



Wood Energy Development in the Western Region



Western Development Commission February 2007

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Foreword

Changing to locally available, renewable energy can make significant positive impacts on the environment and serves to reduce our reliance on imported fossil fuels. Critically for the Western Region, renewable energy presents rural communities with opportunities for economic regeneration, creating wealth and employment in rural areas. The Western Development Commission (WDC) is committed to supporting the progress of the renewable energy sector as part of its remit to foster and promote the social and economic development of the Western Region.

This report, *Wood Energy Development in the Western Region*, was commissioned by the WDC to ascertain how the Western Region can best realise the opportunities in the wood energy segment of the renewable energy sector.

The report shows that the wood energy sector has the potential to grow and bring significant benefits to the Western Region including reducing CO₂ emissions, providing a locally available competitive fuel and generating locally retained income and employment. It details the particular characteristics of the region and establishes how to support the development of the sector. It identifies a number of critical barriers to development including a shortage of information on fuel resources, a lack of market confidence and limited co-ordination within the sector.

The next phase of this project is the development of a strategy and action plan which will serve as a guide to all stakeholders in the strategic and sustainable development of the wood energy sector for the benefit of the region.

The WDC advocates a partnership approach to achieving strategic rural development initiatives. Using this partnership approach we established a Regional Biomass Advisory Group consisting of public and private stakeholders. The Advisory Group guided the project and allowed for close collaboration with other public agencies, the private and community sectors. I would like to most sincerely thank the Advisory Group for the pivotal role they played in the success of the research phase and look forward to their continued support and involvement in the action plan phase of this initiative.

I hope that those involved in the sector will find this research enlightening and useful and that the approach used will act as a model for others who wish to support this emerging sector.

Gillian Buckley
Chief Executive Officer
February 2007

Executive Summary

The Western Development Commission (WDC) is a statutory agency responsible for fostering and promoting economic and social development in the Western Region of Ireland¹. The activities of the WDC involve policy analysis and development, undertaking key rural development initiatives and managing the WDC Investment Fund.²

The WDC supports the growth of the renewable energy sector under its rural development remit. In 2006 the WDC carried out a preliminary review of the biomass sector in the Western Region. The review established that there is significant potential for growth in the sector particularly in the wood energy market. However critical barriers to development were identified including a shortage of information on fuel resources, a lack of market confidence and limited co-ordination within the sector. The review identified the WDC as being ideally positioned to act as a facilitator to support and drive the growth of the sector.

In order to progress proposals on how the Western Region can best realise the opportunities in the wood energy sector, the WDC commissioned this research report *Wood Energy Development in the Western Region*. This report has been prepared for the WDC by Steve Luker Associates Ltd and Developing Alternative Rural Enterprises (DARE) Ltd. It reviews issues associated with wood energy deployment and its potential in the region. This report is a culmination of a phase of research and consultation by the WDC. The information presented will be used as part of the knowledge base for the design of appropriate interventions to support development of the sector regionally.

Biomass in context

Biomass can be deployed to deliver transport fuels, heat, electricity or both in combined heat and power schemes (CHP). Whilst Ireland has a low rate of renewable energy deployment compared with other EU countries (3% as compared with the EU average of 8%), biomass is already the dominant renewable energy in Ireland and the main application is for heating.

Biomass fuels provide, on average, 10% of the EU's heat needs. Over 96% of all the renewable heat energy that the EU uses comes from biomass sources. This is significant because targets for renewable heat become in practice targets for wood heating.

¹ The Western Region includes counties Donegal, Sligo, Leitrim, Mayo, Roscommon, Galway and Clare.

² More details on the activities of the WDC can be found at www.wdc.ie.

Policy context

In 2006 the EU published a *Biomass Action Plan* that outlines support measures for the sector. The Green Paper *Towards a Sustainable Energy Future for Ireland* is designed to set the scene for a national energy strategy for Ireland through to 2020. The Green Paper, while heavily focused on the electricity market, does contain suggested targets for co-firing, heat and transport and proposes the development of a National Bioenergy Action Plan.

The policy context for biomass is clearly broadly supportive and the existence of grant schemes is positive. However at present there is no coherent and specific set of policies to promote wood fuel in particular.

Wood biomass resource

Approximately 11.5% of the Western Region is afforested. Of this about 64,600ha is privately owned plantations which will be suitable for thinning. The main fuel resource at present is wood derived from forestry thinnings, products or primary timber processing. This forms the basis of the report's forecasts. The resource estimates of the combined volume of new to the market pulpwood and co-product will be:

- Year 2010: 210,500 green tonnes per annum
- Year 2015: 423,800 green tonnes per annum

There is a sustainable supply of wood fuel potentially available from private forestry in the Western Region.

Other fuel resources include energy crops and post-consumer wood waste. The expected yield of non-woody biomass crops is about 1,850 tonnes in spring 2009. The research review did not locate any commercial scale planting of woody biomass crops in the region. Therefore the study did not include any forecasts for commercially available energy crops. It is possible that such sources of wood energy could become available in the longer term. Post-consumer wood waste will not play a big part in the regional wood energy market for the immediate future.

Development of wood fuel supply

The potential wood energy market for heating is by its nature a local market³. A wood fuel supply business in the Western Region must be able to sell the fuel close to the forest at a price that makes thinning commercially viable. The analysis demonstrates that in principal **price should not be a limiting factor in liberating the available wood resource for energy purposes.**

³ Unlike CHP and co-firing where the fuel is needed at the power plant that may be very distant from the resource.

Profile of the existing wood energy sector

Installed or contracted wood energy capacity in the Western Region is about 65.5MW or 12% of the installed renewable energy technologies. Overall, there are 19 installers and suppliers operating in the region. There are a further five to ten companies emerging in the fuel supply sector, these companies are at various stages of development.

Relevant technologies and applications

Biomass power generation: Straight power generation from biomass is almost always in the form of using waste streams as the fuel input – and not wood. Wood fired power generation seems an unlikely area of market growth in the region.

Biomass Combined Heat and Power (CHP): The application of wood fired CHP in the region is likely to be quite limited for specific commercial and technical reasons. Put simply there are few places where energy customers are large enough, have the right balance between heat and power needs and are willing and able to contract over 10 or 15 year terms.

Co-firing with biomass: The Green Paper on Energy has proposed a 30% target for co-firing at peat power stations by 2015. There are two such power stations that may therefore require biomass resource from the Western Region - Lough Ree (100MW) and West Offaly (150MW).

Wood fired heating boilers: Wood fired heating technologies are likely to form an important part of market growth in the Western Region. The report summarises a range of technologies and market applications for wood heating presented as a **wood heat market opportunities matrix**. The key finding of the analysis is that the economics are demonstrably attractive for medium and large wood chip boilers (large hotels, care homes, hospitals etc). The role of the public sector in early market development is a key one and an essential priority for action.

It is important to recognise that wood fuel for CHP and co-firing markets will be of a different specification and be more based upon larger scale harvesting operations and make greater use of brash, stumps and other presently unused forestry resources. It can also be delivered wetter and at a much larger scale in larger contracts. This means the market prices for wood fuel in the CHP\co-firing markets can be less.

Scale of market opportunities

The report details the scale of possible market growth and concludes that there are three areas of opportunity in the region. The table below summarises the three wood fuel markets and the possible long term (2015) requirements for wood fuel.

Market	Fuel use (green tonnes pa)	Comments
Co-firing	50,000	Speculative figure – depends upon ESB
CHP	150,000	Speculative figure
Heat	100,000	Based upon 10% of heat oil market
Total	300,000	

The (conservative) resource assessment has suggested that by 2015 the region will be able to sustainably supply 423,000 green tonnes of wood fuel per annum, which exceeds the estimations of the most optimistic market demand by more than 100,000 tonnes and confirms **a key finding of the study; that market growth will not be constrained by the availability of wood resource.**

Best practice comparators

Review of the Scottish experience illustrates that there is a need for a co-ordinated and effectively sequenced policy framework. The development of wood heating in Upper Austria over the past 10 years offers a striking view of what can be achieved from an effectively co-ordinated and properly resourced development programme. The North East of England has published a Biomass Action Plan which places the development of wood energy at the centre of its regional renewable energy strategy. Sweden has a high use of biomass in its energy mix due to the introduction of carbon taxes on competing fuels. **In areas or countries with high levels of renewable energy deployment wood heating is placed at the centre of a renewable energy strategy.**

Business models

Different contractual and commercial arrangements can be configured to help promote effective market development. The market will develop its own business models for its own needs; however a common barrier to early market development is lack of impartial advice on procurement contracts and business models. There are three basic wood\heat supply models:

1. **A simple wood fuel supply contract:** The customer owns and is responsible for maintenance of the wood fired boiler plant and purchases wood fuel like they might purchase oil. This model of contract typically operates well in mature and large wood heat markets.
2. **A wood heat supply agreement:** The customer owns and is responsible for maintenance of the wood fired boiler plant and a wood heat supplier supplies fuel and maintains the boiler plant. In terms of early market development it offers the best model for both parties.

3. **An energy services supply contract:** The supplier owns and operates a wood fuel boiler plant on behalf of the customer. This model typically suits customers who cannot finance the heating plant. This model requires confidence in the wood heat market.

Economic development prospects

The potential economic impacts of a wood energy sector in the Western Region are significant and beneficial. The key reasons for this are that: the use of wood fuel simply displaces imported oil with virtually no displacement impacts; the wood energy market retains a high proportion of the benefits in the local economy; and wood energy is inherently job intensive because of the need to have a fuel supply chain.

Based on the estimated wood fuel requirements stated above, the possible economic impacts of developing a wood energy market in the Western Region are:

HEAT+ CHP + CO-FIRING = TOTAL IMPACT BY 2015⁴

- 145MW of installed capacity
- 300,000 green tonnes of fuel used per annum
- €20 million per annum in wood fuel sales
- 910 new jobs created in the sector
- €117 million capital investment
- €130 million of additional wage income
- €3 million per annum savings on regional energy bills
- 375,000 tonnes per annum CO₂ savings
- Displaces 30 million litres of imported oil

These impacts are heavily associated with growth in the heat market.

Recommendations

A key aspect of the most successful countries and regions in terms of renewable energy is that they place wood fuel heating at the centre of a renewable energy strategy, so it is evident that the sector does require a regional strategy and that the potential benefits of market growth are significant to the region and its economy. The report recommends the following:

A published strategy for wood fuel: A key recommendation is to proceed to strategy development. The WDC and its stakeholders should jointly subscribe to a published wood fuel strategy and a subsequent action plan.

⁴ It is important to recognise that these impacts are based upon scenarios and that these scenarios are then used to infer impact. The CHP and co-firing impacts are in particular highly tentative.

A focus on wood heating: It is evident that the most significant economic gains will occur as a result of market growth in the wood heat sector. Medium and large wood chip boilers offer the most immediate prospects for market growth. Accordingly a second recommendation of this report is that the WDC and its partners focus on supporting wood heat market growth in the most commercially attractive segments of that market.

Co-ordinated, sustained promotional campaign: The report establishes that one of the main issues for market development in the region is the lack of awareness and information about the technology and its potential benefits. The research has reinforced the notion that market growth is at least partly supported through positive promotion and awareness raising. Therefore the third recommendation of this report is that the sector should be supported via a co-ordinated, sustained and professional promotional campaign to build confidence in the market for both energy users and suppliers.

Key Conclusions

- The WDC commissioned the research report *Wood Energy Development in the Western Region* to progress proposals on how the Western Region can best realise the opportunities in the wood energy sector.
- Biomass is already the dominant renewable energy in Ireland and the main application is for heating. Over 96% of all the renewable heat energy that the EU uses comes from biomass sources. This is significant because targets for renewable heat become in practice targets for wood heating.
- The Green Paper *Towards a Sustainable Energy Future for Ireland*, while heavily focused on the electricity market, does contain suggested targets for co-firing, heat and transport. In areas or countries with high levels of renewable energy deployment wood heating is placed at the centre of a renewable energy strategy.
- Approximately 11.5% of the Western Region is afforested. Of this about 64,600ha is privately owned plantations which will be suitable for thinning.
- There is a sustainable supply of wood fuel potentially available from private forestry in the Western Region derived from forestry thinnings, co-products, and primary timber processing.
- The potential wood energy market for heating is by its nature a local market. Price should not be a limiting factor in liberating the available wood resource for energy purposes.
- The (conservative) resource assessment has suggested that by 2015 the region will be able to sustainably supply 423,000 green tonnes of wood fuel per annum, which exceeds the estimations of the most optimistic market demand by more than 100,000 tonnes and confirms a key finding of the research; that market growth will not be constrained by the availability of wood resource.
- The potential economic impacts of a wood energy sector in the Western Region are significant and beneficial. The reasons for this are: the use of wood fuel displaces imported oil with virtually no displacement impacts; the wood energy market retains a high proportion of the benefits in the local economy; and wood energy is inherently job intensive because of the need to have a fuel supply chain. The economic impacts are heavily associated with growth in the heat market.
- The sector requires a regional strategy for development to provide a framework for market growth. The report recommends the following: a published strategy for wood fuel for the Western Region; a focus on wood heating and; a co-ordinated, sustained promotional campaign.

1.0. Introduction

This report has been prepared for the Western Development Commission (WDC) and presents the findings of research on wood energy for the Western Region⁵. It will be used as part of the knowledge base for the design of appropriate interventions to support development of the sector regionally.

The report contains an overview of the sector in terms of markets and technology and a review of the current policy framework.

It then presents an assessment of the wood fuel resource and the issues affecting its development in the region. A profile of existing activities and an analysis of the market opportunities are presented and this has been used with best practice comparators and business models to develop market growth scenarios and offer a view on the economic development prospects for the sector.

All the estimates of market growth in this report are related to the Western Region and do not necessarily imply that national market growth could be the same.

1.1. Western Development Commission

The WDC is a statutory agency with responsibility for fostering economic and social development in the Western Region. The activities of the WDC involve policy analysis and development, undertaking key regional initiatives and managing the WDC Investment Fund.

1.2 Scope of research

In the Western Region the main biomass sources will be wood and the main commercially attractive energy market will be replacements for oil heating, wood for co-firing and possibly CHP.

As a consequence the main thrust of this report is wood biomass and its applications for heat energy use, co-firing and CHP. It is thought that the generation of electricity from wood fuel (other than via CHP) is neither viable or a sensible use of the wood resource.

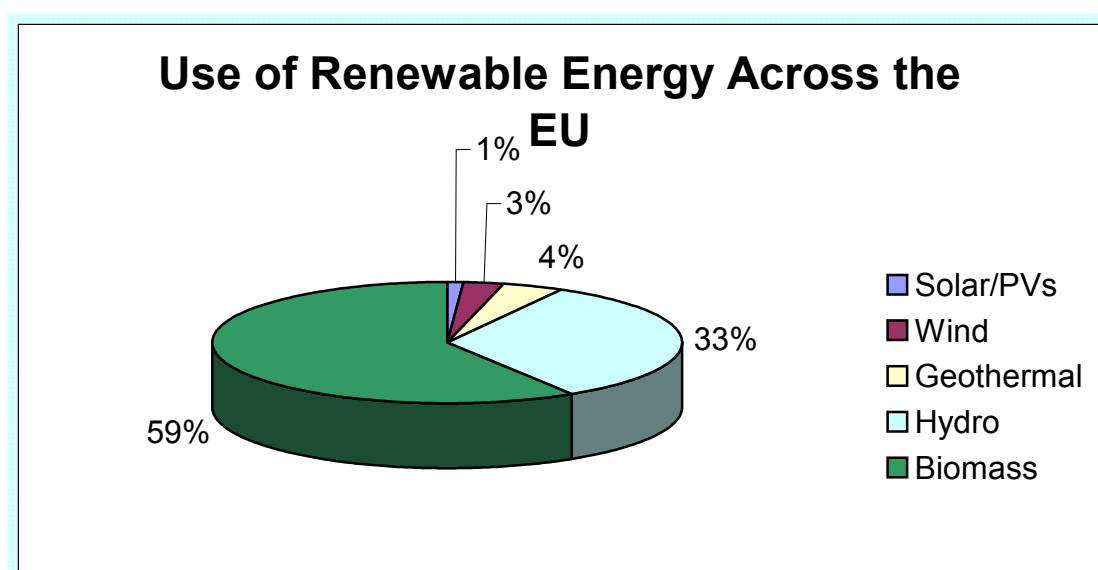
⁵ The Western Region is the seven counties of Clare, Donegal, Galway, Leitrim, Mayo, Roscommon and Sligo.

2.0. Biomass in context

2.1. Renewable energy

Across the EU about 8% of all energy used is from a range of renewable sources. In Ireland only 3%⁶ of energy used is from renewable sources. The pie chart below shows the relative level of deployment of the various renewable technologies across the EU⁷.

Figure 1: Use of Renewable Energy across the EU



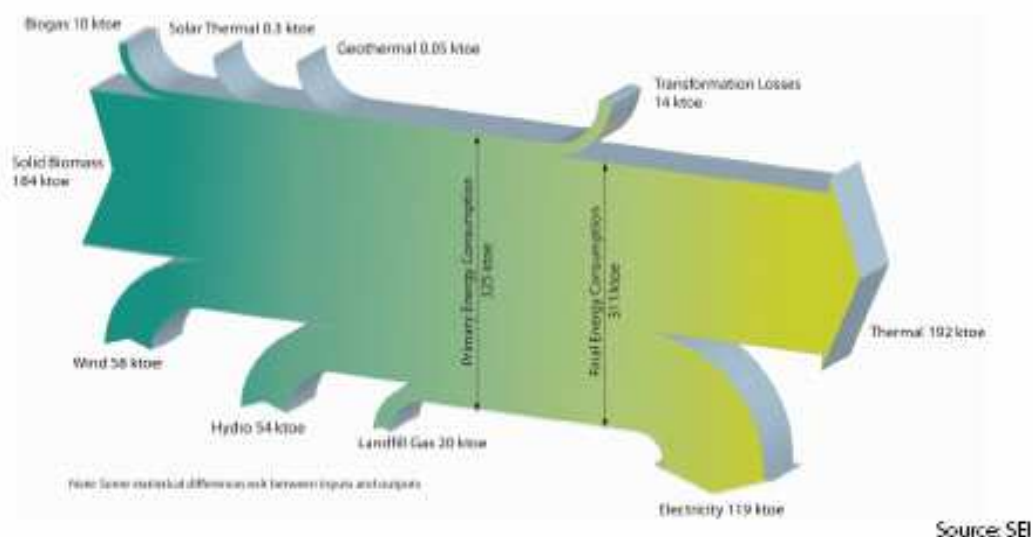
⁶ Source - SEI

⁷ Source EU, 2003\4 (it should be noted the % of biomass share has now increased and is thought to be nearer 70% now)

2.2. Renewable Energy and biomass in Ireland

Figure 2: Renewable Energy Balance 2004

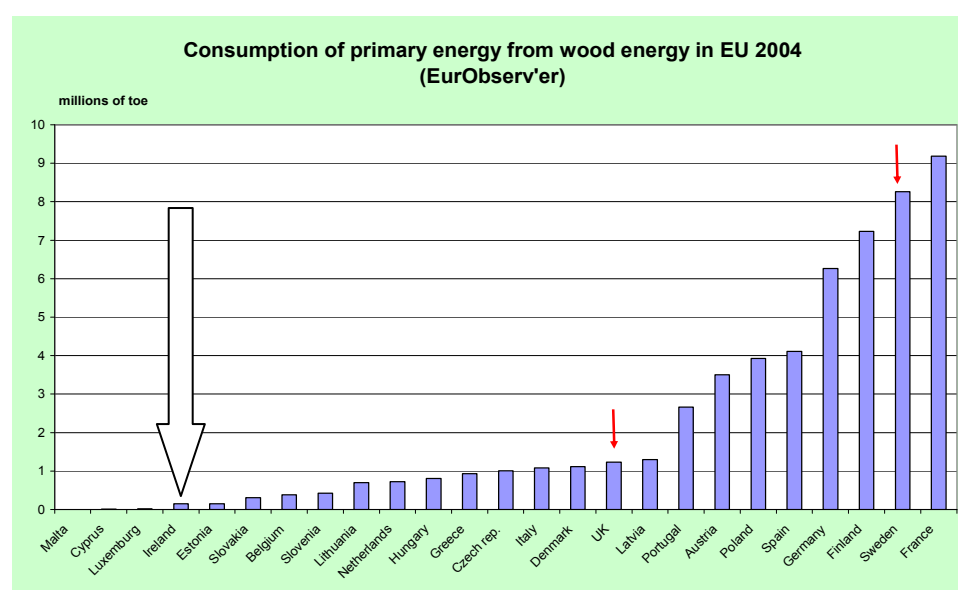
Figure 4.4: Renewable Energy Balance 2004



It is interesting to note that whilst Ireland has a low rate of renewable energy deployment compared with other EU countries, biomass is already the dominant renewable energy in Ireland and the main application is for heating. This is consistent with most other EU markets – albeit on a much smaller scale at present.

