Low Carbon Evidence Base for the West Midlands Regional Economic Strategy

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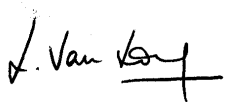
Prepared by	Lise Van Long		October 2007	Project Manager
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NON TECHNICAL SUMMARY

After the success of Al Gore's 2006 film, 'An Inconvenient Truth', and the attention attracted by the 2006 Stern Review, the pressure for action on climate change was bolstered further in 2007 by the publication of the latest assessment reports by the Intergovernmental Panel on Climate Change.

In response, AWM has commissioned a programme of work to underpin its work on producing the UK's first low carbon Regional Economic Strategy. This programme included, among other work streams, the development of an evidence base to support the "low carbon" components of the new West Midlands Regional Economic Strategy (WMES) and an assessment of the impacts of climate change on the economy of the West Midlands.

The evidence base was intended to:

- *Apply the concepts of a low carbon economy in a meaningful way to address the issues of carbon emissions, potential carbon savings, and carbon constraints and opportunities within the different current and future business sectors of the region; and*
- *Identify and prioritise sectors and places (in terms of economics and business) at risk from climate change impacts in the West Midlands, as well as the need to minimise potential impacts or exploit opportunities associated with projected climate changes.*

The evidence base developed by URS for this report includes the following aspects:

1) *A quantitative assessment of greenhouse gas (GHG) emissions associated with the West Midlands region and an analysis of their relative contribution, including a comparison of different emission inventory methodologies;*
2) *An estimate of the potential carbon savings achievable by the region by 2020, including a split by business sectors, and an assessment of those carbon savings that can be influenced by the WMES (influence over partners) or AWM (core functions & funding);*
3) *A qualitative assessment of possible constraints on economic growth resulting from carbon reduction regulations on the current and future business sectors of the region;*
4) *A review of current regional indicators and measures related to carbon intensity (i.e. improvement in Gross Value Added (GVA) and reduction in carbon emissions); and*
5) *Suggestions for the definition of regional indicators that could be used to measure how the region is diversifying into low carbon products, services and techniques.*

This research supported additional workstreams including:

- *An assessment of the potential impacts of climate change on the economy of the West Midlands.*
- *An assessment during the development of the WMES against low-carbon economy, future proofing and broader sustainability criteria.*
- *Research examining what a future regional low-carbon economy may look like.*

- *Prioritisation and initial development of potential low-carbon economy programmes for the WMES Delivery Framework.*

Background

The UK carbon reduction strategy

The 2006 Stern Review on the economics of climate change concluded that without actions to reduce emissions, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year[1] *and GHG emissions could more than treble by the end of the century. In the UK, the Government has demonstrated that the economy can still grow whilst reducing emissions with the UK economy growing by approximately 54% while GHG emissions fell by over 15% in 2005*[2]*.*

In October 2007, the Government published its response to pre-legislative scrutiny and public consultation on the draft UK Climate Change Bill. At the time of writing this report, the Bill, the first of its kind in the world, was expected to set a statutory reduction of at least 60% in CO_2 emissions by 2050. The Bill creates a new legal framework for the UK achieving, through domestic and international action, at least a 60% reduction in GHG (i.e. equivalent CO_2) emissions by 2050 against a 1990 baseline.

Through the Climate Change Bill, the Government is required to set five-year carbon budgets, placing binding limits on aggregate CO_2 emissions. The Bill also establishes an expert, independent body – the Committee on Climate Change, whose remit it is to advise Government on the level of these budgets. As a result, the short term and long-term reduction targets defined in the Bill could become more stringent in future, based on the Committee's recommendations. The Committee will also examine the implications of including greenhouse gases (GHGs) other than CO_2, international aviation and shipping emissions in UK targets.

On an international level, the UK is a signatory to the Kyoto Protocol and has committed to reduce its GHG emissions by 12.5% below base year levels over 2008 and 2012. The GHGs covered by the Kyoto Protocol include carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). CO_2 is the main GHG, accounting for about 85% of the UK total, and the vast majority of CO_2 emissions result from the burning of fossil fuels. In 1997, the UK committed itself to go beyond the Kyoto Protocol target by setting a national goal to reduce CO_2 emissions by 20% below 1990 levels by 2010. In 2003, the Energy White Paper adopted a longer term goal to put the UK on a path to reduce CO_2 emissions by some 60% by 2050, with real progress by 2020.

It should be noted that the findings presented in this report are based on analysis carried out prior to the finalisation of the Climate Change Bill and are therefore in line with the scope of policy measures and targets outlined in the policy available during summer 2007.

There are currently no regional targets for carbon reduction and each region will contribute differently to the national target. As such, the targets identified in the UK Climate Change Bill have been used to contextualise the regional challenge.

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[1] The Stern Review on the economics of climate change was published in October 2006, available at: http://www.hm-treasury.gov.uk/sternreview_index.htm

[2] Defra, 2007. 'UK Climate Change Programme, Annual Report to Parliament'.

The role of Regional Development Agencies (RDAs) in tackling carbon emissions

The Energy White Paper 2007 states:

"The RDAs have an important role to play in tackling climate change and contributing to other energy policy goals, within the context of their regional economic strategies. RDAs are well placed to contribute by:

- *Maximizing UK business opportunities that arise through sector and supply chain support, and promoting business energy and resource efficiency;*
- *Supporting the deployment of essential energy infrastructure and skills at a local and regional level; and,*
- *Supporting low carbon innovation, through support for research and demonstration of new and emerging energy technologies.*

The Government recognises that RDAs are the leading strategic economic and sustainable development body in the regions, and within this context will contribute to the Government's energy objectives. Working closely with the Government Offices and Regional Assemblies, RDAs will have the key role in taking forward the implementation of this White Paper at regional level."

Regional Greenhouse Gas (GHG) Inventory

The term 'carbon footprint' has become increasingly commonly used. Confusion however, remains as to what a carbon footprint actually measures: is it carbon (C), carbon dioxide (CO_2) or greenhouse gases (GHGs) and what is the difference?

The answer is that all can potentially be used. This clearly has led to different numbers being generated in different studies, which are not comparable. The two most common measures are carbon dioxide (CO_2) and carbon dioxide equivalents (CO_2e). The GHGs that are captured under carbon dioxide equivalents are typically the six Kyoto gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs and PFCs) although some standards and guidance require all GHGs to be considered[3].

At UK level, emissions of the 6 Kyoto Protocol GHGs (CO_2, CH_4, N_2O, SF_6, HFCs and PFCs) are compiled annually and this emission inventory is submitted to both the European Union and the United Nations Framework Convention on Climate Change (UNFCCC). UNFCCC inventories are used to track national progress against its Kyoto Protocol reduction target. They are currently available for the period 1990 to 2006.

At the regional level, there is currently no "official" GHG emission inventory covering the 6 Kyoto GHGs and updated on an annual basis from 1990; however there are various emission data sources available, which have been used by URS to estimate regional GHG emissions.

URS has identified three main approaches to calculate GHG emissions from the West Midlands. These approaches provide different results, as they are based on different boundaries and datasets,

[3] As defined in IPCC 4th Assessment Report 2007, available at: http://www.ipcc.ch/ipccreports/assessments-reports.htm

however these are considered to be complementary. Results of the regional GHG inventory for each approach are summarised in the table below.

Inventory approach	Total regional GHG emissions in 2004 (kt CO_2 equiv.) *	Top 3 impact areas	WM share of UK emissions	GHG emissions per capita in 2004 (t CO_2 equiv./cap.)	
				West Midlands	UK average
1) By emission source ("production" approach) Takes into account GHG emission sources located *within the geographical boundaries* of the region	~ 44,500	Industrial, Commercial & Public Sector (39%) (of which 16% from fuel and power production) Road transport (27%) Domestic (17%)	7%	8.4	11.0
2) Taking into account energy end-users CO_2 emissions from the production and distribution of energy (power stations, refineries, oil & gas production, mining) are re-allocated to their *point of consumption (energy end-users)*, rather than being counted where the emissions actually occur	~ 54,000	Industrial, Commercial & Public Sector (39%) Road transport (26%) Domestic energy use (25%)	8%	10.1	11.0
3) "Consumption" approach Takes into account direct and indirect GHG emissions associated with goods and services consumed by the region, including embodied GHG emissions of imported products and materials (from UK and overseas).	~ 61,000	Home & energy (27%) Government & fixed capital (26%) Travel (21% with 15% for car travel)	9%	11.5	11.8

* Covers the 6 Kyoto GHGs (CO_2, CH_4, N_2O, HFCs, PFCs, SF_6)

Results presented in the above table show the following:

- *There are significant differences between GHG emission figures calculated with the three methods, because of differences in the inventory boundaries.*
- *The West Midlands region is a net importer of energy and carbon intensive goods and services. This is shown by the significantly higher emissions calculated when taking into account energy use (Method 2) and all indirect emissions (Method 3), compared with the emissions source approach (Method 1).*
- *All three inventories show that regional carbon emissions per capita are slightly lower than the UK average, although this difference is more substantial in the emission source approach (mainly because of the smaller power generation capacity in the West Midlands, compared with the UK overall).*
- *Methods 1 and 2 identify the same top three impact areas: 1) industrial, commercial & public sector activities; 2) road transport; and 3) domestic activities. This is consistent with the UK picture. Method 3 also identifies Home & Energy and Travel within the top three areas, the third main impact area being "Government & Fixed Capital" (including for example direct and indirect emissions of public buildings and infrastructure).*

For the rest of this research we have employed Method 1 as this is consistent with standard government methodology. However, Methods 2 and 3 have also been used to identify potential opportunities and risks for sectors.

Assessment of potential carbon savings

Aligned with the current UK method of assessing carbon emissions and emissions reductions, URS has calculated potential carbon savings based on Method 1 described above.*URS has applied the following approach to estimate potential carbon savings achievable by the region:*

- *Review of international and national carbon reduction policies, and the associated potential carbon savings (data was sourced from the Energy White Paper 2007), and estimation of the West Midlands' share of expected carbon savings resulting from these policies;*
- *Identification of possible combinations of additional national and regional carbon reduction measures that have been or could be implemented in the region (especially those measures addressing issues not fully covered by national policies) and estimation of potential carbon savings associated with these additional measures.*

Two key challenges for all regions in the UK to realise the savings described below are:

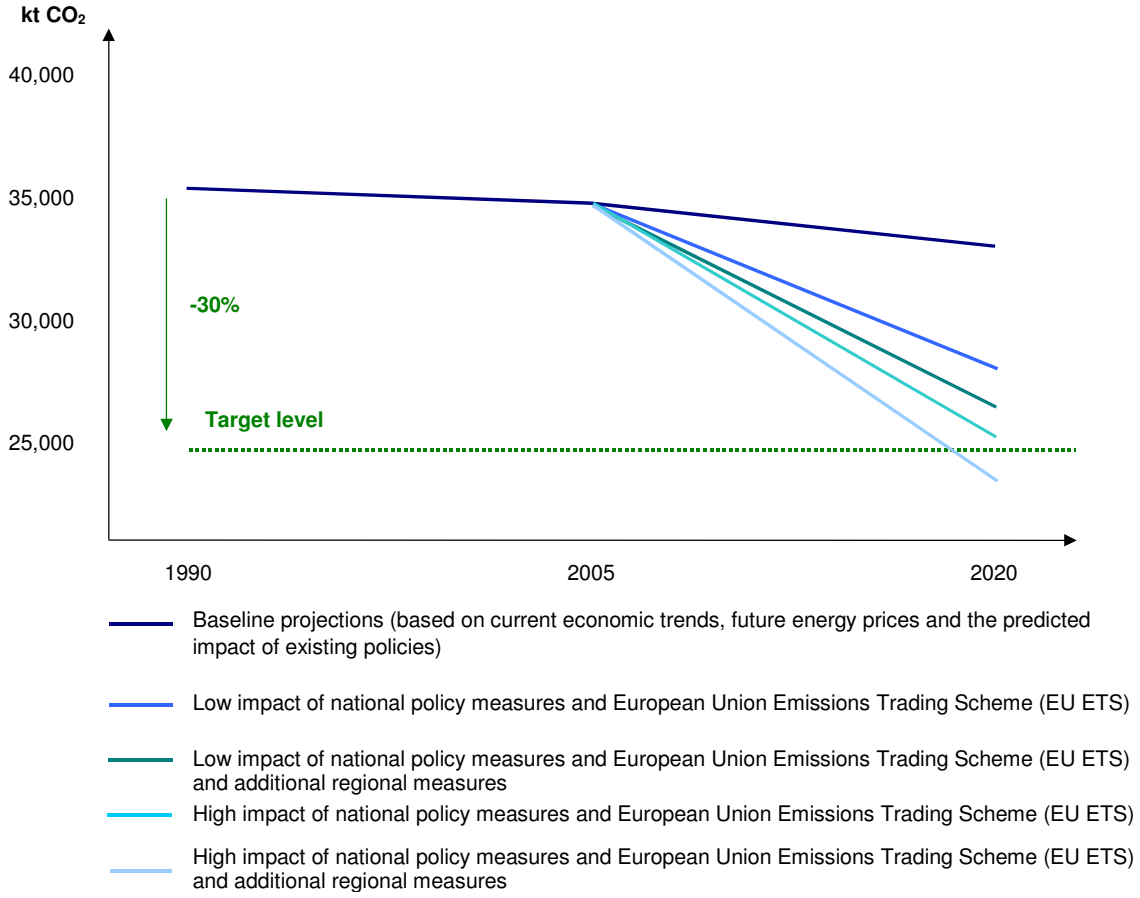
1) *It is likely that all UK national reduction policies will not be entirely implemented and as such, targets will not be met. In this event, regions will need to effectively and thoroughly implement national policies to ensure they get their fair share of emissions reductions from national policies.*
2) *If a region does not implement all the available additional regional measures, they will not meet these reduction targets.*

The results of this assessment are summarised in the table below.

Carbon reduction measures	Potential carbon savings achievable by the West Midlands by 2020	Estimated % reduction of CO_2 emissions between 1990 and 2020
Implementation of national and international policies (as described in the Energy White Paper 2007)	4,900–7,600 kt CO_2	20–28%
Possible additional measures: - "Soft measures" to reduce road traffic - Congestion charging in Birmingham - Decentralised energy generation programme (Combined Heat and Power)	1,400–2,300 kt CO_2	4–7%
TOTAL	6,300–9,900 kt CO_2	24–35%

The potential impact on regional CO_2 emission levels resulting from the implementation of national/international carbon reduction policies as well as additional regional measures as estimated by URS is schematised in the chart below.

Schematic representation of projected estimated regional CO_2 emissions and potential impact of carbon reduction measures



The key findings of this assessment are as follows:

- *It is crucial that regions thoroughly implement both national and regional reduction measures to allow the region to realise these reductions.*
- *It is likely that the implementation of national and international policies will not be sufficient to reach a 30% reduction of CO_2 emissions by 2020 at the regional level. This is also the case at UK level, based on the latest projections.*
- *If the region wishes to achieve a minimum cut of 30%, additional carbon saving measures need to be implemented at the regional level, in particular in areas that are not fully covered by national and international policies such as road traffic reduction and a shift to low carbon public transportation modes.*
- *The implementation of a voluntary carbon offsetting scheme, including project funding within the region, could be an efficient mechanism to achieve additional carbon savings and compensate for the small contribution of the region to the EU Emission Trading Scheme (EU ETS).*

- *Potential carbon savings expected from those measures on which the WMES or AWM can have a direct influence have been estimated to be in the range of 1,100 to 2,300 kt CO_2/year by 2020, which represents 18–23% of the total potential carbon savings from national policies and additional measures.*

Assessment of "carbon constraints" on the business sectors of the region

A first way to assess "carbon constraints" is to identify which sectors are likely to be targeted by carbon reduction regulations, and thus where growth may be constrained due to these carbon regulations. For the purpose of this assessment, URS has classified economic sectors based on their potential exposure to carbon constraints imposed by regulations (such as cap and trade schemes or carbon taxes) and their contribution to regional GVA. The main findings of this assessment are as follows:

- *No high-GVA contribution sectors subject to high regulatory constraints have been identified in the region;*
- *Several sectors have a medium or high GVA contribution coupled with medium or high regulatory constraints on their operations or on their products and services:*
  - *The transport sector (main carbon constraints: possible extension of the EU ETS and Renewable Fuel Transport Obligation);*
  - *The education & health sector (main carbon constraints: EU ETS (due to large scale energy production facilities within universities and hospitals), proposed Carbon Reduction Commitment and Government's carbon neutrality target);*
  - *The retail trade and distribution sector (main carbon constraints: proposed Carbon Reduction Commitment); and*
  - *The construction sector (carbon constraints related to low carbon buildings regulations).*
- *Other sectors with high regulatory constraints but low financial contribution include:*
  - *Transport equipment manufacture, for which carbon regulations apply both to operations (there are a number of sites subject to the EU ETS in the region) and products manufactured (EU fuel efficiency agreements); and*
  - *Food & drink manufacture, mineral products manufacture, chemicals manufacture and electricity supply (main carbon constraints: EU ETS).*

An alternative way of assessing potential "carbon constraints" is to assess the potential impact of carbon prices, and therefore energy prices, on the various economic sectors. According to a report prepared by Oxford Economics for the DTI in May 2007 (Report on modelling the macroeconomic impacts of achieving the UK's carbon emission reduction goal), those industrial sectors that have high energy intensities of production and that are highly exposed to international competition are hit hardest by efforts to reduce carbon emissions. In their report, Oxford Economics modelled the potential economic impact of imposing a 30% CO_2 reduction target by 2020 at UK level, on the various business sectors. Applying the findings of the Oxford Economics' study to the West Midlands shows that:

- *The sectors that represent a high proportion of the regional GVA (e.g. business services) are not likely to be much affected by a 30% carbon reduction target; and*

- *The sectors that are likely to be the worst affected at UK level do not have a significant economic weight in the region, in terms of GVA.*

Although the focus of URS' assessment was on carbon constraints, it should be noted that in certain sectors, carbon mitigation policies could actually trigger innovation and potentially offset the risks posed by carbon constraints. Possible growth opportunities associated with carbon reduction policies in the West Midlands could be found in the following sectors: agriculture (biofuels production); wood (energy production from biomass); transport manufacturing (fuel efficiency innovation); transport services (development of low carbon transport solutions); electrical equipment (energy efficiency innovation, energy metering devices); business services (energy management services, etc.); electricity supply (renewable/decentralised energy production); waste management and recycling sector; construction (low carbon buildings); etc.

Review of current carbon-related regional indicators

URS has reviewed four carbon-related indicators currently used by AWM in order to assess whether these indicators provide a reliable measure of the success of the low carbon WMES and of AWM's interventions in improving resource efficiency and reducing carbon intensity (i.e. reducing carbon emissions while improving GVA). Indicators reviewed were as follows:

- *Carbon per GVA indicator for the West Midlands (t CO_2 per £10,000 GVA);*

- *Draft Regional Index of Sustainable Economic Well-Being (R-ISEW) for the West Midlands, currently under development by the New Economics Foundation (NEF), which takes into account social and environmental factors in measuring sustainable growth through economic well-being;*

- *Measure of carbon savings resulting from AWM's interventions, calculated by the Carbon Project Assessment Tool (developed by ERM);*

- *Carbon Index for Business (kg CO_2 per £ GVA), calculated by the pilot Carbon Index Tool for Business; the pilot Carbon Indexing Project is being undertaken across a representative range of manufacturing companies in the region (20 business), as a first step in the development of a region-wide offering anticipated as being associated with Business Link.*

The key findings of URS' review are as follows:

- *Using a combination of the above indicators will be most effective for measuring and monitoring the low carbon performance of the WMES.*

- *Carbon per GVA will demonstrate those sectors generating carbon friendly growth and accordingly show those sectors, which are performing poorly at a single point in time (in terms of CO_2 emission sources). It is then possible to use indicators such as the Carbon Footprint of AWM's interventions (Carbon Reduction Assessment Tool) or the Business Carbon Index to focus on specific performance of a representative sample of businesses within those sectors in order to measure their improvement in resource efficiency over time.*

- *The R-ISEW alone is not a useful indicator as it cannot isolate and attribute carbon specific growth, however the gap between GVA and ISEW can be used as an indicator alongside others to demonstrate the overall sustainability performance of the WMES.*
- *Only the Carbon Reduction Assessment Tool can demonstrate low carbon growth that can be directly attributed to AWM.*

Definition of low carbon diversification indicators

URS and Forum for the Future shared the findings of their respective research works to compile a list of possible indicators that could be used to measure the progress of the region in diversifying into low carbon products, services and techniques. A more comprehensive assessment of data availability for each of the indicators identified still needs to be conducted with the support of the West Midlands Regional Observatory. This should lead to the selection of a set of relevant indicators that can be monitored by the region.

1. INTRODUCTION

1.1. Context and purpose

After the success of Al Gore's 2006 film, 'An Inconvenient Truth', and the attention attracted by the 2006 Stern Review, the pressure for action on climate change was bolstered further in 2007 by the publication of the latest assessment reports by the Intergovernmental Panel on Climate Change.

In response, AWM commissioned a programme of work to underpin its work on producing the UK's first low carbon Regional Economic Strategy. This programme included, among other work streams, the development of an evidence base to support the "low carbon" components of the new West Midlands Regional Economic Strategy (WMES) and an assessment of the impacts of climate change on the economy of the West Midlands.

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1.2. Background

The UK carbon reduction strategy

The 2006 Stern Review on the economics of climate change concluded that without actions to reduce emissions, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP each year and GHG emissions could more than treble by the end of the century. In the UK, the Government has demonstrated that the economy can still grow whilst reducing emissions with the UK economy growing by approximately 54% while greenhouse gas emissions fell by over 15% in 20054.

In October 2007, the Government published its response to pre-legislative scrutiny and public consultation on the draft UK Climate Change Bill. At the time of writing this report, the Bill, the first of its kind in the world, was expected to set a statutory reduction of at least 60% in CO_2 emissions by 2050. The Bill creates a new legal framework for the UK achieving, through domestic and international action, at least a 60% reduction in GHG (i.e. equivalent CO_2) emissions by 2050 against a 1990 baseline.

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[4] Defra, 2007. 'UK Climate Change Programme, Annual Report to Parliament'.

While the UK is on track to meet its Kyoto Protocol target, more needs to be done to meet the challenging domestic target of 60% reduction by 2050. In response, the UK Government has introduced a range of policies and measures to reduce GHG emissions, on both a domestic and international level. These policies and measures include:

- The Environmental Transformation Fund – to enhance the commercialisation of low carbon and energy efficiency technologies;
- The Renewables Obligation – a mandatory obligation for energy suppliers to produce a percentage of their energy from renewable sources;
- The Climate Change Levy – an environmental tax on industry, commerce and public sector energy use, administered by HM Revenue & Customs;
- The Renewable Fuels Obligation – an obligation for all transport fuel in the UK to be 5% renewable by 2010;
- The Carbon Reduction Commitment – due to begin in 2010, this mandatory emissions trading scheme for large, non-energy intensive private and public sector organisations will cover the likes of large local authorities, government departments, banks, offices, supermarkets. Participants will be required to purchase allowances corresponding to their energy use and surrender them at the end of the year. Allowances will be auctioned with the revenue recycled to participants based on their performance in a CRC league table; and
- A new set of National Indicators (NI) for local authorities as part of a new performance framework (the Comprehensive Area Assessment). The CAA assesses the performance of each local authority against the NIs, including three related to climate change:
  - NI 185: Measures CO_2 emissions reductions from the local authority's own operations;
  - NI 186: Measures per capita reduction in CO_2 emissions in the local authority's area; and
  - NI 188: Measures the local authority's progress in assessing and addressing the risks and opportunities of a changing climate.

It should be noted that the findings presented in this report are based on analysis carried out prior to the finalisation of the Climate Change Bill and are therefore in line with the scope of policy measures and targets outlined in the draft Climate Change Bill available during Summer 2007[5].

[5] The analysis in this report was conducted during the Summer 2007 and as such does not reflect data made available after this date.

The role of Regional Development Agencies (RDAs) in tackling carbon emissions

The Energy White Paper 2007 states *"The RDAs have an important role to play in tackling climate change and contributing to other energy policy goals, within the context of their regional economic strategies. RDAs are well placed to contribute by:*

- *Maximizing UK business opportunities that arise through sector and supply chain support, and promoting business energy and resource efficiency;*
- *Supporting the deployment of essential energy infrastructure and skills at a local and regional level; and,*
- *Supporting low carbon innovation, through support for research and demonstration of new and emerging energy technologies.*

The Government recognises that RDAs are the leading strategic economic and sustainable development body in the regions, and within this context will contribute to the Government's energy objectives. Working closely with the Government Offices and Regional Assemblies, RDAs will have the key role in taking forward the implementation of this White Paper at regional level."

2. REGIONAL GREENHOUSE GAS (GHG) EMISSION INVENTORY

2.1. Methodology

The term 'carbon footprint' has become increasingly commonly used. Confusion has however, arisen regarding what is a carbon footprint actually measures: it is carbon (C), carbon dioxide (CO_2) or greenhouse gases (GHGs) and what is the difference?

The answer is that all can potentially be used. This clearly has led to different numbers being generated in different studies, which are not comparable. The two most common measures are carbon dioxide (CO_2) and carbon dioxide equivalents (CO_2e). The GHGs that are captured under carbon dioxide equivalents are typically the six Kyoto gases (carbon dioxide, methane, nitrous oxide, sulphur hexafluoride, HFCs and PFCs) although some standards and guidance require all GHGs to be considered[6].

