

Yorkshire and Humber
Assembly

**Evaluating the
Contribution that Key
Regional Strategies
Make Towards
Addressing Climate
Change**

Final Report

ARUP



Cambridge Econometrics

Yorkshire and Humber
Assembly

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Final Report

May 2007

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Executive Summary

The Challenge

The Yorkshire and Humber region will be affected by climate change and it will impact across all aspects of life. There is a need to adapt to a changing climate and a need to continue to reduce greenhouse gas emissions in order to reduce future climate change effects.

Regional strategies collectively have a role to guide the progress of the region. Regional policy making to date has focussed on tackling visible issues and delivering against short to medium term goals. Dealing with climate change challenges this approach as its full effects are not yet visible will manifest themselves more greatly in the medium to long term. In order to reduce the scale and magnitude of this impact, action is required now. The challenge for regional policy making is to deliver a consistent and co-ordinated approach to addressing climate change now, that will yield results in the longer term.

Reductions in greenhouse gas emissions are usually sought and measured at source, from production processes or power generation. This report takes an innovative approach and evaluates the impact of current regional strategies in tackling both production and consumption related greenhouse emissions. From this analysis, it is possible to understand the strengths and weaknesses of the current regional approach to reducing greenhouse gas emissions. The report also evaluates the approach that current regional strategies take towards the need to adapt to a changing climate.

The findings of this report are intended to inform how the emerging Integrated Regional Framework can tackle climate change as one of seven regional 'landmark' issues.

Understanding the Risks Associated with Climate Change

Regional strategies should demonstrate understanding of the risks and opportunities associated with climate change to ensure the development, scrutiny and monitoring of effective policy and the implementation of that policy at sub-regional and local level.

Climate change is acknowledged as an issue for the region in most regional strategies. However, few regional strategies have translated this risk to a greater understanding of what it could mean for the pursuit of other policy areas. Implementation of policy in current regional strategies could either be enhanced or diminished by the positive and negative impacts of climate change. Therefore, there is a need for the full risks of climate change to be understood as an inherent part of policy making.

Meeting the Regional Greenhouse Gas Emissions Target

Regional Target

In order to make an assessment of whether regional strategies are contributing towards reducing greenhouse gas emissions, it is important to have a certain and definitive target to assess progress.

In the Yorkshire and Humber region there is no definitive regional greenhouse gas emissions reduction target. Targets have been introduced, emulated and evolved over the respective review cycles of superseded and current regional strategies, but there has been no overall consistent target across all regional strategies. This makes measuring the contribution of all regional strategies towards reducing greenhouse gas emissions more difficult.

A target seeking to reduce greenhouse gas emissions was introduced in the 2003 Regional Economic Strategy. This was mirrored in other regional strategies, but not always consistently, as some strategies include interim or longer term milestones to the target. The 2006 Regional Economic Strategy revised the original target. This new target differs from those included in other regional strategies as it seeks to reduce greenhouse gas emissions "*based on modelling of energy/resources consumption attributable to Y&H*". This means that the factors that should be taken into consideration when measuring the 2003 and 2006 targets are very different. The 2003

target is understood to be based on measuring emissions by source¹ whilst the 2006 Regional Economic Strategy target will be measured by modelling consumption related emissions.

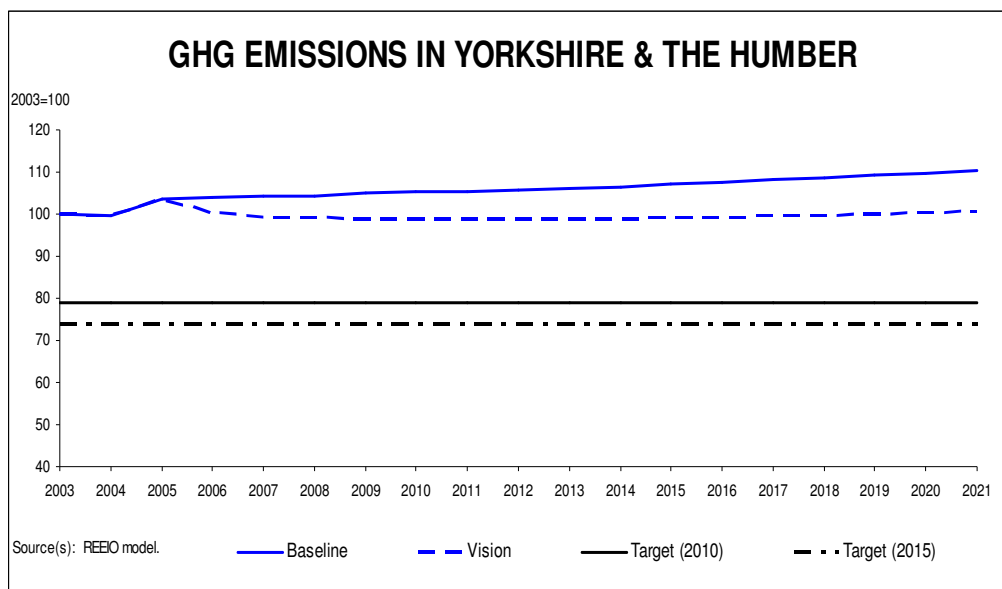
Production and Consumption Related Greenhouse Gas Emissions Modelling

This report has examined the impact that current regional strategies will have on reducing both production and consumption related emissions up to 2021.² The impact on greenhouse gas emissions from production and delivery of goods and services in the region (which are either consumed in the region or outwith the region) are modelled using REEIO³ and referred to as production related emissions. The level of greenhouse gas emissions associated with goods and services consumed in the region (including goods imported to the region) are modelled using REAP⁴ and referred to as consumption related emissions.

Modelling the impact of current regional strategies on both production and consumption related emissions allows progress towards a purely consumption orientated target to be understood. The modelling of emissions has considered a Baseline Scenario (i.e. what would happen in the absence of regional strategies) and a Vision Scenario (i.e. the desired impact of current regional strategies). For consistency the following regional greenhouse gas emissions targets have been used to show whether the desired reduction of emissions is likely to be achieved:

- 20% reduction in 1990 levels of greenhouse gases by 2010⁵
- 25% reduction in 1990 levels of greenhouse gases by 2015⁶

This report has found that current regional strategies will be able to achieve stability of production related greenhouse gas emissions up to 2021, but this will not be enough to meet a 20% reduction in overall greenhouse gas emissions by 2010 and 25% by 2015.



¹ Progress in the Region 2006 (Page 102) sets out the sources of data used to monitor greenhouse gas emissions in the region.

² The Draft Regional Spatial Strategy has the longest lifespan of all current regional strategies and looks forward to 2021.

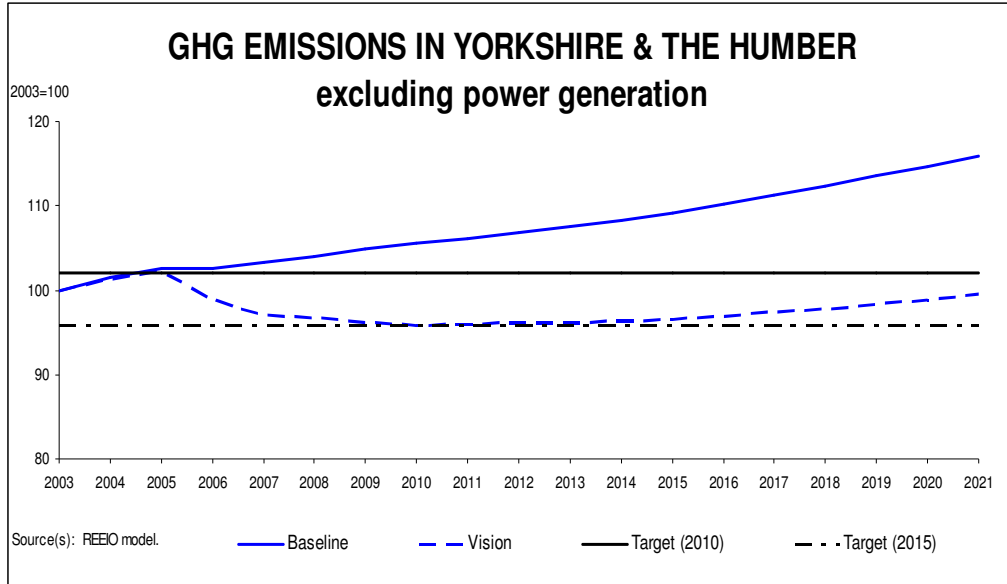
³ REEIO – Regional Economy Environment Input Output Model, developed by Cambridge Econometrics

⁴ REAP – Resource and Energy Analysis Programme, developed by the Stockholm Environment Institute with Centre for Urban and Regional Ecology and World Wildlife Fund.

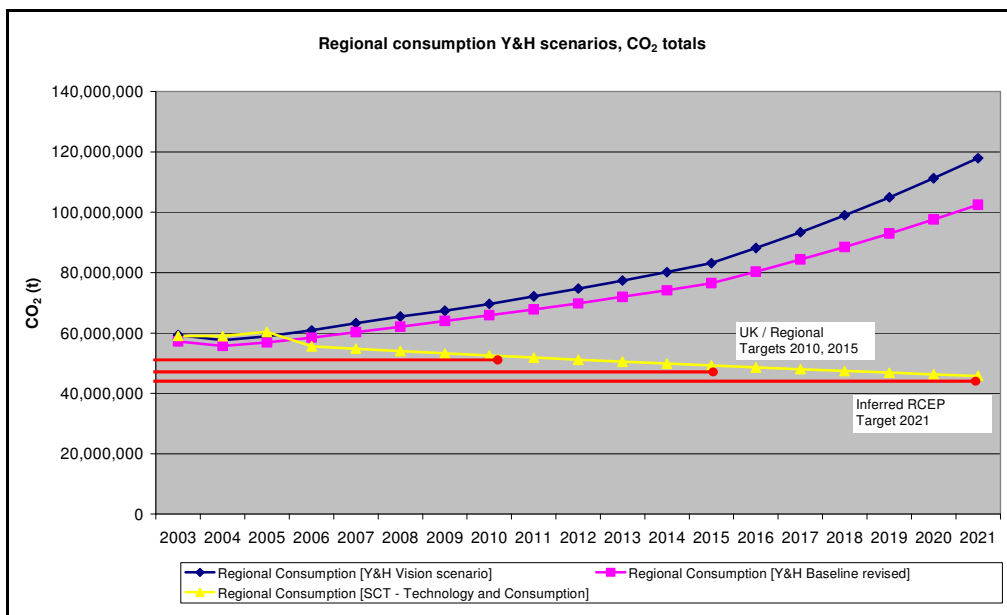
⁵ First set out in the 2003 Regional Economic Strategy and consequently mirrored in other strategies which remain current.

⁶ First set out in the Regional Spatial Strategy for Yorkshire and the Humber to 2016 based on selective review of RPG12, 2004 and taken forward in the Draft Regional Spatial Strategy, draft for public consultation, 2005 and the Yorkshire and Humber Climate Change Action Plan, 2005.

This region provides 18% of the UK’s electricity generating capacity and emissions from this region’s power stations are a significant component of overall regional greenhouse gas emissions. If power generation is excluded from Yorkshire and Humber’s production related greenhouse emissions then current regional strategies can almost meet a target to reduce greenhouse gas emissions by 25% below 1990 levels by 2015, but only for a short time period before emissions are likely rise again.



Current regional strategies are long way off from both stabilising consumption related emissions and achieving a 20% reduction in consumption related emissions by 2010 and 25% by 2015. In fact consumption related emissions are projected to almost double between 2003 and 2021 in the Vision Scenario, which models the impact of current regional strategies.



Delivering Reductions in Greenhouse Gas Emissions

It will be a challenge for this region to deliver a 25% reduction in greenhouse gas emissions by 2015, particularly if this reduction is sought from consumption related emissions.

From a consumption perspective, this report has modelled an additional scenario which examines stabilised consumption related greenhouse gas emissions. The purpose of this scenario is to

indicate the scale of change that may be required in the current regional policy landscape and to highlight the types of measure that will be most effective in delivering reduced emissions. This scenario aligns with the recommendations of the Royal Commission for Environmental Pollution which seeks to reduce greenhouse gas emissions by 80% of 1990 levels by 2050, in order to achieve a stabilisation of concentrations of greenhouse gases in the atmosphere.

Consumption related emissions from housing, transport and food are set to increase up to 2021, despite the efforts of current regional strategies. To achieve anything in the region of an 80% reduction in current emissions by 2050, significant reductions are required in the housing, transport and food sectors. In terms of the housing sector, retrofitting at least 75% of pre 2001 stock over the next 20 years is the most effective measure for reducing greenhouse gas emissions followed by ensuring that 30% of household energy demand is met from renewable energy sources. In terms of the transport sector, increasing vehicle occupancy rates is the most effective measure for reducing greenhouse gas emissions, followed by reducing the distance travelled per person and achieving modal shift, transferring passengers from private car to public transport.

Achieving these kinds of measures will require a very different policy landscape to that which exists in and around current regional strategies. For example, the 'Stabilising Carbon Trends' Scenario assumes that there would be no additional growth in aviation or consumption of consumables, which is very challenging and runs counter to the national agenda rather than being within the sphere of direct regional influence. If such changes are not considered realistic at the current time, this only puts more emphasis on the need to put in place mechanisms to reduce emissions in other sectors.

Adapting to a Changing Climate

The likely impacts of a changing climate on Yorkshire and the Humber were researched in 2002⁷. The region will be between 1.6 and 3.9°C warmer by 2080, winters will be wetter, but summers will be drier and annual average rainfall will reduce between 10% and 20%. The region will need to adapt to sea level rise and increased risk of flooding. Water resources and agriculture and biodiversity will be affected by the changing climate. Buildings and construction, industry and transport will need to adapt to the changing climate.

Despite this research, current regional strategies have a fairly fragmented approach to addressing the need to adapt to the impacts of climate change, particularly over the longer term. The link between other policy objectives and the need to adapt to climate change is not always made. The focus has been on building capacity. The region is cautious about moving forward towards implementing adaptive action without a stronger national steer and more secure resources.

Factors which Inhibit the Ability of Regional Strategies to Address Climate Change

Current regional strategies do not fully understand the risks and opportunities associated with climate change, particularly in term of what it could mean for pursuit of wider environmental, economic and social policy objectives.

There is no definitive regional greenhouse gas emissions target. Although the level of reduction in greenhouse gas emissions sought is comparable, regional strategies are currently working to different target timescales and a consumption related target has just been introduced. This makes measuring the contribution of all regional strategies more difficult. Crucially, it limits understanding of a 'feedback loop' to know what affects the implementation of the strategies.

Where current regional strategies have sought to address climate change, this has resulted in a strong policy direction but to only to a limited number of sectors, for example energy generation. This is not enough to reduce either production or consumption related greenhouse gas emissions to desired levels or for the region to successfully adapt to a changing climate. To deliver a step change, a similar level of emphasis is required to tackle other sectors such as housing, transport,

⁷ Warming up the Region, WS Atkins and SEI, 2002

sea level rise and use of water resources. The emphasis of climate change related policy needs to be broader.

Review cycles and time periods of regional strategies are not always aligned. In practice this makes delivering a consistent message across all regional strategies difficult to achieve. This also means that many regional strategies only look forward to the short to medium term and there can be a tendency for strategies to 'start again' with each review rather than build up layers of action over successive reviews. Regional strategies need to be more closely aligned with a view to the longer term.

The modelling of regional strategies targets policies, aims and objectives is based on the assumption that they are all successfully implemented. This is not always the case and barriers to implementation should be understood, with the learning that arises used in further strategy implementation. It is also more of a challenge to deliver strategies that are not supported by funding or where implementation is not a statutory duty. There is a significant risk that effective climate change related policy in such strategies is not delivered.

Climate change is a global issue and national government is introducing new legislation and policy relating to addressing climate change. Some of this policy will have greater implications for the Yorkshire and Humber region due to its particular economic, physical and social characteristics. There is therefore a need to influence and understand the wider implications of the national climate change agenda on the Yorkshire and Humber region.

Addressing Climate Change More Effectively in the Future

This report sets out a number of recommendations to set a pathway to help the region address climate change more effectively. These are:

Joined up leadership on climate change: The organisations leading the delivery of regional policy (Yorkshire and Humber Assembly, Yorkshire Forward and Government Office for Yorkshire and the Humber) must provide the resources, leadership and influence to join up policy and delivery across a wider range of organisations and strategies to address climate change. This joined up leadership should seek to deliver a consistent message throughout their respective organisations and to the national arena and demonstrate commitment to addressing climate change through how regional bodies operate, procure service, provide funding and seek to influence the public, private and voluntary sectors.

Develop a joined up and stronger regional evidence base on climate change: There is a need to consolidate information already collected relating to how climate change will affect the region and its profile of greenhouse gas emissions and to understand as a whole what it means for the region. This will enable gaps in knowledge to be determined for further research and ensure that research undertaken is of benefit to a wider range of regional strategies. It will also provide a useful tool for debate around the implications of climate change for Yorkshire and the Humber region, which is an important element of the policy making process. The evidence base needs to cover both consumption and production related emissions and understand the linkages between the two.

Wider communication and dissemination to policy makers and stakeholders about climate change: There is a need to make climate change an inherent part of policy making both in terms of producing regional strategies and the culture of policy makers. Communication and discussion with a wide range of policy makers will help to make climate change a more manageable issue that can be related to other policy objectives. This also provides the opportunity to bring together 'Yorkshire and Humber's response to climate change' by sharing knowledge, experience and activities.

Measuring and scrutiny of performance: Measuring performance helps to identify issues that may impede policy implementation and consequently refine policy to ensure the desired outcome is achieved. There is an opportunity to align the respective monitoring frameworks of the emerging Integrated Regional Framework and the emerging Regional Spatial Strategy and make the region

smarter at monitoring issues which may impact on the ability to address climate change. Regular scrutiny of regional strategies is also important to ensure their delivery remains on track.

Develop a long term pathway through a challenging policy landscape to address climate change: A framework which sets out a programme of climate change related actions is required to ensure that all regional strategies take a consistent approach and deliver what they can towards addressing climate change. The framework should:

- Sets a consistent target for the reduction of greenhouse gas emissions in the region.
- Identify the tools that will be required to meet this target and set a programme of actions to ensure that the region develops these tools.
- Cover both mitigation and adaptation.
- Set climate change within a framework of other regional economic, social and environmental issues, and the different scenarios of the region's future more broadly.
- Ensure the region stays on track in meeting its target and can proactively react to new information about the impacts of climate change and the introduction of new national legislation and guidance.
- Be subject to regular review and scrutiny.

1 Introduction

KEY POINTS

- This study seeks to examine how current regional strategies in Yorkshire and the Humber contribute to the long term reduction of greenhouse gas emissions (mitigation) and delivery of adaptation actions.
- The findings of the study will help to inform how the emerging Integrated Regional Framework can tackle the landmark regional issue of climate change.
- This is an innovative study, which looks at the impact of current regional strategies on both production and consumption related greenhouse gas emissions, as well as the need to adapt to the impacts of climate change.

1.1 The Study

Arup together with The Stockholm Environment Institute (SEI) and Cambridge Economics (CE) were appointed by the Yorkshire and Humber Assembly to examine how current regional strategies in Yorkshire and Humber contribute to the long term reduction of greenhouse gas emissions and delivery of adaptation actions.

The objectives of the study were:

- To evaluate and qualify how far identified regional strategies contribute towards meeting agreed targets for the reduction of greenhouse gas emissions within the region;
- To identify where potential conflicts and gaps exist within strategic decision making processes that potentially inhibit the implementation of actions aimed at reducing greenhouse gas emissions and adaptation initiatives;
- To determine and quantify where significant and measurable reductions in greenhouse gas emissions can be delivered and what kind of greenhouse gas emission reduction these are likely to be; and
- To evaluate how far identified regional strategies contribute towards helping understand climate risk and how these influence strategic planning to adapt to the consequences of climate change.

1.2 The Challenge

'Securing the Regions' Futures' (Defra, ODPM, DTI 2006) sets out guidance on strengthening the delivery of sustainable development in English Regions. It recommends rationalising current arrangements to produce a single, high level, strategic framework in line with the UK Sustainable Development Strategy.

To meet the requirements of 'Securing the Regions' Futures', Yorkshire and Humber Assembly propose to bring together Advancing Together and the Regional Sustainable Development Framework into an Integrated Regional Framework.

The Integrated Regional Framework is an opportunity to tackle key sustainable development issues and to further align and integrate regional policies and funding so that they work collectively to deliver a sustainable future. Research informing the development of the Integrated Regional Framework has highlighted seven 'landmark issues' in the region where trajectories and trends are not as desired. Climate change is identified as one of these seven 'landmark issues'.

This report will help to inform how the Integrated Regional Framework can tackle climate change as a regional 'landmark' issue.

1.3 Approach to the Study

This study retains a strategic perspective and regional focus. It is acknowledged that there are a number of other complementary studies applicable at both the regional and sub regional level which seek to understand specific aspects of how responses to climate change can be delivered.⁸

National guidance relating to climate change has been reviewed to understand how it may impact on the region. A wide range of regional strategies have been reviewed to understand their approach towards addressing climate change. The targets and policies within these strategies have been used to inform the modelling of greenhouse gas emissions scenarios from both a production and consumption perspective. Initial scenarios were tested with regional stakeholders at a full day workshop, which enabled assumptions and parameters to be tested and refined. Both exercises indicated the progress that region is making towards reducing greenhouse gas emissions and adapting to a changing climate as well as highlighting potential issues which limit progress.

