and then reviewed some possible alternative development paths and ***scenarios for the next 25- 50 years***.
- The context for this review is the UK Government's target of ***60% reductions*** in emissions responsible for climate change by 2050, as set out in the DTI Energy White Paper. This target reflects international scientific advice on the reductions necessary between all nations to stabilise CO_2 levels to avoid catastrophic global climate change.
- The Taking Stock project recognises the inequalities between rich and poor nations, and their different contributions to climate change and other impacts. So for the South East region, one of the richest in the world, it sets out a target of ***'Factor Four'*** or a ***75% reduction*** in the Ecological Footprint.
- The Factor Four target is based on the simple theme of ***doubling resource efficiency and halving resource usage***. In other words, using one quarter of the energy and materials we currently consume.

The results focus on measuring three main physical indicators:

- Direct and indirect material consumption;
- CO_2 emissions as the largest single cause of climate change; and
- Ecological Footprint, usually measured in 'global hectares per person'.

Carrying out the research for this has been no mean feat, tracking the supply chains and the lifetime impacts of a myriad of products, as consumed in homes, offices, high streets and internal combustion engines around the region. In fact the Taking Stock project is one of a group of such projects around the UK, currently working their way through a mass of databases, coefficients, trend factors, import-export tables and so on. The methodology is still being finalised, and it does not claim to have the complete and definitive answer. But the evidence is building up for some exciting and realistic solutions.

The Energy White Paper mentioned above is probably the most far reaching of any Government policy, with targets following the best international scientific advice. Officially the UK and the South East are on course to meet their climate change emissions targets, i.e. reducing CO_2 by 20% by 2020 as the first step towards further reductions. This, however, is only counting what we can see – the emissions produced in the South East. It completely ignores emissions from those production processes overseas which supply the region with the cheap products we take for granted. Climate change and the emissions which cause it are a global phenomenon which can only be effectively addressed at a global scale.

What did the Materials Flow and Ecological Footprint Analysis find ?

Material Flow Analysis **-** Your kitchen offers a good example of what we mean by materials flow. Every week one or two supermarket trolley loads come in, and three or four bin bags go out. We also need to include the fuel for the energy powering the fridge, cooker, microwave etc, and indeed the energy and materials involved in manufacturing them. And for the household as a whole, the same principle applies for other items such as furniture, carpets, lighting, toilet paper, garden equipment – and, highly significantly, the family car(s).

In the South East we found that the average person is responsible for 11 tonnes of material coming into the region directly. If you count all the material moved around to get that 11 tonnes delivered, it comes up to 26 tonnes per person. With over 8 million people in the region that's quite a bit of stuff. A total of 211 million tonnes, every year, and rising.

Ecological Footprint **–** This is the single simplest measure of our global impacts. The use of energy produces climate-change emissions – how much forest land is then needed to absorb them by turning them back into trees? Materials need both land to produce them and energy to move and process them – here we have a 'real' land element as well as land needed to absorb the energy emissions. The new measure combining these elements is the Ecological Footprint, expressed in 'global hectares' (acronym **gha,** usually expressed per person) - a land requirement which in reality is spread around the world.

So what do we find? The ecological footprint for the average person in the South East region is nearly 7 global hectares – collectively equivalent to almost 30 times the actual land area in the South East. We are living as if there were 3.5 planet earths to share - somebody else, somewhere else, is paying the price.

Factor Four **–** Offers a straightforward measure of what we would need to do to live on the planet sustainably and equitably. In simple terms we are talking about doubling resource efficiency and halving resource use, which would give a 75% reduction in the use of energy and materials. We need to decouple economic growth from ever-increasing use of resources – we need to achieve 'smart growth'.

In the South East, the Taking Stock project found that a Factor Four target, as explored in some detail below through the 'Factor Four scenarios', is quite feasible over the next 50 years. In fact the South East Regional Waste Strategy more or less calls for it, the South East Regional Economic Strategy supports it, and the UK government aspires towards it. Of course 50 years is a long time, and the future can often surprise us, but as a compass setting the signal is pretty clear.

What next?

To summarise, the South East region is currently over budget – our Ecological Footprint is 3.5 times what would be a sustainable Earth share. We can get back on track, although it will probably take at least 50 years. Some of what we now take for granted will change but most things will improve. It depends on all of us, particularly in our roles as producers and consumers. There is everything to gain for the region, not to mention a fairer, safer, more sustainable world. Can we do it? We are confident that the Factor Four scenarios, ideas and case studies below will provide the inspiration for us all to believe that we can – and, more importantly, to translate that belief into action.

3 Overview and regional summary

This report summarises the findings of the Taking Stock Project which carried out a Materials Flow and Ecological Footprint analysis of the South East Region. This is part of a national programme funded by Biffaward to look at resource flows in the UK regions and in certain sectors. The full project report is available on our website at www.takingstock.org together with other materials including case studies of good practice, self-assessment lifestyle calculator and topic fact sheets.

3.1 Ecological Footprinting

There is a limited amount of productive land on the planet to provide for all humanity's needs and wants. Sustainable development requires that we live within the carrying capacity of the earth, allowing our economies to develop while ensuring that basic human needs such as food, clean water, shelter and warmth are provided for everyone. This is becoming increasingly difficult due to population increases, and it is exacerbated by the inequalities that exist between rich and poor nations. Twenty percent of the global population currently consume over eighty percent of the earth's resources, while 1.2 billion people live on less than one dollar per day.

The amount of productive area (land and sea) required to maintain current consumption in a region or community is its ecological footprint. Four basic land types are used in ecological footprint calculations: **bioproductive land** (sub-divided into arable, pasture and forest) and **bioproductive sea** to provide food and other biomass, notional or indirect **energy land**, i.e. forested land required for the absorption of carbon dioxide emissions and **built land** for buildings, roads and other infrastructure. A fifth type **habitat land** refers to the area of land and water that would need to be set-aside to preserve biodiversity. (See figure 1)

Figure 1: Summary of area types used for ecological footprint analysis (Source: Centre for Urban and Regional Ecology (CURE)

The Ecological Footprint (EF) is measured in a standardised area unit equivalent to a world average productive hectare or 'global hectare' (gha), and is usually expressed as global hectares per person to permit comparisons between countries or regions. For reporting this is often divided into 'real land' and 'energy land' or the land needed to soak up the emissions from energy use. Globally, the average ecological footprint per person was 2.3 gha in 1999 (the most recent year for which data has been calculated) – as opposed to an available estimated capacity of 1.9 gha per person (excluding biodiversity considerations) – suggesting that humanity is using more natural resources than can be sustained in the long term.

3.2 Taking Stock

Taking Stock is a project to analyse material resource flows and produce an ecological footprint for the South East region. It provides a useful tool to assess and compare resource productivity and communicate the impacts of our lifestyles to policy makers and the wider public. The results will be used to inform South East policy for sustainable development in a number of key areas, including economic development, waste management, energy provision, transport and regeneration.

Resource flows were assessed for the year 2000 by carrying out a Material Flow Analysis (MFA, sometimes referred to as a "mass balance") for the South East region. This is based on the principle that the mass of inputs to a region equals the mass of outputs in terms of products, emissions and wastes, plus any change in stocks. The analysis focuses on the consumption of goods and services by households and the commercial sector in the South East, including consumption wherever it occurs both inside and outside the region, in order to capture the benefit to South East residents.

It includes materials directly used and consumed, but also 'hidden' material flows including ores and wastes from extraction or harvesting, energy used for extracting, transporting and producing materials and greenhouse gas emissions from energy use. This is also known as the 'life-cycle' approach, including all phases from cradle to grave, i.e. extraction, transportation, production, use and disposal.

The ecological footprint takes things a stage further by helping us to understand the environmental pressures caused by these material flows, thus aiming to give us a comprehensive indicator for ecological sustainability. In other words it tells us whether we are living within the capacity of the earth's biosphere to regenerate itself, or if we are depleting the stocks of natural capital on which we depend. This study calculates the ecological footprint of South East England by considering the amount of land the South East requires to provide the goods and services it consumes and to absorb all the waste and emissions it produces, based on data for the year 2000. The study focuses particularly on transport, food, construction, household products, energy, water and waste.

3.3 The South East Region

The South East region covers 1.9 million hectares to the south and west of London, including 19 counties and unitary authorities and 55 district authorities. It is home to just over 8 million people, making up some 3 million households. In 2000, minority ethnic groups accounted for 3.5% of the population. Since 1991 the population has grown by 5.7 %, mainly by in-migration, and it is expected to grow by 10% over the next 20 years.

Scenically very attractive and environmentally diverse, the South East contains a third of England's ancient woodland, two fifths of its lowland heathland, a third of its wildflower meadows and a quarter of its chalk grassland. There are over 700 Sites of Special Scientific Interest (SSSI) covering 7% of the region, and 72km of the coastline is designated Heritage Coast. Two thirds of the region's land area is used for agriculture, and the region is home to 7 cities with populations of more than 100,000.

3.3.1 The economy

Between 1990 and 2000, the South East economy grew faster than any other UK region, expanding at an average annual growth rate of 3.1% against 2.2% for the UK. Due to the scale of the South East economy, which is critical to the performance of the UK as a whole, and its location, the region acts as the engine of growth and the gateway to Britain. The South East had an estimated GDP of £140 billion in 2002 making it the second largest regional economy in the UK (after London) and the 22nd largest in the world.

With over 255,000 VAT registered businesses and 373,600 business sites, the South East accounts for 15% of the UK's total business base and over 25% of UK business expenditure in research and development. There are over 100 universities, further education colleges and research centres, and the region is also the hub of the UK's communications network, with transport infrastructure of national and international importance. The region's economy is closely linked to that of London, and also significantly influenced by its proximity to mainland Europe.

Total employment in the region stands at 4 million, equivalent to 15 per cent of UK employment. Service industries employ almost 80% of the workforce with a further 19% employed by production and construction industries and a small fraction in agriculture, forestry and fishing. The average level of income in the South East is relatively high and leads to higher than average levels of health indicators and life

expectancy. There is, however, considerable variation within the region. The eastern and southern parts, mainly coastal fringes, are performing below the regional average and a significant proportion of the workforce is employed in low skilled/low paid jobs, with over 600,000 people of working age having no qualifications. There are 372,000 households living in houses classified as poor – the highest figure outside London.

3.3.2 Prosperity and consumption

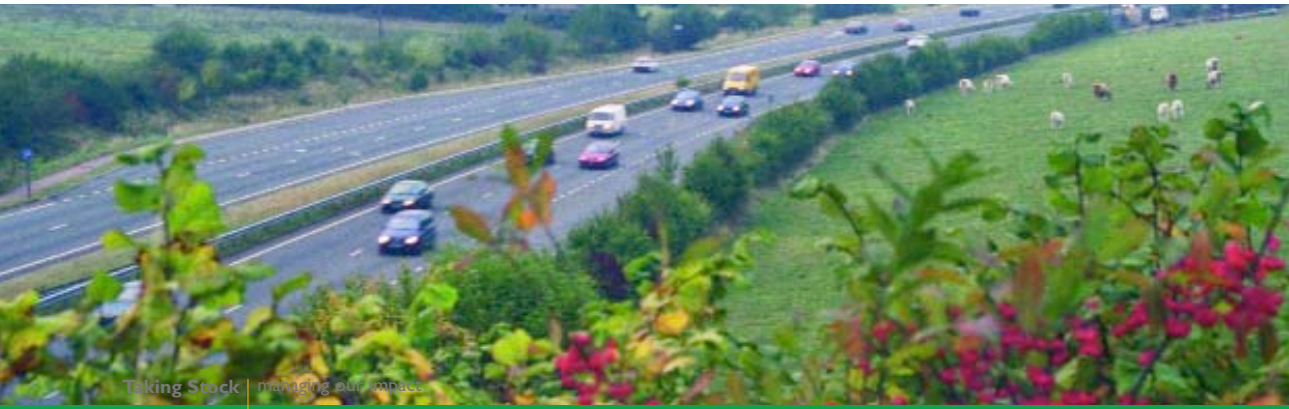
A defining characteristic of the South East is its level of consumption, mainly due to its economic prosperity. Residents of the South East travel further than residents of any other region, they go on more holidays, produce more waste, purchase more consumer items and have the highest demand for housing. Serious transport problems and the worst traffic congestion of any region, except London, is another impact being imposed by the massive economy on the people of the South East. These impacts are probably exacerbated by the lowest level of public investment per head of any English region.