At UK level, emissions of the 6 GHGs covered by the Kyoto Protocol (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6) are compiled annually and this emission inventory is submitted to both the European Union and the United Nations Framework Convention on Climate Change (UNFCCC). UNFCCC inventories are used to track national progress against its Kyoto Protocol reduction target. They are currently available for the period 1990 to 2006.

At the regional level, there is currently no "official" GHG emission inventory covering the 6 Kyoto GHGs and updated on an annual basis from 1990; however there are various emission data sources available, which have been used by URS to estimate regional GHG emissions.

[6] As defined in IPCC 4th Assessment Report 2007, available at: http://www.ipcc.ch/ipccreports/assessments-reports.htm

URS has identified three main approaches to calculate GHG emissions from the West Midlands. Each approach provides different results, as they are based on different boundaries and datasets, however they are considered complementary. Table 1 outlines the main differences between these three inventory approaches and provides some recommendations on how best to use the results of these inventories.

Table 1: Comparison of regional GHG emission inventory approaches

Approach	Scope	Data sources	Limitations	What should it be used for?
Method 1: **By emission source ("production approach")**	Takes into account GHG emission sources located within the geographical boundaries of the region, i.e. corresponds to GHG emissions occurring *within* the region. Approach used for "official" national GHG inventories annually reported under the United Nations Convention Framework on Climate Change (UNFCCC) and used to assess progress against Kyoto targets, therefore UK reduction targets are based on figures derived from this approach.	Bottom-up approach: The main data sources are the Environment Agency Pollution Inventory and regional fuel consumption data from the former Department for Trade & Industry (DTI). The REEIO model (Regional Economic Environment Input Output model) used by the West Midlands Regional Observatory (WMRO), enables a bottom-up calculation of regional GHG emissions using emission data from the NAEI (National Atmospheric Emission Inventory). NAEI emission data include "point source" data (usually large industrial installations covered by the Pollution Inventory), "area source" data and road transport data. Emissions can be broken down by 43 sectors, which can be converted into SIC categories (Standard Industrial Classification).	The emission source approach does not take into account CO_2 emissions resulting from the electricity imported from outside the region. As such, it tends to under-estimate the carbon footprint of the region if it is a net importer of energy, which is the case of the West Midlands. Also, this approach may not provide an accurate picture of the region's progress in terms of energy efficiency. Bottom-up approach: The limitations are mainly associated with the availability and reliability of NAEI data used by the REEIO model, and by the REEIO model itself (which still needs to be improved).	Figures obtained from this approach are useful to monitor the progress of the region in switching to low carbon fuels and renewable energy. Currently available datasets enable an assessment of CO_2 emissions by SIC code, which is useful to identify in detail which sectors are the biggest CO_2 emitters ("prioritisation" exercise). The danger of using this method only is that it would be possible to reduce the region's carbon footprint simply by outsourcing carbon emissions to other regions.

Approach	Scope	Data sources	Limitations	What should it be used for?
		Top-down approach with detailed breakdown by economic sectors: A top-down approach is currently used by the WMRO to calculate regional CO_2 emissions per Gross Value Added (GVA). Regional shares of UK employment by SIC codes are applied to UK CO_2 emissions obtained from the UK Environmental Accounts. CO_2 emissions from the UK Environmental Accounts are split into 93 "EA codes". A conversion table has to be used to convert EA codes into SIC codes.	Top-down approach with detailed breakdown by economic sectors: The calculation using UK Environmental Accounts data assumes that CO_2 emissions per employee in each economic sector are the same in the UK and in WM. This assumption is not always verified; for example, the WM share of UK employment in the electricity/gas/water supply sector is relatively high (13% of UK) but CO_2 emissions from this sector (based on Pollution Inventory data) are relatively small compared to other regions, due to the limited power generation capacity of the West Midlands (West Midlands' emissions from power generation only represent 4% of the UK total).	
Method 2: **Energy end-user approach**	In this approach, CO_2 emissions from the production and distribution of energy (power stations, refineries, oil & gas production, mining) are re-allocated to their *point of consumption (energy end-users)*, rather than being counted where the emissions actually occur.	The main data source is a DEFRA survey ("Local & Regional CO_2 Emissions Estimates for the UK"), available for years 2003 and 2004 at the time of writing this report (2005 data will reportedly be published later in 2007). DEFRA data are mainly based on local and regional energy use data issued by the DTI.	CO_2 emissions from electricity use are estimated based on the average UK emission factor. Therefore any change in the carbon intensity of fuels used for electricity generation at the regional level (e.g. increase in renewable energy production) will not be accurately reflected by this approach. Currently available data aggregates CO_2 emissions from industrial, commercial and public sectors in one single category, and there is no easy way to split emissions by SIC code at this stage.	This approach is considered as the most relevant for monitoring the region's progress in improving energy efficiency. Through their interventions, Regional Development Agencies (RDAs) may have more influence on energy users than on energy producers, so this approach would be relevant to identify the sectors where the RDA should focus their efforts in terms of energy efficiency initiatives and interventions, should a detailed breakdown by economic sectors become available after the publication of this report.
Method 3: **"Consumption approach"**	Takes into account direct and indirect GHG emissions associated with goods and services consumed by the	Approach developed by the Stockholm Environment Institute, on behalf of Ecological Budget UK. The REAP model	Still experimental with significant level of uncertainty on embodied GHG emissions of goods imported from other parts of the world.	Measuring the "extended" carbon footprint of the region and the influence of regional

Approach	Scope	Data sources	Limitations	What should it be used for?
	region, including embodied GHG emissions of imported products and materials (from UK and overseas). As such, this approach is considered as more representative of the actual carbon footprint of the region.	(Resource and Energy Analysis Program) is used to calculate these figures at the regional level.	Considered therefore to have a greater level of uncertainty within the numbers than the other methods.	consumption patterns on global GHG emissions.

Appendix A provides the details of the methodology followed by URS to calculate regional GHG emissions according to Methods 1 and 2 presented in the above table.

2.2. Key findings

At the time of writing this report, the latest year for which emission data was available from all data sources was 2004; therefore regional GHG inventory results presented in this section correspond to year 2004.

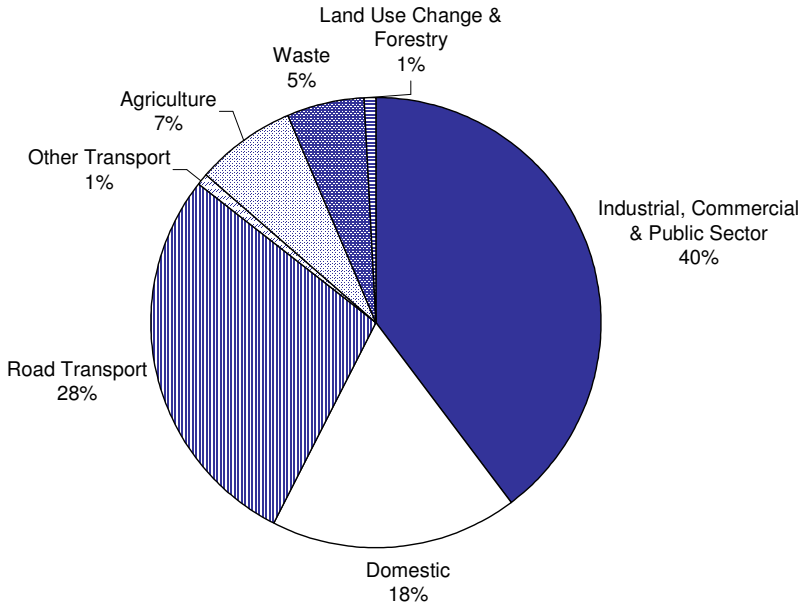
Regional inventories compiled by URS cover the 6 GHGs covered by the Kyoto Protocol (CO_2, CH_4, N_2O, HFCs, PFCs and SF_6).

2.2.1. Regional GHG emissions according to the emission source or "production" approach (Method 1)

Total regional GHG emissions calculated by this first approach are in the order of 44,500 kt CO_2 equivalent, of which just over 86% is associated with CO_2 with the other 5 Kyoto gases comprising the balance.

Chart 1 provides an overview of the key sectors contributing to regional GHG emissions, by emission source. Detailed results are provided in Tables A2 and A3 (Appendix A).

Chart 1: Regional GHG emissions by emission source – Key sectors (2004)



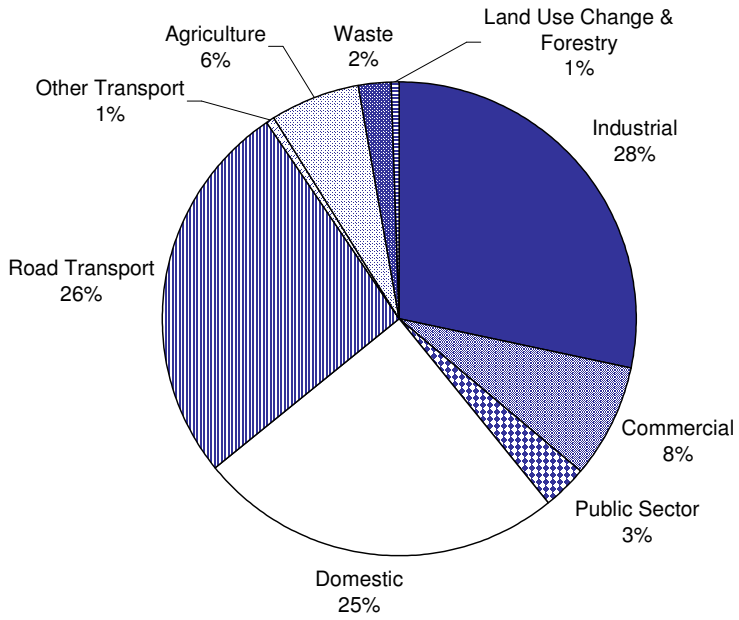
The above chart shows that the three main sectors contributing to regional emissions, in terms of emission sources, are: 1) the industrial, commercial and public sector; 2) road transport; and 3) the domestic sector. This is consistent with the main emission sources at UK level, although the contribution of the industrial sector is slightly lower than nationally due to the smaller number of power stations in the West Midlands compared with other regions (such as the East Midlands for example).

2.2.2. Regional GHG emissions taking into account energy end-users (Method 2)

Total regional GHG emissions calculated by this second approach are in the order of 54,000 kt CO_2 equivalent, of which approximately 88% is associated with CO_2 with the other 5 Kyoto gases comprising the balance.

Chart 2 provides an overview of the key sectors contributing to regional GHG emissions, taking into account energy end-users. Detailed results are provided in Tables A4 and A5 (Appendix A).

Chart 2: Regional GHG emissions with energy emissions re-allocated to end-users – Key sectors (2004)



The above chart shows that the three main sectors contributing to regional emissions, based on the energy end-user approach, are the same as in the emission source approach; however the proportion of the domestic sector is significantly higher given the high electricity consumption of this sector.

CO_2 emissions associated with electricity use in the region represented approximately 14,000 kt CO_2 in 2004 (approximately 33,400 GWh), while CO_2 emissions from power stations located within the region were approximately 7,000 kt CO_2. Therefore the West Midlands has to import electricity from other regions in order cover its use.

2.2.3. Regional GHG emissions according to the "consumption" approach (Method 3)

GHG emissions associated with the consumption of goods and services by the region have been calculated by the Stockholm Environment Institute and published in a report issued in 2006 by Ecological Budget UK: "*Counting consumption – CO_2 emissions, materials flows and Ecological Footprint of the UK by region and devolved country*".

Total regional GHG emissions calculated by this third approach are in the order of 61,000 kt CO_2 equivalent (the year of the data is not specified in the Ecological Budget report).

Regional CO_2 emissions presented in the Ecological Budget UK report are summarised in Table 2 below and illustrated in Chart 3.

Table 2: GHG emissions associated with the consumption of goods and services by the region

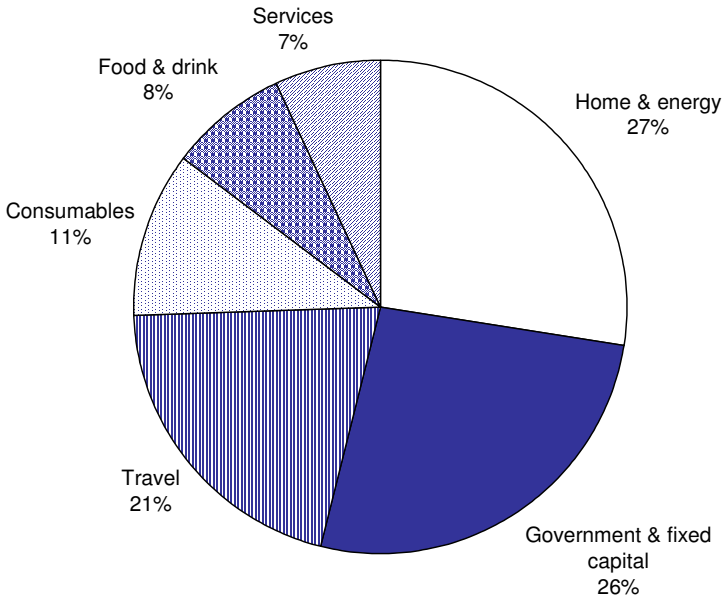
	Total emissions of the West Midlands		t CO_2 equiv. / capita (*)	
	kt CO_2 equiv.	% of total	West Midlands	UK
Home & energy	16,749	27%	3.14	3.10
Government & fixed capital	16,162	26%	3.03	3.03
Travel	12,588	21%	2.36	2.44
Consumables	6,614	11%	1.24	1.46
Food & drink	4,694	8%	0.88	0.87
Services	4,267	7%	0.80	0.90
TOTAL	**61,074**	100%	**11.45**	11.81

** The REAP model used to calculate these figures reportedly takes into account CO_2, CH_4 and N_2O emissions and therefore excludes HFCs, PFCs and SF_6.*

Definition of categories:

- *Home & energy: Domestic fuel including gas and electricity, oil and bio-fuel. Also includes the building, maintenance and repair of dwellings.*
- *Government & fixed capital: Government includes the resources used by national and local government, universities and colleges. Fixed capital includes investment in tangible fixed assets such as plant and machinery, transport equipment, dwellings and other buildings and structures.*
- *Travel: Car fuel, the impact associated with purchasing and maintaining private vehicles, and public transport.*
- *Consumables: Includes durable and non-durable items including newspapers, clothing, appliances, glassware, tools, medical products, audio-visual equipment, personal effects, etc.*
- *Food & drink: Food and drink purchased for home consumption, alcoholic drinks purchased in pubs, restaurants, takeaways, and other catering establishments.*
- *Services: Includes education, postal, telephone, water supply, recreation, insurance, private hospital, financial services, etc.*

Chart 3: GHG emissions associated with the consumption of goods and services by the region



Overall, the regional carbon footprint calculated by this approach is slightly lower than the UK average, with a higher impact for Home & Energy and a lower impact for Travel, Consumables and Services. One of the main reasons for the "Home & Energy" emissions being slightly higher than the UK average is the poorer condition of existing housing stock in the West Midlands (energy efficiency lower than UK average). Regarding travel emissions, it is noted that car travel represents 74% of the total for travel, which is slightly higher than the national average.

2.2.4. Comparison of GHG emissions calculated by the three methods

Table 3 below provides a comparison between regional GHG emission figures obtained by the three inventory methods.

Table 3: Comparison of GHG emissions calculated by the three methods

Inventory approach	Total regional GHG emissions in 2004 (kt CO_2 equiv.)	Top 3 impact areas	WM share of UK emissions	GHG emissions per capita in 2004 (t CO_2 equiv./cap.)	
				West Midlands	UK average
1) By emission source ("production" approach)	~ 44,500 (of which just over 86% arises from CO_2)	Industrial, Commercial & Public Sector (39%) (of which 16% from fuel and power production) Road transport (27%) Domestic (17%)	7%	8.4	11.0
2) Taking into account energy end-users	~ 54,000 (of which 88% arises from CO_2)	Industrial, Commercial & Public Sector (39%) Road transport (26%) Domestic energy use (25%)	8%	10.1	11.0
3) "Consumption" approach	~ 61,000	Home & energy (27%) Government & fixed capital (26%) Travel (21% with 15% for car travel)	9%	11.5	11.8

The above comparison shows the following:

- There are significant differences between the GHG emission figures calculated with the three methods.
- The West Midlands region is a net importer of energy and carbon intensive goods and services. This is shown by the significantly higher emissions calculated when taking into account energy use (Method 2) and all indirect emissions (Method 3), compared with the emissions source approach (Method 1). Emissions calculated with the energy end-user approach (Method 2) are approximately 20% higher than those calculated with the emission source approach (Method 1). Emissions calculated with the "consumption" approach (Method 3) are approximately 35% higher than those calculated with the emission source approach (Method 1).
- All three inventories show that regional carbon emissions per capita are slightly lower than the UK average, although this difference is more substantial in the emission source approach (mainly because of the smaller power generation capacity in the West Midlands, compared with the UK overall).
- Methods 1 and 2 identify the same top three impact areas: 1) industrial, commercial & public sector activities; 2) road transport; and 3) domestic activities. This is consistent with the UK picture. Method 3 also identifies Home & Energy and Travel within the top three areas, the third main impact area being "Government & Fixed Capital" (including for example direct and indirect emissions of public buildings and infrastructure).

With regard to road transport emissions, it must be noted these emissions have been calculated based on regional vehicle specific traffic census data published by the Department for Transport (DfT) in Methods 1 & 2, therefore they include emissions from vehicles that do not contribute to the economy of the West Midlands but are only using West Midlands' roads ("straight-through" traffic), and exclude emissions from West Midlanders outside the region. Given the high proportion of trunk roads and motorways in the West Midlands, a significant proportion of road traffic emissions may only be due to "straight-through" traffic and may not be attributable to the region itself. Data currently available does not allow to estimate the contribution of "straight-through" traffic to overall road traffic emissions, however according to regional traffic statistics published by the DfT the proportion of km travelled on motorways in the West Midlands is higher than the national average (25% of total km travelled in the region are on motorways, vs 19% for Great Britain).

In Method 3, travel emissions include road transport emissions resulting from West Midlanders' journeys inside and outside the region.

For the rest of this research we have employed Method 1 as this is consistent with standard government methodology. However, Methods 2 and 3 have also been used to identify potential opportunities and risks for sectors.

2.2.5. Detailed inventory of CO_2 emissions by SIC code and estimate of 1990 and 2020 baseline emission levels

Methodology

The interim carbon reduction target of 30% by 2020 defined at UK level is defined as follows:

$$\text{\% change in } CO_2 \text{ emissions} = \frac{\text{Projected } CO_2 \text{ emissions in 2020 in the absence of carbon reduction policies ("baseline" emissions)} - CO_2 \text{ savings from carbon reduction policies by 2020}}{CO_2 \text{ emissions in 1990}} - 1$$

To calculate the achievable % reduction in CO_2 emissions, it is necessary to estimate regional baseline emission levels in 1990 and 2020, in addition to the calculation of potential carbon savings.

It must be noted that the 60% reduction target by 2050 (and the 30% interim target by 2020) proposed in the Draft Climate Change Bill only focuses on CO_2 emissions (and not the other Kyoto GHGs). The justification given by the Draft Climate Change Bill Consultation Document (March 2007) is that the UK has made less progress in reducing this gas than other GHGs, and CO_2 is by far the most significant GHG (currently accounting for some 85% of UK GHG emissions); also, the UK has been successful in reducing emissions from non-CO_2 GHGs to date (in 2005 emissions had fallen 44% since 1990 and are projected to fall 50% by 2050) but further non-CO_2 emissions reductions are considered to be very difficult and/or costly.

Consequently, this chapter of the report and the next ones only focus on CO_2 emissions, in accordance with the current definition of the UK reduction target.

In order to provide AWM with detailed findings by business sectors (categories defined by the Standard Industrial Classification or "SIC"), URS has used CO_2 emission data calculated by the REEIO model for 2004 (provided by the West Midlands Regional Observatory). The reason for using the REEIO model is that it provides a breakdown of CO_2 emissions into 43 economic sectors which can easily be converted into SIC categories, and emission data for the main sources are obtained from bottom-up calculations in this model. However it must be noted that REEIO model emission data are calculated based on an emission source approach, therefore they tend to under-estimate the carbon footprint of the region.

CO_2 emissions in 1990 and 2020 have been extrapolated by URS based on the percentage of change by sector at UK level between 1990 and 2004, and between 2004 and 2020. Calculation details are provided in Appendix A. In the absence of any reliable regional data to estimate 1990 emission levels and 2020 baseline emission projections, URS has assumed that the percentage of change in CO_2 emissions from each sector would be the same in the West Midlands and in the UK. Assumptions on the 1990 and 2020 emission levels have a significant influence on the % reduction in CO_2 emissions achievable by 2020; therefore the reliability of the carbon savings calculations could be improved in after the publication of this report should regional estimates of 1990 and 2020 emission levels become available.

"Baseline" emission projections for 2020 presented in this chapter correspond to CO_2 emissions that would occur in 2020 based on current economic trends and future energy prices, including the predicted impact of existing carbon reduction policies by 2020 (i.e. 25 MtC savings by 2020 at UK level), but excluding the predicted impact of new policies proposed in the Energy White Paper 2007. The list of existing policies and associated carbon savings taken into account in the baseline is provided in Table B2 (Appendix B). This definition of baseline emissions is the one used in the Energy White Paper of May 2007.

UK trends by sector that have been used by URS to estimate 1990 and 2020 emissions are presented in Tables A15 and A16 (Appendix A).

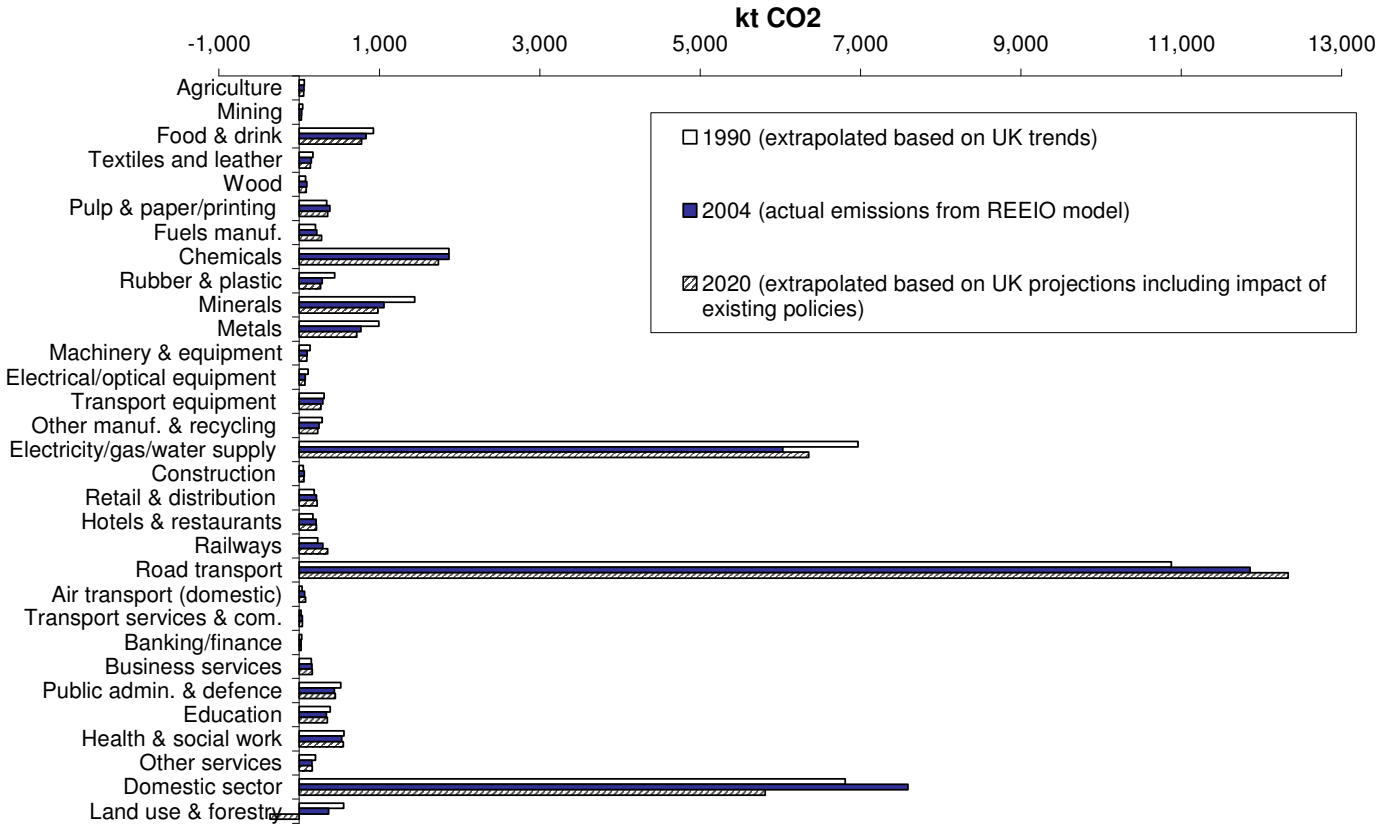
The 2020 trends for the future West Midlands economy have been provided by the West Midlands Regional Observatory to ensure continuity with other evidence base work for the WMES.

Key findings

Overall, it is estimated that regional CO_2 emissions have decreased by approximately 1% between 1990 and 2004, and would further decrease by approximately 6% between 2004 and 2020 if existing carbon reduction policies are fully implemented (but in the absence of any new policies). This gives an overall reduction of approximately 7% between 1990 and 2020 (to be compared with a projected reduction of 6% at UK level).

Chart 4 below illustrates the results of the detailed CO_2 emission inventory by SIC category and the estimated emissions in 1990 and 2020. Detailed emission data are provided in Table A13 (Appendix A).

