GRIP

The Greehouse Gas Regional Inventory Project

Focus North West

The GRIP approach to emissions inventory generation.

A GHG inventory for the North West of England for year 2000.

Four stakeholder derived energy focused scenarios for 2050, backcast to 2020.

grip

foreword

With all the media attention these days, we don't need to remind people that climate change is a serious problem. The Prime Minister has put it at the top of the agenda (with Africa) for his Presidency of the EU and as host of the G8. But what do we have to do? And is there anything that we should do now?

In comparison with other regions, we are fortunate in the Northwest. There are many public bodies actively looking at the region's approach to both mitigation (reducing greenhouse gases) and adaptation - adapting to the inevitable increases in temperature, winds and winter rainfall, and the reduced summer rainfall. These include the Development Agency, the Regional Assembly, councils like Manchester, and the Environment Agency. All are beginning to take appropriate actions. In addition, we have independent organisations like the NW Climate Group and the Tyndall Centre continually pushing at the boundaries of 'what it all means for us in the NW'.

Government scientists say that we have to reduce greenhouse gases (mainly CO_2) by at least 60% by 2050. Against the increase we would expect from 'business as usual', that means reducing greenhouse gases to no more than one-fifth of the amount that would be emitted if we took no action.

Some of the necessary actions will be up to governments – national, regional and local – and big business, like car makers and electricity generators. But we must be involved, when we look at buying a large car against a smaller efficient model, when using that car instead of travelling by bus or train, or when using the tumbler dryer instead of hanging out the washing. And if we oppose a local wind farm, would we rather have a nuclear power station next door, or are we going to give up the car and go by bike and train?

We are indebted to Sebastian Carney, and to the Tyndall Centre and the Environment Agency, for giving us GRIP (Greenhouse Gas Regional Inventory Project). It enables us to see what we have to actively support, and how we have to change our behaviour.

The future depends on us.

Derek Norman
Chair, NW Climate Group and Chair, NW Regional Environment Protection Advisory Committee for the Environment Agency

It is now widely accepted by scientists that global warming is happening, and that this warming will bring about a change in our climate. With this change in climate will come an impact on how and, potentially, where we live our lives over the coming decades.

In the UK a programme of devolution is underway with greater powers and autonomy being given over to regions and localities. With this comes a responsibility for policy makers to embrace policies that encourage an adaption to climate change or aid its mitigation. The Energy White Paper stipulated that the Government was committed to the target of a 60% reduction in carbon dioxide emissions by 2050 as put forward by the Royal Commission of Environmental Pollution (RCEP). The White Paper also outlined a commitment for this reduction to be delivered via the regions.

To facilitate the North West's responsibilities with respect to the White Paper, GRIP initially developed a methodology for establishing GHG (Greenhouse Gases) emissions and subsequently a GHG inventory for the year 2000, by determining emissions from the energy, industrial process, waste and agriculture sectors. GRIP then brought added value to the process by using the collated data, in concert with detailed understanding of the energy system both in and outside the region, to develop a tool that can assess future emissions reductions and policy determinations. This research takes forward the first ever regionally focused report on climate change, carbon counting, which was carried out in the year 2000.

In short, the North West has benefited from four GRIP-derived deliverables to aid understanding of and obligations arising from the challenge of minimising GHG emissions:

- A methodology for calculating emissions at the regional scale;
- A GHG emissions inventory for the year 2000;
- A methodology for establishing emissions associated with potential future energy systems; and
- Four stakeholder generated scenarios outlining potential energy futures for 2050, backcast to 2020.

The GRIP developed scenario process has attempted to faithfully measure the views surrounding progress to date, and potential progress, on the mitigation of greenhouse gases within the energy sector. The scenarios were generated by a process of continual stakeholder engagement. These stakeholders have included: policy makers, local councils, industry representatives, academics and NGOs. For the scenario process alone in excess of 40 interviews were conducted culminating in a workshop attended by more then twenty individuals.

Sebastian Carney
Project Director
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The North West was the first region to produce a GHG inventory at the Government Office regional scale. Since then its lead has been followed by all the other English regions. These inventories have been carried out by a range of organisations that have included consultancies, academics and development agencies themselves.

As a consequence of the broad spectrum of organisations engaged in inventory compilation has come a breath of different approaches to calculation. Several fundamental discrepancies within the inventories have been noted, examples of which include regions that have manipulated boundaries to exclude emission sources, and others taking differing views when assigning emissions from the generation of electricity, attributing them to either the location of the power station (source) or the area where the electricity is consumed (end user). Some approaches engage detailed data sets, whereas others employ a purely top down approach to inventory development – where national data is disaggregated to the regional scale by using an appropriate scaling factor, such as population.

These basic inconsistencies are magnified by disparities in the availability of relevant data, the accessibility of data sources and the depth of understanding regarding GHG emissions and sources.

The upshot of these differing approaches is a high level of mistrust in the resultant emission figures and inventories. These disparate approaches make it difficult to make meaningful comparisons and evaluations across the regions, year-on-year or against the national inventory.

In order to minimise mistrust, uncertainties and misunderstandings, GRIP has produced a consistent methodology over three data levels, with a reliable calculation of the associated uncertainty at each level. The GRIP approach utilises a similar approach to that of the national inventory, while also taking cognisance of the IPCC guidelines governing inventory compilation on a national scale. In addition, GRIP has also taken account of other methods explored within the UK and abroad at a sub-national level.

The GRIP approach is based on five critical principles, making it:

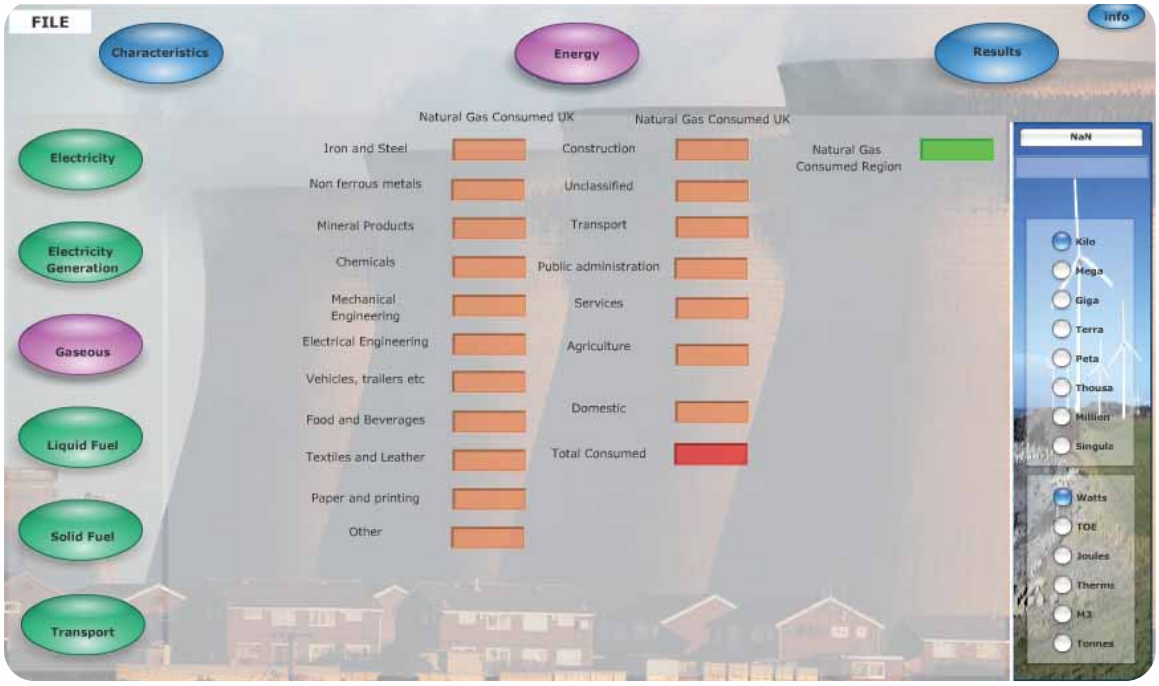
- Timely in its approach;
- Adaptable to available data sets;
- Transparent in nature;
- Easily replicable; and
- Presented with a consistent reporting structure.

GRIP delivers these guiding principles through a practicable inventory methodology that spans three levels of data intensity, each with its own prescribed level of uncertainty. The system is designed to negate double counting and intrinsically programmed to accommodate differing levels of base data accuracy by utilising its integral uncertainty functionality. This allows GRIP to function in environments of differing data availability.

The methodology comes complete with clear instructions, tips on how best to access data sources and a common reporting format for ease of cross comparison. In addition it is free to use by public and voluntary bodies, making it a cost-effective alternative to other inventory packages.