The following diagram⁸ sets out the use of wood for energy across the EU. This shows how limited Ireland's current use of wood for energy is compared with most other EU countries – at 0.2 million tonnes of oil equivalent.

Figure 3: Consumption of primary energy from wood energy in EU 2004



⁸ Source EurObserv'Er - 2004

2.3. Biomass conversion markets

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.

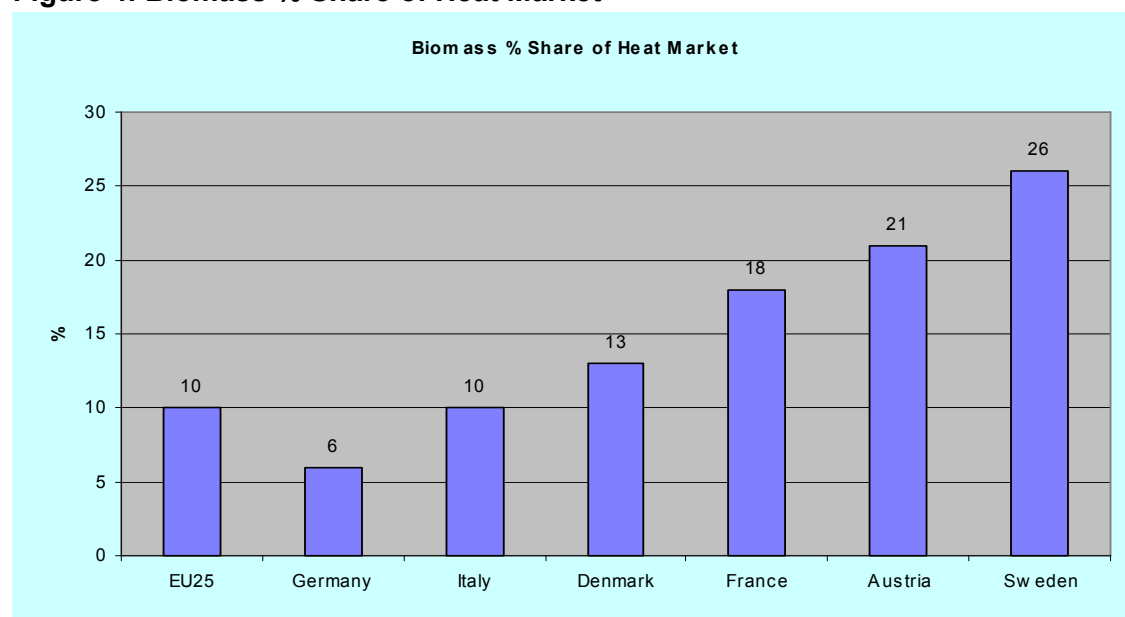
Globally, biomass use amounts to nearly one billion tonnes of oil equivalent, a level comparable to the consumption of gas or coal. This makes it the largest renewable source in use today.⁹

Biomass encompasses a diverse range of well-established technologies and it can be deployed to deliver transport fuels, heat, electricity or both in combined heat and power schemes (CHP). It is sometimes referred to as Bioenergy.

There are no collected figures on the market deployment of biomass in terms of its applications in the heat, CHP, electricity and transport markets either in Ireland or the EU.

The anecdotal experience of this author is that the provision of heating is the largest sector by far in terms of biomass. This is confirmed by some published figures; the bar chart below shows that biomass provides on average 10% of the EU's heat needs. Over 96% of all the renewable heat energy that EU uses comes from biomass sources. This is significant because targets for renewable heat become de-facto targets for wood heating.

Figure 4: Biomass % Share of Heat Market



⁹ Renewable Energy World – July 2005

The next largest sector appears to be large scale (50MW+) biomass CHP. Small scale biomass CHP is not a commercially developed technology.

Finally the use of wood biomass for straight electricity generation is very limited and does not appear to have any measurable market share in the EU. Biomass fuels (in fact any fuels) converted only to electricity operate mostly at 25% to 30% efficiencies¹⁰ and most of energy content is lost as waste heat in cooling towers. Virtually all existing examples of biomass electricity schemes are waste to energy or waste incineration projects where most or all of the fuel input is not wood.

2.4. Biomass Fuels

Across the EU 85% of the biomass market is supplied with solid woody biomass - this is about 100 million green tonnes of wood.¹¹ Appendix 2 of this report lists the other biomass fuel sources. There are four possible sources of solid wood biomass fuel listed and described below:

- ☐ Forestry
- ☐ Co-products
- ☐ Post consumer wood waste
- ☐ Purpose grown energy crops

Forestry produced wood fuels are mostly small diameter logs (small roundwood) that are extracted to roadside, air dried and then chipped and delivered to heat boilers. 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.



Co-products are wood chips, dust and bark produced by sawmills as they process logs into product such as planks. The picture shows wood chips being loaded in a delivery wagon at a large sawmill.

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

¹⁰ Although it is thought that Edenderry operates at 38% efficiency.

¹¹ Renewable Energy World July 2005

Purpose grown energy crops are usually fast growing willow trees planted on agricultural land and harvested every 3 to 5 years (often referred to as short rotation coppice, SRC – willow). This source of wood chip is not used commercially in the EU on a scale that is measurable¹². Energy crops can also be non woody, such as straw, reed canary grass and so on. Non woody energy crops do have some market share, but usually in the CHP and co-firing sectors.

This section of the report has highlighted that wood biomass is the most important source of renewable energy for the EU and also in Ireland. It has established that the biggest energy market for wood energy is heating. In Ireland the key current difference is simply the tiny size of the wood heat market relative to most other EU countries.

¹² It is thought Sweden does have a small commercial market however and in Northern Ireland 450 ha of SRC has already been planted and a further 350 ha of planting is planned in 2007 and 2008.

3.0. Policy Context

The section provides a rapid review of relevant policy context.

EU Policy

The overall target for renewable energy deployment in the EU is 12% by 2010¹³. The actual share predicted to be achieved by renewables is set to be about 10%.

In recognition of this the EU's response is basically to focus on growth in the bioenergy sector. In December 2005 the EU published a *Biomass Action Plan* that focuses on 'soft' market support measures such as training, standards, certification and awareness raising.

This includes proposals for a renewable heat directive and builds upon the Sustainable Energy – Europe (2005-2008) Campaign¹⁴.

Beyond that the Commission has indicated that the 2020 renewable energy target for the EU may well be set as high as a quarter of total energy use.

The key point of relevance to the Western Region is that through targets and support (Bioenergy Action Plan) the importance of bioenergy is set to increase from an already dominant position in the market.

The Green Paper - Towards a Sustainable Energy Future for Ireland

The Green Paper is designed to set the scene for a national energy strategy for Ireland through to 2020. It offers an insight into the approach that Government is likely to take and seeks a productive consultation process.

There are a number of policy areas and themes within the Green Paper that impinge upon WDC's intentions to develop and help deliver a regional wood energy strategy.

The Green Paper says:

*'Bioenergy has significant potential for **electricity**¹⁵ generation as a renewable dispatchable fuel source, for the heat market, which is supported by a grant package for installing biomass*

¹³ As Ireland has only set binding targets for renewable electricity (which is about a quarter of total energy use) it is not clear how Ireland plans to conform to the EU target.

¹⁴ See http://europa.eu.int/comm/energy/res/biomass_action_plan_index_en.htm

¹⁵ Our emphasis

boilers, and as biofuel for the transport sector, which is currently supported by an excise relief package. The newly established Ministerial Task Force on Bioenergy will finalise a National Bioenergy Action Plan, assessing optimum targets for the market penetration of biomass heating, electricity and biofuel transport to 2020. This plan will be developed in the context of the European Commission's Biomass Action Plan.'

It goes on to say that:

'The low level of deployment of Combined Heat and Power (CHP) in Ireland - a highly efficient form of energy generation - will be addressed by a grant scheme for small scale CHP and large-scale biomass-fed CHP. Separate initiatives to promote more widespread deployment include examination by the CER of potential administrative and regulatory barriers and a substantial information campaign by SEI.'

A key issue for the Western Region is the role that wood energy can play in electricity generation and whether this is the best use of this resource. Later sections of this report deal with this issue.

The Green Paper is heavily focussed on the electricity market. There is a proposed target of having 15% of electricity consumed from renewable sources by 2010, rising to 30% by 2020.

The means whereby this might be achieved are dealt with in some detail relative to the other two main energy markets of heat and transport.

However the Green Paper does also contain suggested targets for co-firing, heat and transport:

- 5% renewable provision by 2010 in the heat market,
- 5.75% biofuels penetration by 2010, and
- 30% target for co-firing at peat power stations by 2015.

Therefore the Green Paper proposes challenging near term targets for co-firing, heat and transport energy markets with limited details on how these might be achieved or how such targets were devised.

The (perhaps) unintended outcome of these suggested targets is that the smaller % targets for heat and transport by 2010 would, if achieved, result in greater contributions of renewables than the 15% renewable electricity target (if achieved) set for the same date.

This is because 5% of over three quarters of the total energy market (as embodied in the heat and transport targets) is more than 15% of less than a quarter of the energy market (as embodied in the renewable electricity targets).

The Green Paper also refers to the establishment of a Ministerial Bioenergy Task Force involving all relevant Ministers and Departments, which will oversee delivery of an integrated National Bioenergy Strategy by end of 2006. The Task Force will:

‘Set the agenda for collective delivery of the potential benefits of bio-energy resources across the agriculture, enterprise, transport and energy sectors. It will inform the setting of challenging targets for bio-energy deployment up to 2020 in light also of EU developments. Chaired by the Minister for Communications, Marine and Natural Resources, the Task Force will build on existing cooperation between his Department and the Departments of Finance, Agriculture and Food, Transport, Environment, Heritage and Local Government, and Enterprise, Trade and Employment, as well as all relevant State Agencies.’

Therefore the role of the Task Force will be crucial in establishing if the targets are realistic and achievable – and presumably in creating policies to deliver on any finalised targets. Related it seems odd that no CHP targets are proposed and this can be seen as a problem especially if the focus remains on the less viable bio-electricity sector.

For the Western Region this research study offers an opportunity to develop and promote suitable policy and contribute to the Task Force on Bioenergy.

Sustainable Energy Ireland

Sustainable Energy Ireland (SEI) was set up by the Government in 2002 as Ireland’s national energy agency. Its mission is to promote and assist the development of sustainable energy in Ireland by improving energy efficiency, advancing the development and competitive deployment of renewable sources of energy and combined heat and power and reducing the environmental impact of energy production and use, particularly in respect of greenhouse gas emissions. Overall SEI allows for a co-ordinated approach to supporting biomass and the existence of a single national energy body is clearly an advantage in terms of developing a regional wood energy strategy.

The Greener Homes grant scheme is administered by SEI. A total fund of €27 million has been made available over a five year period and this was topped up by €20 million in 2006. Technologies to be supported include wood pellet/woodchip stoves and boilers. This scheme should help the small scale market for wood fuel.

SEI also runs a Bioheat grant scheme. An indicative allocation of €22 million was made for SEI to run the Programme (2006 to 2010 time frame) and this was increased by €7 million in 2006. Capital investment support is available for up to 30% for eligible costs¹⁶. This scheme is very important to market development and will help underpin the regional wood energy strategy to a very significant degree.

RES-E Directive

The final policy of note is the *EU Directive on the promotion of electricity produced from renewable energy sources in the internal electricity market 2001/77/EC* – which requires Member States to contribute to goals to increase the consumption of renewable energy derived electricity within the EU. Known as the RES-E Directive, it outlines consumption targets for each Member State. Ireland's target is to have 13.2% of electricity produced from renewable sources, such as biomass, wind, wave, solar, by 2010. The RES-E Directive calls for, *inter alia*, national support schemes and preferential grid access for producers of renewable electricity.

Until recently, Ireland's attempts to meet its obligations under the RES-E Directive have centred on the Alternative Energy Requirement (AER) programme. This, in effect, is a competitive price bidding system where renewable electricity generators compete to secure fixed price contracts. More recently the AER system has been replaced by a feed-in tariff system (REFIT). However, a strongly held view by industry is that the feed-in tariff offered to generate electricity from biomass is inadequate to stimulate any significant level of activity in that sector.

In our view the RES-E Directive is likely only be of marginal importance to the biomass sector as conversion of wood fuel into electricity is not a common approach.

Carbon taxes

Unlike almost all other EU countries Ireland has no system of carbon taxes. This puts wood energy at a disadvantage in Ireland compared with other EU countries as it does not benefit from a tax (hence price) advantage in being a renewable form of energy. The remit and purpose of this study precludes any examination of this.

3.1. Summary

The policy context for biomass is clearly broadly supportive and the existence of grant schemes is positive and useful. However from this review of policy it is evident that there is no coherent and specific set of policies to promote wood fuel in particular. As this is by far the most important renewable energy sector in the EU, this can be viewed as a policy gap.

¹⁶

Limited by a maximum qualifying cost profile of €500/kWth at 60kWth, reducing linearly to €250/kWth at 1,000kW

Lack of a carbon tax is particularly unhelpful to wood energy market development.

The most obvious problem with policy is that there is no overall target for renewable energy deployment in Ireland and it follows that this is not then subdivided into market or technology targets at present.

It appears desirable to set targets for all aspects of the renewable energy market rather than just one *small* part of it (the electricity sector). The Green Paper *Towards a Sustainable Energy Future for Ireland* suggests targets for the heat and transport markets and this is clearly a welcome step and will support the Western Region in its work on wood energy.

The key issue will be the level of the targets for heating and co-firing and how to devise detailed policies to underpin and achieve sensibly set targets. The apparent focus on bio-electricity and the lack of a target for biomass CHP may also present challenges for the Western Region. This report will flesh out some of these issues.

4.0. Assessment of the wood biomass resource

4.1. Introduction

The key point in the Western Region is that the total amount of timber available for harvesting is forecast to rise rapidly over the next 20 or 30 years as young conifer plantations come to the point where they require a first thinning.

The following sectors were examined and their wood energy resource potential is summarised in this report for the Western Region:

- ☐ Forestry\co-products
- ☐ Post consumer wood waste
- ☐ Purpose grown energy crops

4.2. Forestry and co-products

Forestry and co-product resources are considered together as the two are linked in terms of supply and demand and via markets and prices - in particular more forestry harvested means more co-product arrives on the market (as through put from sawmills handling increased forestry products).

Context

Forestry in the Western Region can be harvested for three main markets, based upon the diameter of the trees in the forest:

- ☐ **Sawlog** is cut from the butt end, down to a diameter of 20cm at its small end. This category is use to supply timber to the construction industry.
- ☐ **Pallet or Boxwood** is taken from the mid section of the log. The minimum diameter of this category is 14cm. This material as its name suggests is used to supply material for the packaging market.
- ☐ **Pulpwood** is harvested from the top section of the trees. Its minimum diameter is 7cm. Good quality pulpwood is separated and used to supply material to produce stakes.

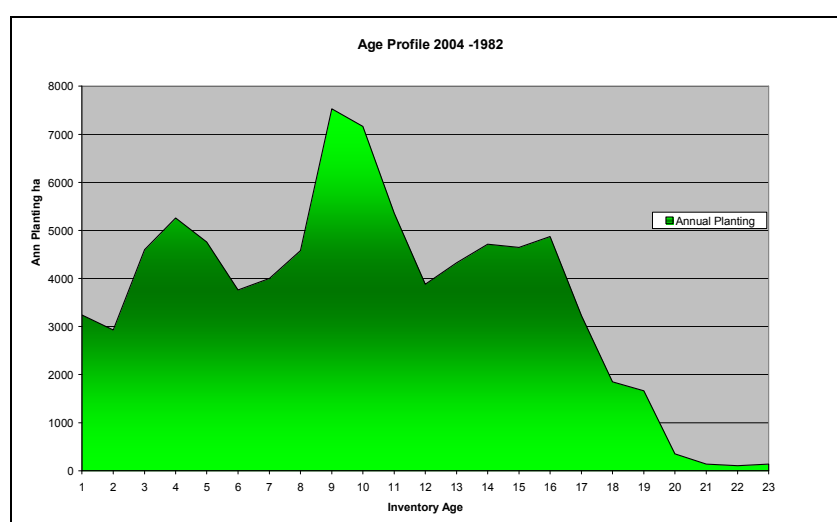
In the Western Region the main harvesting activity will be thinning because the forestry is young. Thinning is the process by which small diameter or poorly formed trees are removed from a plantation, providing space for the remaining trees to develop. As the quantity of timber

removed must be below or at the annual growth rate thinning does not effect the overall production of the plantation and is therefore a sustainable practice.

In practice decisions about when to undertake harvesting in a forest are based upon the value of the timber and the type and age of the forest. Sawlogs and pallet or boxwood command the highest price and have existing reliable markets.

However in the Western Region the predominance of young conifers means that much of harvest in the next 20 years or so will be the smaller diameter and lower value pulpwood that has limited existing markets. The figure below shows the age profile of these plantations.

Figure 5: Age profile of plantations in the Western Region 2004 – 1982



This resource review therefore assumes that the forestry available for wood energy only comes from the pulpwood harvest in the region as this has the lowest value.

Some 280,000ha or 11.5% of the Western Region is afforested, of this about 113,400ha is in private ownership and the remaining 166,500ha is in public ownership¹⁷.

This resource review excludes timber sourced from public sector plantations as most of the pulpwood from this sector is sold on long term contracts and therefore is not considered an available resource.

This means that the resource available for wood energy described in the following is a conservative estimate as it effectively excludes all 166,500 ha of publicly owned forest and only includes the pulpwood element of the private harvest.