These negative impacts look set to continue with government plans for substantial new housing developments to accommodate forecast growth. The South East has to deal with both the effects of an overheated economy and areas of severe social and economic deprivation. Waste is increasing in line with wealth, water is a scarce and often over-committed resource, and levels of energy generation from renewable resources are very low, with a high dependence on fossil fuels. Land availability is a crucial constraint, and it is expected that climate change will lead to an increased risk of flooding and breaches in sea defences.

High economic prosperity in the region has been accompanied by increasing pollution and exploitation of the natural resource base raising great concerns as to the future quality and capacity of the region's environmental assets. While the South East on the whole still performs well in terms of environmental quality, there are clear indications that further economic growth in the region without effective protection of the environment and wise use of natural resources will mean we are unable to sustain the high standards of living currently enjoyed by most residents.

It can also be argued that GDP, the traditional measure of economic prosperity, is sorely inadequate – pollution, ill-health and waste all boost GDP by creating demand to clean up after the mess, but these detract from quality of life. The ecological footprint measure, by attempting to capture all aspects of maintaining our lifestyles, provides a useful supplementary indicator to show the impact of that prosperity.

One of the major challenges for the South East region is making wealth creation less dependent on resources. We need to decouple economic development from increasing use of material resources, and this can be pursued by the twin-track strategy of increasing efficiency and reducing our current levels of consumption. While indications are that some progress has been made towards this 'decoupling' in the UK economy, the South East offers a unique opportunity to further explore these possibilities. The Taking Stock project looks at the gains that can be made through increases in efficiency and investigates the fundamental changes needed in mobility, housing, household consumption and the provision of services.



4 Results: Material Flow Analysis and Ecological Footprint for the region

4.1 This study is based on consumption rather than production in order to capture the use of resources and the impact on the environment that we are responsible for in the South East, wherever it occurs, rather than simply that which takes place in the region. This reflects the benefit to South East residents. For this reason the results of the material flow analysis are presented in two different ways:

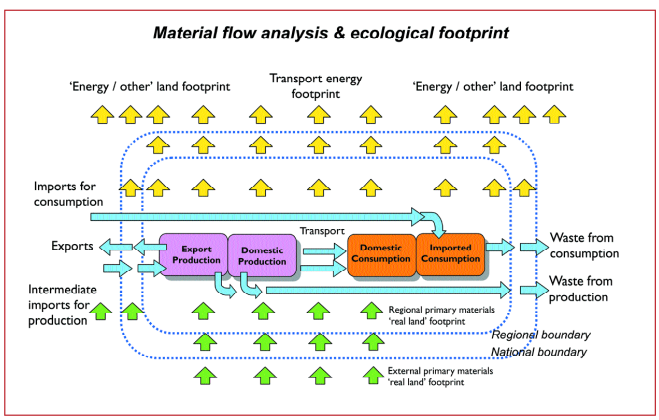
1 As Direct Material Consumption (DMC) which is the total amount of materials directly used in the regional economy and consumed in the region, i.e. excluding exports.
2 As Total Material Consumption (TMC) which is the total material use associated with the regional consumption activities, including DMC and the indirect or 'hidden' material flows associated with it. Again this excludes exports and their associated indirect flows.

While ecological footprinting is an excellent method for communicating total environmental impact, it does have some limitations. These include:

- The aggregation of a range of different environmental impacts to one common measure.
- The simplification of complex life-cycle effects, i.e. in the case of highly manufactured electronic goods.
- The omission of most inter-industry trading, i.e when one industry makes products which are inputs for another industry.
- The definition of boundaries and exports, crucial in defining production and consumption (See figure 2 below).
- The analysis focuses on households and private and public sector economic activity. Social or third sector activities, such as the work of charities and community initiatives, are not included.
- Great care has to be taken to avoid double counting as, depending how results are divided, a component may appear in more than one section. Figures presented in this section are corrected for double counting.

From the economic perspective, the separation into sectors e.g. transport or food, is in a sense artificial, as each sector is inter-dependent on others. This is, however, useful in terms of organising and reporting the findings and in terms of informing regional policy. From the social perspective the use of ecological footprinting is perhaps most useful as an input to a wider discussion on quality of life and the social processes which may enhance it. The footprint results help raise awareness and provide a useful conceptual tool to explore consumption choices.

Figure 2



Results

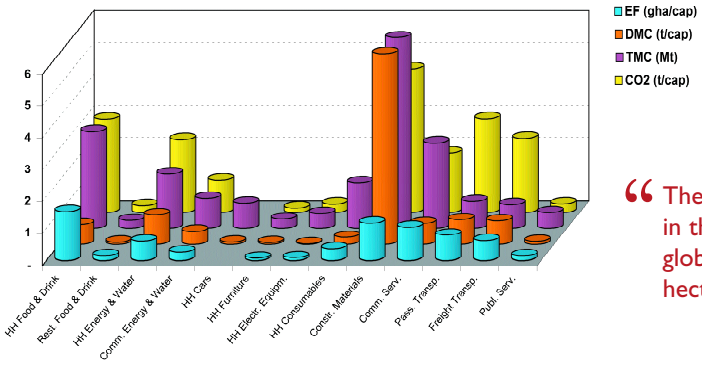
The Direct Material Consumption (DMC) for the South East region in 2000 was 88 million tonnes, which equates to 11 tonnes per person. The Total Material Consumption was 211 million tonnes, or 26 tonnes per person, 2.5 times the direct material input to the regional economy. The direct outflow of materials in solid waste form amounted to 36.8 million tonnes in 2000, 25 million tonnes of which goes into the waste management system.

Activity categories are the headings under which materials and products are represented in Figure 3 below. Summary results are included here, from the detailed tables in the full Project Report. The figure shows that the biggest impact in terms of direct materials consumed, total materials consumed and CO_2 emissions comes from the construction sector. The material requirements of this sector are clearly large at 100 million tonnes (Mt) out of 211 Mt total materials consumed. But energy consumption of building activities is also high and the ecological footprint of the construction sector is the second highest apart from food consumption at 1.17 gha per person.

The ecological footprint (EF) from all consumption-related activity in the South East in 2000 shows a total of 55 million global hectares (gha). This equates to 6.8 global hectares per person. (Built-up areas, gardens etc account for another 0.1 gha per person). This total EF is 29 times the physical land area of the region. By comparing this with the available global capacity mentioned earlier of 1.9 gha per person, we can see that if all the world's population were to live like the average South East England resident we would need three and a half planets. Where are these spare planets? (See Figure 4 for global comparisons)

Figure 3: Ecological Footprint (EF), Direct and Total Material Consumption (DMC, TMC), and CO_2 emissions of household and service sector consumption in the South East in 2000

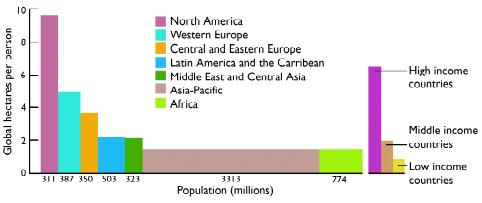
NB: Note that EF and CO_2 emissions from cars are included in the passenger transport component.



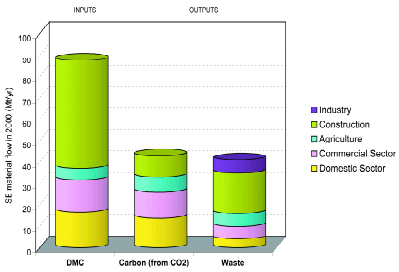
> "The Ecological Footprint from consumption in the South East in 2000 was 55 million global hectares which equates to 6.8 global hectares per person."

Total CO_2 emissions within the region are 58 million tonnes per year, about half of which comes from private transport and home heating. Total CO_2 emissions due to consumption by the region, however, are 158 million tonnes per year, or 20 tonnes per person. These are the emissions involved in delivering the level of affluence of the SE region. This shows around 3 times as much CO_2 involved in 'consumption' with impacts spread around the world, as in 'production' within the region. This clearly has implications for climate change policy.

Figure 4: Global Ecological Footprint comparisons by region and income group. (Source The Living Planet Report, WWF, 2002)



> "The Total Material Consumption in the South East in 2000 was 211 million tonnes, or 26 tonnes per person, 2.5 times the direct material input to the regional economy."



> "If all the world's population lived like the average South East England resident we would need three and a half planets."

Figure 5: Materials Flow data for consumption in the South East in 2000 (NB: CO_2 emissions have been converted into carbon figures).

Household food production, supply and consumption shows the highest footprint component at 1.54 gha per person and accounts – together with passenger transport – for the second highest CO_2 emissions per capita. However, if both passenger and freight transport are taken together, they account for the highest CO_2 emissions by far and a footprint of 1.4 gha per person. Nearly 43 million tonnes of CO_2 were released by all transport in the South East in 2000 (5.3 Mt per capita or 27% of all CO_2 emissions in the South East), however the material flows (DMC, TMC) of transport are relatively low.

Figure 5 shows a comparison between material inputs and outputs of the economic system of the South East. A total of 87.8 Mt of materials is directly consumed (DMC); on the output side there are CO_2 emissions (43.1 Mt of carbon) and waste (35.4 Mt). With respect to materials, the construction sector has the highest input and the highest output in the form of waste. With respect to CO_2 (or carbon) emissions however, the domestic as well as the commercial sector is much more significant.

Figure 6

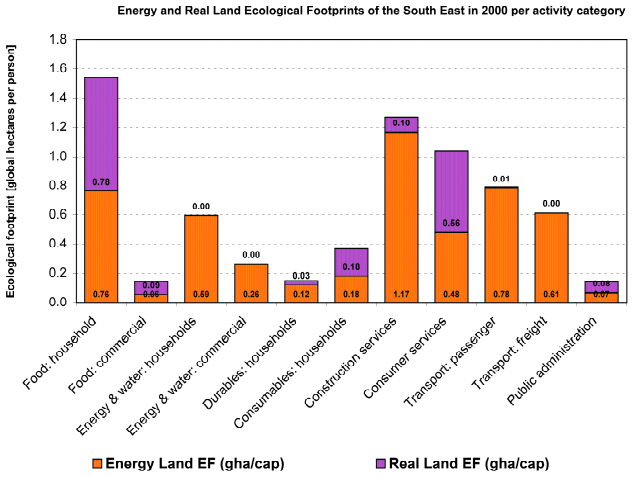
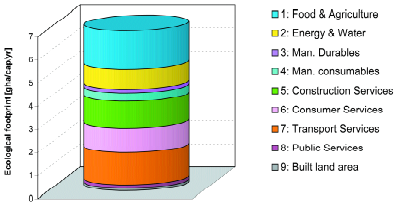


Figure 6 provides a further analysis of the ecological footprint, showing a breakdown in 'real land' and notional or indirect 'energy land' requirements of the different activities. Most of the real land is needed for agriculture (0.78 gha/cap) but consumer services also have a high demand for real land (0.56 gha/cap) due to a high level of paper consumption (for which forests are needed). Altogether the highest contributions to the footprint come from food and agriculture at 1.69 gha/person, transport services at 1.40 gha/capita, and construction at 1.17 gha/person. See also Figure 7.

Figure 7: Ecological Footprint components of the South East in 2000 per activity category



> "The total Ecological Footprint for the South East is 29 times the physical land area of the region."