1.4 Structure of the Report

This report brings together qualitative evaluation of regional strategies with quantitative modelling of greenhouse gas emissions to understand how current regional strategies perform at addressing climate change from a production, consumption and adaptation perspective.

Section 2 provides a brief overview of the national approach to addressing climate change and the potential implications of the national approach on the Yorkshire and Humber region.

Section 3 sets out the regional approach to addressing climate change. It evaluates how current regional strategies seek to address climate change, drawing out whether the emphasis within these strategies is on production or consumption related greenhouse gas emissions or adaptation to a changing climate.

Section 4 sets out how effective current regional strategies are likely to be at reducing production related greenhouse gas emissions compared to a baseline scenario.

Section 5 sets out how effective current regional strategies are likely to be at reducing consumption related greenhouse gas emissions compared to a baseline scenario. This section also sets out a third scenario which seeks to bring about stabilisation of consumption related greenhouse gas emissions and outlines the types of policy measures that may be required to achieve this.

Section 6 brings together sections 3, 4 and 5, linking the evaluation of regional strategies with the scenario modelling by setting out the issues that affect the ability of current regional strategies to address climate change.

Section 7 sets out a number of recommendations relating to how the region can build upon its existing approach to addressing climate change to meet the future challenge.

1.5 Greenhouse Gas Emissions

The levels of national and regional greenhouse emissions reported to date are usually measured by source or energy user for a given territory or region. This means that they are typically production related emissions.

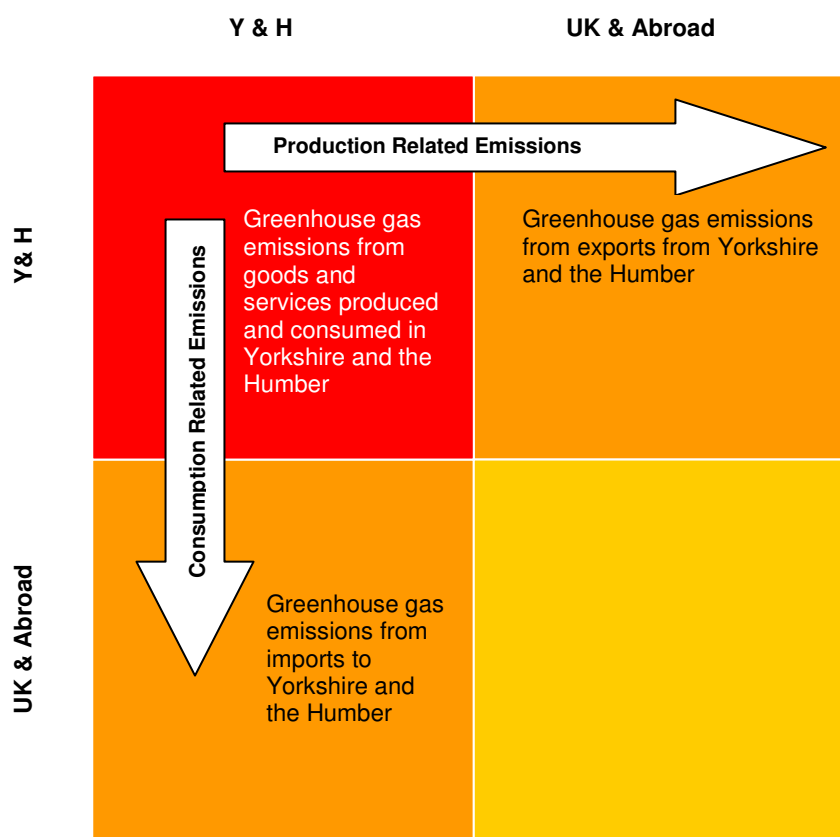
This report takes an innovative approach and seeks to model the impact of current regional strategies on both production and consumption related greenhouse gas emissions. This is in

⁸ These include reports undertaken by: CAG consultants to examine the key policy gaps and alignment of the RHS, RES and RSS; Land Use Consultants to see how far the draft RSS could seek to address climate change and EDWA to see how through implementation of the RHS, the Regional Housing Board can help to address climate change.

order to evaluate and understand the strengths and weaknesses of the current regional approach to reducing greenhouse gas emissions and identify challenges for the future.

The impact on levels of greenhouse gas emissions associated with goods and services produced or delivered in the region (which are either consumed in the region or outwith the region) are modelled using REEIO⁹ and referred to as **production related emissions**. Energy generation, transport, industry and commerce are the sectors from which production related emissions derive.

The impact on levels of greenhouse gas emissions associated with goods and services consumed in the region (including goods imported to the region) are modelled using REAP¹⁰ and referred to as **consumption related emissions**. Households, travel, food, consumer items, public services and capital investment are the main sectors from which consumption related emissions derive.



Source: Arup¹¹

⁹ REEIO – Regional Economy Environment Input Output Model, developed by Cambridge Econometrics

¹⁰ REAP – Resource and Energy Analysis Programme, developed by the Stockholm Environment Institute with Centre for Urban and Regional Ecology and World Wildlife Fund

¹¹ Derived from Figure 1 of Counting Consumption, CO2 emissions, material flows and Ecological Footprint of the UK by region and devolved country, WWF, SEI and CURE

2 National Approach to Addressing Climate Change

KEY POINTS

- Climate Change is a key issue on the international and national political agenda.
- The UK Government has set medium and long term targets to reduce carbon emissions and proposes to make them legally binding through a Climate Change Bill. The UK is set to exceed its Kyoto target, but it is not on track to meet its domestic target.
- Government strategy focuses on reducing production related greenhouse gas emissions through the use of efficiency and fiscal measures. The government does not currently have a direct strategy for tackling consumption related greenhouse gas emissions.
- Measures to adapt to climate change are happening across the UK but are at an early stage, focusing on building adaptive capacity (particularly in the public sector) rather than moving towards implementing adaptive action.
- The existing and emerging national approach to addressing climate change may affect how the Yorkshire and Humber region sets targets to reduce greenhouse gas emissions and measures its performance; the approach the region takes to tackling production and consumption related greenhouse gas emissions; and the resources available to the region to implement and deliver adaptive actions.

2.1 The Challenge

The UK Treasury's Independent Review on the Economics of Climate Change (The Stern Review)¹² highlights that climate change entails costs that are not paid for by those who create the emissions. Climate change is referred to as a 'global problem requiring a global solution' and features heavily in international political debate, with a particular emphasis on the ethical and moral obligation of the more developed nations to set a good example to others.

The Stern Review states that if no action is taken, the overall costs and risks of climate change will be equivalent to losing at least 5% of global GDP per year, now and forever. If a wider range of risks and impacts are taken into account this could rise to 20% of GDP or more. In contrast, the cost of action reducing greenhouse gas emissions to avoid the worst impacts of climate change can be limited to around 1% of global GDP per year.

Developed nations are increasingly keen to be perceived as setting the best example to developing nations, without hampering economic growth and prosperity. There is also a push to develop the cutting edge technology which will assist other nations to reduce emissions and adapt to climate change; no one wants to be left behind.

Political support for tackling climate change is also married with the desire to be less reliant on other (at times politically unstable) nations for our fuel supplies. Reducing reliance on fossil fuels and moving towards lower carbon and renewable energy generating sources tackles both the need to reduce greenhouse emissions and also the desire for a more self sufficient and secure energy supply.

¹² Stern Review: Economics of Climate Change, 2006.

2.2 Targets for Reducing Greenhouse Gas Emissions

2.2.1 Reducing Global Greenhouse Gas Emissions

The 1998 Kyoto Protocol sets legally binding targets to reduce overall greenhouse gas emissions by 5.2% below base-year level (1990) from Annex 1 countries (mainly the developed world) over the first commitment period 2008-2012.

The G8 summit scheduled for June 2007 will discuss the global response to climate change, focusing on how to reduce global greenhouse gas emissions without detrimentally affecting the economic prosperity of developing nations. The summit will also discuss what should replace the Kyoto Protocol when it expires at the end of 2012.

Recently, the European Union has set a target for all member states to reduce greenhouse gas emissions to 20% below 1990 levels by 2020¹³.

2.2.2 Measuring UK Greenhouse Gas Emissions

National greenhouse emission targets are based solely on production related emissions (i.e. emissions that occur as a result of goods and services produced within the UK territory, regardless of whether the goods and service are consumed within UK territory). Current reporting of the progress against national greenhouse gas emissions targets only includes production related emissions.

2.2.3 Reducing UK Greenhouse Gas Emissions

The UK is currently responsible for 2% of global greenhouse gas emissions¹⁴ (this does not include emissions attributed to international aviation or shipping), but has taken a number of steps to reduce and commit to future reductions in the emissions it produces. These steps include signing up to the Kyoto Protocol in 1998, setting domestic greenhouse gas emission targets, developing a UK programme to develop measures to achieve the targets set and most recently considering setting legally binding carbon budgets.¹⁵

The UK has a legally binding commitment under the Kyoto protocol to reduce greenhouse gas emissions by 12.5% below base-year level (1990), on average, over the first commitment period 2008-2012.

The UK also has a domestic target to reduce carbon dioxide emissions by 20% below 1990 levels by 2010 and the Energy White Paper 2003¹⁶ sets a longer term goal of reducing carbon dioxide emissions by 60% by 2050 with real progress to be achieved by 2020.

The UK Climate Change Programme aims to reduce UK greenhouse gas emissions to 23-25% below 1990 levels and reduce the UK's carbon dioxide emission to 15-18% below 1990 levels by 2010.

The government has recently reported that the UK is projected to reduce greenhouse gas emissions by nearly double its commitment under the Kyoto protocol but the domestic target presents a challenge.¹⁷ This is shown in the graph below.

¹³ Proposed in EU Energy and Climate Change Strategy and adopted by EU Heads of State and Government at the 2007 Spring European Council, March 2007.

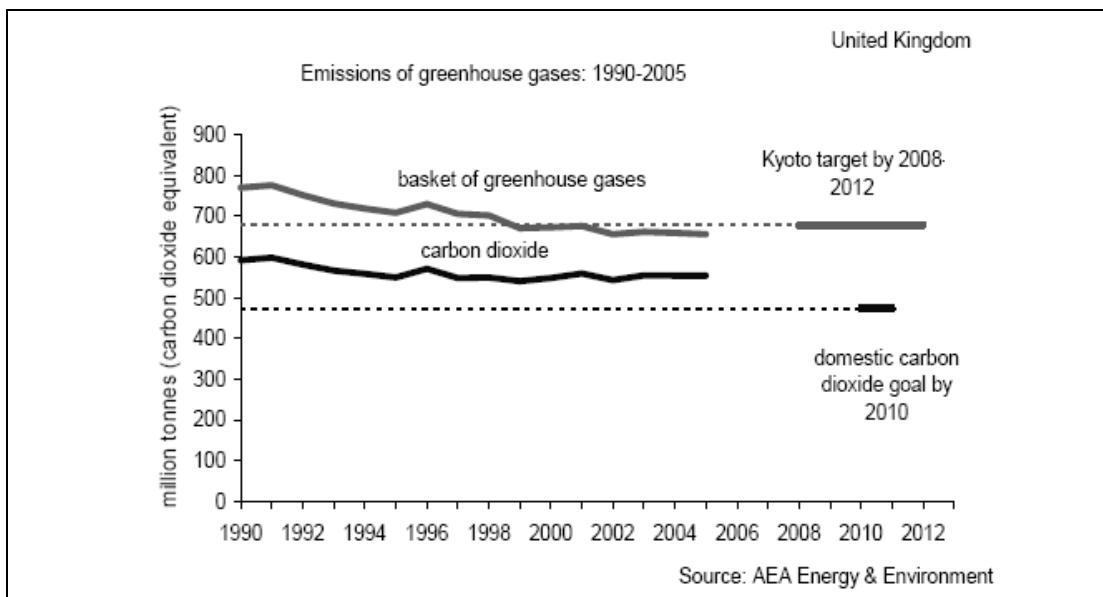
¹⁴ Draft Climate Change Bill, Consultation Document, Defra, March 2007, pg16, paragraph 3.15

¹⁵ Draft Climate Change Bill, Consultation Document, Defra, March 2007

¹⁶ Note: Energy White Paper 2007 is due to be released in June 2007.

¹⁷ Draft Climate Change Bill, Consultation Document, Defra, March 2007

Chart 2.1 UK Emissions of Greenhouse Gases 1990-2005



This shows total UK emissions for the 'basket' of greenhouse gases and specifically CO₂ since 1990, calculated in the format required by IPCC. Carbon dioxide emissions include those achieved overseas through purchasing emissions reduction credits: **Source Draft Climate Change Bill, Defra, 2007.**

In order to meet the national long term target the Government recently published a draft Climate Change Bill which sets an 'economically credible emissions reduction pathway to 2050.' The Bill proposes an independent Climate Change Committee which will oversee the achievement of five-yearly carbon budgets. This will help to meet the overall long term target of reducing carbon emissions by 60% on 1990 levels by 2050. The Bill includes an interim target of 26% to 32% reduction by 2020 to monitor progress towards the 2050 target.

2.2.4 Ecological Footprint and UK Consumption

An ecological footprint estimates the demand of human activities on nature, wherever it takes place geographically. The ecological footprint calculates how much productive land and sea is needed to provide the energy, food and materials used in everyday life and how much land is required to absorb the waste produced. It also calculates the emissions generated from the use of fossil fuels and how much land is required to absorb them. An ecological footprint is measured in global hectares per person (gha/cap).

England has an average ecological footprint of 5.5 gha/cap which is more than twice the world average of 2.2 gha/cap and a global capacity of fair share ust 1.8 gha/cap.

In 2006 the World Wildlife Fund published an 'Ecological Budget UK'.¹⁸ The budget shows the total impact of UK consumption, not only by accounting for direct resource flows and emissions within the UK, but also by including the manufacture of imported products and materials. In terms of carbon dioxide emissions the 'Ecological Budget UK' identified that the total carbon emissions from UK consumption is 11.9 tonnes of carbon dioxide per capita (t/cap). This can be broken down as follows:

- Government and Fixed Capital 3.03 t/cap
- Home and Energy 3.10 t/cap

¹⁸ "Counting Consumption, CO₂ emissions, material flows and Ecological Footprint of the UK derived by region and devolved country", 2006, World Wildlife Fund.

- Travel 2.44 t/cap
- Consumables 1.46 t/cap
- Food and Drink 0.87 t/cap
- Services 0.90 t/cap

2.3 UK Policy Approach to Addressing Climate Change

2.3.1 UK Climate Change Programme 2006

The UK Climate Change Programme 2006 examines where carbon savings can be made nationally through either direct policy measures or indirectly through other policy measures which will result in savings. The Programme highlights that to date, savings have been made through focusing on efficiency and fiscal measures, particularly in the energy supply and business sectors. These existing measures include a Renewables Obligation in energy supply, improvements to Building Regulations and reform of company car taxation. Existing measures are expected to deliver a saving of 17.3 million tonnes of carbon (MtC) by 2010.

Emerging measures to reduce greenhouse gas emissions in the future are also efficiency and fiscal based. Those identified in the UK Climate Change Programme include a Renewable Transport Fuel Obligation, measures to improve the energy efficiency of buildings and domestic appliances, and technological advances to improve the efficiency of vehicles. These measures are expected to save an additional 7 to 12 MtC of carbon by 2010.

Tables 2.1 and 2.2 below show greenhouse gas emissions by source and by end user together with the effect that the policy measures highlighted in the UK Climate Change Programme 2006 will have on greenhouse gas emissions in different sectors up to 2020. Both tables show that emissions from transport as both a source and end user are still set to increase despite the measures introduced, but emissions from business will reduce.

Table 2.1 Greenhouse Gas Emissions by Source, MtC

Sector	Base year	1990	1995	2000	2004	2010	2015	2020
Energy supply	74.4	74.4	63.1	58.2	61.4	56.2	56.0	51.1
Business	58.4	57.5	52.5	43.8	38.7	38.0	39.8	40.4
Transport	34.1	34.1	34.3	36.0	37.4	38.6	40.1	40.7
Domestic	22.3	22.2	22.5	24.6	25.3	21.8	22.0	22.2
Agriculture, forestry and land management	17.0	17.0	15.9	14.7	13.2	11.5	12.1	12.6
Public	3.7	3.7	3.6	3.2	2.9	3.0	3.1	3.2
Total emissions by sources minus total removals by sinks	209.9	209.0	191.9	180.5	178.9	169.2	173.0	170.0

Source: UK Climate Change Programme 2006

Table 2.2 Greenhouse Gas Emissions by End User MtC

Sector	Base year	1990	1995	2000	2004	2010	2015	2020
Business	97.2	96.4	84.7	74.1	70.3	65.2	66.3	66.0
Transport	40.2	40.2	41.2	42.6	45.0	46.5	47.5	47.2
Domestic	45.9	45.8	41.7	42.1	43.7	38.6	39.9	37.7
Agriculture, forestry and land management	18.0	18.0	16.8	15.4	14.0	12.3	12.8	13.1
Public	8.5	8.5	7.7	6.3	5.9	6.5	6.6	6.0
Total emissions by sources minus total removals by sinks	209.9	209.0	191.9	180.5	178.9	169.2	173.0	170.0

Source: UK Climate Change Programme 2006

2.3.2 Adaptation to the Impacts of Climate Change

Some degree of impact from climate change is already inevitable. Most of the changes that will occur over the next 30 to 40 years have already been determined by past and present emissions (or feedback). Therefore, to complement actions to reduce emissions there is a need to adapt to a changing climate.

The table below provides a definition of adaptation and the types of activities that can be considered as adaptive.

Table 2.3: Adaptation Related Activities

Adaptation can mean taking any action to prepare for climate change which is intentional or accidental	
There are 2 adaptation related actions:	
Building Adaptive Capacity	Implementing Adaptive Action
Investigation / research	Manage physical hazard / change (physical resources / flood embankment or irrigation)
Legislation (enabling)	Alter exposure to that aspect of the environment (e.g. relocate / protect properties / reduce damage causes / change crop)
Direct guidance / instruction	Reduce vulnerability to impact (e.g. increase wealth and ability to recover)
Increase institutional capacity to adapt	

Text sourced from 'Linking Adaptation Research and Practice', Tyndall Centre for Climate Change Research, May 2005

Research undertaken as part of Department for Environment and Rural Affairs (Defra) Climate Change Impacts Cross Regional Research Programme 2004 - 2006¹⁹ examined the practice of adaptation. The research found that adaptation is happening, yet each sector is at an early stage, and activity is focused on building adaptive capacity rather than implementing practical actions. Most of the adaptations identified were occurring in the public sector. UK public institutions have an important role and can take the lead to extend capacity. The research found that few adaptations were undertaken solely in response to climate change. ISO standards, EU Directives, sustainable development policies and corporate social responsibility can also have a positive but indirect effect on influencing adaptation to climate change.

¹⁹ Linking Adaptation Research and Practice, Tyndall Centre for Climate Change Research, May 2005

2.3.3 The Emerging Policy Landscape

The government continues to introduce legislation, policy and guidance to address climate change at a national scale. The most recent of these is discussed briefly below.

Code for Sustainable Homes, December 2006

The Code for Sustainable Homes will form the basis for future improvements to Building Regulation standards in relation to carbon emissions and energy use in homes. It will represent the single national standard for sustainable homes.

Draft Supplement to Planning Policy Statement 1: Planning and Climate Change, December 2006

The draft supplement to Planning Policy Statement 1: Planning and Climate Change, sets out how spatial planning can contribute to reducing emissions and stabilising climate change (mitigation) and take into account the unavoidable consequences (adaptation). It requires regional planning bodies (as part of their approach to managing performance on carbon emissions) to produce regional trajectories for the expected carbon performance of new residential and commercial development.

Draft Climate Change Bill, March 2007

The draft Climate Change Bill seeks to set out a clear, credible, long term framework for the UK to reduce carbon dioxide emissions and ensure steps are taken towards addressing the impacts of climate change. As discussed previously in section 2.2.3, the Bill will set "an economically credible emissions reduction pathway to 2050, by putting into statute medium and long term targets". In addition, successive five year carbon budgets will be set. The Bill does not express what specific measures will be used to ensure the targets are met.

Adaptation Policy Framework, due Autumn/Winter 2007

The Government acknowledges that a more strategic approach to adaptation in response to climate change is required. This is in order to identify key risks and opportunities common across a number of policy areas and to coordinate approaches where a number of departments and other bodies in the public sector (and beyond) will need to work together. Therefore, a cross government framework regarding adaptation is due to be issued in late 2007.

2.4 Potential Implications for Yorkshire and the Humber

2.4.1 Introduction

The English Regions have all responded to the issue of climate change in a nature which best suits their particular circumstances and reaction to national legislation and guidance (or lack of, in some cases). The national approach to the climate change agenda may have an influence on how this region (and others) responds to the challenge.

2.4.2 Implications for Setting Regional Targets and Measuring Performance

Regional strategies in Yorkshire and Humber include a number of greenhouse gas emissions targets, the most recent of which is in the 2006 Regional Economic Strategy.²⁰ This is broadly aligned with the 2006 UK Climate Change Action Plan target. However, as highlighted above, the UK is preparing for a new post Kyoto target which may influence a potential review of any Yorkshire and Humber targets.

