East Renfrewshire Community Enterprise Trust

Biomass Feasibility Study

Final Report
March 2001

Table of Contents

Final Report

1 Introduction

1.1 Background

This report provides the result of a study into the potential for developing biomass projects in East Renfrewshire. It stems from a vision produced by East Renfrewshire Community Enterprise Trust (ERCET) while researching renewable energy issues during an application process to the Climate Challenge Fund in January 2010, which identified biomass as an underdeveloped opportunity within East Renfrewshire.

East Renfrewshire has been described locally as the "Renewable Energy capital of Scotland", based largely on the presence of the Whitelee Wind Farm, Europe's largest on-shore wind farm. Developing this theme, East Renfrewshire Council have identified renewable energy as a key potential economic development opportunity within the district, while the Scottish Government have set the world's most ambitious target for reducing CO2 emissions – by 42% by 2020 – noting the potential that renewable energy could contribute to that reduction. In short, the time is right to invest in renewable energy schemes in East Renfrewshire.

Recognising this in 2010, ERCET highlighted biomass as an underdeveloped sector with potential development opportunity in East Renfrewshire and created a vision of a possible biomass sector. The vision comprised a series of biomass powered heating and / or power generation facilities, which could be fuelled by crops grown locally, possibly helping diversify farms with underutilised land. In order to develop this vision ERCET appreciated the need to:

- Research, understand and explain the nature and benefits of biomass
- Assess the feasibility of developing one or more biomass powered heating or power generation facilities within the district
- Identify opportunities to work with the council, landowners and farmers to utilise land for growing crops for fuel

This research has been funded by the Climate Challenge fund who agreed to ERCET including a biomass study within their Powerdown project.

The International Resources and Recycling Institute (IRRI) were commissioned to undertake the project which brought this vision to life.

Clearly the vision has to be developed into a project with sensible and viable parameters, and these were agreed at a project kick off meeting with Barrhead Housing Association, East

Renfrewshire Council and IRRI in October 2010. During this meeting (minutes are found at Appendix 1) it was agreed that:

- Barrhead Housing Association (BHA) as the largest registered social landlord in the area had a number of properties which could possibly be suitable for renewable energy schemes such as biomass. This was narrowed down to two areas: The Saunders Court development was put forward for further investigation for the logical reason that it currently contained an unsatisfactory electric storage heating system and there would be funding made available possibly in 2011 to replace the heating system. The housing estate in Dunterlie was identified as a second area for investigation. This contained a number of houses, most of which were owned by BHA, a community resource centre, a school and a football pitch, together with an area of open grassland.
- East Renfrewshire Council (ERC) facilities within Rouken Glen Park would also make a suitable case study. This contained large greenhouses operated by ERC Parks Department and which currently used a diesel heating system. While ERC only operated the greenhouses and associated training centre, they indicated that there may be potential in considering the neighbouring properties which included a Chinese restaurant and a garden centre. ERC also indicated that Eastwood Park offered some interesting potential but was not a key priority. IRRI agreed to give Eastwood Park consideration.

Looking at the wider picture, if Biomass can be made to work in East Renfrewshire, there is every reason to develop it further as a sector which can generate economic and environmental benefits. Once the feasibility of the individual projects is established, the project can consider the wider economy and seek to develop the potential for creating opportunities to grow crops for fuel.

This report forms the third and final Volume of a series of reports produced by IRRI. It should be read in conjunction with Volume 1; Progress Report, November 2010 and Volume 2; Background Report and Site Studies, January 2011.

Taking the three key areas noted above:

- The aim to “Research, understand and explain the nature and benefits of biomass” is covered in Volume 1 Progress report and expanded further in Volume 2 Background Report and Site Studies.
- The aim to “Assess the feasibility of developing one or more biomass powered heating or power generation facilities within the district” is covered in this Volume 3 Report

- The aim to "Identify opportunities to work with the council, landowners and farmers to utilise land for growing crops for fuel" has been addressed initially in the Volume 2 Report and expanded upon in this Volume 3 Report.

This Volume 3 Report not only addresses the feasibility of the two sites to be assessed in detail but provides a platform for taking biomass opportunities forward across the East Renfrewshire area.

1.2 Objective

The overall aim of the project is to determine first, the potential for a successful biomass heating and/or power plant, and information/actions taken on supply chains, capital and revenue costs, management and sources of finance, and then to assess the ability for fuel to be supplied locally through new initiatives to grow crops for fuel.

The *key objective* is therefore:

- *To determine whether or not the creation of biomass energy projects in the East Renfrewshire area is viable in practical, financial and social terms*

The purpose of an effective Feasibility Study is to determine whether a suggested option is viable in economic, environmental, social or other stated terms. It will offer a comparison, particularly in capital and revenue cost terms, with other suitable alternatives. The report and summary should therefore provide the reader with a simple flow:

- What happens now in the agreed sites to be assessed for feasibility (usage requirements and what they are paying under the current system)

- What issues are to be considered in the agreed sites to be assessed for feasibility regarding Biomass, such as planning and permitting, feedstock, grid connections, and any other?

- The options for change to Biomass in the agreed sites to be assessed for feasibility (different technologies, different variants of biomass/gas), as against maintaining/upgrading the status quo (new boiler)

- What other options should be considered in the agreed sites to be assessed for feasibility

- Likely capital and running costs in the agreed sites to be assessed for feasibility

- The consequent cost comparisons against status quo, and therefore the benefits/penalties in the agreed sites to be assessed for feasibility

- In view of this, we conclude whether Biomass is economically feasible or whether other factors may be required to justify an investment a biomass facility in the agreed sites to be assessed for feasibility.

The report will consider these issues and will identify the likely costs associated with a biomass development at the relevant sites. It will conclude by exploring the potential for a Biomass sector in the East Renfrewshire region.

1.3 Methodology

This project has followed a clear, staged process.
A desk and interview study was conducted in late 2010 to address the general issues relating to biomass in order to demonstrate why, in an area with no previous biomass investments, there may be potential for considering biomass options in future. It further assessed technical details relating to the types of fuel and types of boiler, the differences between generating power and/or heat, the new Government incentives being introduced to encourage the development of biomass projects and the general permitting and licensing issues. This was reported in the Progress report of November 2010.

An assessment of the four locations specified in the kick off meeting was undertaken and an initial review of their potential was presented to ERCET Directors in January 2011. This was reported together with a description of issues relating to local supply of fuels, permitting and planning permissions, possible manage and operational options, and biomass technologies. This assessment is reported in Volume 2 of the study reports, the Background Report and Site Studies.

Following approval by the ERCET board, IRRI were tasked to produce a full feasibility assessment of two sites; Saunders court and Rouken Glen Park. These feasibility assessments were carried out in February 2011 and are reported in this final volume of the project reports.

2 Site Selection and Current Energy Usage

Following the ERCET board approval and liaison with East Renfrewshire Council and Barrhead Housing Association the study focussed on the two areas noted above:

- The Saunders Court housing estate in Barrhead
- The Rouken Glen Park area of Giffnock

Each site has been selected because a biomass project could be deliverable within a defined and self-contained site that is controllable by the Council or by Barrhead Housing Association, so these are good pilot test bases. Ownership and public acceptance should not cause problems, costs savings and carbon reduction will be welcome and the owners are currently considering some developments or changes in the area, such that a biomass facility could be accommodated within current development activity.

2.1 Saunders Court

Saunders court is a relatively small scale development comprising 42 housing units in three 4 story blocks on John Street. These units are owned by Barrhead Housing Association and currently heated by electricity, with storage heaters scheduled for replacement in 2011. There is a considerable variation in the energy consumption within individual units. The Energy Performance Certificates, which were drawn up in June 2009, indicate a typical consumption of about 17000 kWh per year within each unit. However the raw data collected from tenants, by interview, would suggest that the consumption is higher in some units. Consumption is obviously dependent upon occupation patterns, the number of occupants, and whether the occupants are in the units during the day. However for the purpose of this report, we consider it reasonable to assume that average consumption is around 17000kwh per unit, per annum. This figure would be considered to be high compared to similar properties elsewhere. The blocks are surrounded by car parking spaces and external bin stores but there is little available space or unused land area within the site boundary. Neighbouring properties include an East Renfrewshire Council / National Health Service Facility

One of the main benefits of considering a biomass facility for Saunders Court is that the expensive and inefficient electric storage heaters are due for replacement in the near future. This offers the ideal opportunity to consider a form of heating which uses renewable energy and is cheaper to run.

The construction of the buildings incorporates service risers which could accommodate heat distribution pipes serving hot water radiators in the properties, receiving metered heat.

2.2 Current Heating Prices Being Paid by Tenants

In order to obtain current usage and costs, a resident survey was conducted in Saunders Court in February 2011. 20 of the 42 residents were available to take part and while many of these were not in possession of bills over a 12 month period, an idea was gained of their current fuel costs. The results may not however be representative of the entire Saunders Court resident population, but form a statistically sound basis for this feasibility study.

The table below details the kW per hour costs for those residencies where information was obtained[1]. The survey aimed to collect energy usage and costs for the past 12 months, however two main issues arose; few residents retained bills for the past 12 months and many used pre-pay electricity meters. Energy usage and costs over a 12 month period were collected from 4 residents. Energy usage and costs for varying time periods were collected from a further 4 residents. 12 residents provided pre-pay energy meter costs as energy usage readings were not available. From the information obtained, the cost per kWh ranges from £0.06 – £0.12, and the average cost per kW hour for Saunders Court residents is £0.09.

Flat No	Period	Usage (kW)	Cost (£)	kWh costs (£)
3	23.06.10- 04.01.11	4055	514.64	0.1269
4	01.11.09- 01.11.10	16013	1,547.15	0.0966
10	22.06.10- 28.09.10	920	108.53	0.1179
11	05.01.09- 24.03.09	1604	117.70	0.0733
19	24.12.09- 25.03.10	3303	255.24	0.0681
41	30.06.10- 23.12.10	2291	204.77	0.0893

Total (£)	0.5721
Average (£)	0.09535

Of the 20 residents that were spoken to, 18 residents used Scottish Power, 1 used E.On, and 1 used British Gas.

Out of 20 residents, 19 were unsatisfied with the current storage heating system. They complained that it was too expensive and many struggled to pay their bills. Residents also

[1] For full data tables see appendix 1

[2] http://www.heraldscotland.com/mobile/news/home-news/6-million-in-lottery-cash-to-fund-park-projects-

complained that the storage heaters were inefficient and difficult to control. Due to these problems, many residents had either removed or abandoned the storage heaters and replaced them with portable electric heaters. Residents, who did use the storage heaters, restricted their usage due to the expense. The availability and expense of hot water was also raised as a problem by residents. This provides a social justification for replacing the heating system with a new one based on renewable fuel sources, although it should be noted that Barrhead Housing Association have recognised the problems and have agreed to replace the system with a new heating system. If renewable sources of heat are not used, Barrhead Housing association's preferred alternative would be for gas fired central heating systems.

Energy efficiency also appears to be a problem within Saunders Court. The buildings are of an age where insulation levels were lower than current standards. Some residents complained of poor insulation and damp. This could help explain the seemingly high electricity usage. As with any renewable energy or heat scheme, insulation and preventing heat loss should be addressed before a new heating system is installed. If left unaddressed heat may continue to be lost through the building and heating costs will remain high.

The majority of residents asked said they would prefer a gas central heating system which would give them control of both the temperature and timing of the heating. A centralised pellet-fed biomass heating system would also be capable of providing control over temperature and timing of heating.

Although the information collected has created an overall picture of the energy usage and associated costs in Saunders Court, further discussion should be held with residents should a biomass facility appear to be viable in capital and running cost terms. Future public consultation with Saunders Court residents should be held to ensure all residents are contacted and their opinions heard, to outline the benefits of biomass and renewable heating schemes in general and also to draw attention to winter fuel payment benefits, as the information gathered from the current survey suggests that many residents would be eligible.

2.3 Rouken Glen Park

Rouken Glen Park is a public open space of approximately 58 Ha managed by East Renfrewshire Council. The Council together with the Friends of Rouken Glen group were recently awarded Heritage Lottery Funding to provide improvements to the park. While the initial sum of development funding is likely to be ring fenced and not available to help finance any biomass facilities, it indicates that the park is currently going through a period of investment and improvement. The development funding should also in principle unlock

further Heritage Lottery Funding, understood to be up to £2million.[2] The park is increasingly used for events such as the annual Apple Day, running festivals and school visits.

