Bioenergy Strategy and Action Plan for the Mid West Region

Clare County Council	Limerick County Council	Limerick City Council	North Tipperary County Council

Consultants

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Contents

Executive Summary

This report shows that the region can develop a biomass heat sector to meet its share of national renewable energy targets by 2020. This will create over 400 new jobs, reduce regional energy bills and make an important contribution to carbon reduction targets.

Bioenergy fuels cover a wide range of biodegradable residues from the agricultural, forestry and waste sectors, which can be deployed in all the main energy markets of transport, heating and power generation. The Mid West Regional Authority has determined that the region requires a Bioenergy Action Plan with a focus on 'solid biomass'[1]. In the MWRA area there are five sources:

- **Forestry resources** are small diameter logs harvested from commercial forests.
- **Solid farm wastes** are chicken litter, spent mushroom compost (SMC) and straw
- **Wood processing co-products** are the by-products of sawmills.
- **Post consumer wood waste** is recycled waste wood.
- **Energy crops** are fast growing crops such as willow trees or grasses.

Benefits of market development

The following provides an assessment of the benefits of developing the biomass sector:

- By 2020 about 420 new FTE jobs will be created in regional biomass sector
- By 2020 the region will save €9.7 million annually (at 2009 prices) in fuel bills
- The overall amount of CO2 that is saved by 2020 is 167,600 tonnes per annum
- 62 million litres of imported oil will be replaced by locally sourced biomass fuels

Biomass resources of the region

A detailed assessment of the solid biomass resources of the region has been undertaken. The results of this are (figures rounded):

- About 55,000 tonnes available per annum (pa) now
- Estimated 107,000 tonnes available pa in 2015
- Estimated 168,000 tonnes available pa in 2020

[1] Bioenergy sources associated with liquid transport fuels, anaerobic digestion or waste to energy schemes are specifically excluded from this action plan.

Renewable energy targets

The national target is that 16% of energy will be derived from renewable sources by 2020 (from only 3% at present). Individual targets are now set in the different energy markets to meet the overall 16% target. At a national level the main relevant targets by 2020 are:

- Renewable electricity - 40% share of market
- Renewable heating – 12% share of market

In addition there are objectives for the use of biomass in existing power stations (known as co-firing) and to promote more biomass fired Combined Heat and Power (CHP) projects.

This Bioenergy Action Plan recommends a heat target can be set regionally:

Date	% market share	Biomass use pa	Installed capacity
By Year 2015	7.0% of heat market	162,785 tonnes	203 MWs
By Year 2020	12.0% of heat market	279,060 tonnes	349 MWs

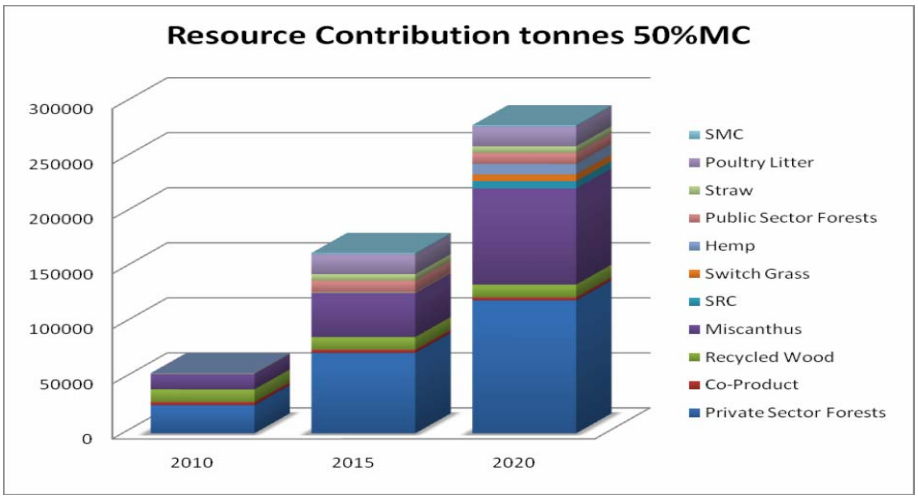
The use of *solid biomass* for renewable electricity generation is inefficient and rarely deployed. There is no national policy target to do this and technologies like wind and hydro are considered more useful in meeting this target. The co-firing of biomass in the Mid West Region is solely dependent upon long term investment plans at Moneypoint and may not be viable at present. Furthermore, development of both would require a biomass supply far in excess of the available biomass resources of the region. Biomass CHP appears to have a limited regional potential and a small number of projects only could be developed.

Stimulating more biomass resource

This report has forecast that only about 168,000 tonnes of solid biomass could be available by 2020, which means there is a shortfall of some 110,000 tonnes per annum by 2020 if the 12% heat target is to be met. A number of actions will increase available biomass resources, these include:

- Ensuring that the private forest resources are fully exploited
- Draw in public forest resources
- Promote the wider deployment of energy crops
- Deploy technology to use resources such as poultry litter, straw and SMC

Exploiting these resources will increase the available biomass resource to meet the 12% heat target by 2020. The bar chart below illustrates the possible contribution of each biomass resource to the 2020 target.



The addition of several biomass CHP projects could reasonably be accommodated given the approximate nature of these estimates (although a specific regional target is not proposed).

It can be concluded that the availability of biomass resources should not be a limiting factor in whether the region is able to meet its share of the national heat bioenergy targets (and CHP). However, the number of biomass installations must grow rapidly to consume the biomass.

MWRA action plan

The demand for solid biomass is created by energy customers converting to solid biomass. ***The most significant barrier to conversion to biomass is the high capital cost of biomass equipment.*** This is an overarching issue that must be addressed.

To deliver the 2020 heat target means a capital investment of €148 million in biomass equipment and about 700 commercial scale biomass installations over the next 11 years. This will equate to about €13.5 million invested and over 60 schools, hospitals etc. converting to biomass each year until 2020. To promote this level of demand there are six proposed short term priority actions:

Biomass Revolving Loan Scheme

This should be regarded as the centre piece strategy for the regional Biomass Strategy and would be in line with a 'Framework for Sustainable Economic Development (February 2009 – Government Document)' for increased investment in clean energy. It proposes a fund be established that offers 100% interest free loans for biomass equipment. The loans taken out can be repaid from the energy savings that result from converting to biomass fuels. It can be assumed about 12 biomass projects could be financed each year at an average cost of

€225,000 per project. Over 4.5 years the scheme could have loaned out and recouped an equal amount. This means the MWRA biomass loan scheme would be broadly revenue neutral – its loans repaid by the savings it creates.

Market awareness\segmentation

The heating of buildings is the largest single use of energy in Ireland. The most obvious and immediate *public and third sector* opportunities on a regional basis are places like leisure centres, large hospitals\community owned care homes, major educational institutes and large public buildings such as prisons, libraries and council offices. For energy users such as these it would be appropriate to focus effort and resource to review the case for biomass investment. They could use the revolving loan scheme to deliver the required investment.

Research and Development into new biomass conversion technology

In the medium term the region will need to develop and exploit the use of energy crops if it is to meet its regional biomass target. This will be necessary because forestry resources will not be sufficient and it is only energy crops that can be established rapidly enough to fill the gap as demand grows over the next few years. Further research is required into the availability of appropriate technology to help develop and use these fuels. This can be undertaken by reviewing applications in mature markets like Austria, Germany or Sweden.

Biomass CHP

An appraisal of possible CHP sites should be undertaken. This would scope out and identify the best regional investment opportunities. These will be limited and can be supported in terms of technical and business development.

Development of policy support

County Councils will face increases in planning applications and might be better able to assess these by using appropriate published guidance. This can include a range of good practice suggestions and describe the circumstances where biomass is best applied and why.

Form an Industry Partnership Biomass Group

It is proposed an Industry Partnership Biomass Group be established to help oversee the development of the sector in the region and to monitor this proposed action plan.

1.0 Introduction

1.1 Background to report

The Regional Planning Guidelines for the Mid West Region has identified the area of Renewable Energy as a priority issue to be addressed at a regional level. In order to address this objective the Mid West Regional Authority (MWRA) under the auspices of the Regional Planning Guidelines set up a Renewable Energy Implementation Sub Group. This Sub Group has been in operation since 2005 and focuses on a number of key areas including:

- Regional bioenergy development
- Planning for renewables (including small scale)
- Regional Energy and Emissions Balance and Climate Change Strategy
- Liquid Biofuels Pilot project in Local Authorities.

In February 2008 the MWRA launched the Country's first regional Climate Change Strategy. In the Strategy the use of renewable energy was clearly identified as important to assist the region in meeting its climate change targets. Also, in 2008, a sub-committee of this group was set up to focus on the area of bioenergy. The committee consists of public and private energy sector representatives from the region. Based on a strategic assessment of the potential in the region the Group has determined that a specific Action Plan is required to support the future development of bioenergy sector in the region.

As a result this study was commissioned to examine the development and promotion of solid biomass in the region. Sustainable Energy Ireland (SEI) provided 65% towards the cost of this study with the balance of the funding provided by MWRA and the Local Authorities in the region. It has been undertaken by Consultants Steve Luker Associates Ltd and Dare Ltd.

1.2 Scope and remit of report

The Study is intended to be action orientated and develop policy responses. It will serve as a tool for the development of the sector in the region. The report focuses on solid biomass resources such as:

- Forestry resources (thinning, residues, by-products (e.g. saw-dust) etc)
- Energy Crops (miscanthus, willow etc.)
- Solid Farm Waste (chicken litter, straw etc.)

It will primarily focus on the heat and combined heat and power (CHP) market.

The study has been divided into four work packages as listed below. Appendix 1 contains the full scope of work.

- Work Package 1: Market evaluation
- Work Package 2: Resource analysis
- Work Package 3: Market consultation and action research
- Work Package 4: Reporting and promotion

1.3 The Mid West Regional Authority

The Mid-West Regional Authority is one of Ireland's eight Regional Authorities established by the 1991 Local Government Act and came into existence in 1994. Under the Act, the Regional Authority has two main functions:

- to promote the co-ordination of public service provision and
- to monitor the delivery of the National Development Plan & EU Structural Fund assistance in the Mid-West region.

The Mid-West Region comprises County Clare, Limerick City, County Limerick and North Tipperary. The region has about 10% of the national land area and 8.5% of national population. Its relationship to the other regional authorities is shown in the plan below:

The total population of the region in 2006 was 361,028 and it covers a total area of 825,111 hectares. In 2006, there were 126,427 dwellings in the region, representing 8.6% of the national total. Over 560,000 hectares of agricultural land exist in the region. In total the Mid West has 111,743ha. of forestry covering 10.5% of the land area. Relevant statistics for each County are listed in appendix 2.

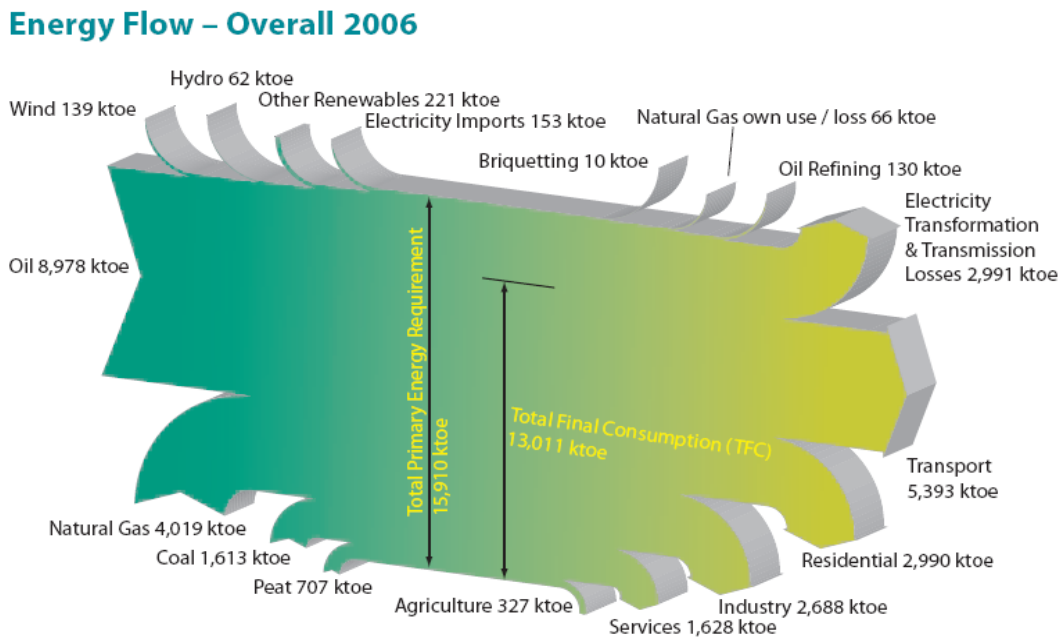
2.0 Renewable energy and the policy context

2.1 Overview

There are two significant trends in Ireland in terms of energy (all statistical sources quoted are from SEI).

First, Ireland now imports over 90% of its energy and so is heavily and increasingly reliant upon imported fossil fuels. The only sector of indigenous energy to rise in the last 10 years is renewables – with coal, peat and gas supplies all falling in absolute and relative terms as a share of national energy supply. This suggests that renewables are set to play an increasingly important role if the reliance on imported energy is to be stabilised or even reduced in Ireland.

Secondly, in Ireland renewable energy sources only meet about 3% of total energy consumption, yet it has agreed to limit the growth in its greenhouse gas emissions to 13% above 1990 levels by 2012 under the Kyoto Protocol. As a result, it is legally bound to meet the greenhouse gas emissions reduction target. It also plans to meet 16% of its energy needs from renewable sources by 2020. The Sankey diagram below shows how limited renewables are in meeting Ireland's overall energy needs at present and serves to illustrate the scale of the challenge to both increase the use of renewables by 2020 and reduce greenhouse gas emissions.



Source SEI 2008

To try and ensure Ireland reaches its target under the Kyoto Protocol and following a comprehensive public consultation process, the Government published the National Climate

Change Strategy in October 2000. The Strategy provided a framework for action to reduce Ireland's greenhouse gas emissions.

The National Climate Change Strategy 2007-2012 follows on from the first national strategy and takes account of the public consultation process which followed the further review in Ireland's Pathway to Kyoto Compliance (2006). The purpose of this revised strategy is twofold:

- to show clearly the measures by which Ireland will meet its 2008-2012 commitment; and
- to show how these measures position Ireland for the post-2012 period, and to identify the areas in which further measures are being researched and developed to enable Ireland to meet its eventual 2020 commitment.

In terms of the period to 2020 the EU has adopted a much more challenging reduction target (than the period to 2012). While Ireland's precise contribution within this new framework has yet to be agreed, it is likely to require a reduction to *below* 1990 emission levels. The table below shows 2 possible targets for 2020 (from the 2007 National Climate Change Strategy)

	Pro-rata to EU target of 20% cut on 1990	Pro-rata to EU target of 30% cut on 1990
2020 emissions before post-2006 measures	74.12	74.12
Additional measures quantifiable to date	10.107	10.107
New 2020 baseline	64.013	64.013
Possible 2020 target	54.7	48.0
Balance required from unquantified and further measures	9.313	16.013

Table 3: possible 2020 scenarios (all figures are Mt CO_2 equivalent)

This illustrates that between 9 million and 16 million tonnes of additional CO2 savings must be delivered by the Country from as yet un-quantified further measures.

In addition to this the MWRA region has also developed a regional Climate Change Strategy. This supports the national requirements described above. Full details of this are contained in Appendix 3 of this report.

It can be concluded that the legal commitment to reduce CO2 and likely additional CO2 savings to 2020 has created a national policy context for renewable energy that is now very supportive and constitutes a core element of the Government's overarching energy policy.

The focus of this Government policy objective is the Energy White Paper entitled 'Delivering a Sustainable Energy Future for Ireland' (March 2007 - see appendix 4). The White Paper states:

'Renewable energy is an integral part of our climate change strategy and sustainability objectives. The additional diversity which renewables bring to Ireland's energy demand will also make a direct contribution to our goal of ensuring secure and reliable energy supplies.'

In summary, the Kyoto Protocol, the National Climate Change Strategy and Energy White Paper provide a compelling national policy context in which to promote bioenergy nationally and in the MWRA area.

Building Ireland's Smart Economy: A Framework for Sustainable Economic Renewal

This Study was commissioned and commenced before the full impacts of the economic downturn became evident and in late 2008 the Government published its most important response to the economic situation. That report is titled:

'Building Ireland's Smart Economy: A Framework for Sustainable Economic Renewal' (Government of Ireland 2008)

The strategy it outlines is designed to address the current economic challenges facing the Irish economy by stabilising the public finances, improving competitiveness, assisting those who lose their jobs, and supporting Irish business and multinational companies. One of its key themes is to implement a 'new green deal' to move away from fossil fuel-based energy production through investment in renewable energy and to promote the green enterprise sector and the creation of 'green-collar' jobs. There is an overt emphasis on the benefits of the green economy and the strategy notes that:

'*The Smart Economy is a 'Green Economy' in that it recognises the inter-related challenges of climate change and energy security. It involves the transition to a low-carbon economy and recognises the opportunities for investment and jobs in clean industry…..A green economy recognises that indigenous clean energy will not only reduce our dependence and expenditure on imported fuels but can act as a platform for economic recovery*'.

