Wales’ Ecological Footprint - Scenarios to 2020

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Executive Summary

The Welsh Assembly Government has chosen to use the ecological footprint as one of five headline measures of progress towards sustainable development in Wales. This can be used to look at how close people in Wales are to living within environmental limits; an underlying principle of environmental sustainability.

This report recalculates Wales’ ecological footprint using 2003 data, and also calculates this for the six Spatial Plan areas in Wales, and for each of the 22 local authorities. For the first time, a time series for the Welsh ecological footprint, covering the period 1990-2003, is provided.

The report also illustrates how components of the ecological footprint may change over time, looking at housing, transport and food. The scenarios created provide footprint trajectories from 2001 to 2020. These scenarios are designed to show the footprint reduction potential of:

- Policies in place today
- Policies planned for the near future
- Further policies that could be implemented on a national scale.

What is the Ecological Footprint of Wales and how has it changed over time?

The ecological footprint is an indicator of the total environmental burden that we place on the planet. It represents the area of land needed to provide raw materials, energy and food, as well as absorb pollution and waste created – in this case by the Welsh population. The report shows that:

- Wales’ 2003 ecological footprint is 5.16 global hectares (gha) per person – lower than that of Scotland, England or any English region. This figure varies by the Spatial Plan areas, from 5.08gha/person in South East Wales, to 5.33gha/person in North West Wales.
- At a local authority level, Monmouthshire has the highest footprint at 5.46gha per person, whilst Blaenau Gwent has the lowest ecological footprint in the whole of the UK at 4.89gha per person. Four of the ten lowest footprints within the UK belong to Welsh local authorities.
- The footprint of Wales has increased at an average rate of 1.5% per year between 1990 and 2003. This closely mirrors the growth in Gross Value Added (GVA) in Wales over the same period. This trend is not unique to Wales and is replicated elsewhere in the UK.
- If the historic growth in footprint were to continue at rate of 1.5% a year, this would result in an ecological footprint 20% higher than the 2003 figure (6.19gha/capita) in 2020.
- Three broad areas of household consumption contribute 63% of the footprint of Wales; these are housing, food and personal travel. The report illustrates how consumption in these areas may change over time, modelling scenarios from 2001 to 2020.

Housing projections

- Policies already implemented could stabilise the per capita footprint of housing by 2020.
- A 6.4% reduction in the footprint of housing is possible by 2020 based on moderate expansion of existing policies and some behaviour change. This is achieved by introducing the Code for Sustainable Homes Level 6 by 2011 (as WAG aspire to do), retrofitting energy conservation measures into 1% of existing houses a year, and the renewal of 20,000 houses with poor energy performance.
- There is the potential to achieve substantial further reductions in the footprint of housing because all of the tools and techniques to deliver energy saving measures in existing homes and build a very high standard of new homes are readily available.
Transport Projections

- For transport, existing trends in current transport behaviour militate against a reduced footprint. The average distance people travel each year is growing at a considerable rate. As a result the transport footprint is predicted to increase by 2020. Even with efficiency improvements in cars the transport footprint is estimated to increase by over 6% by 2020. Including air travel increases this to over 12% over the same time period. This is the largest growth of all consumption categories.

- A package of measures is required in order to address the increasing distance people travel. This should cover the full range of travel behaviour. Initiatives are required which tackle long and short distance travel for all purposes – shopping, leisure, education and commuting.

- Recently announced policies such as the Sustainable Travel Town scheme will be vital for influencing travel behaviour on a local level. Introducing a Sustainable Travel Town initiative in one large urban area in each transport region may reduce the increase in the transport footprint by a third. If the scheme was expanded to all urban areas with a population of over 10,000 the transport footprint would effectively stabilise by 2020.

Food projections

- The supply chain for food accounts for the largest proportion of the ecological footprint associated with food consumption. This means that people’s food purchasing decisions have significant impacts on the ecological footprint as a whole.

- One of the most effective ways of reducing the ecological footprint of food is to not purchase any food that would normally be wasted. WRAP estimates that the edible food thrown away by households equates to between £250 and £400 per household per year.

- In Wales it is possible to reduce the ecological footprint of food by 7.2% on a per capita basis by 2020 by minimising food waste.

How do current policies affect the footprint?

- If underlying trends continue with no policy intervention at all, the combined footprint of food, housing and transport may increase by 4.5% by 2020. Policies already in place, should halve this increase to 2% by 2020. The implementation of policies planned for the near future should further slow the increase, securing a stabilisation by 2020. To achieve any further reductions more needs to be done, and this report models some of the suggested changes that could be considered.

- A 12% reduction in the combined footprint of housing, transport and food is possible by further extending current policy. This is secured in particular by retrofitting 5% of existing housing stock a year, introducing sustainable travel town measures in all urban areas in Wales with a population of over 10,000, and by reducing food waste by one sixth

- Taking into account the other elements of the ecological footprint (such as capital investment) a 12% reduction in the footprint of transport, housing and food leads to an overall reduction in the total footprint of 6.6% by 2020. This would be a significant improvement compared to a continuation of historical trends. It would also set the right direction of travel to achieve further reductions in the future.

Key conclusions

The Welsh Assembly Government’s sustainable development duty and the One Wales Programme for Government, provide an opportunity to stabilise and then reverse the historic trend of an increasing ecological footprint. The One Wales Programme for Government has started to get the direction of travel for the ecological footprint right. If Wales successfully implements all planned policies for food, housing and transport it may have done enough to stabilise its footprint by 2020. One Wales therefore provides a platform for achieving a footprint reduction in the future, and setting an example for the rest of the UK.
Although current policies are moving in the right direction, substantial reductions in Wales’ per capita footprint by 2020 will require additional measures.

An expansion of measures which improve the energy performance of existing housing and reduce food waste have considerable potential to reduce the ecological footprint of Wales. High profile examples, such as the Code for Sustainable Homes, need to be supported by complementary measures such as an expanded retrofit programme for existing housing. Although good sustainable transport schemes exist, more needs to be done to reduce the footprint associated with travel behaviour on a national level. Potential opportunities are offered by the Wales Spatial Plan to deliver a modal shift in travel behaviour.

In general, no one policy or measure can deliver a reduction in the footprint by itself – rather, a package of measures within and across different policy areas, reinforcing each other and sending out consistent messages, is required. Key considerations are:

- Nationally led and high-status policies that contribute to, and explicitly reference, ecological footprint reduction in a consistent fashion. Where possible the potential for footprint reductions should be quantified and presented as part of the business case for implementing a policy.

- Local schemes and initiatives that sit within the national high-level strategies and that effectively target high footprint activities of communities and individuals. The Sustainable Travel Towns scheme will provide a good example of this when it is implemented.

- Support throughout the Welsh supply chain for businesses that want to improve efficiencies and their competitive standing. Government procurement standards could reward low footprint activities in the food supply chain in particular.

- Broad infrastructural changes that reinforce more sustainable behaviours, making them the norm rather than the exception. Good spatial planning for example, can reduce the need to travel.

- A broad understanding amongst the Welsh population of what they are working towards in footprint terms and why this is important. Having a high proportion of Welsh residents that can identify high footprint activities and look favourably on alternatives will be very important.
Mae Llywodraeth Cynulliad Cymru wedi dewis defnyddio pum prif ddull o fesur y cynnydd sy’n cael ei wneud yng Nghymru o safbwynt datblygu cynaliadwy, ac un o’r dulliau hynnyn yw’r ôl-troed ecolegol. Gellir defnyddio’r ôl-troed ecolegol i bwyso a mesur pa mor agos y mae pobl yng Nghymru at fyw o fewn terfy nau amgyleddedd, sy’n un o egwyddorion sylfaenol cynaliadwyedd amgyleddedd.

Eir ati yn yr adroddiad hwn i ail-gyfrifo ôl-troed ecolegol Cymru gan ddefnyddio data 2003, ac eir ati hefyd i gyfrifo’r ôl-troed ecolegol ar gyfer chwe ardal y Cynllun Gofodol yng Nghymru, yn ogystal a phob un o’r 22 o awdurdodau lleol. Am y tro cyntaf, darperir cyfres ôl-troed ecolegol dros amser ar gyfer Cymru, a hynny ar gyfer y cyfnod rhwng 1990 a 2003.

Mae’r adroddiad hefyd yn dangos sut y gall yr elfennau sy’n creu'r ôl-troed ecolegol newid dros amser, gan edrych ar dair, trafnidiaeth a bywyd. Mae’r senarios a grëir yn yr adroddiad yn rhoi amcanestyniadau o’r ôl-troed ecolegol rhwng 2001 a 2020. Diben y senarios hyn yw dangos possibl a chyn siel i leihau’r ôl-troed ecolegol:

- Y polisïau sydd ar waith heddiw
- Y polisïau y bwriedir eu cyfwyno yn y dyfodol agos
- Polisïau erial y gellid eu cyfwyno ar raddfa genedlaethol.

Beth yw Ôl-troed Ecolegol Cymru a sut mae wedi newid dros amser?

Mae’r ôl-troed ecolegol yn ffordd o fesur cyfanswm y baich amgyleddedd yr ydym yn ei roi ar y blaned. Dyma’r arwynedd tir y mae ei angen er mwyn darparu deunyddau crai, ynni a bywyd, ac er mwyn llyncu’r llygredd a’r gwastafrol sy’n cael eu creu - gan boblogaeth Cymru yn yr achos hwn. Mae’r adroddiad yn dangos:

- Bod ôl-troed ecolegol Cymru yn ôl data 2003 yn 5.16 hectar byd-eang (gha) y person – sy’n is nag yn yr Alban, yn Lloegr neu mewn unrhyw un o ranbarthau Lloegr. Mae’r ffirgur hwn yn amrywio ar draws ardaloedd y Cynllun Gofodol, o 5.08gha y person yn y De-ddwyrain i 5.33gha y person yn y Gogledd-orllewin.
- Ar lefel yr awdurdodau lleol, mai Sir Fynwy sydd â’r ôl-troed mwyaf, sef 5.46gha y person, ac mai Blaenau Gwent sydd â’r ôl-troed ecolegol lleiaf yn y DU, sef 4.89gha y person. Awdurddodau lleol o Gymru sydd â phedwar o’r deg ôl-troed ecolegol lleiaf yn y DU.
- Pe bai’r twf hanesyddol yn yr ôl-troed yn parhau ar raddfa o 1.5% y flwyddyn, y byddai hynny’n arwain at ôl-troed ecolegol yn 2020 a fyddai 20% yn uwch na’r ffirgur ar gyfer 2003 (6.19gha y person).
- Bod tair agwedd gyffredinol ar dreuliant mewn cartrefi, sef tai, bwyd a theithio personol, yn cyfrif am 63% o ôl-troed Cymru. Mae’r adroddiad yn dangos sut y gallai treuliant yn y meysydd hyn newid dros amser, ac mae’n modelu senarios o 2001 tan 2020.

Amcanesyniadau ar gyfer tai

- Gallai polisïau sydd wedi’u gweithredu eisoes sefydlogi’r ôl-troed y pen ar gyfer tai erbyn 2020.
- Drwy ddathlygu’r gyneddol ar bolisïau sy’n bodoli eisoes a thrwy newid ymddygiad, byddai modd sicrhau gostyngiad o 6.4% yn ôl-troed tai. Byddai modd cyflawni hyn drwy gyflwyno Lefel 6 o’r Cod ar gyfer Cartrefi Cynaliadwy erbyn 2011 (felly bydd eu cynaliadwyedd à chodi, sy’n bodoli eisoes bob blwyddyn, a thrwy adnewyddu 20,000 o dai sy’n wael o ran eu perfformiad ynni).
Stockholm Environment Institute

...
Y casgliadau allwedol

Mae’r ddyletswydd sydd ar Lywodraeth Cynulliad Cymru o ran datblygu cynaliadwy a’r Rhaelgen Lywodraeth yn Cymru’n Un yn gyfle i sefydlogi’r duedd hanesyddol lle gwelir yr ôl-troed ecolegol yn tyfu, ac yn gyfle hefyd i wrthdroi’r duedd honno. Drwy gyfrwng y Rhaelgen Lywodraeth yn Cymru’n Un, rydym wedi dechrau mynd i’r cyfeiriad iawn o ran mynd i’r afael â’r ôl-troed ecolegol. Os yw Cymru’n llwyddo i weithredu’r holl bolisïau arfaethedig ar gyfer bwyd, tai a thrafnidiaeth, mae’n bosibl y bydd wedi gwneud digon i sefydlogi’r ôl-troed erbyn 2020. Mae Cymru’n Un, felly, yn llwyfan ar gyfer sicrhau gostyngiad yn yr ôl-troed yn y dyfodol, ac ar gyfer dosod esiampl i weddill y DU.

Er bod polisïau cyfredol yn gam i’r cyfeiriad iawn, bydd yn rhai wrth fesurau ychwanegol er mwyn sicrhau gostyngiad sylweddol yn yr ôl-troed y pen yng Nghymru erbyn 2020. Gellid lleihau ôl-troed ecolegol Cymru yn sylweddol drwy ddefnyddio mwy ar fesurau sy’n gweithredu bwyd, os yw’n gwneud digon i sefydlogi’r ôl-troed erbyn 2020. Mae Cymru’n Un, felly, yn llwyfan ar gyfer sicrhau gostyngiad yn yr ôl-troed yn y dyfodol, ac ar gyfer dosod esiampl i weddill y DU.

Yn gyffredinol, ni all un polisi neu fesur ar ei ben ei hun sicrhau gostyngiad yn yr ôl-troed - mae’n rhaid wrth gyfrifos yr ôl-troed mewn amryfau feysydd polisi ac ar draws amryfau feysydd polisi, a rhaid hefyd i’r mesurau hynny ategu ei gilydd a rhoi’r un neges i bobl. Dyma’r ystyriaethau allwedol:

- Polisïau uchel eu statws ar y lefel genedlaethol sy’n cyfieirio’n benodol at leihau’r ôl-troed ecolegol ac sy’n cyfrannu at wneud hynny mewn modd cyson. Lle bo modd, dylid mesur y potensial i leihau’r ôl-troed a chyflwyno’r mesuriadau hynny fel rhan o’r achos busnes dros weithredu polisi.
- Cynlluniau a mentrau lleol sy’n gydnaws â’r strategiaeth lefel uchel cenedlaethol ac sy’n mynd â threfan effeithiol i dargeddu gweithgareddau gan gymunedau ac unigolion sy’n ychwanegu’n sylweddol at yr ôl-troed. Mae’r cynllun Trefi Teithio Cynaliadwy yn enghraifft dda o gynlluniau o’r fath.
- Newidiadau cyffredinol i seilwaith a fydd yn atgyfnerthu ymddygiad mwy cynaliadwy ac a fydd yn datblygu’r arferion cyffredin yn hytrach nag yr hrai anghyffredin. Er enghraifft, gall cynllunio gofodol da olygu bod llai o angen teithio.
- Dealltwriaeth cyffredinol o weithredu polisi Cymru o’r hyn y maent yn anelu ato o ran yr ôl-troed ac a pham y mae hwn yn fater mor bwysig. Mae’n gwbl hanfodol e当事人

Cymru erbyn 2020. Os yw Cymru’n llwyddo i weithredu’r holl bolisïau arfaethedig ar gyfer bwyd, tai a thrafnidiaeth, mae’n bosibl y bydd wedi gwneud digon i sefydlogi’r ôl-troed erbyn 2020. Mae Cymru’n Un, felly, yn llwyfan ar gyfer sicrhau gostyngiad yn yr ôl-troed yn y dyfodol, ac ar gyfer dosod esiampl i weddill y DU.

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- Dealltwriaeth cyffredinol o weithredu polisi Cymru o’r hyn y maent yn anelu ato o ran yr ôl-troed ac a pham y mae hwn yn fater mor bwysig. Mae’n gwbl hanfodol e当事人
This report comes ten years after the National Assembly for Wales became one of the first administrations in the world to adapt a statutory duty to promote sustainable development. Sustainable development is a challenging concept, requiring us to think in a systematic way about the environmental, social, and economic consequences of all that we do. Such an all-encompassing approach can be difficult both to measure and to put into practice.

One way of tracking whether Wales is going in the right direction is to adopt indicators which clearly communicate what sustainability means from an environmental, social, and economic perspective. The Welsh Assembly Government has chosen to use the ecological footprint as one of five headline measures of progress towards sustainable development in Wales. This can be used to look at how close people in Wales are to living within environmental limits; an underlying principle of environmental sustainability.

In 2005 the Stockholm Environment Institute, with WWF Cymru, published the first ecological footprint for Wales, using 2001 data. This new report provides an updated footprint using the latest available data (2003) for Wales. For the first time it also provides a historical times series of Wales’ ecological footprint from 1990 to 2003.

The ecological footprint of Wales is lower than that of any English region and that of Scotland, but has grown by an average of 1.5% per year in the period between 1990-2003, closely mirroring the growth in Gross Value Added in Wales. If these trends were to continue Wales would increase its use of the earth’s resources even though it already consumes more than its ‘equal share’. The central message remains the same as in previous reports, but is even more urgent: if everyone on earth used as much material resources and energy as a person in Wales, we would need another two planets.

The urgency of this message can be placed in the context of a world economy that is driven by growth in the less developed world and threatened by climate change. The good news is that millions of people who aspire to the quality of life of a person in Wales are acquiring the means to do so. But there are limits to the extent to which this can be achieved using the quantity of resource use per person displayed in Wales. For the people of Wales, as with the rest of the world, the question is how can we get more from less?

In ‘world changing’ literature, part of the solution for less developed countries is summarised by the term ‘leapfrog nations’. This describes new innovations which help countries improve upon and ‘leapfrog’ traditional industrial development trajectories to provide people with the means to a better quality of life. In 2007 WWF Cymru published One Planet Wales by Joe Ravetz. Their report demonstrates the measures required to reduce Wales’ ecological footprint by as much as 75% by 2050. The transformative ideas encompassed in the idea of leapfrog nations and One Planet Wales need to inform the practical measures that Wales takes to stabilise and reduce its ecological footprint.

The challenge for the Welsh Assembly Government is to identify practical measures of its own that address the way we use energy and resources in Wales and which bring about benefits on the local and global scale. Included in this report are thematic chapters on housing and energy use, personal travel and food consumption which address this challenge. In each chapter scenarios are used to explore how measures in the Welsh Assembly’s powers may reduce Wales’ ecological footprint by 10% by 2020. The concluding chapter shows that a comprehensive range of initiatives targeted at food waste, travel behaviour, and new and existing housing stock is more likely to bring about change than reliance on a small number of narrow focused measures.

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1 This duty now falls to Welsh Assembly Government under Section 79 of the Government of Wales Act, 2006.

2 Data on household consumption activities exists for later years but the latest available National Footprint Accounts (provided by the Global Footprint Network), are for the year 2003.

3 See www.worldchanging.com
To manage the transition to sustainability, we need measures that demonstrate where we have been, where we are today, and how far we still have to go.

WWF, Living Planet Report 2006

What the ecological footprint tells us

The ecological footprint is an indicator of the total environmental burden we place on the planet. It represents the area of land needed to provide raw materials, energy and food, and to absorb pollution and waste created – in this case by the Welsh population. It is measured in global hectares 4 and is usually expressed as a per person measure.

In this report the ecological footprint is used to look at Welsh consumption activities. It accounts for the environmental consequences throughout the supply chain of what people in Wales buy and use. This form of accounting transcends territorial boundaries and takes into account the impact of products produced in other countries but consumed in Wales. At the same time it excludes the impacts of goods and services manufactured in Wales but exported to other countries.

The ecological footprint takes account of carbon dioxide emissions (CO₂) associated with Welsh consumption activities and expresses them as an area of land.

The burning of fossil fuels contributes to the ‘CO₂ area’ component of the ecological footprint. This is the “biocapacity required to sequester (through photosynthesis) the carbon dioxide emissions from fossil fuel combustion”. This is the fastest growing component of the ecological footprint on a global scale and is the largest component of the ecological footprint in Wales.

In addition the ecological footprint also accounts for the area required to produce the food and fibre people consume and the area required to provide space for Welsh infrastructure such as roads and buildings. It is a completely separate indicator from the carbon footprint (or embedded carbon footprint). The carbon footprint measures the global green house gas emissions of consumption only 5.

The importance of accounting for consumption

Traditional methods of accounting for the impacts on the environment associated with human activities focus on ‘onsite’ or direct impacts only; in Wales the discharge of pollution into our soils, rivers and the air is monitored and controlled. There is a long history of regulating polluting industries and conserving natural areas. However, many of the goods and services the average person buys are sourced from outside of Wales and the pressures they place on the environment are often hidden, and not accounted for in Welsh environmental accounts.

An ideal accounting system would trace all the interactions that took place to produce a product or service. In essence, this would be a boundary free system. This approach starts by acknowledging that every product and service is merely part of an “integral chain” that we call the economy. No product is produced in isolation from this chain, and to account for the direct impacts only will always provide an underestimate of the costs and benefits associated with its use.

The ecological footprint is an accounting system of this nature, recognising the the impact of every good and service purchased. Taking into account all of the energy and resources used to make the product.