5 Policy context, trends and scenarios

5.1 Current policy context

The South East economy can be characterised as advanced, high cost, high income, broadly based and service oriented. Public opinions on positive features of the region highlight the good quality environment and countryside, and the low unemployment and higher than average incomes. Negative features focus on the problems of development and congestion, high costs (particularly housing), and crime and social deprivation.

The main focus for the Taking Stock project is resource management, so in this section we will look at how this relates to existing policies and programmes. In particular we try to identify opportunities for 'win-win' potential, where policy objectives for economic and social welfare can be combined with a sustainable resource management approach.

In the context of our liberalised market democracy, and for the purposes of this project, we can interpret the underlying purpose of public policy as providing for material needs and aspirations while maintaining quality of life and protecting environmental capital, but not intervening in markets and lifestyles beyond the minimum necessary. The central challenge in resource terms is that there is no legal requirement, or specific policy directive, to minimise consumption or the ecological footprint. The result is that consumption and footprint issues tend to fall into the gaps between policies, and that any directive to 'reduce consumption' is likely to be politically non-viable on its own. The South East Sustainable Development Framework, like those of other regions, recognises the existence of global impacts of regional activity, but is not in a position to take much action.

The implication is that we need to take a more lateral approach to the various roles of policy in influencing resource management. In the South East these aspirations may be particularly challenging, since:

- Higher disposable incomes and closeness to London tend to encourage conspicuous consumption.
- Higher housing values mean lower relative prices for material goods and products.
- Higher demand for long distance transport encourages distributed lifestyle and work patterns.

Key regional strategies include the following:

- Sustainable Development Framework for the South East, SEERA, (2001);
- Sustainable Development Appraisal – final report, SEERA (2001);
- Regional Economic Strategy for South East England, SEEDA, (2002);
- Framework for Employment & Skills (2002);
- Transport Strategy (2002);
- Regional Planning Guidance (RPG) (2001);
- Sustainable Communities (national programme) (2003);
- No Time to Waste, Regional Waste Management Strategy, SEERA, (2003);
- Rising to the Challenge? - South East Climate Change Partnership Report (1999);
- Harnessing the elements: a strategy for energy efficiency and renewable energy consultation draft (2002).

In this section we will consider the Sustainable Development Framework and the Regional Economic Strategy in more detail. Other strategies will be referred to in the relevant sections below.

5.2 Sustainable Development Framework for the South East

The regional Sustainable Development Framework, entitled "A Better Quality of Life in the South East" was published in June 2001 by the Regional Assembly as an over-arching policy document to guide and help monitor policy, decisions and actions to improve quality of life for all. It sets out a vision for the region, and proposes objectives, indicators and targets which contain all the themes of sustainable development. Its aim is to clarify what sustainable development means for the South East, and how the region can contribute to

sustainable development for the country as a whole.

The vision it sets out is for "A prosperous region, delivering high quality of life and environment for everyone, now and in the future". The key issues and needs for the region are summarised as:

Cleaner smarter growth – continued economic growth is a key sustainable development objective, but it can only be sustainable if the often negative effects are uncoupled from this growth.
Doing more with less – being more efficient with limited resources is crucial in achieving the uncoupling referred to above. Resource efficiency will have economic, social and environmental benefits.
A fair distribution of economic benefits across the region – through reducing disparity and inequality within the region by improving conditions in deprived areas and targeting the most vulnerable households.
Planning and managing the environment – so that key resources of the region, including its wildlife, water and landscape are protected and enhanced. Managing growth and adapting to the uncertain impacts of climate change will be major challenges in the future.

5.3 Regional Economic Strategy for South East England

Produced by the South East England Development Agency (SEEDA) the current Regional Economic Strategy covers the period from 2002 to 2012. It sets out a ten year framework for delivering the economic aspirations in the Sustainable Development Framework. The core aim is that by 2012 the South East will be recognised by all as one of the world's 15 top performing regional economies, as measured against a broad range of economic, social and environmental indicators.

The principles of sustainable development require that economic growth must be of a particular type, pattern and spread. This 'smart growth', reflecting the particular opportunities and challenges of the South East, is the cornerstone of the Regional Economic Strategy. It has five main objectives:

Competitive businesses – a dynamic, diverse and knowledge-based economy that excels in innovation and turning ideas into wealth creating enterprise.
Successful people – a skilled, motivated, inclusive and highly productive workforce that anticipates and embraces change.
Vibrant communities – an inclusive society characterised by strong, diverse and healthy communities with ready access to high quality jobs, education, homes, health and other services, and low levels of crime and discrimination.
Effective infrastructure – transport, communications, housing and health infrastructures that support and enable continued economic growth and improved quality of life for all.
Sustainable use of natural resources – environmentally efficient businesses and high quality development demonstrate that quality of the environment is a key asset that underpins economic success.

Future scenarios

5.4 Scenarios – what could the future look like ?

The following section looks in more detail at the material flow analysis and ecological footprint findings for major sectors of activity in the South East. As well as key facts and a look at the policy background, for each sector we consider a range of possible future scenarios with different implications for the ecological footprint. In particular we draw attention to a Factor Four scenario in each case, which represents a more sustainable future allowing us to live without depleting the carrying capacity of the earth.

This Factor Four concept, or 'halving resource use – doubling efficiency', first popularised in the book of the same name in 1997, is now starting to inform national policy development having been enshrined in the recent UK Energy White Paper. This sets out the long-term target of a 60% reduction in climate change emissions by 2050. While there is a difference between accounting for CO_2 and EF, they are very closely related. The Taking Stock project aims towards this 60% target, but on a global scale. Taking account of the disparities in wealth and in emissions between developed and developing nations, and on the principle that the rich who are mainly responsible for the problem should be mainly responsible for solving it, we arrive at our overall target of Factor Four, or 75% reduction in ecological footprint by 2050.

6 Sector information

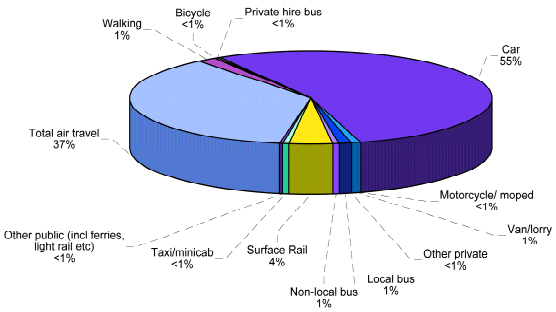
6.1 Transport

Mobility is the basis for modern lifestyles, and transport is the 'maker or breaker' of cities and regions. But the transport system is increasingly dysfunctional - it is breaking local and global environmental limits, and future trends are set to bring the system itself to a halt. The long-standing link between economic growth and transport growth has somehow to be 'de-coupled'. Most people now agree on this, but would prefer to see other people's travel restricted before their own. Integrated transport is now the aim, but will this be enough to contain the inexorable demand and desire for mobility? There are no easy answers here, but we aim to build bridges between the no-win trends of 'business as usual', and the win-win opportunities of a more sustainable future.

Key facts

The average distance travelled on surface transport by South East residents in 2000 was 13,100 km per person, or 36 km per day per person. 85% of the distance was by car, 6% by rail, and 3% by bus. By air the average was 7,600 km per person, of which 97% was international travel, and 26% of this was within the EU. Walking averaged 304 km per person, and cycling 74 km, or one mile per week per person. Given these figures it is not surprising that obesity is a growing problem. See Figure 8 below for the full breakdown of transport modes.

Figure 8: Proportions of distance travelled by different transport modes



Passenger transport in the South East used a total of over 6 million tonnes of fossil fuels, 53% of this by cars and 39% by planes. This resulted in CO_2 emissions of nearly 24 million tonnes per year, or 2.9 tonnes per person. Air travel used a total of 2.5 million tonnes of oil, with CO_2 emissions of 7.9 million tonnes per year.

In terms of the ecological footprint, real land area requirements are very small compared to energy land for transport. The total EF from all passenger transport is 0.78 gha per person, or 11% of the total aggregated EF for the region. Surface travel accounts for 0.53 gha/person, of which 92% is from cars, while the EF of air travel is 0.25 gha/person. The total EF of freight transport is 0.6 gha per person.

The relative efficiency of different modes of transport is key, and this varies considerably as can be seen in Figure 9. Taxis are by far the least efficient (assuming one-way trips), followed by short-haul air and petrol cars. Long distance coach, rail and long distance flights are relatively efficient. The net effect of course

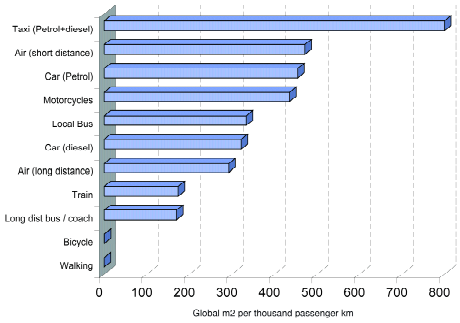


Figure 9: Relative EF factors of main transport modes, per thousand passenger kilometres.

depends on the distance travelled, which in the case of air travel, can be very large indeed.

Policy background

The current forecasts in traffic growth are consistent with recent evidence, despite the government's goals in the 10 Year Strategy for transport. Increasing transport demand is closely linked to economic growth at 2-2.5% per year, i.e doubling in 30-40 years. Commercial transport and air travel are growing fastest, the latter at 5-6% per year doubling in 15 years. A simplified set of trends and drivers include the following:

- Vehicle occupancy levels.
- Passenger travel demand intensity, i.e. how it links to economic growth.
- Public transport as a proportion of all transport.
- Vehicle energy efficiency and the balance of new/existing stock.
- Percentage of alternative fuels in use.

Possible future scenarios

High growth scenario (F-0): Unrestricted growth in travel demand, and privatisation of networks and infrastructure. Access depends on ability to pay.

Business as usual scenario (F-1): Continuing current trends, with an uneasy balance between economic, social and environmental objectives. Traffic doubles in 50 years, while air travel increases 5 times.

Low-growth scenario (F-2): Decline in the rate of growth through economic slowdown and social division. Climate change, international terrorism and fuel shortages disrupt networks and infrastructure.

Factor Four scenario (F-4): A win-win scenario where the quality and efficiency of transport increases rapidly based on integration of networks, coordination of supply and demand, accelerated technology improvements, and demand side management.

Policy implications

Transport policy has to confront contradictions which national governments appear powerless to solve, and it would be difficult for the South East region to provide real solutions. There are, however, various enabling measures which may combine to influence existing problematic trends, for example:

- A multi-sectoral regional and sub-regional integrated transport strategy.
- Incentives for clean technology to reduce emissions.
- Diversification of vehicle ownership and access.
- Coordination of supply and infrastructure with journey demand and cultural mobility.
- Use of ICT as the catalyst for integration, diversification and coordination.
- Demand management: Social economy networks for car and lift sharing; green travel plans; coordination of public transport, etc.

It is clear that the main agenda for transport strategy will be constructed on a range of social and economic objectives, and it is to be hoped that environmental and resource objectives can be combined as a win-win case. Regional transport policy aims to do this by bridging national level policy and taxation and sub-regional/local investment, but it is currently mainly aspirational.

The implication is that some level of trade-off may be necessary between the transport sector, where factor four type reductions are very difficult, and other sectors, where F-4 reductions are much easier. Direct energy to buildings in particular is one where rapid reductions are possible and desirable for all parties involved.

6.2 Food

The UK food system has changed significantly during the last fifty years based on the assumption that people want cheaper food, greater variety and non-seasonal food all year round. Farms have become highly mechanised, larger and more specialised and the distance between food producer and consumer has increased as food supply chains have become more complicated and transport-intensive. Food retailing has become concentrated within a small number of multiple retailers, with many of their stores located away from the traditional high street, now accounting for over three-quarters of UK food sales. Take-away food and ready to eat meals have been introduced and are extremely successful. These changes have influenced the resource consumption and environmental impacts of food supply.