Negotiations relating to this post Kyoto target may also influence the global approach to attributing emissions relating to aviation and shipping (which are currently excluded from national targets). This region has three airports and an international port and shipping

²⁰ Reduce greenhouse gas emissions (CO₂ equivalent) by 20-25% over 1990 baseline, based on modelling of energy/resources consumption attributable to Y&H by 2016', The Regional Economic Strategy for Yorkshire and the Humber 2006-2015.

facilities at the Humber estuary. Emissions produced by these activities, if attributed to the regional greenhouse emission profile, would affect the region's ability to meet a given greenhouse gas emissions target.

The most recent Yorkshire and Humber greenhouse gas emission target as set out in the 2006 Regional Economic Strategy is focused on reducing consumption related emissions where as the national targets are production focused.

The Climate Change Bill proposes to set legally binding carbon targets and Draft Supplement to Planning Policy Statement 1: Planning and Climate Change, proposes that Regional Planning Bodies produce regional trajectories for the expected carbon performance of new residential and commercial development. Guidance relating to how to actually calculate a carbon performance trajectory has not yet been issued. However reporting against both the carbon targets and carbon performance trajectory is likely to place a greater expectation on the regions to collect data and measure performance effectively. This would also enable the government to scrutinise regional results.

2.4.3 Implications for Reducing Regional Greenhouse Gas Emissions by Sector

The UK Government has focused on improving efficiency across sectors as a means of reducing greenhouse gas emissions and this is set to continue. This has, and will continue to have the greatest impact on the energy production and business sectors, with a lesser impact on the domestic and public sectors. Emissions associated with transport are set to increase.

If national government policy is not effective in dealing with sectors that are and will remain a significant source of production or consumption related greenhouse gas emissions, the region may need to take the initiative and seek to influence these sectors in ways it thinks possible, in order to satisfy a regional target.

2.4.4 Implications for How the Region Can Adapt to Climate Change

The national policy steer on adaptation is emerging through a series of recent releases such as Planning Policy Statements and Code for Sustainable Homes. The anticipated Adaptation Policy Framework, due for issue later this year, is expected to provide guidance on how to build adaptive capacity and implement adaptive actions.

Implementing adaptive actions requires resources in the form of staff time and funding. From a Yorkshire and Humber perspective there is a risk that funding may not be available for the scale of adaptive action required. By way of example, there is a fairly significant gap in the proportion of Grant In Aid funding allocated by the Department for Environment Rural Affairs (Defra) to Yorkshire and the Humber to fund flood defence and coastal protection schemes, compared to the number of locations that require protection in this region. This is because the economic weighting used in the national scoring system to appraise a potential scheme's eligibility for Grant In Aid Funding does not necessarily reflect regional priorities or objectives.

Such funding related issues will not be resolved quickly. If the Yorkshire and Humber region wishes to progress with implementing adaptive action in the short to medium term it may need to think of more innovative ways of achieving delivery, which will inevitably require inter-agency working, aligning outputs and outcomes between regional partners and pooling of funding streams.

3 Addressing Climate Change in Yorkshire and the Humber

KEY POINTS

- The Yorkshire and Humber region will be affected by the implications of climate change. Sea levels will rise affecting the Yorkshire coast and Humber Estuary. Winters will be warmer and wetter, and summers will be warmer and drier, affecting the growing season and the habitats of local native species and increasing the risk of flooding. There are likely to be more frequent incidences of extreme weather events.
- This region's power stations provide 18% of the UK's electricity generating capacity and consequently Yorkshire and Humber is the UK region that emits more production related greenhouse gasses than any other.
- The region set a target in 2003 to reduce greenhouse gas emissions. This was revised in 2006 and now seeks to reduce consumption related emissions. Research undertaken in 2002 demonstrated that efforts to reduce greenhouse emissions needed to more than double to meet the original target.
- The majority of the current suite of regional strategies were drafted post 2002 and acknowledge the risk of climate change, but do not necessarily apply that risk to the formulation of their mainstream policy objectives.
- Regional strategies have applied a stronger and largely consistent policy approach to addressing production related greenhouse gas emissions, particularly emissions as a result of energy generation and industrial processes.
- The approach of regional strategies is weaker at addressing consumption related greenhouse gas emissions.
- Although the areas requiring adaptation were identified in 2002, the regional strategies have a fragmented approach to addressing all of these areas and only two or three strategies make the link that pursuit of other policy objectives may have an impact on the region's ability to adapt. The focus remains on building adaptive capacity.
- If policy implementation is not a statutory duty or guaranteed by funding, there is a risk to the delivery of the climate change policies that are present in current regional strategies, particularly policy in more peripheral strategies.
- In addition, the time periods and review cycles of respective regional strategies does not lend weight to a consistent and cumulative impact, which would have a greater affect in light of limited resources and funding.

3.1 The Challenge

3.1.1 Introduction

To understand and evaluate whether the regional strategies are addressing climate change in Yorkshire and Humber, it is first appropriate to set out the particular challenge faced in this region.

3.1.2 Likely Impact of Climate Change in the Yorkshire and Humber Region

Research undertaken in 2002²¹ suggested that the Yorkshire and Humber region will be between 1 and 2.3°C warmer by the 2050's and between 1.6 and 3.9°C warmer by the

²¹ Warming up the Region, WS Atkins and SEI, 2002

2080's. This warming will be accompanied by wetter winters and drier summers and average annual rainfall could reduce by between 10% and 20%.

Sea levels on the Yorkshire coast and Humber Estuary have risen by up to 3.6mm per year since 1920 and are predicted to rise by up to 75cm by 2080, putting a large number of properties and businesses at risk²². In addition, by the 2050s:

- The growing season in the Vale of York will be approximately one month longer;
- Winters could be almost two degrees warmer (1.8°C) and 15% wetter compared to current averages; and
- Summers could be up to three degrees warmer with up to 30% less rain.

These changes could result in more flooding over a wider area, and an increased potential for drought. Higher temperatures will drive some local species like the Black Grouse further north. They would also improve conditions for invasive bracken on heather moorland and increase the potential for summer fires. Many of the regions' towns and cities, particularly Leeds, York and Hull will be more vulnerable to flooding, whether caused by higher sea levels or heavy rainfall swelling river flows.

There are eight areas which will require adaptation to the impacts of climate change in this region, which are²³:

- sea level rise;
- flooding;
- water resources;
- agriculture;
- habitat, biodiversity and landscape;
- buildings and construction;
- industry; and
- transport.

3.1.3 Greenhouse Gas Emissions in Yorkshire and the Humber

Two principal sources of time series data are used in this region, a monitoring and modelling study that estimated total emission for the region in 1990, 2000 and 2004 and the Environment Agency's pollution inventory.²⁴ Current reporting of the progress against meeting regional greenhouse gas emissions targets only includes production related emissions.

In 2000, the Yorkshire and Humber Region emitted 12.5% of the UK's greenhouse gases.²⁵ This had risen to 13% of UK greenhouse gases by 2004 and between 2000 and 2004 total greenhouse gas emissions grew at a very slightly higher rate than nationally in the region.²⁶ This is shown in Chart 3.1.

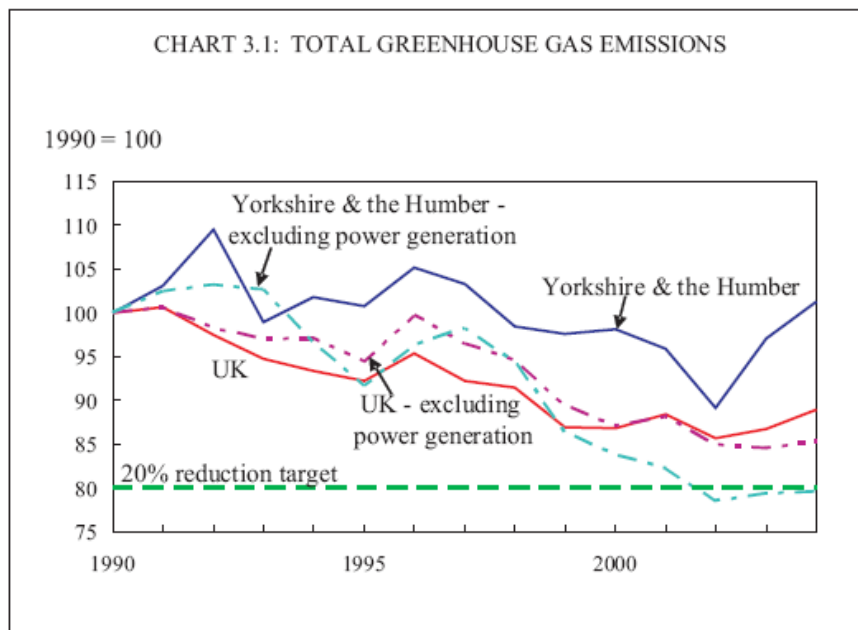
²² Warming up the Region, WS Atkins and SEI, 2002

²³ Warming up the Region, WS Atkins and SEI, 2002

²⁴ Progress in the Region 2006 (Page 102) sets out the sources of data used to monitor greenhouse gas emissions in the region.

²⁵ The Yorkshire and Humber Climate Change Action Plan, 2005

²⁶ Regional Greenhouse Gases Emissions Monitoring and Modelling Study, Update 2006, Cambridge Econometrics

Chart 3.1 Total Greenhouse Gas Emissions in Yorkshire and the Humber 1990 - 2004

Source: *Regional Greenhouse Gases Emissions Monitoring and Modelling Study, Update 2006, Cambridge Econometrics*

3.1.4 Sources of Greenhouse Gas Emissions in Yorkshire and the Humber

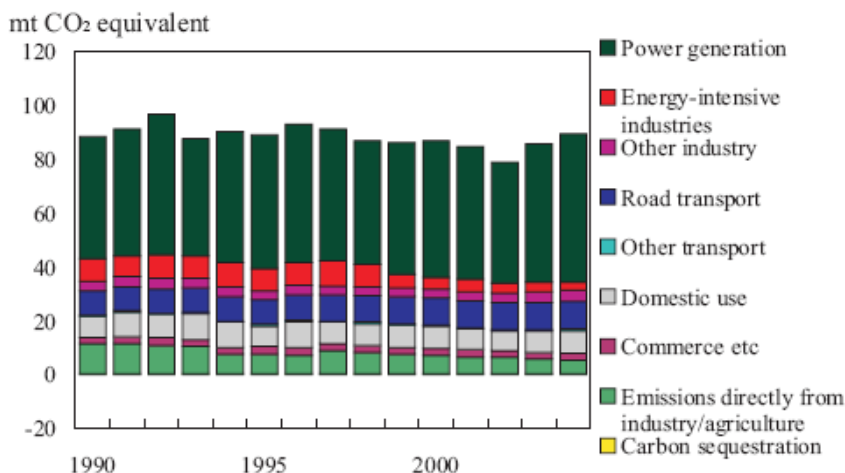
Power generation is the most significant source of greenhouse gas emissions in the region. In 1990 it accounted for 52% of all greenhouse gas emissions and this proportion had risen to 62% in 2004.²⁷ The power stations in Yorkshire and the Humber provide 18% of the UK's electricity generating capacity, whilst the region only consumes 7% to 8%.²⁸ The presence of these power stations means that Yorkshire and Humber emits the largest contribution of greenhouse gas of all the regions. If power generation is excluded from the equation, the region's greenhouse gas emissions are much less than the UK average.

Charts 3.2 and 3.3 show transport is the sector with the second highest level of emissions in the region. Between 2000 and 2004 greenhouse gas emissions from this sector increased. Domestic use of energy (heating and lighting our homes, together with the use of electrical appliances) is the sector with the third highest greenhouse gas emissions. Between 2000 and 2005 emissions from domestic use of energy declined.

²⁷ Regional Greenhouse Gases Emissions Monitoring and Modelling Study, Update 2006, Cambridge Econometrics

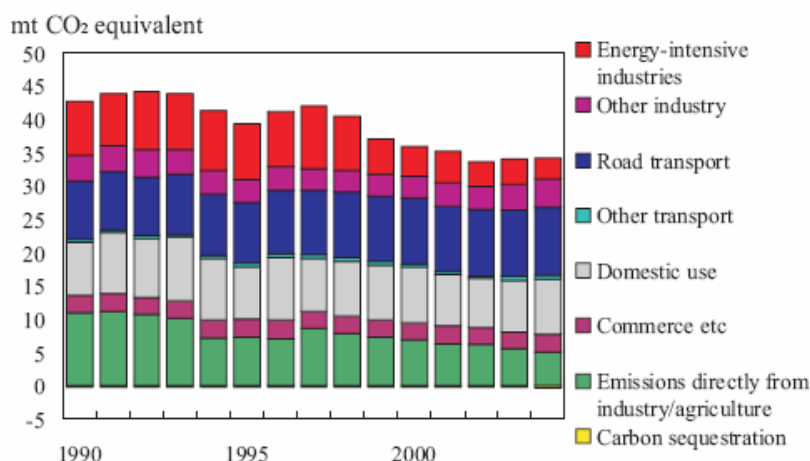
²⁸ Yorkshire and Humber's Climate Change Action Plan 2005, and Regional Greenhouse Gases Emissions Monitoring and Modelling Study, Update 2006, Cambridge Econometrics

Chart 3.2 Yorkshire and Humber Emissions by Source



Source: Cambridge Econometrics

Chart 3.3 Yorkshire and Humber Emissions by Source Excluding Power Generation



Source: Cambridge Econometrics

3.1.5 Targets to Reduce Greenhouse Gas Emissions in Yorkshire and the Humber

Yorkshire and Humber was the first English Region to commit to the UK emission reduction target. The region established a target to achieve a 20% reduction in 1990 levels of greenhouse gas emissions by 2010 in the 2003 Regional Economic Strategy. Additional milestones of a 25% reduction in 1990 levels of greenhouse gas emissions by 2015²⁹, 40% reduction of 1990 levels by 2030³⁰ and to work towards a 60% reduction by 2050 were added by other regional strategies.

The Regional Economic Strategy was revised in 2006 and as part of this process the target was refined. The 2006 target seeks to "Reduce greenhouse gas emissions (carbon dioxide equivalent) by 20-25% over 1990 baseline, based on modelling of energy/resources consumption attributable to Y&H by 2016." This target is not reflected in any other current regional strategies.

²⁹ Regional Spatial Strategy for Yorkshire and the Humber (based on Selective Review of RPG12), December 2004 and Regional Spatial Strategy: The Yorkshire and Humber Plan draft for Public Consultation, December 2005).

³⁰ Yorkshire and Humber's Climate Change Action Plan, December 2005

A report commissioned by Yorkshire Futures in 2002³¹ calculated that the region emitted 87.7 million tonnes of carbon dioxide equivalent in 1990. By 2001, emissions had reduced to 81.7 million tonnes carbon dioxide equivalent, a reduction of 6 million tonnes over 11 years. To reach the 20% reduction target of 70.2 million tonnes carbon dioxide equivalent by 2010 would require a reduction of almost 1.3 million per year for nine years, more than double the rate that had been achieved up to 2001.

This indicated that at the time of setting the 2003 target, significant additional effort was required to meet that target. Appendix A includes a list of all regional strategies evaluated and shows that the majority of the current suite of regional strategies were drafted post 2002. Section 3.2 below explores whether these strategies understood the risk and challenge of climate change and responded with appropriate policy direction.

3.2 Regional Strategy Development and Climate Change: Background

3.2.1 Introduction

Since 1997, the regions have had an increased responsibility to identify their own needs and priorities and apply national policy in a regionally specific way.

There are a number of regional strategies applicable to Yorkshire and Humber which seek to shape its future, and a number of bodies responsible (often in partnership) for developing, monitoring and co-ordinating the delivery of these strategies.

This report has sought to understand the processes of regional strategy development, organisational structures and decision making to gain a fuller picture of how the regional strategies are addressing the challenge of climate change. This includes understanding the risks and opportunities of climate change and the particular emphasis of regional policy (i.e. towards production or consumption related greenhouse emissions or the need to adapt). It also seeks to understand how strategic decision making processes influence the ability of the region to address climate change.

3.2.2 Regional Strategies Evaluated

This study has reviewed and evaluated 17 different regional strategies which have statutory and non-statutory status.³² This is not an exhaustive list, but it was considered that these particular strategies were relevant to how the region currently seeks to address climate change and provides a representative cross section across regional policy.

A table which sets out the full title, production date, author and purpose of the 17 regional strategies evaluated can be found at Appendix A. A more detailed comparative evaluation of the regional strategies reviewed can be found at Appendix B with an individual proforma for each strategy located at Appendix C.

Advancing Together and the Regional Sustainable Development Framework act as 'umbrella documents' to guide and set the principles for the development of other regional strategies. Both are due to be replaced by the Integrated Regional Framework by the end of 2007.

The Regional Spatial Strategy³³, Regional Economic Strategy and Regional Housing Strategy are considered to be the principal regional strategies sitting beneath Advancing Together and the Regional Sustainable Development Framework. Together they set out the region's approach to accommodating new development, regeneration, and improving and diversifying the region's economy and housing. The region's application for Government

³¹ Regional Greenhouse Gas Emissions Monitoring and Modelling Study, November 2002, Cambridge Econometrics

³² The study has a strategic regional focus so the 17 strategies reviewed were all region-wide. No sub-regional or locally specific strategies were reviewed.

³³ This study has examined the draft Regional Spatial Strategy, The Yorkshire and Humber Plan, December 2005

funds as set out in the Regional Funding Allocation is based largely on the schemes and proposals outlined in these three strategies.

There are a number of topic specific strategies, which provide baseline information or policy direction. The need for these strategies may have been identified in Advancing Together or the Regional Sustainable Development Framework. These strategies include The Regional Waste Strategy, The Regional Energy Infrastructure Strategy, Regional Environmental Enhancement Strategy, The Regional Forestry Strategy and the Yorkshire and Humber Climate Change Action Plan.

There is also a series of strategies which translate how the region can respond to a specific national strategy or policy. These strategies are usually topic specific, purpose driven and not always the subject of review or re-issue. They include the Yorkshire Manufacturing Action Plan, The Yorkshire and Humber Vision for Coal and Farming for Food: A Framework for Change.

3.3 Understanding the Risk of Climate Change and the Need to Act

Many regional strategies take their direction from national policy and guidance. As a result the need to address climate change is reflected in most regional strategies, either directly or often as a result of other policy drivers, for example the need to deliver more sustainable patterns of development or reducing fuel poverty.

It is acknowledged that several of the current regional strategies were drafted prior to climate change becoming a more prominent global and national policy issue and so may not reflect the latest in guidance or thinking.

There is a correlation between regional strategies with an interest in and/or an influence over sustainable development and those which understand the risks associated with climate change. These tend to be the overarching and principal strategies and include Advancing Together, The Regional Sustainable Development Framework, The Regional Spatial Strategy, The Regional Economic Strategy and The Regional Housing Strategy.

The strategies which focus on specific topic areas are less likely to understand both the positive and negative impact they may have on the region's ability to address climate change. The Regional Cultural Strategy, Yorkshire Manufacturing Action Plan, the Regional Strategic Framework for Public Health and Farming for Food: A Framework for Change do not make any strong linkages with the climate change agenda.

The Regional Environment Enhancement Strategy, The Regional Waste Strategy, the Regional Energy Infrastructure Structure Strategy and the Yorkshire and Humber Vision for Coal are principally motivated by other policy drivers, which include the need to reduce consumption of goods and energy and to make energy supply cleaner. This has indirectly benefited the region's ability to address climate change.

The Regional Forestry Strategy and of course the Climate Change Action Plan are examples of regional strategies which although topic based, demonstrate a very good understanding of the risks associated with climate change and how they can help to address the issue.

3.4 How Regional Strategies Seek to Address Climate Change

Regional strategies have a number of policy making tools available. They can set targets, include specific policies which guide decision making and include visions, aims and objectives. Targets and policies are considered to be stronger policy tools than vision statements, aims and objectives.

3.4.1 Production Related Greenhouse Gas Emissions

Energy generation, transport, industry and commerce are the main sources of production related of greenhouse gas emissions in this region.

Regional strategies collectively have a strong emphasis on energy. Targets and policies within regional strategies seek to reduce greenhouse gas emissions associated with power generation and industrial processes. Typical measures include making efficiency savings at source, making energy generation cleaner, increasing the contribution of renewable, low carbon or more localised energy generation and encouraging industrial processes to be more resource efficient.

Advancing Together, The Regional Economic Strategy, draft Regional Spatial Strategy, Regional Housing Strategy, Regional Energy Infrastructure Strategy, Regional Forestry Strategy, the Yorkshire Manufacturing Action Plan, Environment Agency's Corporate Strategy for the Region and the Yorkshire and Humber Vision for Coal all contain either targets or strong policy direction relating to improving energy efficiency in the region.

Regional strategies collectively have a weaker emphasis on transport and commerce. There are vision statements and objectives, but it is not often that these are supported by a strong policy direction or target. Typical measures include monitoring transport use and traffic congestion and encouraging modal shift of passengers and freight.

Advancing Together, the Regional Sustainable Development Framework, Regional Economic Strategy and the draft Regional Spatial Strategy are strategies which seek to provide guidance that can help to reduce emissions produced by the transport and commerce sectors.