By implementing the GRIP approach, regions permit themselves to monitor their emissions, gauge the effectiveness of mitigation policies and gain insight into emissions drivers. The GRIP approach also enables inter-regional and year-on-year comparisons, all delivered in a cost-effective, user friendly manner.

The methodology and tools are free to download from **www.grip.org.uk**



Shown are extracts from the GRIP inventory generation approach.

One of the main aims of GRIP was to establish an emissions inventory for the host region, the North West of England. The objective was threefold: to determine a comprehensive register of GHG sources, to estimate actual GHG emissions from the region and to gather the data in a manner that is appropriate to use as a baseline for comparison year-on-year or against other regional and national inventories.

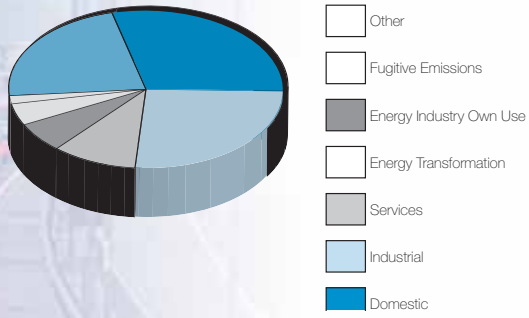
The GRIP process has shown that when compiling a GHG inventory it is important to first understand the characteristics of the region under scrutiny, most notably its population, affluence and economic constituents. Correctly interpreted, this data points towards likely GHG sources and, additionally, engenders the stakeholder with an appreciation of the drivers within the region that affect GHG emissions. The GRIP findings for the North West can be accessed in full on the GRIP website.

England's North West, the birth place of the industrial revolution, is home to 6.7m people dispersed over 2.4m homes. It covers an area of 14,165 sq km and is divided into the three counties of Cumbria, Lancashire and Cheshire together with the metropolitan counties of Merseyside and Greater Manchester. In terms of its size and population, the North West is the most densely populated region outside of London.

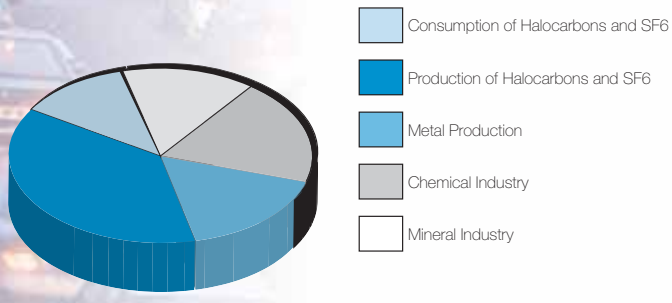
In 2000, the economic wealth of the region was £77bn, equivalent to a GDP per head of just £11,273. This is much lower from the national average of £15,788, ranking the North West second from bottom in terms of wealth creation. In 2000, the North West accounted for 13% of the UK's manufacturing output, largely due to the vehicle and chemical sectors, whilst the textile industry accounted for £1.12bn of the regions economy. Over the five year period 1995-2000, the North West experienced a notable shift from manufacturing based jobs to those in the service industry.

GRIP presents GHG emissions from the North West in terms of CO_2 equivalent (eqv) using the GWP_{100} standard, which demonstrates the impact of all greenhouse gases in terms of CO_2. This method permits an immediate comparison of the respective impacts of each sector.

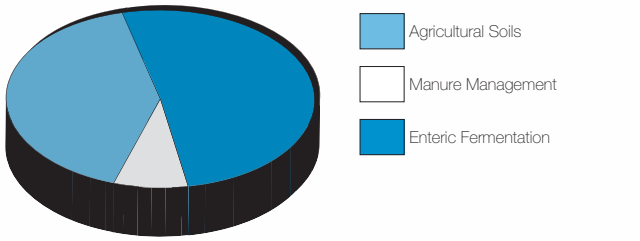
All emissions associated with the consumption and combustion of fuel within the region are accounted for in GRIP as emissions from the Energy sector. This includes energy consumed in the home, by industry and commerce, as well as from transportation, agriculture and offshore and onshore fuel extraction. For the purposes of GRIP, emissions associated with the production of electricity are attributed to the consumer. As a region, the North West contributes 11.5% of national Energy emissions. In 2000, the GHG emissions from the Energy sector, expressed in terms of $C0_2$ equivalents, totalled 63.8MtCO_2eqv, comprised of the following:



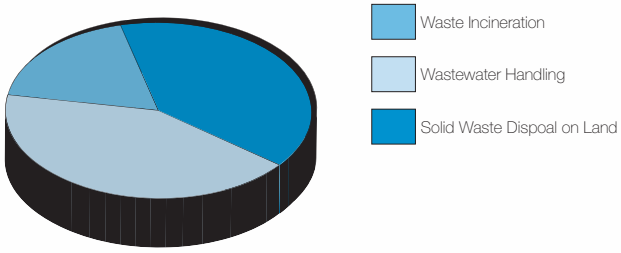
Within GRIP, emissions categorised as Industrial Processes relate to GHG emissions from chemical reactions on industrial sites, and also include emissions from the maintenance of a variety of products. The North West is home to a variety of installations regulated as Part A under the PPC Regulations. Regionally this sector accounts for 6.1MtCO_2eqv, 20% of national industrial process emissions, and is comprised of the following:



GHG emissions from agriculture are attributable to the treatment and management of both crops and farm animals. Although the agricultural economy of the North West has experienced steady decline over the latter part of the 20th century, due in part to the way that its composition has changed over the years, it continues to make a substantive contribution to overall emissions. Emissions from the agriculture sector account for 7.8% of national agricultural emissions. The regional agricultural emissions for the year 2000 were 3.9MtCO_2eqv, and composed of the following:



Waste disposal is a problem facing all UK regions, and the North West is no exception. Waste can be treated and disposed of in a number of ways: including landfilling, incineration and recycling, with GHG emissions associated with each of these processes. GHG emissions from the treatment and disposal of wastes in the North West account for, 2.1MtCO_2eqv - 13.6% of national waste emissions in 2000. The regional emissions can be broken down as follows:



Overall the North West accounted for 75.9MtCO_2 eqv in 2000, equivalent to 12% of national emissions that year. This statistic can be expressed in a variety of ways, each with the aim of engaging either stakeholders or lay people in the inventory process:

- In 2000, 11.2 tonnes of carbon dioxide equivalent were emitted for every man, woman and child in the North West, compared to 11 tonnes nationally.
- In terms of domestic emissions alone, the average household in the region in 2000 accounted for 6.7 tonnes of carbon dioxide equivalent, compared to 5.6 tonnes nationally.
- GHG emissions averaged 0.87 tonnes of carbon dioxide equivalent per £1000 of GVA (Gross Value Added), compared to 0.74 tonnes nationally.

The total figures, broken down by sector and GHG, are displayed below:

Emissions (Thousand Tonnes by Sector)	CO_2	CH_4	N_2O	HFC	PFC	SF_6	GWP_{100}
Energy Total	62,240	50	1	N/A	N/A	N/A	63,764
Industrial Processes Total	1,170	0	3	2,877	54	0.04	6,114
Waste Total	87	82	0	N/A	N/A	N/A	2,150
Agriculture Total	N/A	92	6	N/A	N/A	N/A	3,866

The methodology behind this inventory run, together with the uncertainty analysis, can be found in greater detail within the full report 'GRIP Inventory North West'. The report, and associated GRIP resources, can be accessed online at **www.grip.org.uk**