Opened in 1906 the vast majority of the park area is open space for leisure. For the purposes of this project it was noted that there are a number of buildings and built areas which warrant investigation. These are:

- The Pavilion located adjacent to Rouken Glen Road.
- The Waste Recycling Training Centre and Glasshouses (WRTC)
- The Shangri La Chinese Restaurant
- The Rouken Glen Garden Centre
- The K7X Football Pitch Facility

The Pavilion is used on a daily basis and is operated by East Renfrewshire Council Parks Department. It has irregular heating needs, taking in visitors on some days but not others and is used at various times during the day by park staff, but not consistently. Currently it is served by a switch-on / switch-off wall mounted electric heater system which is used most days between September and May. Although this system incurs relatively high electricity costs, because it has switch on / switch off capability it is relatively efficient and can be switched on only as needed.

The Waste Recycling Training Centre (WRTC) opened in August 2003 with the purpose of delivering Skills Training to the unemployed and school children focussing on Environmental Improvements, Recycling, Construction, Rural Skills, Biology and Horticulture.[3] It comprises a timber clad building which operates an Ecoliving designed heating system, an older stone built classroom building, greenhouses and a garden area. The complex is currently operated by East Renfrewshire Council, which has been employing up to 100 unemployed local people and moving them into more sustainable jobs each year. They have also been delivering training to approximately 700 school children each year. The Centre provides the local community with 500 hanging baskets each year and carries out numerous environmental projects which in the past have included housing regeneration schemes and roadside planting.

In 2008, the building was refurbished to incorporate solar thermal and air source heat pumps to meet the buildings heating requirements in the timber clad building. The Classroom building is still heated by electrically operated heaters while the greenhouses are heated by a diesel powered generator which is separate from the buildings. There is

[2] http://www.heraldscotland.com/mobile/news/home-news/6-million-in-lottery-cash-to-fund-park-projects-1.1075405
[3] http://www.ecolivinguk.com/renewable-energy/case-studies/rouken-glen

therefore potential for the greenhouses and classroom building to be heated through renewable forms of energy to bring it into line with the timber clad building.

If the heating requirements of all three private facilities are included, a fairly large boiler facility would be required. This will necessitate a generous land area for any biomass facility and storage for fuel. While an area is potentially available a sensitive consultation exercise would be essential, especially in light of the current proposal to work with Heritage Lottery Fund to upgrade the park and restore many historical facilities.

However, in the course of the study a survey was undertaken of the energy profile of all the different buildings, but this has not been supported by any of the other occupants except WRTC. Hence for purposes of this report, the only candidate for conversion to Biomass are the greenhouses and classroom building operated by WRTC, the WRTC timber clad building already being served by renewable energy.

2.4 Current Heating Prices at WRTC

Heating prices for the WRTC were obtained from David Kermack, Principal Economic Development Officer at East Renfrewshire Council. From the table below, in 2009 – 2010, £10,069.70 was spent on heating through a combination of oil (£5457.68 + VAT) and electricity (£4612.02 + VAT) usage. This amount is notably less than the previous year 2008-2009 where £15,240.93 was spent on heating the WRTC, presumably due to the introduction of renewable energy generation. Electricity rates are set at 9.15p per kWh.

Table showing WRTC Energy Profile, 2008 – 2010

Energy Bill Period (DD/MM/YY-DD/MM/YY)	**Energy Usage (kWh)**	**Cost (£)**	**Energy Usage Pattern (eg. mainly daytime/ morning+ evening)**
Oil (£0.45/ L)			Electricity usage heavier during winter months due to electric heaters.
2009/ 2010	Oil	£5457.68 +VAT	Heaters do not use overnight storage energy, run off standard

		~ 12, 128. 17 L	energy rates.
2008/ 2009	Oil	£8004.03 +VAT	
Electricity			
24/3/10	264002	9.15p: £701.69: incl levy of £33.45	
11/2/10	256884	9.15p: £537.68: incl levy of £25.70	
14/1/10	251415	9.15p: £767.10: incl levy of £36.93	
18/12/09	243557	9.15p: £492.09: incl levy of £23.48	
31/10/09	238562	estimated	
23/9/09	233259	9.15p: £244.62: incl levy of £11.14	
14/8/09	230888	9.15p: £125.80: incl levy of £5.68	
22/7/09	229679	9.15p: £182.04: incl levy of £8.19	
17/6/09	227937	9.15p: £216.06: incl levy of £9.95	
18/5/09	225820	9.15p: £381.86: incl levy of £18.01	
8/4/09	221988	estimated	

Total 2009/ 2010= £4612.02 +VAT			
2008/ 2009		£7236.90 +VAT	

Section 6 of this report utilises these figures to establish the feasibility of replacing the existing heating systems with a biomass fuelled boiler system.

3 Planning & Permitting

3.1 Planning Permission

Although domestic scale biomass boilers may in many cases fall within Permitted Development rights, the construction of any building, including a woodfuel boiler house, is subject to planning permission from the Local Planning Authority.

In the case of Saunders Court, the proposed new store and boilerhouse building would require planning permission from East Renfrewshire Council as planning authority. A planning application may take around 8 weeks to resolve and will add a fee of £319 to the proposed costs. Neighbours will be notified and will have the opportunity to object to the proposals, but because the building will be relatively unobtrusive it is considered unlikely at this stage that it would attract strong objections. The only issue may be that the drying area would have to be relocated and residents should be consulted first to seek their opinion of a new drying area should this project reach planning application stage.

The small scale facility proposed for Rouken Glen Park would not need planning permission if it utilised the former vermiculture building. Because the proposed boiler would use pellets there would be no need to develop a chip store and therefore a planning application could be avoided. If the vermiculture building is not used and a new Portakabin type facility is to be built to house the boiler, then a planning application would be required. This would generate a fee of £319 and a potential 8 week timetable for resolving the planning application. It would therefore be preferable in planning terms to utilise the vermiculture building.

Should the ambitions ever become greater and the scale of the boiler be increased to supply heat to the neighbouring garden centre and restaurant facilities, then a planning application

would be required. At this stage it is considered unlikely that this would be of sufficient scale to generate a planning application which is considered to be 'Major' - which requires a 12 week consultation period prior to the submission of an application. An Environmental Impact Assessment (EIA) may also be required to accompany a Major Scale application. However, because the location is within a park, and because the ownership/operation of the park is covered by two local authorities, a larger boiler is likely to be seen as a sensitive development and would require a planning application, but not a Major Scale one. This would also generate a £319 fee and potential 8 week planning timescale.

3.2 Grid Connection

There will be no requirement to seek grid connection approval as the boiler will produce heat rather than power. Therefore approval to connect to the electrical distribution grid from the Distribution Network Operator (DNO) will not be required.

3.3 Water Supply & Discharge

Given the proposed scale and nature of the projects there should be no water supply or discharge issues and no need to seek Scottish Water consents.

3.4 Operating Consent

The operation of a plant exceeding 3MWth capacity may be subject to the Pollution Prevention and Control (Scotland) Regulations 2000 (PPC). The facilities proposed here are significantly smaller than that and PPC regulations will not apply.

Initial discussions with East Renfrewshire Council have indicated a broadly supportive view on planning & permitting of renewable energy facilities, but experience across the UK points to caution. In particular, public perception over emissions, flue stacks and fuel haulage can render the planning process difficult and protracted unless there is community consultation beforehand.

4 The Characteristics of Biomass

The analysis of a fuel determines the type and design of equipment needed to process it and recover its energy content. For any biomass installation, it is necessary to know:

- The chemical composition — which indicates the gaseous emissions and dictates what flue gas cleaning equipment is required;
- The calorific value — which indicates the heat to be released;
- The moisture content — which indicates the combustion behaviour; and
- The ash content — which indicates the capacity of ash removal equipment required.

In this report, woodfuel is referred to on a wet weight basis, i.e. as received. When comparing energy content of different woodfuel materials, sometimes a unit of 'oven dried tonnes' (odt) is used, which gives a considerably different weight because of the high moisture content in woodfuel.

For fuel engineers, and therefore in this study, 'wet basis' means the weight of moisture as a percentage of the total wet weight. By contrast, the timber industry, which produces most data on wood properties, quotes 'wet basis' figures as the weight of moisture as a percentage of the dry weight.

The analysis of wood grown for use as fuel is generally very consistent and good data is available. However, biomass residues may vary considerably, even within one category, e.g. forestry residue, so approximations have to be made.

Wood residues like construction and demolition timber vary so greatly between different sources that it is necessary to conduct an audit and laboratory analysis of a sample of the material to determine its characteristics. Even this is only of value if the sample is representative, which is generally impossible because the content of the waste will vary from day to day. It is even more difficult to predict what the waste will contain in future years.

The source, quantity and analysis of the fuel also determine the standards that the plant must meet and the regime applicable for its licensing and regulation. The required standard for design and regulation will have a major impact on the cost of permitting, as well as the capital and operating costs of the plant.

4.1 Fuel Types

The key characteristics of a biomass fuel include its moisture content which affects its energy content (the calorific value), and the particle size/grade. Factors which affect fuel costs include the type of fuel and its associated market availability, the quality of the fuel, the form the fuel is delivered in and the proximity of the fuel source to the point of use[4].

[4] **Carbon Trust In Depth Guide CTG012 – Biomass Heating; A Practical Guide for Potential Users, 2008**

There have been some concerns over the availability of fuel supplies in Scotland due to the potential opening of as many as 5 or 6 new large scale biomass plants which are currently in the planning pipeline. Discussions with the Forestry Commission have provided confidence that there should be no shortage of fuel supplies in Scotland; this is largely because the new large scale developments propose mostly to use imported fuel and from sources which are able to supply large quantities regularly and reliably. Any new facility in East Renfrewshire will be looking for smaller quantities of fuel and should be able to source fuel reliably and relatively locally from one or more of the following:

- Waste wood
- Pellets
- Woodchip
- Logs or Forestry Residues

'Waste' wood comes in 2 distinct categories: sawmill and primary manufacture arisings, clean untreated material and the arisings of forestry and arboriculture form one group, and material derived from construction, demolition and recovery from e.g. civic amenity or waste transfer stations form the second. (Yet a third group does exist, that of treated waste wood, but this is to be avoided since its inclusion can lead to classification as 'hazardous waste').

The differentiation is crucial, in that the former groups are exempt from the requirements of the Waste Incineration Directive (WID) when burnt as fuel but the latter is not. This has a major impact on licensing requirements and plant costs since more stringent pollution control measures are required under the WID.

Wood pellets are made from compressed sawdust, and are well suited to smaller heating systems (under 30kW). Pellets are a good replacement fuel for oil, because the pellets are of consistent quality and tend to 'flow', so they are easy to transfer in bulk. Pellet stoves and boilers are very efficient with low emissions, and usually have programmable timers and even auto-ignition.[5] Since the first wood pellet facility opened in Scotland in 2007 at Highland Birchwoods, a further four facilities have opened, dramatically increasing the availability of pellets. It is estimated that the five plants used in total some 33,000 odt of wood in 2009 and the forecast is to increase this to 157,000 odt in 2010[6].

[5] Forestry Commission Scotland - 6 FEBRUARY 2007NEWS RELEASE No: 9216

[6] Forestry Commission Scotland – Woodfuel Demand and Usage in Scotland Report 2010

The production of wood pellets is more energy intensive than that of other wood fuel production, with 10% of the pellets' own energy content being used in production when using wet, fresh sawdust and 2% of the pellets' own energy content when using dry sawdust. However wood pellets do have a higher energy density than woodchips meaning that more energy can be obtained per delivery, reducing transport energy impacts. Currently wood pellets are produced by large scale industrial pellet manufacturers with links to large saw mills and/or pellet clients making the production costs more economically viable.

Wood pellets, at present, are more popular with domestic users because they are less bulky to store, easier to handle and more suited to automatic handling systems because they are of a consistent size, when compared to other wood fuel sources. They also have a low moisture content 8%-10%, and a consistent density and heat content. Larger biomass boilers tend to be able to take wood chips as they do not have as delicate a feed system as the smaller domestic boilers[7].

The energy density of pellets is around double that of wood chips, creating economy of storage and transportation, and their flowable nature allows them to be blown rather than conveyer or grapple delivered. One disadvantage is that re-wetting will cause the structure to break down, forming a porridge-like mass, so dry storage is essential. They are also vulnerable to breakage if delivery systems are badly designed, and in general terms a combustor system designed to the characteristics of wood chips will not thrive on pellets. Key advantages are convenience and cleanliness of burn.

Wood chips are a bulky material with a relatively low energy density, so they require a large storage area and/or more frequent deliveries. They are prone to clumping if damp, making fuel handling and infeed systems quite sensitive to disruption. For this reason they are usually regarded as suitable only in systems exceeding around 80kWth: smaller systems do not have adequate fuel throughput for the size of infeed equipment suited to wood chips.

Logs may be bought directly from a supplier once they have been left to dry for a period of time to reduce the moisture content and then burnt directly in a boiler or domestic stove. Logs sourced in Scotland tend to have a relatively high moisture content in comparison to some other countries. However, the same applies to wood grown in Northern Ireland and the higher moisture content does not necessarily cause too much of a disadvantage. It does however mean that reliable, and sometimes time consuming, drying facilities are essential. It is not normally possible for logs to be loaded automatically however and are therefore not suitable unless labour is available and affordable.