Consistency of Strategies in Addressing Production Related Emissions

Regional strategies are largely consistent at addressing sources of production related emissions however, there are some minor inconsistencies which could be ironed out.

For example, the Regional Energy Infrastructure Strategy, Regional Waste Strategy and Regional Forestry Strategy all consistently support an increased contribution of energy from combined heat and power (CHP)³⁴. However these strategies provide a mixed message regarding the fuel type which is most appropriate to use in combined heat and power plants, which may affect the implementation and delivery of this policy in the region. The Regional Waste Strategy is concerned that if waste is used as a fuel, this would further add to greenhouse gas emissions and therefore sets a limit on the amount of energy generated from waste in the region. Woodfuel is also a source of fuel for combined heat and power plants. The Regional Forestry Strategy highlights that to ensure there is no net increase in greenhouse gas emissions, the trees from which wood fuel is extracted need to be replanted.

3.4.2 Consumption Related Greenhouse Gas Emissions

Consumption Patterns as a Challenge

Addressing consumption patterns is considered to be a more difficult area to influence. Demand for goods and services is linked to wealth and earnings, i.e. the more we earn the more we generally consume. It is also often the case that the pricing of goods and services does not always reflect the impact they have in terms of the greenhouse gas emissions. For example, it can be cheaper to purchase a replacement item than for the original to be repaired. National Government has so far placed more emphasis on reducing production related emissions, which is more politically palatable and easier to do, than seeking to influence individuals' consumption patterns. However, future economic drivers may lead to a

³⁴ Localised generation of power is considered to be more efficient as there is no loss of energy via transportation along the national grid.

stronger focus on readdressing the balance of pricing goods and services. The Sustainable Consumption Round Table 2006 Report 'I Will if you Will: Towards Sustainable Consumption'³⁵, indicates that there is more political space and public support to act on consumption than the Government assumes.

Approach to Addressing Consumption Related Greenhouse Gas Emissions in Current Regional Strategies

Households, travel, food, consumer items, public services, private services and capital investment are the main sources of consumption related greenhouse gas emissions in this region.

The impact of consumption related greenhouse gas emissions is a less well understood area of climate change in current regional strategies. Regional strategies that do understand the challenge of consumption related greenhouse gas emissions place an emphasis on reducing energy consumption (by households and others) and reducing the need to travel. Whilst this is important it is not a comprehensive approach. There are fewer targets and policies, with most regional strategies including visions statements and aims for reducing consumption related emissions. This is considered to represent a weaker policy approach.

The 2006 Regional Economic Strategy includes a revised greenhouse gas emissions target which refers to energy and resources consumption. The draft Regional Spatial Strategy contains a specific policy which seeks to address climate change and resource use³⁶. The policy identifies how plans, strategies, investment decisions and programmes can help the region to meet its greenhouse gas emissions target (including both production and consumption related actions) and plan for successful adaptation. The draft Regional Spatial Strategy also understands how it can make a contribution. The Regional Sustainable Development Framework sets out a number of aims and actions to reduce consumption of greenhouse gasses from domestic, industrial and commercial sources. The Regional Housing Strategy supports energy efficiency in households and encourages development patterns that reduce the need to travel.

The Regional Environmental Enhancement Strategy, Farming for Food and the Climate Change Action Plan in particular have a good understanding of the challenge faced in seeking to reduce consumption based emissions and suggest some measures to tackle this. However, the role of these particular strategies is generally to inform policy development in other regional strategies. There is a significant risk that the recommendations of these strategies may not be fully translated into the more mainstream regional strategies i.e. that their intended role in leadership is not fulfilled.

There is potential for regional strategies to include more direction to help the region reduce consumption related emissions. For example, the Regional Energy Enhancement Strategy is very much focused on reducing production related emissions and less so on reducing the demand for, and consumption of, energy. Another example is the energy hierarchy message (i.e. improving energy efficiency of buildings, using less energy and then finding lower carbon and renewable sources to generate a higher proportion of the energy required) is not always clear from regional strategies or from national policy. Regional strategies collectively can help to portray this energy hierarchy message consistently.

3.4.3 Adaptation to the Impacts of Climate Change

Adaptation can be in the form of building capacity or implementing adaptive action. The region has thus far focused on 'building capacity'. The particular impacts of climate change

³⁵ 'I Will if you Will: Towards Sustainable Consumption' Sustainable Consumption Round Table, May 2006. Also see 'Positive Energy: Harnessing people power to prevent climate change', Institute of Public Policy and Research, May 2007.

³⁶ Policy YH2 Climate Change and Resource Use.

in this region were researched and reported in 2002³⁷ and the region has a Climate Change Executive Group to discuss and co-ordinate inter-agency action.

In terms of regional strategies, their approach to adaptation is fairly fragmented, with a focus on only two or three of the eight areas requiring adaptive action (sea level rise, flooding, water resources, agriculture, habitat, biodiversity and landscape, buildings and construction, industry and transport) and not necessarily a consistency between how strategies intend to support adaptation. For example, most strategies understand the need to improve the resilience of buildings to adapt to climate change and that the risk of flooding may be exacerbated for certain parts of this region. Fewer strategies understand the need for transport infrastructure to be more resilient to the changing climate, the implications of sea level rise on urban and rural environments or the implications of warmer temperatures and less rainfall on agriculture in this region.

Again the policy measures are mainly focused on building capacity and less so on implementing adaptive action. The Climate Change Action Plan includes adaptation related actions, but is cautious about moving forward in advance of the awaited national adaptation strategy.

With the exception of the Regional Forestry Strategy, Regional Environmental Enhancement Strategy, Climate Change Action Plan and draft Regional Spatial Strategy, other regional strategies are not fully aware of the impact that pursuit of other policy objectives can have on the region's ability to adapt to a changing climate. This does not mean that other policy objectives should be halted, rather that the need to adapt to a changing climate should be considered as an integral part of the policy making process.

The draft Regional Spatial Strategy looks over a longer time period than most of other regional strategies and includes policies relating to safeguarding water resources, managing flood risk and understanding implications for biodiversity and habitats. It encourages adaptive action at the local level when consent for new development is considered. However, it is important to recognise that the Regional Spatial Strategy's role is limited to setting a framework for future development so other regional strategies have a role to play enabling existing development to adapt.

3.5 Risks to the Ability of Regional Strategies to Address Climate Change

3.5.1 Expectation on Regional Strategies to Address Climate Change

Individual regional strategies have very different production processes. These differences include whether they are subject to public consultation, independent examination or scrutiny. Strategies which are more accessible to external influence are often subject to a higher expectation to include a wide range of issues.

By way of example, production of the Regional Spatial Strategy is governed by statutory processes and it is therefore a very public facing document, with a duty to implement and deliver the policies it contains. Anyone with an interest in the region is entitled to engage in the process and make representations to the content of the strategy. There is also the opportunity for local, regional and national agencies to lobby for their particular agenda to be represented in the strategy.

This results in enormous expectation for the Regional Spatial Strategy to deal with a wider range of issues, some of which may be more appropriately represented in other regional strategies. The general public and other bodies do not have the same level of access or ability to influence the production of other regional strategies and other strategies do not have the same statutory duty to deliver their content.

³⁷ Warming up the Region, WS Atkins and SEI, 2002

This therefore skews attention towards the Regional Spatial Strategy with the risk that the potential and role of other strategies is not fully exploited.

3.5.2 Scrutiny, Accountability and Measuring Performance

In the case of most regional strategies there is a statutory duty for them to be produced, but not necessarily for the content of those strategies to be implemented and delivered. The exception is the Regional Spatial Strategy. The vigour with which the strategies are implemented is also dependent upon whether they are linked to funding streams. The Regional Funding Allocation is connected to the delivery of the objectives of the three principal strategies, The Regional Spatial Strategy (which includes the Regional Transport Strategy), Regional Economic Strategy and Regional Housing Strategy.

Climate change is an issue requiring short and medium term action to reduce the severity of the impact in the longer term. The suite of current regional strategies run to different time periods ranging from single issue strategies, which may not have clear timescales, to those which look 5 years or even 20 years ahead. They also have different review cycles, which can be determined by statutory process, such as for the Regional Spatial Strategy or funding cycles, such as for the Regional Housing Strategy. From a practical point of view, this makes it more difficult to ensure a consistent approach to address climate change across a wide range of regional strategies at any given point in time. Strong leadership and a consistent agenda to which the principal strategies adhere to is important for the long term view required for addressing climate change. It is anticipated that the Integrated Regional Framework will take this role.

As discussed in section 3.1.5 previous research undertaken in 2002 highlighted that the region needed to more than double its efforts to meet the greenhouse gas emissions target. Measuring the performance of policy is therefore an essential part of the feedback loop to determine if it is being successfully implemented. Yorkshire Futures (the regional observatory) monitors greenhouse gas emissions in the region (indirectly, through modelling and research³⁸). However meeting the target is reliant on a number of component factors. It is therefore important to understand how each of these components is performing and the contribution they make to the target.

By way of example, the draft Regional Spatial Strategy includes a policy and target (aggregated to local authority level) for the contribution of renewable energy sources³⁹. Increasing the proportion of regional energy production from renewable resources makes a contribution to reducing greenhouse gas emissions from the region. Very recent research⁴⁰ highlights that the region is not likely to reach its 2010 renewable energy target, mainly due to the effort and time it takes to deliver schemes from inception to physical operation. This will put further pressure on achieving the indicative 2020 renewable energy target.

3.5.3 Joining Up Delivery of All Regional Strategies

Without a statutory duty for strategies to be enforced or a funding stream to enable implementation, policy directions in more peripheral regional strategies are at risk of not being delivered.

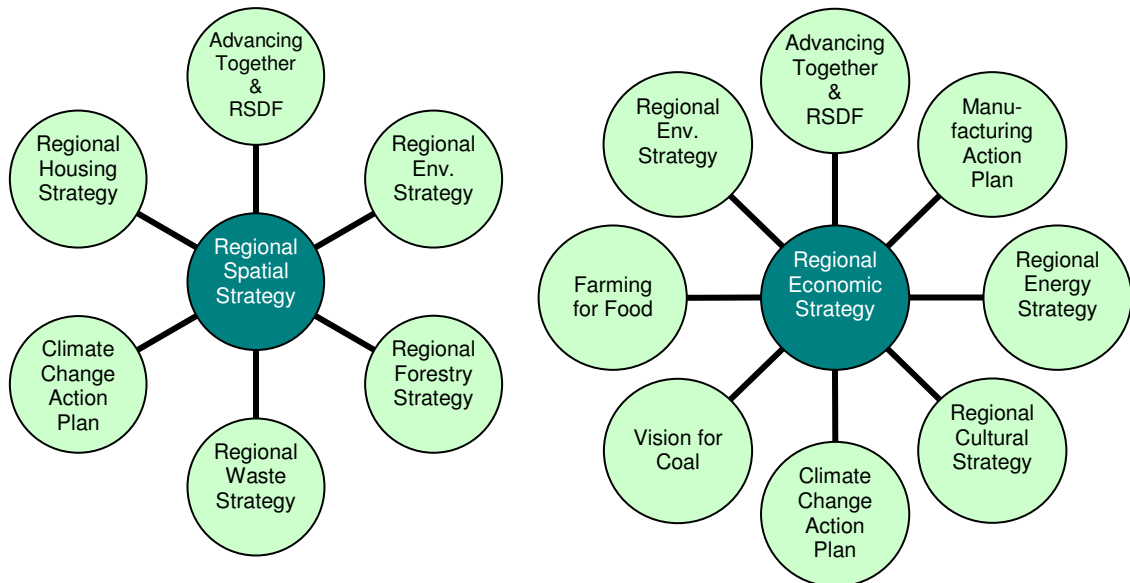
Regional strategies either have strong links with the Regional Spatial Strategy or the Regional Economic Strategy as demonstrated in the diagram below.

³⁸ Progress in the Region 2006 (Page 102) sets out the sources of data used to monitor greenhouse gas emissions in the region.

³⁹ Policy ENV5 Energy

⁴⁰ Low Carbon Energy Capacity Review, Arup on behalf of Yorkshire Futures and the Environment Agency, April 2007

Chart 3.5 Regional Strategy Linkages



Although establishing linkages with the principal strategies helps to ‘mainstream’ some issues, the principal strategies cannot and should not, replicate everything within the more peripheral strategies. There is therefore, a very real risk that recommendations or policies, which may help the region to address climate change are not carried forward or implemented as they have not been ‘mainstreamed’ or attributed sufficient value.

To counteract this, the cumulative effect of action undertaken consistently across a range of strategies, organisations and investment streams can have a greater effect. This approach is currently being used to deliver the Climate Change Action Plan, which includes a number of important actions to be delivered over the next 3-5 years (from 2005). By its own acknowledgement the Climate Change Action Plan has limited staff resources and no new specifically identified funding streams, so is reliant on members of the Climate Change Executive Group and wider partnership advocating and delivering within their own organisations. This has delivered results, although the Action Plan is mainly focused on aiding the region to build capacity by understanding the scale of the issue in more detail; monitoring how the region is managing the issue; and seeking to influence the regional and local policy agenda. Any actions requiring significant funds are on hold.

4 Greenhouse Gas Emissions: Production Perspective

KEY POINTS

- Two production based scenarios (Baseline and Vision) have been modelled using REEIO. The Baseline Scenario is a 'do minimum' scenario and the Vision Scenario assumes the policy direction given in regional strategies is successfully implemented. Both scenarios have examined the inclusion and exclusion of power generation as a factor contributing to regional greenhouse gas emissions.
- The assumptions used in the Vision Scenario are fairly ambitious, but reflect the scale of change required to meet the policy direction given in regional strategies for reducing production related greenhouse gas emissions.
- The targets, policies, aims and objectives of current regional strategies (if achieved) will stabilise production related greenhouse gas emissions in the region.
- However, in the absence of improvements to 'end of pipe' technology, particularly in the area of power generation, the region will not reduce greenhouse gas emissions by 25% below 1990 levels by 2015.
- If power generation is excluded from production related greenhouse gas emissions, then current regional strategies will almost achieve a 25% reduction in greenhouse gas emissions below 1990 levels by 2015. However, it is likely that further growth of emissions will occur post 2015, which will take emission levels above this target.

4.1 Introduction

This section examines how far current regional strategies contribute towards the reduction of greenhouse gas emissions from a **production** perspective. This relates to the greenhouse gas emissions resulting from the production of goods and services in this region, some of which may be exported outside of the region for consumption. Energy generation, transport, industry and commerce are the main sources of production related greenhouse gas emissions in this region.

The Regional Economy Environment Input Output Model (REEIO) has been used to model greenhouse gas emissions from a production perspective, informed by the targets and policies, aims and objectives outlined in current regional strategies.

It is important to note that the sources of regional greenhouse gas emissions discussed in section 3.1.4 were not modelled with REEIO and are therefore not directly comparable.

Two scenarios have been examined to determine the impacts of regional strategies on production related greenhouse gas emissions:

- A Baseline Scenario, effectively a 'do-minimum scenario', see section 4.3; and
- A Vision Scenario, which assumes that desired outcomes stated in regional strategies, which often lack implementation detail, are realised, see section 4.4.

Both scenarios look at the time period 2003 to 2021. For consistency the following regional greenhouse gas emissions targets have been used to show whether the desired reduction of emissions is likely to be achieved:

- 20% reduction in 1990 levels of greenhouse gases by 2010 (first stated in the 2003 Regional Economic Strategy and consequently mirrored in other strategies which remain current).

- 25% reduction in 1990 levels of greenhouse gases by 2015 (first stated in the Regional Spatial Strategy for Yorkshire and the Humber to 2016 based on selective review of RPG12, 2004 and carried forward in the Draft Regional Spatial Strategy, draft for public consultation, 2005).

When interpreting modelling outputs it is important to recognise that all models are inherently flawed as they can never provide a complete picture of reality. Models are created to provide a more simplified view of the world around us. There is no model that can give any meaningful figures without significant uncertainty. Uncertainties and all the assumptions adopted are highlighted throughout the scenario process.

4.2 Regional Economy Environment Input Output Model (REEIO)

The Regional Economy Environment Input Output Model (REEIO) is a unique decision toolkit designed to assist policy makers analyse regional policies and programmes with regard to the economy and environment. It provides a quantitative basis for sustainability appraisal, strategic environmental assessment and benchmarking the resource productivity of businesses and sectors.

REEIO was originally developed by Cambridge Econometrics (CE) as part of the Reward project, a partnership led by the Environment Agency (EA) with the participation of Regional Development Agencies and the National Assembly for Wales. More recently REEIO has since been supported by SCPnet⁴¹ and a version of the software is held by representatives of each English region. This study uses the existing model for Yorkshire & the Humber held by Yorkshire Forward.

REEIO utilises the Region Resource Use and Emissions Database which was commissioned by SCPnet, which in turn draws on data from the Environment Agency Commercial and Industrial Waste Survey 2002/2003 and data on energy use and emissions to air provided by Netcen (who maintain the National Atmospheric Emissions Inventory).

4.2.1 The Scope of REEIO

The links between the economy and the environment are vast and complex. REEIO focuses on one particular set of links, namely those between the economy and the source and sink functions of the environment. Furthermore REEIO focuses on modelling the links between a region's economy and the key environmental pressures of waste, energy, emissions to air and water demand.

REEIO provides annual comprehensive projections for a wide range of indicators including:

- GVA, personal incomes, consumer spending and investment.
- Output and employment by industry.
- Employment by occupations.
- Waste arising by waste streams and industry.
- Waste entering different management routes.
- Energy demand by fuel and fuel user (including transport).
- Emissions to air (e.g. carbon dioxide).
- Water demand by water households and industries.

⁴¹ See <http://www.wwflearning.org.uk/scpnet/> for more information.

4.2.2 How REEIO Models the Link Between the Economy and the Environment

REEIO models the economy using the methodology developed for Cambridge Econometrics Local Economy Forecasting Model (LEFM). The key outputs from the economy module include:

- Output and employment by sector.
- Household incomes.
- Population.

For the purpose of this study the key environmental pressures of relevance are:

Energy Use: The use of energy by fuel type is determined on the basis of the scale of activity (level of output for industry sectors) of the fuel user and the relative price of fuels. The energy demand from power generation in the region is considered by explicit assumptions regarding specific plant capacities and utilisation.

Air Emissions: The projections for air emissions are determined in two parts. The energy-related emissions are determined on the basis of energy use by user and fuel. Emissions that are not energy-related are determined by an appropriate activity indicator.

4.3 Baseline Scenario

4.3.1 Introduction

The Baseline scenario provides a picture of what the carbon dioxide emissions could be if the region was to go for economic growth without any consideration for environmental issues, such as climate change. This provides a valuable benchmark to compare the effectiveness of regional strategies in reducing the adverse impacts of economic growth.

4.3.2 Assumptions

Production Perspective Baseline Scenario: Key Assumptions

- GVA Growth at 2% per annum.
- Strongest growth is in transport and communications and financial and business services sectors.
- Energy efficiency savings: 4-5% per annum for energy intensive industries.
- Energy efficiency savings: 1.5% per annum for less intensive industries and households.
- Demand for transport growth projected to be in line with the economy.

The economic context for this scenario is the forecast for the Yorkshire and Humber economy published by Cambridge Econometrics in July 2005.⁴² In this forecast gross value added (GVA) growth in the region is forecast to average just over 2% pa over 2006-16 (the life of the Regional Economic Strategy). The strongest growth is in transport & communications and financial & business services. Growth in manufacturing is expected to average just 1½% pa. The pattern of economic growth post 2016 through to 2021 (beyond the timeframe of the current Regional Economic Strategy) is largely a continuation of the pattern of growth expected to 2016.

⁴² These forecasts, published in Regional Economic Prospects, July 2005 are the baseline projections in the current version of REEIO for Yorkshire & the Humber.

With regard to the trends in energy use, the scenario embodies national trends for each kind of fuel user and fuel that were prepared for the July 2005 edition of Cambridge Econometrics' Energy and the Environment publication. These in turn are based on analysis that takes account of the measures being undertaken as part of the Government's Climate Change Programme, as well as assumptions about energy costs. In summary, for most industries, quite strong reductions in the energy intensity of production (energy use per unit of output) are assumed. For the most energy-intensive industries these improvement rates could be as high as 4-5% per annum. In the less energy-intensive services sectors rates of energy efficiency gains are typically in the order of 1½% pa. In addition, the most energy-intensive industries are typically among the slowest-growing in the projections.

In relation to transport, the scenario assumes that the total demand for passenger and freight transport rises in line with the growth in the region's economy: a 1% growth in economic activity leads to a 1% increase in passenger kilometres and freight tonne kilometres travelled. The modal split of both passenger and freight transport does not vary over the forecast, nor does the rate of occupancy of the different modes or the energy efficiency of vehicles.

The level of emissions resulting from the consumption of a particular type of fuel by any one fuel user does not change over the forecast period.

4.3.3 Baseline Scenario Implications from Production in the Region

The implications of energy use by sector, as modelled using REEIO on the greenhouse gasses emissions for between 2003 and 2021, are shown in chart 4.1.