¹⁷ Source - Forest Service ITGA Yearbook 2006

Most of the privately owned plantations have been established since 1982, driven primarily by the afforestation programmes which provided generous grant aid and annual premium payments. During the period 1982 to 2004 about 83,000ha¹⁸ were planted in the Western Region. These plantations are now reaching the point of needing a first thinning and hence a market for the harvested timber.

The remaining 30,400ha¹⁹ of privately owned plantations is comprised of mature woodland, amenity or scrub woodlands.

Selecting a Sample

To determine the characteristics of this forest resource and assess its suitability for the energy market a representative sample of plantations were selected and constraints displayed by the sample (in terms of the amount of wood energy it can produce) were applied to all the private sector plantations. The sample selected was the Irish Forest Unit Trust Estate (IForUT) within the Western Region for which there is a complete and accessible inventory. Details of the methodology are shown in Appendix 4.

So by applying these constraints to all the private plantations in the Western Region a forecast for productive area and yield has been determined. These are given in the table below.

Table 1: Forecast for productive area and yield

Criteria	Area ha	% of Total
Total area of target group	83,060	100
Productive area	76,000	91.5
No-thin area	11,400	13.7
Thin area	64,600	77.7
Unproductive area	7,060	8.5

From this it can be concluded that about 64,600ha of privately owned plantations will be suitable for thinning and as such will form the basis of the forecasts included in this report.

Thinning commences when a forest is 18 years old and is repeated on a five year cycle. The average volume which will be harvested is forecasted at 50 tonnes per ha of which about 71% of the first thinning is pulpwood. The percentage of pulpwood decreases with each

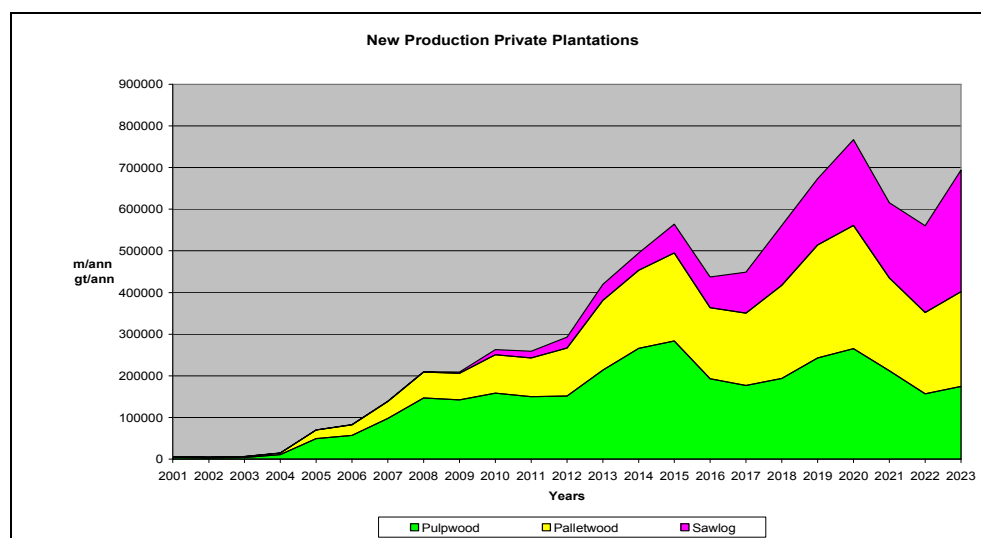
¹⁸ Source - Forest Service ITGA Yearbook 2006

¹⁹ Source - Forest Service ITGA Yearbook 2006

subsequent thinning and by clearfell (after 35 years) the percentage of pulpwood will have declined to about 2.5%.

The figure following illustrates the potential yield from the private plantations across all timber categories showing the cumulative production of pulpwood, palletwood and sawlog for the period 2001 – 2023.

Figure 6: New Production Private Plantations



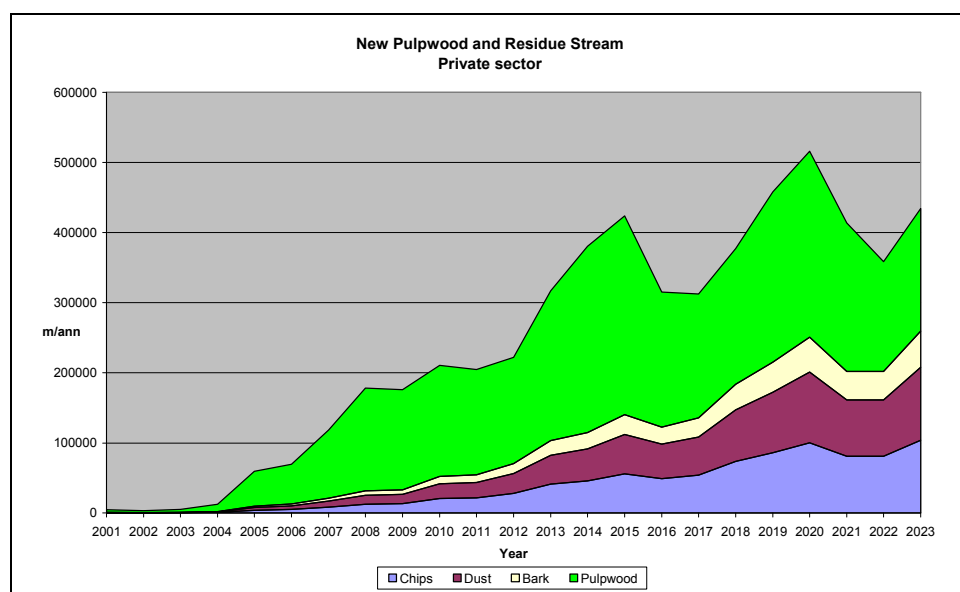
This indicates the increasing annual yield of pulpwood; from 56,600 tonnes in 2006 to 158,000 tonnes in 2010 and to 283,550 tonnes in 2015²⁰.

It also shows the increasing production of palletwood and sawlog which, when processed by the sawmilling sector, will increase the amount of co-product (woodchips, sawdust and bark).

This volume of increasing co-product must be added to the pulpwood harvest to forecast the total potential available wood for energy. The figure below indicates the combined effect of the pulpwood and new stream of co-product over the period 2001 – 2023.²¹

²⁰ Analysis based upon Forestry Commission Booklet no 39 – Stand Over Bark Assortment Tables

²¹ Analysis based upon Forestry Commission Booklet no 39 – Stand Over Bark Assortment Tables plus average conversion rates for co-products at Sawmills.

Figure 7: New Pulpwood and Residue Stream (Private Sector)

As a result of this process of analysing the standing forest resource and applying constraints in terms of harvesting, the combined volume of new to the market pulpwood and co-product will be:

- Year 2010: 210,500 green tonnes per annum
- Year 2015: 423,800 green tonnes per annum

The forest resource can to some extent remain un-harvested; clearly the actual amount of pulpwood harvested will be dependant upon a viable market.

4.3. Post consumer wood waste

In 2005 the EPA estimated that nationwide about 125,000 tonnes²² of mixed wood was recycled. Of this 52% was untreated and therefore suitable for recycling under one of the three processes outlined below.

- Open loop – the material is recycled and incorporated into new materials e.g. panel board and chipboard
- Closed loop – the packaging material (pallets) are refurbished and used again
- Recovery – the timber is shredded and used as a mulch or sold as wood chips for energy.

²² www.epa.ie

Repak²³ who administer the recycling scheme for larger firms²⁴ estimate that in the Western Region about 9,300 tonnes of wood were recycled in 2005, of which 3,737 tonnes were deemed to be “recovery”. This is a conservative estimate as there are a large number of small recycling firms who operate outside the Repak scheme and detailed information on a county by county basis is not available.

However on this basis it appears that this source of wood fuel will not play a big part in the Western Region wood energy market for the time being and especially when compared to the very large volumes of pulpwood and co-products suitable and available for energy use.

4.4. Energy crops

Non-woody biomass crops

At present only 10ha of non-woody biomass crops has been established in the Western Region. This consists of 6ha of miscanthus and 4ha of reed canary grass. These experimental crops are due to be harvested in spring 2008 at which point it will be possible to determine yields. A further 121ha of miscanthus is to be established during 2007 by private enterprise.

Combined all of the above are expected to yield about 1,850 tonnes in spring 2009.

Woody biomass energy crops

We have not located any commercial scale planting of woody biomass crops (e.g. SRC willow) in the Western Region.

In terms of this study we have therefore not included any forecasts for commercially available energy crops.

It is of course possible that such sources of wood energy could become available in the longer term.

4.5. Issues affecting the development of wood fuel supply

The key point about developing a wood fuel supply business in the Western Region is that it must be able to sell the fuel close to the forest at a price that makes thinning commercially viable. Fortunately the potential wood energy market for heating is by its nature a local market²⁵. Of course a host of other factors will affect how viable such a business can be. Appendix 5 considers some of these issues in more detail.

²³ correspondence with Repak

²⁴ Defined by Repak as any company handling over 1000 tonnes of packaging per annum

²⁵ Unlike CHP and cofiring where the fuel is needed at the power plant that may be very distant from the resource

In terms of price the point at which it becomes viable for a forest owner to undertake a first thinning depends upon a complex set of factors. It is important to recognise that in any thinning operation the harvest will comprise a mix of timber for different markets. The larger diameter material will have the best price and be most viable to harvest. Owners are often happy just to cover costs in selling the lower value smaller diameter timber (pulpwood).

We estimate that the following range of prices (for pulpwood) will allow the first thinning to be undertaken on a commercially attractive basis:

Price to grower	= €1.5 to €3 per cubic metre of wood
Harvesting costs	= €26 to €34 per cubic metre of wood
Chipping into energy fuel	= €6 to €8 per cubic metre of wood

This suggests a price in the range €33.5 to €45 per cubic metre of wood (chipped but not delivered). We estimate that this equates to price per tonne (of green wood chips) of between €49 and €67. Typical haulage costs are around €150 per 30 cubic metre load (in a tractor trailer up to 20km). So this will add around €3.35 per green tonne of wood chips.

Overall it is possible to conclude that a price for delivered wood fuel in the range €50 to €70 per green tonne should make it commercially viable to undertake first thinnings.

Section 6.4 of this report considers what kinds of prices energy users might be able to pay for wood fuel and shows that €75 to €95 per green tonne should make wood fuel attractive to energy users.

Our figures demonstrate that in principal price should not be limiting factor in liberating the available wood resource for energy purposes.

4.6. Conclusions

Our work has established that there will be a sustainable harvest of pulpwood and a related supply of co-product that in 2015 is forecast to be 423,000 green tonnes per annum (and rising thereafter).

This material is additional to any current market demand for wood fibre and our figures suggest that there shouldn't be any price based constraints on liberating this resource for energy uses (in the heat market).

We believe all of this material could be supplied into an emerging wood energy market with no displacement implications and without affecting the supply of timber for other markets in the region or beyond.

The methodology we have used provides quite a cautious view on the likely availability of wood for fuel. In particular it does not assume any supply from the state owned forests nor does it rely on post consumer wood waste and energy crops. Finally it assumes that the larger diameter logs will not be used for energy.

To cross check our assumptions we have compared our resource availability figures with another recently published wood energy resource evaluation – from the COFORD-sponsored Wood Energy Strategy Group. This group commissioned ElectroWatt Ekono and Tipperary Institute to undertake a review of the opportunities for wood biomass exploitation in Ireland as a whole. As part of this study, the consultants undertook an analysis of available biomass. This report is available online at www.woodenergy.ie.

The report quantifies the amount of biomass for the whole of Ireland. It shown in the table following²⁶:

Table 2: Biomass Supply Potential – all Ireland ('000s green tonnes)

Biomass Source	Supply Potential -all Ireland ('000s green tonnes)	
	2006	2010
Direct	386	1,040
Indirect	150	250
Post-consumer	221	250
Total	757	1,540

Our figures for 2010 for the Western Region show that 210,500 tonnes of wood fuel will be available.

The COFORD figures show that 1,540,000 tonnes of wood fuel will be available nationally by the same date. As the Western Region represents about 40% of Ireland's forestry it can be

²⁶ This table is extracted from the OC Consulting Report of April 2006 – called WDC Biomass Action Plan – and is based upon the ElectroWatt Ekono and Tipperary Institute review

assumed that the equivalent COFORD figure is 616,000 tonnes in the Western Region. This suggests that our figures are extremely conservative compared with other evaluations.

Clearly whether or not the wood energy market liberates this resource and how much of it is used is an open question and the main subject of the latter part of this report.

5.0. Profile of the existing wood energy sector

5.1. Renewables in the region

The pie chart and table below²⁷ illustrate the present installed capacity for various renewable technologies (for heat and electricity markets) within the Western Region. The present composition is somewhat different from the general European situation where biomass is the dominant technology.

Most of the large scale hydro has been in place for 50 years. Ardnacrusha was commissioned in the late 1920's and was the largest infrastructural project undertaken in the country at that time.

Figure 8: Renewables in Western Region, MW installed and Percentage of Total

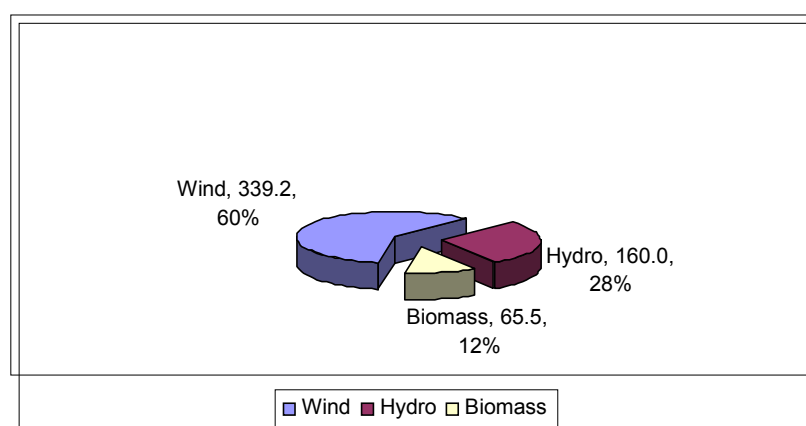


Table 3: Installed renewable energy capacity in Western Region by technology

Technology	Installed MW
Wind Large 5MW+	294.5
Wind Small <5MW	44.7
Hydro Large 5MW+	155.0
Hydro Small <5MW	5.0
Biomass Large 1MW+	52.0
Biomass Small <1MW	10.6
Biomass Domestic	2.9
Total Installed Capacity	564.7

²⁷ Sources La Tene Maps, ESB – Generation, IWEA and project research (telephone survey).

5.2. Current activities in the sector

We conducted a telephone survey of the biomass sector in the Western Region during November and December 2006. We found that installed or contracted wood energy capacity in the Western Region is about 65.5MW or 12% of the installed renewable energy technologies. This can be divided into three sectors:

- large scale 1MW+ installations of which there is 52MW installed
- small scale 1MW installation of which there is 10.6MW installed; and
- domestic size of which there is 2.9MW installed.

All of the large scale installations (a total of 5) are based at sawmills or panel board mills where the boilers provide process heat for drying or reducing woodchips to fibre. The installations consume about 125,000 green tonnes per annum. Most of the boiler fuel is co-product generated on site and a small proportion comes from recycled packaging material.

There are about 30 small scale boilers (under 1MW) totalling 10.6MW that have been installed or are under contracted to be installed in nursing homes, leisure centre, schools, the agricultural sector and some public buildings. All of these applications have a consistent base load. These boilers consume about 10,000 green tonnes most of which is wood chip to be supplied by the emerging fuel supply chains.

The domestic sector, broadly defined as boilers under 60KW rated capacity, are largely installed in the private housing sector. At present there is a great degree of activity in this sector driven by the Greener Homes Scheme. The dominant fuel type is wood pellets.

Overall, there are 19 installers (see Appendix 6) and suppliers operating in the region, with suppliers active in each of the above sectors. Five of the larger installers are prepared to offer fuel supply contracts as part of their services. Two to three seem willing to provide the ESCo²⁸ type solution if boilers are of adequate size. There are a further 5 to 10 companies emerging in the fuel supply sector, these companies are at various stages of development.

Sawmills

Sawmills provide the co-products that can be used for energy. There are 23 sawmills active in the region, their annual intake of round logs is about 750,000 green tonnes. This generates about 380,000 green tonnes of co-product which is used by the board mills²⁹. As already noted this 380,000 tonnes will rise (by at least 100,000 tonnes by 2015).

²⁸ Energy Services Contract

²⁹ This level of activity, 750,000 tonnes, indicates that the harvesting and transport system is in place and needs only to be expanded to include the new private resource coming on stream.

6.0. Relevant technologies and applications

In order to understand the potential for wood energy growth in the Western Region it is important to understand the nature and range of technologies that can be deployed. There are four technologies\markets:

- ☐ Biomass power generation
- ☐ Biomass CHP
- ☐ Co-firing with biomass
- ☐ Wood heating

6.1. Biomass power generation

Straight power generation from biomass is almost always in the form of using waste streams as the fuel input – and not wood. These are commonly referred to as ‘waste to energy’ projects. Domestic and commercial refuse, animal and food wastes³⁰ are all used as fuel for power generation. It is possible that the Western Region will see some growth in this sector, although this is not the subject of this study.

Wood fired power generation seems an unlikely area of market growth in the Western Region. 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.

The only known wood fired electricity plant is presently under construction in Scotland³¹. It is being developed by the German utility company Eon. It has received significant state aid. Because it uses wood chips as the sole fuel input it has been the subject of adverse criticism for two main reasons:

- ☐ Electricity only plants are inherently inefficient - over three quarters of the energy content of the fuel is disposed of as waste heat.
- ☐ The overall supply of wood fibre for other markets in Scotland (for board mills, paper mills, heat energy users etc) is tightening and this project takes nearly 500,000 green tonnes of fuel per annum out of the supply chain adversely affecting supplies to other markets.

Another issue with wood fired electricity projects is that they must be of large scale to make commercial sense and so require massive quantities of wood. This means the wood supply must be from a large catchment area and so requires very long haul distances. This has the

³⁰ Often mixed with fossil fuels such as coal

³¹ To this authors knowledge no other EU country has developed a wood fired power plant.

effect of pushing down the price that can be paid for the fuel as much of the cost is accounted for in transport. It also makes the power plant rely upon a single fuel commodity. No doubt both these factors also explain why wood fired electricity projects are not normally developed.

6.2. Biomass CHP

Combined and Heat Power is a highly fuel efficient technology which typically uses natural gas as the fuel. In conventional electricity generation heat is produced as a by-product and usually released into the atmosphere. Combined Heat and Power (CHP) systems channel this extra heat to useful purposes so that usable heat and electricity are generated in a single process. In the right circumstances CHP can be an economic means of improving the efficiency of energy use and achieving environmental targets for emissions reduction. CHP usually involves the burning of fossil fuels, but heat and electricity are also produced from biomass (including biogas and waste). Appendix 9 contains further details of CHP in Ireland.

The application of wood fired CHP in the Western Region is likely to be quite limited for specific commercial and technical reasons.

Without significant grant aid small scale biomass CHP appears to be commercially challenging and the limited availability of commercialised technology under 5MW(e) suggests this will remain the case. Most biomass CHP projects in commercial operation across the EU are large scale and tend to be 50MW(e) and above, this requires a heat load of 3 or 4 times that size. There are probably no locations in the Western Region where such large single thermal loads are found³².

