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West Midlands

Counting consumption

CO_2 emissions, material flows and Ecological Footprint of the West Midlands

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Biffaward Programme on Sustainable Resource Use

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Foreword

Sound data is at the absolute heart of sound policy development. In business, this is a truism for both the financial and operational performance of a non-financial kind. At a national level, we also have sophisticated yardsticks for measuring conventional financial data – this lies at the heart of our fiscal and monetary management system in order to deliver low inflation, full employment and stability in a complex system involving transfers between regions, societal groups and internal trading partners.

In the environmental area, however – both within industry supply chains and at national level – we have limited understanding of the flow of physical resources through systems that match the sophistication of the so-called "internality" financial flows. True, we have data relating to physical outputs, point emission sources, solid waste arisings and the like, but these tend to comprise isolated reference points in a complex and changing landscape which is little understood.

Lack of such data on the dynamics of the physical resource flow system is being seen as an increasing source of weakness. Why? For a start, there is mounting suspicion that whether one considers regional, sectoral or specific material flows, the message is the same – the overall metabolism between input, intermediate processing and disposal of wastes is occurring at a rate in excess of the natural capacity of the system to neutralise waste outflows. Either we are stockpiling the resultant waste outflows in manmade physical repositories – from landfills to warehouses (in the case of nuclear) – or we are depositing unwanted by-products into natural repositories – the atmosphere and oceans in particular.

Fortunately, the consequences of this approach are beginning to be understood; now, governments are seeking to adapt behaviour through the interaction of new technology, economic instruments, regulation and the concept of Producer Responsibility. As this adaptation gradually progresses, the need for sound understanding of resource flows through a system becomes of paramount importance.

It is this need that this study is designed to target. Without such systems, supply chains and the regulator can only be forced into adapting estimates, incomplete information chains and extrapolated assumptions. Such methodology is dangerous – for supply chain performance assessment and the way it could create an un-level competitive playing field by encouraging freeloaders into false accounting systems.

Such conclusions have already been endorsed by government – and £2m has been committed under the Business Resource Efficiency and Waste Programme (BREW) to develop an accounting network for all waste flows from point of disposal to point of final reprocessing – either as recyclate,

energy, compostable soil material or into landfill. Regional resource flow studies sit at the very heart of this process.

As this report is being published, the government is beginning to consult on the development of a national waste data framework. This is an important first stage in developing a national resource flow database. It's a mammoth undertaking, but one which future generations will thank us for as an important pre-requisite to improving the quality, range and depth of our environmental policymaking.

Information provides wisdom, authority and control. Let's hope that those with the ability to take this initiative forward can do so on behalf of those future generations.

Peter Jones
Director of External Relations, Biffaward

Executive summary

This report looks at the environmental performance of the West Midlands, and the prospects for sustainability in the region. It is one of a set from the Ecological Budget UK project, whose national report, *Counting Consumption*[1], contains more details on the data, methods and comparison between all the regions of the UK.

Here, the focus is on the West Midlands. We look at the region's built environment, economic development, and the pattern of consumption of goods and services. We outline trends and projections, goals and targets, policy options and priorities for action. We show some examples of how this looks for certain topics, including energy, transport and construction – other topic areas are still to be explored.

Ecological Budget UK

The Ecological Budget UK project has produced new datasets, national and regional applications, and an interactive model known as the Resource and Energy Analysis Program (REAP)[2]. There is also a One Planet Economy Network (OPEN) which is taking forward the applications to national policy on taxation, innovation, economic development and so on. A range of practical applications to policy appraisal and business benchmarking is in development.

The core datasets can be seen from two angles:

- *Production*: the 123 sectors of economic and industrial activity, including imports from other regions and from overseas. These sectors take in materials to produce products, and they generate waste and emissions.
- *Consumption*: as in 68 types of household purchases, government expenditure and capital investment, including exports to other regions and overseas.

Three main indicators are used to track the total environmental impacts:

- *resource flows*, including materials and energy;
- *carbon dioxide (CO_2) emissions*, as the largest single cause of climate change; and
- *Ecological Footprint*, as the aggregated index of total impact.

Resource flows in the West Midlands

This indicator tracks the flow of materials, as the most direct result of our systems of production and consumption.

- The Regional Material Input (RMI) into the West Midlands economy is 10.9 tonnes per person (or tonnes per capita – t/cap) per year – primary materials from agriculture, mining etc., plus imports from overseas.
- As much again is transferred back and forth in movements between the West Midlands and other regions.
- More than one third of this – 3.6 t/cap – comes from overseas imports.
- The average person directly purchases 1.8 tonnes of goods and products per year, and throws away nearly half of this over the same period.
- Total waste coming from industrial, commercial and construction/demolition amounts to three times the household waste – more than 2 t/cap per year.

CO_2 emissions in the West Midlands

This indicator tracks CO_2 as the largest single cause of climate change.

- The CO_2 emissions from West Midlands production, which includes goods for export, is 9.4 t/cap (below the UK average by 10 per cent).
- The CO_2 emissions from West Midlands consumption, which includes goods from imports, is 11.5 t/cap (below the UK average by 5 per cent).
- In terms of CO_2 emissions, the most resource-intensive sector is the cement industry, followed by electricity generation.
- The consumption type with the highest impact is domestic energy consumption followed by household car use.
- The consumption type with highest overall impact per £ spent is electricity generation.
- This suggests that the first target for any regional sustainability strategy is to reduce the demand for electricity and car travel.

ADINA TOVY AMSEL/LONELY PLANET

Ecological Footprint of the West Midlands

This indicator tracks Ecological Footprint as the best indicator of overall environmental impact. The Footprint measure is based on the area of productive land or water needed to supply our resources and absorb our pollution: this land may be located anywhere in the world.

- The total Ecological Footprint per person in the West Midlands is close to the national average at 5.4 global hectares (gha).
- If the available productive land area were to be distributed evenly among the global population, the West Midlands is currently overshooting that share by a factor of three. So if everyone lived in the same manner as the average person in the West Midlands, we would need three planets to support our lifestyles.

Implications

The overall result of this investigation is to define a working target for environmental sustainability. This can be defined by a Factor Four increase in resource efficiency, or a 75 per cent reduction in Ecological Footprint, by 2050.

This applies to the region as a whole, and in various ways to local areas, business sectors and consumer choices.

The rate of change across the board is equivalent to between 2.5 and 3 per cent growth in resource efficiency, or a "decoupling" rate of minus 5 per cent per year reduction in resource use relative to continued economic growth. This is more than twice the rate of decoupling seen in recent years.

To achieve this Factor Four reduction in resource flows and, consequently, the Ecological Footprint, a range of actions is set out for regional, sub-regional and local authorities in the short, medium and longer term. Each of these actions then requires the building of an evidence base, enhancing policy applications, and building capacity across all sectors.

1 Barrett, J., Ravetz, J., Minx, J. and Wiedmann, M. Counting Consumption: CO2 emissions, material flows and Ecological Footprint of the UK by region and devolved country WWF/SEI/CURE/Biffaward, 2006. Visit www.ecologicalbudget.org.uk

2 Details on www.sei.se/reap

1 Introduction

This section opens up the question of how to deal with the environmental performance of a region, and how to manage its prospects for sustainability.

The West Midlands is changing from its former engineering base to a more diverse knowledge-based economy. How will this look in 20 or 40 years time, and how far will it be environmentally sustainable? The Regional Economic Strategy (RES) aims for a dynamic business environment, a high-skilled and IT-enabled workforce and inclusive communities. Meanwhile, the Regional Spatial Strategy (RSS) aims at urban and rural renaissance and a balanced pattern of development with Birmingham at its heart. Both these strategies are inspired by the goals of sustainable development as summed up by the UK government – social progress, economic growth and employment, and protection of environments and resources.[1]

In reality, what happens if the newly trained and mobile workforce seeks its quality of life on rural greenfield sites and then drives to work, school and services? What happens if the economic growth targets are achieved, and the results are for more consumer goods, more waste, bigger airports and motorways? At present, while the West Midlands continues its urban renaissance and the process of "cleaning and greening", the global impacts of its production systems and consumption habits continue to rise.

These and many other issues can be measured by the Ecological Footprint (see box) together with "material flow" and CO_2 emissions. Each shows different angles on the global impacts of local activity. But there is a very big challenge looming over the whole picture – the head-on clash between economic growth, environmental limits and social equity between and within nations.

The Ecological Budget UK project provides the first fully detailed evidence on these three types of global impacts across the whole of the UK and its regions. This report is one of several regional applications of that larger national project.

This West Midlands report looks at production and exports from industries in the region; it also examines the material consumption of households, the volumes of imports from around the world and the total impacts caused by all those supply chains. Finally, it looks at trends, future scenarios and policy options to see how the region and all its residents can best achieve the goals of environmental sustainability.

The Ecological Footprint

The Ecological Footprint is a calculation method that estimates the demand of human activities on nature. It measures the resources consumed by a population (the West Midlands in this analysis) and the balance between human demand and nature's supply. The Footprint calculates how much productive land and sea is needed to provide the energy, food and materials we use in our everyday lives, and how much land is required to absorb our waste. It also calculates the emissions generated from the oil, coal and gas we burn, and determines how much land is required to absorb them.

GARY DOAK/WWF-UK

One Planet Living and the Factor Four challenge

The Ecological Footprint is about the best measure of the total global environmental impact of a region, a local area or an individual lifestyle.

The total Ecological Footprint per person in the West Midlands is 5.36 gha – close to the national average.

If the available productive land area were to be distributed evenly among the global population, the West Midlands is currently overshooting that share by a factor of three. So if the world population lived in the same manner as the average person in the West Midlands, we would need at least three planets to support our current lifestyles.

At present, the consumption of the UK and similar countries is still rising at about 1 per cent per year, while the consumption of much larger populations such as China and India is growing more rapidly at 5 per cent or more per year. Meanwhile, the globally available bio-productive area of land and sea is steadily declining as forests are burned, farmland is turned to desert and fish stocks are run down to near extinction.[2]

The UK government, along with a few others, has followed the scientific advice for a target of a 60 per cent cut in climate change emissions by 2050. But we need to factor in the growth of developing nations and the need for greater equity, as above. This points towards a long-term goal of a 75 per cent cut in resource use – a Factor Four increase in resource efficiency.[3] Actions for achieving this are being explored in the One Planet Economy Network (OPEN) programme of WWF and its partners.[4]

Such a step change in resource efficiency is achievable with known technologies and consumption patterns. It represents a 2-3 per cent reduction in physical impact year on year, or a 4-5 per cent increase in 'resource productivity' per unit of economic activity. In the face of opposite growth trends, it is a very challenging target.

Meanwhile in the West Midlands and similar regions, the regional spatial strategies and economic regeneration programmes are a one-off opportunity to steer economic and urban development towards such accelerated resource efficiency. Such a step change can then be both the cause and effect of economic growth and competitiveness.

The overarching question for this report is – how can regional economic and urban development policy help to meet long-term resource efficiency goals?

1 HMG, 2005: Securing the future.
2 WWF, 2005
3 von Weizacker, Lovins & Lovins, 1997
4 See www.ecologicalbudget.org.uk

2 Background

This section outline the methods, scenario types and policy applications of the Ecological Budget UK to the West Midlands.

Starting from now

Consumers, businesses and policy-makers would all like to live in a more sustainable world – but the reality is that current trends of growth and affluence are moving us further away from that goal all the time. The overarching challenge is that there is a very large gap between the regional and local capacity in the short term, and the global and long-term challenges of resource efficiency.

On the subject of sustainable consumption and production (SCP), the UK government says:
"We need a major shift to deliver new products and services with lower environmental impacts across their lifecycle, and new business models which meet this challenge while boosting competitiveness. And we need to build on people's growing awareness of social and environmental concerns, and the importance of their roles as citizens and consumers."[1]

Few policy-makers are employed to look beyond five years, let alone 20 or 40. Most local or regional policy is not equipped to deal with lifestyle changes, business practices or global supply chains. The current concerns of policy in the West Midlands are very much centred on urban and rural renaissance and the rejuvenation of the economy. A step change in resource efficiency is seen as a desirable add-on, but at present, few can take responsibility to make sure it happens.

So for many of the issues highlighted by the Eco-Budget UK research and the REAP toolkit, we need to start rethinking across the board. We need to explore new forms of policy, new patterns of business with less impact and greater value-added, new ways of consuming less for more satisfaction, and new ways of shaping urban and rural communities. In this, the data produced by the Ecological Budget UK is only a starting point – although a very important one.

"We need a major shift to deliver new products and services with lower environmental impacts across their lifecycle, and new business models which meet this challenge while boosting competitiveness."

Policy options

Achieving the Factor Four concept involves not only questions of how much economic or physical growth, but also what kind of growth.

This involves looking closely at choices and policy options in transport, housing, utilities and other physical developments. It also involves a wider agenda for environmental management in production and consumption.

Some key policy options and choices which directly afffect the Footprint calculation can be seen as 'either/or' choices:

- *Housing and construction:* further growth in construction activity and household energy use – or more environmentally sustainable homes and neighbourhoods.
- *Transport:* further growth in road traffic and air travel – or positive encouragement of lower impact modes, demand management and integrated transport.
- *Energy and utilities:* more power stations and dams – or alternative ways of managing demand.
- *Waste policy:* more growth in waste arisings, incineration and landfill – or alternative ways of recycling and re-using materials and products.
- *Industry:* further growth in high-impact industries and branch-plants – or more ecologically/socially responsible industries, more aligned with One Planet Living.[2]

In this report we concentrate on the first three agendas for the built environment, including housing, construction and regeneration, and for transport and energy.

DAVID M HUGHES/COLLECTIONS PICTURE LIBRARY

Policy applications

There is also a range of very practical policy applications at regional and local levels. In this report we focus mainly on the regional level, so that local government can better coordinate its policies and actions.[3]

In reality, local government and other public agencies in health and education have a much larger spending power. It is the task of regional organisations such as Advantage West Midlands, Government Office West Midlands and the West Midlands Regional Association to coordinate, promote and enable the policies and investments of many other bodies.

At the regional level there are three main forms of policy development. The Ecological Budget UK data and REAP toolkit can contribute to each of these, mainly in the form of sustainability appraisal, scenario development and monitoring/benchmarking, as set out below.

Regional Spatial Strategy (RSS)[4]
This focuses on the physical and spatial development of the region and is directly concerned with issues which affect the Ecological Footprint – housing, transport, energy, minerals and so on. As wiwth other regions, the West Midlands version has influence rather than control, and can realistically aim to adjust rather than re-shape trends in the physical region.

Regional Economic Strategy (RES)[5]
This focuses on the productive economy and the conditions for competitiveness, business development and employment growth. Although the West Midlands version says little on the consumption and demand side, some of its themes would have major indirect influence on the issues which impact upon the Ecological Footprint:

- regeneration policies: a range of issues including urban communities, rural areas and local economic development;
- business clusters: a range of issues including environmental technologies, business environment management and waste minimisation; and
- transport issues: infrastructure, demand and logistics.

Regional Sustainable Development Framework
This is a framework – not a strategy – and an important point of reference for policy development and appraisal.[6]

Ideally these various strategies/ frameworks could add up to more than the sum of the parts. For example, in the South East, the Regional Assembly has now set an overall target in its RSS for "stabilisation of the eco-footprint by 2016". This involves an accelerated programme for enhanced resource efficiency in existing and new development in urban and rural areas.[7] The West Midlands has clearly got a challenging agenda, but there is certainly potential for more action to realise its aspirations for sustainability.