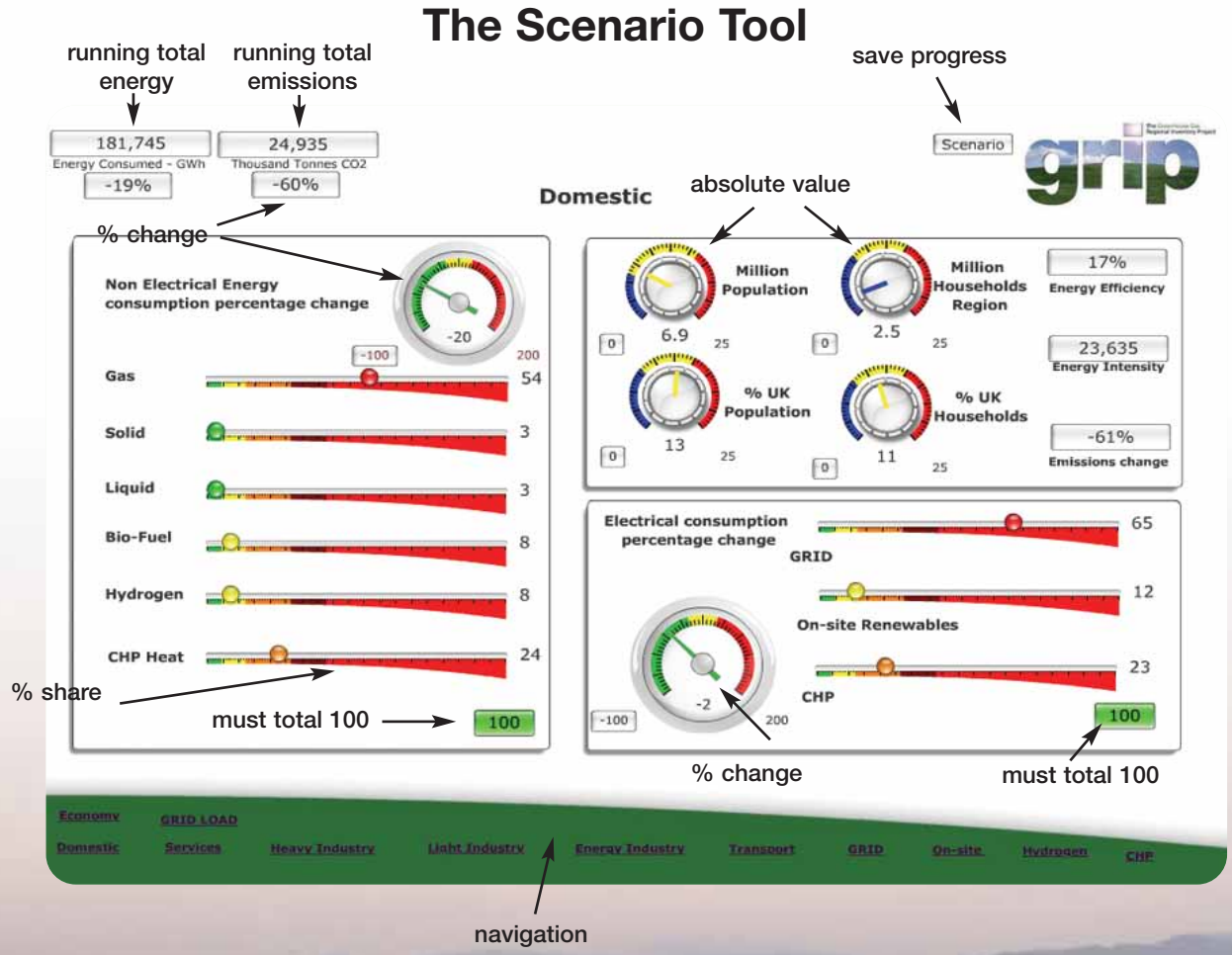
Through the development and promotion of the GRIP approach to GHG inventory estimation, it became clear that stakeholders needed a user-friendly, flexible tool that would allow changes in the energy system to be instantly correlated to changes in GHG emissions.

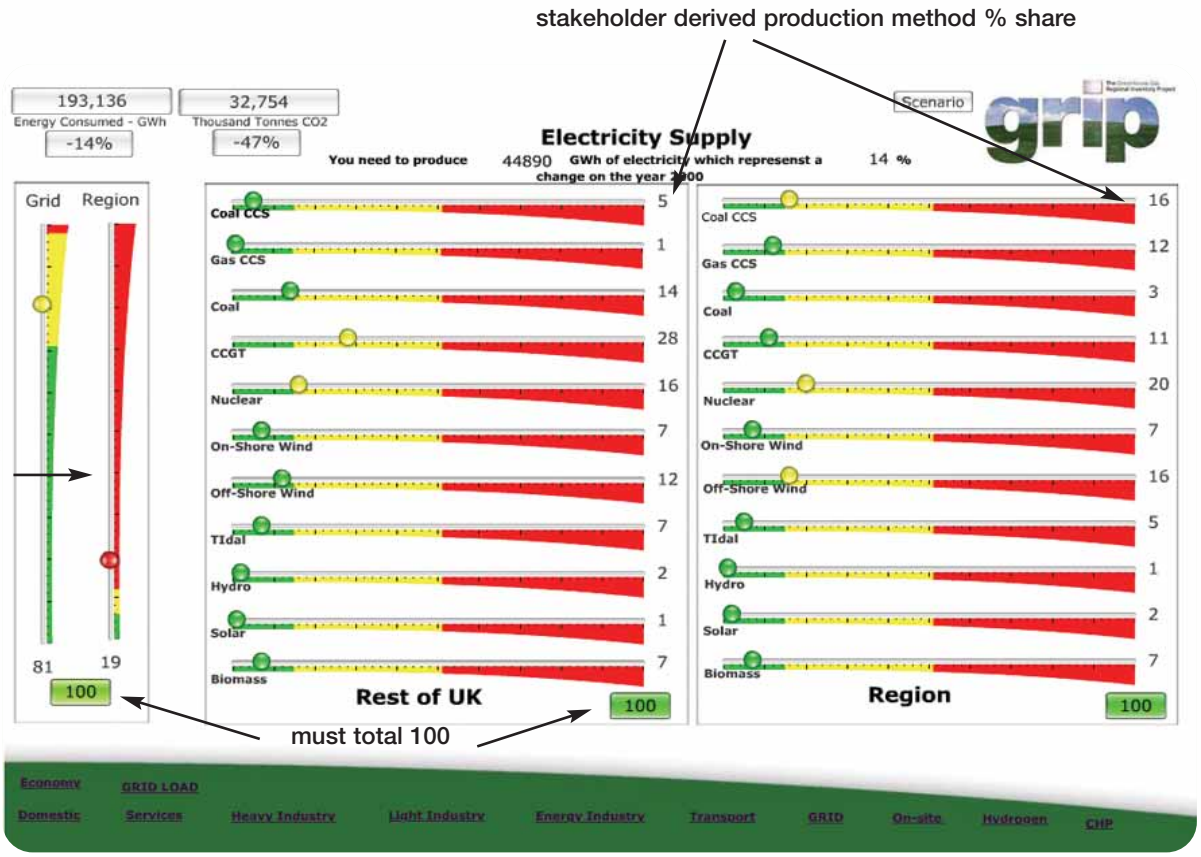
Subsequently, GRIP designed, developed and trialled the GRIP Scenario Tool, capable of offering a threefold benefit by allowing the stakeholder to:

- monitor changes in GHG emissions caused by proposed energy policy decisions;
- provide instant feedback on the effects of policy; and
- provide a holistic approach to the energy system in both the medium and long term.

To manipulate the tool, the user is asked to input a variety of data, including fuel choices for the relevant sector and electricity sources. The tool is the front-end face of a complicated energy system model, which through interactions with the supporting programme, provide the user with immediate feedback in terms of emissions, efficiency and energy consumption within the Domestic, Services, Light Industry, Heavy Industry, Energy System and Transportation sectors. The final output from the tool provides the stakeholder with an emissions estimate for the scenario, a total figure for energy consumption and an assessment of the required efficiency improvements necessary to deliver such a future.

The scenario tool was designed as a user interface for individual use, but has been successfully used in groups. In order to maximise its potential, it is advisable in the first instance, that it should be used as part of a one-on-one interview process.




stakeholder derived production method % share
193,136
Energy Consumed - GWh
-14%
32,754
Thousand Tonnes CO2
-47%
Scenario
grip
Electricity Supply
You need to produce 44890 GWh of electricity which represenst a 14 % change on the year 2000
Grid
Region
amount of UK electricity produced by region
81
19
100
Coal CCS 5
Gas CCS 1
Coal 14
CCGT 28
Nuclear 16
On-Shore Wind 7
Off-Shore Wind 12
TIdal 7
Hydro 2
Solar 1
Biomass 7
Rest of UK
100
Coal CCS 16
Gas CCS 12
Coal 3
CCGT 11
Nuclear 20
On-Shore Wind 7
Off-Shore Wind 16
TIdal 5
Hydro 1
Solar 2
Biomass 7
Region
100
must total 100
Economy
GRID LOAD
Domestic
Services
Heavy Industry
Light Industry
Energy Industry
Transport
GRID
On-site
Hydrogen
CHP


percentage change for sector
193,136
Energy Consumed - GWh
-14%
28,651
Thousand Tonnes CO2
-53%
Scenario
grip
Transport
fuel split by sector
Road Transport
Biomass 5
Liquid 57
Electric 18
Hydrogen 20
100
Energy Consumed
-18
% change kms
12
Rail
Biomass 6
Liquid 12
Electric 75
Hydrogen 7
100
-6
60
Aviation
Biomass 5
Liquid 95
Electric 0
Hydrogen 0
100
35
75
Marine
Biomass 17
Liquid 80
Electric 0
Hydrogen 3
100
5
60
must total 100
Economy
GRID LOAD
Domestic
Services
Heavy Industry
Light Industry
Energy Industry
Transport
GRID
On-site
Hydrogen
CHP

How should these scenarios be used?