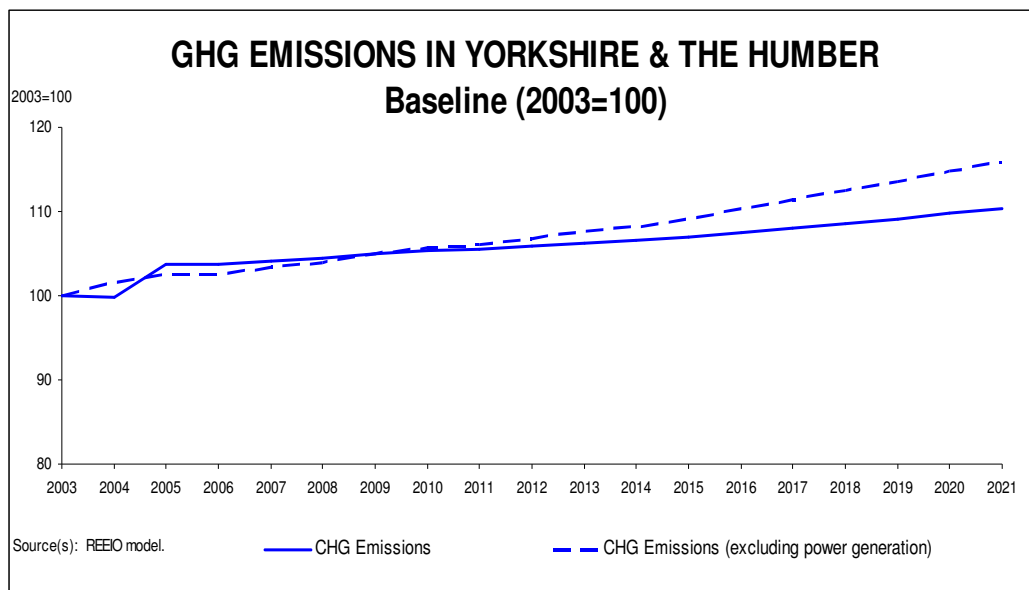
The largest use of energy in the region is from power generation (almost half), followed by households, transport (freight and passenger transport, including for personal use) and industry. In the Baseline Scenario the strongest growth in demand for energy use is from transport followed by commerce and the domestic sector. Energy use in the industrial sector falls by 30% over the period to 2021 (25% to 2016) due to the combined effect of comparatively weak economic growth and strong trends in energy efficiency.

As result of the changes in energy demand in the region, carbon dioxide emissions *due directly* to the use of energy in the region⁴³ rise slightly, by 8%, over the period. This increase is predominantly due to increases in emissions associated with transport and households. If the analysis excludes power generation within the region, carbon dioxide emissions rise by 13%, over the period to 2021. This is slightly higher percentage increase reflects the higher increases in emissions associated with commerce, transport and households, which make up a larger share of the overall emissions if power stations are excluded.

Greenhouse emissions would also increase at a similar rate, to carbon dioxide emissions which is shown in Chart 4.1. In order to compare trends over time of these different variables (the gradients of the chart in this case), the modelled outputs are reported in relative terms rather than absolute terms. This means that the chart is indexed to base year (2003) and changes are shown relative to the base year.

⁴³ Note that this does not include the emissions associated with the generation of electricity consumed within the region.

Chart 4.1: Baseline Scenario: Emissions of Greenhouse Gases (GHG) 2003-2021



4.3.4 Discussion

The baseline scenario would result in an increase demand for energy (particularly from transport and households) which in turn will lead in increased production of energy and therefore higher emissions of both carbon dioxide and all greenhouse gasses.

4.4 Vision Scenario

4.4.1 Introduction

Many regional strategies include targets, policy, aims, objectives and descriptions of what the region could look like in the future. For example, many strategies list that they would like to see more cycling and walking without directly explaining how this might be done. The vision for the economy is that set out in the Regional Economic Strategy, which is that the region “will grow faster and better than its main competitors by 2015”.

This scenario seeks to assign assumptions to the targets, policy, aims set out in current regional strategies and model how they are helping to meet the regional target to reduce greenhouse gas emissions from a production perspective.

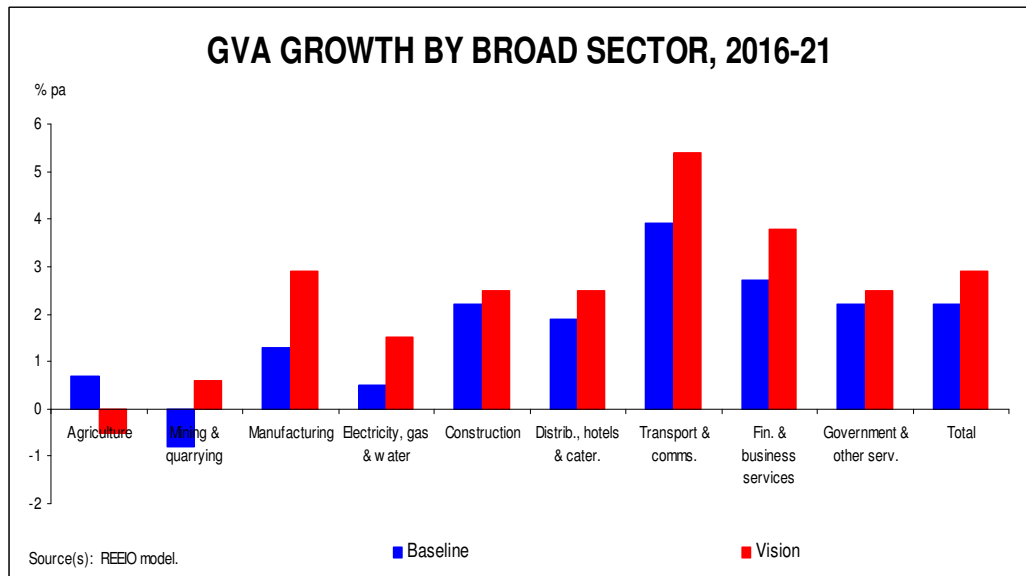
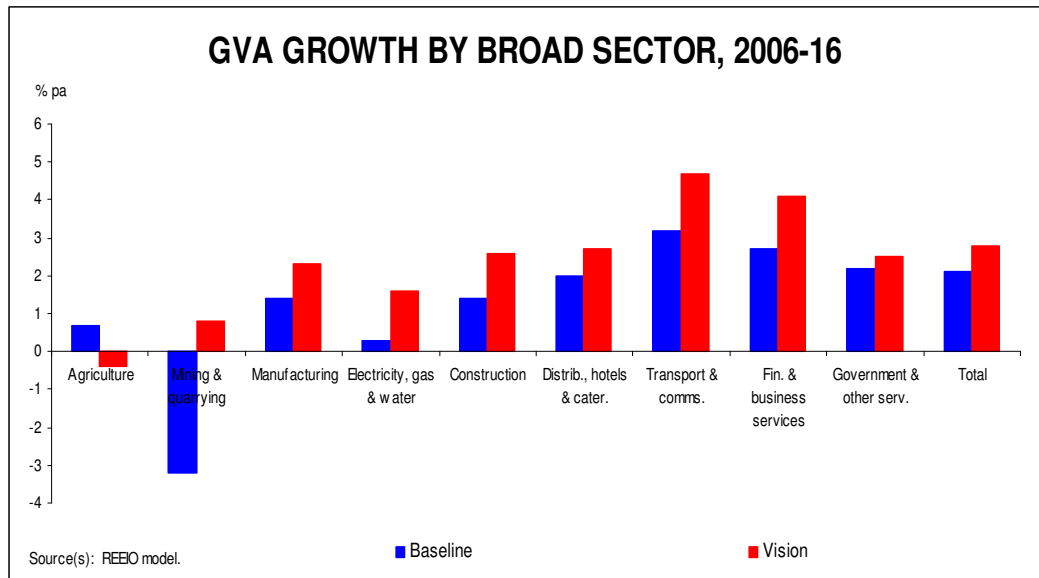
4.4.2 Economic Context

To develop the Vision Scenario from the production side of the region’s economy, the REEIO model has adopted an approach which looks at the scale of change necessary, given the vision for economic growth to stabilise demand for energy in each of the key broad categories of user (industry, commerce, transport and households) and then assessed the implications of this change for greenhouse gas emissions (primarily through carbon dioxide).

The economic context for this scenario, which aims to meet the aspirations of the Regional Economic Strategy in developing the region’s economy, uses economic scenarios prepared by Yorkshire Forward at the time that the Regional Economic Strategy was being developed.

Charts 4.2a and b show the assumed pattern of growth, and how it differs from in the baseline scenario. In the Vision Scenario, gross value added (GVA) grows by an average of 2.8% per annum over the period 2006 to16. The strongest growth is in transport & communications and financial & business services (as it was in the Baseline Scenario). Prospects for manufacturing are improved from those in the Baseline Scenario, but the growth of 2¼% per annum is still slower than for the economy as a whole.

Chart 4.2a and b: Vision Scenario; GVA Growth (2006-2016) and (2016-2021)



4.4.3 Assumptions

Production Perspective Vision Scenario: Key Assumptions

- GVA growth at 2.8% per annum to 2016.
- Strongest growth is in transport and communications and financial and business services sectors.
- Energy efficiency savings: 4-5% per annum for energy intensive industries.
- Energy efficiency savings: 3.5% per annum for commercial and public sectors.
- Energy efficiency savings: 2.5 % per annum for households.
- Capacity for combined heat and power (CHP) = 1,700MWe by 2021.
- Renewable Energy Capacity = 1,800MWe by 2021.
- Transport growth at half the rate of economic growth.
- Strong modal shift in transport sector.

The assumptions for energy efficiency have been developed to achieve stable demand for energy over the forecast period. Given the stronger economic growth in this scenario, the trend in energy efficiency in the commercial and public sector needs to more than double, from 1.5% per annum in the Baseline Scenario to around 3.5% per annum. Energy efficiency improvements by households (defined as energy use per unit of income) also need to increase from 1.5% per annum in the Baseline Scenario to 2.5 to 2.75% per annum.

It is assumed that combined heat and power (CHP) schemes are one way in which energy demands are met, reducing the amount of electricity that would otherwise be met from the Grid. In the Vision Scenario it is assumed that combined heat and power capacity in the region will increase to 1,700 MWe by 2021.⁴⁴ In addition, it is also assumed that the capacity for generating energy from renewable sources in the region will increase to over 1,800MWe by 2021.⁴⁵

Transport was the strongest growing source of energy demand in the Baseline Scenario, and given the stronger economic growth in this scenario it is of no surprise that significant changes are required to stabilise transport's energy demand. In this Vision Scenario, it is assumed that the growth in demand for passenger and freight transport still increases, but at half the rate of overall economic growth (i.e. at around 1.5% per annum). At the same time there is assumed to be a strong shift in the proportion of passenger travel that is made by bus and rail and a corresponding reduction in that by car. Freight traffic is also assumed to be increasingly moved by rail rather than road. Average occupancy rates on public transport are assumed to increase, as do average freight loads carried by road, and there is a steady improvement in the energy efficiency of all modes of transport.

⁴⁴ In 2005 the Yorkshire and Humber Region had 153 combined heat and power schemes producing 1,406 MW of electrical capacity, Energy Trends, DTI, September 2006. This capacity can mainly be attributed to a large plant at Immingham. Cambridge Econometrics applied some modest growth assumptions to this figure to reach an assumed generation of 1,700 MW by 2021.

⁴⁵ At February 2007 the region produced 169.3MWe from renewable sources (Ofcom). The Regional Spatial Strategy sets a target to produce 708MW from renewable sources by 2010 and an indicative target to produce 1,862MW from renewable sources by 2021.

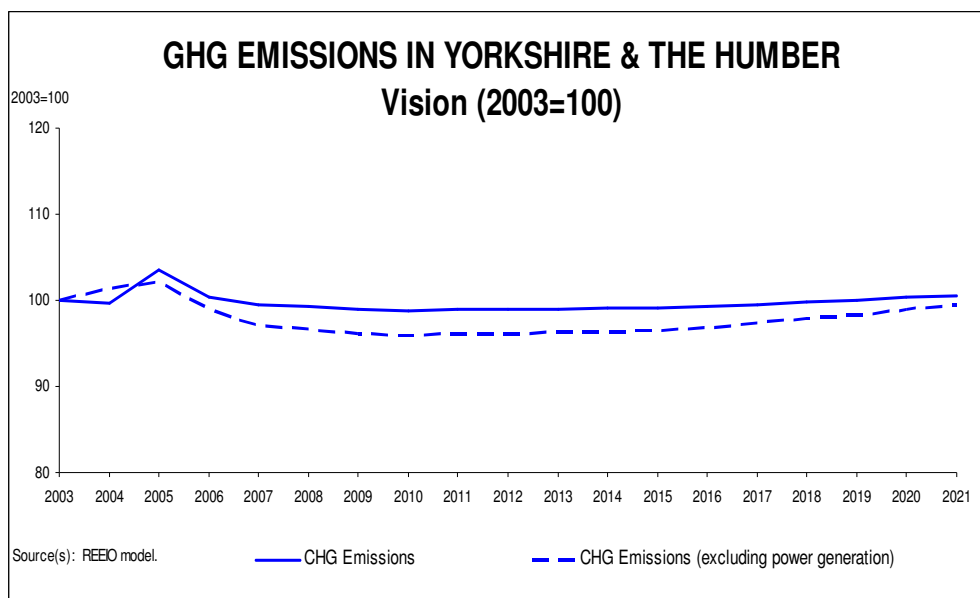
4.4.4 Vision Scenario: Implications from Production in the Region

The implications of energy use by sector, as modelled using REEIO, on the production of greenhouse gasses for between 2003 and 2021 are shown in chart 4.3.

By construction, the Vision Scenario the projected demand for energy for different groups of the economy stabilises in the long term.

Chart 4.3 shows the associated projections for greenhouse gas emissions will stabilise.

Chart 4.3: Vision Scenario: Relative Emissions of Greenhouse Gases 2003-2021



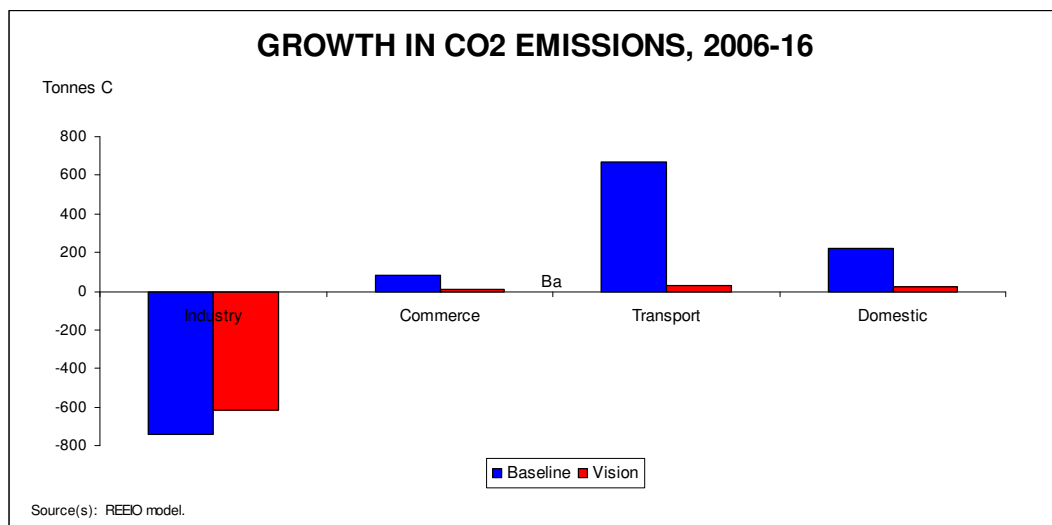
4.4.5 Discussion

The Vision Scenario provides an indication of what would happen if the current targets, policies, aims and objectives set out in the regional strategies were achieved. Greenhouse gas emissions from a production perspective can be stabilised, but in order not to inhibit economic growth, savings need to be made in other areas. The public sector needs to reduce its energy demand significantly. Localised provision through combined heat and power needs to increase and the contribution from renewable sources also needs to increase. In terms of transport, the growth of demand needs to slow, strong modal shift of both passengers and freight is necessary and increased vehicle efficiency is anticipated.

4.5 Comparison of Scenarios

Chart 4.4 shows the change in carbon dioxide emissions by broad sector over 2003 to 2016 under the Baseline and Vision Scenarios. It clearly shows that emissions associated with transport are the main contributor to an increase in carbon dioxide emissions followed by that from the domestic sector. It also demonstrates that the current targets, policies, aims and objectives set out in regional strategies (if achieved) would help to reduce emissions.

Chart 4.4: Growth in Emissions of Carbon Dioxide in Baseline and Vision Scenarios



4.6 Comparison with Regional Targets

Charts 4.4 and 4.5 compare the projections for total greenhouse gas emissions in the region in the two scenarios together with the levels needed to achieve the regional target to achieve reductions of 20% of 1990 emissions by 2010 and 25% by 2015 (as reflected in the 2003 Regional Economic Strategy, Regional Spatial Strategy and the Climate Change Action Plan).⁴⁶

There are no centrally-produced time series of greenhouse gas emissions for the region but work commissioned by Yorkshire Forward has produced estimates using readily available data.⁴⁷

4.6.1 Total Greenhouse Gas Emissions

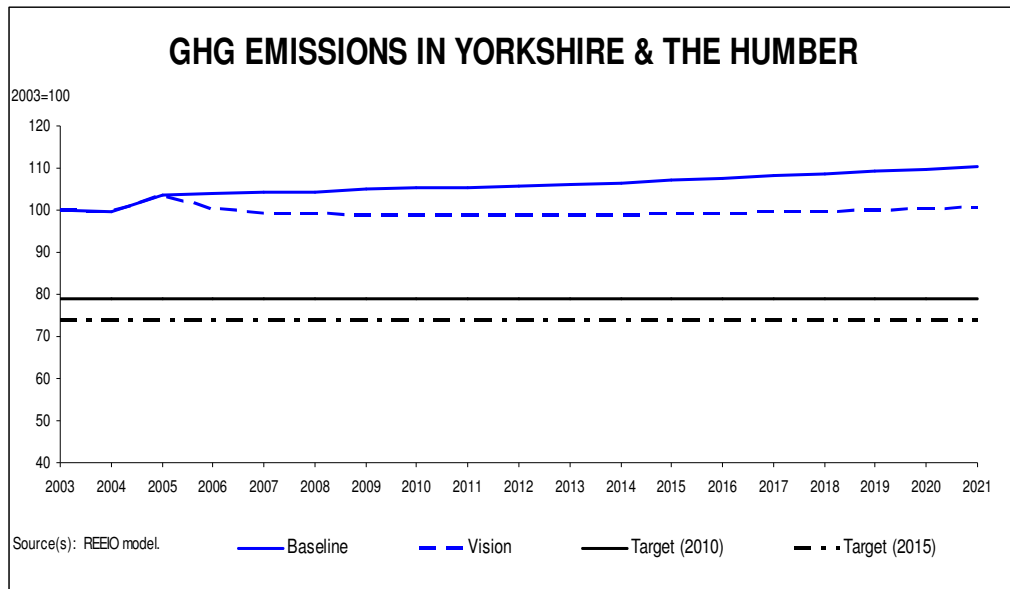
Yorkshire Forward estimates show that overall emissions fell over 1990 and 2000 they then rose quite strongly so that overall emissions in 2004 were 1.25% higher than in 1990. While there has been a sharp decline in emissions from energy-intensive industry, emissions from power generation (which accounts for more than 60% of emissions), transport and commerce have all risen throughout the period.

It is clear from Chart 4.5 that in the absence of improvements in ‘end of pipe’ technology (i.e. emissions associated with consumption of fuel), particularly in the area of power generation, the region is likely to miss the targets set to reduce overall greenhouse gas emissions.

⁴⁶ The 2006 Regional Economic Strategy Target is consumption (not production) related but is broadly aligned as it seeks 20-25% reduction in 1990 levels by 2016.

⁴⁷ Regional Greenhouse Gases Emissions Monitoring and Modelling Study Update of Baseline Data A Final report, submitted to Yorkshire Forward, 31 March 2006, Cambridge Econometrics. The method used to construct the historical time series differs from that used to construct the baseline data in REEIO.

Chart 4.5: Greenhouse Gas Emissions; Baseline and Vision Scenarios.

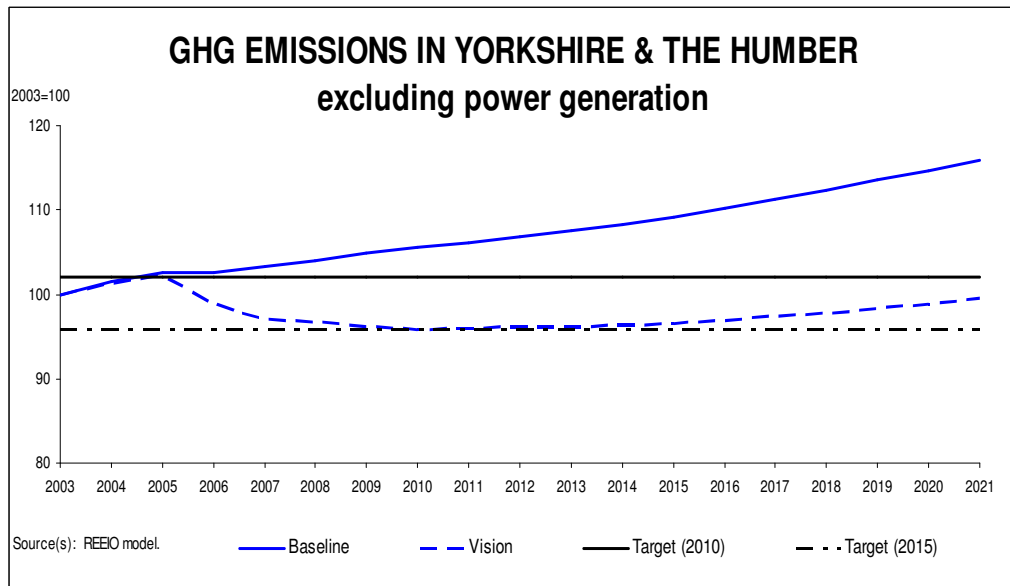


4.6.2 Total Greenhouse Gas Emissions (excluding power generation)

Yorkshire Forward estimates show that emissions excluding power generation fell over 1990 to 2004, so that overall emissions in 2004 were 20% lower than in 1990.