Scenario development

The examples above show how the policy choices and options may be found on the supply side (for example, the construction of energy efficient dwellings) or the demand side (the market for such dwellings). Change is likely to occur as a combination of multiple factors. This is generally termed a "scenario" – a consistent and plausible account of future paths or conditions.

The Ecological Budget UK and the REAP modelling system are constructed around scenarios which are deliberately simple and based on the overall levels of Ecological Footprint which result. This is in contrast to other scenario projects such as the Environmental Foresight of the Department of Trade and Industry, which focused on the possible types of future government and economy.[8]

The Ecological Budget UK/REAP scenarios come in five basic types, with some variations and extensions:

- *Factor 0*: A "high-growth" scenario can be summed up as unrestricted economic growth, material consumption and resulting environmental pressure. The Ecological Footprint growth trend is accelerated up to the level of economic growth, in the UK at 2.25 per cent long-term.
- *Factor 1*: The baseline or default "business as usual" scenario is given in REAP by the pre-set assumptions and economic growth/change projections built in to the settings for each region. These are designed as "policy-off" with no further policy changes, technological trend changes and so on: this is not fixed over time, and may need updating from the time of the model development. The Ecological Footprint growth trend per person of around 1 per cent per year is maintained.

1 HMG, 2005
2 One Planet Living (OPL) is a joint BioRegional/WWF programme through which "people everywhere can lead happy, healthy lifestyles within a fair share of the Earth's resources, leaving space for wilderness and wildlife". For more information visit www.bioregional.com
3 DEFRA, 2006
4 GOWM, 2004
5 AWM, 2004
6 WMRA, 2006
7 www.southeast-ra.gov.uk/southeastplan/publications/research/se_footprint_summary_report_july05.pdf
8 www.foresight.gov.uk

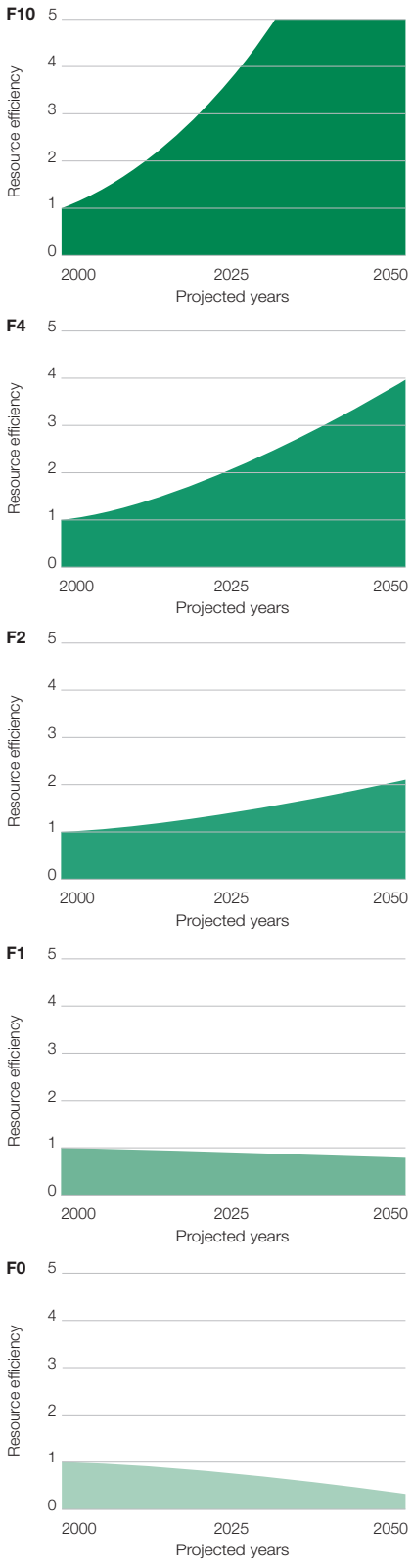


Fig 1 **Long range footprint scenarios** showing the relative increase in resource efficiency (population ÷ Ecological Footprint) from 2000 (2000 = 1)

> *Factor 2*: in contrast, this describes a "dysfunction and decline" future with economic failure, social/political conflict and increasing environmental damage. The Footprint is reduced by 50 per cent, but generally for all the wrong reasons.
> *Factor 4*: A "sustainable development" scenario maps out a desirable and still plausible future combining political commitment, economic investment, technological progress and consumer attitude change. The result is that quality of life and social welfare goes up independently of economic growth, while environmental pressure reduces.
> This scenario is taken further, with two basic variations, in the One Planet Economy research. The "high oil price" scenario foresees a world with diminishing supplies of fossil fuels and accelerated transition to renewable sources. In contrast, the "low oil price" scenario is concerned with rapidly increasing energy/CO_2 taxation to reduce demand in a world of plentiful forms of fossil fuels.
> *Factor 10*: Going even further, a "deep green" scenario envisages a future where society places a value on other species as high as it does on human issues. This scenario is useful to identify an alternative set of options beyond that of the Factor Four scenario, so that the latter may appear as moderate and sensible.
> Also useful for some purposes is an "F??" scenario – a "wild card". This explores how accelerated technological changes in IT, bio- or nano-technology, creates "wild card" future possibilities beyond conventional thinking and into science fiction territory.

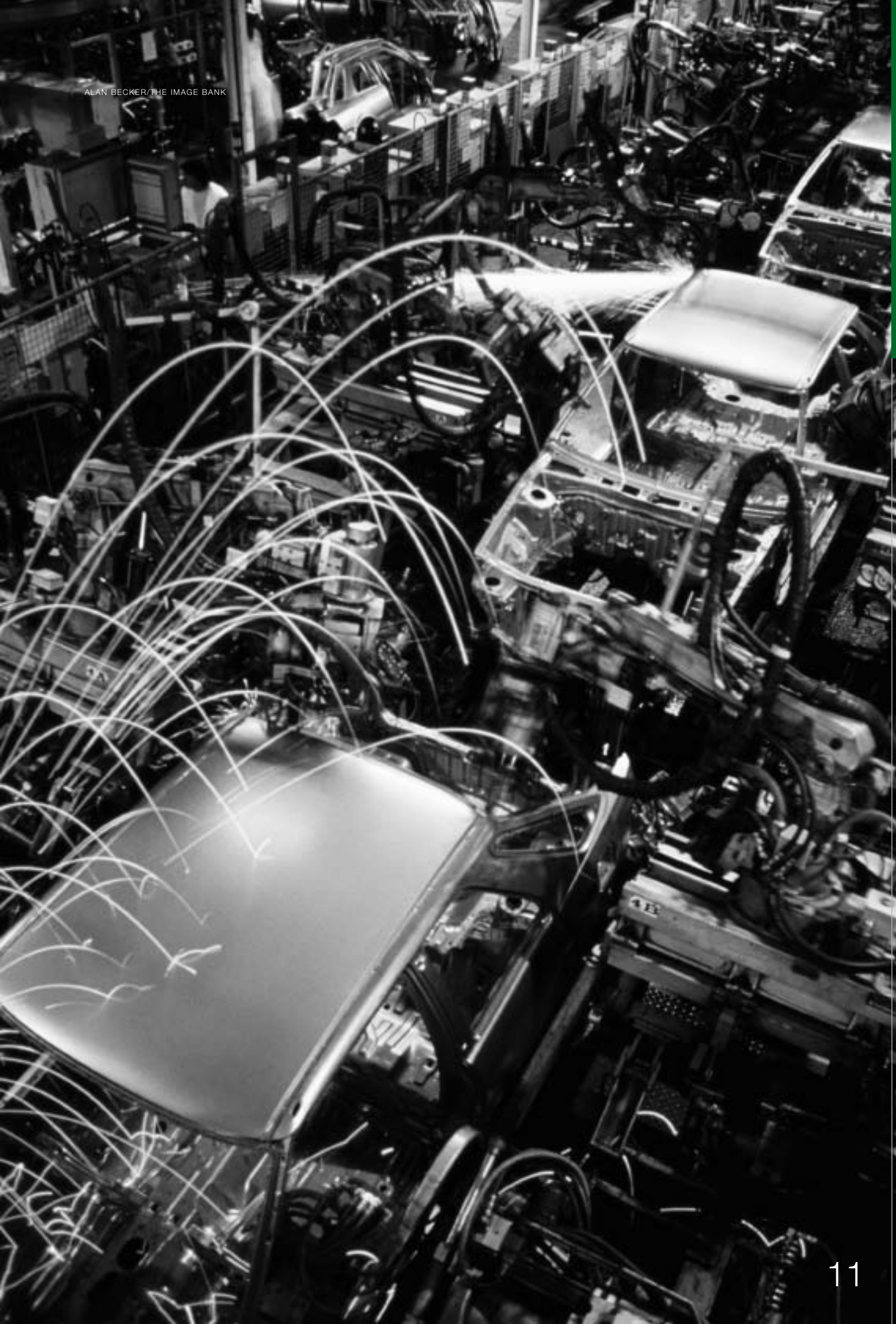
Outside this scenario set, F-1 and F-4 (both with variations) are most plausible and/or desirable, and therefore the subject of close attention. The F-1 scenario is based on existing policy and projections, and needs to be defined in some detail. The F-4 scenarios, with the variations outlined above, are important in setting out the goals and targets and the possible actions to achieve them. For the modelling in REAP, the distance between F-1 and F-4 is crucial for each of the many issues concerned. While this shows the size of the policy gap, the question is then how to bridge it.

Scenario horizons

In the REAP system is a structure of time steps at 10, 20 and 45-year intervals.

> 2010/2015-now: this is the immediate frame, where we start to see the direct effects of current decisions.
> 2025-soon: this corresponds to the regional planning horizon, where a new generation will have to live with the mistakes of the present.
> 2050-later: the far future is of course much more approximate. While targets are set out for long-term issues such as climate change, there will be new challenges which we can hardly imagine.

"Consumers, businesses and policy-makers would all like to live in a more sustainable world – but the reality is that current trends of growth and affluence are moving us further away from that goal all the time."



ALAN BECKER/THE IMAGE BANK

3 Trends and prospects

This section outlines the main issues, trends and projections in the West Midlands which may influence the prospects for the regional Ecological Footprint.

The West Midlands

This is a region of great diversity, ranging from major urban areas (MUAs) to sparsely populated rural areas. This diversity is also reflected in the nature of the population, which comprises a wide range of multi-cultural communities. Combined with the variety of business, employment and skills, this creates major opportunities for the future. The challenge for the region is to use this diversity as one of its key strengths.

Centrally located in England, the region covers some 13,000 square kilometres and is home to around 5.3 million people. Within the region are seven metropolitan district councils, three unitary authorities, four shire counties and 24 district councils. At the centre is the West Midlands conurbation comprising Birmingham, Solihull and the Black Country local authorities of Dudley, Sandwell, Walsall and Wolverhampton. Birmingham continues to develop an international profile, which has brought wider benefits to the whole region. The other MUAs are Coventry and the towns of the North Staffordshire conurbation. All these areas have distinct characteristics and roles.[1]

Regional issues

The West Midlands is in a rapid transition from its former engineering base to a more mixed knowledge-based economy. However, as the UK economy continues to move ahead, the region is still under-performing in terms of Gross Value Added (GVA), incomes, business start-ups and innovation: 20 per cent of the workforce are still in manufacturing, compared with 15 per cent nationally. While the dynamism of Birmingham city centre is the equal of any in the UK, it is surrounded by low quality environments; and due to its central location, many key financial and professional sectors go to London or the M62 corridor. A West Midlands scenario workshop was held in September 2005 to explore the possible connections between regional policy and the Ecological Footprint scenarios. There was a particular focus on the F-4 scenario for environmentally sustainable development. Key questions were debated:

- Are current regional strategies heading towards real sustainable development (as defined by the F-4 goal), or away from it?
- How much does regional governance have the capacity for real sustainable development?
- What are the most important regional issues which can be included in the REAP model?

The workshop focused on the RSS and the Regional Housing Strategy. While these have direct physical effects, their focus is generally on urban location choices and regeneration programmes, and these might seem marginal to these bigger picture and longer-term scenarios.

Scope of regional policy

The general aim of regional policy is to redirect development towards urban regeneration and the urban renaissance – with the general assumption of positive effects on environmental sustainability. In reality, most components of the local area Footprint are directly related to wealth and poverty rather than location. Meanwhile, rural issues and needs are very important to the regional strategy, although more than 80 per cent live in urban areas. While agriculture and the food chain is seen as a crucial element of the Footprint (and of the rural economy) it has yet to be recognised as a major part of regional policy.

Across the region, there is a general picture of disconnection – urban from rural, environmental from economic policy, production impacts from consumption impacts, and so on. The general aspiration of the RES and related strategies is for economic growth in which larger supermarkets and bigger airport runways are an inevitable part. The end results of increased consumption and global environmental damage are not really on the current agenda of regional policy.

To compound the challenge, many of the most important regional policy issues are difficult to analyse or model directly. IT training and business support, for instance, may have complex effects on a local or regional economy. Likewise, labour force skills, inward investment and other economic programmes are likely to increase the general level of material consumption alongside competitiveness and added value.

Regional policy context

The RES sets out its goals with a strong emphasis on partnership with, and coordination of, the many competing agencies in the urban/economic development field[2]:

- develop a diverse and dynamic business base, prioritising clusters and high-technology corridors;
- promote a learning and skilful region, capitalising on its universities and research centres;
- create the conditions for growth in terms of the labour market, infrastructure, business support and ICT (one target is for all businesses and 97 per cent of households to use broadband); and
- regenerate communities: inclusion is a big issue in a very diverse cultural region.

DAVID M HUGHES/COLLECTIONS PICTURE LIBRARY

Environmental improvement is mentioned, but the wider themes of sustainable consumption and production do not appear directly as a first priority in the RES.

Meanwhile the RSS sets its priorities in terms of four major challenges, in reversing previous trends of decentralisation and sprawl[3]:

- *urban renaissance:* developing MUAs so they can increasingly meet their own economic and social needs;
- *rural renaissance:* addressing more effectively the major changes which are challenging the traditional roles of rural areas and the countryside;
- *diversifying and modernising the region's economy:* ensuring that opportunities for growth are linked to meeting needs, and that they help reduce social exclusion; and
- *modernising the transport infrastructure:* supporting the region's sustainable development.

Each of these goals may be laudable, but do not necessarily lead towards environmental sustainability. It could be argued, for instance, that increasing competitiveness in a knowledge-based economy means greater specialisation in a larger labour market, so that travel demand is set to increase whether in urban or rural areas.

Policy tensions

The many tensions in regional strategy can be summed up as two parallel and competing paradigms of regional development. These are not always apparent in policy documents, which tend to present positive win-win aspirations as 100 per cent certain.

- The "growth" model is focused on economic competitiveness, via decentralised space-extensive business and retail parks, servicing highly mobile, affluent and polarised communities. This corresponds mainly to the F-1 or possibly the F-0 scenarios.
- A "quality" model is focused more on social cohesion and environmental goals via urban regeneration, public transport and mixed, vibrant communities. This corresponds more to the F-4 scenario, with perceived risks of an F-2 type collapse.