Key facts

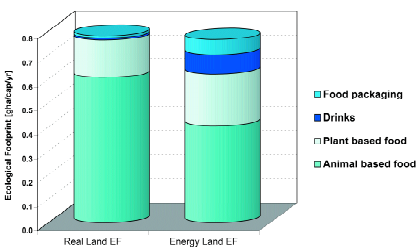
The South East contains 13% of English cultivated land area, or 1.16 million hectares. The region produces 2.7 million tonnes of wheat, which is 23% of UK production, and contains 5% of all cattle and 7% of all pigs in the UK. 31% of food in the UK as a whole (by weight) is imported from overseas, of which 99% arrives by ship.

Five million tonnes of food were consumed in South East households in 2000, equivalent to around 620 kg per person. The packaging used to supply this weighed 660,000 tonnes, or 81 kg per person. Commercial and public catering consumed 0.9 million tonnes of food, equating to 111 kg per person. Over 1 million tonnes of food and drink per year, or 124 kg per person, goes directly to waste. This includes around 43% of food supplied for catering and 14% of household food, and 88% of it ends up in landfill sites.

A total of 25 million tonnes of materials were involved in food consumption in South East households, equivalent to 3 tonnes per person in total materials consumed. The figure for commercial and public catering is 2 million tonnes, or 250 kg per person. Total materials involved in food packaging, including indirect or 'hidden' materials, were 4.14 million tonnes, around 500 kg per person per year.

The ecological footprint of food and drink consumption in the South East is 1.69 global hectares per person, equivalent to over a quarter of the total EF from all activities. Household consumption constitutes 1.47 gha,

Figure 10: Ecological Footprint for household food



catering consumption 0.15 gha, and packaging 0.07 gha, all per person. In contrast to other sectors the notional 'energy land' for food is of a very similar size to the 'real land', each being around 0.8 gha per person for household food (see Figure 10).

In terms of the breakdown of food types, including both household and catering:
- Meat and dairy product consumption accounted for two thirds (66%) of the total food and drink EF.
- Cereals and other plant based food accounted for 23% of the total.
- Drinks of all varieties accounted for 6% of the total.
- Packaging for food and drink products accounted for 4.5% of the total.

Possible future scenarios

High growth scenario (F-0): With rapid economic growth food supply follows a free market model, with falling subsidies, rising imports and chemical use and more pre-cooked convenience foods. These increase the total EF for food and drink by 2.25% per annum or 50% by 2020.

Business as usual scenario (F-1): Based on a continuation of current trends, i.e a rise in packaging, processing and imports, alongside a rise in vegetarian and organic production and food waste composting. The total food and drink EF would rise by 1% per year, equivalent to 18% by 2020 and 64% by 2050.

Low growth scenario (F-2): In a scenario of market failure and environmental hazards, prices rise steeply and food hazards affect spending choices, resulting in a move to more localised production. Demand for cheap 'industrial' food also rises in towns, increasing chemical intensity and packaging.

Factor Four scenario (F-4): This scenario represents a gradual adjustment towards a more sustainable, low impact food system. Imports decrease, with more regional and organic production and greater diversity. Plant based diets increase, accelerated by further food scares. Packaging becomes re-usable and recyclable and composting increases rapidly. EF for food and drink reduces by 40% by 2020 and 75% by 2050.

Policy implications

Food and agriculture is a complex policy area, mostly taking place at national and international level. Key current issues include reform of the EU Common Agricultural Policy and the application of environmental criteria and the ongoing UK government work on sustainable food and farming policy. These policy and market trends are expected to lead to significant changes in the structure of agriculture in the UK, for example:
- Consolidation into larger units of production, to be competitive with EU and world markets.
- New forms of agri-industrial products including pharmaceuticals and specialist chemicals.
- New forms of niche food/drink products, such as regional or local cheeses, fruits or wines.
- A shift towards diversification of agriculture and forestry land use, with environmental and amenity objectives to the fore. This may also be used to ameliorate climate change pressures.

Regional policy has had little engagement with food issues since World War II, when basic production became an overriding priority. This is now changing and a range of factors are involved:
- ***Regional image and marketing*** - The Countryside Agency programme 'Eat the view' is a forerunner of more regional based food activity, already well established in many EU countries.
- ***Food and drink production*** as a priority sector for economic development. The industry is often low skill with high environmental impact, and is seen as an essential part of many regional strategies.
- ***Regional countryside policy*** - this may prioritise farm or land-related employment and intermediate labour market activity.
- ***Regional housing policy*** - may seek to encourage new forms of low impact rural housing, in order to maintain populations and landscape quality, while avoiding the spread of commuter settlements.
- ***Regional landscape policy*** - in most areas the social or visual amenity is closely linked to the maintenance of a populated and diverse agricultural landscape.
- ***Regional climate change policy*** - the extra pressures put on the landscape and habitats by climate change and extreme events may be ameliorated by a diversified and productive countryside. Indeed a changing climate is likely to bring new opportunities for crops and crops/livestock management, as well as changing consumer demand for food types.

6.3 Construction

Cities have always been the hubs for their hinterlands, as those in the centre tend to organise and exploit those on the periphery. But the South East region is a unique case in the UK – the richest and largest region, the hinterland for Greater London, but also in many ways the 'edge city' for the conurbation, with better connections, faster growth, higher quality of life and so on. At the same time it is large and diverse, crowded and congested, beautiful and despoiled, with huge opportunities and problems in its built environment.

This section looks at the practical issues in steering the construction of the built environment towards reduced ecological footprint and greater sustainability. But the built environment is a complex thing, and with many environmental, economic and social angles to explore, we can sketch here only the key features at different scales. The starting point is the 'micro-scale' – the design and materials for the building fabric. This fits into its context at the 'macro-scale' – the location, density and form of urban areas and building types. Then there is the balance between construction and existing buildings, which may be less energy efficient.

Key facts

There are 3 million dwellings in the South East region, and approx 300,000 other buildings. New house-building has recently been at a rate of 22,000 per year. A much greater rate of 28,000 per year, or a 1% per year expansion of the building stock, is proposed in government programmes and the regional strategy.

Construction, the most mass-intensive sector, used 50.5 million tonnes of materials directly (DMC), which is 57% of the regional total, and used 100 million tonnes in total material consumption (TMC). This equates to over 12 tonnes for every person in the SE region. Construction activity produced 23% of the total CO_2 emissions, and 17% of the total ecological footprint from all activity in the region.

Quarry products were by far the largest type of material flow, at 43 million tonnes in total materials consumed, or 43% of the total. Cement based products are the next largest, at 19 million tonnes in total materials, followed by slate, bitumen, stone and other non-metallic minerals at 18 million tonnes. Metal products were 8 million tonnes in total materials, and wood based products 6 million tonnes (see Figure 11).

The ecological footprint of construction of the built environment in the South East is 5 times larger than the

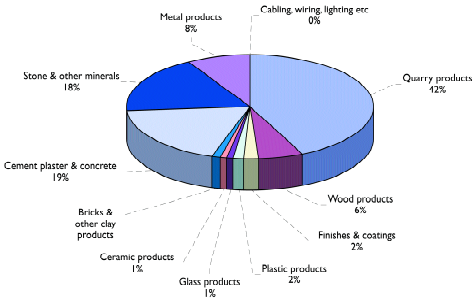


Figure 11: Total Material Consumption - proportion from different construction materials

actual area of the region, which is 1.9 million hectares. The total EF amounted to 9.5 million global hectares, equivalent to 1.2 gha/yr per person. This was 17% of the total EF from all activity. Mineral products made up 41% of this, quarry products 22%, and cement products 14%. Most of the EF is taken up with 'energy land', reflecting the high energy intensity of key construction materials and the small proportion of renewable materials.

Policy background

A key topical issue for the South East region is the effect of the rate of new building on the total ecological footprint, both now and into the future. One starting point is a comparison of construction EF to total lifetime EF for buildings. If we assume that material use is evenly spread by construction expenditure, then there is 25% in housing, 33% in commercial, 11% in public services, 12% in industry and 19% in infrastructure. This implies that 70% of construction materials are used in housing or services.

The whole building stock consumes energy in use with an ecological footprint of 4700 gha in a year. This is twice the EF of the construction sector, which adds approx 1% of new housing and 3% of new commercial stock in the region every year. So the housing energy EF total is roughly similar to the housing construction EF, which constructs 1% of the housing stock each year.

So how long does it take before the energy in use is greater than the energy of construction? For housing under current specifications, about 50 years. For commercial stock, about 1/3 of that i.e.15 years. This kind of calculation is important if we aim to optimise the investment in low energy / long life buildings. A key question for regional strategy concerns the possible effects of changing either the rate of new building, or reducing the EF in construction, or the EF of the direct energy in use in buildings. It is entirely possible to achieve massive reductions in energy and water use by using efficient / ecological building techniques, even to the extent of creating 'zero energy' developments. (See Case Study 1)

Possible future scenarios

High growth scenario (F-0): Here there is unrestricted growth in urban development, with privatisation of infrastructure, and growing use of energy and materials. Housing shows polarisation of growth and decline based on access to hubs and services, with big price differentials. Commercial property turns over rapidly.

Business as usual scenario (F-1): Continuation of current trends, with strict controls on land use and larger, multi-storey and higher density buildings. Construction planning becomes more integrated, and there is more strategic management of the balance of housing demand and supply.

Low growth scenario (F-2): This sees a decline in the rate of construction as a result of economic stagnation, social conflict and environmental hazards. There are large inter-regional displacements of housing and jobs due to climate stress, managed retreats to urban enclaves and large flows outwards to rural new communities.

Factor Four scenario (F-4): This 'win-win' scenario sees the quality and overall efficiency of construction increase rapidly. Brownfield sites are redeveloped, affordable housing provided and there are moves towards more integrated community living. In housing quality of space and proximity to services are at a premium, while more commercial activity is organised locally. Many city centre offices are converted to housing.

Policy implications

Generally the South East region is under more pressure than any other region to incorporate new housing on a massive scale. Population is forecast to grow 5.5% per decade, and a reducing household size combines with problems of over-heating, congestion, housing affordability and shortages of key workers. Dealing with such problems raises interesting issues for applying a footprint method to policy making, for example:

- Spatial strategy: The location, density and form of buildings.
- Built environment activity in the urban system: The provision of new buildings for housing, commercial and public services, and the balance of stock / turnover / demolition.
- Construction design and materials: The materials and energy intensity per unit of floorspace.
- The energy use and other demands of buildings over their life cycle, the length of that life cycle and their eventual fate.

The regional spatial strategy has an influence on density and location, and local planning and building regulations have limited influence on building form and energy efficiency. To go further than this, particularly for the existing building stock, would require a new raft of regional powers and resources. There may be a need for some level of trade-off between the construction sector, where factor four levels of reductions are difficult to anticipate, and the building direct energy sector, where large reductions are technically feasible.

Positive measures might include:

- Integrated resource management enterprises, which achieve step changes in material efficiency and material impact, by coordination between designers, contractors, material suppliers, and demolition.
- Integrated energy services consortiums which achieve step changes in energy efficiency by coordination with utilities, financiers, developers, designers, contractors, owners and tenants.

Case study 1: Thames Gateway Eco-homes

A recent study investigated the implications of building 200,000 new homes to different environmental standards in the Thames Gateway, part of the government's Sustainable Communities plan for the South East. By developing these 200,000 new homes to a minimum of the Building Research Establishment (BRE) Eco-Homes 'Very Good' standard, many environmental savings could be made per home per year when compared with homes built to current Building Regulations: A 32 per cent reduction in carbon dioxide (CO_2) emissions from energy use in the home (this saving of 0.993 tonnes of CO_2/home/year equates to 198,840 tonnes of CO_2 for the 200,000 homes each year), and a 39 per cent reduction in water use could be achieved.