A second challenge with biomass CHP is that it would usually need long term energy purchase contracts to justify third party finance and related it would require third party providers willing to invest³³. This combination of companies willing to purchase energy long term and suppliers willing to offer the technology and finance reduces the chances of finding suitable projects in the region even further.

Put simply there are few places where energy customers are large enough, have the right balance between heat and power needs and are willing and able to contract over 10 or 15 year terms.

There is some interest in small scale biomass CHP. However the economics of the technology at this scale are not promising for specific technical and practical reasons. CHP

³² In other countries city wide district heating grids offer the large thermal loads needed to justify biomass CHP

³³ Normally CHP ownership and operation is by third parties selling heat and power as energy users tend not to want to be owners of power stations and trade in electricity

engines are inherently expensive and to justify the investment they must be deployed (operated) most or all of the time.

The capital costs of small scale biomass CHP are not established as the technology is not generally available. We know that at about 10MW(e) costs are in the range of €2 million to €3 million per installed MW³⁴, therefore reduced scale biomass CHP will be even more expensive per installed MW. Compared to wood heat projects around the 50KW to couple of MW's scale (at €50,000 per installed MW) we can reasonably conclude small scale biomass CHP will be very much more costly per installed MW. As capital costs for wood heating are a big barrier they are only magnified when considering small (and large) scale biomass CHP.

This investment cost must be recouped by selling heat and power. This is fine for the electricity they are generating from the biomass fuels as electricity can be sold as generated. However while the CHP engine is generating that electricity it is also producing 3 to 4 times more heat – that must also be sold – to pay for the biomass fuel that is operating the CHP engine. It is difficult to imagine many locations where the heat is needed 24\7 year round.³⁵ In the end this need for a combination of matching heat and power loads preclude biomass CHP in smaller scale locations, unless the project does not need to be commercially viable.

6.3. Co-firing with biomass

It is possible to co-fire biomass fuels into existing solid fuel power stations. This market is vibrant and growing in the UK and parts of continental Europe. The Green Paper *Towards a Sustainable Energy Future* for Ireland has proposed a 30% target for co-firing at peat power stations by 2015. There are two such power stations that may therefore require biomass resource from the Western Region - Lough Ree (100MW) and West Offaly (150MW).

6.4. Wood fired heating boilers

Wood fired heating technologies are likely to form an important part of market growth in Western Region. The technology used for providing wood heating may be broken down into a number of generic types according to fuel source, scale and market application.

- ☐ Log boilers – domestic and small scale.
- ☐ Pellet central heating boilers (generally for single buildings but with some potential to serve *micro-nets*³⁶).
- ☐ Small-medium sized wood-chip boilers, ≤~500kW: generally for single buildings / users or *micro-nets* or small-scale community heating.

³⁴ Based upon costs for a CHP project in South Scotland.

³⁵ One of the reasons Biomass CHP is large scale is that it works by being connected to city wide district heating networks where there is stable and massive thermal load.

³⁶ A mini districting heating network.

- Medium-large sized wood-chip boilers, ~500-5,000kW: providing for a variety of applications, including community heating.
- Large-scale wood-chip boilers, >5,000kW: generally for large process applications or, potentially, large district heating. Most viable CHP applications would fall within this category

A qualitative review of the key features, constraints and commercial applications of each type is provided in Appendix 7.

6.5. The economics of wood heating in the Western Region

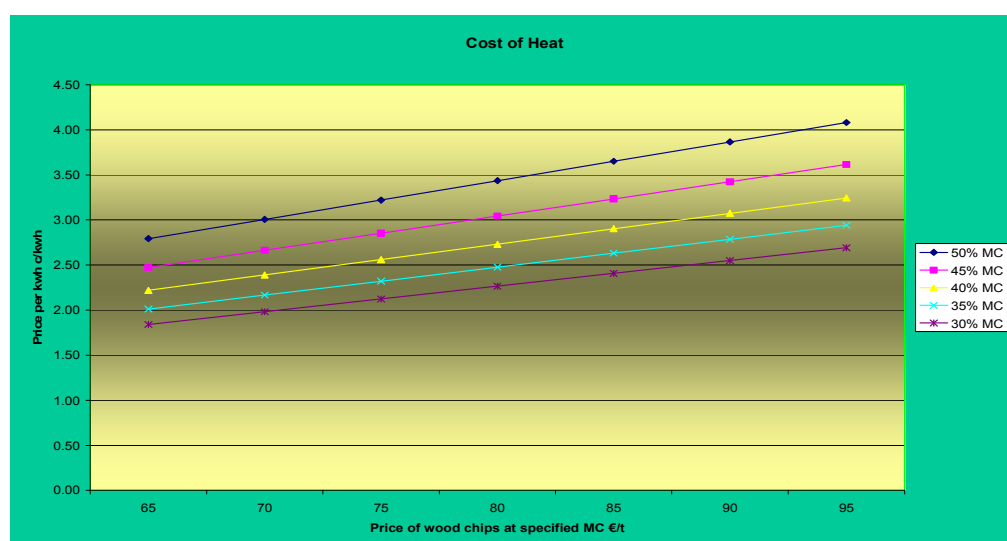
Wood heating systems are much more **expensive to install** than oil or gas heating systems. However they are much **cheaper to operate** as the cost of wood fuel is much lower than oil and gas. In simple terms wood heating will gain market share where the fuel savings justify the capital investment.

The price of wood fuel

For attractive paybacks to be achieved the price of wood fuel must be much lower than oil. The price of wood fuel is built up by a series of fixed 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.

We have already shown that a price for delivered wood fuel in the range €50 to €70 per green tonne should make it commercially viable to undertake first thinnings for all those involved (see section 4.5). The drier the wood fuel the greater its energy content. The table following illustrates the cost of heat (on the vertical scale) for differing wood fuel moisture contents at differing prices per tonne (for the wood chips on the horizontal scale).

Figure 9: Cost of heat for differing wood fuel moisture contents



Bearing in mind that heating with oil costs 6 cents per kWh³⁷ this figure illustrates that wood heating can be a very attractive fuel option. It is not clear what the exact price of heating with wood will be in the Western Region and of course this is a matter that the 'market will determine'. The key point is that taking into account the need for wood fuel suppliers to operate at a profit and the need for energy users to buy wood fuel at less than oil to secure a realistic payback the economics are demonstrably attractive for medium and large wood chip boilers.³⁸ A final point is that wood fuel costs appear to be reasonably stable and are linked to the long term price of wood fibre. This means that wood fuel heating can offer price predictability over the longer term.

Wood heat market opportunities matrix

The range of technologies and market applications for wood heating is summarised in the following table. The table is based upon our professional judgment of the markets and the technologies and is well used technique for illustrating markets and opportunities in this sector.

Appendix 8 contains more details on the methodology employed to produce the table.

Table 4: Wood heat market opportunities matrix

Sector	Log boilers	Pellet boilers (inc small networks)	Small-medium wood- chip boilers (≤500kW)	Medium-large wood- chip boilers (500kW- 5,000kW)	Large wood-chip boilers (>5,000kW) inc. CHP
Domestic					
private householders					
social housing					
housing 'developers' - private sector & social					
Commercial & industrial					
public sector - LA's, eg. schools, offices,					
public sector - other, eg. health / further					
private sector - farms / estates					
private sector - horticulture					
private sector - offices / light industrial / retail					
private sector - mining & quarrying					
private sector - utilities					
private sector - industrial					
private sector - manufacturing (inc food processing)					
private sector - other 'poor' load eg. construction, transport, storage etc					
private sector - other 'good' load, eg. hotels, care homes, residential schools etc					

	Good market opportunity - highest priority
	A level of market penetration possible but either cost or other market barriers will limit impact or niche opportunity
	Unlikely to achieve significant market penetration due to technical issues, costs or other barriers

³⁷ With oil at 55 cents a litre

³⁸ It is important to recognise that wood fuel for CHP and co-firing markets will be of a different specification and be more based upon larger scale harvesting operations and make greater use of brash, stumps and other presently unused forestry resources. It can also be delivered wetter and at a much larger scale in larger contracts. This means the market prices for wood fuel in the CHP/co-firing markets can be less.

The role that all five wood heat technologies have to play in a developed market, including log boilers at one end and large scale process heat applications at the other, is acknowledged, although at this stage of early market development it seems desirable to focus only on the most attractive market situations in the Western Region.

The role that pellets can play in opening up market opportunities otherwise unsuited to wood fuel is a very real one and is reflected in the Matrix, but this is predicated on the development of an effective supply infrastructure which *should* be based on indigenous production. It is only the lack of such an infrastructure that prevents a higher priority being given to pellet applications in the Matrix.³⁹

The role of the public sector in early market development is a key one and an essential priority for action. This includes not just county councils, but all of the public sector, including in particular 'high load' users such as hospitals, prisons, and university campuses and so-on.

Within the public sector, the role of social housing providers must be specifically pulled out given the raft of policy goals aimed at addressing fuel poverty. High density urban housing, some of which may already have fossil-fuelled community heating, is a specific instance where market development is likely.

Related to the above, the role of both small-scale micro-nets and larger-scale community heating in bringing wood heating both to third party heat users and to large numbers of users must be acknowledged and addressed.

But perhaps the key message of this section is that where (medium and large) wood chip boilers (in places like large hotels, care homes, hospitals, leisure centres etc) replace oil boilers the economics are likely to be the most attractive relative to any other wood energy technology.

³⁹ Plans to develop pellet mills in Clara (County Offaly) and Tuam (County Galway) are known about and could allow indigenous production

7.0. Scale of market opportunities

The preceding section has highlighted some of conversion technologies and market based issues that will impact upon market growth and suggested which technologies and markets have the best prospects for growth.

It can be concluded that there are three areas of opportunity in the Western Region:

- ☐ Co-firing
- ☐ Biomass CHP
- ☐ Wood heating – particularly in the medium and large scale.

This section of the report deals in more detail with scale of possible market growth.

7.1. Co-firing market

The two power stations that can use wood biomass from the Western Region use 2 million tonnes of peat per annum and so 600,000 tonnes of biomass (equivalent) will be needed to meet this demand by 2015 if the Green Paper target is to be met.

It can be assumed that some of this market demand will be met with biomass resource from the Western Region. It is not clear at this stage how ESB will source this biomass requirement and to what extent it will be met from woody biomass from the Western Region. A few observations can be made.

ESB could source or import non woody biomass fuel (fish and bone meal, palm oils, olive stones etc). Such fuel sources will probably be much less expensive than wood biomass.

The type of biomass fuel sought will depend upon how ESB intend to grind up the biomass to mix it with peat. For example the peat power stations could invest in on site grinders and buy in round logs and the so called 'fibre logs'⁴⁰.

Interestingly fibre logs can be produced in addition to the overall production of timber and would be additional to the supply scenarios outlined in this report as this source of wood biomass is not counted at present as the material is left in the forest to act as a brash mat for harvesting and for nutrient return.

Subject to these two factors a large quantity (100,000 tonnes +) is potentially available for co-firing.

⁴⁰ Fibre logs are bundles of brash and branches commonly used in countries like Finland for co-firing.

Clearly the development of a supply chain by ESB is fundamental to what happens next, together with how regulations emerge (for example in terms of having a phased or reduced target for co-firing or restricting fuel types or the % imported).

For the purposes of this report we have assumed that 50,000 tonnes of **wood** biomass is used in co-firing sourced from the Western Region.

7.2. Biomass CHP market

The biomass CHP market will be restricted to a number of large single projects. As already noted small scale biomass CHP is not a commercially viable technology at present.

Looking at the Western Region it can be assumed that there are about 5 to 7 locations where suitable combinations of heat and power use combine to offer the prospect of biomass CHP investment. This might include large process heat users in the pharmaceuticals industry, food processors, cement works, chemicals and possibly major public buildings like hospitals.

Nevertheless we have taken a positive view on the prospects for market growth. Assuming 5 projects of 5MW(e) are developed this would require in the order of 150,000 tonnes of wood fuel⁴¹.

25MW of electrical generation implies at least 75MW of heat output could be available depending upon the technology and application.

7.3. Wood heating market

The wood heating market offers the best prospect of growth where wood fuel replaces oil in medium and large boilers as highlighted by the 'wood v oil payback' chart and opportunities matrix.

In order to understand the scale of the opportunity we have reviewed the use of oil for heating in the Western Region.

Although we cannot find any published figures one way of estimating heating oil use in the Western Region is to use the total consumption figure for oil in Ireland and pro-rata the consumption based upon a population proxy.

This calculation is set out in the following table.

⁴¹ This fuel resource estimation is based upon commercially sensitive data obtained by the authors on a similar scale wood fired CHP project being developed at present in south Scotland

Table 5: Oil consumption in the Western Region

County	Pop 2006	% Total Irish Population	Oil Usage Litres
Clare	110800	2.62%	47,650,206.35
Galway	231035	5.46%	99,357,991.20
Leitrim	28837	0.68%	12,401,525.28
Mayo	123648	2.92%	53,175,566.02
Roscommon	58700	1.39%	25,244,288.02
Sligo	60863	1.44%	26,174,499.18
Donegal	146956	3.47%	63,199,311.60
Total	760839	17.97%	327,203,387.66
% of Total		17.97%	17.97%
Tonnes woodchips @40% MC⁴² (If 100% oil replaced)	871,053		
Tonnes woodchips @40% MC (If 5% oil replaced)	43,553		

This table shows that if all the heating oil use in the Western Region was replaced with wood fuel that 870,000 tonnes of wood chip (@40% MC) would be needed per annum.

Even a 5% share of the heating oil market replaced by wood fuel means 43,500 tonnes (@40% MC) per annum.

⁴² Moisture Content

Of course a 5% share of the heating oil market is not the same as a 5% share of the total heat market as envisaged as the 2010 target in the Green Paper on Energy.

Appendix 10 looks at oil use in the Western Region and establishes that oil for heating is the dominant energy market and accounts for more than 50% of the total heat market. This suggests that wood heating would need to account for about 10% of heating oil use by 2010 to achieve the 5% renewable heat target.

The practical implications are spelt out below.

If this degree of market share was to be achieved in the Western Region it would result in the consumption of about 100,000 green tonnes of wood chips per year.

100,000 green tonnes of wood chips would require about 120 MW of installed boiler capacity⁴³ to be installed.

This suggests that by 2010 about 80 (say 500KW rated) wood boilers need to be installed *each year* to get to the 5% market share.

With installed costs at around €500 euro per KW this represents an annual capital expenditure of over €20 million per year and €60 million in total.

To get some sense of this, it means 6 or 7 installation contracts per month⁴⁴, each with a value of €250,000.

From a standing start this degree of market growth seems very challenging in the timescale and illustrates the constraint on market growth that exists in terms of the capacity to design and install boiler capacity. This suggests that one area of market support should be in terms of capacity building for designers and installers of wood boilers.

7.4. Summary

The table below summarises the three wood fuel markets and the possible long term (2015) requirements for wood fuel.

⁴³ Based upon 1MW of boiler using about 800 green tonnes per year.

⁴⁴ For example schools, large hotels, hospitals, leisure centres, food processors etc

Table 6: Wood fuel markets and estimates requirements by 2015

Market	Fuel use (green tonnes pa)	Comments
Co-firing	50,000	Speculative figure – depends upon ESB
CHP	150,000	Speculative figure
Heat	100,000	Based upon 10% of heat oil market
Total	300,000	

It is important to emphasise that these figures are simply scenarios based upon a review of technologies and markets in the Western Region.

In terms of co-firing it seems possible that ESB could seek this requirement in only a few large supply contracts and that they could be up and running well before 2015.

CHP projects may take some years to plan, design and commission and it seems more reasonable to assume this demand will happen in several large chunks over the next 4 to 9 years (by 2015).

Heat energy market growth is by its very nature organic and small scale and the most optimistic assumption could be that demand to this level is achieved by 2015. This market can only create fuel resource demand in a phased manner and so is the most attractive from a fuel supply chain perspective. It will enable capacity to build up rather than require single massive chunks of wood supply.

The final point is that our (conservative) resource assessment has suggested that by 2015 the region will be able to sustainably supply 423,000 tonnes of wood fuel per annum, which exceeds the estimations of the most optimistic market demand by more than 100,000 tonnes and confirms a key finding of this study; that market growth will not be constrained by the availability of wood resource.

8.0. Best practice comparators

We have considered a range of comparator regions or countries and present a description of each of these in Appendix 11. The following summarises the issues we have identified as far as they have implications or use to the Western Region.

8.1. Scotland

Scottish biomass policy has similarities to Ireland.

In 2003\4 the Scottish Executive established the Forum for Renewable Energy Development Scotland (FREDS). This group was chaired by a Scottish Minister and senior representatives of the key players and was tasked with developing policy proposals to increase the amount of renewable electricity. A biomass sub group was formed and proposed the need for:

- ☐ A national wood fuel resource study
- ☐ A network of wood fuel information officers
- ☐ A web based advice service
- ☐ An installation and fuel supplier grant scheme
- ☐ The publication of a national wood fuel strategy
- ☐ National targets for renewable heat

A number of lessons can be drawn from this process for the Western Region.

It remains the case that there is no single view on the amount of available wood fuel resource and this has not helped to instil confidence in the wood energy market.

The wood fuel information officers are too thinly spread, although their role has been invaluable in helping energy users and fuel suppliers enter the market.

Little thought was given to supply side capacity building in the installers market or to making the grant scheme build up over time reacting to the ability of installers to build capacity.

A national biomass strategy is in formulation and is to be published next year. The strategy comes after some of actions to underpin it have been started.

Much lobbying has occurred to stimulate the creation of renewable heat targets and it is now intended to develop these by the end of 2007. It is not clear on the level of the targets or the timescales over which they should be achieved.

For the Western Region it is instructive to note that the policy response to wood energy in Scotland has been somewhat uncoordinated and ineffectively sequenced. Overall (to date) there seems to be lack of understanding as to the role and importance of wood heating in the renewable energy sector.

8.2. Austria (Upper Austria and Styria)

The development of wood heating in Upper Austria over the past 10 years certainly offers a striking view of what can be achieved. Here, a clearly defined strategy for RE development in which wood heating forms a key element has been pursued via an effectively coordinated and properly resourced development programme since 1994. The initial target for RE uptake was 25% and by 2002 the actual figure had reached 30%, with biomass providing 14%.

In 1980 Styria had one biomass district heating scheme, by 2000 Styria had 175 installed schemes. The Energy Agency of Styria provides a clear analysis of how this was achieved by:

- The publication of a Styrian Energy Plan in 1984,
- A €10 million per year fund to subsidize the costs of installing heating boilers,
- Through a single contact point the Energy Agency in Styria aggressively promoted wood fuel heating, backed by demonstration projects and R&D.

8.3. North East England

In 2003 a Biomass Action Plan for the North East of England was published. This placed the development of wood energy at the centre of a regional renewable energy strategy.

In 2006 One North East took the decision to allocate £1 million (pounds sterling) to a three year biomass support programme. It is intended to work alongside existing UK biomass grant schemes and does not in itself offer grants. The interesting thing from a WDC perspective is that One North East has been able justify such a large support budget over a sustained period that is over and above national grant support.