In specific terms energy efficient measures will include retrofitting of housing stock, smart metering and tax incentives for expenditure on energy efficient equipment will help business and the householder reduce their energy costs.

It highlights that through Government supports and semi-state investment plans, over €30 billion will be invested in clean energy over the next 15 years.

The strategy notes that an industry-led Competence Centre Programme is being rolled-out in Bioenergy and under action area 3 it develops the theme of enhancing the environment and securing energy supplies. Other key actions include:

- In the first quarter 2009 the Government published its National Energy Efficiency Action Plan including the targeted 33% improvement in energy efficiency in its own services by 2020;

- Environmental considerations will be further integrated into the public procurement process in 2009, with the goal of bringing us in line with the best performers in Europe;

- Current capital appraisal and cost-benefit analysis guidelines will be amended in 2009 to incorporate best practice in reflecting the cost of CO2 emissions in cost benefit analyses;

The overall impact of the economic slowdown is difficult to predict in terms of the MWRA region and how the biomass sector might grow in the coming years. It is evident that the Government's response through 'Building Ireland's Smart Economy: A Framework for Sustainable Economic Renewal' is helpful and supportive to renewable energy and bioenergy. In particular, it seems to suggest that future investment in renewable energy will be valued and prioritized, although it does not offer specific details at this stage, as to how that is going to be delivered.

It is possible to conclude that the measures highlighted in this Strategy will lead to investment in biomass and that subject to greater details such investment will happen as part of the public sector, but may include the private sector.

Mid West Region Regional Economic Strategy and Regional Planning Guidelines

This May 2004 statutory document sets out the regional development strategy and regional planning guidelines for the Mid West Region of Clare, Limerick City and County and North Tipperary, within the framework of the government's National Spatial Strategy and other national, regional and local strategies.

The development of new Regional Planning Guidelines (RPG's) provides the circumstances for a regional focus on a range of issues including the issue of climate change. It is

appropriate to develop bioenergy on a regional basis as, in general, bioenergy fuels are grown, processed and used solely on a regional basis.

2.2 The existing renewable energy targets

The current overall targets set for renewable energy deployment in the EU as a share of total energy use were set in January 2007 by a Communication from the Council of Europe to the European Parliament (the Communication is titled the Renewable Energy Road Map Renewable: Energies in the 21st century: Building a More Sustainable Future) and are:

- 12% by 2010 and
- 20% by 2020.

Ireland – at 3% in 2008 - has a huge challenge and a significant opportunity to promote the greater use of renewable energy. Ireland has yet to formally decide if it will commit to the 20% target – but in January 2008 the draft renewable energy directive indicated that it will set a 16% overall target.

It is necessary to set individual targets in the different energy markets to meet these overall renewable energy targets and in 2008 the Government announced it was going to increase its renewable electricity target from 33% to 40% by 2020.

Other relevant Irish heat, co-firing and CHP targets are described below. Appendix 4 – Energy White Paper – contains fuller details on the policy context for these targets.

The Bioenergy Action Plan for Ireland

In early 2007 the Bioenergy Action Plan for Ireland was published. This established the following national bioenergy targets (in line with the Energy White Paper):

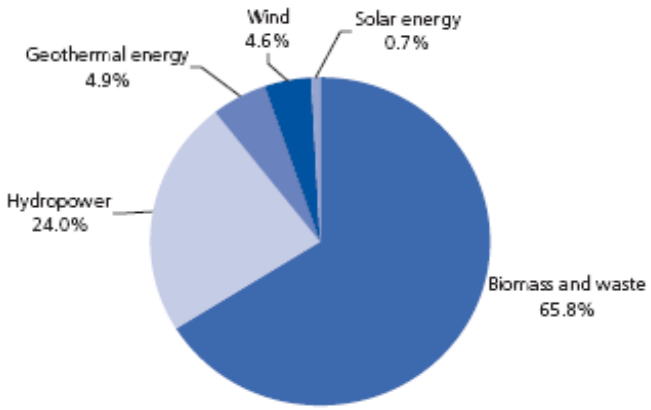
- 5% renewable share in heating sector by 2010
- 12% renewable share in heating sector by 2020
- 30% co-firing in peat stations by 2015
- 10MWe to 15MWe of biomass CHP (2007 to 2013)[2]

It is understood that if each of these targets is met, along with renewable targets in the transport sector, then the overall 16% target can be met by 2020.

[2] This is the 'target' associated with the biomass CHP grant scheme

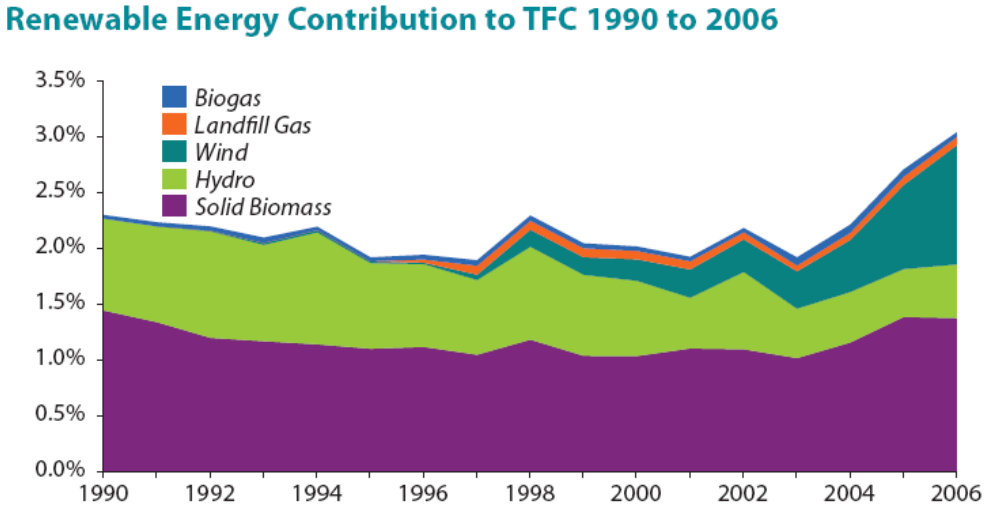
2.3 Use and deployment of renewable energy

Bioenergy is the main component of the renewable energy sector. The following pie chart[3] illustrates the main technologies and their relative importance in terms of use world-wide.



This shows that 65.8% of all renewable energy used is derived from bioenergy (biomass and waste). The next most important renewable energy by use is hydropower at 24%. Geothermal, wind and solar technologies combined only represent 10.2% of worldwide renewable energy use.

Across the EU around 7% of **all energy** used is from a range of renewable sources[4]. Bioenergy provides 59% of this renewable energy[5]. It can be concluded that bioenergy provides most of the world's and the EU's renewable energy. The diagram below shows the roles of different renewable energy in Ireland.



Source SEI 2008

[3] Source Eurostat 2006

[4] Source – Eurostat 2005

[5] For the EU15. Source – Eurostat 2004

This confirms solid biomass provides the majority of Ireland's renewable energy – albeit that the current levels of relative deployment are very low.

Renewable energy in the MWRA area

The Mid West Climate Change Strategy shows that in 2005 renewable energy provided 220.9GWh of the regions total use of 15,880GWh. This means only 1.4% of the regions energy comes from renewable sources.

Bearing in mind the 2020 target is that 16% of the nation's energy should come from renewable sources it is very clear that the region must rapidly accelerate the use of renewable to help deliver its part of this target.

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3.0 Bioenergy market evaluation and possible targets

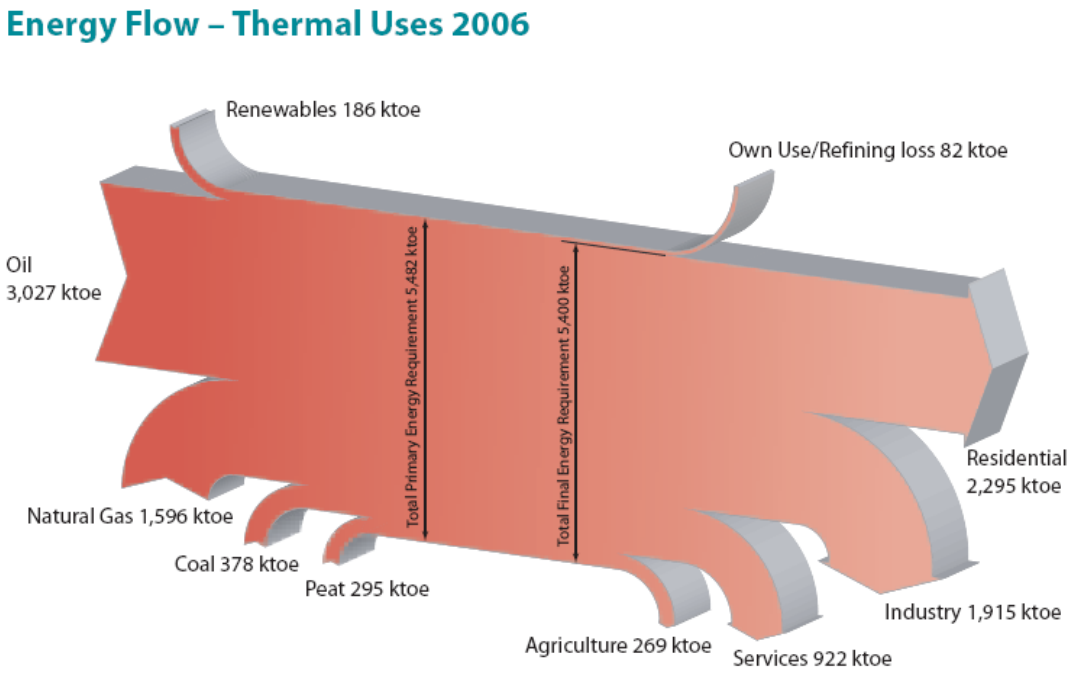
This part of the report reviews the energy market sectors where it is possible to deploy and use solid biomass in the MWRA area. There are three main energy markets:

- Heat
- Power generation and co-firing
- CHP

The remit of this Study excludes examination of Anaerobic Digestion technologies and the use of bioenergy for liquid transport fuels and waste to energy schemes.

3.1 The heat energy market

Oil dominates the Irish heat market, as shown by the Sankey diagram below. This data can be used to infer what might be an equitable regional share of bioenergy in the future regional heat market, based on national renewable heat targets.



Source SEI 2008

As there are no published figures on the size of the heat market in the region SEI national figures have been used – that define the total Irish heat market as being equal to 5.5 million tonnes of oil equivalent. The region contains 8.5% of the total Irish population.

Using the population proxy the regions total heat market should equal 8.5% of the national heat market. This means the regions heat market is equal to 467,500 tonnes of oil equivalent, or 5437 GWh[6]. This equates to approximately 525 million litres of oil.

A thousand tonnes of solid biomass at 50% moisture content (MC) typically contains 2.3 GWh's of energy. This means that to supply 100% of the regions heat market would require 2.36 million tonnes of 50% MC solid biomass per annum.

One of the main issues that this action plan must address is what can be considered realistic and achievable targets for the deployment and use of bioenergy in the Mid West region. In this context the approximate current use of biomass in the EU is at a 10% share of the total heat market. It is also worth restating the national heat targets in that regard:

- 5% renewable share in heating sector by 2010
- 12% renewable share in heating sector by 2020

If these national 5% and 12% targets were applied to MWRA region it would mean:

- a 5% market share of the heat market would be in the order of 145MW using 116,275 tonnes of solid biomass at 50%MC per annum by 2010.

- a 12% market share of the heat market would be in the order of 350MW using 279,000 tonnes of solid biomass at 50%MC per annum by 2020.

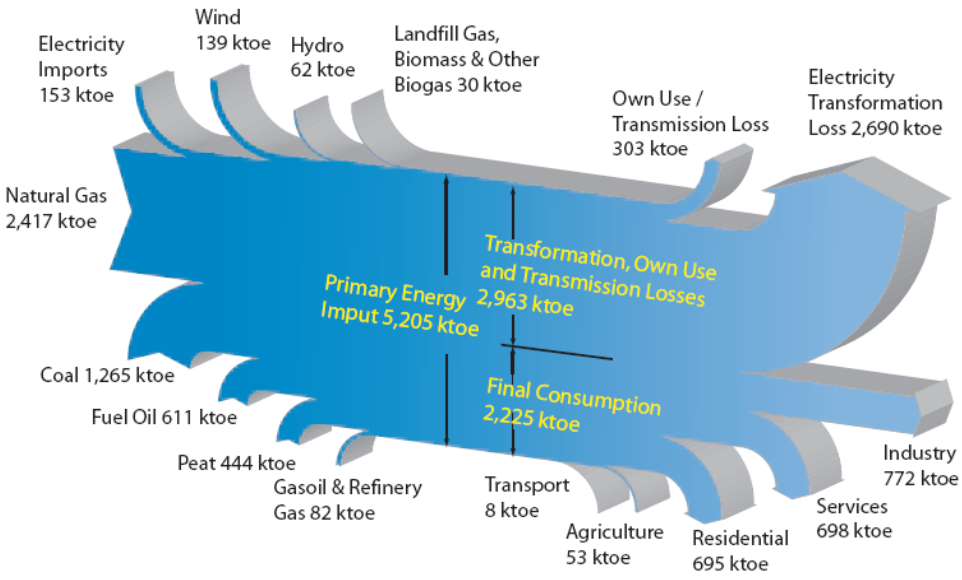
This would meet the Bioenergy Action Plan for Ireland 2020 target. Later parts of this report evaluate the extent to which these are achievable in the MWRA context.

3.2 Power generation and co-firing

As there are no published figures on the size of the electricity market in the region we have used the SEI figures contained in the Sankey diagram following:

1. [6] Using 1ktoe => 11.63GWh

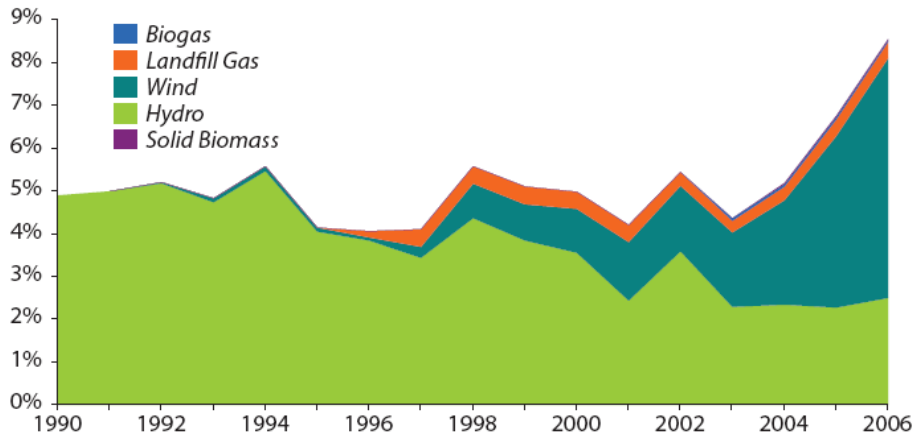
Energy Flow – Electricity Generation 2006



The regional Climate Change Strategy indicates that the regional electricity market based on final consumption is equivalent to 189,000 toe or 2,200GWh, which is equal to approximately 208 million litres of oil. However, the primary energy input for the region is 442,425 toe or 5145GWh (using population proxy); this suggests a conversion factor of approximately 43%. Therefore to meet this demand using solid biomass would require 2.3 million tonnes of biomass at 50% moisture content.

The national renewable electricity target is set at 40% by 2020. However, this target does not include sub targets for renewable electricity from bioenergy, wind, hydro and so on. So it is not possible to directly infer what might be a reasonable regional target for solid biomass generated electricity. At present solid biomass currently makes a negligible contribution to existing renewable electricity (see SEI diagram below).

Renewable Energy Contribution to Gross Electricity Consumption 1990 to 2006



It might be reasonably concluded that there is a negligible role for solid biomass in the 40% renewable electricity target. Following consultation with SEI and the Renewable and Sustainable Energy Division of the Department of Communications, Energy and Natural Resources it has been confirmed that this is a reasonable assumption in terms of new solid biomass electricity generation plant in MWRA region[7].

Co-firing

However the region does contain Moneypoint power station –using approximately 2 million tonnes of coal per annum to generate electricity (and Ardnacrusha hydropower station). There are three other fossil fuel stations in close proximity to MWRA area: Tarbet – oil fired, and Edenderry and West Offaly at Shannonbridge both of which are peat fired electricity plants. These latter plants are also close enough to the region to be included in any consideration as part of this report. Therefore, Money Point, Edenderry and West Offaly at Shannonbridge may present co-firing[8] opportunities.