The added value of the ecological footprint is the emphasis it places on exploring where reductions in the footprint can be made through policies which influence individuals’ consumption patterns and behaviour. An ideal system would use a suite of environmental

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4 A hectare of land with world average productivity

5 See ‘a definition of ‘carbon footprint’ by ISA-UK consulting for a brief overview of the definition: http://www.isa-research.co.uk/docs/ISA-UK_Report_07-01_carbon_footprint.pdf
Fig 1: Simplified structure of SEI methodology with important data sources

See the “REAP methodology and data sources” - guidance note for further information
indicators to enable this to happen in a systematic fashion, applied to the entire policy framework.

**Using cutting edge methodologies**

The ecological footprint results provided in this report use the best available data and cutting edge modelling of the economy. As with many other indicators used by government, the methodology used by SEI is subject to constant development and this is reflected by periodic adjustments and updates to the data provided. A separate guidance note has been produced which accompanies this report and provides an overview of the underlying methodology. The basic structure of the methodology with important data sources is provided in figure 1. It takes into account the production efficiency of goods and services, trade and the structure of the domestic economy and patterns of consumption at a UK, Welsh national and sub national level.

**Creating plausible scenarios for the future**

Scenarios are used in this report to describe how the ecological footprint may change over time based on a number of variables. They have been created using the Resources and Energy Analysis Programme (REAP) software tool created by SEI.

In simple terms the scenarios show the impact on the ecological footprint that can be expected from individual policies, based on the way they influence consumer behaviour. Scenarios are inherently uncertain, given the large number of variables and the interaction of different dynamics such as population, economics and cultural change. It is important to highlight that the scenarios presented in this report illustrate what may happen based on stated assumptions. They can never fully predict what will happen, but are extremely valuable for offering an insight into the potential impact of policies during the decision making process.

**Further outputs from this project**

The Welsh Assembly Government has a two year licence to use REAP, provided by the Stockholm Environment Institute. REAP can be used at a national, regional or local level to provide a baseline ecological and carbon footprint and to create policy scenarios over time.

SEI have produced a series of four page guidelines to compliment this report. The Guidelines provide a fuller description of REAP, the underlying methodology and practical applications in relation to housing, energy, transport and food policy development.

To find out more about how REAP is used in the UK, post questions and contact existing users you can subscribe to a REAP User Forum. Go to: [http://www.sei.se/reap/forum/](http://www.sei.se/reap/forum/)
Benchmarking performance: a global comparison

Wales’ 2003 ecological footprint is 5.16 global hectares (gha) per person – lower than that of Scotland, England or any English region. National Footprint Accounts published by the Global Footprint Network provide international comparison. The ecological footprint of the USA is 9.6 gha per person, for China it is 1.6 gha per person and Brazil is 2.1 gha per person. The world average is 2.2 gha per person, but the biological land actually available on a global level is 1.8 gha per person. This means that if everyone lived the same way as a person in Wales we would need another 1.8 planets to provide the resources that this would require.

Historical trends: progress to date

In March 2005 SEI calculated Wales’ 2001 ecological footprint as 5.25 gha per capita. Improvements to the footprint methodology between the 2005 report and this report mean that the 2001 and 2003 ecological footprint figures are not directly comparable. However, SEI have created a footprint time series which indicates the direction of travel from 1990 to 2003. This is shown in figure 2 and compared to changes in economic activity (Gross Value Added per capita) over the same period. Between 1990 and 2003 the ecological footprint has increased by 19% on a per capita basis, compared with a growth in GVA/capita of 22% over the same period. The trend of an increasing footprint and increasing GVA is not unique to Wales and is replicated elsewhere in the UK. The growth in the footprint averages out as a steady growth rate of 1.5% a year which, if it were to continue, would result in a footprint of 6.19gha/capita in 2020.

This growth in footprint is not unique to Wales, similar growth patterns have occurred across the UK. In some areas, such as the South East of England, there has been a greater increase since 1990 than has been estimated for Wales.

The results presented here represent a first attempt by SEI to calculate the ecological footprint of Wales from 1990 onwards. They reflect shifts in the structure of the

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Welsh economy, and changes in production efficiencies down the supply chain. They also reflect changes in consumption patterns by Welsh residents. In the process of calculating the historic trends we have encountered some problems with the historical data sets which mean they do not meet SEI’s standards for robustness. We have decided to include the historical trends because the direction of travel is correct. We have not included year on year figures as these are subject to adjustment in future iterations of the results.

**Wales in detail: a spatial analysis**

The latest consultation of Wales’ Spatial Plan includes an aspiration to drive for a sharply reduced ecological footprint - using the spatially disaggregated footprint to focus on priority interventions and measuring the impact over time⁷.

At the Spatial Plan area level, the footprints of North West and Central Wales and Pembrokeshire Haven are higher than those of the West Midlands, the North East and Yorkshire and Humber in England, but are still below the UK average. South East Wales and Swansea Bay have a lower ecological footprint than that of any English region or Scotland.

### Table 1: Spatial Plan Area Footprint Results

<table>
<thead>
<tr>
<th>Spatial Plan Area1</th>
<th>Ecological Footprint (gha/capita)</th>
</tr>
</thead>
<tbody>
<tr>
<td>North West Wales</td>
<td>5.33</td>
</tr>
<tr>
<td>Central Wales</td>
<td>5.30</td>
</tr>
<tr>
<td>Pembrokeshire Haven</td>
<td>5.26</td>
</tr>
<tr>
<td>North East Wales</td>
<td>5.24</td>
</tr>
<tr>
<td>Swansea Bay</td>
<td>5.15</td>
</tr>
<tr>
<td>South East Wales</td>
<td>5.08</td>
</tr>
</tbody>
</table>

At a local authority level the variation in the 2003 results is marginally less than those for 2001. Monmouthshire has the highest footprint at 5.46 gha per person. Blaenau

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⁷ People, Places, Futures: The Wales Spatial Plan 2008 Update Consultation
Gwent has the lowest ecological footprint in the UK at 4.89gha per person. Four of the ten lowest local authority footprints within the UK belong to local authorities in Wales. See Annex A.

The variation in footprint at a local level is influenced by a number of factors including income, demographics, patterns of household expenditure and the energy performance of housing stock.

**Consumption themes**

The ecological footprint is influenced by the food people eat, the way they travel and the energy they use in the home. It also accounts for the purchase of products and services from insurance to televisions to items of clothing. Finally, impacts such as construction activity and investment in infrastructure in Wales are also included in the Welsh footprint figure, although these activities are beyond the influence of individual consumers.

By grouping the ecological footprint by final demand theme it is possible to identify four broad areas that contribute significantly to the ecological footprint of Wales; housing, food, transport (or personal travel), and consumer items. Figure 4 shows that together these

![Fig 4: Ecological footprint of Wales by theme](image)

**Box 1: Ecological footprint themes**

The footprint of **housing** measures the impact of fuel emissions from direct household energy use for heat, hot water, lighting and electrical appliances as well as the impact from household maintenance and from household construction.

The footprint of **food** measures the impact of all food and drink consumed by households and at restaurants and takeaways.

The footprint of **transport** measures the impact of fuel emissions from personal travel in public and private vehicles as well as the impact from maintaining vehicles, buying new vehicles and building the transport infrastructure.

The footprint of **consumer items** measures the impact of producing all products bought by households, from newspapers to appliances.

The footprint of **private services** measures the impact from services ranging from entertainment to financial.

Additionally, spending on **public services**, (e.g. education, sewage and healthcare), capital investment, (e.g. mineral extraction) and **other**, (e.g. impact of overseas tourists), is included in the total footprint but these figures are averages for the entire UK so are the same for each Local Authority.
account for 78% of the ecological footprint of Wales. The broad consumption activities included in each theme are listed in the footprint themes box below.

**High impact consumption activities: focus on households**

It is possible to separate the consumption of households, spending on capital investment and government spending. Consumption of households makes up 74% to the total ecological footprint. Capital investment and government spending make up the remaining 26%.

The fifteen household consumption categories that contribute most to ecological footprint of Wales are shown in figure 5. Activities include those that are part of every day lives (such as heating the home) and those activities that are less frequent but have a high impact per pound spent (such as international air travel). This highlights the importance of trying to reduce the impact associated with routine activities as much as luxury or conspicuous consumption.

![Figure 5: The highest 15 household consumption categories that contribute most to the Welsh ecological footprint](image)
Direct and indirect impacts of household consumption

As shown on the previous pages, the ecological footprint can be broken down in different ways - by general theme, and by consumer group (households, capital investment and government). Within the household group the footprint can also be separated into direct impacts and indirect impacts.

Some activities have a direct impact, such as the burning of fuels. However, the majority of items consumed have an indirect impact on the footprint - they do not emit pollutants directly at the point of use, but have been made using various resources and energy along the supply chain.

The direct impacts account for only 22.6% of the ecological footprint from households. The majority of the household footprint (77.4%) comes from the purchase of goods and services with indirect impacts.

The concept of direct and indirect impacts is important. Environmental policies often focus on direct impacts. The indirect impacts tend to be less well understood by the consumer and harder to communicate. We have highlighted this issue in our scenarios - emphasising the difficulty of addressing the ecological footprint of food compared to fuel use in the home or personal travel behaviour. For example, people do not generally associate food wastage with wasting energy in the same way that they equate poor loft insulation or an inefficient boiler with energy loss. As figure 6 shows, food has predominantly indirect impacts, whereas fuel use in the home and transport are both considered to have direct impacts, which are, in energy user terms, often more obvious to the consumer.

![Diagram showing ecological footprint]

Fig 6: Consumption activities with a direct and indirect input on the ecological footprint of households only.

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8 The percentages in this diagram are different from those in figure 4 because Government Spending and Capital Investment are not included. In other words, we are only looking at Household consumption activities.
Overview of Thematic Chapters

The next chapters illustrate how components of the ecological footprint may change over time, the first looks at housing, the second at transport and the third focuses on food. The scenarios created for each chapter provide footprint trajectories from 2001 to 2020. These scenarios are designed to show the footprint reduction potential of:

- Policies in place today
- Policies planned for the near future
- Further policies that could be implemented on a national scale

A summary of all the policies used to create the scenarios in each chapter are described below:

Chapter 1: Housing
The housing chapter focuses on the impact of energy use in new and existing homes on the housing footprint. Scenarios are built around the following policies:

**Policies in place today:**
- Code for Sustainable Homes to UK timetable
- Home Energy Efficiency Scheme (HEES), based on historic funding levels; retrofiting 0.8% of houses per year

**Policies planned for the near future:**
- Code for Sustainable Homes brought in early to the WAG timetable
- Planned increases in the funding of HEES, retrofiting 1.1% of houses per year

**Policies that could be implemented on a national scale:**
- Behavioural change campaign, reducing energy consumption by 10% by 2020 in 40% of the population.

Chapter 2: Transport
The Wales Transport Strategy Draft Consultation contains many ideas of what can be done on a sub national level to encourage sustainable travel. Beyond this, nation-wide schemes which tackle travel behaviour are limited in scale. This chapter focuses on policies being planned for the near future and areas of travel behaviour that could be tackled on a national scale.

**Policies planned for the near future:**
- Sustainable Travel Towns – one in each transport area in Wales

**Policies that could be implemented on a national scale:**
- Achieving modal shift for long distance journeys from cars towards trains
- Increasing the average occupancy rates of cars of Wales
- Reducing the need to travel through spatial planning

Chapter 3: Food
This chapter is organised slightly differently – firstly three different profiles of food consumption are modelled to demonstrate the impacts of the different components of the food footprint. Two further scenarios are then modelled looking at the impact of potential national level policy interventions.

**Policies which are not yet developed on national scale:**
- Reducing energy consumption across food supply chain industries
- Reducing food consumption by one sixth across Wales, by not buying food that would be wasted.

Chapter 4: Achieving a 10% reduction in the ecological footprint
A concluding chapter demonstrates the combined impact of existing and planned policies and demonstrates what could be done to get towards a 10% reduction in the ecological footprint by 2020. It should be emphasised that none of these scenarios are based on a cost-benefit analysis and policies are compared based on their impact on the ecological footprint alone.
Chapter 1 Housing

Key Messages

• Housing is the largest component of the ecological footprint of Wales. At a local authority level it accounts for between 22% and 27% of the footprint.

• The housing footprint of Wales is projected to stabilise by 2020. However, the housing sector provides one of the best platforms to reduce the footprint. It has potential to achieve substantial reductions in the ecological footprint per capita because it is one of the largest household consumption sectors. In addition, all of the tools and techniques to deliver energy saving measures in existing homes and build a very high standard of new homes are readily available.

• It is essential for footprint reduction that all new homes are built to the highest standards possible. Wales has taken a lead in this area and aims to build all new houses to Code Level 6 of the Code for Sustainable Homes (‘zero carbon’) by 2011. This target demonstrates leadership and should promote innovation in the housing sector. Introducing the new code early could mean that between 2008 and 2020, 76% of new homes will be built to Code Level 6 standard; almost 60,000 more than if Level 6 was not implemented until 2016.

• Retrofitting of the existing housing stock is vital for reducing the footprint of housing as it can be implemented across the majority of the housing stock. Over 90% of the homes in Wales today will still exist in 2020, but only a small proportion will have a full set of energy efficiency measures. There is huge scope for expansion in this area. The UK government has recognised the importance of retrofitting, emphasising that energy efficiency is the “cheapest, cleanest and safest way for creating a low carbon economy” (DTI, 2003).9

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9 Energy White Paper: Our energy future - creating a low carbon economy, DTI 2003
Fig 7: The housing footprint per capita for local authorities in Wales
The provision of housing and the way we live in our homes puts a pressure on the environment, not only for land and construction resources, but also energy use within the home. Housing accounts for 25% of the ecological footprint of Wales, at a local authority level Torfaen has the highest ecological footprint for housing, The Vale of Glamorgan has the lowest (see figure 7).

This chapter explores the potential for footprint reductions based on current and potential policies. It highlights the importance of intervention at a national level and looks at whether the interventions to date go far enough to stabilise and then reduce the footprint by 10% by 2020. It then goes on to consider the impact of extending these policies further.

The analysis is organised around three sets of scenarios that model the change in the housing footprint from 2001 to 2020.

The focus of these scenarios is on energy demand in the home and the range of options available to the Welsh Assembly to reduce this. Housing, planning and control over energy efficiency budgets are all devolved to Wales. This presents a number of options which can be used to reduce the housing footprint and which are analysed in the following scenarios:

- Increasing the supply of modern, energy efficient homes
- Improving the standards of existing homes
- Replacing poor quality housing stock
- Targeting energy use by households

The first scenario models the baseline trends, looking at how the footprint may change with no intervention from the Welsh Assembly Government. This takes into account predicted house building and demolition rates, population growth and underlying trends in energy consumption. The second scenario illustrates the potential impact of existing Welsh plans for energy performance in new homes and energy efficiency improvements in existing homes. The final section explores the opportunities for taking these policies further, expanding energy efficiency schemes and developing a housing market renewal policy.

These scenarios do not model changes to energy supply. Policy in the UK is mainly reserved to the UK Department for Business, Enterprise and Regulatory Reform, although Wales still plays an active role in this area. For example, WAG has recently consulted on a Renewable Energy Route Map. This sets out specific actions on how Wales can meet the renewable electricity self-sufficiency objective, how biomass resources could be used for significant renewable heat production and how Wales can support energy efficiency and small-scale micro-generation ambitions.\(^\text{10}\)

\(^{10}\) Renewable Energy Route Map for Wales consultation on way forward to a leaner, greener and cleaner Wales, 2008
One Wales commits the Welsh Assembly Government to the provision of ‘a stock of good quality, affordable homes’ in all four corners of Wales. This implies a need for policies that target both the existing housing stock and new build. These are both areas where the potential for footprint reduction is considerable.

Wales has both the technological capabilities and the political powers to make significant reductions in the housing footprint. There are 1.3 million homes in Wales, only a small percentage of these have a full set of energy efficiency measures (such as double glazing and cavity wall insulation), and there is huge potential for improvement within the existing housing stock. But this potential has to be set in the context of local conditions, 72% of homes in Wales are privately owned, many are ‘hard to treat’. In addition 30% of dwellings were built before 1950, and nearly two fifths of households are not connected to the gas network. Older houses tend to be less energy efficient and as a source of energy, gas has less impact per pound spent on the ecological footprint than conventional alternatives such as national grid electricity. These are structural challenges which can be expensive to remedy.

In comparison to England the number of new dwellings that are planned in Wales is relatively low, but the Welsh Assembly is committed to pursuing the devolution of building regulations to the Assembly. This would provide it with the freedom to set building regulations and energy performance standards for all new housing to a timetable of its own choosing.

The challenge for Wales is to design a set of policies that will reduce the footprint and contribute to broader housing objectives in a cost effective and efficient manner.

11 Properties are considered hard to treat if they have solid walls and are off the gas network. This means that they can not be treated with cavity wall insulation and have a limited choice of heating systems (Centre for Sustainable Energy).
Scenario modelling is a useful tool for examining the impact that policies will have over a number of years. Each scenario we have constructed for this analysis uses data on the energy use of the current housing stock in Wales and illustrates how this may change over time with the introduction of certain measures or legislation. All scenarios are modelled from the baseline year of 2001 to 2020.

A summary of the scenarios we have developed for this report is shown in table 2, below. The analysis is broken down into three sections. The first creates a baseline scenario based on underlying trends. The second looks at currently implemented policies (policies in place today), the final section looks at the practical expansion of existing policies. A more detailed description of the components of each scenario is provided at the beginning of each section.

The scenarios were created using the following data sources, rules and assumptions:

**UNDERLYING TRENDS**

A number of underlying trends are incorporated into all of the scenarios. These trends are based on historical data and predictions for the future and are important as they can have a significant impact on the overall footprint of housing.

Over the past thirty years the energy used for household appliances has increased by 157% across the UK, whilst the energy consumed for hot water and cooking has decreased. Based on information provided in the Housing Condition Survey each scenario includes an underlying change in energy use; the exact changes in energy use that we have applied in the scenarios are shown in the table below:

<table>
<thead>
<tr>
<th>Consumption Activity</th>
<th>Percentage change in energy use per year</th>
</tr>
</thead>
<tbody>
<tr>
<td>Space heating</td>
<td>0.4%</td>
</tr>
<tr>
<td>Hot water</td>
<td>-0.5%</td>
</tr>
<tr>
<td>Cooking</td>
<td>-1.8%</td>
</tr>
<tr>
<td>Lighting and appliances</td>
<td>2.2%</td>
</tr>
</tbody>
</table>

Unless stated otherwise the following assumptions are also made:

- Population estimates are based on the Government Actuary’s Department (GAD) national population projection for

### Table 2: Summary of housing scenarios

<table>
<thead>
<tr>
<th>Scenario Name and Number</th>
<th>Policies</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Scenario</td>
<td>Underlying trends</td>
<td>House building, demolition and underlying trends, no policy intervention</td>
</tr>
<tr>
<td>Policies in place today (1) Code for Sustainable Homes UK timetable</td>
<td>Improving building regulations for new builds</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Retrofitting</td>
<td>Improving the existing housing stock</td>
</tr>
<tr>
<td>Practical expansion (2) Housing market renewal</td>
<td>Removing older houses and replacing them with newer more energy efficient homes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Code for Sustainable Homes WAG timetable</td>
<td>Introducing legislation for new builds more quickly than planned in the UK</td>
</tr>
<tr>
<td></td>
<td>Increased Retrofitting</td>
<td>Increasing the funding available for retrofitting schemes to make further improvements to the existing stock</td>
</tr>
</tbody>
</table>

12 English Housing Condition Survey, 2004
Wales. The projections use the Office for National Statistics (ONS) 2003 mid-year estimates of the usually resident population as their base. Together with the housing projections, the population estimates can be used to calculate an average household occupancy rate. We have calculated that the household occupancy rate in Wales is set to decline from 2.44 people per household in 2001 to 2.26 in 2020 (this is also in line with historical trends).

• It is assumed that any projected increase in households will require addition housing. The models use Household Projections Data taken from the sub-national household projections from Wales for 2003 to 2026, produced by the Anglia Ruskin University on behalf of the Welsh Assembly Government. This information along with Local Authority house building plans (from Unitary or Local Development Plans) are used to estimate a house building rate from 2001 to 2020. Approximately 11,000 houses will be built in Wales annually, giving a total of just over 220,000 built between 2001 and 2020.

• Demolition rates per annum are based on the average demolition rate in Wales over the past 15 years, using data published in Welsh Housing Statistics 2005. Based on housing condition information the least energy efficient houses only are demolished (energy efficiency rating E to G).\(^\text{13}\)

• To model the existing housing stock we used information from the Living in Wales Survey 2004 and the Home Energy Efficiency Database produced by the Energy Saving Trust. These datasets provide information on the energy efficiency of the current housing stock, with for example, figures on the number of houses with double glazing or a condensing boiler.

• Because we are comparing energy demand scenarios no changes are assumed in the energy mix of the national grid. This allows us to focus on the impact of individual policies under constant energy supply conditions. In addition, it is unlikely that any major low carbon energy sources would be fully established by 2020.

• All new builds are assumed to be average size and have average levels of energy consumption by purpose for a house of that type and use the same energy mix.

• All policies are implemented with immediate effect, this is an optimistic assumption for building regulations which are not always followed and for energy efficiency measures which can have varying degrees of success.

