Development of New Renewable Energy and Recycling Industries for Lancaster and Morecambe

Final Report

Lancaster & Morecambe Vision Board

June 2006

CONFIDENTIALITY (Confidential or not confidential):	**CONFIDENTIAL**
Project Name:	Development of New Renewable Energy and Recycling Industries for Lancaster and Morecambe
Project Number:	**LMVB001**

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Revision History Records

Revision	Date	Creation / Update summary
R0	28/5/06	Gill Fenna
R1	9/6/06	Gill Fenna
R2		

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Overview

This study has been carried out for Lancaster & Morecambe Vision Board by Quantum Strategy & Technology Ltd to identify the potential for the development of renewable energy and recycling industries in Lancaster & Morecambe, and to assess the potential contribution of renewable energy to the district's energy consumption.

The study shows that there is sufficient potential for both renewable energy and recycling industries to justify taking a number of options further. It recommends that Lancaster & Morecambe support the development of;

- Biomass energy, including local production of biomass, use of biomass in large-scale heating systems and a biomass power station;
- Low-carbon buildings technologies, including low-carbon design of new developments, improvements to existing buildings, micro-generation and controls technologies;
- Recycling industries, including collection and reprocessing organisations and the development of the Middleton Recycling Park;
- Wind energy installations in suitable locations;
- A small energy-from-waste plant linked to the Middleton Recycling Park.

The existence of expertise within Lancaster University of the developing marine energy technologies leads to the conclusion that the potential for this industry should be investigated further.

It is possible that a local renewable energy industry could support over 350 jobs in the medium term, with a further 580 short-term jobs in construction. The recycling industries could generate over 250 extra jobs.

The development of local renewable energy generation capacity could provide up to two-thirds of the electricity demand of the district, and make available sufficient heat to replace 40% of the gas demand, provided that this could be used cost-effectively.

Executive Summary

Lancaster & Morecambe Vision Board has recently developed an economic Vision for Lancaster & Morecambe, which is an ambitious statement of how they would like to see the district develop in the 21st century. As part of this Vision, seven "transformational projects" have been proposed, which are seen as the key actions needed to turn the Vision into reality. One of these transformational projects is "the development of a new renewable energy industry to become a major UK centre of excellence for environmental technology".

This study has been carried out for Lancaster & Morecambe Vision Board by Quantum Strategy & Technology Ltd in response to an identified need to educate the Vision Board about the potential for a new renewable energy industry, the barriers and competition from other areas, and the realistic economic impact of such a development. The Vision Board have commissioned the study to provide recommendations on;

- The development of high value employment in the renewable energy sector within Lancaster & Morecambe, with the aim of replacing at least 1,600 nuclear industry jobs by 2025;
- The potential for local self-sufficiency in renewable energy;
- The potential synergies in addressing both the renewable energy and waste & recycling sectors.

This study provides information on the main renewable energy technologies and recyclable materials, and identifies the potential to develop industries in both these areas.

Market Drivers

Global investment in renewable energy reached over £20 billion in 2005, accounting for 20-25% of all investment in the power industry. Although home to a significant proportion of renewable energy resources, the UK was slow to enter this market. However, government policies on climate change, as well as security of supply issues, have lead to a rapid increase in the installation of renewable technologies and support for the development of new technology areas. The most significant pieces of UK legislation are;

- *Climate Change Levy (CCL),* effectively a tax on business energy use, increasing unit energy prices by around 15%.
- *Renewable Obligation (RO),* a requirement on electricity suppliers that by 2010, at least 10% of the energy they provide must come from certified renewable sources, with interim targets for each year up to 2010.
- *Energy Efficiency Commitment (EEC),* a requirement on electricity and gas suppliers to achieve targets for improvements in domestic energy efficiency.
- *Renewable Transport Fuel Obligation (RTFO),* which will be introduced in 2008, will require the fuel supply industry to incorporate a minimum percentage of biofuels into the fuel mix.

In the waste sector, the rapid loss of available sites for landfill, coupled with two important pieces of legislation, have improved the economics of recycling and lead to the growth of that industry. The two main fiscal incentives are;

- The Landfill Tax, which was introduced in 1996 and currently stands at £21/tonne;
- The Packaging Regulations, under which businesses have to account for the recycling of a proportion of the packaging which they generate.

Market Size

The UK renewables sector is expected to see £15 to £19 billion worth of capital expenditure by 2020 and the North West has been one of the leading regions in identifying the economic opportunities provided by both the renewable energy industry and climate change issues. A mapping exercise of the industry in the North West carried out in 2002 identified over 100 companies in renewable energy with a turnover of around £52 million. This report suggested that the sector had strong growth potential, with the available renewable energy market within the North West expected to be around £580 million by 2010 and employment increased to around 1500 high-value jobs. An update of this work in 2005 showed that the North West industry had almost doubled in size in 3 years to over 900 employees with an annual turnover of £104 million.

Potential for Lancaster & Morecambe

Lancaster & Morecambe has a number of generic strengths which would recommend it as a location for both the generation of renewable energy and the development of renewable energy and recycling industries, including;

- A coastal position with good wind resources and access to marine energy resources;
- A good electricity distribution infrastructure radiating from Heysham which will minimise the costs of grid-connection, thus over-coming one of the key barriers to renewable electricity in many areas;
- Two major utility companies with a significant level of expertise in energy engineering, transmission and storage;
- Easy access to import facilities which may be essential for some energy schemes;
- Expertise in some renewable energy technologies and related control systems within Lancaster University;
- Planning permission for a new waste and recycling centre at Middleton to deal with municipal waste;
- Several waste handling organisations currently collecting and separating municipal & commercial waste;
- A population with a relatively good understanding of environmental issues and a significant number of people committed to pursuing a green lifestyle;
- Support for green issues within the City Council, both among members and officers;
- A strong LSP with good co-operation between public agencies and local businesses as well as particularly active Forums in Energy and Recycling.

However, the district has a relatively weak manufacturing sector and few local companies are involved in the renewable energy field. It is an unlikely area for inward investment, particularly in the more traditional engineering-based energy industries. The district is far more likely to develop industries based on the skills and interests of existing companies or inhabitants who have no reason to move away.

Recommendations

There is sufficient potential for both renewable energy and recycling industries to justify taking a number of options further. We would recommend that Lancaster & Morecambe supports the development of;

- Biomass energy, including local production of biomass, use of biomass in large-scale heating systems and a biomass power station;
- Low-carbon buildings technologies, including low-carbon design of new developments, improvements to existing buildings, micro-generation and controls technologies;
- Recycling industries, including collection and reprocessing organisations and the development of the Middleton Recycling Park;
- Wind energy installations in suitable locations;
- A small energy-from-waste plant linked to the Middleton Recycling Park.

The potential for marine and hydrogen technologies in the longer term should be investigated further.

Economic Value

We estimate that the energy industries recommended could generate employment for around 360 people, in the medium-term (10 years) and add over £12 million/year to the local economy. A breakdown of the employment and annual GVA generated (at 2006 values) by these industries is shown below.

Energy Industry	GVA/employee	Annual GVA	Employment
Biomass power station	£47,480	£1,424,390	30
Biomass supply	£23,206	£4,641,176	200
Small biomass supply & installation	£47,480	£1,899,186	40
Wind	£47,480	£142,439	3
Energy from Waste	£40,942	£818,846	20
Marine/Hydrogen	£47,480	£949,593	20
Energy Services/Low Carbon Buildings	£47,480	£2,373,983	50
Total	**£33,745**	**£12,249,614**	**363**

In addition, a further 580 jobs could be created during construction of wind turbines and a biomass power station.

The recycling industries could generate around 265 jobs, with an annual GVA of around £7 million.

Renewable Energy Generation Capacity

The maximum realistic renewable energy generation capacity within Lancaster & Morecambe (excluding off-shore) is 100 MW electricity and over 200 MW heat. This is sufficient to power 56,000 homes, or provide 66% of the projected electricity demand in the district in 2020. The heat generated could theoretically replace 42% of the projected gas demand in the district, but only if efficient uses can be found for the output from CHP plants. The breakdown of energy production potential is shown below.

Energy Source	Capacity MW		Output GWh	
	Electricity	**Heat**	**Electricity**	**Heat**
Wind	66		130	
Biomass - large	30	90	240	(700)
Energy from Waste	3	3	30	30
Microgeneration	1	120	3	120
Total	**100**	**213**	**403**	**150 - 850**
Lancaster & Morecambe Demand 2020			611	2,109
Potential supply from renewables 2020			**66%**	**7 - 42%**

Recommended Actions

Action 1. Gain Commitment from Lancaster City Council

Lancaster & Morecambe Vision Board have already committed to the development of a renewable energy industry within their Vision.

Lancaster City Council needs now to publicly declare support for a local low-carbon, low-waste economy and the development of renewable energy and recycling industries. This should include the setting of a target for a reduction in CO_2 emissions across the district.

Lancaster City Council will need to allocate resources to achieving this goal. This will include, at least;

- Resources to manage an internal climate change programme, to demonstrate a reduction in emissions related to the council's own activities;
- Resources to contribute to managing the implementation of the renewable energy projects identified within this report.

Lancaster City Council will also need to contribute to the achievement of a low-carbon, low-waste economy via the planning system through the introduction of policies favouring renewable energy and challenging targets for on-site renewable energy and recycled material content in the Local Development Framework.

Action 2. Recruit an Energy Project Manager

To get to the stage where these suggestions become reality will take considerable organisation and will involve a large number of people. We would therefore recommend that Lancaster & Morecambe Vision Board, in conjunction with Lancaster City Council, recruit a project manager to take responsibility for developing the projects and applying for funding, as well as to provide a focal point for the networks of people & organisations involved.

This project manager would work on the following projects.

- Biomass – development of biomass-fuelled power station and heating systems, supported by local growth of energy crops;
- Wind – detailed investigation of a number of possible sites for small-medium sized developments;
- Recycling & Energy-from-Waste - development of the Middleton site as a Recycling Park and providing support for increased collection and reprocessing facilities in the district;
- Low Carbon Buildings - investigating the potential for a low-carbon buildings demonstration site and providing business support to local organisations involved or moving into low-carbon buildings or microgeneration technologies;
- Communication - Developing a communications plan to involve local inhabitants and businesses in Lancaster's low-carbon, low-waste economy.

This is an exciting opportunity for Lancaster & Morecambe, and, if properly supported, will put the district on the path to realising the significant economic potential of the low-carbon, low-waste future.

Acknowledgements

Quantum would like to thank the following for giving their input to this study;

Adrian Maddocks	Wind Direct
Alison Page	Furniture Matters
Andrew Dobson	Lancaster City Council - Planning
Andrew Swarbrick	Lancashire County Developments Ltd.
Ann Johnson	Utility Auditing
Ann Morris	Lancaster Chamber of Commerce
Bob Whitaker	Bob Whitaker Stoves
Chris Roberts	C&G Recycling
Chris Shearlock	Envirolink
Claire Gloyne-Philips	ReMade NW
David Howard	Centre for Ecology & Hydrology
David Taylor	Irvine Taylor
Elizabeth Bruce	CLAREN
Fiona Nicholls	Sustainability North West
George Aggidis	Lancaster University
George Jardine	CMS UK
Graham McClean	Port of Heysham
Graham Webster	Glasson Grain
Helen Sweeney	GONW
Huw Davies	Graveson Energy Management
Ian Sibbick	Envirolink
Jim Birkett	Lancaster District National Farmers Union
Joe Flanagan	NWDA
John Lovell	Regional Assembly
John Metcalfe	Lancashire Rural Futures
John Saunders	WRAP
Julian Carter	RNW
Kevin Cochrane	Centrica
Kevin Lambert	Carbon Trust NW Office
Kevin Thompson	Peter Grant Papers
Lucia Marquart	Lancashire CC Projects Team
Malcolm Mitchell	Heat Log Energy
Marie Heesom	Hainsford Energy
Mark Bacon	Lancaster University

Martyn Butlin	British Energy
Matt Wilkinson	Regional Assembly
Midge Kelly	West Lancashire District Council
Mike Kay	United Utilities
Nick Jenkins	Joule Centre
Patrick McConville	Energos
Richard Collins	John Amos & Co
Rowena Hammon	NW NFU
Simon Clark	Centrica Renewables
Stephen Dickinson	Ecometric
Steve Talbot	E & S Fuels
Stuart Ede	Northern Tissue Group
Sue Proctor	Lancashire County Council Waste Team

Contents

1 Introduction

1.1 Background

Lancaster & Morecambe Vision Board, a public/private partnership of 26 individuals, supported by Lancaster City Council and NWDA, has recently developed an economic Vision for Lancaster & Morecambe, which is an ambitious statement of how they would like to see the district develop in the 21st century. As part of this Vision, seven "transformational projects" have been proposed, which are seen as the key actions needed to turn the Vision into reality. One of these transformational projects is "the development of a new renewable energy industry to become a major UK centre of excellence for environmental technology".

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The results of this study and recommendations will be used to support informed decisions on actions and investments in the district.

1.2 Structure of the Report

To address the requirements laid out by the Vision Board for education, analysis and recommendations, this report is structured as follows;

<u>Sections 2-6: Education</u>

- Section 2 contains an analysis of developments in energy policy at the international, national and regional level, which are driving the markets for renewable energy and energy efficiency technologies.
- Section 3 summarises the energy production and consumption trends in the UK and the corresponding statistics for the Lancaster District.
- Section 4 provides an overview of the size of the renewable energy industry in the North West and potential for growth.
- Section 5 provides detailed information on the range of renewable energy technologies, the current and likely future market for the technology, current suppliers, and links with Lancaster & Morecambe.

- Section 6 provides information on the major recyclable materials and opportunities for re-use and recycling industries.

Sections 7 - 9: Analysis

- Section 7 is the SWOT analysis covering the potential to develop renewable energy and recycling industries within the district and the potential for local renewable energy generation.

- Section 8 gives a detailed assessment of the most promising options.

- Section 9 assesses the economic and employment implications of the proposed options.

Sections 10 - 11: Conclusions and Recommendations

- Section 10 provides two possible scenarios for the development of renewable energy and recycling industries in Lancaster & Morecambe.

- Section 11 proposes a set of actions required to take forward the recommended options.

1.3 Methodology

The first phase of the project consisted of background research to summarise information available from a range of sources, including national and regional studies of the renewable energy market, national and regional studies on the recycling sector and EU and UK government energy and waste policy documents.

This was supplemented by interviews and informal contacts with the major organisations involved in renewable energy in the region, including the NWDA, the NWRA, Renewables NW, Sustainability NW, Envirolink NW and the Joule Centre, to get an up to date assessment of policy direction and other initiatives in the region.

Finally, a series of interviews were carried out with local organisations which have, or could have, a role to play in helping to develop renewable energy and recycling industries in Lancaster & Morecambe. A list of interviewees in given in the Acknowledgements section at the front of this report.

2 International, National and Regional Energy Policies

This section reviews the international, national and regional policies and programmes which are relevant to developments in the energy field and renewables in particular.

2.1 International Policies and Programmes

The most important international agreement in the energy area is the Kyoto Protocol. This was negotiated in response to concerns about the effect that our activities are having on global climate change. The initial treaty was agreed by most industrialised countries in 1998 but it did not come into force until 2005 when Russia ratified the treaty and pushed the total commitments to over 55% of global emissions of greenhouse gases (GHG). The most important GHG is carbon dioxide (CO2), most of which arises from burning fossil fuels. The treaty aims to reduce emissions of GHG by 5.2% of 1990 levels by 2012. The United States and Australia have refused to sign the treaty because they believe doing so would damage their economies and important developing countries such as China, India and Brazil do not have targets in this first phase. The 141 countries who have ratified the treaty have already agreed that there should be a second phase after 2012 and that the developing countries will be directly involved. There have also recently been the first signs from the USA (in Presidential speeches) that they are beginning to take the threat of climate change seriously.

The Protocol involves a complex set of mechanisms which encourage energy efficiency and the use of low carbon technologies such as renewable energy. It also allows for trading of emissions between countries on the premise that this will provide the most economic means of reducing GHG emissions globally, e.g. an investment in an energy saving project in a developing country is likely to save more energy (and provide a greater reduction in GHG emissions) than an equivalent investment in, say, the UK or Germany.

The EU has always been a strong supporter of the Kyoto Protocol and has developed a number of policies and programmes aimed at reducing greenhouse gas emissions. The EU as whole is committed under Protocol to reducing its GHG emissions by 8% from a 1990 base. Since different countries within the EU have a different carbon profile, the total amount has been shared on a differential basis amongst member states, with the result that the UK has to reduce its emissions by 12.5% by 2012. This will almost certainly be achieved, largely through the increased use of gas rather than coal for power generation since the early 1990s (coal combustion emits around 60% more CO_2 per unit than gas). However, the UK's CO_2 emissions have been increasing in the last three years.

The EU introduced its own Emissions Trading Scheme (EU ETS) in 2005, mainly affecting power generators and several energy intensive sectors. The EU ETS allocates each organisation in the scheme an annual CO_2 allowance (their 'cap'); if an organisation exceeds this allowance they must purchase additional allowances from someone who is below their cap or face a significant fine. This encourages investment in renewables (which emit no CO_2) and energy efficiency measures as well as stimulating a market in trading allowances.

EU energy policy priorities are aimed at three main objectives as set out in the recent Green Paper[1] for consultation:

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[1] Green Paper: A European Strategy for Sustainable, Competitive and Secure Energy. COM (2006) 105 final.

- *Sustainability* with three strands addressing the development of competitive renewable sources of energy, curbing energy demand within Europe and leading global efforts to halt climate change and improve local air quality;

- *Competitiveness* dealing with opening-up of energy markets to competition whilst stimulating investment in clean energy production, mitigating the impact of higher international energy prices and keeping Europe at the cutting edge of energy technologies;

- *Security of supply*; tackling the EU's rising dependence on imported energy through a variety of means including an integrated approach to reducing demand and diversifying the energy mix based on indigenous and renewable energy sources.

EU policies are implemented through a series of white papers and directives, covering areas such as renewable electricity, energy performance of buildings, liquid biofuels, cogeneration of heat and power and energy services. The directives can have a significant impact on energy markets, for example the Biofuels Directive has stimulated some major investments in biodiesel and bioethanol capacity.

The EU operates a number of programmes which support the development and deployment of sustainable energy technologies and services. The two main ones are:

- The Framework Programmes which provide funding for R&D and technology demonstration covering a wide range of technologies including energy. The current programme, Framework 6 (FP6), ends this year and does not have any new calls for proposals in the energy field. However, the plans for FP7, which will run from 2007 to 2013, include a significant budget (€2.95 billion) for energy R&D covering topics such as hydrogen & fuel cells, renewable energy, CO2 capture & storage, clean coal technologies, smart networks and energy efficiency and savings. The programme will also be used to support large scale demonstration projects through innovative financing mechanisms aimed at fostering private sector expenditure by improving access to European Investment Bank loans;

- Intelligent Energy Europe (IEE) which provides funding support for projects to address the non-technological barriers to the deployment of renewable energy and energy efficiency technologies. These projects could cover aspects such as awareness raising, training, events, financing schemes and supply chain initiatives. The current programme is nearing completion but there will be one more call for proposals at the end of May 2006 with a budget of around €50 million and a deadline in the autumn. This could provide an opportunity for a project in the Lancaster & Morecambe area linked to other EU Member States. IEE will continue beyond 2006 under the banner of the Competitiveness and Innovation Programme.

2.2 UK National Policy

The UK national policy for energy sits within the framework of the Kyoto Protocol and, of course, takes account of EU Directives. An Energy White Paper (EWP) was published in 2003 with four main policy goals:

- To put ourselves on a path to cut the UK's CO_2 emissions by 60% by 2050, with real progress by 2020;

- To maintain the reliability of energy supplies;
- To promote competitive markets in the UK and beyond;
- To ensure that every home is adequately and affordably heated.

The 60% target emanated from a report by the Royal Commission for Environmental Protection (RCEP) which recommended that this level of reduction was necessary to reverse the effects of climate change. Subsequent work by the Carbon Trust suggested that the target could be achieved by a combination of energy efficiency improvements, renewables and emerging technologies such as fuel cells. A sub-text of the EWP was that, by taking the lead in tackling climate change, the UK could become a leader in low carbon technologies and services and be in a position to export this expertise to other countries.

The policy is supported by several pieces of legislation, the most important of which are:

- *Climate Change Levy (CCL).* CCL is effectively a tax on business energy use, increasing unit energy prices by around 15%. All non-domestic use of gas, electricity, coal and LPG is subject to the CCL but energy intensive sectors can obtain a rebate of 80% if they enter a long-term agreement with the government to improve their energy efficiency by a specified amount each year. This has stimulated significant investment in energy efficiency measures and, latterly, renewable energy schemes (because energy from renewables is exempt from the CCL).

- *Renewable Obligation (RO).* The RO is a requirement on electricity suppliers that by 2010, at least 10% of the energy they provide must come from certified renewable sources, with interim targets for each year up to 2010. Suppliers are able to purchase Renewable Obligation Certificates (ROCs) from other parties to meet their commitments and this has led to a market in ROCs which effectively subsidises the investment in the renewable scheme. The current ROC price is such that it is higher than the market value of the electricity produced. It is this mechanism which has stimulated the current interest in wind generation in particular.

- *Energy Efficiency Commitment (EEC).* Under the EEC, electricity and gas suppliers are required to achieve targets for improvements in domestic energy efficiency. At least 50% of energy savings must be focussed on a priority group of low-income consumers in receipt of certain benefits and tax credits/pension credit so the EEC should also contribute to the eradication of fuel poverty. This has led to the promotion and subsidy of measures such as low energy lighting and appliances, loft and cavity wall insulation and condensing boilers.

- *Renewable Transport Fuel Obligation (RTFO).* In November 2005, the government announced that a RTFO will be introduced in 2008, which will require the fuel supply industry to incorporate a minimum percentage of biofuels into the fuel mix. The proportions of biofuels have been set at 2.5% for 2008/9, 3.75% for 2009/10 and 5% for 2010/11. In a similar mechanism to the ROCs, there will be the possibility to buy and sell credits for biofuel production.

The government has just (March 2006) published a consultation document, *"Our Energy Challenge",* as part of a current energy policy review. This reiterates the four main policy goals of the EWP and reviews progress against these goals in the light of recent changes in the energy sector. These include increased worries about long-term effects of climate change, security of supply issues and steep rises in energy prices, all of which are currently high profile in the media and hence in the minds of the public. The EWP highlighted the role of energy efficiency and renewables in achieving its goals but the Consultation Document, whilst confirming the importance of these routes, also states that nuclear and coal generation (with carbon abatement technologies – see below) could have an important role to play. In fact, Tony Blair has announced ahead of the consultation results that there will be a new-build nuclear programme.

Consideration of nuclear and coal is coming about because the UK is increasingly becoming a net importer of oil and gas and the market penetration of renewables and energy efficiency technologies is slower than anticipated. All of these solutions could have a big impact on the economy and job creation prospects.

There have been a number of other developments at a national (and EU) level which have important implications for the energy sector. These include:

- An increase in the level of the Renewable Obligation to 15.4% by 2015/16 to encourage continued investment in renewables;
- The doubling of the Energy Efficiency Commitment aimed at energy savings in the domestic sector which is expected to lead to investment of over £2 billion between 2005 and 2011;
- Additional funding of £140 million over the period 2005-08 for Warm Front which helps to take households out of fuel poverty;
- The establishment of the Nuclear Decommissioning Agency to take responsibility for the clean-up of 20 UK civil nuclear sites;
- The production of a Carbon Abatement Technology (CAT) Strategy which addresses the potential for the UK to take a leading role in the development and commercialisation of CATs that can make a significant and affordable reduction in CO_2 emissions from fossil fuel sources. CATs include higher efficiency conversion processes, switching to lower carbon alternatives and CO_2 capture and storage.
- Government plans to support demonstrations in the field of fuel cells and hydrogen probably in the form of Capital Grants with a budget of £15 million over the next 4 years;
- The publication of the Government's strategy for the promotion of micro-generation and the replacement of support programmes such as Clear Skies with the Low Carbon Buildings Programme. This also addresses key issues concerned with the introduction of the EU Buildings Directive and changes to the UK Building Regulations.

All of these developments suggest a growing, long-term market for energy technologies and services.

2.3 NW Regional Policies and Actions

The NW region was quick off the mark in establishing its energy position, led by the North West Development Agency (NWDA). The initial work was an assessment of the renewables resource potential in the region (in 2001) and this was followed by a project to map the regional renewables supply chain in 2002. This led to the formation of Renewables NW, funded jointly by NWDA and United Utilities, to promote renewables in the region. The following year this project was extended to cover the whole of the energy sector supply chain. This showed that there are some 53,000 people employed in the sector in the NW (a third of whom are in the nuclear industry) producing over £5 billion in output to the regional economy and exports valued at around £1.2 billion per annum. This was comparable to sectors such as aerospace (48,000 employees) and chemicals (45,000 employees).

