LD213

WASTE TO ENERGY (W2E) ACTION PLAN

CUMBRIA COUNTY COUNCIL

A “living” draft for discussion

December 2012

Version 3.0

Waste to energy (W2E) EU partners

CONTENTS

APPENDICES

1. EXECUTIVE SUMMARY

1.1 The way in which we manage our waste has changed considerably over recent years. This has been largely through legislative changes in connection with environmental issues and to take advantage of the potential of resource recovery but also to respond to public expectations.

1.2 Even the vocabulary of waste management is changing as it progresses towards a sustainable future. Whilst materials that have been discarded were once called waste, they are increasingly being seen as a low carbon resource.

1.3 With advances in technology, the treatment plants that are now being used can be described as industrial production units rather than waste facilities. Taking a Mechanical and Biological Treatment plant as an example, the residual waste/low carbon resource is taken in and, through various industrial processes, is turned into a range of products. These can include the feedstocks for glass and plastic recycling factories, metals for re-smelting, compost, alternative construction aggregates and fuel.

1.4 Fuels, derived in this way from waste, figure prominently in a European Union-funded project with which Cumbria County Council has been engaged, together with partner organisations from six other EU countries (please see the map at the start of this report and Appendix 1). The project is known by the acronym W2E, Waste to Energy.

1.5 Through exchanging ideas and looking at best practices, the project aims to spread the word throughout the EU about the advantages and opportunities that using residual wastes as an energy resource can offer as part of sustainable waste management. This ties in with the waste hierarchy, which has been refined recently to give greater prominence to recovery of energy.

1.6 This report is Cumbria County Council's W2E Action Plan. It is intended as a "living" document that will be developed through discussions with interested parties. It sets out broad areas of further work about measures that could increase levels of energy recovery that may be agreed and achieved in the interests of people in Cumbria. As elements of the Action Plan are explored further, it can be revised to feedback on progress and set a "road map" for further activity.

1.7 At this initial stage, five Actions and a possible pilot project are suggested. These can be summarised:-

- local policies;
- targets;
- raising awareness;
- opportunities and markets;
- wood waste pilot project;
- check progress.

2. Background to the project

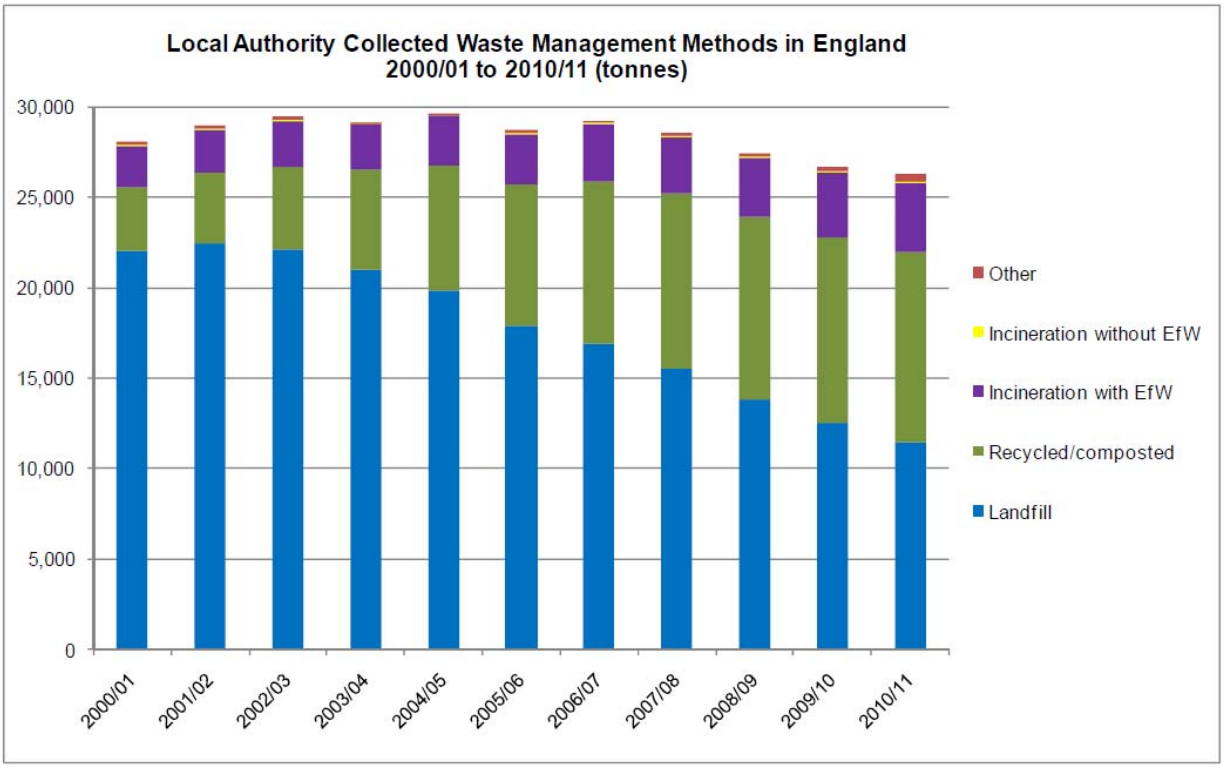
Why waste to energy?

2.1 The main driver is the waste hierarchy and the need to divert waste from landfill or other disposal. Recovery of energy from waste is the first step up on the waste hierarchy. The EU Directive recognises that there are circumstances when it could be higher. The importance given to this is demonstrated by the European Commission's reasoned opinion, dated 22 March 2012, about Slovakia's environmental legislation. One of the concerns identified in this opinion is that the legislation "does not prioritise energy recovery when it is preferable to material recycling for environmental and cost-benefit reasons."

2.2 No country has successfully been able to divert waste away from landfill simply through recycling/re-use; all have had to use the waste to energy route or, as more commonly called in this country, energy from waste. Using waste as a fuel also provides opportunities in relation to the low carbon agenda.

2.3 Figure 1 shows the trends in how municipal waste has been treated over the last 10 years in the UK. It shows the modestly increased contribution that using waste as a fuel has made to date. That is likely to change significantly as additional waste treatment facilities that produce a fuel become operational.

Figure 1



2.4 Information about waste in EU countries is published by the European Environment Agency:

http://www.eea.europa.eu/soer/countries/hu/soertopic_view?topic=waste

The low carbon agenda

2.5 The size of the challenge that will be faced in meeting the commitment to reduce carbon dioxide emissions is illustrated in Figure 2. The objective to reduce 1990 emissions by 80% by 2050 means that less carbon dixide should be emitted by that date than was emitted in 2007 by the electricity generation sector alone.

2.6 Taken together with the anticipated increase in electricity use between now and 2050, there is a need to very substantially reduce the carbon intensity of electricity generation. Waste to energy can contribute to this.

Is waste to energy low carbon?

2.7 Taking municipal solid waste as an example, its composition includes 32% carbon and approximately 65% of its energy content is from biomass. Using such waste as an energy resource is low carbon in the sense that it limits the increase in our “current carbon” inventory. This is because it uses carbon that is already in the system; this is known as “short cycle” carbon. This displaces the extraction of virgin materials, such as fossil fuels, which would involve the release, and addition to the inventory, of carbon from long term storage. Figure 3 illustrates this.

Figure 2

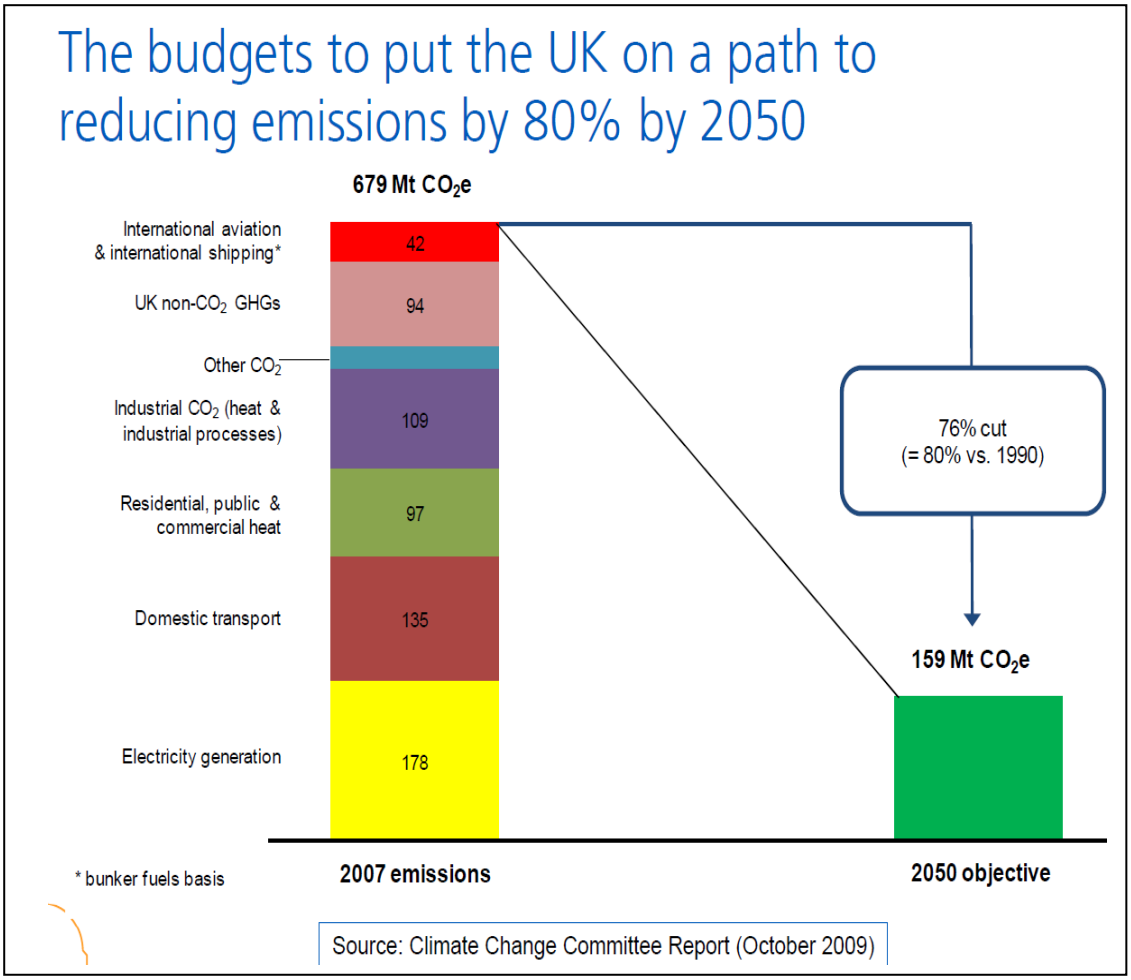
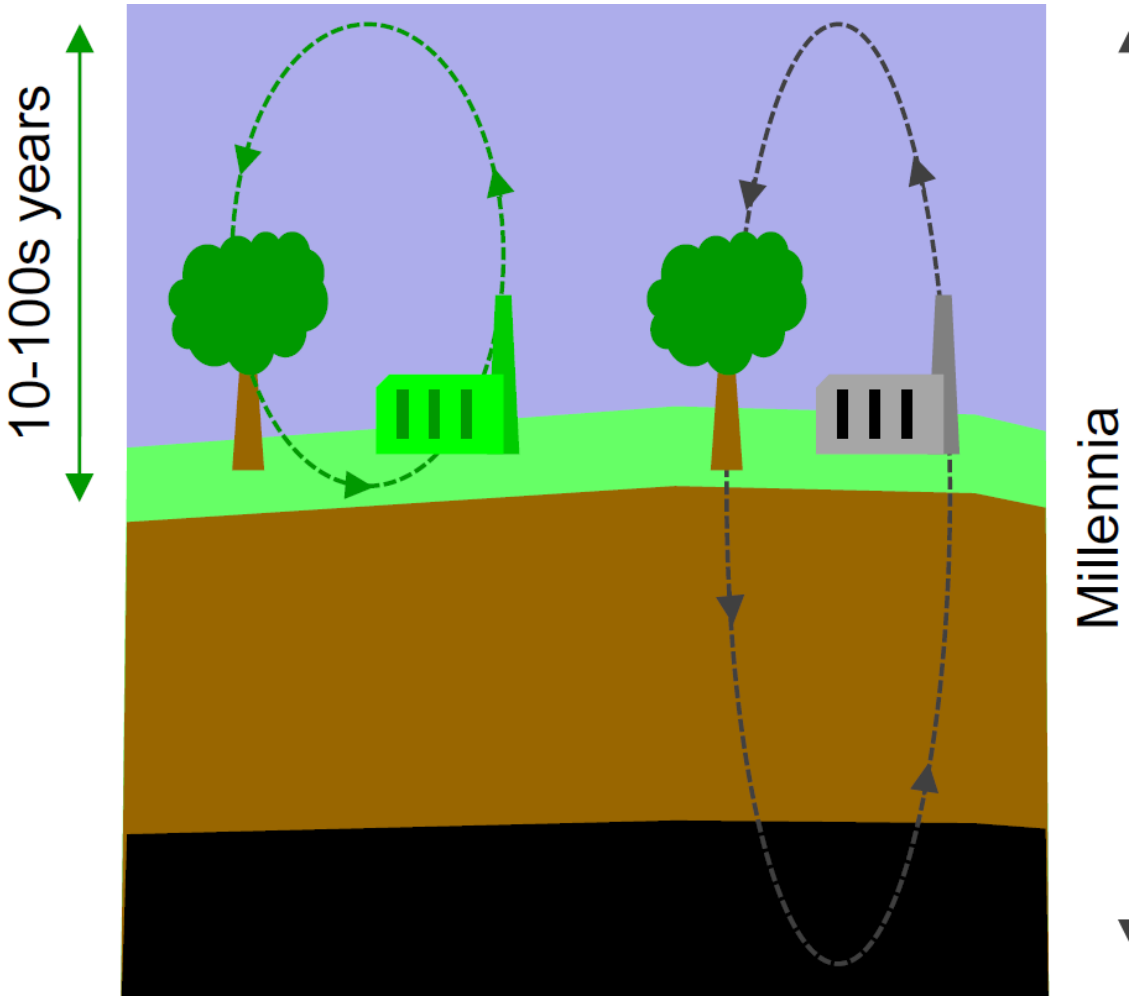