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\(^{13}\) The energy efficiency rating is allocated based on SAP ratings (Standard Assessment Procedure) of homes. Code A is the highest level, with good standards of energy efficiency and code G is the lowest.
Scenarios and analysis

THE BASELINE SCENARIO

The baseline scenario gives an indication of what may happen over the next 20 years by using historical trends; exploring what would happen if these trends continued. The limitation of this approach is that the scenario does not take into account any unexpected events such as a large increase in energy prices. However, the advantage of using this method is that, with the assumption of relatively stable conditions, it can compare individual policies over time. An outline of the baseline scenario is shown in Table 4 below.

Within the baseline scenario we have assumed that there is no national investment in retrofitting and the average energy efficiency of the existing homes stays relatively constant. There are only minor improvements made by individuals, independent of any specific retrofit strategy.

The change in the average energy use per person between 2001 and 2020 for each area of energy consumption is displayed in Figure 8.

The gas used for hot water decreases due to efficiency improvements in boilers and heating systems. Energy use for cooking decreases as the energy efficiency of cooking appliances improves and a natural trend for people to cook less at home. There is a large increase in the electricity used for lighting and appliances as the number and electricity demand of appliances in the home increases.

Table 4: Baseline scenario

<table>
<thead>
<tr>
<th>Scenario</th>
<th>New builds</th>
<th>Population</th>
<th>Demolition</th>
<th>Retrofit</th>
<th>Behavioural change</th>
<th>Trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Scenario</td>
<td>Current housing projections of 220,000 from 2001-2020. Built to building regulation standard from year of implementation in UK</td>
<td>Derived from occupancy rate based on current population projections</td>
<td>Average rate over past 15 years – 425 houses per year. 9000 in total</td>
<td>No additional retrofit (only minor changes made by householders)</td>
<td>No behavioural change</td>
<td>Underlying trends of increasing energy use for heating and lighting and appliances. Decreases in cooking and hot water</td>
</tr>
</tbody>
</table>

Fig 8: Change in energy consumption by activity between 2001 and 2020
Baseline Scenario Results

The outcomes of the baseline scenario show that:

- A 9.3% growth in the Welsh population by 2020, contributes to a 10% increase in the total footprint for housing.
- In the absence of any interventions to reduce energy use, the housing footprint per person remains relatively stable. Between 2001 and 2020, it increases by just 0.8%.

These projections provide a starting point for all of the scenarios in this chapter. Any interventions are measured against these underlying trends, rather than a stable baseline.

Box 3: Explanation of Terms: Global Hectares and Global Square Kilometres

Footprint per capita is measured in global hectares. A global hectare is a hectare with world-average ability to produce resources and absorb wastes. This is a useful measurement for the per capita footprint; however the total footprint of the whole of Wales is much larger and the hectares unit is too small. We have therefore displayed the total footprint in global square kilometres.

1 hectare = 10 000 m²
1 1000 hectares = 1 kilohectare
10 km² = 1 kilohectare
1km² = 100 hectares
SCENARIO 1: POLICIES IN PLACE TODAY

This scenario considers the impact on the housing footprint of two current policies – implementation of the Code for Sustainable Homes to the UK timetable and the Welsh Home Energy Efficiency Scheme. These policies are summarised in table 5.

The Code for Sustainable Homes (UK Timetable)
The Code for Sustainable Homes (CSH) is a new guide for industry on the construction of more sustainable homes. Any homes built to the new standards will be more energy efficient than a house built to current (2006) building regulations. The code is progressive, with each level demanding, amongst other things, higher levels of energy efficiency.

Figure 11 displays the improvements in energy efficiency (in terms of carbon emissions) for an individual house at each level of the code. The minimum energy requirements for each Code level are shown in table 6 (next page).

The 2006 Building Regulations represented a significant shift in performance over the average home (nearly 50%). After this the Code for Sustainable Homes gradually tightens the regulation to achieve increasingly better efficiency rating. Level 1 to 4 shows this incremental improvement with level 4 delivering 44% saving from the 2006 Regulations. After this the improvements are even more substantial.

Building a house to Code Level 6 of the Code for Sustainable Homes gives over a five fold reduction in the carbon emissions of an individual house compared to current building regulations. However, at present, few examples can be found of a development that would reach Code levels 5 and 6. While level 6 is described as “zero carbon”, the construction of the home along with the provision of renewable energy does have some carbon output.

It is the improvement in the energy efficiency of new homes that is modelled in these scenarios. It is important to note that although the implementation of the Code for Sustainable Homes would ensure that all new houses are more energy efficient, new houses are still being built and these will have a considerable construction impact.14

Any new building is an additional use of energy and resources. The impact of this is demonstrated by looking at the total ecological footprint from housing, as it will always increase with a growth in households, unless that growth can be offset by a reduction in the footprint per capita.

To understand the impact of the Code for Sustainable Homes we have modelled its implementation according to the UK timetable and compared it to the baseline and the other scenarios. (The UK timetable is currently applicable in Wales as power over Building Regulations is not yet devolved to the Assembly).

Table 5: Policies in place today

<table>
<thead>
<tr>
<th>Policy</th>
<th>New builds</th>
<th>Population</th>
<th>Demolition</th>
<th>Retrofit</th>
<th>Behavioural change</th>
<th>Trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>CSH UK</td>
<td>Current housing projections of 220,000 from 2001-2020. CSH implemented to UK timetable</td>
<td>Derived from occupancy rate based on current population projections</td>
<td>Average rate over past 15 years – 425 houses per year. 9000 in total</td>
<td>Minor improvements independent of any national policy</td>
<td>No behavioural change</td>
<td>Underlying trends of increasing energy use for heating and lighting and appliances. Decreases in cooking and hot water</td>
</tr>
<tr>
<td>Retrofitting</td>
<td>Current housing projections of 220,000 from 2001-2020. Built to building regulation standard from year of implementation in UK</td>
<td>Derived from occupancy rate based on current population projections</td>
<td>Average rate over past 15 years – 425 houses per year. 9000 in total</td>
<td>Improvements based on HEES outcomes</td>
<td>No behavioural change</td>
<td>Underlying trends of increasing energy use for heating and lighting and appliances. Decreases in cooking and hot water</td>
</tr>
</tbody>
</table>

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14 The impact of construction and the construction industry is significant, but is not modelled in these scenarios.
The UK timetable states that all homes should be built to:

- Code Level 3 by 2010
- Code Level 4 by 2013
- Code Level 6 by 2016

We have made the following assumptions:

- Changes in energy use of the new homes are consistent with the percentage improvements over 2006 Building Regulations described in the Code for Sustainable Homes guidance, i.e. building a new house to code level 1 would result in a 10% reduction in the average energy use of a house that was built to 2006 regulations.
- Each code level standard is implemented across the housing industry with immediate effect. This assumes a clear enforcement strategy and full compliance from housebuilders. Research shows that up to one third of new houses fail to reach building standards (Boardman, 2007). \(^{15}\)

| Table 6: Minimum energy requirements for Code for Sustainable Homes |
|-----------------|--------------------------------------------------|
| Code Level      | Percentage better than Part L of 2006 building regulations |
| 1               | 10% |
| 2               | 18% |
| 3               | 25% |
| 4               | 44% |
| 5               | 100% |
|                 | (zero emissions from heating, hot water, ventilation and lighting) |
| 6               | A zero carbon home |
|                 | (zero net emissions of CO\(_2\) from all energy use in the home) |

15 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050
The Home Energy Efficiency Scheme
The Welsh Assembly Government currently supports a Home Energy Efficiency Scheme that provides heating and insulation improvements to households in Wales that are in receipt of certain benefits. More information about the scheme can be found in box 4.

Providing houses with heating and insulation measures would have an impact on the amount of energy used in the home. Under the Home Energy Efficiency Scheme householders are offered a number of measures including gas and electric heating improvements and cavity wall and loft insulation. Of these measures, SEI have calculated that increasing the number of homes with condensing boilers gives the greatest footprint reduction, followed by reducing the number of homes with very poor or no loft insulation.

Since 2001 HEES has provided assistance over 70,000 households, equivalent to approximately 0.8% of the total number of households in Wales per year. In 2005/06 21,804 measures were completed in homes across Wales. Of these measures, 2,000 were cavity wall insulations, nearly 4,000 were loft insulations and another 15,000 were heating system improvements. This helped nearly 10,000 households and cost approximately £14 million.

The scenarios have modelled the impact of these measures by considering the change in energy use per capita if the total number of houses in Wales with a condensing boiler for example, increased from 1% to 6.5% by 2020.

It is assumed that HEES receives a similar level of funding each year and would provide improvements to approximately 0.8% of homes each year up to 2020.

Box 4: Welsh Home Energy Efficiency Scheme
The New Home Energy Efficiency Scheme (HEES) for Wales commenced in November 2000. HEES offers packages which includes heating improvements as well as insulation measures to households in receipt of certain benefits. HEES is targeted at both private and public housing and offers:

- Grants to the value of £1,500 for insulation measures and room heaters to households on low income.
- Grants to the value of £2,700 for an extended package of measures, called HEES Plus (under which central heating is provided) to pensioner households, lone parent, sick and disabled households.

The scheme is broadly similar to the Warm Front scheme in England although the size of grants available differs with HEES Plus offering a further £200 over Warm Front Plus to reflect the higher cost of heating systems in Wales (DEFRA & DTI, 2001). HEES is the Assembly’s primary vehicle for meeting its Fuel Poverty Strategy commitments. It is currently targeted at vulnerable low-income households, with passport benefits being the only qualifying criteria.

It is important to note that not all households in Wales would benefit from the package of measures currently offered by the Home Energy Efficiency Scheme. In rural areas for example, many houses have solid walls and no access to the gas network and studies have shown that take up of the Home Energy Efficiency Scheme is often much lower in these areas (Centre for Sustainable Energy, 2006). Therefore, any plans for expansion of these schemes must consider how these ‘hard to treat’ properties can be targeted. This is very important in Wales as over 30% of houses have solid walls and no access to gas.

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16 Ashford’s Footprint – Now and in the Future, SEI, 2008
17 Baker and Preston, Centre for Sustainable Energy, 2006 Targeting energy efficiency resources in Wales
Results for policies in place today

Table 7 provides a summary of the results from the policies in place today. The single most effective measure is retrofitting under existing HEES funding. Combining this with the policy for new builds results in a 1% reduction in the footprint per capita by 2020. This is a 2.2% improvement on the baseline scenario, but still some way short of a 10% reduction in the per capita footprint.

These results highlight a number of points in the context of housing policy:

The scope of policy matters
The potential impact of policies in place today depends on the proportion of houses targeted. The total number of new builds (houses built after 2006) makes up only 12% of the total housing stock by 2020. Based on the UK timetable the number of houses built to Code Level 6 is even smaller, less than 4%. The HEES provides improvements to approximately 0.8% of homes per year. Because such a small proportion of the housing stock is targeted it is difficult to bring about considerable reductions in the footprint.

The impact of new build depends on replacement rates
Every year less than 0.1% of the housing stock in Wales is replaced with new homes. The demolition rate in Wales has fluctuated between 0.02% and 0.08% of the housing stock per year over the past 20 years (a slightly lower rate than the UK as a whole). This means that it would take 2,000 years for the housing stock to be fully replaced.

The extent to which new buildings are a solution depends on the rate at which old, inefficient properties are removed from the stock, by demolition. Otherwise, a new, additional building is an extra source of carbon, whereas a replacement building is a saving (2007)\(^{18}\).

Combining new build policy with the removal of older, inefficient homes would make this more effective. The potential for this is explored in the practical steps scenarios under a programme of housing market renewal.

The timescale of policy is important
The Welsh Assembly Government has a commitment to ensure the supply of affordable housing increases by at least 6,500 over the next four years.

The timetable for introducing the Code for Sustainable Homes is important because enforcing high standards of new builds today will have benefits in future. It is absolutely necessary that these homes are built to the highest standards to prevent the footprint increasing further.

With any policy to reduce the ecological footprint or carbon emissions the sooner it is implemented the less the footprint or emissions can increase, making future targets easier to achieve.

### Table 7: Summary of the current policies

<table>
<thead>
<tr>
<th>Policies</th>
<th>Percentage Change in per Capita Footprint 2001 to 2020</th>
<th>Percentage Change in Total Footprint 2001 to 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.8% (increase)</td>
<td>10.2% (increase)</td>
</tr>
<tr>
<td>CSH Implemented to UK timetable</td>
<td>No change</td>
<td>9.3% (increase)</td>
</tr>
<tr>
<td>Retrofitting under existing HEES funding</td>
<td>-0.6% (decrease)</td>
<td>8.7% (increase)</td>
</tr>
<tr>
<td>Current Policies combined</td>
<td>-1% (decrease)</td>
<td>7.4% (increase)</td>
</tr>
</tbody>
</table>

18 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050
What comes next?
The policies in place today do not provide the framework for significant reductions in the housing footprint. Neither can natural change be relied upon for reduction as the baseline indicates that the footprint per capita would remain relatively stable.

In order to gain a more substantial reduction in the footprint there are a number of options for example: target a greater proportion of the population or implement policies earlier - these are explored in the practical steps scenario.
SCENARIO 2: PRACTICAL STEPS

Practical steps that could be taken to reduce the housing footprint include:

- Housing market renewal
- Behavioural change
- Expansion of retrofit policy

All of these options are modelled in the following scenario. Many are an extension of the policies in place today, analysing the impact if they were further developed or given increased funding.

Within this scenario there is an implicit assumption that funding would be increased in order to deliver the policies. All of the changes would require an initial investment beyond what is currently allocated to the existing policies. However, this is not a cost benefit analysis, the policies are compared by their impact on the housing footprint alone, not on their costs.

A summary of the three practical steps policies is shown in the table 8. These are modelled separately and then combined to show their cumulative impact.

**Housing market renewal**
Removing energy inefficient houses from the housing stock and replacing them with new more efficient homes reduces the energy consumption of the housing sector as a whole.

In this scenario we firstly consider the impact of demolishing more homes than at present and replacing them with new properties. Initially the new properties are only built to the current Building Regulation standard to demonstrate the impact of demolition alone.

The modelled demolition rate is increased to four times that of the current rate (in line with Boardman, 2007), increasing the number demolished from 425 per year to 1,700, between 2008 and 2016 and then demolishing at a constant rate of 1,700 until 2020. This gives a replacement rate of 760 years and a total of nearly 20,000 are houses demolished by 2020.

It is often the case that large, older, detached homes tend to have the poorest energy standards and some of the lowest grade houses may therefore have a high heritage value. 72% of the houses in Wales are privately owned and demolishing a high number of homes may not be a very popular policy. Despite this, there is still an opportunity to increase the housing market renewal beyond current levels. Approximately 4.8% of houses in Wales (around 57,000 homes in total) are classed as unfit (Living in Wales Survey, 2004) and these could potentially be replaced with new homes.

**Box 5: Housing Market Renewal Assumptions**

- The houses demolished are assumed to be the lowest grade either E, F or G. This may be optimistic as according to Boardman (2007), previously only 20% of the houses that have been demolished in the UK were classed as unfit (2003, ODPM).
- The energy reduction from demolishing each grade of house is different. Demolishing grade G gives the greatest reduction.
- The rate of demolition of each grade is proportional to the number of each grade that currently exists in the housing stock.
- House building is increased to counteract the rate of demolition to ensure that the stock numbers remain in line with the housing forecasts and all the other policies (this also means that population growth remains the same as the other policies).
- It is assumed that all new builds are built to the specified Code Level immediately. Historically up to one third of new houses fail to reach building standards.

19 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050
Code for Sustainable Homes – Welsh Assembly Government Timetable

In February 2007 the then Minister for Environment, Planning and the Countryside announced the aspiration that all new homes in Wales should be zero carbon by 2011, five years ahead of England. At present the Welsh Assembly Government does not have the devolved powers over Building Regulations to make this a legal obligation across the sector. However, they do aim to have powers in the near future and we have therefore modelled the impact the policy would have should it come into force.

Expansion of the Retrofit Policy and Behavioural Change

The practical steps scenario for retrofitting analyses the impact of the expansion of the Home Energy Efficiency Scheme. It models an increase in spending on energy efficiency measures in existing homes in line with the 2006/07 HEES budget increase from £14.1 million to £19.5 million, documented in the Sustainable Development Annual Report 2006. This increases the number of houses provided with retrofit measures from 0.8% to 1.1%, per year. This scenario also includes behavioural change and models the impact of this alone and combined with the increase in funding for HEES.

Providing additional funding for the retrofitting of existing housing is an important policy for a number of reasons:

- It can be applied to the majority of the housing stock; other policies only target a small percentage.
- It is a key delivery agent for the reduction of fuel poverty in Wales.
- A lack of price incentives to reduce individual consumption and the high costs of making a home more energy efficient for the private individual make a policy that help private households to reduce consumption very important – particularly because of the high levels of private home ownership in Wales.

Encouraging behavioural change is also very important; the advantages of this are described in box 6. Potentially at least a third of the carbon savings in the residential sector could come from behavioural changes (Boardman, 2007).

<table>
<thead>
<tr>
<th>Table 8: Practical step policies</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Policy</th>
<th>New builds</th>
<th>Population</th>
<th>Demolition</th>
<th>Retrofit</th>
<th>Behavioural change</th>
<th>Underlying trends</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demolition and Housing Market Renewal</td>
<td>A comparison of houses built to standard regulations, the CSH UK timetable and the CSH WAG timetable</td>
<td>Derived from occupancy rate based on current population projections</td>
<td>Demolition rate increased by ~100 per year until reaches 1700/yr by 2016, 20,000 in total</td>
<td>Minor improvements independent of any national policy</td>
<td>No behavioural change</td>
<td>Underlying trends of increasing energy use for heating and lighting and appliances. Decreases in cooking and hot water</td>
</tr>
<tr>
<td>CSH WAG</td>
<td>CSH implemented to WAG timetable, number of new builds remains the same</td>
<td>As above</td>
<td>Average rate over past 15 years – 425 houses per year. 9000 in total</td>
<td>Minor improvements independent of any national policy</td>
<td>No behavioural change</td>
<td>As above</td>
</tr>
<tr>
<td>Increased Retrofitting</td>
<td>Current housing projections, built to building regulation standard from year of implementation in UK</td>
<td>As above</td>
<td>Average rate over past 15 years – 425 houses per year. 9000 in total</td>
<td>Improvements on original HEES outcomes resulting from increased funding</td>
<td>Behavioural change assumption of 1% per year, by 40% of the population</td>
<td>As above</td>
</tr>
</tbody>
</table>

20 Boardman, 2007 Home Truths: A low-carbon strategy to reduce UK housing emissions by 80% by 2050
Box 6: The Potential for Behavioural Change

A recent comparison of energy wasting habits in five European countries by the Energy Saving Trust revealed that people in the UK have the most wasteful patterns of energy use in their everyday life. British people often leave their appliances on stand-by, electric chargers plugged in and lights on in unoccupied rooms. The study predicts that over £11 bn will be wasted in the UK unless energy wasting habits are curbed (SEI, March 2007). The relatively low cost of energy compared to other consumer items result in a lack of price incentive to change, consequently other means of encouraging behavioural change must be found.

The potential for energy use reduction from behavioural change is very substantial; with estimates as high as 50%. However, the reduction achieved is dependent on numerous factors and some schemes, such as a national scheme that allocates carbon allowances, could have a very large impact on energy usage. Alternatively, other schemes may have very little impact, unable to influence the majority of consumers. A further complication is that any reduction in energy usage and therefore potential cost saving to the consumer may cause a rebound effect, with the overall footprint increasing if the money saved is spent on other consumer items with their associated footprints.

It is very difficult to predict probable behavioural changes, take up rates of schemes or reaction to awareness campaigns. However, estimates have been made. The Carbon Trust for example, has suggested that a maximum a 15% reduction in energy use from behavioural change is an achievable aim.

For this scenario we have assumed that there will be a 10% reduction in overall energy use by 40% of the population by 2020, as a result of energy reduction campaigns such as those run by the Energy Savings Trust and more localised campaigns.

A recent research paper published by COI and the Welsh Assembly called “Attitudes to Climate Change and Environmentally Friendly Behaviours in Wales” (Aug 2007) looks at the best ways to target individual behavioural change, with policies aimed at specific groups of the population. This type of targeting is important to ensure that any marketing or awareness scheme is appropriate and delivers the maximum benefits.

Results for practical step policies

Table 9 provides a summary of the results from the practical step policies. The single

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Percentage Change in per Capita Footprint 2001 to 2020</th>
<th>Percentage Change in Total Footprint 2001 to 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline</td>
<td>0.8% (increase)</td>
<td>10.2% (increase)</td>
</tr>
<tr>
<td>Increased demolition</td>
<td>-0.1% (decrease)</td>
<td>9.2% (increase)</td>
</tr>
<tr>
<td>CSH Implemented to WAG timetable</td>
<td>-0.3% (decrease)</td>
<td>9% (increase)</td>
</tr>
<tr>
<td>Retrofitting with increased HEES funding</td>
<td>-1% (decrease)</td>
<td>8.4% (increase)</td>
</tr>
<tr>
<td>Increased demolition combined with CSH UK – housing market renewal.</td>
<td>-1% (decrease)</td>
<td>8.3% (increase)</td>
</tr>
<tr>
<td>Increased demolition combined with CSH WAG – housing market renewal.</td>
<td>-1.3% (decrease)</td>
<td>7.9% (increase)</td>
</tr>
<tr>
<td>Improved retrofitting from increased HEES funding and behavioural change</td>
<td>-4.4% (decrease)</td>
<td>4.6% (increase)</td>
</tr>
<tr>
<td>Practical Step Policies combined: increased demolition rates CSH WAG, increased HEES funding and behavioural change.</td>
<td>-6.4% (decrease)</td>
<td>2.3% (increase)</td>
</tr>
<tr>
<td>Practical Step policies combined without behavioural change</td>
<td>-2.9% (decrease)</td>
<td>6.1% (increase)</td>
</tr>
</tbody>
</table>
most effective measure is retrofitting under increased HEES funding and behavioural change. Combining all of the practical step policies results in a 6.4% reduction in the footprint per capita by 2020. However, the majority of this comes from the behavioural change. Without the behavioural change the footprint decreases by 2.9% by 2020.

