THE EUCO2 80/50 PROJECT
STAGE 2
GLASGOW AND THE CLYDE VALLEY

THE SUPPORTING ARCH OF THE CLYDE
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glasgow and the clyde valley sdpa

Introduction to Glasgow (GCV)

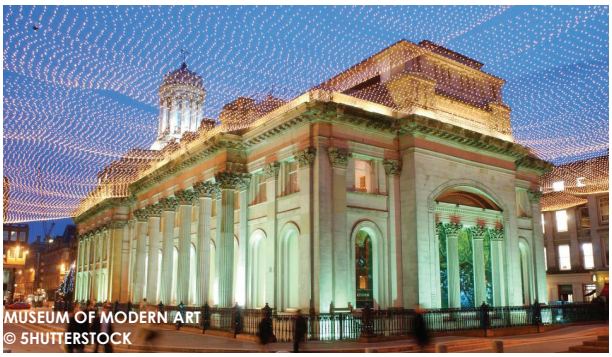
Glasgow and the Clyde Valley is one of Scotland's Strategic Development Planning Authorities and represents eight local authorities. In 2005 the population of the region was 1.75 million and there were 800 000 households. Glasgow, by population, is the largest city in Scotland and the third largest in the UK.

The region's economic activity is dominated by the city of Glasgow. The city's economy, once focused on ship building and its port, is now service based. Elsewhere in the region there continues to be some heavy industrial activity as well as coal mining. In 2005 the region accounted for 32% of Scotland's manufacturing output. The region's agriculture accounts for approximately 2% of the UK's farm yard animal population.

Glasgow was the European Capital of Culture in 1990 and has over 200 arts organisations, including the Scottish Ballet and Scottish Opera. The region borders the south-west highlands. Tourist features include the New Lanark World Heritage Site, a restored 18th century cotton mill close to the Falls of Clyde.

The region has one airport, Glasgow International. Which handled 7 million passengers in 2005. It is the largest and busiest airport in Scotland. Although some diesel trains continue to run, the main railway line connecting the region to the rest of Scotland and the UK is electrified. Glasgow City has an underground system, with 1 circular line and 15 stations. In 2005, approximately 593,500 cars were registered in the region, which is approximately one for every three people. However, according to the 2001 census, 42% of households did not have a car.

In August 2009, the Scottish Government passed its Climate Change Act. It has a target of an 80% reduction



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in Kyoto greenhouse gases by 2050, and an interim target of 42% by 2020 (in the UK Act, this target is 34%). The 2009 Renewables Action Plan commits Scotland to measures to increase the capacity and consumption of electricity from renewable sources, including the headline targets of 20% of Scottish energy use coming from renewable sources by 2020.

In December 2010, Glasgow City Council published its climate change strategy and action plan, which covers the themes education and awareness, energy, resource management, transport, sustainable procurement, cultural and natural heritage, water, planning and the built environment. The strategy builds upon the goals already expressed in the Single Outcome Agreement (SOA). It is intended to more explicitly address climate change adaptation and mitigation in the next SOA.

A carbon neutral approach to future services and activities will be encouraged by Glasgow with businesses aiming to reduce CO_2 emissions and adapt to climate change. Climate change, locally, has been positioned as an opportunity to reduce health inequalities by mitigating against disproportionate negative health impacts and promoting modes of transport that raise activity levels and improve air quality. The Carbon Management Plan seeks to reduce the energy consumption of council operations by 20% by 2012, against a 2005 baseline and to eliminate fuel poverty, 'as far as is reasonably practicable', by 2016.

Emissions Inventory and Energy Baseline

Total emissions from the region in 2005 were 15739 kt CO_2e. This comprised of 90% from the Energy sector, 2% from Industrial Processes, 5% from Agriculture and 4% from Waste. These figures can be viewed in the table below and a more thorough presentation can be found at getagriponemissions.com.

The energy sector is the main focus of this study with emissions from four types of processes considered: combustion, distribution, transformation and extraction. Each process produces GhG emissions: carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O). The level of emissions varies depending on the manner and state (gas, solid, liquid) of energy that is combusted/distributed/transformed/extracted within the region, as well as how the electricity the region consumes is produced. CO_2 is the dominant greenhouse gas in this sector and consequently is the focus of this study.

Glasgow Chart 1 displays the CO_2 emissions from the energy sector in 2005. A total of 13267 kt CO_2 was emitted and was associated with an end user energy consumption of 42235 GWh . The figures show that in 2005 the emissions from the residential sector accounted for 37% of energy emissions, the service sector 12%, the industrial sector 19% and the transport sector 27%; the transport sector emissions comprising 92%, 6%, 1% and 2% from road, rail, marine and domestic aviation respectively. The energy industry accounted for 2% of emissions and fugitive emissions 3%. GRIP level 1, 2 & 3 methodologies were used to estimate 85%, 14% and 1% of the emissions respectively.