The programme will offer hundreds of businesses and energy users the prospect of structured support to develop a wood heating scheme. It includes a sophisticated awareness raising and promotional campaign designed to create a high level of initial interest in key energy markets. For every organisation entering the process they will receive an initial diagnostic check to establish the case for wood energy investment. Following this organisations are offered free and impartial technical and procurement advice right up to the point of investment.

Parallel with this the programme is supporting measures to build capacity in the installers sector and fuel supply chain.

8.4. Sweden

Sweden is along with one or two other EU countries the market leader in terms of wood energy. Biomass (biofuels and peat) provides 17% of Sweden's total energy supply (2004).

Perhaps the key lesson for the Western Region is that the main reason that Sweden has such a strong use of biomass in its energy mix is the introduction of carbon taxes on competing fuels. It is understood that the carbon tax in Sweden is now effectively set at 30%. This explains the very large price difference between wood chips and oil up to 2003. In 2003 oil was about 7 cents kWh and wood chips were 1.1 cents kWh. Recent hikes in the prices of oil have only served to increase this differential.

It is also known that boiler capital grant schemes had no real role in market development. Some experts in Sweden have even argued that capital grant schemes have an adverse effect on market growth as grants can encourage installed prices to rise simply in line with the level of grant available.

The overall message from Sweden is that one way for wood energy to develop large market share is for the price of competing fuels be much greater - and in Sweden this is achieved by carbon taxes.

8.5. Finland

Finland has the highest per capita use of wood for energy in the EU. This review focuses on the small scale heating market, which began to emerge on the early 1990's. At the end of 2005 the total amount was 300 plants and 150 MW of installed capacity. The average size is 500 kW, the biggest plants are 2.5-3.5 MW and they are mainly heating networks or industrial sites.

The costs of wood heat are around 5 cents kWh and wood chip suppliers are paid about the equivalent of 2 cents kWh⁴⁵ for delivered wood chips. It is thought that the costs of oil heating are around 7 cents kWh.

It can be inferred from these figures that in Finland – unlike its neighbour Sweden – the wood heat market is not being driven by a large price difference between wood and oil. Market growth can be partly explained by a system of capital grants for heating plant. It also appears that the economics of the heating plants is being helped by very cheap wood fuel (it is purchased by the heating plants at the energy equivalent price of 2 cents kWh and sold at 5 cents kWh.)

⁴⁵ (= 40 euro per solid cubic metre)

This system of low prices for wood fuels and higher prices for the resulting heat is supported by forestry grants to produce wood fuel.

It can be concluded that both in Finland and Sweden a range of taxation and subsidies are used to create large wood energy markets.

In the Western Region it seems unlikely that the unmediated existing oil\wood price difference will be sufficient to establish such big markets. This does not mean that some degree of market isn't possible and this is examined in more detail in section 10 of this report.

A final lesson that can be drawn from this is that in areas or countries with high levels of renewable energy deployment wood heating is placed at the centre of a renewable energy strategy and is seen as the key plank in delivering renewable energy.

9.0. Discussion of business models

9.1. Background

This section of the report considers how contractual and commercial arrangements are best configured to help promote effective market development.

To some extent the market will develop its own business models for its own needs; however a common barrier to early market development is lack of impartial advice on procurement contracts and business models.

For example lack of access to standard installation contracts reduces the chances of good quality and value for money in terms of heating plant installation. Equally well drafted wood heat or wood fuel supply contracts are needed by energy users and fuel suppliers to make effective long term commercial relationships happen.

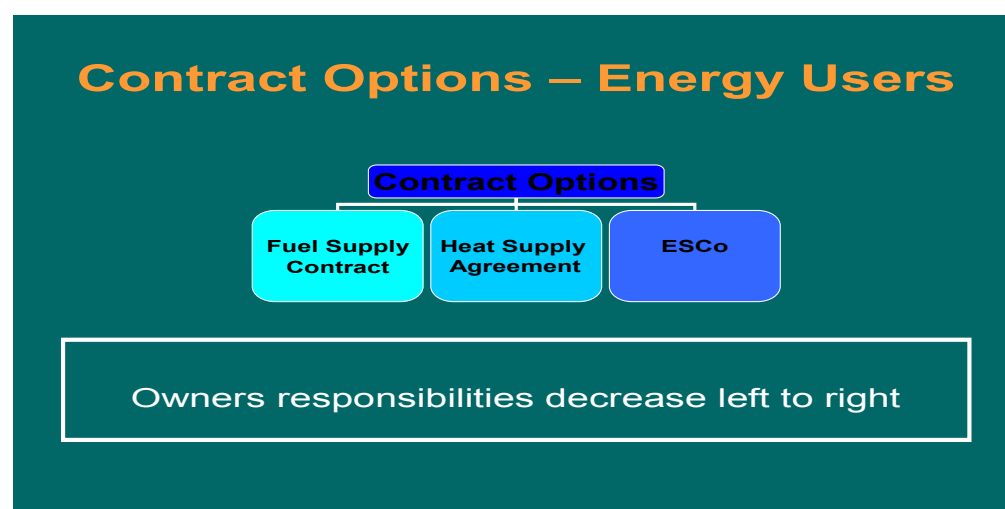
This suggests a key task is to identify, contextualise and make available such business model information and then allow the market to make use of it as needed.

9.2. Wood heat supply contracts\ESCO's⁴⁶

There are probably three basic wood\heat supply models (shown in the diagram):

- ☐ A simple wood fuel supply contract
- ☐ A wood heat supply contract
- ☐ An energy services supply contract

Figure 10: Contract options



⁴⁶ Energy Services Contract

1. A simple wood fuel supply contract

In this model the customer would own and maintain the wood fired boiler plant and purchase wood fuel like they might purchase oil – effectively on-the-spot market basis.

It is normal to buy green (wet) wood chips per oven-dried tonne (odt) at a fixed price per tonne. The fuel would need to comply with the boilers warranties in terms of chip dimensions and moisture content (m\c) and being free from contamination. This will usually mean chips at 30 – 45% moisture content.

The key issue is that, although it is relatively easy to measure the moisture content of delivered wood chips and of course as the payment is in ODT and so energy users don't actually pay for wetter less energy dense chips, they must find a way measuring the moisture content. This is difficult unless the heating plant is continuously manned and ideally has a weighbridge.

Therefore this model of contract operates well in mature and large wood heat markets – but is not so useful in emerging markets⁴⁷ with fewer smaller installed heating plants

2. A wood heat supply agreement

In this model the customer would own and maintain the wood fired boiler plant and a wood heat supplier would supply fuel and maintain the boiler plant. The customer pays for heat used (heat tariff in Euro\MWh measured at the heat meter) and standing charge to maintain the plant.

This model can be varied to suit the customers needs in terms of the term of the contract and the extent to which maintenance is carried out. Appendix 12 of this report contains the basic outline of a contract like this.

The key issue is that the energy customers would get a fixed price and hassle free contract. It also creates a commercial incentive on the wood fuel supplier to provide high quality and reliable fuel supply as they only receive payment if the boiler is selling heat. In terms of early market development it offers the best model for both parties.

However the supplier must be able to organise the:

⁴⁷ apart from perhaps in rural areas where both suppliers and customers are familiar with wood chips – e.g. estates, sawmills

- A. Harvesting, chipping, storage and delivery of wood chips
- B. Maintain a wood fired boiler
- C. Contract over several years and under the terms of wood heat contract – issuing utility bills

3. An energy services supply contract

In this model the supplier **owns** and operates a wood fuel boiler plant on behalf of the customer. There is a higher heat tariff to enable the capital cost of the plant to be paid back. The customer avoids any upfront capital cost.

This model might suit customers who cannot finance the heating plant and are less interested in making operational savings. It requires great confidence that the wood heat customer is reliable and long term and will still be purchasing heat in 5 or 10 years (and vice versa).

It is not a common commercial arrangement.

It is possible to have hybrid versions of 2 and 3, where **joint** ownership and finance – especially in the first year or two are agreed.

9.3. Wood boiler procurement

In early markets it has proved a challenge for energy customers to secure well designed and properly installed wood heating plants, but it is also about customers using suitable procurement contracts.

In large part this is about the quality and capacity of the installers. It is worth noting that bad experiences in terms of wood boiler installations can set back market development as investment will be seen as a risk if the boiler fails to operate properly or costs more than was expected. There are signs in the Western Region that one or two such installations will cause just this problem.

It is therefore critical that wood energy customers are able to procure the technology in a risk free manner.

A key point in all this is that the actual challenge for boiler installers is mostly in terms of design and not installation. At the moment if you want a wood heat plant installed you must seek a 'design and build' solution from one of few installation companies. The value they add is the small bit of specialist design (most of construction work is carried out by conventional building subcontractors).

It follows that a wood heat plant installation is mostly a conventional construction project (civil engineering for the fuel store, pipework, controls, pumps etc) added to a small bit of specialist knowledge about fuel reception, handling and delivery plus the particulars of wood boiler. This means that a conventional building contractor could install one. The bit missing is the ability of the design engineer to design the wood system so the ordinary building contractor can build it.

Therefore there are two ways of procuring a wood boiler:

1. Use a specialist wood boiler installer to provide a 'design and build solution'
2. Use a consulting engineer to produce a fully specified design and procure the system through a standard fixed price building contract.

In reality it is not possible to secure a suitably qualified consulting engineer at present, so unless or until engineers obtain the specialist skill sets needed it will be necessary to procure the wood boiler via a design and build contract from a specialist installer.

Under these circumstances it is vital that both parties to the contract (installer and energy user) agree clear contractual terms and operate under a suitable design build contract. No such contracts are drafted (although SEI has published a useful procurement checklist).

9.4. Community and cooperative models

It would be desirable from a local economic development perspective to stimulate the role of local people in supply chain to supply wood fuel or install and maintain boilers.

In mainland Europe there many examples of this. However these models operate in mature and not emerging markets. The following offers some observations on the prospects for this.

In the Western Region there are many farmer\foresters who could be encouraged to set up a fuel supply business on a co-operative basis. This implies a new start business. The problem with that is that energy users considering converting to wood fuel may find it problematic to contract with a new start business owned by farmers with limited financial backing. For example a large hotel will almost certainly wish to impose some form of penalty on a fuel supplier in the event they fail to deliver wood fuel or deliver poor quality fuel. The hotel will view the wood fuel supplier like they view any other major energy utility supplier and would be unlikely to have confidence in a small new start co-operative venture. They cannot after all run a hotel without heating.

This suggests that co-operative fuel supply companies should be promoted after several years of market development as and when the market is mature enough to have confidence in the fuel supply.

This does not mean that farmers/foresters cannot become involved in the market as they will be able to offer to harvest, process and deliver wood fuel via subcontracts with larger companies.

In the north west of England a public sector funded producer group has been established (www.newfuels.org.uk). The concept is that local growers co-operate to meet supply demand fronted via a new company that underwrites some of the start up costs with public funds. It is also thought that the Newfuels Company offers greater confidence to potential wood energy users. This might be a model to replicate in the Western Region.

In terms of the installation and boiler maintenance markets similar comments apply and the likelihood is that local people will be able to offer much of the routine maintenance services.

10.0. Economic development prospects

10.1. Methodology

We have analysed the potential economic impact of wood energy development for the region.

Most of these indicators can be provided as firm numerical values depending upon the rates of market growth achieved over time. The methodology for arriving at these impacts has been partly based upon similar work completed in Scotland by the Fraser of Allander Institute⁴⁸.

This methodology is based upon developing a suite of economic impacts using growth in the use of wood fuel *sold for heat* as the base measure. This means that for each 1000 tonnes of wood fuel sold there is a quantifiable impact in terms of employment, wages, capital investment and so on.

One obvious limitation of this approach is that the model was developed for the Scottish economy using the *2001 Scottish Input Output Tables*. It cannot be assumed that the impacts in the Western Region would exactly match those of Scotland. A second limitation is that the authors of this report are not professional economists. Finally the method is not fully applicable to the CHP and co-firing market.

The assumption built into the following estimated impacts is that the high levels of market share in countries such as Finland, Austria and Sweden (of around a quarter of the total energy market) are simply not achievable in a foreseeable period and without the introduction of all Ireland taxes or incentives. Large changes in energy policy and new methods of taxation and subsidies would be needed to develop market share of this order.

However the basic price difference of wood and oil for heating in the Western Region and the widespread availability of the wood resource do suggest that more modest market share is achievable. Section 11 of this report suggests some of the actions needed to underpin modest market growth and the following impacts assume these are acted upon and that market share does grow somewhat towards the EU average in the heat market at least.

⁴⁸ The Economic Impact of Wood Heat in Scotland -A Report to Scottish Enterprise Forest Industries Cluster from the Fraser of Allander Institute- February 2006. The impact model was developed from the 2001 Scottish Input Output Tables (SIOT) published by the Scottish Executive. The SIOT depict, inter alia, one structural aspect of the Scottish economy of particular use in the present context, the detailed pattern of sales and purchases made by 123 economic local industries. It is then possible from these data to estimate how much expansion in any one industry will affect all others by examining the pattern of purchases – in effect, how expansion in one sector creates demands down the industry supply chain. In fact, the SIOT allows us to estimate how an increase in demand in one industry will affect the supply chain of all industries, and therefore to estimate the total impact of an increase in demand for wood fuel.

10.2. Impacts

Impacts in the heat market

This study has already established the markets and technology that will be most attractive in the Western Region and considered the scale of wood fuel use assuming a 5% market share in the heat market (= to a 10% share of the oil heat market). The key assumption to be made is how quickly that degree of market share will be achieved. Given the current capacity of the sector market growth is likely to be slow and constrained by a lack of skilled installers. Thus this report assumes wood heat will be able to secure a 5% share of the heat market by 2015. On that basis the following impacts can be estimated:

Impacts of 5% target by 2015

- **100,000 green tonnes of fuel used per annum**
Estimated by replacing 10% of the oil consumption in the Western Region (see section 7.3).
- **120MW of wood boilers installed**
Typically 1MW of installed boiler capacity requires about 800 green tonnes of fuel per year, thus if the fuel used is known the amount of boiler capacity can be inferred.
- **€8 million per annum in wood fuel sales**
We have based this on €80 green tonne.
- **800 new jobs created in the sector**
This figure is based on the multipliers used in the Fraser of Allander Institute report simply using the 100,000 green tonnes of fuel sold figure for the Western Region.
- **€60 million capital investment**
Based upon our current market knowledge that wood heating systems will cost on average €50,000 per installed MW.
- **€64 million of additional wage income**
This figure is based on the multipliers used in the Fraser of Allander Institute report simply using the 100,000 green tonnes of fuel sold figure for the Western Region.
- **€3 million per annum savings on regional energy bills**
Assumption is that 75% of the wood fuel is sold to business in the Western Region. This means of the resulting €6 million a saving of 50% is possible as wood fuel is 50% cheaper than oil.
- **100,000 tonnes per annum CO₂ savings**
One tonne of green wood fuel used saves 1 tonne of CO₂ as a rule of thumb.

- **Displaces 30 million litres of imported oil**

One tonne of green wood fuel replaces 300 litres of oil as a rule of thumb.

By 2015 and with a 5% market share the sector will have developed a critical mass of installers, suppliers and the inherent skills and expertise. This suggests market growth can then be more rapid.⁴⁹

Impacts in the co-firing market

The economic impacts of an emerging co-firing market are different and less than in the heat market. This is because there is little capital investment (as the fuel is used in existing infrastructure) and there are fewer jobs created in the fuel supply chain (as the supply chain is on a larger and more mechanised scale). Nevertheless there will be positive economic impacts and these are estimated and set out below.

50,000 tonnes of wood fuel will be sold. The value of this fuel is very difficult to determine, but is assumed to be in the range €50 to €70 a green tonne at the power plant gate. This means the value of fuel sales could be in the range €2.5 to €3.5 million per annum.

Annual CO₂ savings will be 50,000 tonnes.

Some new jobs will be created in the fuel supply chain. There is no reliable way of estimating this at present until ESB decides how they intend to procure the biomass. The experience of co-firing supply chains elsewhere suggests relatively low rates of new employment. A highly speculative but very cautious figure of 30 new jobs in the supply chain and 5 new jobs at the power plants is assumed for now. This means 35 new jobs could be created.

There will be some investment associated with co-firing, both at the peat power stations to handle and process biomass and in the supply chain to harvest fuel. Again estimates are very difficult to arrive at. For the purposes of this report it has been assumed that €3 million of new investment is made.

The timescales for all this investment are assumed to be by 2015 to be in line with Green Paper.

⁴⁹ This report assumes that the next 5 years will double market share achieved from the period 2007 to 2015 – thus reaching the current EU average market share.

Impacts in the CHP market

The economic impacts of an emerging CHP market are different and also less than in the heat market. This is because there are fewer jobs created in the fuel supply chain (as the supply chain is on a larger and more mechanised scale). Nevertheless there will be positive economic impacts and these are estimated and set out below.

150,000 tonnes of wood fuel will be sold. The value of this fuel is very difficult to determine, but is assumed to be in the range €50 to €70 a green tonne at the power plant gate. This means the value of fuel sales could be in the range €7.5 to €10.5 million per annum.

Annual CO₂ savings will be 150,000 tonnes.

Some new jobs will be created in the fuel supply chain. There is no reliable way of estimating this at present. The experience of CHP supply chains elsewhere suggests relatively low rates of new employment. A highly speculative but very cautious figure of 75 new jobs in the supply chain and 10 new jobs at the power plants is assumed for now. This means 85 new jobs could be created.

There will be investment associated with CHP. Again estimates are very difficult to arrive at. For the purposes of this report it has been assumed that each MW(e) of installed capacity equals €2 million, thus 25MW(e) represents €50 million⁵⁰.

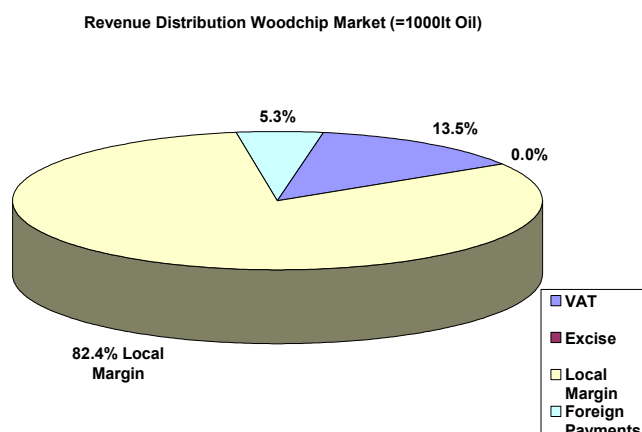
The timescales for all this investment are assumed to be by 2015.