Has the scope of the policies expanded enough?
Most of the changes modelled in the scenario have been relatively moderate in scale. Currently HEES funds are only available for those households in receipt of certain benefits and funding was only increased in line with estimates in the 2006/07 budget. Similarly, housing market renewal was limited to the demolition of less than 20,000 houses over a 20 year period.

This demonstrates that these modest increases have led to equally modest reductions in the housing footprint.

By comparison the modelled policy for behavioural change brought about a 10% reduction in energy use for 40% of the population. This assumption may be regarded as optimistic, but demonstrates the impact of a policy with wider scope that targets a larger proportion of the population. This resulted in a 3.4% reduction in the footprint by 2020 alone.

The impact of timescale improvements
In this scenario implementing the Code for Sustainable Homes Level 6 by 2011 results in a small decrease in the footprint. Whilst this is a modest decrease it may have far reaching benefits for Wales:

- It would give a clear message that the housing stock is being improved, demonstrating the dedication of the WAG to promoting advances in the housing sector.
- It has the potential to drive forward innovation and encourage new technologies to the market.
- It could have knock-on benefits for existing housing; demonstrating what could be achieved in the housing sector; making energy saving technologies more widely available; and promoting the benefits of energy efficient housing.
- If all new houses are built to the highest possible standard (zero carbon, Code Level 6) by 2011 they will not need further retrofitting in 20 or 30 years time. If the
houses are built to lower standards, they become housing requiring retrofit in the future. It is therefore essential that houses are built to the highest energy efficiency standards as soon as possible; the benefits will then be realised in all subsequent years after the policy is introduced.

- Ensuring that all new houses are built to Code Level 6 in 2011 rather than 2016 means that there is a carbon emissions saving from the housing sector earlier. The houses built between 2011 and 2016 would contribute to an increase in emissions (and the housing footprint) if they are not built to the highest code level. This is true of any policy to reduce the ecological footprint or carbon emissions – the sooner it is implemented the less the footprint or emissions can increase, making future targets easier to achieve.
EXISTING POLICIES

The scenarios demonstrate the scale of intervention necessary in order to achieve a reduction in the footprint per capita and show that even more would need to be done to reduce the total footprint.

The policies in place today combined provided a 1% reduction in the footprint per capita and the practical steps policies only managed to improve on this by just over 5%, the majority of which (3.4%) came from behavioural change. The impact of the policies would have to almost double to reach a 10% reduction in the footprint per capita. All of the policies that we have modelled have also resulted in an increase in the total footprint, predominantly due to the increase in number of households and the underlying trends of increasing consumption.

There are a number of reasons why there has been little policy movement towards increased energy efficiency to date. Analysing these potential barriers to change and reasons for lack of momentum is important for deciding how and where to target future policies:

• **Lack of price incentives**
  Currently there is no great price incentive for households to reduce their energy bills. The average household in the UK spends less of their income on energy now than in the 1970s. As a result energy use continues to rise and there is no incentive to look for ways to reduce the cost of energy in the home. A sharp increase energy prices in the future could have an effect on energy consumption, but this is neither easy to predict and control, nor a policy option.

• **Housing markets and enforcement**
  Building new houses to higher energy efficiency standards needs greater initial investment. The construction industry may be reluctant to invest for fear of becoming uncompetitive in the market. The Code for Sustainable Homes would impose higher standards of new builds, but it is essential that clear enforcement strategy is in place to ensure full compliance.

• **The scope of policy**
  The potential impact of policies depends in part on the proportion of houses targeted. The scenarios demonstrate that policies modest in scale lead to equally modest reductions in the housing footprint.

THE OPPORTUNITIES

The housing sector offers some of the greatest opportunities for reduction in the footprint for a number of reasons:

• It is one of the largest household consumption sectors; therefore any reductions have the potential to have a large impact on the overall footprint.

• Reductions could be made relatively easily compared to other sectors. It can be very difficult in some sectors to directly influence individual consumption activity; however, in the housing sector the tools and technology to do this are readily available.

• Any retrofit or housing market renewal measures will help to reduce consumption without requiring a major change in lifestyle. In addition, even small changes to behaviour would prove beneficial.

• There would be many additional benefits for Wales; removing unfit dwellings from the market and installing energy efficiency measures could improve residents’ quality of life and also make a significant contribution to the eradication of fuel poverty.

THE FUTURE

Current policy from the Welsh Assembly Government is moving in the right direction; pushing for the implementation of the Code for Sustainable Homes by 2011 is an example of this, clearly demonstrating that the WAG are keen to make progress in the housing sector.

Encouraging innovation, the use of new technologies and the achievement of the highest standards possible in new builds will
show what is possible within the housing sector. However, it is important that such progressive and ambitious policies are developed for the existing housing stock.

With such a low turnover of the housing stock and no plans to increasing housing market renewal, policies that tackle the majority of the existing stock are vital. Developing interesting, high profile policies in this area has the potential to substantially reduce the housing footprint of the individual. It may also encourage behavioural changes which could lead to even further footprint reductions in this sector.

From analysing the scenarios in this chapter it is very apparent that some additional interventions are required. There are many examples of successful local and regional policies that have had a considerable impact on the energy consumption in households, many of which could be used in Wales. Policies for the future could include:

- **Expansion of the HEES Scheme**
  The Home Energy Efficiency Scheme in Wales could be launched on a much bigger scale and include many more households. A large retrofit programme such as this would have considerable benefits, not only for the reduction of the footprint, but also for tackling other issues such as fuel poverty and improving unfit dwellings.

- **Promoting new technologies**
  The implementation of the Code for Sustainable Homes could provide a driver for the promotion of new technologies across the existing housing sector. There are many examples of how low or zero carbon technologies can be successfully implemented to reduce the energy consumption across entire communities. Meeting and extending the targets for renewable energy generation in the Micro-generation Action Plan as part of the package of measures for housing would complement the expansion of retrofit policy.

- **Encouraging behavioural change**
  Analysis has shown that behavioural change can have a huge impact on the footprint per capita. Developing policies to target behavioural change across different sectors of the population are necessary to support the structural and technological improvements mentioned above. Current research into the attitudes towards behavioural change can provide a framework for this and successful policies in other sectors such as transport can be used to guide programme development.

- **Developing housing market renewal schemes**
  Increasing the rate at which the housing market is renewed would improve the energy efficiency of the housing stock overall. Developing a policy of targeted renewal and supporting this with the implementation of code level 6 of the Code for Sustainable Homes by 2011 would increase the benefits further.

All of these changes need a strong lead from government. Combining these policies into a package of measures would build on the existing schemes and set a clear objective for improvements to the housing stock and a reduction in the housing footprint.

There is no one policy that can deliver a reduction in the footprint by itself; instead, all of the measures considered in this chapter have a role to play. Focusing too heavily on one aspect housing will not deliver the changes required as the policies are far more successful when combined. A set of ambitious and proactive measures for the housing stock will send a clear message about the urgency and priority given to reducing the footprint in Wales.
Chapter 2 Transport

Key Messages

• Transport accounts for 18% of the total ecological footprint of Wales. This is similar across the local authorities.

• The average distance people travel each year is growing at a considerable rate. As a result the transport footprint is predicted to increase by 2020. Even with efficiency improvements in cars the land transport footprint is estimated to increase by over 6% by 2020. Including air travel increases this to over 12% over the same time period. This is the largest growth of all consumption categories.

• A package of measures is required in order to address the increasing distance people travel. This should cover the full range of travel behaviour. Initiatives are required which tackle long and short distance travel for all purposes – shopping, leisure, education and commuting.

• It is important to measure and understand personal travel behaviour rather than just traffic or rail as sectors. The individual’s transport footprint is determined by the travel choices that the person makes on a daily basis.

• Recently announced policies such as the Sustainable Travel Town scheme will be vital for influencing travel behaviour on a local level. The three main themes\(^1\) in the Welsh Transport Strategy Consultation Document (2006) are also supportive of local initiatives to encourage lower footprint travel behaviour.

• Regional transport consortia will need support to change current travel behaviours. Local level schemes work for a targeted population, but need to be reinforced by regional and national initiatives, otherwise it will be difficult to secure a reduction in the footprint on a national level.

• Behavioural change is essential for any reduction in the transport footprint and relies on a combination of soft and hard measures. Hard measures that improve the transport infrastructure are needed to lock people into more sustainable travel behaviour. Soft measures support this by informing people about how to make the most of the new infrastructure.

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\(^1\) Achieving a more efficient transport system structure; reducing the need to travel overall and; using more sustainable and healthy modes of travel.
**Fig 15:** The transport footprint per capita for local authorities in Wales

**KEY**

Transport Footprint (Global Ha per capita)

- 0.78 - 0.83 gha/capita
- 0.84 - 0.88 gha/capita
- 0.89 - 0.92 gha/capita
- 0.93 - 0.97 gha/capita
Introduction

Transport makes up 18% of the total ecological footprint of Wales. This component of the ecological footprint covers personal travel behaviour and spending on transport infrastructure. This means it accounts for the direct emissions from exhausts of private and public transport as well as the resources used to build roads, lay railway tracks and keep the transport network going. It also includes the services employed to support the operation and maintenance of private vehicles. Freight travel is excluded and accounted for separately in the supply chain impact of other goods and services people buy.

Domestic and international travel by air is included in the transport footprint. For the purposes of this chapter we have separated the land and air based personal travel. This allows us to show the impact of policies on land based travel alone.

At first glance there are more measures available to encourage low footprint travel in Wales than there are to encourage low footprint housing. Tackling energy use in the home requires policy makers to focus on energy performance of the housing stock, the energy consumption of households, the nature of energy supply and achieving individual behaviour change. The footprint of personal travel can be addressed by looking at fuel efficiency, modal choice, spatial planning, integrated public transport, infrastructure efficiency, journey purpose, financial incentives... and the list goes on.

But in many ways personal travel is much more difficult to address. There are many simple changes which can be made in the home without fundamentally changing the way people live: turning appliances off standby for example. A shift in transport behaviour often requires a more radical change. Car use in Wales, as with the rest of the UK, is part of the culture and the way people travel is part of their routine. It is no easy task persuading people to change an every-day habit especially if it is perceived as more convenient, cheaper or quicker as car use often is. Transport demand tends to be relatively less reactive to changes in price compared to other consumption areas. This makes it difficult to influence with minor price incentives.

Difficulties can also arise because of a limited understanding of travel behaviour. Local and regional travel data tends to focus on congestion or the travel sector as a whole (freight and personal travel). It is more difficult to track personal travel over time and to address people’s motivations for the way they travel. This makes it challenging to target policy interventions and to predict their full impact.

The scenarios created for this chapter have been developed with the complexity of travel behaviour in mind. Rather than develop a set of policy initiatives that may cumulatively bring about a 10% reduction in the ecological footprint, we have focussed on specific interventions and specific elements of personal travel. Each scenario focuses on ‘soft measures’ – those that influence behaviour change - but there is an implicit assumption that they will be supported by complementary infrastructure changes.

The first set of scenarios look at alternative ways of introducing sustainable travel towns to Wales. These are followed by individual scenarios which focus on long distance travel, spatial planning and infrastructure efficiency. Each shows the potential for reducing the ecological footprint associated with personal travel in Wales.
Background

Many transport interventions including the promotion of regional transport planning have been devolved to the Welsh Assembly. The consultation for the Wales Transport Strategy has placed an emphasis on three themes which are central to improving the Welsh transport system:

- Achieve a more effective and efficient transport system
- Achieve greater use of the more sustainable and healthy forms of travel
- Minimise the need to travel

Underlying each theme are a number of measures which may be used to improve social, economic and environmental wellbeing in Wales. These are suggestions that support the flexible approach employed by WAG for engaging with the four regional transport consortia: SEWTA, SWITCH, TAITH and TRACC. These consortia are expected to deliver on the Welsh Transport Strategy themes but each will have its own distinctive way of doing so.

Wales has a population density of only 140 persons/km² compared with 242 persons/km² in the UK as a whole. At the same time, one quarter of households in Wales do not have a car and rely on public transport or walking and cycling. This along with a distinctive geography is a key challenge to the provision of an effective transport system in Wales.

Once the Welsh Transport Strategy has been finalised the next step is the delivery of a set of Action Plans and Regional Transport Plans. The following scenarios are designed to inform this process. They look at the impact on Wales as a whole of delivering a range of targeted plans.
A summary of the scenarios that we have developed for this report is shown in table 10. The analysis is shaped around the three Welsh Transport Strategy themes:

**Theme 1**: achieving a more effective and efficient transport system;

**Theme 2**: achieving greater use of the more sustainable and healthy forms of travel;

**Theme 3**: minimise the need to travel

Each scenario models the impact of a policy on the transport footprint per capita in Wales. The transport footprint can be broken down into the land transport footprint and the aviation footprint.

Scenarios 1-4 focus on the land transport footprint and exclude the aviation component. This is because the policies in scenarios 1-4 mostly act on road and rail travel behaviour and do not influence air travel. Air travel can have such a large impact on the footprint that changes in other sectors can be hidden. The impact of air travel is therefore considered independently in scenario 5. The term ‘transport footprint’ includes both the land and aviation components.

All the scenarios are modelled from the baseline year of 2001 to 2020. A more detailed description of the components of each scenario is provided at the beginning of each section.

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### Box 7: Factors that affect the footprint of personal travel

There are a number of factors that can influence the size of a transport footprint. The direct emissions from personal travel in Wales would be affected by the following:

- **Distance travelled per year** – travelling a greater distance increase the footprint.
- **Mode used** – some modes have more of an impact on the footprint than others, for example, aircraft and cars have a large impact, walking and cycling have very little.
- **Occupancy rate of vehicle** – improving the occupancy rates of vehicles reduces the average distance travelled over a year per person, as the total number of journeys made decreases.
- **Efficiency of cars** – travel in cars is a large component of the transport footprint (nearly 60% of the average total passenger kilometres per year in Wales) and therefore reducing the emissions per kilometre travelled can have a large impact on the footprint. (For example, the EU proposal for new cars to emit an average 140g of CO₂ per km is modelled in the underlying trends efficiency improvement scenarios).
- **Efficiency of other modes** – such as buses and trains.

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### Scenario Assumptions

Certain assumptions have been used throughout the scenarios. Each scenario details the specific assumptions of the model. The assumed growth in the Welsh population is incorporated into all of the scenarios. These population estimates are based on the Government Actuary’s Department’s national population projections for Wales and the

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### Table 10: Summary of transport scenarios

<table>
<thead>
<tr>
<th>Scenario Name and Number</th>
<th>Summary</th>
<th>Related Transport Strategy Theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline Scenario</td>
<td>Increase in distances travelled by car, train, other public transport,</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>taxi and plane. Decrease in the distance travelled on local buses.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Increasing efficiency of cars, planes and buses</td>
<td></td>
</tr>
<tr>
<td>Sustainable Travel Towns</td>
<td>Implementing a Sustainable Travel Town scheme in urban areas across</td>
<td>Theme 2 – sustainable and healthy</td>
</tr>
<tr>
<td>(1)</td>
<td>Wales</td>
<td>modes of travel</td>
</tr>
<tr>
<td>Domestic long distance</td>
<td>Changing the mode used for domestic long distance travel from car to</td>
<td>Theme 1 – more effective and</td>
</tr>
<tr>
<td>travel (2)</td>
<td>train</td>
<td>efficient transport system</td>
</tr>
<tr>
<td>Occupancy Rates of Cars</td>
<td>Increasing the average occupancy rates of cars to two people per car</td>
<td>Theme 1 – more effective and</td>
</tr>
<tr>
<td>(3)</td>
<td></td>
<td>efficient transport system</td>
</tr>
<tr>
<td>Spatial Planning (4)</td>
<td>Reducing the need to travel for all purposes (shopping, education,</td>
<td>Theme 3 – minimise the need to</td>
</tr>
<tr>
<td></td>
<td>commuting, leisure and other) through spatial planning</td>
<td>travel</td>
</tr>
<tr>
<td>The Impact of Air Travel</td>
<td>Analysing the impact of the growth of air travel on the footprint of</td>
<td>-</td>
</tr>
<tr>
<td>(5)</td>
<td>transport</td>
<td></td>
</tr>
</tbody>
</table>
Office for National Statistics 2003 mid-year population estimates.

A number of underlying trends are included in all of the scenarios. These trends are based on historical data and predictions for the future. They are important as they have a very significant impact on the footprint of transport. The two main transport trends included are an increase in the distance travelled per person and an improvement in the efficiency of vehicles.

**Vehicle Efficiency**

All of the scenarios modelled include underlying efficiency improvements in cars, buses and planes. On average cars have become approximately 10% more efficient today than they were in 1980. Based on these historical trends the efficiency of cars is forecasted to improve by 1% per year. An EU Voluntary Agreement to reduce the emissions from new cars would improve this further; potentially up to 2% per year assuming all cars are replaced by 2020. The efficiency of buses is forecast to improve by just under 0.5% per year and planes by 0.8% per year. To show the effect of different assumptions we have modelled the impact of different levels of vehicle efficiency on the transport footprint. Generally, if the mode of transport becomes more efficient the transport footprint is reduced.

**Distance Travelled**

Over a relatively short time period personal travel has increased dramatically. The average distance people travel annually has increased by about 60% in the last 30 years. On an individual basis people living in Wales today are travelling 10% further than they did 10 years ago. Changes in air travel have been even more marked; across Great Britain the distance travelled by aircraft has increased by over 230% since 1980 from 3bn passenger kilometres in 1980 to nearly 10bn in 2006.

Fig 16: Change in passenger kilometres by mode, 1961 - 2005

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22 Although the replacement rate of cars may be optimistic, the EU agreements mean that CO₂ emissions from cars are being reduced frequently and therefore the efficiency improvements may exceed the 140g/km average in the near future. For example, the European Commission has recommended that targets for a reduction to 120g/km be introduced for 2012.


24 DfT, Transport Trends 2007
The Welsh Transport Strategy Consultation Document (2006) has identified the following transport trends experienced across Wales:

- An increasing dominance of car use for all journey purposes;
- A downward trend in the use of more sustainable and healthy modes of transport, particularly walking and cycling;
- Increasing distances travelled.

These trends are the result of a variety of economic and social factors such as the falling real costs of running and owning a private car, compared to cost of public transport. Additionally, improvements in transport links mean that people can live further away from work and services.

The UK Commission for Integrated Transport\(^{25}\) discusses some of the reasons for the observed growth in distanced travelled by car in particular. It mentions the increase in disposable incomes, stable motoring costs and an increase in car ownership levels. In fact, the Commission highlights that in the UK car ownership has increased so much that the proportion of households with more than one vehicle is now higher than the proportion of households without access to a car.

Figure 16 (previous page) shows the change in passenger kilometres for road and rail between 1961 and 2005.

Alongside this is the growth in air travel. The distance travelled on domestic flights in the UK has more than doubled since 1980 and the number of passengers at UK airports has grown from 32 million in 1970 to 235 million in 2006.\(^{26}\) The growth in air travel is shown in figure 17.

All of these trends result in an increase in the footprint of transport and as the Welsh Transport Strategy Consultation Document states – “undermine the efforts to improve the quality of life for future generations in Wales”.

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\(^{25}\) Sustainable Transport Choices and the Retail Sector Advice to Government from the Commission for Integrated Transport, July 2006

\(^{26}\) Recent trends in growth of UK air passenger demand, Civil Aviation Authority, Jan 2008

![Fig 17: Change in air travel passenger kilometres, 1961 - 2005](image)
Box 8: Transport Trends Assumptions – are they reasonable?
Historically, there have been huge increases in the total distances travelled across the UK. The underlying trends used in all of the scenarios use a combination of these historical patterns and additional forecasts from the Department of Transport to predict the transport trends up to 2020. However, transport growth is dependent on a number of factors and the trends may over or under estimate the growth. Limiting factors such as the size and number of airports, the capacity of the road network, the cost of petrol or road pricing for example may all contribute to a stabilisation of trends. On the other hand, increased airport expansion, rising disposable incomes and the decentralisation of services may result in a more dramatic increase in the average distances travelled per person. For these reasons the Department for Transport re-estimates transport forecasts on an annual basis.