The Energy Mapping study led to the formation of the NW Energy Council (NWEC) and the appointment of a Head of Energy at NWDA to oversee the implementation of a number of 'flagship' projects aimed at reducing CO_2 emissions in the region and maximising the economic benefits of action on climate change. Unfortunately, owing to funding problems at NWDA, progress has been slower than anticipated but one major project – the Joule Centre – has been implemented and a start has been made on several other fronts. The Joule Centre has been established to co-ordinate energy R&D in the North West and to support the work of the NWDA and NWEC in the energy field. It is based at the University of Manchester but has a remit to involve all the region's universities and to stimulate the involvement of the private sector. It is developing a core research programme through a series of calls for proposals, the first one of which has been in the field of offshore renewable energy.

Combating climate change is once again at the forefront of NWDA's activities following a recent announcement by the Chairman and a new regional energy strategy is currently being developed in conjunction with the Regional Assembly. Consultation events were held in April and May 2006.

NWDA has also been instrumental in establishing Envirolink NW as the regional 'cluster' organisation for environmental technologies and services (ETS). Envirolink has sub-sectors for both renewables and energy efficiency and maintains a database of NW companies active in these areas. This includes 10 companies in the Lancaster District in addition to the education and research centres. They also regularly sponsor events to highlight the regions skills, e.g. they have organised a number of inward and outward trade missions to promote local involvement in the wind industry. In March 2006 they co-hosted an event to formulate a regional response to the current EWP consultation. This reiterates the importance of continuing to promote renewables and energy efficiency but also calls for a full review of the economics of nuclear (including the waste issue) against other low carbon technologies prior to sanctioning any new nuclear power stations.

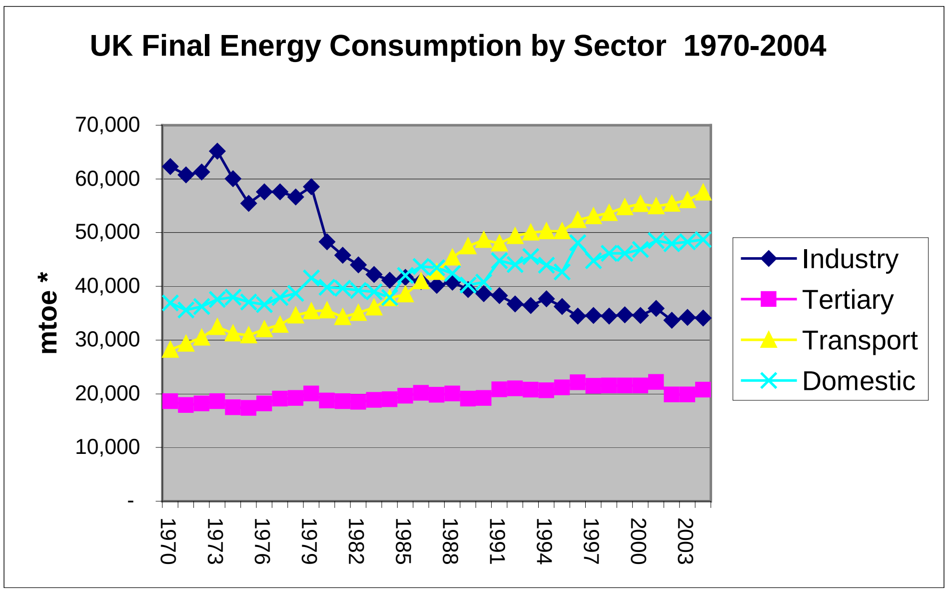
From all of the above it is evident that there would be strong regional support and assistance available to any programme aimed at promoting sustainable energy technologies in Lancaster and Morecambe.

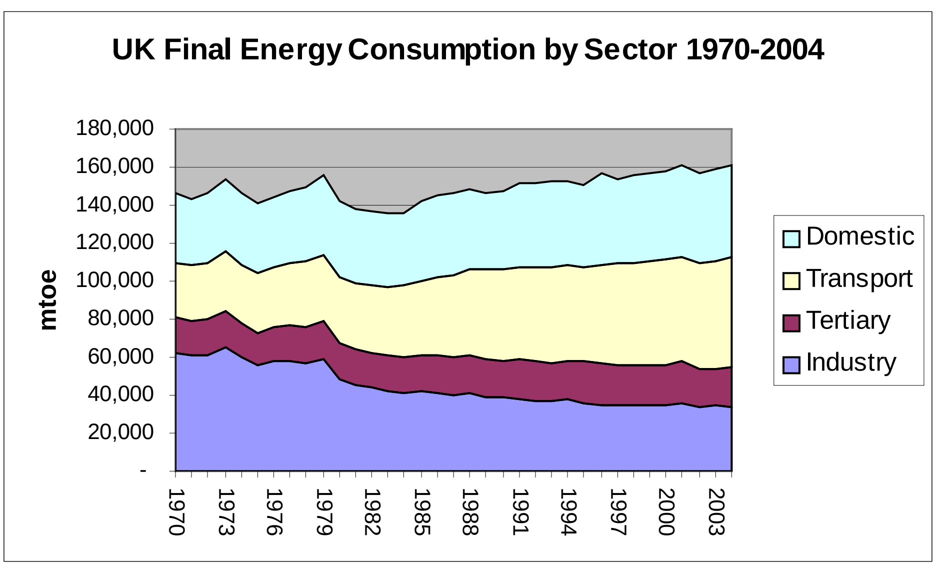
3 Energy Consumption and Production Trends

This section summarises national data on energy consumption and production trends published by the DTI and information on energy consumption patterns within the Lancaster District, based on the DTI survey data for 2003.

3.1 Energy Consumption Trends

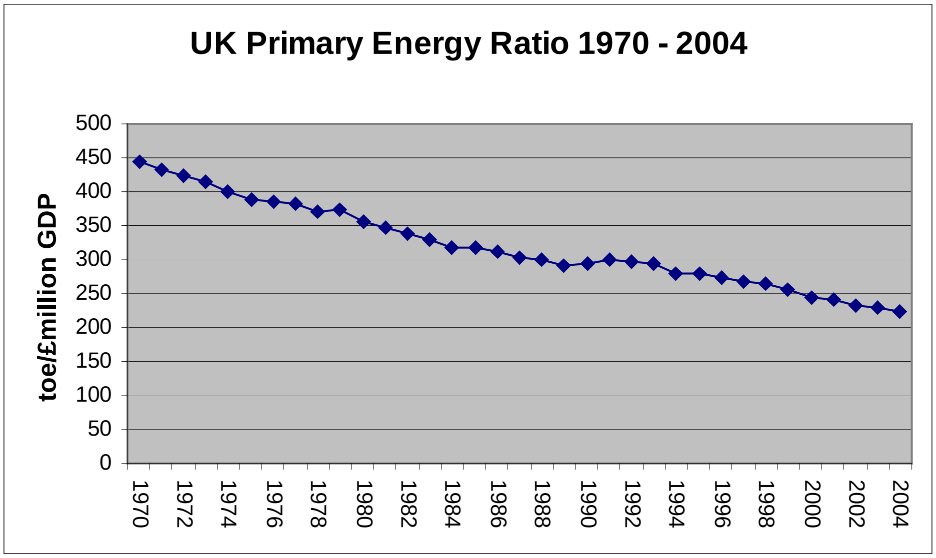
The graphs below show consumption patterns from 1970 – 2004 for final energy (energy at the point of use, not including conversion and distribution losses). As these show, the dramatic reduction in industrial energy use resulting from the decline of manufacturing industries has been more than matched by the increase in both domestic and transport energy consumption.





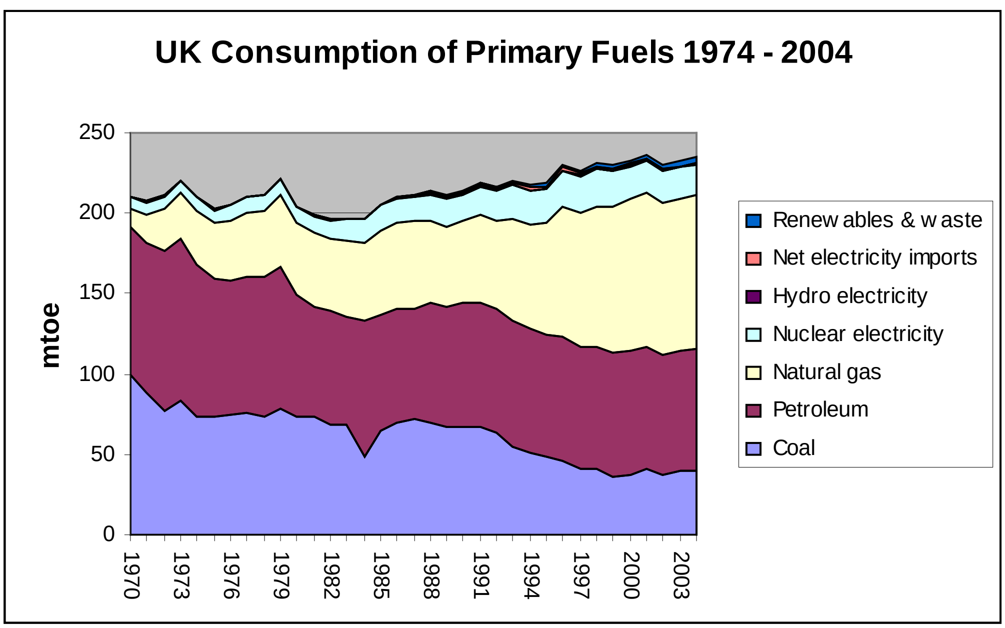
1. Mtoe – million tonnes of oil equivalent.

Since the 1970s, primary energy consumption as a function of economic performance has declined steadily, and we now use half the energy per unit of GDP as was required in 1970.

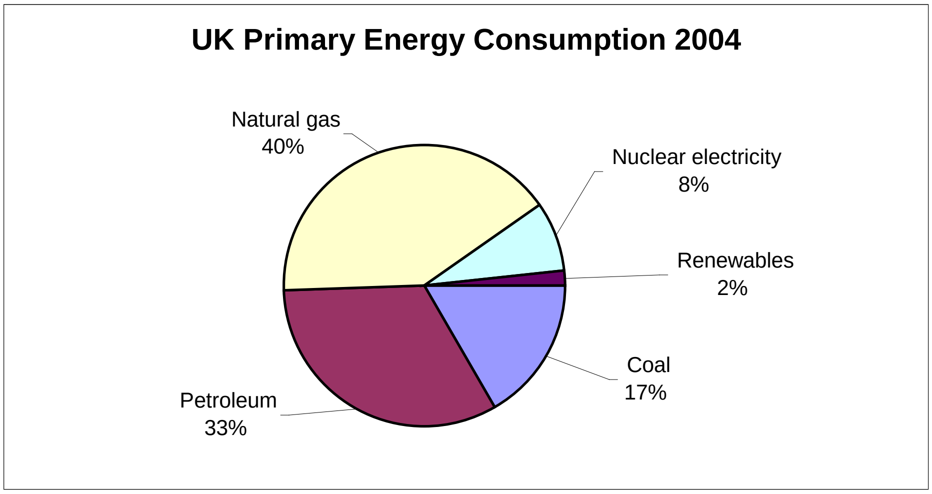


3.2 Energy Production Trends

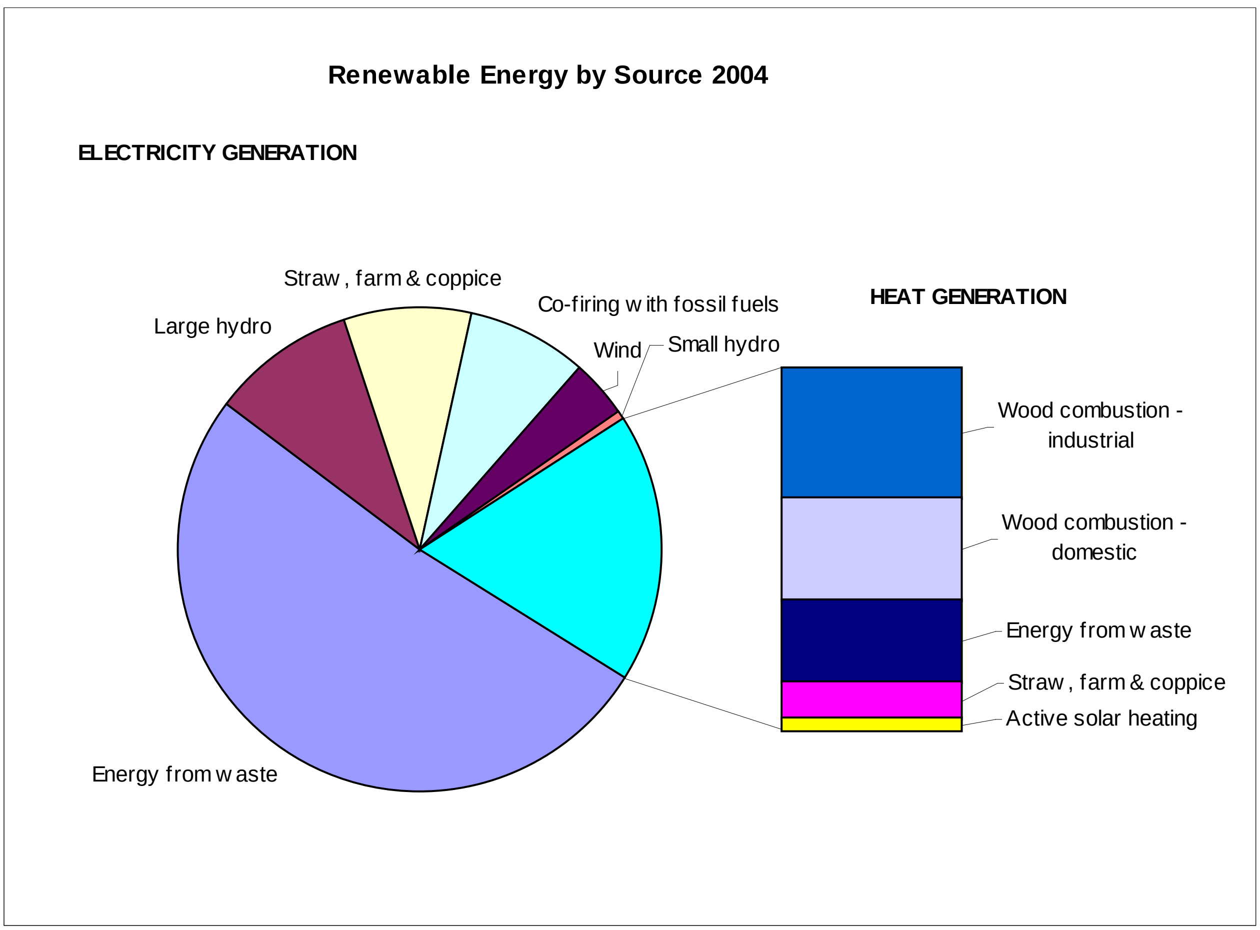
The graph below shows the trend in primary energy consumption by fuel type. Coal has lost its dominant position, having been replaced by natural gas both for heating and electricity generation.



By 2004, renewable energy, including hydro-electricity and energy from waste, accounted for only 1.8% of primary energy.

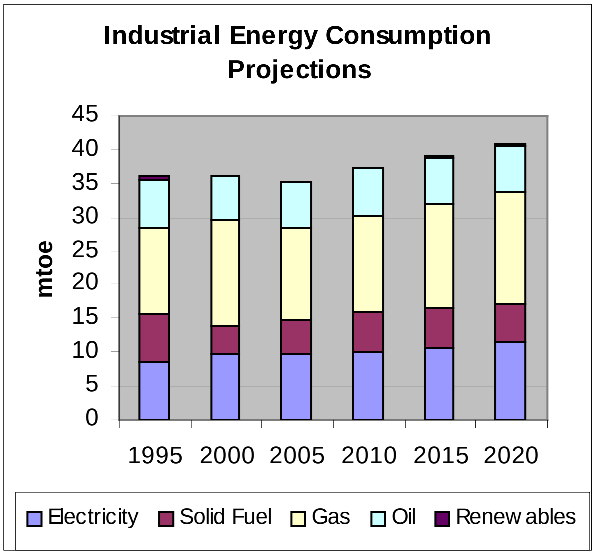


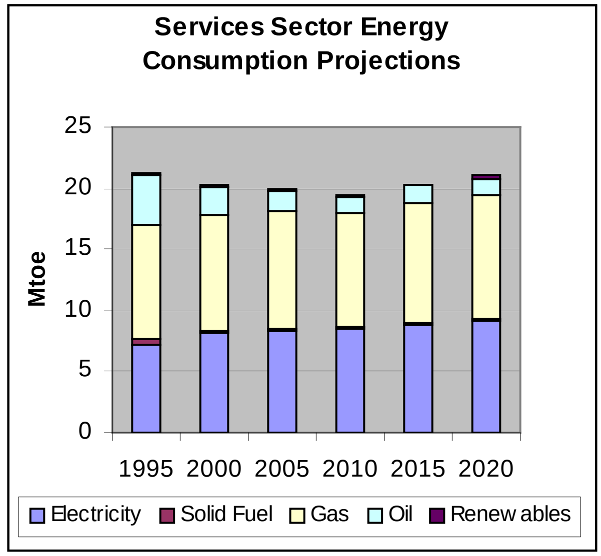
The graph below shows the sources of renewable energy. The majority (over 60%) currently originates from waste materials, either landfill gas, digestion of sewage sludge or combustion of municipal, farm and other waste streams. PV, at only 0.01%, is not shown.

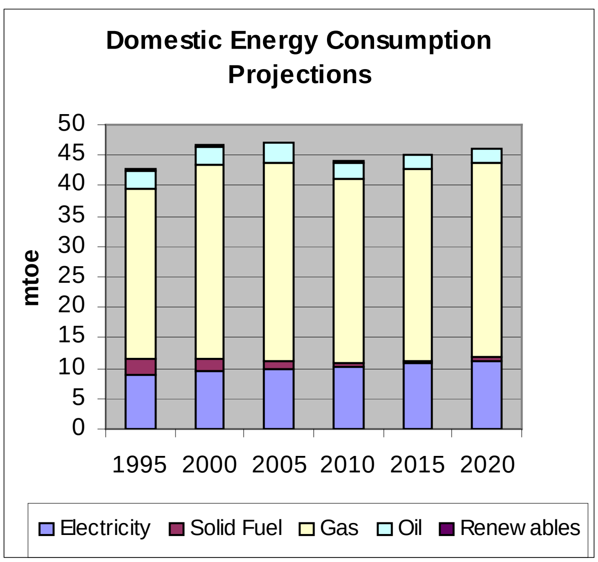


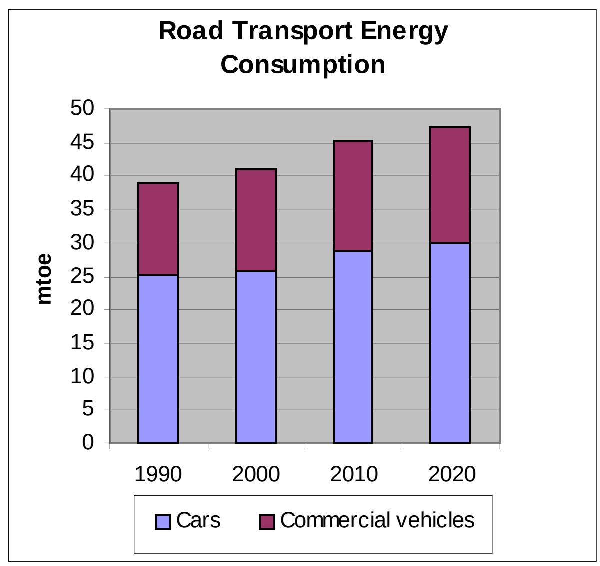
3.3 Energy Projections to 2020

The DTI has recently updated its predictions for energy production and consumption[2]. As the tables below show, final energy consumption, which has remained static or fallen in all sectors except transport since 2000, is expected to rise across all sectors.









These forecasts are based on the assumption that fossil fuel prices peaked in 2005 and by 2010 will have dropped by between 10% - 50% from that peak.

[2] DTI UK Energy and CO2 Emission Projections February 2006

3.4 Energy Consumption in the Lancaster District

Energy statistics at the District level are difficult to obtain, although the DTI carried out an exercise in 2004 to allocate national energy consumption to Local Authority areas. This was based on a combination of information from metered sources and allocation of national data. There are some issues with the accuracy of this data, and the collection methods mean that certain energy sources, such as renewables, were not included. At the same time Defra were carrying out an assessment of CO2 emissions by Local Authority area. As the methodologies used for the two studies were different, the results from the two are not directly comparable.

3.4.1 Metered energy consumption

Data for electricity and gas consumption in the Lancaster District is given below.

Lancaster District Electricity & Gas Consumption 2003[3]

	Domestic GWh	Commercial & industrial GWh	Total GWh
Electricity	248	325	**573**
Gas	950[4]	943	**1893**

These figures are based on metered sales, and do not include any non-metered supply such as off-grid renewable energy, diesel generators or electricity from CHP plants.

3.4.2 Non-metered energy consumption

There is no local data for other heating sources such as oil, coal and wood. Using the national breakdown of domestic use of these fuels[5] would suggest that the quantities of other energy sources are approximately;

- Oil 83 GWh
- Coal & coke 29 GWh
- Other solid fuels 6 GWh.

It is known that coal & smokeless fuels are delivered to around 2,000 homes in the district, which suggests a slightly higher than average use of this fuel.

Industrial use of other fuels is impossible to predict, without having specific information for the large users in the district.

[3] Source: DTI database from National Grid/Transco postcode-level supply data, published March 2005

[4] Includes small industrial/commercial consumers with annual consumption < 73,200 kWh

[5] Digest of UK Energy Statistics 2005, DTI

3.4.3 Transport energy consumption

Transport energy use has been modelled by the DTI, based on population densities and traffic flow measurements for different road types. For the Lancaster district, this gives an estimated annual fuel consumption of just under 100,000 tonnes of oil equivalent (toe) in 2003. This does not include energy consumption for rail transport.

Lancaster District Transport Energy Use 2003

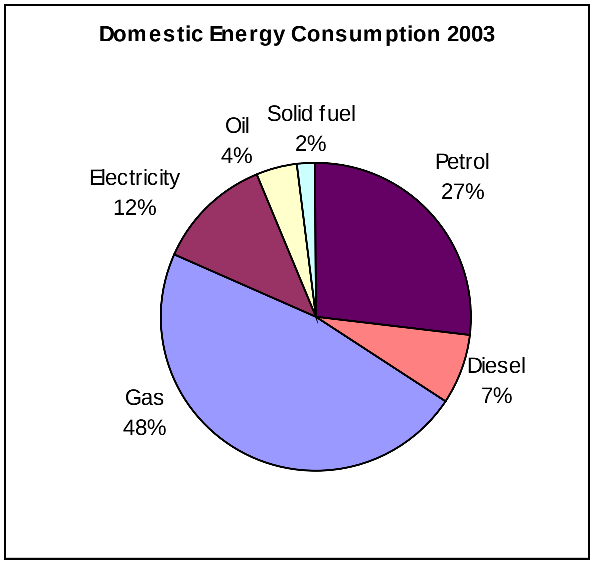
Energy Unit	Buses	Diesel Cars	Petrol Cars	Motor cycles	Total Personal	HGV	Diesel LGV	Petrol LGV	Total Freight	Total
ktoe	3.2	9.1	46.4	0.3	59.1	25.8	10.4	1.3	37.5	96.6
GWh	37	106	540	4	687	300	121	15	436	1,123

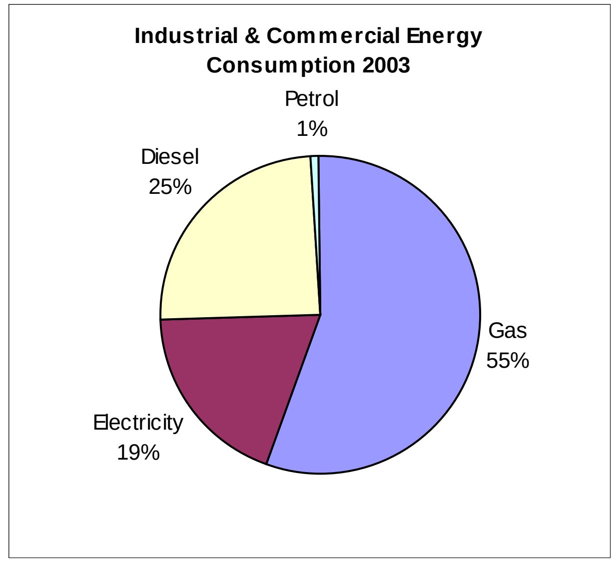
3.4.4 Total Energy Consumption in Lancaster & Morecambe

The total energy consumption in Lancaster & Morecambe is calculated to be around 3,700 GWh per year.