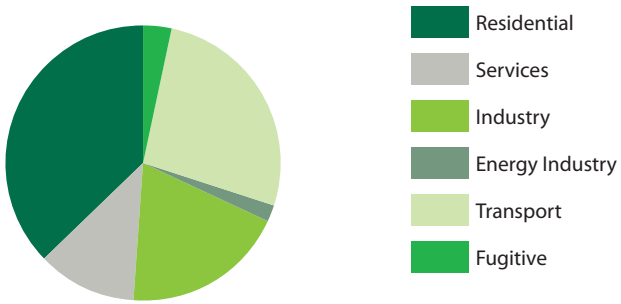
Glasgow (GCV) GhG Inventory 2005

Sector	CO_2 (kt)	CO_{2eqv} (kt)
Residential	4908	4974
Services	1565	1581
Industry	2534	2574
Energy Industry	260	267
Transport	3558	3568
Fugitive	443	1249
Total Energy	13267	14214
Industrial Processes	0	246
Waste	13	559
Agriculture	0	721
Total	13280	15739

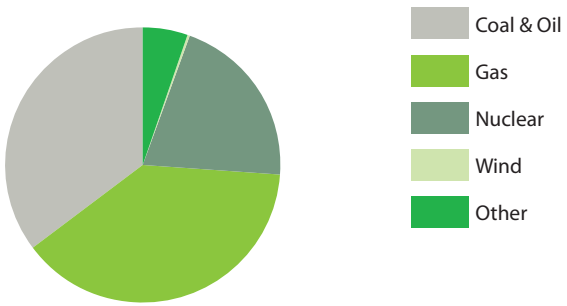
Glasgow Chart 2 below shows how electricity was generated in the United Kingdom in 2005.

In 2005, 35% and 0% respectively of electricity generated in the UK and the region was from coal and oil generation, 38% and 0% was from combined cycle gas turbines, 21% and 0% was from nuclear power, 1% and 100% was from wind power and 5% and 0% was largely from other forms of renewables. The country imported approximately 2% of its electricity in 2005.

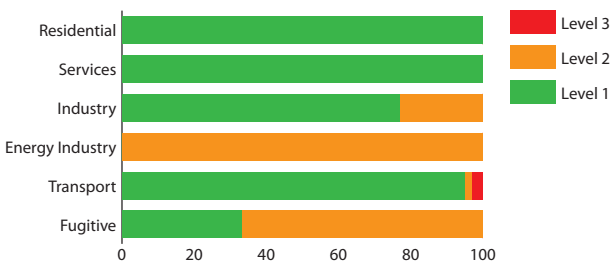
Glasgow (GCV) Chart 1: Energy Sector



Glasgow (GCV) Chart 2: National Electricity Generation



Glasgow (GCV) Chart 3: GRIP Methodologies Used



Scenario Overview

INTRODUCTION

There were two scenario sessions conducted in the Glasgow and the Clyde Valley (GCV) Region, both of which focused on reducing CO_2 emissions by 80% by 2050.

To ensure that the scenarios were developed independently, the participants in the two sessions were not informed how previous groups either in the GCV or outside had acted. This section provides a comparison between the approaches taken in the first two scenarios.

The emissions decrease by 87% and 90% and energy demand decreases by 40% and 32% in Scenarios 1 & 2 respectively.

ECONOMY AND POPULATION

In both scenarios there has been inward migration of climate refugees. In Scenario 1, these migrants come primarily from southern England. In Scenario 2 they come from southern Europe. This helps Scotland to maintain an active working population. In both scenarios the average household size reduces due a greater number of the elderly and young living alone. In Scenario 1, urban areas are more attractive, as people seek access to shops, schools and other services, amidst rising transportation costs. In both scenarios the region's share of the economy remains at 3% as changes in the region reflect developments across the UK. In both scenarios the sectorial split in the economy remains the same and economic growth is modest. In Scenario 2, a national (Scotland) decision has been made to limit economic growth.

RESIDENTIAL SECTOR

Emissions decrease by 89% and 95% in Scenarios 1 & 2 respectively. In both scenarios, heat demand in the residential sector reduces more, in percentage terms, than electricity demand. Furthermore, the share of fossil fuels used for heating reduces, replaced by electric heating as a 'cheap and easy' option for heating buildings. Combined Heat and Power (CHP) has a role in both scenarios, contributing no less than 5% of the heat in each. On-site renewable electricity generation provides 2% and 20% of electricity demand in scenarios 1 and 2 respectively. In Scenario 1, renewable heat generation provides a greater proportion of heat demand than Scenario 2. This is due, in part, to a limited amount of roof space in urban areas.