[7] www.esru.strath.ac.uk/EandE/Web_sites/06-07/Biomass/HTML/biomass_fuel.htm

Forestry residues arise from forestry operations such as thinning plantations and trimming felled trees to prevent forest fires and accelerate growth. They may also include wood trimmings from urban parks and landscaping schemes. These residues and wastes offer a large potential for an energy supply.

4.2 Biomass Crops Grown For Fuel

Energy crops are crops grown specifically for use as fuel. This practice is supported by Defra, which has stated: "The growing of energy crops and their use should be encouraged".[8]

The Forestry Commission in Scotland is currently working on a number of projects relating to fuel for biomass plants and has provided the research with a good deal of helpful information. It has also indicated that it is currently involved in trials and experiments in several areas, including South Lanarkshire and Renfrewshire where it is working with farmers to develop new sources of fuel grown specifically for biomass.

The Forestry Commission website[9] has information on forestry trials, looking especially at short rotation coppicing (SRC) and short rotation forestry (SRF). SRC requires better quality agricultural land, preferably not too wet. Harvesting is November - March which tends to be the wettest time of year. SRF is usually eligible for higher grants from the Scotland Rural Development programme but can have a 10-15year horizon before harvesting. When working with farmers it is usual for a farmer to expect some level of certainty before planting a crop and prices can rise and fall significantly within the 15 year period before harvesting. This makes SRF less appealing to many farmers. Conversely it may give them alternative options as they could leave a few more years and sell for timber if the price for fuel falls.

Many farmers rely on irrigation to provide an economic return, but irrigation licences issued by SEPA are increasingly difficult to obtain, and at the time of renewal, licences are assessed to ensure water abstraction rates do not compromise water flows and other water users' interests. In some recent programmes in the UK, local farmers have become interested in the potential of growing energy crops on land that had previously been set aside or growing low value crops.

[8] ww2.defra.gov.uk/food-farm/
[9] www.forestry.gov.uk/forestry/HCOU-5YHKGG

5 Fuel Supply in East Renfrewshire

5.1 Waste Wood

Processing of wood derived from the waste stream is a specialist activity, with one such company known to operate within the study area: Wm Tracey Waste Management of Linwood indicate that they alone currently collect around 30,000t of waste wood per year which is stored in Linwood and could be made available as a biomass fuel with a reasonably high calorific value. This material includes the approximately 500 tonnes per annum material received at the Council's civic amenity sites[10]. Although further discussions would be required with Tracey's, there may be advantages to using this source as a fuel; it utilises waste and therefore has the dual environmental benefit of reducing landfill; it is relatively local with a minimal haulage distance; and it should be reasonably cost effective. However, a form of tie in contract would be required to ensure long term security of supply.

If this could be used, the waste wood is likely to be made available as shredded fuel material. Shredded wood (sometimes called Hog Fuel) tends to be dirty, with a high ash fraction. It is also problematic to handle and transfer, since the particle size is much more variable than that of chipped material, so it is only suited to larger plants designed to use it. It is however a cheaper material than wood chips, largely because its diversion from landfill represents a saving to the processor. It also tends to have a lower moisture content than wood chips, so is energetically preferable.

Costs vary according to source, grade and market conditions, but typically run at around £25 – 35 per tonne (25% moisture content).

However, this waste source is probably only likely to be viable if relatively large quantities are required. Smaller plants tend to have much tighter requirements in terms of fuel size – and waste wood can be provided with significantly different sized material in each batch. Tracey's themselves will almost certainly only wish to enter a long term service agreement if they can sell adequate quantities of the material and are also unlikely to provide any high quality screening if they are only selling small batches. This suggests that waste wood would be suitable only for a large scale plant.

[10] This probably includes Renfrewshire council sites. East Renfrewshire Council have indicated that Waste wood from their Civic Amenity Sites at Greenhaggs and Barrhead is collected in separate skips and then sold for use as chipboard/MRF.

At this stage on the basis of the scale of the facilities suggested for Saunders Court and Rouken Glen Park, there appears to be no realistic scope for using the waste wood from Tracey's despite its desirability in cost and landfill reduction terms.

5.2 Wood Chips

Wood chips are increasingly being produced from forest material, by forestry contractors or owners seeking to add value to their product. Their quality can be variable depending upon source and equipment used in production, but there are specification standards under development which the better suppliers are able to meet.

Costs in the range of £55 - £70 per tonne (35% moisture content) are typical for this material, although this may increase to £75 – £120 per tonne once transport costs have been taken into consideration. Although for local or 'self-chipping' Chippers can cost £200/day to hire and can chip 40t/hour. Efficient use of chippers is essential. Appendix 3 shows prices quoted by the chip providers.

5.3 Wood Pellets

There are currently five wood pellet production facilities operational in Scotland with a sixth currently under consideration. Unfortunately most of these are some distance from East Renfrewshire which means that high transport costs will be involved. The closest is at Grangemouth, although the possible new facility may locate in Ayrshire which may be more convenient.

Wood pellets are formed by drying finely milled wood chips, sawdust and primary production residues to around 20% moisture content. The resulting pellets are clean, dry, durable cylinders of 6 or 8 mm diameter and around 30mm length.

Initial discussions with the pellet providers have indicated that pellet prices are currently higher than expected at the outset of this report. Appendix 3 shows prices quoted by the pellet providers.

5.4 Biomass Grown for Use as Fuel: Energy Crops

To date there is no knowledge of East Renfrewshire farmers growing crops specifically for fuel. The final phase of this project will involve liaison with farmers' representatives and the Forestry Commission which will aim to develop a local scheme that helps East Renfrewshire farmers and land owners make land available for growing crops for fuel. Before they can consider doing this, they will need some assurances that there will be a market for their

crops, such that the consultation exercise will start once the approval to develop the biomass ideas further has been granted.

The aim is to assess the potential for working with local farmers to use underperforming land for growing SRC or SRF. The farmers could then become the fuel suppliers which would keep the supply chain local, retain expenditure within the local economy, reduce transport costs and help farmers who may currently have land producing marginal benefits.

Initial investigation suggests that it can be difficult to set up partnership deals with local farmers. One concern is that farmers will not grow crops until they are certain that the biomass facility will go ahead, while conversely, the facility cannot go ahead until it knows where it will source its fuel supplies.

However, it is worth noting that East Renfrewshire has a substantial rural area. According to agricultural statistics provided by the Scottish Government, in 2007 there were 197 farm holdings in East Renfrewshire, covering 12,561 hectares. Within this area there are likely to be at least some farms who may be interested in growing crops for fuel.

6 Saunders Court

There are 42 units in Saunders Court, in three 4 story blocks. There is a considerable variation in the energy consumption within individual units. This was identified during consultation interviews with occupants. While there was inconsistent information available, i.e. some residents did not have payment records going back more than several months, it was evident that some residents are paying up to £1000 per annum for heating and hot water provision.

The Energy Performance Certificates, (EPCs), which were drawn up in June 2009, indicate a typical consumption of about 17000 kWh per year within each unit. They also identify the split between heating load and hot water provision, in the ratio of 2:1. However the raw data collected from tenants, by interview, would suggest that the consumption is higher in some units. Consumption is obviously dependent upon occupation patterns, the number of occupants, and whether the occupants are in the units during the day. However for the purpose of this report, we think that it reasonable to assume that average consumption is around 17000kwh per unit, per annum. This figure would be considered to be high compared to similar properties.

6.1 Boiler Sizing

Using the figure of 17000 kWh per annum, we estimate that each flat requires 4kW for space heating. This equates to an estimated load of 168kW. (4kw x 42No units). In addition we estimate that a further 1.5kW per flat would be required to provide domestic hot water. Therefore the total load would be 231kW.

In light of this, our proposal is based on installing a 200kW Biomass Boiler and a 250kW gas boiler to act as a back-up and manage any additional load which may arise as a result of extreme weather conditions. Biomass boilers should be installed with additional hot water storage capacity, i.e. a buffer tank to smooth out the load variation experienced during operation. It is therefore normal to install a biomass boiler with a smaller capacity than the actual load and to install an oil or gas boiler with a capacity in excess of the load. Biomass boilers tend to run longer hours than gas boilers, because they are designed to run more continuously whereas gas boilers satisfy instantaneous demand.

We are recommending using a backup gas boiler for several reasons. While pellet boilers are now recognised as a reliable form of heating, it is generally accepted that they are still slightly less reliable than gas. This is as a result both of unfamiliarity with the technology, and issues with pellet quality which are now largely resolved. There is also increased risk with installing a retrofit system. The flats have been designed to run with electric heating and have done so, since they were constructed. However the new installation will not be custom designed for the building such that a perfect fit can never be guaranteed. This would apply to all technologies when retrofitted.

Using 5.5kW per flat and estimating a minimum of 3000 Full Load Hours per annum, we estimate that the minimum annual space heating & domestic hot water demand, per flat, will be 16500 Kwh per annum and 693,000 kWh per annum for the full development. Most flats of this type would normally expect to run approximately 2500 hours per annum. However the data collected from the tenants, in terms of total expenditure, would indicate that running hours are higher than normal for a property of this size. This is either as a result of lower levels of insulation, or is indicative that many of the flats are occupied continuously during the day. All calculations have been made using the figure of 16500 Kwh per annum.

6.2 Proposed Site for Biomass Boiler Plant

Having carried out a site visit, it is our recommendation that the best solution for a biomass boiler house and fuel store is to erect a prefabricated, purpose built unit which is located on the triangular area of grass, at the gable end of one of the blocks. It would need to have a floor area of approximately 36square meters, with a storage area accounting for half of the total. This unit would be designed to hold all associated ancillary equipment e.g. buffer

storage tanks and also the proposed gas back up boiler. Planning approval will be required to install a prefabricated unit in this location. It will also be necessary to confirm that there are no services in the ground in this area. The existing washing line area may have to be altered to accommodate the boiler cabin.

It is also possible to construct a purpose built boiler house of traditional construction, with concrete foundations, brick walls and a pitched tiled roof. This option is likely to cost about £36000 (36sq.m @ £1000/sq.m), and will require more disruption than the prefabricated option. It will require to be sunk into the ground to facilitate the delivery of wood chips, should chips be specified as the preferred fuel.

However, we are recommending using wood pellets in preference to wood chip for several reasons. The storage capacity of the unit will be reduced considerably if pellets are used, as their bulk density, at 550kg/cu.m, is greater than that of chips which are typically around 250kg/cu.m. The quality of pellets is guaranteed, while the quality of chip is dependent on the capability and reliability of the supplier. There will also be an issue with the design of the fuel store if chips are used as the fuel store will have to be partly underground to allow the chips to be tipped in. Pellets can be delivered by blowing from a pellet truck, and the store can be level with the truck.

The only downside of using pellets is the cost. Pellets will cost approximately £180 per tonne delivered (see Appendix 2), against wood chip delivered at £140 per tonne. (Indicative prices of chip delivered to site, at £110 per tonne are misleading as the moisture content of the chips is likely to be around 35%. The moisture content of pellets is around 10% and the 25% difference means that the chips have a lower calorific value, and are therefore less efficient to burn).

6.3 Saunders Court Costs

Detailed breakdown of proposed equipment and costs.

	Saunders Court 200kW boiler	**RRP**
1	250kW wood pellet boiler (includes lambda probe).	£35000
1	Flue Gas Dust Extractor inc Cyclone inc casing & insulation &	£4000

	silencers	
1	3 Way Mixing Valve & Pump	£2000
1	Feed System Inc Drive Unit & Conveyor Channel (Est 5 mts cc)	£7000
1	Extending Feed System	£1,500
1	SMS Messaging System	£1700
1	Delivery	£3000
1	Cranage at site	£800
1	Assembly & Installation	£3,500.00
1	Commissioning	£2000
	Total	**£60500**
1	Stainless Steel Flue 300mm I/D (supply & Install)	£6000
1	Monitoring Software with Bus Control including outstation	£1,300
1	10,000L Insulated Buffer Storage Tanks	£20000
1	Prefabricated Boiler House & Fuel Store	£18000
1	Plumbing Works	£10000
1	250kW Heat Exchangers	£3000
1	Pumps	£2000
1	250kW Gas Boiler - Supply & Install	£6000
	Grand Total	**£126800**

6.4 Delivering Heat to Each Flat

The flats are currently running on Economy 7. They, therefore, do not have the infrastructure in place to accept heat from a biomass heating system. A wet system would have to be installed in each flat (this of course will apply to most alternative technologies and is not specific to biomass). We estimate that this will cost approximately £4000 per flat. We have been involved in a similar scheme in Northern Ireland, with Northern Ireland

Housing Executive, for the provision of a biomass boiler for similar units in Larne. The figure of £4000 was provided by their Term maintenance contractor, for that scheme. This figure could be revised in consultation with Barrhead Housing Association who may have locally based suppliers offering alternative costs. However, for the purposes of this feasibility study this is used as a likely indicative cost.