The study showed that even greater savings could be made per home per year by developing all homes in the Thames Gateway to what it calls Z^2 standards (Zero fossil Energy, Zero Waste): This would achieve a 99% reduction in CO_2 emissions from energy use in the home (this saving of 3.05 tonnes of CO_2/home/year, equates to 610,640 tonnes of CO_2 for the 200,000 homes each year), a 65% reduction in water use and a 76% reduction in waste sent to landfill.

The Z^2 standards are based on the experience of the Beddington Zero Energy Development in South London. This is an urban eco-village developed by the BioRegional Development Group in conjunction with Peabody Trust which aims to show how green living is a real, attractive and affordable option. It comprises 82 homes, offices and live-work units, including a mix of social housing, designed for a comfortable and highly resource efficient way of life. This development recognises that the lifestyles of residents has an important bearing on overall environmental impact, and it makes every effort to make it easy to be 'green'.

For more information see report 'One Planet Living in the Thames Gateway' at www.seiy.org

6.4 Household consumption

Consumption of household goods is one of the key 'lifestyle aspirations' – having got a larger house than last year, the average consumer will then want to fit it out with the latest and best furnishings, appliances and electronic gear. These we term durable goods, for example cars, furniture and electrical goods, and including anything of significant material weight with an average lifetime of more than one year. In this section we also consider household consumables, typically small diverse items most of which have an average lifetime in the household of less than one year, such as papers, clothes, books, shoes, cosmetics, chemicals, toys, etc.

Consumption can be a complex issue, clear in the case of food or clothing but less so in material terms for a visit to a theatre or the purchase of shares. What if a consumer buys mainly second hand clothes and reads only library books? The analysis in this section does not claim to be full and complete, but it is at least a start in bringing to light the material metabolism of our affluent society in the South East of England.

Key facts

Durable goods
The largest single item of household consumption is the private car, with 1 person in 20 on average buying a new car every year. This amounts to a total of 415,000 tonnes per year, or 50 kg per person. Furniture is not far behind, with householders in the South East consuming 400,000 tonnes in 2000, or just under 50 kg per person. South East householders consumed 100,000 tonnes of household electrical appliances in 2000, an average of 13 kg per person. Washing machines make up 22,000 tonnes, fridges and TVs each 10,000 tonnes and personal computers 6,000 tonnes. The grand total of direct materials consumed for durable goods is 1 million tonnes.

Overall, the total material consumption from household durables is 12.5 million tonnes or 6% of all consumption in the SE region. A third of this is from purchases of cars, which include, by weight, over 50% steel, 11% plastics, 11% aluminium products and 5% rubber. In furniture paper/pulp products are a third of the total materials, while wood, steel and plastics are each 8-10%. In household appliances, steel comprises 40% by weight, with over 26% in miscellaneous materials.

Durable items are highly manufactured and have very complex supply chains, but on the basis of available information the total ecological footprint of furniture and electrical equipment adds up to 0.15 gha per person. Only 10% of the overall EF of cars is due to manufacture and maintenance, the vast majority being due to fuel use and emissions in use which are in the transport section. For furniture the 'real land' footprint component is half the total, mainly due to the use of wood products. By contrast for electrical goods, the 'real land' component is only 1% of the total, the vast majority being made up of the indirect 'energyland' component.

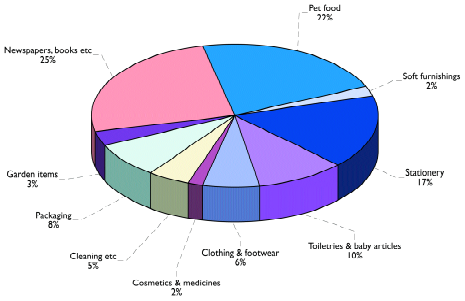
Consumable goods
Direct materials consumed in the South East by household 'consumables' is over 1.75 million tonnes per year, or nearly a quarter of a tonne per person. The total material consumed, including indirect material flows, is six times greater at nearly 12 million tonnes per year. This comprises 5% of the total material consumed from all activity in the SE region. Newspapers are about a fifth of the total by weight, and other paper products over a third. Pet food is a quarter of a million tonnes per year, with a higher than average footprint due to the highly intensive meat content

The materials in this diverse range of products are dominated by paper based items in newspapers, books, cardboard boxes and chipboard products of every variety. Soaps and household chemicals make up 12%, toilet paper almost 7% (14kg per person per year) while textiles are 4% of the total by weight. Household consumables form a major part of the household waste stream, at over 30%.

The total ecological footprint from all consumables is 0.37 global hectares per person per year, equivalent to

5% of the total EF from all activity. The product with the largest single footprint is pet food, with 22% of the total EF from consumables. Stationery, newspapers and books comprise 40% of the total (see Figure 12). The footprint of wood and pulp-based products are two thirds 'real land' based while the EF of petfood is about even between 'real land' and indirect 'energy land'.

Figure 12: Ecological Footprint proportions of different consumable items.

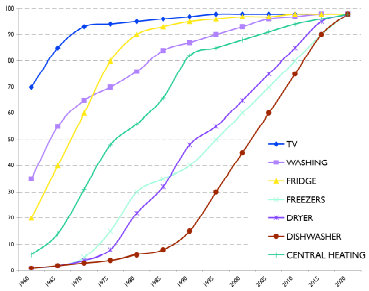


Policy background

Future trends in consumer durables depend on 'saturation' and 'turnover', i.e. whether consumption slows down once all households have a particular item. This is difficult to predict as lifestyle and fashion becomes as strong an influence as functionality, and technological improvement is the main driver of new purchases. So, for instance, demand for televisions has moved from one per household towards one per room, and rapid improvements in computers make regular replacement likely.

Past trends show growth in consumption from 1-3% per year in various items. 93% of households in the SE have a freezer, but only 31% have a dishwasher, and ownership trends may reach saturation at 100%, unlike televisions. Nearly half of households have 1 vehicle, and over a third have two, while only 1 in 6 have no car at all. Saturation effects may slow down the growth of the total market and put greater emphasis on the turnover and replacement trends for the acquisition of new goods. These various factors can be seen in the recent trends in appliance ownership (see Figure 13 - only UK figures are available). These appear to point towards a moment in about 2020 when 100% of households will possess "all that they need" in terms of product types, but we should bear in mind the 'television effect' for some products, and the ability of technology and marketing to create new 'needs'.

Figure 13: Trends in appliance ownership, UK



The demand for household consumables is driven by a combination of factors, which are often less predictable and apparently more volatile than with durable goods, making forecasting difficult. There is less of a 'saturation' effect, i.e. there is no particular limit to the number of shoes or clothes people will buy. Important factors include the pace of change of technology, relative costs, cultural pressures, income levels, re-use and recycling proportions, and perceived satisfaction from consumption.

Possible future scenarios

High growth scenario (F-0): The 'throw-away' economy continues to accelerate, with consumers driven by the mass media to work harder and buy more. Houses get larger, products are discarded more quickly, and even with more paper recycling the EF continues to rise at 2.5% per year, doubling every 30 years.

Business as usual scenario (F-1): Current trends continue with steady growth in purchases of durable and consumable products from increasingly global supply chains. There is some measure of corporate responsibility, but the continuing spread of affluence puts unremitting pressure on natural resources, which technological improvements such as paper-free newspapers can hardly stem.

Low growth scenario (F-2): Material consumption declines, but mostly for the wrong reasons – economic stagnation, social malaise and environmental disruption. The cost of energy and materials goes up, environmental regulations reduce, and imports and exports decline. Technological innovation slows down and incomes reduce.

Factor Four scenario (F-4): This win-win scenario sees the quality and efficiency of household durables and consumables rising rapidly. The fixation of consumers on acquisition of new products begins to dwindle, as more people find satisfaction in non-material experiences. The social economy grows, with sharing, networking, re-use and recycling of goods becoming a major economic sector, using sophisticated databasing to match supply and demand.

Policy implications

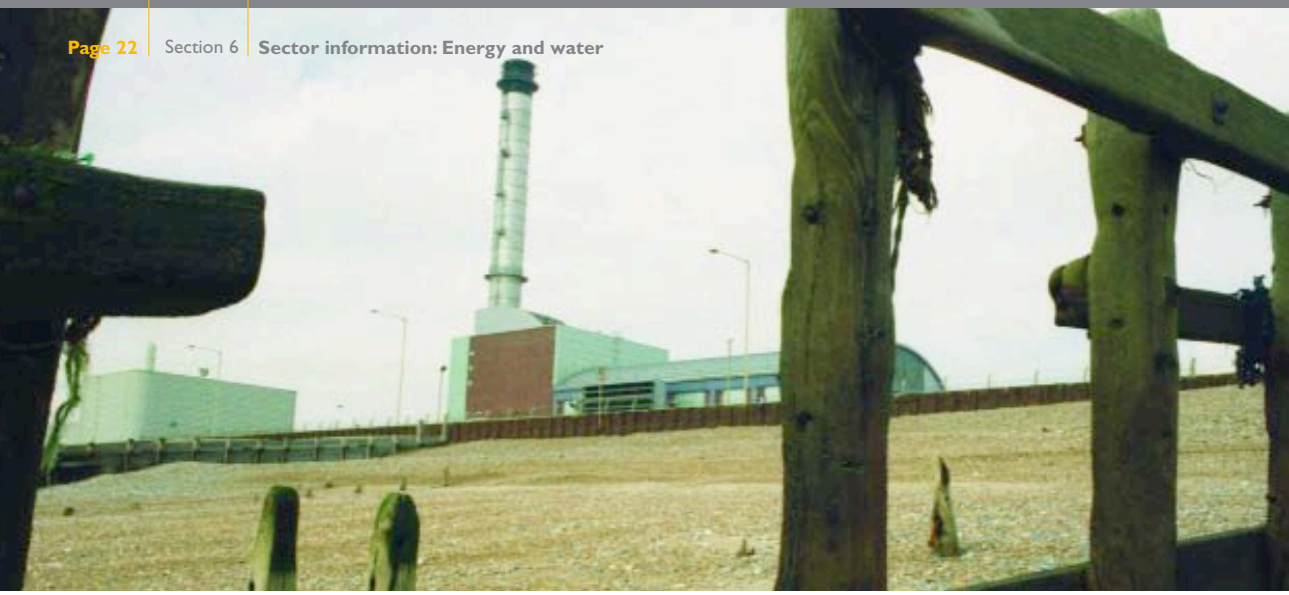
Up to now there has been almost no involvement in the issues relating to consumption from regional policy. At the national level, the government published in 2003 its strategy for ' Sustainable Consumption and Production' (SCP). This is mainly a review of possibilities, but the key themes include:

- Taking a holistic approach that considers whole life-cycles of products and services.
- Working with the grain of markets, and identifying and tackling market failures.
- Integrating SCP thinking and objectives in all policy development and implementation.
- Using a well-designed package of policy measures and following the principles of better regulation.

The question here is how much this is a regional agenda, and something that the regional organisations can promote. It has to be said that the obvious starting point – consuming less 'stuff' – is apparently opposite to mainstream economic policy and its goal of GDP growth. The challenge is to demonstrate to a wide range of players the potential benefits in sustainable production and consumption. These might include economic benefits such as more competitive operations; environmental benefits at the local, regional and global scale; and social benefits through better distribution of resources, more social economy activity and training and job opportunities.

In practical terms, and against the mainstream in regional policy, there may be potential win-win opportunities in:

- Promoting innovation in manufacturing technology, to increase productivity with less impact.
- Encouraging integrated industrial clusters to increase recycling and remanufacturing.
- Innovation in materials and waste management, to create markets for re-use, recycling, recovery.
- A regional 'green' investment bank promoting environmentally efficient production and distribution.
- Setting up public sector sustainable purchasing consortia to co-ordinate public spending on environmentally friendly/ethical goods to build up supply chains and enable new markets.
- Promoting retail clusters and networks which encourage service economies i.e. leasing and hiring.
- Promoting social economy groups and networks for sharing, re-use and recycling.