The budgets to put the UK on a path to reducing emissions by 80% by 2050
679 Mt CO_2e
International aviation & international shipping*
UK non-CO_2 GHGs
Other CO_2
Industrial CO_2 (heat & industrial processes)
Residential, public & commercial heat
Domestic transport
Electricity generation
42
94
109
97
135
178
76% cut
(= 80% vs. 1990)
159 Mt CO_2e
* bunker fuels basis
2007 emissions
2050 objective
Source: Climate Change Committee Report (October 2009)

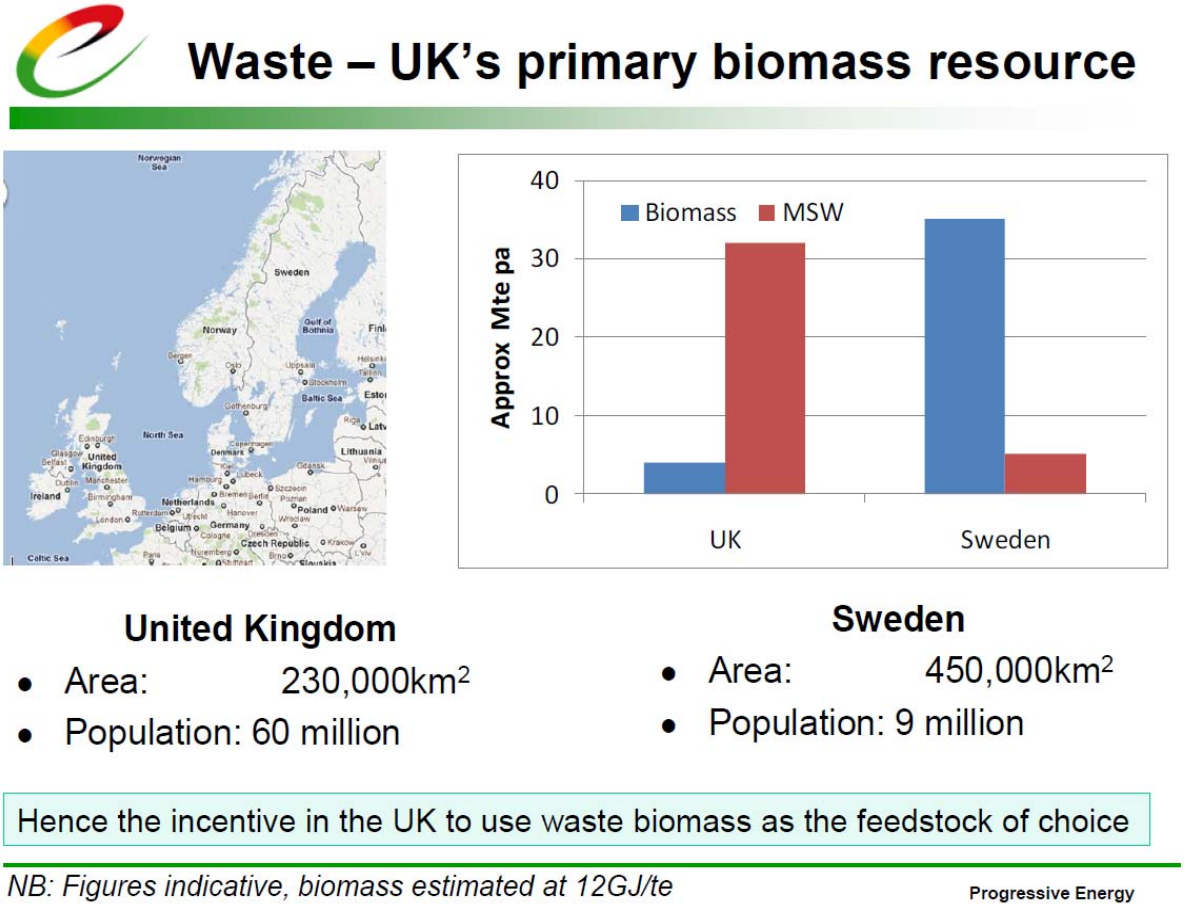
Figure 3



short cycle" carbon **Long term storage carbon**

2.7 The importance of waste as a biomass resource in the UK is highlighted in Figure 4, which illustrates some of the differences between the UK and Sweden, the lead partner in the W2E project.

Figure 4



Why Cumbria?

2.8 The W2E European project was initiated at a time when the County Council was preparing its waste planning policy documents and was also in the final stages of agreeing its long term municipal waste management contract.

2.9 The project offered the opportunity for staff involved with the County Council's statutory roles as the waste disposal authority and the waste planning authority to gain from the experiences of other countries. This was particularly relevant at a time when many of the waste management techniques and technologies that were being put forward were new to this country. It has not been a one-way process. Projects and initiatives that have been undertaken in Cumbria have proved useful to the other countries.

2.10 Cumbria has a Joint Municipal Waste Management Strategy, which has been developed by the County Council and the six Cumbria District Councils. The wider waste planning policy is part of the Cumbria Minerals and Waste Development Framework (MWDF). It will be incorporated into the Minerals and Waste Local Plan, under the new development plan system that was brought

into effect in April 2012. Among other things, these set out the policies and identify the sites that the County Council considers are needed for the management of all Cumbria's waste streams in accordance with the waste hierarchy.

2.11 The municipal waste management contract involves the construction of two Mechanical and Biological Treatment (MBT) plants which produce a solid recovered fuel (SRF) from residual municipal waste, after recyclables have been removed.

2.12 Waste to energy is also a relevant issue for Cumbria because its industrial base includes several high energy use industries. There have been expressions of interest in waste to energy plants. West Cumbria has also been identified as "Britain's Energy Coast" in relation to possible potential for new build nuclear power stations and renewable energy schemes. One major issue that is being addressed is the capacity of the electricity distribution network and the need to reinforce it.

3. WASTE TO ENERGY TECHNOLOGIES

3.1. For this project, the term waste to energy refers to the treatment of residual wastes in order to generate energy in the form of electricity, heat or an alternative to fossil fuels for vehicles. This, recovery of value, is the first step up the waste hierarchy from disposal. The European Directive provides for departure from the hierarchy if this can be justified. The technologies that have been considered are:-

- Mechanical and Biological Treatment (MBT) to produce a fuel;
- Incineration;
- Anaerobic Digestion (AD);
- Advanced Thermal Treatment (ATT).

These technologies are described in Appendix 2.

3.2 Electricity is the most common energy output as it is the easiest to distribute and can be sold on to utility companies or other end users. Wherever possible, preference should be given to combined heat and power (CHP) schemes. This is because they increase energy efficiency and environmental benefits compared to the output of a single type of energy. The form of energy produced must take into account the needs of the end user.

3.3. The only CHP schemes that have been identified are for electricity and heat, usually steam. The end user for heat typically needs to be in reasonable proximity to the plant to reduce distribution costs, although in Sweden there are examples of heat being transmitted over 28 km. Some waste treatment processes use some of the heat they generate within the process itself.

3.4 Technologies and their use continue to develop and it has not been possible to assess every type of W2E facility during the project. In the UK, some of the ones that are gaining prominence are plasma technologies; “mining” of old landfills with gasification plant to produce an alternative to natural gas; and the planned production of aviation fuel from waste.

4. WHERE WE ARE STARTING FROM IN CUMBRIA

4.1. Cumbria is the second largest county within England (700km^2); but with a population of just under 500,000 it is also one of the most sparsely populated. It includes some of the country's finest environments, including the Lake District National Park, see Figure 5 below.

Figure 5

4.2. Employment within the County relies mainly on health, education and public administration (around 25%), wholesaling and retailing (18%), manufacturing (17%), hotels and restaurants (11%) and agriculture and supply chain industries (3%)[1].

4.3. Many areas have single sector employment opportunities, with both Copeland and Barrow having high proportions of population employed by larger employers. This is seen within Copeland where 42.2% of employment relies on manufacturing at the Sellafield nuclear facility[2]. Conversely, Carlisle relies on the public sector as the major employer.

[1] Cumbria Local Economic Assessment, November 2010
[2] Cumbria Economic Strategy, February 2009

4.4. Cumbria's Economic Strategy 2009 identifies opportunities for an Energy and Low Carbon Economy. It highlights that energy from renewable sources offers particular opportunities for economic development, which in turn will assist local, regional and national targets for carbon reduction. Of particular interest to Cumbria is seen to be the utilisation of waste to energy materials from its hospitality and food and drink sectors to create biogas and the abundant natural resources from tidal and wind projects to woodlands for biomass.