Fuel	Domestic (GWh)	Industrial & Commercial (GWh)	Total (GWh)
Gas	950	943	1,893
Electricity	248	325	573
Oil	83	N/a	83
Solid Fuel	35	N/a	35
Transport	687	436	1,123
Total	2,003	1,705	3,708

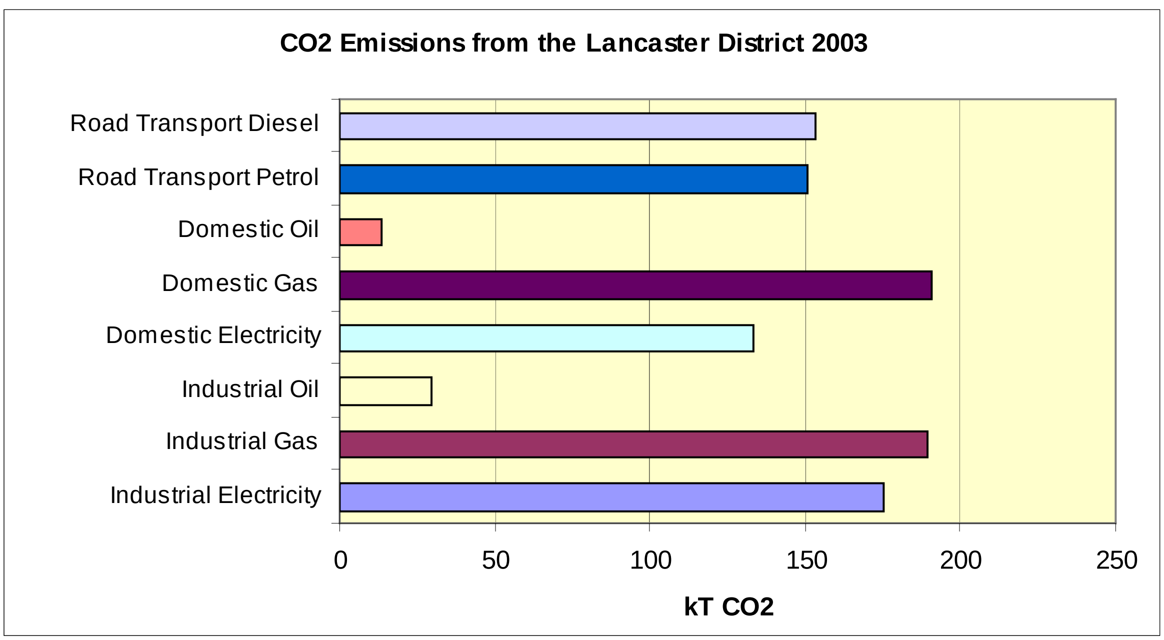
The breakdown of fuel use by sector is shown in the graphs below.





3.4.5 CO2 emissions

From the Defra calculations, it is estimated that the Lancaster District emits some 1.1 million tonnes CO2 per year, or 0.2% of the UK total. The breakdown by source is shown below.



4 Overview of the NW Renewable Energy Industry

Global investment in renewable energy reached over £20 billion in 2005, accounting for 20-25% of all investment in the power industry. Although home to a significant proportion of renewable energy resources, the UK was slow to enter this market.

The UK renewables sector is expected to see £15 to £19 billion worth of capital expenditure by 2020[6]. The NW has been one of the leading regions in identifying the economic opportunities provided by both the renewable energy industry and climate change issues.

The Cluster Mapping exercise carried out in 2002[7] identified over 100 companies in renewable energy with a turnover of around £52 million. However, the sector had only 500 employees in the region and only 10% of the turnover was within the region. This report suggested that the sector had strong growth potential, with the available renewable energy market within the North West expected to be around £580 million by 2010 and employment increased to around 1500 high-value jobs. The additional installed capacity of renewable energy within the region was projected to be between 500 – 1200 MW, with a mid-point projection of 870 MW. The opportunities identified at this time were;

- Off-shore wind off the NW coast and in the Irish Sea
- On-shore wind farms in strategic locations;
- Energy from waste and landfill gas;
- Large and small-scale biomass plants and supporting biomass supply industry;
- Photovoltaic (PV) design and installation
- Power systems engineering and embedded generation,
- Alternative fuels including hydrogen, fuel cells, micro CHP, novel PV technologies and tidal/wave power.

The update of this work carried out by Envirolink in 2005[8] showed that the NW industry had almost doubled in size in 3 years to over 900 employees with an annual turnover of £104 million. The industry is young and the vast majority of businesses are SMEs, with over half being established since 1990. Most of the renewable energy companies in the region provide services across a range of technologies, and the biomass and energy-from-waste sector, with associated CHP plants, represent the main business areas. For most companies in this field, renewable energy represents only a part of their business, with the energy and waste sectors providing the majority of their work. Micro-generation companies represented the smallest sector but have seen the greatest growth since 2002.

[6] *Renewables Supply Chain Gap Analysis* DTI 2004

[7] *Renewable Energy Sector Mapping Report* Enviros 2002

[8] *Market survey of companies operating within the renewable energy sector in England's Northwest* Envirolink 2005

The latest survey also showed that R&D is important to the sector with companies having a relatively high level of in-house research capacity and links to research establishments. The sector remains optimistic about future growth.

4.1 Employment Potential in the Renewables Industries

The renewable energy industries create a relatively high number of jobs per kWh generated, compared to traditional energy industries and with higher than average income per employee.

The 2002 Mapping Report produced estimates for the employment potential of the main technologies in both the construction and operating phases, as shown in the table below.

Technology	Construction and installation full time employees per M Euro investment	Operation and maintenance full time employees per GWh energy generated
Wind offshore	7.8	0.2
Wind onshore	4.6	0.15
Small scale hydro	5.1	0.08
Biomass combustion	4.3	0.08
Anaerobic digestion	7.3	0.22
Biomass gasification	6.2	0.09
Energy crops	11.1	0.42

This data should be treated with some caution as it originated from a 1990 study for the European Commission.[9]

[9] *The impact of renewables on employment and economic growth*, EUROFES, report for the European Commission, DG Energy, 1990

5 Sustainable Energy Technologies

In this section we provide an overview of sustainable energy technologies including:

- the main large-scale renewable energy technologies which are currently deployed in the UK;
- micro-generation technologies for use on or in individual buildings;
- energy-from-waste technologies;
- alternative transport fuels;
- energy technologies which are currently under development and not yet deployed widely on a commercial scale;
- energy efficiency technologies and services, particularly those for use in sustainable buildings.

5.1 Large-scale Renewable Energy Technologies

These technologies include onshore and offshore wind, biomass, hydro and landfill gas.

5.1.1 Wind

Wind is the most commonly deployed renewable energy technology in the UK, producing around 3% of our electricity, and turbines are now a familiar sight in many parts of the country. The turbines harness the power of the wind via the blades to turn a shaft which drives a generator through a gearbox. Individual turbines can range in size from 1kW (usually mounted on the roof of a building) to 5MW (always used offshore because of their physical size). Onshore windfarms typically consist of groups of 10 to 30 turbines, usually each of 1 to 3 MW, producing 10 to 90 MW in total. Offshore windfarms are larger, utilising turbines of 2.5 to 5 MW with a total capacity of up to 500MW. There is also a trend to installing small numbers (1 to 5) of medium sized (500 to 750kW) machines on industrial and brownfield sites. The technology is well developed and the main barrier to installation (assuming the local wind speed is high enough) is obtaining planning permission, particularly for onshore installations.

Because of the Renewables Obligation, wind installations are economically viable and the installed capacity is increasing rapidly. The British Wind Energy Association (BWEA) database indicates that the current installed capacity is 1564 MW from 1557 turbines which generate sufficient electricity for 874,000 homes. In addition there are 660MW under construction, a further 2147MW with planning consent (of which 855MW is offshore) and at least as much again seeking planning permission. Lancaster District has one wind farm at Caton Moor, which is currently being increased in capacity from 3 MW to 16 MW (equivalent to 9000 homes). There are four operational off-shore windfarms around the UK, with planning consent or applications in for a further 8.2GW. Off the Lancashire, Cumbria and North Wales coasts there is one operational windfarm with five more under construction or planned.

The major turbine manufacturers are based in Denmark, Germany, Spain and the Netherlands because these countries developed their wind industry much earlier than the UK. There is therefore little opportunity for NW businesses to access this market. There are, however, opportunities for component suppliers (e.g. gearboxes, control systems) and for companies to construct and maintain the installations.

There is one wind developer in the Lancaster District (Wind Direct) and a number of support businesses, e.g. designing or providing materials for foundations, undertaking PR and communications. Caton Moor is operated by Hainsford Energy and the Barrow offshore wind farm by Centrica Energy. It is likely that this offshore installation will be serviced from Barrow, since it is considerably closer than Heysham, but the new developments off the Lancashire coast may provide opportunities for Heysham Port.

The Envirolink Wind Supply Chain Directory lists almost 200 companies in the NW region who are active in the sector. These companies range from hardware suppliers, through controls, monitoring and maintenance to design and consultancy. The market is therefore already quite crowded.

5.1.2 Biomass

The definition of biomass in EU legislation is "the biodegradable fraction of products, waste and residues from agriculture (including vegetable and animal substances), forestry and related industries as well as the biodegradable fraction of industrial and municipal waste". Biomass therefore includes trees, arable crops, agricultural and forest residues, manures, effluents, sewage sludge, industrial by-products and the organic fraction of municipal solid waste. The last four of these are not regarded as renewable sources for the purposes of the Renewables Obligation and are considered later under the Energy from Waste (EfW) section. Manures are 'renewable' but are also considered under EfW because of the treatment process involved. The remaining sources are regarded as renewable because they are 'carbon neutral', i.e. whilst they are growing they absorb carbon dioxide which is released into the atmosphere when they are burned.

In practice the main forms of biomass used for energy in the UK are:

- Residues from forestry and the timber industry (often chipped or pelletised for ease of handling for transport and combustion);
- Waste wood from industry and commerce which is difficult to recycle (e.g. treated timber, MDF/chipboard);
- Specially grown energy crops such as short rotation coppice (e.g. willow) or miscanthus grass.

Biomass provides an alternative source of fuel for heat (rather than electricity) and so does not qualify for a 'subsidy' from the Renewables Obligation. Some relatively large-scale plants to produce both heat and electricity have been built but most have not been economically successful or have suffered from fuel supply chain problems. Heat-only systems are, however, becoming more common, for example to supply schools or multi-apartment blocks. These usually use pelletised forestry waste but there is increasing interest from waste wood processors in accessing these markets in urban areas using the timber which cannot be recycled to other markets. Many UK coal-fired power stations are co-firing biomass (up to about 5%) to obtain ROCs but often the biomass is imported from abroad (e.g. waste husks from coffee production) because of the cost and the quantities involved. The nearest example to Lancaster District is Fiddlers Ferry power station near Warrington.

Systems using specially grown energy crops are not yet economically viable and at the moment there is a 'chicken and egg' situation – there is insufficient demand to persuade farmers to grow the crops and so large systems cannot be guaranteed a stable supply of fuel – hence few are built. The government is trying to address this barrier by stimulating demand in public sector buildings. They are also considering a Renewables Obligation scheme for heat as well as other possible subsidies (e.g. capital grants for biomass-fired boilers).

Despite the current barriers, the potential for biomass over the next 10 -15 years is very large, particularly as oil and gas prices are expected to continue to rise. Suppliers of systems tend to be small companies installing a few tens of boilers each year, though there are currently none in Lancaster District and few elsewhere in the NW. There will undoubtedly be room for more suppliers as the market expands and also a need for people to install and maintain the systems and provide fuel in a suitable form. In the longer term there could also be opportunities in the farming community to grow energy crops as this route becomes more economic.

5.1.3 Hydro Power

Hydro power is produced when the kinetic energy of flowing water is converted into electricity by a turbine connected to an electricity generator. It can be exploited at various different scales. Large-scale is typically taken to mean more than 20 MW of generating capacity and is usually associated with a dam and a storage reservoir. The UK currently generates about 0.8 per cent of its electricity from hydroelectric schemes – most of which are large-scale installations in the Scottish Highlands built in the 1950s. Hydroelectric is a proven and efficient technology and the most modern plants have energy conversion efficiencies of 90 per cent and above. The potential for identifying new large-scale schemes is now limited, not only because there are fewer commercially attractive sites still available, but also because of environmental constraints.

Schemes of less than 20 MW now offer a greater opportunity for providing a reliable power source with minimal environmental impacts, though most installations in the UK are at the ‘micro’ scale, with a capacity of only a few tens or hundreds of KW. Small scale schemes can be associated with a dam and storage reservoir but most small UK systems are located in a moving stream ("run of river"). There are three installations in the Ribble Valley and several more in Cumbria and in the Pennines to the east of Manchester.

There is significant potential for more such schemes in the UK, especially in hilly areas such as Lancaster District. The DTI estimates that if small-scale hydroelectric power from all of the streams and rivers in the UK could be tapped, it would be possible to produce enough electricity to meet 3 per cent of our total electricity needs and make a significant contribution to the Government’s renewables target. Whether this level can be achieved will depend mainly on economics since the technologies are already well developed.

There are no local suppliers of small hydro systems in Lancaster District but the University has interests in this area and has recently obtained funding from NWDA to investigate the potential for the technology in the NW region. This will be a 2½ year study (reporting end 2008) of the hydro resource, engineering options, economics & public acceptability of small-scale hydro.

The University has been developing a micro-hydro system with the Beck Mickle company outside Kendal. With support from The Lake District National Park Sustainability Fund, they have designed a low cost, 1kW low head hydro system. The first system was due to be commissioned in April 2006, and the company expects to need to tool-up for large-scale production in the short to medium term.

5.2 Microgeneration

Microgeneration refers to small-scale energy supply technologies integrated into housing or other buildings. It includes;

- renewable energy sources; micro wind turbines, micro-hydro (see 5.1.3), photovoltaics (PV) and solar thermal, which depend on the availability of the energy source (sun, wind, water). These require energy for manufacture (embodied energy) but once installed generate no further carbon emissions. The embodied energy is usually matched by generation output in the first few months of operation.

- low-carbon energy sources; biomass (mostly wood) which releases recently-captured carbon when burnt but requires some ongoing energy for transformation into useable materials and transport.

- lower-carbon technologies; micro-chp – single domestic units which generate electricity as well as heat, and ground-source heat pumps which use low-grade heat from the ground but require electricity to transform this into high-grade heat (or cooling).

Microgeneration technologies have been supported by a variety of government grant programmes, mainly aimed at the end user of the technology. From April 2003 to March 2006, the £10 million Clear Skies Programmes provided grants to householders, local authorities and community organisations for the installation of solar thermal, small wind, biomass stoves & boilers, small hydro and ground source heat pumps. A separate programme run by the DTI provided support for the installation of PV.

These two programmes have been replaced by the Low Carbon Buildings Programme, which supports similar technologies but also requires energy efficiency measures to be carried out prior to the installation of renewable energy sources. Micro-CHP systems are also expected to be included although the details for this have not yet been released. The LCBP will provide £10.5 million of support over 3 years to householders and communities and a further £18 million to Local Authorities. A further £50 million support for these technologies was announced in the 2006 Budget but no details of this are available yet.

5.2.1 Solar Hot Water

Solar hot water dominates the current installed base of microgeneration technologies. A typical household solar panel will generate between 1,000 – 2,000 kWh per year, or 30% - 50% of a household's hot water needs. Solar panels cost between £3,000 - £6,000 installed (although DIY kits are available) and are expected to last 20 – 25 years with minimal maintenance. In economic terms, a solar panel is unlikely to pay back the initial investment over its lifetime. Systems are often sold on their green credentials rather than costs savings, and can be a sensible option in combination with, for example, a wood heating system, or in properties not supplied by natural gas. As installation is a significant component of the total cost, larger schemes are more cost-effective and are particularly suitable for establishments with large hot water demands such as care homes and groups of sheltered housing. Many of the larger schemes have been installed with the assistance of local authority or housing association funding, for example to alleviate fuel poverty.

There are around 80,000 systems installed in the UK[10]. Under the LCBP (and Clear Skies) grants can only be claimed for installations made by registered installers. The nearest manufacturer of solar panels is Solartwin in Chester. There are only 11 registered installers in the region, and none in Lancaster & Morecambe. However, at least one non-registered installer operates in the Lancaster District.

5.2.2 Photovoltaics (PV)

Solar PV converts solar radiation into electricity. PV systems can be installed on any south-facing roof with a pitch of less than 40º which is not over-shadowed. Two types of system are appropriate for domestic installations; bolt-on panels and roof-integrated panels or tiles. Roof-integrated systems are more expensive than bolt-on, but if installed as part of a new build or roof replacement, this will be offset by the savings on standard roof tiles. A typical system would be rated at 1.5kW – 2kW (peak generation) and cost between £4,000 - £9,000 per kW installed or £6,000 - £18,000 in total depending on the size and type of system. The average output is 750 kWh/year per kW installed. Annual savings are in the region of £110-150, giving a simple payback period of around 50 years (excluding grant funding).

Solar PV systems can be stand-alone or grid-connected. Stand-alone systems require some form of energy storage (usually battery). Grid connected systems require the installation of two-way meter and an agreement to sell surplus electricity to the electricity supplier.

The PV market has been supported since 2002 by the DTI's PV Major Demonstration Scheme, which ended in March 2006 and has to date funded around 1200 domestic and 180 commercial installations. Small-scale installations were eligible for a grant of up to 50% of the installed cost.

The largest PV installation in the UK is on the CIS Tower in Manchester, a 400ft high array costing £5.5 million and expected to generate 180 MWh/year.

There are several UK suppliers of PV panels, although most panels are manufactured abroad. Solarcentury, who are responsible for the CIS Tower project, have an assembly plant in the UK. Within the North West we are aware of 5 PV system suppliers.

Within Lancaster and Morecambe, we are aware of one large PV installation, on a house in Scotforth.

5.2.3 Wind

Grid-connected micro-wind turbines are relative newcomers to the market, despite having been available for off-grid applications for many years. There are two UK systems currently in the market, which offer a full installation package, although DIY systems are available via many internet sites.

Windsave have developed a 1kW system which is retailing for around £1,000, plus installation costs of around £500, making it currently the most cost-effective renewable energy system, provided that the generation claims are proven. This system is designed to provide only the base-load electricity requirement for an average house (e.g. fridge-freezer and equipment on standby) and therefore does not require a two-way meter or an

[10] Installation statistics from EST "Potential for Microgeneration" 14/11/2005

agreement to sell the surplus electricity. However, the company has some supply problems at present and are concentrating on sales to local authorities. Windsave have also an agreement with Centrica to supply systems under their EEC commitment.

Renewable Devices have developed the Swift Rooftop Wind Energy System, rated at 1.5kW, with an expected annual output of 4500 kWh. These are being sold and installed through Scottish and Southern Energy plc, at a total cost of around £6,000, although the company has indicated that this cost is expected to drop in the near future.

Turbines can have a life of up to 20 years but require service checks every few years to ensure they work efficiently. Wind power is not suitable for all domestic locations, as wind speed is a critical factor in the success of the installation of this technology. Wind speed increases with height and absence of wind breaks so mast-mounted turbines in an exposed locations will be more efficient than building-mounted ones in urban locations. Planning issues such as visual impact, noise and conservation issues also have to be considered, and these have not yet been resolved within Lancaster District. The manufacturers of very small systems are trying to get these included in the planning exemptions covering satellite dishes.

5.2.4 Biomass Stoves

There are two main ways of using biomass, stand-alone stoves providing space heating for a room, usually fuelled by logs or pellets, or boilers connected to central heating and hot water systems. These are suitable for pellets, logs or chips, and are generally larger than 15 kW.

Stand-alone stoves (4 – 8 kW) are generally installed for aesthetic value in the living area of the house, and will be backed up by another heating system. Cost is also dependent on aesthetics but will usually be in the range £400 - £1,000. A disadvantage of wood burning stoves is the effort required to feed and clean them, together with a need for space to store the fuel and a means of disposing of ash.

Pellet boilers (typically 20kW for a three-bedroom semi-detached house) cost around £5000 installed, including the cost of the flue and commissioning. Automatic feed coupled with large storage facilities for fuel and ash reduce the need for cleaning to around once/month. A manual log feed system of the same size would be slightly cheaper, but requires considerably more effort. Fuel costs for wood pellets depend on the supply chain, but can be comparable to gas.

There are numerous small suppliers of logs and at least two companies who supply and install wood-burning stoves in Lancaster district, although neither of these currently supply biomass boilers. E&S Fuels in Lancaster are already manufacturing compressed waste wood logs for wood-burning stoves, and are looking at installing capacity to make wood pellets and supply pellet boiler systems.

The nearest supplier of wood pellet boilers are Talbott’s in Staffordshire, who supply boilers for larger buildings (>50kW) and are not suitable for most domestic applications. A few UK companies manufacture domestic pellet boilers (located in the Midlands & SW), but most domestic scale wood boiler systems are imported – Germany and Denmark are the main suppliers, with other LCBP registered products available from Spain, Finland and the Czech Republic.

5.2.5 Ground Source Heat Pumps (GSHP)

Ground source heat pumps transfer heat from the ground into a building to provide space heating and, in some cases, to pre-heat domestic hot water. For every unit of electricity used to pump the heat, 3-4 units of heat are produced. As well as ground source heat pumps, air source and water source heat pumps are also available.

There are three important elements to a GSHP, the ground loop which is a length of pipe buried in the ground, and is filled with a mixture of water and antifreeze, which is pumped round the pipe absorbing heat from the ground, the heat pump (just like in a fridge or air conditioning circuit) and a heat distribution system, consisting of under floor heating or radiators for space heating and in some cases water storage for hot water supply.

A typical 8kW system costs around £10,000. Based on current fuel prices, a GSHP can be a cheaper form of space heating than oil, LPG and electric storage heaters. It is however more expensive than mains gas. It also cannot be classed as a renewable heat supply system unless the electricity required is generated from renewable sources. The emissions resulting from the grid electricity used roughly equal those saved from a standard gas heating system.

5.2.6 Micro CHP

A number of manufacturers are currently developing small scale combined heat and power (chp) systems potentially suitable for the domestic sector. These systems tend to be based on one of three competing technologies:

- Stirling Engines
- Conventional Boiler plus a Rankin Cycle unit to produce power from heat
- Fuel Cells

Of these technologies, the Stirling engine units are the closest to market with both British Gas and Eon (formerly PowerGen) funding major field trials of units. Costs of these units are difficult to ascertain. The Eon unit is available for trials by Housing Associations at an installed cost of £3,000 although there is a suspicion that this is heavily subsidised.

Dependent on power purchase agreement for exported electricity one of these units can save around £150 per annum in fuel bills and thus cost effectiveness is highly dependent on having installation and maintenance costs within a £1,000 of a conventional gas boiler. The large-scale trials are expected to report during 2006, although early indications are that the economics may not be as good as predicted. Commercial introduction is not expected until at least 2010, whilst fuel cells are not expected on the market till 2015.

Baxi also offer their DACHS unit based on a small internal combustion engine. This unit generates around 5.5 kW and is aimed at providing heat and power to multiple residences.

It is likely that the manufacturers will lease units to householders, with the lease costs partially recovered through energy savings. Both BG and Eon are currently retaining control of training for installation and maintenance of their units. Until recently Eon were funding EA Technology in Chester to provide training but the unit manufacturer Whispertec have now established their own training centre in Coventry. There is unlikely to be any opportunity for a supply industry for this technology in Lancaster & Morecambe.

5.3 Energy from Waste (EfW) Technologies

EfW is most commonly thought of as mass-burn incineration of municipal waste but in fact includes other systems such as landfill gas recovery, gasification, pyrolysis and anaerobic digestion.

5.3.1 Incineration

Incineration of municipal waste is much less common in the UK than in countries such as Germany and Denmark (where it is often used to produce heat for district heating systems and electricity for the grid). There is strong public opposition to large EfW plants in the UK and only one exists in the NW (near Bolton). EfW plants which provide heat and power have existed in Sheffield and Nottingham for many years but the technology has failed to gain general support in the UK, largely because landfill has been the cheap option.