Chart 4: Regional CO_2 emissions by source, detailed by SIC categories (1990, 2004, 2020)



The detailed breakdown of CO_2 emissions by sector shows that the largest CO_2 emitting sectors, by emission source, are road transport, the domestic sector and the electricity supply sector. For these three sectors, the emission trends between 2004 and 2020, in the absence of any new reduction policies, are predicted to be as follows:

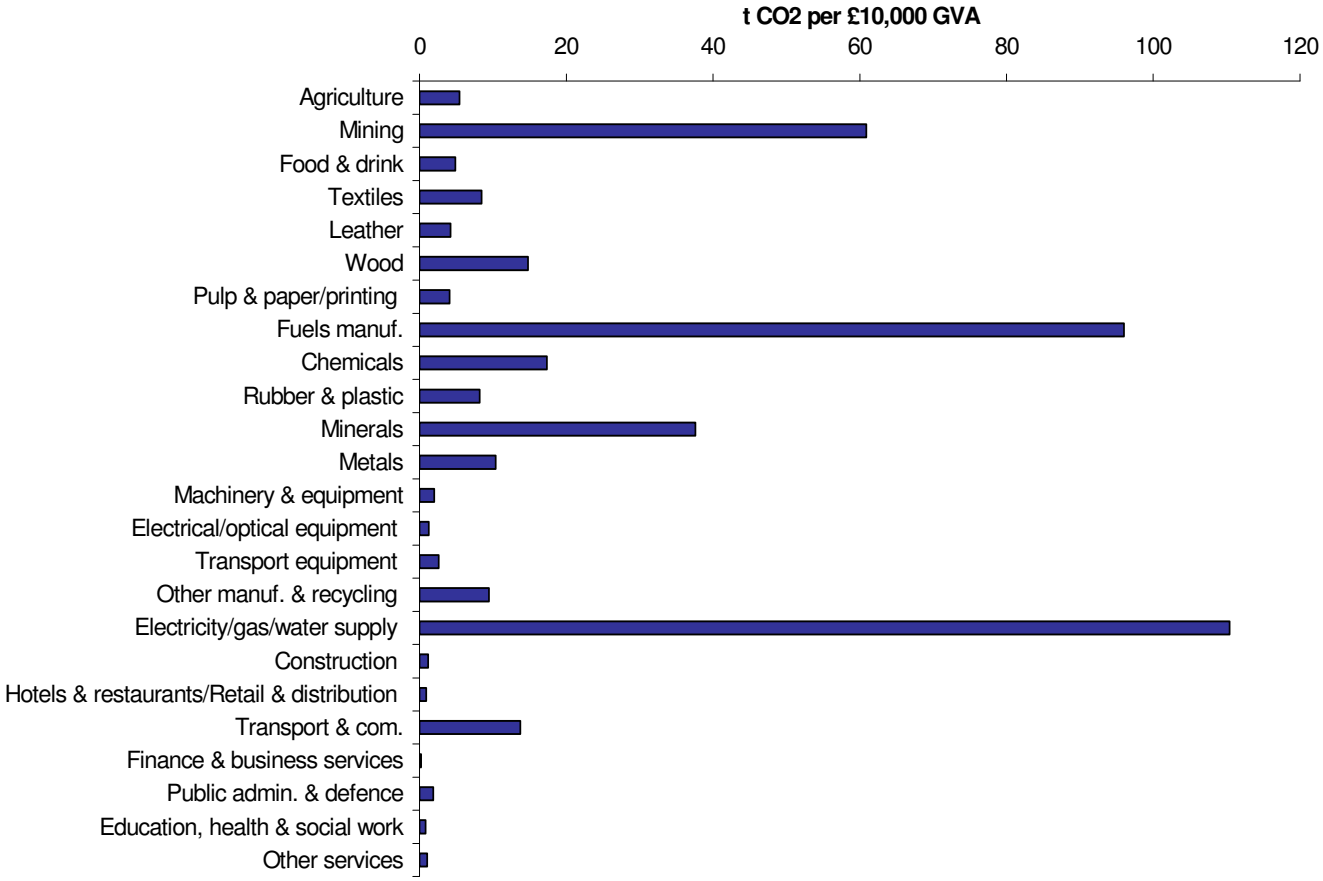
- Power station emissions would increase by approximately 5% by 2020, following a 15% decrease between 1990 and 2004 which was mainly due to fuel switching from coal to gas;
- Road transport emissions would continue to increase (+4% by 2020); and
- Domestic sector emissions would decrease significantly (-23% by 2020) mainly as a consequence of the long-term impact of existing energy efficiency policies; this follows an increase between 1990 and 2004 (+11%).

It must be noted that the overall emission trends by sector between 2004 and 2020 would be quite similar if calculated by the energy end-user approach.

2.2.6. CO_2 emissions per GVA per SIC category

CO_2 emissions per GVA data are calculated by the West Midlands Regional Observatory (WMRO) for each SIC category. The results are presented in Chart 5 below.

Chart 5: Regional CO_2 emissions (tonnes) per £10,000 GVA, by emission source (2004)



As shown in the previous graph, the five most "carbon intense" sectors (calculated by emission source) are: electricity supply; manufacture of fuels; mining; manufacture of minerals; and manufacture of chemicals. A comparison between Charts 4 & 5 indicates that some of the largest CO_2 emitting sectors such as electricity supply, minerals and chemicals are also among the most "carbon intense" in terms of CO_2 per GVA. For mining and fuels manufacture, the high carbon intensity is driven by the low GVA of these sectors rather than their CO_2 emissions.

The five least "carbon intense" sectors are: financial intermediation/real estate/business activities; education, health and social work; wholesale and retail trade/hotels and restaurants; other community, social and personal service activities; and construction. However the carbon intensity of these sectors would be higher if electricity use was taken

into account in the calculation, however the data is not available in a format to enable this comparison to be made.

2.2.7. Comparison with other regions

A comparison between CO_2 emissions of the West Midlands and other English regions is provided on the Government's Sustainable Development website (http://www.sustainable-development.gov.uk/progress/regional/summaries/index.htm).

A crucial caveat to these comparisons is that the differences in the regional emissions are not a ranking and do not reflect the actual performance of each region in reducing emissions. The comparisons are a reflection of the differences in the regions, for example, the economic geography. Regions in England have a diverse set of individual circumstances and priorities, and emissions reduction potential could be significantly different across regions. As such, the contribution for each region to meeting the UK national targets differs.

Charts 6 and 7 below provide a comparison of CO_2 emissions of English regions for the three main sectors (industrial and commercial; domestic; road transport).

Chart 6: CO_2 emissions of English regions, by end users (2004) (Source: http://www.sustainable-development.gov.uk/progress/regional/summaries/02.htm)

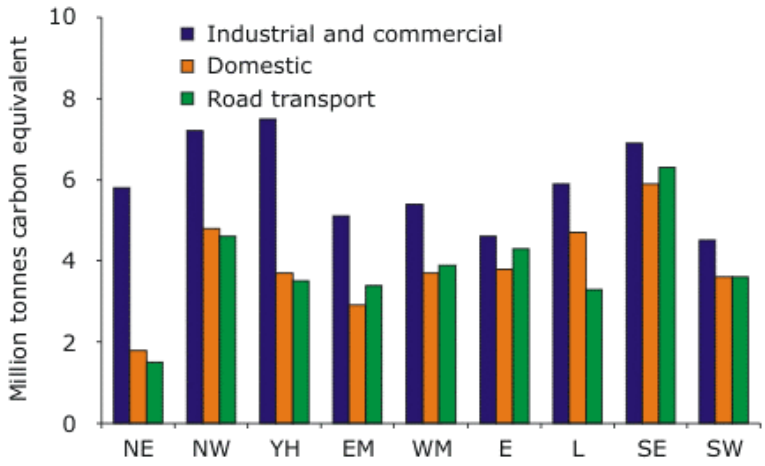
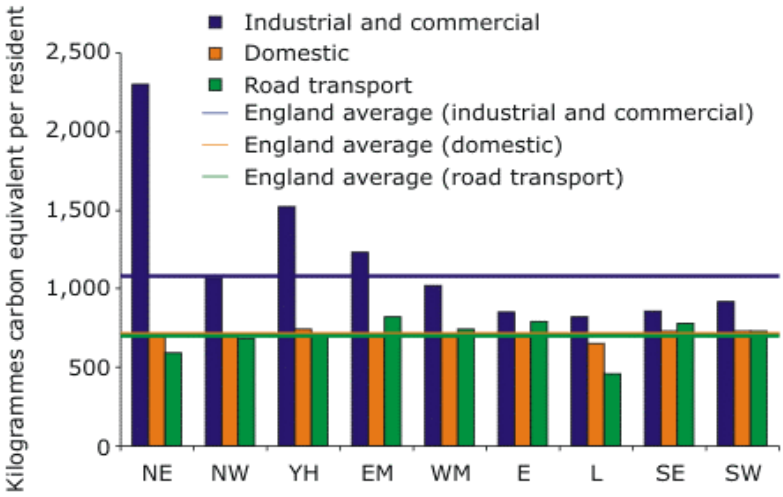


Chart 7: CO_2 emissions of English regions, by end users, per head (2004) (Source: http://www.sustainable-development.gov.uk/progress/regional/summaries/02.htm)



The previous graph shows that the West Midlands' industrial and commercial emissions are lower than the English average, while domestic emissions and road transport emissions are close to the English average.

3. ASSESSMENT OF POTENTIAL CARBON SAVINGS

There are currently no regional targets for carbon reduction and each region will contribute differently to the national target. As such, the targets identified in the UK Climate Change Bill have been used to contextualise the regional challenge.

3.1. Methodology

URS has applied the following approach to estimate potential carbon savings achievable by the region:

- Review of international and national carbon reduction policies, and the associated potential carbon savings (data was sourced from the Energy White Paper 2007);
- Estimation of the West Midlands' share of expected carbon savings resulting from these policies. It is expected that regional carbon savings will depend upon the following main factors:
  - The contribution of the region to UK CO_2 emissions from the sectors targeted by the various policies;
  - The level of implementation of the policies at the regional level (the UK carbon savings associated with certain policy measures are given as a relatively wide range by policy documents, and the final result can be greatly influenced at the regional level, in particular in areas where the region has specific strengths, such as biofuels in the West Midlands); and
  - Regional characteristics (e.g. due to its geography, the West Midlands have a lower potential for wind energy than other regions).

- Identification of possible additional carbon reduction measures that have been or could be implemented in the region, through discussions with AWM and the review of available information;
- Estimation of potential carbon savings associated with these additional measures; and
- Identification of those carbon savings that can be directly or indirectly influenced by the West Midlands Regional Economic Strategy (WMES) or AWM, based on discussions with AWM.

The main reasons for choosing the above method were:

- To use a reliable and recent source of carbon savings data, i.e. the Energy White Paper published in May 2007, as a basis for our calculations; and
- To assess the level of effort required by the region, in addition to the implementation of national policies, in order to achieve at least a 30% reduction in carbon emissions by 2020.

There are numerous other data sources for carbon savings (e.g. carbon savings associated with various carbon mitigation technologies) however these figures vary significantly from one publication to another, and therefore this was considered to be a less reliable source of information than the Energy White Paper.

With regard to additional measures that could be implemented at the regional level, URS has focused on realistic carbon reduction measures that could be quantified with a reasonable level of accuracy and did not overlap with each other; therefore our approach can be considered as relatively conservative.

CO_2 emission data used for the assessment of potential carbon savings are actual 2004 emission levels calculated by the REEIO model, and emission levels for 1990 and 2020 extrapolated from actual 2004 emissions (see Section 2.2.5). The reason for using these data sets is that they are the only ones to include a breakdown according to SIC categories.

Potential carbon savings for the West Midlands have been estimated by URS for the year 2020, which is consistent with the data currently available at UK level. There is little data available on potential carbon savings that could be achieved beyond 2020, and the uncertainties on such data are significant, therefore no attempt has been made to estimate potential carbon savings by 2050.

Appendix B provides a summary of each of the policies reviewed by URS, with their expected carbon savings, and outlines the sectors which are likely to be targeted by the various policies in the West Midlands.

3.2. Key findings

3.2.1. Potential carbon savings from national and international policies

Table 4 below summarises the potential carbon savings expected to result from the implementation of national/international policies in the West Midlands, and indicates those savings that could be directly or indirectly influenced by the WMES or AWM. Calculation details can be found in Appendix C.

Table 4: Potential carbon savings from policies proposed in the Energy White Paper of May 2007

PROPOSED POLICIES (ENERGY WHITE PAPER 2007)		WM expected C savings by 2020 ($ktCO_2$/year)	Under WMES and partners influence	Under AWM influence	Comments
EU Emission Trading Scheme (EU ETS)	Based on same allowances as Phase II, but UK may decide to tighten the C allowances after 2012	2,009			
Energy Efficiency in Business	Carbon Reduction Commitment (CRC) in the business sector	235			
	Energy Performance of Building Directive EPBD	59 – 147			
	Business Smart Metering	29 – 59			AWM could make it a requirement as part of project funding.
	More energy efficient products in business sector	147 – 411			The WMES can encourage innovation and stimulate demand for low carbon products. AWM can provide funding to companies specialising in low carbon products, as well as R&D and skills development in relation to low carbon products
	Energy Performance Certificates	unspecified			
	Existing Building Upgrade (industrial & commercial buildings)	unspecified			AWM can provide financial support for improving/expanding buildings and AWM can impose energy efficiency requirements for building refurbishment projects, depending on the type of building
Energy Efficiency in Business Total		**470 – 852**			
Energy Efficiency in Households	Energy Performance of Building Directive EPBD	66 – 198			No direct influence, but AWM can maximise the application of these policies in the projects they fund
	Zero Carbon Homes	363 – 396			
	Code for Sustainable Homes	unspecified			
	Real time display for electricity meters in households	0 – 99			
	Better billing	0 – 66			
	More energy efficient products in domestic sector	132 – 429			
	Supplier obligation	990 – 1,320			There are opportunities in the WMES to ensure maximum savings are achieved through this policy, by ensuring all households are aware of it and suppliers are providing innovative services to their customers.
	Energy performance certificates	unspecified			
	Raising awareness (DEFRA CO_2 calculator launched)	unspecified			

PROPOSED POLICIES (ENERGY WHITE PAPER 2007)		WM expected C savings by 2020 ($ktCO_2$/year)	Under WMES and partners influence	Under AWM influence	Comments
	Microgeneration and the low carbon buildings programme	unspecified			Encouraging small scale energy production through renewables is part of the WMES' sustainable living objective. AWM and partners can fund such programmes.
Energy Efficiency in Households Total		**1551 – 2481**			
Energy Efficiency in the Public Sector	Carbon Reduction Commitment (CRC) in the public sector	59			
	Carbon Neutral Government (carbon neutrality to be reached in 2012)	59			
	More energy efficient products in public sector	29 – 88			
	Energy Performance of Building Directive EPBD	59 – 147			
	Sustainable procurement	unspecified			
	New guidelines for energy efficiency	unspecified			
	Display of energy performance certificates	unspecified			
Energy Efficiency in the Public Sector Total		**206 – 353**			
Transport	Renewable Transport Fuel Obligation (RFTO)	0 – 330			The WMES can support economic growth opportunities associated with biofuels manufacture. AWM can provide funding to specific initiatives to improve the biofuel supply chain in the region and to stimulate demand for biofuels.
	Successor to EU voluntary agreements on new car fuel efficiency (expected for 2009)	594 – 1,353			Car manufacturing is an important economic sector in WM. Cars manufactured in WM are usually high specification cars, so meeting EU fuel efficiency targets is likely to be challenging for regional car manufacturers. AWM could facilitate the use of existing R&D resources to help car manufacturers meet EU targets, but it must be recognised that these measures may represent an economic threat for this sector. Also note that C savings associated with improvements made by regional car manufacturers may not actually occur within the region.
	Inclusion of domestic aviation in EU ETS	22 – 44			
Transport Total		**616 – 1727**			
Energy supply	Changes to Renewables Obligation (electricity generation)	59 – 161			

PROPOSED POLICIES (ENERGY WHITE PAPER 2007)		WM expected C savings by 2020 ($ktCO_2$/year)	Under WMES and partners influence	Under AWM influence	Comments
	Carbon Capture & Storage (CCS) demonstration project (none in the West Midlands)	0			
Energy Supply Total		**59 – 161**			
TOTAL potential C savings ($kt CO_2$/year)		**4,900 – 7,600**	(rounded figures)		
Projected CO_2 emissions in 2020 *without* impact of proposed policies ("baseline") ($ktCO_2$)		**32,900**			
Projected CO_2 emissions in 2020 *with* proposed policies ($ktCO_2$)		**25,300 – 28,000**			
CO_2 emissions in 1990 ($kt CO_2$)		**35,200**			
% change vs 1990 level		**–20% to –28% (average: –24%)**			

Notes

Colour code:

WMES or AWM and partners can have a direct influence on the carbon reduction measures, i.e. AWM can support the carbon reduction measures through their intervention programme or the carbon reduction measures correspond to one of the objectives of the WMES.

WMES or AWM and partners can have an indirect influence on the carbon reduction measures, by increasing awareness and encouraging uptake of the measures, in order to help the region achieve the high end of the expected range of carbon savings.

Carbon savings are estimated against projected baseline CO_2 emissions for 2020

Certain policies and programmes have not been included in the above table, either because there is high uncertainty as to whether and how they will be implemented (e.g. inclusion of surface transport in the EU ETS after 2012, nuclear power) or because the associated carbon savings have not been clearly defined at the UK level and/or overlap with other policies (e.g. UK Biomass Strategy), or because they will have an impact on non-CO_2 GHGs (e.g. UK Landfill Regulations, EU Regulation on certain fluorinated GHGs and EU Directive relating to emissions from mobile air conditioning systems in cars).

Potential carbon savings at UK level

The UK goal, as set out in the draft Climate Change Bill, is to reduce CO_2 emissions by at least **60% below 1990 levels by 2050** with "real progress" to be made by 2020, which means a reduction of **26–32% by 2020**.

Potential carbon savings from new policies proposed in the Energy White Paper 2007, including the continuation of the EU Emission Trading Scheme (EU ETS) beyond 2012, represent approximately 23–33 MtC (84,000–121,000 kt CO_2) abated by 2020.

This adds to potential carbon savings from existing policies, estimated to be approximately 25 MtC (91,700 kt CO_2) by 2020, although most of the savings are expected to be realised by 2010. These 25 MtC savings have not been taken into account in the calculation of regional carbon savings, as they are already included in the 2020 baseline emission projections.

Based on the latest emission projections presented in the Energy White Paper, the above carbon savings would result in a **21–27%** cut in CO_2 emissions by 2020. Therefore, only if policy measures are fully implemented and achieve the upper end of the range of savings, the UK would be on track to achieve real progress by 2020 towards the 60% reduction goal.

Potential carbon savings in the West Midlands

Table 4 shows that the implementation of the Energy White Paper policies in the West Midlands could result in potential carbon savings in the range of **4,900–7,600 kt CO_2 by 2020.**

Given regional CO_2 emission estimates for 1990 and 2020, the above savings would provide a **20–28% reduction below 1990 levels.** This is similar to what could be achieved at UK level based on current projections (21–27%), however this is slightly below the UK target range (26–32%).

Potential carbon savings in the West Midlands only account for approximately 6% of expected savings at UK level, while the West Midlands' share of UK CO_2 emissions is approximately 7% by emission source and 9% by energy end user. This is mainly due to the relatively small proportion of industrial sites subject to the EU ETS in the region, while the EU ETS is expected to provide almost half of UK savings presented in the Energy White Paper (the West Midlands account for approximately 4% of UK CO_2 emission allowances for EU ETS sites, while for example the East Midlands account for approximately 11% of total UK allowances). A list of installations subject to the EU ETS in the West Midlands is provided for information in Appendix D.

The smaller carbon savings associated with the EU ETS in the region are however compensated by a greater projected reduction in CO_2 emissions between 1990 and 2020 in the absence of new policies (projected reduction of 7% vs 6% for the UK).

It is important to note that there are a number of uncertainties on the potential carbon savings figures published in the Energy White paper, in particular:

- Potential carbon savings from the EU ETS are based on the assumption that the cap on emissions applied to EU ETS sectors in the UK in 2020 is equal to that agreed for Phase II (2008-2012). Therefore the estimated carbon savings for the EU ETS do not take into account a possible reduction of UK carbon allowances after 2012, which would provide higher carbon savings at UK level. However the West Midlands may not benefit from a strengthening of the EU ETS as much as other regions, since the proportion of EU ETS sites in the region is relatively low (see above).

- UK policies with the greatest uncertainties in the range of potential carbon savings are the Renewable Transport Fuel Obligation, the EU voluntary agreements on new car fuel efficiency and the changes to Renewables Obligation. Therefore there are opportunities for the region to ensure full implementation of these policies in order to achieve the upper end of the expected carbon savings.

It should also be noted that carbon savings associated with the implementation of the UK Landfill Regulations (in particular, avoided methane emissions) are expected to represent over 1,000 kt CO_2/year by 2020 for the West Midlands. These savings have not been included in the previous calculations, as URS has limited the scope of the assessment to CO_2 emissions (in accordance with the current scope of the 60% UK reduction target).

3.2.2. Potential carbon savings from additional measures

In addition to the implementation of international and national policies, there are a number of carbon reduction measures that could be implemented by the region to secure a 30% reduction of carbon emissions by 2020, especially in areas not fully addressed by national policies and/or where there is a great uncertainty on the range of potential carbon savings achievable (e.g. road transport).

Table 5 below presents some rough estimates of additional carbon savings that could be achieved by the region and indicates those that may be directly or indirectly influenced by the WMES or AWM. These are suggested interventions and do not represent AWM policy.

Table 5: Additional potential carbon savings achievable by the region

	Additional carbon reduction measures	Potential C savings in WM ($ktCO_2$/year)			Year from which expected C savings could be realised	Data sources & assumptions	Under WMES influence	Under AWM influence	Comments
		Min	Max	Average					
Road Transport	Implementation of "soft measures" to reduce road traffic and travel needs, including: - Teleworking - Workplace travel plans - Personalised travel planning - Car clubs - Car sharing schemes - Teleconferencing - Home shopping	170	850	510	2015	Data source: "Soft measures: smart choice or soft option?" Facing the Flood TRANSform Scotland Conference, May 2006 (www.ukerc.ac.uk/component/option,com_docman/task,doc_download/gid,683/) Estimated potential C savings from "soft measures" at UK level = 0.5 to 2.5 MtC/year. URS assumes that WM share of C savings is proportional to WM current share of UK employment (~ 9% of UK) Note that teleworking and personalised travel planning each accounts for approx. 18% of the total savings.			The WMES has objectives related to teleworking. The region already had a successful experience in the development of personalised travel plans: Worcester was selected in 2004 by the DfT to be one of the 3 Sustainable Travel Demonstration Towns in the UK (5 year programme to showcase the role of soft measures (or "Smarter Choices") in reducing traffic by promoting walking, cycling and public transport. The impact of the programme in Worcester, between 2004 and 2006, was estimated as follows (among the population targeted): car trips decreased by 12%, public transport trips increased by 22%, walking trips increased by 17% and cycling trips increased by 36%.

	Additional carbon reduction measures	Potential C savings in WM ($ktCO_2$/year)			Year from which expected C savings could be realised	Data sources & assumptions	Under WMES influence	Under AWM influence	Comments
		Min	Max	Average					
	Congestion charging in Birmingham	50	70	60	2020	URS has made a rough estimate assuming that overall CO_2 emissions from road traffic in Birmingham could be reduced by 4 and 6% by 2020. This figure is based on car traffic reductions achieved in other cities where congestion charging has been implemented or proposed: 18% car traffic reduction in the charge zone of London (report by the UK Commission on Integrated Transport 2005), 90% car traffic reduction in Durham's small charge zone, 9% reduction in carbon emissions expected from a proposed congestion charge in Cambridge (http://www.cambridgefutures.org/futures2/report6.htm). Also a report by the UK Commission on Integrated Transport on congestion charging showed that traffic levels would fall overall by about 5% ("Paying for road use" report, 2002). The assumed 5% cut in CO_2 emissions has been applied by URS to CO_2 emission data from road transport in Birmingham in 2004 (data sourced from a DEFRA report:" Local and regional CO_2 emissions estimates for 2004": 1,170 kt CO_2 in 2004)			Congestion charging to be explored as part of the WMES, but the WMES has little influence on this
	Driver behaviour and travel habits	250	250	250	2020	Data source: WM Energy Strategy 2004			
	Commercial vehicles and drivers (improvement in driver behaviours and delivery methods, better logistics management)	200	200	200	2020	Data source: WM Energy Strategy 2004			
	Public sector initiatives (efficient vehicles, car sharing, travel plans)	300	300	300	2020	Data source: WM Energy Strategy 2004			
Road Transport Total		**970**	**1,670**	**1,320**					
Decentralised energy generation	Decentralised energy generation (CHP) for domestic and commercial use	430	630	530	2020	URS has made a rough estimate assuming that, between 2004 and 2020, 8 to 12% of electricity from conventional sources will be replaced by decentralised CHP plants (based on 2004 electricity use in WM (33,433 GWh), assuming no changes in the conventional fuel mix between 2004 and 2020 and assuming the avoided transmission losses are approx. 30% of electricity use)			

	Additional carbon reduction measures	Potential C savings in WM ($ktCO_2$/year)			Year from which expected C savings could be realised	Data sources & assumptions	Under WMES influence	Under AWM influence	Comments
		Min	Max	Average					
"Green" electricity	AWM is considering imposing "green energy" requirements to their applicants, i.e. AWM would make it a requirement for the applicants to switch to "green electricity" if they wish to obtain funding. In a first stage, this would be applied primarily to public sector applicants.	–			–	URS considers that the potential carbon savings would overlap with those expected from carbon reduction policies in the public sector (energy efficiency, CRC, carbon neutral government). Therefore no additional carbon savings have been accounted for.			
Voluntary offsetting scheme	The scheme would be available to businesses not covered by the EU ETS. Offsetting projects would be located in the WM or in countries which have certain connections with the population of the WM (e.g. India or Pakistan as the WM has a high proportion of inhabitants of Indian or Pakistanese origin)	Not yet quantifiable			–	The scope of such an offsetting scheme has not yet been defined; therefore potential savings are not quantifiable at this stage.			
	Total	**1,400**	**2,300**	**1,850**	(Rounded figures)				

Notes

Colour code:

WMES or AWM can have a direct influence on the carbon reduction measures, i.e. AWM can support the carbon reduction measures through their intervention programme or the carbon reduction measures correspond to one of the objectives of the WMES.