4.5. Cumbria County Council has entered into a public-private partnership to build and operate two waste treatment plants, using mechanical-biological treatment (MBT), that will process residual waste to extract valuable materials and will then produce a low-carbon fuel, known as Solid Recovered Fuel (SRF).

4.6. There are already a number of projects within Cumbria that are seeking to promote renewable energy and the opportunities Cumbria offers in terms of encouraging new 'green' business.

4.7. In west Cumbria, the Britain's Energy Coast programme is a £2 billion package of regeneration projects, which will promote diversification into other forms of low carbon industries such as renewable energy. The plan extends to 2027 and is expected to create 16,000 jobs and boost the economy by £800 million.

4.8. Community Renewable Energy North West (CoRE (NW))[3] is a franchise that has been set up initially to work with farmers to use slurry, manure and agricultural waste to set up a cluster of Energy Farms. A cluster of 15 Energy Farms is intended to be built over the next 10 years that will bring social, economic and environmental benefits. The aim is that these Energy Farms will:

- Create over 105 jobs, safeguard 390 and save 2.3 million tonnes of CO_2eq;
- Stimulate local economic growth through the availability of low cost renewable heat and electricity in, for example, glasshouses growing year round food or visitor attractions;
- Create a major AD industry in Cumbria to meet growing demand in the UK, built on its strengths in farming and energy.

Waste Arisings

4.9. The waste streams that are of most relevance to W2E are agricultural wastes, wood wastes, household waste and commercial and industrial waste, together with some construction and demolition wastes.

4.10. In 2008, approximately 165 million tonnes of waste was generated in England. Of this, circa 23 million tonnes was household waste and 47.9 million tonnes were generated by businesses (Commercial and Industrial (C&I) waste).

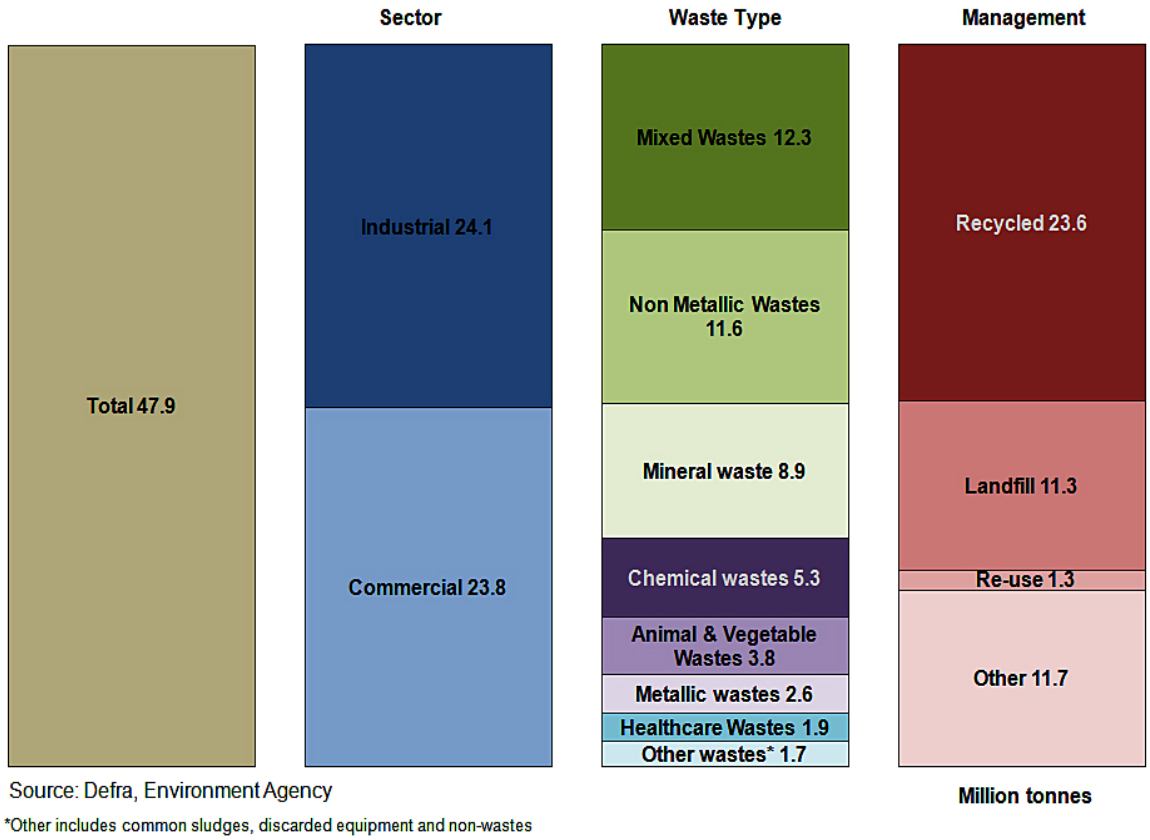
[3] http://www.corecoop.net/index.php?option=com_content&task=view&id=39&Itemid=48

4.11. Figures from the 2010 survey of Commercial and Industrial waste arisings in England, show that 52% of the waste was reused, recycled or composted, while only 2% was sent for incineration with energy recovery[4].

4.12. The typical composition of Commercial and Industrial waste is given in Figure 6 below.

[4] DEFRA – Government Review of Waste Policy in England 2011

Figure 6: Commercial and Industrial Waste arisings – England 2009



4.13. The Environment Agency's figures show that 315,876 tonnes of inert Construction and Demolition wastes were managed in Cumbria in 2008/9, of which 227,741 tonnes (72%) was landfilled. The amount of Commercial and Industrial waste managed in Cumbria in 2004/05 was recorded as 541,944 tonnes, of which 291,500 tonnes (54%) was landfilled.[5]

4.14. It can be seen that the ratio of C&I waste and C&D waste seen in Cumbria is similar to the national data.

4.15. A substantial proportion of Commercial and Industrial waste is similar in composition to municipal waste and so is suitable for similar treatment options.

4.16. Industrial waste in Cumbria still accounts for an estimated 60% of Commercial and Industrial waste, which is slightly higher than for England as whole.

4.17. In 2010/11 around 131,000 tonnes of household waste was collected for treatment in Cumbria, just under 580 kg per household, An additional 110,000 tonnes was collected directly for recycling/composting. In total 46% of household waste was recycled/re-used/composted the remainder was landfilled. There will be a significant reduction in landfilling now that the first of the MBT plants is operational and the other will be by 2013. No household waste will then be sent directly to landfill.

[5] Cumbria MWDFCore Strategy 2009

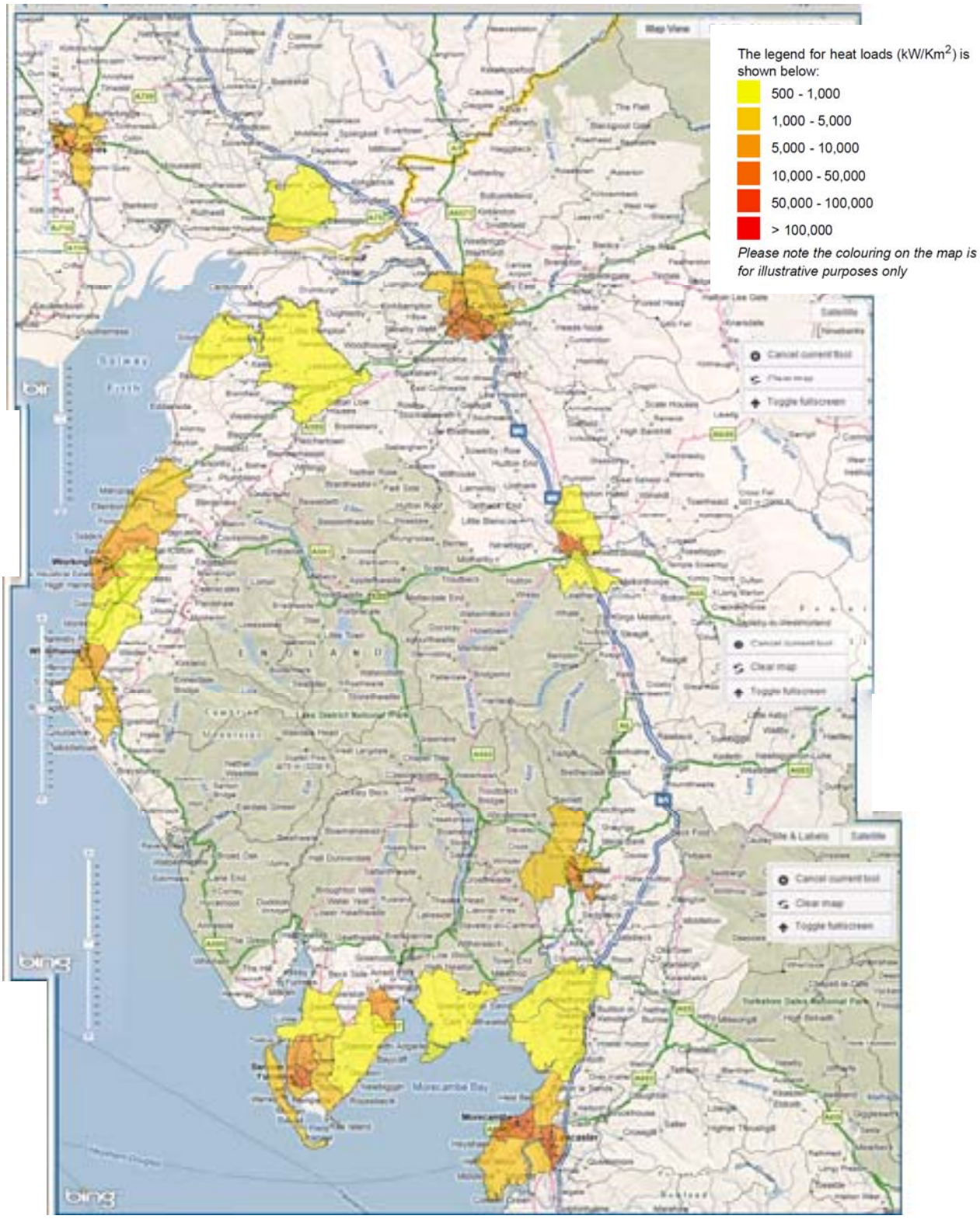
Energy requirements

4.18. A revised UK industrial heat map has been developed for the UK Government. The map was originally developed to assist power station developers consider the opportunities for combined heat and power. However, the map is also a useful tool to identify the locations where Combined Heat and Power, renewable heat plants and district heating would have the greatest technical and economic potential, and therefore the largest positive environmental impact.

4.19. Figure 7 shows the heat map for the County[6]. It can be seen that, as would be expected, the areas of highest demand are the six main towns of Barrow in Furness, Carlisle, Kendal, Penrith, Whitehaven and Workington, together with the smaller town of Ulverston. It should be noted that the map does not identify more localised high energy using industries, such as the Hardendale Works limekilns, British Gypsum at Kirkby Thore and Sellafield.

[6] DECC http://chp.decc.gov.uk/developmentmap/

Figure 7: Cumbria Heat Map



Source: DECC

Waste Facilities

4.20. The County Council has procured a long term contract to manage the municipal waste arisings within the County. The waste will be treated at two MBT facilities; one located at Carlisle and one at Barrow. The Carlisle plant is now operational, whilst the Barrow facility is currently in the construction phase and is anticipated to be operational by 2013. Treatment will be via MBT with a Solid Recovered Fuel output.