The national target for co-firing biomass fuels in peat fired power stations is set at 30% of fuel input by 2015[9]. To meet the 30% co-firing target Bord na Mona Energy Ltd estimate that 1 million tonnes of biomass material (at 50% moisture content.) are required[10].

In 2007 Bord na Mona indicated that for them a commercially viable purchase price of biomass must be around €50 a tonne at 50% moisture content.

It is extremely unlikely that the Mid West region sourced biomass could be processed and delivered to the peat plants profitably at this price. Even if this was to prove economic it would only be so for material harvested very close to the peat fired power plants and so it would effectively exclude supply from the vast majority of the MWRA region (where transport costs would be far too high). On that basis it is unlikely that the bioenergy resources of the MWRA region could be deployed in the peat plants without changes to national policy and regulation.

There is no technical reason why the power plant at Moneypoint could not also co-fire solid biomass with coal. The political basis for this is set out in the government Energy White Paper (published 2007) and there is a stated intention to set a target for co-firing at Moneypoint by 2010. As a result Moneypoint will examine the idea of co-firing, but indicates that any possible

[7] If such a project(s) was to emerge it would require massive capital investment by a major utility and probably significant state support to make it commercially viable.

[8] Solid biomass can be mixed with peat or coal and used in existing power stations – this is known as co-firing.

[9] This target appears to be based upon the technical capacity of the plants to accommodate biomass fuels without significant investment.

[10] Currently the 3 power stations combined use about 3 million tonnes of peat annually. This peat contains about 23.7 PJ/a of energy. This means the 30% co-firing target must provide 7.1 PJ/a of energy.

investment to achieve this will not happen in the next few years. Following consultation with Moneypoint it can be assumed any target to co-fire will be limited to 5% of fuel input.

To co-fire at Moneypoint at a rate of 5% would require 275,000 tonnes of solid biomass at 50% MC.

There are a number of factors that will dictate when or whether co-firing will occur at Moneypoint.

First, it will require significant capital investment to handle and process biomass fuels. This investment cannot be foreseen or influenced as part of this Bioenergy Action Plan.

In addition the price of biomass fuels must be low enough to make the process commercially viable. It seems that biomass fuels produced in the MWRA region will not be viable for co-firing at the peat plants and there is no reason to assume the economics will be substantially better at Moneypoint.

Another important factor for the MWRA region is that Moneypoint – in common with all thermal power plants – operates at lower than 40% efficiency levels[11]. This means most of the energy in biomass (and coal) fuels is lost as waste heat. Unless this heat can be usefully deployed the use of biomass resources at Moneypoint is less efficient than the use of that same resource in the heat or CHP energy markets.

Overall the economics, timescale and conversion efficiencies of co-firing at Moneypoint suggest it would be not be appropriate for this Bioenergy Action Plan to set targets that support co-firing at Moneypoint. The decision to co-fire at Moneypoint should be left to the power plant itself in the context of national policy objectives.

3.3 Combined Heat and Power in the MWRA area

The development of biomass CHP in the region would contribute to both heat and electricity targets. At present there are no biomass CHP projects in the region. In fact, there are currently only two commercially operating biomass CHP plants in Ireland: Grainger's sawmill, with a 1.8MW_e scheme in County Cork,[12] and a further 3 MW_e biomass CHP installation which was commissioned in November 2008 at Munster Joinery in County Cork. (Balcas also operate a 2.7MW_e unit in Co Fermanagh, Northern Ireland). In 2007 a national objective of 10

[11] Fuel is converted to electricity in thermal power plants at under 40% conversion efficiency, in the heat and CHP sectors the conversion efficiency can be above 80% efficient and so less fuel is required to generate more heat or more heat and power.

[12] Both of these are in large sawmills that produce fuel as a waste product of their sawmilling operations. They also require heat to process their finished product and electricity to run their machinery.

MWe[13] to 15 MWe of biomass CHP (2007 to 2013) was set under the biomass CHP grant scheme.

As the region contains about 8.5% of the population of Ireland it can be assumed that the region should contribute to about 8.5% of the national biomass CHP grant objective.

This suggests 0.85 MWe to 1.275 MWe should be installed by 2013 to allow the region to make an equitable contribution to national objective in line with its share of population. In practice this more than likely means that a single biomass CHP project developed in the MWRA area would provide an equitable contribution. Whether one, or several projects are developed and what output they have is very difficult to foresee and it would not appear practical to set specific numerical targets for the number and output of CHP projects that emerge in the region.

A 1 MWe project would use up to 12,000 tonnes of solid biomass per year. The cost of the unit will be approximately €4 million. It would provide about 5.2 GWh of electrical output and 20 GWh of heat output. It would save around 9,000 tonnes of CO2.

3.4 Recommendations on scope of regional targets

This section of the report has examined what targets could be set for biomass on a regional basis in the heat, electricity and CHP markets. The table below provides a simple summary of possible targets:

Energy Market	Possible biomass use p.a.	Comments
Heat	279,000 tonnes assuming 12% target is applied regionally	Desirable and allows region to meet national targets
CHP	12,000 tonnes assuming national grant scheme objective met regionally	Meets grant scheme objective, but difficult to set numerical target
Co-fire	275,000 tonnes assuming 5% at Moneypoint	No national target at present and largely depends upon long term investment by Moneypoint
Electricity	880,000 tonnes assuming the 40% renewable electricity target is applied regionally and only to solid biomass	No national biomass target and not desirable regionally, wind and hydro are set to be the main providers.

[13] MWe refers to the installed capacity in terms of MW electrical. As in all cases a CHP project is capable of generating more heat than power it can be assumed that 1MWe also represents 3MWt. This means 3 MW of heat output.

The report does not recommend a renewable electricity target in terms of bioenergy use for the region. This would not be an achievable issue for a regional strategy – because in practice it would represent a single massive investment project without national policy support.

The report recommends that the co-firing target should remain national as it would be difficult to see how a regional strategy could help deliver on projects that would be national in scale and character and only delivered by national policies.

A simple numerical CHP target is difficult to set as only one or handful of individual projects are likely to emerge. As such a target would not be useful or deliverable. It is likely that some CHP investment will happen in the region, but numerical targets would not affect whether that occurred. However, it would be beneficial to seek to develop and promote biomass CHP on a case by case basis –where such projects are commercially viable.

Setting a renewable heat target is in line with national policy and would support market development on a regional basis. This strategy therefore recommends that the heat target is set on a regional basis to be line with national heat targets. Such a target can be expressed in two ways:

- MW's of installed capacity
- Tonnes of fuel used

The strategy recommends that the time frame for targets is 2020. This would replicate supranational and national targets and an 11 year horizon is a good balance between allowing enough time and not being too far into the future as to be unrealistic.

Both these metrics are simple to measure and easy to verify. This strategy also recommends that the heat target is monitored so that the other outcomes and benefits of the target can be estimated or measured, as listed below:

- % Penetrations of the heat market
- Millions of Tonnes of Oil Equivalent
- Value of capital investment
- Value of fuel sold
- CO2 savings
- Fossil fuel displacement
- Jobs created
- Savings in fuel costs

This strategy recommends an incremental target is set in 2015 which offers an opportunity to develop actions and policies in the short term and review the impact of these in a reasonable time frame. For reasons outlined in section 5.2 this strategy recommends that a renewable heat target for 2010 is neither desirable nor practical on a regional basis.

The following section of this strategy examines the bioenergy resource, so that the level of the targets can be considered.

4.0 The current bioenergy resource in the region

4.1 Introduction

This part of the report provides an evaluation of the existing bioenergy resources of the MWRA area. It provides the context to evaluate the extent to which bioenergy could be deployed in the MWRA area.

Bioenergy can be defined as the biodegradable fraction of products, wastes and residues from agricultural, forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste. There is no common definition of biomass fuels, but the following list summarises the main sources[14]:

- Cereal and agricultural crops (straw\OSR\sugar beet etc)
- Spent cooking oils
- Animal slurries
- Solid municipal waste and refuse derived fuels
- Industrial and commercial wastes (particularly from the food sectors)
- Wood
- Purpose grown energy crops

This study focuses on solid biomass. Therefore it has excluded spent cooking oils, animal slurries, municipal waste and refuse derived fuels and industrial and commercial wastes. This is due to the fact that these sources are associated with liquid transport fuels, anaerobic digestion or waste to energy schemes.

For the MWRA area there are five possible sources of solid biomass;

1) Forestry resources.
2) Wood processing co-products.
3) Post consumer wood waste.
4) Purpose grown energy crops.
5) Solid farm wastes.

Forestry resources are mostly small diameter logs (small roundwood) that are extracted to roadside, air dried and then chipped and delivered to heat boilers. These are known as thinnings.

[14] It should be noted that woody energy crops are not part of this mix at present.

At a larger scale whole tree chipping and chipping of brash and branches (usually in forest) can supply wood fuels to CHP and co-firing markets.

Wood processing co-products are wood chips, dust and bark produced by sawmills as they process logs into product such as planks.

Post consumer wood waste is recycled wood that is processed and chipped into clean wood chip by timber recycling companies.

Purpose grown energy crops are usually fast growing and harvested on short rotations or an annual basis. Willow trees planted on agricultural land and harvested every 3 to 5 years these crops are also used for bioremediation where sludges are spread and a gate fee is charged. These crops are known as short rotation coppice or SRC; other purpose grown grasses include miscanthus, switch grass and hemp. These crops are harvested annually and usually come to full production in two to three years.

The development of this sector is currently being driven by establishment grants and energy crop premia.

Solid farm wastes are chicken litter from the poultry sector; spend mushroom compost (SMC) and straw.

Appendix 5 contains full details of the sources of solid biomass of the MWRA region. Appendix 9 contains a breakdown of biomass resources by County.

4.2 Existing bioenergy resources

The table below presents a simple summary of the available biomass resource in the MWRA region in 2009.

This shows the immediately available resources in the top part of table. This indicates that the region *can currently supply* 54,745 tonnes of solid biomass at 50% MC.

The bottom part of the table includes public forestry (which is only available at the discretion of Coillte) and straw, poultry litter and SMC that need specialist technology to combust them. This material could be available for energy use subject to some stimulation in terms of availability of suitable technology and overall increase in demand to help supply chains form. This totals 34,487 tonnes of solid biomass at 50% MC.

Source		Units	Quantity	Energy Content			Tonnes @ 50%MC	Notes	
				GJ/t	MWh/t	GWh			
Private Sector Forests @ 50%MC	*1	t fresh	25750	8.38	2.33	59.9	25637	*1	Assumes all pulpwood harvested is available to market
Co-Product @ 45%MC	*2	t	2500	9.46	2.63	6.6	2810	*2	Currently used as fuel source
Recycled Wood @ 15%MC	*2	t	6100	15.95	4.43	27.0	11560	*2	Currently used as fuel source
Miscanthus @ 15 - 18%MC	*3	t	7862.5	14.70	4.08	32.1	13732	*3	85% of total crop. 15% used as animal bedding
SRC @ 15%	*4	t	70	15.95	4.43	0.3	133	*4	New to market limited availability
Switch Grass @ 18%MC	*5	t	152	19.20	5.33	0.8	347	*5	New to market
Hemp @ 15%MC	*5	t	263	16.85	4.68	1.2	527	*5	New to market
Total Available 2010			**42698**			**128.0**	**54745**		
Public Sector Forests @ 50%MC	*6	t fresh	10000	8.38	2.33	23.3	9956	*6	Will be made available on demand if required
Straw @ 15 - 18%MC	*7	t	3750	13.50	3.75	14.1	6015	*7	Not widely used as fuel stock requires specialised equipment
Poultry Litter @ 30%MC	*7	t	16900	9.00	2.50	42.3	18071	*7	Not widely used as fuel stock requires specialised equipment
SMC @ 50%MC	*7	t	1170	3.20	0.89	1.0	445	*7	Not widely used as fuel stock requires specialised equipment
Potential Resources Requires Demand	***8**		**31820**			**80.6**	**34487**	*8	Potentially available if market and technology are put in place

Grand Total Available + Potential Resource **89232**

In total the current biomass resource of the region is 89,232 tonnes (at 50% mc).

Some of this biomass is already being used.

This existing biomass use has been reviewed and is estimated at about 15,720 tonnes in the following locations:

Installed Capacity MW	Clare	Limerick	Nth Tipp	Total MW
Old Comm. Biomass Co-firing with oil	2.00	0.00	0.00	2.00
Non Grant Aided Biomass Boilers 5x200kW	0.00	1.00	0.00	1.00
Comm. Large Biomass Grant Aided	2.53	0.09	0.09	2.71
Comm. Small Biomass Pellets	0.09	0.15	0.08	0.31
Domestic biomass (average 15kW)	3.75	3.00	1.19	7.94
Totals	**8.37**	**4.24**	**1.36**	**13.96**

The region **is** therefore capable of meeting an additional demand of 39,025 tonnes of biomass annually in 2009. With some stimulus it could immediately supply a further 34,487 tonnes of solid biomass, making a total currently available of up to 73,512 tonnes at 50% MC.

However, this biomass resource is forecast to grow sustainably over the next 11 years. The rate at which it will increase partly depends upon the rate of demand for biomass. Section 5 of this report reviews proposed biomass use targets and forecast biomass growth.

4.3 Costs of producing bioenergy fuels

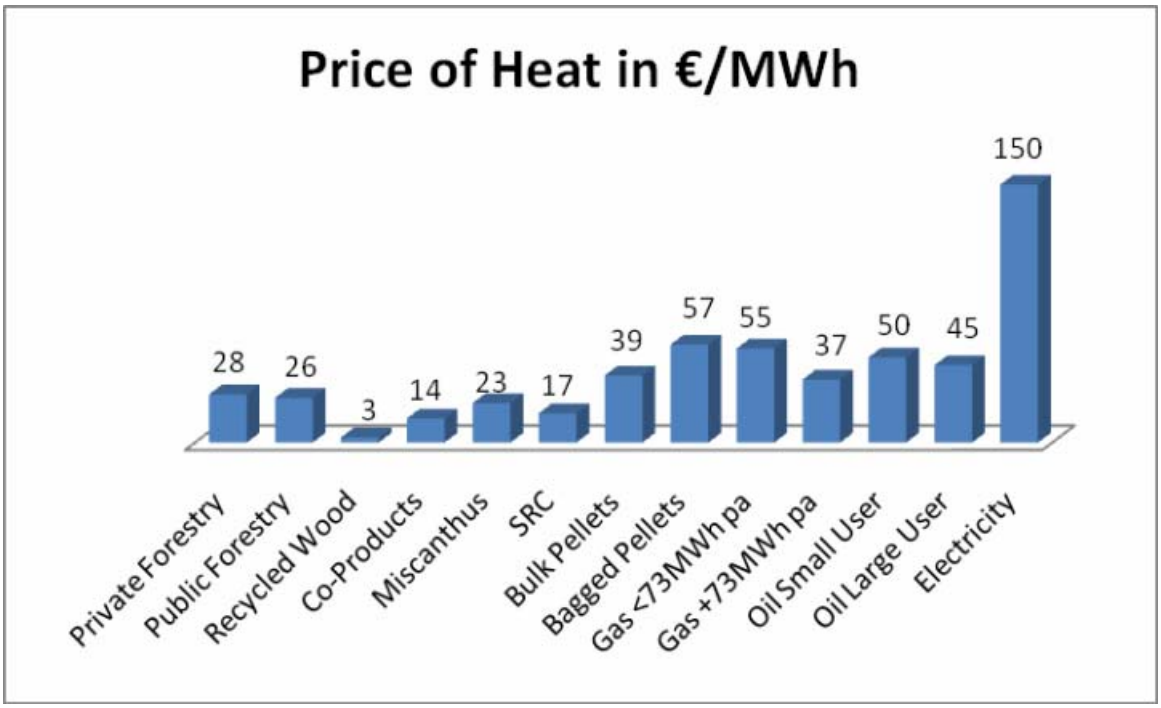
This part of the report examines the likely market prices that the various bioenergy fuels need to be sold at. This takes into account a judgement of the various production costs and the need for suppliers and producers to secure a reasonable commercial profit. Appendix 6 provides details on how the costs of biomass fuels were estimated.

Price comparison

The table below shows the price per tonne and equivalent heat price of different fuels and compares this to oil, gas and electricity fuels for heating. The delivered price takes account of assumed transport costs to the biomass installations. All prices are at trade MC%.