10.3. Summary

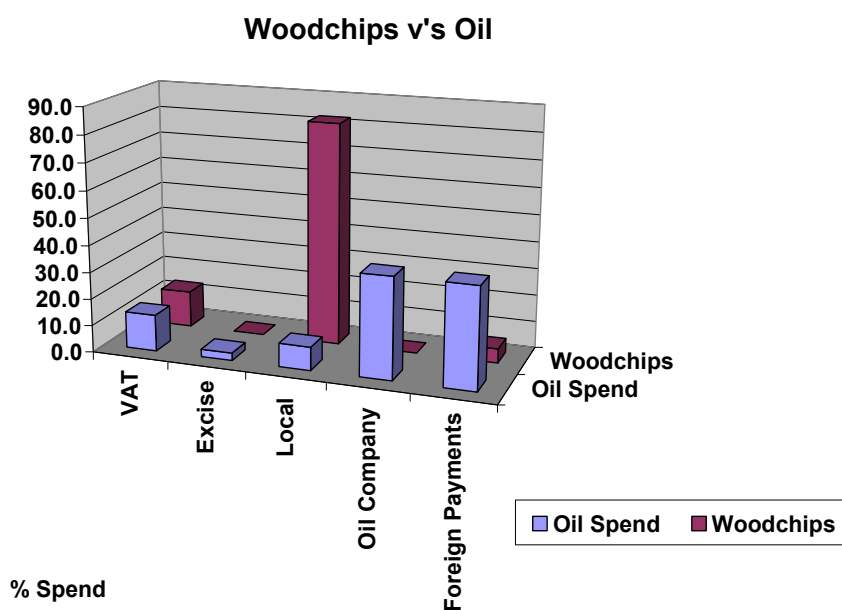
The potential economic impacts of a wood energy sector in the Western Region are enormous and beneficial. A key reason for this is that the use of wood fuel simply displaces imported oil, thus unlike economic development in many other sectors there are virtually no displacement impacts. The principal of this is graphically illustrated by the figure below – showing that extent of retained local benefits with wood fuel⁵¹:

⁵⁰ Private sector CHP project in development at 5MW(e) scale – South Scotland

⁵¹ Source Dare Ltd

Figure 11: Revenue Distribution of woodchip market (=1000lt oil)

The following figure ⁵² compares wood with oil where most of the benefits are exported.

Figure 12: Woodchip v's oil in regard to locally retained benefits

The other key point about wood energy is that it is inherently job intensive because of the need to have a fuel supply chain. This is unlike most other renewables – which are passive technologies that rely on the wind, the sun, or the waves to collect energy. Most of the economic benefits of these technologies occur at the capital investment stage and are not sustained over the lifetime of the investment.

⁵² Source Dare Ltd

In summary therefore the overall possible economic impacts of a wood energy sector in the Western Region are outlined below:

HEAT + CHP + CO-FIRING = TOTAL IMPACT BY 2015⁵³

- 145MW of installed capacity
- 300,000 green tonnes of fuel used per annum
- €20 million per annum in wood fuel sales
- 910 new jobs created in the sector
- €117 million capital investment
- €130 million of additional wage income
- €3 million per annum savings on regional energy bills
- 375,000 tonnes per annum CO₂ savings
- Displaces 30 million litres of imported oil

These impacts are heavily associated with growth in the heat market, if as seems likely wood heat reaches critical mass by 2015 and then continues to grow strongly - then beyond 2015 the economic benefits will also grow strongly.

⁵³ It is important to recognize these impacts are based upon scenarios and then these scenarios are used to infer impact. The CHP and co-firing impacts are in particular highly tentative.

11.0. Conclusions and recommendations

A key aspect of the most successful countries and regions in terms of renewable energy is that they place wood fuel heating at the centre of a renewable energy strategy, so it is evident that the sector does require a regional strategy and that the potential benefits of market growth are significant to the region and its economy. This report is not intended to set out a strategy or action plan; however the following does attempt to describe some of the components of this and offer suggestions as to the next steps for WDC and its partners and stakeholders.

A published strategy for wood fuel

A key recommendation is therefore that the WDC does proceed to the next stage of strategy development. It is clear that the WDC and its stakeholders should jointly subscribe to a published wood fuel strategy (as opposed to biomass) and a subsequent action plan. This process requires both engagement from the stakeholders and in many cases direct time and resources to deliver it.

A focus on wood heating

It is also evident that the most significant economic gains will occur as a result of market growth in the wood heat sector. This report has highlighted the segments of that heat market that offer the most immediate prospects of market growth.

Accordingly a second recommendation of this report is that the WDC and its partners focus on supporting wood heat market growth in the most commercially attractive segments of that market.

Co-ordinated, sustained promotional campaign

The process of completing this report included extensive consultations. This established that one of the main issues for market development in the region is the lack of awareness and information about the technology and its potential benefits. The review of other regions and countries has reinforced the notion that market growth is at least partly supported through positive promotion and awareness raising.

Therefore the third recommendation of this report is that the sector should be supported via a co-ordinated, sustained and professional promotional campaign to build confidence in the market for both energy users and suppliers. In this context the WDC will have pivotal role in securing consensus on the strategy needed and actions required to deliver on that.

For this process to be successful it should be based upon timescales that are responsive both to the stakeholders and key market players. For example the strategy should set realistic targets for market growth based upon the ability of installers to respond to market needs.

One of the key functions of this report is to highlight the potential benefits of market development and seen in this context even quite resource intensive actions seem justifiable given the potential economic and environmental benefits.

Finally it is also significant that market growth will not be constrained by the availability of wood resources and conversely the forest sector will benefit from a new market that should help underpin a large volume of grant funded private forestry that is going to be seeking an outlet.

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Appendix 1: Members of the Advisory Group

The WDC wishes to thank the Advisory Group members:

- Pearse Buckley, Sustainable Energy Ireland
- Philip Carr, The Forest Service, Department of Agriculture and Food
- Barry Caslin, Teagasc
- Frank Conlon, Udarás na Gaeltachta
- Dr. Billy Fitzgerald, Institute of Technology Sligo
- Dóirín Graham, Clare Rural Development Ltd (LEADER programme)
- Christine Hutton, Rural Generation Ltd
- Peter Keaveney, Association of Irish Energy Agencies (Galway Energy Agency)
- Paula Keelaghan, Balcas Timber Ltd
- Katherine Licken, Department of Communications, Marine and Natural Resources
- Barbara Maguire, IFA Farm Forestry
- Hugo McCormick, Imperative Energy Ltd
- Steven Meyen, Teagasc
- Kathleen Stack, Department of Community, Rural and Gaeltacht Affairs

The support of the Forest Service in carrying out primary research was invaluable as was the significant involvement and input from SEI. Many thanks are also due to those who attended the workshops and participated in the surveys conducted for this report.

Appendix 2: Other Biomass Fuels

There is no common definition of the non wood biomass fuels, but the following list summarises the main sources:

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

Appendix 3: Bioheat and Greener Homes grant schemes

Greener Homes Scheme

In March this year the Minister for Communications, Marine and Natural Resources announced the introduction of a new grant scheme to encourage homeowners and house builders to install renewable energy technologies to heat their buildings.

The Greener Homes scheme is administered by Sustainable Energy Ireland and full details are available at www.sei.ie. A total fund of €27 million has been made available over a five year period. Technologies to be supported include heat pumps, solar panels and wood pellet/woodchip stoves and boilers. The following grant levels are now available:

Solar Thermal Space and/or Hot water heating	€300 per m ² (to max. 12 m ²)
Heat Pump - Horizontal ground collector	€4,300
Heat Pump - Vertical ground collector	€6,500
Heat Pump - Water (well) to water	€4,300
Heat Pump - Air source	€4,000
Wood Chip/Pellet Stove	€1,100
Biomass / Wood pellet Stove with integral boiler	€1,800
Wood Chip/Pellet Boiler	€4,200

Bioheat grant scheme

SEI runs a bioheat grant scheme, this emerged via the 2006 Budget, when the Minister of Finance announced the allocation of €65 million over the period 2006 to 2010 to “*launch several innovative grant schemes relating to biofuels, combined heat and power, biomass commercial heaters and domestic renewable heat grants*”. An indicative allocation of €22 million was made for SEI to run the Bioheat Boiler Deployment Programme (2006 to 2010 time frame).

The new programme will provide grant support to assist the deployment of boilers fuelled by wood chips and wood pellets and applied in large buildings/small industrial sites in Ireland. It supersedes the “Pilot Bioheat Boiler Deployment” Programme.

The focus of the programme is boilers in the size range 60kW to 1,000kW. However, boilers larger than 1,000kW will also be considered on a limited basis. Grant support up to 40% or €5,000 (whichever is less) is available for feasibility studies; the total amount of support being

limited to €100,000⁵⁴ for all feasibility studies. Capital investment support is available for up to 30% for eligible costs .

This scheme is very important to market development and will help underpin the regional biomass strategy to very significant degree.

⁵⁴ Limited by a maximum qualifying cost profile of €500/kWth at 60kWth, reducing linearly to €250/kWth at 1,000kW

Appendix 4: Irish Forest Unit Trust Estate (IForUT) Sample Methodology

A sample⁵⁵ of about 3,700ha representative of all counties, site types, species and growing conditions was studied to determine the quantity of timber that is harvestable. We used the following criteria to determine the volume of harvestable timber:

1. Productive Area – the area on which a commercial crop has been established
2. No-thin area – the area which will not be thinned because of low production, exposure and poor soil conditions
3. Thinning area – the area which will be thinned commencing at 18 years and continuing on a five year cycle
4. Unproductive areas
5. Yield Class
6. Harvest yield in m³ overbark

The results contained in the table below show that 77.7% of the sample area will be thinned and that a very substantial proportion of these thinnings will be in the pulpwood category.

Criteria	Area ha	% of Total
Total area of sample	3687.6	100
Productive area	3373.4	91.5
No-thin area	506.0	13.7
Thinning Area	2867.4	77.7
Unproductive area	314.2	8.5
Assumed YC	22	
Age of 1 st thinning	18	
Average volume harvested	50m ³ /ha or 50t/ha	100
Pulpwood volume	35.5m ³ /ha or 35.5t/ha	71
Palletwood	14.5m ³ /ha or 14.5t/ha	29

By applying these results to all the private plantations a forecast for productive area and yield can be determined. These are given in the table below.

⁵⁵ The IForUT estate

Criteria	Area ha	% of Total
Total area of target group	83,060	100
Productive area	76,000	91.5
No-thin area	11,400	13.7
Thin area	64,600	77.7
Unproductive area	7,060	8.5

From this it can be concluded that c. 64,600ha of privately owned plantations will be suitable for thinning and as such will form the basis of the forecasts included in this report.

It should also be noted that not all the forestry included in this evaluation is in current active management. It is assumed that any such forestry would be brought into management if a viable local market emerged.

Appendix 5: Issues affecting wood fuel supply chains

There are five interrelated issues which can impede the development of the getting forestry into the supply chain for the fuel wood sector:

- ☐ Owners operating in isolation
- ☐ Dispersed pattern and average size of plantation (average size 9ha)⁵⁶
- ☐ Road access both internal and external
- ☐ Distance to markets; and of course
- ☐ Price

To some extent these obstacles can be overcome by identifying the owners and grouping their plantations into clusters which are capable of supplying wood on an ongoing basis in a five year cycle.

It is not economic to consider thinning small single plantations as the cost relative to the amount of timber harvested is prohibitive. However, by grouping plantation the volume to be harvested increases which makes it attractive to harvesting contractors.

Since pulpwood is the least valuable part of the harvest the cost associated with harvesting and haulage has a major impact on the returns to a grower. It has been found that the maximum haulage distance for pulpwood is about 40km¹³. If the distance is greater then the grower incurs a loss which is usually offset against the sale of stakewood and palletwood.

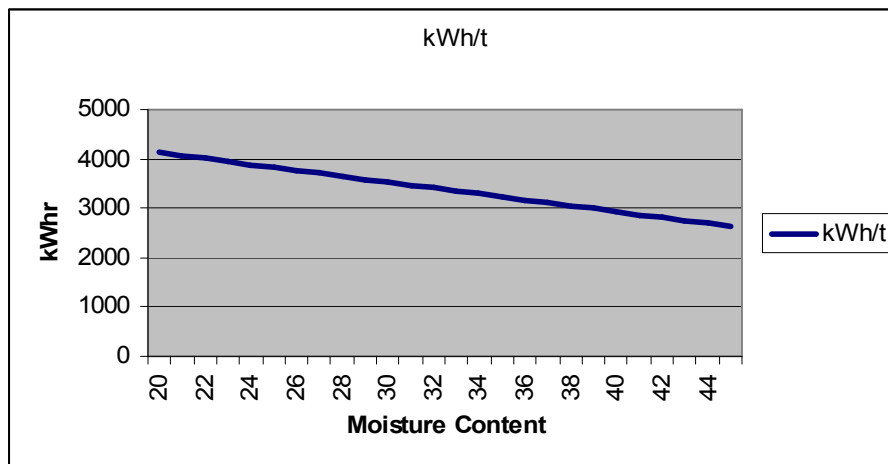
Fuel quality issues

There is much confusion surrounding fuel quality as there is no single standard for Europe at present⁵⁷. Therefore, it is essential that the region adopts a recognised standard, from one of Europe's leading biomass markets, which sets out the various fuel characteristics and the physical properties and sizes for each. All suppliers of biomass fuels should be registered with and have their fuel type and equipment certified to promote market confidence.

The moisture content of biomass fuels has a major impact on the energy content of the fuel. The wetter the fuel the lower the energy content. Therefore, it is necessary to control the delivered moisture content of the fuel to ensure that the heat demand will be met. Moisture content is normally expressed as a percentage of total weight. The figure below shows the relationship between moisture content and energy value.

⁵⁶ CCWEP Study

⁵⁷ Although I.S CEN TS/1A961:2005 is a useful standard



The physical size of the particles is also important if “bridging” (obstruction) of the fuel feed system is to be avoided and prevention of small particles and dust choking the grid.

Appendix 6: Western Region Installers

Company	County	email	web	Phone
Heatmerchants	Clare	derek.barry@heatmerchants.ie		065 6844922
Shamrock Solar Solutions	Clare	info@shamrocksolar.com	www.shamrocksolar.com	065 6868468
Clearpower	Dublin	info@clearpower.ie	www.clearpower.ie	086 1517378
Imperative Energy				086 2554182
Heatmerchants	Donegal	andrew.moore@heatmerchants.ie		074 9188377
Solar Energy Ireland		solarenergyireland@eircom.net	www.solarenergyireland.com	071 9183219
The Alternative Energy Co		info@altenergyco.ie	www.altenergyco.ie	076 6020364
Eirtherm Ltd	Donegal	eirtherm@eircom.net		074 9140075
Heatmerchants	Galway	john.scarry@heatmerchants.ie		091 705150
Total Energy Management	Galway	info@tem.ie	www.tem.ie	091 769174
Cahills Home Value Hardware	Galway	cahillsofgort@eircom.net	www.cahillshomevalue.ie	091 632275
MarDel Wastecare Products Ltd	Galway	info@mardelwastecare.com	www.mardelwastecare.ie	094 9643067
Naturally Gas	Galway	info@naturallygas.net	www.naturallygas.net	091 876816
Renew IT	Mayo	info@renewit.it	www.renewit.ie	094 9621921
Powertech	Tyrone	francis@powertechireland.co.uk	www.powertechireland.co.uk	048 80761005
NPS	Waterford	info@nps.ie	www.nps.ie	051 832777
Igneus	Wexford	gerald@igneus.ie	www.igneus.ie	087 6287978
REMS	Cork	trevor@rems.ie	www.rems.ie	023 29197
Moycullen Mechanical Services	Galway			091 555322
Kiernan Mechanical Services Ltd	Galway	info@kmsl.ie	www.kmsl.ie	091 630618
Rural Generation Ltd	Derry	chutton@ruralgeneration.com	www.ruralgeneration.com	048 71358215

Appendix 7: Wood Fired Heating Technologies

Log fired heating boilers

Current state-of-the art log boiler appliances offer a high degree of refinement and efficiency, with less refined but lower cost appliances also available. The 'best' of the currently available log boilers, often referred to as *gasifying boilers*, have a large *log chamber* and closely controlled combustion (generally making use of a lamda sensor to monitor flue gas oxygen levels and thereby optimise the supply of combustion air). Overall, they offer:



- Very high efficiency (>90%);
- clean operation (cleaner emissions than an oil boiler);
- Minimal and easy maintenance; and
- Long burn-periods (up to 20 hours on a single charge of fuel).

Combined with a thermal store known as an *accumulator tank* or *buffer vessel*, well specified systems need lighting just once per day in cold weather and are now able to offer a very high level of utility to users. Their high efficiency also means that the total amount of fuel burnt to heat a whole house might be little 4\5 tonnes of logs per annum.

Space constraints, perceived lack of convenience and capital cost may preclude deployment. However, experience elsewhere in Europe shows that logs are a commonly used form of woodfuel, and certainly the fuel supply chain itself is relatively straightforward. Thus, log boilers and central heating stoves are sold in large numbers in Europe (they are the most numerous type of wood boiler installation of all).

Pellet central heating boilers

The level of refinement of the latest generation of pellet boilers means that they can now provide a degree of utility or 'user-friendliness' almost akin to a conventional oil or lpg boiler.

Typical features include:

- Sophisticated combustion controls to give high efficiency (>90%) and very clean emissions.
- Automatic ignition so that they respond to the heating demand without user intervention.
- Modulating controls to allow them to follow the heat demand of the building and maintain maximum year-round efficiency.

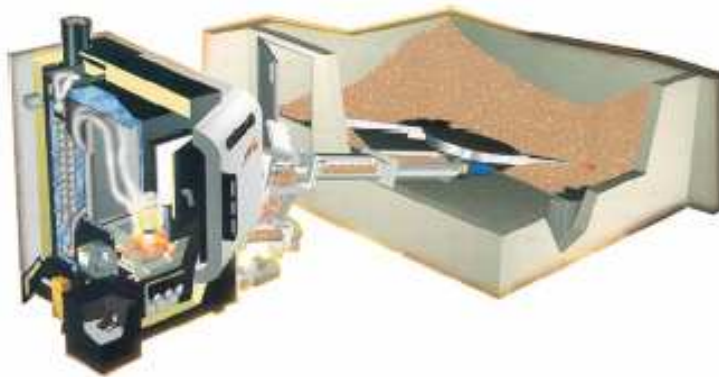


- Automatic cleaning and de-ashing to give minimal maintenance requirements (emptying of the ash bin fortnightly or even monthly and an annual service).
- A 'menu' of fuel delivery, storage and handling options to suit a wide variety of circumstances.

In common with log boilers space, both for the boiler itself and for fuel storage, is still a limiting factor in locating a pellet boiler in many premises.

Wood Chip Heating Systems

Wood chip boilers provide the vast bulk of wood fired heat energy and technology starts at the scale of about 50KW (sufficient to provide space heating in small building such as a primary school.) The principals of small scale wood chip system are illustrated in the images that follow:



Cut away of small scale wood chip system



100KW boiler

Larger wood chip boilers are commonly available up to about 5MW. The images following show wood fuel boiler systems in the range 300KW to 500KW that would be capable of heating a large secondary school.



The key design issue for wood chip boilers is the fuel handling, reception and storage design. The following images illustrate some of the options:



Appendix 8: Wood heat market opportunities matrix methodology

The table uses the concept of an *Opportunities Matrix* to provide a clearly defined sectoral analysis. Specifically, the market is segmented both by technology and according to end-use, and a review of each is used to provide a two-dimensional graphical summary that highlights the key market opportunities for wood heat:

Technology sectors

- ☐ Log boilers
- ☐ Pellet boilers(inc small networks)
- ☐ Small-medium woodchip boilers ($\leq 500\text{kW}$)
- ☐ Medium-large woodchip boilers (500kW- 5,000kW)
- ☐ Large wood-chip boilers ($>5,000\text{kW}$)

These sectors are developed from the technology review. One important reason to sub-divide wood chip boilers into 3 sectors is that small to medium wood chip boilers are manufactured in volume and can be purchased off a production line. Large wood chip boilers tend to be one off engineering projects and this makes design and procurement different.