As the GRIP process has shown, the energy sector in the North West accounts for 98% of regional carbon dioxide emissions and 83% of total regional emissions of all greenhouse gases. Thus, it is obvious that energy policy, and its underlying decision-making process, will have a both a direct and a substantial impact on GHG emission levels. It is essential that any effective GHG emissions reduction strategy puts energy policy at centre stage. Consequently, the composition of any future energy system will be the fundamental element of any individual, regional or national mitigation strategy.

With this in mind, GRIP developed four stakeholder derived scenarios based on the manipulation of the energy system composition. The scenarios were produced through a series of forty interviews, culminating in a group workshop.

The scenario generation process took place in two stages: the initial stage involved individual interviews with a range of pertinent stakeholders that included representatives from academia, industry, policy makers, local governance, NGOs and pressure groups. Each interview was conducted using substantial interaction with the scenario software tool, and taped for later analysis. The purpose of these interviews was to ascertain how these stakeholders perceived the governmental target of 60% CO_2 reduction being delivered by 2050, rather than how they wanted it to be delivered. Under this remit, an array of responses was recorded showing carbon dioxide emissions reduction of between 38% and 90% against year 2000 levels.

Following a comprehensive analysis of the quantitative and qualitative stakeholder responses, four scenarios were generated classifying potential energy futures in terms of emission reductions (40%, 50%, 60% and 70%) for the North West by 2050.

The second stage, which took the form of an interactive group workshop, divided the stakeholders into groups according to their own perception of the future energy system. With facilitation from pre-appointed leaders (Simon Shackley, Kevin Anderson, Sarah Mander and Alice Bows) the individual groups were asked to backcast the 2050 reductions to determine what needed to be done within the energy system by 2020 to achieve the relevant end point.

The four scenarios generated by the GRIP process present the findings, descriptions and discussions sourced from the individual interviews and the group workshop. In addition, the tone of each scenario is taken from stakeholder responses, presented in an impartial manner by GRIP.

Scenarios are storylines, they are not projections - the GRIP scenarios represent four potential futures for the North West region, describing the social, economic, and energy system make up, together with the perceived level of emissions reduction associated with that future.

The following are a selection of the comments received during the interview process or extracted from the feedback form.

"Tony Blair should have a go"

"Have you thought about patenting this?"

"I really enjoyed that, it really made me think"

"The scenario tool really tested my knowledge, and forced you into making your trade off decisions"

"The challenge is greater than I thought (and I knew it was big)"

"How hard it is to reach a 60% reduction, and the number of parameters involved."

"I had the opportunity of 'playing God'"

"Even with quite a lot of nuclear - VERY hard to hit the target!"

"The many drivers that are need to be taken account of in order to reduce emissions."

"I would like to take the tool and have another go, and encourage the development of an even more simplified version to for use at events, workshops"

"It's a very interesting tool that should be part of the education curriculum"

"Complexity of the systems"

"Need for rules about making trade-offs"

"Difficulty of reaching deep emissions cuts without major socio-economic change"

"How chosen options might combine to achieve savings"

"It was surprising to see how much effect efficiency improvements in products such as cars can help reduce emissions."

"Just how much effect transport has on the overall emissions total. How difficult it will be reduce emissions"

"The value of this kind of inter-active and practical "game" based approach as a learning experience"

"Seeing for the first time a 'result' of all my views on the various aspects of energy technology options and consumption options brought together"

"The difficulty of meeting a 60% target just with your 'pet' subjects - i.e. even once you have entered all the things that you think should be done there is still a long way to go!"

"I was surprised at how little overall difference certain changes made"

"I was surprised that I managed to get to a 60% reduction without needing nuclear"

The first stakeholder derived scenario, '4x4xbye', is associated with a low economic growth coupled with a predominantly unchanged level of energy demand. The economy of the North West region retains the same basic composition as that of today, while improvements in energy efficiency slightly outstrip economic growth. A small switch in fuel choices has occurred on both the demand and supply side.

Population

The region's population is an aging one, showing a marginal increase from 6.9m to 7.7m. Associated with this change is a slight increase in the number of homes in the region, mostly in the form of new apartment complexes in existing urban areas. North Westerners continue to exhibit a desire to live on their own and, for preference, choose to live nearer to work. Life expectancy has increased as a result of medical advances.

Economic and social development

The region has just managed to hold on to its percentage share of the economy by growing faster than some of the other regions who have gone into decline, although a higher level of growth continues in the southern regions of the UK. Trade has taken on an increased global perspective and products are sourced mostly from China and India. The EU accession states have helped maintain low levels of inflation due to the lower cost of imported goods from Eastern Europe. The North West continues to maintain a high level of manufacturing; however this has taken on a more sophisticated form, and requires an elevated skill base.

Fuel poverty was not an issue for the region leading up to 2040 but has become widespread since. This is due to greater levels of worldwide demand for fossil fuels and a huge international pressure to reduce emissions. Individual attitudes towards fuel consumption are beginning to change, but people continue to heat their homes and offices inefficiently. Cumbria has built upon its tourist industry and also become a retirement hotspot.

Education standards remain among the best in the land, and due to the large skill based industry here more graduates are opting to remain in the region. Overall, the south of the region enjoys a better quality of life than the north.

Energy and Technology

The scenario shows a slight decrease in overall energy consumption, driven primarily by a marked increase in motor car efficiency. This drive has resulted in part from pressures on the car market to find fossil fuel alternatives, but also from slower growth in road transport in recent decades, and the disappearance of the 4x4s outside of agricultural communities. Biofuel has experienced a strong surge in popularity, with a proportion of the necessary biomass grown in the agricultural areas of the region. Shell Stanlow now converts bio-crops into petroleum grade fuels.

The scenario is dominated by fossil based energy sources, with natural gas the established fuel source of preference. Solid fuels are restricted to electricity production and are invariably associated with carbon capture and storage. The use of both Combined Heat and Power (CHP) and on-site renewables as energy sources have increased but remain small and are restricted to individual homes and small housing developments, rather than community based schemes. Although industrial parks have begun to invest in on-site renewables and large CHP plants, this did not occur until 2020.

Freight has continued to be transported by road, aided by more efficient road vehicles and an upgrading of the road network.

Hydrogen is not used in the generation of electricity, because the grid is more than 75% fossil and nuclear based. Coal power stations, without associated carbon capture, are used during times of peak demand.

Inside the region there is proportionally more electricity produced from off-shore wind and nuclear power than elsewhere in the UK. The region is self sufficient in terms of electricity production.

Security of supply is a matter of concern as natural gas, the dominant source of fuel, is imported albeit from a range of countries. The increasing levels of energy demand is coupled with decreasing availability as no new gas fields have been found for over a decade.

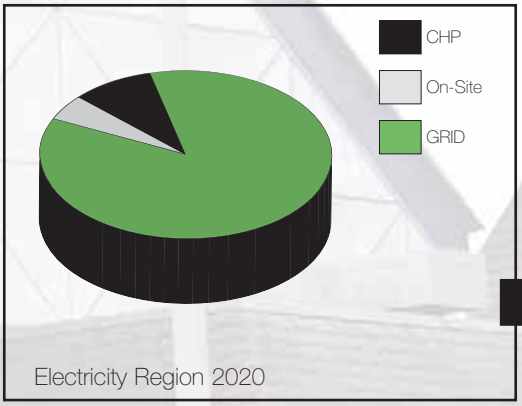
Transport

There has been an increase in urbanisation thanks to the East Lancashire corridor experiencing better transport links, and with this has come a few more satellite towns. The road transportation infrastructure has boomed with the M6 being a ten lane motorway in most places. Manchester, Liverpool and Chester all have extensive light rail schemes.

Environment

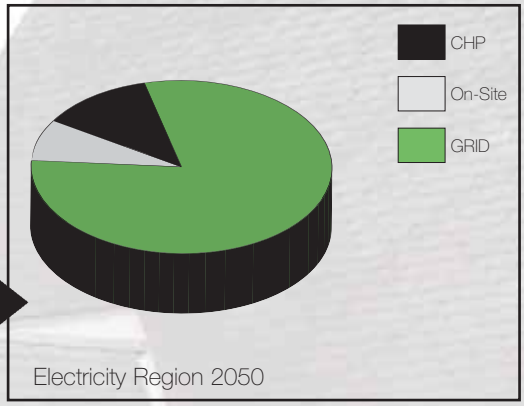
The region has experienced an average warming of around 2°C in comparison to the year 2000.