Despite the fact that landfill space is rapidly running out, mass burn incineration is unlikely to be a common solution in the future. Instead, most of the waste disposal authorities (who operate mainly at county level) are considering Mechanical Biological Treatment (MBT) systems which separate out the recyclable material and leave an organic residue. This is pelletised before being burned or gasified and is known as Refuse Derived Fuel (RDF). Public opinion on this route has still to be tested, however. Lancashire County Council have opted for a different MBT process where the residue is in the form of a low grade compost which can be used for improving the quality of contaminated or brownfield land. Hence there are unlikely to be any combustion systems in Lancaster District and so few opportunities for local suppliers unless they can access the wider NW opportunities.

5.3.2 Landfill Gas

Recovery of landfill gas is a well-established renewable energy technology and currently produces around 600MW nationally. All landfill sites contain large amounts of organic material (e.g. garden waste, food waste, paper, wood, textiles) which, as it decomposes, produces significant amounts of methane. This gas has long been collected for safety reasons and up to 15 years ago was simply flared. Nowadays it is normally burned in a gas engine to produce electricity which is sold to the grid. There are several examples of this technology in Lancashire including the landfill site at Salt Ayre. The NW also has a number of suppliers of gas collection systems and components.

The waste industry believes that there is still scope to expand landfill gas generation by about 50% so there may be more opportunities for local suppliers across the UK. However, there are several reasons why this market will not continue to expand in the long term:

- The most economically viable UK sites already have collection and generation systems;
- Few new landfills will be built because of planning restrictions and the fact that the economics of waste management are moving in favour of recycling;
- The EU Landfill Directive is progressively reducing the amounts of organic waste which can be landfilled because methane is a powerful greenhouse gas and so contributes to global warming.

Hence it is unlikely that this area will produce opportunities for new business entrants.

5.3.3 Gasification

Gasification is a thermo-chemical process in which organic waste is heated in an oxygen deficient atmosphere to produce a low-energy gas containing hydrogen, carbon monoxide and methane. The gas can then be used as a fuel in a turbine or combustion engine to generate electricity. Gasifiers fuelled by fossil sources such as coal have been operating successfully for many years, but they are now increasingly being adapted to accept more mixed fuels, including wastes. Gasifiers operate at a smaller scale than incineration plants and can be provided in modular form to suit a range of different scales of operation. As mentioned above, gasification is a potential route for dealing with RDF and may be more acceptable to the public than incineration.

A number of British companies are leading in this emerging technology, one of which is Graveson Energy Management, a company originating from Carnforth but now based in the south of England. Energos, a Manchester-based company have a several systems in operation in Europe, but not yet in the UK.

5.3.4 Pyrolysis

Pyrolysis is another emerging technology, sharing many of the characteristics of gasification. With gasification partial oxidation of the waste occurs, whilst with pyrolysis the objective is to heat the waste in the complete absence of oxygen. Gas, oil and char are produced in various quantities. The gas and oil can be processed, stored and transported prior to combustion in an engine, gas turbine or boiler. Char can be recovered from the residue and used as a solid fuel, or may be passed to a gasifier.

5.3.5 Anaerobic Digestion

Anaerobic Digestion (AD) is a well-established technology which again has not so far been widely adopted in the UK (except in larger sewage treatment plants). The biological processes that take place in a landfill site can be harnessed in a specially designed, closed vessel (the digester) to accelerate the decomposition of wastes and produce methane. AD is particularly suitable for wet wastes such as sewage sludge, manures and food waste. The biodegradable fraction of municipal wastes can be added to wetter wastes to increase the biogas output.

AD is a technology which is likely to see significant growth over the next few years. Many Local Authorities are moving towards separate collection of kitchen waste which, because of the Landfill Directive, cannot be landfilled and must be treated by other means such as in-vessel composting or AD. New legislation is also coming into force which will affect food production plants; AD could be particularly effective here because the methane can be used to fire boilers to produce heat for processes and space heating. The Carbon Trust is actively looking to fund AD demonstration plants, but the economics are still poor except for very large quantities of organic waste.

5.4 Transport Fuels

Biofuels covers the production of liquid transport fuel from energy crops. The Government has introduced two measures to stimulate demand for biofuels. A 20p/litre duty incentive on biodiesel has been in place since July 2002, on a rolling 3-year basis, which will continue until at least 2009.

The Renewable Transport Fuels Obligation (RTFO) will be introduced in 2008, which will require fuel suppliers to include up to 5% (by volume) of renewable fuels within their product sales by 2010/11. For the road transport diesel market, this would imply a biodiesel production of almost 1 million tonnes/year, assuming the 2005 levels of fuel demand, with a similar quantity of bioethanol for petrol vehicles. It is expected that the level of biofuel inclusion will be increased through the RTFO in later years, up to at least 10%.

An issue which has yet to be resolved is that of the capacity of vehicles to use biofuels. At present most vehicle manufacturers will only guarantee their engines for up to 5% biodiesel, which is the blend most commonly on sale in the UK. This issue will need to be resolved before any increase in the RTFO can be introduced.

The RTFO can be met through either biodiesel or bioethanol, and there is no indication as yet whether the fuel suppliers will favour a greater proportion of one over the other. UK production capacity so far is concentrated on biodiesel, although bioethanol plants are planned. It has been estimated that 6 million tonnes of energy crops will be needed in order to meet the RTFO demand for biofuels, which will have important implications for agriculture. In the short term, it is expected that the shortfall will be met by imports of both raw materials and biofuels. It is also possible that the supply industry will buy-out its obligation through the RTF Credit mechanism.

Carbon savings from the use of biofuels depend on the energy-intensity of the agricultural process, but in the UK are expected to be around 50% of the comparable fossil fuel emissions. Carbon emissions related to the supply chain will be monitored as part of the RTFO.

Biofuels, and their raw materials, are internationally-traded commodities. Whilst it would be environmentally preferable to produce sufficient biofuels in the UK to meet our needs, in reality, world prices and the economics of home production will determine whether the UK becomes a major supplier.

5.4.1 Biodiesel

Biodiesel can be manufactured from oil seed rape (OSR), waste vegetable oil (WVO), used cooking oils (UCO) and tallow. The Northwest is not well favoured for growing oil seed rape, but WVO, UCO and tallow are available in the region, although it is estimated that regional production is between 50-75,000 tonnes.

At a 5% blend with diesel, the regional demand for biodiesel would be around 100,000 tonnes.

There are at least 8 companies currently operating or constructing biodiesel production facilities across the UK. A total production capacity of approximately 600,000 tonnes/year will become available once all these facilities are in operation. However, all of the major facilities are located outside the Northwest, with the principal sites being in Scotland, Teeside, Humberside, East Anglia and Essex. These locations offer both access to the best OSR growing areas and allow easy import/export of raw materials and biodiesel products to other European markets.

Although the Northwest has lagged behind other regions in investment in biodiesel, a couple of companies are now undertaking feasibility studies with the aim of setting up large-scale facilities in the Cheshire/Merseyside area. That part of the region has the benefits of an established oil refining industry, access to ports and access to the best potential regional OSR production areas. These plants are expected to be of the order of 100,000 tonnes, which is close to the smallest economic production capacity at current fuel prices.

Biodiesel is now on sale in many areas of the UK, particularly those close to the main production areas. Within the Northwest it is available at a limited number of service stations in the urban conurbations, and not at all in Lancaster or neighbouring districts. At current consumption levels, the 5% RTFO would lead to a demand for around 2,250 tonnes of biodiesel in 2010 in Lancaster & Morecambe.

At current OSR production levels, the UK cannot supply enough raw materials to meet the requirements of the RTFO. It is possible to increase levels of OSR production, although it is expected that there will still be a need to import either biodiesel or raw materials (such as palm oil). The Lancaster District is not suited to growing OSR, and with the loss of tallow production from Nightingale Hall Farm, there is little to recommend it as a site for biodiesel production.

5.4.2 Bioethanol

Bioethanol can be blended into petrol, where it offers air quality as well as carbon benefits. Bioethanol can be produced from a number of crops including sugar beet and wheat. Future technologies may allow bioethanol to be produced from a variety of source materials including wood, grass, straw and green waste.

At present the major bioethanol producers are Brazil and the US, and it is likely that imports will play a large part in meeting the RTFO, as imported prices are currently less than the (theoretical) cost of UK manufacture.

If the RTFO is met through roughly equal proportions of biodiesel and bioethanol, it will require around 3 million tonnes of wheat (or beet), which is greater than the current UK surplus of wheat. While there is potential to supply the total demand from UK crops, the economics of production and quality of grain produced will determine whether the supply is home-grown.

The main wheat-producing areas are in the east and south of the country. While the Northwest has grain production areas, these are predominantly south of Preston. It is unlikely that the Lancaster district will gain any significant part of the increased market for grain or beet. At current consumption levels, the 5% RTFO would lead to a demand for around 2,600 tonnes of bioethanol in the Lancaster district in 2010.

Two bioethanol plants are planned at present, in Southampton and Norfolk, and bioethanol is being sold by Tesco in some southern and eastern areas.

5.5 Developing Technologies

5.5.1 Wave Energy[11]

Wave energy makes use of the power generated within waves by the wind blowing over the surface. The energy available depends on both the height of the wave and time period between the wave crests. The west coasts of the UK and Ireland have some of the best wave & tidal resources in the world. The worldwide wave energy resource is estimated at 2,000 TWh/year, with the UK's *practical* capacity around 8 TWh/year. Wave power is also

[11] Data in this section has been sourced from Lancaster University and the Carbon Trust's publication "Future Marine Energy" – the results of the Marine Energy Challenge programme.

predicted to provide significantly more energy at peak times than at other times. Installed capacity could reach 1 – 2.5 GW by 2020.

Despite having been researched since the 1970's, wave technology is still at an early stage of development. Early devices suffered from a lack of research funding, the fall in energy prices and the development of North Sea oil. To date, research funding for marine energy technologies has been significantly less than for other renewable energy sources. However, support for marine energy was re-introduced in 1999 and the UK is now at the forefront of this research, with Lancaster University recognized as one of the main players, along with the Scottish Universities. Within the EU, Portugal is also offering support for marine energy and is aiming to be a key competitor in this field. At present, the US is not a major competitor, but it is recognised that they will become so as test devices near commercialisation.

Lancaster University has recently participated in the Marine Energy Challenge, a Carbon Trust programme which aimed to assist the development of marine energy technologies and identify the likely costs, timescales and competitiveness of these technologies as part of the UK electricity supply system. Lancaster University is also a partner in the Supergen Marine Energy Research Consortium, a group of universities, marine energy technology and energy supply companies, which is undertaking collaborative research to achieve a step change in the technologies.

Current installed capacity is only a few MW from demonstration devices. There are a number of competing technologies under development, including;

- Pelamis, 750 kW, by Ocean Power Delivery Ltd of Edinburgh, about to be tested off Portugal
- LIMPET, 500kW, by Wavegen of Inverness, in operation off Islay
- PS Frog, Lancaster University's device
- Wavemaster, by Ocean WaveMaster Ltd a UMIST spin-out company and involving Bendall's in Cumbria
- Wave Dragon, a 7MW Danish device being tested off Wales
- Archimedes Wave Swing, a Dutch device being tested off Portugal.

It is expected that the first technology to reach a commercially-acceptable cost of energy generation will be the one to be supported to full deployment, regardless of whether it is the best technical option.

Morecambe Bay is not the ideal location in the UK in terms of wave resource, having a low mean wave power, although some devices are being tested at lower wave heights. It does, however, have the advantage of a good transmission and distribution infrastructure through Heysham, which will have an impact on the economics of systems off the Scottish coast.

5.5.2 Tidal Energy[12]

Tidal energy makes use of the flow of water as the tide rises and falls. The amount of energy available depends on the speed and area of the flow. The Marine Energy Challenge estimated that the UK tidal stream resource is around 18TWh/year, or about 10 – 15% of the known worldwide resource.

Tidal barrage technology is similar to that used in hydro-electric schemes, and hence is relatively mature. However, there are very few commercial-scale tidal barrage schemes worldwide. Within the UK, the 8.6 GW Severn Barrage scheme was investigated in detail between 1974-87 but was abandoned due to economic and environmental difficulties. Tidal barrage schemes face fierce opposition on environmental grounds as they change the characteristics of the inter-tidal zone, impede fish migration and have also been shown to change the tidal regime downstream of the barrage.

Tidal stream devices are basically submerged wind turbines, and harness the flow of the tides without significantly impeding them. These are relatively new technologies and are still under development. The greater density and slower flow rate of water mean that the turbines can be smaller than those used in wind for the same rated power, but there are considerable difficulties to be solved in floating the devices or anchoring to the sea bed, and devising robust power connection mechanisms.

At least 30 suitable locations have been identified in the UK, and a number of devices are under development. Marine Current Turbines appear to be leading the field with the 300kW Seaflow project off the North Devon Coast, in which Bendall's Engineering in Cumbria are involved. MCT are also constructing a 1kW Seagen device. Other concepts under development include the 150kW Stingray (The Engineering Business, Northumberland), TidEL (SMD Hydrovision, Newcastle), Lunar Energy (East Yorkshire), Swanturbine (Swansea University), SeaSnail (Robert Gordon University) and TidalStream. Worldwide, companies in Norway, Canada and the US are strong in this field.

In the NW, the Mersey Estuary and Morecambe Bay are currently being investigated for tidal stream devices. The Bridge Across the Bay project incorporates tidal stream turbines, but, as a combined communications/economic development/energy supply project, the cost cannot be set against energy generation alone. This project is undergoing an Environmental Impact Assessment and it is thought that the practical energy generation capacity will require further investigation.

5.5.3 Hydrogen & Fuel Cells

The combination of hydrogen and fuel cells is seen by many to offer a key solution to the problem of the sustainable and efficient production of power and heat for the 21st century.

Hydrogen is an energy carrier rather than a primary energy source like coal and gas. Currently, it is produced mainly from fossil fuel sources e.g. by reforming natural gas and hence the CO_2 reduction benefits are limited. However, there is potential to develop carbon-free energy pathways for hydrogen from nuclear energy (e.g. by electrolysis of water) and from fossil fuel sources with carbon capture and storage. In the longer term, renewable energy and thermo-chemical sources could become the most important routes for the production of hydrogen.

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[12] Data in this section has been sourced from Lancaster University and the Carbon Trust's publication "Future Marine Energy" – the results of the Marine Energy Challenge programme.

Fuel cells, based on hydrogen and other hydrocarbon fuels, can be used in a wide range of applications from very small scale portable devices, such as mobile phones and PCs, through transport applications in cars, buses, delivery vehicles and ships to heat and power generation for domestic and industrial use. There are also applications for the direct combustion of hydrogen in internal combustion engines, Stirling engines and turbines.

The benefits of hydrogen and fuel cells are associated with very low to zero carbon emissions at the point of use and no emissions of other harmful materials such as NOx, SOx, carbon monoxide and particulates. Hydrogen is a convenient way of storing energy for intermittent renewable sources such as wind, wave and tidal power and for load balancing purposes. Fuel cells also provide high quality and high efficiency electrical supply and quiet operation.

The main challenge for hydrogen and fuel cells is to reduce the system costs to compete with conventional fuels and energy carriers where performance and value-for-money expectations are extremely high. Currently, fuel cells are commercially competitive only in narrow "premium power" niches where reliability and quality of electricity are of primary concern or where no other technology is appropriate (e.g. in some space and defence applications). The use of hydrogen raises problems with distribution, storage and safety issues. There is also the problem of lack of experience and familiarity compared with existing energy systems.

A report on the UK Hydrogen Energy Strategy Framework in 2004 provided a comprehensive analysis of the potential for a switch to a hydrogen economy in the UK and concluded that by 2030 hydrogen energy could provide competitive CO_2 reductions in a number of applications especially in transport. It identified a number of major barriers including the absence of viable end uses for hydrogen. It suggested a range of measures to address this problem such as the deployment of hydrogen and fuel cell vehicles, demonstration of refuelling stations and stimulation of the market for low carbon vehicles. The report also identified a need for the UK to participate in international R&D projects to develop sources of "green" or low-carbon hydrogen, such as from biomass gasification and nuclear technology. Other measures proposed include the use of existing gas pipelines and sub-sea pipelines from offshore renewable energy facilities.

The Government has responded to the report positively and has announced funding of £15 million over the next 4 years for demonstrations of hydrogen and fuel cell technologies. There is also funding for R&D and innovation in this field from the DTI's Technology Programme and the Carbon Trust.

5.5.4 Carbon Abatement Technologies

The DTI has recently produced its strategy for Carbon Abatement Technologies (CATs) in the context of its review of the Energy White Paper goals and the need to achieve the government's CO_2 reduction targets. CATs cover a number of options for reducing the CO_2 emissions from fossil fuel combustion. They include:

- *Higher efficiency conversion processes* to reduce the amount of fuel consumed and hence the associated CO_2 emissions. Examples include advanced boiler and steam or gas turbine designs and improved gasifiers for converting coal and heavy oils to synthesis gas. It is estimated that this could contribute emissions reductions of 10-30% depending on the performance of the existing plant;

- *Fuel switching to lower carbon alternatives in existing facilities* – the main option for this is co-firing of biomass (which is carbon neutral) in large coal-fired power stations (e.g. Fiddlers Ferry). Sources of the biomass include energy crops, agricultural and forestry wastes and food processing wastes. The proportions of biomass for co-firing are generally in the range 5 to 10% and hence this dictates the emission reductions which can be achieved;

- *CO_2 capture and storage (CCS)* in which the CO_2 is captured before or after combustion and committed to long-term storage in geological formations. There are various approaches to the capture of the CO_2 including pre-combustion, amine scrubbing, oxy-firing and the use of ion transport membranes and fuel cells. The transport of the CO_2 is well proven but there are a range of issues associated with its long term storage in geological formations such as depleted oil and gas reservoirs, deep saline aquifiers and unused coal seams. It is estimated that CCS could reduce emissions by up to 85% depending on the type of fossil fuelled plant involved.

The first two options do not appear to offer much in terms of local opportunities for Lancaster & Morecambe since there are no large scale fossil fuelled plants in the area and the expertise is based in other parts of the UK e.g. in Yorkshire. The scope for the use of biomass and energy-from-waste is covered elsewhere in this report.

There could be more potential in the CCS field associated with CO_2 storage in depleted gas reservoirs but the main expertise and developments here are also being led from outside the NW e.g. by British Geological Survey in the East Midlands.

5.6 Energy Efficiency Products & Services

5.6.1 Insulation

Insulating materials consist mainly of mineral wool, wool and foam building products and insulating glass. The UK market for insulating materials was estimated to be worth £600 million in 2004. This market has been growing steadily as a result of a buoyant construction sector, an increase in the levels of insulation demanded in the Building Regulations, the insulation programmes run by the energy utilities under the Energy Efficiency Commitment and social housing upgrades prompted by the Decent Homes standard. The market for insulation is largely supplied nationally, although there is competition for high-performance products from Scandinavia and Germany.

The NW is a major supplier for these materials, having three of the large, international players in the region; Pilkington (glass), Kay-Metzeler (polyurethane insulation) and Knauf Alcopor (mineral wool & foam insulation). Whilst the mainstream market is dominated by standard materials, niche markets are developing for both higher-performance materials and more environmentally-conscious materials such as wool and waste paper.

Within Lancaster & Morecambe there are no domestic insulation manufacturers, or specialist installers, although most general builders will carry out this work. Much of the grant-funded work is carried out by Home Insulation Services in Preston, where there are a cluster of insulation companies. A major regional distributor, Varley Insulation products, is also based in Preston. Thermafleece wool insulation, is manufactured by Second Nature UK in Penrith.

There is one insulation company in Lancaster; Lancaster GBT Systems manufacture specialist products for high temperature industrial and fire-resistant applications.

5.6.2 Energy metering, controls & management systems

Effective controls are the simplest and most cost-effective way of reducing energy consumption in most cases. Metering and control systems have been a common feature of industrial energy management systems for many years, and building energy management systems are used to control the supply and use of heat & cooling in relation to actual temperatures and building use patterns. However, within smaller companies, buildings and, particularly, in housing, the cost of effective metering and time required to monitor this, has outweighed the savings available.

The EU Directive on Energy End-use Efficiency and Energy Services, which was adopted in April 2006, aims to create the conditions for the development and promotion of a market for energy services. This legislation includes a raft of measures aimed at the provision of energy consumption information and requirements for auditing, which will have an enormous impact on the market for energy metering and control devices. In particular, the legislation will require the use of “smart meters” in buildings which allow the building occupant to easily monitor actual consumption (rather than estimated) and access targeted information on how to make savings.

In response to this, the UK government announced, in the 2006 budget, a £5 million fund to co-finance a pilot study of domestic smart metering. This will monitor and provide feedback to 3000 homes over 2 years.

The market for metering, controls and energy management systems is expected to grow rapidly in the next 5-10 years. Within Lancaster & Morecambe, a spin-out company from Lancaster University has set up to tap into this market, with a domestic smart metering device.

5.6.3 Energy efficient technologies

Energy efficient technologies covers equipment that is inherently more efficient than standard models, or provides the same output (light, heat, motion) with less energy input. It includes a vast range of items such as domestic electrical equipment (washing machines, fridges, lightbulbs etc), industrial electric equipment (motors, drives, air conditioning units) heating equipment (burners, economisers, chp units etc.). The market for most of these technologies is international, with the German and Scandinavian countries particularly strong in the low-energy technologies.

The markets for efficient technologies have been growing steadily, due to improved information (e.g. labelling) and government support programmes offering both advice and financial incentives. However, ease of access to products and the higher capital cost of the lower energy equipment remain barriers to sales.

5.6.4 Low-carbon buildings

The term low-carbon buildings covers the integration of elements of design, insulation, renewable energy supplies, efficient technologies and construction materials with low embodied energy to minimise the emissions generated over the lifetime of the building. Low Carbon Buildings are the subject of a substantial amount of government policy and funding at present.

The Building Regulations have moved away from the specification of the energy performance of individual building elements to standards for overall energy performance. The European Energy Performance in Buildings Directive, which comes into force this year with a 3-year bedding-in period, takes this concept one step further. All new buildings will have to have an energy performance certificate and all public-access buildings will have to display their actual annual energy performance.

These measures will have an impact on the design of new buildings, increasing the demand for architects and builders with experience in all the elements of low-carbon design. They will also lead to an increase in demand for energy services, including auditing, the provision of advice and the design of alterations to improve the energy performance, as well as monitoring devices and building energy management systems.

Within Lancaster & Morecambe there are a (small) number of architects and builders with the skills and experience to design and build low-carbon buildings.

5.6.5 Energy efficiency services

Energy efficiency services includes the provision of advice and information as well as contract energy management. The North West is recognised as having a strong position in the provision of energy services, with the presence of some major international energy consultancies and contract energy management firms.

The provision of advice falls into two categories; free advice and support via government agencies, and commercial energy consultancy. The Energy Savings Trust (EST), Renewables Northwest, Carbon Trust, Envirowise, Envirolink, Business Link etc, all provide free advice in the energy field. For businesses this is usually in the form of an energy audit with recommendations for energy savings measures and potential to invest in renewable energy. The advisor will usually assist companies in accessing any grant or fiscal support available to help with implementation. The Carbon Trust targets mainly larger firms, with advice for SMEs being provided via Envirowise or the Business Links. EST is responsible for domestic and transport sector energy advice, through a network of Energy Efficiency Advice Centres (EEACs). Within the region there are few direct employees of these organisations and most employ specialist private-sector energy consultants to carry out the work.

Lancaster & Morecambe is not well-serviced by the existing domestic or business energy support agencies. For energy efficiency in domestic housing, Lancaster & Morecambe is covered by the Lancashire EEAC, based in Blackburn, who admit that they do not have a strong presence in the district. Business advice is provided by the Business Environment Association (run by Groundwork Blackburn), who have recently run a Green Business Park initiative on White Lund. Energy advice services in the urban areas of the region appear to be in much closer contact with their customers, and some Local Authorities have taken a lead in providing their own energy advisors for householders.

Lancaster Chamber of Commerce has signed up to the Utility Auditing service, which provides members with a free audit of utility costs. This is predominantly a tariff analysis exercise (i.e. finding the cheapest supplier) but will provide some energy efficiency advice and assist larger companies to access services from The Carbon Trust. The company is based in Manchester but has one consultant in Lancaster & Morecambe. Around 30-40 local companies have signed up for this service.

Private sector consultancies are generally employed by larger organisations, both private companies and public sector, to make recommendations on energy efficiency and renewables as well as the wider field of energy policy and strategy. This sector is under-represented in Lancaster & Morecambe, with demand being met from companies in Manchester and further south.

Contract energy management firms take on the responsibility for providing energy-related outputs (heat, power, light etc) and finance and manage the energy supply equipment. As such, it is in their interests to operate the energy supply equipment in the most efficient manner, and their income is generated through the savings made. This approach has been used successfully for the replacement of large energy supply equipment in organisations unable to access capital, such as the public sector, or companies that do not wish to include energy management in their core activities. There is one newly-formed contract energy management company in Lancaster & Morecambe.