4.21. Planning permission has been granted for the following waste to energy facilities within the County:

- an EfW plant at the Port of Barrow, mainly using imported wood waste;
- a steam raising plant, using solid recovered fuel and paper waste, near Kendal;
- an anaerobic digester (AD) plant for agricultural wastes near Siloth; and
- an anaerobic digester plant for agricultural wastes near Kirkbride.

4.22. The Silloth proposal is for a 1,000kW AD facility with potential generation of electricity for 2,000 households and is being delivered through the CoRE NW Scheme.

4.23. The Kirkbride proposal is for a 500kW AD facility and is also being delivered through the CoRE NW Scheme.

4.24. In addition, there is a proposal near Barrow in Furness for an 80MW biomass power station. This would be a replacement for the gas-fired power station at the site, which is nearing the end of its working life. Indications are that waste would only provide a small amount of the feedstock for the facility; its main feedstock is proposed to be imported wood chips.[7]

4.25. During the preparation of the Cumbria Minerals and Waste Development Framework (MWDF) Site Allocation Policies, there were expressions of interest in developing waste to energy facilities. Some of these would be within existing industrial complexes. In addition to such examples, the MWDF Site Allocations Policies that were submitted to the Secretary of State for consideration include four potential sites for waste to energy facilities:-

- Lillyhall waste management centre, which is next to a large employment site in the Workington/Whitehaven area;
- Port of Workington, which is near high energy using industries;
- Kingmoor Park East, Carlisle, which is part of a large business park complex served by a single electricity main;
- Oldside, Workington.

4.26. The University of Cumbria's Newton Rigg campus is pursuing an aim to become completely carbon neutral. This involves a range of projects undertaken by the National School of Forestry. The work that is going into this project includes coppicing for wood fuel, studies of Cumbria's biomass supply

[7] http://www.centrica.com/index.asp?pageid=1053

chains, and systems that ensure university vehicles and boilers are as low carbon as possible.[8]

4.27. Waste wood was identified as a priority material for action in the Waste Strategy for England 2007and its 2011 review, which outlined the Government's intention to facilitate greater recovery of energy from waste wood. In 2010, 4.1M tonnes of waste wood was produced in the UK, 2.44M tonnes of this were recovered, the remainder was sent to landfill.

4.28. A W Jenkinson Forest Products is Britain's largest independent wood fibre and wood co-products trading company, handling over 2.4M tonnes of raw materials annually. From virgin roundwood, woodchips, sawdust, bark and other primary co-products, to recycled wood and greenwaste recovered from waste management operations. A W Jenkinson, working in partnership with Stobart Biomass Products Limited, have been identified as key players in Cumbria's ambitions to become a major generator of renewable energy (reference made to Invest in Cumbria - http://www.investincumbria.co.uk/our-Strengths/agriculure.php).

[8] http://www.cumbria.ac.uk/AboutUs/Subjects/ScienceNaturalResources/Research/Forestry/BiomassResearch.aspx

5. THE CUMBRIA ACTION PLAN

5.1. These actions are intended to be challenging but realistic, with a reasonable anticipation of success in the interests of people in Cumbria. They build on the existing situation in the county and identify what could be needed to optimise waste to energy as part of sustainable waste management, having due regard to environmental, social and economic considerations.

5.2. Possible timescales are suggested for the actions:-

- Short - 1 to 5 years;
- Medium - 5 to 10 years;
- Long - over 10 years.

ACTION 1: LOCAL POLICIES

Policies on their own are of limited use without the knowledge of how they could be delivered. Before anything else, it is necessary to understand the various roles of organisations and individuals and how they relate to each other. In simple terms, who can do what. This includes, whose decisions are needed before any proposed initiatives can get off the ground, what local and other policies come into play and whose decisions are needed before anything actually goes ahead.

BACKGROUND	POSSIBLE WAYS TO ENCOURAGE W2E	TIMESCALE
Private developers have the key role in initiating W2E projects and securing, and deciding whether to use, the necessary resources.	CCC and others may seek to work with developers and waste technology providers to help bring forward private sector developments and financing CCC and others may act as a conduit between technology providers and waste producers.	Short/ medium
The Cumbria local authorities have statutory roles in connection with economic regeneration and as local planning authorities. The County Council is the planning authority for developments that are for managing wastes. Cumbria County Council's (CCC) principal roles in delivering a sustainable W2E programme are in terms of spatial planning and economic development opportunities.	The Localism Act gives district councils more freedom to offer business rate discounts - to help attract firms, investment and jobs. Consideration could be given to introducing incentives to businesses to implement new waste management proposals, which would contribute to the lower carbon economy.	
Policies regarding W2E could benefit by being integrated into relevant local strategies. There are specific policies relating to W2E within the Cumbria Minerals and Waste	Consideration could be given within the County, District and National Park Local Plans for policies to promote measures to meet the County's energy requirements and to implement national targets such as those regarding climate change.	

Development Framework. With the imminent revocation of the Regional Spatial Strategy and a new National Planning Policy Framework, there is a need for local authorities to consider which of the previous regional and national policies now need to be included in Local Plans. The Local Government Information Unit's (LGiU) survey with members of the 'Carbon Saving Public Sector', highlights that none of the respondents have yet managed to progress a Feed in Tariff scheme. Of those who have decided on a course of action, delays due to financial or legal reasons were cited. In order to assist Councils to navigate their way through the policy choices and financial considerations, the LGiU have developed 'The 10 Pillars of Local Energy Security' these are; 1 Keep the lights on 2 Manage costs	Further policy work relating to the promotion of W2E and siting of facilities could look at;- • Identifying suitable areas for W2E infrastructure based on existing need at employment sites and identified through heat maps; and • Identifying residential and other land allocations where there could be potential for combined heat and power schemes, including district heating. Local partners could consider developing a specific energy policy, demonstrating how the energy requirements within the County could be met and the role that the renewable energy sector might take. The Energy Map for Cumbria identifies most of the areas of highest energy demand in the county and this could provide a useful starting point for specific targeting of energy policy requirements in the short term. Of particular relevance to waste to energy projects, the LGiU advocates: • Installing the right technology, which should consider the purpose of the technology, the scale of the technology and government policy on the type of technology. • Incentives that will stimulate innovation; Council's can help this by linking up universities with entrepreneurs and established companies. Innovation should lead to new jobs and growth in the green economy. • Looking to the long term - planning for energy security is by its nature a long-term project.	

3 Install the right technology 4 Compliance 5 Reduce carbon emissions 6 Minimise the impacts on communities 7 Maximise the benefits for communities 8 Make decisions democratically 9 Look to the long term 10 Get the right advice		

ACTION 2: TARGETS

There could be specific targets for renewable energy met through W2E projects. This could involve considerations of whether previous national or regional targets need to be set out locally or whether more challenging targets than those would be appropriate.

BACKGROUND	POSSIBLE WAYS TO ENCOURAGE W2E	TIMESCALE
It may be useful to establish and monitor targets for Renewable Energy to be met through W2E by specific dates, e.g. 2020, 2030. The baseline could be the existing landfill gas powered generators.	Targets and/or objectives could include separate ones for biomass waste, SRF/RDF and other waste streams. Also for their use in incineration, anaerobic digestion, gasification and for electricity generation or combined heat and power facilities. Once the RSS has been revoked, there will be no targets in place relating to climate change and energy requirements. The intention is that Local Authorities should co-operate with each other and introduce new local targets, which will contribute to meeting national ones. Examples could be to have x MW of electricity generated by W2E by 2020 and/or to have x numbers of AD plants dealing with agricultural wastes by 2015 and/or to have x CHP plants providing electricity and heat to district heating schemes or industries by 2020.	Medium/ long

ACTION 3: RAISING AWARENESS

It seems particularly worthwhile if exemplar projects can be identified within Cumbria and elsewhere, for which people can see the details of facilities in operation.

BACKGROUND	POSSIBLE WAYS TO ENCOURAGE W2E	TIMESCALE
Some of the technologies that are being proposed are relatively new to this country. An increasing number of these modern plants are now up and running and could provide tangible good examples, which can be seen and assessed for impacts. There is still considerable antipathy about, and prejudice against, waste to energy schemes, particularly anything regarded as incineration. Countries with more experience of such schemes do not appear to experience this problem. Local authorities have many links into their communities and businesses for engaging and liaising with them.	Good communication about 21st century W2E technologies and their environmental impacts is vital in order to avoid misunderstandings and overcome concerns. It seems important that opportunities are taken to ensure that a wide audience becomes better informed about good examples. Work currently being progressed by BEC and CoRE NW could possibly help to identify these. Factual information about how modern plants in this country are operating, including details of the monitoring of emissions, traffic and other impacts, could answer some of the concerns that are expressed. Visits to plants could be arranged when similar ones are being proposed. CCC put considerable effort into arranging visits to the Dumfries MBT plant and the Grimsby incinerator when the competing bids for the municipal waste management contract were being considered. It may be possible to facilitate meetings with the business community to raise awareness and get feedback about W2E issues, opportunities and developments. This could possibly lead to waste to energy champions within local business communities. Waste treatment providers may also want to put forward ideas to stimulate market interest and development of facilities. Consideration could be given to developing briefing notes, for example on the availability of funding.	Short and ongoing

ACTION 4: OPPORTUNITIES AND MARKETS

There is something of a “chicken and egg” situation with regard to the promoting opportunities and developing markets for solid recovered fuel.

BACKGROUND	POSSIBLE WAYS TO ENCOURAGE W2E	TIMESCALE
Obviously the market cannot be developed until the fuel is being, or is about to be, produced. There seems little doubt that it will increasingly be seen as a valuable low carbon resource. This view is supported by the large number of W2E schemes that have been put forward within the north west of England. The total capacity of these exceeds the amount of fuel that could be produced from the region’s wastes. SRF is currently classified as a waste under UK legislation. This limits the market potential and facilities where this material can be used as a feedstock. The grade of SRF that is produced can be used as a feedstock in the UK cement kiln industry. However, this end market is not sufficiently large to handle large volumes and there are no facilities in proximity to Cumbria. In Cumbria, there is no “centre of gravity” or “critical mass” of waste arisings. We are a rural County with a dispersed pattern of towns and of waste producers. This is particularly relevant in connection with the	With one of the County Council’s MBT facilities now operational and the other programmed for 2013, there is a need to identify the markets for the 75,000 tonnes of SRF that will be produced. This could include seeking to develop end markets for this material within the County. It is known that local high energy using businesses have been in contact with the municipal waste contractor about possible use of the fuel produced by the MBT plants. It may be worthwhile to assess the potential for integrating waste to energy plant into larger development sites identified in Local Development Frameworks. There may be opportunities to explore possible “pump starting” of W2E facilities. An example could be supplying the initial feedstock to demonstrate the feasibility of a new W2E facility servicing a business park. Market development research into potential UK markets and technologies able to utilise the differing grades of SRF produced could be undertaken. It may be possible to carry out a feasibility study regarding the use of SRF within CHP for industrial/residential properties or the Council’s own estate. This may include financial and technological assessment. The UK market for SRF is not yet fully developed and it has been suggested that, in the short term, the large volume end market may involve export to facilities in Germany or Belgium. It may be appropriate to consider a lobbying role about the effects of the classification of SRF. The aim would be to help to encourage its use within the UK in a wider range of facilities.	Ongoing

Commercial and Industrial waste streams. The UK currently produces 100 million tonnes of organic waste, 90% (by weight) comes from agriculture. The government estimates that if all this waste were used in anaerobic digestion, it would produce up to 7.5% of the renewable energy that the government has pledged the UK to produce by 2020. It is therefore a potentially major source of energy (CoRE NW).	There may be opportunities for joint W2E working, for example, by rural waste producers. Waste streams such as farm and hospitality/food waste may be able to be treated in the same facility. For farm wastes, there has already been the CoRE NW private sector initiative for AD facilities. This is seeking to deliver several new Energy Farms in Cumbria. It may be worth discussing if the scope of the project could be expanded. The promotion of such AD schemes is supported by Government policy. This recognises the potential of anaerobic digestion and encourages a much greater uptake of anaerobic digestion by local authorities, businesses and farming. There may be opportunities for promoting local/community W2E solutions, which could lead to reduced carbon footprint and reduced waste road miles. Locations and anticipated waste tonnages could be mapped, in order to identify potential waste hubs and links with farm areas and to look for synergy and priority areas. Joint schemes may also be able to extend opportunities for waste management that may otherwise be precluded to smaller waste producers because of cost or transport logistics. Greater local publicity may be able to be given to opportunities, such as WRAP funding for food waste collection from businesses.	