Each can be seen as hanging over day to day policy, and the sustainability outcomes in terms of Footprint or other measures cannot be assumed for either. For instance, the newly affluent, urban, loft-dwelling professionals are quite likely to have large Footprints via second homes and foreign holidays; meanwhile the suburban estates or rural smallholders might enable increased biodiversity and local food cultivation.

On the positive side, many initiatives show best practice in energy efficiency, low-impact transport, increasing urban green space and revitalising local economies and communities. In assessing the performance of the regional strategy, it has to be recognised that the regional component is small in relation to local and national government influence, and even that is small in relation to the private business and consumer influence.

The implication is that an effective F-4 strategy to reduce the Footprint has to address private businesses and consumers, as well as the easier target of local and regional policy.

Regional prospects

In terms of economic projections, the RES suggests that, without intervention, the West Midlands will remain fairly static:

- the region will perform at or close to the UK average in GVA and employment terms, resulting in relatively little net employment creation in the region; and
- unemployment is expected to rise.

In terms of spatial development, the West Midlands has the second lowest population projection of any region, with a growth rate of a quarter of 1 per cent per year. The RSS proposes new housebuilding rates of around 15,000 dwellings a year, with the balance shifting towards urban rather than rural locations. Housing demolitions are anticipated at nearly 3,000 a year, or more than 0.1 per cent of a total stock of 2.25 million.

The question is how these broad projections then impact on the projections and scenarios for resource use and efficiency. From various sources we can put together a comparison of regional prospects with the national picture.

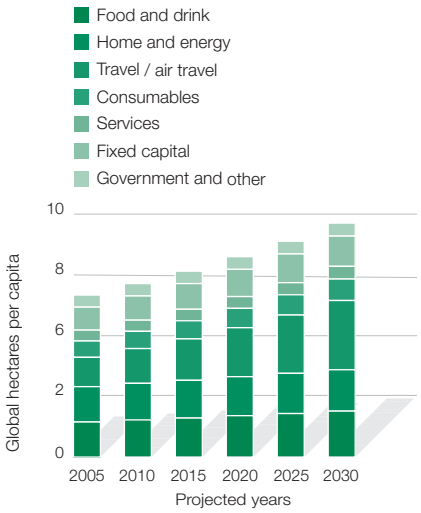


Fig 1 **Medium range footprint projections**

- *Construction of the built environment:* higher than average rates of refurbishment and replacement, with consequent impacts of construction.
- *Domestic energy demand and climate emissions:* a higher than average proportion of terraced housing shows probable low energy efficiency; a higher rate of planned demolitions and replacement brings the potential for rapid gains.
- *Industrial/commercial energy demand:* a larger proportion of manufacturing on older sites is likely to mean lower energy efficiency in commercial property. Again, restructuring brings the potential for positive change.
- *Transport:* the general layout and complex geography of the main conurbation will tend to make corridor/hub patterns more difficult, and public transport less viable. The region is likely to follow the national projections (~2 per cent average growth in road traffic).
- *Food and other consumption:* some effects of the RES could be to level up the poorer communities at faster than UK projections.

General trends in Ecological Footprint

The position of the West Midlands in relation to the UK economy shows a regional Ecological Footprint per capita close to the UK average. While the present day calculations are now in place, the question of trends and projections is still being explored. The best available evidence so far shows that:

- on average, the Footprint of the UK has risen from 3.81 gha/cap in 1961 to 5.35 gha/cap in 2001, equivalent to an average annual growth rate of 0.85 per cent;
- the total amount of land required to sustain the inhabitants of the West Midlands region was 31m hectares, roughly 25 times the land area of the region;
- Two-thirds of the region's Footprint is required to absorb CO_2 and other types of climate emissions ("energy land"). One-third of the Footprint is the actual area somewhere in the world needed to supply infrastructure, crops, forest products, minerals etc. ("real land").

For trends and projections, research is still in progress but points towards some general results:

- The total Ecological Footprint is calculated as the sum of shelter, transport etc., each of which has its own range of growth forecasts. The medium growth forecasts for each sector would result in a total Footprint value of 7.6 gha/cap by 2030.
- This growth over 25 years equates to about 1.4 per cent per annum growth in total Footprint per capita, or 0.09 gha/cap growth per year.

Trends in urban development

Here we focus on the growth trends in urban development and transport sectors, as these are mainly within the scope and remit of the RSS. Each of these trend projections is based on the "F-1" business as usual 'central scenarios' from DfT, DTI and other government departments.

- The total Ecological Footprint above includes urban development sectors (energy demand and construction in housing / property: surface and air travel): and other sectors (including food, consumables, investment and other).
- The trend projections for 'home and energy' are medium scale growth at 0.65 per cent growth per year: this also applies to 'services' i.e. commercial property construction and energy demand.
- Surface transport is also projected at medium growth of 0.65 per cent, due to limits on the infrastructure.
- The wild card is the very high rates of growth in air travel, projected in the medium term at 5 per cent per year, and after 2020 at 3 per cent per year. (The effects are calculated in the REAP system as the total CO_2 emissions from half of each journey, but not including for the secondary effects of high level emissions). This high growth rate then skews the whole of the rest of the Ecological Footprint projection.
- For food and consumables (manufactured products) which involve globalized supply chains, there is little data available, but preliminary research indicates growth trends of about 1.1 per cent per year for each.

All the figures quoted above are generally in Ecological Footprint / capita, which factors out any change in the total population: i.e. population growth has no effect on the Ecological Footprint / capita.

4 DTI, 2006; DFT, 2003; REAP activity model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4 Regional resource flows

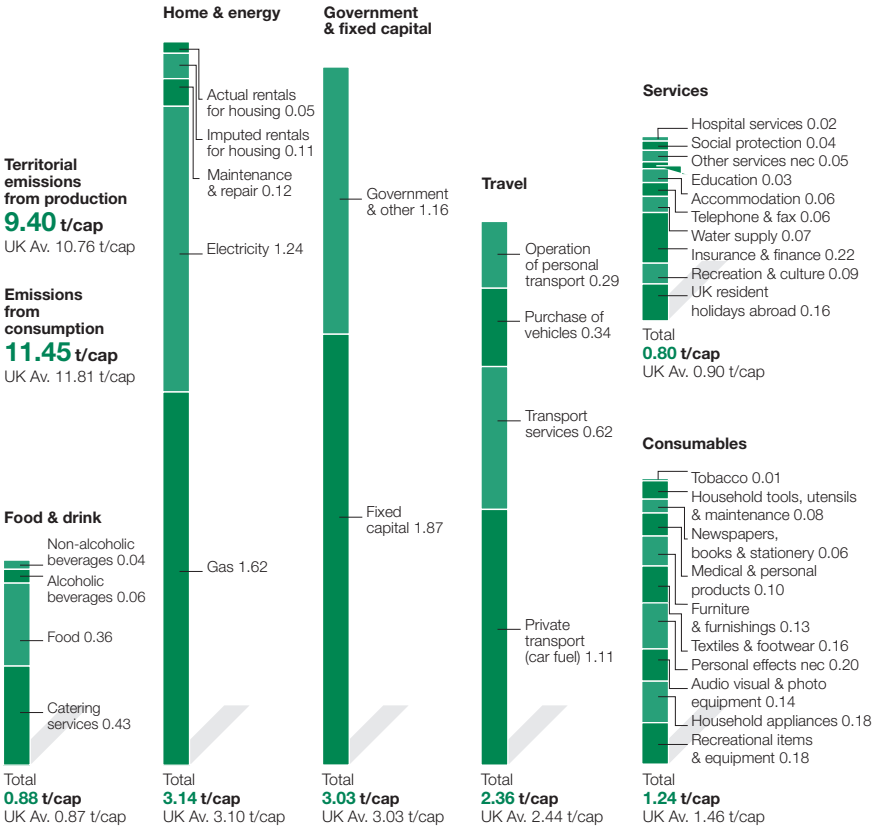

Fig 1 **CO_2 emissions from consumption in West Midlands (t/cap)**

CO_2 emissions

The West Midlands' CO_2 emissions from consumption (11.5 t/cap) are 4 per cent lower than the UK average, while emissions from production (9.4 t/cap) are 13 per cent lower than the UK average. Although most of the UK consumes more than it produces, the discrepancy in the West Midlands between consumption and production is twice the UK average. This reflects not only the decline of West Midlands manufacturing, but also the continuing growth in household consumption, more than ever supplied from industries outside the region.

Like many other regions and devolved countries, CO_2 emissions from home maintenance and energy use (3.14 t/cap) are the largest single sector in consumption. This component is slightly higher than the national average, and highlights the potential for reducing overall CO_2 emissions by focusing on the home and energy sector.

Transport is the next biggest component of the West Midlands' total emissions. CO_2 emitted per capita from travel is 3 per cent lower than the average, and makes up 21 per cent of the Footprint. Car use dominates West Midlands' travel emissions (74 per cent of the travel total, slightly higher than the national average). Of all surface transport, 87 per cent is by car, and most of the remaining emissions are due to air travel. The more efficient public transport modes amount to less than 9 per cent of the total travel.

Why focus on CO_2?

CO_2 is the most significant greenhouse gas. Although its effect is not as intense per tonne emitted as other greenhouse gases, it is the most significant in terms of total tonnes emitted and total effect on the global climate. For this reason, and because of its currency in UK policy documents, we have chosen to focus on emissions of CO_2 as one of our headline sustainability indicators. However, in addition to CO_2, the REAP software can also account for the other important greenhouse gases emitted from either consumption or production: methane, nitrous oxide, sulphur hexafluoride (SF6), perfluoro CO_2s (PFCs), and hydrofluoro CO_2s (HFCs).

CO_2 emissions from consumption and from production

Most governments measure the CO_2 emitted from production and direct fuel processes within a given region – called CO_2 emissions from production, or territorial emissions. We offer an additional measure: CO_2 emissions from consumption. This accounts for all the upstream CO_2 emitted in the production of a consumed product, wherever it was produced. The CO_2 impacts of a television, a meal in a restaurant, or a GWh of electricity, for example, are assigned to whichever region consumed that item, not whichever region produced it. This reflects how a region's consumption patterns contribute to global CO_2 emissions in a way that the conventional method doesn't. For a fuller discussion of our CO_2 emissions methodology, see the Ecological Budget UK report *Counting Consumption* at www.ecologicalbudget.org.uk.

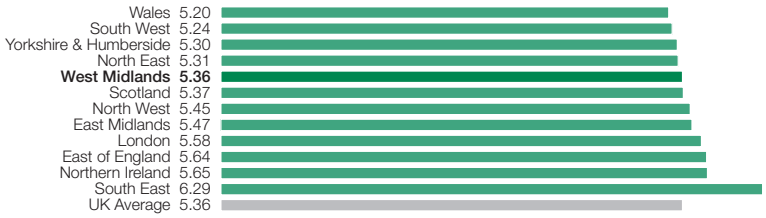

Fig 2 **The West Midlands' Ecological Footprint (gha/cap) compared to other regions of the UK**

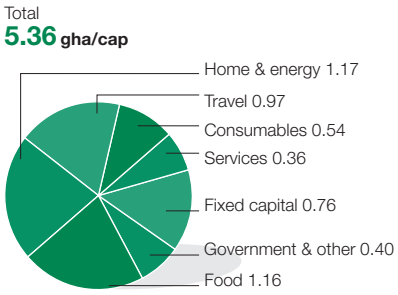

Fig 3 **The components of the West Midlands' Ecological Footprint (gha/cap)**

Ecological Footprint

The West Midlands' total Ecological Footprint is near the UK average – 5.36 global hectares per person ('gha/cap'). However, this average can obscure real variations from the national average between different local authorities and socio-economic groups, both of which are further explored below. The West Midlands' average Footprint also comprises different consumption sectors that can be either above or below the national average.

The West Midlands' consumables and durables Footprint (0.54 gha/cap) is low, around 17 per cent lower than the UK national average (0.65). This is due to residents buying on average fewer products such as electrical equipment, newspapers, household goods and textiles. The Footprint of the service sector (0.36 gha/cap) is around 10 per cent lower than the UK average, although this might alter rapidly with the effects of the RES in encouraging knowledge-based business.

The travel Footprint (0.97 gha/cap) is 15 per cent higher than the UK average, due to higher car use, which is explored in the section below. The food Footprint (1.16 gha/cap) is slightly higher than UK average. One recent study shows that higher consumption of organic food could decrease the food Footprint by around 10 per cent. The same study showed that consuming less meat and more fresh, seasonal and local organic food – not just organic food per se – would be three times as effective and achieve a 30 per cent Footprint reduction.[1] Government procurement could help drive these changes to the region's food Footprint.

Generally, home construction, maintenance and heating are the most significant components of the regional Footprint. This supports government findings that 20 per cent of West Midlands households suffer from fuel poverty – a combination of low incomes and the poor condition of the housing stock.[2] This is further explored below.

Ecological Footprint

The Ecological Footprint is a calculation meethod that estimates the demand of human activities on nature. It measures the resources consumed by a population (the West Midlands in this analysis) and the balance between human demand and nature's supply. The Footprint calculates how much productive land and sea is needed to provide the energy, food and materials we use in our everyday lives, and how much land is required to absorb our waste. It also calculates the emissions generated from the oil, coal and gas we burn, and determines how much land is required to absorb them.

Resource flows

Material flows are the final reference point for analysing environmental performance.

- The net RMI into the West Midlands economy is 10.9 t/cap per year (primary materials from agriculture/mining etc., plus imports from overseas);
- as much again is transferred back and forth in movements between the West Midlands and other regions;
- more than a third of this – 3.6 t/cap – comes from overseas imports;
- the average person directly purchases 1.8 tonnes of goods and products a year, and throws away nearly half of this; and
- total waste coming from industrial, commercial and construction/demolition amounts to three times the household waste – more than 2 t/cap per year.

The gross RMI (the total tonnes of materials used in the region's economy) and Regional Material Consumption or RMC (the total tonnes of materials "consumed") in the West Midlands are just below the UK average, at 22.5 t/cap and 10.8 t/cap respectively. With regional material production being comparatively low (the third smallest) at 7.39 t/cap of materials (33 per cent of RMI), 67 per cent of total RMI input was provided by imports – 60.6m tonnes from other UK regions and 19.1m tonnes from the rest of the world.