WMES or AWM can have an indirect influence on the carbon reduction measures, by increasing awareness and encouraging uptake of the measures, in order to help the region achieve the high end of the expected range of carbon savings.

The implementation of additional savings estimated in Table 5 would allow the region to achieve overall carbon savings in the order of **6,300–9,900 kt CO_2 by 2020**, i.e. an overall reduction of **24–35%** below 1990 levels.

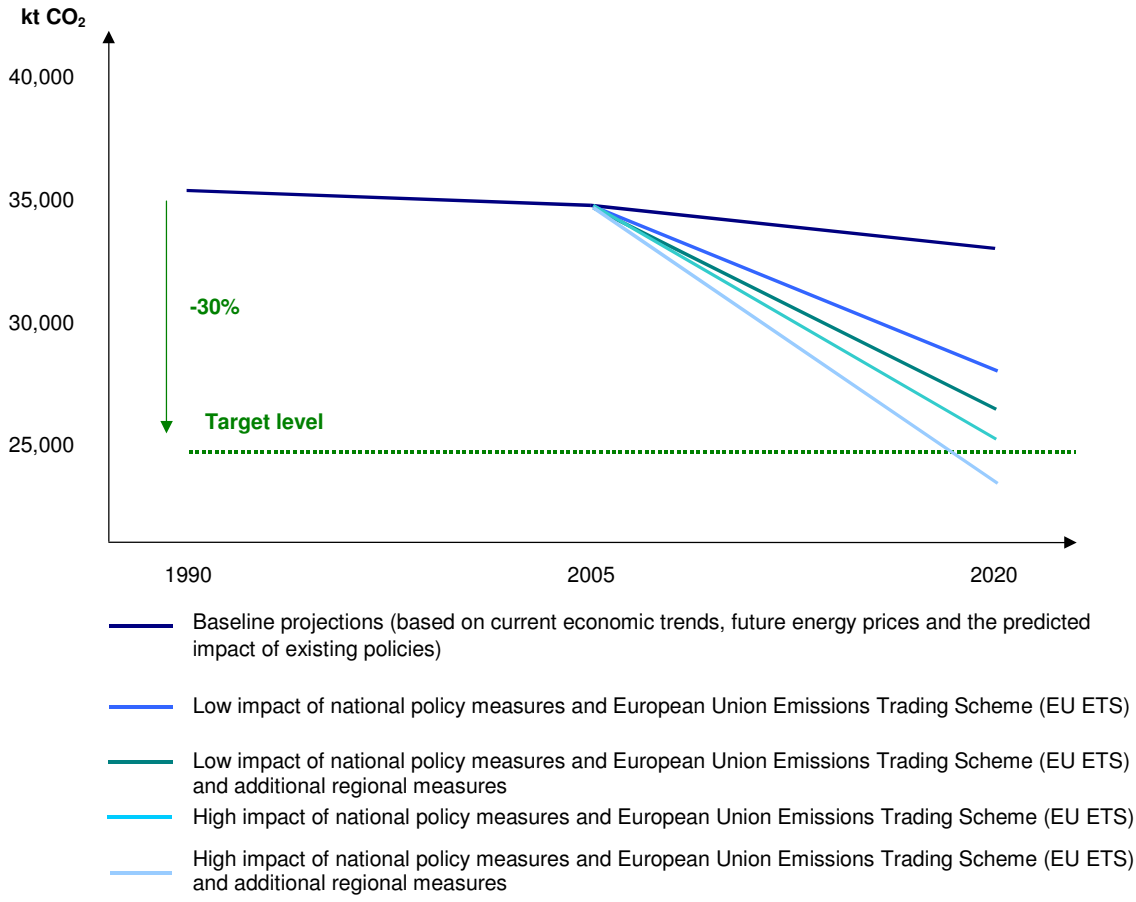
It is worth mentioning again the two key challenges for all regions in the UK to realise potential savings:

1) It is likely that all UK national reduction policies will not be entirely implemented and as such, targets will not be met. In this event, regions will need to effectively and thoroughly implement national policies to ensure they get their fair share of emissions reductions from national policies.

2) If a region does not implement all the available additional regional measures, they will not realise the potential savings.

The potential impact on regional CO_2 emission levels resulting from the implementation of national/international carbon reduction policies as well as additional regional measures is schematised in Chart 8 below.

Chart 8: Schematic representation of projected regional CO_2 emissions and potential impact of carbon reduction measures



The key findings of this assessment are as follows:

- It is likely that the implementation of national and international policies will not be sufficient to reach a 30% reduction of CO_2 emissions by 2020 at the regional level. This is also the case at UK level, based on the latest projections.
- If the region wishes to achieve a minimum cut of 30%, additional carbon saving measures need to be implemented at the regional level, in particular in areas that are not fully covered by national and international policies such as road traffic reduction and a shift to low carbon public transportation modes.
- The implementation of a voluntary carbon offsetting scheme, including project funding within the region, could be an efficient mechanism to achieve additional carbon savings and compensate for the small contribution of the region to the EU ETS.

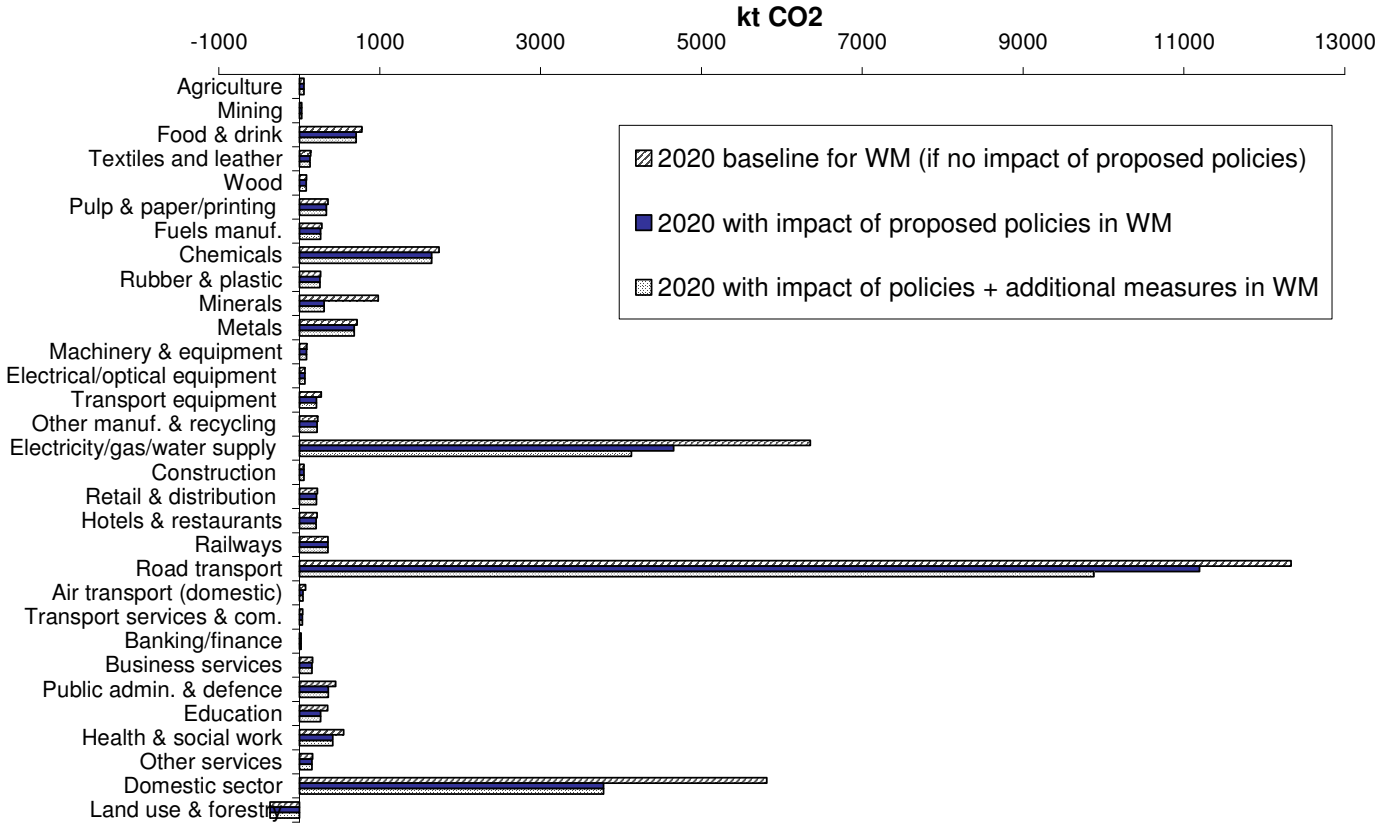
3.2.3. Potential carbon savings per sector

URS has also made an attempt to estimate how the potential savings associated with each carbon reduction measure would be spread across the various individual sectors (including SIC categories). Potential carbon savings by sector have been estimated by URS the following way:

- Identifying the overall sectors that are likely to be targeted by each of the policies reviewed, in the West Midlands (e.g. EU ETS sectors, public sector, etc.);
- Calculating the contribution of CO_2 emissions from each individual sector (e.g. each SIC category) to the overall sectors targeted by the policies (e.g. calculating the share of CO_2 emissions from electricity supply in total regional emissions from EU ETS sites);
- Calculating individual potential carbon savings by multiplying regional potential carbon savings by the contribution of each individual sector.

Detailed results by sector are provided in Appendix C. Chart 9 below provides a comparison of projected CO_2 emissions in 2020, by sector, with and without the implementation of new carbon mitigation policies and regional measures.

Chart 9: Estimated potential carbon savings by 2020, split by sectors



The analysis of potential carbon savings per sector shows the following:

- The sectors where the greatest carbon savings are likely to be achieved, in terms of *absolute CO_2 emissions saved by 2020*, are as follows: domestic sector, road transport, electricity/gas/water supply and mineral products manufacture. These sectors have also been identified as the largest CO_2 emitters in the Section 2.2.5 of this report. Among these sectors, the road transport sector is the one for which national carbon reduction policies are expected to have the least impact on baseline emission projections for 2020; as this sector is a major contributor to regional CO_2 emissions, there is a potential gap that could be addressed by additional regional measures (the impact of the additional measures considered by URS is shown on Chart 9).

- The sectors where the *greatest % reduction between 1990 and 2020* are likely to be achieved are as follows: land use/forestry, public sector, mineral products manufacture, rubber/plastic manufacture and domestic sector. In the case of land use/forestry and rubber/plastic manufacture, the expected CO_2 reductions are more influenced by economic trends than carbon reduction policies.

3.2.4. Potential carbon savings under the influence of the WMES and AWM

Regional Development Agencies (RDAs) have an important role in tackling climate change and supporting carbon reduction within their regions. However, there is a limit to the level of influence an RDA has on the businesses and individuals within their region meeting targets.

Carbon mitigation measures that can be directly or indirectly influenced by the WMES and partners and/or AWM have been identified by URS based on discussions with AWM, and are outlined in Tables 4 & 5 (see the notes on the colour code).

Potential carbon savings expected from those measures on which the WMES or AWM can have a *direct* influence have been estimated to be in the range of **1,100 to 2,300 kt CO_2/year by 2020**, which represents 18–23% of the total potential carbon savings from national policies and additional measures.

The WMES and AWM may also have a direct influence on a number of existing policies such as the Carbon Trust programmes and the strategy for non-food crops, but this has not been taken into account because the associated carbon savings are included in the 2020 baseline emission projections.

4. ASSESSMENT OF "CARBON CONSTRAINTS" ON THE BUSINESS SECTORS OF THE REGION

4.1. Assessment of business sectors' exposure to carbon reduction regulations

A first way to assess "carbon constraints" is to identify which sectors are likely to be targeted by carbon reduction regulations, and thus where growth may be constrained due to these carbon regulations.

Tables 6 and 7 below propose a classification of the sectors based on their potential exposure to carbon constraints imposed by regulations (such as emission cap and trade schemes or carbon taxes) and their contribution to regional GVA.

The classification of sectors according to the level of regulatory constraints (Low/Medium/High) is qualitative (see Appendix B for further details on the carbon mitigation policies reviewed by URS and the sectors targeted by these regulations). Two assessments have been made, depending on whether regulations apply to the operations, or to the products and services provided by the sectors reviewed.

The financial contribution of sectors to the region's economy has been assessed based on the GVA share of each individual sector in 2004 (data from the REEIO model, provided by the West Midlands Regional Observatory). It must be noted that, based on the GVA projections for 2020 calculated by the REEIO model, the classification of sectors in the Low/Medium/High categories used in the tables below is similar for 2004 and 2020. Appendix E provides the full GVA data used for the ranking, as well as employment data per sector. The comparison of GVA and employment data per sector shows that the

Low/Medium/High classification of sectors based on employment weights would have been very similar to the classification based on GVA shares, except for the metals manufacture sector which represents a high contribution to regional employment (17%) but a low contribution to regional GVA (4%).

Tables 6 & 7: Classification of sectors based on their potential exposure to carbon constraints from regulations and their contribution to regional GVA (in 2004)

			Carbon constraints from regulations *on operations*		
			High (EU ETS, Renewable Fuel Transport Obligation, Renewables Obligation)	**Medium** (Carbon Reduction Commitment, Carbon Neutral Government, etc.)	**Low**
Financial contribution of sector to region	**High**	>10% of regional GVA	–	Retail & distribution (G) (14.6%) **Total GVA share: 14.6%**	Business services (K) (13.7%) **Total GVA share: 13.7%**
	Medium	5-10% of regional GVA	Transport & communications (I) (7.6%) Education (M) (6.7%) Health & social work (N) (7.8%) **Total GVA share: 22.1%**	–	Construction (F) (6.7%) Finance & insurance (J) (7%) **Total GVA share: 13.7%**
	Low	<5% of regional GVA	Transport equipment manufacture (DM) (3.5%) Food & drink manufacture (DA) (2.3%) Electricity, gas & water supply (E) (2.3%) Mineral products manufacture (DI) (1.2%) Chemicals manufacture (DG) (0.6%) **Total GVA share: 9.9%**	Other manufacturing sectors (12.2% in total) Hotels & restaurants (H) (3.2%) Public administration & defence (L) (4.7%) Miscellaneous services (O) (4.5%) **Total GVA share: 24.6%**	Agriculture (AB) (1.2%) Mining (C) (0.1%) **Total GVA share: 1.4%**

Note:
Wood and paper (DD), basic metals (DJ) and fuels manufacture (DF) have not been classified as highly exposed to regulatory constraints because there are no installations belonging to these sectors that are subject to the EU ETS in the West Midlands (based on the list of EU ETS installations provided by DEFRA).

			Carbon constraints from regulations *on products and services*		
			High (EU car fuel efficiency, Building Regulations, Zero Carbon Homes, Code for Sustainable Homes)	**Medium** (Energy efficient products)	**Low**
Financial contribution of sector to region	**High**	>10% of regional GVA	–	–	Business services (K) (13.7%) Retail & distribution (G) (14.6%) **Total GVA share: 28.3%**
	Medium	5-10% of regional GVA	Construction (F) (6.7%) **Total GVA share: 6.7%**	–	Transport & communications (I) (7.6%) Finance & insurance (J) (7%) Education (M) (6.7%) Health & social work (N) (7.8%) **Total GVA share: 29.1%**
	Low	<5% of regional GVA	Transport equipment manufacture (DM) (3.5%) **Total GVA share: 3.5%**	Manufacture of electrical equipment (DL) (1.7%) **Total GVA share: 1.7%**	Agriculture (AB) (1.2%) Mining (C) (0.1%) Other manufacturing sectors (14.7% in total) Electricity, gas & water supply (E) (2.3%) Hotels & restaurants (H) (3.2%) Public administration & defence (L) (4.7%) Miscellaneous services (O) (4.5%) **Total GVA share: 30.7%**

The main findings of this qualitative assessment are as follows:

- No high financial contribution sectors subject to high regulatory constraints have been identified in the region;
- Several sectors have a medium or high financial contribution coupled with medium or high regulatory constraints on their operations or on their products and services (see the yellow cells in the above tables):
  - The transport sector (the main carbon constraints are associated with a possible extension of the EU ETS and the Renewable Fuel Transport Obligation);
  - The education & health sector (the main carbon constraints are associated with the EU ETS (due to large scale energy production facilities within universities and hospitals), the proposed Carbon Reduction Commitment and the government's carbon neutrality target);
  - The retail trade and distribution sector (the main carbon constraints are associated with the proposed Carbon Reduction Commitment);
  - The construction sector (carbon constraints related to low carbon buildings regulations).
- Other sectors with high regulatory constraints but low financial contribution include:
  - Transport equipment manufacture, for which carbon regulations apply both to operations (there are a number of sites subject to the EU ETS in the region) and products manufactured (EU fuel efficiency agreements);
  - Food & drink manufacture, mineral products manufacture, chemicals manufacture and electricity supply (the main carbon constraints are associated with the EU ETS).

The above findings apply to the region as a whole, however some areas of the region may be more significantly affected than others, in particular where there is a higher proportion of industrial activities.

4.2. Potential economic impacts of carbon reduction policies

An alternative way of assessing potential "carbon constraints" is to assess the potential impact of carbon prices, and therefore energy prices, on the various economic sectors. According to a report prepared by Oxford Economics for the DTI in May 2007 (*Report on modelling the macroeconomic impacts of achieving the UK's carbon emission reduction goal*), those industrial sectors that have high energy intensities of production and that are highly exposed to international competition are hit hardest by efforts to reduce carbon emissions. The extent to which these sectors will be affected depends upon a number of factors, including: the underlying path of fossil fuel prices over the forecast period, the pace of technological change in response to higher energy prices, the price elasticity of demand for energy, the extent (if any) of concerted European or global action to reduce

carbon emissions and the scope for UK firms to purchase carbon allowances from other countries.

In its report, Oxford Economics modelled the potential economic impact of imposing a 30% CO_2 reduction target by 2020 at UK level, on the various business sectors. This modelling has identified the key sectors that are likely to be the worst or the least affected by such a reduction target (see Table 8 below).

Table 8: Predicted impact on GVA of imposing a 30% CO_2 reduction target by 2020, at UK level

	Sector	Potential impact on GVA in 2015-20 at UK level (1)	Financial contribution of sector to the West Midlands (% regional GVA)	
			2004	2020 (projection)
Sectors likely to be the *worst* affected	Basic metals	-20.6%	0.9%	0.6%
	Wood	-5.8%	0.6%	0.4%
	Paper	-5.3%	0.9%	0.6%
	Agriculture	-5.0%	1.2%	1%
	Food & drink	-4.8%	2.3%	1.7%
Sectors likely to be the *least* affected	Electrical engineering	-1.6%	1.1%	0.7%
	Finance	-1.6%	5.7%	6.8%
	Public services	-1.4%	4.7%	4.3%
	Business services	-1.2%	13.7%	17%
	Communications	-1.1%	3.3%	4.2%

(1) Data sourced from a report by Oxford Economics for the DTI: "Report on modelling the macroeconomic impacts of achieving the UK's carbon emission reduction goal" (May 2007)

Applying the findings of the Oxford Economics' study to the West Midlands shows that:

- The sectors that represent a high proportion of the regional GVA (e.g. business services) are not likely to be much affected by a 30% carbon reduction target; and
- The sectors that are likely to be the worst affected at UK level do not have a significant economic weight in the region, in terms of GVA.

4.3. Possible growth opportunities

The analysis presented in the above sections only looked at carbon mitigation regulations in terms of growth constraints, but did not take into account the potential growth opportunities associated with these policies.

In certain sectors, climate change mitigation policies could actually trigger innovation and potentially offset the risks posed by carbon constraints. Some of the sectors that are the most likely to be affected by carbon mitigation could also be the ones where the best growth opportunities are to be found (e.g. wood products and agriculture may be more affected by carbon reduction policies than other sectors, due to their high energy use, but they also have significant growth opportunities associated with the development of bio-energy).

Possible growth opportunities associated with carbon reduction policies in the West Midlands could be found in the following sectors:

- Agriculture (biofuels production);
- Wood sector (energy production from biomass);
- Transport manufacturing (fuel efficiency innovation);
- Transport services (development of low carbon transport solutions);
- Electrical equipment (energy efficiency innovation, energy metering devices);
- Business services (energy management services, etc.);
- Electricity supply (renewable / decentralised energy production);
- Waste management and recycling sector; and
- Construction sector (low carbon buildings).

4.4. Comparison of sectors at risk from carbon regulations and from climate change impacts

A separate study was conducted by URS for AWM, looking at the impacts of climate change on the economy of the West Midlands. This study identified sectors at risk and opportunities from three types of climate change impacts considered to require the most urgent attention in the region: more frequent and severe flooding; more frequent and severe summer rainfall shortages; and more frequent and more extreme summer temperatures.

Table 9 below provides a brief comparison between sectors at risk and opportunities from carbon regulations and from climate change impacts in the West Midlands.

Table 9: Comparison of sectors at risk from carbon regulations and from climate change impacts in the West Midlands.

	Sectors at risk	Sectors that may found opportunities
Carbon reduction policies	<u>High exposure to carbon regulations:</u> Transport & communications Education Health & social work Transport equipment manufacture Food & drink manufacture Electricity, gas & water supply Mineral products manufacture Chemicals manufacture Construction	Agriculture (biofuels production) Wood sector (energy production from biomass) Transport manufacturing (fuel efficiency innovation) Transport services (development of low carbon transport solutions) Electrical equipment (energy efficiency innovation, energy metering devices) Energy management services Electricity supply (renewable / decentralised energy production) Waste management and recycling sector Construction sector (low carbon buildings)
Climate change impacts	<u>High risk from climate change impacts:</u> Agriculture (flooding, drier and hotter summers) Distribution (flooding, hotter summers) Transport and communications (flooding, hotter summer)	Builders, plumbers, electricians Construction Providers of mobile electricity generators Manufacture of water saving devices Manufacture of cooling devices

	Electricity/gas/water supply (flooding, drier summers Food & drink (flooding, hotter summers) Hotels and catering (flooding) Real estate, renting services (drier and hotter summers) Mining (hotter summers) Insurance (hotter summers) Construction (hotter summers)	Tourism (hotels, catering) Agriculture (e.g. new plants being able to grow)

Based on the above table, economic sectors that may be at risk from both carbon reduction regulations and climate change impacts include:

- Transport and communications;
- Food and drink manufacture;
- Electricity, gas and water supply; and
- Construction.

In terms of growth opportunities, sectors that may found opportunities from both carbon regulations and climate change impacts include:

- Construction;
- Agriculture; and
- Electrical equipment.

5. REVIEW OF CURRENT CARBON-RELATED REGIONAL INDICATORS

A number of indicators have been proposed at the regional level and a number of measurement tools have been implemented in order to monitor how the region is improving resource efficiency, i.e. improving GVA while reducing carbon emissions. In particular, this includes: the Regional Index of Sustainable Economic Well-Being (ISEW) which incorporates a number of sustainability factors among which the cost of climate change; the Carbon per GVA indicator; and the carbon measures derived from the Project Assessment Tool.

URS has reviewed whether these indicators could provide a reliable measure of the success of the low carbon WMES and of AWM's interventions in improving resource efficiency. Below we have provided some recommendations on the definition of headline regional context/outcome indicators intended to provide a robust measure of how the region is diversifying into low carbon products, services and techniques, including but going beyond environmental technology (for which regional indicators already exist).

URS has reviewed several carbon-related indicators currently used by AWM in order to assess whether these indicators provide a reliable measure of the success of the low

carbon WMES and of AWM's interventions in improving resource efficiency and reducing carbon intensity (i.e. reducing carbon emissions while improving GVA).

Four indicators have been reviewed:

- Carbon per GVA indicator for the West Midlands (t CO_2 per £10,000 GVA);
- Draft Regional Index of Sustainable Economic Well-Being (R-ISEW) for the West Midlands, currently under development by the New Economics Foundation (NEF), which takes into account social and environmental factors in measuring sustainable growth through economic well-being;
- Measure of carbon savings resulting from AWM's interventions, calculated by the Carbon Project Assessment Tool (developed by ERM);
- Carbon Index for Business (kg CO_2 per £ GVA), calculated by the pilot Carbon Index Tool for Business; the pilot Carbon Indexing Project is being undertaken across a representative range of manufacturing companies in the region (20 business), as a first step in the development of a region-wide offering anticipated as being associated with Business Link.

Table 10 presents the key findings of URS' review of the above indicators, explaining their scope and evaluating their reliability and applicability for measuring the success of the WMES.