ACTION 5: PILOT PROJECT

Two possibilities have been suggested for a pilot project to demonstrate the potential for Waste to Energy in Cumbria. These are one based on wood waste and one based on food waste.

It may be that, in a rural county like Cumbria, and with the interest that has already been shown, that wood waste could be looked at as an appropriate first priority for attention. However, considerable efforts have already been made by a major company in the county. It may be that there are no significant quantities of waste wood arising within Cumbria that are not already committed for recycling/re-use. In those circumstances the project may be able to identify the measures and circumstances that have led to this success and see if they are transferable to other waste streams.

Significant quantities of food waste are generated in Cumbria. This is not only from households but also from businesses which cater for the 40 million visitors/year who are attracted to the county. .

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BACKGROUND	POSSIBLE WAYS TO ENCOURAGE W2E	TIMESCALE
There are already proposals in Cumbria to use biomass wood, including waste products for W2E. In addition, wood waste is identified in Waste Strategy 2007 and in the National Waste Policy Review 2011 as a priority waste stream, with a view to reducing the reliance on landfill as the waste management option. Defra has recently undertaken consultations about restrictions on the landfilling of wood waste. In these circumstances, it may be appropriate to consider the opportunities that wood waste presents as one of the first priorities	Initiatives may be appropriate to promote the domestic and commercial use of sustainable wood fuel. There could be opportunities to assess the requirements and capacity for new facilities to deal with wood waste within the County. CCC, through Cumbria Woodlands, could liaise with the Forestry Commission and major waste producers to explore the potential to use locally sourced material within existing and planned W2E biomass facilities. Alternatively, lessons may be able to be learned, from successful experience of making full use of this waste stream within the county, that may be relevant and transferable to other waste streams.	Medium
The County Council, as the waste disposal authority and the District Councils, as the waste collection authorities, are assessing a range of possibilities for achieving further diversion of municipal waste away from landfill. One of these is separate collection of food waste. The County Council has recently secured funding to provide households in three district council areas with separate bins for collecting food waste.	Food waste is identified as a waste that has potential as a feedstock for waste to energy, usually by anaerobic digestion. There may be commercial interest in developing a plant to take advantage of this resource.	

ACTION 6: CHECK PROGRESS

This should not mean just monitoring what gets built, but also identifying any constraints that are preventing or delaying progress.

Matters that are able to be measured objectively and regularly offer the most tangible way of establishing a starting point and then measuring progress. The most obvious examples would be targets that would be set out in connection with Action 2. More difficult may be gauging the degree to which interested parties take ownership of the proposed actions.

BACKGROUND	POSSIBLE WAYS TO ENCOURAGE W2E	TIMESCALE
Monitor which W2E schemes get built and, for any that do not, ascertain the reasons.	Monitoring on its own would achieve little, it would need to be combined with ongoing programmes of support and information about W2E issues, opportunities and developments. Starting with a 1 January 2012 baseline, all W2E proposals within Cumbria could be recorded together with when they become operational, the amounts of waste managed, the energy produced and its use and the net carbon impact. Lessons learned could contribute to feasibility studies concerning technological and economic issues. Examples could be for certain waste streams, such as hospitality waste or the successes achieved or specific problems faced in more remote parts of the county. The W2E Project has provided useful networking opportunities and links into best practice from other countries. It would be useful to continue and improve these contacts, perhaps on a six-monthly basis by teleconferencing, in order to continue to benefit from the lessons learned by the other partners and the best practice opportunities they have identified.	Short and ongoing

APPENDIX 1

The W2E Project

Cumbria County Council is one of the partner "regions" taking part in the European Union funded INTERREG IVC Waste to Energy (W2E) project. For the purpose of this report, any reference to this region should be assumed to refer to the administrative County of Cumbria. The other partners are:-

- CAB Östergötland County Administrative Board (Sweden) - the lead partner
- ARAEN Abruzzo Regional Energy Agency (Italy)
- South Great Plain Regional Development Agency (Hungary)
- Kujawsko-Pomorskie Voivodeship (Poland)
- SIEA Slovak Innovation and Energy Agency (Slovak Republic)
- REA Regional Energy Agency (Slovak Republic)
- Dambovita County Council (Romania)

The project aims to develop regional Action Plans to stimulate increased levels of energy recovery as part of sustainable waste management. In doing so, it will address three linked issues:-

- support policies which divert waste from landfill;
- demonstrate ways to increase production of sustainable energy; and
- contribute to low-carbon economic growth.

The project commenced in 2009 and work carried out to date includes knowledge sharing, study visits to look at good practice in action and seminars to share experience. A policy assessment tool (referred to from this point forward as the W2E Policy Tool) has been developed by the project partners and is based on the principles of the Waste Framework Directive.

The purpose of the W2E Policy Tool is to enable a region to evaluate its current waste management position and assess where there may be potential for improvement. Using information gathered from this assessment, the final stage of the project is for each region to develop an Action Plan, which can be used to support its wider Waste Management Strategy. The actions should seek to improve sustainable waste management by supporting the development of renewable energy sources, as well as contributing to the growth of the low carbon environmental technologies sector. The Policy Tool's assessment of Cumbria is included as Appendix 3.

This report sets out how the aims of the project could be implemented within Cumbria. It has used the outputs of the W2E Policy Tool supplemented with local knowledge of the current situation in Cumbria, including existing and currently proposed waste management/treatment facilities. It identifies where Cumbria is now and includes a series of actions aimed at where we could aspire to be in terms of recovering energy from waste as part of sustainable waste management.

Following discussions about the Action Plan and its further development, an analysis of the Political, Economic, Social, Technological, Legal and Environmental (PESTLE) effects of the proposed actions will be carried out.

APPENDIX 2

WASTE TO ENERGY TECHNOLOGIES

Mechanical and Biological Treatment

1. Mechanical and Biological Treatment (MBT) describes a number of different processes and, as its name suggests, it is a combination of both biological and physical processes. For the W2E project, the main interest is the fuel MBT plants can produce. This is usually referred to as Solid Recovered Fuel (SRF). The alternative description, of Refuse Derived Fuel (RDF), is usually applied to less sophisticated waste sorting processes.
2. Some MBT plants have, as the first stage, mechanical sorting and removal of the recyclable and non-biodegradable fractions of waste. Others, including Cumbria's, have bio-drying of the waste stream first, in order to make it easier to mechanically sort and reclaim recyclables. The removal of these waste fractions leaves an organic-rich or biodegradable fraction, which is ideal for biological treatment.
3. The biological processes of MBT include aerobic decomposition to produce a soil conditioner or compost and a fuel.
4. An increasing number of MBT plants with fuel as an output have been or are being developed in the UK. These include the two plants procured by Cumbria County Council to deal with the County's municipal waste. The one near Carlisle is already operational, the other, near Barrow in Furness, will come on stream in 2013.
5. The solid recovered fuel (SRF) that they produce is a good quality fuel with an energy content around two-thirds that of coal and a low moisture content. It can replace fossil fuels in electricity generation, industrial heat and power (CHP) and in a range of industrial processes, including cement manufacture. It is also an ideal feedstock within gasification or pyrolysis processes.
6. A series of European standards for SRF (CEN/TC 343) have been developed by the Finnish Standards Association, in order to provide a high level quality assurance and control. Compliance with these standards distinguishes SRF from other, less sophisticated, fuels.
7. RDF/SRF have a high carbon neutral content see paragraph xxx), so provide a source of low carbon renewable energy that can displace fossil fuels and their CO_2 emissions.
8. In the UK, SRF is currently classified by the Environment Agency as a waste until it is burned as fuel and the energy recovered. This means that any facility using it as a fuel must meet the requirements of the Waste Incineration Directive (WID) or have appropriate justification for derogation. This has significantly limited the type of facilities that can utilise SRF as a feedstock.
9. Other European countries have longer experience of MBT plants with SRF output. It is in the main used to supply the cement industry, industrial CHP facilities and in co-generation facilities. The following are examples:-
    - In Sweden, it is utilised in district heating schemes.
    - Holland and Germany have dedicated SRF combustion plants.

- In Germany, SRF displaces up to 10% of the hard coal used in Werne Power Plants for electricity generation. SRF is also widely used in cement manufacturing and paper mills.[9]
- In Finland, SRF is gasified in a circulating fluidised bed gasifier with the synthetic gas being co-fired in a conventional steam raising power station boiler.
- In Austria, SRF is used widely in the cement, paper and steel manufacturing industries.
- In Spain, the Poligas plant runs combustion engine sets on the gas produced from SRF.
- In England, SRF from the Shanks' Frog Island Facility is used in cement kilns in Rugby.

10. In terms of potential markets in the UK, at present the cement and paper making industries appear to have the greatest capacity. Unlike the power plant industry, the cement industry has a specific derogation under the WID enabling them to co-fire waste-derived fuels in their kilns. However, there is competition from other waste-derived fuels (e.g. scrap tyres and waste oils) to act as feedstock.
11. Current estimates indicate that the cement industry could take between 350-500,000 tonnes of SRF per annum. The paper-making industry could potentially take more (up to 600,000 tonnes per annum) for co-incineration with paper sludge but present off take levels are low. A recent example in Cumbria stalled because some of the paper wastes had hazardous waste properties.
12. In terms of specific CHP facilities, the Ineos Chlor Thermal Power Station is currently under construction near Runcorn. This is a combined heat and power plant which, when complete in 2014, will generate 80MW of electricity and 54MW of heat for the adjacent Ineos Chlor chlorine manufacturing plant.
13. The first phase of the power station is being developed to receive the SRF from the Greater Manchester municipal waste facilities. The SRF for the plant will be delivered by road and rail.[10].

Incineration

14. For this Action Plan, only residual waste has been considered for incineration. This is because, in a sustainable waste management strategy, waste to energy should be demonstrated to be replacing landfill, not replacing recycling or minimising waste. European experience illustrates that recovery of energy from residual waste (including by incineration) is compatible with high recycling rates.
15. The difference between incineration and other thermal processes is that it directly releases the energy in the waste by combustion. Pyrolysis and gasification thermally treat the waste to generate secondary products (gas, liquid and/or solid) from which energy can be generated.
16. An advantage of incineration may be that there is long experience of its use, which contributes to the development of facilities that are appropriate and acceptable for the 21st century. Also, the direct combustion of a waste usually releases more of the available energy compared to pyrolysis and gasification.