2020

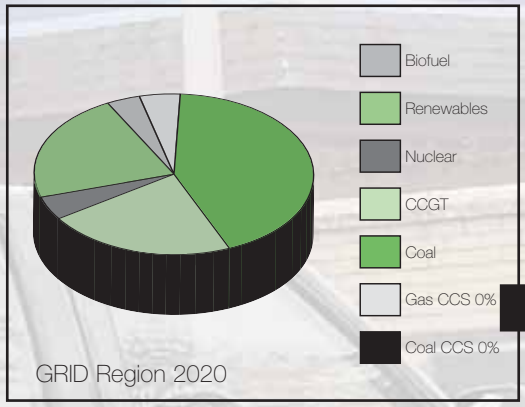


Electricity Region 2020

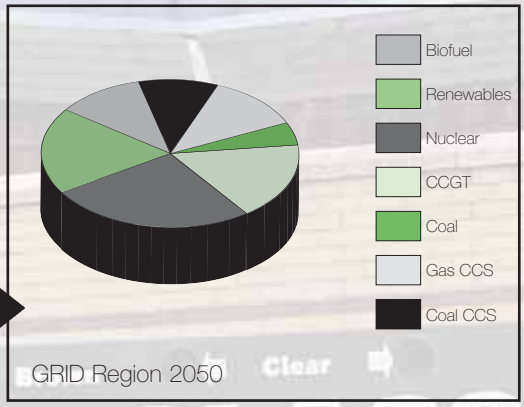
2050



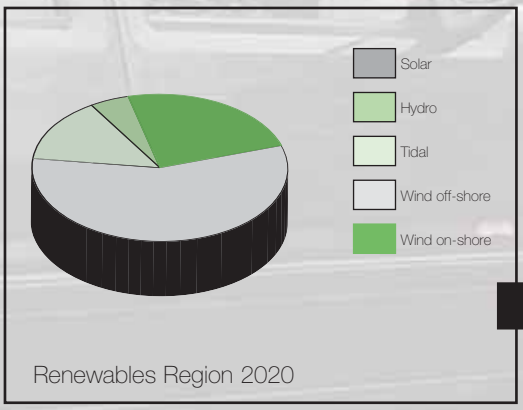
Electricity Region 2050



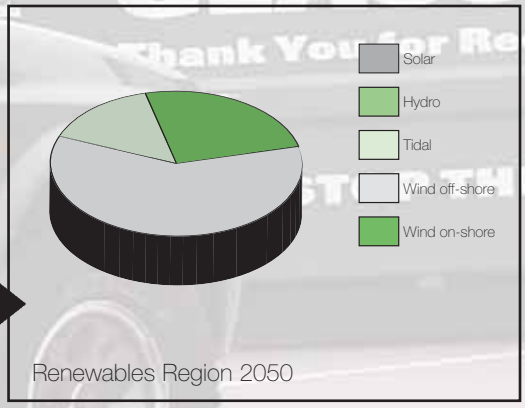
GRID Region 2020



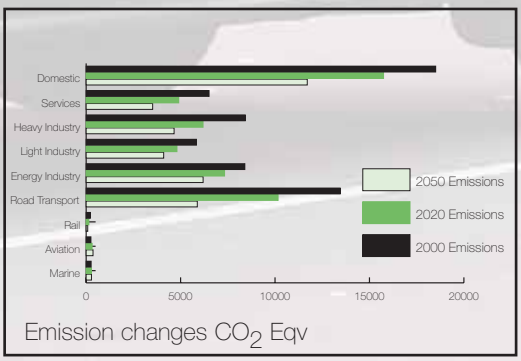
GRID Region 2050



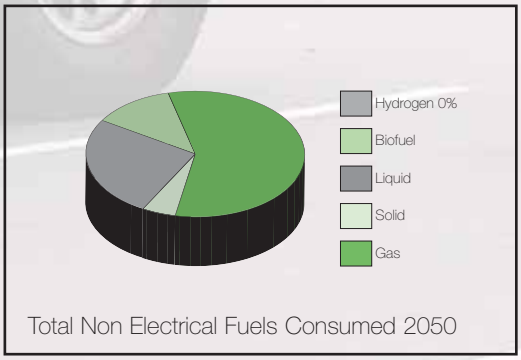
Renewables Region 2020



Renewables Region 2050



Emission changes CO_2 Eqv



Total Non Electrical Fuels Consumed 2050

This scenario, 'Hanging Out the Washing', is characterised by a low level of economic growth, with all sectors experiencing a net decrease in energy demand. The economy is based upon the commercial and service industries.

Population

Although the population of the North West has grown only marginally, the demand for housing has mushroomed. The demand is driven by an aging, longer living population tending towards single occupancy. Low birth rates characteristic of the region are a consequence of these living habits and the slow economic growth experienced over the period to 2050.

Economic and social development

Economic wealth and investment is, as always, concentrated in London and the South East, which continues to enjoy a higher level of economic growth than other parts of the UK. Imports are being sourced from a now industrialised China and developing Africa, due to the continued increase in labour costs throughout Europe and the accession states. This has lead to an increase in global energy demand.

Despite the low rate of economic growth, the North West is performing better than other regions, with some actually experiencing negative growth rates.

Energy and Technology

The types of fuel consumed have remained predominantly unchanged between 2020 and 2050, with the majority of emissions reductions arising as a direct consequence of energy efficiency measures implemented prior to this period.

Since 2020 emissions reductions have been based on fuel switching both on the demand and the supply side. In the years leading up to 2020, gas powered plants became dominant with renewable sources accounting for only 11% of regional supply. The intervening years have been characterised by the expansion of the nuclear programme. As a result, electricity generation both within the North West and in the UK as a whole is noted for its high level of nuclear power, complemented by in excess of 20% of generation coming from renewable sources, with a further 6% from bioenergy.

Recently it became clear that the UK would fail to meet its 60% target in emissions reduction. This, together with concerns surrounding the security of the gas supply, has led to the decision to reopen old coal mines and extract coal for electricity generation, with associated carbon capture and storage to limit GHG emissions. There is a noted reluctance to exploit the large onshore wind reserves available to the North West, with the anti-wind lobby remaining strong.

Power stations, with the exception of nuclear facilities, have been built closer to the end user; this has brought with it a slight reduction in distribution losses. The early investment in efficiency has paid dividends in achieving this reduction, with hydrogen used as a storage system since finally becoming cost effective in 2040.

Transport

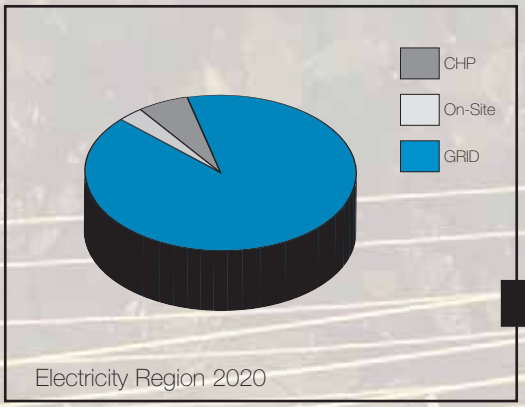
The road infrastructure is relatively similar to today, and government policy is focused on road charging and innovative tolling regimes as means of controlling congestion and energy demand. All company cars are powered by carbon neutral sources. On a worldwide scale, fuel prices have rocketed; due in part to the scarcity of new supplies and the emergence of industrial development in Africa, with the expansion of infrastructure in China and India adding further strain. Fuel poverty is seen as a priority for most countries.

The energy efficiency drives of the first two decades of the millennium brought with them an expansion of urban green areas, which have remained intact. With this came a host of new light rail schemes across the region. Every city in the North West now benefits from a metro system similar to that available in the Greater Manchester area, although they are smaller in size. Old commuter lines have been reopened where practicable and people are more willing to use public transport.

Environment

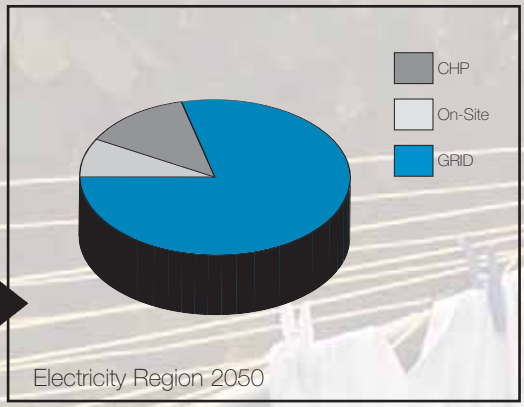
Although there has been a fall in average precipitation levels, some parts of the region are prone to severe flash flooding and are now deemed uninhabitable.