Classification of end-uses

The break-down of end-user types is one devised by the author as being appropriate to the context of the Western Region. It is in part derived from the *United Kingdom Standard Industrial Classification of Economic Activities* (UKSIC 92) but is modified to be of more utility in the present context (including the addition of Domestic users). The sectors used are essentially self-explanatory and are set out below:

Domestic

- ☐ private householders
- ☐ social housing
- ☐ housing 'developers' - private sector

Commercial & industrial

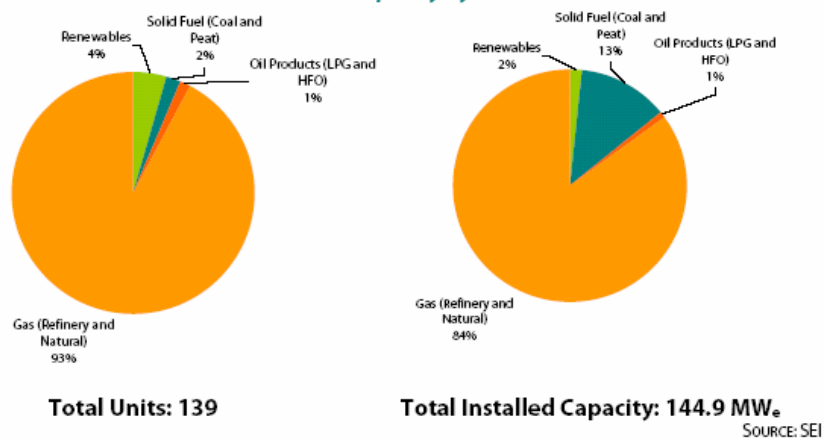
- ☐ public sector - LA's, eg. schools, offices, leisure facilities
- ☐ public sector - other, eg. health / further education / prisons / military
- ☐ private sector - farms / estates
- ☐ private sector - horticulture
- ☐ private sector - offices / light industrial / retail
- ☐ private sector - mining & quarrying
- ☐ private sector - utilities

- ☐ private sector - industrial
- ☐ private sector - manufacturing (inc food processing)
- ☐ private sector - other 'poor' load eg. construction, transport, storage etc
- ☐ private sector - other 'good' load, eg. hotels, care homes, residential schools

Appendix 9: CHP in Ireland

The installed capacity of CHP in Ireland at the end of 2004 was 145 MW(e) (139 units)⁵⁸. The figure below illustrates that the majority of the installed CHP projects are operated using fossil fuels.

Figure 1: Number of Units and Installed Capacity by Fuel 2004



⁵⁸ Source SEI

Appendix 10: Oil use in the Western Region

The table below shows total Irish primary energy requirement by fuel type⁵⁹. It illustrates that over half of all energy used in Ireland is from oil. It can be assumed that the Western Region will have an even higher reliance on oil as it has less mains gas than other parts of Ireland.

Table 18.3 Total primary energy requirement by fuel type

	Millions of tonnes of oil equivalent (TOE)							Percentages						
	1985	1990	1995	2000	2001	2002	2003	1985	1990	1995	2000	2001	2002	2003
Coal	1.05	2.16	1.92	1.99	2.04	1.98	1.91	13.1	22.9	17.9	14.2	13.8	13.4	12.9
Peat	1.45	1.36	1.21	0.80	0.88	0.86	0.84	18.0	14.4	11.3	5.7	6.0	5.8	5.7
Oil	3.89	4.29	5.45	7.92	8.44	8.26	8.02	48.4	45.5	50.9	56.5	57.2	56.0	54.1
Natural Gas	1.99	1.45	1.92	3.04	3.14	3.33	3.69	19.8	15.4	17.9	21.7	21.3	22.6	24.9
Renewables	0.06	0.17	0.20	0.36	0.26	0.29	0.36	0.7	1.8	1.9	1.9	1.8	1.9	1.8
Electricity imports	0.00	0.00	0.00	0.01	0.01	0.04	0.10	0.0	0.0	0.0	0.1	0.0	0.3	0.7
Total	8.04	9.43	10.70	14.02	14.77	14.75	14.81	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Sustainable Energy Ireland

We have not identified any specific published oil use data for the Western Region alone, but in County Clare and Limerick 34,431 households rely on oil for heating. The other 29,709 households use other heating fuels such as coal, gas and peat⁶⁰.

The Limerick and Clare Energy Balance Study states that 40% of energy use is accounted for by buildings and that 73.8% of total final energy consumption is accounted for by oil.

The Galway Energy and Emissions study (August 2001, produced by the Galway Energy Agency) indicates that in 2000 oil use in Galway was 3700GWh (TFC) out of a total final energy consumption for Galway as a whole of 4800 GWh.

It seems likely that such figures would be broadly similar for WDC as a whole and suggest that for the Western Region oil for heating will be the dominant energy market and that it will account for more than 50% of the total heat market.

⁵⁹ Source SEI

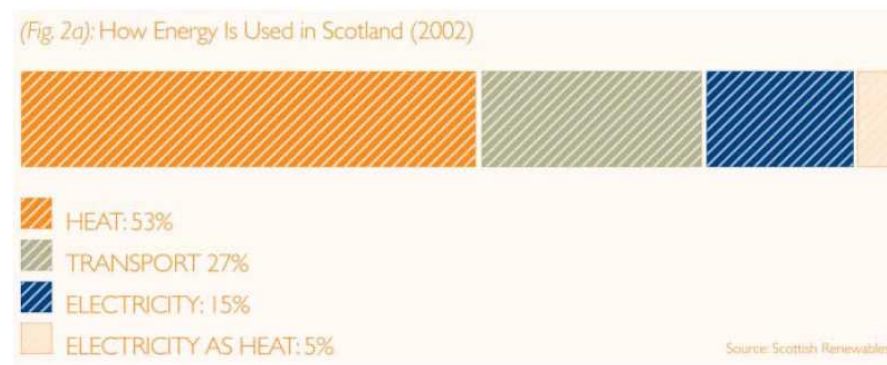
⁶⁰ Source ESRI 2003

Appendix 11: Best practice comparators

Scotland

Scotland has a total use of wood energy of around 300,000 green tonnes pa at present. This is set to rise quite rapidly in 2007 as several large biomass CHP and electricity projects come on stream and as the wood heat market continues to grow from a small base. In many ways the Scottish biomass market is similar to Ireland.

Scottish biomass policy also has similarities to Ireland. For example Scotland has no renewable energy targets, no renewable heat targets and has the sole policy of renewable electricity targets. In essence this means the policy context is very similar. It is noteworthy that in Scotland a debate is emerging about how energy is used and therefore what types of policy and support are needed. This table below illustrates the use of energy in Scotland and it does seem that the Western Region would benefit from the publication of similar data.



In 2003\4 the Scottish Executive established the Forum for Renewable Energy Development Scotland (FREDS). This group was chaired by a Scottish Minister and senior representatives of the key players and was tasked with developing policy proposals to increase the amount of renewable electricity. A biomass sub group was formed and this developed a series of policy recommendations to help promote market development of the biomass sector. To some extent the group was hampered by the electricity only remit, but it did deliver a few outcomes that are relevant to the Western Region, notably the sub group proposed the need for:

- ☐ A national wood fuel resource study
- ☐ A network of wood fuel information officers
- ☐ A web based advice service
- ☐ A installation and fuel supplier grant scheme
- ☐ The publication of a national wood fuel strategy
- ☐ National targets for renewable heat should be established

Each of these is now progressed by the Executive and its agencies. The key partners in this process are Forestry Commission Scotland and Scottish Enterprise. A number of lessons can be drawn from this process for the Western Region.

The national wood fuel resource study has had some limited use in creating confidence in the long term supply of wood fuel, but the results have not been effectively disseminated and remain available at a rather technical level. The study was also expensive and time consuming as it was based upon detailed production forecasts by forest district. In hindsight it might have been more practical to complete a more market based approach based upon existing published production forecasts. It remains the case that there is no single view on the amount of available resource and this has not helped to instil confidence in the wood energy market.

The wood fuel information officers (there are 3) are too thinly spread, although their role has been invaluable in helping energy users and fuel supplier enter the market. The provision of *independent*⁶¹ and authoritative advice is seen as very helpful. It proved problematic to recruit suitably qualified staff and in the end staff recruited received on the job training to develop the required level of technical expertise.

The website (www.usewoodfuel.co.uk) has taken several years to develop and go live, but is now offering a useful portal and signposting service.

A grant scheme has been in gestation for 2 years and is now about to be launched. It appears that the grant money will need to be spent in a 12 month period and it seems improbable that the capacity to design and install the systems to achieve the required grant spend (of 7.5 million pounds) will be achieved. Little thought was given to supply side capacity building in the installers market or to making the grant scheme build up over time reacting to the ability of installers to build capacity.

A national biomass strategy is in formulation and is to be published next year. The strategy comes after some of the actions to underpin it have been started.

Much lobbying has occurred to stimulate the creation of renewable heat targets and it is now intended to develop these by the end of 2007. It is not clear on the level of the targets or the timescales over which they should be achieved. All the lobbying to date has suggested 10% targets by 2020 might be a possibility. No detailed work has been done on how this is to be achieved and if the sector has capacity to deliver it. It is clear that renewable heat targets are

⁶¹ It has proved hard for wood heat customers to get help from independent sources and they need to rely upon the commercial installers – who of course wish to sell their own products and services rather than offer totally impartial advice.

not perceived as a proxy for wood heating targets and it is assumed that solar thermal, GSHP's etc will form a big part of the markets response to such targets.

For the Western Region it is instructive to note that the policy response to wood energy in Scotland has been somewhat uncoordinated and ineffectively sequenced. For example it would have been better to prepare a strategy for wood heating based upon clear targets for renewable heating and then address capacity constraints and introduce a phased grant scheme. One unfortunate outcome of the Scottish experience is that grant scheme is very likely to be under spent and does not (because it is very short term) provide confidence to the sector that the market will grow or even be viable after the 12 month period. Uncoordinated and stop start help seems to create more problems than it solves for market development.

Overall there seems to be lack of understanding as to the role and importance of wood heating in the renewable energy sector. This partly explained by the cross cutting nature of the sector and the fact that no single Government department seems to have responsibility for the sector.

Upper Austria

Upper Austria is one of the nine states of Austria. Its capital is Linz. Upper Austria borders on [Germany](#) and the [Czech Republic](#), as well as on the other Austrian states of [Lower Austria](#), [Styria](#), and [Salzburg](#). With an area of 11,980 km² and 1.3 million inhabitants, Upper Austria is the fourth largest Austrian state by land area and third largest by population.

Although the context is in many ways quite different, and it is important not to make over-simplistic assumptions about the degree to which experience there may be replicated in Ireland, the development of wood heating in Upper Austria over the past 10+ years certainly offers a striking view of what can be achieved.

Here, a clearly defined strategy for RE development in which wood heating forms a key element has been pursued via an effectively coordinated and properly resourced development programme since 1994. The initial target for RE uptake was 25% and by 2002 the actual figure had reached 30%, with biomass providing 14%. It is instructive to note that this period of support was sustained (over 10 years) and that it has been delivered within an overall framework for renewable energy deployment. The critical importance of biomass – which accounts for half of all the renewable energy – was recognized from the outset -as was the need to focus on the heat market rather than solely the electricity sector.

The following is a list of a few key statistics:

- Forest cover: 41 % (491,180 ha)

- ☐ Modern wood heating systems 15,100 (852MW)
- ☐ Biomass district heating plants 200
- ☐ Wood pellet installations 4,500
- ☐ Large pellet producing companies 12
- ☐ Companies producing biomass boilers and stoves 15

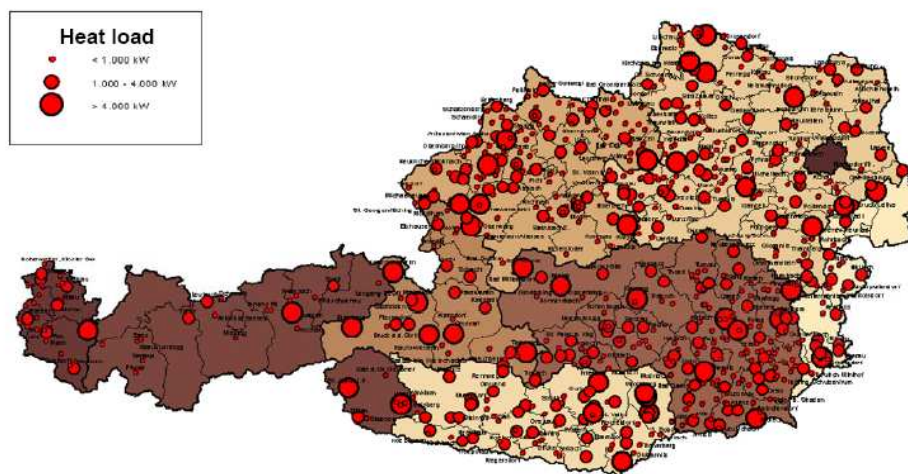
Clearly, one difference between Upper Austria and the Western Region is the proportion of forested area. However, while significant, this difference is not necessarily a fundamental determinant, and in this regard it is telling that a wide range of other RE technologies have also been successfully deployed in Upper Austria, including:

- ☐ 650,000m² of solar collectors
- ☐ 600pv plants (2,600kWp)
- ☐ >500 small hydro plants
- ☐ 17 wind plants (14.4MW)
- ☐ >30 biogas plants >
- ☐ 30 sewage gas plants

These imply that the success in developing wood heating is by no means simply accounted for by the extent of forestry in the region. Overall a key conclusion that emerges from a review of the experience in Upper Austria is the extent to which comprehensive and concerted actions, including a whole range of measures from fiscal intervention to promotion and facilitation, can be effective in stimulating market development. The two ends of the wood heating market in Upper Austria are illustrated following- a district heating plant and a modern wood pellet delivery by tanker to individual houses.



The overall deployment of wood heat plant in Austria is shown below:



Styria – Austria

Styria is located in the south east of [Austria](#). In area, it is the second largest of the nine Austrian states, covering 16,388 km². It borders [Slovenia](#) as well as the other Austrian states of [Upper Austria](#), [Lower Austria](#), [Salzburg](#), [Burgenland](#), and [Carinthia](#). The population (as of 2001) was 1,183,303. The capital city is [Graz](#). From a standing start in the early 1980's Styria now generates 14% of its total energy needs from biomass, mostly in the form of district heating.

In 1980 Styria had 1 biomass district heating scheme, by 2000 Styria had 175 installed schemes. The Energy Agency of Styria provides a clear analysis of how this was achieved by:

- The publication of a Styrian Energy Plan in 1984, setting clear targets based on well argued reasons (jobs, security of supply, environment etc), a presumption against fossil fuels, the preference for local solutions, energy efficiency and the need to minimize environmental impacts.
- A €10 million per year fund to subsidize the costs of installing heating boilers. This was created by requiring electricity producers to pay a small amount for each kWh of produced electricity into a state fund.
- Through a single contact point the Energy Agency in Styria aggressively promoted wood fuel heating, backed by demonstration projects and R&D.

The question of pellets or chips seems have been answered by the Austrian experience. In the mid 1990's penetration of biomass heat into the energy market began to reach a limit as the non-residential heat market for chips reached saturation. The only big market left was the heating of single homes and the best way to enter this market was to use pellets and this is now growing at 20% a year. In other words the supply of wood chips established the market, but the later supply of pellets allowed access to the single house residential market (half a

million Austrian homes are now heated with pellets).

Jura

The region of Jura on the French Swiss border. This area has been recognised by ITEBE – the European Technical Institute for Wood Energy⁶². It contains the ‘European Wood Energy Road’ which is a French-Swiss cross-border initiative organised by ITEBE to provide access to a large range of wood-fuelled installations. It is a ready-made network of demonstration sites comprising small (200kW_{th}) to large (3MW_{th}) boiler installations fuelled variously by pellets, forest wood-chips, recycled wood and arboricultural arisings. It is mentioned in this report to highlight that it offers the opportunity for ‘learning journeys’ from the Western Region to help influence key players either in terms of policy support or in terms of wood energy investment.

North East England

In 2003 a Biomass Action Plan for the North East of England was published. This placed the development of wood energy at the centre of a regional renewable energy strategy. From a WDC perspective it is relevant to note that the regional development agency (One North East) picked up on the importance of the sector in terms of jobs, local economic development and its ability to accelerate the deployment of renewable energy and reduce carbon emissions in the region. Other players (notably the public sector housing providers) saw the opportunities to help alleviate fuel poverty.

The recognition of these benefits and the critical role of wood fuel heating were established by the publication of the Action Plan.

In 2006 One North East took the decision to allocate one million pounds to a 3 year biomass support programme. This programme will commence in 2007. It is intended to work alongside existing UK biomass grant schemes and does not in itself offer grants. The interesting thing from a WDC perspective is that One North East has been able justify such a large support budget over a sustained period that is over and above national grant support.

The programme will offer hundreds of businesses and energy users the prospect of structured support to develop a wood heating scheme. It starts with a sophisticated awareness raising and promotional campaign using a professional advertising agency working in tandem with specialist wood energy consultants. This is designed to create a high level of initial interest in key energy markets (process heat users, hospitals, communal housing etc). For every organisation entering the process they will receive an initial diagnostic check to establish the case for wood energy investment.

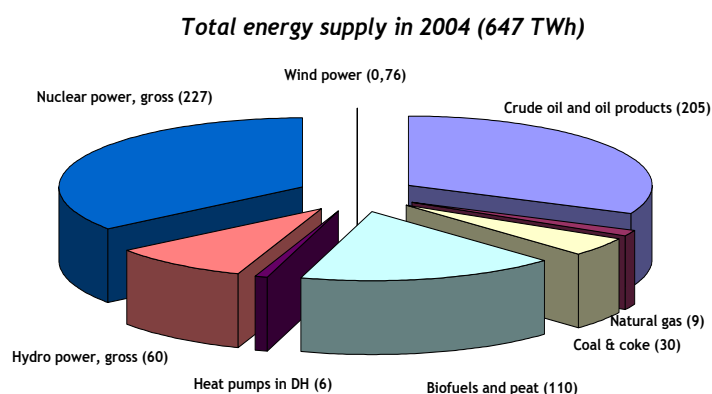
⁶² www.itebe.org

Following this organisations are offered free and impartial technical and procurement advice right up to the point of investment.