Install Wet System in Each Flat PC Sum £4000 x 42No flats	£168000

The hot water generated by the biomass system can be transported to the blocks using pre – insulated pipe which is laid underground.

In order to deliver heat, a Hydraulic Interface Unit (HIU) would have to be installed in each flat. This HIU is a pre-packaged unit which contains a plate heat exchanger, heat meter & pre- payment facility. We would suggest that the pre-payment facility is then installed in a local business where cards can be topped up. This system of pre-payment is working well in other biomass district heating schemes. It is also the most effective to avoid the requirement for debt management.

The costs for both the insulated underground piping and supplying & installing HIU's are outlined in detail below.

120 Mts of Flexalen Pipe DN 63	£10000
Laying of Flexalen Pipe	£2000
Digging & Reinstating Trenches PC Sum	£12000
Supply & Fit 42 No Consumer Units Which inc Heat Exchanger, Heat Meter & Pre Payment	£46200
Grand Total	**£70200**

6.5 Total Cost for Biomass Boiler:

Boiler Installation	126800
Wet system heating	168000
Supply Pipework	70200
	365000

6.6 Contracting Options

There are several contracting options, including:

- Straight purchase
- Service Agreement
- Energy Services Contract

Straight purchase involves a capital expenditure of £365000 to install the complete system, including the boiler, prefabricated boiler house, supply pipework and heating installation within the flats. The Landlord/Barrhead Housing Association would then be responsible for the maintenance of the boiler and for ordering fuel (wood pellets). Although this would be a new activity for the Housing Association it is one which is relatively straightforward and should be simple for current staff to learn.

A Service Agreement involves Barrhead Housing Association incurring the full capital expenditure , but then subcontracting the maintenance and fuel supply to a third party. This will remove a certain amount of maintenance time, but will result in a higher cost of heat supply as the service company will be responsible for operating, maintaining and fuelling the boiler.

Under an Energy Services Contract (ESCo) the entire process is let out to a supply company responsible for:

- Financing of the capital expenditure required to purchase equipment.
- Supply/installation and commissioning of this equipment.
- Fuelling the boiler for 20 years.
- Operating, servicing & maintaining the boiler.
- Spare Parts
- Ash removal

The supply company would then charge tenants a price per kWh of heat used, as determined by the heat meter, or in the case of pre-payment, tenants can the buy heat at a price per kWh. This ESCO contract would be for a 20 year period. The benefits of this option are that Barrhead Housing Association incurs no upfront capital cost, the wood fuel supply is guaranteed for the contract duration & all operation & maintenance costs are included in the pricing structure.

It should be noted that if the straight purchase option is followed, BHA may have opportunities to attract loans or grants to assist the purchase. At present most grant schemes designed to encourage renewables projects, such as Community Energy Scotland's CARES scheme, are closed. However, new interest free loan schemes have just been announced by Energy Savings Trust while CARES have set up a new loan fund together with Siemens to help potential investors carry out pre planning works.

6.7 Gas fired boiler option

If Barrhead Housing Association choose to replace the existing electric heating system with a gas fired system from a central boiler, the costs may be as follows.

	£
250 kW gas fired boiler	6000
Pumps, distribution system	2000
Plumbing and installation	6000
Prefabricated boiler house	10000
Wet system heating	168000
Supply Pipework	70200
Total	262200

6.8 Other Options

We also considered two other options, including a separate boiler for each of the blocks, and a separate biomass boiler in each flat.

Separate boiler for each block

This would involve 3 separate boiler houses positioned as close as possible to each flat block. It will cut down on the length of underground pipework but the cost of providing 3No boilers is considerably more.

	Saunders Court 3No 80 kW boilers	**RRP**
3	80 kW wood pellet boiler (includes lambda probe).	£75000
3	Flue Gas Dust Extractor inc Cyclone inc casing & insulation & silencers	£9000
3	3 Way Mixing Valve & Pump	£4500

3	Feed System Inc Drive Unit & Conveyor Channel (Est 5 mts cc)	£12000
3	Extending Feed System	£3600
3	SMS Messaging System	£4200
1	Delivery	£4500
1	Cranage at site	£1200
1	Assembly & Installation	£5500
1	Commissioning	£3000
	Total	**£118000**
3	Stainless Steel Flue 300mm I/D (supply & Install)	£12000
1	Monitoring Software with Bus Control including outstation	£3300
3	5,000L Insulated Buffer Storage Tanks	£36000
1	Prefabricated Boiler House & Fuel Store	£39000
1	Plumbing Works	£14000
3	80kW Heat Exchangers	£5100
3	Pumps	£4500
3	80kW Gas Boiler - Supply & Install	£9000
	Grand Total	**£240900**

Install Wet System in Each Flat PC Sum £4000 x 42No flats	£168000
60 Mts of Flexalen Pipe DN 63	£5000
Laying of Flexalen Pipe	£1000
Digging & Reinstating Trenches PC Sum	£6000
Supply & Fit 42 No Consumer Units Which inc Heat Exchanger, Heat Meter & Pre Payment	£46200
Grand Total	**£226200**

Total for 3 separate heating installations	**240900**
	226200
Total	**£467100**

Separate biomass boiler in each flat

This would involve installing a pellet fired biomass boiler in each flat. It will also require a wet radiator system in each flat, but will not require an external boiler house or the attendant infrastructure. The estimate includes for installing a 6kW, pellet stove in each flat with a wet radiator system.

The main disadvantage, apart from the cost is that the occupants would be responsible for buying pellets in bags, transporting them to and storing them in the flat and filling the stoves on a daily basis. This is likely to be unacceptable for many of the residents. The cost of the fuel will also be greater than buying pellets in bulk.

	Saunders Court 42 No 6 kW pellet stoves	**RRP**
42	6 kW wood pellet stoves @ £5300 each	£222600
42	Delivery 42@ £200	£8400
42	Supply & Fit 42 No Consumer Units Which inc Heat Exchanger,	£46200
42	Install Wet System in Each Flat PC Sum £4000 x 42No flats	£168000
1	Commissioning	£3000
	Total	**£448200**

6.9 Economics

ESCO contracts tend to be financially viable in cases where there is a high heat load over 1,000,000 kWh per annum. This proposed project is estimated to have an annual demand of 714,000 kWh per annum, which is slightly under the typical usage which makes a project economically viable. In addition the requirement to install a wet heating system in each flat

has added a significant capital cost to the project, which is making the ESCO option very unattractive in comparison to fossil fuels.

The total costs for a biomass project would be £365,000 which would translate to a price of heat at 13.5p per kWh, almost twice the current prices being paid by tenants. We have been provided with this cost by Rural Generation, an ESCo company based in Northern Ireland who are also operating in Scotland. They have calculated the rate based on figures supplied by us for the total expenditure and the anticipated heat load.

In the "Straight Purchase" option, for a biomass boiler, Barrhead Housing Association would incur an up front capital outlay of £365000. Over a 20 year life, this equates to 3p per kWh, without finance charges, which would have to be factored in (unless interest free loans were secured). At a fuel cost of 4.6 p per kW hour, based on pellets delivered at £180 per tonne, plus 3p capital cost, pellets are not competitive at 7.6p, against a gas supply price of 3.3p per Kwh. However there is also the capital cost of installing a centralised gas fired system at £262200.

It is evident that without some additional contribution the biomass boiler option would not proceed. It is obvious that this option is still financially unattractive, in comparison to what tenants are currently paying per kWh of electricity.

The financial viability and payback period for Biomass boilers is largely dependent upon the total running hours per annum. Biomass fuel is more cost effective than gas or oil, but the capital cost of installation is greater. Therefore a system running 6000 hours per annum will have a payback period half that of a system running 3000 hours per annum. The fact that the flats do not currently have a wet radiator heating system also mitigates against the biomass option being viable.

It is likely that individual gas fired units in each flat would be the most cost effective option, but we are not in a position to provide accurate figures for that option. It should be possible for BHA to obtain a direct quote from a gas installation and heating contractor for individual units in each flat.

6.10 Alternative Renewable Energy options

Several other Renewable Energy options are available but have not been considered in detail, for this scheme, for the following reasons.

- Ground source heat pump. Two types are available. Deep drill and surface lay. The surface lay option is not possible in this location as it would require an area of approx. 1 hectare to deliver sufficient heat. The deep drill is considerably more

expensive and it is likely to cost more than the biomass boiler option that we have already considered.

- Solar water panels. They could provide domestic hot water for the flats but could not provide sufficient energy for the heating system. It is likely that the 42 flats would need something of the order of 160 sq.m of flat plate panels to sully water, i.e. 4 sq.m per flat. This area is not possible in this location

- PV panels. They would provide electricity, but again the scale of panels required, even to provide 2kW per flat, could not be achieved in this location.

6.11 Renewable Heat Incentive

The details of a Renewable Heat Incentive (RHI) were confirmed in the U.K. on Thurs 11th March 2011. It would incentivize the biomass option. Under the U.K. scheme, the RHI would be paid to the owner of the equipment; therefore an ESCo supplier or BHA would expect to be eligible to claim this payment. This would effectively reduce the 13.5p, under an ESCo, to approximately 10p. It is a tiered price, reducing after the first 1314 annual running hours. The RHI is dependent upon the size of the installation. For a 200kW boiler it would pay 4.7p for the first 1314 hours, and 1.9p for the remaining 1686 hours.

200kW x 1314 hours x 4.7p = £12351.60
200kW x 1686 hours x 1,9p = £ 6406.80

Total RHI income £18758.40

The same payment of £18758, p.a, is available to Barrhead HA if they chose the "Straight Purchase" option. This would effectively reduce the running costs of the pellet fuel option by 3.1p per kWh (200kW x 3000 running hours = 600 000 kWh. £18758 ÷ 600 000 = 3.1p)

6.12 Summary

The existing electrical heating system in the flats is inefficient and expensive to run. The capital cost of installing a centralised biomass boiler is £365000, which is unlikely to be an attractive financial option. It is possible to avoid the upfront capital expenditure by choosing an Energy Services Company who install, operate and maintain the boiler for a price per kW. However the cost is still likely to be around 13p per kWh, which is not comparable to gas, and is nearly three times what the tenants are paying at present. The introduction of the Renewable Heat Incentive later this year would reduce the running costs of the biomass

option by approximately 3p per kW, but this would still not make the scheme economically viable.

It is possible to install a centralised gas fired heating system in the flats, but again the capital cost is likely to be prohibitive, at around £260 000.

It is likely that individual gas fired boilers in each flat would be the most cost effective option, however that option has not been considered in detail within this report.

7 Rouken Glen

For the purposes of this report, there are a number of buildings and built areas which have been considered. They are:

- The Pavilion located adjacent to Rouken Glen Road.
- The Waste Recycling Training Centre and Glasshouses (WRTC)
- The Shangri La Chinese Restaurant
- The Rouken Glen Garden Centre
- The K7X Football Pitch Facility

As noted in section 2, the irregular nature of the heating requirement for this building means that the current switch on / switch off system is probably the most suitable and, despite its inefficiency and dependence on fossil fuels, does not warrant consideration for change. The pavilion is therefore not considered within the biomass feasibility assessment.

The WRTC includes a timber clad building which operates an Ecoliving designed heating system installed in 2008, and incorporating solar thermal and air source heat pumps to meet the buildings heating requirements. There is therefore no need to consider replacing the heating system in this building.

The heat consumption within the WRTC classroom building is considerable for its size. The data would indicate that it is costing approximately £2000 p.a to heat a 120sq.m. building.

The greenhouses however are heated by a 117kW Powermatic, oil fired boiler delivering hot air, ducted through the greenhouse which has a floor area of 310 sq.m. There is therefore the potential for both the classroom building and the greenhouses to be heated through renewable forms of energy to bring it into line with the timber clad building within the centre.

The Restaurant, garden centre and football facility are private enterprises located adjacent to the training centre. In theory, all the facilities could potentially be heated through one source. However we were unable to obtain access to the heating system in the Garden

Centre despite numerous requests to do so. We were also unable to gain access to the restaurant and therefore this analysis is based on supplying heat to the Pavilion and to the greenhouse, both of which are under the management of the Council.

7.1 Boiler Sizing

The existing oil fired boiler in the greenhouse is rated at 117kW. However the efficiency of this system is poor, typically around 65%. It is consuming, on average, about 14000 litres of 35 second oil per annum, which would indicate that the boiler is only running for about 1600 hours per annum. In effect it is oversized and running intermittently. This is not unusual for a system of this type.

The size and nature of the classroom building of traditional construction, with stone walls, mono pitched slated roof, would indicate that it has a thermal load of approximately 16kW.