SERVICE SECTOR

Emissions decrease by 92% and 98% in Scenarios 1 & 2 respectively. In both scenarios, demand for heat and electricity has decreases and the share of fossil fuels reduces. The increase in electric heating is more pronounced in Scenario 1, with biofuels playing a larger role in Scenario 2. In both scenarios, CHP plays a small role and is fired by bioenergy.

INDUSTRIAL SECTOR

Emissions decrease by 79% and 74% in Scenario 1 & 2 respectively. Energy demand decreases in Scenario 1 and remains static in Scenario 2. In both scenarios, there has been a move away from heavy industry toward hi-tech and 'green' businesses. CHP provides more energy than it does in the residential and service sectors and a greater proportion of its energy mix is fossil fuel, mainly natural gas. Renewable heat production provides 15% of demand in both scenarios.

ENERGY INDUSTRY

In both scenarios the coal-based energy industry is no longer present in the region, substituted in Scenario 2 by a bioenergy refinery.

TRANSPORT

Road transport emissions decrease by 89% and 91% in Scenario 1 & 2 respectively. There is no change in the number of vehicle kilometres travelled by road in Scenario 1 and a 20% increase in Scenario 2, this difference is partly a function of population growth. In both scenarios an increasing cost of fuel has limited the impact on vehicle travel and 80% of energy use in road transport is electric. However, due largely to the low-carbon-intensity of electricity, Scenario 2 has a greater reduction in emissions than Scenario 1. Electrification of rail has increased to 95% in Scenario 1 and 100% in Scenario 2, replacing diesel. In Scenario 1 there has been an increase in kilometres on rail, reflecting a degree of modal shift.

ELECTRICITY GENERATION

In Scenario 1 the region is part of an UK grid and in Scenario 2 part of an EU grid. Connection to the EU grid reflects a desire to benefit from the advantages of being able to 'export' wind energy and 'import' solar power from southern Europe. In both scenarios, all the electricity generated in the region itself is from on-shore wind.


Emissions EUCO2, with GRIP level

Scenario 1: Glasgow

Scenario Characteristics

IN THIS LOW GROWTH SCENARIO CO_2 EMISSIONS REDUCE BY 87% AND PER CAPITA EMISSIONS CONTRACT TO 1T. END USER ENERGY CONSUMPTION SHRINKS BY MORE THAN A THIRD. THE POPULATION SIZE DOES NOT CHANGE. POLICY HELPS TO DRIVE DOWN ENERGY CONSUMPTION IN THE RESIDENTIAL SECTOR. THIS IS COMPLEMENTED BY AN UPTAKE OF ONSITE RENEWABLE ENERGY GENERATION. PUBLIC ADMINISTRATION TAKES THE LEAD IN REDUCING EMISSIONS IN THE SERVICE SECTOR. A SWITCH TO HIGH TECH INDUSTRY FURTHER HELPS REDUCE EMISSIONS. PRIVATE VEHICLE USE DOES NOT CHANGE DESPITE AN INCREASE IN THE COST OF MOTORING. THE REGION RECEIVES ITS ELECTRICITY FROM A LOW-CARBON SCOTTISH GRID, WHICH IS A NET EXPORTER OF ELECTRICITY.

"You can't use a ground-source heat pump to bash metal!"

ECONOMY AND POPULATION

"Energy is a big problem in the South East, so data management industry could relocate to the North West. And climate change could lead to a very competitive advantage."

The population of the region has remained stable. This lack of population growth can be accounted for by two factors: an aging population and economic migration, though this is balanced by people moving to the region to escape water stress and energy shortages. Household size has reduced as people desire to live alone.

The economy of the region has experienced an average annual growth rate of 0.5%, mirroring that of the UK. Climatic changes across the UK have meant some competitive advantages in Scotland. Industry forms a 33% share of the regional economy, driven in part by manufacturing renewable energy technologies. The relative shares of the economy held by agriculture, commercial and public administration have remained unchanged.

RESIDENTIAL SECTOR

Emissions have reduced by 89% due to legislation requiring a 45% decrease in household heat demand. Two-thirds of households now use low-carbon grid electricity for direct space and water heating. On-site technologies for heating and cooling, primarily solar thermal panels with some air- and ground-source heat pumps, are popular, providing 15% of household heat demand. These technologies are installed mainly on new houses, although there has been some retrofitting. A small amount of bioenergy is used directly in households. A community-level CHP, fuelled entirely by bioenergy is being developed. Natural gas and fossil solid are still burned directly in some homes.

"More smart metering! So we know how much a shower costs."

Household electricity demand, not including that used for heating, has reduced by 30%. Technological developments have made household appliances more energy-efficient, and economic difficulties mean that the boom in consumer electronics seen at the start of the century was unsustainable. Economic difficulties have led to adoption of energy efficiency measures and behavioural change aided by smart metering. Financial penalties for poor performing houses were considered and rejected on social equality grounds.