It is clear from Chart 4.5 that the 25% reduction target by 2015 will not be met under the Baseline Scenario. The Vision Scenario comes close to meeting the 2015 target, although further growth in emissions post 2015 puts emission levels in later years above the target.

Chart 4.6: GHG emissions, excluding power generation; Baseline and Vision Scenarios.



5 Greenhouse Gas Emissions: Consumption Perspective

KEY POINTS

- The 2006 Regional Economic Strategy has a consumption related greenhouse gas emissions target based on “modelling of energy/resources consumption attributable to Y & H.”
- The Baseline and Vision Scenarios demonstrate that there is likely to be significant growth in consumption related carbon dioxide emissions through to 2021. This means that current regional strategies (as modelled by the Vision Scenario) are unlikely to meet regional targets for the reduction of greenhouse gas emissions.
- The Stabilising Carbon Trends (SCT) scenario presents a challenging vision of the level of intervention and change that will be necessary to reduce patterns of consumption. This scenario is constructed by ‘working backwards’ from an ideal policy landscape that will deliver significantly reduced consumption related emissions. In developing the scenario it is recognised that funding and resource constraints will influence the ability of agencies to deliver this level of change. The SCT scenario meets the regional and Royal Commission for Environmental Pollution targets, although it should be noted that the margin by which the scenario meets these targets is relatively small.
- The Stabilising Carbon Trends (SCT) future will look vastly different from today’s patterns of production and consumption. Ultimately, the link that needs to be broken is between increased wealth and carbon dioxide emissions. Stockholm Environment Institute has undertaken a regression analysis that demonstrates that wealth has the strongest link with emissions. This does not mean that lower carbon dioxide emissions require increasing poverty, but it does require a sophisticated policy approach to identify where both quality of life and carbon dioxide emissions go hand in hand.
- Typically, housing and transport account for more than 50% of consumption related emissions. Observations from the analysis undertaken are provided below:
 - Retrofitting is clearly an effective tool when looking at consumption related emissions from housing. Presently retrofitting is not a feature of current regional strategies.
 - Transport remains a significant element of the consumption impact. The ability to deliver year on year reduction of transport impacts will make a significant contribution to the region’s ability to reduce overall carbon emissions
 - Linkages can be made between different agendas which can beneficially reduce greenhouse gas emissions. Regional policy making can help to forge these linkages. A good example is that of food, linking reduced carbon emissions to the healthy eating agenda.

5.1 Introduction

This section examines how far current regional strategies contribute towards meeting the regional carbon emissions target from a **consumption** perspective.

The greenhouse gas emissions analysis has been undertaken using the Resource and Energy Analysis Programme (REAP)⁴⁸ tool developed by the Stockholm Environment

⁴⁸ www.sei.se/reap

Institute (SEI) with the Centre for Urban and Regional Ecology (CURE) in Manchester and the World Wildlife Fund (WWF).

As with the production analysis a number of scenarios have been examined to determine the impacts of regional strategies on greenhouse gas emissions. Two of the scenarios were the same as those assessed for the production analysis, namely:

- Baseline Scenario, described in section 5.3.1, based on the output from the REEIO analysis; and
- Vision Scenario, also described in section 5.3.1 and again based on the REEIO output.

In addition, for the consumption analysis alone, a third scenario was assessed which focused on achieving a significant reduction in consumption based emissions. This scenario, referred to as the Sustainable Carbon Trends (SCT) Scenario, looks to describe the extent of policy intervention and behavioural change necessary to achieve a significant reduction in consumption based emissions. The analysis also describes the relative performance of a range of potential measures.

All Scenarios look at the time period 2003 to 2021. For consistency the following regional greenhouse gas emissions targets have been used to show whether the desired reduction of emissions is likely to be achieved:

- 20% reduction in 1990 levels of greenhouse gases by 2010 (first stated in the 2003 Regional Economic Strategy and consequently mirrored in other strategies which remain current).
- 25% reduction in 1990 levels of greenhouse gases by 2015 (first stated in the Regional Spatial Strategy for Yorkshire and the Humber to 2016 based on selective review of RPG12, 2004 and carried forward in the Draft Regional Spatial Strategy, draft for public consultation, 2005).

When interpreting modelling outputs it is important to recognise that all models are inherently flawed as they can never provide a complete picture of reality. The REAP modelling provides an indicative view of carbon dioxide emissions under a range of policy scenarios. Uncertainties and all the assumptions adopted are highlighted throughout the scenario process.

5.2 Resource and Energy Analysis Programme (REAP)

REAP is a sophisticated model that can be used at the local, regional and national level to assess the full life-cycle impacts of greenhouse gas emissions, air pollutants, energy consumption, heavy metals, Ecological Footprint, and material flows of products and services. REAP can also model the impacts of different policies and create plausible scenarios of the future. These can then be set against targets or compared to alternative futures based on selected trends or assumptions. All indicators take into account the direct and indirect pressures of consumption of products and services throughout the full economic supply chain.

5.2.1 Methodology

The basic methodology underpinning REAP combines existing Material Flow Accounts (MFA), National Environment Accounts and National Footprint Accounts (NFA) with input-output analysis. Environmental input-output analysis is a well-established approach that makes it possible to track and assign intermediate resource flows to consumption categories. This is important because industries trade resources with each other in the process of producing goods and services and it is necessary to be able to track these 'indirect' or 'offsite' impacts as well as those associated by the 'direct' or 'onsite' use of

resources⁴⁹. This impact can be expressed in carbon dioxide emissions or by using the Ecological Footprint.

REAP provides an analysis of all household expenditure and therefore provides a complete picture of household carbon dioxide emissions. This includes both direct impacts, such as fuel use, and indirect impacts, such as emissions that occur prior to consumption along the complete supply chain.

5.2.2 Baseline and Vision Scenarios

The modelling of the Baseline and Vision scenarios was based on economic time series data, in the form of household expenditure, provided by Cambridge Econometrics from the REEIO model. The underlying assumption in the REEIO analysis being that changes in the economic output of industrial sectors will lead to changes in expenditure by households in the region.

5.2.3 Sustainable Carbon Trends (SCT) Scenario

The modelling of the SCT scenario was undertaken using the REAP model alone based on the assumptions that had been put into the REEIO Baseline Scenario. This approach allows the link between economic growth and expenditure, which is assumed in REEIO, to be adjusted through various policy interventions as described in the assumptions below, see Section 5.3.2.

5.3 Assumptions

5.3.1 Baseline and Vision Scenarios

The inputs for the Baseline and the Vision Scenarios were the economic forecasts and models provided by Cambridge Econometrics, as described in Chapter 4. The key indicators for both scenarios are summarised below, Table 5.1.

Table 5.1 Key REEIO Assumptions; Baseline & Vision Scenario

Growth in key indicators	Baseline Scenario % per year	Vision Scenario % per year
Total GVA	2.1	2.8
Total Employment	0.4	0.7
Population	0.4	0.4

For both scenarios, the major growth areas both in terms of GVA and industrial productivity occur in manufacturing, electricity, gas and water production, construction, transport and communications, financial and business services. However, in an attempt to counterbalance increasing emissions resulting from such growth rates, both scenarios assume high annual energy efficiency improvements, as previously described in Sections 4.3 and 4.4.

5.3.2 Sustainable Carbon Trends Scenario

Context

The UK Government Energy White Paper identifies a target of reducing carbon dioxide levels by 60% by 2050, based on 1990 levels. However, to reach stabilisation of atmospheric levels of carbon dioxide the Royal Commission on Environment and Pollution (RCEP) has concluded that even higher reduction levels of up to 80% may be required by

⁴⁹ The underlying methodology has been described in detail by Wiedmann et al. (Thomas Wiedmann, Jan Minx, John Barrett, Mathis Wackernagel (2006). Allocating ecological footprints to final consumption categories with input-output analysis. *Ecological Economics* 56 (2006) 28-48).

2050. Beyond this, further reductions could be necessary to reach stabilisation by the end of this century.⁵⁰

The SCT Scenario provides a challenging vision and looks to identify a suite of measures that could move consumption based emissions towards the Royal Commission on Environment and Pollution target. This scenario is produced from 'working backwards' from an ideal policy landscape that will deliver significantly reduced emissions. It is recognised that funding and resource constraints may limit the ability of agencies to deliver on these measures. However, the analysis does provide an indication of the degree of policy change that will be necessary if there is to be any significant reduction in consumption based emissions and certainly provides a basis for regional debate and discussion.

The measures addressed include changes in resource efficiency, energy mix and consumption patterns. Past evidence suggests that simply relying on one of these options alone will not deliver the necessary emission reductions.

Resource Efficiency

Every time an industrial sector reduces its emissions per unit output this in turn reduces the impact of each consumption group. Every consumption category is affected by a change in one industrial sector as, indirectly, each consumption group relies on every industrial sector. The input-output table in REAP maps these relationships.

In terms of the analysis of consumption effects it is important to understand that any production efficiency improvements in the region do not necessarily reduce the impact of items consumed by residents in the region. This is because not every item consumed in the region is produced in the region.

However for the purposes of this modelling exercise the analysis assumes that the resource productivity gains that could occur in the Baseline Scenario are applied to the SCT Scenario (ie that the efficiencies we are assuming for the region apply to all areas outside the region from which goods are consumed). This approach is likely to over-estimate the impacts of any behavioural change.

Energy Mix

Due to the modelling constraints in REAP, the proportion of renewable energy in the Grid supply is adjusted separately to improvements in resource productivity. The SCT Scenario assumes efficiency gains in electricity supply of 1.5% per annum and that the proportion of renewable energy in supply increases to 30%.

Consumption Patterns

In terms of consumption effects, travel, housing and food typically represent more than 60% of total emissions. In order to achieve a reduction of the order of 60 to 80% dramatic behavioural change in the way we travel and heat our homes will be required. These changes are explored in the SCT Scenario with the key assumptions summarised in Table 5.2.

⁵⁰ The Royal Commission on Environmental Pollution's 22nd Report (<http://www.rcep.org.uk/newenergy.htm>). See also: C. Egenhofer, J.C. Jansen, S.J.A. Bakker and J. Jussila Hammes (2006). Revisiting EU Policy Options for Tackling Climate Change: A Social Cost-Benefit Analysis of GHG Emissions Reduction Strategies. Centre for European Policy Studies CEPS.

Table 5.2 Key Assumptions SCT Scenario: Consumption

Production / Consumer Category	Specific Consumption Area	Annual Growth / Technology Change Rate
Travel	Car (Distance travelled)	1.5% year reduction in distance travelled by car
Travel	Local Bus (Distance travelled)	Approximately a 1% annual increase
Travel	Train (Distance travelled)	Approximately a 2.3% annual increase
Travel	Car Occupancy	Increase of 1.6 to 2.5 people per car by 2021
Travel	Efficiency of Cars	1.2% annual increase in the carbon dioxide emissions per km travelled
Travel	Air travel (distance travelled)	0% growth in aviation
Housing	Energy Use	A 1.5% annual reduction in total energy use of households
Consumables and Services	All categories	0% growth in consumption
Food	Meat	Reduction in consumption by 1% a year and corresponding increase in other food categories
Food	All categories	Reduction in food wasted by 1% a year

5.4 Progress Towards Meeting Regional Greenhouse Gas Emissions Targets

As outlined in section 3.1.5 the regional strategies adopt interim targets for reducing greenhouse gas emissions are working towards meeting an overall target of 60% emissions reduction by 2050.

In terms of mapping this target there is currently no consumption related data available for the 1990 baseline. It is therefore assumed that between 1990 and 2003 carbon dioxide emissions associated with consumption have reduced by 7% (equivalent to the change in production based emissions). In reality the level of change in consumption emissions from 1990 is unlikely to be as significant as this. The REAP model identifies that regional carbon dioxide emissions⁵¹ were around 57 Mt tonnes in 2003. On this basis the targets presented in Table 5.3 have been identified.

It should be noted that SEI has recently secured funding from Department for Environment, Food and Rural Affairs (Defra) for a study to develop a time series of carbon dioxide emissions from 1992 to 2003. These should be available for the Yorkshire and Humber region later this year. This will allow a more accurate assessment of the baseline, from a consumption perspective, to inform target setting and measure progress.

⁵¹ From the key sectors Housing, Transport, Food, Consumer Item, Private and Public Services, and Capital Investment.

Table 5.3 Target Levels Carbon Dioxide: Consumption

Year	1990	2003	2010	2015	2021
Target			20% reduction (regional target)	25% reduction (regional target)	28% reduction (assumed to meet RCEP)
Value (m tonnes CO ₂)	61	57	49	46	44

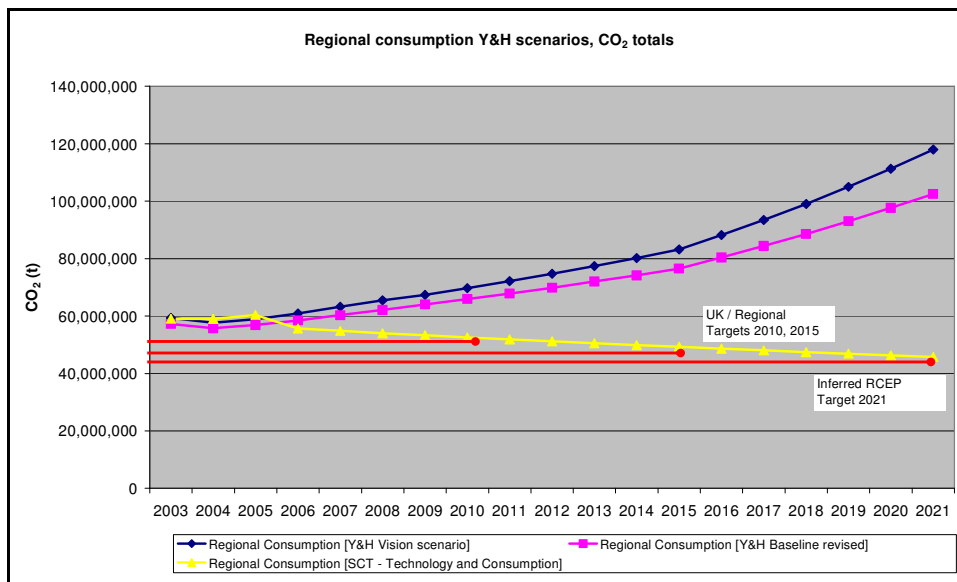
5.5 Total Carbon Dioxide Emissions

In the absence of any policy measures that address the reduction of greenhouse gas emissions, by 2021 carbon dioxide emissions will have increased by 79% in the Baseline Scenario. The impact of current regional strategies as reflected in the Vision Scenario will see carbon dioxide emissions increase by 99%, see Chart 5.1. This equates to an average increase over the period of between 4.4% and 5.5%. None of the regional greenhouse gas emissions targets are met under these scenarios.

In comparison, the SCT Scenario achieves a 28% reduction in carbon dioxide emissions. This scenario also achieves the regional and Regional Commission for Environmental Pollution targets, although it should be noted that the margin by which the scenario meets the targets is relatively small.

The Baseline and the Vision Scenarios both show a trend of increasing carbon dioxide emissions. From a consumption perspective this demonstrates that efficiency measures alone cannot support delivery of reduced carbon dioxide emissions. The result of just driving for resource efficiency, which in turn will increase economic output, will lead to an increase in household consumption with associated increases in emissions.

Chart 5.1 Total CO₂ Emissions (Annual)



5.6 Sector Emissions: Overview

Housing and transport are the principal sources of consumption based emissions. Looking at 2003 data, together they contribute to more than half of the total emissions from all

consumption categories, with the next largest categories being consumer items, services, and food, see Chart 5.2.

Chart 5.3 summarises all scenarios and projected changes for the regional CO₂ emissions. The most significant changes in relative terms under the Baseline and Vision Scenarios occur in the housing, transport, consumables and private services sectors. In both scenarios transport and housing emissions still account for greater than 50% of total emissions.

In the SCT Scenario the potential policy measures upon which it is based result in significant reductions in the impacts of housing and transport.

Chart 5.2 Principal Emission Sources

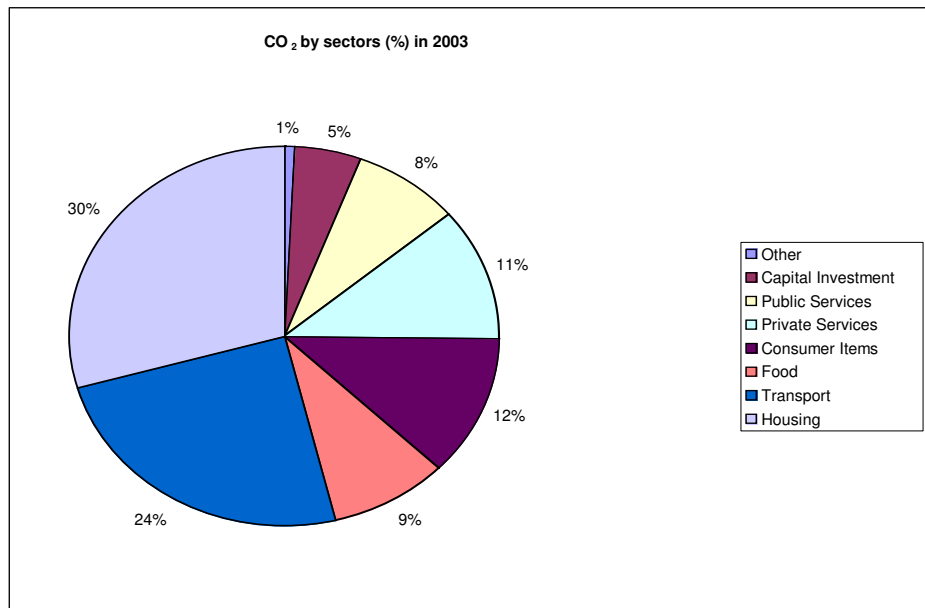
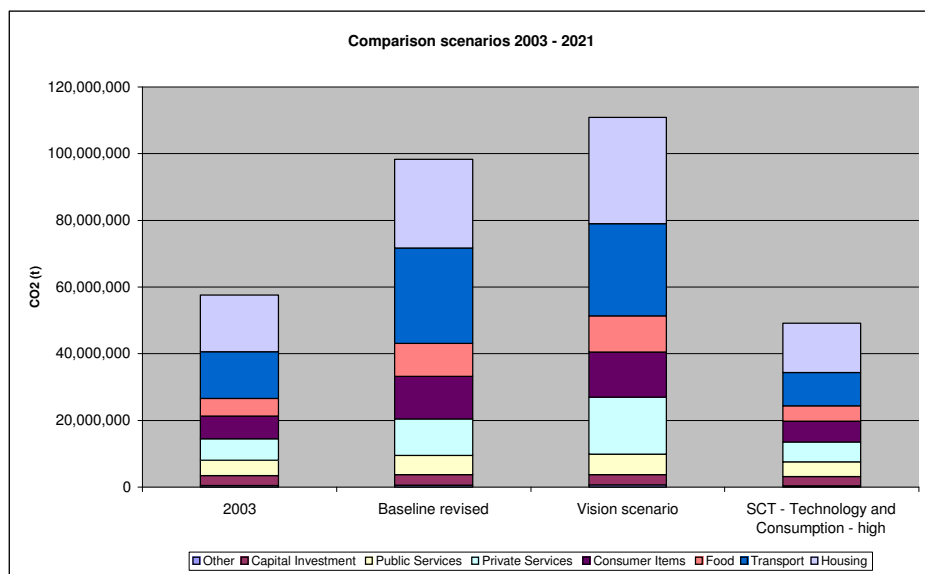


Chart 5.3 Categories and Projected Net Changes



5.7 Sector Emissions: Housing

5.7.1 Introduction

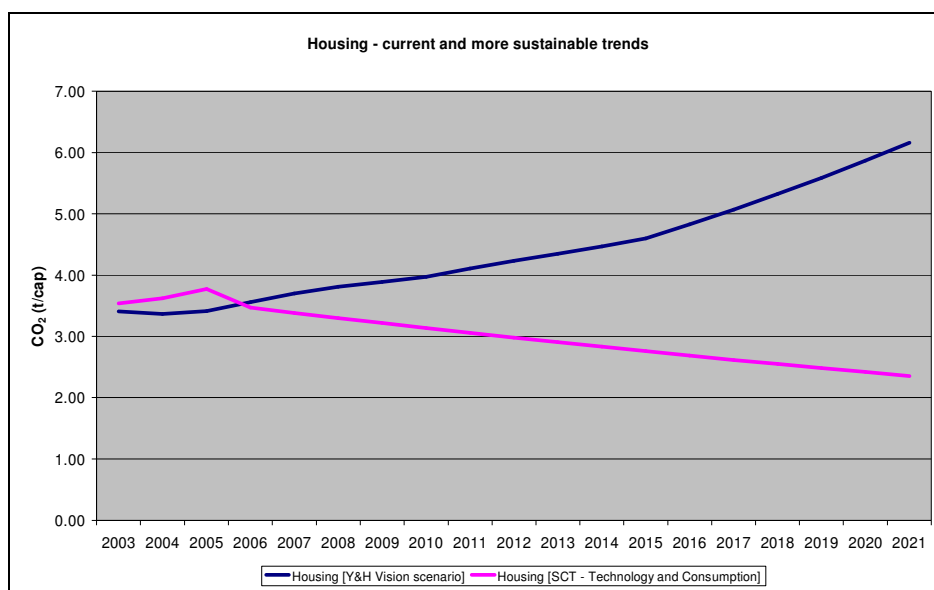
The following sections of the report examine the impact of behavioural change and policy on consumption based emissions. The analysis is based on an assessment of emissions of carbon dioxide per capita.