[9] Shanks Solid Recovered Fuel – www.shanks.co.uk/sites/default/files/SRF_brochureupdated_lo84_1.pdf
[10] http://www.fichtner.co.uk/projects/project/ineos-runcorn-tps.html

17. All waste incineration plants must comply with the Waste Incineration Directive (WID). This Directive sets the most stringent emissions controls for any thermal processes regulated in the EU.

18. Although technology and environmental standards have improved, there still remains considerable prejudice against incineration in the UK. The site visits in Sweden demonstrated a greater level of acceptance of it and the role it can play in delivering renewable district electricity and heating supplies.

19. There are three main types of incinerator technology. All can be designed to meet the technical requirements of the WID, e.g. a minimum temperature of 850°C and a two second residence time for processing MSW. The technologies are grates (either fixed or moving), fluidised bed and rotary kiln. As part of the knowledge exchange element of this project, the site visits that were arranged by our Swedish partner included grated and fluidised bed incinerator plants.

Anaerobic Digestion (AD)

20. Anaerobic means the absence of oxygen; the basis of AD is micro-organisms that are employed in the breakdown of organic waste feedstock in a controlled (non-oxygen) environment.

21. Waste streams suitable for processing via AD include organic agricultural, domestic, commercial or industrial waste. AD processes have historically been employed in sewage treatment plants and on farms for treating waste such as manure, sewage and animal by products.

22. Source separated food waste has a composition that is well suited to anaerobic treatment and biogas production. In addition, source separation reduces the contamination of material with substances toxic to the micro-organisms that are vital for the process.

23. Anaerobic Digestion has two main outputs:

    - Biogas - a gas with high methane content suitable for generating electricity, heat or methane for injection to grid or use as vehicle fuel.
    - Digestate - a solid and/or liquid output. The liquid output is nutrient rich and can be used as a soil improver/fertiliser; the solid output is generally a good quality product, high in moisture and rich in nutrients. However, it is a very different product from compost.

24. The site visits arranged by the Hungarian partner demonstrated several examples of biogas production and use.. In Sweden, site visits demonstrated that energy recovery can also take the form of fuel production for road vehicles.

25. The energy generation potential of AD processes is dependent on the quality of the input material, and the throughput of the facility, as well as the specific technology employed. These characteristics must be determined early on in the project feasibility stage, as typically the process must be tailored to suit the waste stream.

26. The digestate that is produced by AD may be solid and/or liquid. The raw digestate material may be spread directly onto farmland as a slurry or separated into a solid and a liquid fraction. The solid fraction can then be made into dry and fully stabilised compost, by maturing it for two to four weeks, and the liquid fraction may be recycled for use back in the process, sent to a wastewater treatment plant or applied to farmland as liquid fertiliser. Depending on the constituents of the feedstock, the solid output must usually be refined (post-treated) for use in horticulture or agriculture.

27. In terms of standards, PAS 110 is the British Standards Institute's (BSI) specification for whole digestate, separated liquor and separated fibre derived from the anaerobic digestion of source-segregated biodegradable materials.

28. The Quality Protocol sets out criteria for the production of quality outputs from Anaerobic Digestion of material that is biodegradable waste (biowaste). Quality outputs from AD include the whole digestate, the separated fibre fraction and the separated liquor. If these criteria are met, quality outputs from AD will normally be regarded as having been fully recovered and to have ceased to be waste.

29. The main advantages of AD processes are that they facilitate energy recovery, produce valuable outputs and offer higher revenue potential using the Renewable Obligation Certificates (ROC's)/Feed in Tariffs (FITS) and Renewable Heat Incentive (RHI).

Advanced Thermal Treatment (ATT)

30. Gasification, pyrolysis and plasma technologies form part of a group of processes collectively known as Advanced Thermal Treatment (ATT). Gasification and pyrolysis involve a chemical reaction that takes place at high temperature. This usually generates energy from organic or hydrocarbon containing materials. These processes were previously confined to applications mainly in the oil and chemical industries. Plasma technology involves high temperature degradation of the waste.

Gasification

31. Gasification is a thermal process, in which carbon is converted to synthesised gas "syngas" leaving a limited amount of solid residue. This takes place in the presence of air, or air enriched with oxygen. Temperatures employed are generally at 900°C–1100°C when in air and 1000°C–1400°C using oxygen. Two main types of gasification reactors are fluidised bed and fixed bed. The supply of oxygen is limited so that not all of the waste is oxidised and full combustion cannot occur.

32. Almost any type of waste can be treated via a gasification process apart from non-combustible materials (e.g. aggregates, glass and metals). Gasification requires some form of pre-treatment such as shredding, drying and removal of inert materials to improve the calorific value of the waste stream. Waste streams suitable for processing via gasification include agricultural waste, municipal waste, commercial and industrial waste. A good source of feedstock is Refuse Derived Fuel (RDF) or Solid Recovered Fuel (SRF).

33. The process has two main outputs:

    - Synthesis gas (Syngas)
    - Bottom ash

34. The most common use of syngas is to burn the gas in a boiler to generate steam and then use the steam in a CHP unit to produce electricity and heat. The syngas can also be used as a fuel in a dedicated gas engine to generate electricity or used in an existing power station. Syngas is also a source of hydrogen, which can be used in power generation (turbines) or transport. Again, these uses require a very high quality gas. The energy generation potential is wholly dependent on the Calorific Value (CV) of the input waste stream.

35. Overall, the characteristics of the residues depend upon the waste inputs and the process used to treat the waste. Principal amongst these is the 'ash', the solid output after the thermal degradation of the waste has taken place. It is important to note that

although it looks like natural ash, it is not as a result of direct incineration. Bottom ash that is generally 5% of the total waste handled is refined and recycled in specialist processes for use in the construction sector. There is a developed market in the UK and abroad for bottom ash recycling. The remainder is usually hazardous and disposed of in appropriate landfill.

36. The main advantages of gasification processes are that they facilitate energy recovery in the form of electricity and heat, are compact facilities in terms of spatial requirements and they generate higher revenues using ROC's and the proposed Renewable Heat Initiative.

Pyrolysis

37. Pyrolysis is the chemical and physical decomposition of matter that occurs at high temperature in absence of oxygen. It does not involve combustion. The conditions created cause complex organic molecules to breakdown into simpler molecules and thus fundamentally alter their properties at molecular level. There is a requirement for an external heat source to maintain a temperature between 300°C to 850°C. There are three main types of reactors used in pyrolysis, namely; rotating kiln, heated tube and surface contact.

38. Almost any type of waste can be treated via pyrolysis, apart from non-combustible materials (e.g. aggregates, glass and metals). Some form of pre-treatment such as shredding, drying and removal of inert materials is required to improve the calorific value of the waste stream.

39. A good source of feedstock is RDF or SRF, which is processed waste mainly made up of plastics, paper, card, waste wood and the higher CV fraction of waste.

40. Pyrolysis has three main outputs:

    - Syngas
    - Biochar and
    - Bio-oil

41. The most common use of syngas is to burn the gas in a boiler to generate steam and then use it in a CHP unit to produce electricity and heat. The syngas can also be used as a fuel in a dedicated gas engine to generate electricity or used in an existing power station. Syngas is a source of hydrogen, which can be used in power generation (turbines) or transport. Again, these uses require a very high quality gas. The energy generation potential of pyrolysis process is wholly dependent on the CV of the input waste stream. Other parameters affecting the energy output from the process are moisture content and the presence of heavy metals.

42. Biochar is 'charcoal' created by the process and differs from conventional charcoal in the sense that its primary use is not for fuel, but for carbon sequestration, capture and storage.

43. Bio-oil can be used as a replacement for fuel oil in numerous applications, including space heaters, furnaces, and boilers. Additionally, these bio-oils can be used to fuel some combustion turbines and reciprocating engines, and as a stock to create several chemicals.

Non-conventional thermal treatment

44. Plasma technology does not involve combustion, but the thermal degradation of waste at a high temperature to produce a gas that can be used to produce energy. Plasma is an ionized gas that occurs naturally in the environment in the form of lightning.

45. Whilst plasma is emerging as a waste treatment technology with real potential, it remains largely commercially unproven in the UK with only a single plant in Oxford. Plants in Japan and Canada have employed plasma arc technologies for treating waste.

46. Air Products is proposing to develop a 49MW power plant on Teesside. It will be located on industrial land, adjacent to the North Tees Chemical Complex near Billingham. The proposed facility would use advanced gasification technology to provide renewable electricity for up to 50,000 homes in the North East[11].

47. Almost any type of waste can be treated via plasma waste treatment technologies. They require some form of pre-treatment such as shredding, drying and removal of inert materials to improve the CV of the waste stream. A good source of feedstock for plasma waste treatment technologies is RDF or SRF. Plasma waste treatment technologies have two outputs:

    - Syngas
    - Inert residue

48. The most common use of syngas is to burn the gas in a boiler to generate steam and then use it in a CHP unit to produce electricity and heat. The syngas can also be used as a fuel in a dedicated gas engine to generate electricity or used in an existing power station that would be able to accept the syngas directly. Syngas is a source of hydrogen, which can be used in power generation (turbines) or transport. Again, these uses require a very high quality gas. The energy generation potential of plasma waste treatment processes is wholly dependent on the CV of the input waste stream.

49. An inert residue is produced by plasma waste treatment technologies, which can be used as a substitute to aggregate in the construction industry. As such, the plasma technology offers a real opportunity for a zero waste treatment process.

[11] http://www.airproducts.co.uk/teesvalley/

APPENDIX 4

The background of European, National and Local for waste and energy policy

European

1. The Waste Framework Directive (WFD)[12] sets out the overall framework and policy throughout Member States. It lays down "measures to protect the environment and human health by preventing or reducing the adverse impacts of the generation and management of waste and by reducing overall impacts of resource use and improving the efficiency of such use".
2. The Revised Waste Framework Directive[13] was adopted in December 2008, with Member States being required to implement the revisions by December 2010. This included a key modification to Article 4, which states that the waste hierarchy of Prevention, Preparing for re-use, Recycling, Other Recovery and Disposal shall apply as the priority order in waste prevention and management legislation and policy. The revised Directive allows for deviation from the waste hierarchy where it can be clearly demonstrated that there is a better environmental outcome from doing so. The UK Government recognises that this may apply for energy recovery from certain waste streams, although it is necessary to consider the relative net carbon impact.
3. The Directive also sets out that Member States should seek to implement a series of targets. An example of these, for one of the largest waste streams, is to increase the volume of non-hazardous construction and demolition waste material that is reused, recycled or recovered to a minimum of 70% by weight by 2020.
4. One of the most notable pressures on waste management is the Landfill Directive (Council Directive 1999/31/EC on the Landfill of Waste)[14]. This seeks to prevent or reduce possible negative environmental effects from the landfilling of waste, by introducing uniform standards throughout the EU. The Directive sets ambitious targets for the reduction of biodegradable municipal waste (BMW) that is disposed of to landfill. The following National Diversion Targets have been set for the UK:
    - By 2010 biodegradable municipal waste (BMW) had to be reduced to 75% of the total BMW (by weight) produced in 1995
    - By 2013 BMW must be reduced to 50% of the total BMW (by weight) produced in 1995
    - By 2020 BMW must be reduced to 35% of the total BMW (by weight) produced in 1995
5. The deadlines are later for newer members of the EU. The site visits arranged by our Romanian partner demonstrated how quickly progress can be made when supported.