Our proposal is based on installing a 50kW Biomass Boiler. The biomass boiler should be installed with additional hot water storage capacity, i.e. a buffer tank to smooth out the load variation experienced during operation. Again, it is normal to install a biomass boiler with a smaller capacity than the actual load and to install an oil or gas boiler with a capacity in excess of the load. Biomass boilers tend to run longer hours than the oil fired boiler in the greenhouse, because they are designed to run more continuously whereas the oil fired boiler satisfies instantaneous demand.

In this instance we do not recommend installing a backup system, as the level of reliability from a pellet boiler should be acceptable, considering the use of the buildings.

7.2 Proposed Site for Biomass Boiler Plant

It is our recommendation that the best solution for a biomass boiler house and fuel store is to install the boiler in the building which currently houses the composting and vermiculture unit. The building has not been used for anything other than storage for several years. The new pellet boiler and store could be installed within the confines of this building for minimal cost. A new 50kW boiler and fuel store would require a dedicated floor area of 24 sq.m, i.e. 8m x 3m. The boiler footprint is 5m x 3m, with a 3m x 3m store, for pellets, attached. We think that this can be accommodated within the existing building, without precluding its further use as a vermiculture unit.

If the management of the site wish to retain the store and do not want to house the boiler and fuel store, it would be necessary to use a prefabricated boiler house and store, at an additional cost of £16000. This cost has not been included within the figures contained in this.

It is also possible to construct a purpose built boiler house of traditional construction, with concrete foundations, brick walls and a pitched tiled roof. This option is likely to cost about £27200 (34sq.m @ £800/sq.m), and will require more disruption than the prefabricated option.

Again, we are recommending using wood pellets in preference to wood chip for several reasons. The storage capacity of the unit will be reduced considerably if pellets are used. The quality of pellets is guaranteed, while the quality of chip is dependent on the capability and reliability of the supplier. There will also be an issue with the design of the fuel store if chips are used as the fuel store will have to partly be underground to allow the chips to be tipped in. Pellets can be delivered by blowing from a pellet truck, and the store can be level with the truck. This can be accommodated within the existing compost house. The only downside of using pellets is the cost. Pellets will cost approximately £180 per tonne delivered, against wood chip delivered at £140 per tonne.

7.3 Rouken Glen Costs

	Rouken Glen 50kW boiler	**RRP**
1	50kW wood pellet boiler (includes lambda probe).	£19000
1	Flue Gas Dust Extractor inc Cyclone inc casing & insulation & silencers	£3000
1	3 Way Mixing Valve & Pump	£2000
1	Feed System Inc Drive Unit & Conveyor Channel (Est 4 mts cc)	£4000
1	SMS Messaging System	£1500
1	Delivery	£2000
1	Cranage at site	£400
1	Assembly & Installation	£3000
1	Commissioning	£1000
	Total	**£35900**

1	Stainless Steel Flue 200mm I/D (supply & Install)	£4000
1	Monitoring Software with Bus Control including outstation	£1000
1	8000L Insulated Buffer Storage Tank	£9500
1	Plumbing Works	£4000
1	Pumps	£1200
1	Convert compost store	£1000
	Grand Total	**£56600**

7.4 Delivering Heat to Greenhouse and Classroom Building

The classroom building does not have a wet radiator system for distributing heat. It would be necessary to install a system throughout the building.

The greenhouse has a warm air ducted system that would be difficult to utilise with a biomass boiler. It is possible to retain the ducted system by putting a heat exchanger on to the boiler but it would be an inefficient way of using the heat, the cost would be greater than converting the existing system and the running costs would be higher as the system would require an electric fan to distribute the air. We recommend installing a steel pipe system at ground level to distribute the heat in the greenhouse.

Install Wet System in classroom building	£4000
Convert glasshouse to water piped supply	£3800
Total	£7800

The costs for supplying & installing the insulated underground piping are outlined below.

60 Mts of Flexalen Pipe DN 63	£5000
Laying of Flexalen Pipe	£1600
Digging & Reinstating Trenches PC Sum	£5000
Total	**£11600**

7.5 Total Cost for Biomass Boiler:

Boiler installation	56600
Wet system heating	11600
Supply pipework	7800
Total	**£76000**

7.6 Contracting Options

There are several contracting options, including:

- Straight purchase
- Service agreement
- Energy services contract

Straight purchase involves a capital expenditure of £76000 to install the complete system, including the boiler, supply pipework and heating installation within the classroom building and Greenhouse. The Council, or operator of the WRTC, would then be responsible for the maintenance of the boiler and for ordering fuel (wood pellets).

A service agreement involves the council incurring the full capital expenditure , but then subcontracting the maintenance and fuel supply to a third party. This will remove a certain amount of maintenance time, but will result in a higher cost of heat supply as the service company will be responsible for operating, maintaining and fuelling the boiler.

Under an Energy Services Contract (ESCo), the entire process is let out to a supply company. The supply company would then charge the Council a price per kWh of heat used, as determined by the heat meter. This ESCo contract would be for a 20 year period. The benefits of this option are that the council incurs no upfront capital cost, the wood fuel supply is guaranteed for the contract duration and all operation and maintenance costs are included in the pricing structure.

Current heating costs:

From information supplied to us, the annual cost of heating the buildings is as follows:

Classroom building	2000
Greenhouse	7000
Current running cost	9000

7.7 Economics

ESCo contracts tend to be financially viable in cases where there is a high heat load over 1,000,000 kWh per annum. This proposed project is estimated to have an annual demand of 150,000 kWh per annum, which is way below the typical usage which makes an ESCo project economically viable. In addition, the requirement to install a wet heating system in the classroom building and to convert the supply system in the greenhouse has added capital cost to the project, which is making the ESCo option very unattractive.

7.8 Renewable Heat Incentive

The Renewable Heat Incentive (RHI) would incentivise the biomass option. Under the U.K. scheme, the RHI would be paid to the owner of the equipment. It is a tiered price, reducing after the first 1314 annual running hours. The RHI is dependent upon the size of the installation. For a 50kW boiler it would pay 7.6p for the first 1314 hours, and 1.9p for the remaining 1686 hours.

50 kW x 1314 hours x 7.6p = £4993.20
50 kW x 1686 hours x 1,9p = £1601.70

Total RHI income £6594.90

Running cost on pellets	40 Tonnes @ £185/T =	7400.00
Maintenance		500.00
Total running cost		7900.00
Less RHI		6594.90
Effective running cost		1305.10
Current running cost		9000.00
Less new effective running cost		1305.10
Saving		7694.90

Capital cost of new biomass boiler £76000 ÷ £7694 = 9.88 years payback. Say 10 year payback.

This could be reduced if installation costs could, be part funded through grants or interest free loans. While the opportunity to secure interest free loans is currently positive, there may also be some potential to win grant funding given the nature of the use of the WRTC. This should be considered further if a biomass proposal is to be pursued. As grant funds are continually changing it would be appropriate to consider grants at the point where finance is being raised.

The payback period is directly related to the total number of running hours. In the assessment above, it has been assumed that the boiler will be running for 300 hours. If, however the greenhouse is used more commercially and the heat requirement goes up, then the payback period will decrease. The table below summarises the options:

Running hours	Pellet cost	Total cost	RHI Revenue	Effective running cost	Saving	Payback Years
3000	7400	7900	6594.90	1305.10	7694.90	9.88
4000	9866.66	10366.66	7544.90	2821.76	9178.24	8.28
5000	12333.33	12833.33	8494.90	4338.43	10661.57	7.13

The increased running hours of the boiler will create additional savings if there is an increased heat demand. It is obviously not intended that the boiler will run additional hours unless there is a demand. That demand could be created if the greenhouses, which appear to be used intermittently, are used continuously to produce additional plant material. The savings contained in the table above assume that the current heating cost, for an oil fired system, of £9000, would increase pro rata, in accordance with the additional running hours.

7.9 Summary

It was not possible to obtain details of the heating installation within the garden centre or the Chinese restaurant and the report is therefore focussed on the classroom building and the glasshouses. The timber clad building is already served by both an air source heat pump and solar water heating and has not been considered.

The WRTC classroom is heated by very inefficient and expensive electric panel heaters. The annual cost is approximately £2000 p.a. The glasshouses are heated by an oil fired Powermatic air boiler, which costs between £5500 and £8000 p.a.

It is possible to install a biomass boiler adjacent to the glasshouse which could provide heat for the glasshouse and the pavilion building. We have assumed that the building, which houses the compost and vermiculture unit, could be converted and used as the new boiler house and fuel store. To facilitate fuel delivery, wood pellets are recommended. The total cost of this option is £76000. It will also require the modification of the heating delivery system within the glasshouse, as it is currently provided by ducted air, which would be difficult to operate from a biomass boiler.

With the income from the RHI, the installation of a biomass boiler is economically viable. It has a payback period of around 10 years. Without the RHI, this scheme would not be feasible.

7.10 The Bigger Picture

Given the reluctance of Rouken Glen Garden Centre and Shangri La Chinese Restaurant to discuss their heating demands at this stage, it is difficult to be positive about developing a larger scale facility which would heat these buildings. However, there is currently an unprecedented opportunity for local government and the public/third sector to become involved in, and benefit from, the potential to generate heat and power.

With the introduction of the Feed-In Tariff and Renewable Heat Incentive, Scotland's local authorities and wider public sector now have the opportunity to play a direct role in driving the low carbon transition. The Scottish Council Development and industry have estimated that at a time of significant budget cuts, local authority power generating projects could help win revenues from an estimated pot available of up to £12 billion over the next two decades[11].

The Scottish Futures Trust has been commissioned by COSLA to produce a draft report which will facilitate local government development of low carbon energy projects. This will include heat and power generation and is part of the government driven aim to encourage and motivate the public sector to invest in renewable energy schemes.

There is clearly an opportunity for the public sector to generate revenue streams through investing in renewable heat and power projects. The range of facilities at Rouken Glen Park look to be ideally suited for such an investment. But it is early days, with little precedent or experience to encourage public sector investment. The Scottish Government is attempting to make it easier for the public sector to develop the confidence to invest in heat and power schemes and it is without doubt worth East Renfrewshire Council or ERCET considering the opportunity further.

[11] EMPOWERING SCOTLAND: Maximising the Potential of Public Assets for Low Carbon Energy. Conference promoted by COSLA & SCDI, 21 June 2011, Aberdeen

8 A Biomass Sector

Given East Renfrewshire's growing position as a centre of renewable energy, it is worth asking whether biomass can become a means of generating economic development through attracting additional biomass related activities to the area, rather than just seeing biomass as a means of heating a series of buildings. Could East Renfrewshire develop a 'Biomass Sector' and add value through horizontal or vertical linkages? Could it increase the development opportunities through adding biomass to the mix of renewable energy activity already located in the area? And could biomass become a means of creating local jobs and new economic activity?

The means to achieve this are likely to be through:

- Growing crops or creating fuel
- Research and development (R&D)
- Manufacture of kit or facilities
- Developing markets locally
- Using biomass as a means to decrease running costs for local businesses

Initially however, it would appear difficult to develop a biomass sector if there is not at least one facility operational within the area, ideally the potential Rouken Glen facility because this could be highly visible and easy to use as a promotional tool. But if the Saunders Court proposal is deemed non-viable then it will be difficult to persuade potential investors to buy into the biomass concept. This would potentially apply to at least four of the above five headings.

8.1 Growing Local Crops

At the outset of this project it was hoped that any biomass facility that resulted from the feasibility study could be fuelled through locally supplied fuel sources. The nearest pelletiser is currently located at Grangemouth, some 40 miles away; the nearest chip suppliers are in Mid Lothian or Perthshire, again over 40 miles away. If demand for either chip or pellets could be generated in East Renfrewshire then it would appear logical to consider developing a local fuel supply stream.

In areas such as the Limavady region of Northern Ireland, farmers have co-operated to grow short rotation coppice to supply a local medium scale biomass plant. This appears to be working successfully with farmers gaining an income for their crops and the operator of the

boiler guaranteed a local supply with low transport costs and a known quality. As East Renfrewshire is home to almost 200 farms, there would appear to be an opportunity to develop a local growing scheme for biomass fuel. In addition there may be opportunities to utilise underused land currently owned by East Renfrewshire Council.

While land area may be available there are other conditions and difficulties which will have to be overcome. The evidence from Limavady and elsewhere shows that the problems can be overcome, but this may take time.