SERVICE SECTOR

"Mortuaries as combined heat and power again!"

Emissions have reduced by 92%. Electricity and heat demand have reduced by 40% and 25% respectively. Fossil fuels now meet a fifth of heat demand and electric heating systems meet 70% of heat demand. On-site renewable technologies, principally solar thermal panels with some air- and ground-source heat pumps, meet 7% of heating requirements. Behavioural and technological changes such as sensors to turn off lights when a room is unoccupied have helped to reduce electricity consumption. The public administration sector took a lead in bringing about these demand changes.

INDUSTRIAL SECTOR

"Fabrication of new materials for construction has plenty of opportunity in Glasgow."

Emissions have reduced by 79%. Industrial activity in the region has become more high-tech, requiring electricity rather than fossil fuels. This driver has led to heat demand dropping by 30%. Industry has its own CHP units mainly powered by bioenergy. On-site renewables are used for lower temperature processes where possible.

"We're likely to see a reduction in energy consumption in industry as we move to more high-tech production rather than other types of industry."

ENERGY INDUSTRY

The coalfield in the Clyde Valley has closed. Energy industry emissions have therefore reduced to zero.

TRANSPORT

"How will people socialise? If they're not going out to the pub, and socialise on Facebook, do we have to worry about transport as much?"

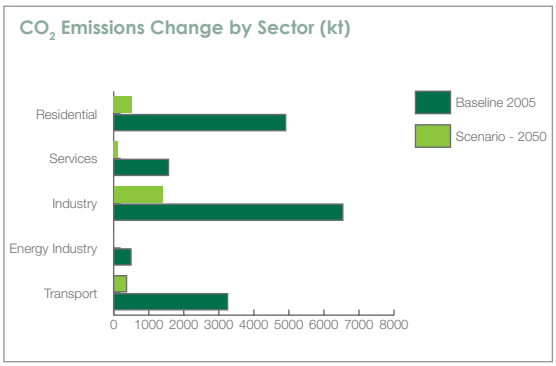
Emissions from road transport have reduced by 89%. Significant price rises led to an initial reduction in road transport kilometres, but people grew accustomed to the high prices and started to use their cars again. Kilometres travelled now are the same as in 2005. However, the majority of the road fleet is electric and legislation meant that all new cars had to be highly efficient; improvements in engine design mean that road transport is twice as efficient as it was in 2005. Flexible working hours have minimised road congestion and changes to commuting times have spread rail use evenly throughout the day. Vehicle kilometres travelled by rail have increased by 20% and the rail sector has reduced its emissions, by 87%.

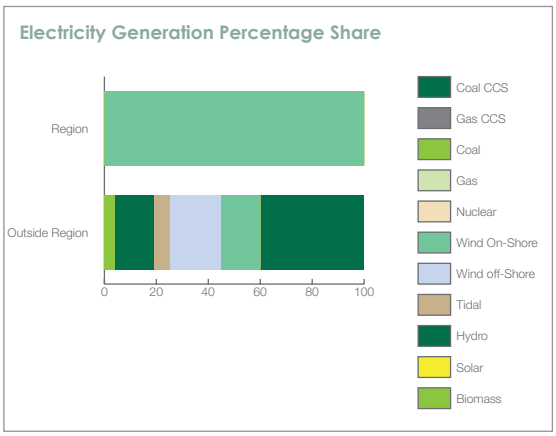
"Hydrogen may not be the way forward, but it's a good interim option on the way forward. Would there be a hydrogen grid to move it about the country?"

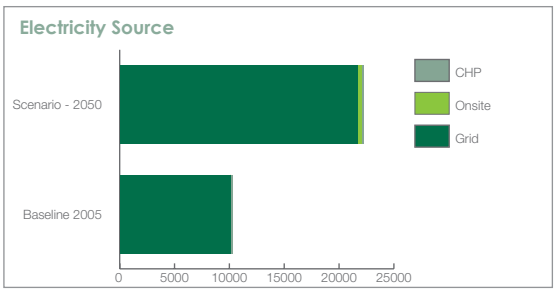
The marine sector is more energy-efficient, but the relatively long lifespan of ships means that it will be some time before the whole fleet meets high energy standards. Petroleum remains the only fuel used. The aviation sector has grown since 2010, but competition from high-speed rail, which has received UK-wide investment, has meant that the growth was less than expected. The sector has reduced its emissions by 43% through improving engine efficiency and introducing a small amount of bioenergy into the fuel mix.