6.5 Energy and water

Energy is fundamental to the life of every region – but the current energy system is disrupting the global climate. This is possibly the greatest single threat to the global environment, affecting every nation and every region, for which we all need to take responsibility. The ecological footprint approach has much to offer this agenda. It provides a common platform for comparing energy and infrastructure to other sectors, as well as a direct assessment of the impact of different energy futures and energy strategies on the global environment.

In this section we consider direct energy and water consumed by households and the service sector. Transport energy is considered separately, as is the energy used during the production of goods consumed in the South East, which is termed 'embodied' energy. Direct energy is consumed in the form of electricity, gas, coal, wood and fuel oil. In the UK, there has been a significant shift from solid fuel to natural gas in the 30 years to 2000.

Key facts

The total energy consumed in South East households in 2000 was 75,000 million kilo-Watt-hours (kWh), or 9,000 kWh per person, three quarters of which was gas. This energy supply produced over 2 tonnes of CO_2 per year per person. Over half of the energy consumed in homes was for space heating, 18 % was for cooking, lighting and appliances, and most of the remaining 24% was for heating water. The current price of electricity per unit is 4.5 times as much as the price of gas.

The total ecological footprint of household energy is 4.7 million global hectares, or 0.6 gha per person. This equates to about 9% of the total footprint per person. Total energy consumed in services was 28,000 million units (kWh). Half of this was in gas, a third in electricity, and the rest mainly in oil. The total footprint of this energy is over 2 million hectares, or about 4% of the total.

Nearly all the energy produced directly within the region is in the form of electricity, of which 30% is from coal, 25% from gas, and 40% from nuclear. The region imported about one third of its power via the national grid. Renewable energy supplied less than 1% of the total, nearly all of it from waste incineration. The current 'best practicable' target is for renewable energy to supply 6% of the SE production of electricity by 2016. This is considerably lower than the national target to supply 10% by the year 2010.

At present, energy demand is rising slightly, while CO_2 emissions are reducing slowly due to the shift to gas power. A recent report on energy futures foresaw the end of cheap North Sea gas, at a time when most of the world's diminishing fossil fuels reserves will be in the most politically unstable regions. Continued reliance on these reserves may have implications for the reliability and security of energy supplies in the UK.

Nationally, about half of all water use is for cooling power stations. Public water supply for households and for services accounts for 30 per cent of consumption. Household water consumption in the South East amounts to 165 litres per person per day, or about 60,000 litres per person each year. One third of this goes in flushing of WCs. The energy used in the South East water supply system is 860 million units (kWh). Supply to households, and the drainage / sewage system, are each about 40% of the total. Most of the rest goes in leakages. The ecological footprint of the water supply system is about a sixth of 1% of the total EF per person.

Policy background

The long-term target is for the UK and the SE region to move towards the internationally advised target of 60% reduction in CO_2 emissions by the year 2050. The key question in achieving a factor four reduction is whether this is going be achieved by greatly expanded renewable energy, greatly improved efficiency, or a new set of nuclear power plants. The net effect of policy and market trends is expected to be quite rapid changes in the structure of energy production in the UK.

The DTI Energy White Paper sketches out a powerful scenario for the energy system in 2020, which it maintains is on the path towards the recommended 60% cut in 2050: "We envisage the energy system in 2020 being much more diverse than today. At its heart will be a much greater mix of energy, especially electricity sources and technologies, affecting both the means of supply and the control and management of demand."

Key energy scenario indicators include:
- Energy demand from household and services building stock.
- Renewable energy supply from the region.
- Heat supplied directly, e.g. from passive solar.
- Combined heat and power, generally co-generation with district heating.
- Energy recovery from waste, through incineration and other technologies.
- Water demand per m^2, leakage rates and regional supply balance.

Possible future scenarios

High growth scenario (F-0): In a scenario of rapid economic growth, the energy and water utilities are shifted more than ever to a free market, supplier dominated industry. New supplies are opened up and globalised with large-scale technology. This sees continuing growth at 1% per year in the EF of the regional energy supply, resulting in a 60% increase by 2050.

Business as usual scenario (F-1): Current trends continue, combining the government's aspirations in the Energy White Paper, with the realities of a globalised industry. Offshore carbon sequestration appears to be the ultimate technical fix, enabling fossil fuel production to continue while stocks last. The result is an EF which changes little between now, 2020 and 2050.

Low growth scenario (F-2): In a scenario of market failure and environmental hazards, the current consumption levels fall with severe social and environmental costs. Climate change becomes increasingly disruptive, leading to water shortages and increasing demand for power, but unstable supply means prices rise rapidly, causing hardship for some. As a result of this disruption and economic stagnation energy use, carbon emissions and the total EF reduce by about 1.5% per year.

Factor Four scenario (F-4): The Factor 4 scenario represents an aspirational mix of best practices, including those on demand, infrastructure and supply sides. An integrated energy-climate strategy will seek opportunities to combine employment, environmental gains and social objectives, and emphasis will be given to energy from renewables and more efficient use of water. Combined heat and power (CHP) will be a major provider in urban areas and ultra low energy building designs will be used. Energy services companies will mediate between suppliers, distributors and users. The result is a reduction in carbon emissions and EF of 35-40% by 2020, and 75% by 2050.

Policy implications

Regional policy has had very little engagement with energy issues since the setting up of the Central Electricity Generating Board and the national grid and the introduction of a national gas supply. There is now a resurgence in the light of aspirations for renewable energy sources. However this is focused on regional planning, which although significant is only part of a bigger picture which includes investment and market signals for utilities, co-generation, and energy efficiency in buildings.

To achieve anything like the factor four scenario above, a much more pro-active regional energy strategy is needed, and it will need to operate at sub-regional and urban level (see Case Study 2). It will achieve best practice in new development and conversions by bringing together institutions and financial mechanisms needed to steer developers, utility managers and contractors into a low-energy mode of practice. At the same time it will seek win-win economic and social opportunities from this agenda. Key factors will include:

- Supply side: combined heat and power and expanding generation from renewables.
- Demand side: aggressive energy efficiency policies for new and existing buildings, plus pro-active partnership arrangements on the energy services model, at an urban or sub regional scale.
- Increases in water efficiency, reduced supply leakages plus water collection and re-use.

Case Study 2 - Woking Borough Council Energy Services

Over the past 11 years Woking Borough Council has implemented a series of sustainable energy projects, including the UK's first small-scale combined heat and power (CHP) heating and heat fired absorption cooling system; the first local authority direct supply residential CHP and renewable energy systems; the largest domestic integrated photovoltaic/CHP installations; the first local sustainable community energy system; the first fuel cell CHP system; and the first public/private joint venture Energy Services Company (ESCO). These have resulted in savings of nearly £4.9 million for the Council, and further savings for householders and businesses in the Borough. Woking is recognised as the most energy efficient local authority in the UK, and gained the Queen's Award for Enterprise: Sustainable Development 2001, the only local authority to have achieved this.

The table shows the savings achieved in Woking, and a rough estimate of potential savings in the South East based on numbers of households. Woking now has a Climate Change Strategy with the key target to achieve an 80% reduction in Woking's CO_2 equivalent emissions of it's 1990 level by 2090, in line with the Royal Commission on Environmental Pollution's national targets.

Category	Savings over 11 years – Woking since 1990/91	% saving	Potential savings over 11 years – South East
Energy consumption savings	170,170,665 KWh	43.8% saving	14,413.5 GWh
Carbon dioxide CO_2 emissions savings	96,588 tonnes	71.5% saving	8,181,000 tonnes
Nitrogen oxides NO_x emissions savings	319.1 tonnes	68 % saving	27,000 tonnes
Sulphur dioxide SO_2 emissions savings	976.6 tonnes	73.4 % saving	82,700 tonnes
Water consumption savings	340,011,000 litres	43.8% saving	28,799,000 m^3
Savings in energy and water budgets	£4,889,501	34.3% saving	£414,141,000

6.6 Waste

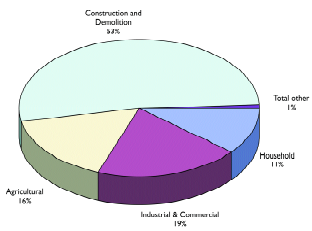
Solid waste is the residue at the end of the material chains of an industrial society – a massive resource devalued to zero or less by our wasteful production and consumption. Until recently the waste industry was mainly concerned with holes in the ground, but now there is no such thing as a cheap and environmentally acceptable method of disposal. In the longer term, the issue is not so much ***waste*** management as ***materials*** management – where recycling, re-using, recovery and minimisation are the only viable options. This will involve re-organising and re-engineering material chains and processes throughout the region.

In reality this is a huge challenge. Growth in national waste arisings estimated at 1-3% per year means waste could double in 25 years, and responsibility for such a growing mountain is fragmented into many competing purchasers and providers. Each of these is getting to grips with interlocking contracts, new subsidies and taxes, new technology, new standards, targets and directives, and new commodity markets – altogether a rich mixture. The main contribution of the regional Material Flow Analysis and Ecological Footprint study is to provide some fundamental information on the environmental impacts and benefits of waste streams and different options for management

Key facts

A total of 36.8 million tonnes of waste were produced in the SE region in 2000. The waste management industry dealt with 25 million tonnes (Mt) of this waste: 4.2 Mt of municipal solid waste (MSW); 7.2 Mt commercial & industrial (C&I); and 13.5 Mt of construction & demolition waste (C&D). The 6 Mt each from quarrying and agriculture is generally managed on site. (see Figure 14)

Figure 14: South East waste proportions 2000



The 4.2 million tonnes of municipal waste (collected by local authorities) is only 11% of the total, but the most difficult and expensive to deal with, due to its diversity and dispersal. Commercial waste was around 5.8 million tonnes, almost 16% of the regional total. Nearly half of this was paper and card of which around 30% was recycled. Sewage sludge amounted to 151,000 tonnes per year which, although a relatively small proportion, is a sizeable problem. The South East also took 3.2 million tonnes of waste from Greater London, much of this in C&D waste - this volume is projected to be halved in 20 years by current strategies.

There is a considerable difference between the recycling rates of the sub-regions, the lowest being Kent and East Sussex (14 per cent) and the highest Hampshire (23 per cent), although all the South East sub-regions have achieved a higher recycling rate than the UK average. Sub-regions that have higher recycling rates also, on average, produce more rubbish per person.

The ecological footprint for waste is supplementary to the EF of the main consumption sectors for the region as a whole, since materials which go to waste are already included in the EF for the relevant sectors, e.g. food. We include it because of the importance of waste management to regional strategy, and in particular because it is key to an integrated resource management approach.

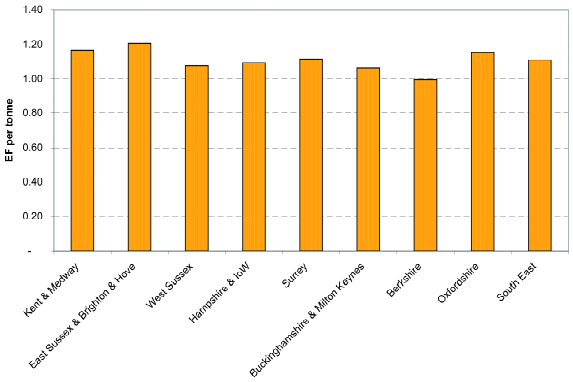


Figure 15 : Ecological Footprint per tonne of waste, South East sub-regions, 2000.

The EF for household waste management in the SE region in 2000 amounts to 4.5 million global hectares. This is equivalent to 8% of the overall regional total EF. From the domestic waste stream, paper and card accounts for over 50% of the total EF from landfilling this waste, while other combustibles account for 17%.