2020

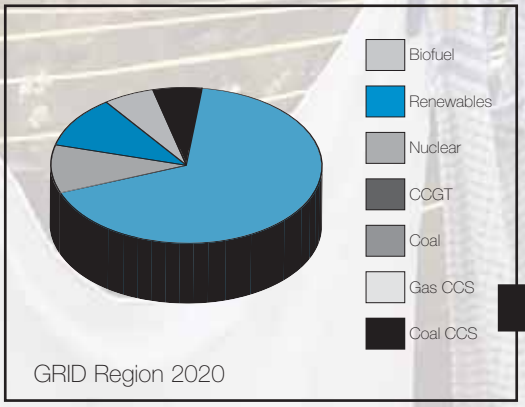


Electricity Region 2020

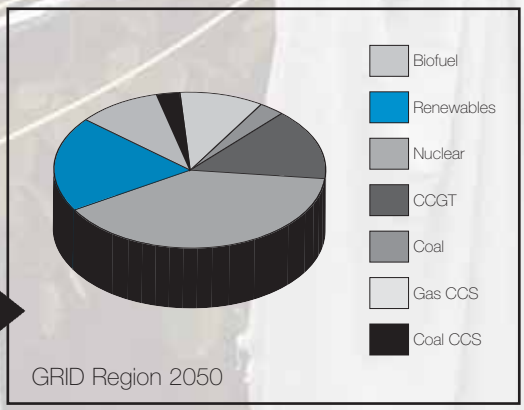
2050



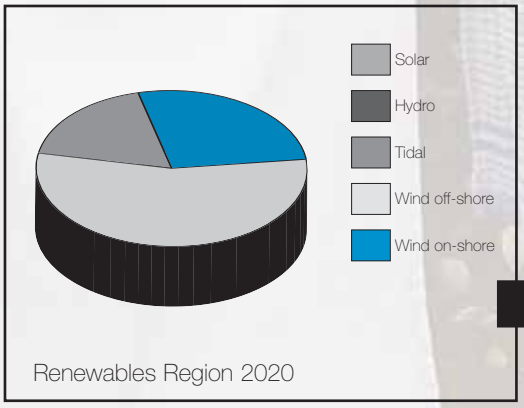
Electricity Region 2050



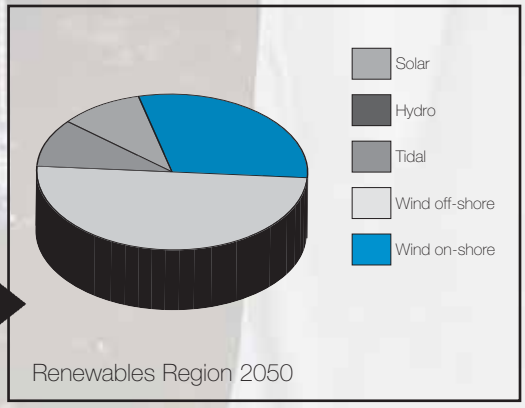
GRID Region 2020



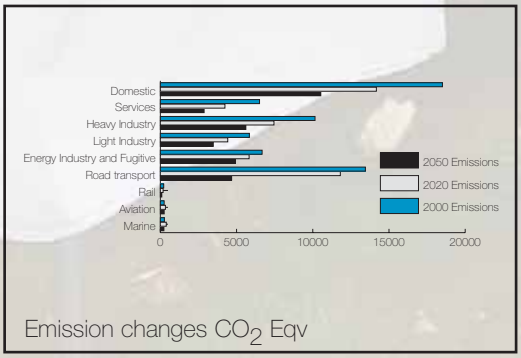
GRID Region 2050



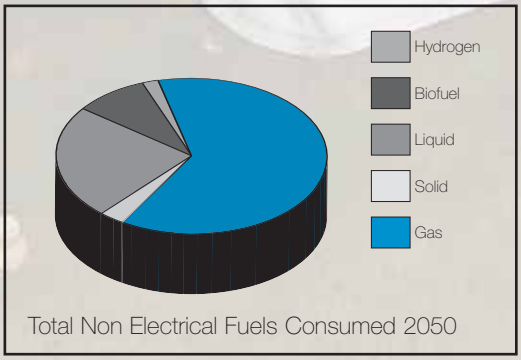
Renewables Region 2020



Renewables Region 2050



Emission changes CO_2 Eqv



Total Non Electrical Fuels Consumed 2050

60% Scenario – Greening busin

This scenario, 'Greening Business is Usual', sees a future with a 60% reduction in GHG emissions, characterised by a region with an economy that has tripled in size. This phenomenal growth has been achieved in combination with a reduction in energy demand of about 20%, delivered through massive increases in efficiency, in a region that continues to be led by its service sector.

Population

The population has grown by 20%, fuelled an aging population, an influx of migrants and a substantial increase in birth rates. Migrants are attracted to the region by the comparatively high levels of economic growth. The aging population is living longer, with people living well into their hundreds. People continue to work into later life but on a part time basis. The region has become prosperous when compared to the rest of the UK.

Economic and social development

The profitable regional economy has resulted in an increased level of university attendance together with an overall improvement of education standards amongst its inhabitants. These levels have been aided by the North West's continued attraction to skilled workers. The economy is built upon the services sector, boosted by public sector jobs relocated from the south as a direct result of the policy of governmental devolution.

Where manufacturing does occur it is highly technologically dependent, particularly true of the chemicals and electronic sectors, and is due to the broad knowledge base of the region. All large scale manufacturing takes place outside of the region, and indeed beyond the boundary of the EU. Economic growth in the North West outstrips that experienced by the rest of the country allowing the region to claim a respectable share of the nations wealth that is above average for its population - the North West is no longer viewed as a poor northern UK region.

People are not working from home to any greater degree preferring the social interactions experienced within an office environment. There are excellent transport links, with cities catering for the hectic lives of young, urban professionals.

There is a structured programme of tax breaks for the retrofitting or installation of renewable on-site generation. From 2030, every new boiler purchased had to be a CHP unit. Fuel poverty is no longer a concern, abated due to the increase in economic affluence, efficient heating and insulation, stringent regulation in all new built structures and rental properties and government subsidies to encourage the use of renewable energy sources.

A policy of rebuild and regeneration, as well as a trend toward new high rise flats in cities to accommodate people's desire to live near to work, is characteristic of the region. Otherwise there is essentially very little change; people are still experiencing the same mode of living, flat sharing in cities with families staying predominantly in the suburban areas.

Energy and Technology

Improvements in energy efficiency and utilisation have been heavily influenced by technological advancements - people have maintained their desires for creature comforts from which they are not prepared to deviate. Despite booms in housing regulations and policies governing domestic appliances, overall efficiency in the domestic sector has only reached 30%, due predominantly to the continued desire for appliances and gadgets in the household.

Grid losses associated with electricity distribution remain the same. Due to the altered nature of the grid, particularly increased dependency on renewables, intermittency of supply has worsened. Hydrogen is used within the electricity supply system as energy storage to help maintain a constant supply. The excess energy stored in hydrogen is produced from renewable sources during off-peak times when supply outstrips demand, and hydrogen fuel cells are becoming commonplace in homes as a backup store of energy.

Renewable energy sources, including biomass, account for 40% of the electricity produced by the North West. The harnessing of onshore wind is gaining greater acceptance, setting the region apart from others. The use of tidal energy has gained popularity as the energy industry seeks to take advantage of the inherent resources of the region and new developments in power technologies. Nuclear powered generation is accounting for a fifth of supply inside and outside of the region. The remainder of the demand is delivered by coal-fuelled power stations fitted with carbon capture mechanisms, supplemented by gas powered stations for peak demand periods, an arrangement that is mirrored nationally. Where practicable, disused coal mines have been reopened to support this generation.

Vast improvements in energy efficiency and insulation systems in the home have been complemented by a small switch to bioenergy for heat and space heating. In addition, CHP units within the domestic and service sectors are encouraged, resulting in a large uptake of the technology. CHP plants of various sizes are found throughout the region, their popularity dependant on the age, size and density of the housing stock. CHP is almost completely derived from gas, the exception being in industry where CHP from biomass is popular. On-site renewable energy sources are community based, and fully connected to the national grid. The public administration sector pioneered widespread on-site generation in the second decade of the century.