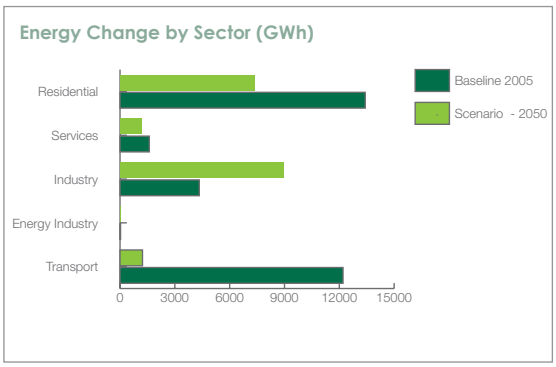
ELECTRICITY GENERATION

Scotland is a net exporter of electricity. Hydroelectricity has increased and tidal power has been widely introduced. Coal fitted with CCS contributes slightly more of the electricity mix than it did in 2005. Scotland's nuclear power plants were decommissioned at the end of their operational lives. Scotland has capitalised on one of its strongest natural resources, wind, which provides 35% of grid electricity. Bioenergy plants have not been widely adopted. As in 2005, the only large scale electricity generation plants in the Glasgow region are onshore wind farms.









Emissions Change	-87%
Energy Change	-40%
Emissions per Capita	1t

Scenario 2: Glasgow

Scenario Characteristics

IN THIS MEDIUM GROWTH SCENARIO CO_2 EMISSIONS REDUCE BY 90% AND PER CAPITA EMISSIONS CONTRACT TO 0.7T. END USER ENERGY CONSUMPTION SHRINKS BY MORE THAN A THIRD. THE EMISSIONS REDUCTIONS OCCUR DESPITE A POPULATION INCREASE WHICH IS PARTLY DRIVEN BY CLIMATE MIGRANTS. POLICY, PARTIALLY INFLUENCED BY ENERGY SECURITY, DRIVES DOWN ENERGY CONSUMPTION IN THE RESIDENTIAL SECTOR. THE SERVICE SECTOR TAKES ADVANTAGE OF THE LOW-CARBON INTENSIVE ELECTRICITY TO ELECTRIFY ITS HEATING. EFFICIENCY IMPROVEMENTS IN THE INDUSTRIAL SECTOR STABALISE ENERGY USE. PRIVATE VEHICLE USE INCREASES AT A SLIGHTLY LOWER RATE THAN POPULATION GROWTH. THE REGION RECEIVES ITS ELECTRICITY FROM A LOW-CARBON EUROPEAN GRID WHICH SCOTLAND WAS KEY TO SETTING UP.

ECONOMY AND POPULATION

"Scotland could become more attractive as a region to migrate to as the climate changes."

The population has increased to 2 million. The population in the rest of the UK has grown at the same rate which means that the Glasgow region still accounts for 3% of the UK population. Climate change in southern Europe has prompted migration to cooler countries such as Scotland. The average number of people per household has decreased to 1.5, reflecting a trend, especially amongst the young, for people to live alone. Half a million homes have been built to accommodate this change in living patterns. Holyrood limited economic growth to an average of 1.5% per year. The sectorial shares of the economy have not changed.

RESIDENTIAL SECTOR

"Tenants [do not have] control over energy efficiency of their [residential] building."

Emissions have reduced by 95%. On average, each home uses 75% less energy to keep it warm. Demand for electricity, excluding that used for heating, has decreased by a fifth. Rising energy costs and smart metering have acted as incentives to save energy and use efficient technologies. Technological convergence means that one device can often provide the service that was provided by several devices.

"There is no evidence that consumers will become more efficient through their own behaviour change. Especially as young people now use more and more gadgets."

Despite pressure from the gas supply industry, the share of natural gas use in the residential sector has declined. There was public concern about Scotland's reliance on other countries for its energy supply, which made natural gas unattractive. Electric heating has developed and is the primary form of heating in residential buildings. The relatively short payback period of ground-source and air-source heat pumps has made them a popular choice for home heating. Increasingly, new housing stock has high standards of energy efficiency due to the introduction of concrete legislation after 2010, and incentives have encouraged retrofitting of the existing building stock. However, the residential sector has been one of the slowest to adopt new technologies, due to the cost of renovations and tenants in rented accommodation having little autonomy to make changes.

SERVICE SECTOR

Emissions have reduced by 98%. Heat demand has decreased by 60%. This was a challenge and took time as many old Victorian buildings required specialised retrofitting. Like the residential sector, electric heating is popular, and meets 54% of heat demand. On-site heat renewables meet a further 10%. Strong legislative measures have discouraged the use of air conditioning and reduced electricity consumption by lighting and appliances by 30%.

"A lot of Victorian office buildings are currently being fitted with air conditioning – this is likely to put up energy consumption."