6 Opportunities in Re-use and Recycling

Nationally and regionally, waste is an important business sector, and the potential value of recyclable materials is being recognised. At the national level, the government's Waste Strategy has set targets for increases in the recycling rates of municipal waste, and is providing assistance to local authorities and commercial organisations to help achieve these.

The Waste & Resources Action Programme (WRAP) was set up in 2001 to promote sustainable waste management and develop stable markets for recycled materials. WRAP provides financial assistance for technology development and business support in six material streams: aggregates, glass, organics, paper, plastics, and wood.

The Regional Waste Strategy[13] set out the following targets for municipal waste;

	Recycle or compost	**Recover value[14]**
2005	25%	40%
2010	35%	45%
2015	45%	67%
2020	55%	

The RWS also includes the following targets for commercial and industrial waste streams;

- Achieve and retain 0% growth in waste arisings
- Recycle 35% by 2020
- Recover value from at least 70% by 2020
- Provide sufficient treatment and landfill capacity for these waste streams.

The Wider Waste Action Plan has been developed by the NWDA to address non-municipal waste in the region. It identifies a number of short-medium term actions to be carried out by a range of regional bodies (NWDA, Envirolink, Carbon Trust, Envirowise etc).

All of this is leading to a significant increase in the requirement for reprocessing capacity. However, for a number of waste streams, the inherent value of the material is insufficient to justify the investment in reprocessing. To combat this, two fiscal mechanisms have been introduced which improve the economics of recycling.

- The Landfill Tax, which was introduced in 1996 and is increasing annually. It currently stands at £21/tonne for all materials except inert waste and some exemptions (from April 2006). The waste industry projects that by around 2010 the costs of landfill will be more than the costs of reprocessing for most materials.

[13] Regional Waste Strategy for the North West, September 2004

[14] Recovering value includes energy from waste.

- The Packaging Regulations, under which businesses have to account for the recycling or recovery of value from a proportion of the packaging which they generate. This has lead to the PRN (packaging recovery note) system which tracks waste packaging through manufacturing and disposal. PRNs have a market value which can add significantly to the value of a recycled material. PRNs for glass and metals are currently the most expensive.

The Lancaster District Waste Collection Authority collects around 50,000 tonnes/year of municipal waste (MSW), around 18% of which is recycled. Organic material accounts for the largest tonnage of the material recycled, followed by paper & glass. This reflects the collection priorities of the WCA as well as the relative densities of recyclable materials.

In addition, it is estimated that there will be around 100,000 tonnes of waste arising from the commercial and industrial (C&I) sectors. No local data is collected and regional data is based on an Environment Agency survey from 1999, updated in 2005. Although the majority of this waste is classified as “mixed waste”, it appears that recycling rates in the commercial & industrial sectors are higher than for MSW.

The collection of MSW from households is the responsibility of Lancaster City Council (the Waste Collection Authority), although management and disposal of this waste, and operation of the Household Waste Recycling Centres (HWRCs, at Salt Ayre & Carnforth) is the responsibility of Lancashire County Council (the Waste Disposal Authority).

The responsibility for arranging disposal of C&I wastes lies with the individual company. Lancaster City Council provides a commercial collection service for Trade Waste, although this does not yet include the separate collection of recyclables. A number of local companies also provide trade waste collection services, and some offer separate collection of recyclables.

The main recyclable materials are covered in the following sections.

6.1.1 Organics

‘Organics’ in this context means garden and kitchen waste from the household waste stream, green waste from grounds maintenance, and food waste from C&I production and distribution and the catering sectors. The main route for recycling organic waste is composting. Other options include the generation of energy through anaerobic digestion or gasification (see section 5.3).

There are strong legislative drivers forcing the diversion of organic wastes away from landfill:

- The EU Landfill Directive will progressively decrease the amounts of biodegradable wastes which can be sent to landfill;

- The Landfill Allowances Trading Scheme (LATS) operated by DEFRA will impose fines on Local Authorities of £150 per tonne if they fail to meet targets or purchase allowances on the open market to make up the shortfall;

- The forthcoming Animal By-Products Legislation (ABP) will ban any food wastes with an animal-derived content from landfill and will also prevent it from being composted in the open.

A significant increase in composting capacity is planned to handle these additional volumes and there are concerns that the volumes generated will exceed the demand needed in land reclamation. New markets will have to be found for the products. There is a particularly urgent problem with food wastes since there are currently very few in-vessel composting facilities in the Region, although Lancashire County Council is planning IVC at a number of its new waste handling facilities, including Middleton.

Lancaster CC and Piccadilly Garden provide a collection service for garden waste to some households and there are collection facilities at the two Recycling Centres.

6.1.2 Paper & Card

Paper & Card is the second largest component of the municipal waste stream and large volumes are also present in the C&I stream. Lancaster City Council operate kerbside collection schemes and Recycling Centre drop-off facilities for municipal paper and card and most of this is sold to paper reprocessors (primarily Shotton). Potential alternative markets such as animal bedding or moulded pulp packaging use only small volumes, although a few such businesses operate within Lancashire and Cumbria.

Paper & card accounts for a large volume of trade waste, particularly that from retail & city centre businesses, where the cost of disposal is related to volume rather than weight. Collection of C&I paper & card is offered by a number of local companies including C&G Recycling and Eurowaste, although a considerable amount remains in the mixed waste stream and is landfilled. Lancashire County Council and Furniture Matters are looking at options to develop a cardboard collection scheme for small businesses in the district.

There are two paper manufacturers in Lancaster & Morecambe - The Northern Tissue Group (Celtech) and Peter Grant Paper, both of whom make recycled tissue paper.

6.1.3 Glass

Containers

Container glass makes up around 8% of the municipal waste stream and Lancaster CC through both kerbside collection and ‘bring’ sites recovers over 20% of this. National recycling rates are currently around 40% and by 2008 the recycling rate must increase to 60% in order to meet the EU Packaging Regulations.

The main glass reprocessors are in Yorkshire, although a new reprocessing plant has just opened in Ellesmere Port.

Lancaster CC, in alignment with most Local Authorities are moving more towards mixed colour collection, through the increased use of kerbside collection. The glass reprocessors will pay significantly higher prices for clear glass than for either green or mixed, although the economics of colour separation are not yet good enough to make it worthwhile.

Pubs, clubs, hotels & restaurants also provide significant tonnages of container glass and most of this is currently sent to landfill. At present no commercial glass collectors operate within the district, although Lancaster CC is looking at providing this service for the University, and Furniture Matters are continuing to investigate providing this service. The distance to the main reprocessors is a major economic hurdle. There may be potential for a colour sorting facility if an alternative, local, high-value use can be found for green glass.

WRAP has done a lot of work on developing higher value markets for glass such as a replacement for sand in applications such as water filtration, shot-blasting and golf bunkers and a flux in the manufacture of bricks (where it decreases the firing temperature).

Flat Glass

Pilkington Glass in St. Helens is one of only three flat glass producers in the UK, the other two being in East Yorkshire. Currently Pilkingtons only recycle waste from within the glass plant into the float glass process (which produces window glass) although external cullet, much of it from Viridor Richardson, is used in the rolled glass line (which produces patterned glass).

WRAP is working on a programme to recover flat glass from replacement windows and Viridor Richardson report that they are obtaining post consumer glass with contamination levels indistinguishable from that of window manufacturers from a small business in South Wales. There could be opportunities to provide a similar service from companies in the district, although transport distance may again render such a scheme uneconomic.

6.1.4 Plastics

Plastics recycling is important to the NW because the Region has the greatest concentration of reprocessors and manufacturers in the UK. Most of the reprocessors are sourcing plastics from outside of the Region and few of the manufacturers appear to be using recycled material in their products.

Most of the recyclable plastics in the municipal waste stream are in the form of bottles. Other plastics tend to be general packaging which is difficult to separate and recycle because it is of mixed polymer types and is usually contaminated with food residues.

There is a strong export market for mixed plastics, especially to China and SE Asia, where it is used in energy generation or worth sorting prior to reprocessing because of the low labour costs. However, good prices can be obtained from reprocessors in the UK for sorted clean plastic recyclate.

Lancaster CC currently does not collect plastic in its kerbside collections because of their light weight (and hence little contribution to meeting recycling targets) and large volume (hence taking up disproportionate space on kerbside collection vehicles). However, they are investigating the use of an in-vehicle crusher and may begin to offer this service. The only other collection facilities for plastics are the two Recycling Centres.

Recent work by RECOUP, the national organisation promoting plastics recycling, has shown good economics for both schools/offices and for local collection companies, especially when combined with other recyclables collection schemes such as for paper. This may be an opportunity for small community businesses.

A significant source of waste plastics from the C&I stream is tertiary packaging film from businesses such as supermarkets, retail parks, manufacturing plants, construction sites and farms. Waste from the larger sites is collected by commercial Waste Management Companies, whilst that from smaller businesses is usually landfilled as part of the general waste stream. At least 50% of film from agricultural sources is burned and less than 20% is recycled or re-used. Recent legislation will ban farmers from burying or burning this waste unless they obtain a waste management licence.

Again there could be an opportunity for small businesses in collecting and bulking film from clusters of smaller sites. Farm collection and recycling schemes could benefit rural areas (exemplar schemes exist in North Yorkshire and Somerset), although the economics would need to be investigated, as a scheme in Cumbria has recently folded.

Plastics should be a priority material as their value is increasing and collection rates do not yet meet demand.

6.1.5 Wood

Most of the wood collected from the municipal waste stream comes from HWRCs where it is usually mixed grades and often contaminated. The C&I stream also provides significant quantities of waste wood, particularly used pallets which are classed as packaging waste and so are subject to the Packaging Regulations. Forestry operations provide large quantities of wood wastes in Cumbria in particular.

The NW has a very strong wood reprocessing sector including some of the UK's most progressive companies. Around 90% of the processed wood is used in the particleboard industry, with one plant on Merseyside (Sonae) and another just outside of the Region near Wrexham. Paradoxically, one of the main problems for the wood processors is the increasing amounts of particleboard in the waste stream because this cannot be re-used in the manufacturing process. WRAP is currently working on an R&D project to solve this problem by removing harmful contaminants from processed waste.

There is a large wood reprocessor in Cumbria (AW Jenkinson) which deals with over 700,000 tonnes/year waste wood from across the UK and converts it into material for particleboard as well as animal bedding and bark for horticultural uses.

The main barrier to increased collection is economics because it is still cheaper to landfill mixed wood wastes that to separate them. Unsorted waste wood does not have an intrinsic value at present – the reprocessors will charge the collection point between £15 - £25/tonne to take it away – although it has a PRN value (Packaging Regulations compliance fee) of £8 – 11/tonne. WRAP has done a lot of work in developing higher value markets for reprocessed wood such as animal bedding, mulches for horticulture and wood/polymer composites.

One major potential use for low grade wood waste and particleboard waste is in energy production, and a Lancaster-based company is looking into a technology in this field – see Biomass section.

6.1.6 Metals

Metal recycling is one of the largest and most established recycling sectors in the UK. The sector is served by a network of collection merchants, who sort and bulk scrap metal from mainly industrial sources. Metals within the municipal waste stream are predominantly food and drinks cans and are collected at the kerbside or bring sites. There are also a number of small voluntary and charitable organisations collecting aluminium to fund their other activities. There are still significant quantities of non-recycled cans in both the municipal and commercial waste streams. Whilst the former will be reduced by the increase in kerbside collection, there is some potential for can collection schemes in commercial, public sector and educational establishments.

These are relatively valuable waste materials, with steel cans fetching around £60/tonne and aluminium worth over £900/tonne. Cans also qualify for PRNs which increases their value to reprocessors by £40 - £100/tonne.

Collection, bulking and reprocessing of metals is commercially viable and hence does not qualify for support. The main commercial operator in Lancaster is Morecambe Metals.

6.1.7 Bulky Waste and White Goods

Bulky waste and white goods are primarily valuable if they can be re-used. They also have a lesser, residual value if stripped down into components which can be recycled.

Bulky waste (large household items) has until recently been collected by Lancaster CC and disposed of to landfill. From May 2006, Furniture Matters has taken over this collection service to run alongside their existing collection service for furniture. FM estimate that they will be able to recover value from 50% of the materials collected, either through re-use or recycling of components. In addition to their provision of furniture to needy households, FM will sell re-furbished items to the public.

Since 2002, fridges & freezers could not be landfilled and Lancashire County Council provides collection facilities at their Recycling Centres. In addition, FM collect and re-furbish refrigeration equipment. Under the WEEE Directive, which was due to implemented in 2005 but was delayed for a year, waste electronic equipment will no longer be landfilled, and again, both Lancashire CC and FM provide collection facilities for some white goods.

FM have also just received funding to set up a collection scheme for SMEs which will include the materials they currently handle such as furniture, computers and white goods.

6.1.8 Textiles

Textiles are generally recycled via charity shops and jumble sales, although Lancaster CC collects from households and collection facilities exist at most bring sites. Items that cannot be re-sold are either exported for sale to developing countries or sold to textile reprocessors for conversion into cloths & rags. While the market for second-hand clothes has reduced dramatically with the growth of cheap clothing shops, this has also reduced the supply of second-hand clothes of sufficient quality for re-use.

Recycled textiles are a relatively valuable commodity, attracting prices of £100 – £250/tonne, higher than most other materials apart from aluminium and sorted plastics.

While there area no textile reprocessors in the Lancaster District, two organisations collect waste textiles and sell on to reprocessors - International Aid and a local entrepreneur.

6.1.9 Other Re-use Organisations

Re-use & recycling services are also provided by the 15 charity shops in the district and social enterprises/voluntary organisations such as the DIY Recycling Shop in Morecambe, as well as the more informal jumble sales, school fairs, car boot sales etc and websites such as freecycle and ebay.

7 SWOT Analysis

7.1 Lancaster & Morecambe's Economic Position

Lancaster & Morecambe sits on the fringe of the industrial area of the Northwest. In economic, physical and perceptual terms, the district relates more to Cumbria than to the "Northern Way" area bounded by Preston, Manchester and Liverpool. This has been recognised in the Regional Spatial and Economic Strategies, which present Lancaster & Morecambe as a cultural and tourist centre linked to a knowledge-based economy.

The district has a large rural area (although this is not a major economic factor), and a predominance of small businesses and public services serving local markets. The population of the Lancaster District is 136,700 (2005/6), including over 13,000 students, and has been rising relatively rapidly over the last 10 years.

Employment in Lancaster & Morecambe is heavily dependent on the public sector, particularly Health & Social Services (especially Royal Lancaster Infirmary) and Education (predominantly Lancaster University and St Martin's). Retail and wholesale provide the highest number of jobs in the private sector, with manufacturing relatively low compared to the Northwest. The energy sector (British Energy) is an important single employer, providing highly-skilled jobs, although only representing 3% of the total. The largest growth areas between 1998 and 2003 have been in the professional, finance and business services sector, with strong development in ICT in particular.

Lancaster & Morecambe has a high employment rate and has seen one of the largest growths in employment in the Northwest in recent years. We have a highly-qualified workforce, with 31% of economically-active adults holding degrees.

However, the average wage and GVA/job is low, compared both regionally and nationally. This demonstrates the split nature of the local economy, with a smaller number of highly-paid, knowledge-based jobs, but a much larger number of low-paid and low-skills jobs. There are also pockets of serious deprivation, particularly in the Morecambe & Heysham areas. A need for alternative employment models, such as social enterprises and the growing community & voluntary sector, has been recognised as important for the future to engage those people on the margins of employment.

Lancaster & Morecambe is seen as an attractive place to live and work, and the aim is to create 8,300 new jobs between 2003 and 2015. In order to achieve other parts of the Vision, it is essential that a large proportion of these jobs are high-value, but also include opportunities to integrate the existing marginally-employed population. A stated goal of the Vision Board is to retain a much higher proportion of the city's alumni, which implies a development of industries based on the University's areas of excellence, including ICT and environmental technologies.

There are 10 Lancaster & Morecambe companies listed in the Envirolink Environmental Technologies Sector database, plus the educational establishments. Of these, only two are directly involved in renewable energy and five in recycling. Our research has shown this to be an under-representation, with at least a further ten supplying, or potentially supplying to these markets.

7.2 SWOT Analysis for Lancaster & Morecambe

7.2.1 Strengths

Lancaster & Morecambe has a number of generic strengths which would recommend it as a location for either the generation of renewable energy or the development of renewable energy and recycling industries.

- A coastal position with good wind resources and access to marine energy resources;
- British Energy; which is home to a significant level of expertise in energy engineering, and is required to generate a proportion of renewable energy or purchase ROCs to meet its Renewable Obligation;
- Centrica; with significant expertise in gas engineering, transmission and storage as well as a renewable energy business and a Renewable Obligation;
- A good electricity distribution infrastructure radiating from Heysham which will minimise the costs of grid-connection, thus over-coming one of the key barriers to renewable electricity in many areas;
- The Morecambe gas field and the associated infrastructure;
- Heysham port; easy access to import facilities may be essential for biomass or energy-from-waste schemes;
- Over 90 acres of undeveloped industrial land close to the port and the power transmission infrastructure;
- Expertise in renewable energy and related control systems within Lancaster University;
- Experience in the supply and distribution of solid fuels, which can be used for the distribution of biomass fuel;
- A relatively large number of households using solid fuels;
- Some expertise in low-carbon building design and construction;
- Planning permission for a new waste and recycling centre at Middleton to deal with municipal waste;
- Several waste handling organisations currently collecting and separating municipal & commercial waste (including C&G Recycling, Eurowaste, Piccadilly Garden, DIY Recycle Shop)
- Furniture Matters; a regionally-recognised re-use and recycling organisation committed to social inclusion and training;
- Distance from major reprocessing organisations, which improves the economics of local reprocessing capacity;
- A population with a relatively good understanding of environmental issues and a significant number of people committed to pursuing a green lifestyle;

- Support for green issues within the City Council, both among members and officers;
- A strong LSP with good co-operation between public agencies and local businesses as well as particularly active Forums in Energy and Recycling.

7.2.2 Weaknesses

There are also a number of generic weaknesses which particularly mitigate against the development of renewable energy industries within the district.

- Distance from major conurbations and industrial complexes, for both materials supply and markets;
- Relatively weak manufacturing sector and related skills;
- Few local companies involved in the renewable energy field;
- Few local companies providing installation services for insulation or small-scale renewables;
- No recognition in the region as a centre for renewable energy;
- No recognition as a centre for low-carbon building expertise;
- Little recognition within the region as a city addressing energy and recycling issues;
- No local access to information, advice and support for energy efficiency and renewable energy installation.

All of these suggest it is an unlikely area for inward investment, particularly in the more traditional engineering-based energy industries. We are far more likely to develop industries based on the skills and interests of existing companies or inhabitants who have no reason to move away.

7.2.3 Opportunities

Both the renewable energy and recycling industries are expected to continue to grow, as a result of the opportunities presented by international and national government policies, issues of security of supply and lack of disposal options for waste. These include;

- Government support programmes for Marine Research (£50 million)
- Government support programmes for low-carbon buildings technologies (Low Carbon Buildings Programme, at least £28.5 million over 3 years);
- Government support programmes for wind & biomass technologies (ROCs)
- Potential sites for wind farms and individual turbines in low-impact areas;
- Potential site for recycling industries adjacent to the planned Middleton municipal waste handling centre;
- Very little current competition in the biomass field;

- Very little competition in some microgeneration technologies e.g. wind and hydro;
- Large rural areas suitable for growing some energy crops, with a number of farmers actively interested in diversifying into this;
- A number of local firms interested in investing in biomass and recycling technologies;
- Sites within and adjacent to the University suitable for attracting companies developing technologies in the renewable energy, transmission & distribution, low-carbon buildings and metering and controls areas;
- Access to the Morecambe Bay gas and offshore wind infrastructure for the development of hydrogen technologies.

7.2.4 Threats

Most of the threats identified apply to both renewable energy generation projects and the development of renewable energy or recycling industries.

- Competition for raw materials for biomass projects;
- Relatively small quantities of waste generated within the district;
- Lack of good transport links to Heysham, which will impact on biomass and recycling projects;
- Strong competition from other areas within the NW for biofuels;
- Strong competition and expertise in other countries for wind turbine manufacture;
- Lack of City Council support for wind turbine development;
- Lack of a clear planning policy for large-scale renewable energy;
- Lack of a clear planning policy for small-scale renewable energy;
- Lack of agreed targets for the energy and recycled material performance of new developments;
- Lancashire County Council decision not to allow energy-from-waste for municipal waste;
- Poor commercialisation skills within the University to allow the successful development of marine technologies;
- Potential to divert attention and resources away from renewable energy if a Heysham 3 nuclear power station is proposed.

7.3 Market Analysis of the Technologies

The relative potential for entrants to each technology market has been assessed by rating the technology against a number of factors, on a scale of 1-5. These factors were then weighted to reflect the relative importance of each. The factors and weightings used (in brackets) are;

- Market size (1)
- Growth potential (3)
- Market accessibility - capital required to enter (3)
- Technology risk (1)
- Support availability (1)

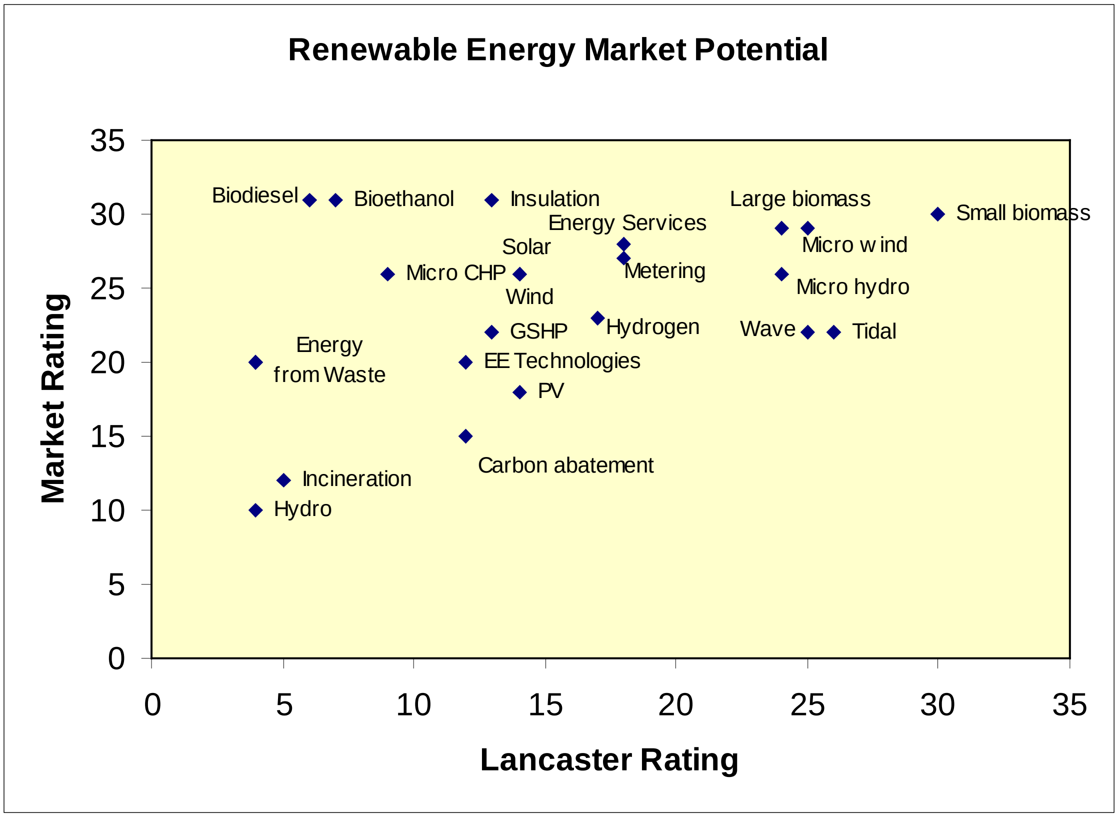
A similar process was carried out for the attractiveness of Lancaster & Morecambe for each technology, taking into account the findings of the SWOT analysis. The factors and weightings used are;

- Raw material availability (1)
- Competition for the Lancaster & Morecambe market (3)
- Infrastructure (1)
- Expertise (2)
- Availability of skilled labour (1)

Where raw material availability is not an issue (e.g. for energy services) it was given a mid-range value (3).

A separate analysis was carried out for the renewable energy and recycling sectors. Details of the ratings for each factor are given in Appendix 1.

7.3.1 Renewable Energy Market Analysis



The technologies in the top right hand corner are those which appear the most attractive for Lancaster & Morecambe. These are;

- Large-scale biomass, due to the availability of a potential site, local expertise in energy engineering, easy access to grid-connection, the possibility of growing energy crops locally and government support.