Discussions with East Renfrewshire farmers' representatives have identified the following concerns:

- Farmers would be expected to give land to production with the first crop 4-5 years away, and future crops every second year. They would lose the flexibility to respond to market prices (i.e., to grow a crop which is expected to fetch high prices in any given year)
- While the skills required for growing short rotation coppice or short rotation forestry are not extensive, farmers would be expected to grow an unknown crop
- Farmers are generally reluctant to look too far ahead as they live in a world of fluctuating prices so will be wary of promised returns in 4-5 years time
- There is, as yet, no proven market. If a new local biomass plant starts by importing fuel and then decides to continue importing after local supplies come on stream, there could potentially be no *actual* local market. It may be difficult to convince farmers that this wouldn't happen
- Farmers would be expected to undercut established suppliers, some of which may have developed economies of scale or cheaper logistics operations

There was also concern expressed over a precedent known to local farmers, but now somewhat dated, when a Fife based farmer tried unsuccessfully to grow short rotation willow around 10 years ago. While conditions are now different, memories of failed experiments last long and farmers would have to be convinced that they wouldn't similarly fail

These issues can be overcome, as areas such as Styria in Austria and Altmark in Germany have proven[12]. But it will take effort. In this regard, East Renfrewshire may be able to offer three advantages.

[12] Footnote: "in the local authority areas of Altmark in Sachsen Anhalt Germany, and Styria (Steiermark), Austria, renewable energy has been used as a policy instrument to help develop the regional economies. In both areas, European funds have been used to grow various aspects of the renewables economy, with Altmark over 10,000 people are employed in renewables technologies http://nuke.biomasstradecentres.eu/Portals/0/Metschina_Lk%20Stmk_Bimasse%C3%B6fe.pdf while a

- First, East Renfrewshire Chamber of Commerce and Voluntary Action East Renfrewshire have secured major funding through the local Leader programme to work with local rural businesses and social enterprises (including farms) to help develop business opportunities and help them through difficult economic times. This provides an opportunity to promote the potential associated with biomass plantations and growing crops for fuel. Both schemes will provide an opportunity until late 2012 and could be contacted to see if they can help develop a biomass advisory service
- Second, East Renfrewshire has good transport links. The M77 links the area to Ayrshire and Glasgow, while the new M74 extension, due to open in summer 2011, will hopefully reduce journey times by road to the central belt and south of Scotland. As with any bulky item, transport is a high element of total biomass fuel costs, and these road links should place East Renfrewshire closer to potential mass markets than any other current chip or pellet supplier. This however, should be treated with caution. Both south Lanarkshire and Renfrewshire have considered developing local fuel growing schemes, such that this potential competitive advantage could be lost. Monitoring of these two proposals is recommended
- Third, East Renfrewshire has been subject to large scale planning applications for renewable energy and recycling initiatives that could potentially benefit from locally grown biofuels. Should the major scale applications go ahead, then there could be a steady and large scale demand on the doorstep.

In addition there could be a timely new opportunity. East Renfrewshire Council have been developing an idea which involves growing aspen for fuel. They have identified an industrial site in Barrhead which could be a suitable candidate for growing aspen. The reasons are:

- Aspen is known to assist some forms of decontamination and may be a suitable agent to help decontaminate the former industrial site
- There is no current demand for uses of the site that accord with the Development Plan. At some point in the future this may change, but for the present, and possibly the next 5 years or so, the site is likely to remain derelict
- Aspen could be planted and then sold for fuel in four - five years time.

purpose designed vehicle has been set up to develop biomass across the region http://www.biomassehof-stmk.at/

- There may be potential for winning grant funding towards establishing an aspen plantation, possibly through the Central Scotland Green Network Development Fund
- In five years time, if the crop is sold for fuel, but is not replanted, it could open the door for local farmers to become replacement suppliers. In other words, the farmers would watch the council's initiative to grow and sell crops, thus establishing the market, and then gain the confidence to follow.

Potentially this could be an exciting project which plays an important role in pioneering a possible biomass expansion in East Renfrewshire.

In summary, it is premature to say at this stage whether it is feasible to develop a local "crops for fuel" growing strategy. It will be difficult, but the next 12 months offer the opportunity to overcome the difficulties through the two current grant funded schemes, through the potential new projects (if they are granted planning permission), through the forthcoming new road linkages, and through the possible East Renfrewshire Council initiative in Barrhead.

8.2 R&D

The potential for developing R&D opportunities locally is probably limited. This is largely because biomass is a relatively mature sector with R&D tending to be a function of private companies looking to improve their own product. Unlike some other renewables technologies, such as tidal power, biomass has been accepted in the market for many years, particularly in Central European countries such as Germany and Austria, and the scope for extensive additional research contracts is therefore small.

Biomass however, covers all living materials and the maturity in the sector is largely confined to wood and wood based products. Research into some alternative crops such as miscanthus is relatively well advanced, but there is still a current gap in understanding the potential associated with all bio products, especially materials which are considered to be waste. Within Europe, there are pockets of research which could be leading to new products entering the market and this suggests that if research funding could be secured then there may be an opportunity locally to develop new bio products. An example of this already happening is found in the German local authority of Altmark in Sachsen Anhalt[13]. Here the local authority have part funded research into using farm waste and parks waste to generate heat and power through both combustion and digestion. This has attracted additional research funds from European and German sources and one small local company

[13] In a March 2011 visit to Altmark, IRRI researchers were advised of a council backed and European funded project which was generating power from weeds. The council indicated that they are currently working on developing this as a commercial venture

is currently about to enter the market with a new energy generating product which is fuelled by roadside weeds. While the market success of this product is still to be seen, it demonstrates that there may be opportunities to combine research and business development at the local level. For the Altmark Government, the financial support was justified because it aims to position itself as Europe's leading renewables authority and combines a growing momentum in wind and bio crops.

Translating this to East Renfrewshire may not be easy, and the rewards may be both small and slow, but to attempt to trigger an R&D element to the sector, East Renfrewshire Council or ERCET could consider making an application to the Intelligent Energy Europe fund (IEE), or combine with established research institutes to help develop some of the less advanced aspects of biomass.

There may also be some potential associated with the proposed new college. If the current plans to work closely with Reid Kerr College come to fruition, then there is potential from 2013 or 2014 onwards for courses in renewable energy to be offered in Barrhead. Discussions with Reid Kerr staff indicated that skills appropriate for installing solar and other technologies could well form part of the curriculum to be offered within the potential Barrhead College. Courses relating to biomass could possibly be added to this, albeit with the caveat that all courses would only be offered where the college perceives there will be market demand. These courses could cover design and feasibility assessments, installation and potentially some research.

In summary, there is no obvious opportunity for East Renfrewshire to develop a strength in biomass R&D, but there should be potential for biomass associated skills to be offered within the potential new college. Small steps could also be taken through applying to research funds such as (IEEF) to help assess the potential associated with a range of materials where the market is less mature.

8.3 Manufacture of kit or facilities

It would also appear that the opportunity to develop a manufacturing element within a potential biomass sector is limited, although it is beyond the scope of this report to determine the precise factors which may lead to a manufacturing set up. Currently most biomass boilers are imported into the UK from Austria and elsewhere and it will be difficult to influence a start-up manufacturing facility in East Renfrewshire, an area which has seen its manufacturing sector decline dramatically in the past 20 years.

8.4 Developing Markets Locally

Moving to a low carbon economy is considered in Scotland to be an economic and environmental imperative – and one of the Scottish economy's biggest opportunities to replace demand lost as public spending falls.

If a critical mass of biomass boilers could be established in the area then a facility such as a pelletiser could be a welcome addition to the area's declining manufacturing sector. Although, as noted above, the area would not appear currently to be the most obvious to open a new manufacturing facility. However, local demand and low transport costs could be convincing factors. It could also encourage farmers to grow crops. In this way, the Scottish and regional economy could be seen to be taking one of the opportunities highlighted as a means of advancing the low carbon economy.

To assist this, a capacity building or promotional programme could be started for small business, community and residential groups and developed through Chamber of Commerce and Voluntary Action contacts. This would also include working with the public sector, especially East Renfrewshire Council who may have excellent potential for generating income in future. This is because the opportunity is currently available for local authorities to generate income through power and heat. To date the public sector in Scotland has played a limited direct role, with only 0.01% of UK electricity generation currently by local authority-owned renewables. In Germany, it is 100 times higher[14].

However, since August 2010 local authorities have been able to take full advantage of the Feed in Tariff for small-scale renewable electricity generation, and the Renewable Heat Incentive announced in March 2011 has been designed to encourage investment in heat generating schemes.

Local authority assets include land, buildings, roadsides and some treatment facilities, such as waste sites. Local authorities may currently see some of these sites as a burden with potentially large bills under the Carbon Reduction Commitment and increasing oil based energy price rises. But these could become assets offering scope to install projects which drive the low carbon transition and generate annual income, ideally to reinvest in low carbon projects or support local services or residents.

[14] Huhne ends local authority power struggle (Press release) (Chris Huhne, Secretary of State for Energy and Climate Change) *09 August 2010 DECC Press release PN 2010/89*

Together with the promotion of renewable energy that could come from the Chamber of Commerce and Voluntary Action activity and any future PowerDown projects, the time and opportunity could be perfect for increasing interest in, and installation of, a number of smaller scale renewable energy plants in East Renfrewshire.

8.5 Decreasing Local Businesses Costs

Closely linked to developing market demand, a campaign could be established to advise local business on the dual benefits of reducing carbon emissions and reducing costs through implementing biomass or other renewable energy sources. However, the findings of the Saunders Court feasibility assessment suggests that caution should be urged and a headlong rush into low carbon solutions may not always be economically viable.

Funding has been available for such campaigns, most recently through the Climate Challenge Fund, Leader and some European sources such as IEEE, but securing funding will either be slow or dependent on the direction future Scottish funding takes. This is something that could be considered further should East Renfrewshire Council or ERCET see the development of a biomass sector as a viable part of the growing low carbon economy.

9 Increasing Viability and Developing A Way Forward

The scheme in Saunders Court does not initially appear suitable for biomass heating, in that while it is technically possible, it is not cost effective. The main reasons for this are:

- Retrofit is more expensive than the comparable cost of new build[15]
- The existing flats are heated by electric storage heaters and there is the additional cost of installing a wet system of heating , throughout the buildings
- The absence of an existing wet system means that there are additional costs associated with items such as the consumer unit within each flat
- There is a cost associated with providing an underground pipe distribution system to each of the blocks which has proven to be more expensive than originally imagined
- While it would be more cost effective to run the biomass boiler on wood chips, instead of wood pellets, it is not possible, given the space constraints on the site, to install a wood chip boiler. To operate efficiently, the wood chip boiler would require a store approximately three times the size of the pellet store to accommodate the same fuel reserve, as the fuel density of chips is a third that of pellets. The chip store

[15] Note: there are many successful retrofit schemes such as Dornoch Castle Hotel but the particular configuration of Saunders Court has made a retrofit project difficult for a centrally based scheme.

would also need to be below ground level to facilitate delivery of chips, which need to be tipped. Pellets can be blown.

While some of the above points would apply also to a gas based system, gas still comes in considerably cheaper than biomass.

In order for it to become viable, the following would have to happen:

- BHA secure an installation grant (which is currently difficult) or at the minimum an interest free loan, which are currently available for renewable energy projects.
- The price of gas to increase. It probably will but it is difficult to know by how much
- The cost of pellets to come down. The currently high price is understood to be a reflection of supply and demand and there are views within the biomass industry in Scotland that pellet prices should come down, but again it is not possible to say by much or when.

For this reason, the variables that could be addressed are hard to determine with any level of accuracy and therefore, with the exception of the potential for winning an interest free loan to fund the installation, the ability to improve the financial feasibility of a biomass installation is limited. Unfortunately this means that we are unable to make a biomass project more viable in this location at this point in time.

However, it is possible that there are other opportunities, to develop biomass heating, in the Barrhead area.

The next step is to identify the conditions that are likely to be viable. They are:

- The building scheme that is most likely to be suitable would be a new build. Distributed housing, i.e. individual houses requiring a large infrastructure of underground heating, is not ideal, as the capital cost is likely to be a disincentive. However a new block of flats, with a single heat load, over 500kW, should be cost effective if the decision is made at an early design stage to incorporate biomass heating. Wood chips will be less expensive, than pellets, in terms of running costs, but will be more expensive in terms of capital expenditure. The store for chips will need to be larger and should be underground to facilitate delivery.
- A building containing a swimming pool, such as a Leisure Centre, will have a relatively large base heat load. In a typical Leisure Centre, with a 25m pool, the total heat load is likely to be around 1MW, and the heat load associated with the pool is likely to be approximately 400kW. As with Saunders Court, if the building is already constructed, it is probably most cost effective to install a containerised unit, rather than construct a new boiler house and fuel store

- A Nursing Home also has a relatively stable and consistent heat demand, which is suitable for biomass heating. In addition to heating requirements, there is a continuous demand for hot water that makes the heat demand profile predictable and flat.
- An industrial process requiring low temperature, hot water, heat, such as a food processing plant or cheese factory, is suitable for biomass heating. If the process requires steam, it will be more problematic as there is an additional cost associated with raising the temperature and pressure of the water, above what is normal with a standard biomass boiler. However if the requirement is for hot water only, and particularly if the demand is relatively large, i.e. over 1 MW, the biomass option is likely to be competitive. Industrial processing plants also tend to have spare capacity onsite, and space is usually not a problem for the siting of additional buildings
- A building, with a boiler which has come to the end of its useful, life will be a more cost effective option than one where the boiler is relatively new, or only half way through its 25 year life cycle.
- It is unlikely that the payback period, for a biomass heating system, will be less than 5 years, for most applications. Therefore, if the organisation, which owns the building being considered, usually requires a 2-3 year payback period on capital investment, it is improbable that the scheme will ever pass that criterion.