INDUSTRIAL SECTOR

Emissions have reduced by 74%. The industrial sector is more efficient, and despite growth, overall there has been no increase in electricity or heat demand. The water industry is electricity-intensive, so the low-carbon intensity of the grid has been pivotal in helping to reduce its emissions. The petrochemical industry has contracted and there has been a growth in 'green' manufacturing, including wind turbines and metals recycling.

"Glasgow has high electricity consumption in industry, because the water consumption is electricity-hungry, i.e. a large reduction can be achieved by decarbonising the grid."

It has been possible to introduce a greater range of fuels in industry than in the residential and services sectors. The heat energy mix is similar to the residential and services sectors; electric heating dominates. Natural gas and biofuel contribute to the energy demand and on-site heat technologies provide more heat than

in the residential and services sectors, reflecting larger roof areas and the greater requirement for heat in industry. CHP is more extensive in industry, contributing 16% of heat energy and 9% of electricity and is fuelled by bioenergy and natural gas.

ENERGY INDUSTRY

Coal extraction in the region has finished, new bioenergy refineries are the only remaining energy industry. Some of the bioenergy crops used are grown locally. Heat demand in this sector has doubled since 2005, but all of this energy is carbon-free.

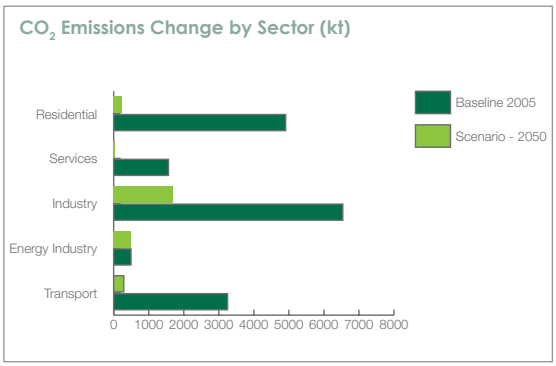
TRANSPORT

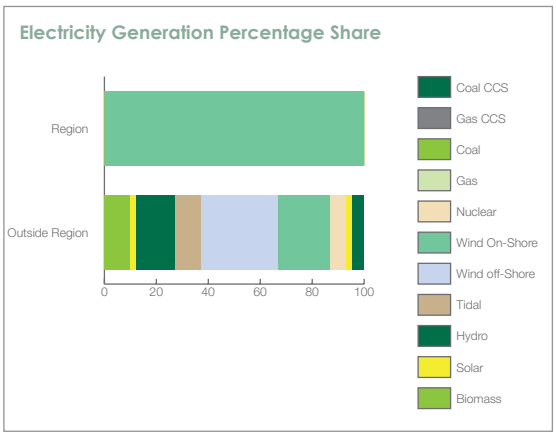
Road transport emissions have reduced by 91%. Road vehicle kilometres have increased by less than the region's population, at 20%. In parallel with this increase there have been improvements in engine efficiency. Early in the century, the price of petroleum rose and this deterred people from travelling by car. As cleaner, more efficient technologies were developed, car use increased. Road vehicles are largely electrically propelled.

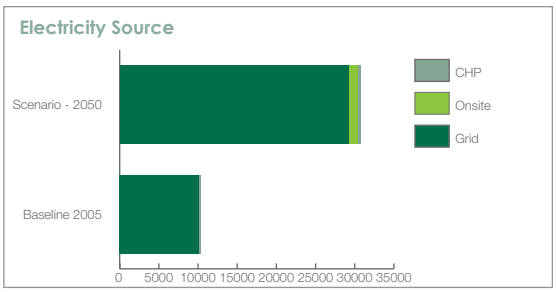
Emissions from rail transport have reduced by 99% due to electrification and low-carbon electricity production. Marine emissions have halved due to fuel switching. There has been no change in aviation vehicle kilometres although bioenergy now accounts for half the energy mix.

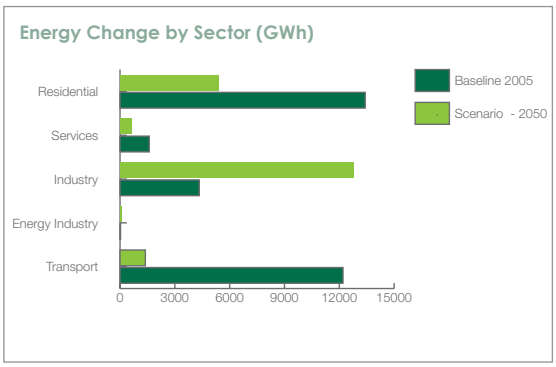
ELECTRICITY GENERATION

Scotland helped create a European grid to overcome intermittency issues associated with using renewables. Solar energy from Southern Europe accounts for a small amount of electricity generation. Nuclear's share of the grid is relatively small, as incentives have been directed to renewables. Half of grid electricity is sourced from on-shore and off-shore wind, with a significant amount from tidal power, hydroelectric and bioenergy. Coal-fired and natural gas power stations are scarcer across the continent, but all now have CCS technology fitted. The grid is therefore 93% carbon-free. It is carefully managed to balance electricity supply. As in 2005, the only grid electricity generated in the region is from on-shore wind.