National

6. The Government Review of Waste Policy in England 2011 aims towards a "Zero Waste Economy" and a "Green Economy". It supports efficient energy recovery from residual waste, which can deliver environmental benefits, reduce carbon impacts

[12] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF
[13] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:312:0003:0030:EN:PDF
[14] http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:1999:182:0001:0019:EN:PDF

and provide economic opportunities. It is important to recognise that the Government's aim is recover the energy potential out of residual waste, not to get the most waste into energy recovery.

7. Local Authorities in England have been set targets to deal with municipal waste arisings and must also abide by European Union and Government policy and legislation.
8. The targets are to:
    - Achieve 50% household waste recycled by 2020
    - Recover 70% construction and demolition waste by 2020

    These targets are in line with and do not exceed, those set by the European Union through the WFD.
9. The review also highlights the need to meet a range of producer responsibility targets, e.g. packaging, Waste Electrical and Electronic Equipment (WEEE), End of Life Vehicles (ELV) and batteries.
10. In addition, the review announced that the Landfill Allowance Trading Scheme (LATS), which to date has provided financial incentive to Local Authorities (LAs) to divert BMW from landfill, will come to an end in April 2013. However, as a whole the UK must still achieve the targets from the Landfill Directive as outlined above).
11. While the focus of Government policy to date has been on improving recycling services to householders, surveys show that businesses are still continuing to achieve higher recycling rates than households, but households are catching up (in 2010 52% of commercial and industrial waste was recycled or re-used compared with 40% household waste recycling). The Government sees further improvements in the management of business waste as critical to the move towards a zero waste economy.
12. In terms of the relationship between waste and climate change, the 2011 review highlights that the waste sector is estimated to account for around 3% of all direct UK greenhouse gas emissions. Therefore, one of the priorities is to target waste streams with high carbon impacts. This includes embedded carbon, food, metals (aluminium in particular), plastics and textiles and reducing direct emissions from landfill by reducing the disposal of food, paper, card, textiles and wood. The Government is also looking at promoting the measurement and reporting of waste management in carbon terms, as an alternative to current weight based measurements. This should favour waste to energy schemes.
13. The Scottish Government's Waste Strategy "Moving Towards a Zero Waste Scotland"[15], states that the government will introduce a carbon metric for waste, to identify and prioritise the materials with the highest environmental benefit for recycling, leading to better environmental outcomes and a more efficient economy. This metric will complement the existing tonnage metric. The document states that it is imperative that materials that could be reused or recycled are not directed to mixed waste treatment facilities such as EfW facilities.
14. The Climate Change Act 2008 requires Government to cut greenhouse gas emissions by at least 34% by 2020 and 80% by 2050, below the 1990 baseline (see Figure 2 in this report) .

[15] http://www.scotland.gov.uk/Resource/Doc/314168/0099749.pdf

Local

15. In 2007, the County Council approved the Joint Municipal Waste Management Strategy for the County, which guides the management and treatment of municipal solid waste (MSW).

16. In terms of energy recovery, the strategy proposes that this issue should be left to the market and any decision will be via negotiation in the Private and Public Partnership (PPP) waste contract. It does, however, promote, where practical, exploitation of local knowledge and expertise with the Strategic Partner, in order to identify potential uses of recovered energy.

Planning

National

17. The National Planning Policy Framework was published on 27 March 2012 and replaced previous policy documents, except PPS 10: Planning for Sustainable Waste Management. At its heart, is a presumption in favour of sustainable development, including encouraging the development of renewable energy.

18. The Coalition Government has also published the Waste Infrastructure Plan (2011), which states that by 2015, the Government expects that the Country's energy system will be on track to meet carbon targets and that the proportion of the UK's energy that is generated by renewable sources will have increased from 3.3% in 2010 to over 5.4% by 2015.

Local

19. In 2010, the Coalition Government announced its intention to abolish Regional Spatial Strategies (RSSs). The loss of regional policies will mean that the requirement to set planning policy to meet national targets will fall to Local Authorities.

20. Following the revocation of the RSS, the expectation is that Local Authorities (LAs) will continue to work together on cross boundary strategic issues. This will be supported by the new duty to co-operate, required though the Localism Act 2011.

21. This will seek to ensure that local authorities and other public bodies are involved in a continual process of constructive and active engagement, which will maximise effective working on development planning in relation to strategic planning issues that cross administrative boundaries. One such issue that could be explored with Cumbria County Council's neighbouring authorities, is energy requirements and target setting. The RSS had identified (Policy EM17)[16] a target of producing at least 10% of the electricity supplied within the region from renewable energy sources by 2010 rising to 15% by 2015 and 20% by 2020.

22. The statutory spatial planning development plans that Local Authorities were required to prepare were known as Local Development Frameworks. This system was replaced on 6 April 2012 by one based on Local Plans, which will provide the policies and proposals for development within the local authority's area.

23. Under the old system, Cumbria County Council prepared the documents, which together would comprise the Minerals and Waste Development Framework.

[16] http://www.4nw.org.uk/downloads/documents/oct_08/nwra_1224233062_Final_adopted_RSS_300908_Envir.pdf

24. The adopted Core Strategy Policies seek to encourage combined heat and power energy generation from residual waste and developments that would enable fossil fuels to be replaced by refuse derived fuels.

25. The adopted Development Control Policies state within Policy DC4, that when considering energy from waste proposals, preference will be given to combined heat and power providers. Proposals located on an industrial site or premises where the waste arises or heat can be used will be favoured.

26. The draft Site Allocations Policies identify sites for Energy from Waste plants within the County at;

    - Oldside, Workington
    - Lillyhall Waste Treatment Centre, Workington
    - Port of Workington
    - Kingmoor Park East, Carlisle

27. To date, several planning permissions have been granted for Energy from Waste plants; however, these tend to be located in the south of the county.

28. There has also been interest in developing additional EfW plants for the commercial and industrial waste streams, both within and outside of the Framework's proposed sites, closer to where waste is generated and where there are high energy businesses.

Energy

European

29. By 2020, the Renewable Energy Directive sets an obligatory target for all Member States that 20% of all energy used must come from renewable sources.

National

30. The Renewable Energy Strategy for the UK was launched in 2009 and sets out how the UK will meet targets for reducing carbon emissions in the Climate Change Act 2008 (paragraph 2.16 above), and to meeting its binding renewable energy target of 15% of all energy to come from renewable sources by 2020. The Annual Energy Statement, published in July 2010, and more recently the Carbon Plan, published in March 2011, set out the steps being taken to cut carbon emissions and deliver affordable, secure and low-carbon energy.

Local

31. In March 2009, the Cumbria Climate Change Commitment was agreed. The aim was to introduce a range of actions to reduce carbon emissions and to adapt by climate proofing their operations.

32. This Commitment was developed by the Cumbria Strategic Partnership. It recognised that Cumbria must contribute a proportionate and fair share of the national target to reduce greenhouse gases by a minimum of 80% by 2050.

33. The Climate Change Project has now come to an end. In light of this, and the recent abolition of the RSS, the only specific policy relating to climate change or energy for the County is Minerals and Waste Development Framework Core Strategy Policy 1 – Sustainable location and design.

Economic

34. The European Commission has recently launched an economic strategy; EU2020. This proposes three mutually reinforcing priorities of smart growth, sustainable growth and inclusive growth, which should help the EU and the Member States deliver high levels of employment, productivity and social cohesion. Each Member State has adopted its own national targets in each of these areas.

35. The sustainable growth aims include:

    - building a more competitive low-carbon economy that makes efficient, sustainable use of resources
    - protecting the environment, reducing emissions and preventing biodiversity loss
    - capitalising on Europe's leadership in developing new green technologies and production methods
    - introducing efficient smart electricity grids
    - reducing greenhouse gas emissions by 20% compared to 1990 levels by 2020. The EU is prepared to go further and reduce by 30% if other developed countries make similar commitments and developing countries contribute according to their abilities, as part of a comprehensive global agreement
    - increasing the share of renewables in final energy consumption to 20%
    - moving towards a 20% increase in energy efficiency

APPENDIX 5

LESSONS LEARNED

1. The waste to energy project study visits, good practice exchange meetings and presentations, have demonstrated what can be done by public and private enterprise in varying circumstances. Those circumstances span a wide range of matters, including public perception, governance, local political systems, taxation, cultures and energy prices. The study visits took place in Sweden, Poland, Hungary and Cumbria.
2. Firstly, it is important to note that, when considering waste-to-energy as a sustainable way of managing both waste and providing energy, no single technology dominates – there is a no "one size fits all" solution. The project's partners have shown various technological approaches based on varying criteria, needs, limitations, opportunities and public acceptability.
3. The project has involved presentations by a wide range of private and public sector organisations, about how they are tackling the waste management agenda in their countries, and site visits to see technologies in operation. Three of the main lessons learned are:-
    - the wide range of potential opportunities that are out there for improving what we do with discarded materials;
    - the need to ensure that solutions that are chosen are consistent with local circumstances and cultures; and,
    - because many waste management solutions involve long-term investment decisions, they require a level of certainty about the medium to long term future. This is particularly in relation to their regulatory context and financial support mechanisms introduced by governments.

Sweden

4. Sweden has been the lead partner in the W2E project and has demonstrated the longest and most comprehensive experience of waste to energy. However, its circumstances lend themselves to solutions that may not be readily applicable to other countries. Some of the differences between the UK and Sweden are shown on Figure 4 in section 2 of the main report, which also illustrates the importance of waste as a UK biomass resource.
5. Combined heat and power plants are long established in Sweden. Prior to the 1950s most space heating on a domestic and light-industrial basis was provided by wood burning, the fuel being sourced locally with the country having extensive forestry resources. This, however, led to intense localised pollution. "Clean Air" legislation, similar to that which was enacted in the United Kingdom, brought about the development of more centralised combined heat and power plants.
6. The infrastructure for delivery of both electricity and hot water for space heating was co-developed along with energy plant, with wood as the primary fuel source and with these utility companies being wholly owned and operated by the municipality. The step to using waste as a primary fuel source was gradual, taking advantage of the existing infrastructure, with updated plant being developed as needs dictated and technology improved.
7. The study visits to Sweden demonstrated how central Combined Heat and Power (CHP) is to both waste treatment and energy production and plant has developed to

reach treatment capacities of as much as 400,000t/yr. Indeed this is both an advantage and a hindrance: Treatment capacity is high and thus large amounts of energy can be produced with associated economies of scale. However, the feedstock required for such large plant requires that wastes are transported long distances in order to maintain energy production. This is commonly known as “feeding the beast”.