The REAP analysis identifies that current emissions in the region are of the order of 11.5 tonnes CO₂/person.

5.7.2 Housing

Housing currently represents over 30% of the region’s carbon dioxide emissions. Chart 5.4 provides a comparison between the Vision Scenario the SCT Scenario.

Chart 5.4 Housing Emissions; Vision and SCT Scenarios



In the Vision Scenario the econometric modelling assumes that there is a direct link between economic growth and energy demand by households. This assumption is based on historical evidence and there is no reason to suggest why this trend would not continue without the implementation of specific policies to tackle the issue. For the housing sector the model predicts an 81% increase in carbon dioxide emissions through to 2021, representing an average annual growth rate of 4% over the period. This scenario has taken into account improvements in the energy efficiency of new housing in line with the Code for Sustainable Homes.

The SCT Scenario shows a reduction in the carbon dioxide emissions of housing of around 44% per person equivalent, to an average annual reduction of 2.4%.

The principal assumptions of the SCT Scenario for housing are given below.

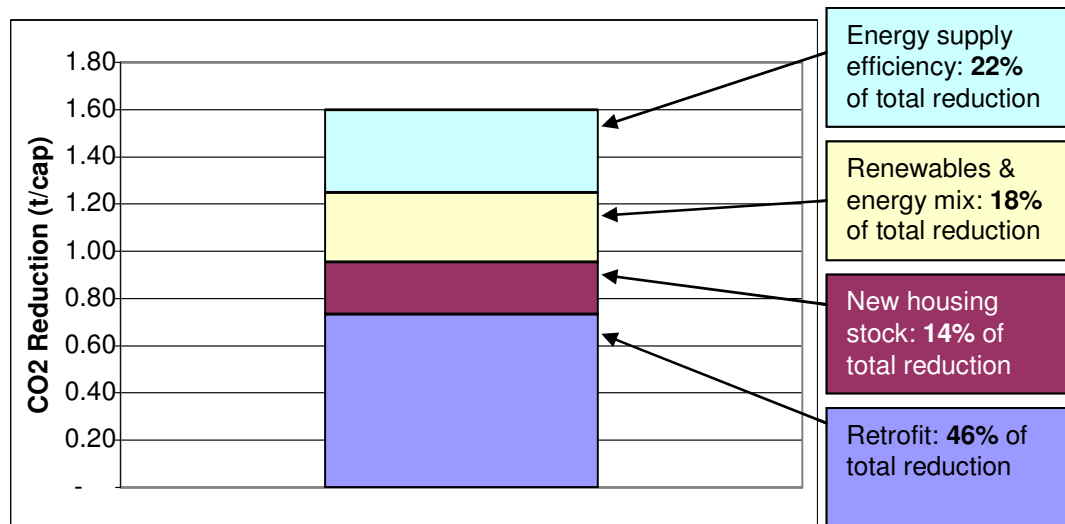
- **Energy supply efficiency;** assumed efficiencies in the sector of 1.5%, as discussed in Section 5.3.
- **Renewables and energy mix;** the modelling does not distinguish between on-site (or decentralised) renewables and renewables provided through the national grid. The scenario assumes that grid achieves a renewables contribution of 30% by 2021. This is a considerable growth from the present national level of under 2%. It is important to point out the difference between production and consumption of energy. This scenario is a “consumption” based scenario and therefore assumes that 30% of household energy demand is provided by renewables and not necessarily 30% of the region’s energy

production. It is also assumed that, in terms of the energy mix, space heating in the future will be provided mainly by gas and renewables and that oil and coal will be phased out. Therefore, the scenario assumes no increase in coal use and reducing demand for oil central heating systems.

- **New housing stock;** policy intervention primarily addresses the inefficiency of new housing stock. Over the 18 year period the scenario assumes that a 50% improvement in the energy efficiency of new buildings will be achieved. This accounts for a 3% a year improvement in energy efficiency. This assumption is in line with the Code for Sustainable Homes.
- **Retrofit;** work undertaken by SEI on the Leeds City Region demonstrated that improving energy efficiency in the existing housing stock was by far the most important factor in reducing carbon dioxide emissions. The assumption has been adopted that a minimum of a 50% reduction in the energy demand of an average house is achievable with a range of energy efficiency and retrofit measures. This assumption is based on an analysis undertaken by SEI employing Energy Saving Trust and BRE data, based on current technology, although there is a possibility that insulation technology will continue to improve and deliver further energy savings. The assumption of adopting current technology is justified by the fact that not all technologies can be installed in all housing types, for example cavity wall insulation in a single brick construction. In terms of the number of houses that need to targeted over the next 20 years it is assumed that a 50% reduction is achieved in 75% of the pre-2001 housing stock.

Overall, the above assumptions (or potential policy measures) give a reduction of 1.6 tonnes per capita by 2021. Chart 5.5 below highlights the relative impact each of these policies have on the total reduction of carbon dioxide emissions. The most significant reduction comes from retrofitting existing housing stock. Improvements in new build will only deliver around a 14% reduction due to the small number of new build houses when compared with the size of the existing housing stock.

Chart 5.5 Effectiveness of Policy Options: Housing



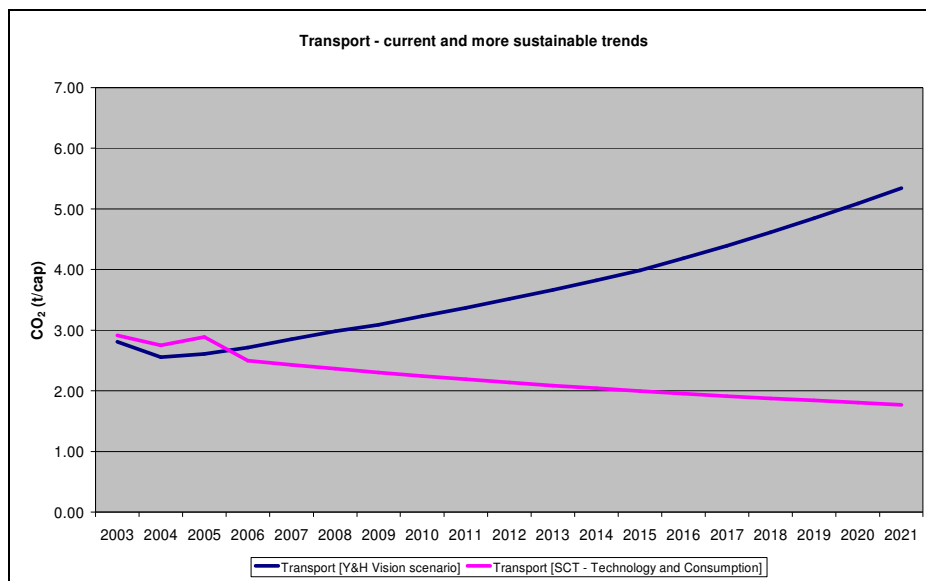
The analysis highlights the importance of targeting existing households to reduce energy use. In addition to the above interventions further reductions could be achieved through a behavioural change programme. It is estimated that activities, such as turning down the thermostat by 1 degree and ensuring that appliances are not left on stand-by, lead to a 15% reduction in carbon dioxide emissions.

As discussed previously the scenarios analysed do not aim to predict the future and there may be other external influences on consumer behaviour that have not be considered in this analysis. For example, energy pricing is a key driver influencing energy use and any significant changes to the pricing structure, will influence carbon dioxide emissions.

5.8 Sector Emissions: Transport

Transport currently contributes 24% of the region’s carbon dioxide emissions. A comparison between the Vision and SCT Scenarios is presented in Chart 5.6.

Chart 5.6 Transport Emissions; Vision and SCT Scenarios



Transport is one of the key consumer activities in terms of carbon dioxide emissions and the upward trend in emissions from personal travel in the Vision scenario reflects wider national trends. Under the Vision Scenario the model predicts a 90% rise in carbon dioxide emissions by 2021, equivalent to emissions of 5.3 tonnes per capita associated with transport alone. To achieve the levels of overall carbon reduction outlined in the UK Energy White Paper by 2050 the region will need to reduce total emissions to about 5 tonnes per capita. Therefore if transport emissions are left unchecked they would represent all of the emission “allowance” for the region.

The SCT Scenario delivers a 35% reduction in transport carbon dioxide emissions. The principal assumptions (or potential policy measures) behind this scenario are listed below:

- **Car efficiency**; improving through to 2021 as suggested by the Department for Transport.⁵²
- **Car occupancy**; increasing from 1.6 to 2.5 people per car. This assumes that, on average, 50% of cars will be full. The national trend currently points in the opposite direction with continuing reductions in car occupancy. The greatest area of concern is commuting, where in some areas of the UK the occupancy rate is as low as 1.1.
- **Total distance travelled**; in 2001 the average resident in the Yorkshire and Humber region travelled 9936 kms. National car use is forecast to rise by between 12% and 20% over the decade ending 2010.⁵³ For the purposes of this analysis it is assumed that, by 2021, the average person in Yorkshire and Humber will travel 6,630 kms per year, a

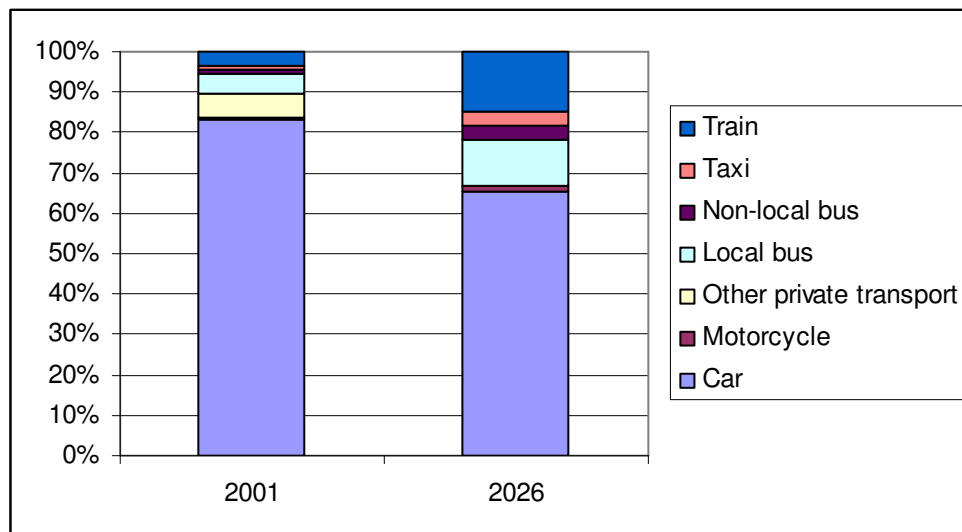
⁵² DfT Online Statistics

⁵³ National Travel growth forecasts. <http://www.transwatch.co.uk/transport-policy.htm>

reduction of 35% in the overall distance travelled. This equates to a year on year reduction of 2%.

- **Modal shift;** Chart 5.7 describes the suggested modal shift by 2021 in comparison to the baseline.

Chart 5.7 Transport: Modal Shift



% Change form 2001 to 2021: Car = -21%, Bus = 230%, Train = 450%

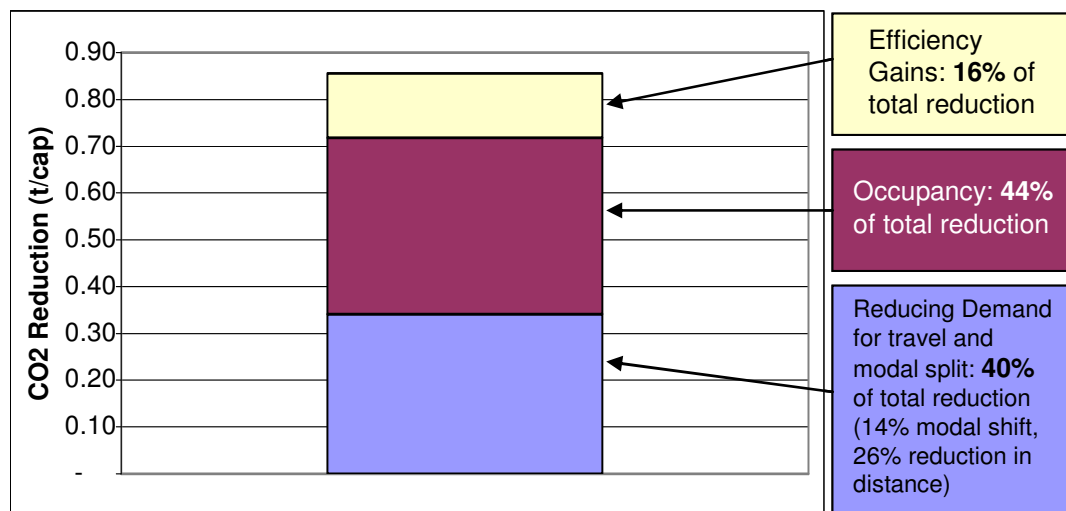
Overall, the assumptions above give a reduction of 0.85 tonnes per capita by 2021. Chart 5.8 highlights the relative impact each of these policies have on the total reduction. Relying on efficiency improvements alone will only deliver around 16% of the overall reduction. The remainder requires behavioural change in terms of either the mode of transport or the distance travelled.

5.8.1 Aviation

The consumption analysis includes the impacts of aviation associated with travelling for business and holidays. Under the Vision Scenario the analysis shows that the per capita impact, included in the transport figures above, will increase from 0.45 t of CO2/cap to 0.5t of CO2/cap. Under the Vision Scenario therefore, with increased growth in other elements of transport the relative contribution from aviation decreases from around 15% to 10%.

Under the SCT Scenario, assuming 0% growth in aviation, the relative contribution of aviation will increase from 15% in 2003 to nearer 25% of total transport emissions.

Chart 5.8 Effectiveness of Policy Options: Transport



5.9 Sector Emissions: Food

The food we eat, and the way it is produced and manufactured, has a significant impact on health, the environment, and the economy. Figures from England, Scotland, and Wales reveal that obesity and associated diseases are increasing rapidly.⁵⁴ At the same time, treating diet-related illnesses costs the NHS at least £2bn each year.⁵⁵ Yet a healthy diet provides all the nutrients that are essential for avoiding disease and for achieving general wellbeing. A healthy food selection consists mainly of fruit and vegetables, wholegrain products, potatoes, legumes, milk and dairy products, nuts and seeds.

Research by SEI and others has shown that a healthy diet is also good for the environment. A healthy diet that follows nutrition recommendations can reduce carbon dioxide emissions and Ecological Footprint by between 15 and 25% when compared to average UK eating patterns, even up to 40% if the food is vegetarian, organic, and sourced locally.

In the SCT Scenario a number of assumptions have been adopted that will lead to a change in either the tonnage of food purchased or the composition of an individual’s diet. While it may seem beyond the scope of regional policy to affect what people in the region eat, it may be possible to consider linking a reduction in carbon dioxide emissions from food with campaigns for healthy eating.

There are also significant opportunities to reduce the amount of food that is wasted, past analysis undertaken by SEI shows that approximately 15% to 20% of all food purchased is never eaten and is thrown away. In addition new research by WRAP (Waste & Resources Action Programme) has revealed that households in the UK throw away 6.7m tonnes of food every year, accounting for around a third of all of the food we buy.

The principal assumptions in the SCT analysis are:

- Efficiency gains in the agricultural sector have been taken into account. From 2006, it is assumed that agricultural output will improve by an efficiency rate of 2.6% a year.
- Adjustments have been made to diets assuming meat consumption reduces by 1% a year.

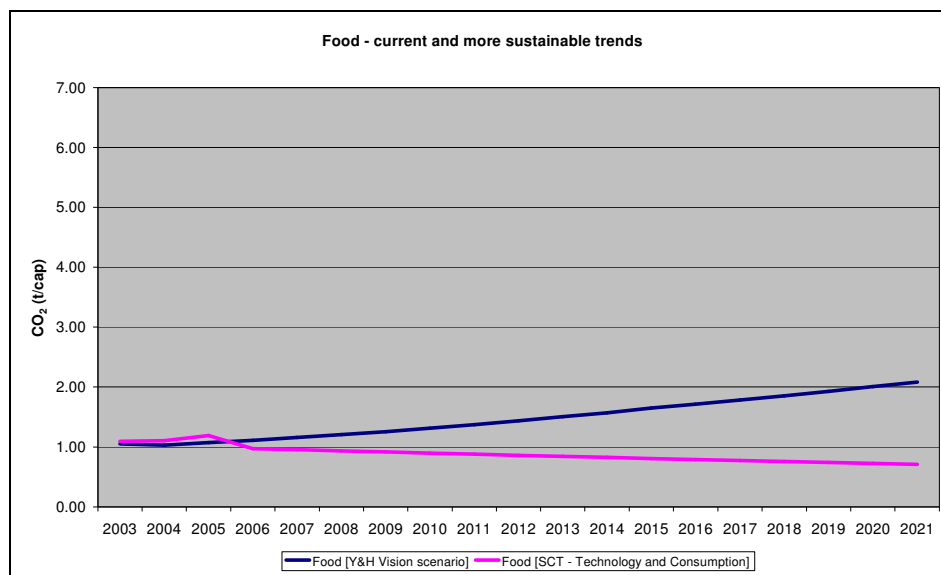
⁵⁴ NHS Health and Social Care Information Centre (2005)

⁵⁵ British Heart Foundation (1998). Coronary heart disease statistics: economic supplement. www.heartstats.org

Combined with a healthy eating strategy, there is no reason why regional policy could not play a part in bringing about more healthy and sustainable behaviour. The potential results are shown below, Chart 5.9.

The Vision Scenario demonstrates that an increase of approximately 98% or 4% per year on average in carbon dioxide emissions associated with food is likely to occur by 2021. The SCT Scenario identifies a potential reduction of approximately 40% (around 2% a year on average).

Chart 5.9 Food Emissions: Vision and SCT Scenarios



5.10 Sector Emissions: Consumables and Services

Under the Vision Scenario, average growth in the consumables and service sector is 4% per year. The only reduction achieved in these sectors is resource efficiency along with a stabilisation in the level of impact from consumables and services, see Charts 5.10 and 5.11.

In the SCT Scenario for consumables and services it was assumed that increase in prices will go hand in hand with an increase in salaries. Hence, there would be no increase in the environmental impact per pound spent but given the underlying efficiency improvements, overall carbon dioxide emissions would level or decrease. This, however, does not take into account the *rebound effect* which could lead to overall increasing emissions as efficiency gains are spent elsewhere. (For example, because fewer resources are being used to produce a mobile phone and it therefore becomes cheaper, the money saved would be spent on something else).