Table 10: Review of carbon-related indicators used by AWM

Indicator	Scope of Indicator	Degree of reliability (limitations, data sources and calculation methods)	Rationale for use: value for reflecting success of WMES
Carbon per GVA indicator (as calculated by the West Midlands Regional Observatory)	Measures CO_2 emissions for each sector calculated using a top-down approach. Indicator can demonstrate key "carbon friendly" growth sectors but will not show efficiency across sectors at regional level as it only gives a UK average.	Calculated using a top-down approach – applying regional employment weights by SIC code to UK CO_2 emissions sourced from the UK Environmental Accounts data. CO_2 emissions from the UK Environmental Accounts are split into 93 "EA codes". A conversion table is available to convert EA codes into SIC codes. Use of UK emissions versus regional employment weights assumes symmetry between the West Midlands and the UK in terms of carbon emissions per employee per each sector. Also, the CO_2 data from the Environmental Accounts are calculated by emission source (i.e. emissions associated with electricity production are allocated to power stations, not the end users). As the West Midlands are a net importer of electricity, this tends to under-estimate the actual CO_2 emissions for which the region is responsible (see also comments in Table 1 of this report).	Strong indicator for demonstrating where West Midlands has grown in "carbon friendly" sectors but it will not reflect resource efficiency within sectors at a regional level.
Regional Index of Sustainable Economic Well-Being (R-ISEW) for the West Midlands	An 'adjusted' alternative indicator to measure holistically the sustainable economic well-being of the region, taking into account those factors not captured by conventional, simplistic economic measures such as GVA e.g. social, economic and environmental costs and externalities such as crime, health, social cohesion, climate change impacts, pollution, etc. The index takes into account the long-term costs of damages caused by climate change.	Methodology used to calculate these results is that used in 2005-2006 for several other English regions. Limitations in the availability of regional data. This is a qualitative overall well-being indicator and it is not clear how the specifically low carbon related component of growth could be extrapolated/calculated.	Indicator too aggregated to be useful for separating out and measuring specifically low carbon related component of growth in the economy.
Gap between GVA per capita and R-ISEW per capita	Charts the deviation between growth in GVA per capita and growth in R-ISEW per capita, demonstrating the degree of efficiency with which a region translates economic growth into actual growth – sustainable well-being – in the region.	The specific carbon related component of growth cannot be calculated using this indicator.	This indicator can be broadly useful for demonstrating how well growth is being translated into sustainable economic well-being. R-ISEW will always remain lower than GVA in absolute terms because of the cost of managing social, economic and environmental externalities. The smaller the difference in performance between the

Indicator	Scope of Indicator	Degree of reliability (limitations, data sources and calculation methods)	Rationale for use: value for reflecting success of WMES
			two indicators over time however, the more efficiently the low carbon and sustainability elements of the WMES are being implemented thus reducing the costs of managing social and environmental factors affecting economic growth. Useful as a cross regional benchmarking and context setting indicator, especially as other regions are developing it.
Measure of carbon savings resulting from AWM's interventions (Carbon Reduction Project Assessment Tool)	Tool calculates reductions of GHGs (in t CO_2eq) per year and over the lifetime of any capital projects to be funded by AWM. GHGs covered include CO_2 and CH_4 (for waste-related projects). The lifetime of projects is assumed to be ten years. The lifetime of revenue per project is equal to the number of years of funding from AWM. Reductions are calculated by comparing the GHG emissions from the project with emissions from the baseline scenario. Baseline scenario is what would have occurred in the absence of the project. May be theoretical e.g. for a new building project the baseline would be the typical emissions for a building of the same size. Or baseline can be calculated from actual energy readings in e.g. energy efficiency or refurbishment projects. For new build or refurbishment projects if no data or estimates of CO_2/energy savings are available, the model can estimate the reductions using the total floor area of the building and the building standard. Model will ask for project specific information where possible (e.g. load factor and heat to power ratio for combined heat and power; ratio for combined heat and power plant) but where not known, default values are given. A significant part of the carbon savings are expected to be avoided methane (CH_4) emissions due to waste recycling projects (waste diverted from landfills). Note that CH_4 is not covered by the Carbon per GVA indicator or the Carbon Index Tool for Business.	Tool is also accurate in terms of measuring low carbon growth directly attributable to AWM through specifically low carbon interventions and initiatives e.g. investment in energy efficient building construction or renewables technology development. Tool is limited in its application partially by not being able to accurately measure the outputs of less tangible investments or interventions by AWM e.g. research and development, capacity building initiatives, tourism promotion. Only direct impacts of a carbon reduction project are taken into account, not indirect impacts/secondary effects (e.g. changes in transport emissions associated with land redevelopment). Intensive information gathering for baseline data will add to accuracy of this tool but again availability of good baseline data will be reduced for more intangible interventions where low carbon impacts are less direct and measurable and quantifiable.	Tool is particularly useful for measuring effectiveness and outputs/impacts of specifically low carbon related interventions and programmes but may underestimate these interventions as it cannot so accurately give a measure of the intangible less quantitative or directly low carbon related interventions.

Indicator	Scope of Indicator	Degree of reliability (limitations, data sources and calculation methods)	Rationale for use: value for reflecting success of WMES
Carbon Index for Business	This bottom up methodology calculates kg CO_2 emissions per £ GVA by company, based on direct and indirect emissions from energy use (on-site fuel combustion and electricity use).	Tool measures CO_2 emissions company by company so is very thorough and provides micro level assessment. Tool time consuming and labour intensive to implement. Tool assumes all companies have necessary data and ability to gather it effectively and accurately.	Tool only useful for measuring direct economic impacts of business per GVA. Would provide highly clear picture of efficiency of business by energy use if implemented over the long term and a large scale for all businesses across whole region. But could also give useful measure of low carbon performance across representative samples of businesses to show trends in strong or weak performing sectors.

In summary:

- Using a combination of the above indicators will be most effective for measuring and monitoring the low carbon performance of the WMES.
- Carbon per GVA will demonstrate those sectors generating carbon friendly growth and accordingly show those sectors, which are performing poorly at a single point in time (in terms of CO_2 emission sources). It is then possible to use indicators such as the Carbon Footprint of AWM's interventions (Carbon Reduction Assessment Tool) or the Business Carbon Index to focus on specific performance of a representative sample of businesses within those sectors in order to measure their improvement in resource efficiency over time.
- The R-ISEW alone is not a useful indicator as it cannot isolate and attribute carbon specific growth, however the gap between GVA and ISEW can be used as an indicator alongside others to demonstrate the overall sustainability performance of the WMES.
- Only the Carbon Reduction Assessment Tool can demonstrate low carbon growth that can be directly attributed to AWM.

6. DEFINITION OF LOW CARBON DIVERSIFICATION INDICATORS

URS conducted some initial research to define what "low carbon diversification" means for the region and what the key components of this low carbon diversification would be. URS also reviewed the "Future Vision for the West Midlands: 2020", a document prepared by Forum for the Future for AWM, which provides a vision of what the West Midlands could look like in fifteen years time when it is successfully travelling the route to a low carbon economy. Further work is to be done to explore the findings of this initial research.

It is clear that a number of elements need to be considered when selecting the key indicators, however, of particular relevance for this study is timescale. The target being set is for 2020 and therefore indicators appropriate for tracking progress towards this target may well consider medium term changes. However, the WMES is for a two-three year period only, and indicators need to be selected which can shown performance changes in this shorter time frame.

In developing and considering indicators we have sought to consider two types of indicators:

- Short term indicators which will be able to measure steps being taken in the timeframe of the WMES (3 years) which should demonstrate interim progress towards;
- Long term indicators, which should demonstrate actual changes in performance or GHG emissions.

Initial ideas for these indicators are presented in Table 11 below along with thoughts regarding potential data availability.

Table 11: Possible low carbon diversification indicators

Potential aspects	Possible indicators	Data availability	Short-term indicators for the WMES (next 3 years)	Long-term indicators (2020)
ENERGY				
Overall energy consumption reduced by about a 5th in absolute terms from 2004 Heating and power bills lowered	Total kWh of energy (by type) used by the industrial, commercial and domestic sectors kWh of energy used in the domestic sector per inhabitant kWh of energy used by industrial/commercial sector per employee	DTI energy use statistics	X	
20% of all electricity from renewable sources	% of regional electricity produced from renewable sources	RESTATS (Renewable Energy Statistics Database for the UK)	X	
Many communities, businesses and individual buildings have their own micro-generation facilities e.g. wind turbines, solar panels, ground source heat pumps Energy production so high that sometimes WM communities making profit from selling excess back to grid	kWh of electricity from micro-generation being sold back to the grid No of solar panels sold No of licensed installers of solar panel equipment kWh of electricity produced by micro-generation (split by type of energy) and % of total regional electricity production % public sector energy use coming from renewables	Difficult to measure at present – would require dedicated surveys		X X X X X
WM a hub for low carbon technology	Sales of low carbon technology No of companies in the field of low carbon tech Patent applications in region for low carbon technology R&D spend in low carbon tech and innovation Export/sales in low carbon technology in relation to high tech corridors	Difficult to measure at present – would require dedicated surveys		X X X X X
Projects to encourage, support and promote UK businesses to enter the supply chain for wind energy and the development of hydrogen fuel cells (support and funding from RDAs)	Number of projects supported by AWM in the field of wind energy and hydrogen fuel cell development	Available from AWM	X	
Power stations still used but now use carbon capture and storage (CCS) to ensure lowered emissions	Number of power stations equipped with CSS Tonnes of CO_2 captured	Should be easily available by 2020		X X
Strong emphasis on Combined Heat and Power (CHP) – key to cutting emissions	No of CHP plants kWh electricity generated by CHP plants % of regional electricity production from CHP No of CHP plant planning applications	Should be available from EA or DEFRA or OFGEM	X X X X	

Potential aspects	Possible indicators	Data availability	Short-term indicators for the WMES (next 3 years)	Long-term indicators (2020)
	No of applications for CHP plants to be connected to the National Grid	National Grid?	X	
Other aspects identified by URS: Closure and decommissioning of coal mines – increase in demand for service for conversion and refurbishment of old mines and structures, methane production	Number of coal mines converted into power generation facilities (methane combustion) kWh of electricity generated from coal mine methane in WM	Should be available from The Coal Authority		X X
LAND USE				
Landscape changed – increased flood defences erected (walls and embankments to ditches and increased field drainage) Increased flood protection scheme – farmers with land on flood plains can apply for grants to maintain vulnerable areas as water meadows (better protection and enhanced biodiversity)	% of the WM areas liable to flooding and provided with 100-year flood defence protection Expenditure on flood protection defences and measures Measure of speed of economic recovery ex-post natural disasters e.g. floods (new business, increase in turnover, employment rates, working hospitals and public services, declared bankruptcies etc.) Average number of business days lost due to flooding events	Difficult to measure at present – would require dedicated surveys		X X X X
Farmers growing proportion of their own fuel, growing biofuel crops and making use of results – system subsidised by AWM since 2010	Volume of biofuels produced and sales of biofuels in WM	Available from Bioenergy WM?	X	
Rural management schemes – regionally funded e.g. woodland areas managing local energy production from biomass	Number of rural management schemes funded by AWM	Available from AWM	X	
Separate tree planting schemes act as additional carbon sinks	Number of tree planting schemes Tonnes of CO_2 captured by carbon sinks	Available from AWM?		X X
Agricultural base now a mix of organic and low input farming (where chemical inputs are minimised)	% of agricultural area with organic farming No of applications for organic farming	Should be available from "Farming & Food WM" (joint venture GOWM and AWM)	X X	
More localised system – WMidlanders buying 40% of their food from local sources	% of supermarket foods procured locally within the region	Difficult to measure at present – would require a dedicated survey		X
Fruit and vegetable production concentrated near population centres – limit transport of bulky commodities More Market gardens and Urban farms e.g. multi-storey car parks – vertical urban farms Incentives for communities to convert their concrete space to soil	Area dedicated to home cultivation % of food consumed coming from home produce/urban cultivation Number of market gardens and urban farms	Difficult to measure at present – would require dedicated surveys		X X X

Potential aspects	Possible indicators	Data availability	Short-term indicators for the WMES (next 3 years)	Long-term indicators (2020)
for home cultivated produce (e.g. lower council tax)				
HOUSING				
Low carbon and zero carbon new homes	No of zero carbon homes No of new homes with a minimum rating of 3 against the Code of Sustainable Homes	Would require dedicated surveys	X X	
Increase in home refurbishment business – home energy portfolio assessments installation of energy saving measures e.g. loft lagging, draft proofing Incentivised energy saving measures – e.g. rebate on Stamp Duty in exchange for installation	No of homes refurbished to improve energy efficiency No of companies offering energy efficiency advice for homes			X X
Visible metering to monitor energy use – smart home technology to regulate and control temperature and monitor expenditure	No of homes equipped with SMART meters No of companies involved in SMART meters installation			X X
Construction industry evolved to keep pace with demands of low-carbon structures	Number of vocational courses offering skills in the field of low carbon construction			X
Building grants and planning/permitting process must demonstrate sustainability credentials for funding (low carbon design using integrated energy efficiency devices within structure)	Grants given for low carbon construction or refurbishment		X	
TRANSPORT				
Electric vehicles – low carbon emissions, cheaper, and purchase incentivised by lower congestion charges and parking charges	Car sales by type No of cars registered by type % of automobile R&D spent on low carbon technology Carbon intensity of cars manufactured in WM	Would require a survey No of motor cars licensed in WM by CO_2 band (DfT) Would require a survey Would require a survey	 X	X X X
Reduced traffic volume	Road miles by type and associated carbon emissions % of trips undertaken by car	Regional traffic flow for all motor vehicles per year (DfT) Distance travelled along roads per year in WM, split by motorway/rural/urban (DfT) Tonnes of oil equivalent consumed	X X	

Potential aspects	Possible indicators	Data availability	Short-term indicators for the WMES (next 3 years)	Long-term indicators (2020)
		by motor vehicles in WM per year, by type of vehicle (buses, diesel cars, petrol cars, motorcycles, HGV, diesel LGV, petrol LGV) or by type of purpose (personal/freight) (DfT) Annual CO_2 emissions from road transport in WM (DEFRA Local & Regional CO_2 emission estimates)		
	Bicycle sales	Would require a survey		X
	Miles of designated bike lanes, coach lanes and car share lanes	Would require a survey		X
	Number of cities with Park & Ride schemes and volume of cars using it	Would require a survey		X
Shift of heaviest freight from road to rail	Freight road miles per tonnage used	Tonnes km per year of road freight transported in WM – goods moved by origin of goods (DfT)	X	X
Improved logistics cooperation/coordination between remaining HGV companies for retail business for e.g. on road – minimise transport costs, lower number of empty load journeys	Number of empty truck journeys Number of journeys/freight miles avoided through better logistics	Would require a survey		X X
Increase in internet sales leads to better coordinated and more efficient delivery services – reducing traffic volume	% increase in sales from online shopping and delivery	Would require a survey		X
Central pedestrian zones and congestion charges – fewer cars in business/social centre of city	Areas dedicated to pedestrians in urban centres Traffic reduction achieved through congestion charging	Would require a survey	X X	
Public Transport use all time high – high investment in past 10 years – better connecting the WM	% increase in purchased travel/rail cards or participation in low cost travel schemes % capacity increase of bus, coach, tram and train journeys	No of bus and light rail passenger journeys per year for region (DfT) Total rail passenger journeys per year in region (Office of Rail Regulation)		X X
Bike sharing schemes e.g. sponsored by retail client as means of offsetting unavoidable carbon emissions	Number of bike sharing schemes	Would require a survey	X	
Car sharing schemes	% of businesses that have financial incentives for use of public transport/car	Would require dedicated surveys		X

Potential aspects	Possible indicators	Data availability	Short-term indicators for the WMES (next 3 years)	Long-term indicators (2020)
Designated car sharing lanes	sharing schemes			
Redundant parking spaces sold off or redeveloped and money reinvested through local council into transport as part of company green travel plans	No of registrations for car sharing schemes (public and within companies)			X
	Sale of and refurbishment/reuse of car parking space			X
	Number of cars per head	DfT statistics	X	
Decreased demand for travel – improvements in teleworking	% working population that is home working	Would require dedicated surveys	X	
Marked increase in teleworking especially in rural areas – less need for business travel	% businesses which have home working policies		X	
	Office floor area (m^2) per employee		X	
	Number of "working hubs"			X
	Sales in video-conferencing systems			X
Eco-tourism	Transportation data related to tourism trips (number of trips, mode of transport, destination)	Total trips by West Midlanders (domestic and overseas) per year (UK Tourism Survey/International Passenger Survey (Office for National Statistics))		X
	% increase in domestic tourism (vs overseas holidays)			X
	Number of eco-hotels			X
Reduction in European air travel	Air traffic data for West Midlanders	No of air transport movements per year at WM airport (Civil Aviation Authority)		X
		No of terminal passenger per year at WM airport (Civil Aviation Authority)		X
Development of low carbon aerospace technologies	R&D expenditure in low carbon aerospace technologies	Would require a survey	X	
Development of low carbon rail technologies	R&D expenditure in low carbon rail technologies	Would require a survey	X	
BUSINESS				
Increase number of jobs in businesses offering low carbon products and services	No of jobs in businesses offering low carbon products and services	Would require dedicated surveys		X
Innovation and improvements in energy management and monitoring systems have been invaluable in reducing carbon emissions from operations	No and fees of energy management companies and environmental consultancies, carbon footprinting and supply chain auditing			X

Potential aspects	Possible indicators	Data availability	Short-term indicators for the WMES (next 3 years)	Long-term indicators (2020)
Waste management systems improved – National Industrial Symbiosis Project (NISP) – resource efficiency through matching members waste outputs to inputs and advises on efficiency	Number of NISP projects Quantity of waste reused through NISP projects Tonnes of CO_2 avoided by NISP projects	NISP database	X X X	
Many business links with small scale carbon offset projects overseas e.g. funding biogas stoves in rural areas, often in countries with personal and community ties from their workforce e.g. India and Pakistan	Tonnes of CO_2 offset No of offsetting projects	Could be available from AWM in the after the publication of this report, if AWM initiates the creation of a voluntary offsetting scheme		X X
Design and construction of alternatives to cars: intelligent 'smart' public transport systems	Number of jobs in businesses specialising in smart public transport systems	Would require a survey		X
Increase in holistic healthcare provision and approaches. Health clinics that contain pharmacies, optometrists, dentists, physiotherapy, occupational therapy as well as primary medical care	Number of integrated health clinics	Would require a survey		X
Increase in climate change and adaptation related R&D, development of education and training schemes	No of climate change-related training schemes No of climate change-related diplomas Low carbon R&D expenditure	Would require a survey		X X X
Entrepreneurial R&D in fields of medicine, agriculture, materials technology, environmental monitoring, biotechnology, micro technology, nanotechnology	R&D expenditure in medicine, agriculture, materials technology, environmental monitoring, biotechnology, micro technology, nanotechnology	Would require a survey		X
Development of mobile and wireless communications	% increase in mobile and wireless communications	Would require a survey		X
Research and development in IT and Telco	R&D expenditure in IT and Telco	Would require a survey		X
SRI and clean capital investment	Low carbon capital investment in the region	Would require a survey		X
Improved domestic waste collection and segregation services Increase in recycling facilities and infrastructure Community composting facilities Rehabilitation of landfill sites, management of contaminated land and associated liabilities	% of waste recycled No of community composting facilities	Household recycling rate (DEFRA Municipal Waste Mgt Statistics)	X X	

ABBREVIATIONS

AWM	Advantage West Midlands
CH_4	Methane
CHP	Combined Heat and Power
CO_2	Carbon dioxide
DEFRA	Department of Environment, Farming and Rural Affairs
DfT	Department for Transport
DTI	Department of Trade and Industry (now the Department of Business, Enterprise and Regulatory Reform)
EA	Environment Agency
EU ETS	European Union Emission Trading Scheme
HFCs	Hydrofluorocarbons
GHG	Greenhouse Gas
GVA	Gross Value Added
ISEW	Index of Sustainable Economic Well-Being
LULUCF	Land Use, Land Use Change & Forestry
N_2O	Nitrous Oxide
PFCs	Perfluorocarbons
PI	Pollution Inventory
RDA	Regional Development Agency
REAP	Resource and Energy Analysis Program
REEIO	Regional Economy Environment Input Output model
SF_6	Sulphur Hexafluoride
SIC	Standard Industrial Classification
UNFCCC	United Nations Framework Convention on Climate Change
WM	West Midlands
WMES	West Midlands Regional Economic Strategy
WMRO	West Midlands Regional Observatory

Appendix A

Regional GHG inventory – Methodology and detailed results

Appendix A
Regional GHG inventory – Methodology and detailed results

1) Compilation of the regional inventory by the emission source approach

Methodology

The first step was to identify the emission sources to be taken into account in the regional inventory. The table below provides a listing of these emissions sources, with details on the data sources that have been used by URS and the key assumptions that have been made in the calculations.

Table A1: Emission sources taken into account in the regional inventory

Source category				CO_2	CH_4	N_2O	HFC	PFC	SF_6	Data sources used by URS and key assumptions
ENERGY (emissions from stationary and mobile energy sources)	Fuel combustion	Energy industries		X	X	X				Pollution Inventory (regional data provided by the Environment Agency)
		Manufacturing industry and construction		X						Pollution Inventory (regional data provided by the Environment Agency) For industries not covered by the Pollution Inventory, URS has used the Regional CO_2 Emission Estimates published by DEFRA (emissions from industrial energy use are mainly based on regional fuel use statistics published by the DTI)
		Transport	Road transportation	X						Regional CO_2 Emission Estimates published by DEFRA (based on regional vehicle specific traffic census data published by the Department for Transport (DfT) – fuel use is calculated for each vehicle type on a road link basis using fleet weighted emission factors for each vehicle type and assumptions about speeds on each road type). CH_4 and N_2O emissions not calculated as considered to be negligible
			Railways	X						Regional CO_2 Emission Estimates published by DEFRA (based on diesel use by rail reported in regional fuel use statistics published by the DTI) CH_4 and N_2O emissions not calculated as considered to be negligible
			Civil aviation	X						Derived from UK UNFCCC inventory, assuming proportional to passenger numbers in Birmingham and Coventry airports (passenger numbers sourced from the Civil Aviation Authority (CAA) statistics) Only domestic flights have been included in the inventory (emissions from international flights provided as a memo item only) CH_4 and N_2O emissions not calculated as considered to be negligible

Source category				CO_2	CH_4	N_2O	HFC	PFC	SF_6	Data sources used by URS and key assumptions
			Water-borne navigation	X						Domestic navigation: According to the DfT "Waterborne Freight Benchmark Report 2002", the length of waterway track in the WM represents only 1.3% of the UK and none of these tracks are used for freight (only small size waterways). So this was considered as negligible. International navigation: not considered as there are no ports in the WM
		Other sectors (agriculture, commercial, public sector, domestic)		X						Regional CO_2 Emission Estimates published by DEFRA (emissions from energy use are mainly based on regional fuel use statistics published by the DTI) CH_4 and N_2O emissions not calculated as considered to be negligible
	Fugitive emissions from fuels	Solid fuels	Coal mining and handling		X					Derived from UK UNFCCC inventory, assuming proportional to the amount of coal produced (regional coal production data was sourced from the Coal Authority). Also assuming that the proportion of CH4 recovered/flared is the same in West Midlands and UK.
			Abandoned coal mines		X					Calculation method similar to the one used in the UK UNFCCC inventory, using an experimental emission factor defined in a DEFRA survey (" Development of a methodology for estimating methane emissions from abandoned coal mines in the UK"). Fugitive methane emissions are estimated by multiplying the amount of methane reserves in abandoned mines in the region by the experimental emission factor.
			Solid fuel transformation		X					Derived from UK UNFCCC inventory, assuming proportional to solid fuel use (regional solid fuel use data was sourced from regional fuel use statistics published by the DTI)
		Oil & natural gas (venting, flaring, etc.) from offshore platforms and onshore terminals			X					There are no oil tanker terminals in the West Midlands, so this source has not been considered
INDUSTRIAL PROCESSES (by-product or fugitive process emissions)	Mineral industry, chemical industry, refineries, metal production, pulp & paper, production of halocarbons & SF6			X	X	X	X	X	X	Pollution Inventory (regional data provided by the Environment Agency)
	Consumption of halocarbons & SF6						X	X	X	Derived from UK UNFCCC inventory, assuming proportional to number of inhabitants
AGRICULTURE	Cattle enteric fermentation				X					Derived from UK UNFCCC inventory, assuming proportional to animal headcount by type of animal (regional cattle headcount data was sourced from DEFRA regional farming statistics)
	Manure management				X	X				
	Agricultural soils	Direct soil emissions				X				Derived from UK UNFCCC inventory, assuming proportional to crop area (regional crop area data was sourced from DEFRA regional farming statistics)

Source category			CO_2	CH_4	N_2O	HFC	PFC	SF_6	Data sources used by URS and key assumptions
		Emissions from pasture, range and paddock manure			X				Derived from UK UNFCCC inventory, assuming proportional to pasture area (regional pasture area data was sourced from DEFRA regional farming statistics)
		Indirect soil emissions from atmospheric deposition and nitrogen leaching and run-off			X				Derived from UK UNFCCC inventory, assuming proportional to crop area (regional crop area data was sourced from DEFRA regional farming statistics)
WASTE	Solid waste disposal on land			X					Pollution Inventory (regional data provided by the Environment Agency) Emissions from active landfills regulated by the EA are included in the EA Pollution Inventory, as well as any landfills closed after 1994. It is assumed that the contribution of older landfills is negligible and will anyway decrease over time.
	Wastewater handling			X	X				Derived from UK UNFCCC inventory, assuming proportional to number of inhabitants
	Waste incineration			X					Pollution Inventory (regional data provided by the Environment Agency)
LULUCF (Land Use, Land Use Change & Forestry)	Emissions and removals from forest land, cropland, grassland, wetland, settlements, etc.		X						Regional CO_2 Emission Estimates published by DEFRA (the compilation of LULUCF data for the DEFRA survey is subcontracted to the Centre for Ecology & Hydrology (CEH))

The inventory was compiled by URS the following way:

1) Emission data provided by the Environment Agency Pollution Inventory was used as a starting point (available for the 6 GHGs);
2) CO_2 emission data from the DEFRA Regional CO_2 Estimates was added to the above, for the emission sources not covered by the Pollution Inventory;
3) Emissions from the sources not covered by the above two data sources were estimated by URS, usually by top-down calculations based on UK emission data (see Section 3).