8. This presents a risk in ensuring treatment capacity does not outstrip the availability of wastes. Outside of the project, anecdotal information has been given that the low gate fees that large Swedish plants are now having to offer are bringing wastes in from Norway and that this may be having adverse impacts on the viability of some plants in that country. It is not known if this is a correct interpretation of what is happening.
9. Delivery systems for electricity and heat are required in conjunction with the waste to energy plant. This is less of a challenge in Sweden because of the co-development and municipality ownership of waste management, energy production and distribution utilities.
10. In Sweden, the municipalities have a very wide range of statutory responsibilities. The most obvious examples are that they own the companies that operate some of the power plants that burn waste or operate anaerobic digestion (AD) plants. In connection with these, they have an internal market for heat energy produced in the extensive district heating systems that they own and for biofuels in public service vehicles.
11. Two of the visits in Sweden were to AD plants. One owned by the municipality and one private enterprise. A common factor for both is very high distribution costs for biofuels. An issue raised by the private sector company was the need for regulation or interactions to favour the use of waste in AD plants rather than crops. This has also been a concern in the UK.
12. The municipal plant is producing a biogas fuel for cars and other vehicles from sewage sludge, abattoir waste and biomass grown on set-aside land. The target is to produce 22 million cubic metres of this gas by 2014 (1m^3 is approximately equivalent to 1 litre of petrol). Residual sludge from the plant is used as fertiliser.
13. The vehicle fuel tanks for this gas are pressurised to 200 bar and the gas is not compatible with LPG. It is competitively priced with petrol/diesel, but only because it has no fuel tax. It was said to have helped the municipality achieve a 50% reduction in its own vehicle emissions compared with 1990.
14. The private enterprise biogas company’s AD plant uses sewage sludge and it is sceptical about using household and food waste because of their lack of homogeneity. It focuses on an alternative to diesel for buses and lorries, which it sees as the most viable market. Vehicles less than 7 to 8 years old can be converted to dual fuel - 10% diesel, 90% biogas. Production costs are similar to those for petrol/diesel. The company demonstrated the world wide market for these technologies. It designs, builds and operates plants; one of its biggest markets is South Korea.
15. An example of a company seeking to reduce its reliance on oil as a fuel, was provided by another visit in Sweden. This was to a factory that produces white lined cardboard for food packaging for the European market, using only recycled materials. It has recently installed a W2E plant using approximately equal quantities

of wood; plastic and paper. Part of these fuels is the company's own waste, particularly the plastic (40kt/y), that it has to strip off the materials it is recycling.

16. Other visits to two municipalities near to Linskoping, demonstrated initiatives by the local political systems. One had decided in the late 1990's to focus on separating the 62% of its household waste that is food waste. It has a municipal waste management policy requiring 75% of household waste to be used for the centralised production of biogas and is planning to construct a 20,000t/y biogas plant.

17. The other municipality showed what a much smaller authority (22,000 people) can do. It had made a political decision in the 1990's to stop using fossil fuels and is now producing around 60% of its energy requirements from waste. This is despite the considerable additional costs of providing and operating boilers that can use a range of alternative fuels.

18. On a different scale was a visit to a new E.ON combined heat and power plant using municipal and industrial waste, forest fuels, recycled wood, wood chips, coal and tyres for fuel. Wastes are prepared by source separation and shredding. The gate fees paid by waste consignors had decreased by 50% over the previous two years. The plant was taking waste from Norway as well as Sweden and had had discussions about taking UK waste. This seems to illustrate the "feed the beast" issue. There are conflicting views about whether such plants are likely, eventually, to have to buy in the waste as a fuel rather than being paid a gate fee to take it.

19. In the context of wider sustainable waste management, a visit to a plant that prepares cans and plastic bottles demonstrated what can be achieved in terms of the waste hierarchy by co-operation and returnable deposits. The company is jointly owned: 25% by drinks manufacturers, 50% by breweries and 25% by the food retail foundation. It has achieved a 90% recycling rate by installing 5,000 reverse vending machines, into which customers return their cans and bottles and are credited with the returnable deposit that has been charged on them – 10cents on aluminium cans and ½ litre plastic bottles and 20cents on 1litre bottles.

20. A significant difference between Sweden and the UK is that here utilities are not publicly owned. Waste management plants (at least for domestic waste) are largely under the jurisdiction of the local authority in some form of public-private financing arrangements. Other utilities, such as energy production/distribution and water (including supply and treatment), are privately owned. A consequence is, that to fully develop integrated waste to energy systems, further partnering arrangements would be required. Whilst not impossible to achieve, such contractual arrangements are complex.

21. The culture of Sweden also appears much "greener" than most other countries and has enabled local political leadership-led initiatives, which others would find difficult.

22. Public acceptability is key to waste management and energy production and is constantly in flux. Technological developments and geo-political events play major roles in this. Waste to energy solutions must demonstrate their safety and suitability to the needs and views of the population. The Government has recently announced a further assessment of any health impacts associated with waste to energy plants.

23. Thermal treatments, where waste is burned, still have a poor public perception in the UK, despite such practices being strictly regulated. Events such as the so-called Arab Spring, affecting oil prices and the disaster at Fukushima having called into question the safety of nuclear energy, have raised the issue of local energy security and affordability. These issues are clearly expressed in the Local Government

Information Unit's publication *"The 10 Pillars of Local Energy Security"* (see Action 1).

24. Whichever technology is selected to treat waste and provide energy must clearly demonstrate economic, environmental and societal benefits, that is, they must be *truly sustainable*.

Romania

25. Romania can be regarded as the opposite end of the spectrum to Sweden. It is the most recent of the partners to join the EU. The visit showed how much can be achieved within a short time, in effect, starting from scratch with modern waste management techniques.

26. Dambovita County Council is being used as a pilot scheme. This has involved the closure of numerous uncontrolled landfills, which did not comply with modern standards, a purpose built properly engineered and managed new landfill/landraise and the introduction of an organised modern waste collection system delivering waste for the separation of recyclables and compost materials. It also demonstrated a flourishing private sector initiative for collecting and recycling plastics and cardboard from the commercial waste stream.

Hungary

27. In Hungary, the W2E partners learnt about the national and local waste management plans; the role of the regional development agency and its environmental projects; and the partnering arrangements with Austria for its expertise. The importance of political support and for effective education and media campaigns, in the changing climate of waste management, were stressed. One example of change needed to meet EU standards was a reduction in the number of landfills from 2700 to 72.

28. Problems caused by the country's very complicated authorisation and regulatory processes were highlighted in the presentations and visits. One biogas plant had required permits from 24 different authorities, another required eight. One reason for this is that plants overlap between regulatory regimes for waste, power and agriculture.

29. The visits included one to a 60,000m^3/day capacity sewage treatment works, with an AD plant producing 4,200m^3/day of biogas and 10,300kwh of electricity. It was also planning to take in wastes from the dairy and other food products industries. The very high energy costs involved in running the plant were highlighted. A waste incinerator was being planned, although there were uncertainties about its viability for a population of only 210,000.

30. There was a very interesting visit to a large farm growing oyster mushrooms for the European market. High energy costs and a 33% grant had prompted it to invest to become an energy supplier, not just an energy use. It was calculated that the return period for the investment would be 10 years. Its 2,000 tonne capacity AD plant, with a 40 day retention time, took in not just the spent mushroom compost, but also 3,200 tonnes of silage and agricultural waste, 4,000 tonnes of corn waste from a canning factory and 3,000 tonnes of pig manure. Inputs needed to be balanced in order to maintain the correct carbon-nitrogen balance and sugar content. The AD plant annual output was 1.25 Mm^3 of biogas, 2,580Mwh electricity and 2,658Mwh heat energy. The heat was used on-site – 10% to keep the fermentation plant at 38°C and the rest for heating the mushroom growing houses.

31. A much larger municipality-owned W2E power plant, built in 1982 in Budapest, took in 420,000 tonnes of municipal waste per year, at between 1,000 and 2,000 tonnes/day. It provides heat and hot water to 25,000 people and electricity to 116,000.

Poland

32. The visit to Poland showed how Torun had led the way in moving to modern waste management practices from the early 1990's; the initiatives included separated waste collection, combined heat and power landfill gas utilisation plant, using local operators' distribution grids. The energy produced was equivalent to that produced by 2,500 tonnes of coal; the emissions savings included around 13 tonnes of carbon dioxide emissions and 28 tonnes of sulphur dioxide. The procedures that had been involved in reaching this stage were explained together with the timetable.

33. Poland provided another example of a municipality taking ownership of the waste mangment facilities. Torun City is the major shareholder in a biogas fuels company, which operates fuel stations and runs some of its buses on this fuel. Another combined heat and power plant was based at a sewage treatment plant.

34. Presentations were also given about planned schemes, which included a biogas plant for organic wastes and a thermal wastes conversion plant. The latter is a very ambitious scheme, with potential to serve a population of around 720,000. It could generate nearly 28 Mw of heat and 7 Mw of electricity.

35. The Regional Energy Conservation Agency had been established in 1996. It is a voluntary self-governing organisation of energy producers, distributors and users and appliance manufacturers. It promotes energy conservation and savings, raises awareness and organises training sessions and co-ordinates local energy saving programmes.

Slovakia

36. The visit to Slovakia was mainly concerned with discussions about the Policy Tool that the lead partner had commissioned.

Italy

37. None of the seminars and study visits have been in Italy, but the Italian partners have described the issues they face, including the negative perception of W2E plants. The final conference is being held in Italy, when more information about what is happening in the Abruzzo region should be available. At the commencement of the project, the main priority for the Abruzzo region had been clearing up after a recent devastating earthquake, which had destroyed one of the historic towns.

Cumbria

38. The focus of the Cumbria message that we have tried to put over, is the need to look at the wider context of not only waste management but of energy use. The partners have been impressed by such things as the public acceptance of kerb side separation systems, the co-operation between the different authorities, the private sector and charities and the holistic approach to energy and waste management, demonstrated by the eco-school at Cockermouth.

APPENDIX 6

GLOSSARY OF ACRONYMS

Abbreviation	Definition
AD	Anaerobic Digestion
ATT	Advanced Thermal Treatment
BEC	British Energy Coast
BMW	Biodegradable Municipal Waste
BSI	British Standards Institute
CCC	Cumbria County Council
CHP	Combined Heat and Power
CHPQA	Combined Heat and Power Quality Assurance
CoRE	Community Renewable Energy
CO_2	Carbon Dioxide
CO_2 eq	Carbon Dioxide Equivalent
CV	Calorific Value
C&D	Construction and Demolition
C&I	Commercial and Industrial
DECC	Department of Energy and Climate Change
EfW	Energy from Waste
ELV	End of Life Vehicles
EU	European Union
EWWR	European Week for Waste Reduction
FAME	Fatty Acid Methyl Ester
FIT	Feed in Tariff
ha	Hectare
IEE	Intelligent Energy – Europe
LA	Local Authority
LATS	Landfill Allowance Trading Scheme
LDF	Local Development Framework
LGiU	Local Government Information Unit
MBT	Mechanical and Biological Treatment
MSW	Municipal Solid Waste
MWDF	Minerals and Waste Development Framework
PAS 110	Publicly Available Specification 110
PCPA	Planning and Compulsory Purchase Act
PESTLE	Political, Economic, Social, Technological, Legal and Environmental

PPP	Private and Public Partnership
RDA	Regional Development Agency
RDF	Refuse Derived Fuel
RHI	Renewable Heat Incentive
RO	Renewable Obligation
ROC	Renewable Obligation Certificate
RSS	Regional Spatial Strategies
SRF	Solid Recovered Fuel
tpa	Tonnes per annum
UK	United Kingdom
W	Watt
WEEE	Waste Electrical and Electronic Equipment
WFD	Waste Framework Directive
Wh	Watt hour
WID	Waste Incineration Directive
Wth	Watt thermal
W2E	Waste to Energy
WRAP	Waste Resources Action Programme