Emissions Change	-90%
Energy Change	-38%
Emissions per Capita	0.7t

Next Steps: Glasgow and the Clyde Valley

INTRODUCTION

This section identifies how the Glasgow and Clyde Valley region might work towards meeting at least an 80% reduction in CO_2 emissions by 2050. It has been informed by discussions in the scenario sessions, information provided by the region and, the knowledge of the research team.

To facilitate the transition to a low-carbon economy it is important to take a full energy systems perspective. To advance the low-carbon agenda, policy makers have a range of approaches available to them including education and awareness raising, taxation, financial incentives and planning regulations. These approaches will need to work across sectors, regions and countries, and are key components of building a sustainable energy action plan. It should be noted that whilst climate change mitigation was the original focus of the $EUCO_2$ scenarios, discussion in the sessions often focused on other agendas including energy cost control, security of energy supply and energy self-sufficiency. These agendas and others may be mutually beneficial to the mitigation cause, whilst also, potentially, enabling the 'buy in' of climate sceptic stakeholders.

The $EUCO_2$ scenarios focus on achieving an 80% reduction in CO_2 emissions by 2050; in line with the European target. However, this absolute reduction target may not be appropriate for every region. This is because different regions and sectors have different opportunities to reduce their emissions due to the nature of their activities, and the availability of renewable resources. The year 2050 is used as a future trajectory point to project emissions beyond and therefore the likely global warming that will occur. The European target for 2050 can also be considered as a 2 tonnes CO_2e per capita target (including international aviation and shipping). This alternative target has the advantage of providing a common goal for each region that is not relative to a baseline, but it doesn't overcome the target setting difficulties associated with varying regional sectors and differing renewable access.

Both of the scenarios produced emissions reduction of at least 80% by 2050. The scenarios could be further publicised to show how different actions may lead to different emissions reductions. Further analysis could examine each sector's change in energy consumption and fuel switch to explore different ways in which emission reduction can be achieved. Approximately 10% of heat demand in the service sector is met by on-site renewable heat technologies in both scenarios. One action could be to assess the current technical maximum potential for geothermal energy and set policies and actions to maximise take-up.

RESIDENTIAL SECTOR

In 2005, the residential sector generated 37% of GCV's CO_2 emissions. Heat demand was met by fossil fuels; mostly natural gas. To reduce emissions the approach should focus on demand reduction and fuel switching. If the carbon-intensity of the grid is reduced, electric heating will be an option, and this approach was taken in both scenarios. Behavioural change is key to demand reduction, particularly in the short term and can be promoted through education campaigns. Incentives and information can be used to encourage 'carbon literate' decisions when buying household products, such as fridges, televisions and light bulbs. The introduction of smart meters can help residents to better understand their energy use, and budget to make reductions. The authorities can lead the way with publicly owned housing by retrofitting buildings and subsidising the purchase of efficient household appliances.

Step	Action
1	Use the next step tick sheet at the end of this document to identify which areas of action are within the region's remit, and which need attention at national, European and/or international levels; as well as which areas of action the region would like control of to take effective action.
2	Put in place data collection protocols to monitor emissions using GRIP.
3	Establish renewable energy capacity in the region.

SERVICE SECTOR

The service sector faces similar mitigation challenges to the residential sector in terms of building operations. However, it is arguable that the public authorities should be seen to be taking the 'climate change lead' in their own properties by reducing energy consumption and implementing on-site generation. There may be benefits to the commercial sectors in terms of setting a positive image by taking actions to reduce emissions. As the commercial sector's building stock turns over more rapidly than the residential sector, changes may be implemented faster. Demand reduction and switching to a low-carbon fuel mix is essential to emissions reductions as is a transition to low-carbon intensive electricity.

It is not just a simple matter of changing the sector's buildings, but also the people that work within them. Training programmes to increase the 'carbon literacy' of staff can help to instil sustainable practices, leading to lower emissions, and potentially have a secondary impact on behaviour outside of work. Such activities can also benefit Corporate Social Responsibility (CSR) reporting. Regional level award schemes can help to motivate businesses to make energy efficiency enhancements and provide opportunities for sharing examples of best practice. Furthermore, where such changes involve international companies, actions may diffuse to sites elsewhere.

Energy Service Companies, often in the private sector, can provide financial structures to firms and residential developments that are seeking to reduce their emissions through improved efficiency and the use of renewable technologies.