Tonnes of CH_4, N_2O, HFCs, PFCs and SF_6 were converted in tonnes of CO_2 equivalent using the Global Warming Potentials of the IPPC in its Second Assessment Report (1996). GWP factors have been updated in the IPCC 3rd Assessment Report (2001), however it has been agreed internationally that these will not apply to the Kyoto targets under the 1st commitment period (all calculations and inventory submissions throughout this period shall be based on the GWP given in the IPCC 1996 report).

	100-year Global Warming Potential (GWP)
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
HFC-23	11,700
HFC-125	2,800
HFC-134a	1,300
HFC-143a	3,800
HFC-152a	140
HFC-227ea	2,900
HFC-236fa	6,300
Perfluoromethane (CF_4)	6,500
Perfluoroethane (C_2F_6)	9,200
Sulfur Hexafluoride (SF_6)	23,900

At the time of writing this report, the latest year for which emission data was available from all data sources was 2004; therefore the regional GHG inventory was calculated for the year 2004.

Results

Detailed results are presented in Tables A2 and A3 below.

Table A2: Regional GHG inventory by emission source (2004)

	Categories	GHG emissions in thousand tonnes (kt) of CO2 equivalent							Data sources & key assumptions
		CO2 (net emissions)	CH4	N2O	HFCs	PFCs	SF6	Total GHG	
Emission sources covered by the Pollution Inventory	Fuel & power production & associated processes (fuel combustion)	7,193	2	35				7,231	**Regional GHG data extracted from the Environment Agency Pollution Inventory (2004 data)**
	Metal production & processes (fuel combustion + process emissions)	53		1				54	EA Pollution Inventory includes GHG emissions data for the 6 Kyoto GHG and covers the sites regulated by the EA, i.e. sites regulated under IPC, PPC, sites with waste management licences that are moving to PPC, or are sewage treatment works subject to a Ministerial Direction under the Water Industries Act. Thresholds for reporting emission data to the EA are: 10,000 t/y of CO2; 10 t/y of CH4; 10 t/y of N2O; 1 t/y of HFC (total); 100 kg/y of PFCs (total); 50 kg/y of SF6. Releases to be reported under the Pollution Inventory include fugitive emissions.
	Mineral industries (fuel combustion + process emissions)	785	1					786	
	Chemical industry (fuel combustion + process emissions)	52		15				67	
	Waste incineration / production of fuel from waste	916						916	Landfills: Emissions from active landfills regulated by EA are included in the EA Pollution Inventory, as well as any landfills closed after 1994. It is assumed that the contribution of older landfills is negligible and will anyway decrease over time.
	Waste landfill	318	957					1,274	
Emission sources covered by DEFRA Regional CO2 Emission Estimates	Agriculture Oil	298						298	Regional CO2 emission data published by DEFRA (electricity-user basis, 2004 data). Annually prepared by AEA Energy & Environment.
	Agriculture Solid Fuel	2						2	
	Agriculture Non fuel	3						3	
	Domestic Gas	6,806						6,806	
	Domestic Oil	407						407	
	Domestic Solid Fuel	411						411	
	Domestic Home & Garden Machinery	23						23	
	Domestic Household Products	132						132	
	Road Transport Petrol (Major roads)	3905						3,905	
	Road Transport Petrol (Minor roads)	2,143						2,143	
	Road Transport Diesel (Major roads)	4,645						4,645	
	Road Transport Diesel (Minor roads)	1,498						1,498	
	Road Transport Other	51						51	
	Railways	243						243	
	LULUCF Emissions: Agricultural Soils And Deforestation	71						71	
	LULUCF Emissions: Other	1,096						1,096	
	LULUCF Removals	-802						-802	
Other key emission sources	Fuel combustion in small industrial & commercial sites & public sector (not covered by EA Pollution Inventory)	8,252						8,252	These emissions were estimated as follows: Total Industrial & Commercial CO2 Emissions from the DEFRA Regional CO2 Estimates (excluding electricity use but including power stations) - Total CO2 emissions from EA Pollution Inventory
	Fugitive emissions from coal mining and handling		1,076					1,076	Derived from UK UNFCCC inventory, assuming proportional to the amount of coal produced, and assuming that % of CH4 recovered/flared is the same in West Midlands and UK (regional coal production data was sourced from the Coal Authority) - Please refer to Table A6 for calculation
	Fugitive emissions from abandoned coal mines		35					35	Estimated using an experimental emission factor used in the UK UNFCCC inventory - Please refer to Table A6 for calculation details
	Fugitive emissions from solid fuel transformation		0.4					0.4	Derived from UK UNFCCC inventory, assuming proportional to solid fuel use (regional solid fuel use data was sourced from regional fuel use statistics published by the DTI) - Please refer to Table A6 for calculation details
	HFC, PFC and SF6 from product use				772	8	64	845	Derived from UK UNFCCC inventory, assuming proportional to number of inhabitants - Please refer to Table A11 for calculation details
	Cattle (enteric fermentation)		1,199					1,199	Derived from UK UNFCCC inventory, assuming proportional to animal headcount by type of animal (regional cattle headcount data was sourced from DEFRA regional farming statistics) - Please refer to Table A7 for calculation details
	Manure management		212	98				310	
	Direct emissions from soils			709				709	Derived from UK UNFCCC inventory, assuming proportional to crop area (regional crop area data was sourced from DEFRA regional farming statistics) - Please refer to Table A8 for calculation details
	Direct emissions from pasture, range & paddock manure			184				184	Derived from UK UNFCCC inventory, assuming proportional to pasture area (regional pasture area data was sourced from DEFRA regional farming statistics) - Please refer to Table A8 for calculation details
	Indirect emissions from atmospheric deposition & nitrogen leaching and run-off			513				513	Derived from UK UNFCCC inventory, assuming proportional to crop area (regional crop area data was sourced from DEFRA regional farming statistics) - Please refer to Table A8 for calculation details
	Wastewater handling		71	108				179	Derived from UK UNFCCC inventory, assuming proportional to number of inhabitants - Please refer to Table A10 for calculation details
	Domestic civil aviation	66						66	Derived from UK UNFCCC inventory, assuming proportional to passenger numbers in Birmingham and Coventry airports (passenger numbers sourced from the Civil Aviation Authority (CAA) statistics) - Please refer to Table A12 for calculation details
	International aviation (for info only)	*1,557*						*1,557*	Only domestic flights have been included in the inventory (emissions from international flights provided as a memo item only)
	Total Regional Emissions in 2004	**38,567**	**3,554**	**1,662**	**772**	**8**	**64**	**44,628**	
Totals by main sectors	**Industrial, Commercial & Public Sector**	16,335	1,115	51	772	8	64	17,234	
	Domestic	7,779	0	0	0	0	0	7,779	
	Road Transport	12,242	0	0	0	0	0	12,242	
	Other Transport	309	0	0	0	0	0	309	
	Agriculture	302	1,411	1,503	0	0	0	3,216	
	Waste	1,234	1,028	108	0	0	0	2,370	
	Land Use Change & Forestry	366	0	0	0	0	0	366	

Table A3: Regional GHG inventory by emission source compared with UK (2004)

		West Midlands				UK	
		Total GHG (kt CO2 equiv.)	% of total WM emissions	% of UK sectoral emissions	t CO2 equiv./cap.	kt CO2 equiv. (1)	t CO2 equiv./cap.
	Total Regional Emissions	**44,628**	100%	**7%**	**8.4**	**658,511**	**11.0**
Industry, commercial & public sector	Fuel & power production & associated processes (fuel combustion) (CO2, CH4, N2O)	7,231	16%	3%		208,739	
	Metal production & processes (fuel combustion + process emissions) (CO2, N2O)	54	0.1%	no data available		no data available	
	Mineral industries (fuel combustion + process emissions) (CO2, CH4)	786	2%	no data available		no data available	
	Chemical industry (fuel combustion + process emissions) (CO2, N2O)	67	0.2%	no data available		no data available	
	Fuel combustion in small industrial & commercial sites (not covered by EA Pollution Inventory) (CO2)	8,252	18%	no data available		no data available	
	Fugitive emissions from coal mining and handling, abandoned coal mines and solid fuel transformation (CH4)	1,112	2%	21%		5,402	
	HFC, PFC and SF6 from product use	845	2%	9%		9,422	
Domestic	Domestic energy use (gas, oil, solid fuel, home and garden machinery, household products) (CO2)	7,779	17%	5%		153,527	
Road transport	Road Transport (CO2)	12,242	27%	9%		129,074	
Other transport	Railways (CO2)	243	1%	10%		2,500	
	Civil aviation - domestic flights (CO2)	66	0.1%	3%		2,302	
	Civil aviation - international flights (CO2) (for info only)	*1,557*	*na*	*5%*		*33,124*	
Agriculture	Agriculture energy use (oil and solid fuel) and non-energy emissions (from pesticides) (CO2)	302	1%	7%		4,187	
	Cattle (enteric fermentation) (CH4)	1,199	3%	7%		17,856	
	Manure management (CH4, N2O)	310	1%	11%		2,820	
	Agricultural soils (N2O direct and indirect emissions)	1,405	3%	4%		36,920	
Waste	Waste landfill (CO2, CH4)	1,274	3%	no data available		no data available	
	Waste incineration / production of fuel from waste (CO2)	916	2%	no data available		no data available	
	Wastewater handling (CH4, N2O)	179	0.4%	9%		2,030	
Land Use Change & Forestry	LULUCF emissions & removals (CO2)	366	1%	na		-1,942	

(1) UK data sourced from UK UNFCCC Inventory and DEFRA Regional CO2 Emission Estimates

2) Compilation of the regional inventory taking into account energy end-users

Methodology

In terms of emission sources, the main difference with the first approach is that CO_2 emissions from power stations have not been counted while CO_2 emissions from electricity use have been included (estimated by applying the average UK emission factor for electricity to regional electricity use data).

The inventory was compiled by URS the following way:

1) CO_2 emission data from the DEFRA Regional CO_2 Estimates was used as a starting point;
2) Emission data provided by the Environment Agency Pollution Inventory was added to the above for non-CO_2 GHGs;
3) Emissions from the sources not covered by the above two data sources were estimated by URS, usually by top-down calculations based on UK emission data.

For the emission sources that were not covered by the Pollution Inventory nor by the DEFRA Regional CO_2 Emission Estimates, the details of the calculations made by URS are provided in Tables A6 to A12.

Results

Detailed results are presented in Tables A4 and A5 below.

Table A4: Regional GHG inventory with energy emissions re-allocated to end users (2004)

	Categories	GHG emissions in thousand tonnes (kt) of CO2 equivalent							Data sources & key assumptions
		CO2 (net emissions)	CH4	N2O	HFCs	PFCs	SF6	Total GHG	
Emission sources covered by DEFRA Regional CO2 Emission Estimates	Industry & Commercial Electricity	8,579						8,579	**Regional CO2 emission data published by DEFRA (energy end-user basis, 2004 data). Annually prepared by AEA Energy & Environment.**
	Industry & Commercial Gas (excluding power stations)	5,538						5,538	The DEFRA CO2 emission data represent the primary emissions from the consumption of fuel or other process activities that emit CO2, with the emissions relevant to the production of and distribution of energy (power stations, refineries, oil & gas production, mining) re-allocated to their point of consumption (rather than where the emissions actually occur). Elements of the data (such as the domestic gas and electricity estimates and the estimates for road transport) are of reasonable certainty as they are based on local meter readings, sales data and traffic counts. Other components of the estimates (including solid and liquid fuels combustion, land use estimates) are much more uncertain as they are based on less well linked spatial data (including population, satellite images and fuel surveys) and incorporate many assumptions. It should be noted that the results at regional level are much more robust; most of the difficulties in allocating data to local authorities have little impact at regional level.
	Industry & Commercial Oil (excluding power stations)	1,197						1,197	
	Industry & Commercial Solid Fuel (excluding power stations)	1,174						1,174	
	Industry & Commercial Wastes & Biomass (excluding power stations)	106						106	
	Industry Process Gases	1,156						1,156	Key data sources of the DEFRA survey are:
	Industry Non Fuel	380						380	**1) Local energy use estimates published by the DTI** (electricity, gas, coal, oil ans smokeless solid fuels) split between Industrial & Commercial and Domestic,
	Industry Off-Road Machinery	1,026						1,026	plus road transport fuel consumption estimates.
	Agriculture Oil	330						330	Emissions associated with electricity consumption have been estimated using an average UK factor in terms
	Agriculture Solid Fuel	2						2	of kT CO2 per GWh. This average allocates equal shares of coal, gas, oil and renewable powered generation to the
	Agriculture Non Fuel (pesticides use)	3						3	electricity consumers and is derived from the UK inventory for 2004. Note that the DTI data includes 7,400 GWh of electricity
	Domestic Electricity	5,551						5,551	as direct sales to high voltage lines that cannot be allocated to any region or Local Authority due to the lack of information.
	Domestic Gas	6,919						6,919	**2) EU ETS data** (for large gas users excluded from the DTI data for confidentiality reasons)
	Domestic Oil	442						442	**3) Detailed vehicle specific traffic census data from DfT** (fuel use is calculated for each vehicle type on a road link basis
	Domestic Solid Fuel	417						417	using fleet weighted emission factors for each vehicle type and assumptions about speeds on each road type).
	Domestic Home & Garden Machinery	23						23	4) **Diesel use by rail included in local energy statistics published by the DTI** (NB: electricity use by rail transport is included in Commercial & Industrial DTI data)
	Domestic Household Products	132						132	**5) CO2 emission data from the NAEI (National Atmospheric Emission Inventory) for other fuel uses by the industrial & commercial sector**
	Road Transport Petrol (Major roads)	4,707						4,707	**or process emissions** (combustion of mine methane, combustion of landfill biogas, CO2 from cement and lime, etc.)
	Road Transport Petrol (Minor roads)	2,583						2,583	6) **LULUCF data prepared by the Centre for Ecology & Hydrology** (CEH) mapped agaisnt the local authorities using dynamic models
	Road Transport Diesel (Major roads)	5,224						5,224	of change in stored carbon driven by land use change data.
	Road Transport Diesel (Minor roads)	1,685						1,685	
	Road Transport Other	51						51	NB: Unallocated consumption (for the whole UK) amounts to (in CO2 equiv.): 2338 kt for Industrial Electricity, 180 kt for Industrial Gas, 62 kt for Domestic Electricity and 169 kt for L
	Railways	269						269	In addition, emissions associated with large electricity users (high voltage lines) at unknown location amount to 3880 kt CO2 (for the whole UK).
	LULUCF Emissions: Agricultural Soils And Deforestation	71						71	
	LULUCF Emissions: Other	1,096						1,096	
	LULUCF Removals	-802						-802	
	Power Station Emissions (for information only)	*6,994*							
Other key emission sources	Fugitive emissions from coal mining and handling		1,076					1,076	Derived from UK UNFCCC inventory, assuming proportional to the amount of coal produced, and assuming that % of CH4 recovered/flared is the same in West Midlands and UK (regional coal production data was sourced from the Coal Authority) - Please refer to Table A6 for calculation details
	Fugitive emissions from abandoned coal mines		35					35	Estimated using an experimental emission factor used in the UK UNFCCC inventory - Please refer to Table A6 for calculation details
	Fugitive emissions from solid fuel transformation		0.4					0.4	Derived from UK UNFCCC inventory, assuming proportional to solid fuel use (regional solid fuel use data was sourced from regional fuel use statistics published by the DTI) - Please refer to Table A6 for calculation details
	CH4 & N2O from combustion processes (major industrial sites)		2	35				37	EA Pollution Inventory data
	CH4 from mineral industries		1					1	EA Pollution Inventory data
	N2O from metal production & processing			1				1	EA Pollution Inventory data
	N2O from chemical industry			15				15	EA Pollution Inventory data
	HFC, PFC and SF6 from product use				772	8	64	845	Derived from UK UNFCCC inventory, assuming proportional to number of inhabitants - Please refer to Table A11 for calculation details
	Cattle (enteric fermentation)		1,199					1,199	Derived from UK UNFCCC inventory, assuming proportional to animal headcount by type of animal (regional cattle headcount data was sourced from DEFRA regional farming statistics) - Please refer to Table A7 for calculation details
	Manure management		212	98				310	
	Direct emissions from soils			709				709	Derived from UK UNFCCC inventory, assuming proportional to crop area (regional crop area data was sourced from DEFRA regional farming statistics) - Please refer to Table A8 for calculation details
	Direct emissions from pasture, range & paddock manure			184				184	Derived from UK UNFCCC inventory, assuming proportional to pasture area (regional pasture area data was sourced from DEFRA regional farming statistics) - Please refer to Table A8 for calculation details
	Indirect emissions from atmospheric deposition & nitrogen leaching and run-off			513				513	Derived from UK UNFCCC inventory, assuming proportional to crop area (regional crop area data was sourced from DEFRA regional farming statistics) - Please refer to Table A8 for calculation details
	Landfills		957					957	EA Pollution Inventory data (captures active landfills + landfills closed since 1994 - It is assumed that the contribution of older landfills is negligible and will anyway decrease over time)
	Wastewater handling		71	108				179	Derived from UK UNFCCC inventory, assuming proportional to number of inhabitants - Please refer to Table A10 for calculation details
	Domestic civil aviation	66						66	Derived from UK UNFCCC inventory, assuming proportional to passenger numbers in Birmingham and Coventry airports (passenger numbers sourced from the Civil Aviation
	International aviation (for info only)	*1,557*						*1,557*	Authority (CAA) statistics) - Please refer to Table A12 for calculation details
	Total Regional Emissions & Removals	**47,923**	**3,554**	**1,662**	**772**	**8**	**64**	**53,984**	
Totals by main sector	**Industrial, Commercial & Public Sector**	19,155	1,115	51	772	8	64	21,165	*The split of CO2 emissions from energy use between Industry, Commerce & Public Sector is estimated to be approximately*
	Domestic	13,484	0	0	0	0	0	13,484	*69% Industry / 22% Commerce / 9% Public Sector, based on the West Midlands Energy Strategy Monitoring Report figures for 2004*
	Road Transport	14,250	0	0	0	0	0	14,250	
	Other Transport	336	0	0	0	0	0	336	
	Agriculture	334	1,411	1,503	0	0	0	3,248	
	Waste	0	1,028	108	0	0	0	1,136	
	Land Use Change & Forestry	366	0	0	0	0	0	366	

Table A5: Regional GHG inventory with energy emissions re-allocated to end users compared with UK (2004)

		West Midlands				UK	
		Total GHG (kt CO2 equiv.)	% of total WM emissions	% of UK sectoral emissions	t CO2 equiv./cap.	kt CO2 equiv. (1)	t CO2 equiv./cap.
	Total Regional Emissions	**53,984**	100%	**8%**	**10.1**	**658,511**	**11.0**
Industry, commercial & public sector	Industrial, Commercial & Public Sector energy use excluding power stations (electricity, gas, oil, solid fuel, waste and biomass) (CO2, CH4, N2O) (2)	16,631	31%	8%		206,648	
	Power station emissions (for info only)	*6,994*	*na*	*4%*		*177,669*	
	Industry process gases, non-fuel emissions and off-road machinery (CO2)	2,561	5%	8%		31,992	
	CH4 from mineral industries	1.4	0.003%	10%		14	
	N2O from metal production & processing	0.9	0.002%	11%		8	
	N2O from chemical industry	15	0.03%	0%		3,567	
	HFC, PFC and SF6 from product use	845	2%	9%		9,751	
	Fugitive emissions from coal mining and handling, abandoned coal mines and solid fuel transformation (CH4)	1,112	2%	21%		5,402	
Domestic	Domestic energy use (gas, oil, solid fuel, home and garden machinery, household products) (CO2)	13,484	25%	9%		155,140	
Road transport	Road transport (CO2)	14,250	26%	9%		150,471	
Other transport	Railways (CO2)	269	0%	10%		2,771	
	Civil aviation - domestic flights (CO2)	66	0.1%	3%		2,302	
	Civil aviation - international flights (CO2) (for info only)	*1,557*	*na*	*5%*		*33,124*	
Agriculture	Agriculture energy use (oil and solid fuel) and non-energy emissions (from pesticides use) (CO2)	334	1%	8%		4,187	
	Cattle (enteric fermentation) (CH4)	1,199	2%	7%		17,856	
	Manure management (CH4, N2O)	310	1%	11%		2,820	
	Agricultural soils (N2O direct and indirect emissions)	1,405	3%	4%		36,920	
Waste	Landfills (CH4)	957	2%	4%		21,777	
	Wastewater handling (CH4, N2O)	179	0.3%	9%		2,030	
Land Use Change & Forestry	LULUCF emissions & removals (CO2)	366	1%	na		-1,942	

(1) UK data sourced from UK UNFCCC Inventory and DEFRA Regional CO2 Emission Estimates (the sum of CO2 emissions from individual sources does not perfectly match total GHG emissions for the UK, as there a a few discrepancies between the DEFRA data and the UK UNFCCC inventory data)

(2) The split of CO2 emissions from energy use between Industry, Commerce & Public Sector is estimated to be approx. 69% Industry / 22% Commerce / 9% Public Sector, based on the West Midlands Energy Strategy Monitoring Report figures for 2004

3) Calculation of emissions from agriculture, solid fuels, waste management, use of HFCs/PFCs/SF6 and aviation

Calculation details for those emission sources that were not covered by the Pollution Inventory nor by the DEFRA Regional CO_2 Emission Estimates are provided in Tables A6 to A12 below.

Table A6: Fugitive CH4 emissions from solid fuels (2004)

		UK data (2004)		WM data (2004)		
		Coal production (t) (1)	CH4 emissions (kt of CH4) (1)	Coal production (t) (2)	Estimated CH4 emissions (kt of CH4)	Estimated CO2 equivalent emissions (kt)
Coal mining and handling	Underground mines	12,540,000	216	2,977,425	51.24	1,076
	Surface mines	11,990,000	4.07	6,083	0.002	0.04

Abandoned coal mines	Method used at UK level: Based on DEFRA survey on abandoned mines (*Development of a methodology for estimating methane emissions from abandoned coal mines in the UK* - http://www.defra.gov.uk/science/project_data/DocumentLibrary/GA01039/GA01039_2787_FRP.pdf) **CH4 emissions (t) = CH4 reserves in abandoned mines (t) * 0.74%** CH4 reserves in WM in 2004 estimated at 318 million m3 (=228,006 t) in the DEFRA survey (see Appendix H of the DEFRA report:sum of gas reserves for major coal fields in Staffordshire + a number of minor coalfields in Coventry, Chatterley, South Staffordshire, Coalbrookdale, North Staffordshire, Shrewsbury and Wyre forest) Volumetric mass of CH4 = 0.717 kg/m3	1.69	35

Solid fuel transformation	UK data (2004)		WM data (2004)		
	Solid fuel use (kt oil equiv) (3)	CH4 emissions (kt of CH4)	Solid fuel use (kt oil equiv) (3)	Estimated CH4 emissions (kt of CH4)	Estimated CO2 equivalent emissions (kt)
	803	0.53	29.1	0.02	0.44

Total	53	**1,112**

(1) Data from UK UNFCCC inventory (Table 1B1)
(2) Annual production and manpower returns published on the Coal Authority website (http://www.coal.gov.uk/services/licensingindemnities/productionandmanpowerreturnsarchivedreturns.cfm) taking into account 1 opencast mine in Shropshire and 1 underground mine in Warwickshire

(3) Data from DTI regional fuel consumption statistics (*Regional and local estimates of non gas, non electricity and non road transport fuels*). Data for manufactured solid fuels industrial + domestic

Table A7: CH4 emisions from enteric fermentation and manure management (2004)

	UK data (2004)		WM data (2004)		
	Population size (1)	CH4 emissions (kt of CH4) (1)	Population size (2)	Estimated CH4 emissions (kt of CH4)	Estimated CO2 equivalent emissions (kt)
A. Enteric Fermentation		**767**		**57**	**1,199**
1. Cattle					
Dairy Cattle	2,131,353	217	205,000	21	438
Non-Dairy Cattle	8,466,925	363	573,000	25	516
2. Buffalo	0	0	0	0	0
3. Sheep	35,880,958	173	2,336,000	11	236
4. Goats	91,515	0.5	8,183	0.04	0.9
5. Camels and Llamas	0	0	0	0	0
6. Horses	329,319	5.93	?		
7. Mules and Asses	0	0	0	0	0
8. Swine	5,160,367	7.7	243,000	0.4	7.7
Deer	28,858	0.3	?		
B. Manure Mgt		**122**		**10**	**212**
1. Cattle					
Dairy Cattle	2,131,353	53	205,000	5.1	108
Non-Dairy Cattle	8,466,925	36	573,000	2.4	51
2. Buffalo	0	0	0	0	0
3. Sheep	35,880,958	4.1	2,336,000	0.3	5.6
4. Goats	91,515	0.01	8,183	0	0
5. Camels and Llamas	0	0	0	0	0
6. Horses	329,319	0.5	?		
7. Mules and Asses	0	0	0	0	0
8. Swine	5,160,367	15	243,000	0.7	15
9. Poultry	173,582,661	14	19,975,000	1.6	33
Deer	28,858	0.01	?		