This review indicates that, while a biomass based heating system is not likely to be viable at Saunders Court, in comparison to gas based systems; this does not mean that there is no future for biomass in East Renfrewshire.

At Rouken Glen Park a system does appear viable, albeit with a possible 10 year payback period, but if an interest free loan is secured, this could start to look attractive.

One original suggestion that was not pursued was that Eastwood Park may offer suitable opportunities to develop a biomass based heating system. The original thought was that there may be some woodfuel available within the park due to a possible scheme to fell some trees; but early consultation with East Renfrewshire Council and the forestry Commission dismissed this idea due to the limited volume and quality of the trees concerned. However, there may be benefits in revisiting Eastwood Park. It contains a swimming pool, leisure centre, theatre and café self contained in the centre of the park, with council offices and a school not adjoined, but still within the park grounds. The buildings would meet the requirement of a roughly constant heat demand, especially with the swimming pool, and there may be space to install adequate storage for a chip based facility.

There is also an opportunity to liaise with local farmers and East Renfrewshire Council to establish a woodfuel growing project, especially if the Council are able to utilise their industrial land to get a long term project started.

Although Saunders Court does not look to be a suitable candidate for a biomass heating facility, there are an increasing number of domestic scale individual pellet boilers being introduced in Scotland and a number of hotels are converting to biomass. This suggests that there is still potential for biomass within the area. Two of the key original reasons for assessing biomass remain:

- Gas and oil/diesel prices are set to rise. Alternative fuels should be considered wherever possible
- The Scottish Government still has its ambitious target to reduce greenhouse gas emissions and any scheme which replaces a fossil fuelled system with a renewables based scheme will contribute to that.

For these reasons, biomass should still be considered as a suitable fuel in many cases in East Renfrewshire. This project has shown that it will be difficult to retrofit into a building with the configuration of Saunders Court, that is three separate four storey blocks.

Section 8 has shown that biomass could be a contributor to East Renfrewshire's potential to use renewable energy to increase economic development. The precise biomass opportunity is probably small scale, but the timing is good with Leader funded projects about to start which could be used for promoting biomass issues in the rural sector while the new Renewable Heat Incentive may make the economics of biomass more attractive, at sites beyond Rouken Glen and throughout the district.

10 Recommendations

This report makes the following recommendations:

The installation of a biomass boiler based heating system for Saunders Court is desirable in terms of improving the heating systems for the residents and through reducing Greenhouse Gas Emissions, but is not justified on economic grounds. Individual gas boiler systems will come in at significantly lower capital cost. While the RHI will increase the income associated from biomass boilers, it will not be adequate to justify a biomass boiler ahead of a gas system.

A biomass boiler system is economically viable at Rouken Glen Park where a payback period of approximately 10 years would be expected. The investment could potentially be financed

through an Energy Saving Trust interest free loan, with Renewable Heat Incentive payments made for the next twenty years. This would provide a cheaper and greener alternative to the existing system and equipment and fuel storage could be accommodated within the vermiculture shed. This would meet the ethos of the training centre and reduce its running costs.

A pelletised boiler is recommended for Rouken Glen Park and further negotiations should be held with Verdo Renewables Ltd of Grangemouth and Pentland Biomass of Midlothian in order to secure the best value deal for pellet supply.

There is further potential to establish a wider biomass sector within East Renfrewshire and the opportunity should be taken to link with East Renfrewshire Chamber of Commerce and Voluntary Action East Renfrewshire to see if there is potential to use their current consultation projects to promote the opportunities for growing fuels to East Renfrewshire farmers. A separate opportunity exists to grow trees on land owned by East Renfrewshire council.

These schemes would not necessarily grow fuel to be used at Rouken Glen Park where a pelletised boiler is recommended. But there are many other opportunities for biomass projects within East Renfrewshire which could use woodchip or locally grown wood for fuel.

Although Saunders Court did not prove as positive as hoped in financial terms, there are still good prospects for developing biomass projects within East Renfrewshire. The policy support from Scottish Government for biomass means that financial incentives such as RHI and the interest free loans make this a good time to invest in biomass. Facilities such as swimming pools are often suitable for biomass in that they tend to have the best heat profile for making a quick return on investment. There would be benefit in revisiting the swimming pool complex at Eastwood Park which may be an excellent candidate for a woodchip based biomass boiler.

Appendix 1a Meeting Minutes 20.10.10

East Renfrewshire Community Enterprise Trust

Biomass Feasibility Study

Kick Off Meeting		
Present	Shirley Robison (BHA) Hamish Campbell (ERC)	Steve Taylor Nick Lyth Richard Price
Date	20.10.10	
Location	Barrhead Housing Association	

Purpose of Meeting

To refine the parameters of the study;

To introduce the key players of the IRRI team to the key client group personnel;

To determine the areas of greatest interest to BHA and ERC;

To establish lines of contact and responsibilities.

Discussion Points

HC indicated that there had been no previous studies that he'd been aware of regarding biomass in East Renfrewshire. There are no biomass plants installed in ER, but ERC have given it some thought in the past. The Carbon Trust had written a positive report on biomass which he had seen and it had led to some enthusiasm in East Renfrewshire but had not previously been an ERC priority.

HC asked that the study considered which types of fuel might be appropriate. He believed that pellets from sawmills may be the best fuel source but he also wondered if there were tree thinnings in East Renfrewshire or woodchip or specifically grown crops.

RP noted that there are only limited pellet suppliers in Scotland, and that pellets require storage facilities.

There was a discussion regarding Eastwood Park. HC indicated that the swimming pool both requires heat and generates waste heat all year round. This would appear to be a good case for a CHP scheme. The Eastwood leisure complex uses around 1MW of power per year, St Ninians School approximately 800,000 kW/year and their offices in Eastwood Park around 500,000kW/year. Eastwood House also has a small demand for heat and power, but overall within the park there is a huge demand for heat and power. Meeting this demand would require a huge facility/ huge investment but could have a significant impact on reducing the Council's CO2 emissions. A new boiler house would be needed for any boiler facility, and if it was of a suitable scale to service all the park's facilities it would inevitably be large scale – within the park setting this would be controversial.

HC suggested that the downsides would be the scale of the boiler house (possibly with a large chimney?) and should retrofitting biomass facilities increase costs, then the council would be unlikely/unable to cover additional costs associated with retrofitting. The cost of retrofit will depend on the nature and condition of both the existing heating facilities and the existing building fabric, together with other factors relating to distance between boiler and end user, layout of buildings, availability of ducts or service channels etc.

HC indicated that ERC are involved in building a new school at Eastwood High School which is a Scottish Futures Trust funded scheme. It will be linked with West Lothian on a knowledge sharing basis. The school will have a new build nursery adjacent. If the nursery and/or school were to be heated through a biomass scheme, it would have the advantage of being designed into the building and no need for the retrofitting difficulties. In East Renfrewshire the new Isobel Mair School is fitted with Ground Source Heat Pumps, Air Source Heat Pumps and Solar Thermal. This has set the precedent for East Renfrewshire investing in renewable energy in large scale new facilities and indicates the council's interest in such schemes.

HC also advised that ERC Parks Department managed large greenhouses in Rouken Glen Park. These are used by the WRTC (training centre which produces hanging baskets for the council) and are heated through an oil based system. This could be a good candidate for a biomass system, especially if it could use wood thinnings from the park. This should be a priority for feasibility assessment.

The discussion moved to Barrhead, and whether the proposed new Barrhead College offered an opportunity to be powered or heated through biomass and whether there may be any community heating options in the Barrhead area.

SR advised that BHA are changing the heating system at Saunders Court. This is a flatted housing complex off John Street which is currently heated through electric storage heaters. It would be useful to explore how to retrofit to buildings already heated through other systems. There is also a sheltered housing complex off Main Street which is currently heated through gas storage heaters. As residents of sheltered housing already pay a service charge could we target that – i.e. recover heating costs through the service charge?

SR asked that IRRI speak to Dougie McIntyre, BHA property manager. As the residents of Saunders Court have been identified as being in fuel poverty and as the heating system is due for replacement, then funding should be available in 2011. For this reason, this development should be a priority for feasibility assessment.

SR suggested that the most likely location for a community heating scheme would be Dunterlie where there are a number of BHA owned properties close to the resource centre and the school. This could possibly be suitable for a district heating system.

RP provided some initial background information on different types of wood fuels and types of boilers. ST provided some information on current government funding regimes and NL provided information on community energy projects that IRRI had been involved in.

Regarding Rouken Glen Park, IRRI were asked to contact Donnie McManus (ERC Parks), Erica Kemmet (ERC Recycling officer), Andrew Corrie (ERC Waste Manager) and Dougie Morrison (WRTC)

Although Eastwood Park appears to have plenty of potential it is not a priority for this project due to the likely scale of the project. While the original brief and proposal had mentioned that the potential allotment sites in Eastwood Park and Dunterlie should be reviewed, this was rejected due to the uncertainty of progress with the sites concerned.

The meeting agreed that, whereas the proposal indicates a concentration on two allotment sites, the study should in fact be broadened to cover three, and possibly four sites, two residential, and two public parks with public facilities.

Actions

IRRI to contact DMcI of BHA and DMcM, EK, AC or ERC

IRRI to focus on Rouken Glen Park, Saunders Court and Dunterlie.

IRRI to give some thought to Eastwood Park

Appendix 1b Meeting Minutes 28.10.10

East Renfrewshire Community Enterprise Trust

Biomass Feasibility Study

Forestry Commission		
Present	Virginia Harden (FC)	Steve Taylor
Date	28.10.10	
Location	Eastwood Park	

Purpose of Meeting

- To appraise FC biomass officer of our project and gain any useful information she may hold
- To discuss the potential of using the self regenerated woodland in Eastwood Park which may be felled anyway
- To discuss supply and demand issues involving various biomass fuels across Scotland
- To find out about other relevant projects which may impact on our work.

Discussion Points

Sources of Information and Contacts

Forestry Commission have set up a useful website with a full list of fuel suppliers.

They are involved in similar projects to ours in Renfrewshire and Lanarkshire. We should contact those projects.

The Carbon Trust is also a useful source of information. Brendan Reid and Jenny Cassells (01355 581814) are good contacts. There is a biomass energy centre on their web site.

Supplier confidence: FC are currently working up business plans with a number of farming co-operatives. They tend to be based on unmanaged woodlands but the key point is the co-operation between farmers.

It is worth contacting the Ayrshire Woodfuel Forum. We are invited to join them to a visit to the UPM Paper Mill in Irvine in early December.

Transport

Transport and fuel costs are major issues within the feasibility. There has been too much evidence of higher costs due to vehicles moving without full loads – due to bad planning or bad management

Types of Fuel

The FC Website has information on forestry trials, looking especially at short rotation coppicing and short rotation forestry. SRC requires better quality agricultural land, preferably not too wet. Harvesting is November - March which tends to be the wettest time of year. SRF is usually eligible for higher grants from the Scotland Rural Development programme but can have a 10-15year horizon before harvesting. When working with farmers it is usual for a farmer to expect some level of certainty before planting a crop and prices can rise and fall significantly within the 15 year period before harvesting. This makes SRF less appealing to many farmers. Conversely it may give them alternative options as they could leave a few more years and sell for timber if the price for fuel falls.

The South Lanarkshire project is looking at working with farmers. FC is setting up a series of farm woodland demonstration days next year.

FC have produced a woodfuel in Scotland report. VH will send ST a copy.

SRF may be more suitable for a community driven project. SRF tends to work better on marginal quality land and is often better for biodiversity. FC Energy trials team have reported that some SRC schemes haven't worked well. But FC are prepared to come out and do presentations to farmers to encourage them to grow SRF or SRC. ST to contact Neil Harrison at Ayrshire Woodfuel Forum

Boilers

Larger boilers (above 500kW) tend to be less specific about the moisture content of the wood fuel and can burn wet wood. Smaller systems have more specific requirements and need wood with a lower moisture content. This usually means that some storage space is required for drying wood first.

Security of supply

The larger facilities such as the Forth ports proposals will almost certainly only take supplies from the larger suppliers. As they require large volumes they are unlikely to look at the smaller suppliers. They are also likely to import some supplies to ensure constant supplies. VH believes they are unlikely to suck up all the potential Scottish supplies of fuel.