Source At Trade MC%	Units	Quantity at Trade MC%	Energy Content			Gate Price		Delivered Price	
			GJ/t	MWh/t	GWh	€/t	€	€/t	€
Private Sector Forests @ 50%MC	t fresh	25,750	8.38	2.33	59.9	33.75	869,063	65.25	1,680,188
Co-Product @ 45%MC	t	2,500	9.46	2.63	6.6	N/A	-	36.00	90,000
Recycled Wood @ 15%MC	t	6,100	15.95	4.43	27.0	N/A	-	30.00	183,000
Miscanthus @ 15 - 18%MC	t	7,863	14.70	4.08	32.1	65.00	511,063	92.00	723,350
SRC @ 15%	t	70	15.95	4.43	0.3	25.40	1,778	74.00	5,180
Switch Grass @ 18%MC	t	152	19.20	5.33	0.8	65.00	9,880	92.00	13,984
Hemp @ 15%MC	t	263	16.85	4.68	1.2	165.00	43,395	N/A	-
Public Sector Forests @ 50%MC	t fresh	10,000	8.38	2.33	23.3	28.00	280,000	60.00	600,000
Straw @ 15 - 18%MC	t	3,750	13.50	3.75	14.1	60.00	225,000	N/A	-
Poultry Litter @ 30%MC	t	16,900	9.00	2.50	42.3	15.00	253,500	N/A	-
SMC @ 50%MC	t	1,170	3.20	0.89	1.0	N/A	-	N/A	-
Total Value Based on Trade MC%					**208.6**		**2,193,678**		**3,295,702**

The chart (next) graphically illustrates the relative costs of each different fuel type in the cost of delivered heat in Euros per MWh. It includes fossil fuel heating costs.



This chart illustrates that there is a choice in the fuel options and that there is wide variation in the prices for biomass but all biomass options are cheaper than fossil fuels

5.0 Targets and forecast biomass resources

5.1 Introduction

This strategy has evaluated the currently available regional biomass resource – which could be up to 73,512 tonnes at 50% MC. It has shown these resources can be deployed at much lower costs than competing fuels like oil and gas. It has also examined the possibilities of setting targets in the different energy markets to use that biomass resource. It is worth re-stating the possible targets:

Energy Market	Possible biomass use pa
Electricity	880,000 tonnes assuming the 40% target is applied regionally
Co-fire	275,000 tonnes assuming 5% at Moneypoint
CHP	12,000 tonnes assuming national grant scheme objective met regionally
Heat	279,000 tonnes assuming 12% target is applied regionally

This strategy has established that regional targets for biomass electricity are not required and that regional co-firing targets are not desirable in the short and medium term. Despite this the currently available biomass resource of 73,512 tonnes will not meet the proposed heat target and some growth in the CHP market. However, the proposed 12% heat target and the CHP objective cannot be met immediately because it would a number of years to install enough biomass equipment to meet such targets. Therefore, there is time to grow the biomass resource in line with growth in biomass installations over a number of years. This part of the strategy examines how growth in the resources and biomass use can develop in the region.

5.2 The heat target and the biomass shortfall

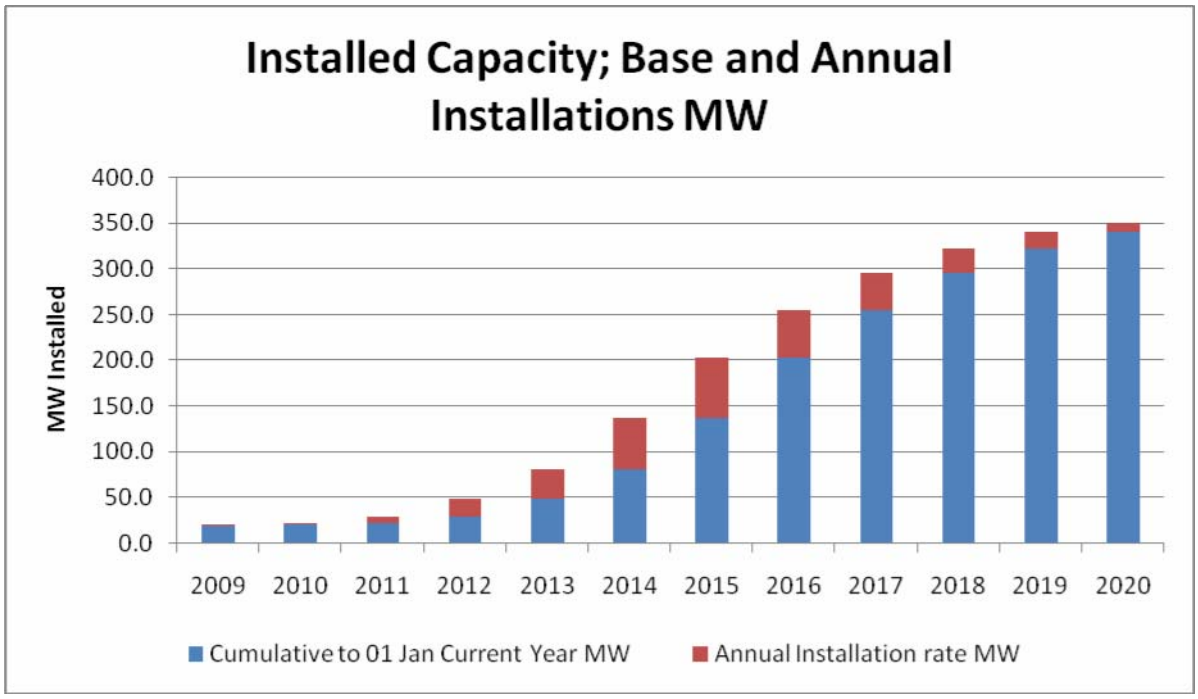
As noted earlier in this strategy there is a *national target* to achieve 5% share of the heat market by biomass by 2010. If the 2010 target were to be reached in the MWRA region it would require 116,275 tonnes of biomass. ***This is well above what is currently available*** from regional resources and there is insufficient time to develop more biomass resource on this scale. It is clear that it would not be desirable to set a regional target for 2010 that cannot be met by the available regional biomass resource.

In addition to this to achieve the 5% target would require 125 MW of biomass installations by the end of 2010 and an investment of €56.25 million. This translates into around 15 to 20 commercial scale biomass schemes installed per month (hospitals, secondary schools etc). Such a rate of development has never occurred in Ireland and it is difficult to foresee circumstances in which this can be achieved by 2010.

In simple terms the region cannot set a regional target for 2010 that is in line with the national target. However it can work towards the 12% national target set for 2020. As a stepping stone to the 2020 target it is proposed that the region set an interim target of 7% for 2015. The table below shows what that means in terms of biomass use and installed MWs.

National Bioenergy targets applied for the MWRA area		Target	ktoe	GWh	Required biomass @ 50%	Required installed capacity
					tonnes	MWs
MWRA Interim 2015	%	7.0%	32.7	381	**162,785**	203
MWRA Target 2020	%	12.0%	56.1	652	**279,060**	349

To achieve the targets there will need to be rapid and sustained growth in the use of biomass and the biomass resource of the region. The projected growth in installed capacity is illustrated below.

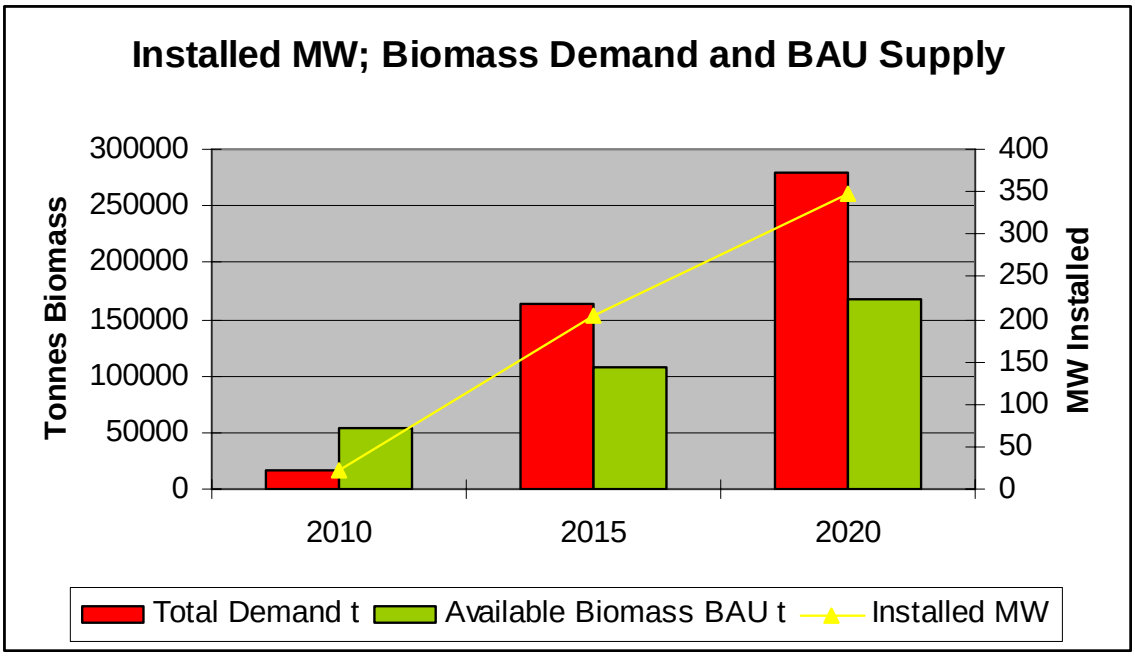


This graph has been produced using the author's professional judgement. It assumes relatively slow growth in 2010 that reflect the adverse economic circumstances and the existing slow rate of market development. It assumes more rapid market growth from 2011 to 2017 as an action plan to support market growth takes effect.

Biomass shortfalls

If the market can be supported to grow at the levels illustrated in the table above the demand for biomass will exceed the current available regional resource. The predicted biomass shortfalls are set out in the following table and bar chart for 2015 and 2020 if a 'business as usual approach' (BAU) is adopted.

Target Biomass "Business As Usual"	% of Total heat market	Total Required Biomass	Available Biomass under BAU	Shortage (-) of Biomass
2015 Regional Target	7%	162,785 t	107,327 t	**-55,485t**
2020 Regional Target	12%	279,060 t	167,914 t	**-111,147 t**



The BAU forecast is based upon the known forestry resources that will come on stream as already planted woodlands require thinning and felling. It also includes an increase in the availability of energy crops that is in line with current trends in new planting. Nevertheless, despite this forecast growth the shortfalls in required biomass under BAU could be as high as:

- 2015 – 55,485 tonnes of biomass shortfall
- 2020 – 111,147 tonnes of biomass shortfall

The next section of this report examines if the available biomass resource can be increased to meet the proposed targets 2015 and 2020.

5.3 Biomass stimulus

A number of key stimulus factors will, if addressed, free up and increase available biomass resources and these include:

- Technology is matched with the resources - this would enable fuel stocks such as poultry litter, straw and SMC to be used. At present these are not used as there is no outlet for them. Furthermore, these resources are capable of relatively rapid deployment, unlike forestry that could not be established rapidly enough.

- Ensure that the private forest resources are fully exploited, as at present these resources are not fully exploited and so not all included in the BAU forecast.

- Promote the wider deployment of energy crops. At present these have tiny market share as there is no outlet for them. Furthermore, these resources are capable of rapid deployment, unlike forestry that could not be established rapidly enough to meet the 2015 and 2020 shortfalls. A large part of the required stimulus can be met through increased planting of energy crops.

The BAU estimates of resource already take into account some forecast growth in private forestry resources and some limited growth in energy crops such as miscanthus, in line with current growth trends. However, the four resources noted below are excluded from the BAU forecast:

- Public Sector Forests – 9,956 tonnes @ 50%MC
- Poultry Litter – 18,071 tonnes @ 50%MC
- Straw – 6,015 tonnes @ 50%MC
- SMC – 445 tonnes @ 50%MC

Of the above public sector forests would be first to be drawn in to the market as it could supply existing and new wood chip boilers.

The stimulus is assumed to be provided fundamentally by greater demand and the use of technologies which can utilise a diverse range of fuel types and possibly multi-fuel boilers and better prices from a locally based emerging energy market. These issues are discussed below:

Private forestry stimulus

The yield from private sector forests could be increased in three ways.

First, there could be increased thinning, essentially by undertaking thinning at the correct time and not delaying due to lack of suitable markets.

The National Forest Inventory (2007 Forest Service) has indicated that only 25% of privately owned plantations which have reached the age of first thinning have been thinned. There are a number of reasons for this: lack of awareness, high harvesting costs for small plantations. If this situation were to apply in 2010 only 6,410 tonnes would be harvested out of a possible 25,637 tonnes.

Second, the yield could be further increased by thinning areas which were due for thinning between 2003 and 2008 but were left un-thinned at the time.

Finally, further increases in yields could be achieved by harvesting only pulpwood in small or remote plantations. The harvesting costs are reduced where only a single log size is cut. Such practices might increase the yield by 10 – 15%.

The possible increase in yield arising from thinning areas left un-thinned prior to 2008 and the increase of 10 -15% achieved are set out below:

- 2015 business as usual - 61,416 tonnes \With Stimulus – 73,180 tonnes
- 2020 business as usual – 104,377 tonnes\ With Stimulus – 120,483 tonnes

The increased yields resulting from the above recommendations will be maximised between 2010 and to 2015, post 2015 it will not be possible to increase the area available for thinning as any plantations established after 2005 will not have reached the age of first thinning.

The additional resources that forestry could provide above the BAU forecast cannot meet the proposed 2015 and 2020 heat targets.

Energy crops stimulus

Any increase in demand for biomass will need to be met by a combination of the following resources if shortfalls are to be avoided:

- increased deployment of energy crops,
- utilisation of poultry litter, straw and SMC
- Fibres logs are another potential source of fuel – research is due to commence in summer 2009 and no data is available as to yield or cost.
- Importation of biomass from outside the region.

The most viable option is to increase the area planted with energy crops. To date, miscanthus is the most widely planted energy crop in the region. The total area planted exceeded 500ha. in 2008. The availability of grants and energy premia has been a driving force in the expansion of this crop. Applications for grant approval totalling 450ha. where received by the Department of Agriculture from the mid west region for the 2009 planting season.

Miscanthus will, given the current rates of planting, be the main focus and will supply the majority of the energy crop biomass resource.

This strategy estimates that to ensure there are sufficient resources available to meet the forecast shortfall in biomass the average annual increase in the planted area will need to be in the order of 312 ha, resulting in a minimum of 3,630 ha by 2020.

This rate of planting will need to be front end loaded if the 2015 – 7% target is to be achieved, particularly in the years 2010 to 2013 as the crop requires two years to mature. This implies an annual planting rate of circa 370 ha between 2010 and 2013 inclusive. After 2013 it must continue at a rate of about 310 ha per annum to 2020.

SRC is also grant aided, but despite this its deployment rate to date has been very low. SRC has alternative use in bio-remediation which would provide growers with an additional income. This additional income may incentivise more growers to consider this, particularly near treatment plants and other industrial plants which have sludges to dispose of. Given the current deployment rates and the maturing time of three to five years SRC is unlikely to make a significant contribution to the 2015 targets.

Switch grass and Hemp are not grant aided and both are relatively new introductions to Ireland and information regarding current planting rates in the region is limited. However, in the south east region both crops are now being planted by GEGA. GEGA have recently set up GESCo's in the region which will use these crops.

The table below gives the current areas occupied by each of the energy crops, also included are the estimated areas required to achieve the interim 2015 and final 2020 heat targets.