Using an EF per tonne measure, a useful indicator of resource productivity, Berkshire, at just over 1 global hectare per tonne, is able to process their waste more efficiently than any of the other sub-regions. Potential reasons for this include lower 'embodied' energy in the waste stream due to a different material composition or a different recycling composition (see Figure 15).

Policy background

The latest UK Government Report on waste "Waste Not, Want Not" emphasises the need to reduce the growth of waste and to recycle more. The fundamental shift in waste management relies on the "Waste Hierarchy" (reduce - re-use – recycle – recover) to establish the priorities for waste management. It introduces the idea of incentive based schemes, where householders are charged for general waste collection.

The South East has very little remaining landfill space, but the report suggests that a change to a more sustainable approach to waste management could take between 10 and 15 years. This highlights the need for urgent action, and standards have been set for local authorities to meet recycling targets of 30% by 2010.

The consultation draft of the regional strategy "No Time to Waste" produced by the South East England Regional Assembly (SEERA) sets out the priorities of minimising the amount of waste produced and ensuring the overwhelming majority of materials are re-used, recycled or recovered in order to protect and enhance the environment for future generations. Again the waste hierarchy is emphasised.

Future scenarios

High growth scenario (F-0): 3% annual growth in waste arisings continues as increasing amounts of material are processed, purchased and disposed, in ever shorter time cycles. Mechanical biological treatment (MBT) is increasingly used, but this is energy intensive and the total EF in the waste sector doubles in 25 years.

Business as usual (F-1): This scenario reflects a combination of aspiration and reality on the part of the SE Regional Waste Strategy. Waste grows at around 2% per annum. A diverse mixture of larger scale technologies is introduced, with a rather brave assumption that recycling rates increase up to 50-75%. Here the EF is roughly static, a balance between growing volumes and increasing recycling rates.

Low growth scenario (F-3): This assumes that whatever can go wrong probably will. Householders don't participate, new facilities cannot get planning permission, the MBT technologies don't work as expected, and there is a shakeout of commercial operators, all of which results in chaos. The EF implications are for little growth in waste, with little processing or recycling, and hence stalemate all round.

Factor four scenario (F-4): This scenario assumes rapid waste minimisation giving a 14% reduction in waste by 2020, coupled with recycling rates up to the technical optimum for each material stream. It depends on social, political and cultural changes to produce the desired framework for integrated resource management. The overall result and EF forecast for this scenario would see a halving of waste arisings, with a doubling of efficiency in recovery or recycling by 2050.

Policy implications

Overall the prospects for waste management in the SE region show pressing problems and uncertainties, but on the horizon there is a new kind of material metabolism in production and consumption. Non-essential

throughput of materials would be minimised, all products would be designed for re-use and recycling, and remaining waste would be sorted on collection. The analysis we have undertaken of the different waste streams supports the theories behind the "Waste Hierarchy" - in every case it is most beneficial not to produce the waste in the first place.

The preferred scenario in the regional strategy, proposing a 60% recycling rate by 2025, would bring about a substantial reduction in the ecological footprint, possibly a 58% reduction by 2020. This is based on reducing growth in waste to 1% per year. If no reduction in growth is achieved the EF would only reduce by 29%, meaning that half the reduction would be due to waste minimisation. Our analysis shows that sub-regions with the highest recycling rates did not necessarily have the lowest EF, since they tend to produce more waste, again emphasising the importance of minimisation (see Case Study 3).

The analysis also highlights materials of concern that cannot be recycled or where the benefits of recycling are marginal. The energy required to recycle is always lower than that used in producing the product from virgin materials, but there is a large variation between products in the potential for energy savings from recycling. For example the EF for recycled aluminium cans is 95% less than for those made from virgin materials, whereas recycling some plastics gives only an 11% advantage over using raw materials.

To achieve the reduction in landfill disposal required by the EC Directive and UK guidance, the regional strategy proposes rapid increases in recycling and a diversity of treatment technologies, with more benefits coming from larger facilities. There is some risk of failure due to reliance on unproven technologies, and also because the question of where the waste comes from, and how far it can be minimised, is largely outside the powers or resources of the public sector.

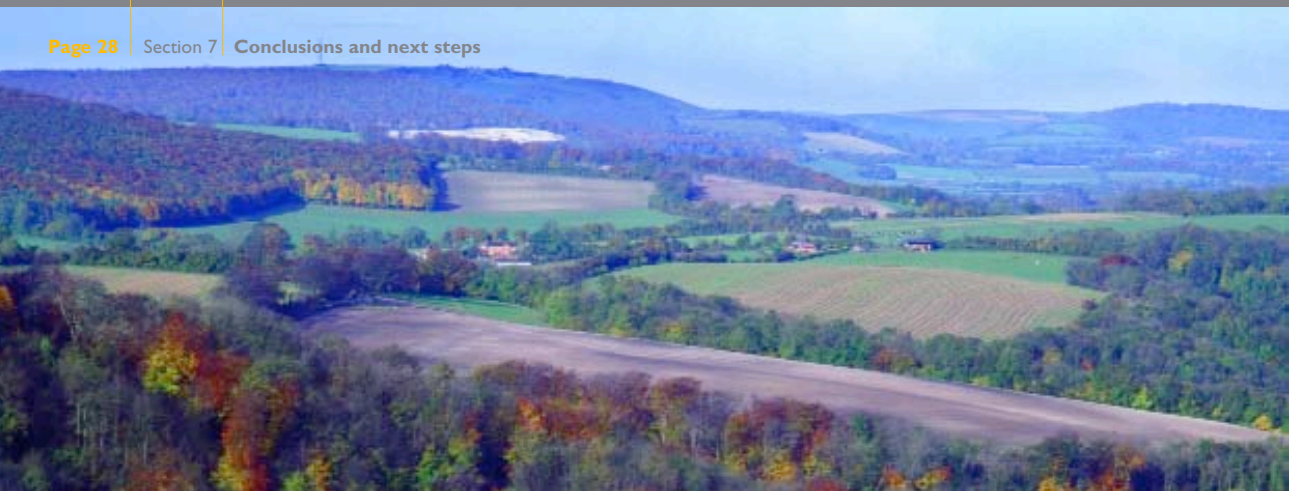
Taking a wider view, success could only be achieved by co-ordinating public waste management for municipal waste, with private sector waste management of Commercial and Industrial, Construction and Demolition and special waste streams. It also depends on coordination between retailers, packagers, producers, and many others. The most effective way forward might be through an accelerated 'greening' of public sector purchasing and procurement, within a regional strategy for integrated resource management.

Case Study 3 - Betre West Sussex Project

Over 300 small businesses took part in the West Sussex **b**usiness **e**xcellence **t**hrough **r**esource **e**fficiency (betre) project aiming to reduce waste, water and energy use and make significant cost savings. The programme offered free support and advice over 18 months, including workshops, newsletters, environmental audits, grants and a technical helpline. 308 businesses took part, 158 were trained and 64 implemented 214 different actions to improve efficiency and reduce waste. The table below summarises the successful outcomes of the project. Based on the experience of other similar projects, future savings could potentially top £1 million as businesses continue to identify and implement further actions. Environmental compliance was also improved with the potential to save a further £204,000 in avoided fines. Taking the savings achieved by 64 SMEs as outlined, rough estimates can be made of the potential savings at regional level if all SMEs were to take similar actions, as shown in the table.

For further information see full case study on project website at www.takingstock.org

Main Category	Betre W Sussex total savings (From 64 SMEs, 11 - 199 employees)	Estimated potential regional savings (Based on 34,376 SMEs in SE region, with 11 - 199 employees)
Waste reduced per annum	1,437 tonnes	771,800 tonnes
Energy saved p.a	1,559 milion KWh	837 million KWh
CO_2 emissions reduced p.a	668 tonnes	359,000 tonnes
Water saved p.a	62,900m^3	33,795m^3
Cost saved p.a	£215,357	£115,700,000
Cost to implement actions (Note some costs are ongoing annual costs, making this hard to gross up)		



7 Conclusions and next steps

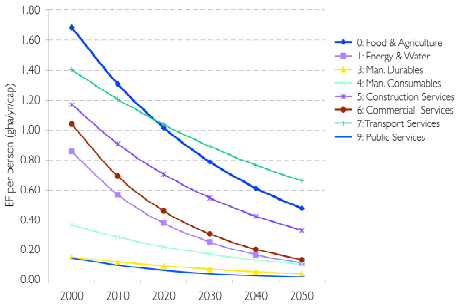
7.1 Ecological Footprint targets

The above analysis should provide some evidence on how to achieve the factor four reductions. Clearly not all sectors are equal to this challenge. As change in each sector involves a combination of social, economic, political, technology and infrastructure factors, we can only suggest where the barriers and opportunities might lie:

- The food sector produces the largest single impact at 25% of EF, and 16% of CO_2 There is great scope for localising food production, reducing energy intensive processing and meat content. This could produce an EF reduction target of Factor 4 or 75% reduction.
- The utilities sector (household and commercial energy and water) is responsible for 17% of total CO_2 emissions, and 12.5% of total EF. Here, while the technological potential for almost zero energy buildings is proven, achieving it depends also on lifestyles and institutions. In this sector an EF reduction target of 'Factor 8' or 87% reduction is suggested.
- Manufactured durables and consumables each show opportunities for demand management, supply chain management, process efficiency, and localised production. In combination these could produce an EF reduction target of Factor 4 or 75% reduction.
- Construction activity is materials and land intensive, but again there is potential for demand management, supply chain management, process efficiency, and localised production, with an EF reduction target of Factor 4 or 75% reduction.
- Commercial and public services show somewhat greater potential for integrated resource management than households. In these sectors an EF reduction target of 'Factor 8' or 87% reduction is suggested.
- The transport sector is responsible for 21% of total EF and 27% of total CO_2 emissions, (including freight transport). Growth is partly due to social equity and cohesion, at the local and global scale, and where there are few alternatives to energy intensive technologies, particularly air travel. So there is a case for less stringent targets, combining social equity with technological innovation. In this sector an EF reduction target of Factor 2 or 50% reduction is suggested.

The various targets and change rates for each sector are summarised in the chart and table below (Figure 16) in per person terms. The overall targets for 2050 may look extremely challenging, however 50 years is a long time. So the table also shows at the right hand side, the '2020 Factor of change', in other words at the horizon of many current plans and strategies. This shows that most of the sectors are aiming at a Factor 1.7 or around 40% improvement by 2020, in other words a challenging but not impossible rate of progress.

These overall targets are suggested for further investigation. In no way can they be taken as forecasts. The modelling system which has been developed to test these can hardly cope with the sheer range of possibilities, in technology, society, the economy and politics. So the targets summarised here are simply the



	2000	2010	2020	2030	2040	2050	reduction target	annual growth	2050 Factor of change	2020 Factor of change
0: Food & Agriculture	1.69	1.31	1.02	0.79	0.61	0.48	72%	-2.50%	4	1.7
1: Energy & Water	0.86	0.57	0.38	0.25	0.17	0.11	87%	-4.00%	8	2.3
3: Man. Durables	0.15	0.12	0.09	0.07	0.06	0.04	72%	-2.50%	4	1.7
4: Man. Consumables	0.37	0.28	0.22	0.17	0.13	0.10	72%	-2.50%	4	1.7
5: Construction Services	1.17	0.91	0.71	0.55	0.42	0.33	72%	-2.50%	4	1.7
6: Commercial Services	1.04	0.69	0.46	0.31	0.20	0.14	87%	-4.00%	8	2.3
7: Transport Services	1.40	1.21	1.04	0.89	0.77	0.66	53%	-1.50%	2	1.4
9: Public Services	0.15	0.10	0.06	0.04	0.03	0.02	87%	-4.00%	8	2.3
Total EF per person (units in gha/yr/cap)	**6.8**	**5.2**	**4.0**	**3.1**	**2.4**	**1.9**	**72%**		**4**	**1.7**

Figure 16: Factor Four scenario and EF targets for each sector.

result of asking the question – ***'what if'*** the SE region was able to move towards its aspirations for environmental sustainability at the global level.