Box 9: Historical Changes in Mode
Since the 1950s the most commonly used mode of travel has changed. In Great Britain in 1952 over 40% of the total distance people travelled was by bus or coach. By 1997 this had declined to under 10%. A similar pattern occurred for rail use. The percentage of the total distance for which a car, van or taxi was used has however increased from just below 30% to over 85%. This pattern, along with the overall increase in distance travelled has contributed to a considerable increase in the footprint from the transport sector.27

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Scenarios and Analysis

BASELINE SCENARIO

In 2001 the average person in Wales travelled a total distance of 12,500 kilometres; over half of this distance was travelled by car. 26% of the total distance was from international air travel and the remaining 17% was from other forms of transport including rail, taxi and bus. (This does not include the distance travelled by walking and cycling). Using our projections the average distance travelled per person per year will have increased significantly to approximately 17,000 kilometres by 2020.

The forecasted growth in road and rail travel in this report is largely based on historical trends monitored by the Department for Transport (DfT) in the National Travel Survey and additional forecasts where appropriate. It is assumed that the historical trends continue on a similar path. Estimates from the UK Air Passenger Demand and CO\textsubscript{2} Forecasts indicate that international air travel will continue to grow by 4.5% every year and domestic flights will increase by 3.6% annually across the UK. The forecasted annual percentage increases in distance travelled assumed between 2001 and 2020 are shown in table 11.

Table 11: % change per year in distance travelled between 2001 and 2020

<table>
<thead>
<tr>
<th>Mode</th>
<th>% change per year in distance travelled between 2001 and 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>0.7%</td>
</tr>
<tr>
<td>Local Bus\textsuperscript{1}</td>
<td>-0.5%</td>
</tr>
<tr>
<td>Taxi</td>
<td>3%</td>
</tr>
<tr>
<td>Train</td>
<td>4%</td>
</tr>
<tr>
<td>Other public transport</td>
<td>2.5%</td>
</tr>
<tr>
<td>International air travel</td>
<td>4.5%</td>
</tr>
<tr>
<td>Domestic air travel</td>
<td>3.6%</td>
</tr>
</tbody>
</table>

\textsuperscript{1} the only mode with predicted decline.

Table 12 and figure 18 (next page) show the projected change in distance travelled by mode from 2001 to 2020 as a result of the trends detailed above.

Table 12: Projected change in distance travelled by mode from 2001 to 2020

<table>
<thead>
<tr>
<th>Mode</th>
<th>Average distance travelled per person per year in Wales in 2001 (km)</th>
<th>Average distance travelled per person per year in Wales in 2020 (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>7,162</td>
<td>8,213</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>63</td>
<td>63</td>
</tr>
<tr>
<td>Other private transport</td>
<td>784</td>
<td>784</td>
</tr>
<tr>
<td>Local bus</td>
<td>285</td>
<td>257</td>
</tr>
<tr>
<td>Non-local bus</td>
<td>135</td>
<td>135</td>
</tr>
<tr>
<td>Taxi</td>
<td>72</td>
<td>120</td>
</tr>
<tr>
<td>Train</td>
<td>525</td>
<td>1043</td>
</tr>
<tr>
<td>Other public transport</td>
<td>150</td>
<td>248</td>
</tr>
<tr>
<td>International air travel</td>
<td>3,265</td>
<td>6,056</td>
</tr>
<tr>
<td>Domestic air travel</td>
<td>77</td>
<td>129</td>
</tr>
<tr>
<td>Total</td>
<td>12,519</td>
<td>17,049</td>
</tr>
</tbody>
</table>

\textsuperscript{28} DfT Road Transport Forecasts for England 2007, DfT transport model and DfT Transport Trends 2007

\textsuperscript{29} DfT UK Air Passenger Demand and CO\textsubscript{2} Forecasts, Nov 2007
Baseline Scenario Results

- With the just the underlying trends, the land transport footprint increases by 15% between 2001 and 2020, shown in figure 19.

- If efficiency improvements similar to those of the past 20 years are included the land transport footprint increases by only 6% by 2020.

- The growth in car travel could almost be offset, if the EU Voluntary Agreement achieves an average car efficiency level of 140g/km of CO$_2$. However, this model assumes that all cars are replaced by
2020, which is an optimistic assumption. Also, the footprint per capita does rise again after 2016 as the increasing travel trends start to counteract any further improvements.

The Impact of Air Travel
Estimates of the transport footprint trends have so far excluded aviation. The transport footprint per capita is higher when air travel is included because the distance travelled per person increases when flights are included as shown in figure 20.

- Aviation efficiencies are expected to decrease fuel consumption by 0.8% per year, but even with this improvement the transport footprint per capita still increases by 12% between 2001 and 2020.
- The reductions in the footprint as a result of car efficiencies have less of an impact when aviation is included in the analysis. Even with the ambitious EU Voluntary Agreement for car efficiencies and improvements in aviation efficiency the transport footprint still increases by 7%.

This analysis demonstrates that improvements in transport technology will help to slow the growth of the transport footprint. However, technology alone will not be enough to counteract the trends of increasing travel.

Currently, even with efficiency improvements, the transport footprint is predicted to increase by an average of 0.7% per year. If the transport footprint per capita is to be stabilised or reduced, personal travel behaviour must be addressed.
The Welsh Assembly Government recently released a publication called “Smarter Choices: Wales” (February, 2007). This is a guide to initiatives that can be used to change personal travel behaviour, such as travel planning at schools and workplaces, car sharing and car clubs and travel awareness campaigns. Research has shown that these types of measures have influenced people’s travel choices and helped to reduce congestion and pollution in some areas.

In 2004 the UK government launched a Sustainable Travel Towns project where three demonstration towns (Peterborough, Worcester and Darlington) were selected to receive support for the sustained implementation of a package of Smarter Choices measures and infrastructural improvements, over a period of five years. The impact of the Sustainable Travel Town initiative was measured and there was found to be a significant change in travel behaviour across all of the demonstration towns, with increases in walking, cycling and the use of public transport and decreases in car use.

The Welsh Assembly Government has planned to “work with the regional transport consortia to select the four towns in the Sustainable Travel Towns initiative and to develop detailed proposals for each.”

In order to explore the impact of this policy on the average footprint in Wales the following scenarios compare the implementation of the Sustainable Travel Towns initiative in different groups of towns/cities:

- One large urban area in each transport region – Cardiff, Swansea, Abergele and Aberystwyth
- Four large urban areas – Cardiff, Swansea, Newport and Pontypool
- In all the urban areas with a population over 10,000 people.

Some urban areas are included in all of the groups, for example, Cardiff and Swansea are in the largest urban area group and also in different transport regions, so included in that group. They are also both urban areas over 10,000 people, so are in the final group as well.

Using a different combination of towns will help to investigate where this initiative could be most effective.

**The effectiveness of Sustainable Travel Towns**

One of the main elements of the Sustainable Travel Town initiative is the implementation of a town-wide individualised travel marketing scheme. This was successfully applied in the demonstration Sustainable Travel Towns in 2004/05 in England and the results from those towns are used to predict the impact on the transport footprint in Wales.

We have modelled the impact of the schemes starting in 2009, continuing through to 2020. The model assumes that the people who change their behaviour as a result of the initiative continue with the same travel behaviour every year, resulting in a standard reduction in the short distances travelled in that town or city. (Table 14 on the next page, shows the proportion of the Welsh population affected by each policy.)

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30 Further information about the Sustainable Travel Town scheme can be found on the Department for Transport website at: http://www.dft.gov.uk/pgr/sustainable/demonstrationtow ns/sustainabletraveldemonstrati5772

31 The Deputy First Minister and the Minister for the Economy and Transport (Ieuan Wyn Jones)

32 All urban area population data is taken from the Census. The urban areas geography consists of major urban agglomerations, cities, and smaller towns defined in terms of their physical extent rather than by any administrative boundaries. Urban areas have been defined starting with the Office of the Deputy Prime Minister’s areas of urban land use - areas in England and Wales of at least 20 hectares in extent identified using a tangible bricks-and-mortar approach. Then Census Output Areas have been fitted to the boundaries of the urban land. (Nomis, Office of National Statistics).

33 Different groups of the population are targeted and given rewards, incentives and travel information packs to change their travel behaviour. Home visits and surveys are included. For example, Worcester implemented a ‘Choose how you move’ marketing campaign targeting 6,300 private residential households. Similar programmes were also completed in workplaces and schools.
The underlying trends of increasing travel and efficiency improvements are still applied to the rest of the population in Wales.

An example of the changes in transport behaviour achieved as a result of the Sustainable Travel Town individualised travel marketing initiative are shown in table 13 (this particular data is taken from the Darlington scheme report34):

They successfully reduced the number of trips taken by car and increased walking, cycling and the use of public transport. These results, along with the results for Worcester and Peterborough were used to model the impact of similar schemes in Welsh towns and cities.

### Table 13

<table>
<thead>
<tr>
<th>Mode</th>
<th>Change in number of trips following implementation of individualised travel marketing scheme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Walking</td>
<td>+ 14%</td>
</tr>
<tr>
<td>Cycling</td>
<td>+ 19%</td>
</tr>
<tr>
<td>Motorbike</td>
<td>n.a.</td>
</tr>
<tr>
<td>Car Driver</td>
<td>- 6%</td>
</tr>
<tr>
<td>Car Passenger</td>
<td>- 16%</td>
</tr>
<tr>
<td>Public Transport</td>
<td>+ 9%</td>
</tr>
</tbody>
</table>

We have assumed that once the change in transport behaviour has been established in the town with the Sustainable Travel Town initiative it continues every year following the implementation.

### Results of Sustainable Travel Towns Scheme

The outcomes of this modelling are shown in figure 21. Only the impacts on road and rail transport are shown, air travel is not included as this initiative is aimed at short distance local travel. The impacts of air travel are considered at the end of the chapter (page 50). The main findings are as follows:

- The largest change in the per capita transport footprint comes from implementing Sustainable Travel Town measures in all of the larger urban areas (areas over 10,000 people) in Wales. In this scenario the per capita transport footprint from road and rail decreases by 0.7 % over 19 years from 2001.

- The impact of the scheme is apparent immediately in 2010 after its implementation in 2009. By 2010 in the ‘one urban area in each transport region’ scenario for example, the footprint per capita across Wales is 1.5% lower than the baseline in 2001.

- After the initial reduction from the scheme in 2010 the underlying trends of increasing travel cause the per capita footprint to rise again. By 2020 in both the ‘four largest urban areas’ and the ‘one in each transport region’ schemes, the transport footprint has increased above the 2001 level. Although, this increase is significantly lower than if the trends continue with no intervention. This demonstrates the importance of instigating the policy as soon as possible.

### Table 14: Change in land transport footprint per capita, Sustainable Travel Town results

<table>
<thead>
<tr>
<th>Policy</th>
<th>Percentage 2020 population included in each scenario</th>
<th>Change in land transport footprint per capita from 2001 – 2020 (without domestic and international aviation impacts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underlying trends (including efficiency improvements)</td>
<td>100%</td>
<td>6.2 % increase</td>
</tr>
<tr>
<td>One large urban area in each transport region</td>
<td>23%</td>
<td>2.1 % increase</td>
</tr>
<tr>
<td>Four largest urban areas in Wales</td>
<td>28%</td>
<td>1.6 % increase</td>
</tr>
<tr>
<td>All urban areas over 10,000 people</td>
<td>43%</td>
<td>- 0.7 % decrease</td>
</tr>
</tbody>
</table>

The Potential for Sustainable Travel Towns

It is difficult to predict the exact impact of a behavioural change programme such as the Sustainable Travel Towns project. However, in all three demonstration towns in England (Peterborough, Worcester and Darlington) there was a shift from car use to public transport, walking and cycling. On average there was a 13% reduction in car trips and walking and cycling was up by around 22%.

A Sustainable Travel Town Scheme may have additional benefits, such as a reduction in congestion or localised pollution. People may also re-consider long distance journeys and the mode of transport they choose as well as adjust their short distance trips.

This type of scheme may also have improved success over a number of years as the provision of supporting infrastructure is enhanced (with cycle paths, pedestrianised areas, better spatial planning for example). In addition, increasing funding for supplementary initiatives may also improve the success rate of the scheme. Darlington for example was also awarded Cycling Demonstration Town status and set up an additional ‘Pedestrian Heart’ scheme.

Sustainable Travel Town schemes are an effective way to reduce the short distance travelled by car in towns and cities. The benefits could be even greater if this type of policy is combined with travel reduction focused spatial planning. The impact of this is analysed in the Spatial Planning section starting on page 49.

The daily travel choices made by individuals are an important component of the transport footprint, however, the distance and mode used for one off longer journeys is also important and can have a significant impact on the transport footprint per capita. The next scenarios have therefore been constructed to give an indication of the impact of long distance travel, reducing the overall need to travel and increasing the occupancy rates of vehicles.

SCENARIO 2: DOMESTIC LONG DISTANCE TRAVEL

In Great Britain 94.8% of trips are short distance trips (of 40 km or under) and only 2.1% are long distance (80 km or over). However on average, 25% of the overall distance travelled per person per year is completed in long distance trips.\(^\text{35}\)

According to the National Travel Survey of Great Britain the vast majority of long distance trips are made by car (83%), a further 10% are made by rail, just fewer than 5% by bus and coach, 1% by air and 1.5% by other modes.
For very long trips (over 560 km) air travel has become increasingly popular, increasing from 18% of very long trips in 1996-2001 to 39% in 2006 (this includes only those trips within Great Britain, no international travel is included)\(^\text{36}\).

**Long distance travel assumptions**

Assuming that the trends continue as predicted in the underlying trends, the average distance travelled per person in Wales by 2020 would be 17,000 km. Just over 3,000 km of this would be travelled on domestic long distance trips (not including international flights).

The predicted average distance travelled per person per year on long distance trips in Wales by mode is shown in table 15. This excludes international air travel.

This scenario models the impact of one third of the population of Wales changing their transport modes for long distance travel; reducing the proportion of long distance travel by car by 15% and switching this to train. As a result the average distance travelled by train per person per year rises and the distance by car falls.

The assumptions for this set of scenarios are as follows:

- The overall distance travelled increases in line with the underlying trends.
- There is no additional increase in travel as a result of the policy; rail is used as an alternative for journeys that would have been made by car, with train occupancy rates increasing from 26% to 50% by 2020\(^\text{37}\).

**Results for domestic long distance travel**

Table 16 shows the percentage change in the transport footprint per capita by 2020 as a result of one third of the population switching from car to train for 15% of their long distance trips and an increase in occupancy rates of trains. International air travel is excluded from the scenario, but domestic air travel is included.

<table>
<thead>
<tr>
<th>Policy</th>
<th>Change in per capita transport footprint from 2001 – 2020 (without international air travel impacts)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underlying trends</td>
<td>6.4 % increase</td>
</tr>
<tr>
<td>Modal shift with increase in train occupancy</td>
<td>2.6 % increase</td>
</tr>
</tbody>
</table>

Changing the mode of transport used for long distance travel from cars to trains and increasing the occupancy rate of trains reduces the increase in per capita transport footprint to 2.6% by 2020. This is 3.4% below what it would have been in 2020 with underlying trends and no intervention.

Increasing the occupancy rates on trains is very important. Shifting the mode of travel from cars to train will have little impact if new train services have to be run.

**Table 15: Long distance travel modal split**

<table>
<thead>
<tr>
<th>Mode</th>
<th>Domestic Long Distance km in 2020</th>
<th>Original Modal Split in 2020</th>
<th>Modal split following shift by 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>1864</td>
<td>62%</td>
<td>47%</td>
</tr>
<tr>
<td>Other private transport</td>
<td>284</td>
<td>9%</td>
<td>9%</td>
</tr>
<tr>
<td>Non-local bus/coach</td>
<td>108</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Taxi</td>
<td>16</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Train</td>
<td>478</td>
<td>16%</td>
<td>31%</td>
</tr>
<tr>
<td>Other public transport</td>
<td>135</td>
<td>4%</td>
<td>4%</td>
</tr>
<tr>
<td>Domestic air travel</td>
<td>129</td>
<td>4%</td>
<td>4%</td>
</tr>
</tbody>
</table>

36 National Travel Survey, DfT 2006

37 The baseline occupancy rate (26%) is based on UK figures and may be lower than the present occupancy rate in Wales.
The potential for a modal shift in domestic long distance travel

Changing the mode and occupancy of long distance domestic travel does have an important impact on the footprint per capita, but the footprint continues to rise due to the underlying trends of increasing distances travelled.

Wales has a number of aims and aspirations for the transport sector that, if delivered with the impact on the transport footprint in mind, could encourage modal shift for long distance travel (increasing the use of trains and reducing the need for cars). There is the danger however, that some policies may just increase long distance travel on all modes and therefore have an adverse impact on the footprint.

For example, the economic aims in the Wales Transport Strategy Consultation Document state that:

- “We will invest to develop strategic road and rail networks, giving priority to the ‘strategic gateways’ to Wales.”
- “We will support a new intra-Wales air service, as well as international flights which improve business connectivity and encourage inbound tourism.”

Delivering these aims could promote an increase in long distance travel, which would in turn increase the transport footprint.

Other aims detailed in the Transport Strategy do however, promote a reduction in travel and a shift in mode. These if delivered would have a beneficial impact on the transport footprint. For example:

- “We will make sure that the potential for new technology is fully exploited to minimise the need for people to travel.”

This policy could include the promotion of teleconferencing, broadband and home working which may reduce the need for both short and long distance trips.

- “We will use new technology to improve the information available for transport users and thereby seek to make the most of our existing services.”

Improving the existing structure and information available to the users would be an important part of encouraging modal shift and increased occupancy rates.

Fig 22: Transport footprint per capita, modal shift for long distance travel
SCENARIO 3: OCCUPANCY RATES

Increasing the occupancy rates of vehicles has a similar impact on the land transport footprint as improving vehicle efficiencies. The operating efficiency of a car has a direct impact on the emissions from that vehicle; occupancy rates indicate how efficiently the existing infrastructure is being used.

The Welsh Assembly Government has recognised the importance of structural efficiency and occupancy rates in the Transport Strategy; Theme 1 aims to achieve: “greater efficiency in terms of vehicle technology, as well as seeking more efficient use of available infrastructure (for example achieving higher capacity on some existing routes).”

Improving the occupancy rate implies that the infrastructure becomes more efficient, using the existing network to carry more passengers. The importance of this was highlighted in the previous section, which clearly demonstrated that the benefits of a modal shift from cars to trains are only apparent if occupancy rates are increased.

Historical Trends of Occupancy Rates

The principle of making infrastructural efficiencies by increasing occupancy rates of trains is also applicable to cars – increasing their occupancy rates to use the existing road network more efficiently. Over the past ten years the occupancy rate in cars across Great Britain has remained fairly stable at around an average of 1.6 people per vehicle, however over the longer term occupancy rates have declined. Changes in demography have impacted on traffic levels, with for example, the number of households with one car increasing and the average household size becoming smaller resulting in a fall in car occupancy rates.

Average vehicle occupancy rates for the UK are shown in table 17. The figures are shown as a percentage; cars for example, have an average occupancy of 31% per journey (carrying an average of 1.56 people, with an average five person car). Planes by comparison are nearly 70% full on an average journey.

In this scenario we assume a change in occupancy rate of cars as a result of policies such as car sharing schemes or multiple occupancy lanes. The model shows the impact of increasing the average car occupancy in Wales to two people per car, for all purposes, resulting in a change in the average occupancy rate from 31% in 2001 to 40% in 2020.

Table 17

<table>
<thead>
<tr>
<th>Mode</th>
<th>Average Occupancy Rate (2001)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>31%</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>55%</td>
</tr>
<tr>
<td>Other private transport</td>
<td>50%</td>
</tr>
<tr>
<td>Local bus</td>
<td>20%</td>
</tr>
<tr>
<td>Non-local bus</td>
<td>27%</td>
</tr>
<tr>
<td>Taxi</td>
<td>34%</td>
</tr>
<tr>
<td>Train</td>
<td>26%</td>
</tr>
<tr>
<td>Other public transport</td>
<td>50%</td>
</tr>
<tr>
<td>International air travel</td>
<td>69%</td>
</tr>
<tr>
<td>Domestic air travel</td>
<td>69%</td>
</tr>
</tbody>
</table>

Results of a change in occupancy rates

Increasing the occupancy rate of cars from a current average of 1.6 people per journey to two people per journey is an ambitious aim. However, if it is achieved it would reduce the footprint by nearly 7%, by 2020 (see table 18 on the next page).

The scale of this policy is large - it assumes a change in average occupancy across the whole of Wales. Consequently, large reductions in the footprint are achieved compared to those policies modelled on a smaller scale.

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38 Sustainable Transport Choices and the Retail Sector Advice to Government from the Commission for Integrated Transport, July 2006

39 Data taken from REAP.
The potential for increasing occupancy rates of cars

Car sharing and increasing occupancy rates can be achieved through behaviour change. This behavioural change can be influenced through marketing policies and education.

Structural changes such as the creation of high occupancy vehicle lanes would further encourage an increase in occupancy rates.

There are numerous local initiatives such as car clubs and workplace travel plans that could be funded in order to increase the occupancy rates of cars.

In order to achieve the reductions modelled in this scenario policies must be implemented across the whole of Wales. They must affect the national average occupancy rate.
SCENARIO 4: SPATIAL PLANNING

Spatial planning and the way towns or cities are designed can have a huge impact on the distance people travel for commuting, shopping and leisure.