The Scottish Forestry strategy is to plant 10,000 Ha/year (note: check this fig). As they are not always meeting the target there is support for tree planting. There is competition for wood from Scottish sources, primarily from woodchip manufacturers. If the Renewable Heat Initiative increases the demand and price of wood then more trees may be planted as a result.

FC have produced an arboriculture arisings study (VH to send to ST). This looked at the feasibility of using offcuts and clearings. Early findings suggest there is too much bark, which has a high ash content, so is not ideal for burning. There is also potential with recycled wood for contamination through nails etc. Barnsley Council have been a leader in using recycled wood for energy generation.

One option is to use under managed woodland in East Renfrewshire. Woodland management could be financed through selling fuel. This works in Lanarkshire where a heat contract pays for management.

Scale

Larger scale developments are inevitably more efficient. With pipeline costs coming in at around £100/m, or possibly £50/m using voluntary labour to dig trenches,

District Heating Schemes

Highland Wood Energy and Buccleuch Estates have implemented district heating schemes

CHP

The technology is suitable for large scale plants but unproven for small scale.

Storage Options

Storage is a key component to get right at the beginning. Storage capacity should be between 10% and 50% of annual usage. There have been disasters due to poor storage design. Handling fuel and inefficient transport increases costs, and good storage options can help overcome this.

Pellets/Chips

Chippers can cost £200/day to hire and can chip 40t/hour. Efficient use of chippers is essential. Buying in woodchip today costs £75- £120/tonne depending on the transport distance.

Pellets can cost £100 - £150/t. Pellets are often preferable where storage is limited. There are now 5 companies in Scotland providing pellets, with a new facility opening in Grangemouth recently.

Maintenance

Maintenance is not difficult. In general a janitor or workman can be readily trained to carry out basic and regular maintenance.

Eastwood Park woodlands

VH is not qualified to comment on the volume or potential quality of the self regenerated woodlands in Eastwood Park, but agreed that if they are to be felled anyway, then there would be some potential to use them for biomass. Transport distances to an Eastwood facility would be low and the educational benefits would be worthwhile due to the proximity of the nearby schools.

Actions

VH to send reports

ST to attend Ayrshire Woodfuel Forum

VH to send contact details of Renfrewshire & Lanarkshire projects

ST to follow up website links

VH to discuss Eastwood woodlands with her colleagues

Appendix 1c Meeting Minutes 15.11.10

East Renfrewshire Community Enterprise Trust

Biomass Feasibility Study

ERC Rouken Glen Training Centre Manager		
Present	Dougie Morrison	Steve Taylor
Date	15.11.10	
Location	phone	

Purpose of Meeting

To assess whether ERC would be keen to consider biomass as a new source of heat and/or power for the greenhouses and training centre in Rouken Glen Park.

To ask DM if he had any wider interest in the feasibility study or would like to contribute any points/ask any questions

Discussion Points

DM indicated that he no longer manages the centre and we should contact Phil Prentice or John Bergin.

DM indicated that in his new role he had no real interest in the study. His role is helping new small businesses in the area. ST explained the potential that biomass could play and how small businesses could possibly be involved, but DM recommended that we speak to PP or JB if we want further information.

Actions

ST to contact PP and JB.

Appendix 1d Meeting Minutes 15.11.10

East Renfrewshire Community Enterprise Trust

Biomass Feasibility Study

East Renfrewshire Council Recycling officer		
Present	Erica Kemmet	Steve Taylor
Date	15.11.10	
Location	phone	

Purpose of Meeting

To determine current ERC use of waste wood and to see if there is any potential waste materials that could be used as a fuel source.

Discussion Points

EK indicated that waste wood is collected at the council's two CA sites (Greenhaggs in Newton Mearns and Barrhead) which both act as waste transfer stations with materials recovery.

Waste wood is collected in separate skips and then sold for use as chipboard/MRF. ERC currently have a contract to supply the wood to a chipboard manufacturer, but EK was unsure how long the contract had to run.

Wood is brought to the CA sites by ERC Parks Dept staff and members of the public.

EK did not know what percentage of wood waste was being captured, but ERC have a new fortnightly bin collection which suggests that bulky materials such as wood are unlikely to be lost to landfill through the domestic bin collection (due to the size of the bins and the less regular emptying).

ST Observations

The current system relies on members of the public taking their wood waste to the CA sites and voluntarily depositing in the wood skips. There is no indication of the proportion of total wood waste that this captures.

It would not be easy to break the current contracts – arguably it is better that the waste wood is reused rather than burnt so idealistically we may not want to break their current system.

There was little confidence that the Parks Department were gathering offcuts and cuttings. Felled trees are usually left in situ in parks for habitat creation, but there should still be some offcuts with fuel potential that are possibly being stored or lost. The meeting with Donnie McManus on Wednesday may help answer this.

Actions

ST to check on parkland wood waste arisings with DMcM

General comment in report that waste wood arisings may be difficult to use as a fuel due to existing contracts with chipboard manufacturers to reuse the wood collected at the CA sites

ST to investigate further as to whether there are significant non-park waste arisings outside of that voluntarily taken to the CA sites.

Appendix 1e Meeting Minutes 02.03.11

Biomass Feasibility Study

Place: Barrhead Housing Association Offices, Barrhead

Date: 2nd March 2011

Present:	Sandra Inrig	East Renfrewshire Council
	Shirley Robison	BHA
	Dougie McIntyre	BHA
	Michael Doran	IRRI
	Steve Taylor	IRRI
	Philip Munro	IRRI

Saunders Court

- BHA are looking for some immediate feedback including an overview of the Saunders Court survey
- MD stated that it would approximately cost 5-6k per flat to install biomass at Saunders Court
- There is the potential for the RHI to provide funding post installation
- The pipe work for the buildings would be external which could have visual impacts

- DM confirmed there is a service riser in the centre of each stairwell
    - BHA will have someone check the dimensions of this service riser

Other

- The pros and cons of an energy service supplier contract were discussed
- BHA expressed concern that they have underestimated the potential scale of the project
    - Is there scope for further exploration
    - Are there case studies to compare for a bigger picture in Barrhead
- BHA express that their main driver is more efficient and economical service for tenants
- After explanation from MD regarding pellet prices tracking those of oil/gas, BHA express concern and question whether wood chip would be more feasible
- MD states that he will have his report finished by the end of March
- BHA will find out the specific info/data for the biodiesel kit held at WRTC (technical outputs and processing unit)
- BHA would like case studies for projects similar to Saunders Court and Rouken Glen
- BHA would like an update for the progress of the additional scope
- BHA need invoices from IRRI as soon as possible

Appendix 2

East Renfrewshire Community Enterprise Trust

Saunders Court Energy Usage Survey

Flat/ building number	Energy Provider	Energy Bill Period (DD/MM/YY-DD/MM/YY)	Energy Usage (kWh)	Cost (£)	Peak Usage
2	Scottish Power		Meter	£25- 30/ wk	Evenings.
3	Scottish Power	23.06.10-04.01.11	4055	£514.64	Evenings and cold weather.
		Last Period	2777		

4	**Scottish Power**	**Nov 09- Nov 10**	**16013**	**Estimate £1547.15**	**All day**
9	**Scottish Power**		**Meter**	**£20/wk**	**Evenings.**
					In flat temporarily- no bills.

Flat/ building number	**Energy Provider**	**Energy Bill Period (DD/MM/YY-DD/MM/YY)**	**Energy Usage (kWh)**	**Cost (£)**	**Peak Usage**
10	**Scottish Power**	**22.06.10-28.09.10**	**920**	**£108.53**	
		04.02.10-24.03.10	**1266**	**£50.96**	
		18.04.09-05.07.09	**578**	**£60.86**	

11	**Scottish Power**	**05.01.09-24.03.09**	**1604**	**£117.70**	
				£20-30/ wk	
12	**Scottish Power**	**Jan 10- Oct 10 (est)**	**Meter**	**£750**	**Evenings**
		Jan 11- Feb 11		**£75**	**Winter**
16	**Scottish Power**		**Meter**	**£60-70/wk**	**Heating and water on constantly- 5 children.**

Flat/ building number	Energy Provider	Energy Bill Period (DD/MM/YY-DD/MM/YY)	Energy Usage (kWh)	Cost (£)	Peak Usage
17	Scottish Power				
19	Scottish Power	24.12.09-25.03.10	3303	£255.24	
		Last Year	2598		
22	Scottish Power		Meter	£20/wk	Heating on all day.
				£30/wk in cold weather	

24	**Scottish Gas (?)**		**Meter**	**£20/ wk**	

Flat/ building number	**Energy Provider**	**Energy Bill Period (DD/MM/YY-DD/MM/YY)**	**Energy Usage (kWh)**	**Cost (£)**	**Peak Usage**
27	**Scottish Power**		**Meter**		**Evening**
28	**Scottish Power**		**Meter**	**£50/ wk**	**Morning/ Evening**

31	**Scottish Power**	**April 2010**		**£441.12 (£30/ wk)**	**Evening**
		Last Year	**9309**		
		Est for next year		**£849**	
33	**British Gas**		**Meter**	**£20- 30/wk**	**All day**

Flat/ building number	**Energy Provider**	**Energy Bill Period (DD/MM/YY-DD/MM/YY)**	**Energy Usage (kWh)**	**Cost (£)**	**Peak Usage**
37	**E.On**	**Sept 10**	**Meter**	**£50**	**All day.**
		Dec 10		**£85**	
		Winter 09 (3 months)		**£250**	

41	**Scottish Power**	**Past 12 months**	**6085**	**Est for next year: £574.61**	**Only uses heating when cold.**
		30.06.10- 15.10.10	**1150**		
		15.10.10- 25.11.10	**816**	**£204.77**	
		25.11.10- 23.12.10	**325**		
43	**Scottish Power**		**Meter**	**£25/ wk**	**Evening.**
					Varied usage.
49	**Scottish Power**		**Meter**	**£80/ month**	**Varied usage throughout the day.**

Saunders Court Energy Usage

Survey Comments

X 11 **Would like gas central heating**

- **Better for cooking too x1**

X 2 **Would like a combi-boiler**

x 4 **Unsure about gas**

- **Safety x1**
- **Flooring getting ruined x3**

X 6 **Storage heaters are too expensive**

- **Especially in winter x1**

X 6 **Difficult to control**

X 3 **Only use 2 storage heaters**

X 4 **Removed Storage heaters- too expensive.**

X 5 **Uses plug-in heater too**

X 3 **Fitted electric fire**

X 1 **Storage heaters frequently break**

X 2 **Can't get enough hot water**

X 2 **Draughty windows**

X 2 **Need better insulation in the walls**

Appendix 3 Fuel Suppliers

The following tables provide information on biomass fuel supply in Scotland.

Biomass Pellet Suppliers in Scotland				
Supplier	**Location**	**Cost (per tonne)**	**Transport Cost**	**Capacity to Supply**
Arbuthnott Wodd Pellets Ltd	Laurencekirk, Kincardineshire	£165 + VAT	£50 + VAT per tonne	Up to 9 tonne blown delivery
Balcas Brites	Cromarty Firth Industrial Estate, Invergordon	£195 + VAT	Included in cost per tonne	Can arrange blown delivery
Blairquhan Estate	Maybole, Ayrshire	£240 + VAT	£1 per mile	Just bags
Lauderdale	Earlston, Scottish Borders	£235	Could not provide quote	Up to 24 tonnes tipped delivery
NUERGY Biomass	Kirknewton, West Lothian	£210 + VAT	£35 per tonne	Can arrange blown delivery
Puffin Pellets	Banff, Aberdeenshire	£224	Included in cost per tonne	Can arrange blown delivery
The real Firewood Company	Duns, Scottish Borders	£250	Included in cost per tonne	Bulk deliveries on request
Verdo Renewables Ltd	Grangemouth, Stirlingshire	£270	Included in cost per tonne	Can arrange blown delivery
HW Energy	Fort William, Lochaber	£200 + VAT	On request	Can arrange blown delivery

Biomass Chip Suppliers in Scotland			
Supplier	**Location**	**Moisture Content**	**Approx. Cost (per tonne Inc. delivery to East Renfrewshire)**
Balcas Brites	Cromarty Firth Industrial Estate, Invergordon	<30%	Did not provide quote
Puffin Pellets	Banff, Aberdeenshire	40 – 50%	£80 – 90
HW Energy	Fort William, Lochaber	<30%	£90 exc. VAT
RTS Woodland Management	Gilmerton, Perthshire	25% for small boilers, 35-40% for large boilers	£110
Reith Partners	Methven, Perthshire	<30%	£75 per tonne exc. Delivery
Pentland Biomass	Loanhead, Midlothian	<35%	£85 exc. VAT

For further information please contact International Resources and Recycling Institute:

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