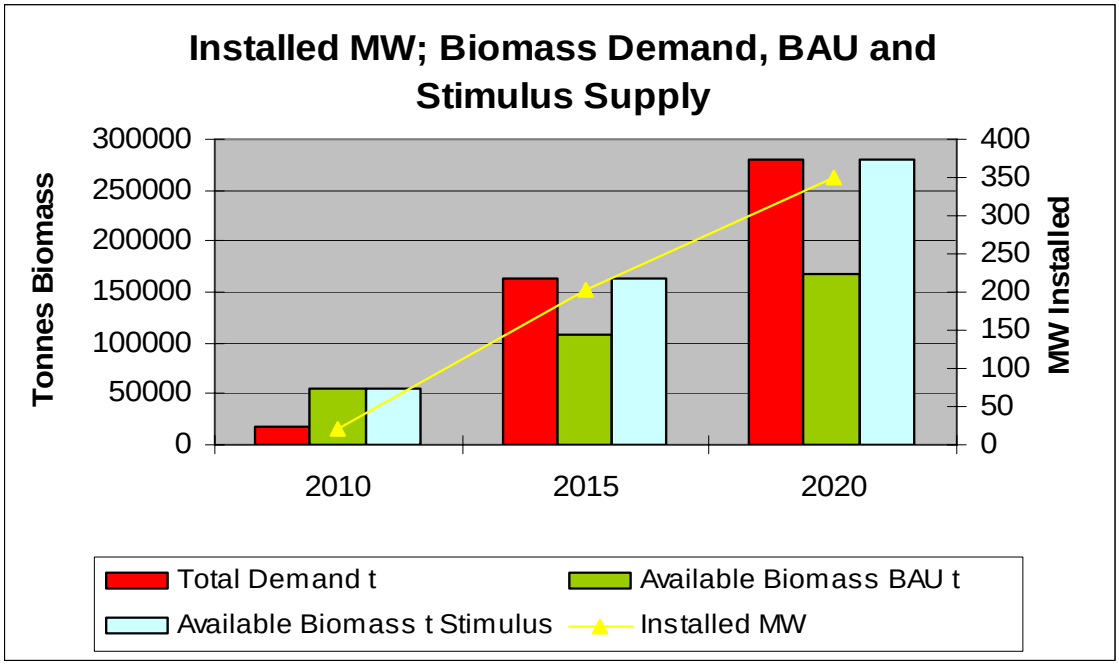
Source	Units	2010	2015	2020	Increase	Ave ha pa
Miscanthus	ha	514	1800	3630	3116	312
SRC	ha	5	22	438	433	43
Switch Grass	ha	15	30	274	258	26
Hemp	ha	22	44	395	373	37
Totals		**556**	**2166**	**4736**		

5.4 Biomass forecast

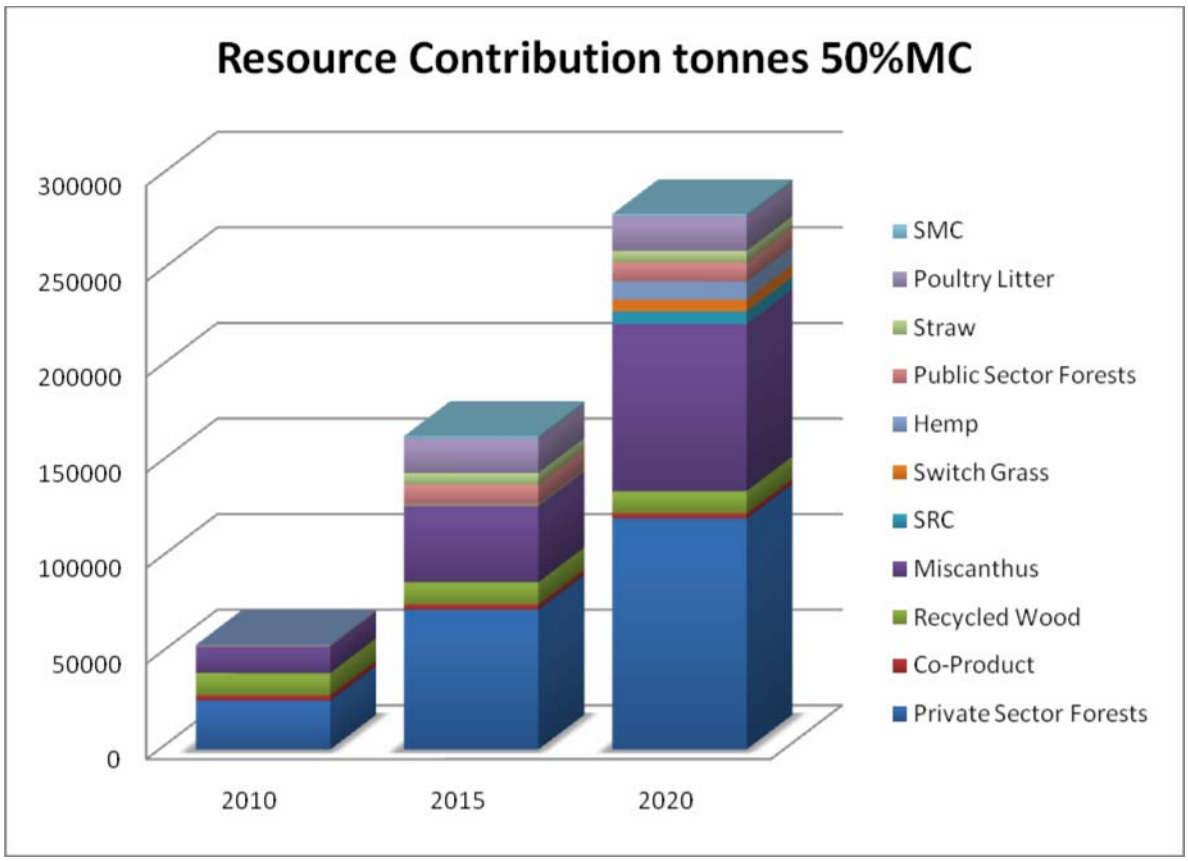
The previous sections have brought together all the data on available biomass now and forecast biomass growth to 2020 and forecasts have been completed assuming business as usual and assuming the stimulus described above that brings more forestry and energy crops into the biomass supply chain.

With a stimulus the available resources are forecast to rise to meet the proposed targets. This is shown in the table and graph below:

Source at 50%MC Equivalent	2010	2015	2020	2015	2020
	BAU t	BAU t	BAU t	Stimulus t	Stimulus t
Private Sector Forests	25,637	61,417	104,377	73,180	120,843
Co-Product	2,810	2,810	2,810	2,810	2,810
Recycled Wood	11,560	11,560	11,560	11,560	11,560
Miscanthus	13,732	30,283	47,596	39,500	87,325
SRC	133	166	207	332	6,633
Switch Grass	347	433	542	693	6,241
Hemp	527	658	823	700	9,477
Public Sector Forests				9,956	9,956
Straw				6,015	6,015
Poultry Litter				18,071	18,071
SMC				445	445
Total Available	**54,745**	**107,327**	**167,915**	**163,262**	**279,376**
Total Demand	**16,800**	**162,785**	**279,060**	**162,785**	**279,060**
Shortfall (-) or Surplus	**37,945**	**- 55,458**	**- 111,145**	**477**	**316**



The following graph illustrates the estimated contribution made by each resource stream and the change in each over time.



5.5 Comments on biomass stimulus

The above illustrates how it would be possible to stimulate the biomass resources to meet the region's 2015 and 2020 heat targets. The addition of several CHP projects could reasonably be accommodated given the approximate nature of these estimates. It can be concluded that the availability of biomass resources should not be a factor in whether the region is able to meet its share of the national heat bioenergy targets (and CHP) provided the number of biomass installations grows rapidly. Clearly, this also requires that action is taken immediately to more widely deploy energy crops and that forest resources, particularly private forestry, are utilised to their full potential. In turn, further actions are required to ensure the technologies deployed are suitable for some of local biomass stocks such as straw and SMC.

However, it is important to recognise that the stimulus this strategy refers to is entirely dependant upon the demand for biomass increasing in line with the national targets. It also important to recognise that the development of co-firing at Moneypoint or biomass electricity sector could not in addition be accommodated by the available regional biomass resource.

The increased planting of energy crops provides the bulk of additional biomass resource from 2015 to 2020. This is because there is no other way of bringing biomass resource on stream as quickly. The extent to which the market decides to grow and produce energy crops is largely dependent upon whether the biomass installation growth meets the targets proposed in this report. Simply setting targets, nationally and regionally, does not mean they will be met. For this reason the MWRA region must instil confidence and promote actions that lead to market growth. If the energy crop growers do not have confidence that the market will grow they will not plant new crops at the rate required.

6.0 MWRA action plan

The action plan needs to stimulate demand for biomass use as an immediate priority, as the current economic circumstances are not helpful to investment in new biomass projects. In the medium term – as demand builds – there will be a greater need to focus on skills, capacity and fuel supply development. On that basis this strategy puts forward six proposed short term priorities:

Subsequent sections of the report analyses some of the factors that are influencing market development and then suggests some additional actions that the MWRA and its partners could implement to help deliver the targets proposed in this report. The development of the biomass CHP will require a different approach to the development of the heat sector, so we have separated out the issues.

6.1 The immediate priorities for the action plan

1. Biomass Revolving Loan Scheme

The region has sufficient biomass resource to meet its targets; however, this resource and the targets are totally dependent upon energy users converting to biomass. Whilst there is a fuel price incentive to convert to biomass fuels, the capital costs of biomass systems create a significant barrier. The current economic downturn and difficulties in obtaining credit appear likely to make this the key issue for market development of biomass in the short and medium terms.

In response to this, this strategy recommends that the MWRA and its partners should lobby for, develop and deliver a Biomass Revolving Loan Scheme. This should be regarded as the centre piece strategy for a regional biomass action plan. It could be viewed as a pilot scheme for a national scheme and may provide a successor to the current SEI grant scheme that ends in 2010. It would also be in line with a 'Framework for Sustainable Economic Development' for increased investment in clean energy.

Many of the range of other barriers, such as confidence and capacity are inherently addressed by the development of new biomass schemes by a loan fund, as it starts to create a regional critical mass of installations in high quality and appropriate locations.

Its purpose, design and operation is explored below.

The Challenge: Biomass heating systems are significantly more expensive to install than fossil heating systems, however they are much cheaper to operate as biomass fuels are 50% less than many fossil fuels. In some market segments biomass systems will pay back in the

range 3 to 5 years. However, these markets lack access to investment capital to fund biomass installations and so secure these savings.

The Solution: If a fund was established that offered 100% interest free loans it would allow investment in biomass systems. The loans taken out can be repaid from the energy savings that result from converting to biomass fuels. The scheme could be competitive, with only the most attractive investments securing loans each year. This means the scheme will only fund the most commercially viable schemes in the region.

The Mechanism: It can be assumed about 12 biomass projects could be completed each year at an average cost of €225,000 per project (a notional 500KW project for say hospital or secondary school). This comes to €2,700,000 per year. Each scheme could save an average of €50,000 in energy bills each year. Therefore, over 4.5 years the scheme could have loaned out and recouped an equal amount. This means the MWRA biomass loan scheme would be broadly revenue neutral – its loans repaid by the savings it creates.

It would require around €2.7 million start up contribution. In addition a scheme like this will require administration and promotion that may add around 10% to costs. In addition, the cost of finance and insurance must be factored in. Overall around €500,000 to €600,000 might be required to lever and deliver in the €2.7 million capital spend. This scale of funding is clearly something that could not be delivered regionally, and so MWRA and its partners should seek to lobby for Government funds based upon the findings in this strategy. In this regard, it could examine private sector loan funds, using public resources only for some form of loan insurance and the running costs. If private sector funds were involved it may mean that the scheme should be designed – initially at least – to focus on public sector heat markets. This could effectively reduce the risks of loans as they funded from secure energy users such as County Councils and the HSE.

Timescale: Investigate and lobby September 2009 to December 2009. Secure legal and contractual agreements by March 2010. Develop and roll out scheme by Summer 2010.

2. Market awareness\segmentation

The heating of buildings is the largest single use of energy in Ireland. Biomass heating systems could be deployed into this market. The most obvious and immediate *public and third sector* opportunities on a regional basis are:

- Leisure centres
- Large hospitals\community owned care homes
- Major educational institutes – large secondary schools, LIT, UL
- Large public buildings –for example prisons, libraries, council offices

For energy users such as these it would be appropriate to focus effort and resource to review the case for biomass investment. A partnership of Local Energy Agencies, SEI, Shannon Development and Leader could work with HSE, the County Councils and others to identify and develop biomass investment opportunities.

Timescale: Investigate September 2009 to December 2009.

3 Research and Development into new biomass conversion technology

In the medium term this strategy has shown the region will need to develop and exploit the use of energy crops if it is to meet its regional biomass targets. This happens because forestry resources will not be sufficient to meet the 2015 and 2020 targets and it is only energy crops that can be established rapidly enough to meet quite rapid demands within a few years.

The use of forestry chips for heat and power generation is a very well established sector in the EU and is also well developed in Ireland and the MWRA area. However, the use of energy crops like straw for heat energy generation is not so well established particularly in an Irish context.

This strategy recommends that further research is undertaken into the availability of appropriate conversion technology. This can be undertaken by reviewing applications in mature markets like Austria, Germany or Sweden. The technology and its applications could be reviewed and the findings published in a report that can be made available to the Irish biomass installers and energy users.

It is recommended that the Limerick Clare Energy Agency and the Tipperary Energy Agency jointly undertake this technical research study. The growers will also benefit from this research as it will help them determine the specification and form of the biomass fuel they can produce.

Timescale: Investigate issues starting December 2009. Prepare report by May 2010. Publish report Summer 2010.

4. Biomass CHP

This strategy has noted that only the largest energy users in the region could benefit from biomass CHP. It is proposed that a rapid appraisal of the range of possible sites be undertaken. This would scope out and identify the best regional investment opportunities. It would seek to target a number biomass CHP investment opportunities in the region. For each site it would briefly review the investment case and highlight the commercial opportunity to the

site owners. If this established a genuine interest then 'technical support' could be provided to help develop the CHP project in more detail. This may result in one or more major biomass investment for limited cost in terms of some development funding backed by the MWRA and its partners.

This strategy recommends that the MWRA in partnership with the Limerick Clare Energy Agency and the Tipperary Energy Agency jointly commission the CHP study.

Timescale: Draft study scope by December 2009. Commission study January 2010. Complete study Summer 2010.

5. Development of policy support

County Councils will face increases in planning applications that include biomass systems if this action plan is fully implemented. This will range from simple domestic installations to large scale commercial and public sector building projects. The scope will include retrofit and new build. County Councils might be better able to assess planning applications that include biomass energy, or at a pre-planning stage promote consideration of biomass energy by using appropriate published guidance.

This can include a range of good practice suggestions and describe the circumstances where biomass is best applied and why. It can include a summary of the regional biomass resource. It could also contain summarised non technical guidance to planning officers that allows them to promote biomass energy at a pre planning stage and to ensure appropriate checks are made on submitted planning applications.

This strategy recommends that the MWRA in partnership with the local authorities of Clare, Limerick City, Limerick County and North Tipperary, Limerick Clare Energy Agency and the Tipperary Energy Agency jointly develop a suitable checklist. This can include a range of good practice suggestions and describe the circumstances where biomass is best applied and why.

Timescale: Draft checklist by December 2009. Publish and disseminate to local authorities January to March 2010.

6. Form an Industry Partnership Biomass Group

Under the Regional Planning Guidelines Subgroup 2 has responsibility to develop a common approach to renewable energy. It is proposed that under the auspices of Subgroup 2 an Industry Partnership Biomass Group is established to help oversee the development of the sector in the region and to monitor the implementation of this proposed action plan. That

group will comprise representatives of public and private sectors and elected representatives. The medium and longer term aspects of the action plan can be planned and developed.

Timescale: Established by beginning of 2010.

6.2 Heat market - actions and stakeholders

The demand for solid biomass and the investment in new technology are created by energy customers converting to solid biomass. ***The most significant barrier to market development is the high capital cost of biomass equipment.*** This is an overarching issue that must be addressed. Under the current economic circumstances the capital costs of biomass systems will create a barrier for many possible users and this represents a pinch point in terms of the rate of market development. For example, to deliver the 2020 heat target means a capital investment of €148 million. This is about €13.5 million each year. It also means about 700 commercial scale biomass installations are required. This means over 60 schools, hospitals etc converting to biomass each year until 2020.

This means that an action plan should founded on a means to help overcome this barrier. However, if access to capital for investment can be addressed a range of other issues and barriers must also be addressed. The table below provides a summary of these issues and barriers, with possible actions and stakeholders.