The energy industry in the North West remains vibrant, with Shell Stanlow involved in the transformation of fuels. From here, hydrogen is shipped across the region in tankers in just the same way as petrol is today.

Transport

The region is a net importer of goods which has resulted in widespread infrastructure improvements across a broad range of transport modes. A strategic approach to the mobilisation of freight is necessary to accommodate the import dependency and an inter-modal approach that encapsulates inland waterways has thus been pioneered. The road infrastructure includes a range of toll roads, ten lane motorways and additional charges levied per mile travelled.

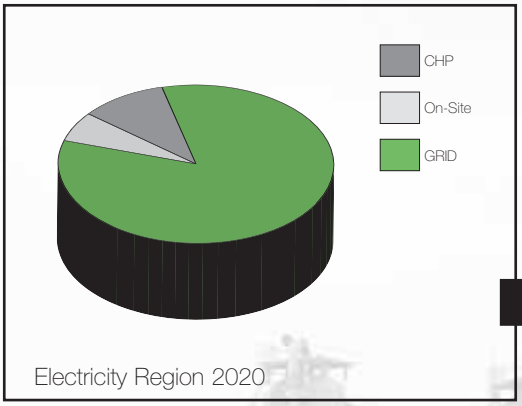
The rail network has undergone substantial development, with extensive light rail schemes in every North West city and the introduction of new commuter lines linking previously isolated areas of the region. Aviation travel has grown slightly, mostly to accommodate short haul trips to Europe, with only the most affluent travelling farther afield.

Security of supply remains a small concern, with gas supplies dependent on sources outside the regional boundary.

Environment

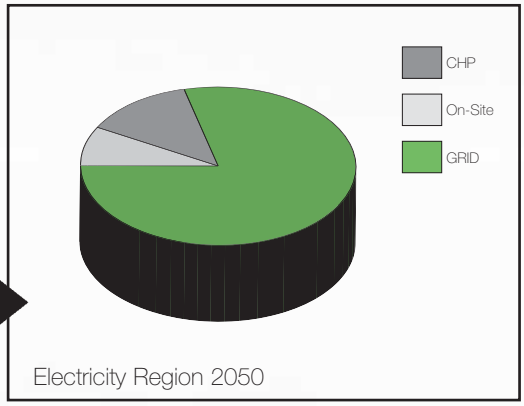
There has been a warming of 2.5°C under the energy future predicted by this scenario. The climatic impacts of this have been felt by the North West, but it is the consequences experienced abroad over the past two decades that have finally proved climate change to be real.

2020

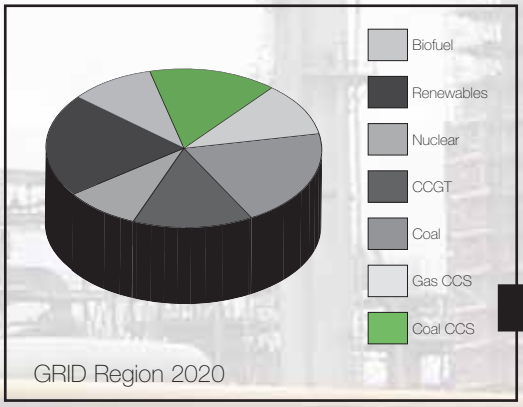


Electricity Region 2020

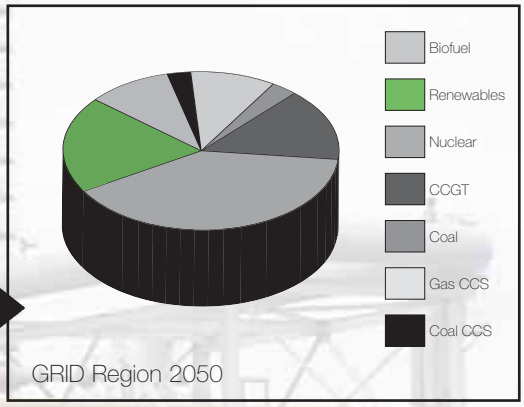
2050



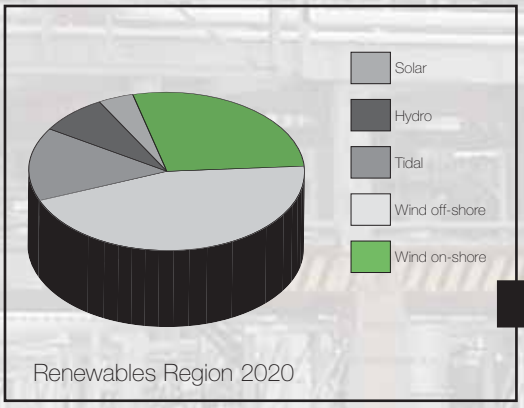
Electricity Region 2050



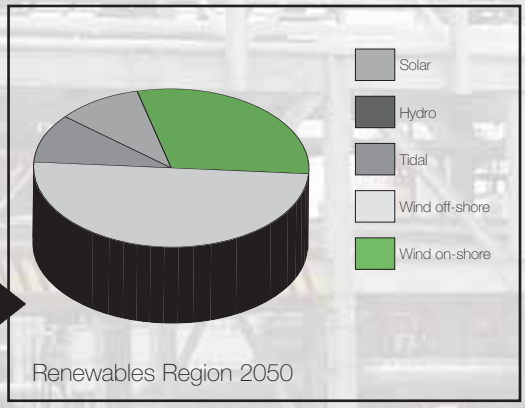
GRID Region 2020



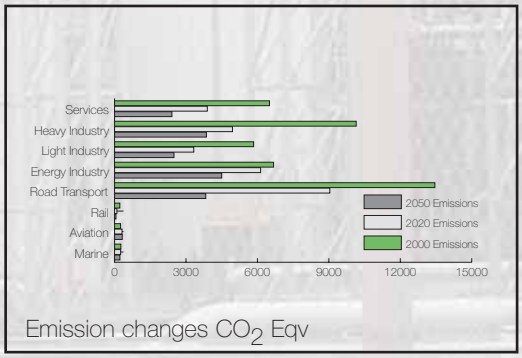
GRID Region 2050



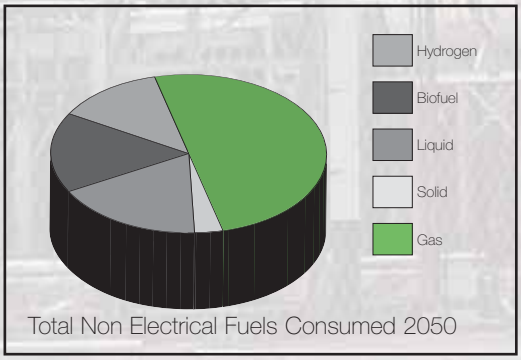
Renewables Region 2020



Renewables Region 2050



Emission changes CO_2 Eqv



Total Non Electrical Fuels Consumed 2050

The distinguishing features of the 'Upwardly Mobile' scenario are a combination of high level economic growth in conjunction with innovative and widespread use of new energy efficiency techniques. Although the economy has blossomed, it remains relatively unchanged in terms of its mix across the service and manufacturing sectors when compared to the year 2000.

Population

Since 2000, the population of the region has expanded by 25%, aided by both higher birth rates and the perception that the North West is an attractive area to live – driven by the apparent higher living standards and the vibrant economy. This population increase has brought with it an increased demand for new homes, which has in turn created an increase in the housing stock of 30% to support the continual population expansion and the propensity to live on "ones own".

Economic and social development

Policies and laws have an intrinsic environmental bias. A proliferation of EU directives and regulations have been in force for several decades which specify both the acceptable levels of energy required during manufacture as well as the operational energy efficiency of all products sold within the EU. New technologies, along with government grants, have led to widespread innovation within the region, making the North West a market leader within several manufacturing sectors, most notably the chemical division. This well worked strategy has enabled the North West to enhance its competitive advantage over the other English regions. Trade barriers have narrowed and as a direct result of the aforementioned environmental regulation, together with the successes enjoyed by the Clean Development Mechanism, a vibrant trade agreement has been established with Africa from whom the largest proportion of imported goods are acquired.

Although the region has become prosperous there remains, sadly, some large internal discrepancies in wealth distribution and environmental degradation, mostly associated with the coastal areas in the north of the region. These problems have been magnified by the Manchester-centric focus of the region.

In this highly mobile region, people are choosing to work from home.