- Supply of three micro-generation technologies;

  – biomass materials and heating systems for buildings, largely due to the development of a local supplier, the lack of competition and the prioritising of biomass for government support;

  – micro-wind systems, largely due the lack of competition, suitable wind resources, government support and expertise in the related controls technologies

  – micro-hydro systems, due to the lack of competition, available resources, government support and expertise in this field at Lancaster University.

- Marine technologies, due to the expertise within Lancaster University, expertise in transmission and distribution at British Energy and Centrica, access to available resources, and government support.

A second cluster of technologies which may be interesting to investigate further for Lancaster & Morecambe are;

- Energy Services, due to lack of local provision and relative ease of entry to the market;
- Metering & controls, due to the expertise in this field within Lancaster University and the existence of some small spin-out businesses;
- Hydrogen, due to the links with nuclear and marine technologies.

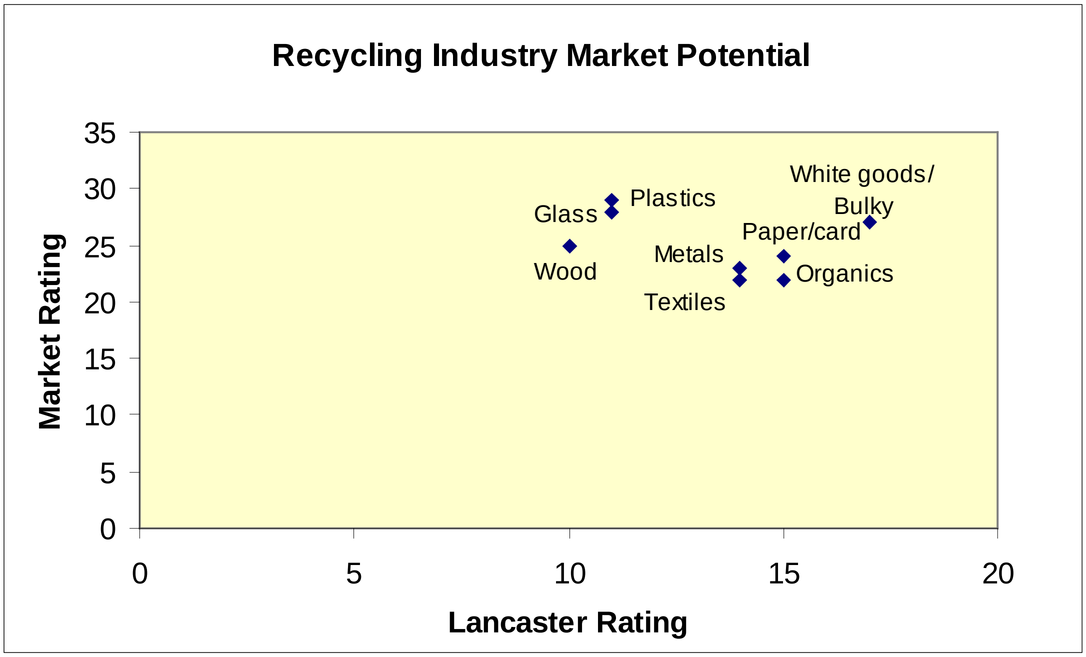
For a further group of technologies it appears beneficial to investigate installation rather than development of the supply industry. These include;

- Wind turbines, due to potential sites with good connection facilities and a local developer;
- Microgeneration technologies; solar, PV, ground-source heat pumps, due to lack of local installers and the potential to develop demand among the "greener" inhabitants;
- Insulation, again due to a lack of local installers and a large number of houses eligible for support;
- Energy from waste to deal with residual commercial & industrial waste.

The following technologies will not be considered further due to prohibitive competition from other areas;

- Large-scale wind industry; manufacturing capacity and expertise are established in Northern Europe and related industries to supply off-shore wind are being supported in other areas in the region e.g. Barrow;
- Biofuels; little potential to grow OSR or wheat and the NW supply industry is expected to concentrate around Cheshire & Merseyside
- Micro-CHP; considerable research, development and investment is being carried out by the 3 large players in the market in other locations
- Large-scale hydro; the technology is mature and few viable sites remain;
- Incineration & landfill gas; the market is not expected to grow
- Insulation materials
- Energy efficient technologies.

7.3.2 Recycling & Reprocessing Market Analysis



The recycling/reprocessing industry potential is primarily based on the value of the reprocessed materials, the capital required to set up as a reprocessor and the availability of materials and expertise within Lancaster & Morecambe. The results reflect the district's existing expertise in bulky waste and white goods, paper reprocessing and organic material collection & composting. The need to remove these materials from landfill will grow and the existing organisations in these areas should be supported to expand.

Other areas which offer promise for the development of industries are;

- Plastic reprocessing, due to the high value of the material, high cost of transport out of the district and potential for technology-led solutions to its disposal, again supported by government programmes;

- Increased collection, sorting and bulking of paper, particularly from commercial organisations, with the possibility to supply the existing paper plants.

Glass and wood may offer some potential for collection services if accompanied by the development of alternate uses, such as crushed glass and decontamination of wood for biomass energy.

The collection and reprocessing markets for metals and textiles are largely mature and the high position of these reflects the existence of sufficient organisations in these markets within the district.

8 Options for Development

8.1 Energy Industries

8.1.1 Biomass

Large Scale Systems.

The recent problems with the large-scale biomass plants mentioned in Section 5 have largely come about because the developers were trying to use an unproven technology (gasification) linked to a novel source of fuel (energy crops) and the overall economics were not sufficiently robust to withstand the technical difficulties which inevitably arose. The industry has now taken a step back and several large scale schemes are being developed to use biomass combustion using conventional sources of wood. The heat production systems will be linked to steam turbines to produce electricity and hence be eligible for ROCs. For example:

- The utility company E.on (which acquired PowerGen) is building a 44MW power station at Lockerbie in Scotland which will use forestry wastes and energy crops as a feedstock. This is expected to create 40 jobs at the plant and support a further 300 in forestry and farming. Initially the plant will use residues from sawmills close to Lockerbie but a contract has been signed with the growing consortium in Yorkshire which was originally set up to supply the failed ARBRE project. The intention is to encourage farmers in the south of Scotland and Cumbria to move into growing willow for the station.

- SembCorp Utilities is developing a 30MW power station at Wilton on Teesside. This will require 300,000 tonnes per year of wood which will be sourced both from forestry and from recycled wood from the construction, industrial and domestic waste streams. A feasibility study is being undertaken to investigate the possibility of building a wood recycling facility adjacent to the power station.

There is potential to build a similar plant on (or adjacent to) the British Energy site at Heysham, where there is space available and an existing grid supply point. There is also the technical capability at the nuclear power station in handling steam and, of course, electricity generation. British Energy, like all electricity suppliers, is under an obligation to supply an increasing proportion of electricity from renewable sources and already has several joint ventures in wind farms and is co-firing biomass at its coal fired power station in Yorkshire. A biomass plant would help them to achieve their renewables target. Initial contact with British Energy suggested that, even though they are committed to nuclear at the Heysham site, there would be no objection in principle to investigating the possibility of a biomass plant and that they would be willing to join a working group to consider the topic. The respondent added that the workforce would be likely to welcome such a development as a further demonstration of the company's 'green' credentials.

There would then be the question of fuel supplies. As with the above two schemes, both wood waste and forestry/sawmill by-products are possibilities in the short term and energy crops in the longer term (though in the case of the latter two there may be competition, especially in Cumbria, from the Lockerbie plant). There is also the potential to import feedstock via Heysham port if local sources are in short supply or too expensive. The problematic road link to Heysham could be a barrier to transporting large quantities of biomass to the site by road.

According to the DEFRA website, and confirmed by consultation with several organisations dealing with the subject, there should be no problem in growing willow (as short rotation coppice – SRC) in the Lancaster District and nearby. This requires moist conditions and will grow well in the normal temperatures found in NW England. Miscanthus (commonly known as 'elephant grass') is currently being successfully grown in Denmark (with a similar climate to the NW), near Aberdeen and on land up to 300m in East Yorkshire, although there is some doubt as to whether it would thrive with local rainfall levels. Once established, the crops need little or no fertiliser and a minimum of attention. SRC produces a crop every 3-4 years whilst miscanthus is harvested annually. Yields are likely to be in the range of 9 to 13 tonnes per hectare (dry weight) and produce a fuel with a calorific value around 60% that of coal.

Grants to establish energy crops and to set up producer groups are available via DEFRA's "Energy Crops Scheme". Establishment grants for SRC and miscanthus are £1000 per hectare and £920 per hectare respectively but the applicant needs to show that they have an end-user for the crops such as a biomass power plant or a community heating scheme. These must be within 10 miles for small installations or 25 miles for power plants. Funding is also available for legally-formed producer groups growing SRC (but not miscanthus); this covers up to 50% of the costs of setting up the group up to a maximum grant of £200,000.

A second grant scheme, the "Bio-energy Infrastructure Scheme" is currently closed for new applicants but a second application round is likely to be launched in 2006/7. The original scheme included funding for producer groups (this time including miscanthus), training of members and capital grants for specialist equipment and storage facilities. The maximum grant per producer group was again £200,000.

It is not clear whether growing energy crops would provide more jobs in farming since it would depend whether the farmers use land which is currently set-aside (in which case there would probably be new jobs) or whether they switch from other crops (in which case the existing jobs would be safeguarded. This would require further discussions with potential producer groups and the local NFU, who are interested in developing the market and opening up opportunities for growers.

72,000 hectares of land are farmed in the Lancaster District, 96% of which is given over to grazing with only 800 hectares under crops or set-aside. Some 70% of the land available is thought to be suitable for SRC. 20,000 - 30,000 ha cultivating short-rotation coppice would generate sufficient biomass to fuel a 30 MW power station, depending on the yield achieved (around 40%-55% of the suitable land in the Lancaster District).

It therefore appears that Lancaster District could potentially supply fuels to a biomass power plant (though more would be needed from elsewhere) or for smaller scale community schemes and individual boilers.

A power station of around 30 MW would be likely to generate around 30 jobs (although co-location with British Energy may reduce this) and may generate or safeguard around 200 jobs in material supply, although not all of these will be within the district.

Small to Medium Sized Systems

Biomass is the only widespread source of high grade renewable heat but its potential has largely been ignored in energy policy. In the UK, biomass supplies around 1% of our heat needs whereas in countries such as Sweden and Finland it is closer to 20%. Small and medium sized systems cannot economically be designed to produce electricity and so are not eligible for the ROC 'subsidy'. This emphasis on renewable electricity and the consequent slow development of heat-only systems was recognised by the Biomass Task Force which reported to the government in October 2005.

The Task Force pointed to the enormous potential for biomass heating in public buildings, housing developments and commercial & industrial estates; they also estimated that land not being used for food production could produce 8 million tonnes per year of energy crops and that there are 2-3 million tonnes per year of contaminated waste wood available which cannot be effectively recycled but could be used as a fuel. They recommended a number of measures to overcome the problems, including a capital grant scheme fixed at 40% of the capital cost. The government has responded positively to the report and has announced a range of initiatives including:

- A five-year capital grant scheme for biomass boilers with funding of £10-15 million;
- Agreement in principle for support to energy crops under a new Rural Development Programme to be introduced in 2007;
- Government leadership through public procurement to introduce biomass heating within the government estate;
- Working with regional bodies to promote more widespread use of biomass for heating.

In April 2006, VAT on wood-fuelled heating systems (including stand-alone stoves) was reduced to 5%. The Low Carbon Building Programme will provide grant funding towards the cost of installation of automatic-feed wood stoves and boilers of up to £1,500.

All of the above means that the market for small and medium sized biomass heating systems, and the fuels to supply them, will grow significantly over the next five to ten years.

The council and other large organisations have influence over a large number of buildings, either through direct ownership or through the local planning system and this could be used to increase the number of biomass fired systems. There are currently no manufacturers of biomass (or any other) boilers in Lancaster & Morecambe but it may be possible to attract new businesses (possibly from overseas) if the local market and fuel supply is assured.

We are aware of one biomass boiler within the district, which has been supported under one of the government initiatives. This is at Ellel Grange, and the wood is sourced from within their grounds. There is also a small company in Chipping who are developing a biomass supply from their own woodland.

Lancaster has at least 2 suppliers of wood-burning stoves. The market for these, and solid fuel cookers, has grown rapidly in the last 2 years. One of the suppliers has noticed a change in the attitude of customers who are installing the stoves to reduce gas consumption (for environmental or cost reasons) rather than just for aesthetic value. This company is selling around 500 units a year in an area from Carlisle to Manchester.

One of the problems identified with any planned increase in small-scale biomass is the lack of trained installers. There are just 3 HECA-accredited solid-fuel stove installers covering the district (although two of these live outside). The grant programmes can only be accessed by using accredited installers, so this lack will need to be addressed.

Lancaster has three solid fuel merchants, one of which manufactures compressed waste wood logs. This company, E&S Fuels, is looking to produce wood pellets and expand their business to supply the stoves & boilers. They have just identified a suitable site for manufacturing within the district and are working towards gaining planning permission for the site.

8.1.2 Marine

There is potential to supply 20% of the UK's electricity demand from the marine resources within our waters. This resource, coupled with the research expertise within the universities and some private companies, mean that this sector will now be fully supported by the government as part of the Climate Change programmes. The Marine Renewables Deployment Fund will provide £50 million for research & development of these technologies.

The economics of demonstration technologies are still far from good. Current costs for wave energy are in the range 22 – 25 p/kWh, compared to the current cost of on-shore wind electricity of 3-4 p/kWh. Capital costs for prototype devices are in the range £4,300 - £9,000/kW, although it is expected that by the time these technologies are developed, wave farms could be installed for £1,700 - £4,300/kW. (On-shore wind is approximately £600/kW, off-shore wind is around £900/kW). Current costs of tidal stream energy are lower than wave energy at 12 – 15p/kWh, with initial predictions for the capital costs of tidal stream farms at £1,400/kW - £3,000/kW.

Grid-connection is a significant problem for marine energy, and only 3% of the potential energy is located close to good grid connections. As a location for marine energy, although the inherent wave resource is relatively small, Lancaster & Morecambe has extremely good grid connection facilities.

The Marine Energy Challenge programme identified cost reduction as the major goal of future technology developments, and recommended that promising technologies be further supported, promising concepts be investigated further but unpromising technologies should be dropped. Unfortunately, it appears that Lancaster University's device (PS Frog) is one of the less promising technologies.

Lancaster University Engineering Department has other promising marine surge devices and arrays at the concept stage. To develop a new concept to full scale testing can take up to 10 years, although this could be reduced to 5 years if sufficient funding is secured for the whole programme. The research funding requirements are in the region of £10 – 15 million. The Lancaster team is highly regarded, but relatively small, and are in danger of "missing the boat". We are concerned about both the support that marine research will get within the University and the ability of this team to commercialise their technology. Although the University has centralised role in commercialisation of their technical developments, it is rather conservative, and may not be happy to support such a large and potentially risky project.

Left to its own devices, Lancaster University is unlikely to lead the development of a marine energy industry in the district. However, it would be a waste to lose this local expertise in a developing and potentially important energy technology. If Lancaster & Morecambe is to get a share of this, we need to find investors and entrepreneurs with the interest and commercial acumen to lead a project through to full-scale testing and deployment. These investors are likely to come from the power industries. Npower, Eon and Siemens are already investing in this market. Possible local investors would be British Energy or Centrica, or through existing links with the University, United Utilites and NNC.

8.1.3 Hydrogen & Fuel Cells

A wide range of hydrogen and fuel cells initiatives are in progress in the UK with the most advanced being in Teesside, Wales, the West Midlands and London.

In the North West of England, some work has been carried out on the development of a regional hydrogen and fuel cells initiative through the auspices of the Joule Centre for Energy R&D and the NW Energy Council. This has identified a number of regional strengths including:

- expertise in the universities in the region e.g.
  - hydrogen storage and metal hydride systems at Salford
  - fuel cells and biomass conversion to hydrogen and biofuels at Manchester
  - chemical engineering and process integration expertise at Manchester
  - sociological research into public reactions to hydrogen at Salford University
  - materials and catalysis for fuel cells at Liverpool University
  - environmental sciences to assess the impacts at Lancaster University and CEH.
- the availability of substantial quantities of high purity by-product hydrogen in the Runcorn area which could be used in the short term for fuel cells in transport and static applications;
- pipelines that are currently distributing hydrogen, or have the potential to be converted for hydrogen use, e.g. in the Mersey Banks area, St Helens and further north;
- large scale, high integrity storage capacity in salt caverns that could be used for hydrogen;
- technical and commercial expertise in hydrogen production, storage and distribution though companies such as Air Products and Linde;
- offshore wind, biomass and nuclear sources of energy that could be used in the production of green hydrogen;
- fuel cell development, testing and production e.g. at Baxi, EA Technology;
- suppliers of components for fuel cells e.g. Ineos Chlor, Morgan;
- a major transport fuels production and distribution operation at Stanlow operated by Shell;
- the test track at Leyland (LTC Ltd.) that could be used for demonstration and testing of hydrogen/fuel cell vehicles;
- a strong process engineering and contracting resource in the region that could be used in the design and construction of facilities e.g. AMEC and Costain.

A report on the scope for a hydrogen network in the NW has identified a number of potential projects to demonstrate the use of hydrogen for various transport and static applications. This includes the plans by Eclipse Energy concerning their development of the Ormonde Field in Morecambe Bay which would involve the generation of hydrogen through the electrolysis of water using wind turbines to generate the electricity. The aim would be to use the hydrogen for load balancing since it could be stored in the depleted gas reservoirs.

Another development with relevance to the local area has been identified by the CLAREN project. This would address the scope for using hydrogen to store energy from intermittent sources of renewable energy especially onshore wind turbines. Similar projects have been initiated in the Shetlands and Loughborough.

The main opportunities for Lancaster & Morecambe with respect to the development of a hydrogen initiative are as follows:

- access to nuclear power for the production of low-carbon hydrogen e.g. through a facility based on the Heysham Power Station site;

- use of offshore wind and, potentially biomass sources, for the production of "green" hydrogen;

- demonstration of energy storage, based on hydrogen, for intermittent sources of renewable energy especially wind, hydro and wave/tidal power;

- use of existing gas pipelines to transport hydrogen as a mixture with natural gas and/or as a pure gas.

A key issue will be the identification of local applications for the hydrogen. The priority areas are in transport based on the direct combustion of hydrogen or the use of fuel cell vehicles with the most likely applications being in public transport and local delivery vehicles. There are potential applications in combined heat-and-power, uninterruptible power supply (UPS) systems and remote, off-grid uses. A number of small scale, portable applications for fuel cells are also emerging e.g. for portable power supplies, PCs and consumer products such as hair dryers.

The projected timescale for the emergence of large scale commercial markets for hydrogen and fuel cells is long (2020 to 2030) – see the EU Roadmap in Appendix 2. Hence this is not a short term opportunity for job creation in Lancaster & Morecambe. Within the timescale of the closure of the Heysham nuclear power stations, however, some significant markets should be developing and there is funding available for R&D and demonstration projects in the near future. If this opportunity is to be pursued, then a local project champion will need to be found. The most obvious candidates would be:

- British Energy – use of the site to produce low-carbon hydrogen from nuclear power and biomass (if this development goes ahead);

- British Gas/Centrica – use of gas pipelines for hydrogen transport;

- Eclipse Energy for the offshore load levelling application;

- CLAREN and Envirolink Northwest for the small scale wind energy storage application;

- A local transport operator such as the Local Authority fleet or Stagecoach.

8.1.4 Energy Services & Low-Carbon Buildings Technologies

These technology areas link naturally together although it is possible to develop some components separately. We propose looking at a cluster of technologies and services covering;

- Manufacture or supply of micro-generation systems including micro-wind, micro-hydro and biomass boilers
- The provision of information and advice on energy efficiency, renewable energy, planning issues, suppliers and installation
- Development of a network of local installers
- Manufacture or supply of metering and controls equipment specifically linked to energy efficiency and renewable energy
- Development of smart metering information systems.

The customer base for these technologies and services is predominantly householders and small businesses. Lancaster & Morecambe is a relatively small market for energy services and low-carbon buildings technologies, but the preferred source for these types of service is local. Larger companies and public sector organisations are used to looking for regional or national suppliers. Even though national and international information is readily available through the internet, smaller organisations and individuals prefer to get their advice and information from someone who can point them towards a local builder, architect, installer etc, and who can easily come and look at their premises.

There are a number of very small businesses within Lancaster & Morecambe who provide products and services within these fields, and there are significant opportunities for new entrants. The total employment within existing businesses is under 30 people. However, with organisation and support, there is potential for very rapid growth, at similar levels as has been seen in the local recycling initiatives over the last 5 years.

The three microgeneration technologies which show the greatest opportunity for the development of industries within Lancaster & Morecambe are micro-wind, micro-hydro and biomass boilers (which is covered in the biomass section). Both micro-wind and micro-hydro technologies are relatively new, although their large-scale counterparts are well-developed. There are very few companies in either of these fields within the UK, and a growing demand, particularly for micro-wind, partly as a result of a few high-profile installations. Entrants to these markets will need to overcome the technical difficulties facing these technologies, such as;

- For micro-wind, noise reduction and the structural integrity of the building connection;
- For micro-hydro, economic power extraction from low-head and variable flow water courses.

For both of these technologies, (as well as for PV) there are also significant grid-connection, installation and planning issues, which will need to be addressed by any supplier, to simplify the installation procedure for householders and building owners.

There is technical expertise on micro-hydro within Lancaster University, which may be tapped to support the development of a local industry. However, the University is already working with a company in Cumbria on this. The resources available for micro-hydro are being studied at the University and results will be available by the end of 2008.

Lancaster's Local Strategic Partnership has just approved a bid from the Energy Forum, together with CVS and Lancaster University Management School, to develop the Lancaster Energy Store (working title only). This will be a centrally-located shop providing

- Sales of a range of "green" products; renewable energy gadgets and educational materials, household items (low-energy light-bulbs, toiletries & cleaning products, nappies, garden items from recycled materials etc) and DIY materials (paints, insulation etc).

- Brokerage (commission-based sales) of larger items – solar hot water, micro-wind turbines, biomass boilers and fuels, insulation materials, low-energy appliances

- Provision of independent advice for householders (initially) on energy efficiency and renewable energy technologies, local suppliers and installers and assistance with grant funding.

- Provision of, and assisting access to, training for installers with the aim of achieving the required accreditation for grant schemes.

Other options that will be investigated in the medium term will;

- An "outreach" facility, providing a mobile demonstration vehicle which would be used as an educational activity for schools and mobile sales/brokerage facility at events, markets etc around the district.

- Development of the Lancaster Energy Fund, based on the carbon-offset model. This will allow local residents to buy carbon credits to offset emissions from air or road travel, for example, providing an investment fund for local energy efficiency and renewables projects.

The Energy Store is expected to employ 1 full-time and 2 part-time staff in the short term, and should be self-financing after 4 years. It is hoped that the Store will start up in April 2007.

The Energy Store should be able to assist with the development of a local market for low-carbon buildings technologies and services. However, there is a need for three activities beyond the work of the Energy Store; demonstration, business support and communication.

A key activity to support this market will be the development of a high-profile demonstration site for zero-carbon buildings. This could be a single building (similar to Solaris in Blackpool) and there have been discussions along these lines among the Middleton project team. It could also be a housing or mixed-use development, and possible sites for this are being investigated by members of the Energy Forum. Potential demonstration sites also include Bailrigg Science Park and the Moor Hospital.

There is also the potential to provide support to small businesses involved in, or moving into, the provision of equipment or services related to low-carbon buildings. This will include micro-generation technology areas with untapped potential such as wind, hydro and small biomass, metering and controls suppliers and insulation materials.

One of the key components in generating local demand for low-carbon technologies & services is effective marketing. The recent work by the Green-Engage project has developed a set of effective messages for marketing "greener" lifestyles, which engage with ordinary people by avoiding the "hair-shirt" messages of traditional environmental campaigns. The key is to make it the easiest option – create the means, promote small improvements, create brands and target different sectors differently. This is particularly aimed at individuals but also extremely relevant for small businesses for whom energy is a small component of their overheads and not worth spending time on.

In 2005, Manchester:Knowledge Capital developed a communications programme to help achieve a step-change in local energy behaviour (Manchester Is My Planet www.manchesterismyplanet.org). As this work was funded by Defra under the Climate Challenge programme, the materials produced and marketing strategies are freely available for use by other organisations. Lancaster & Morecambe needs to develop a climate change activities "brand" that is instantly recognisable and obviously local. Lancaster University has expertise in the societal aspects of environmental issues which could be value to this type of campaign.