Issues\barriers	**Possible actions:**	**Possible stakeholders:**
Capital costs: Biomass heating systems cost 5 to 10 times more than fossil fuel heating systems. In the current economic climate the capital costs of biomass systems will be the most important barrier to market development.	Provide access to working capital through grants or loans. Develop and promote biomass revovling loan fund scheme	MWRA, Energy Agencies, SEI and DCENR. Plus private sectors banks
Awareness\market segmentation: Many energy users are not fully aware of the technology and its benefits. The heating of buildings is the largest single use of energy in Ireland. Biomass heating systems could be deployed into this market.	The most obvious and immediate *public and third sector* opportunities are users such as leisure centres,hospitals\community owned care homes, major educational institutes and large public buildings. Focus effort to	MWRA, Energy Agencies, SEI, Shannon Development and Leader

	promote biomass on these markets and develop and promote biomass revovling loan fund scheme	
Confidence: The technology and fuel supply chain are relatively new to the region. Clearly, energy users will tend to lack confidence until they see a critical mass of users and installations.	Implement action plan and deliver proposed regional targets. Develop and promote biomass revovling loan fund scheme	All
Fuel supply confidence. Energy users know they can get oil delivered – but currently lack full confidence that solid biomass can be supplied reliably and that it will not 'simply run out'.	Publish and promote this action plan with resource figures.	MWRA, Energy Agencies
Confidence in long term price: A key reason to convert to solid biomass is that it is cheaper than oil and gas – so it must be 'proved' that it will remain so over a long term	Develop model biomass fuel contracts and track market prices over time	Energy Agencies and Teagasc
Reliability and usability' of the technology: Many energy users are not aware of the sophistication of the technology and how it can operate in a manner equal to the automation of gas or oil boilers. They also express concerns over how reliable the technology is. These issues are not raised or considered when contemplating investment in oil or gas boilers. However – communication and demonstration of these issues is important to overcome energy customers concerns.	Promote sector through the MWRA action plan and other measures notably the biomass revolving loan fund scheme	MWRA, Energy Agencies, SEI, Shannon Development and Leader
Regulations\Emissions to air: Energy customers often express concerns over the combustion of solid biomass,	Ensure County Councils are aware of the issues	EPA, County Councils and Energy

which they see as an issue – unlike the combustion of gas and oil.		Agencies
Understanding the business case: To make an investment decision a customer must know what it will all cost and how the economics work. Most energy users are unaware of this and unable to obtain impartial and reliable information. Any cost information they can get is from market players – hoping to sell fuel or technology and this reduces the chances of energy users making investment decisions.	Provide commercial and technical advise and support to potential biomass users	SEI, Enterprise Ireland, Shannon Development and Energy Agencies
Complexity of investment process: If energy users wish to invest in fossil fuel systems they can do so with considerable ease. They can secure advice, help and support very easily and they have confidence it will be a simple enough process. This is not the case with bioenergy. In many instances – even if the business case is attractive – the effort of managing an investment process does not appear worthwhile. Most energy users are focussed on what their business does day to day (running a hospital, leisure centre, and hotel and so on) and to devote effort to a process that seems risky or difficult and complex is often a key barrier.	Provide commercial and technical advise and support to potentail biomass users	Leader, SEI, Enterprise Ireland, Shannon Development and Energy Agencies
Capacity of installers: This is a factor in the rate of market development. There are between 20 and 30 companies involved in the sector, they are all small and many are not based in the region. Based upon consultations as part of this report we believe that the majority of these companies employ fewer than 3 people. About 7 or 8 companies probably	In the longer term as demand increases the capacity of biomass installers will need to expand to cope with demand. This will require additional and bespoke training for installers to recruit trained staff.	CEB's, E.I., Leader, SEI, Skillsnet

employ more than 10 staff and will have installed around 10 systems each to date. Most of these companies have been established in the last 5 years. Many of them are cross sectoral and also involved in the supply of other renewable technologies – such as solar thermal panels.		
Design and project management skills: This is factor related to capacity – as there are only a small number of individuals in Ireland who presently have the technical and design skills to install a biomass energy system. It will take some years for the number of well qualified and suitably experienced individuals to grow to a point where market demand can be properly satisfied.	In the longer term as demand increases the capacity of biomass installers will need to expand to cope with demand. This will require additional and bespoke training for installers to recruit trained staff	CEB's, E.I, Leader, SEI, Skillsnet
Design quality: Related to capacity issues the impact that poor quality and badly specified projects can have on market development is very important. In most cases potential energy users will seek out examples of projects, so when there are very few examples those that are not good they provide good reason not to move forward. In that context the success and quality of the installed projects in the first few years of market development is much more important than in mature markets – where critical mass has already establish the sector.	In the short term good quality biomass installations are essentail to build market confidence. Best practice must be disseminated and all installed projects should be well designed, managed and implemented	SEI
Aftercare and maintenance: Energy users will be almost as interested in the quality of aftercare and maintenance as they will be in the quality of design and installation. This aspect of the market is not well developed and it is quite difficult	The capacity of biomass installers will need to be enhanced to offer higher levels of aftercare. This will require additional and bespoke training for	CEB's, E.I Leader, SEI, Skillsnet

for newly established companies to prove they can provide after sales service in a reliable and cost effective way.	installers to recruit trained staff	
Fuel supply: The development of a fuel supply chain is of course fundamental to market development. However it proceeds and not precedes installation of technology. Wood boiler systems demand fuel, rather than fuel supply companies creating markets simply because they exist. This creates a timing and scale issue. The main point is that as markets emerge it makes sense for fuel supply companies to become established if the fuel contracts on offer are commercially large enough to establish a business. This is one of the reasons why small scale installations are more difficult to develop in an early market.	Demand must be stimulated so that fuel supply can be developed by the private sector. The biomass loan scheme will provide help.	All
Fuel supply chains: In the longer term, as demand increases, there will be a need to establish more purpose grown energy crops and to extract more biomass from forestry sources.	Work to develop energy crops and provide advice and support in terms of growing and harvesting solid biomass. Research combustion technologies that can use energy crops	Teasgasc, Forest Service

6.3 CHP Market issues

In November 2008 the Western Development Commission published a report called an 'Assessment of Biomass CHP Market Potential in the Western Region'. This report concludes that:

'that biomass CHP using commercially available and proven technologies is only feasible for users with a continuous heat load of over 600 kW_{th}. This is a significant finding of our research.'

In the MWRA area this (continuous heat load) might include large process heat users in the pharmaceuticals industry, food processors, cement works and possibly a very few major public buildings like regional hospitals\airports and so on. This is a tightly defined and strictly limited market opportunity. There will only be a few locations to develop biomass CHP in the region.

The economics of biomass CHP.

The Renewable Energy Feed in Tariff price for electricity produced from biomass CHP has been set at €120 per MWh since January 2008. This was an increase from €72 per MWh prior to that. The impacts of this on the rates of market development in Ireland and the Mid West Region have yet to be established.

In addition grant aid funding is available through SEI's biomass CHP programme. However, there are a number of challanges with this funding:

- Projects must be completed by 2010 in order to secure grant
- The total cost of projects will often include district heating networks which are not covered by the SEI grant.
- This programme will not grant aid units smaller than 100 kW_e and will only support 5 units smaller than 500 kW_e.
- A planning application must be lodged,
- A power purchase agreement should be in place, and a grid offer applied for.

It is not expected that any biomass CHP project could be planned and developed by 2010 and be able to meet these conditions – on that basis any market development that does occur will only be able to benefit from the REFIT price. It has yet to be established if the REFIT price offers sufficient incentive for a few biomass CHP projects to emerge in the region.

Overall the possibilities for the development of biomass CHP in the region are limited, but there is reason to suppose one, or a number of larger projects could emerge by 2020.

6.4 Benefits of market development

The following provides an assessment of the benefits of developing the biomass sector. These are all based upon the targets proposed in this report to 2020:

- 2020 – 279,060 tonnes of biomass use and 349MWs of installed capacity

The assumptions that underpin these benefits are shown in appendix 8 of this report.

% penetrations of the MWRA heat market

The overall amount of the heat market that biomass can achieve is shown below

- 2015 – 7%
- 2020 – 12%

Fossil fuel displacement

The overall amount of oil that is replaced by 2020 is 56,100 tonnes of oil equivalent. This is equal to 62 million litres of oil.

Value of capital investment

The overall amount of capital expenditure expected (in 2009 prices) by 2020 is €148 million.

CO2 savings

The overall amount of CO2 that is saved by 2020 is 167,600 tonnes

Savings in fuel costs

The difference in price between imported fossil fuels and using locally produced biomass means that by 2020 the region will save €9.7 million annually (at 2009 prices).

Jobs created

By 2020 about 420 new FTE jobs will be created in the supply chain and installation of biomass systems.

Appendix 1: Scope of work

Work Package 1: Market evaluation

This initial phase draws upon the existing information and data available on the potential end-use of solid biomass in the region. It presents a general picture of the scope for development within the region while also identifying issues which need to be addressed in future work packages; it covers:

- Policy, fiscal, regulation and planning context
- Data collection\consultation and desk based review of heat\CHP market (size\extent\prices etc)
- Consideration of co-fire and bio-electricity market prospects
- Data collection\consultation and desk based review of current wood energy market activity
- Analysis of data, consideration of market potential for wood energy
- Identification of data/information gaps which will require addressing

Work Package 2: Resource analysis

This phase involves a review of the resource within the region (existing and potential), it covers:

- Data collection\consultation and desk based review of
    - forestry sector – focus on small roundwood forecasts\site constraints etc
    - energy crop sector – focus on miscanthus initially
    - solid farm wastes – chicken litter, straw etc.
- Sawmill co-product\post consumer wood\energy crops analysis – volumes\prices etc
- Competing market uses\prices – board mills etc
- Consideration of data and review fuel supply challenges\problems\constraints
- Identification of data/information gaps which will require addressing

Work Package 3: Market consultation and action research

This phase was a sustained period of consultation with a wide range of market players to ensure that the final action meets the needs of the market. The actions involved in this work package include:

- Development of lists of actors in the relevant supply chains
- Surveys of potential suppliers and end-users
- Targeted events including:
    - a ‘wood fuel suppliers workshop’
    - focused meetings with installers, or
    - bringing together possible wood heat customers

Work Package 4: Reporting and promotion

The final phase is effectively this report and it presents the findings of the study in terms of:

- The resource(s) in the region – current and potential
- The end-users for the resource – current and potential
- The steps to be taken to maximise the local use of that resource
- The steps the relevant stakeholders have to take to achieve this
- A realistic and achievable set of actions for the next 5 years to meet the targets identified.

Appendix 2: County by County Statistics

County Clare:

The population of this area was 110,800 in 2006. This accounts for 30.72 percent of the total regional population. Clare has 43,694 ha of forestry covering 14% on the land area, with 47% of that in private ownership. Clare accounts for 28% of the regions total final energy consumption.

North Tipperary:

The population of this area was 65,988 in 2006, which is 18.30 per cent of the regional population. North Tipperary has 47,793 ha of forestry covering 11.2% on the land area, with 41% of that in private ownership. North Tipperary accounts for 23% of the regions total final energy consumption.

City of Limerick:

The population of the city of Limerick accounts for 52,560 inhabitants. Limerick City accounts for 13% of the regions total final energy consumption.

County Limerick:

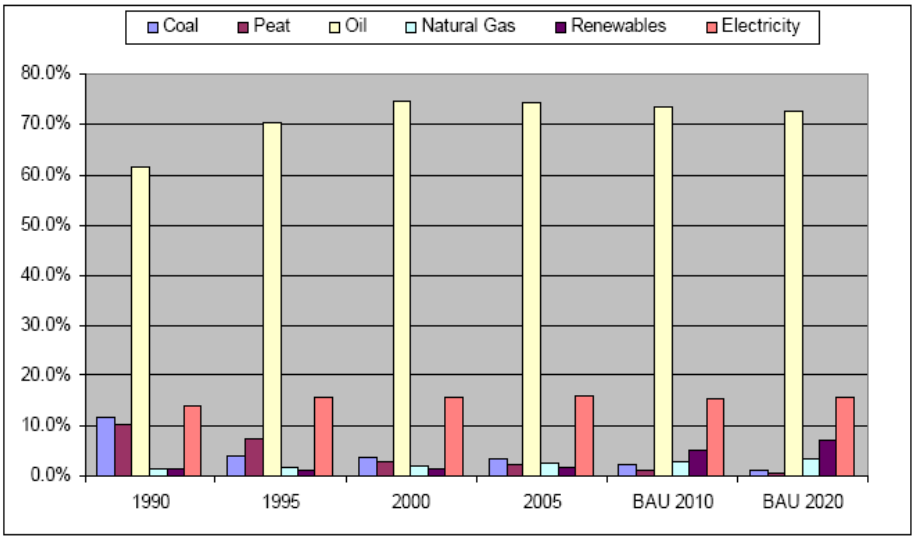
The population of this area was 131,303 in 2006. This is over a third of the population in the region (36.41 per cent). . Limerick has 20,256 ha of forestry covering 8% on the land area, with 42% of that in private ownership Limerick County accounts for 36% of the regions total final energy consumption.

Appendix 3: Mid West Climate Change Strategy

The Mid West Regional Authority produced a Climate Change Strategy in 2007, which was launched in February 2008. The Strategy identifies the issues which the region faces in terms of achieving its Kyoto and post Kyoto targets and the activities which need to be taken regionally and within each Local Authority in the Mid West Region. The Strategy shows how the region uses energy.

This is illustrated in the table and chart below, which show total final energy consumption by fuel type in GWhs since 1990 and forecast going forward to 2020.

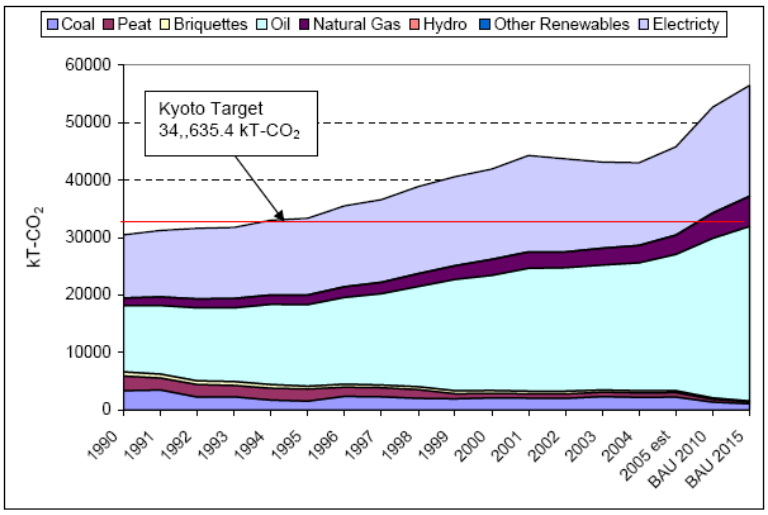
GWh	1990	1995	2000	2005	BAU 2010	BAU 2020
Coal	860.8	322.4	411.8	449.2	338.9	185.1
Peat	762.9	614.6	304.4	282.0	193.1	80.7
Oil	4,629.4	5,883.5	8,368.6	9,813.3	11,646.4	12,875.4
Natural Gas	100.6	138.9	206.1	350.0	453.4	581.7
Renewables	111.3	105.3	150.7	220.9	812.7	1,238.7
Electricity	1,036.2	1,298.1	1,751.4	2,097.6	2,415.5	2,749.0
TFC	7,501.2	8,362.9	11,193.0	13,212.9	15,860.0	17,710.6



The most relevant point about this is that region relies heavily on oil.

The strategy shows that all areas within the region are projected to exceed the requirements as set out under the Kyoto Protocol in terms of CO2 emissions.

On a national basis this is illustrated in the table below:



This translates in significant implications in terms of cost, as shown in the table below:

	Energy Related Emissions k T-CO_2	**Projected Difference to Target**	**Projected Cost of CO_2/ton Trading Price (€)**	**Annual CO_2 Costs (Million €)**
1990 Levels	30,649	-	-	-
Kyoto Targets +13%	34,635.4	-	-	-
2005 Estimate	43,758	9,125	27	246
2010 BAU	51,451	16,818	35	589

The total quantity of CO2 savings that will be required in the MWRA region is estimated to be 1,700 kTonnes of CO2 by 2010. This equates to a value of 4.8 to 5.2 Tonnes of CO2 per person in the County areas and 3.1 Tonnes CO2 within the City.

The following levels of exceedance have been identified in the region:

- 654 kTonnes CO2 in Limerick County
- 552 kTonnes CO2 for Clare County
- 346 kTonnes CO2 in North Tipperary
- 164 kTonnes CO2 in Limerick City

In recognition of the need to find ways of reducing reliance on oil and reduce C02 emissions an Action Plan was published to accompany the strategy and actions have been assigned to the Regional Authority, Local Authorities and the two local Energy Agencies.

The Mid West Climate Change Strategy states:

'technologies which present the most significant opportunities (for thermal energy production) include:

- *Solid Biomass (wood, energy crops etc.)*
- *Anaerobic Digestion*
- *Large Scale Geothermal/Solar projects'*

The climate change strategy reinforces the national policy and confirms the focus on bioenergy in the region.

Appendix 4: Energy White Paper

In March 2007 the Department of Communications Energy and Natural Resources published a Government White Paper on energy called 'Delivering a Sustainable Energy Future for Ireland'.

The White Paper places sustainability at the heart of the Government's energy policy objectives. The challenge of creating a sustainable energy future for Ireland is proposed to be met through a range of strategies, targets and actions to deliver environmentally sustainable energy supply and use, including:

- Accelerating the growth of renewable energy sources
- Delivering an integrated approach to the sustainable development and use of bioenergy resources

The White Paper contains three core issues:

- Sustainability
- Security
- Competitiveness

The development of a bioenergy action plan for the MWRA region is well aligned to these objectives and issues for the following reasons:

Bioenergy is sustainable because the fuel resource will be harvested from sustainably managed forests, agricultural land and other *regional* sources, and replace the use of imported and finite fossil fuels. In addition fossil fuels emit CO2 when they are used for energy production. However bioenergy fuels are in a closed carbon cycle. They fix carbon during growth and release the equivalent amount of carbon when used for energy.

In terms of security virtually all fossil fuels used in the Mid West region are imported – these resources are not owned or controlled by the region or Ireland as a whole. In contrast, most bioenergy will be owned, grown, managed and processed in the region.

In terms of competiveness this report shows bioenergy fuel is usually the lowest cost energy source in the region.