The vision of the Wales Spatial Plan (2004) is to;

- Sustain communities by tackling the challenges of population and economic change.
- Grow in ways which will increase competitiveness and spread prosperity.
- Reduce negative environmental impacts.
- Enhance the natural and built environment and well-being.
- Sustain distinctive identity.

Spatial planning and transport can have a major influence over a number of these aims. For example, reducing the need to travel for work could have a positive impact on quality of life and well being. Enhancing service accessibility may help spread prosperity and tackle social exclusion. Planning towns and cities in a way that minimises the need to travel will also have numerous benefits for the environment, reducing localised pollution and congestion.

The Welsh Assembly Government has highlighted the importance of spatial planning in the Transport Strategy; recognising the contribution that land use planning makes to reducing the need to travel and minimising the number of journeys made.

Historical trends in planning

Historically a change in the way towns are organised and services are provided has led to a change in travel behaviour that has resulted in an increase in distance travelled. Shopping habits for example have changed considerably over the past forty years, as emphasised by the Office for National Statistics below:

“Until the 1960s the majority of people relied on public transport to get them to work and for leisure and shopping journeys. The most convenient place to shop, therefore, was the town or village centre. As car ownership has increased, town centres with their restricted parking facilities and traffic jams have become less attractive. This led to the development of out-of-town supermarkets, shopping centres, leisure complexes and park and ride facilities. This phenomenon first took off during the mid-1980s and, at its peak in 1989, 74 new out-of-town shopping developments, retail warehouse parks and factory outlet centres (whose size were 4,645m² and greater (gross) were completed in Great Britain).”

UK trends in personal travel from the DfT show that the average trip length for all purposes has increased by one third since the 1980s. Part of this increase will be due to changes in spatial planning such as the emergence of out of town shopping centres, along with increases in distances travelled for commuting as people live further away from workplaces.

The concept of a compact city, with short distances between residential areas, working and shopping locations could therefore provide significant reductions in the transport footprint of the local population. This scenario models the impact of reducing the need to travel by one third for all purposes (work, leisure, shopping, school and other incl. medical etc.) in four large urban areas in Wales – Cardiff, Swansea, Newport and Pontypool.

Results of spatial planning policies

Reducing the need to travel in four large urban areas means that the land transport footprint increases by 2.6%, compared to a 6.2% increase with no interventions (just the underlying trends). This is shown in table 19.

Achieving a reduction of one third across four large urban areas may be an optimistic

<table>
<thead>
<tr>
<th>Policy</th>
<th>Change in per capita transport footprint from 2001 – 2020 without air travel impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underlying trends (including efficiency improvements)</td>
<td>6.2 % increase</td>
</tr>
<tr>
<td>Reducing the need to travel for all purposes in four large urban areas</td>
<td>2.6 % increase</td>
</tr>
</tbody>
</table>

40 Office for National Statistics, ONS
41 Department for Transport, National Travel Survey 2006
assumption, however not unrealistic. In Groningen in the Netherlands for example, 66% of all journeys are made by walking or cycling as a result of incorporating environmental criteria into traffic control policy and the creation of an infrastructure favouring bicycles.42

A study by Meurs and Haaijer (Aug 2001) investigated the relationship between spatial planning and travel. It concludes that the characteristics of the spatial environment appear to have a demonstrable relationship with mobility and choice of mode of transport. The study found that nearly 40% of the total number of trips could be related to personal location and environmental characteristics. More than 30% of trips made for shopping were influenced by the residential environment.43

The Potential for Spatial Planning

Towns and cities are constantly changing, undergoing development and regeneration. As a result there is regular opportunity to plan and design areas in such a way that the transportation required is minimised or reduced. The Wales Transport Strategy Consultation Document emphasises the role of planning highlighting how the land use planning system can alter travel patterns, promote sustainable travel and contribute to environmental improvements, by guiding the location of new development and controlling change of use.

To successfully reduce the need to travel planning must aim to bring destinations closer to origins, maintain a high density of smaller local facilities, and favour development in locations which can be well served by public transport and local access.44

There is a lot of scope to develop towns in a way that reduces the need to travel. This would not only reduce the transport footprint, but could also have a very positive impact on quality of life and reducing inequalities between communities – a key aim of the Wales Spatial Plan.

SCENARIO 5: THE IMPACT OF AIR TRAVEL

Historical Trends

The analysis has so far excluded the impact of air travel on the transport footprint. It was briefly explored in the long distance travel section, where domestic flights were included in the final footprint figures. However, the distance travelled on domestic flights is relatively minor compared to the distance covered on international flights, which accounts of over one quarter of the total distance travelled per person per year in Wales.

The underlying trends scenario gave an indication of the historical and forecasted trends for air travel across the UK. Over the past 10 years the number of passengers travelling through UK airports has grown by an average of 7.3% per year. The distance people travel by air has also increased as figure 24 shows (next page).

For Wales in particular; Cardiff International Airport has grown faster in terms of passenger traffic than the average of UK regional airports over the past decade. The number of passengers moving through Cardiff Airport trebled between 1991 and 2000 with an average growth of 12.7% per year.45

This may increase further in the future, with the proposed expansion of airports in Wales and the development of the Intra-Wales air service. The Welsh Assembly Government is currently looking into the feasibility of establishing a tourism-based and business investment marketing scheme to attract new air routes to and from Wales. In addition, a new air service between Anglesey and Cardiff commenced on the 8th May 2007.

The Welsh Assembly Government considers that the service is essential for the economic development of north-west Wales, providing

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42 Towards a low footprint Scotland, SEI, March 2007, further details can be found on the European Academy of the Urban Environment website (www.eaue.de).

43 Spatial structure and mobility Henk Meurs and Rinus Haaijer, August 2001.


45 Department for Transport, The future development of air transport in the UK: Wales (summary)
improved business connectivity, new tourism opportunities and reduced journey time. However, the rapid growth in the aviation sector has a number of implications for:

- People who live close to airports or under their flight paths
- The built and natural environment
- Surface access services and infrastructure

There are a number of impacts of air travel growth including: an increase the number of people exposed to aircraft noise; and an increase in emissions, contributing to local air pollution and global warming. There may also be localised transport problems with increased congestion and pollution from people travelling to and from the airports.

**The Contribution of Air Travel to the Transport Footprint**

The impact of air travel on the transport footprint is displayed in figure 25. In 2001 including the impact of air travel increases the transport footprint per capita by around 14%. By 2020 after the trends are applied the difference between the transport footprint with and without air travel is over 20%.

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46 Department for Transport, The future development of air transport in the UK: Wales (summary)

47 Department for Transport, The future development of air transport in the UK: Wales (summary)
Proportionally, transport excluding air travel makes up around 90% of the transport footprint. However, by 2020 air travel is predicted to make up nearly 17% of the footprint and with all other modes making up the remaining 83%.

**The Effect of Air Travel on the Scenarios**

So far the scenarios have excluded air travel. When air travel is incorporated into the modelling the policy interventions have less of an impact on the overall transport footprint per capita.

Despite this, the policy interventions for road and rail transport are very important for a number of reasons:

- The footprint per capita would increase even more without them.
- Sustainable transport systems and reducing the need to travel have many additional benefits including reducing local level pollution and congestion and improving access to services and quality of life.
- Changing the modal split for long distance travel by encouraging train use and an increase in occupancy rates may help to reduce the demand for domestic air travel.
- Increasing the occupancy rates for cars will help to reduce congestion and stem the growth in overall distances travelled by car.

Table 20 shows the impact of all the scenarios on the transport footprint, with and without the impact of air travel. Policies that decrease the road and rail footprint per capita by 2020 will not decrease the transport footprint when air travel is included.

Increasing car occupancy rates has the greatest impact on the transport footprint per capita, both with and without air travel. The decrease of the land component of the transport footprint is considerable at -6.6%. However, this policy does assume that the average occupancy rate for all car journeys across Wales will increase to two people per car by 2020.

<table>
<thead>
<tr>
<th>Policy</th>
<th>Change in transport footprint per capita from 2001 – 2020 excluding air travel</th>
<th>Change in transport footprint per capita from 2001 – 2020 including domestic and international aviation impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underlying trends (including efficiency improvements)</td>
<td>6.2 % increase</td>
<td>12.3 % increase</td>
</tr>
<tr>
<td>Sustainable travel towns: One large urban area in each transport region</td>
<td>2.1 % increase</td>
<td>9 % increase</td>
</tr>
<tr>
<td>Sustainable travel towns: Four largest urban areas in Wales</td>
<td>1.6 % increase</td>
<td>8.6 % increase</td>
</tr>
<tr>
<td>Sustainable travel towns: All urban areas over 10,000 people</td>
<td>- 0.7 % decrease</td>
<td>6.7 % increase</td>
</tr>
<tr>
<td>Long distance travel: Modal shift with increase in train occupancy</td>
<td>2.6 % increase*</td>
<td>9.2 % increase</td>
</tr>
<tr>
<td>Increase car occupancy rates to an average of 2 people per car</td>
<td>-6.6 % decrease</td>
<td>1.8 % increase</td>
</tr>
<tr>
<td>Reducing the need to travel: for all purposes in four large urban areas</td>
<td>2.6 % increase</td>
<td>9.4 % increase</td>
</tr>
</tbody>
</table>

* this increase is slightly higher as it includes domestic air travel.
As an example of the impact of air travel on our scenarios figure 26 shows the change in transport footprint per capita with and without aviation impacts following an increase in car occupancy. When air travel is included the footprint still increases, but only by 1.8%.

Although air travel has a considerable impact on the transport footprint, it is very important to recognise the necessity of policies to reduce the footprint of road and rail. They are vital for preventing even greater increases in the transport footprint and delivering many additional benefits such as a reduction in congestion, local pollution and improved accessibility and quality of life.

Policies that encourage the use of air travel domestically and internationally should be implemented with the knowledge that the growth of air travel could have a significant impact on the ecological footprint of transport.

![Fig 26: Transport footprint per capita, increased car occupancy rates with and without aviation](image-url)
The key themes in the Welsh Transport Strategy are supportive of a lower footprint transport system. As demonstrated by the scenario modelling, achieving a more efficient transport system structure, reducing the need to travel overall and using more sustainable and healthy modes of travel will have great benefits for individual’s land transport footprint.

In comparison to other components of the ecological footprint, such as housing, the impact of transport policy can be ambiguous. Many of the measures are associated with behavioural change, rather than physical changes to the build of a house for example, and it is therefore difficult to guarantee that measures would be effective. This analysis has demonstrated however, that if measures such as the Sustainable Travel Towns initiative are implemented they can have a large impact on the trends for increasing travel.

A summary of all of the most effective scenarios modelled in this chapter is shown in table 21. The scenarios have demonstrated the impact of specific schemes such as the Sustainable Travel Town initiative, but also the changes in transport footprint achievable with different changes to personal travel behaviour. The table is ordered from the policy with least impact on the footprint per capita to the policy with the most impact.

It is important to note that the coverage of each of the interventions varies. For example, the Sustainable Travel Towns is only implemented in four cities in Wales, where as the increase in occupancy rates scenario assumes that the average occupancy rate for the whole of Wales will increase.

### Table 21: Summary of the impact of the most effective transport scenarios

<table>
<thead>
<tr>
<th>Scenario</th>
<th>The travel behaviour that is effected/ scale of policies</th>
<th>Change in transport footprint per capita from 2001 to 2020 (excluding aviation)</th>
<th>Change in transport footprint per capita from 2001 to 2020 (including aviation)</th>
<th>Examples of policies available (taken from the Welsh transport Strategy consultation document)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underlying trends – no intervention</td>
<td>All</td>
<td>6.2 % increase</td>
<td>12.3 % increase</td>
<td>Identifying areas of poor access&lt;br&gt;Understanding reasons for poor access&lt;br&gt;Land use planning&lt;br&gt;Multi-disciplinary teams</td>
</tr>
<tr>
<td>Reducing the need to travel</td>
<td>Short and long distances, but not flights</td>
<td>2.6 % increase</td>
<td>9.4 % increase</td>
<td>Demand management measures&lt;br&gt;Public transport services&lt;br&gt;Safety measures&lt;br&gt;Cross boundary working&lt;br&gt;Seamless interchange</td>
</tr>
<tr>
<td>Domestic long distance travel shift from cars to trains (and increased occupancy rates on trains)</td>
<td>Average long distances travelled across Wales</td>
<td>2.6 % increase</td>
<td>9.2 % increase</td>
<td>Smarter choices, travel planning and publicity&lt;br&gt;Improving walking and cycling infrastructure&lt;br&gt;Environmental project management</td>
</tr>
<tr>
<td>Sustainable Travel Towns (one in each transport region)</td>
<td>Short distance travel in four towns in Wales</td>
<td>2.1 % increase</td>
<td>9 % increase</td>
<td>Traffic management&lt;br&gt;Road space reallocation&lt;br&gt;Stringent demand management measures</td>
</tr>
<tr>
<td>Increasing average occupancy rates of cars to 2 people per car</td>
<td>Average car occupancy across Wales</td>
<td>-6.6 % decrease</td>
<td>1.8 % increase</td>
<td></td>
</tr>
</tbody>
</table>
The impact of individual policies will depend on their coverage (geographically and in travel behaviour terms) and effectiveness; generally the greater the coverage across Wales the greater the impact on the average transport footprint per capita.

The impact is also influenced by the transport sector tackled. For example, the occupancy rate scenario affects all types of travel, short and long distance for all purposes. The long distance scenario however, only considers the long distance proportion of travel and therefore has less of an impact on the transport footprint.

It is important to measure and understand personal travel behaviour rather than just traffic or rail as sectors. The individual’s transport footprint is determined by the travel choices that the person makes on a daily basis. Designing towns or cities and their transport systems in a way that encourages use of the lowest impact forms of transport such as cycling or walking and discourages the use of cars will have considerable benefits for the transport footprint in Wales.

Overall, a package of initiatives tackling different areas of travel behaviour will be required to reduce the transport footprint. It is particularly important that the Welsh Assembly Government encourages, recognises and champions individual changes, as behavioural change is essential for any reduction in the transport footprint. Policies must be aligned to encourage a change in behaviour, supported by improvements to the transport infrastructure.
Key Messages

- Food accounts for 20% of the ecological footprint in Wales. Other food related activities create an additional impact on the ecological footprint of travel and energy. These include cooking, refrigeration and travel to the shops.

- The supply chain accounts for the largest proportion of the ecological footprint associated with food consumption activities. This means that people’s food purchasing decisions have significant impacts on the ecological footprint as a whole. One of the most effective ways of reducing the ecological footprint of food is to not purchase any food that would normally be wasted. SEI’s food waste reduction scenario reduces the ecological footprint of food by 7.2% on a per capita basis.

- Eating out and expenditure on catering has a large impact on the ecological footprint of food. People in the UK now eat out more than ever, it has been estimated that this requires up to 10 times the energy of eating at home.
Fig 27: The food footprint per capita for local authorities in Wales
The Food component of the ecological footprint incorporates the consumption of food and drink in the home as well as the purchase of alcoholic beverages, restaurant meals, catered meals and take-away meals outside the home. It measures the material and energy use associated with food consumption through the supply chain. This is sometimes described as from ‘farm to fork’ and includes the impacts associated with farming, processing, packaging and freight distribution (food miles).

The food supply chain accounts for the largest proportion of the ecological footprint by itself, but other food related activities also have an environmental impact. Recent estimates suggest the food chain contributes 18% of total UK greenhouse gas emissions when household food waste, cooking, storage and travel to the shops is also taken into account.

Typically, agriculture accounts for the greatest proportion of environmental pressures associated with the food supply chain but this differs from product to product and food related household activities are also important. Households produce more food waste than hotels and restaurants, food manufacturers and retailers combined48. Cooking activities account for 2.5% percent of energy use in the home and food shopping accounts for approximately 10% of all trips by UK households.

Cooking and food shopping activities are typically accounted for in the energy and transport components of the ecological footprint but this chapter takes them into account as well as providing a narrower food supply chain focus. The analysis in this chapter covers the following issues:

- **Patterns of food consumption**
  Three individual footprint profiles are provided here based on the Welsh Assembly segmentation of environmental behaviours. For each profile a food footprint has been calculated based on the diet, cooking behaviour and travel choices of the individual.

- **Waste reduction and production efficiency**
  A recent Cabinet Office discussion paper has described existing patterns of food production as 'not fit for a low-carbon, more resource constrained future'. This section looks at how food waste reduction in the home and efficiency improvements in the entire food supply chain could reduce the food footprint of Wales up to 2020.

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Food policy warrants a joined up approach at every stage of the supply chain. What people eat, and how they eat it, has implications for personal nutrition, public health and waste management. How food is produced, distributed, and sold has an implication for landscape, the rural economy, and the accessibility, availability, and choice of food. The WAG is working on an action plan which will bring together food production, processing, distribution, retailing, education, consumption, and waste policy issues, and so meet policy goals on public health, social justice, and sustainability. Throughout the food chain, there are a number of points where the Welsh Assembly Government can work with partners to reduce the footprint associated with food:

- **Working with food producers and the agriculture sector**
  The biggest impact on the environment from the food chain comes from the growing and production of food. A support programme to promote energy efficiency and renewable energy production ‘on farm’ in Wales is being planned. The forthcoming Food and Drink Strategy for Wales 2008-2013 may provide further opportunities to support food producers and the agricultural sector.

- **Making a statement through public sector procurement**
  Public sector procurement shows growing support for Welsh produce; 24% of food and drink purchased by the public sector in 2005 was from Wales. This represents a 6% increase on the 2003 figure, and indicates that public sector bodies in Wales are increasingly buying locally grown or reared produce.\(^{49}\) Decisions made in this sector can have an influence over the complete supply chain from farmers to caterers. The Welsh Assembly has committed to setting in motion a major new initiative on local food procurement.

- **Improving food access and availability**
  The size and location of shops influence the way people travel to and use them. 76% of food shopping trips are made by car or van and studies suggest that two thirds of congestion is local traffic caused by people driving their cars to purchase food. In the TraCC Welsh transport region only 17% of residents are within 30 minutes of shopping in ‘key centres’ by bus or foot.

- **Targeting households**
  The indirect consequences of food purchasing are shaped by consumer choice. What people buy has an impact on the means of production, source and seasonality of food as well as the degree of packaging used. Existing patterns of food consumption are predicted to result in problems with obesity and diet-related ill health. Also important are the direct impacts associated with travel choice, storage, and waste.

- **Working with retailers**
  In the UK 55,540 grocery retailers service the UK’s demand for food and drink through nearly 103,000 outlets. Two-thirds of all food brought from retailers is sold through supermarkets. Supermarkets and retailers therefore have a considerable influence over the choice of food available to consumers – where it is from, how it is produced. There is scope for the Welsh Assembly Government to work with retailers in order to educate consumers and support them in making informed choices about the food they buy.

\(^{49}\) The Public Sector Food Purchasing Survey (Welsh Development Agency, 2006)
People care about food. They make food purchasing decisions based on a complex set of needs and values. They are increasingly interested in where food comes from as well as production techniques and branding. What a person buys can be an expression of their wealth, aspirations, tastes and politics. In this context it is important to set out how much is known and how much we can say about the environmental consequences of food using the ecological footprint.

Studies exist which look at the supply chain impacts of food at this level of detail but often they are not comparable. Different studies take into account or define the supply chain in different ways. Additionally, the complexity of food supply chains makes impacts difficult to trace. REAP uses a standardised approach which models the entire supply chain for each product group. This scope of this analysis is not yet matched in detail but there are a number of areas where REAP can contribute to an understanding of the food footprint:

**Diet**

Using the REAP software model SEI can distinguish the environmental impacts associated with 15 broad categories of food and drink. This means it is possible to show the impact of meat compared to fruit but not lamb compared to beef.

Previous studies conducted by SEI have shown that low meat, vegetarian or nutritionally balanced diets tend to have a lower footprint associated with them than unhealthy diets or those that have a very high meat content.

**Food Miles**

How, and how far, food is transported does have significant consequences for the environment. Transport accounts for one third of the energy consumed in the food chain each year, with road freight being the biggest contributor, although air freight is growing. But this alone should not be used as criteria for sourcing food locally. In fact evidence that food miles should be considered a proxy for environmental sustainability is weak. Taking all stages of the supply chain into account can mean that in some cases global sourcing has a lower environmental impact. Until the evidence improves SEI make no distinction between local and non-local food. A food product produced in the UK is assumed to have the same impact as one produced in Spain or China.

Local food is obviously attractive for a number of other reasons including supporting the local economy. These are considerations that go beyond the realms of footprint analysis but are important in their own right.

**Organic produce**

There is strong growth in the Welsh organic agricultural sector. The land area under organic production is now at 4.5% of total Welsh agricultural land (Dec 2006), up 13% on the previous year. Some consumers associate organic food with a range of benefits which go beyond ethical standards to better taste and quality and personal health. As an indicator the ecological footprint looks solely at the material and energy requirements of agriculture, but REAP does make a distinction between organic and non-organic products.

**Packaging and food waste**

Packaging and the use of plastic bags are symbolic environmental issues but the importance placed on them can be out of proportion to their impact compared to kitchen waste. Plastic bags account for 0.3% of domestic waste in the UK, in comparison kitchen waste accounts for 17%. Strong arguments can be made for targeting plastic bags but there should also be quick wins associated with tackling food waste. A recent WRAP study estimated that the edible food thrown away by households equates to between £250 and £400 per household per year.