This type of provision of advice and equipment is exactly the target for the next Intelligent Energy in Europe call for proposals (see section 2.1), which has just been announced with a deadline in the autumn. This will include a topic on Sustainable Energy Communities with priorities for proposals being in areas such as:

- Raising awareness of citizens and decision-makers about the social, economic and environmental impacts of RUE and RES measures;
- Addressing the energy behaviour of citizens by setting-up agreements for energy awareness and training;
- Transfer of knowledge and experience from front-running communities to less experienced communities;
- Exchanges of experiences and joint actions between communities in different member states.

The concept of a Low Carbon Buildings programme could fit into this framework but it will be necessary to involve EU partners and to demonstrate the value of doing the project at a European level. Some degree of novelty would also be necessary. Typical funding levels for IEE projects are around €500 to 600K i.e. total project values of about €1 million split between at least 3 partners. Given about 6 to 8 months for proposals evaluation and negotiation, it should be possible to start a project by Spring or early Summer of 2007.

The Energy Savings Trust is looking at changing the way it manages the provision of energy advice to householders, and it is expected that there will be 3 Sustainable Energy Centres covering the North West. Two of these will be in Manchester & Liverpool. Lancaster would be an appropriate location for the third, to cover the more rural areas of North Lancashire and Cumbria. This could help with funding the activities of the Low Carbon Buildings programme and Energy Store. However, Lancaster will face competition for this from East Lancashire (where Lancashire EEAC are located) and possibly Blackpool and Carlisle.

8.2 Recycling Industries

8.2.1 Regional & Local Initiatives

Within the region, all five Waste Disposal Authorities are in the process of developing their own waste strategies, primarily to deal with municipal waste. Lancashire WDA is planning to use Mechanical Biological Treatment (MBT) to treat the remaining (non-recycled) waste, which results in the production of compost suitable for use in reclaiming brown-field sites, and in-vessel composting for organic waste. The County Council is in the final stages of agreeing a PFI contract with Global Renewables, an Australian-based company, to take responsibility for management of all municipal waste. It is understood that the contract will include some responsibility for the development of markets for recyclable materials, and some support for recycling organisations in the community and voluntary sector. It is also clear that the production of energy from waste will not be part of Lancashire's strategy for municipal waste, although this does not preclude its use for commercial & industrial waste streams.

The Salt Ayre landfill site is due to close in (approximately) 2008. As part of the Lancashire Waste Strategy the County Council has obtained planning permission for a Waste Treatment Facility on the site of the former ICI works at Middleton, which will handle all the municipal waste from the Lancaster District. The facility includes a recyclate handling plant to deal with 21,000 tonnes annually, an in-vessel composting plant (28,000 tpa) and a mechanical/biological treatment plant (34,000 tpa).

Adjacent to this facility is a large (140 ha) site owned partly by Lancaster City Council and partly by Lancashire County Council. A joint project team has been set up to investigate potential uses for this site, which include the development of a recycling business park. The project team includes representatives from Lancashire County Council (Projects Team), Lancaster City Council (Planning), Lancaster Sustainability Partnership, Furniture Matters, local architects and wildlife/conservation experts. The land is heavily contaminated and, as parts of it have been used as a nature reserve, ecological and contamination issues need to be addressed before any work can be started on the recycling park. The remedial work may be carried out by the Environment Agency but is unlikely to be completed before 2009. The project team applied for Lottery funding in December 2005 to start the process, but were unsuccessful, so alternative funding sources need to be secured.

8.2.2 Economic Value of Recyclates

Lancaster has few recyclate reprocessors, and the majority of waste that is not landfilled leaves the district.

Using Remade Northwest's economic model, the value of the municipal waste recyclate currently being collected each year is calculated at around £1 million (including re-use). If this material were all reprocessed locally, it would add a further £300,000.

Adding in the value of C&I waste, and assuming that 50% of all waste arisings could be recycled, the maximum value of recyclate collection in the district could be £3 - £5 million with a further £2.5 - £4.5 million in reprocessing. Some of this value is already captured through the waste collection industry with some separate collection of commercial waste paper & cardboard, although no data is available on the extent of this. Furniture Matters is also about to start collection of WEEE and office furniture from the business community.

Obviously, it is not economically viable to reprocess all of this material locally, due to the economies of scale of reprocessing facilities. However, there may be local markets for some materials which currently travel long distances for reprocessing.

Areas in which there may be potential to develop reprocessing industries include;

- Plastics – the highest value material for which there is local potential
- Glass – for lower-value uses such as filtration media and brick manufacture
- Paper & card – for high-value tissue as well as animal bedding and moulded products
- Wood – as an energy source, although there may be strong competition for raw materials (see biomass section)

Lancaster & Morecambe is recognised within the region as being a leader in the re-use industry, through the work of Furniture Matters in particular. This provides both goods and equipment for the less well-off households and valuable employment and training facilities for local people. The social enterprise model works well in this situation and there is potential to expand both in providing collection and recycling facilities and in exporting the expertise in this field to other areas. Furniture Matters employ over 40 staff and have over 80 regular volunteers contributing over 20,000 hours/year. As well as furniture and white goods, they refurbish bicycles and collect and distribute waste paint.

8.2.3 Plastics

The key barrier to plastic recycling is the lack of infrastructure for its recovery. The materials themselves are valuable (clean, baled LDPE fetches £270 – £290/tonne) but separation, particularly from domestic sources, is very difficult. Mixed bottles are only worth £80 - £135/tonne and delivery is expensive.

Very little plastic is separately collected in Lancaster & Morecambe, as it is not yet included in the kerbside collection scheme. The low value-weight ratio of plastic means that it is uneconomic to collect, sort and transport over any great distance. The available collection facilities in the district at the 2 HWRCs are directed at plastic bottles, which are of a more uniform material (although there is no control over how these skips are used).

The main opportunity for Lancaster & Morecambe lies with the development of a local reprocessor, and an opportunity to use mixed waste plastics would be extremely valuable. One company in Lancaster has taken out the UK licence for a technology to manufacture floor tiles from mixed plastic waste, which would use 3,000 tonnes/year of raw material, significantly more than is collected either locally or within the County.

WRAP is supporting the development of plastic sorting facilities as well as looking at expanding the commercial applications for different materials. ReMade NW will also have plastic as one of its priority materials for the development of reprocessing facilities. Both of these organisations have expressed an interest in working with any projects identified within Lancaster & Morecambe.

8.2.4 Glass

850 tonnes of glass was collected by the WCA in kerbside collections in 2005/6, which covered around 1/3 of households. There are also 21 glass collection sites and the 2 HWRC's for which tonnages are not available. The roll-out of kerb-side collections to most

of the remaining areas by 2008 should generate around 2,500 tonnes of waste household glass.

There are also around 500 licensed premises in the Lancaster District. A brief survey of waste from these premises carried out by the Recycling Forum in 2005, estimated that these generate over 4,000 tonnes of waste glass each year. None of the pubs/clubs contacted in this survey already had a recycling collection contract, and only one of these had investigated setting up their own recycling scheme. The overall response was that the licensed trade would support a separate collection service for glass bottles, provided that the cost was on a par with existing trade waste rates. A number of organisations were prepared to pay a premium for this service.

The value of this commercial waste glass is between £40,000 - £60,000 for mixed glass collection only, but separating would add a further £40,000 and reprocessing would attract £100,000 - £120,000 in PRNs. The value of glass collected is not sufficient to cover the costs of collection and transport to the nearest reprocessor (Viridor-Richardson in St Helens). However, if an alternate, local market can be found for the materials, collection could become viable.

The quantities of glass available cannot justify investment in standard glass reprocessing plant (into bottles). Glass crushing is relatively cheap and could be justified for the quantities involved. One possible use for crushed glass is as a fluxing agent in bricks, with the potential to link up with Hanson's brickworks in Claughton.

WRAP are currently funding a series of pilot projects, including the collection of glass from licensed premises, which will report in June 2006. The results of these trials and work on alternate markets will give a clearer indication of the economics of collection and processing in areas at a distance from the main reprocessing industries. Furniture Matters is interested in setting up a collection scheme within the district and is pursuing options for funding.

8.2.5 Paper & card

Around 16,000 tonnes of waste paper & card is generated within Lancaster & Morecambe, although we have no information on the breakdown of different material grades.

The two local paper manufacturers have an annual demand of around 12,500 tonnes of high-grade recycled paper.

Peter Grant Papers use high-grade office waste, leaflets and flyers, sourced from intermediaries who collect, sort and bale the material. There is one local intermediary (C&G Recycling) who supply a small proportion of their materials. PGP would be interested in taking more locally-collected materials, provided that they could be suitably separated, cleaned and baled.

NTG use tissue waste from mills. They have used office waste in the past, and had their own de-inking plant, but had problems with quality and security of supply. NTG would be interested in a local supply of de-inked office paper if it could meet their quality requirements.

C&G Recycling collect, shred and bale confidential paper (as well as providing a range of other waste recycling services). They have contracts with several of the large organisations within the district, including the City Council, University & NHS. Demand for this service is increasing rapidly and they are at the stage where they need to investigate options for expansion. The operation is very labour-intensive and collection costs from Lancaster are affected by the poor transport links with Morecambe.

Cardboard is probably the largest component (by volume) of the commercial and industrial waste. At present the poor price for cardboard (£10 – £26/tonne) coupled with the need to sort and remove plastic, means that cardboard collection is not economic unless a local higher-value use can be found.

There is potential to increase the collection of both office paper & cardboard within the district and the economics of providing this service for small businesses in particular should be investigated further.

8.3 Renewable Energy Supply

This section covers the potential for the *installation* of renewable energy generation within the district, as distinct from the potential to develop industries in this field.

8.3.1 Wind

Much of the district is rural and a large proportion of this land is in Areas of Outstanding Natural Beauty hence it is unlikely to gain planning permission for wind turbines.

Wind Direct, based in White Cross, have provided a map of potential suitable locations within the district (see Appendix 3). As expected, these are predominantly on the Heysham peninsula and to the south-west around Glasson. There is also some potential around Carnforth. The realistic potential would be up to around 6-10 small developments of 1-5 turbines, with a maximum combined capacity of 50MW. There may also be potential for a number of smaller turbines on brownfield sites, such as White Lund. More work will need to be done before the realistic potential of these sites can be assessed.

8.3.2 Energy from Waste

It is estimated that the district generates around 150,000 tonnes of waste per year, of which around 40,000 tonnes are currently recycled. The policy of Lancashire County Council is to avoid energy from waste for the municipal waste stream (c. 50,000 tonnes). It is feasible that the industrial & commercial sector can achieve recycling rates of 60%, given sufficient provision of separate collection facilities. Therefore the maximum amount of waste available within the district for an energy-from-waste plant is 40,000 tonnes/year, although this figure should be treated with some caution until actual waste data can be assessed.

This level of waste could generate between 3-4 MW electricity plus 3-4 MW heat in a combined gasification/CHP plant or 50 – 60 GWh in total.

8.3.3 Biomass

As indicated in section 8.1.1, there is potential for a biomass power station of around 30MW. With a CHP plant, this would generate 240 GWh/year electricity and 700 GWh/year heat.

8.3.4 Micro-generation

There are around 60,000 households within the district. The maximum potential for microgeneration technologies, given full support through local and national initiatives, can be estimated using the following assumptions;

- 90% of households are in buildings with their own roof (i.e. not flats)
- 90% of households have gas central heating
- 35% of houses have SE-SW facing roofs
- 15% of houses have potential for wind turbines
- 5% of owners of suitable properties could be persuaded to install solar heating by 2020
- 10% of owners of suitable properties could be persuaded to install micro-wind by 2020
- 10% of households could be persuaded to convert to biomass-fired heating systems by 2020.

Using these rough assumptions suggests a maximum potential for;

- 6,000 biomass boiler systems
- 1,000 solar panels
- 900 wind turbines.

The energy generated from these systems would be around 122 GWh heat (99% from biomass) and 2.7 GWh electricity.

All of these figures should be treated with some caution, as both the market and the technologies are still new, and penetration rates depend on a range of local factors which have yet to be tested.

8.3.5 Micro-hydro

Micro-hydro differs from the other microgeneration systems in that it is not linked to buildings. The suitable micro-hydro resources within the region are currently under investigation, so it is not yet possible to estimate the potential contribution of this technology within Lancaster & Morecambe.

8.3.6 Wave & Tidal

It is too early to identify the realistic marine energy generation potential from within the Morecambe Bay area. The Bridge Across the Bay project claims that the maximum available resource in the tidal stream between Heysham and Barrow is 515 MW. However, the practical resource will be significantly less than this. Experts from Lancaster University are not yet in a position to validate the true potential of this project.

8.3.7 Hydrogen

Hydrogen is not a source of renewable energy in itself but could be used for energy storage and load levelling when linked to intermittent sources such as wind, wave and tidal energy. There is also scope to demonstrate the production of "green" hydrogen, from renewable energy and/or nuclear sources, particularly for transport applications,

8.3.8 Total Potential Supply Within Lancaster & Morecambe

The maximum realistic renewable energy generation capacity within Lancaster & Morecambe (excluding off-shore) is 100 MW electricity and over 200 MW heat. The electricity supplied is sufficient to power 56,000 homes, or provide 66% of the projected electricity demand in the district in 2020.

The heat generated could replace up to 42% of the projected gas demand in the district. However, this figure should be treated with some caution, as the efficient use of heat from CHP plants requires either a large user nearby, or investment in a district heating network. We have no information on the heat demand of industries on the Heysham peninsula, which appears to be the most suitable location for the biomass plant. Investment in district heating for heat distribution is expensive and only economic for new developments. It will therefore be necessary to consider whether CHP is the most appropriate option for the power station.

The breakdown of energy production potential is shown below.

Energy Source	**Capacity MW**		**Output GWh**	
	Electricity	**Heat**	**Electricity**	**Heat**
Wind[15]	66		130	
Biomass - large	30	90	240	(700)
Energy from Waste	3	3	30	30
Microgeneration	1	120	3	120
Total	**100**	**213**	**403**	**150 - 850**
Lancaster & Morecambe Demand 2020			611	2,109
Potential supply from renewables 2020			**66%**	**7 - 42%**

8.4 Planning Issues

The development of almost any renewable energy supply will require planning permission. Similarly, the planning office has a significant influence over the identification and development of sites for location of the supply industries and the encouragement of low-carbon buildings. Lancaster City Council has until recently had no specific position on this, although the current Head of Planning strongly supports both renewable energy supply and sustainable buildings.

[15] Includes Caton Moor (16MW).

Development proposals are currently covered by the Local Plan, which runs until 2006. The Local Development Framework (LDF) which replaces this will come into effect over the period 2007 to 2009, with individual policies being in force until the replacement is approved.

Nationally, significant changes have been introduced to ensure that sustainable development is at the core of planning policy, and this is being reflected within the local planning system. However, there still remains plenty of opportunity for local interpretation of the guidelines, and it is therefore up to Lancaster City Council to decide whether we wish to become a beacon for sustainable planning. It is possible to push the boundaries through tighter requirements on developers and engaging with the renewable energy supply industry, and this can be achieved within the LDF policies currently under discussion.

The LDF Core Strategy, which is under development, now includes a policy supporting the development of renewable energy resources. This policy will need Cabinet approval but is consistent with national and regional guidance. The supporting Development Control Policies have not yet been drawn up, but are expected to include policies on large-scale renewable energy developments, micro-generation and minimum efficiency standards for new buildings.

8.4.1 Wind Turbines

Under the current Local Plan there is no specific policy to promote renewable energy. For wind turbines, section E22 states that the location of any proposed development will be assessed against issues of nature conservation, the character of the landscape and the impact on nearby dwellings, and only proposals for which there is no other suitable site will be considered. In practice, most developers have been looking at upland areas, the majority of which are in the AONB, and therefore no sites (other than Caton Moor) have progressed beyond initial feasibility studies.

The wind sites identified are mainly in the Heysham peninsula, and Lancaster City Council is considering renewable energy options on the land it owns in that area. In order to progress these, as a first step, developers and community renewables organisations need to be made aware of the potential sites and approach of the planning department.

8.4.2 Biomass energy generation

There should be few planning issues associated with building a biomass power plant at Heysham, other than that of transporting fuels to the plant. The power plant would be physically small compared with the nuclear installation and should have no difficulty in fitting into the existing landscape.

Small to medium sized installations in buildings would be a little larger than their gas-fired equivalents, primarily because of the need for fuel storage. However, this should pose little problem from a planning perspective provided that space exists on site although there may be issues related to access for fuel deliveries.

The Planning Department has no role in the conversion of agricultural land to biomass production.

8.4.3 Micro-generation systems

For new developments, the Planning Department has already indicated to developers that they wish to see improvements in the carbon footprint of the buildings, which will mean achieving higher levels of insulation and introducing on-site renewable energy generation.

Within the LDF, it is expected that minimum levels of on-site renewable energy generation will be introduced, following the lead of authorities such as Merton and Oldham, although this level has not yet been determined.

For existing buildings the national guidance on the acceptance of solar panels in PPS22 states that "in general solar water heating schemes are to be encouraged. In some cases, provided the installation is not of an unusual design, or involves a listed building, and is not in a designated area, SWH systems are regarded as "permitted development" and is thus deemed not to require a planning application."

For micro-wind turbines, the industry is attempting to have these covered under the existing regulations for satellite dishes, thus not requiring planning permission except in specified cases such as listed buildings or conservation areas.

There is no policy in favour of micro-generation at present within Lancaster, and the automatic response to proposals appears to be negative. There are issues within the planning department which need to be addressed before acceptance of micro-generation becomes the norm. These include;

- Increasing staff understanding of the technologies, their visual impact on buildings and suitability for different types of structure

- Introducing a mechanism to encourage consideration of micro-generation by anyone applying for planning permission for conversion/extension work.

It is possible to introduce a Local Development Order which would allow the installation of micro-generation systems within certain limits (e.g. height above roof) without planning permission. This general acceptance can be applied in all areas, with exceptions made for certain areas or types of building, for which permission could be sought on a case-by-case basis. The Head of Planning supports this proposal and we would recommend that the Vision Board formally request such an Order.

9 Economic and Employment Implications

Overall, a concerted programme of actions to develop the renewable energy and recycling industries could generate or safeguard over 600 jobs, worth almost £20 million to the local economy.

9.1 Renewable Energy Industries

We estimate that the energy industries recommended could generate employment for around 360 people, in the medium-term (10 years) and add over £12 million/year to the local economy. A breakdown of the employment and annual GVA generated by these industries is shown below.

Energy Industry	GVA/employee[16]	Annual GVA	Employment
Biomass power station	£47,480	£1,424,390	30
Biomass supply	£23,206	£4,641,176	200
Small biomass supply & installation	£47,480	£1,899,186	40
Wind	£47,480	£142,439	3
Energy from Waste	£40,942	£818,846	20
Marine/Hydrogen	£47,480	£949,593	20
Energy Services / Low Carbon Buildings / Microgeneration	£47,480	£2,373,983	50
Total	**£33,745**	**£12,249,614**	**363**

The majority of the jobs are those created or safeguarded in farming, through growing energy crops. These appear, however, the least valuable, although an increase in the value of energy crops could improve this.

In addition, a further 580 jobs could be created during construction of wind turbines and a biomass power station.

Construction Projects	GVA/employee	Annual GVA	Employment[17]
Biomass power station	£37,400	£14,960,000	400
Wind farms	£37,400	£6,500,000	180
Total	£37,400	£21,460,000	**580**

[16] Source: DTI Annual Business Inquiry released 16/12/2005, supplemented by data from NW Renewable Energy Mapping report 2005

[17] Source: Data from Wind Direct & Hainsford Energy and estimates from Wilton biomass power station.

9.2 Recycling Industries

We estimate that the recycling industries could generate around 265 jobs, although these figures are less robust.

Sector	GVA/employee[18]	Annual GVA	Employment
Plastic	£26,300	£789,000	30
Glass	£26,300	£394,500	15
Paper & card	£26,300	£263,000	10
Organics	£26,300	£263,000	10
Collection & sorting	£26,300	£2,630,000	100
Bulky Waste & WEEE	£26,300	£2,630,000	100
Total	**£26,300**	**£6,969,500**	**265**

These figures are based on national data and have not been adjusted for the average values of jobs in the District. It is also difficult to assess the value added of organisations in the community & voluntary sectors. However, the total GVA fits with the range predicted by the ReMade NW model, which put the GVA for collection & reprocessing of all Lancaster & Morecambe's waste at between £5.5 - £9.5 million.

[18] Source: DTI Annual Business Inquiry released 16/12/2005

10 Conclusions

10.1 The Optimist's Scenario

Lancaster & Morecambe has, within its natural and human resources, sufficient strengths to enable the development of vibrant renewable energy, energy services and recycling industries. The particular areas for which the district could become recognised are;

- Biomass energy
- Marine energy technologies
- Low carbon buildings and industries
- A recycling industry that handles at least all of the waste generated locally.

Looking back from 2020, one would see the path taken by the local authority, industry, community groups and social enterprises.

2006

Lancaster City Council publicly declares support for a local low-carbon economy and broadcasts a plan to attract renewable energy developers to the city.

Lancaster & Morecambe Vision Board agrees to take forward a number of proposals to turn the city into a low-carbon economy.

The Biomass Working Group, bringing together the site owners, biomass suppliers (farmers and importers) and technical experts, starts to develop a large-scale biomass power station project, and investigate the potential for the supply of smaller-scale biomass boiler systems.

The Wind Working Group brings together the City Council Planning Department, wind developers, site owners and community groups to develop a group of wind farms and identify sites for smaller-scale brownfield wind developments.

The Recycling Industries Development Group, working with Lancaster City Council, Lancashire County Council, ReMade NW, the Environment Agency, local recycling industries, the Lancaster District Recycling Forum and community & voluntary sector groups publishes it plans for the development of the Middleton site as a Recycling Park.

Lancaster University develops links with a utility company to identify the expertise and funding requirements to establish a viable marine energy industry.

A local company announces the development of a site within the district to manufacture wood pellets and supply biomass boilers.

Lancaster City Council agrees to introduce challenging targets for on-site renewable energy and recycled material content in its Local Development Framework. The Planning department introduces training on renewable energy for its staff and is the first authority in the country to introduce a Local Development Order favouring the installation of micro-generation systems without planning permission.

The Lancaster Energy Forum, in conjunction with other agencies, develops and finds funding for the Lancaster Energy Store.

Lancaster City Council and Lancaster University agree to work together to develop the Bailrigg Environmental Industries Science Park, with an emphasis in attracting companies to support the likely renewable energy industries such as information & controls technologies, marine engineering, energy transmission and distribution equipment and micro-generation equipment.

2007

Lancaster City Council, in partnership with the LSP, sets a target for reduction in CO2 emissions across the district.

The designs for new developments in Lancaster & Morecambe are feted for their coherent approach to energy demand reduction and sensitive reduction of their environmental impacts. Building work starts on the first zero-carbon housing scheme.

Lancaster City Council, the PCT and Lancaster & Morecambe College set up projects to install biomass boilers in some of their buildings.

The Lancaster & Morecambe Biomass Co-operative is formed to allow farmer to contract for growing energy crops for the biomass power station, and other interested users.

Outline planning permission is granted for a biomass power station and 3 new wind farms, and the Middleton Recycling Park.

The University announces an increase in funding for their Marine Energy Research team as a result of inward investment generated by the Working Group.

The Lancaster Energy Store is set up, providing advice to householders and businesses on energy savings and renewable energy, training in energy auditing techniques and acting as a technology supplier/facilitator.

The Lancaster & Morecambe Energy Fund is set up, based on the carbon-offset model, to provide investment assistance for local energy efficiency and renewables projects.

A buzz is generated when the Lancaster is My Planet communication programme is launched, raising awareness of the potential for individual contributions to reducing emissions. All the large energy users within the district, and 1,000 householders sign a pledge to reduce their carbon emissions, generating demand for energy advisers and micro-generation technologies.

Negotiations are started with a number of small companies interested in the micro-generation and related metering fields to set up local operations to supply the local market.

2010

The Middleton Recycling Park employs 250 people and becomes recognised as part of the tourist package for The Green City of Lancaster & Morecambe. Demand generated by the specialist plastics reprocessing business has lead to the collection of all local waste plastic.

There are 3 new wind-farms in the district, one of which is community-owned in partnership with the Local Authority, and part of a local green tourist attraction.

The Heysham Biomass Power station is operational, employing 30 staff.

150 farmers jobs are secured through diversification into energy crops, with a further 50 employed in biomass preparation and transport.

LancasterWave – a joint venture company between the university and a major utility, demonstrates that it can generate electricity economically in test conditions.

The Lancaster Energy Store, which now runs operates as the Sustainable Energy Centre for N Lancashire & Cumbria, has increased to 20 staff to cope with the growing demand. Three local installation companies have set up as a result of training programmes run by the Store.