Another important aspect of the White Paper is the emphasis it places on partnerships to deliver on the aspirations. It states:

'We will improve the linkages between Government Departments, State-sponsored bodies and regional and local organisations to enhance the delivery of energy policy and service delivery at all levels, and, in that context, review the remits, structures and funding arrangements associated with the local energy agencies, with the aim of enhancing their valuable role, taking account of the need to balance efficiency, operational economies of scale and the benefits of local action'

The MWRA bioenergy action plan is in line with national policy and it will involve and engage key regional stakeholders.

Appendix 5: Solid Biomass Resources of the Region

Forestry Resources

The National Forest Inventory (NFI) published by the Forest Service, Department of Agriculture Food and Fisheries 2007 indicates that the total stocked forest area for both the public and private sectors is 106,460ha for the counties Clare, Limerick and Tipperary (in its entirety) this equates to approximately 10.5% of the total MWRA area. The breakdown of this resource is shown in the table below.

County	Clare	Limerick	Tipperary Nth & Sth	Totals
Public '000ha	22.52	9.98	26.72	59.22
Private Grant Aided '000ha	14.08	9.98	12.36	36.42
Private Other '000ha	6.84	0.40	3.59	10.83
Totals – 000ha	43.44	20.36	42.67	106,460

Source: NFI Forest Service 2007

The areas quoted above refer to net forest areas, that is, all unproductive areas within the plantations have been excluded. By using net productive areas the production forecasts are more accurate. Clearly these forest areas supply wood for a range of existing markets, and so we have attempted to estimate the quantity of material that might be available for energy use. This report considers the potential available supply for wood energy from both the private sector and public sector woodland resource.

Private sector forestry

The timber coming from the private sector is all *new to the market* and therefore is available to the biomass sector without displacing any existing markets. We have therefore assumed all the current and future harvest of private sector timber will be available for biomass markets.

However in calculating the potential yield from the private estate only grant aided plantations established since 1982 have been included, this excludes old mature plantations which will yield little in the form of pulpwood and furthermore it excludes any areas of scrub type forests such as that found on the Burren. A further provision has been made for areas which will not be thinned due to access problems or where soil types would prevent thinning.

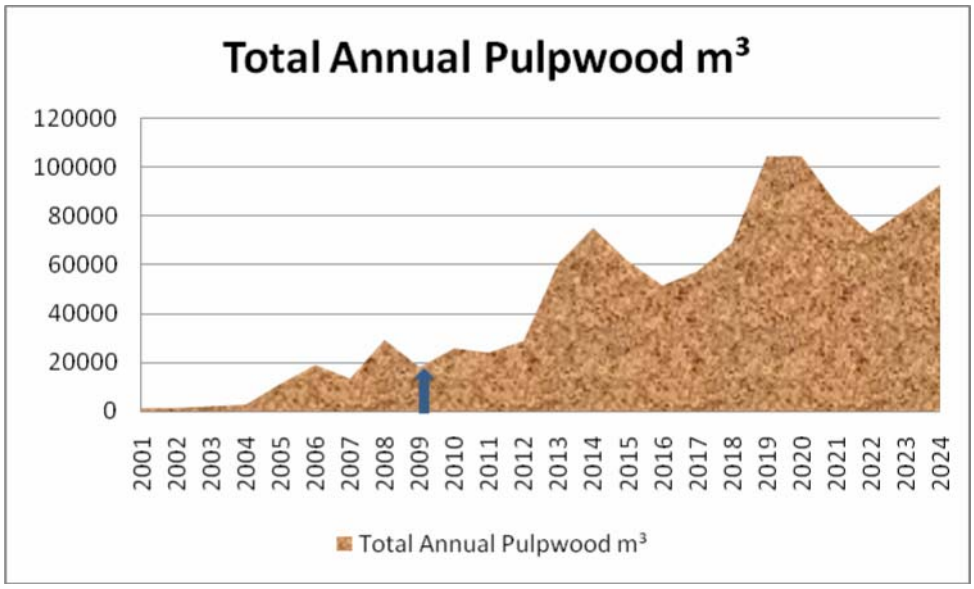
The graph below indicates the private planting in the Mid West Region excluding South Tipperary. The portion of the graph coloured blue is the area which is deemed suitable for thinning.

Annual Planting – Thinning area and no thin area – Source Forest Service and Average thinning yields

Thinning is the removal of a portion of the crop, it commences between the ages of 15 and 21 years depending on the productivity of the site and other site specific factors. Thinning is generally carried out on a five year cycle. Up to 70% of the annual increment (the amount a forest grows each year) can be removed during thinning without having a negative impact on total volume production over the course of the rotation (the tree life) . For this reason thinning is considered to be sustainable practice.

The forecast below is based on the average volume removed during a thinning - 50m³ per hectare. This is based on actual yields from thinnings carried out over a wide range of tree species and site types and is some 15 to 20m³ per ha less than the recommended level. Therefore, the production forecast is deemed to be consevative in terms of potenial yield.

The graph below indicates that the potential yield from the private estate in 2009 could be in the order of 18,050m³ of solid wood, increasing over time to a potential yield 105,000m³ in 2020.



Annual supply of pulpwood from the private sector.

The forecast variation in annual yield (2009 to 2024) will level out in practice because thinning will commence at different ages and with different management practices. This should all be available for energy use in the region. This shows that there is large and radiply expanding resource of forest thinings from the privately owned forests that will be avilable for biomass use.

Public sector forestry

The forecast from the public sector woodlands is based on Coillte's internal inventory and their estimate of the volume which would be available to the biomass market over and above their contractual commitments to existing boardmills. Again this means we are only forecasting wood for biomass that has no existing market and would not be used for other markets.

Coillte has indicated they could make available up to 10,000 tonnes annually to the biomass market, without impacting on it's contractual commitments to the existing boardmills. This timber would be sold by the "on-line" timber auctions.

Where Coillte enters into a joint venture with an end user to install a biomass system, we understand that the fuel requirement for such a project would be in addition to the 10,000 tonnes referred to above. We have not included this pontentail material in our forecasts as we cannot predict if it will be avilable as that will be at the discretion of Coillte and in part be a function of how demand holds up in the boardmill sector.

Lop and top

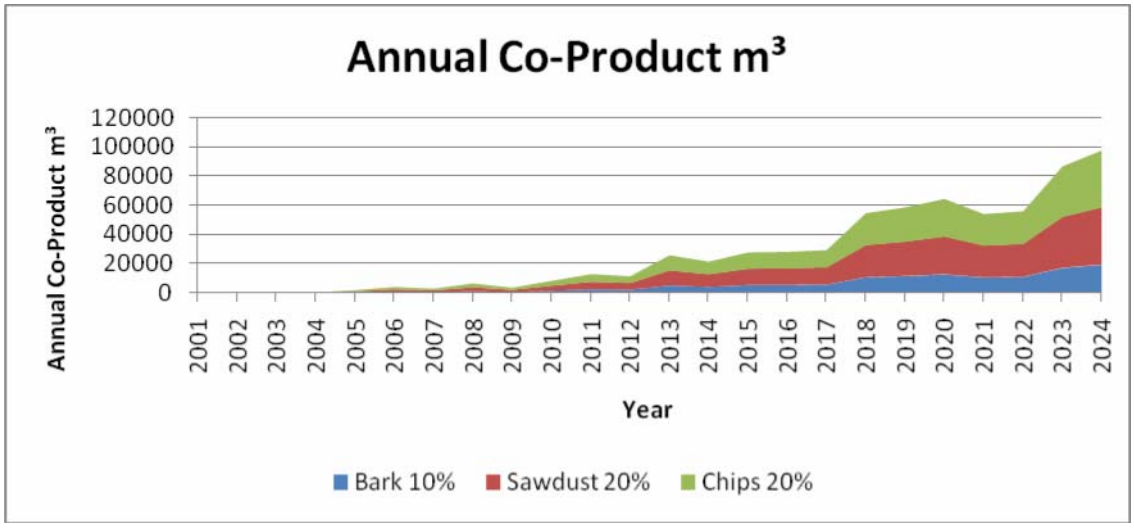
A third potential source of wood from the forests is the removal of 'lop and top'. These are the branches, tree tops and broken stems left on site after the crop has been clearfelled. This

material is gathered and bailed and may yield up to 20m³ per ha in the form of a fibre log suitable for large boiler installations. Coillte have plans to undertake a study into this form of harvesting in 2009.

Wood processing co-products

There are no significant timber processors (sawmills) within the MWRA area and therefore round logs are exported to other regions for processing. This results in a loss of raw material to the supply chain. The graph below illustrates the volume of co-product which is lost to the region. It assumes the following;

- bark represents 10% of total volume of round logs
- sawdust and woodchips account for 40% of the total volume of round logs



Estimated volume of co-product lost to the region based on round log processing taking place in sawmills outside the MWR.

We have consulted with key industry players and currently we estimate that 2,500 tonnes are produced and retained within the region. This material is used as boiler fuel or for the production of timber briquettes or sold as off cuts into firewood market. The remainder is lost to the region because of a lack of processing facilities.

Post consumer wood waste

Statistics for recycled wood are not available on a regional basis as companies reporting to Repak and the EPA do so on total in-take and processing and their operating radius may cover a number of regional areas. Therefore, our estimate for post consumer wood waste is based on a population proxy. The population of mid west region in the National Census 2006 is 8.5% of the total population.

The EPA's National Waste Report 2007 states that the national figure for recycled wood is 223,924 tonnes (including packaging material and other streams). Of this total figure 71,774 tonnes were recycled as woodchips for biomass boilers. By applying the population proxy the estimate for the region is 6,100 tonnes at 45% MC is used for biomass at present. We believe this material was either sold to existing large scale biomass boilers or used as a blender with miscanthus to produce briquettes.

Annual production of recovery wood i.e. wood chips available for wood energy is largely dependent on general economic activity and the quantities at any given time will reflect the level of activity across many sectors of the economy. This suggests that over the next few years there may be a decline in the availability of post consumer wood waste for biomass use.

Purpose grown energy crops

Purpose grown energy crops are usually fast growing and harvested on short rotations or an annual basis. Miscanthus and willow short rotation coppice (SRC) plantations are considered the main crops.

SRC is planted on agricultural land and harvested every 3 to 5 years, the annual average productivity is about 6-12 tonnes of dry matter per hectare (Teagasc, 2008). These crops can also be used for bioremediation where sludges are spread and a gate fee is charged.

Miscanthus, switch grass and hemp. These crops are harvested annually and usually come to full production in two to three years. Miscanthus shows biomass yields of 10-15 tonnes of dry matter (d.m) per hectare per year. Teagasc, Oakpark achieved yields of 12t/ha for Hemp during three year research trials between 1997 and 1999.

The table below indicates how many hectares have been planted with energy crops. Of particular note is the rapid expansion of Miscanthus, this trend is set to continue given the level of applications for grant received by the Department of Agriculture.

Crop	**Clare**		**Limerick**		**Nth Tipperary**		**MWR Total**	
Units:	ha	t	ha	t	ha	t	ha	t
Miscanthus @16% MC	14.99	270	416.00	7488	83.85	1509	514.84	9267
Switch Grass @ 18% MC					15.2	152	15.2	152
Hemp @15% MC			7.59	91	14.33	172	21.92	263
SRC @15% MC					4.76	72	4.76	72

Distribution and Planting of energy crops from 2004 to 2008 Source: Department of Agriculture and Contractors

There are some variations between the Department of Agriculture's figures and those supplied by contractors involved in the establishment of energy crops. These variations arise for a number of reasons including that some of the early crops planted are recorded by the Department of Agriculture as fodder crops rather than energy crops. However, since the introduction of grants and premia for miscanthus and SRC all crops are now recorded as energy crops.

Solid farm wastes

Solid farm wastes include chicken litter from the poultry sector; spent mushroom compost (SMC) and straw.

Poultry Litter

Poultry litter is used mainly in land spread as a fertiliser and within the horticultural industry or as a component of mushroom compost. The commercial poultry sector is based in West Limerick, producing 13 million birds per annum.

The annual production of poultry litter is estimated by the producers as follows:

1.3 tonnes per 1,000 birds => 13m / 1000 = 13,000 X 1.3 = 16,900 tonnes at 30% MC per annum.

This is a reduction from a peak of 30,000 tonnes and reflects major changes which the poultry sector has undergone in recent years.

At present 55% of the litter is used for land spread and 40% is used for composting. 5% is being used in a pilot project to assess the potential of chicken litter as a fuel source using fluidised bed combustion technologies.

Disposing of the litter represents a charge to the producers or at best a break even. On that basis it could be assumed that the poultry litter producers would be willing to sell all 16,900 tonnes into a biomass market – should it emerge.

Spent Mushroom Compost SMC

There is only one operating mushroom farm within the region, this farm is currently producing 20 – 25 tonnes of compost per week – annually this amounts to 1170 tonnes @ 50% MC.

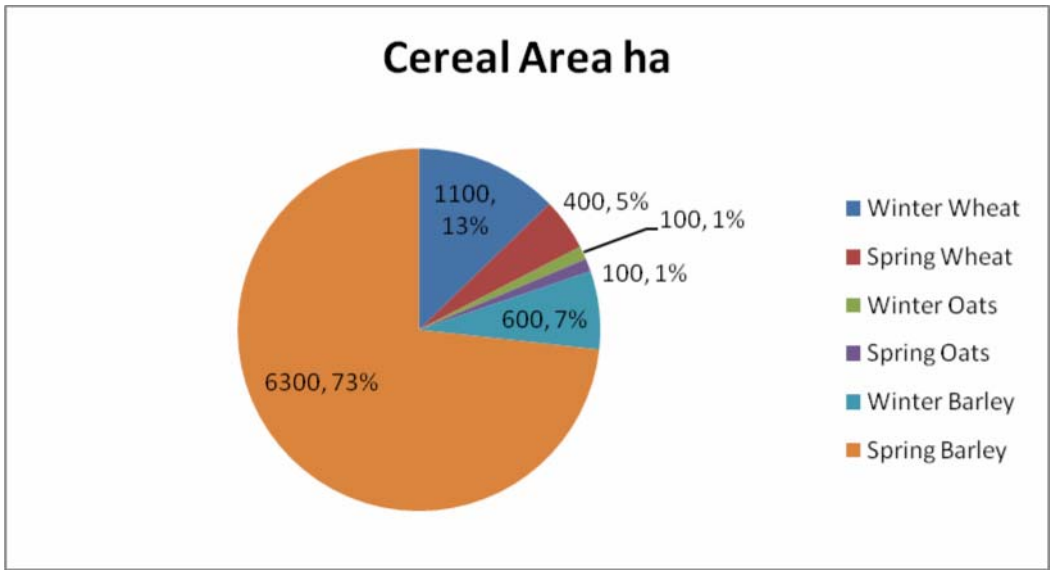
At present this is land filled which incurs charges or it is given away to horticultural contractors and individuals to avoid haulage costs. On that basis it could assumed that the producer would be willing sell all 1170 tonnes into a biomass market – should it emerge.

Straw

Straw is a side-product of the wheat, barley and oats harvest. Dried, it can be used as a feedstock for biomass combustion plants. 76% of straw produced in Ireland today is used for animal bedding. Barley straw is the best quality straw and is used in bedding or as an additive to concentrated foods. Wheat straw with its higher moisture content is suitable for production of mushroom compost.

The production of straw from the three main cereal crops is considered in this part of the report. The CSO Farm Survey 2007 (published December 2008) provides key agricultural data regarding all aspects of farming. The information is gathered from sample farms and this data is then extrapolated to county, regional and finally to national levels.

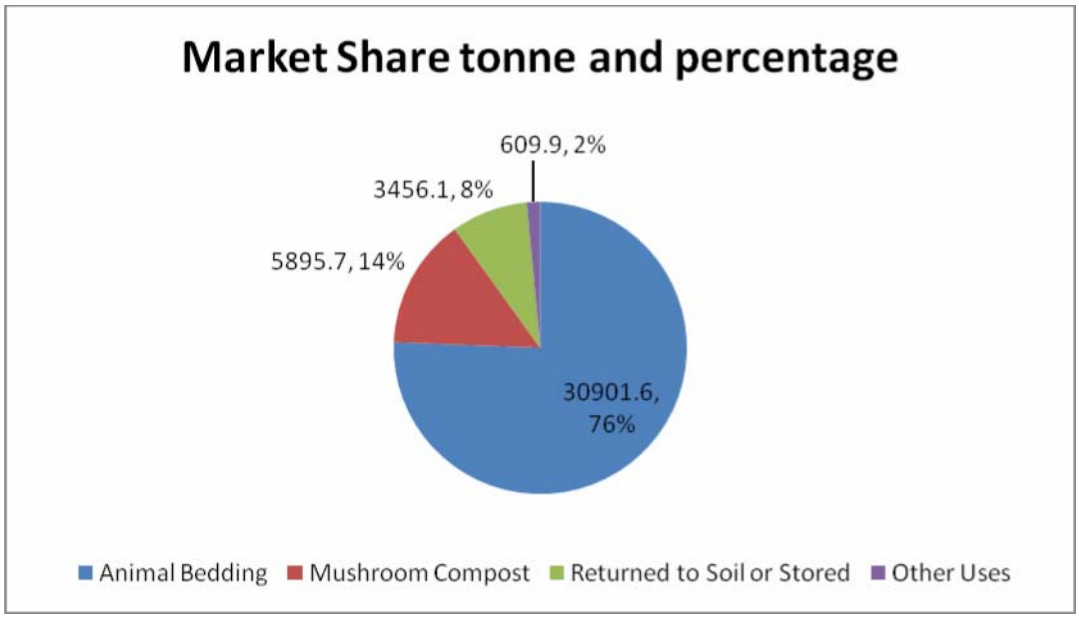
The chart below illustrates the areas in hectares for the six cereal crops grown within the region. The total for June 2007 was 8,600ha of which Spring Barley account for 73% or 6,300ha.