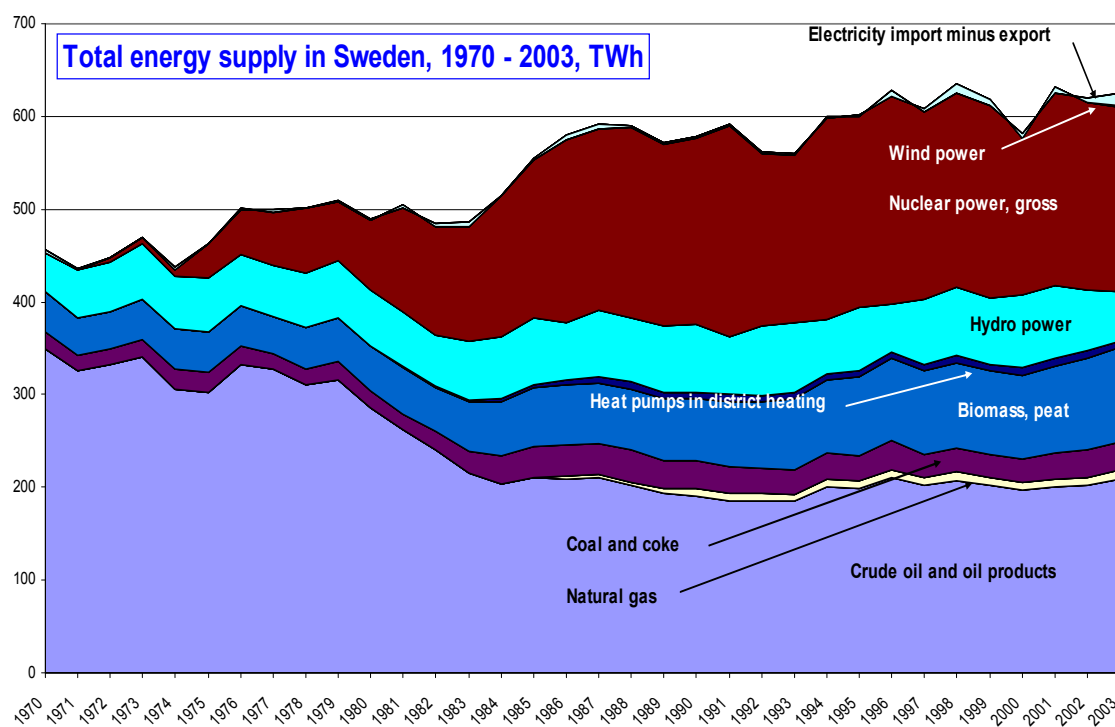
Parallel with this the programme is supporting measures to build capacity in the installers sector and fuel supply chain. It is overall a concerted, generously funded and well structured support programme. Of course it cannot be known if this will result in effective market growth,

Sweden

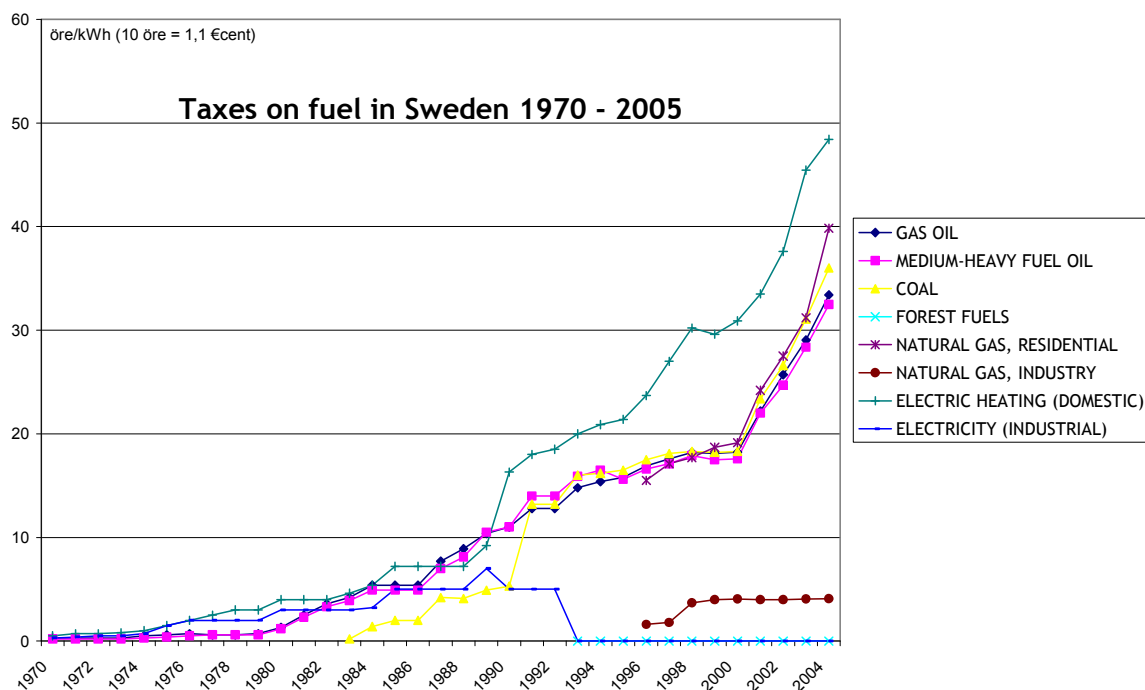
Sweden is along with one or two other EU countries the market leader in terms of wood energy. Biomass (biofuels and peat) provides 17% of Sweden's total energy supply (2004). This is illustrated in the pie chart following.



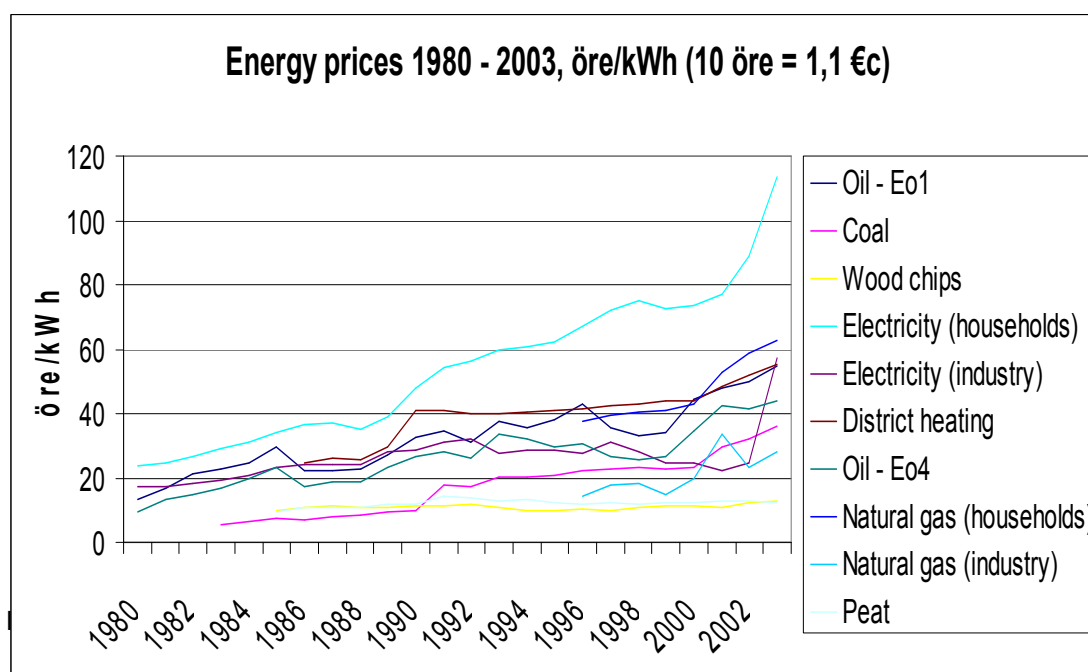
The following table illustrates the steady growth in biofuels and peat use since 1970.



Perhaps the key lesson for the Western Region is that the main reason that Sweden has such a strong use of biomass in its energy mix is the introduction of carbon taxes on competing fuels. The table following shows that during the early 1990's the Government introduced progressively aggressive taxation on fossils fuels.



It is understood that the carbon tax in Sweden is now effectively set at 30%. This explains the very large price difference between wood chips and oil up to 2003. As the slide below shows in 2003 oil was about 7 cents kWh and wood chips were 1.1 cents kWh. Recent hikes in the prices of oil have only served to increase this differential.



It is also known that boiler capital grant schemes had no real role in market development. Some experts in Sweden have even argued that capital grant schemes have an adverse effect on market growth. It seems that grant schemes provide short term 'stop start' help that deters companies from becoming wood boiler installers as the grants can come and go. A second issue is that grants can encourage installed prices to rise simply in line with the level of grant available.

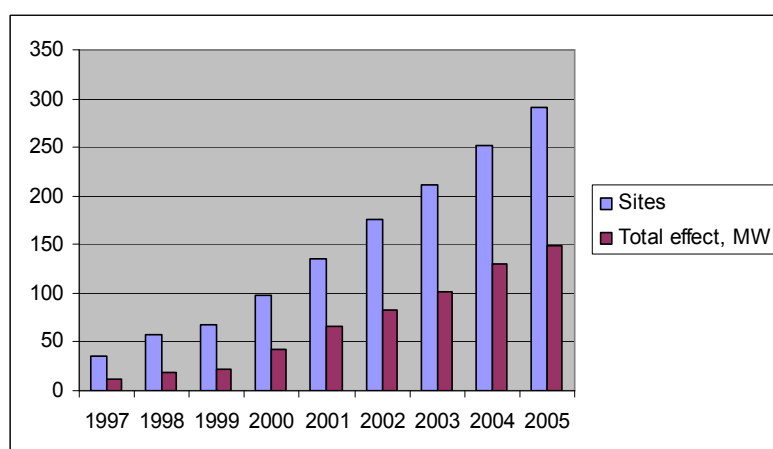
The overall message from Sweden is that one way for wood energy to develop large market share is for the price of competing fuels be much greater - and in Sweden this is achieved by carbon taxes.

Finland

Finland has the highest per capita use of wood for energy in the EU. This review focuses on the small scale heating market, which began to emerge on the early 1990's. The first plants were established in 1992, for example village schools and other small public buildings. At the beginning the boiler houses were mainly owned by municipalities. A typical plant is shown below:



Growth in this market is illustrated in the following diagram.

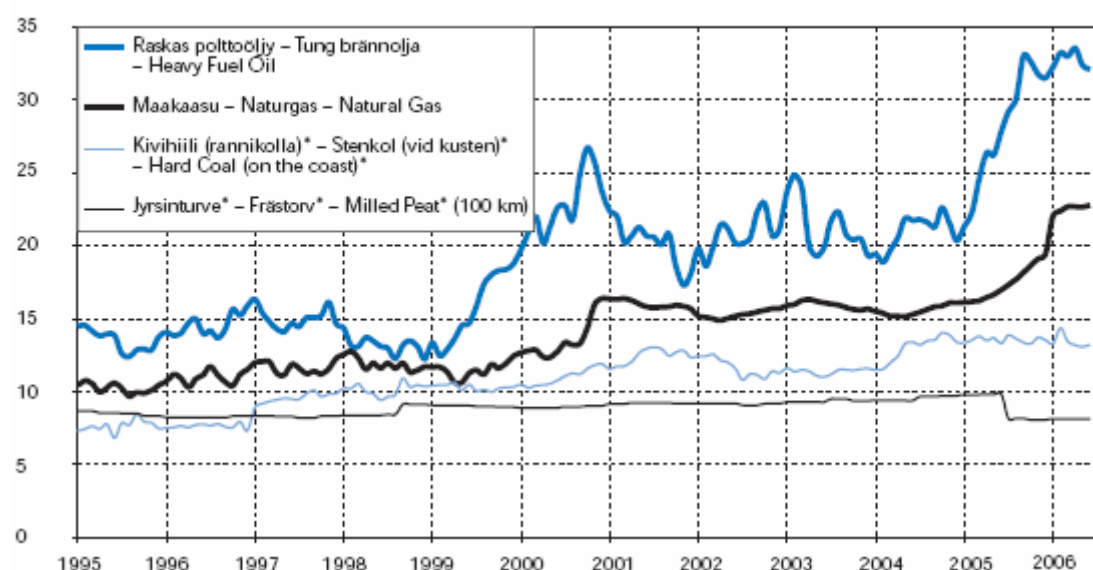


At the end of 2005 the total amount was 300 plants and 150 MW of installed capacity. Annual growth is about 50-70 new sites⁶³. The average size is 500 kW, the biggest plants are 2.5-3,5 MW and they are mainly heating networks or industrial sites.

The costs of wood heat are around 5 cents kWh and that wood chip suppliers are paid about the equivalent of 2 cents kWh⁶⁴ for delivered wood chips.

It is thought that the costs of oil heating are around 7 cents kWh. The graph below shows the costs of gas, oil, coal and peat heating since 1995.

Figure 9. Fuel Prices in Heat Production 1995-, €/MWh



It can be inferred from these figures that in Finland – unlike its neighbour Sweden – the wood heat market is not being driven by a large price difference between wood and oil. Market growth can be partly explained by a system of capital grants for heating plant. It also appears that the economics of the heating plants is being helped by very cheap wood fuel (it is purchased by the heating plants at the energy equivalent price of 2 cents kWh and sold at 5 cents kWh.)

This system of low prices for wood fuels and higher prices for the resulting heat is supported by forestry grants to produce wood fuel. Wood fuel suppliers receive an area based payment of 150\250 euro/ha. They also get a chipping subsidy of 4 euro per cubic metre. The subsidies are not paid if the harvesting and chipping operations are for non energy wood markets.

⁶³ It is relevant to note that this pace of market share, although rapid, needs to be replicated in WDC

⁶⁴ (= 40 euro per solid cubic metre)

It can be concluded that both in Finland and Sweden a range of taxation and subsidies are used to create large wood energy markets.

In the Western Region it seems unlikely that the unmediated existing oil\wood price difference will be sufficient to establish such big markets. This does not mean that some degree of market isn't possible and this is examined in more detail in section 10 of this report.

APPENDIX 12: WOODHEAT SUPPLY AGREEMENT

The agreement is made between:

the Supplier who operates wood-fired boiler plant

the Purchaser who has installed a wood-fired boiler the Purchaser operates the Premises which require heating and hot water services

The Supplier agrees to operate and maintain the Wood Boiler Plant, including the supply of fuel, and to supply to the Purchaser Heat which the Purchaser has agreed to purchase

By "Wood Boiler Plant" is meant the hot water boiler fuelled by chipped woodfuel that is located in the boilerhouse with the associated ancillary woodfuel handling plant as identified in **Drawing number 1**

By "Heat" is meant heat energy as carried by hot water supplied at a flow temperature from the Wood Boiler Plant of not less than **82° C**.

By "Heat Meter" is meant the hot water metering device installed within the mechanical services installation in the Boilerhouse that will record the quantity of Heat supplied to the Premises.

Basis of Supply.

In order to provide a supply of Heat, the Supplier shall take responsibility for the operation and maintenance of the Wood Boiler Plant in the Boilerhouse including provision of supplies of woodfuel.

The Purchaser shall make available such electricity and water as may be required by the Supplier to operate and maintain the Wood Boiler Plant at no charge to the Supplier.

The Supplier shall provide adequate maintenance and repairs to the Wood Boiler Plant to ensure it remains fit for purpose.

In addition to providing routine maintenance the Supplier shall make good any breakdown or other defects to the Wood Boiler Plant in a workmanlike and timely fashion. The cost of such works shall be born by the Purchaser.

The Purchaser shall maintain appropriate insurance against sudden and unforeseen damage to the Wood Boiler Plant.

Boiler Operation

The Supplier shall operate the Wood Boiler Plant in accordance with all relevant manufacturers' instruction manuals and any relevant manufacturers' warranties.

The Supplier shall use due discretion in exercising his rights of access and shall generally seek to confine access to the following normal working hours - eg:

08.00 - 18.00 Monday to Friday excluding Public Holidays

08.00 - 13.00 Saturdays

The Supplier shall arrange that all deliveries of woodfuel shall be made at the following times:

Times?

Removal of ash The Supplier shall empty the ash receptacle(s) that form part of the Wood Boiler Plant and remove the ash from the Boileroom for disposal in an appropriate fashion

Woodfuel Supplies

The Supplier shall fuel the Wood Boiler Plant with chipped woodfuel that confirms to the Onörm standard specification as set out in Schedule III to this Agreement.

Quantity of Heat Supplied

The total quantity of Heat provided by the Supplier to the Purchaser shall be measured by means of the Heat Meter such measurements being expressed in megawatt hours ("MWh").

The quantity of Heat measured by the Heat Meter shall be taken to provide a definitive record of the quantity of Heat supplied to the Purchaser unless it has demonstrably ceased to operate effectively.

Surety of Supply

The Supplier shall at all times use his best endeavours to ensure that Heat is made available to the Purchaser and to this end shall effect an appropriate maintenance programme for the Wood Boiler Plant to ensure in so far as is possible that all plant remains serviceable. In addition he shall take such steps as are necessary to rectify any operational problems with the Wood Boiler Plant in a timely fashion.

Payments

Payments shall be made by the Purchaser to the Supplier in three forms:

a monthly Standing Charge to provide for the cost of undertaking the routine maintenance tasks referred to in Clause 2.1 and set out in Schedule II to this Agreement

pro rata payments for Heat supplied according to the Monthly Tally as defined in Clause 5.4

ad hoc payments for repairs to breakdown or other faults as may be required from time to time

Monthly Standing Charge

The Standing Charge shall be £xxx.00 (xxxxxx hundred euros) per calendar month.

The level of *pro rata* charges for Heat supplied shall be calculated by multiplying the Monthly Tally (in MWh) by Euroxx.00/MWh (xxxxxx euros per megawatt hour) (hereinafter "the Heat Tariff").

Charges for *ad hoc* repairs shall be made as follows:

components: at cost plus 30%

labour: at a day rate (hereinafter "Day Rate") of Euro 250.00

The Purchaser shall make all payments due within thirty (30) days of receipt of an appropriate invoice from the Supplier. Invoices shall be sent to the following address and marked for the attention of xxxxxxxxxxxxxxxxxxxxxxxx:

On the 1st January each year the level of the Standing Charge, the Heat Tariff and the Day Rate shall increase in line with the Retail Price Index "CPI"

VAT shall be applied to all payments at the appropriate rate.

Contract Start and Duration

This Agreement shall take effect from the date of the Agreement and shall remain in force for a period of five (5) years thereafter.

Signed on behalf of)

XXXXXXX LIMITED)

Signed on behalf of)

Wood heat customer)

Schedule I: Wood Boiler Plant installation drawings

Schedule II: Wood Boiler Plant routine maintenance tasks

The routine maintenance tasks required by the Wood Boiler Plant are summarised in the table below. This table should be read in conjunction with the Operating Manual issued to the Supplier separately to this Agreement.

Schedule III: Onörm woodfuel specification

Boiler model: xxxxxxxxx

Raw material:

The raw material or feedstock for woodfuel production must be composed of clean untreated wood products and co-products from the agricultural, forestry and timber processing sectors and be free of contamination by materials such as soil, stones, metal objects or other foreign bodies.

Particle size:

Chipped woodfuel should be provided according to the **G30** grade, as set out below:

Parameter	Measurement	G30	G50	G100
Max cross sectional area	<i>cm²</i>	3	5	10
Max length (long thin material)	<i>cm</i>	8.5	12	25
Coarse material, max 20%	<i>retained by sieve mesh width, mm</i>	16	31.5	63
Main material, 60 to 100%	<i>retained by sieve mesh width, mm</i>	2.8	5.6	11.2
Fine material (inc dust), max 20%	<i>retained by sieve mesh width, mm</i>	1	1	1
Dust, max 4%	<i>Passing sieve mesh width, mm</i>	1	1	1

Moisture content:

Woodfuel should be provided according to the **W33** grade, defined as wood at no more than **33%** moisture content on a gross or wet basis, that is:

Woodfuel Moisture Content = (weight of water in sample / total weight of sample) x 100%

Schedule IV: Operating Procedures

Appropriate Operating Procedures will be agreed and appended to this contract.