Table A8: N2O emissions from agricultural soils (2004)

	UK data (2004)		WM data (2004)		
	Crop area (ha) (3)	N2O emissions (kt of N2O) (1)	Crop area (ha) (2)	Estimated N2O emissions (kt of N2O)	Estimated CO2 equivalent emissions (kt)
1. Direct Soil Emissions	4,589,000	38	272,751	2.29	**709**

	UK data (2004)		WM data (2004)		
	Pasture area (ha) (3)	N2O emissions (kt of N2O) (1)	Pasture area (ha) (2)	Estimated N2O emissions (kt of N2O)	Estimated CO2 equivalent emissions (kt)
2. Pasture, Range and Paddock Manure	12,429,000	15	500,225	0.59	**184**

	UK data (2004)		WM data (2004)		
	Crop area (ha) (3)	N2O emissions (kt of N2O) (1)	Crop area (ha) (2)	Estimated N2O emissions (kt of N2O)	Estimated CO2 equivalent emissions (kt)
3. Indirect Emissions	4,589,000	28	272,751	1.65	**513**

(1) Data from UK UNFCCC inventory (Table 4s1)
(2) Data from DEFRA regional farming statistics (http://www.defra.gov.uk/esg/work_htm/publications/cs/farmstats_web/2_SURVEY_DATA_SEARCH/COMPLETE_DATASETS/regional_level_datasets.htm)
Total crop area does not include bare fallow
Pasture area = temporary grass + permanent grass + rough grazing
(3) Data from DEFRA quick agricultural statistics - Agricultural land use UK Table 3.1 (http://statistics.defra.gov.uk/esg/publications/auk/2006/table3-1.xls)
Pasture area = all grass under 5 years old + all grass over 5 years old + sole right rough grazing + common rough grazing

Table A9: N2O emissions from manure management (2004)

	Population size		N exc. rate (kg N/head/yr) (1)	Nitrogen excretion per Animal Waste Management System (AWMS) (kg N/yr)					
				Liquid system		Solid storage and dry lot		Other	
	UK (1)	WM (2)		UK (1)	WM	UK (1)	WM	UK (1)	WM
Dairy Cattle	2,131,353	205,000	105.78	67,034,298	6,447,562	21,555,353	2,073,259	na	
Non-Dairy Cattle	8,466,925	573,000	48.51	16,631,351	1,125,528	64,094,447	4,337,598	na	
Sheep	35,880,958	2,336,000	6.82	na		3,917,046	255,016	na	
Swine	5,160,367	243,000	10.04	13,029,444	613,552	22,660,847	1,067,092	na	
Poultry	173,582,661	19,975,000	0.67	na		na		70,278,203	8,087,254
Buffalo	0	0	na	na		na		na	
Goats	91,515	8,183	9.00	na		na		26.36	2.36
Camels and Lamas	0	0	na	na		na		na	
Horses	329,319	?	40.00	na		na		421,528	?
Mules and Asses	0	0	na	na		na		na	
Deer	36,900	?	14.54	na		83,928.30	?	na	
			Total per AWMS	96,695,094	**8,186,642**	112,311,622	**7,732,965**	70,699,758	**8,087,257**

							Total in CO2 equiv. (kt)	
							UK	**WM**
N2O emission factor for an AWMS (kg N2O-N/kg of Nex in AWMS)	0.0010	0.0010	0.0200	0.0200	0.0048	0.0048		
Total N2O emissions from manure mgt (kt)	0.15	**0.01**	3.53	**0.24**	0.53	**0.06**	**1,306**	**98**

(1) Data from UK UNFCCC inventory (Table 4.B (b))
(2) Data from DEFRA regional farming statistics (http://www.defra.gov.uk/esg/work_htm/publications/cs/farmstats_web/2_SURVEY_DATA_SEARCH/COMPLETE_DATASETS/regional_level_datasets.htm)

Table A10: CH4 & N2O emissions from wastewater handling (2004)

	UK data (2004)		WM data (2004)		
	Population size (1)	CH4 emissions (kt of CH4) (2)	Population size (1)	Estimated CH4 emissions (kt of CH4)	Estimated CO2 equivalent emissions (kt)
CH4 emissions from wastewater handling	59,835,000	38.06	5,334,000	3.39	**71**

	UK data (2004)		WM data (2004)		
	Population size (1)	N2O emissions (kt of N2O) (2)	Population size (1)	Estimated N2O emissions (kt of N2O)	Estimated CO2 equivalent emissions (kt)
N2O emissions from wastewater handling	59,835,000	3.90	5,334,000	0.35	**108**

(1) Population data from ONS estimates for mid-2004 (http://www.statistics.gov.uk/downloads/theme_population/PopTrends122v1.pdf)
(2 Data from UK UNFCCC inventory (Table 6)

Table A11: HFC, PFC & SF6 emissions from product use (2004) 0.089145149

	UK data (2004)			WM data (2004)		
	Population size (1)	Emissions (kt) (1)	Emissions (kt of CO2 equiv.) (2)	Population size (1)	Estimated emissions (kt)	Estimated emissions (kt of CO2 equiv.)
HFC	59,835,000	na	8,663	5,334,000	na	**772**
PFC	59,835,000	na	94	5,334,000	na	**8**
SF6	59,835,000	0.03	717	5,334,000	0.003	**64**

HFC: Includes refrigeration/AC, foam blowing, fire extinguishers, aerosols/metered dose inhalers, solvent use
PFC: Includes use in electrical and semi-conductors applications
SF6: Includes emissions from electrical equipment (insulation in electrical transformation and distribution - e.g. switchgear), from semi-conductor manufacture and from training shoes

(1) Population data from ONS estimates for mid-2004 (http://www.statistics.gov.uk/downloads/theme_population/PopTrends122v1.pdf)
(2) Data from UK UNFCCC inventory (Table 2(I)s2)

Table A12: Civil aviation CO2 emissions (2004)

	UK data (2004)		WM data (2004)	
	Total passengers UK airports (1)	CO2 emissions (kt) (2)	Passengers using WM airports (1)	Estimated CO2 emissions attributable to WM airports (kt)
Domestic flights	48,514,674	2,302	1,400,910	**66**
International flights (for info only)	167,165,976	33,124	7,858,119	**1,557**

(1) Data from CAA statistics for Birmingham + Coventry airports: Domestic traffic from the Domestic Terminal Passenger Traffic table; International traffic from the EU & Other International Passenger Traffic table

(2) Data from UK UNFCCC inventory (Table 1s1 & Table 1s2)

4) Detailed inventory by SIC code and estimate of 1990 and 2020 emission levels

Methodology

In order to provide AWM with detailed findings by business sectors (categories defined by the Standard Industrial Classification or SIC), URS has used CO_2 emission data calculated by the REEIO model for 2004 (provided by the West Midlands Regional Observatory). The reason for using the REEIO model is that it provides a breakdown of CO_2 emissions into 43 economic sectors which can easily be converted into SIC categories, and emission data for the main sources are obtained from bottom-up calculations in this model. However it must be noted that REEIO model emission data are calculated based on an emission source approach, therefore they tend to under-estimate the carbon footprint of the region.

CO_2 emissions in 1990 and 2020 have been extrapolated by URS based on the percentage of change by sector at UK level between 1990 and 2004, and between 2004 and 2020. In the absence of any reliable regional data to estimate 1990 emission levels and 2020 baseline emission projections, URS has assumed that the percentage of change in CO_2 emissions from each sector would be the same in the West Midlands and in the UK.

The emission projections for 2020 correspond to the baseline scenario calculated by the DTI, as described in the Energy White Paper of May 2007. This corresponds to CO_2 emissions that would occur in the absence of any new carbon reduction policies, but taking into account the effect of current carbon reduction policies over the next few years as well as the effect of future energy prices).

Results

Detailed results are presented in Tables A13 and A14 below.

Table A13: CO2 emissions by SIC category (1990, 2004, 2020)

		SIC Code	AB	C	DA	DB + DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	E	F	G	H	I 60.1	I 60.2	I 62	I 63-64	J	K	L	M	N	O	No SIC Code	No SIC Code	TOTAL
CO2 emissions for West Midlands region (kt CO2)	1990	Extrapolated based on UK trends	64	44	926	172	82	344	205	1,867	444	1,441	993	135	111	313	284	6,968	53	189	173	234	10,877	36	25	32	153	517	388	558	202	6,808	554	**35,192**
	2004	REEIO model data (1)	61	31	836	151	95	383	220	1,869	287	1,059	772	101	75	292	248	6,029	64	217	211	296	11,860	66	38	22	159	437	341	533	158	7,590	366	**34,866**
	2020	Extrapolated based on UK trends, including impact of existing policies	57	29	777	140	88	356	280	1736	266	983	717	94	69	271	230	6353	60	224	217	353	12333	79	39	23	164	451	351	549	163	5812	-366	**32,898**
Trends in CO2 emissions at UK level (% change)	1990 - 2004 (2)		-5%	-29%	-10%	-12%	16%	11%	7%	0%	-35%	-27%	-22%	-25%	-33%	-7%	-13%	-13%	21%	15%	22%	27%	9%	91%	51%	-32%	4%	-15%	-12%	-5%	-22%	11%	-166%	**-1%**
	2004 - 2020 (3)		-7%	-7%	-7%	-7%	-7%	-7%	27%	-7%	-7%	-7%	-7%	-7%	-7%	-7%	-7%	5%	-7%	3%	3%	19%	4%	19%	3%	3%	3%	3%	3%	3%	3%	-23%	-200%	**-6%**
	1990 - 2020		-12%	-34%	-16%	-19%	8%	3%	37%	-7%	-40%	-32%	-28%	-30%	-38%	-13%	-19%	-9%	13%	18%	26%	51%	13%	116%	56%	-29%	7%	-13%	-9%	-2%	-19%	-15%	-166%	**-7%**

(1) Data provided by the West Midlands Regional Observatory, except for air travel and LULUCF emission data (not included in the REEIO model) which have been calculated by URS separately. Air travel emissions have been calculated based on the UK UNFCCC inventory (see Table A12); LULUCF emission data comes from the DEFRA Regional CO2 Emission Estimates.

(2) See calculations in Table A15

(3) See calculations in Table A16

Table A14: Correspondance table used by URS to convert REEIO model categories into SIC categories

REEIO model categories	SIC codes
Power Generation	E
Other Energy transformation	E
Energy industries own use electricity generation	E
Energy industries own use: other	DF
Basic metals	DJ
Mineral products	DI
Chemicals	DG
Pharmaceuticals	DG
Mechanical engineering	DK
Metal goods	DJ
Electronics	DL
Electrical engineering & instrumentation	DL
Motor vehicles	DM
Other transport equipment	DM
Food drink & tobacco	DA
Textiles clothing & leather	DB + DC
Paper, printing & publishing	DE
Other mining	C
Wood & wood products	DD
Rubber & plastics	DH
Manufacturing nes & recycling	DN
Water supply	E
Construction	F

REEIO model categories	SIC codes
Rail transport	no SIC code
Road transport	no SIC code
National navigation & pipelines	no SIC code
Domestic use (households)	no SIC code
Public administration & defence	L
Education	M
Health & social work	N
Retailing	G
Distribution nes	G
Hotels & catering	H
Other transport services	I
Communications	I
Banking & finance	J
Insurance	J
Computing services	K
Professional services	K
Other business services	K
Agriculture	AB
Miscellaneous services	O

Appendix B

Carbon reduction policies reviewed by URS

APPENDIX B - Carbon reduction policies reviewed by URS

Cells highlighted in orange correspond to the West Midlands' sectors that are likely to be targeted by the policies
The expected carbon savings at UK level are those published in the Energy White Paper 2007. Carbon savings are estimated against projected baseline CO2 emissions for 2020.

Table B1: New carbon reduction policies proposed in the Energy White Paper of May 2007

Policy type	Summary	Expected C savings at UK level by 2020 (MtC/year)	Agriculture (AB)	Mining (C)	Manufacture of food products, beverage and tobacco (DA)	Manufacture of textiles, clothing and leather (DB,DC)	Manufacture of wood products (DD)	Manufacture of pulp and paper, publishing and printing (DE)	Manufacture of fuels (DF)	Manufacture of chemicals (DG)	Manufacture of rubber and plastic (DH)	Manufacture of mineral products (glass, ceramics, clay, cement, lime, plaster, concrete, etc.) (DI)	Manufacture of basic metals and fabricated metel products (DJ)	Manufacture of machinery and equipment (DK)	Manufacture of electrical & optical equipment (DL)	Manufacture of transport equipment (DM)	Manufacture of other products and recycling (DN)	Electricity, Gas and Water Supply (E)	Construction (F)	Retail and distribution (G)	Hotels and restaurants (H)	Transport services and communications (I excl. road, rail and & air transport)	Road transport	Railways	Aviation (domestic)	Banking, finance & insurance (J)	Computing services, professional services and business services (K)	Public administration & defence (L)	Education (M)	Health and social work (N)	Miscellaneous services (including waste mgt) (O)	Domestic sector	Land use, land use change & forestry (LULUCF)
EU Emission Trading Scheme (EU ETS)	Based on same allowances as Phase II, but UK may decide to tighten the C allowances after 2012 The EU ETS is currently the main mechanism implemented in the EU to achieve the Kyoto Protocol reduction target (12.5% cut on emissions of 6 GHG between 1990 and 2012 for the UK)	13.7																														
Energy Efficiency in Business	**Carbon Reduction Commitment (CRC)** in the business sector The CRC will target emissions from energy use in large non energy intensive organisations (business and public sector) whose mandatory half hourly-metered electricity consumption is greater than 6000 MWh per year. The CRC will target both carbon emissions from direct energy use as well as indirect carbon emissions (i.e. from electricity). The CRC will not target emissions covered by the CCAs nor direct emissions covered by the EU ETS.	0.8																														
	Building Regulations (Energy Performance of Building Directive EPBD)	0.2-0.5																														
	Business Smart Metering The White Paper announces that the Government will consult later in 2007 on a proposal that energy suppliers should extend to all but the smallest business users in Great Britain and those larger businesses not already subject to half hourly metering, advanced and smart metering services within the next five years.	0.1-0.2																														
	More energy efficient products (e.g. UK Government working with retailers and manufacturers to phase out energy inefficient light bulbs by around 2011)	0.5-1.4																														
	Energy Performance Certificates The White Paper announces that the Government will consult later in 2007 on a requirement to display Energy Performance Certificates in business premises.	unspecified																														
	Existing Building Upgrade The White Paper simply states that the Government is working with a range of interested parties to consider how improvement can be made to the wider sustainability of the existing building stock.	unspecified																														
Energy Efficiency in Households	**Building Regulations** (Energy Performance of Building Directive EPBD)	0.2-0.6																														
	Zero Carbon Homes (UK Government currently consulting on making this mandatory from 2016)	1.1-1.2																														
	Real time display for electricity meters in households The White Paper states that the Government expects that, within the next 10 years, all domestic energy customers will have smart meters. The White Paper proposes that, from May 2008, every household having an electricity meter replaced and every newly built domestic property will be given a real-time electricity display, free of charge. Furthermore, energy suppliers should give any household requesting a real-time display for their electricity meter one free of charge. The White Paper states that this should be implemented as soon as possible in 2008 through to March 2010.	0-0.3																														
	Better billing Government will work with energy suppliers to ensure that household gas and electricity bills contain historic information on energy consumption	0-0.2																														
	More energy efficient products	0.4-1.3																														
	Supplier obligation The Government is committed to continuing to achieving carbon savings from the domestic sector using some form of supplier obligation until at least 2020. The White Paper states that the Government is evaluating the costs and benefits of the various options for a supplier obligation after the Carbon Emission Reduction Target (CERT) finishes in 2011.	3-4																														
	Code for Sustainable Homes The Government will make it a condition of Government funding that all new homes built by registered social landlords and other developers and all new homes developed by English Partnerships will comply with Rating 3 of the Code for Sustainable Homes. UK Government currently consulting on whether all new homes should be required to be rated against the Code from April 2008.	unspecified																														
	Energy performance certificates 4 bedroom homes will have to supply an Energy Performance Certificate from Aug 2007	unspecified																														
	Raising awareness (DEFRA CO2 calculator launched)	unspecified																														
	Microgeneration and the low carbon buildings programme Redesign of the Low Carbon Buildings Programme and further financial incentives for the take up of microgeneration, including rewarding the export of excess electricity.	unspecified																														
Energy Efficiency in the Public Sector	**Carbon Reduction Commitment (CRC)** in the public sector	0.2																														
	Carbon Neutral Government (carbon neutrality to be reached in 2012) Savings from central government office estate, whose emissions constitute around 1/4 of the total from the wider central government estate	0.2																														
	More energy efficient products	0.1-0.3																														
	Building Regulations (Energy Performance of Building Directive EPBD) Higher standards of energy efficiency in schools and service families accomodation, e.g. Rating 3 of the Code for Sustainable Homes	0.2-0.5																														
	Sustainable procurement (Government's Sustainable Procurement Action Plan launched in March 2007)	unspecified																														
	New guidelines for energy efficiency By spring 2008 the Government will publish guidelines setting out criteria for energy efficiency and energy savings to be used by the public sector in its procurement procedures.	unspecified																														
	Display of energy performance certificates From April 2008, buildings greater than 1,000m2 occupied by public authorities and by institutions providing public services will be required to display a certificate showing an energy rating for the building.	unspecified																														

Policy type	Summary	Expected C savings at UK level by 2020 (MtC/year)	Agriculture (AB)	Mining (C)	Manufacture of food products, beverage and tobacco (DA)	Manufacture of textiles, clothing and leather (DB+DC)	Manufacture of wood and wood products (DD)	Manufacture of pulp and paper, publishing and printing (DE)	Manufacture of fuels (DF)	Manufacture of chemicals (DG)	Manufacture of rubber and plastic (DH)	Manufacture of mineral products (glass, ceramics, clay, cement, lime, plaster, concrete, etc.) (DI)	Manufacture of basic metals and fabricated metal products (DJ)	Manufacture of machinery and equipment (DK)	Manufacture of electrical & optical equipment (DL)	Manufacture of transport equipment (DM)	Manufacture of other products and recycling (DN)	Electricity, Gas and Water Supply (E)	Construction (F)	Retail and distribution (G)	Hotels and restaurants (H)	Transport services and communications (I excl. road, rail and & air transport)	Road transport	Railways	Aviation (domestic)	Banking, finance & insurance (J)	Computing services, professional services and business services (K)	Public administration & defence (L)	Education (M)	Health and social work (N)	Miscellaneous services (including waste mgt) (O)	Domestic sector	Land use, land use change & forestry (LULUCF)
Transport	**Renewable Transport Fuel Obligation (RFTO)** From 2008, the RFTO will place an obligation on fuel suppliers to ensure that a certain % of their aggregate sales is made up of biofuels. The effect of this will be to require 5% of all UK fuel sold on UK forecourts to come from a renewable source by 2010. The carbon savings estimate is an illlustrative estimate of additional carbon savings that would occur if the RTFO was extended beyond 5%. Upper estimate assumes Obligation rising to 10% by 2015. Lower estimate reflects RTFO remaining at 5% from 2010.	0-1																															
	Successor to EU voluntary agreements on new car fuel efficiency (expected for 2009) EU target is 120 g CO2/km by 2012. The carbon savings estimate is an illlustrative estimate reflecting annual improvements in new car fuel efficiency of 1.5%-3.6% p.a. Actual efficiency improvements will depend on the level of target set at EU level and application in the UK.	1.8-4.1																															
	Domestic aviation included in EU ETS The carbon savings estimate is an illustrative saving from UK domestic aviation, assuming a cap at 2005 emissions on projected 2020 levels, in line with the current EU Commission proposal. Carbon savings from international aviation have not been estimated in the absence of agreement on how to allocate emissions.	0.2-0.4																															
	Possible inclusion of surface transport in EU ETS UK encouraging the EU to consider inclusion of surface transport in the EU ETS after 2012 (including road transport could save 1-2 MtC/year in 2020)	1-2																															
Energy Supply	**Changes to Renewables Obligation** (electricity generation) Requirement for all licensed electricity suppliers to purchase a specified and rising proportion of their electricity sales from renewable sources. Obligation size is 10% energy from renewables by 2010, and 20% by 2020 The carbon savings estimate assumes a range based on different technology assumptions - the low figure is based on high technology cost assumptions, and the high figure on low technology cost assumptions.	0.4-1.1																															
	Carbon Capture & Storage (CCS) The Government has launched a competition to build the world's first full scale CSS demonstration plant. Eight CCS projects are currently planned for the UK (none in the West Midlands) The carbon savings estimate is based on around 0.3 GW to 1.9 GW of demonstration plants displacing equivalent gas fired generation without CCS	0.3-1																															
	Nuclear power UK government is currently consulting on the proposal of allowing the private sector the option of investing in new nuclear power stations (1 new nuclear plant could save up to 1.1 MtC/year)	unspecified																															
	TOTAL	**23-33**																															

Table B2: Existing carbon reduction policies (excluding EU ETS)
Source: Table D1 of the DTI report "Updated Energy & Carbon Emission Projections - The Energy White Paper, May 2007"
Carbon savings resulting from these existing policies have been included in the 2020 baseline emission projections presented in the Energy White Paper.

Sector	Policy	Expected C savings at UK level by 2020 (MtC/year)	Agriculture (AB)	Mining (C)	Manufacture of food products; beverage and tobacco (DA)	Manufacture of textiles, clothing and leather (DB+DC)	Manufacture of wood and wood products (DD)	Manufacture of pulp and paper, publishing and printing (DE)	Manufacture of fuels (DF)	Manufacture of chemicals (DG)	Manufacture of rubber and plastic (DH)	Manufacture of mineral products (glass, ceramics, clay, cement, lime, plaster, concrete, etc.) (DI)	Manufacture of basic metals and fabricated metal products (DJ)	Manufacture of machinery and equipment (DK)	Manufacture of electrical & optical equipment (DL)	Manufacture of transport equipment (DM)	Manufacture of other products and recycling (DN)	Electricity, Gas and Water Supply (E)	Construction (F)	Retail and distribution (G)	Hotels and restaurants (H)	Transport services and communications (I excl. road, rail and & air transport)	Road transport	Railways	Aviation (domestic)	Banking, finance & insurance (J)	Computing services, professional services and business services (K)	Public administration & defence (L)	Education (M)	Health and social work (N)	Miscellaneous services (including waste mgt) (O)	Domestic sector	Land use, land use change & forestry (LULUCF)
Business	**Carbon Trust support to business sector** (savings expected from 2010) Advice to businesses (e.g. Private sector Carbon Management Programme for large organisations), free energy surveys, etc.	1.1			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Carbon Trust support for investment in energy efficiency in SMEs (savings expected from 2010) Provides interest-free loans	0.1			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Measures to encourage or assist SMEs to take up energy saving opportunities (savings expected from 2010) - Obligation on the energy suppliers to encourage or assist SME customers to take up energy saving opportunities.	0.1			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	UK Emission Trading Scheme (UK ETS) (savings expected from 2010)	0.3			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Building regulations in business sector	1.6			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Climate Change Levy (CCL) From 1 April 2007 Climate Change Levy rates are increasing on a yearly basis in line with inflation. The CCL was launched in 2001 and is a tax on the use of energy in industry, commerce and the public sector, with offsetting cuts in employers' National Insurance Contributions (NICs), and additional support for energy efficiency schemes and renewable sources of energy through Enhanced Capital Allowances.	1.1			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Climate Change Agreements (CCAs) (savings expected from 2010) Lauched in 2001. Eligible businesses can secure an 80% discount from the Climate Change Levy in return for meeting targets to reduce energy consumption and carbon emissions. Participants' targets for 2010 will be reviewed in 2008. Subject to State Aid approval, participants meeting their 2010 targets will continue to receive the Climate Change Levy discount until March 2013.	2.9			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Subsidy to biomass (savings expected from 2010)	0.1			■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
	Renewables Obligation	3.9																	■															
Transport	**Voluntary Agreement package** (excluding extension beyond 2009)	3.6																					■											
	10 Year Transport Plan (savings expected from 2010) Tackling congestion and pollution by improving all types of transport	0.8																					■	■										
	Local Authorities policies (savings expected from 2010)	0.2																					■	■										
	Fuel Duty Escalator Annual above inflation increase in the duties on road fuels introduced in 1993	1.9																					■											
Residential	**Building Regulations in domestic sector**	3.5																														■		
	Package of measures (e.g. energy efficiency in buildings) (savings expected from 2010)	0.1																														■		
	Energy Efficiency Commitment EEC1 (2002-2005), EEC2 (2005-2008) / **Carbon Emissions Reduction Target (CERT)** (savings expected from 2010) Energy suppliers encouraged to help customers save energy by shifting their focus to the provision of energy services rather than simply selling units of energy. CERT will replace the EEC for the Phase III period of 2008 – 2011.	1.9																														■		
	Warm front and fuel poverty programmes (savings expected from 2010) Provides a free grant up to £2,700 (in most cases) for home energy improvements and is available to those claiming certain benefits. The grant can provide both insulation measures (for example, loft inulsation, cavity wall insulation, draught proofing etc) and, for homes which lack adequate heating, efficient room heaters or a central heating system for the main living areas	0.4																														■		
	Energy efficient products (savings expected from 2010)	0.4																														■		
Agriculture & land use	**Strategy for non-food crops** (savings expected from 2010) Expansion in use of non-food crops could provide carbon savings through crops used as a bio-energy source, and where industrial products derived from renewable raw materials substitute for those based on non-renewable resources.	0.1															■					■	■										
	Woodland grant scheme in England (savings expected from 2010) The scheme aims to encourage good management of forests and woodlands, including well-timed regeneration, particularly looking after the ancient and semi-natural woodlands.	0.2																																■
Public sector	**Revolving loan** / **Programmes implemented by devolved administrations** / **Carbon Trust support for Public Sector** (savings expected from 2010) Revolving fund available, via application, to all public sector organisations, to cover the initial costs of seeking expert advice and assistance and implementing energy efficiency measures, with full repayment from the energy costs savings over a defined period.	0.6																											■	■	■			
	TOTAL	25																																

Existing policies focusing on non-CO2 emissions

UK Landfill Regulations (implementation of EU Landfill Directive)
Diverting biodegradable waste from landfill to meet the EU Landfill Directive targets will result in C savings (through avoided CH4 emissions) of 2.7 MtC by 2010 and 3.3 MtC by 2020 (compared to 2000 levels). Additionally, the increase in energy recovery from biomass waste at incineration plant is projected to save 0.2 MtC in 2010.