"THE ARMADILLO" CONCERT HALL
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The Greenhouse Gas Regional Inventory Project

INDUSTRIAL SECTOR

In 2005, industry was responsible for a fifth of the region's CO_2 emissions in 2005. Energy use is primarily for heat demand and this is met by fossil fuels. The region's industry presents mitigation challenges due to the slow rate of capital stock turnover, lack of financial and technical resources, and limitations in the ability of firms to access and incorporate technological information. There may be limitations in the extent to which regional authorities can influence industry: companies may be bound by the European Union Emissions Trading Scheme (EU-ETS) and/or be part of large transnational organisations.

Industry in the region may be able to take advantage of subsidies and tax credits, which are likely to be provided nationally. Due to their size, industrial buildings are often well suited to on-site generation, and electricity companies may be interested in renting space for installations that feed into the grid.

TRANSPORT

In 2005, transport accounted for 27% of the region's CO_2 emissions. Road transport, marine transport and aviation are currently entirely dependent on oil and, if allowed to grow, may increase emissions. Regional policies can aim to reduce the amount of road vehicle kilometres travelled through encouraging the use of public transport, walking and cycling, and by promoting the transition to lower-carbon fuels. Activities in other policy areas such as the location of housing can influence transport demand and it is therefore important that all planning measures consider the implications for transport provision. The region has relatively low car ownership and therefore further investment in public transport, and walking and cycling schemes will have benefits by lowering social exclusion in addition to mitigation. Providing the additional

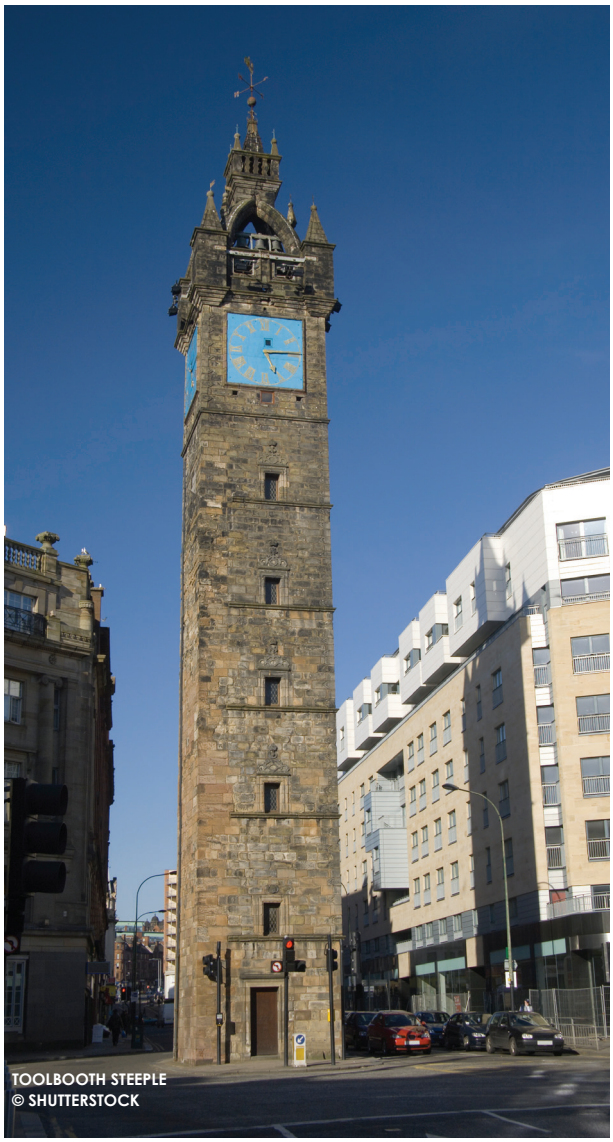
generating capacity requirements can be met and the carbon intensity of electricity can be reduced, electric cars could be part of a sustainable transport system for the region.

The emissions reduction potential of the aviation sector can be met by improving fuel efficiency of technology, operations, and air traffic management, for example, by introducing the continuous descent approach. However, such improvements are expected to only partially offset the growth of emissions if the sector continues to grow. The longevity of aircraft implies that enhancements in engine technology will not happen as rapidly as in the case of, for example, private cars.

ELECTRICITY GENERATION

The carbon intensity of electricity decreases in both scenarios. There may be opportunities to import low-carbon electricity from other countries in the future. Scotland may be able to capitalise on its renewable capacities; meeting its own need, and exporting surplus supply abroad. Research is underway to establish the capacity for generating electricity from low-carbon, renewable sources in the region. It is important not to delay action on electricity generation, since infrastructural longevity means that technology installed now is likely to still be in use for several decades.

We trust that the outputs of $EUCO_2$ are helpful in developing their climate change strategy and in bringing about meaningful change that embeds emissions reductions in the activities of region.



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