Lancaster City Council receives recognition for the impact of its LDF policies in assisting the economic regeneration of the area.

Medium-scale biomass boilers are installed in the new Council premises, as well as two other public-sector organisations.

The Bailrigg Environmental Industries Science Park houses 10 growing companies who supply technologies and services to the energy & recycling industries.

2020

Lancaster & Morecambe has a small but thriving renewable energy industry, directly employing around 400 people in operation and material supply to the industry, design & construction of low-carbon buildings, installation of low-carbon technologies and provision of energy services. The University and linked Science Park is recognised as one of the centres of excellence in the growing marine energy and hydrogen sectors.

The Middleton Resource Park continues to be a major local employer, with the value of jobs in this sector having increased due to the expertise developed and increasing value of recycled materials. It is a recognised centre of excellence for training and the development of new markets for materials.

The district is recognised as a beacon for sustainable resources, having transformed the energy performance of its building stock and industries and generating over 50% of its own energy from renewable sources. Lancaster City Council is one of the Authorities quoted in national and local studies on practical achievement of carbon reduction targets and economic development of recycling industries.

The district is seen as a cultural centre with a strong green flavour, a lively student population, good shopping facilities and a regenerated seaside resort, coupled with sensitively-developed rural tourist trails and a good cycling network.

10.2 The Sceptic's Scenario

There is no reason why Lancaster & Morecambe should be particularly attractive to investors in the renewable energy industries, and the employment potential of these will not make up for the loss of jobs in the nuclear industry. However, the district has a few natural and human resources, which should enable the development of some local industry, although it should be recognised that we are unlikely ever to be seen as a major player in these fields.

There is more significant potential through the development of recycling industries, which are expected to generate higher numbers of jobs, although a large proportion of these will be at the lower end of the pay scale. However, given the skills base within the District, and high levels of deprivation in some wards, this type of employment is very valuable to the District.

Given the strong competition from other areas, and the lack of specific local expertise, it would be sensible to concentrate on;

- A recycling industry that handles the majority of the waste generated locally;
- Biomass energy.

Looking back from 2020, one would see the path taken by the local authority, industry, community groups and social enterprises.

2006

Lancaster City Council publicly declares support for a local recycling and biomass industry.

Lancaster & Morecambe Vision Board sets up the Biomass Working Group, bringing together the site owners, biomass suppliers (farmers and importers) and technical experts to develop a large-scale biomass power station project, and investigate the potential for the supply of smaller-scale biomass boiler systems.

Lancaster & Morecambe Vision Board announces its support for the development of the Middleton site as a Recycling Park. A Working Group, involving Lancaster City Council, Lancashire County Council and community & voluntary sector groups, looks for funding to carry out the preparatory work.

Lancaster Planning Office agrees to introduce challenging targets for on-site renewable energy and recycled material content in its Local Development Framework, but these are over-ruled by the Council for fear of losing potential developers.

The Lancaster Energy Forum, in conjunction with other agencies, develops and finds funding for the Lancaster Energy Store.

Lancaster City Council designates the Bailrigg Employment Site as a Business Park, opening it up to retail and distribution industries.

The developers involved in new development sites in Lancaster & Morecambe are not convinced of the benefits of environmentally-sensitive designs and their proposals reflect only the current Building Regulations.

A local company announces that it is to relocate to south Lancashire for its wood pellet manufacturing operation, due to planning difficulties.

2007

The Lancaster & Morecambe Biomass Co-operative is formed to allow farmer to contract for growing energy crops for the biomass power station, and other interested users.

Lancaster City Council, the PCT and Lancaster & Morecambe College set up projects to investigate the installation of biomass boilers in some of their buildings.

Outline planning permission requests for a biomass power station and 3 new wind farms are halted by local opposition.

The Middleton Recycling Park receives outline planning permission, but funding for the costs of cleaning up contaminated land are unresolved.

The University announces the closure of their Marine Energy Research team as its Head is poached by a Scottish wave energy developer.

The Lancaster Energy Store is set up, providing advice to householders and businesses on energy savings and renewable energy, acts as a technology supplier/facilitator, and provides training in energy auditing techniques. Negotiations are started with a number of companies to supply insulation, micro-generation and related metering technologies, but all materials are supplied from outside the district.

The government announces its plans for a replacement nuclear industry, including Heysham 3. Lancaster City Council decides that with the potential employment generated by this, there is no need to investigate other renewable energy industries.

British Energy pulls out of the Biomass Working Group as they no longer have a site available. Other sites on the Heysham peninsula are investigated and plans for a smaller-scale scheme are drawn up.

2010

The Middleton Recycling Park is finally under construction and organisations planning to locate there could handle 30% of Lancaster & Morecambe's recylable waste.

Following changes to the proposals, a small biomass energy plant is expected to be operational by 2012, linked to the Middleton Recycling Park. Raw materials are to be supplied primarily by imports, supplemented by a small number of local farmers.

After the first 3 years of operation, lack of support from the local authority, coupled with rising rates for their premises, lead to the announcement that the Lancaster Energy Store will have to close.

Changes in the Building Regulations, and the introduction of the EU's Energy Services Directive lead to an increase in the demand for low-carbon building materials and microgeneration technologies across the UK. Within Lancaster & Morecambe, this market is supplied almost exclusively by manufacturers in other areas.

A Scottish team announces the results of their wave energy trial – with production costs approaching those of off-shore wind. Government support is directed at commercialisation of this technology.

2020

Employment within Lancaster & Morecambe has grown, due to the development of ICT and recycling industries, and a resurgence in tourism generated in part by the increased cost of air travel. The district is seen as a cultural centre with a lively student population, good shopping facilities and a regenerated seaside resort, coupled with sensitively-developed rural tourist trails and a good cycling network.

The district has no reputation for renewable energy. Caton Moor remains the only windfarm and objectors to its further upgrade appear to be winning the argument.

10.3 The Decision

What will make the difference between the two scenarios? We believe that a strong factor in leading the district towards one or other scenario is the decision taken by Lancaster City Council whether to aim to be a low-carbon city. This decision will colour all future opportunities, whether for householders looking to save on their energy bills or for investors looking for sites to invest in renewable energy operations.

The potential exists to make the Optimist's scenario a reality, what is needed is the will. There are a sufficient number of people in the district who are, or could be, committed to taking forward this vision. All our interviewees have supported the concept. The objections and difficulties which result in the Sceptic's scenario will have to be met and dealt with, but this is far easier if starting from the assumption that it can happen and there is support from a wide range of organisations.

One important factor is outside local control; that of the future of nuclear energy. Nuclear and renewable energy can co-exist as part of the national energy supply mix. In employment terms, renewable energy is more people-intensive than most other forms of energy generation, so investment in renewable industries will generate high-value jobs. However, it is our opinion that investment in a new generation of nuclear reactors may skew the market for renewable energy technologies, reducing support for renewable electricity generation in particular. The knock-on effect of the decision to support nuclear may be a reduction in support for the less-advanced technologies such as marine energy. It may also reduce the political will within Lancaster & Morecambe to support the development of jobs in the renewable energy and recycling industries. We believe that Lancaster City Council should support the development of these industries regardless of the position of nuclear energy, to provide both medium term employment and the opportunity to develop long-term expertise in national and international markets.

11 Recommendations

There is sufficient potential for both renewable energy and recycling industries to justify taking a number of options further. We would recommend that Lancaster & Morecambe supports the development of;

- Biomass energy, including local production of biomass, use of biomass in large-scale heating systems and a biomass power station;
- Low-carbon buildings technologies, including low-carbon design of new developments, improvements to existing buildings, micro-generation and controls technologies;
- Recycling industries, including collection and reprocessing organisations and the development of the Middleton Recycling Park;
- Wind energy installations in suitable locations;
- A small energy-from-waste plant linked to the Middleton Recycling Park.

The potential for marine and hydrogen technologies in the longer term should be investigated further.

11.1 Recommended Actions

11.1.1 Gain Commitment from Lancaster City Council

Lancaster & Morecambe Vision Board have already committed to the development of a renewable energy industry within their Vision.

Lancaster City Council needs now to publicly declare support for a local low-carbon, low-waste economy and the development of renewable energy and recycling industries. This should include the setting of a target for a reduction in CO2 emissions across the district.

Lancaster City Council will need to allocate resources to achieving this goal. This will include, at least;

- Resources to manage an internal climate change programme, to demonstrate a reduction in emissions related to the council's own activities;
- Resources to contribute to managing the implementation of the renewable energy projects identified within this report.

Lancaster City Council will also need to contribute to the achievement of a low-carbon, low-waste economy through the planning system by;

- The introduction of challenging targets for on-site renewable energy and recycled material content in the Local Development Framework;
- The introduction of a Local Development Order favouring the installation of micro-generation systems without planning permission;

- Training on renewable energy for Planning staff to actively promote these in new developments, alterations and refurbishment work for which planning permission is required.

11.1.2 Recruit an Energy Project Manager

To get to the stage where these suggestions become reality will take considerable organisation and will involve a large number of people. We would therefore recommend that Lancaster & Morecambe Vision Board, in conjunction with Lancaster City Council recruit a project manager to take responsibility for developing the projects and applying for funding, as well as to provide a focal point for the networks of people & organisations involved.

This project manager would work on the following projects.

Biomass

Set up a Biomass Working Group to develop the opportunities for biomass. This would include investigation of the following options;

- a large-scale biomass power station project
- smaller biomass heating installations in larger buildings, including council offices and housing, RLI, educational establishments such as Lancaster University, St Martin's, Lancaster & Morecambe College and schools, and biomass-fired district heating schemes for key new developments in the district;
- development of a local energy crops growers co-operative to supply the fuel for the biomass schemes.

The Working Group should bring together potential site owners, biomass suppliers (farmers and importers) and technical experts (from within and outside the district).

We recommend that at least the following are invited to join the Biomass Working Group;

- British Energy and/or Centrica and/or Heysham Port.
- David Howard, Centre for Ecology & Hydrology
- Jim Birkett, NFU
- Graham Webster, Glasson Grain.
- Mike Derham, Lancaster CC, Housing & Property Services;
- CLAREN, the Cumbria & Lancashire Renewable Energy Network.

Helen Sweeney, GONW's Regional Biomass Contacts Group co-ordinator has offered to be involved to provide advice from a regional perspective.

Wind

Set up the Wind Working Group, to develop a group of wind farms and identify sites for smaller-scale brownfield wind developments. The Group should consist of at least,

- Lancaster City Council Planning Department, (Andrew Dobson or Jason Kennedy)
- Potential site owners (mostly farmers, via Jim Birkett)
- Community groups with an interest in community-owned schemes (via the Energy Forum)
- CLAREN/ Renewables Northwest
- Envirolink.

Wind Direct have offered to provide input to this group although a decision should be taken as to whether to involve one specific developer at this stage.

Recycling & Energy-from-Waste

Provide support for the development of the Middleton site as a Recycling Park and investigate possibilities for energy-from-waste on this site. This will involve joining, and possibly taking a leading role in the existing, rather loosely-formed, group which is looking at the options for this site.

Identify and develop opportunities to support existing organisations (both private and community sector) to provide collection and reprocessing facilities for locally-generated waste. ReMade NW and WRAP should be able to provide input to this work.

Work with the existing network of recycling organisations to identify opportunities to export local expertise in recycling and develop business opportunities outside the district.

Marine & Hydrogen

Initiate discussions with Lancaster University to review the realistic potential for long-term support of their marine energy expertise. If the response proves positive, set up the Marine & Hydrogen Energy Working Group, to identify the expertise and funding requirements to establish a viable marine energy industry, and the potential role of hydrogen in this option. The Working Group should aim to bring together the University, Lancaster Environment Centre, one of the major utilities and Envirolink.

Micro-hydro

Initiate discussions with Lancaster University to get a view on the realistic potential for micro-hydro within the district, and whether there is potential for a local company to enter this new market. This may be dependent on the outcome of the resources review (end 2008).

Low Carbon Buildings

The development of a local industry to supply and install low-carbon buildings technologies (including micro-generation, insulation and controls) will be helped by two activities which are currently underway within the district;

- The Lancaster Energy Store which should be operational in 2007 and will aim to develop a local market for energy efficient and microgeneration technologies;
- The introduction of policies supporting renewable energy in the Local Development Framework.

The project manager's role will be to;

- Investigate the potential for a low-carbon buildings demonstration site, working with the planning office;
- Identify and provide business support to local organisations involved or moving into low-carbon buildings or microgeneration technologies.

Communications

Develop a communications plan to involve local inhabitants and businesses in Lancaster's low-carbon, low-waste economy. Support for this could be sought from Defra under their Climate Change Communications Fund and from other sources such as EST and the Carbon Trust.

11.1.3 Funding

There are a number of funders of organisations providing advice and economic development support in the energy and waste fields. However, there are few opportunities to tap into these funds for small-scale initiatives at the district level. It is expected that the majority of funding will need to come from local sources. The most obvious sources are;

- Lancaster City Council
- Local utility companies (British Energy, Centrica, Hainsford Energy)
- Local waste & recycling companies.

Other options, which should be investigated, but cannot be relied upon to fund the overall programme include;

- EST, for the development of a Sustainable Energy Centre covering the north of the region;
- IEE for awareness-raising and knowledge-transfer activities;
- NWDA, for assistance with specific projects, such as the biomass power station;
- WRAP for certain recycling projects;
- Technology-specific grant support programmes (e.g. DTI, Carbon Trust, EU 7th Framework).

This is an exciting opportunity for Lancaster & Morecambe, and, if properly supported, will put the district on the path to realising the significant economic potential of the low-carbon, low-waste future.

Appendix 1 – Market Analysis

Market Attractiveness Ratings

	Technology	**Market size**	**Growth Potential**	**Market Accessibility**	**Technology Risk high=1**	**Support Programmes**	**Total**
Weighting		***1***	***3***	***3***	***1***	***1***	
Large scale RE	Wind	5	3	1	4	5	18
	Hydro	2	0	1	5	0	8
	Large Biomass	1	5	2	2	5	15
Microgeneration	Solar	2	2	3	4	5	16
	PV	1	1	2	3	5	12
	Micro-wind	1	3	4	2	5	15
	Micro-hydro	1	2	4	2	5	14
	Small biomass	1	3	4	3	5	16
	Micro CHP	1	4	2	2	5	14
	GSHP	1	1	3	4	5	14
Energy from Waste	Incineration	1	0	2	5	0	8
	Landfill Gas	4	1	2	5	0	12
	Gasification	1	3	2	2	2	10
	Pyrolysis	1	3	2	2	2	10
	AD	1	3	2	2	3	11
Transport fuels	Biodiesel	1	5	2	4	5	17
	Bioethanol	1	5	2	4	5	17
Developing	Wave	1	3	2	1	5	12
	Tidal	1	3	2	1	5	12
	Hydrogen	1	3	2	2	5	13
	Carbon Abatement	0	2	1	2	4	9
Energy Services	Insulation	5	2	4	5	3	19
	Metering	5	3	3	3	1	15
	EE Technologies	4	3	1	3	1	12
	Services	3	2	4	5	2	16
Reprocessing	Organic	0	0	4	5	5	14
	Paper/card	2	2	2	5	5	16
	Glass	2	3	2	3	5	15
	Plastics	1	4	3	2	5	15
	Wood	1	3	3	4	5	16
	Metals	3	1	4	5	0	13
	White goods/Bulky	1	2	4	3	5	15
	Textiles	2	1	4	5	0	12

Lancaster Rating							
	Technology	**Raw material**	**Competition high=1**	**Infrastructure**	**Expertise**	**Skilled labour**	**Total**
Weighting		***1***	***3***	***1***	***2***	***1***	
Large scale RE	Wind	3	1	4	1	2	11
	Hydro	0	1	0	0	1	2
	Large Biomass	3	3	3	3	3	15
Microgeneration	Solar	3	2	3	0	3	11
	PV	3	2	3	0	3	11
	Micro-wind	4	5	3	0	3	15
	Micro-hydro	3	5	3	0	3	14
	Small biomass	4	5	4	3	1	17
	Micro CHP	3	1	2	0	1	7
	GSHP	2	2	3	0	2	9
Energy from Waste	Incineration	1	1	0	0	1	3
	Landfill Gas	1	1	4	5	4	15
	Gasification	1			0	3	4
	Pyrolysis	1			0	3	4
	AD	1			0	3	4
Transport fuels	Biodiesel	0	1	1	0	2	4
	Bioethanol	1	1	1	0	2	5
Developing	Wave	2	3	3	4	3	15
	Tidal	3	3	3	4	3	16
	Hydrogen	1	2	4	1	4	12
	Carbon Abatement	2	1	3	1	2	9
Energy Services	Insulation	3	1	2	1	3	10
	Metering & controls	3	1	3	3	3	13
	EE Technologies	3	1	2	1	2	9
	Services	3	3	3	1	1	11
Recycling	Organic	1	4	3	4	3	15
	Paper/card	1	4	3	4	3	15
	Glass	1	4	2	0	3	10
	Plastics	1	3	2	2	3	11
	Wood	1	2	3	2	3	11
	Metals	1	2	4	4	3	14
	White goods/Bulky	1	4	4	4	4	17
	Textiles	1	2	4	4	3	14

Appendix 2 – Hydrogen Road Map

The EU is placing a strong emphasis on R&D into both hydrogen and fuel cells to overcome the technical and economic barriers to achieve widespread deployment. The European Commission in October 2002, has produced a report presenting a vision that outlines the research, deployment and non-technical actions necessary to move from today's fossil-based energy economy to a future sustainable hydrogen-oriented economy with fuel cell energy converters[19]. This includes a "skeleton" proposal for a European hydrogen and fuel cell roadmap covering the period from 2000 to 2050 (see diagram below).

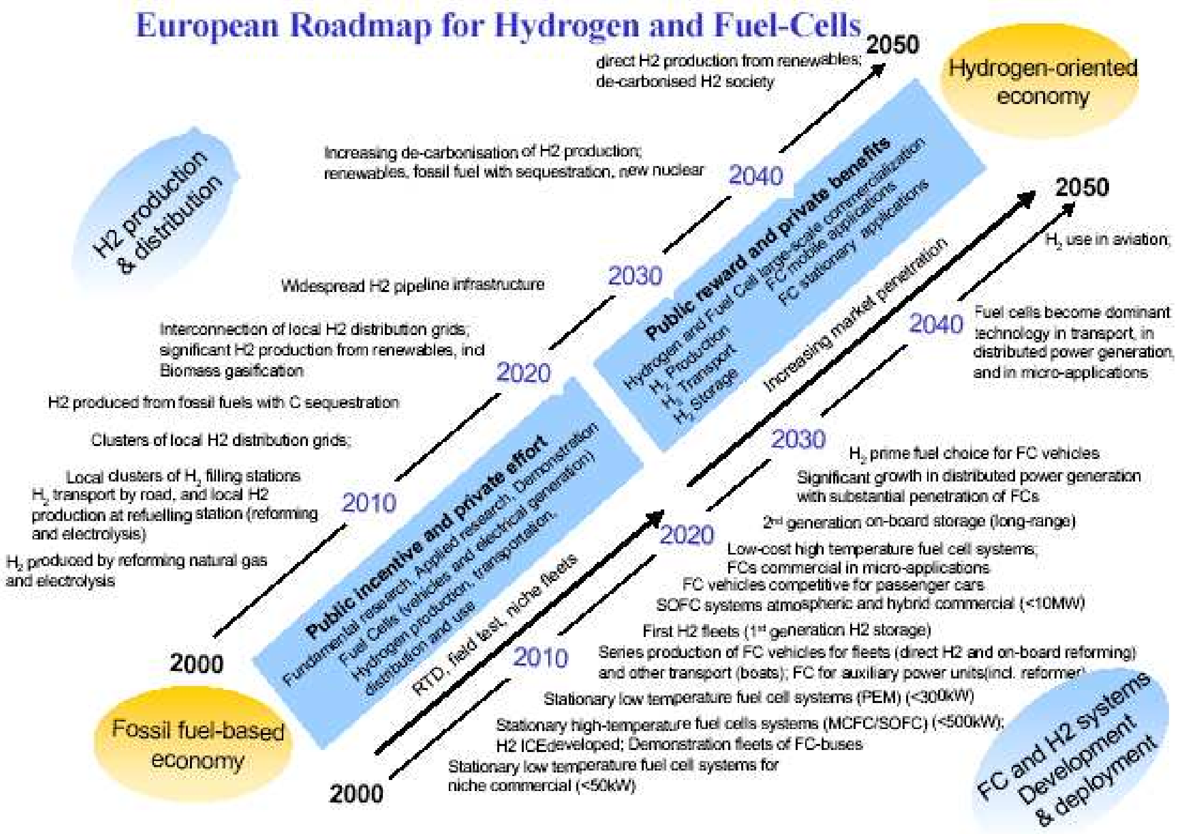
In the period from now until 2020, the focus in the short term (to 2010) is on the development of local clusters of hydrogen distribution and re-fuelling stations based on hydrogen produced by reforming natural gas and electrolysis. Towards 2020, the Roadmap points towards the development of hydrogen distribution grids and their interconnection with a move to the production of "green" hydrogen from fossil fuels (with carbon capture/storage) and renewables. In parallel with this, the development of fuel cells moves from niche stationary and transport applications to series production for co-generation, vehicle fleets and cars.

EU activities are now being co-ordinated through the Hydrogen and Fuel Cells Technology Platform which brings together a wide range of key players to develop the Roadmap further and to identify the priorities for further R&D and technology demonstration. The 7th Framework Programme (FP7) for European R&D (2007 to 2013) will have a strong emphasis on hydrogen and fuel cells based on these priorities. A major initiative in this context is the development of "lighthouse" projects to demonstrate wide spread use of hydrogen in communities and large scale test facilities for the production of hydrogen and electricity. These will be funded through a combination of FP7 and the private sector with support from the European Investment Bank.

Both the USA and Japan are placing a strong emphasis on the development and deployment of hydrogen and fuel cells. In the USA, the Federal Government has proposed funding of $1.7 billion, over a five-year period from 2003, to develop hydrogen fuel cells, hydrogen infrastructure and advanced automotive technologies. According to the US Department of Energy, this will create 750,000 new jobs by 2030.

Japan is also actively pursuing the research and demonstration of hydrogen and fuel cells with a budget of around $240 million in 2002. Developments include six hydrogen fuelling stations in Tokyo, commercialisation targets of 50,000 fuel cell vehicles by 2010 and installed stationary fuel cell capacity of 2.1GW by 2010 rising to 10GW by 2020.

[19] Hydrogen Energy and Fuel Cells: A vision for our future EUR 20719 EN.


European Roadmap for Hydrogen and Fuel-Cells
Hydrogen-oriented economy
Fossil fuel-based economy
H2 production & distribution
FC and H2 systems Development & deployment
2000
2010
2020
2030
2040
2050
direct H2 production from renewables; de-carbonised H2 society
Increasing de-carbonisation of H2 production; renewables, fossil fuel with sequestration, new nuclear
Widespread H2 pipeline infrastructure
Interconnection of local H2 distribution grids; significant H2 production from renewables, incl Biomass gasification
H2 produced from fossil fuels with C sequestration
Clusters of local H2 distribution grids;
Local clusters of H_2 filling stations
H_2 transport by road, and local H2 production at refuelling station (reforming and electrolysis)
H_2 produced by reforming natural gas and electrolysis
Public incentive and private effort
Fundamental research, Applied research, Demonstration
Fuel Cells (vehicles and electrical generation)
Hydrogen production, transportation, distribution and use
Public reward and private benefits
Hydrogen and Fuel Cell large-scale commercialization
H_2 Production
H_2 Transport
H_2 Storage
FC mobile applications
FC stationary applications
Increasing market penetration
RTD, field test, niche fleets
H_2 use in aviation;
Fuel cells become dominant technology in transport, in distributed power generation, and in micro-applications
H_2 prime fuel choice for FC vehicles
Significant growth in distributed power generation with substantial penetration of FCs
2nd generation on-board storage (long-range)
Low-cost high temperature fuel cell systems;
FCs commercial in micro-applications
FC vehicles competitive for passenger cars
SOFC systems atmospheric and hybrid commercial (<10MW)
First H2 fleets (1st generation H2 storage)
Series production of FC vehicles for fleets (direct H2 and on-board reforming) and other transport (boats); FC for auxiliary power units(incl. reformer)
Stationary low temperature fuel cell systems (PEM) (<300kW)
Stationary high-temperature fuel cells systems (MCFC/SOFC) (<500kW);
H2 ICEdeveloped; Demonstration fleets of FC-buses
Stationary low temperature fuel cell systems for niche commercial (<50kW)

Appendix 3 – Potential Wind Development Locations