Energy and Technology

On the domestic front, space and water heating has become far more efficient. Regeneration during the second decade of the century provided a very good learning platform, prompting widespread retrofitting of properties, aided by new developments in cavity wall insulation and some external cladding of properties. Public acceptance of this drive towards efficiency has enabled the government to implement far reaching policies with ease.

As a consequence of these environmentally favourable strategies, only a third of the power supplied to the national grid comes from fossil fuels, with just 8% provided by fossil fuel powered plants that do not have carbon capture technologies installed. These non-abated plants are used for peak demand periods only. Inside the electrically self sufficient North West, one third of all electricity is sourced from renewable sources, with a further 18% from biofuels. Therefore more than half the electricity of the region is generated from carbon free fuel sources. The two nuclear plants located within the boundaries of the North West account for a further 20% of generation. In all, 75% of the Grid is powered from fossil fuel free resources.

There has been widespread implementation of onsite electricity generation, which now fulfils a third of total demand. The onsite renewable facilities are mostly shared and operated by small communities, it now being considered socially unacceptable to live in an apartment block without some form of renewable generation onsite. This social shift is attributable to a greater awareness of the impacts of climate change both here and abroad. The CHP units vary in size depending on the density of households they serve, and where density is low individual CHP units dominate.

Products are far more efficient, both in the construction and operational phases of the life cycle. Intelligent metering is available to limit the operation of specified products to preset times of the day and week in order to minimise cost to the consumer. This has direct benefits for both regional demand management and GHG emissions.

Transport

The transport sector has seen large emissions reductions, resulting from both greater levels of efficiency and a switch in fuels. The mobilisation of freight is subject to greater governmental control, with firms encouraged to use new and existing rail lines for inter-modal transportation. Hydrogen is produced via electrolysis and, having overcome some of its initial teething problems, has now become the major fuel of choice, stimulated by governmental tax incentives. The transportation of hydrogen is through a combination network of piping and road based distribution.

With such an intense focus on energy and transportation efficiencies, people have failed to switch fuels for domestic purposes, which mean that natural gas in particular continues to be used. Elsewhere bioenergy has increased in utilisation.

The North West benefits from an excellent set of transport links, linking cities in and outside of the region through the introduction of new rail lines and the reopening of disused parts of the network. Travel to London can now be achieved inside of two and half hours from anywhere within the region. Each city has an extensive light rail system.

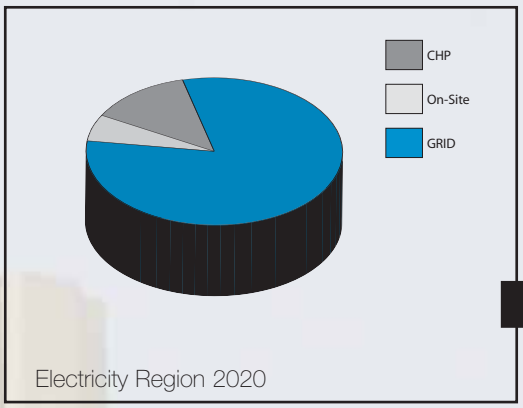
As well as the rail improvements, the road network has been considerably upgraded, although this development has remained focused around existing roads. Although there is a noteworthy use of biomass in transporation, it is mostly imported from abroad.

Environment

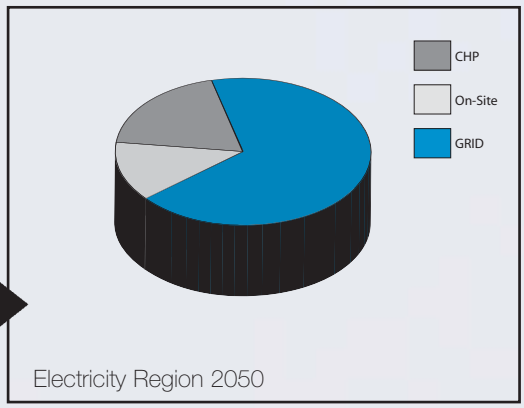
Climate change has become more visible, with the region experiencing a warming of around 2°C on the year 2000.

2020

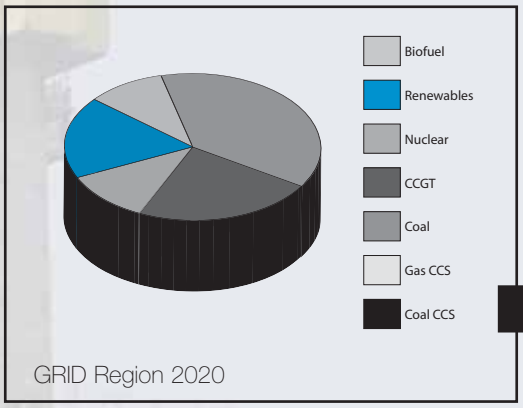
2050



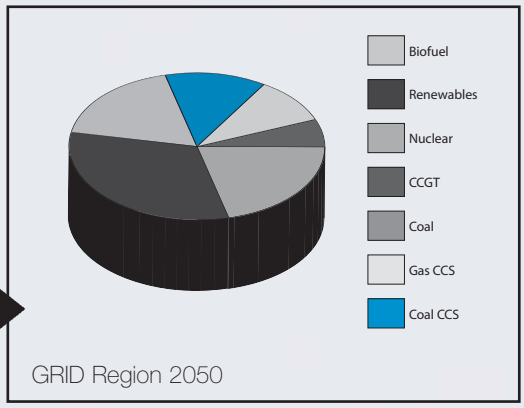
Electricity Region 2020



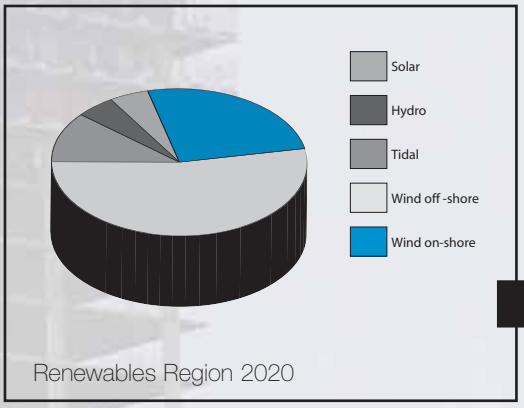
Electricity Region 2050



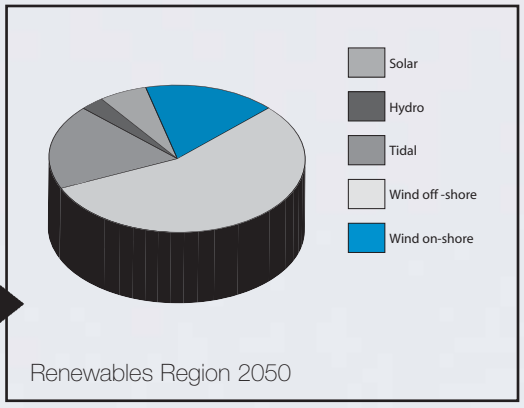
GRID Region 2020



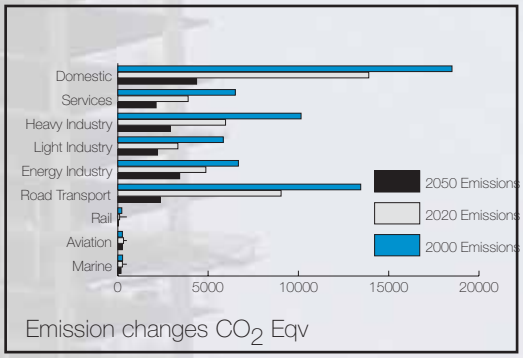
GRID Region 2050



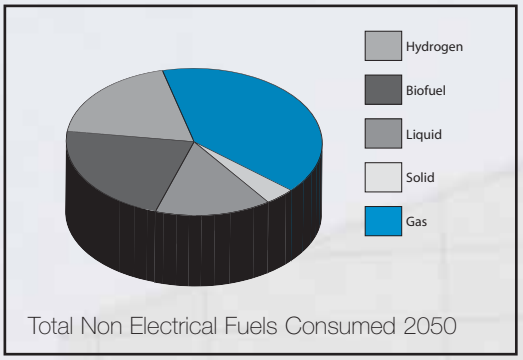
Renewables Region 2020



Renewables Region 2050



Emission changes CO_2 Eqv



Total Non Electrical Fuels Consumed 2050

future work

The GRIP approach to scenario generation offers exciting opportunities for the other English regions. The underlying principles are already being taken forward at both a national and international level by Manchester University's Tyndall Centre. In addition, there are opportunities to manipulate the model for enhanced applicability to a wider audience, including schools, policy meetings, and general discussions, with the aim of generating informed debate - particularly around the issues of trade offs.

acknowledgements

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