The West Midlands stands out for its import from other world regions of 8.6m tonnes of energy-producing materials. This accounts for 45 per cent of total non-UK imports, as well as 2.7m tonnes of basic and fabricated metals, and 2.1m tonnes of coke and petroleum products. Imports from other UK regions were dominated by products from a wide range of industries: 25 per cent by weight

1 Barrett, et al., 2005, Reducing Wales' Ecological Footprint, WWF Cymru.

2 UK government Sustainable Development Indicators: www.sustainabledevelopment.gov.uk/indicators/regional/2003/h04.htm

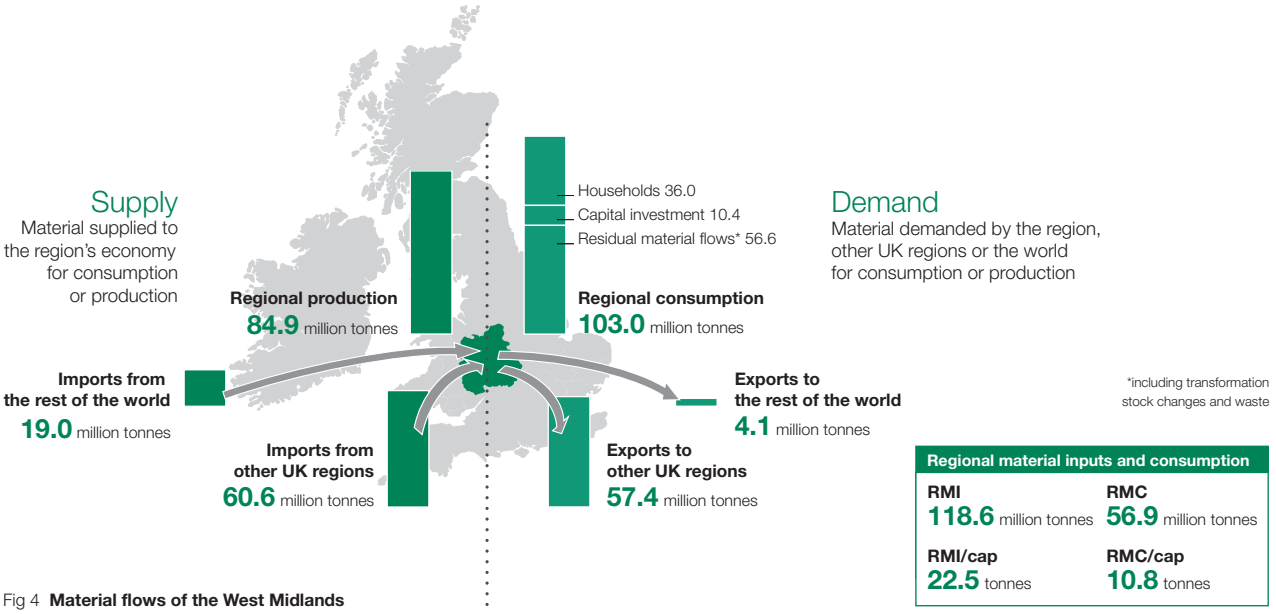

Fig 4 **Material flows of the West Midlands**

stemmed from publishing and printing, while 23 per cent came from the food, beverages and tobacco industry. Although the West Midlands exports a substantial 61.7m tonnes of materials, it still depends on other places in the UK and abroad on a net basis. Subtracting total exports from total imports, the West Midlands is the third largest net material importer across the regions with a surplus of 18m tonnes. Due to this surplus, the RMC is slightly higher than the RMI when compared with other regions.

The RMC and RMI take into account all material flows within the West Midlands and implicitly assign responsibility for these to the region. However, a considerable amount of physical flows might actually occur in the production of goods and services elsewhere. Re-allocating these upstream lifecycle material flows to the region of final consumption provides an alternative view of regional material flows.

Taking into account all the flows that West Midlands consumers trigger in other UK regions, within the West Midlands itself and in the rest of the world, the average West Midlands consumer requires a total of 6.8 t/cap of materials compared with a national average of 7.5 t/cap. This is the third smallest of the UK regions. Compared with others, the household consumption category is quite evenly distributed across the UK. Yet it is the biggest driver of material production, so even small variations in the measurement have large ripple effects on the production chain and total resource use.

Material flow analysis

While in the past most environmental initiatives focused on containing concentrated toxins and pollutants, many contemporary environmental problems are a result of the sheer volume of resources required by the human economy. The material flow analysis (MFA) results from the Ecological Budget UK catalogue the tonnages of material resources needed to supply every form of consumption and production in the West Midlands and the UK as a whole. MFA can identify resource-greedy production and consumption sectors, at which the government can target efficiency efforts. It can then measure in material terms the effects of increased efficiency and lower consumption.

Industrial metabolism

As the West Midlands is an industrial region in transition, it is useful to see the industrial metabolism in terms of material flows. This shows the material flow data from the REAP system, which covers the ONS sectors 1-84: sectors beyond that, such as construction or transport, are deemed "services" for which standardised material data does not exist.

Figure 5 shows first the regional production and imports by industrial groups. The figures are shown in terms of their proportions of the total material input to the regional system: this includes primary inputs from agriculture, forestry and mining, together with all forms of imports from overseas. The accounts do not include inter-regional trade which balances approximately across the regions. It is not possible to add the total regional production as this would double count many of the transactions from one sector to another. Figure 6 shows the regional demand side in terms of:

- *purchases by households* (this does not take account of the passage of materials through the retail sector);
- *capital investment* (this is mainly concerned with plant, equipment and buildings);
- *waste and residuals* (although the most recent industrial and commercial waste data is only a rough estimate, it appears to form more than 90 per cent of this item); and
- *exports to overseas* (this is a smaller item, but it shows how the higher added value sectors towards the top tend to export larger proportions of their production).

This outline metabolism can then be contrasted with the economic growth trends and projections for certain industrial groups, as in Figure 7. Most noticeable are the high growth sectors of chemicals and construction: these contrast with the low growth sectors of food, pulp, iron and steel, and the apparent collapse of the remaining textiles industry.

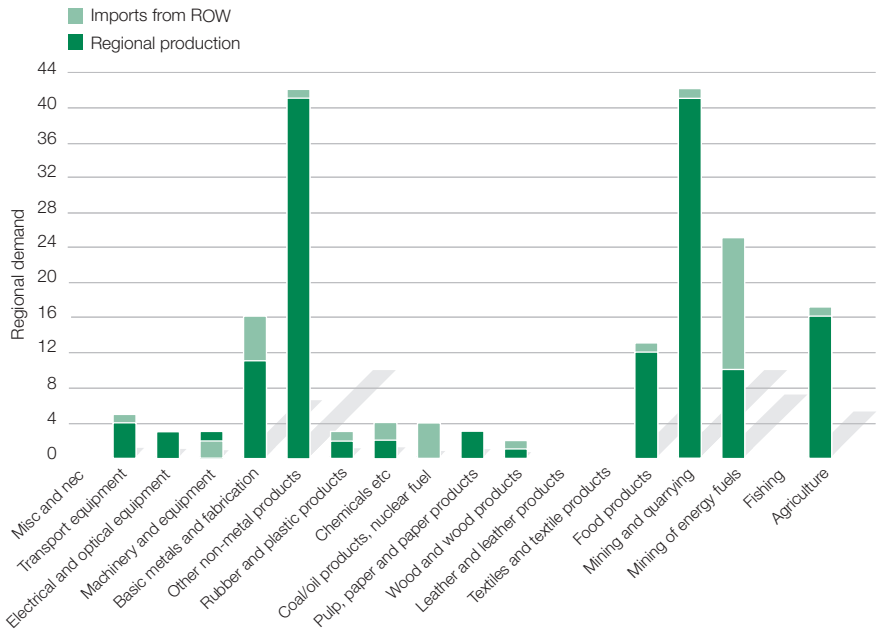

Fig 5 **Regional production and imports by industrial groups in the West Midlands**
(West Midlands data shown as percentage of total)

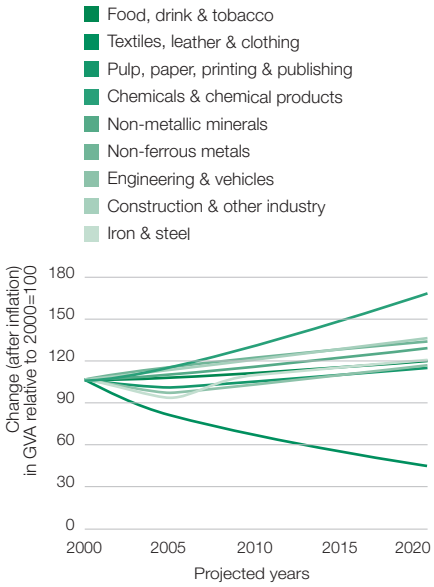

Fig 7 **Economic projections for industrial groups**

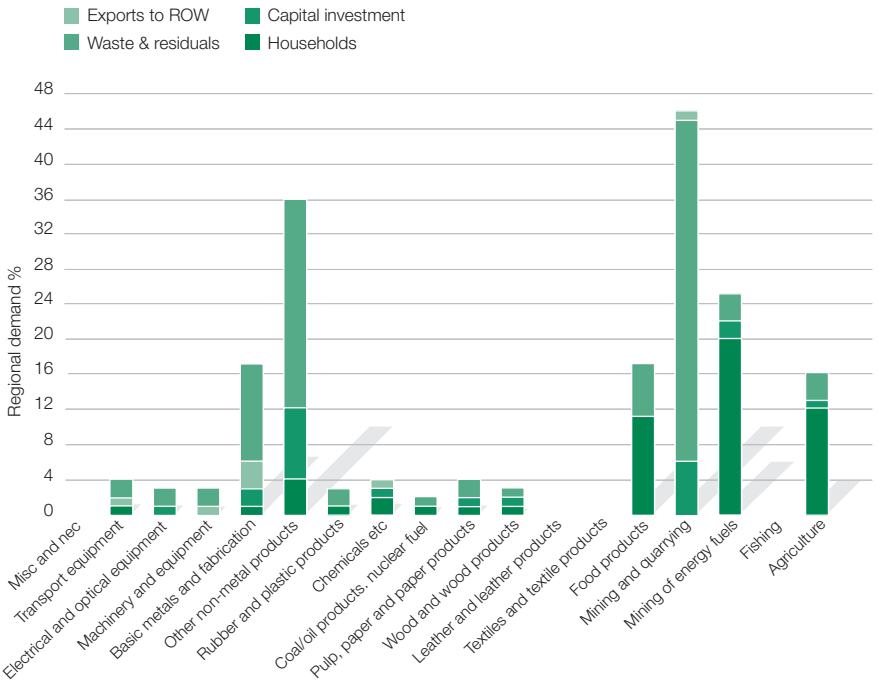

Fig 6 **Regional consumption and exports by industrial groups**
(West Midlands data shown as percentage of total)

"The average West Midlands consumer requires a total of 6.8 t/cap of materials compared with a national average of 7.5 t/cap. This is the third smallest of the UK regions."

5 Energy and climate

Here we look briefly at the question of energy, both on-site and embedded in imports for consumption, and the possibilities of extending the regions energy stategy.

The aim of the West Midlands Energy Strategy is to make the region the most energy efficient in the UK.[1] Energy policy continues to rise up the national agenda, due to concerns about energy security and climate change – an increasingly accepted, understood and imminent reality. Meanwhile the security and availability of UK energy supplies is in question. As a net consumer of energy, the West Midlands' efforts to improve energy efficiency can bring very real benefits to homes and businesses, and in controlling CO_2 emissions.

CO_2 emissions can be accounted for in different ways. The West Midlands Energy Strategy takes a territorial approach, calculating only those emissions that have been discharged in the region. This accounts for all goods and services produced in the region but it does not recognise the impact of those which are consumed in the region. This isn't an approach specific to the West Midlands: indeed, its Energy Strategy is a response to the targets set out in the 2003 Energy White Paper. At the same time, it is recognised that the region's activities do not exist in isolation and have environmental impacts beyond its geographical reach. For this reason it is useful to explore the implications of taking the CO_2 emissions from consumption into account.

Figure 1 shows that calculating territorial producer and consumer emissions from CO_2 in the West Midlands can provide very different results. Consumer emissions are 32 per cent higher overall than those for production. This would suggest that an integrated energy policy should address the consumption side rather than simply production. However, this could be seen as more indirect and beyond the remit and responsibility of UK national policy, let alone regional policy.

Energy and emissions scenarios

The West Midlands is a net importer of all forms of energy, and its power generation capacity covers only a third of its power demand of 33,000 GWh (2002 data).[2] Most of this electricity comes from two large coal-fired power stations at Ironbridge in Shropshire and Rugeley in Staffordshire. The West Midlands also has 95 Combined Heat and Power (CHP) schemes varying in scale (these can provide energy for anything from an individual home to an entire community. Some CHP systems can run on renewable fuels such as wood and can reduce CO_2 emissions by as much as 30 per cent.) Only 1 per cent of energy is generated from renewable sources at present.

Therefore the regional energy strategy is basically an interpretation of national policy and market directions. It is modest and cautious in setting targets which are not unrealistic – the principal one being to generate 5 per cent renewable energy by 2010, and 10 per cent by 2020 (some way behind the UK national targets, given the geographical limits of the region).

Generally, the UK's energy and CO_2 emissions are projected under known policy assumptions as roughly stable and zero growth to the year 2020, despite the target set elsewhere for a 60 per cent cut in CO_2 by 2050. This modest view contrasts with the much wider set of possibilities and aspirations in the Ecological Budget UK scenarios.

The most recent set of energy and emissions projections for the UK have been carried out by the DTI, as background for the 2006 Energy White Paper review.[3] The scenario structure is based on a range of assumptions and uncertainties, and highlights the anticipated effects of the UK climate change programme of policies and measures. The scenarios include:

- a high fossil fuel price case;
- a central fossil fuel price case, but with the assumed prices somewhat favouring gas in generation;
- a central fossil fuel price case, but with the assumed prices somewhat favouring coal in generation; and
- a low fossil fuel price case.

The "baseline" (central gas favoured) scenario for primary energy fuels is shown below (Figure 2). This, of course, is a hostage to forthcoming national policy, but for now it assumes the phasing out of nuclear and coal, expansion of gas, and rapid expansion of renewables from their very small base. The general picture is to show how a rapid transformation on the energy supply side is unlikely in the next decade or two, given the long lead-in times for plant and equipment; and that there may be much greater opportunities on the demand side.

The long-range CO_2 emissions scenarios put this into context:

- *F-0 (high growth scenario):* this sees continuing growth at 1 per cent per year in the Footprint of the regional energy supply, resulting in a 60 per cent increase by 2050.
- *F-1 (business as usual scenario):* this contains in a narrow band the above DTI scenarios. It is interesting that the difference between the high and low fossil fuel price is only about 3 per cent of the total. The result changes little between now, 2020 and 2050.
- *F-2 (low growth scenario):* this sees energy use, CO_2 emissions and the total Footprint reducing by about 1.5 per cent per year – a result of economic stagnation and the increasing disruption

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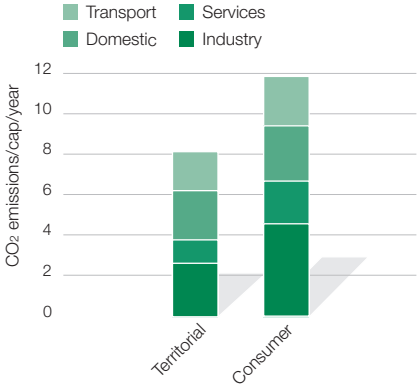

Fig 1 **CO_2 emissions: comparison by territorial (direct) and consumption (indirect) emissions**

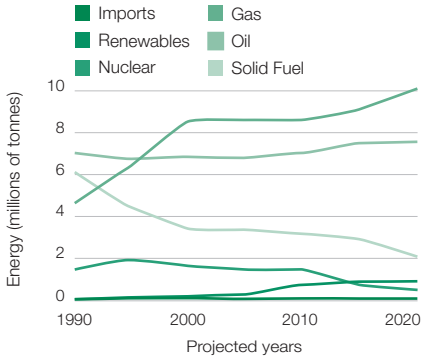

Fig 2 **UK 'baseline' scenario for primary energy fuels**

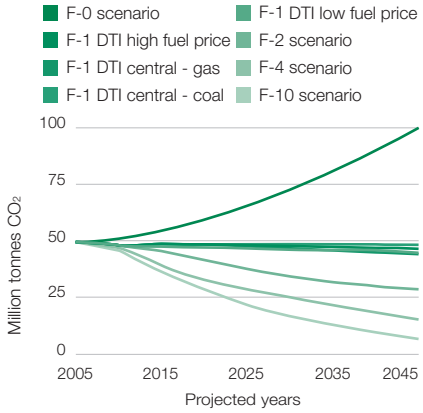

Fig 3 **CO_2 emissions: long term scenarios**

of climate change – with impacts on the distribution between wealthy and poorer communities.