One of the scenarios created for this chapter looks at reducing food waste by not purchasing food that would otherwise be wasted.

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50 Available on the SEI website: www.sei.se

51 WRAP Understanding Food Waste, Research Summary, March 2007: Exodus Diary Research: Kitchen Diary Top Line Results Based on 284 Diaries and analysis by WRAP based on Defra’s Expenditure & Food Survey 2004/5.
A summary of the scenarios we have developed for this chapter is shown below. A more detailed description of the components of each scenario is provided at the beginning of each section.

### Table 22

<table>
<thead>
<tr>
<th>Scenario Name and Number</th>
<th>Summary</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus on Food Consumption</td>
<td>Food consumption profile modelling of three different behavioural types</td>
</tr>
<tr>
<td>Supply Chain Efficiencies</td>
<td>Analysis of the impact of reducing energy use in the food supply chain</td>
</tr>
<tr>
<td>Reducing Food Waste</td>
<td>Reducing food purchases by reducing the amount wasted by one sixth</td>
</tr>
</tbody>
</table>

### SCENARIO 1: FOCUS ON FOOD CONSUMPTION

In August 2007 the Welsh Assembly together with COI published ‘Attitudes to Climate Change and Environmentally Friendly Behaviours in Wales’. This classified the Welsh population into seven different environmental behaviour groups, following qualitative in-depth interviews. The profiles used in this report are based on three group’s hypothecated food consumption over one week: The profiles we have modelled are for the following groups:

**Consumers with a conscience**

“You should do everything you can within the constraints of modern living”

Environmentally conscientious, but relatively wealthy, they take one shopping trip per week in their new fuel efficient car. They are keen gardeners and have a large garden, so have the space to grow their own vegetables. Consequently they spend very little on fruit and vegetables at the supermarket. They travel slightly further than average to get to the supermarket, but top up their weekly purchases by walking to the local shops. The majority of the food they buy is organic. They enjoy food so do a lot of cooking from scratch with a modern electric oven and gas hob. Food is stored in an A rated and stylish fridge. They treat themselves to a meal out in the evening once a week.

**Efficiency Focused**

“You should live life thinking about what you are doing (whether it is right) and what you are using (waste not want not)”

The efficiency focused profile fits that of a person who is less wealthy than average and tries to minimise their spending as far as possible. They get a weekly lift to the supermarket in the neighbour’s aging car. Costs and purchasing are kept down by planning of meals and a low meat diet; very little food goes to waste. Cooking is on an electric hob and food is stored in an old but small fridge-freezer. Trips out to the café or restaurant are rare.

**Disinterested**

“You be honest, I don’t really think about the environment”

The disinterested person has an average income from a job in the nearby city centre. They take a detour to the supermarket in their car most days after work. They buy ready-made convenience food and therefore do very little cooking, using the microwave most evenings. The meals tend to have high meat content and they spend more than average on alcohol. They have a large new fridge freezer for storage and enjoy take-away meals once or twice a week. They eat lunch every day in the work canteen.

A summary of the assumptions used to model the profiles is shown in tables 23, 24, and 25.
**Table 23: Travel assumptions**

<table>
<thead>
<tr>
<th>Shopping Travel</th>
<th>Consumers with Conscience</th>
<th>Efficiency Focused</th>
<th>Disinterested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of shopping trips per week</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Distance travelled to shops per week (km)</td>
<td>16 km</td>
<td>10 km</td>
<td>26 km</td>
</tr>
<tr>
<td>Number of people per car (occupancy)</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Efficiency of the vehicle</td>
<td>More efficient than average</td>
<td>Less than average efficiency</td>
<td>Average efficiency</td>
</tr>
</tbody>
</table>

**Table 24: Food purchasing assumptions**

<table>
<thead>
<tr>
<th>Food</th>
<th>Consumers with Conscience</th>
<th>Efficiency Focused</th>
<th>Disinterested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total amount purchased* per person week (kg)</td>
<td>7.9 kg</td>
<td>7.2 kg</td>
<td>9.9 kg</td>
</tr>
<tr>
<td>Percentage breakdown</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fruit and vegetables</td>
<td>1%</td>
<td>16%</td>
<td>4%</td>
</tr>
<tr>
<td>Meat, fish and dairy</td>
<td>42%</td>
<td>19%</td>
<td>46%</td>
</tr>
<tr>
<td>Oils and Fats</td>
<td>6%</td>
<td>8%</td>
<td>4%</td>
</tr>
<tr>
<td>Non-Alcoholic drinks</td>
<td>8%</td>
<td>13%</td>
<td>9%</td>
</tr>
<tr>
<td>Alcoholic drinks</td>
<td>22%</td>
<td>7%</td>
<td>22%</td>
</tr>
<tr>
<td>Bread, flours and cereals</td>
<td>15%</td>
<td>29%</td>
<td>9%</td>
</tr>
<tr>
<td>Sugar, confectionary and other foods</td>
<td>6%</td>
<td>9%</td>
<td>6%</td>
</tr>
<tr>
<td>Percentage organic</td>
<td>72%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>Percentage non-organic</td>
<td>28%</td>
<td>99%</td>
<td>99%</td>
</tr>
</tbody>
</table>

*Only purchased food is included, home grown fruit and vegetables for example, are not included in the amounts purchased per week.

**Table 25: Energy use and catering assumptions**

<table>
<thead>
<tr>
<th>Energy and Catering</th>
<th>Consumers with Conscience</th>
<th>Efficiency Focused</th>
<th>Disinterested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooking</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity (kWh/week)</td>
<td>3.8 kWh</td>
<td>9.6 kWh</td>
<td>4.7 kWh</td>
</tr>
<tr>
<td>Gas (kWh/week)</td>
<td>5.4 kWh</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Storage (fridge and freezer)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Electricity (kWh/week)</td>
<td>8 kWh</td>
<td>5 kWh</td>
<td>11.5 kWh</td>
</tr>
<tr>
<td>Catering*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Meals eaten outside of the home £/week</td>
<td>£20</td>
<td>£0</td>
<td>£24.50</td>
</tr>
</tbody>
</table>

*Catering includes purchase of restaurant meals, catered meals and take-away meals outside the home. For the profiles we have taken into account expenditure on evening meals and food for lunch.
Food Consumption Results

Using these assumptions we have calculated a food footprint for each profile their average week. The results of this are shown in table 26, below. Please note that because the footprint is on such a small scale (per person per week) for food and components of travel and energy use only, it is shown in global acres rather than hectares52.

<table>
<thead>
<tr>
<th></th>
<th>Consumers with Conscience</th>
<th>Efficiency Focused</th>
<th>Disinterested</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ecological footprint (global acres per person per week)</td>
<td>0.08</td>
<td>0.04</td>
<td>0.10</td>
</tr>
</tbody>
</table>

The breakdown by category: food purchase, travel for shopping, energy used for cooking and storage and catering for each profile is shown in figure 28, below.

The efficiency focused person has the lowest footprint. They spend less on food purchases and catering than both the consumer with a conscience and the disinterested person.

Expenditure on catering has a large impact on the overall food consumption footprint. Every person in the UK now spends roughly 25 minutes a day eating in restaurants or cafes at an average cost of £11.41 a week – nearly a third more in real terms than 10 years ago. Catering services have a high impact on food footprint because of the higher energy use compared to eating at home. It has been estimated that dining out could require up to ten times the energy compared to dining at home, due to transport, high space consumption requiring heating and lighting, long operation times of kitchen appliances, and the waste of food ingredients53.

The domestic electricity use is similar across all of the profiles. The disinterested person uses more electricity on refrigeration, but far less on cooking than the efficiency focused person and consumer with a conscience.

The impact of using the car to shop is similar in the consumer with a conscience and disinterested profiles. The consumer with a conscience only uses the car for shopping once per week and therefore has a lower footprint component from car use than the disinterested person who regularly drives to

Fig 28: Ecological footprint of food consumption related activities

52 Global acres are used because the size of the footprint per person over one week is too small to be expressed in terms of hectares. One hectare is approximately equivalent to 2.47 acres.

53 Sustainable Consumption Governance in a Globalizing World, D. A. Fuchs and S. Lorek, 2002
the supermarket. By sharing the shopping journey the efficiency focused person reduces their footprint from car use to less than half of the disinterested person. As demonstrated in the transport chapter, increasing the occupancy rates in cars can have a considerable impact on the footprint.

Figure 29 shows a break down of the food purchasing component of the footprint for each profile. Again, results are shown in global acres per person, rather than hectares.

Moderate Food Purchasing Footprint – Consumer with a conscience
The consumer with a conscience has a very small fruit and vegetable footprint as they grow the majority of their own vegetables and only purchase a small amount that they can not grow. (The home grown fruit and vegetable is assumed to have no impact on the food footprint). However, their overall food purchasing footprint remains higher than the efficiency focused person as they still purchase goods such as meat and alcohol which have a high impact.

Low Food Purchasing Footprint – Efficiency Focused
By reducing the amount of food wasted and planning meals the efficiency focused person spends less on food in general, they also buy less alcohol and meat than average and therefore have a lower food footprint than the other profiles.

Higher Food Purchasing Footprint - Disinterested
The disinterested person consumes a lot of meat, fish and dairy along with slightly higher than average alcohol and confectionary. They buy more and therefore waste more food so have the highest food footprint of all the profiles.

The importance of healthy diet for the food footprint
Not eating a balanced diet can have a negative the food footprint as well as health. This analysis does not give an indication of the footprint of a nutritionally balanced diet compared to one that is unbalanced, but it does complement the guidelines of the Eatwell plate from the Food Standards Agency. The Eatwell plate indicates the types and proportions of foods needed to have a healthy and well balanced diet, advising to eat plenty of fruit and vegetables, starch and wholegrain; some meat, fish, dairy products and other sources of protein; and just a small amount of foods that
are high in fat and/or sugar.\textsuperscript{54} This is similar to the diet modelled for the efficiency focused profile.

This Eatwell diet model would have a lower food footprint than one where meat, dairy and high fat/sugar foods make up the majority of the food consumed, rather than fruit, vegetables and starchy foods.

Potential for Changing Behaviour and Diets
The COI and Welsh Assembly report classifying the behaviours that we have used in the profiles also provides a target and implications section, with recommendations for communication and activity development.

Within this framework there are many opportunities for changing behaviour and diets. At present the Attitudes to Climate Change and Environmentally Friendly Behaviours in Wales survey found that there was no real awareness of the connection between eating more fruit and vegetables and less meat and the environment. For most, the rationale for more fruit and vegetables was connected to health and many cited the five a day campaign. This demonstrates that work to raise awareness about health has already had some success, which may have an inadvertent but positive implication for the food footprint. There is the potential to expand these types of awareness campaigns to help people make the link between the environment and food. (This is already being developed in the food waste area through the Waste and Resources Action Programme (WRAP) and Waste Awareness Wales campaign. This is discussed in more detail in the Reducing Food Waste scenario).

One example of how food consumption can be influenced at the local level is through schemes such as the Community Food Co-operative in Wales. This programme piloted the supply of locally sourced, affordable fruit and vegetables to disadvantaged communities through the development of local food distribution networks. To date, 128 Community Food Co-operatives have been opened under this programme. A successful project such as this has the potential to expand and positively influence the food footprint per capita across Wales. The Attitudes to Climate Change and Environmentally Friendly Behaviours in Wales study also concluded that community and social networks could be influential in encouraging (or constraining) attitudes and behaviour and that the extent to which other people in the locality do (or do not) demonstrate an attitude of behaviour affects their own contributions. Community schemes could therefore be very important in the effort to change food consumption behaviours.

**SCENARIO 2: SUPPLY CHAIN EFFICIENCIES**

As the food profiles show it is the indirect supply chain impacts associated with food consumption that contribute most to a household’s ecological footprint. The indirect impacts of food such as, packaging, construction materials for warehouses and supermarkets and fuel for transportation make up a total of 86% of all the materials used for food production. Food that is eaten (approximately 600kg/year) makes up only 14% of all the materials used in the food supply chain\textsuperscript{55}. The modern food chain is also highly dependent on energy, mostly from fossil fuels – from the production of fertilizer through to food preparation\textsuperscript{56}. At the same time the decisions households make have implications all the way along the supply chain.

The scenarios presented here illustrate the extent to which efficiency improvements in the supply chain can reduce the footprint. Although the Welsh food chain is increasingly connected to global markets, self sufficiency is still high - 60% of the food people consume is still UK grown\textsuperscript{57}. This provides scope for government to support elements of the food industry in making efficiency savings.

There are numerous supply chain factors that influence the food footprint which can make it very difficult to have any targeted footprint

\textsuperscript{54} Taken from the Food Standards Agency website: http://www.eatwell.gov.uk/healthydiet/eatwellplate

\textsuperscript{55} Reducing Wales’ Ecological Footprint, SEI and WWF, March 2005


reduction policy. With housing for example, it is much easier to identify where efficiency improvements can be made and then tackle those areas with specific policies. One single approach would not be suitable for all sectors involved in food production; a number of interventions, policies or programmes would be required to achieve reductions throughout the food supply chain.

**Historical Trends**

In the UK the food industry has taken a lead in efforts to reduce its emissions, with many companies showing genuine leadership without incentive or regulation. This includes voluntarily cutting energy use, setting emissions reductions targets and establishing the carbon footprint of a business. Data from individual companies show that some companies have already cut their energy use in excess of the government’s targets. The UK brewing industry, for instance, has reduced CO$_2$ emissions by 52% since 1990. The DTI Digest of United Kingdom Energy Statistics (DUKES) data indicate that CO$_2$ emissions from food manufacturers fell by 15.2% between 1990 and 2005.

**Assumptions**

Using the emissions reductions data as a proxy for the reduction in energy use, this scenario assumes that all sectors of the food supply chain can reduce energy consumption by 1% per year (a similar reduction to the historical trends recorded in the manufacturing industry). The 1% reduction only applies to the food production industry (from fertilizers to packaging etc.). It does not include the fuel used for freight transport to distribute the goods.

The scenario also models in the impact on the food footprint per capita if the food supply industries exceed this and manage a 1.5% reduction in energy use per year, giving a total of 60% reduction in energy use by 2050.

**Results of supply chain efficiency improvements**

Reducing the energy requirement across all sectors reduces the food footprint. Projecting the historical trends (of 1% reduction in energy use between 1990 and 2005)

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**Fig 30: Food footprint per capita, with supply chain efficiencies from 2010**

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58 Final submission of the Food Industry Sustainability Strategy Champions’ Group on Energy and Climate Change, Defra, May 2007
per year) into the future gives an overall food footprint reduction of 0.9% per capita between 2010 and 2020. Increasing the reduction in energy use to 1.5% per year gives a food footprint per capita reduction of 1.32% by 2020. 60

Reducing the energy used in the supply chain can reduce the individual food footprint, without any changes in consumption patterns. Combining efficiency improvements with a reduction in consumption will reduce the footprint further.

**Potential for Improved Supply Chain Efficiency**

The Food Industry Sustainability Strategy Champions’ Group on Energy and Climate Change believe that a significant number of businesses within the food and drink sector have the potential to make emissions reductions through the application of a number of technologies, as well as through better control and use of energy consumption data. 61

Opportunities exist for the development of technology, low or zero carbon energy generation, industry collaboration and consumer engagement, which could reduce the food footprint even further. Some sectors may have greater potential for energy consumption reduction than others and therefore may need to be targeted individually to achieve their maximum potential. However, there may be a number of barriers to change including investment, management and implementation barriers.

**SCENARIO 3: REDUCING WASTE**

- Each week the average UK household purchases 15.6kg 63 of food and wastes 5kg of it. 64

When food is thrown away all of the energy required to produce, package and distribute that food is also wasted, but, this is not obvious in the final product. People would not generally associate food wastage with wasting energy in the same way that they can equate poor loft insulation or an inefficient boiler with energy loss.

It is also difficult for the consumer to determine the individual footprint impacts of food as the supply chains and life cycles of products are very complicated. For example, is it better to buy local food grown out of season, or imported food that has travelled further?

Because of this complexity a broader approach such as eating a more healthy diet for example, or reducing food waste, could be more successful than focusing on individual products or supply chains. If all the food that is wasted is not bought in the first place food consumption would decrease.

Many consumers may be unaware of how much food is wasted in the home. WRAP estimates that each year the average household throws away one third of the food that they buy, of which nearly one half could be eaten. This is equivalent to £250-£400 in food per household per year. Food waste is so high because consumers buy more than they need as a result of purchasing factors such as: ‘buy one get one free’ offers; buying more perishable food; poor storage management; high sensitivity to food hygiene and the time taken on meal. 65

Reducing the food wasted by not buying it in the first place, would not only help to reduce the food footprint (as consumption would decrease), but will also help to meet waste targets and save the individual consumer money.

This scenario models the impact of reducing food waste by one sixth (the estimated amount that could be eaten that is currently thrown away).

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60 A 1% reduction in energy consumption across the food supply chain does not give a 1% reduction in the food footprint because some industries not directly associated with food production (such as protective clothing food processing plants) indirectly contribute to the food footprint. We have assumed that only the main industries associated with food production have made energy savings, not all industries.


64 Defra (2006) Family Food & Expenditure Survey

65 Understanding Food Waste, WRAP, March 2007
Results of reducing food waste

Reducing the average amount of fruit, vegetables, meat, fish, dairy and bread purchased by one sixth across Wales gives a per capita food footprint reduction of 7.22%. This is shown in figure 31 and compared to the 1.32% reduction from supply chain efficiency improvements.

Reducing the average amount of food bought can have a large impact on the food footprint. However, this is dependent on consumer behaviour and although it can be influenced (and has been successfully in other areas such as transport behaviour) reducing consumption by one sixth across Wales may be an optimistic target.

Reducing waste in the household can easily be achieved through better planning of meals, storage and cooking of food. In addition waste could be reduced before it reaches the household by reducing packaging and encouraging new packaging innovations.

Wise About Waste, The National Waste Strategy for Wales has key policies to reduce waste, reduce landfill and manage unavoidable wastes, with waste prevention the first priority for food followed by composting/anaerobic digestion. The Welsh Assembly Government has recently part funded a national food waste prevention campaign run jointly by the Waste and Resources Action Programme (WRAP) and Waste Awareness Wales to educate consumers about the importance and benefits of reducing food waste. The campaign is entitled “Love Food, Hate Waste”.

Box 10: Food Waste Assumptions

According to WRAP research nearly everyone wastes food. However, around 30% of people are considered to be high food wasters – they are predominantly younger working age people and families with school aged children.

- This scenario assumes that everyone can make a reduction in the food waste, resulting in an average reduction of one sixth of the food currently purchased.

The top five most frequently discarded food items have been found to be lettuce/bagged salad, bread, fruit, milk and cooked meat. WRAP research suggests there is more raw food in the bin than cooked food.

- We have therefore modelled a waste reduction of predominantly fruit and vegetables, bread, meat and dairy products, assuming that waste will be reduced by people not purchasing the food that they would normally throw away.

![Fig 31: Food footprint per capita, supply chain efficiencies and reducing waste](image-url)
There are real opportunities to introduce measures that reduce the footprint of food and meet other food related objectives in Wales. In 2006 the National Assembly for Wales called on Assembly Government to develop and consult on a wide-ranging Quality of Food Strategy to improve the quality of food consumed in Wales. The Welsh Assembly Government has consulted on a Strategy and is now working on an Action Plan that will aim to bring together action in the Welsh supply chain, public sector procurement and public engagement. Already the links are being made between food providence, sustainability, quality, nutrition and public health.

This joined up approach is important, it recognises that there is a need to target consumer behaviour as well as the supply chain to bring about larger reductions in the food footprint. Although the impact of this new strategy can not yet be measured it holds the potential to support action on food waste and on improving the efficiency of the Welsh supply chain. The scenarios created in this chapter suggest that reducing the consumption of food by one sixth across Wales (by assuming that any food wasted would not be purchased) may reduce the food footprint by 7.2% between 2001 and 2020. A summary of the reductions in food footprint per capita associated with annual efficiency improvements in the food supply chain are shown in table 27.

The food consumption profiles provide a first attempt by SEI to illustrate the footprint impacts associated with different diets and with different food related activities. To the best of our knowledge this may also be a first for this type of analysis in Wales. The balance of a person’s diet will affect the size of their footprint but just as important is their attitude to shopping, storage and the act of cooking. The increase in expenditure by households on restaurants and catering adds to the importance of working with these industries to increase efficiency and reduce waste.

The complexity of the supply chain of food makes it difficult to provide detailed and comparative results on the impact of different food types and this is an area of analysis that will need to be improved on over time. What is clear is that local and organic food can have benefits beyond those associated with the ecological footprint.

Perhaps the most important message to emerge from this analysis is that the footprint of food can be reduced and that it is worth focussing on. Defra’s 2007 Public Attitude Survey found that the actions for which the smallest proportion of people though would have a major impact on climate change were ‘buying food produced locally rather than abroad’ and ‘wasting less food’. The evidence on reducing food waste, and hence unnecessary consumption demonstrates the importance of changing peoples minds through campaigns such as ‘Love food, Hate Waste’.