It is, however, very relevant that the SE Regional Waste Strategy is aiming for a similar or even greater rate of change based on a detailed assessment of policy targets, technology improvements and behaviour changes. The waste sector is outside the accounts above, as waste proportions are built into each of the other sectors. However there is a strong conclusion – if the waste management sector can do it, why not other sectors?

7.2 Integrated resource management models

In addition to the detailed advice in the sector reviews above, there are also cross-sectoral models or general principles which help co-ordinate material flow analysis & ecological footprint programmes. These can be used as directions for regional and local policy – they are shown here with 'signposts' to examples:

- ***Strong environmental management model***: This principle puts environmental issues to the forefront, as a driver for economic competitiveness and resource productivity. Where there are 'externalities' of pollution and waste, the business or organisation will aim to account for these. An example would be the Co-op bank which has put environmental and ethical goals at the top of its agenda, with the result of faster growth than any other.
- ***Evolutionary model:*** The Factor 4 approach to 'dematerialisation' and 'decarbonisation' of the economy will be a shift on a massive scale. It relies on businesses and organisations anticipating such shifts in their own terms over years or decades, and steering their own evolution to turn potential problems into opportunities. One image comes from the local authority in Woking, possibly the most energy efficient authority in the country.
- ***Service model***: This works on the producer / procurement side, where products are leased, taken back, re-manufactured or recycled, with huge savings in raw materials, processing energy and waste impacts plus continual updating. The image is one of the new generation of floor covering firms which lease their products rather than selling them.
- ***Social economy model***: This works on the consumer demand side. In many cases there are opportunities to reduce material consumption while increasing human satisfaction, by social trading schemes, equipment banks, lift sharing, and social cohesion in general. An image comes from the car-sharing club at the BedZed living development in Surrey.
- ***Integrated resource management model***: This brings each of the above together, and aims to provide the infrastructure to make it work. Such infrastructure can be 'hard' pipes and wires, and/or 'soft' organisations and networks. An example comes from Copenhagen, where over 90% of the construction waste is recycled within the city.

7.3 Regional win-win solutions

In practical terms what can be done to improve the situation in the region using a sustainable resource management approach? Given that it is unlikely that people will voluntarily reduce consumption if they believe this will reduce their standard of living, we can propose two clear win-win propositions:

- Sustainable consumption and resource management as a generator of social welfare, human needs fulfilment and quality of life.
- Sustainable production and resource management as a generator of economic competitiveness, added value and employment.

Analysing the components of the material flow analysis and ecological footprint study shows a practical breakdown of different models or pathways which can be used as a basis for forming new policy initiatives and analysing their effects. Below are a number of ideas for combining resource efficiency with business viability and meeting consumer demand.

a) Reduce primary resource inputs
All materials quarried or resources harvested will at some point become a future waste, therefore a life-cycle approach is needed taking into account all stages from extraction to disposal. Land use planning has an important role to play in managing demand and impacts, and solutions include:
- Enhanced durability and flexibility of buildings and infrastructure.
- Design of components and materials for subsequent recycling (disassembly).
- Tackling the liability issues in specification which lead to over-design and engineering (lean design).
- Environmental taxes such as the aggregates tax need to be targeted and set at levels which ensure maximum impact.

b) Regional self-sufficiency
The transport component is a major part of the ecological footprint for most materials, therefore there is a strong policy objective for the region to be as self sufficient as possible. Clearly this is a relative self-sufficiency in a globalised economy, but there are areas such as food and aggregates where more local production or use can be encouraged. The aim should be to target future demand more in line with regional resources.

c) Closing material loops
The challenge is to move from linear processes where resources become products and then go to waste, to circular 'closed loops' where resources are re-used and recycled back into products and waste is minimised. Sometimes termed 'eco-efficiency' this can be promoted by a range of measures:
- Change material specifications to target performance rather than content.
- Shift from low quality recycling towards reprocessing for higher quality re-uses.
- Promote multi-material recycling centres close to urban areas to minimise transport.
- Set targets for alternative materials within public procurement policy.
- Introduce segregation of re-usable materials in regional demolition and landfill practice.

d) Whole life-cycle responsibility
Generally we need to shift our concept of waste from rubbish to one of potential resources, and the concept of recycling to one of resource management throughout the life-cycle of a product. Ideas include:
- Promotion of business opportunities in resource management.
- Contracts ensuring re-use or 'take back' of resources in infrastructure works.
- Public sector promotion of recycling and markets for recycled materials and products.

e) Integrated materials management
Suppliers, producers, regulators, users and consumers of materials all need to be aware of the opportunities for increased eco-efficiency and productivity. Business information systems for 'integrated materials

management' will need to match supply and demand, identify alternatives and spot business opportunities, and for this an improved knowledge base is essential. Steps would include:

- Collation of a comprehensive material flow database with consistent boundaries and definitions.
- Improve management potential through greater collaboration within and between regions, aiming to match supply and demand more closely.

Achieving the factor four targets will be very difficult unless new forms of networks, partnerships and consortiums can be formed. At present the fragmentation between sectors, departments and different levels, makes coordinated action very difficult. These new forms of networks and partnerships are in formation at present, generally on the boundaries between public and private sectors: between private and community / NGO sectors: and between public and community / NGO sectors. Actions to take this agenda forward should focus on these 'breeding grounds' for environmental entrepreneurs.

The government has set an agenda and a direction in 2003 with the Sustainable Consumption & Production strategy. At this point it is very general and aspirational but it deserves to be followed through in every sector and at every level, including the regional level. The Taking Stock project is a first step in that direction.

8 Glossary

Ecological Footprint or 'EF': A measure of how much productive land and water an individual, a city, a country, or humanity requires to produce the resources it consumes and to absorb the waste it generates, using prevailing technology. This land could be anywhere in the world. The ecological footprint is measured in "global hectares".
Global hectare or 'gha': 1 hectare of biologically productive space with world-average productivity. In 2002 the biosphere had 11.4 billion hectares of biologically productive space corresponding to roughly one quarter of the planet's surface. This includes 2.0 billion hectares of ocean and 9.4 billion hectares of land. 1 global hectare is a hectare representing the average capacity of one of these 11.4 billion hectares. Global hectares allow the meaningful comparison of the ecological footprints of different countries, which use different qualities and mixes of cropland, grazing land, and forest. An ecological footprint is usually expressed in gha per person.
Material Flow Analysis (MFA): The analysis of all material inputs and outputs to an area or activity, here the South East region.
Direct Material Consumption (DMC): The total amount of materials directly used in the regional economy and consumed in the region, i.e. excluding exports.
Total Material Consumption (TMC): The total material use associated with the regional consumption activities, including DMC and the indirect or 'hidden' material flows associated with it. Again this excludes exports and their associated indirect flows.
CO2: Carbon dioxide, the principle cause of global warming: a non-poisonous gas emitted when fossil fuels are burnt.

Key references

Factor Four: Doubling wealth, halving resource use, E. von Weizsäcker, A. B. Lovins, L. H. Lovins, Earthscan, 1997.
The Living Planet Report 2002, WWF, 2002.
Material Flow Analysis and Ecological Footprint of York, Stockholm Environment Institute – York, 2002.
Human Development Report 2003, UNDP, 2003.
UK Environmental Accounts, Office for National Statistics, 2002.
National Food Survey, Office for National Statistics, 2000.
Region in Figures – South East, Office for National Statistics, 2001.
Transport Statistics for the UK, UK Department of Transport, 2002.
Mass Balance UK – Mapping UK resource and material flows; C. Linstead, P. Ekins, RSNC, 2001.
The Construction Industry Mass Balance, R.A Smith, J R Kersey, P.J Griffith, Viridis, 2002.
City Region 2020: Integrated planning for a sustainable environment, Joe Ravetz, Earthscan, 2000.
Sharing Nature's Interest: Ecological Footprints as an indicator of sustainability, N. Chambers, C. Simmons, M. Wackernagel, Earthscan, 2000.
Changing Patterns – UK Government Framework for Sustainable Consumption and Production, DTI/DEFRA, 2003.
Our Energy Future: Creating a Low Carbon Economy, the Energy White Paper, DTI, 2003
Strategic Waste Management Assessment Report for the South East, Environment Agency, 2001.
South East regional strategy documents as listed in Section 5.

Project materials

For a full range of materials, as listed below, please visit the Taking Stock Website at **www.takingstock.org**

- Full Taking Stock Project Report – Material Flow Analysis and Ecological Footprint of the South East.
- Frequently Asked Questions.
- Policy scenarios, storylines and interactive questionnaire.
- Sector Factsheets covering transport; food; construction; energy & water; household consumption; and waste.
- Case Studies: West Sussex betre (business excellence through resource efficiency) project.
  Woking Borough Council Energy Services.
  ReMaDe Kent and Medway.
  The Earth and Stars Pub, Brighton.
  Beacon Press, East Sussex.
  Global Action Plan – Action at School, South East Region.

Contacts

EcoSys, Level 7 South, New England House Business Centre, New England Street, Brighton BN1 4GH.
Tel: 01273 245587. E-mail: admin@ecosys.org.uk

Stockholm Environment Institute – York, University of York, Heslington, York YO10 5DD.
Tel: 01904 432897. E-mail: seiy@york.ac.uk Web: www.seiy.org

Centre for Urban and Regional Ecology, School of Planning and Landscape, Manchester University, Oxford Rd, Manchester M13 9PL. Tel: 0161 275 6879. E-mail: cure@man.ac.uk Web: www.art.man.ac.uk/planning/cure

Acknowledgements

Project funders
Biffaward
South East England Development Agency (SEEDA)

Project team
EcoSys Environmental Management and Education
Nancy Bluck
Rob Graham
Nick Hutchinson (Report editor)
Mel Sealey
Leonie Simpson

Stockholm Environment Institute – York University
John Barrett
Nia Cherrett
Andy Jones
Harry Vallack
Tommy Wiedmann

Centre for Urban and Regional Ecology (CURE) – Manchester University
Joe Ravetz

Centre for Environmental Strategy - University of Surrey
Professor Tim Jackson

Steering Group
The project team would like to acknowledge the valuable help and support of the project Steering Group:

Ian Avery – Hampshire County Council
David Carter – Waste Improvement Network South East
Polly Chancellor – Environment Agency
Terry Clarke – Government Office for the South East
Peter Day – South East Regional Technical Advisory Body on waste
Mark Goldthorpe – South East Climate Change Partnership
Brian Jones – Environment Agency
David Payne – South East England Regional Assembly
Graham Tubb – South East England Development Agency
Lucy Young – WWF UK

Design by **Fifty Nine Ltd**. www.fifty-nine.com 0800 0612759

All photographs © **Simon Warner** (except where indicated otherwise) on behalf of Fifty Nine Ltd. www.simonwarner.co.uk 01535 644644

Printed by **The Beacon Press** using their pureprint® environmental print technology. The printing inks are made using vegetable based oils, no film or film processing chemicals were used. 95% of the cleaning solvents are recycled for further use and 84% of the waste associated with this product will be recycled. The electricity was all generated from renewable sources. The Beacon Press is a Carbon Neutral® company and is registered to ISO14001 and EMAS. The paper used is 100% recycled.

www.takingstock.org

Biffaward
investing in the environment

SEEDA
SOUTH EAST ENGLAND DEVELOPMENT AGENCY
Working for England's World Class Region

Produced by EcoSys

Design by Fifty Nine Ltd www.fifty-nine.com. Printed by The Beacon Press on 100% recycled paper using eco-friendly processes.

photograph supplied by Gugs - www.gugs.com