> *F-4 (Factor 4 scenario):* this combines demand reduction through proactive efficiency programmes, and a rethinking of energy supply systems. All new development is effectively zero-energy net requirement; energy services companies mediate between suppliers, distributors and users; regional renewable energy is a major growth industry. The result is a reduction in CO_2 emissions and Footprint of 35-40 per cent by 2020, and 75 per cent by 2050.

> *F-10 (Factor 10 scenario):* this is for reference, with emissions reductions at a trend of minus 2.5 per cent per year

If the consumption-based CO_2 accounts above are included, the starting point of total emissions would be 30 per cent higher and the target reductions correspondingly greater.

The implication is that if the territorial CO_2 emissions targets are achieved while material imports from overseas rise, the gap with the consumption-based emissions will also increase rapidly. Therefore the consumption-based emissions will be more important than before, and it will be more urgent to tackle these through purchasing choices and supply chain management.

Towards a Factor Four scenario

The Factor Four scenario is based on the combination of every available best practice, including those on demand, infrastructure and supply sides. It aims towards the 75 per cent reduction in CO_2 from the energy system as a whole, and hence the total Footprint and is based on international modelling of best practice.[6] It also reflects the aspirational direction of the 2003 Energy White Paper: this avoided targets and projections, but sketches out a powerful picture of the energy system in 2020, which it maintains is on the path towards the recommended 60 per cent cut by 2050. The general picture includes greater diversity and localised sources, embedded micro-generation, distributed heat and cooling, and large numbers of near zero-energy buildings, vehicles and industrial processes.[7]

This all fits into a recommended integrated regional energy/climate strategy. This would seek every available opportunity to combine economic, employment and social objectives, with environmental gains.

It would take an integrated approach to the supply side, with accelerated incentives for micro-generation, renewable energy in rural areas and advanced industrial technologies. It would also take a similar approach to the demand side, with the formation of "energy services" businesses in intermediate labour/training markets. These would tackle energy efficiency in urban regeneration, with the strategic aim of transforming the urban environment at neighbourhood level.

To achieve anything like this, a much more proactive regional energy strategy is needed. This is likely to operate at the urban and sub-regional level, bringing together the institutions and financial mechanisms needed to steer developers, financiers, utilities, planners, designers, contractors and building managers into a low-energy mode of practice.

1 WMRA. 2005
2 WMRA, 2004
3 DTI, 2006 UK energy and CO2 emissions projections: updated to 2020: London, DTI.
4 ibid
5 ibid
6 EEA,2005
7 DTI, 2003, Energy White Paper

6 Transport and spatial strategy

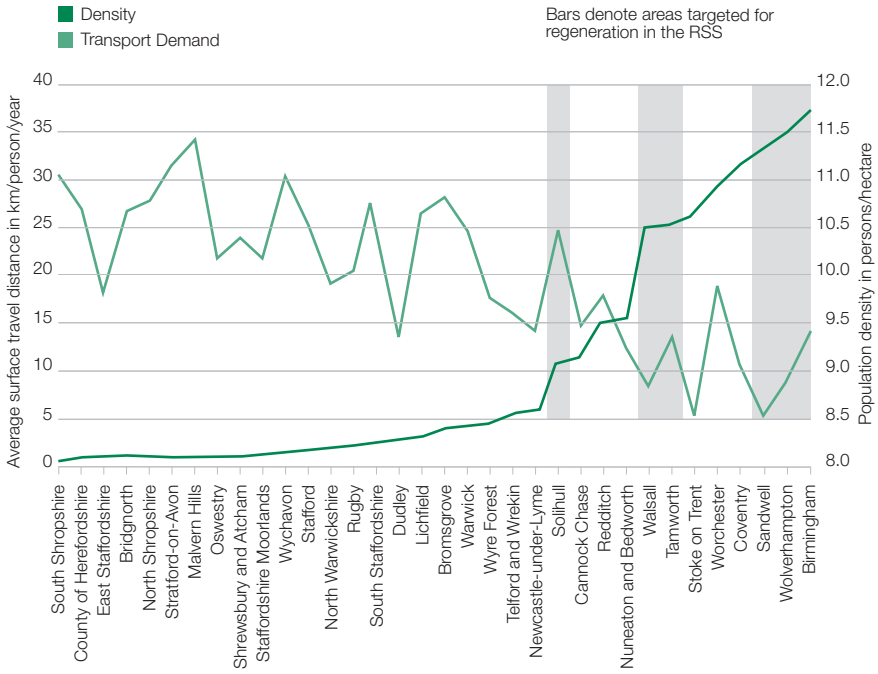

Fig 1 **Travel demand and population density in the West Midlands by local authority area**

The West Midlands is at the centre of the national road and rail network, and this gives rise to competing demands at local, regional and national levels. Transport problems are increasingly severe as people and jobs move away from urban areas, and widespread congestion has a major impact on businesses and quality of life.

In line with the national Planning Policy Statement 1, the development of future transport infrastructure should follow the principles of sustainable development. This implies developing initiatives that manage demand, reduce the need to travel, make better use of existing infrastructure and encourage the use of public transport.

Transport is a central focus of the RSS and has been the subject of five governmental reports in recent years. The aim of the RSS Transport Policy 1 (T1) is to improve access in and across the West Midlands in a way that reduces the need to travel, expands travel choice, tackles congestion, improves safety and protects the environment. This is a target worth investing in: the regional cost of road congestion was estimated at £3bn, the cost of physical inactivity at £1bn, and the cost of pollution-related emissions at least £60m.[1]

The real costs of these impacts are hard to estimate and intangible to the public. In contrast, the freedom that the car brings is highly valued. In many parts of the UK, government shies away from placing any kind of control on car use for this very reason.

The RSS recognises that better public transport is vital if everyone is to have real travel choices. Transport Policy 5 (T5) sets out the public transport objectives for the region. From a sustainability perspective, provision of a widely used public transport network is essential. Those without access to a car can potentially face social and economic exclusion if public transport is inadequate (the local bus is by far the most common form of public transport used in the West Midlands).

From a political perspective it is more positive and constructive to improve transport services, to encourage walking and cycling and invest in transport infrastructure. While these are all part of the West Midlands approach, there is also recognition that the existing infrastructure is biased towards the car. When the car is always easy and cheap to use it is more convenient, a first choice mode of transport unless the alternatives are of exceptional standard. Transport Policy 8 (T8) sets out guidelines to encourage local authorities to bring forward local charging schemes in congested city centres before 2011. This is a positive step towards directly addressing car use, but there is also room here for non-governmental organisations to play a role.

Planning and regeneration

By using regional transport data and applying expenditure data to local authority areas, it is possible to get an understanding of the relationship between population density and distance travelled by individuals.[2] This is shown in Figure 1.

The figure indicates that the higher the population density, the less distance residents travel. This could be one reason why there are substantial localised variations in the region's travel Footprint. Rural areas in the UK as a whole also tend to have a higher Footprint, as do those with a higher level of wealth.

Figure 1 also shows the local authority areas highlighted in the RSS for regeneration activities. Recent migration trends in the West Midlands indicate that more people want to live in low-density countryside, but that the extra transport burden this creates could be substantial. Targeted regeneration policies play an important role here by helping to attract people back to high-density areas through the development of attractive living and employment opportunities.

The aim of the RSS Transport Policy 2 (T2) is to reduce the need to travel. The Strategy recognises that by planning high-density developments well served by public transport, it can move towards this aim. The overarching challenge is to get the urban and rural balance of development right so that people live near their work and do not have to travel long distances to access the services they need.

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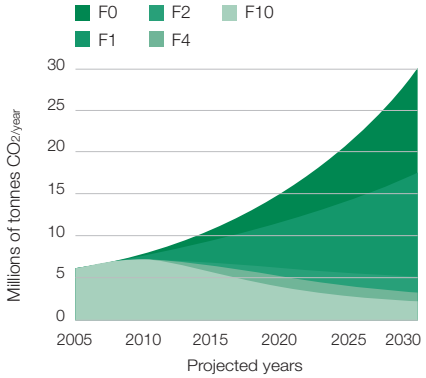


Fig 2 **Transport CO_2 emissions: medium term scenarios**

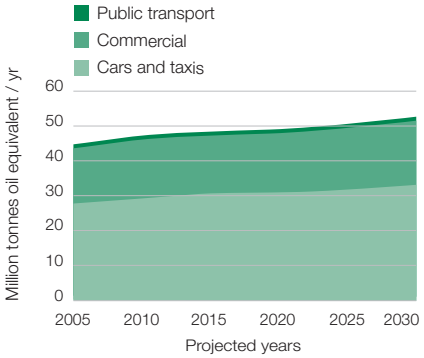


Fig 3 **Business as usual projections for surface transport fuel** [4]

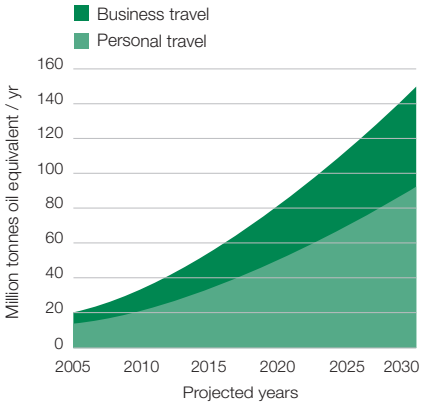


Fig 4 **Business as usual projections for UK aviation fuel use**

Transport trends and scenarios

Transport is the fastest growing source of CO_2 emissions and the fastest growing component of the Ecological Footprint. If the current growth trends in air travel are included in the transport total as they should be, then the "business as usual" scenario is dominated by this much higher rate of growth. This makes the F-2 and F-4 scenarios look even more radical than they would otherwise.

Trends and projections in transport are the subject of many engineering models and policy studies. The current forecasts in traffic growth are consistent with recent evidence, despite the government's goals in the 10-year strategy for transport and the longer term projections of the DTI and the EU[3] (see Figure 3).

> In recent decades the overall demand for surface transport has been closely linked to economic growth at between 2 and 2.5 per cent growth per year – a 30 to 40-year doubling time. Most "business as usual" projections continue these trends.
> Light commercial transport is growing at a faster rate than passenger transport, at 3-3.5 per cent per year.
> Air travel is growing at the astonishing rate of 5-6 per cent per year, with a doubling time of less than 15 years. Across the EU the aviation growth rate is estimated long-term at more than 3 per cent per year in the period 2020-2050.
> Increasing the rate of growth are affluence/lifestyle factors, technology improvements, the falling price of fuel and induced demand – for example from internet-enabled business activities and social networks.
> Restricting the rate of growth are physical limits and infrastructure congestion, time constraints on the part of consumers and businesses, government pricing and fiscal policies, and (not least) environmental objectives which may encourage regulation and market measures.

In terms of projecting these trends, there are some key factors:

> *Vehicle occupancy:* basically, the higher the occupancy, the less the vehicle movements and the greater the efficiency. This occupancy factor will be influenced by technology, information systems, demand management, green travel plans and so on.
> *Passenger travel demand intensity (economic):* this is an overall measure of the linkage or "decoupling" of economic growth from travel demand.
> *Public transport proportion of all transport:* this is the holy grail of the "modal shift"; this works at different geographical scales (rapid shift in central urban areas, for example) but is more difficult in the diffused economy and social networks of the rural areas of the West Midlands, where orbital and cross-country movements are dominant.
> *Vehicle energy efficiency:* at the moment the average 4x4 vehicle has three times the impact of a smaller car with an engine size between 1 and 1.4 litres. Fuel-efficient cars will bring about a reduction in environmental impacts but do not affect car use or occupancy. A labelling

1 Royal Commission on Environmetnal Pollution, 1994.
2 Where local transport data is available, this has been used to replace local expenditure data as it is more accurate.
3 DTI, 2006: CEC, 2004: Transport & energy to 2030.
4 DTI, 2006

"Car travel accounts for the largest proportion of Footprint in the West Midlands and national trends suggest this pattern is set to continue."

scheme for cars, similar to that for electrical equipment, may bring about a significant improvement in efficiency. Fiscal instruments could also build on the 2006 Budget and make it more financially attractive to drive smaller cars.

- *Vehicle stock:* the turnover effect, size of the stock, and any effects on vehicle efficiency which may be higher in new vehicles.
- *Alternative fuels percentage:* this includes complex combinations and transformations from one medium to another – gas, renewable oil, hydrogen and other forms of electric power.

Car use and demand management

The West Midlands is targeting transport demand directly through its 2005 Regional Transport Plan as well as through the RSS. Car travel accounts for the largest proportion of Footprint in the West Midlands and national trends suggest this pattern is set to continue.

If the West Midlands continually expands its transport infrastructure to meet future car transport demands, it is unlikely to be able to stem the increase in the Footprint. In this context a range of approaches can be suggested on the theme of "soft policies requiring no new infrastructure".

Infrastructure efficiency initiatives have the benefit of low cost and flexibility – the downside is that it is difficult to say whether recent experience is a one-off or part of a larger trend. The Provisional West Midlands Transport Plan 2005 recognises this and places behaviour change at the centre of its commitment to provide value for money. By introducing a range of complementary policies for existing infrastructure, it is possible to move away from large-scale infrastructure schemes and bring about real transport supply improvements. Recent initiatives include:

- car clubs and car sharing schemes;
- workplace and school travel plans;
- personalised travel planning, travel awareness campaigns, and public transport information and marketing; and
- teleworking, teleconferencing and home shopping.

Previous studies have shown that by adopting soft policies to their maximum potential, it is possible to bring about a reduction in car use of 11 per cent. This would help reverse the increase in car use suggested if current national trends continue.

There are many approaches that can be considered under the soft policies umbrella, but these policies have to be right for the West Midlands. The West Midlands Transport Plan places a particular emphasis on "Safer Routes to Schools" schemes in the context of road safety, but also highlights the need to promote TravelWise schemes and to have a significant impact on travel behaviour. Transport planners should consider how they can add to existing national schemes by developing innovative ways to tackle local and regional transport issues. The recently announced DfT funding for the West Midlands conurbation offers them this opportunity.

Best practice: sustainable local transport

Projects such as the Jewellery Line, Midland Metro Line 1 and the first three Bus Showcase routes in the West Midlands are helping to encourage public transport use.