Chart 5.10 Consumables Emissions: Vision and SCT Scenarios

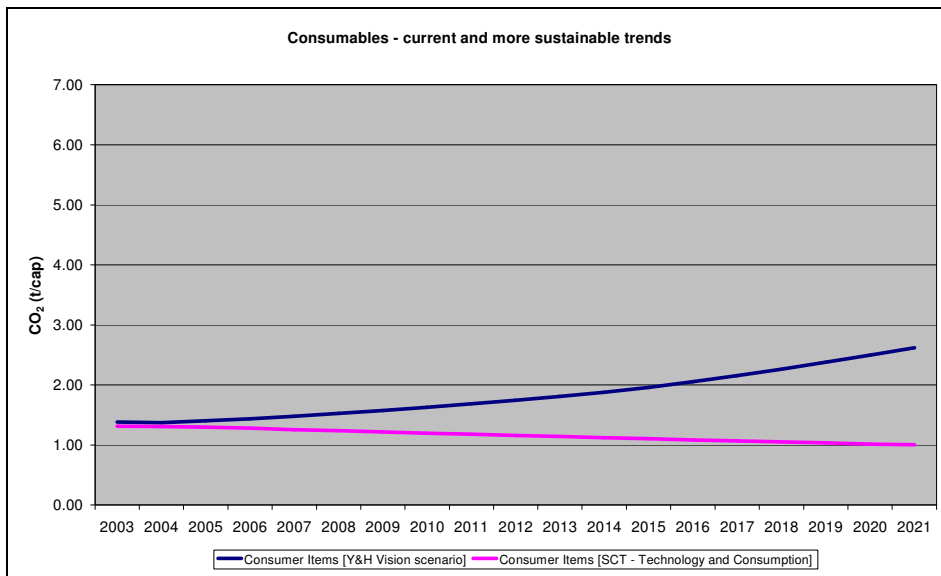
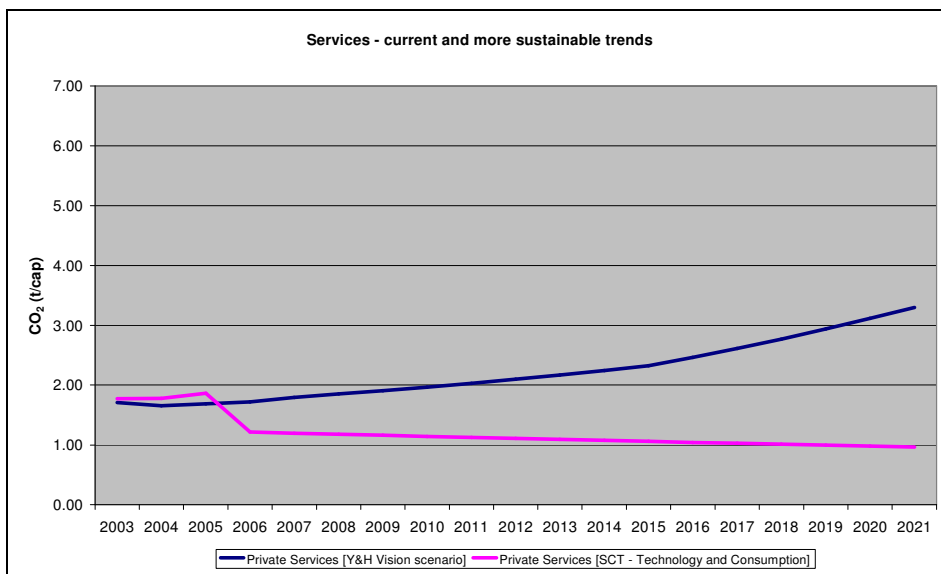


Chart 5.11 Services Emissions: Vision and SCT Scenarios



5.11 Margins of Error

As previously stated, no scenario provides an accurate forecast of the future, but instead provides a coherent story of the future based on a set of assumptions. The scenarios cannot take into external changes that could affect the region significantly. For example, if energy prices were to double tomorrow this would undoubtedly effect household energy consumption.

In terms of the SCT Scenario a “margin of error” has been generated that suggests the reduction of consumption related greenhouse gas emissions will be between 27 and 34%. This was generated by assuming different levels of technological change over the next 20 years. An annual review will help to add more precision to these figures over time and it is suggested that REAP is used to refine the analysis and therefore understand the reduction that regional strategies are achieving with increasing accuracy.

6 Effectiveness of Current Regional Strategies in Addressing Climate Change

KEY POINTS

- Current regional strategies will not deliver a sufficient reduction in greenhouse gas emissions to meet regional targets. They also have a fairly fragmented approach to addressing the need to adapt to climate change.
- This section identifies a number of issues which potentially limit the region's ability to address climate change through its current regional strategies. These include:
 - A lack of a clear and definitive regional greenhouse gas emissions target.
 - An incomplete understanding of the impact of climate change on mainstream policy objectives.
 - A need to broaden the emphasis of climate change related policy.
 - A need to make strategy alignment even tighter and more consistent, with a view to the longer term in relation to climate change.
 - A need to ensure effective implementation and delivery of policy that will help to address climate change.
 - A need to both influence and understand the wider implications of the national climate change agenda on Yorkshire and the Humber.

6.1 Introduction

This study has adopted an innovative approach, seeking to examine both production and consumption related greenhouse gas emissions, as well as the region's approach to adapting to a changing climate.

This section draws together the analysis undertaken in Sections 2 to 5 to identify the key issues which both affect the ability of regional strategies to address climate change and represent the challenge for future strategy development.

The recommendations outlined in Section 7 aim to set out a pathway to help the region overcome these issues and prepare for the future climate change challenge.

6.2 Recap: How Effective Are Current Regional Strategies?

This report demonstrates that current regional strategies will be able to achieve stability of **production** related greenhouse gas emissions up to 2021, but this will not be enough to meet a 20% reduction in overall greenhouse gas emissions by 2010 and 25% by 2015. This region is a net exporter of energy generating capacity. If power generation is removed from Yorkshire and Humber's production related greenhouse emissions then the target can almost be met, but only for a short time period before emissions are likely rise again.

The current regional strategies are long way off from both stabilising **consumption** related emissions and achieving a 20% to 25% reduction in consumption related emissions by 2015. Section 5 indicates the scale of change and types of policy measures that could stabilise consumption related emissions and this is a very different policy landscape to what exists in current regional strategies.

The current regional strategies have a fairly fragmented approach to addressing the need to **adapt** to the impacts of climate change, particularly over the longer term. The link between other policy objectives and the need to adapt to climate change is not always made. The

emphasis has been on building capacity. The region is cautious about moving forward towards implementing adaptive action without a stronger national steer and more secure resources.

6.3 Factors which Limit the Region's Ability to Address Climate Change

6.3.1 Issue 1: Lack of a clear and definitive regional greenhouse gas emissions target

A target seeking to reduce greenhouse gas emissions was introduced in the 2003 Regional Economic Strategy. This was mirrored in other regional strategies, but not always consistently, as some strategies include interim or longer term milestones to the target. The 2006 Regional Economic Strategy revised the original target. This new target differs from those included in other regional strategies as it seeks to reduce greenhouse gas emissions "*based on modelling of energy/resources consumption attributable to Y&H*". This means that the factors that should be taken into consideration when measuring the original and 2006 targets are very different

In summary there is no definitive regional target. Targets have been introduced, mirrored and evolved over the respective review cycles of superseded and current regional strategies, but there is no overall consistent target across all regional strategies. This makes measuring the contribution of all regional strategies towards reducing greenhouse gas emissions more difficult. A definitive target in one overarching strategy would enable the contribution of specific regional strategies to meeting that target to be mapped and therefore potential gaps identified and filled.

The 2006 Regional Economic Strategy makes the link to address consumption patterns. However, other regional strategies are not prepared for this challenge. Where they do acknowledge the need to reduce emissions, stronger policy directions are focused on production related measures to address a uniform target. Reducing greenhouse emissions to meet this target will require significant change in consumption patterns, many of which are outside the 'comfort zone' of current regional strategies. Therefore, the significance and importance of this target needs to be more deeply engrained in policy making.

Measuring performance against this target at the current time may also be a challenge as the 1990 baseline information for consumption related greenhouse gas emissions is not yet known.⁵⁶ It is important to monitor performance on a regular basis in order to understand how the region is progressing towards meeting the target. Some initiatives take time to move from concept to operation and hence contribute to the target, so 'blockages' in implementation if identified early through monitoring, can be resolved with a lesser impact.

Reporting against both the carbon targets (The draft Climate Change Bill) and carbon performance trajectory (Draft Supplement to PPS1) is likely to place a greater expectation on the regions to collect data and measure performance effectively. This would also enable the government to scrutinise regional results.

Whilst reducing consumption related emissions will be increasingly important component of reducing overall greenhouse gas emissions, there is still a role for continuing to reduce production related emissions, particular in the sectors with less of a policy emphasis (e.g. transport). Production and consumption related emissions cannot be simply added together, but a separate target for both may be beneficial.

⁵⁶ Although this will be available by the end of 2007. The Stockholm Environment Institute is currently retrospectively determining 1990 consumption related greenhouse gas emissions for Department for Communities and Local Government.

6.3.2 Issue 2: Incomplete understanding of the impact of climate change on mainstream policy objectives

The implications of climate change in this region and a profile of greenhouse gas emissions and the sectors which contribute was established through research undertaken 2002. The first region based greenhouse gas emissions target was established in the 2003 Regional Economic Strategy.

All of the current regional strategies were drafted, or at minimum partially revised post 2002. However, whilst they demonstrate understanding of climate change as a challenge facing the region, not all regional strategies translate this into a strong policy direction or understand how the implications of climate change could impact both positively and negatively on the achievement of other policy objectives.

This could be for a number of different reasons. The 2002 research was primarily undertaken as evidence to inform development of the Regional Economic Strategy. It may not have necessarily been applied to the development of other strategies. Conversely, at that time, the wider implications of the research may not have been as well understood by policy makers.

The inter-agency working relationships and joint use of evidence is now much improved in this region. The membership of the Climate Executive Group is a good example of a wider range of different agencies working successfully together.

There is still a risk however, that climate change is perceived as a specialist domain to be discussed by representative technical experts or bodies with a knowledge base or keen interest to respond (i.e. the Environment Agency, Friends of the Earth or the Yorkshire and Humber Environment Forum). These experts and bodies can impart very valuable knowledge and experience, but the region should not hide behind them. Climate change will have social and economic implications; it is not just an environmental issue. It should be ingrained in wider policy making. The evidence base and research relating to climate change needs to be translated, communicated and used in a manner appropriate for broader understanding and wider policy application. This will aid the next round of regional strategies to both make a stronger contribution and understand implications for mainstream policy objectives.

6.3.3 Issue 3: Identified need to broaden the emphasis of climate change related policy

Greenhouse gas emissions can be production or consumption related and derive from a number of sectors. Where current regional strategies have sought to address greenhouse gas emissions and the impact of climate change, this has resulted in providing strong policy direction but only to a limited number of sectors. These are usually aligned with sectors to which national government has also provided a stronger policy direction.

Whilst this has made an important contribution, it is not enough to meet regional greenhouse gas emission targets from either a production or consumption perspective. In addition, the regional strategies have not reflected all of the areas of potential adaptation that will affect this region.

To deliver a step change, a similar level of emphasis is required to tackle production or consumption related greenhouse gas emissions other sectors or require adaptation. These include the more challenging areas of transport (from a production, consumption and adaptation perspective), households, public and private services and food (from a consumption perspective), sea level rise, water resources and agriculture (from an adaptation perspective).

This will be a challenge. Sectors where regional strategies have a weaker policy direction are usually sectors where national guidance is either lacking or not definitive. This may be

for a number of different reasons. Addressing emissions or the need to adapt in certain sectors could be politically sensitive as a compromise with other objectives, often economic growth, is perceived. Alternatively, it could require a steer or action beyond the traditional or defined remit of current regional strategies and the mechanisms to initiate this may not be in place.

Addressing the challenge that managing the climate related implications of these other sectors presents to the region, particularly with a lack of a strong national steer will require confidence and joined up leadership to develop a joined up regional approach (both in terms of consistent strategy development and messages from respective regional bodies). Developing a shared research and evidence base to inform what action the region can take will be a useful starting point.

6.3.4 Issue 4: Regional strategies should be aligned more closely and be more consistent, with a view to the longer term

The review cycles of particular regional strategies are often driven by external influences (such as revised national legislation, statutory requirements and funding streams) and are therefore not always aligned. The time periods to which different regional strategies look forward can also vary considerably. In practical terms this makes presenting a consistent message across all regional strategies more difficult to achieve.

Advancing Together and the Regional Sustainable Development Framework currently act together to provide a consistent set of objectives and a sustainability appraisal framework for all regional strategies. However, it is sometimes the case that regional strategies reflect the Advancing Together objectives that align more closely with the strategy's own principal aims rather than the full suite of objectives. Whilst this is not a significant issue in itself, it does demonstrate how an issue such as climate change, which requires a broad and comprehensive approach and has implications across a wide range of sectors, can be 'missed' by some strategies.

The emerging Integrated Regional Framework presents an opportunity to redefine and mainstream the region's key objectives, to ensure that all objectives are considered appropriately across the suite of regional strategies.

Climate change is an issue that will have greater impact in the medium to long term, but requires action in the short term to manage the scale and magnitude of that impact. The time periods of many regional strategies only look 5 to 10 years ahead. This leads to a focus on shorter term actions and does not lend well to building up 'layers' of action to reduce greenhouse gas emissions and adapt to climate change. A longer term view is particularly important for the delivery of adaptation measures as it can take time for a scheme to be either implemented (e.g. design and construction of flood defences) or to be fully effective at the time it is needed (e.g. planting of trees now to limit soil erosion in the future).

Issue 5: Effective implementation and delivery are essential

This report demonstrates that although the targets, policy, aims and objectives of current regional strategies will not deliver a sufficient reduction of greenhouse gas emissions to meet the regional target, they will still have a positive impact on emissions, which is preferable to a baseline, or no policy position. However, the key to delivering this positive impact is the successful implementation of policy.

It is more of a challenge to deliver the outcomes of a strategy when a strategy is not supported by funding or where implementation is not a statutory duty. In such circumstances efforts tend to be focused on building capacity, such as through working groups and forums, with actions tailored to the limited resources available. Building knowledge and capacity is important, but there comes a time when it is prudent to move towards delivering action.

Even if there is funding available or a statutory duty to deliver certain strategies, successful implementation is not necessarily guaranteed. Barriers to implementation can include:

- a lack of a consistent message across regional strategies;
- public and political acceptance at regional and local level;
- limited funding or constraints over how funds can be used; and
- technological and practical issues (for example, wind turbines are restricted in many parts of the UK due to aviation and MOD exclusion zones).

These can all impact on the time it takes to move from concept to operation and therefore the point in time at which policies will actually deliver results and make a contribution to reducing greenhouse gas emissions or implementing adaptive action.

Monitoring performance is an essential component of understanding the delivery pipeline and understanding what barriers are making an impact. This region does take positive steps to monitor how the regional is performing through Progress in the Region and whether the outcomes of the Regional Spatial Strategy are being delivered through the Regional Spatial Strategy Annual Monitoring Report (amongst others).

However, it is crucial that what is learned from monitoring performance is fed back to policy makers to help to identify if any actions can be taken either to improve a particular policy, address alignment between multiple regional strategies dealing with a single issue or leave public and political support and additional funding if necessary.

Successful implementation of regional strategy objectives can also be achieved though how the public sector procures goods and services. For example, Yorkshire Forward usually requires that development schemes on land within their ownership to meet the BREEAM Excellent standard. In addition, a recent study undertaken on behalf of Yorkshire Futures has examined the draft Programme for European Regional Development Funding (ERDF) in the region from 2007-13 and assessed what the carbon impacts of the programme might be, together with whether those impacts could be reduced or removed. The study concluded that the carbon impact of the Programme can be reduced by (amongst other measures) stipulating clear requirements in grant offer letters to beneficiaries under the new Programme and setting aside funds to provide advice and guidance to enable beneficiaries to meet those requirements.⁵⁷

6.3.5 Issue 6: There is a need to both influence and understand the wider implications of the national climate change agenda on Yorkshire and the Humber

Climate change is a global issue and the national government is, with increasing frequency introducing new legislation and policy relating to addressing climate change. Some of this policy will have greater implications for the Yorkshire and Humber region due to its particular characteristics. Regional bodies can both influence this national policy development and highlight the impact it may have on the Yorkshire and Humber Region, both to national government and to regional policy makers. This will be most effective if the regional bodies have a sound grasp of the issue and represent a consistent message.

⁵⁷ Carbon Assessment of the Draft ERDF Programme, Arup on behalf of Yorkshire Futures, 2007.

7 Moving Forward – Recommendations

KEY POINTS

- Climate change will impact across social, economic and environmental agendas and the future challenge is to make it an inherent part of policy making in the region.
- Joined up leadership, a stronger regional evidence base and wider communication and dissemination of the implications of that evidence base, along with measuring performance more smartly and developing a consistent programme over the longer term will all help the region to be in a stronger position to address the challenge of climate change in the future.

7.1 Introduction

This section sets out a number of recommendations which aim to set a pathway to help the region to overcome the issues identified in Section 6.

7.2 The Future Challenge

There is a need to adapt to the inevitable consequences of past and current greenhouse gas emissions. There is also a need to continue to reduce current greenhouse gas emissions to minimise the scale and magnitude of these consequences.

This is a challenge for regional policy making in that it requires action now against an issue where the full effect is not yet visible, in order to yield results in the longer term. Regional policy making to date has predominantly focused on very visible issues and particularly in the north, how to resolve these issues to deliver more prosperous and better performing regions in the future.

However, climate change will impact across social, economic and environmental agendas. It will therefore inevitably affect how the Yorkshire and Humber Region can achieve its primary objectives. The challenge is to make consideration of climate change an inherent part of policy making and approach the issue with confidence, rather than treat it as an 'unknown quantity' to be discussed by experts. The region should be certain it is in the best possible position to manage both the positive and negative impacts of climate change and still achieve positive change in terms of its other key regional objectives.

7.3 Recommendations

7.3.1 Recommendation 1: Joined up leadership on climate change

The organisations that are leading the delivery of regional policy (Yorkshire and Humber Assembly, Yorkshire Forward and Government Office for Yorkshire and the Humber) must provide and exert the resources, leadership and influence to join up policy and delivery across a wider range of organisations and strategies to address climate change.

This joined up leadership should seek to develop a consistent message, which is understood throughout the structure of their respective organisations to ensure that acknowledgement of the climate change issue and its potential implications for the region is translated through to actual policy making and importantly, delivery.

This joined up leadership should also seek to take a consistent message to the national arena, to both exert influence on policy development and relay the implications of particular policy instruments on the Yorkshire and Humber Region's ability to address climate change.

This joined up leadership also has the ability to demonstrate commitment to addressing climate change through how regional bodies operate, procure services, provide funding and seek to influence the public, private and voluntary sectors.

It is acknowledged that organisations in this region are already making positive steps to achieve this recommendation, however leadership behind a clear and consistent message is key.

7.3.2 Recommendation 2: Develop a joined up and stronger regional evidence base on climate change

Regional organisations have been collecting information and undertaking research to understand how climate change will affect the region and also understand the region's profile of greenhouse gas emissions for a number of years.

There is a need to consolidate this information and also understand as a whole what it means for the region. This will enable gaps in knowledge to be ascertained for further research and ensure that research undertaken is of benefit to a wider range of regional strategies. It will also provide a useful tool for debate around the implications of climate change for Yorkshire and the Humber which is an important element of the policy making process. The evidence base needs to cover both production and consumption related emissions and understand the linkages between the two.

A framework for providing a shared evidence base was established for the production of the Regional Spatial Strategy and Regional Economic Strategy. The lessons learned from this process⁵⁸ can be applied to developing an efficient system of collecting and understanding the implication of evidence to inform the region's approach to addressing climate change.

7.3.3 Recommendation 3: Wider communication and dissemination to policy makers and stakeholders about climate change

There is a need to make climate change an inherent part of policy making if this region is going to achieve a comprehensive approach to addressing the issue, both in terms of regional strategies and the culture of policy makers.

Wider communication and dissemination with policy makers will help to demystify the myths associated with climate change and help to make it a more manageable issue that can be related to other policy objectives.

Wider communication and dissemination is also an opportunity to bring together 'Yorkshire and Humber's response to climate change' by sharing knowledge, experience and related activities.

7.3.4 Recommendation 4: Measuring and scrutiny of performance

Implementation and delivery of policy is just as important as having the right type of policy in the first place. Measuring performance is not just about collecting information. It is also important to use this information to identify issues that may impede policy implementation and feed it back into refinement of policy to ensure the desired outcome is achieved.

Progress in the Region monitors the performance of the region against the objectives of Advancing Together and provides a very comprehensive profile of the region. As part of developing the draft Regional Spatial Strategy an outcome focused monitoring framework was devised.⁵⁹ Both the revised Regional Spatial Strategy Monitoring Framework and the reshaping of Progress in the Region to align with the emerging Integrated Regional Framework, provide the opportunity (if both are in turn well aligned) for the region as a

⁵⁸ Evaluation of the Process used to Develop the Regional Spatial Strategy, Arup on behalf of Yorkshire and Humber Assembly, April 2007.

⁵⁹ Developing a Monitoring Framework for Yorkshire and the Humber: RSS Monitoring Approach EIP Background Paper 5, Arup and Jacobs Babbie, 2006

whole to be smarter at monitoring issues which may impact on the region's ability to address climate change. This will also importantly, help to establish an effective 'feedback loop' highlighting areas which are not working and enable policy makers the opportunity to respond.

To address regional strategies which do not have a monitoring or implementation requirement, action against their recommendations can at times, slip from programme or be more difficult to deliver. Regular scrutiny of the delivery of these strategies could be a mechanism to ensure they stay on track, including finding ways to overcome difficulties.

7.3.5 Recommendation 5: Developing a pathway through a challenging policy landscape to address to climate change

Climate change is an issue that requires action now to minimise the magnitude of the impact in the longer term. However the time periods of regional strategies and their respective review cycles limits the ability to take a consistent long term view.

It is recommended that a framework aligned with the Integrated Regional Framework is set out to guide the region's long term approach to addressing climate change. This should be an essential reference for regional strategies when they are reviewed to ensure a consistent and cumulative approach to addressing climate change.

The framework would also enable debate and discussion about the more challenging policy measures that can reduce consumption related greenhouse gas emissions highlighted in Section 5.

The framework should:

- Sets a consistent target for the reduction of greenhouse gas emissions in the region.
- Identify the tools that will be required to meet this target and set a programme of actions to ensure that the region develops these tools.
- Cover both mitigation and adaptation.
- Set climate change within a framework of other regional economic, social and environmental issues, and the different scenarios for the region's future more broadly.
- Ensures the region stays on track in meeting its target and can proactively react to new information about the impacts of climate change and the introduction of new national legislation and guidance.
- Be subject to regular review and scrutiny.