The table below shows that the total straw resource within in the region in 2007 was estimated to be 40,660 tonnes at 16% MC, with an average yield of 4.7t/ha.

Crop Type	ha	Ave Straw t/ha	Total Yield
Winter Wheat Straw	1100	8.0	8,800
Spring Wheat Straw	400	6.0	2,400
Winter Oats Straw	100	7.0	700
Spring Oats Straw	100	5.6	560
Winter Barley Straw	600	5.0	3,000
Spring Barley Straw	6300	4.0	25,200
Totals	8600		40,660

The market for straw fluctuates over time depending on weather, market demand and costs of inputs; diesel and fertilisers. SEI's report into Dry Agricultural Residues in Ireland – indicates that the average demand from various markets for straw can be illustrated as follows:



Animal bedding accounts for 76% of the market for straw, followed by mushroom composters at 14%.

The demand for bedding depends on a number of factors such as livestock numbers. In recent years the numbers of live stock have fallen resulting in a lower demand for bedding. The rapid increase in the number of slatted houses will also reduce the demand for bedding.

Any straw which is available for bioenergy will come from the class returned to soil or stored. This could potentially yield 3,450 tonnes at 16% MC annually; the availability of straw from this category will depend on value of the straw as fertiliser.

Straw has a relatively high value as a fertiliser when ploughed in and returned to the soil. Given the current high cost of compound fertilisers straw now has a potential value of between €72 and €139 per hectare as a fertiliser (IFJ July 2008). Therefore the cost benefits of incorporating (ploughing in) or baling straw must be carefully considered. However, the slight fall in demand from the bedding and mushroom sector may compensate for straw which is ploughed in.

Taking all this into account we estimate that approximately 3,500t to 4,000 tonnes @ 15 – 16% MC is available for energy use.

Appendix 6: Cost of biomass fuels

Forestry resources

The price of forestry produced wood fuel is built up by a series of costs. These comprise the costs of harvesting, chipping, haulage and need for the forest owners and the contractors involved in harvesting and chipping to secure a reasonable profit.

Based upon interviews with forestry contractors we have found that the following range of prices (for pulpwood) will allow the first thinning to be undertaken on a commercially attractive basis[15] in the region:

Price to grower	= €2.5 to €5 per tonne
Harvesting costs	= €26 to €34 per tonne
Haulage to wood fuel process depot	= €6 to €8 per tonne
Chipping into energy fuel	= €7 to €10 per tonne
Haulage to boiler	= €6 to €8 per tonne
Overheads and admin costs	= €8 to €10 per tonne
Total	**= €55.50 to €75**

This report concludes that a price for delivered forestry produced wood fuel in the range €55.5 to €75 per tonne (at 50% moisture content) should make it commercially viable for all those involved in the supply chain.

Timber sourced from the Public Sector will be sold via an “on-line” auction, however it is expected that the forest gate prices will be in the region of €26 - €30 per tonnes and that similar chipping and haulage charges will apply to those in the private sector.

At present there is no data available for fibre logs because this type of harvesting is still at a research stage. Coillte are scheduled to undertake this research during the summer of 2009.

Wood processing co-products

Prices for woodchips and sawdust at 45% moisture content to boardmills are between €32 and €38 per tonne delivered.

Post consumer wood waste

This material is either supplied to large scale biomass boilers or it is used to produce briquettes – either in pure timber briquettes or a mixed with other fuels such as miscanthus to produce briquettes. Prices quoted €15/t .

[15] All figures are shown at 50% moisture content

Purpose grown energy crops

Miscanthus and Switch Grass

Prices quoted to date for miscanthus and switch grass are €60 to €65/t at the farm gate. Processing cost to produce a shredded material suitable for combustion are similar to those involved in producing wood chips.

Harvesting cost per tonne for Miscanthus and Switch Grass

Price to grower	= €48.50 per tonne
Harvesting costs	= €16.50per tonne
Haulage to fuel process depot	= €6 to €8 per tonne
Shredding into energy fuel	= €7 to €10 per tonne
Haulage to boiler	= €6 to €8 per tonne
Overheads and admin costs	= €8 to €10 per tonne

This implies a cost of ***€92 per tonne*** delivered to a silo at a biomass installation.

Hemp

Prices quoted for baled hemp i.e. a gate price range from ***€150/t to €180/t*** depending on time of delivery.

SRC (Willow)

SRC – there are two common harvesting options for SRC:

- Rod harvesting, where the stems are cut and piled in loose piles at roadside to dry down to the required moisture content
- Direct chip harvesting in which the stems are harvested and chipped. Freshly harvested chips have a moisture content of 50% and therefore forced drying is required to ensure long-term storage.

Harvesting cost per tonne for SRC 15 – 20% MC

Price to grower	= €5.40 per tonne
Harvesting costs	= €20.00 per tonne
Haulage to fuel process depot	= €8 to €12 per tonne
Drying	= €12 per tonne
Chipping into energy fuel	= €7 to €10 per tonne
Haulage to boiler	= €8 to €12 per tonne
Overheads and admin costs	= €8 to €10 per tonne

Therefore a tonne of SRC chips at 15 – 20% MC is approximately ***€56.50 per tonne***

Solid farm wastes

The farm gate price for straw based on a 4'X4' round bale is currently between ***€50 and €65 per tonne.***

At present poultry litter and SMC are treated as a cost to the business where land fill or land spread charges are incurred or at best these wastes are removed at a cost equal to the transport cost.

Appendix 7: Energy Users Consultation Events

In January 3 events were undertaken to obtain the views of energy users in the Region. These were held on 21st and 22nd of January 2009 in:

- Ennis
- Nenagh
- Limerick

The events were publicised in the local press. In addition a large number of emails were sent out to companies and organisations it was hoped would be interested to attend. These emails were supplemented by direct telephone calls to invite other organisations. Both the emails and calls were followed up.

The following attended the events:

Domonic O'Rourke	Reagcon
Bill Keough	Clogrendane Lime
Jerry Ryan	Arrabann Co-op
Siona Daly	Tipperary Energy Agency
Paul Kerry	Tipperary Energy Agency
Brian Pope	Tipperary Institute
Pauline Ryan	Tipperary Institute
Kevin Healion	Tipperary Institute
Derek Blackworl	Tipperary Institute
James Haugh	
Breida Russell	Irish Cement
Brian Sleel	Wyeth Nutrienal
John Sullivan	E3 Energy Solutions
Neil Lremin	Anderson Ireland
Jack O'Connor	Biomass heating solutions ltd

At the 3 meetings the preliminary results of study were presented. This included information on the policy context, the available biomass resource and the market opportunities. The presentations focused on the market barriers and market opportunities and sought to stimulate discussion on what energy users might need to invest in biomass solutions.

The findings

All the meetings stimulated a number of questions and established the views of the participants to various aspects of the biomass sector.

It was evident that most participants supported efforts to help grow the Biomass sector in the Region.

Overall, it can be noted that there was agreement on the need to focus on the heat and CHP markets. There appeared to be a consensus that electricity and co-fire markets were not worth promoting on a Regional basis.

Many of the larger energy users that attended seemed particularly interested in CHP and it appeared there may be a greater level of interest in this sector than there has been in the past.

Several participants highlighted that access to capital funds were a key stumbling block, even if the payback was highly attractive. The ability for energy users in all sectors to secure investment finance seemed to be a large issue.

Related to this some energy users highlighted the challenges of securing independent and reliable advice and support as they develop biomass schemes.

One or two participants expressed concerns over planning permission and the delays this can introduce to the development process.

Some participants acknowledged the ambitious national targets for biomass and wondered why there wasn't a greater level of national fiscal support to help deliver these. They pointed out that many other EU nations had much greater levels of support. Some suggested tax changes and others suggested higher feed in tariffs for renewable electricity.

There was a good level of support for a Regional biomass fund to support capital investment. Those with CHP needs expressed the need for some assistance in project development.

Notice of Public Meeting for Large Energy Users

The Mid Western Regional Authority MWRA has engaged Steve Luker & Ass. Ltd, (SLA) and Developing Alternative Rural Enterprise, (DARE) to progress work in relation to the development of solid biomass in the region. The MWRA wishes to put a plan together which will be action orientated and serve as a tool for the development of the sector in the region. It is planned that the action plan will focus on solid biomass resources such as:

- Forestry resources (thinning, residues, by-products (e.g. saw-dust) etc)
- Energy Crops (miscanthus, willow etc.)
- Solid Farm Waste (chicken litter, straw etc.)

It will primarily focus on the heat and Combined Heat and Power (CHP) market.

As part of this research the MWRA wishes to consult with energy users to discuss the potential for biomass within the region with regard to EU, National and Regional Targets for Renewable Energy. To facilitate these discussions the MWRA will be hosting a series of seminars to present the case for biomass and to gather the opinions of those within the region with ***annual energy bills in excess of €40,000.***

Date	Time	Venue	Location	County
21/01/09	10.00am – 12.30pm	Abbey Court Hotel	Nenagh	Co. Tipperary
21/01/09	3.00pm – 5.30pm	Maldron Hotel	Limerick	Limerick City
22/01/09	10.00am – 12.30pm	Clare Inn	Dromoland	Co. Clare

Those interested in attending should contact:

Seamus Treacy, Mid-West Regional Authority streacy@mwra.ie or 067 33197

Or

Paddy Donovan, DARE Ltd 091 637964 or 0872852066 or by email dare@iolfree.ie

Appendix 8: Benefits of biomass

Year	Market Share % *1	New Capacity installed MW	Total Capacity Installed MW	Capital Value €m *2	Biomass tonnes @ 50%MC t *3	Estimated Value of Fuel €m *4	Target GWh	ktoe	CO_2 Savings kt *9	Fossil Fuel Displaced Oil	Fossil Fuel Cost €m *6	Fuel Savings £m *7	Jobs Created *8
2010	5.00%	1	21	9.6	16800	1.1	39	3.4	24.2	3.7	1.7	0.6	26
2015	7.00%	182	204	91.7	162785	10.6	381	32.7	96.1	36.1	16.2	5.7	245
2020	12.00%	145	349	157.1	279060	18.1	652	56.1	167.6	61.8	27.8	9.7	419
Total		329											

Notes

*1 Revised Regional targets set to achieve National Targets by 2020

*2 Assuming a cost of €450,000 per MW installed

*3 Converted a common base tonnes of biomass at 50%MC

*4 Delivered price of biomass to silo €65/t @ 50% MC

*5 Fuel displaced at 10.55kWh per litre of oil

*6 Price per litre of oil €0.45 per litre

*7 Difference between Oil and Biomass

*8 Estimated 1.2 jobs per MW installed

*9 Based on 71.4 t CO_2 per TJ

Appendix 9: County by County biomass resource data

Source tonnes at 50%MC	Current Supply			BAU 2015			BAU 2020	
	Clare	Limerick	Nth Tipperary	Clare	Limerick	Nth Tipperary	Clare	Limerick
	2010	2010	2010	2015	2015	2015	2020	2020
	Avail	Avail	Avail	BAU	BAU	BAU	BAU	BAU
Private Sector Forests	10479	4723	10436	22756	25974	12686	58014	33527
Co-Product	2810			2810			2810	
Recycled Wood	3551	5893	2115	3551	5893	2115	3551	5893
Miscanthus	400	11096	2236	882	24469	4932	1386	38458
SRC			133	20		146	51	
Switch Grass			347		46	387		96
Hemp			527		80	578		160
Public Sector Forests								
Straw								
Poultry Litter								
SMC								
Total Supply	**17240**	**21712**	**15793**	**30020**	**56463**	**20845**	**65812**	**78134**
Estimated Demand tonnes @ 50%MC				50011	82989	29785	85734	142267
Shortfall (-) or Surplus tonnes @ 50%MC				-19992	-26526	-8940	-19922	-64133
				Regional Shortfall			Regional Shortfall	
Regional Situation				2015	-55458		2020	-111145

Appendix 10: Explanation of terms

Short Rotation Coppice (SRC)

Trees, usually willow, that are specially planted and managed to produce wood fuel on agricultural land. SRC is harvested every 3 to 5 years as the trees grow and produce enough wood for a harvest.

Business as Usual (BAU)

Used in this report to refer to a situation that assumes no changes to the current situation. It allows a comparison with proposed interventions and compares these to a continuation of current polices and practices.

Mid Western Region Area (MWRA)

The Mid-West Region comprises County Clare, Limerick City, County Limerick and North Tipperary. The region has about 10% of the national land area and 8.5% of national population.

Carbon neutral fuel source

Strictly there are no carbon neutral fuel sources, as in operation all energy sources will be responsible for some carbon emissions during their production or combustion. However this study has assumed sustainably managed forestry is a carbon neutral fuel source. This is because the wood chips this forestry produces emit an equal amount of carbon during combustion as they did during the growth of the tree they came from. This is known as a closed carbon loop and defines such wood fuels carbon neutral.

Biomass

Biomass can be defined as the biodegradable fraction of products, wastes and residues from agricultural, forestry and related industries, as well as the biodegradable fraction of industrial and municipal waste. There is no common definition of biomass fuels, but the following list summarises the main sources:

- Cereal and agricultural crops (straw\OSR\sugar beet etc)
- Spent cooking oils
- Animal slurries
- Solid municipal waste and refuse derived fuels
- Industrial and commercial wastes (particularly from the food sectors)
- Wood

Wood chips

The most common form of wood fuel made from solid wood (usually round logs) that is chipped into graded particles.

Wood pellets

A common form of biomass fuel made from sawdust feedstock that is compressed into a small energy dense pellet.

Moisture Content (MC)

Wood chips can be produced and supplied to differing moisture contents and the moisture content affects the energy content of the wood chips. For example 1 tonne of wood chips at 50% moisture content contains much less energy than 1 tonne of wood chips at 30% moisture content. Therefore to provide equal amounts of energy higher moisture content wood fuels must be used in greater quantity. Purchasers of fuel often therefore agree to a price based the MWhs of energy it provides measured via a heat meter. This avoids the need to measure the moisture of every delivered load.

Wood heat

A term used to define wood fuel combustion technologies designed to provide heating and hot water. Generally these technologies replace conventional gas or oil fired heating boilers. They will include pellet, chip and log boilers.

Wood energy

A subset of biomass energy. Across the EU 85% of the biomass market is supplied with solid wood biomass - this is about 100 million tonnes of wood. There are usually four possible sources of solid wood biomass fuel:

6) Forestry
7) Co-products of sawmill industry
8) Post consumer wood waste
9) Purpose grown energy crops.

Energy crops

Biomass fuels produced from purpose grown agricultural crops such as straw and fast growing willow coppice.

KW or MW

KW (Kilowatts) and MW (Megawatts) are terms used to rate the maximum energy output of a boiler.

KW or MW hours

One watt-hour is the amount of energy expended by a one-watt load (e.g., light bulb) drawing power for one hour. For example a 100W light bulb (0.1 kW) left on for 10 hours per day will consume 1 kilowatt-hour per day (0.1 kW x 10 h). A 500KW wood chip boiler will probably run at full load for say 3,000 hours a year and so its annual output will be 500KW x 3000 hours = 1,500,000KWhs.

The table below shows the most common multiples and terms:

Multiple	Name	Symbol
1	watt-hour	W·h
1,000	kilowatt-hour	kW·h
1,000,000	megawatt-hour	MW·h
1,000,000,000	gigawatt-hour	GW·h

So for example 1 tonne of wood chips at 40% moisture content contains 2929 kWhs of energy or 2.93 MWhs of energy.

Appendix 11: List of Consultees

Department of Agriculture, Fisheries and Food
Teagasc
Coillte Teo
Central Statistics Office
Environmental Protection Agency
REPAK
ESB
Bord na Mona
Clare County Council
Limerick County Council
Limerick City Council
North Tipperary County Council
IFA
JHM Crops Ltd.
Clean Ireland Ltd
Clare Wood Chip Co. Ltd
Torpey Timber Products Ltd
Snowcap Mushrooms Ltd.
Biomass Heating Solutions Ltd.
Edwin Stryker – Poultry Producer
McMahon Biofuels Ltd.
GEGA

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