Bus Showcase is a private/public sector partnership between Centro, local authorities and bus operators to drive up the quality of bus travel. Through this initiative, bus operators are investing in new low-floor, easy access buses, while Centro is investing in new bus shelters designed for comfort, better information and access for people with mobility difficulties. Local authorities are providing bus priority and other demand management measures to enable buses to compete on a more space-saving and efficient footing with the car. Investment in Line 33 has resulted in a sustained growth in patronage for the corridor of more than 10 per cent, while SuperLine and PrimeLine corridors have shown 8 per cent and 5 per cent increases respectively.

Further information from www.centro.org.uk/source/CorpInfo

GARY DOAK/WWF-UK

7 Construction and the built environment

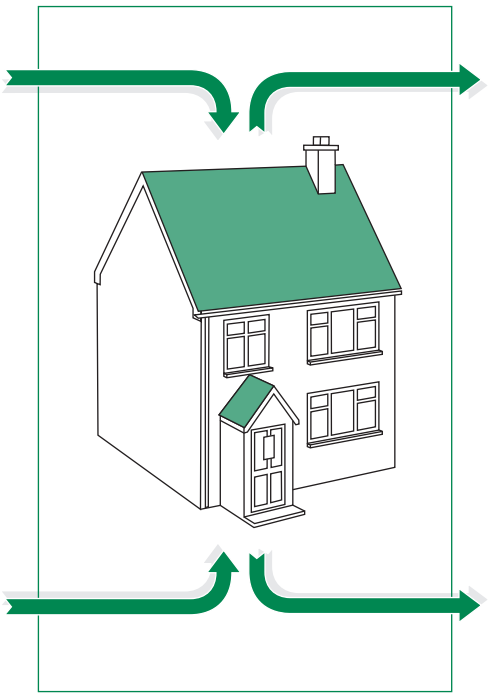
Here we look at the physical region itself, the construction of its material fabric, and the number one challenge for sustainability – keeping the buildings warm.

Materials for constuction

	(tonnes)
Other mining and quarrying	137.56
Structural clay products	19.60
Cement, lime and plaster	15.03
Articles of concrete, stone etc	105.78
Wood and wood products	7.82
Paints, varnishes, printing ink etc	0.69
Rubber products	0.11
Plastic products	2.10
Glass and glass products	0.99
Ceramic goods	0.76
Iron and steel	2.52
Structural metal products	2.00
Electric motors and generators etc	0.94

Materials for maintenance

	(tonnes)
Other mining and quarrying	0.19
Structural clay products	0.01
Cement, lime and plaster	0.05
Ariticles of concrete, stone etc	0.16
Wood and wood products	0.05
Paints, varnishes, printing ink etc	0.01
Rubber products	0.00
Plastic products	0.02
Glass and glass products	0.00
Ceramic goods	0.00
Iron and steel	0.01
Structural metal products	0.00
Electric motors and generators etc	0.00

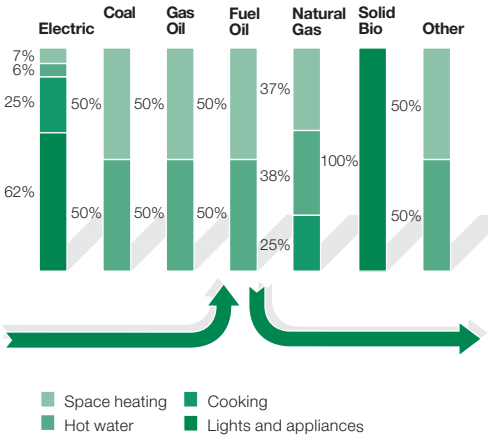


Materials for constuction

	CO_2 (tonnes)
Other mining and quarrying	2.58
Structural clay products	3.68
Cement, lime and plaster	10.09
Articles of concrete, stone etc	8.03
Wood and wood products	5.27
Paints, varnishes, printing ink etc	0.35
Rubber products	0.12
Plastic products	2.70
Glass and glass products	1.73
Ceramic goods	1.47
Iron and steel	10.25
Structural metal products	13.60
Electric motors and generators etc	1.29

Materials for maintenance

	CO_2 (tonnes)
Other mining and quarrying	0.00
Structural clay products	0.00
Cement, lime and plaster	0.03
Ariticles of concrete, stone etc	0.01
Wood and wood products	0.03
Paints, varnishes, printing ink etc	0.00
Rubber products	0.00
Plastic products	0.02
Glass and glass products	0.00
Ceramic goods	0.00
Iron and steel	0.03
Structural metal products	0.03
Electric motors and generators etc	0.00



Direct energy

	KWh
Electricity	4,603.00
Coal	546.00
Gas Oil	73.00
Fuel Oil	1.00
Natural Gas	15,307.00
Solid Biomass	98.00
Other Fuels	1,642.00

Direct energy

	CO_2 (tonnes)
Electricity	1.98
Coal	0.16
Gas Oil	0.02
Fuel Oil	0.00
Natural Gas	2.91
Solid Biomass	0.00
Other Fuels	0.31

Fig 1 **Flows of materials and energy**

GARY DOAK/WWF-UK

This theme covers a wide range of activity – from material sources in minerals and forestry to the manufacture of building products, to the construction industry itself – together with related activities such as property and insurance. In material flow terms, the largest bulk flows are in aggregates from the quarry into the construction sector. The most significant direct impact is from the energy used in buildings, and there are many other indirect impacts generated through the effect on transport, water use, land use and so on. The built environment theme can be divided into three main types:

> housing – driven by a complex of social and economic factors;
> other commercial, industrial and public buildings of all shapes and sizes; and
> other infrastructure and engineering (not discussed in this report).

In each of these are distinct stock flow effects: for example, the average turnover in the building stock is 1-2 per cent per year. The whole sector is very dependent on energy supply, but this is a long-term issue for the turnover of the stock as much as day-to-day usage. For demonstration buildings, it appears possible to achieve ultra-low energy use with increasing capital costs towards zero energy; but for the mainstream industry it appears to be very difficult to improve efficiency because of the many institutional barriers. The much larger issue is the residual building stock and the many barriers to sound investment, such as the split of responsibility between landlords and tenants.

All this combines in the agenda for ustainable construction – covering construction activity, construction products, and the overall matrix of urban development.[1] This agenda is much favoured by policy, but often struggles to make headway in the complex and fast moving construction industry. Current developments in thte REAP toolkit are providing an evidence base in terms of assessments of materials, components, products, processes and firms.[2]

Summary All figures in gha	1 year per HH	60 years per HH	1 year per person	60 years per person
Building	-	0.49	-	0.21
Maintenance	-	0.13	-	0.06
Direct energy	-	0.94	-	0.40
Total	**-**	**1.56**	**-**	**0.66**

Fig 2 **Breakdown of built environment impacts**

Resource flows in housing

The average house in the West Midlands has a distinct profile:

> 2.35 people living in it with 0.4 cats and 0.3 dogs;
> it consumes 9,127 KWh of energy, producing 5.18 tonnes of CO_2 a year;
> it weighs about 150 tonnes, with another 140 tonnes for the foundations;
> it requires 0.5 tonnes of materials each year for maintenance and repair; and
> most of the energy is derived from natural gas (66 per cent) and electricity (24 per cent).

Figure 1 shows the flow of materials into a house required for maintenance and repair, as well as the energy required every year to provide heating, hot water, lighting and energy for appliances and cooking.

Of the 150 tonnes required to build the average house, most comprises concrete and stone. Over the 60-year lifetime of the building, a theoretical 4.8 tonnes of materials are consumed each year. An extra 0.5 tonnes are required every year to maintain the house and build extensions or other improvements. In total, the average house requires 5.3 tonnes of products a year. Construction of the average home produces an average 61 tonnes of CO_2. When disaggregated over the lifetime of the buildings, the CO_2 impact is approximately 1-2 tonnes a year, depending on the assumed life and whether a depreciation calculation is used. Maintenance and repair add another 0.19 tonnes of CO_2, or 10-20 per cent, every year. However, the most significant emissions come from the operational use of the house. Use of direct energy (gas, electricity and other fuels) produces an average of 5.38 tonnes per year – a total of 6.57 tonnes of CO_2 per house per annum.

The Ecological Footprint results paint a slightly different picture to that of CO_2 emissions. Approximately 60 per cent of the Footprint is derived from direct energy use.

1 House of Commons Environmental Audit Committee, 2004
2 Upcoming details on www.eco-region.org

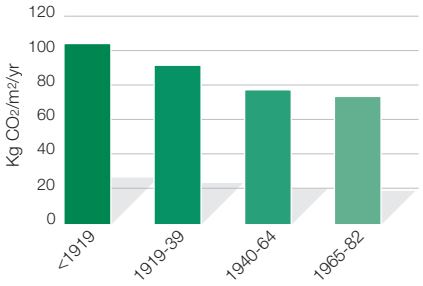


Fig 3 **Average energy requirements of different house ages in the West Midlands**

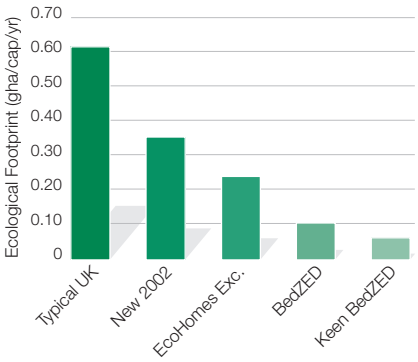


Fig 4 **Ecological footprint of the component energy for different scenarios of homes and lifestyles**

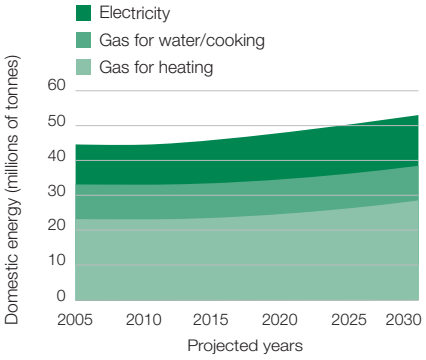


Fig 5 **Business as usual scenario for domestic demand** [3]

Durability and flexibility

Many West Midlands inner city houses were built during the late 1800s and still stand today. The advantage is that many were built to a high specification and have truly lasted the test of time. However, their operational performance has a lot to be desired. Figure 3 shows the average energy requirements of different house ages.

If a building were to last only 30 years, it would demand around two tonnes of CO_2 a year. This would reduce to 0.70 tonnes for a building that lasted for 120 years. This saving of 1.3 tonnes can be compared with the energy efficiency saving over the same period. If we assume that the average floorspace is 98m^2, the CO_2 emissions of a 1900 house would be 10 tonnes a year, compared with the 1982 house producing seven tonnes – a saving of 2.8 tonnes per year. The REAP analysis shows that the net balance of energy efficiency gains over the past century means that building new high-efficiency housing is beneficial in terms of reducing the total CO_2 emissions and the Ecological Footprint.

Construction resource flows

If we assume that material use is evenly spread in proportion to construction spending, there is 25 per cent in housing, 33 per cent in commercial, 11 per cent in public services, 12 per cent in industry and 19 per cent in infrastructure.

- Construction as a whole in the region uses 35m tonnes of materials directly (DMC), and uses 70m tonnes in total material consumption (TMC). This equates to more than 10 tonnes for every person.
- 50 per cent of TMC is used on quarry products including aggregates, sand, crushed rock and limestone.
- Cement, concrete and plaster products are the next largest, at 15m tonnes.
- Slate, bitumen, stone and other non-metallic minerals are 6m tonnes.
- Metal and metal products of all kinds are 1m tonnes.
- Wood/wood-based products are 2.5m tonnes.
- Raw materials make up roughly 90 per cent of material inputs for the construction sector, while only 10 per cent are recycled or secondary.
- The Footprint of transporting quarry material is seven times higher than the Footprint of the production and use of the material.

Research by the Stockholm Environment Institute – York (SEI) and the Centre for Urban and Regional Ecology – Manchester (CURE) suggests that an average home in the West Midlands requires 151 tonnes of materials to construct, but BRE data suggests this figure is closer to 121 tonnes. The difference is mainly in the allocation of foundations and fill material.

Ecological Footprint of construction

The construction sector in the region can be characterised as follows:

- The total Ecological Footprint of the construction sector is 7.1m gha, second only to the Footprint of the food sector. The energy content of common construction materials and the reliance on virgin materials serves to drive most of the Footprint.
- Most of the Footprint is taken up with “energy land”, reflecting the high energy intensity of key construction materials (cement, bricks, glass and so on), and the small proportion of renewable materials.
- The largest material Footprint type was 47 per cent with minerals, bitumen and other mineral products: these are both heavy and energy-intensive.
- Quarry products comprise 24 per cent of the construction Footprint where energy/emissions are involved with transport.
- Cement and plaster manufacture, which are particularly energy-intensive, consume 14 per cent of the construction Footprint.
- A Factor Four improvement in resource efficiency is the general target for sustainable construction, equating to a 75 per cent reduction in resource use.

Units: KWh/m²/yr	1919	1919-39	1940-64	1965 -	All ages	West Midlands stock	Construction England total
Detached	768	630	525	489	601	19%	21%
Semi-detached	529	398	351	324	390	32%	31%
Terrace (mid)	343	290	282	270	311	35%	30%
Flat / maisonette	236	190	173	159	185	4%	19%
All types	**428**	**380**	**322**	**308**	**359**	**100%**	**100%**
Age distribution							
West Midlands	18%	19%	24%	39%	100%		
England total	21%	18%	21%	40%	100%		

Fig 6 **West Midlands housing stock and energy efficiency**

Energy in buildings

Energy use in homes depends on type, size, layout, tenure, occupancy and domestic technology. Detached houses use the most (365W/m²/yr), with semi-detached using less (276W/m²/yr), terraced houses consuming even less (243W/m²/yr) and flats and maisonettes using the least (182W/m²/yr). The average detached house is three times as energy intensive as the average flat for the same floor area. The total West Midlands housing stock type, age and energy efficiency is shown here in comparison with the England average.[4]

The Footprint associated with the energy consumption of typical UK housing types is shown below. More efficient new homes can save energy over the long term, but require materials and energy to construct, and may generate waste and transport costs if demolition is necessary. Refurbishment may not achieve the same energy savings as new build, but the social and resource conservation benefits can also be significant.

Built environment scenarios

The projections and scenarios for the built environment are generally contained in a narrow band: this seems to show little relation to the CO_2 targets or Factor Four reductions needed, as in the Footprint scenarios below:

- *F-0 (high growth scenario):* unrestricted growth in urban development with privatisation of infrastructure and growing use of energy and materials.
- *F-1 (business as usual scenario):* continuation of current trends as shown in Figure 6. There are increasingly strict controls on location and land use, but increasing amounts of imported materials for buildings which tend to be larger, multi-storey and higher density.
- *F-2 (low-growth scenario):* this sees a decline in the rate of construction through economic stagnation, social conflict and environmental hazards. Materials are increasingly expensive but environmental regulation is a luxury that few can afford.
- *F-4 (Factor Four scenario):* a win-win scenario based on integration of planning and development at different scales, coordination of supply and demand, accelerated technology improvements, and demand side management.