EU Regulation on certain fluorinated GHGs & EU Directive relating to emissions from mobile air conditioning systems in cars
Regulation provisions set to apply from 2007-08
Directive to be transposed by the Vehicle Certification Agency
Estimated savings of 1 MtC/year in 2010 (according to the Regulatory Impact Assessment of the UK Climate Change Programme 2006)

Other policy goals overlapping with the above:

EU Integrated Energy and Climate Change Package to cut emissions for the 21st Century
20% cut in GHG emissions by 2020 (vs 1990 levels) (30% if in conjunction with action by other countries)
At least 20% of Europe's energy use to come from renewable sources by 2020 (including 10% of transport fuel from biofuels)
20% of energy savings vs. current projections of energy use for 2020
2008 and 2009 targets for office and street lighting

UK Draft Climate Change Bill (March 2007 - currently under consultation)
Cut CO2 emissions by at least 60% by 2050, with 26-32% reduction by 2020 (vs 1990 levels), i.e. UK CO2 emissions falling within a range of 110-120 MtC (or 438-402 MtCO2) by 2020

UK Biomass Strategy 2007
Potential C savings arising from substitution of grid electricity and heating oil (for energy generation) based on existing biomass resources and current energy conversion efficiencies: estimated to be 12.87-15.08 MtC/year (no timeframe provided).
Includes 2.35-2.82 MtC for electricity only, 3.76-4.53 MtC for heat only, 4.88-5.85 for heat & elec and 1.88 MtC from avoided landfill.
No expected C savings in relation to planned policy measures have yet been defined. Probably overlapping with the Renewables Obligation.

Appendix C

Calculation of potential carbon savings from policies

Appendix C - Calculation of potential carbon savings from policies

Colour code:

WMRES or AWM can have a direct influence on the carbon reduction measures, i.e. AWM can support the carbon reduction measures through their intervention programme or the carbon reduction measures correspond to one of the objectives of the WMRES

WMRES or AWM can have an indirect influence on the carbon reduction measures, by increasing awareness and encouraging uptake of the measures, in order to help the region achieve the high end of the expected range of carbon savings

	SIC Code	AB	C	DA	DB + DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	E	F	G	H	I 60.1	I 60.2	I 62	I 63-64	J	K	L	M	N	O	No SIC Code	No SIC Code	TOTAL
CO2 emissions for West Midlands (kt CO2)	1990 (extrapolated based on UK trends)	64	44	926	172	82	344	205	1,867	444	1,441	993	135	111	313	284	6,968	53	189	173	234	10,877	36	25	32	153	517	388	558	202	6,808	554	35,192
	2004 (actual emissions from the REEIO model)	61	31	836	151	95	383	220	1,869	287	1,059	772	101	75	292	248	6,029	64	217	211	296	11,860	66	38	22	159	437	341	533	158	7,590	366	34,866
	2020 (extrapolated based on UK trend)	57	29	777	140	88	356	280	1,736	266	983	717	94	69	271	230	6,353	60	224	217	353	12,333	79	39	23	164	451	351	549	163	5,812	-366	32,898
Split of CO2 emissions for C savings calculation by sector	Sectors targeted by EU ETS			1.61%					0.25%		31.07%				2.20%		63.31%											0.65%	0.91%				N/A
	Business Sector			5.86%	1.06%	0.66%	2.68%	2.11%	13.10%	2.01%	7.42%	5.41%	0.71%	0.52%	2.05%	1.74%	47.95%	0.45%	1.69%	1.64%				0.30%	0.17%	1.23%				1.23%			13,250
	Public Sector																										33.35%	25.99%	40.65%				1,351

PROPOSED POLICIES (ENERGY WHITE PAPER 2007)		Expected C savings at UK level by 2020 (ktCO2/year)			WM share of UK CO2 emissions from targeted sector in 2004 (2)	WM expected C savings by 2020 (ktCO2/year)			Under WMRES influence	Under AWM influence	Comments	AB	C	DA	DB + DC	DD	DE	DF	DG	DH	DI	DJ	DK	DL	DM	DN	E	F	G	H	I 60.1	I 60.2	I 62	I 63-64	J	K	L	M	N	O	No SIC Code	No SIC Code	TOTAL
		Min	Max	Average		Min	Max	Average																																		
EU Emission Trading Scheme (EU ETS)	Based on same allowances as Phase II, but UK may decide to tighten the C allowances after 2012	50,233	50,233	50,233	CO2 from EU ETS sites ~ 4% of UK EU ETS emissions	2,009	2,009	2,009						32.39					5.02		624.20				44.20		1,272.05									13.11	18.35				
Energy Efficiency in Business	Carbon Reduction Commitment (CRC) in the business sector	2,933	2,933	2,933		235	235	235						13.75	2.48	1.56	6.30	4.95	30.74	4.72	17.41	12.70	1.67	1.23	4.81	4.08	112.52	1.05	3.97	3.85				0.70	0.40	2.90			2.89			
	Energy Performance of Building Directive EPBD	733	1,833	1,283		59	147	103						6.02	1.08	0.68	2.76	2.17	13.45	2.06	7.62	5.56	0.73	0.54	2.10	1.78	49.23	0.46	1.74	1.68				0.31	0.17	1.27			1.26			
	Business Smart Metering	367	733	550		29	59	44			AWM could make it a requirement as part of project funding			2.58	0.46	0.29	1.18	0.93	5.76	0.88	3.26	2.38	0.31	0.23	0.90	0.76	21.10	0.20	0.74	0.72				0.13	0.07	0.54			0.54			
	More energy efficient products in business sector	1,833	5,133	3,483	CO2 from industrial & commercial sector ~ 8% of UK	147	411	279			The WMRES can encourage innovation and stimulate demand for low carbon products. AWM can provide funding to companies specialising in low carbon products, as well as R&D and skills development in relation to low carbon products			16.33	2.94	1.85	7.48	5.88	36.51	5.60	20.68	15.08	1.98	1.46	5.71	4.84	133.62	1.25	4.71	4.57				0.83	0.47	3.44			3.43			
	Energy Performance Certificates	unspecified				unspecified																																		
	Existing Building Upgrade	unspecified				unspecified					AWM can provide financial support for improving/expanding buildings and AWM can impose energy efficiency requirements for building refurbishment projects, depending on the type of building																															
Energy Efficiency in Households	Energy Performance of Building Directive EPBD	733	2,200	1,467		66	198	132			No direct influence, but AWM can maximise the application of these policies in the projects they fund																														132.00		
	Zero Carbon Homes	4,033	4,400	4,217		363	396	380																															379.50		
	Code for Sustainable Homes	unspecified				unspecified																																	0.00		
	Real time display for electricity meters in households	0	1,100	550		0	99	50																															49.50		
	Better billing	0	733	367		0	66	33																															33.00		
	More energy efficient products in domestic sector	1,467	4,767	3,117		132	429	281																															280.50		
	Supplier obligation	11,000	14,667	12,833	CO2 from domestic sector ~ 9% of UK	990	1,320	1,155			There are opportunities in the WMRES to ensure maximum savings are achieved through this policy, by ensuring all households are aware of it and suppliers are providing innovative services to their customers.																														1,155.00		
	Energy performance certificates	unspecified				unspecified																																				
	Raising awareness (DEFRA CO2 calculator launched)	unspecified				unspecified																																				
	Microgeneration and the low carbon buildings programme	unspecified				unspecified					Encouraging small scale energy production through renewables is part of the WMRES' sustainable living objective. AWM can fund such programmes.																																
Energy Efficiency in the Public Sector	Carbon Reduction Commitment (CRC) in the public sector	733	733	733		59	59	59																													19.57	15.25	23.85				
	Carbon Neutral Government (carbon neutrality to be reached in 2012)	733	733	733		59	59	59																													19.57	15.25	23.85				
	More energy efficient products in public sector	367	1,100	733	CO2 from public sector ~ 8% of UK	29	88	59																													19.57	15.25	23.85				
	Energy Performance of Building Directive EPBD	733	1,833	1,283		59	147	103																													34.24	26.69	41.74				
	Sustainable procurement	unspecified				unspecified																																				
	New guidelines for energy efficiency	unspecified				unspecified																																				
	Display of energy performance certificates	unspecified				unspecified																																				
Transport	Renewable Transport Fuel Obligation (RFTO)	0	3,667	1,833		0	330	165			The WMRES can support economic growth opportunities associated with biofuels manufacture. AWM can provide funding to specific initiatives to improve the biofuel supply chain in the region and to stimulate demand for biofuels.																						165.00									
	Successor to EU voluntary agreements on new car fuel efficiency (expected for 2009)	6,600	15,033	10,817	CO2 from road transport ~ 9% of UK	594	1,353	974			Car manufacturing is an important economic sector in WM. Cars manufactured in WM are usually high specification cars, so meeting EU fuel efficiency targets is likely to be challenging for regional car manufacturers. AWM could facilitate the use of existing R&D resources to help car manufacturers meet EU targets, but it must be recognised that these measures may represent an economic threat for this sector. Also note that C savings associated with improvements made by regional car manufacturers may not actually occur within the region.																						973.50									
	Inclusion of domestic aviation in EU ETS	733	1,467	1,100	Passengers in domestic flights using WM airports ~ 3% of UK	22	44	33																																				
Energy supply	Changes to Renewables Obligation (electricity generation)	1,467	4,033	2,750	CO2 from power stations ~ 4% of UK	59	161	110																																				
	Carbon Capture & Storage (CCS) demonstration project (none in the West Midlands)	1,100	3,667	2,383	0	0	0	0																																				
	TOTAL potential C savings (kt CO2/year)	**85,800**	**121,000**	**103,400**		**4,910**	**7,608**	**6,259**				**0**	**0**	**71**	**7**	**4**	**18**	**14**	**91**	**13**	**673**	**36**	**5**	**3**	**58**	**11**	**1,699**	**3**	**11**	**11**	**0**	**1,139**	**33**	**2**	**1**	**8**	**93**	**86**	**132**	**8**	**2,030**	**0**
	Projected CO2 emissions in 2020 *without* impact of policies ("baseline") (ktCO2) (3)	**554,400**				**32,898**						**57**	**29**	**777**	**140**	**88**	**356**	**280**	**1,736**	**266**	**983**	**717**	**94**	**69**	**271**	**230**	**6,353**	**60**	**224**	**217**	**353**	**12,333**	**79**	**39**	**23**	**164**	**451**	**351**	**549**	**163**	**5,812**	**-366**
	Projected CO2 emissions in 2020 *with* existing and proposed policies (ktCO2)	**468,600**	**433,400**	**451,000**		**27,988**	**25,289**	**26,639**				**57**	**29**	**706**	**133**	**84**	**338**	**266**	**1,644**	**253**	**310**	**682**	**89**	**66**	**214**	**219**	**4,655**	**57**	**213**	**207**	**353**	**11,194**	**46**	**37**	**21**	**155**	**358**	**266**	**418**	**155**	**3,782**	**-366**
	CO2 emissions in 1990 (kt CO2) (4)	**592,167**				**35,192**						**64**	**44**	**926**	**172**	**82**	**344**	**205**	**1,867**	**444**	**1,441**	**993**	**135**	**111**	**313**	**284**	**6,968**	**53**	**189**	**173**	**234**	**10,877**	**36**	**25**	**32**	**153**	**517**	**388**	**558**	**202**	**6,808**	**554**
	% change vs 1990 level	**-21%**	**-27%**	**-24%**		**-20%**	**-28%**	**-24%**				**-12%**	**-34%**	**-24%**	**-23%**	**2%**	**-2%**	**30%**	**-12%**	**-43%**	**-78%**	**-31%**	**-34%**	**-41%**	**-32%**	**-23%**	**-33%**	**7%**	**12%**	**20%**	**51%**	**3%**	**26%**	**48%**	**-33%**	**2%**	**-31%**	**-31%**	**-25%**	**-23%**	**-44%**	**-166%**

(1) Carbon savings are estimated against projected baseline CO2 emissions for 2020. The 2020 baseline corresponds to CO2 emissions that would occur based on current economic trends and future energy prices, also taking into account the predicted effect of existing carbon reduction policies

(2) West Midlands' share of UK CO2 emissions from the sectors targeted by the policies, based on regional CO2 estimates by sector in 2004. For the industrial & commercial sector, the public sector and the domestic sector, the WM share of UK CO2 emissions is based on the regional CO2 inventory taking into account energy end-users

(3) WM baseline emissions for 2020 have been estimated by applying UK emission trends 2004/2020 to regional emissions for 2004 (UK emission trends by sector for the period 2004/2020 have been calculated based on data from the Energy White Paper 2007 and the UK Climate Change Programme 2006)

(4) WM emissions for 1990 have been extrapolated from 2004 actual emissions, by applying UK emission trends 1990/2004 to regional emissions for 2004 (UK emission trends by sector for the period 1990/2004 have been calculated based on CO2 emission data from the UK Environmental Accounts)

425	1,375	900 **Under WMRES direct influence (kt CO2/year) - national policies**
425	1,375	900 **Under AWM direct influence (kt CO2/year) - national policies**
1,152	2,313	**1,732** **Under WMRES direct influence (kt CO2/year) - national policies + additional measures**
1,152	2,313	**1,732** **Under AWM direct influence (kt CO2/year) - national policies + additional measures**

Appendix D

List of installations subject to the EU Emission Trading Scheme in the West Midlands

Appendix D: List of installations subject to the EU Emission Trading Scheme (EU ETS) in the West Midlands (list provided by DEFRA - excludes Ministry of Defense sites)

Operator	Installation	Location	Installation ID	Allowances Allocated (t CO2)			SIC code
				2,005	2,006	2,007	
MINTEQ UK LTD	SPECIALTY MINERALS LIFFORD	Birmingham	GB-118	23,940	23,940	23,940	DI
Heartlands Power Limited	Heartlands Power Limited	Birmingham	GB-267	54,158	54,158	54,158	E
Jaguar Cars Ltd	Jaguar Cars Ltd - Castle Bromwich	Birmingham	GB-332	38,606	38,606	38,606	DM
University Hospital Birmingham NHS Trust	Queen Elizabeth Medical Centre	Birmingham	GB-393	28,001	28,001	28,001	N
University Hospital Birmingham NHS Trust	Selly Oak Hospital	Birmingham	GB-395	7,666	7,666	7,666	N
The University of Birmingham	The University of Birmingham Estate Management Office	Birmingham	GB-436	29,822	29,822	29,822	M
MG Rover Group Ltd	Boiler Houses	Birmingham	GB-444	34,453	34,453	34,453	DM
Aston University	Main boiler house	Birmingham	GB-476	5,708	5,708	5,708	M
Severn Trent Water Ltd	Minworth Generating Station	Birmingham	GB-493	91	91	91	E
Sandwell & West Birmingham Hospital NHS Trust	City Hospital	Birmingham	GB-360	13,948	13,948	13,948	N
Burton Hospital NHS Trust	Queens Hospital	Burton on Trent	GB-515	4,334	4,334	4,334	N
Unilever Bestfoods UK Ltd, Burton Plant	Unilever Bestfoods UK Ltd Wellington Road	Burton Upon Trent	GB-241	13,588	13,588	13,588	DA
Gastec Packington Partnership	Packington Power Plant	Coventry	GB-263	0	0	0	E
PEUGEOT CITROEN AUTOMOBILES UK Ltd	PSA Peugeot Citroen Ryton	Coventry	GB-318	12,928	12,928	12,928	DM
Rolls-Royce plc	Rolls-Royce plc - Ansty	Coventry	GB-336	4,456	4,456	4,456	DM
University of Warwick	UW Construction Ltd/University of Warwick	Coventry	GB-340	22,093	22,093	22,093	M
Jaguar Cars Ltd	Jaguar Cars Ltd - Browns Lane	Coventry	GB-350	12,815	12,815	12,815	DM
Jaguar Cars Ltd	Jaguar Cars Ltd - Whitley	Coventry	GB-437	1,792	1,792	1,792	DM
CRADLEY SPECIAL BRICK COMPANY LTD	CRADLEY SPECIAL BRICK COMPANY LTD	Cradley Heath	GB-95	1,772	1,772	1,772	DI
Interserve (Facilities Management) Ltd	Russells Hall Hospital, Estates Department, Interserve Ltd	Dudley	GB-472	5,347	5,347	5,347	N
Rugby Limited	Rugby Cement Works	RUGBY	GB-91	1,163,632	1,163,632	1,163,632	DI
Rugby Limited	Barrington Cement Works	RUGBY	GB-92	281,244	281,244	281,244	DI
Rugby Limited	South Ferriby Cement Works	RUGBY	GB-96	561,323	561,323	561,323	DI
Rugeley Power Station	Rugeley Power Station	Rugeley	GB-137	3,343,356	3,343,356	3,343,356	E
DAIRY CREST GROUP PLC	Dairy Crest Ltd - Crudgington	SHROPSHIRE	GB-226	17,410	17,410	17,410	DA
Land Rover	Combustion Plant	Solihull	GB-262	71,919	71,919	71,919	DM
Transco plc	Alrewas Compressor Station	Staffordshire	GB-114	21,484	21,484	21,484	E
Blue Circle Industries PLC	Lafarge Cement UK - Cauldon	Staffordshire	GB-732	0	0	455,908	DI
Blue Circle Industries PLC	Lafarge Cement UK	Staffordshire	GB-733	0	0	223,970	DI
Daniel Platt Ltd.	Brownhills Tileries	Staffs	GB-489	8,282	8,282	8,282	DI
E.ON UK CHP Ltd	Stoke CHP plant (Michelin Tyres), EON UK plc	Stoke	GB-205	78,058	78,058	78,058	E
SSE Generation Ltd	North Staffs NHS Trust - SSE Trading Ltd.	Stoke	GB-312	4,511	4,511	4,511	N
E.ON UK plc	Ironbridge Power Station - EON UK plc	Telford	GB-132	2,045,310	2,045,310	2,045,310	E
Blockleys Brick Ltd	Blockleys Brickworks	Telford	GB-292	22,672	22,672	22,672	DI
British Sugar Plc	Allscott Sugar Factory - British Sugar plc	Telford	GB-724	0	0	111,343	DA
Transco plc	Churchover Compressor Station	Warwickshire	GB-111	30,605	30,605	30,605	E
Land Rover	Product Development Site	Warwickshire	GB-319	3,255	3,255	3,255	DM
The Royal Wolverhampton Hospitals NHS Trust	New Cross Hospital	Wolverhampton	GB-389	13,928	13,928	13,928	N
Schenectady Europe Limited	Schenectady Europe Limited - Four Ashes	Wolverhampton	GB-491	22,056	22,056	22,056	DG
Cinergy Global Power (UK) Ltd	Cinergy Global Power (UK) Ltd - Redditch Power Station	Worcestershire	GB-229	805	805	805	E
Lend Lease Facilities and Estate Management	Worcestershire Royal and Newtown Hospital	Worcestershire	GB-556	2,916	2,916	2,916	N
Transco plc	Wormington Compressor Station	Worchestershire	GB-121	15,535	15,535	15,535	E
Roxel (UK Rocket Motors) Ltd	Roxel (UK Rocket Motors) Ltd	Worcs	GB-228	13,982	13,982	13,982	DM
	Total West Midlands without New Entrant Reserve (t CO2)			**8,037,801**	**8,037,801**	**8,829,022**	
	Total UK without New Entrant Reserve (1) (t CO2)			206,125,204	206,058,525	215,928,415	
	WM share of UK totals			**3.9%**	**3.9%**	**4.1%**	

(1) New Entrants Reserve represents 46,541,659 t CO2 for the 2005-2007 period at UK level

						% of total
By SIC category	Manufacture of food, beverages and tobacco products	DA	30,998	30,998	142,341	1.6%
	Manufacture of chemicals	DG	22,056	22,056	22,056	0.2%
	Manufacture of other non-metallic products (glass, ceramics, clay,	DI	2,062,865	2,062,865	2,742,743	31.1%
	Manufacture of transport equipment	DM	194,206	194,206	194,206	2.2%
	Electricity, Gas and Water Supply	E	5,589,402	5,589,402	5,589,402	63.3%
	Education	M	57,623	57,623	57,623	0.7%
	Health and social work	N	80,651	80,651	80,651	0.9%

Appendix E

GVA and employment per sector in the West Midlands

Appendix E - GVA and employment per sector in the West Midlands

GVA data (2004 actual data and 2020 projections)
Source: REEIO model data provided by the West Midlands Regional Observatory (WMRO)

Classification used by URS to rank the sectors according to their financial contribution to the region:

High	> 10%
Medium	5-10%
Low	<5%

		2004			2020 projections		
REEIO model category	**Corresponding SIC code**	**GVA (£million)**	**%**	**% per SIC category**	**GVA (£million)**	**%**	**% per SIC category**
Agriculture etc	AB	932	1.2%	1.2%	1,066	1.0%	1.0%
Coal	C	19	0.0%		8	0.0%	
Oil & Gas etc	C	0	0.0%	0.1%	1	0.0%	0.1%
Other Mining	C	89	0.1%		117	0.1%	
Food, Drink & Tob.	DA	1,755	2.3%	2.3%	1,891	1.7%	1.7%
Text., Cloth. & Leath	DB + DC	296	0.4%	0.4%	222	0.2%	0.2%
Wood & Paper	DD	464	0.6%	0.6%	447	0.4%	0.4%
Printing & Publishing	DE	669	0.9%	0.9%	711	0.6%	0.6%
Manuf. Fuels	DF	63	0.1%	0.1%	68	0.1%	0.1%
Pharmaceuticals	DG	31	0.0%	0.6%	62	0.1%	0.5%
Chemicals nes	DG	453	0.6%		499	0.5%	
Rubber & Plastics	DH	974	1.3%	1.3%	973	0.9%	0.9%
Non-Met. Min. Prods.	DI	923	1.2%	1.2%	682	0.6%	0.6%
Basic Metals	DJ	683	0.9%	4.0%	709	0.6%	3.0%
Metal Goods	DJ	2,353	3.1%		2,590	2.4%	
Mech. Engineering	DK	1,832	2.4%	2.4%	2,061	1.9%	1.9%
Electronics	DL	432	0.6%	1.7%	1,037	0.9%	1.6%
Elec. Eng. & Instrum.	DL	872	1.1%		766	0.7%	
Motor Vehicles	DM	1,646	2.2%	3.5%	1,929	1.8%	3.0%
Oth. Transp. Equip.	DM	1,058	1.4%		1,394	1.3%	
Manuf. Not elsewhere classified	DN	703	0.9%	0.9%	927	0.8%	0.8%
Electricity	E	793	1.0%		824	0.8%	
Gas Supply	E	528	0.7%	2.3%	620	0.6%	1.7%
Water Supply	E	400	0.5%		428	0.4%	
Construction	F	5,124	6.7%	6.7%	6,900	6.3%	6.3%
Distribution	G	6,443	8.4%	14.6%	9,485	8.7%	15.1%
Retailing	G	4,716	6.2%		7,059	6.4%	
Hotels & Catering	H	2,456	3.2%	3.2%	3,419	3.1%	3.1%
Land Transport etc	I	3,137	4.1%	7.6%	4,259	3.9%	8.5%
Water Transport	I	55	0.1%		64	0.1%	
Air Transport	I	79	0.1%		376	0.3%	
Communications	I	2,496	3.3%		4,618	4.2%	
Banking & Finance	J	4,383	5.7%	7.0%	7,470	6.8%	7.9%
Insurance	J	928	1.2%		1,200	1.1%	
Computing Services	K	1,916	2.5%	13.7%	4,717	4.3%	17.0%
Prof. Services	K	6,218	8.1%		10,234	9.3%	
Other Bus. Services	K	2,327	3.0%		3,646	3.3%	
Public Admin. & Def.	L	3,564	4.7%	4.7%	4,696	4.3%	4.3%
Education	M	5,114	6.7%	6.7%	6,974	6.4%	6.4%
Health & Social Work	N	5,948	7.8%	7.8%	9,477	8.6%	8.6%
Misc. Services	O	3,449	4.5%	4.5%	4,950	4.5%	4.5%
Unallocated		*-2,426*			*-3,688*		
Total		**76,321**		100%	**109,573**		100%

Employment data (2004)
Source: Annual business inquiry data provided by the West Midlands Regional Observatory (WMRO)

	2004	
SIC code	**Employee numbers**	**Share of regional employment (%)**
AB	19,744	0.7%
C	1,623	0.1%
DA	34,130	1.3%
DB + DC	10,272	0.4%
DD	7,683	0.3%
DE	23,092	0.9%
DF	747	0.0%
DG	9,358	0.3%
DH	26,225	1.0%
DI	23,114	0.9%
DJ	455,139	16.8%
DK	42,342	1.6%
DL	32,074	1.2%
DM	64,957	2.4%
DN	21,314	0.8%
E	10,964	0.4%
F	102,757	3.8%
GH	579,957	21.4%
I	128,417	4.7%
JK	405,565	15.0%
L	116,153	4.3%
MN	488,844	18.0%
O	106,696	3.9%
Total	**2,711,167**	100%