### Table 27

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Change in food footprint per capita, 2001 to 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual supply chain energy efficiencies of 1% in selected parts of the supply chain</td>
<td>- 0.9%</td>
</tr>
<tr>
<td>Annual supply chain energy efficiencies of 1.5% in selected parts of the supply chain</td>
<td>- 1.3%</td>
</tr>
<tr>
<td>Reducing food waste by one sixth across Wales</td>
<td>- 7.2%</td>
</tr>
</tbody>
</table>
Chapter 4: Achieving a 10% reduction in the ecological footprint

Key Messages

• Wales has the lowest ecological footprint in the UK. The Welsh Assembly Government’s sustainable development duty and the One Wales Programme for Government, provide an opportunity to stabilise and then reverse the historic trend of an increasing ecological footprint.

• The One Wales Programme for Government has started to get the direction of travel for the ecological footprint right. If Wales successfully implements all planned policies for food, housing and transport it may have done enough to stabilise its footprint by 2020. One Wales therefore provides a platform for achieving a footprint reduction in the future, and setting an example for the rest of the UK.

• Although current policies are moving in the right direction, substantial reductions in Wales’ per capita footprint by 2020 will require additional measures. An expansion of measures which improve the energy performance of existing housing and reduce food waste have considerable potential to reduce the ecological footprint of Wales. Although good sustainable transport schemes exist, more needs to be done to reduce the footprint associated with travel behaviour on a national level. Potential opportunities are offered by the Wales Spatial Plan to deliver a modal shift in travel behaviour. In general, no one policy or measure can deliver a reduction in the footprint by itself – rather, a package of measures within and across different policy areas, reinforcing each other and sending out consistent messages, is required.

• In all areas of consumption activity it is important to identify ways of changing consumer behaviour, then “locking in” sustainable behaviours. Hard measures that make it easier to act sustainably must be supported by soft measures that encourage people to consider it an attractive option.

• The key message is that a large number of small changes in consumer behaviour will have a cumulative and potentially large impact on the ecological footprint over time. So too will the dissemination of complimentary and consistent messages. Small changes must be made to count. The impact of specific measures can be amplified beyond the target audience through effective communications.

• Wales has many of the mechanisms in place to encourage sustainable behaviour and is showing signs of using them in a progressive fashion. High profile examples such as the new Code for Sustainable Homes need to be supported by complimentary measures such as an expanded retrofit programme for existing housing.

• The scenarios created in this report focus on measures to reduce the footprint of transport, food and housing. These account for almost two-thirds of Wales’ footprint. If historical trends in spending on consumables such as clothing and household appliances continue, further action will be needed which tackle this area of household activity.
This report has shown how a range of policies could reduce the size of ecological footprint components over time. All of the policies considered in the report have the potential to reduce the ecological footprint. Their effectiveness will depend on the scale of their implementation and their ability to influence patterns of consumption behaviour. The purpose of this concluding chapter is to illustrate the combined impact of the most effective measures.

Some of the policies modelled have a relatively small impact between now and 2020 but they should not be evaluated on their impact on the ecological footprint in this timescale alone. Many policies have additional benefits, for example:

- Wales intends to implement the most progressive timetable for the Code for Sustainable Homes in the UK. Although this may have a relatively small impact in the period to 2020, it should promote innovation in the housing sector and will send a strong signal about the WAG’s commitment to reduce energy consumption in all homes. It will also ensure that new homes are built to the highest standard possible and prevent future retrofit requirements.

- The Sustainable Travel Towns scheme is a high profile initiative that may help to reduce local pollution and congestion in towns and cities across Wales. It may also provide health benefits that are not modelled.

- Initiatives to reduce the footprint of food may improve diets, support the local economy and help to reduce waste. These are all issues which are high on the national agenda.

This chapter brings together the scenarios modelled separately in previous chapters and considers their impact on the food, housing and transport components of the footprint when combined. It looks at:

- **Policies in Place**: policies which have already been implemented related to transport, food and housing.

- **Planned Policies**: the additional impact of policies which will be implemented in the near future.

- **10% reduction policies**: A selection of further policies which could achieve a 10% reduction in the combined housing, transport and food footprint per capita in Wales.

All the scenarios created so far have focussed solely on transport, food or housing. Other areas of household consumption that have been omitted from the scenarios, these include the purchase of consumer items and private services. Therefore the final section of this chapter looks at the combined impact of the housing, transport and food interventions on the ecological footprint as a whole (including the housing, transport and food sectors, but also other consumer items, private and public services and capital investment).

All of the analysis looks at the potential impact of policy interventions purely from a footprint reduction perspective. A more holistic cost-benefit analysis would be required to assess whether a policy should be applied.
THE COMBINED IMPACT OF HOUSING, TRANSPORT AND FOOD INTERVENTIONS

Table 28 shows the policies used to create the scenarios in this chapter. Those policies in the ‘planned policies’ column are planned by WAG but not yet implemented, or may come about as a result of EU legislation. For the food component of the footprint it is difficult to calculate the reductions associated with the ‘Love Food, Hate Waste’ scheme, the Organic Farming Scheme and the forthcoming Food and Drink Strategy. They are referenced in the table but at the moment there is limited quantifiable evidence on their potential impact on food consumption in Wales. The ‘10% reduction’ scenario is used to demonstrate the potential impact of these food initiatives.

Table 28

<table>
<thead>
<tr>
<th>Theme</th>
<th>Policies in Place</th>
<th>Planned policies</th>
<th>10% reduction scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Code for Sustainable Homes UK timetable</td>
<td>Code for Sustainable Homes WAG timetable</td>
<td>Code for Sustainable Homes WAG timetable</td>
</tr>
<tr>
<td>Housing</td>
<td>Under HEES 0.8% of households retrofitted per year</td>
<td>Under HEES 1.1% of households retrofitted per year</td>
<td>5% of households retrofitted per year, under increased funding for HEES</td>
</tr>
<tr>
<td></td>
<td>No behavioural change</td>
<td>No behavioural change</td>
<td>60% of the population achieve a 15% reduction in energy use by 2020, through behavioural change</td>
</tr>
<tr>
<td></td>
<td>Demolition rates same as historical average – 9,000 demolished by 2020.</td>
<td>Demolition rates same as historical average – 9,000 demolished by 2020.</td>
<td>Housing Market Renewal - 20,000 houses demolished by 2020</td>
</tr>
<tr>
<td>Transport (including aviation impacts)</td>
<td>No sustainable travel towns</td>
<td>Sustainable Travel Towns – one in each Transport Region</td>
<td>Sustainable Travel Town schemes are implemented in all urban areas with a population over 10,000 in Wales</td>
</tr>
<tr>
<td></td>
<td>Average occupancy rates of cars, buses and trains, 31%, 20% and 26% respectively</td>
<td>Average occupancy rates of cars, buses and trains, 31%, 20% and 26% respectively</td>
<td>Occupancy rates of cars, buses and trains 40% 30% and 50% respectively</td>
</tr>
<tr>
<td></td>
<td>Efficiency Improvements of cars, buses and trains</td>
<td>Efficiency Improvements of cars, buses and trains</td>
<td>Efficiency Improvements of cars, buses and trains</td>
</tr>
<tr>
<td>Food</td>
<td>Joint WRAP and WAG waste reduction campaign – “Love Food Hate Waste”.</td>
<td>Joint WRAP and WAG waste reduction campaign – “Love Food Hate Waste”.</td>
<td>Reducing food waste across the population by one sixth</td>
</tr>
<tr>
<td></td>
<td>No national food supply chain improvement scheme</td>
<td>Food and Drink Strategy implemented from 2008</td>
<td>Food supply chain efficiency improvements, 1.5% decrease in energy use across supply chain</td>
</tr>
<tr>
<td></td>
<td>Organic Farming Scheme provides ongoing support to the Welsh organic system</td>
<td>Organic Farming Scheme provides ongoing support to the Welsh organic system</td>
<td>Increased proportion of organic food purchased</td>
</tr>
</tbody>
</table>

66 This scheme provides payments to farmers to help them convert to organic farming, and provides ongoing support for the organic system.
- Improved transport infrastructure efficiency with increased rates of public and private vehicle occupancy levels;
- The expansion of the Sustainable Travel Town scheme to all urban areas across Wales;
- An increase in organic food consumption, reflecting the continued support for Welsh organic farming;
- A substantial reduction in food waste based on measures which support the ‘Love Food, Hate Waste’ campaign;
- Targeted annual improvements in specific sectors in the food supply chain driven by the Food and Drink Strategy 2008-2013 and continued thereafter.

Results of combined interventions
If underlying trends continued with no policy intervention at all, the combined footprint of food, housing and transport may increase by 4.5% by 2020. Based on policies already in place, the footprint increase may be reduced to 2% by 2020. The implementation of policies planned for the near future would halve this to a 1% increase by 2020. This is shown on figure 32. In all cases the underlying trends of travel prove hardest to offset because of the large growth in this area. All the scenarios which involve a travel component include an underlying trend of people travelling further, particularly by car and by plane. When personal air travel is excluded from the results, planned policies for the near future secure a reduction in the footprint of 0.7% by 2020. In the 10% scenario the footprint reduction exceeds the target and has decreased by 11.7% by 2020.

The results show that in areas that the Welsh Assembly Government can make a difference it should be able to stabilise and may reduce the footprint in size by 2020. To achieve any further reductions more needs to be done. The policy of implementing the Code for Sustainable Homes by 2011 is absolutely essential to ensure that all new houses are built to the highest standards but a similarly progressive approach is needed for the existing housing stock. The same could be said for travel; Sustainable Travel Towns will be vital for reducing the land transport footprint and instilling sustainable travel behaviour across Wales, but more could be done to manage the demand for transport and the trends of increasing travel on a national scale.

Reductions in the ecological footprint do not have to come from uniform reductions across all components of the footprint. Larger
reductions look more easily achievable for the housing component of the footprint than for transport and this is demonstrated by figure 33. Figure 33 shows the combined impact of planned and existing policies compared to the 10% scenario. Based on existing and planned policies, the housing component of the footprint is the only one to reduce in size between 2001 and 2020. Food remains stable and transport actually increases.

The 10% reduction scenario gives reductions in each of the footprint components, but the reduction is not uniform. The most significant reductions come from the housing and food components. Although transport contributes less to the 10% reduction it is the component with the largest difference between the two scenarios. In the planned policies scenario the transport footprint increases by nearly 9%, in the 10% reduction scenario it decreases by over 6%. If this large change in the transport footprint did not occur in the combined footprint would have reduced by 6.5% only.

**ACHIEVING A 10% REDUCTION: THE BIGGER PICTURE**

The 10% saving modelled here is centred on a large increase in the percentage of existing houses that are retrofitted per year and a decrease in energy use from behavioural change. This area has a large scope for expansion; it is an area where Wales has the opportunity to again be a leader in the UK. However, housing, transport and food make up only 63% of the total ecological footprint in Wales. The other 37% comes from other consumer items, private and public services and capital investment. The policy interventions that we have modelled have an impact on the housing, transport and food segments of the ecological footprint alone. Figure 34 shows the impact of the 10% reduction interventions on the ecological footprint as a whole on a per capita basis.

As a result of the 10% reduction policies for housing, transport and food the overall ecological footprint per capita decreases by 6.6 % by 2020.
For comparison we have taken the historical trends in the ecological footprint of Wales from 1992 to 2003 and projected them forward to 2020. This shows that if Wales were to continue on the same path as previously the ecological footprint would increase by 22% over 2001 levels by 2020. These projections are similar to those created for England and Scotland and lower than that of many English regions.

Achieving the reduction of 6.6% modelled in these scenarios would be a significant improvement compared to a continuation of historical trends. It would also set the right direction of travel to achieve further reductions in the future. Beyond specific measures there is scope for greater reductions in footprint if the Welsh Assembly takes action to:

1. Introduce prominent national initiatives across all sectors

It is important that footprint reduction schemes in all sectors are guided by national coordination and leadership. The Welsh Assembly Government has already shown examples of this with the implementation of the Code for Sustainable Homes by 2011 and the Sustainable Travel Towns project.

These are examples of high-status policies that demonstrate the Welsh Assembly Government’s commitment to footprint reduction and they are an extremely important initial step; however they will not achieve significant reductions in the footprint alone. They must be supported by other prominent initiatives that address the issues across and within all sectors.

The scale of initiatives is very important. Many of the current policies and schemes that would reduce the transport and food footprint in Wales have generally been local level programmes. However, for the purposes of these scenarios we have expanded policies and assumed that they will have an impact across Wales, reducing the amount of food purchased by one sixth for example (as a way of reducing food waste), or increasing occupancy rates to two people per car.

Local level schemes are important for making progress with footprint reductions, as well as offering opportunities for learning and for demonstrating local leadership. However, they are often not far-reaching enough to change the average footprint per capita in Wales. To address this, the local policies need to be coordinated and led by national programmes, with a core aim of reducing the footprint.
The impact of this was demonstrated when we looked at existing policies for transport. For example, we took the proposal for high occupancy lanes on roads and assumed that the result of this was an increase in car occupancy to two people per car on average across Wales. This was an ambitious assumption, but clearly demonstrated the benefits of policy on a national scale. Having a high occupancy lane on one stretch of road would undoubtedly have an impact on the footprint if local occupancy rates were increased. However, in order for this to be as successful as it was in the scenario we assumed that it was implemented on the majority of the major roads in Wales, and therefore changed the behaviour of enough people to increase the average occupancy rates of cars to two people.

The introduction of high occupancy lanes is not the only way of achieving an increase in car occupancy. Other initiatives such as car share clubs and workplace travel plans contribute to higher occupancies and all these measures exist in some form in parts of Wales. The challenge is to target as great a number of people as possible by coordinating support for and expansion of these measures.

2. Amplify the impact of policy through campaigns

Many of the changes that we have modelled in this report involve changes in people’s every-day behaviour. If it is easy, or cheap, or part of the way the system works, then people will act in a sustainable fashion. Too often, sustainable consumption is perceived as expensive or difficult to accommodate, and sometimes this perception is true. This means that Welsh Assembly Government must focus on changing opinions and behaviours as well as on systems. If a lower footprint transport infrastructure is created, this needs to be communicated; individuals need to be informed, they need to be persuaded that this is a good idea and that they should take advantage of it accordingly. Government campaigns dealing with a range of issues have succeeded on this front in the past. Examples include the multimedia advertising campaign ‘recycle now’ which was launched in 2004 and received a doubling in funding to £9 million a year. This came after a positive assessment of the first year of the campaign which reached 97% of the target TV audience in the first year. ‘Recycle now’ was originally fronted by the rower Mathew Pinsent and the comedian Eddie Izzard and has a feel-good message: ‘the possibilities are endless’. After four years the ‘recycle now’ brand has recognition amongst over 65% of adults in England.

Today recycling is not yet a universally accepted activity but surveys indicate that a majority of people do it, think it will make a difference and are willing to do more of it. Liz Goodwin, the Chief Executive of WRAP sums the situation up as follows:

The steady and substantial increase in recycling reflects the continued and growing support for recycling by households, increased availability of facilities which make it easier for people to recycle, investment by the reprocessing sector and the growth in markets for recycled materials and products. This is a tribute to everyone involved – the public, local authorities, government and businesses.

People want to be part of a good thing, by recycling they believe they are making a difference. The same needs to be the case for other areas of peoples lifestyle; do the majority of the population know they can install energy efficiency measures and reduce their energy bills, do they realise how easy this is, or how they can get some good advice? Campaigns lead by Waste Awareness Wales and the Energy Saving Trust are doing important work in this area but there are further opportunities related to food, to personal travel and the goods and services people buy. When the

68 http://www.recyclenowpartners.org.uk/local_authorities/brand_benefits.html
69 See for example the Defra 2007 Survey of public attitudes or Ipsos Mori’s ‘Turning Point or Tipping Point’ report.
70 http://www.morethanwaste.com/Site/Default.aspx/A3393BDEC1BA87959E9C
Welsh Assembly Government implements progressive measures it needs to make sure Welsh people know about it. It also needs to ensure they understand how it connects to other parts of their lives. So when Code level 6 for new build homes becomes mandatory people need to know what they can do in their own homes. When sustainable travel towns are introduced in some areas, people in other areas need to know about car share schemes where they live. Ideally this would all come under one banner or brand.

On a national level the number of people influenced by a policy is highly important, but if a policy does not directly affect everyone, ways need to be found of using it as a hook to engage the entire population.

Although the impact of campaigns is not specifically measured in this report, it should be regarded as providing the potential for an ‘amplifier effect’. Wales is small enough for the Welsh Assembly Government to encourage low footprint behaviour beyond the targeted population of a specific set of measures.

Box 11: Extensions to this work

The scenarios that we have developed have mainly focused on behavioural change of individuals. We have touched on industrial efficiencies in some areas, such as the efficiency of new cars, the energy use in the food supply chain and the energy efficiency of homes, but have not considered all the possibilities for technological improvements and the efficiency improvements of production.

There are a number of reasons for this; as an example, many of the goods consumed by Welsh residents are not produced in Wales and therefore the Welsh Assembly Government has little influence over the efficiencies of these sectors. Where a large proportion of production occurs in Wales, in the food sector for example, we have modelled an increase in efficiency. Also, in areas where efficiencies are forecast, such as the car, bus and aviation industries we have incorporated the improvements into the underlying trends.

In addition the Welsh Assembly Government has a lot of influence over behavioural change and is already implementing a number of schemes that would have an impact on the footprint per capita. There is the potential to expand these schemes and develop new initiatives that would reduce the footprint further.

For future studies and to achieve further reductions in the footprint the following factors could be considered:

- Technological innovation
- Further production efficiencies and energy savings
- A change in the national energy mix (increased use of renewables for example)
- Decentralised energy systems and community energy schemes
- Fiscal measures to change behaviour (such as congestion charging)


### Conclusion

Many examples of low footprint practice exist in Wales at a local level and more are proposed at a national level. Wales is moving in the right direction from a footprint reduction perspective, but additional and expanded measures are required to achieve and sustain reductions in the ecological footprint. Having the following in place will help Wales to secure reductions in its ecological footprint by 2020:

- Nationally led and high-status policies that contribute too, and explicitly reference ecological footprint reduction in a consistent fashion. Where possible the potential for footprint reductions should be quantified and presented as part of the business case for implementing a policy.

- Local schemes and initiatives that sit within the national high-level strategies and that effectively target high footprint activities of communities and individuals. The Sustainable Travel Towns scheme will provide a good example of this when it is implemented.

- Support throughout the Welsh supply chain for businesses that want to improve efficiencies and their competitive standing. Government procurement standards could reward low footprint activities in the food supply chain in particular.

- Broad infrastructural changes that reinforce more sustainable behaviours, making them the norm rather than the exception. Good spatial planning for example, can reduce the need to travel.

- A broad understanding amongst the Welsh population of what they are working towards in footprint terms and why this is important. Having a high proportion of Welsh residents that can identify high footprint activities and look favourably on alternatives will be very important.

Some of these features described here focus on ‘a way of doing things’, processes or messages rather than specific actions. This report shows that by building on existing strategies it is possible to get near to a stabilisation the footprint in Wales, but there is some way to go before we can be confident that a 10% reduction by 2020 would be achieved. By concentrating on both processes and policy the Welsh Assembly Government has the power to make the changes necessary to reach a 10% reduction in its ecological footprint.
### Annex A

#### Table 29 Ecological Footprint by Local Authority

<table>
<thead>
<tr>
<th>Local Authority</th>
<th>Ecological Footprint per capita (2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blaenau Gwent</td>
<td>4.9</td>
</tr>
<tr>
<td>Bridgend</td>
<td>5.1</td>
</tr>
<tr>
<td>Caerphilly</td>
<td>5.0</td>
</tr>
<tr>
<td>Cardiff</td>
<td>5.1</td>
</tr>
<tr>
<td>Carmarthenshire</td>
<td>5.2</td>
</tr>
<tr>
<td>Ceredigion</td>
<td>5.3</td>
</tr>
<tr>
<td>Conwy</td>
<td>5.3</td>
</tr>
<tr>
<td>Denbighshire</td>
<td>5.4</td>
</tr>
<tr>
<td>Flintshire</td>
<td>5.2</td>
</tr>
<tr>
<td>Gwynedd</td>
<td>5.3</td>
</tr>
<tr>
<td>Isle of Anglesey</td>
<td>5.3</td>
</tr>
<tr>
<td>Merthyr Tydfil</td>
<td>5.0</td>
</tr>
<tr>
<td>Monmouthshire</td>
<td>5.5</td>
</tr>
<tr>
<td>Neath Port Talbot</td>
<td>5.1</td>
</tr>
<tr>
<td>Newport</td>
<td>5.1</td>
</tr>
<tr>
<td>Pembrokeshire</td>
<td>5.3</td>
</tr>
<tr>
<td>Powys</td>
<td>5.3</td>
</tr>
<tr>
<td>Rhondda, Cynon, Taff</td>
<td>5.0</td>
</tr>
<tr>
<td>Swansea</td>
<td>5.2</td>
</tr>
<tr>
<td>The Vale of Glamorgan</td>
<td>5.1</td>
</tr>
<tr>
<td>Torfaen</td>
<td>5.1</td>
</tr>
<tr>
<td>Wrexham</td>
<td>5.1</td>
</tr>
</tbody>
</table>
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