Towards a sustainable built environment

A Factor Four efficiency transformation in the built environment is a very challenging goal – at present, most efforts under the label of "sustainable construction" activity are marginal to this bigger picture. We can at least point to potential transformations at each stage of the chain:

- Building materials and sources: more renewable materials, less high-energy materials such as cement or aluminium.
- Building design and specification: more low-impact design on eco-building sustainable communities lines.
- Building stock and life cycle: new build design for long life and loose fit; coordinated upgrading of existing buildings for energy and services efficiency.
- Planned replacement of the least efficient portion of the UK building stock, as proposed in the "40 per cent house" research.
- Building performance: beyond the EcoHomes excellent standard, approaching the BioRegional BedZed "Z²" goals of zero CO_2 and zero waste.

These goals, very challenging in practice, raise many questions. What is the acceptability of rebuilding large parts of the housing stock? How far can natural resistance be shifted in the construction and property industry? And what is the trend for new types of energy use such as patio heaters, air conditioning and electronic equipment not yet invented?

3 DTI, 2006
4 ODPM, 2001

"Many West Midlands inner city houses were built during the late 1800s and still stand today. The advantage is that many were built to a high specification and have truly lasted the test of time. However, their operational performance has a lot to be desired."

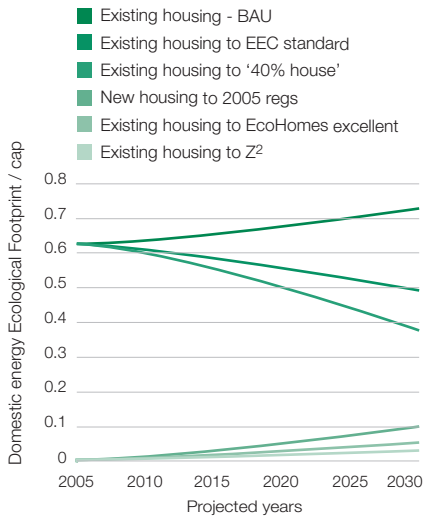


Fig 7 **Alternative energy policy scenarios for existing and new housing**

Housing and sustainable regeneration

Within the 20-year horizon of the West Midlands RSS, refurbishing and improving the existing housing is much more significant than the new housing stock, as shown in Figure 7 below. But this type of upgrading is often more complex to manage, less predictable and dependent on others, more sensitive to the lifestyles of residents, and more constrained by housing finance and tenure issues.

The policy scenarios are based on a phased programme which reaches the whole of the housing stock over the next 30 years, through and beyond the life of the RSS. This may be somewhat optimistic given past experience, but serves as a working target:

- Business as usual – no change to existing housing.
- Basic improvements under the current national EEC scheme (Energy Efficiency Commitment/Warm Front).
- Full-scale improvements as per the "40 per cent house" programme: based on the project at the Oxford University Environmental Change Institute.[5]
- Additional effects of lifestyle shifts, and possible major changes in energy prices or quotas.

For new housing, the incoming Building Regulations will provide a small step forward: more organisations are aiming for the EcoHomes excellent standard, while the possibilities are set by the "Z²" standard for development – near-zero emissions and waste.

In practice, while the technology is known and the costs relatively modest, it is the tenure and investment questions which are crucial to any improvement strategy:

- Owner occupier housing: often more concerned with investment and resale value of any improvements;
- Social landlord: generally more concerned with long-term maintenance, but heavily constrained by cost limits and quotas; and
- Private landlord: more concerned with short-term rental value, generally the worst performance in long-term investment.

There is an issue on which actions can be achieved at neighbourhood level. This can make the difference between viability and non-viability:

- Renovation and upgrading is much more economically viable on a block/area basis.
- Grant regimes and possible private finance can also be geared to a block/area basis.
- There is then a greater possibility of district heating distribution.
- Other services such as waste recycling can then be reorganised with greater efficiency; and
- A neighbourhood renovation makes possible a complete turn-around of housing stock in physical terms, together with social and economic attitudes and expectations.

5 Boardman et al, 2005

Renovation and energy efficiency

As above, the selection of energy/ environmental improvements is very case-specific, and dependent upon:

- whether the house has recently been renovated;
- the age and construction of the building;
- the tenure – what level of investment and upgrading cycle it is feasible to manage and finance;
- the public grant and subsidy regime; and
- the possibility of investment by a utility or energy services company, or mortgage re-finance incentives.

For example, the age of the building may limit energy efficiency measures:

- Pre-1919: solid brick walls prevent wall insulation; rising damp, old flues and draughty floors all complicate energy efficiency works.
- Pre-1944: heating and plumbing are often very inefficient, requiring new systems to be installed.
- Pre-1964: system building problems, ventilation and condensation issues can make installation of energy-saving measures problematic.
- To present: ventilation, hazardous substances in buildings, faulty gas heating and other problems require major renovation projects and investment to resolve, particularly in blocks of flats or on housing estates.

Some of the more radical options for major reductions in energy demand and Ecological Footprint depend on new technologies or new applications, often feeding energy back into the National Grid, as in the "40 per cent house" project. For example micro-CHP, domestic wind turbines, ultra low-E glazing, heat pumps and ventilation heat exchangers.

The challenge is then to combine this ambitious environmental agenda with the need for socially sustainable communities and local economic development. The West Midlands can show some outstanding examples (see box).

Best practice in sustainable regeneration

The Optima Community Association's role in the regeneration of Attwood Green, a Birmingham city centre estate, has achieved national recognition. Attwood Green was the overall winner of the Award for Sustainable Communities for its outstanding achievement in turning around a former no-go area into a desirable place to live.

The regeneration of Attwood Green offers valuable lessons in creative financial agreements and in first class community engagement. The project also shows strong environmental commitment in demolition and new build, and in seeking to end distinctions in the quality of homes for sale and those for social housing. As one award panel member commented, "Attwood Green proves it can be done!"

Further information: www.optima.org.uk

8 Local area Footprints

In contrast to the regional view, here we look at the local perspective and the consumer choices of local people.

Fig 1 **The Ecological Footprints of the West Midland's local authorities**

Locally-specific resource accounting is important for local policy-making. Just as regions require customised approaches to achieving sustainability, so do local authorities, local strategic partnerships and other organisations and partnerships. By analysing the profiles of consumer groups in different areas, it is possible to tailor policy interventions that reduce the Ecological Footprint.[1]

Ecological Budget UK has produced every local authority area's Ecological Footprint and rates of CO_2 emissions due to consumption in the UK. As in other regions, there are distinct variations across the West Midlands. The area with the largest Footprint (the Malvern Hills) has one that is 14 per cent larger than the area with the smallest (Stoke on Trent). One way of understanding this difference is through a socio-economic analysis. Figure 2 compares the Footprint of different West Midlands local authorities with their various income levels.

This data is generated from the REAP modelling method, which uses the ACORN consumer classification system to profile the consumption patterns of different groups in each local area.[2] This analysis accounts for the difference in Footprint between different local authority areas, and it can highlight the activities with the highest impact.

Components of the local Footprint

All other things being equal, household income correlates with a higher Footprint – but some local authorities with similar income levels have significantly different Footprints. This is because income is mediated by consumption choices which differ from one household to another. The Footprint of households spending more money on items with a high Footprint per £ spent – electricity, food or foreign holidays, for example – may be higher than those who spend more on items with a lower Footprint such as clothing or education, as in Figure 3.[3]

At one level there are certain policy approaches that can be used to target "win-win" solutions, clearly leading towards quality of life, a strong regional economy and a reduced Ecological Footprint. Measures that reduce fuel poverty but improve energy efficiency, that improve access to services but reduce the need to travel, that minimise the creation of waste in the economy but increase competitiveness are some of these.

At another level, sustainable consumption policies need to be closely targeted on the needs and desires of social groups, cultures and households.[4] Components of a modern lifestyle which are potential targets include food and drink, consumables and appliances, domestic energy, holidays and personal travel. Some, such as food, demonstrate a lower variation in consumption levels than others: the differences between high-cost and low-cost diets are not as simple as high or low Footprint. However, the links between consumption and impact are significant on the regional and national scale. For example, the average West Midlands household consumes 10 per cent more meat and 20 per cent less fresh fruit than the UK average, while 20 per cent more of the population drinks more than eight units of alcohol a week. There could be some causal link with health impacts, where the West Midlands average mortality rate is up to 5 per cent higher than the UK average.[5]

The sector with the most variation and the most rapid growth trend is air travel and foreign holidays; like many other items of consumption, this is not yet on the agenda of local or regional policy.

Ultimately, no single ACORN social type yet demonstrates all the components of a sustainable lifestyle. This reflects the general picture at national, regional and local levels.

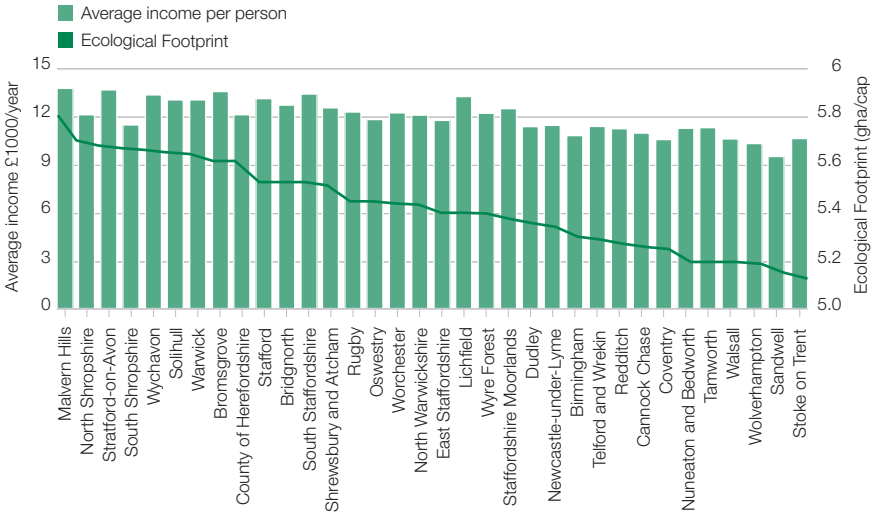


Fig 2 **Local area footprints and income levels**

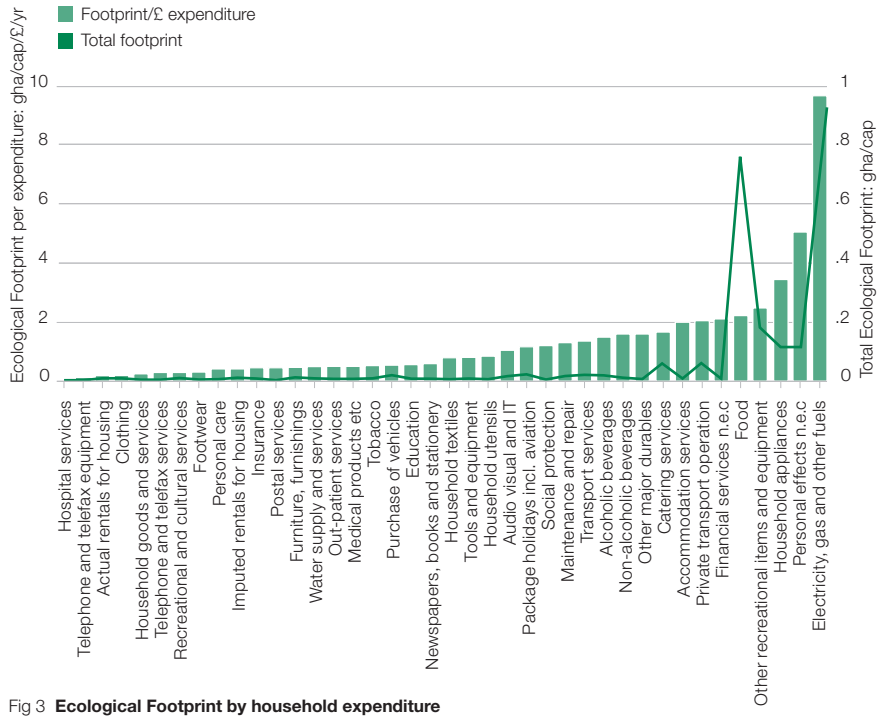


Fig 3 **Ecological Footprint by household expenditure**

It is possible to construct an ideal model, but the changes required to make the "model sustainable consumer" a reality are significant. For the moment particular components of a sustainable lifestyle can be encouraged, and some initiatives already exist in the West Midlands to encourage this. Future development of the REAP system aims to provide more detailed evidence, with details of product life cycle analysis coupled with details of the supply chain paths by which they reach the consumer. This should then provide insight on whether to buy local fruit from Hereford or Spain.

1 Barrett, J., et al, 2005
See www.walesfootprint.org
2 Results for every local authority in the UK are available at www.sei.se/reap
3 Weidmann, T., et al, 2005
4 Jackson & Michaelis, 2003
5 Data from ONS 2005: Regional Trends

9 Conclusions and next steps

This section draws together the strands of this report and points towards future strategy.

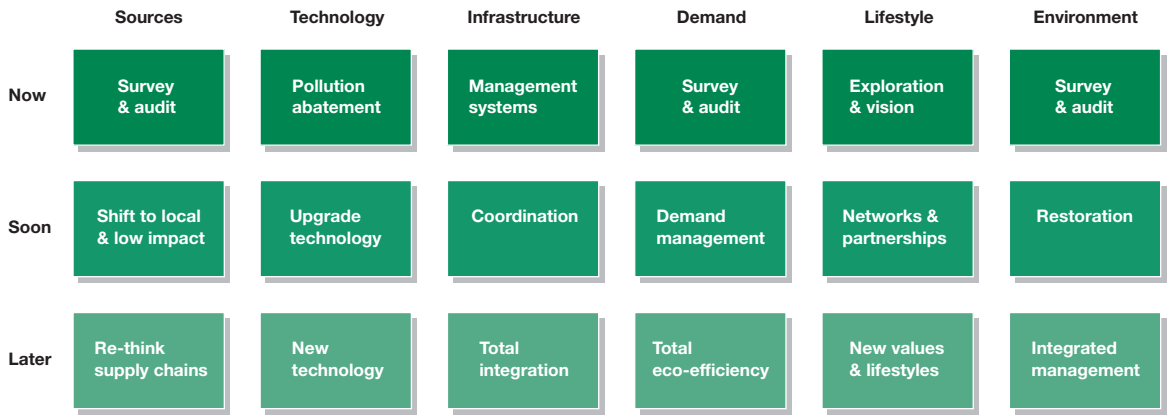


Fig 1 **General strategic programme or business plan for a cradle-grave approach to environmentally sustainable development**

The overall implication of this report is to highlight the challenge for the West Midlands to move towards environmentally sustainable development.

We take the measures of this as consumption-focused CO2 emissions, material flow and Ecological Footprint, as defined by the Ecological Budget UK analysis. We take the target as the four-fold increase in resource efficiency, as defined by the F-4 scenario.

This is a tightly focused agenda, which leaves aside for the moment the many other dimensions of sustainability – social, cultural, economic and so on. Even so this material challenge raises huge questions on who is responsible, how it can be achieved, what are the next actions required, and how much are the costs and benefits to each party involved.

This report can only provide a sketch of such questions, and point to other more in-depth discussions in other parts of the UK.[1]

> There is a question on *governance*. Although Advantage West Midlands (AWM), the Government Office West Midlands (GOWM) and the West Midlands Regional Assembly (WMRA) are the main coordinating bodies for the West Midlands, (with many other acronyms to support them), their actual powers are limited in comparison to central and local government. How far can the WMRA and its member authorities mobilise real capacity to achieve their goals, in the complexities of regional and local policy?

> A second question is on *resources*. To make realistic progress requires public finance for investment. There are also wider issues on the role of the public sector in the market, and in market development of technology and infrastructure. For instance, if all public bodies in the West Midlands were to require their buildings to have solar panels produced in the region, the price would fall rapidly and the renewables programme could achieve viability.

> A third question is on *attitudes* – how far are the general public and businesses committed to this kind of strategy, and what it would take to increase such commitment. For instance, there is evidence that the most cost-effective action to reduce climate emissions is not so much technology, as in how it is used – coming back to the agenda of public awareness and business attitudes.

This study provides an outline of how each of the policy options can be addressed in the short, medium and longer term. A typical strategic programme for reducing Ecological Footprint will contain both 'demand side' and 'supply side' components – both 'physical' actions and 'human' actions – and will need both technical and economic resources. The 'next steps' are the actions which cost little, use available technology, gain political viability and generate social benefits – the ideal win-win situation. In general these will include:

> *vision*: generating scenarios, projections and visions in combination with all stakeholders;

> *resources*: building institutional 'capacity' for cohesion, cooperation and longer term thinking; and

> *action*: strategic business planning for short, medium and longer terms.

The likely shape of a strategic programme can be charted out on a material 'cradle to grave' basis, showing the likely actions at each stage for now, soon and later (Figure 1).

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Recommendations: short term

For regional and local authorities, the first question is how they can most effectively work together, whether through Local Strategic Partnerships, sub-regional groupings or inter-regional networks. Following this are some suggestions for practical 'horizontal' actions in the shorter term, 2006-2011:

- Corporate policy and mission: promote Sustainable Community Strategies, Local Agenda 21, and other vision and consensus building exercises.
- Information and management: enhance the existing audits and benchmarking schemes for State of Environment, social and community audits, place checks, quality of life surveys and so on.
- In-house improvements: beginning of green purchasing policies, travel demand management, environmental management systems, targeting and monitoring.
- Policy integration between sectors, levels and agencies, to take forward the regional sustainable development framework.

Recommendations: policy targets

Sooner or later the West Midlands RES and RSS, and all the sub-regional or local strategies which follow on from these, will need to take on board 'hard' targets and measures to fulfil their aspirations. The following suggestions are made for further debate in future reviews of the RSS, RES and associated documents:

- 'Stabilisation': reducing current growth trends in Ecological Footprint.
- Consumption targets: a phased programme of reductions in the purchasing Ecological Footprint of households and other final consumers.
- Production targets: a phased programme of reductions in the business and industrial sectors of the West Midlands.
- Infrastructure targets: likewise a phased programme of reductions in the built transport, energy and utilities sectors of the West Midlands.

Each of these will generally aim at the basic target trend-curve of -2.5 per cent per year. This challenging target will then require further research and evaluation as below.

Recommendations: further research

To enable the above, the Ecological Budget UK research programme is being taken forward into new phases, at both the national and regional levels. Collaboration with bodies in the West Midlands along with other regions will be essential, to ensure that the results are topical and timely:

- more detailed analysis of the RSS options, links with the RES, and localized impacts;
- spatial analysis of infrastructure and regeneration activity to focus on opportunities for resource efficiency;
- public procurement analysis, covering buildings, transport, materials etc, to ensure that the public sector is in the lead;
- business-environment benchmarking, to enable more accurate monitoring and priority setting for business sectors;
- product-environment benchmarking, to enable more responsible consumer purchasing;
- comprehensive and detailed 'triple bottom line' accounting and appraisal framework for all forms of policy evaluation and impact assessment;
- target-based programme development for 'consumption', 'production' and 'infrastructure', as set out above: using least-cost and integrated asset management techniques.

One example of further research is the 'West Midlands Sustainable Communities' project (see box below).

1 Ravetz, 2000: WWF, 2004:

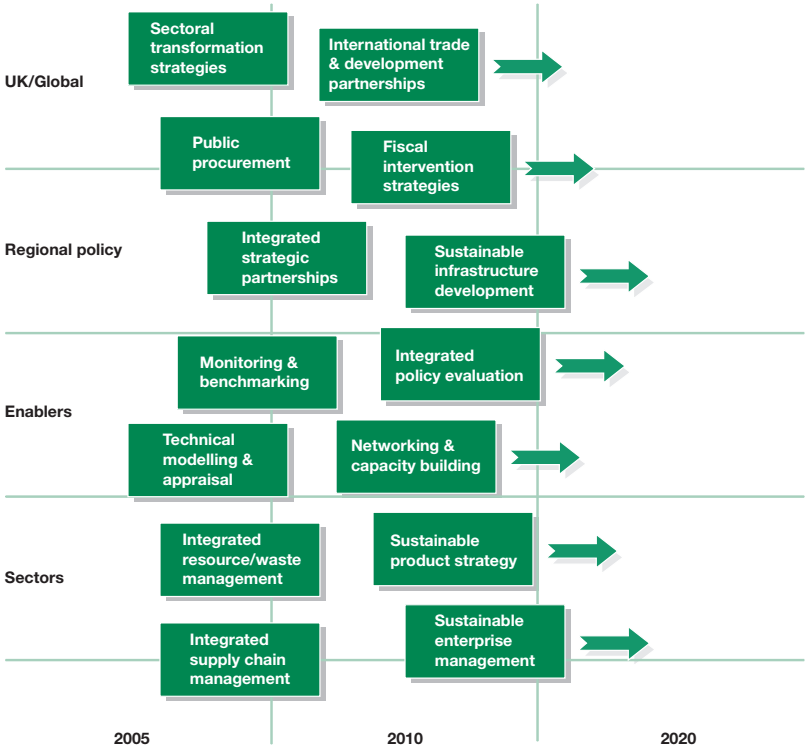

Fig 2 **Road map for sustainable regional development**

Recommendations: strategic programmes

Regional level activity is likely to be most effective as a coordinator and enabler of national and international actions in the public and private sectors. These are shown in concept form in Figure 2. The 'road map' concept is used here to show the general direction of travel and the cross-linkages between these broad and challenging themes.

National and global level: these general principles are being explored further in the One Planet Economy Network research programme.

- Ecological transformation: the general prospect is that each industry and business sector will need to develop a transformation strategy, in order to maximise added value, minimise environmental impacts and risks, and enhance corporate social responsibility.
- International development and trade policy is a key issue, relating particularly to material intensive imports of commodities.
- Fiscal intervention – environmental tax and subsidy – is a key principle in shifting market patterns towards environmental responsibility.
- Procurement by the public and quasi public sectors. Procurement is possibly the first priority as the principles of least-cost planning and integrated asset management can be applied.

Firm and product level: the business/environment programmes below are not exactly new – but the incentives and urgency have increased, and the tools and techniques to enable them have also improved:

- Integrated supply chain management – rather than each firm drawing a line at its gate, this looks at the total supply chain for opportunities in new processes, logistics, technologies and business models;
- Integrated resource and waste management: integrated energy and climate emissions strategy;
- Sustainable product strategy – includes the issues of operational impacts, end of life fates, etc.;
- Sustainable enterprise management – includes the issues of CSR, employee welfare, shareholder value, risk management, etc.

West Midlands Sustainable Communities project

The government's Sustainable Communities Plan sets an ambitious programme of new building, rehabilitation and housing market renewal across the nation. To date, the question of what the environmental impacts of the plan are, and how sustainable these might be, has not been asked in detail. So the Biffaward-funded West Midlands Sustainable Communities project is focusing on this theme – how sustainable is this scale of new building and rehabilitation? Its results, to be launched in mid 2006, throw light on questions such as:

- Is it better to rehabilitate or to replace and build new?
- Is it better to build from timber or brick?
- What are the top priorities in reducing the Footprint?
- How much difference does location make to the impact?
- Should we focus on individual houses or on the neighbourhood scale?

Further information on www.eco-region.org

"This material challenge raises huge questions on who is responsible, how it can be achieved, what are the next actions required, and how much are the costs and benefits to each party involved."

Role of enablers

In the centre of the 'road-map' are the so-called 'enablers'. At the regional level these are currently focused through the SCP-net ('Sustainable Consumption and Production network') for technical development and capacity-building:

- Technical modelling and appraisal tools – of which REAP and REEIO (Regional Economy-Environment Input-Output (Model) are the most relevant at the moment.
- Monitoring and benchmarking techniques, with continuous improvement of audits, databases, case study libraries, etc..
- Integrated policy appraisal and evaluation – applying these tools and techniques to the policy and management cycle.
- Networking and capacity building – training, dissemination, etc.

There is a notional timescale shown from 2006–2020, where each of the above factors is an ongoing programme. However where there are clear targets and milestones, such as in the series of EU Directives on waste, then a more specific application of this road map would be useful. A further stage would then link back various targets and technology factors to the analytic models of REAP, REEIO and similar programmes.

Demand side issues

Missing from the above are the issues of consumption and lifestyle patterns and expectations. These are generally outside the boundaries of local and regional policy, but no less crucial for the goals which have been set. The agenda includes:

- general factors in behavioural change – community, media, social networking;
- industry-led demand side management, e.g. as in business-voluntary sector compacts and networks, and general marketing and communications;
- social enterprise and community action as enablers of latent potential, together with promotions schemes such as Community Action 2020 and Eco-Teams (Global Action Plan);
- new economy networks and logistics possibilities – e.g. internet trading of re-used goods and products.

Next steps

Overall, this report will have served its purpose if it helps to illuminate a much longer programme of investigation and debate in the West Midlands. We aim to show that environmental sustainability is the only responsible path to follow in the 21st century. To back this up we provide the beginnings of an evidence base to measure conditions, trends and targets.

We put the case that the West Midlands Regional Assembly, Development Agency and all organisations involved, should take forward these recommendations. This will involve a multi-level programme of evidence and capacity building, in preparation for major actions over the coming decades.

Appendix:

West Midlands regional profile

West Midlands summary

The amounts of household waste and CO_2 emissions per person in the West Midlands are lower than the England average. The region has seen the largest decrease in the number of people killed or seriously injured in road accidents since 1993. The proportion of sites judged to have unsatisfactory or poor local environmental quality had improved the most amongst the regions.

The West Midlands has a higher proportion of pensioners in poverty than all other regions and has seen the smallest reductions in both child and pensioner poverty since 1995/6-1997/8. The region has the highest infant mortality, but has seen the largest reduction since 1981. The West Midlands has the highest proportion of dwellings, 39 per cent, judged to be below the 'Decent Homes' standard in 2001.

Greenhouse gas emissions

> The West Midlands emitted 11.7 million tonnes carbon equivalent of CO_2 in 2003; the sixth highest amount of the regions.
> This equated to 2.2 tonnes per resident; below the average rate for England and the second lowest rate of the regions, with only London with a lower rate.

CO_2 emissions by end user

> Around 36 per cent (England average, 45 per cent) of CO_2 emissions in the West Midlands were from industry and commerce, compared with approximately 34 per cent (England average, 30 per cent) from domestic sources and 28 per cent (England average, 25 per cent) from road transport.

Waste

> 18 million tonnes of waste were produced in the West Midlands in 2002-3; 10 per cent of the England total.
> 44 per cent of all West Midlands waste was produced by construction and demolition (England average, 48 per cent) and 39 per cent came from industry and commerce (36 per cent, England average), whilst the remaining 12 per cent was municipal waste (England average, 17 per cent).
> 39 per cent of waste in the region was disposed of by landfill (England average, 43 per cent) and 48 per cent was recycled (England average, 43 per cent).

Household waste

> On average, 497 kilograms of household waste were produced per person in the West Midlands in 2003-4 (England average, 510 kilograms); an increase of 7 per cent compared with 1998-9 (England overall increase 6 per cent, but a decrease from 2002-3).
> The West Midlands had the fifth highest recycling rate of the regions, with 16 per cent of household waste recycled (England average, 18 per cent).

Mobility

> The number of walking and cycling trips in the West Midlands decreased between 1992-4 and 2004, as did the number of journeys by public transport.
> Walking and cycling accounted for 25 per cent of all trips in the region, with private transport accounting for 67 per cent of journeys and public transport 8 per cent.
> The total number of trips per person in the region increased from 1,027 in 1992-4 to 1,044 in 2004 (the only other region to see an increase was the South West).
> The total distance travelled per person in the region in 2004 was 6,669 miles, an increase of 602 miles per person since 1992-4.
> 26 per cent of the total mileage was on shopping and personal business, 29 per cent on commuting and business, 5 per cent on education and escorting children to education, and the remaining 40 per cent on leisure and other pursuits.

Housing conditions

> 828,000 dwellings in the West Midlands failed to meet the 'Decent Homes' standard in 2001. This represented 38.5 per cent of the region's of dwellings (England average, 33 per cent).

Households living in fuel poverty

> 8.5 per cent (England average, 7.2 per cent) of households in the West Midlands lived in fuel poverty (based on income and heating costs) in 2003, down from 15.2 per cent in 2001. In 2003 the region had the third highest proportion of households living in fuel poverty.
> In 2003 the West Midlands contained 2.25 million dwellings (up from 2.08 million in 1991), 2.19 million households (up from 2.04 million) and 637,000 one person households (up from 514,000).

Extracts from West Midlands Factsheet, Published by Defra, December 2005, available on www.gos.gov.uk/gowm/docs/177226/394418/SDWMfactsheet1205

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Established in 1999, the Centre for Urban & Regional Ecology (CURE) carries out multidisciplinary research in three inter-related programme areas:
> Sustainable City-Regions;
> Landscape Impacts & Futures;
> Land Restoration & Management.

The common theme is the organisation and interaction of complex communities, both natural and human, at various scales from the local to the European. The research is underpinned by an advanced technical capability for spatial analysis, modelling and visualisation.

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SEI is an independent, international research institute specialising in sustainable development and environment issues. It works at local, national, regional and global policy levels. SEI has been engaged in major environment and development issues for a quarter of a century and has become established as a leading expert on the subject of Sustainable Consumption within Europe and especially the UK. Working closely with the European Environment Agency as well as national, regional and local governments, has ensured that the research is applied, relevant and timely. The Sustainable Consumption (SC) Group contributes to the overall SEI mission statement by bridging the gap between science and the policy arena.

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Established in 1961, WWF works to conserve endangered species, protect threatened habitats and address global threats, seeking long-term solutions that benefit both people and nature. WWF is committed to exploring alternative lifestyles based around sustainable consumption; this is a vital task which requires us to understand and measure the global environmental impact of our everyday decisions and actions. We also need to know where change is most beneficial and most needed – whether at a policy, economic, business or personal level. WWF's Ecological Footprint Programme has been developed to meet this need, providing all levels of government with the information and tools they need to make informed decisions, and developing models and case studies to demonstrate footprint strategies in action.

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Partners

Biffaward Programme on Sustainable Resource Use

Funded by:

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 Programme's 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.

More than 30 different mass balance projects have been funded by Biffaward. For more information on the Mass Balance UK programme please visit **www.massbalance.org**

The mission of WWF – the global environment network – is to stop the degradation of the planet's natural environment, and to build a future in which humans live in harmony with nature, by:
· conserving the world's biological diversity;
· ensuring that the use of renewable resources is sustainable;
· reducing pollution and wasteful consumption.

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